FINAL

WORK PLAN
MILITARY MUNITIONS RESPONSE PROGRAM
MUNITIONS RESPONSE SITES
SITE INSPECTION

RAVENNA ARMY AMMUNITION PLANT, OHIO

Submitted To:

US ARMY CORPS OF ENGINEERS
OMAHA DISTRICT
CENWO-PM-HC
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SIGNATURE PAGE

engineering-environmental Management, Inc.

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SEPTEMBER 2007

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Acronyms

AEDB-R	Army Environmental Database-Restoration
AOC	Area of Concern
bgs	Below Ground Surface
BRAC	Base Realignment and Closure
CENWO-CT	USACE, Omaha District Contract Officer
CENWO-PM	USACE, Omaha District Project Manager
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CIH	Certified Industrial Hygienist
CRREL	Cold Regions Research and Engineering Laboratory
CSM	Conceptual Site Model
CTC	Cost to Complete
CTT	Closed, Transferring, and Transferred
DERP	Defense Environmental Restoration Program
DMM	Discarded Military Munitions
DoD	Department of Defense
DQCR	Daily Quality Control Report
DQO	Data Quality Objectives
DSA	Diane Short and Associates, Inc
e²M	engineering-environmental Management, Inc
EPA	United States Environmental Protection Agency
ERIS	Environmental Restoration Information System
F&O	Final Findings and Orders
FPM	Field Project Manager
FS	Feasibility Study
FSP	Field Sampling Plan
ft	Feet
FY	Fiscal Year
GIS	Geographic Information System
GPS	Global Positioning System
H&S	Health and Safety
HE	High Explosives
HRR	Historical Records Review
HTRW	Hazardous, Toxic and Radioactive Waste
IRP	Installation Restoration Program

Acronyms

JMC	Joint Munitions Command
lb	Pound
MC	Munitions Constituents
MEC	Munitions and Explosives of Concern
MI	Multi-Incremental
mm	Millimeter
MMRP	Military Munitions Response Program
MPPEH	Material Potentially Presenting and Explosive Hazard
MRS	Munitions Response Site
MRS-PP	Munitions Response Site Prioritization Protocol
NDAA	National Defense Authorization Act
NFA	No Further Action
NGB	National Guard Bureau
No.	Number
NSDI	National Mapping and National Spatial Data Infrastructure
OB/OD	Open Burn/Open Detonation
OE	Ordnance and Explosives
OHARNG	Ohio Army National Guard
Ohio EPA	Ohio Environmental Protection Agency
ORC	Ohio Revised Code
OSD	Office of Secretary of Defense
PA	Preliminary Assessment
PARCCS	Precision, Accuracy, Representativeness, Completeness, Comparability, and Sensitivity
PE	Professional Engineer
PM	Project Manager
PMP	Project Management Plan
POC	Point of Contact
PRG	Preliminary Remediation Goal
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RCRA	Resource, Conservation and Recovery Act
RDX	Royal Demolition Explosive
RI	Remedial Investigation
RTLS	Ravenna Training and Logistics Site
RVAAP	Ravenna Army Ammunition Plant

Acronyms

SARA	Superfund Amendments and Reauthorization Act
SDSFIE	Spatial Data Standards for Facilities Infrastructure and Environment
SI	Site Inspection
SOW	Scope of Work
SSHP	Site-Specific Safety and Health Plan
SR	Special Report
STL	Severn Trent Laboratories, Inc.
TAL	Target Analyte List
TNT	Trinitrotoluene
TOW	Tube-launched, optically-tracked, wire-guided missile
TPgM	Technical Program Manager
TPM	Technical Project Manager
TPP	Technical Project Planning
U.S.C.	United States Code
US	United States
USACE	United States Army Corps of Engineers
USAEC	United States Army Environmental Command
UXO	Unexploded Ordnance
WP	Work Plan
WWII	World War II

1.0 INTRODUCTION

engineering-environmental Management, Inc. (e²M) has prepared the following Work Plan (WP) for the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Site Inspection (SI) of the other than operational ranges and other sites with known or suspected unexploded ordnance (UXO), discarded military munitions (DMM), or munitions constituents (MC) at Ravenna Army Ammunition Plant (RVAAP), Ohio. These Munitions Response Sites (MRSs) are being addressed under the Military Munitions Response Program (MMRP), Contract Number DACA63-03-D0009, Task Order Number DK01.

This WP has been developed to provide a description of the necessary tasks to complete this SI, and to ensure it will be performed in conformance with the United States Army Corps of Engineers (USACE), Omaha District project Scope of Work (SOW), dated June 2005. This WP incorporates the findings of the Historical Records Review (HRR), Conceptual Site Model (CSM), and the resolutions and ideas generated during the Technical Project Planning (TPP) development process and other discussions held with the Stakeholders.

This WP will be used with the understanding that unanticipated conditions may dictate a change in the plan as written. Any necessary deviations from the plan will be brought to the attention of the USACE, Omaha District Project Manager (CENWO-PM) and Ohio Environmental Protection Agency (Ohio EPA) as soon as possible and a written request for variance will be submitted to document the decision made.

1.1 Regulatory Framework

The regulatory structure for managing MRSs at RVAAP is guided by a mixture of federal, state, and local laws, as well as Department of Defense (DoD) and United States (US) Army regulations and guidance. The picture is further complicated by debates at the national level between DoD and the US Environmental Protection Agency (EPA) over key issues including uncertainty of the final structure of the MMRP. However, key legislative and administrative precedents to date will undoubtedly influence the final regulatory framework of the MMRP. Key legislative and administrative precedents include the following:

- The Office of the Secretary of Defense (OSD) Defense Environmental Restoration Program (DERP) Guidance (September 2001) established an MMRP element for defense sites with known or potential UXO or DMM. The history of DERP dates back to the Superfund Amendments and Reauthorization Act (SARA) of 1986 and is defined in 10 United States Code (U.S.C.) §2701(b), which states the goals of the program shall include the following:

  - ➢ The identification, investigation, research and development, and cleanup of contamination from hazardous substances, and pollutants and contaminants; and
  - ➢ Correction of other environmental damage (such as detection and disposal of UXO) which creates an imminent and substantial endangerment to the public health or welfare, or to the environment.

- Sections 311-312 of the National Defense Authorization Act (NDAA) of Fiscal Year (FY) 2002 reinforced the OSD 2001 DERP Guidance by tasking the DoD to develop and maintain an inventory of defense sites that are known or suspected to contain UXO, DMM, or MC.
  - ➢ Section 311 requires the DoD to develop a protocol for prioritizing defense sites for response activities in consultation with state regulators and Tribal members.
  - ➢ Section 312 requires the DoD to create a separate program element to ensure the DOD can identify and track MMRP funding.

The OSD 2001 DERP Guidance and the NDAA 2002, described above, established the MMRP. The DERP and the MMRP provide guidance and methods for conducting a baseline inventory of defense sites known or suspected to contain UXO, DMM, or MC.

The RVAAP is also bound to the "Final Findings and Orders" (F&O) issued June 10, 2004 by the Ohio EPA pursuant to the authority vested under Chapters 3734, 3745, and 6111 of the Ohio Revised Code (ORC). The objective of the Orders is to ensure that the public health, safety, and welfare, as well as the environment, is protected from the disposal, discharge, or release of contaminants (including munitions and explosives of concern [MEC] which includes UXO, DMM, or MC at explosive concentrations) and MC at or from the Installation, through the implementation of a CERCLA based environmental remediation program. Pursuant to the Orders, the Installation is required to develop and implement the following:

- a Remedial Investigation/Feasibility Study (RI/FS), a Proposed Plan, a Record of Decision or other appropriate document, and a remedy for each Area of Concern (AOC) or appropriate group of AOCs at RVAAP; and
- a Facility-Wide Ground Water Investigation, Monitoring, and Remediation Program at RVAAP.

1.2 Project Objectives

The primary objective of the MMRP SI is to collect the appropriate amount of information to support one of the following recommendations concerning the presence of MEC and/or MC:

- No Further Action (NFA);
- Immediate Response; and or
- Further Characterization.

The secondary objectives of the SI are to:

- Collect information that allows for the refinement of the MMRP Cost to Complete (CTC) estimates by the US Army;
- Upload analytical data into the Environmental Restoration Information System (ERIS);
- Populate the Munitions Response Site Prioritization Protocol (MRS-PP) with background information and analytical data, as appropriate, and calculate a draft Protocol score for each MRS. In compliance with 32 Code of Federal Regulations (CFR) 179.5, the MRS-PP scores for the MRSs are considered interim pending stakeholder input; and
- Refine MRS boundaries

The SI investigative approach was developed based on a series of proposed MRS sampling approaches and activities that were reviewed by USAEC, USACE, and Ohio EPA, followed by subsequent discussions. To accomplish these goals, field data will be collected to assess whether MEC and/or MC are present at the following seventeen MRSs identified at RVAAP:

- Ramsdell Quarry Landfill (RVAAP-001-R-01)[1]
- Erie Burning Grounds (RVAAP-002-R-01)
- Demolition Area #2 (RVAAP-004-R-01)
- Load Line #1 (RVAAP-008-R-01)
- Load Line #12 (RVAAP-012-R-01)
- Fuze and Booster Quarry (RVAAP-016-R-01)
- Landfill North of Winklepeck (RVAAP-019-R-01)
- 40mm Firing Range (RVAAP-032-R-01)
- Firestone Test Facility (RVAAP-033-R-01)
- Sand Creek Dump (RVAAP-034-R-01)
- Building #F-15 and F-16 (RVAAP-046-R-01)

---

[1] Army Environmental Database-Restoration (AEDB-R) Number

- Anchor Test Area (RVAAP-048-R-01)
- Atlas Scrap Yard (RVAAP-050-R-01)
- Block D Igloo (RVAAP-060-R-01)
- Block D Igloo – TD (RVAAP-061-R-01)
- Water Works #4 Dump (RVAAP-062-R-01)
- Group 8 MRS (formerly known as Area Between Buildings 846 and 849) (RVAAP-063-R-01)

Based on the findings of the HRR, a majority of the MRSs are suspected of containing MEC and/or MC, and will require additional site investigation under the MMRP; that is, these sites will be recommended for further action beyond the completion of this SI. Due to the complexity of these sites, the investigative field work will be limited to confirming the presence of MEC and/or MC (i.e., at sites not covered under the Installation Restoration Program [IRP]). Furthermore, at the MRSs identified during the HRR that are less likely to contain MEC and/or MC, more rigorous investigative field work will be conducted to determine if the site can be recommended for an NFA.

A number of the MRSs are co-located with sites that are covered under the IRP. At these sites, adequate chemical data exists to document the presence of MC, which can be used to populate the MRS-PP. This data is summarized and discussed in the Stakeholder Final, Military Munitions Response Program, Historical Records Review, Ravenna Army Ammunition Plant, Ohio, dated January 2007 (RVAAP Final HRR).

1.3 Work Plan Organization

In addition to **Section 1.0**, Introduction, this WP consists of the following sections:

- **Section 2.0**: Installation Background and MRS Descriptions provides historical information and a physical description of the Installation and the MRSs;
- **Section 3.0**: Scope of Work discusses the proposed activities to be conducted by e^{2}M as part of the SI;
- **Section 4.0**: Project Management outlines the project schedule and the project team's roles and responsibilities;
- **Section 5.0**: Project Deliverables presents a summary of the reporting to be completed for the SI; and
- **Section 6.0**: Provides References.

More detailed site specific operating protocols and procedures are presented in the following appendices:

- **Appendix A**: Field Sampling Plan (FSP);
- **Appendix B**: Quality Assurance Project Plan (QAPP);
- **Appendix C**: Site-specific Safety and Health Plan (SSHP); and
- **Appendix D**: TPP Meeting Minutes.

2.0 INSTALLATION BACKGROUND AND MRS DESCRIPTIONS

RVAAP (Federal Facility Identification number: OH213820736) is located in northeastern Ohio within Portage and Trumbull Counties, approximately 4.8 kilometers (3 miles) east northeast of the city of Ravenna and approximately 1.6 kilometers (1 mile) northwest of the city of Newton Falls. The MRSs are solely located within Portage County. The Installation is approximately 17.7 kilometers (11 miles) long and 5.6 kilometers (3.5 miles) wide bounded by State Route 5, the Michael J. Kirwan Reservoir, and the CSX System Railroad on the south; Garret, McCormick, and Berry roads on the west; the Norfolk Southern Railroad on the north; and State Route 534 on the east (see **Figure 1**). The Installation is surrounded by several communities: Windham on the north; Garrettsville 9.6 kilometers (6 miles) to the northwest; Newton Falls 1.6 kilometers (1 mile) to the southeast; Charlestown to the southwest; and Wayland 4.8 kilometers (3 miles) to the south. Currently, the Installation is known as the Ravenna Training and Logistics Site (RTLS). During the operational years, prior to the RTLS, the entire 21,683-acre parcel was a government-owned, contractor-operated industrial facility. The RVAAP MMRP encompasses investigation and cleanup of past activities over the entire 21,683 acres of the former RVAAP, and therefore references to the RVAAP in this document are considered to be inclusive of the historical extent of the RVAAP, which is inclusive of the combined acreages of the current RTLS and RVAAP, unless otherwise specifically stated.

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 have been subsequently licensed to the Ohio Army National Guard (OHARNG) for use as a military training site. The current RVAAP consists of 1,280 acres scattered throughout the OHARNG RTLS. These 1,280 acres consist of former industrial facilities that are being remediated and managed by the Base Realignment and Closure (BRAC) Office who have, among other responsibilities, the task of overseeing inactive status installations.

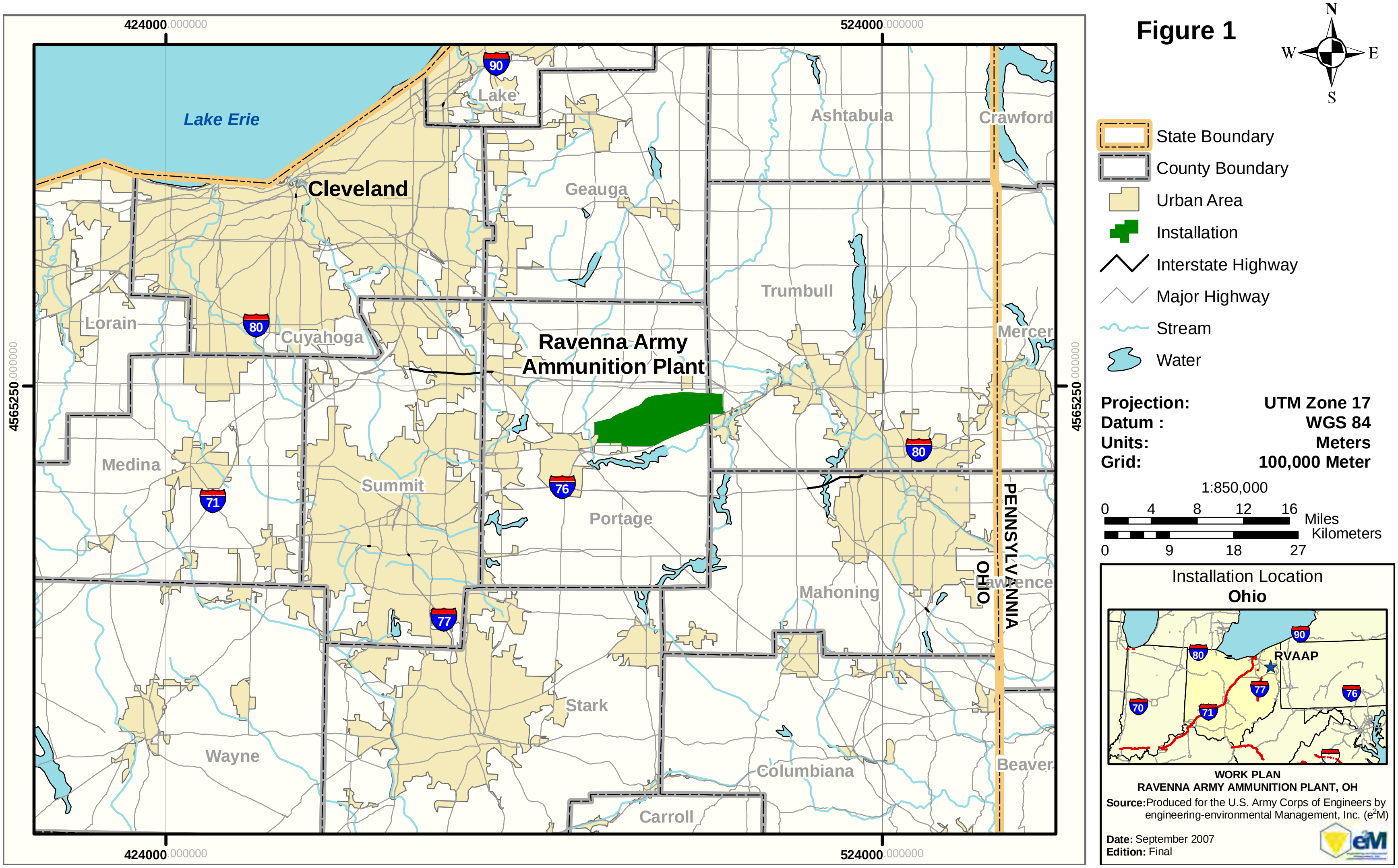
Eighteen MRSs were identified during the US Army inventory of closed, transferring and transferred (CTT) military ranges and defense sites (US Army CTT Range/Site Inventory) with the potential to contain UXO, DMM or MC. This number was reduced to seventeen when the operational status of the Old Hayfield MRS (RVAAP-064-R-01), which was formerly known as the “Field at the NE Corner of Intersection”, was changed to operational range. As such, this MRS became ineligible for the MMRP and was subsequently removed.

One additional site, the Winklepeck Burning Grounds, was also identified in the US Army CTT Range/Site Inventory. The MRS is no longer eligible for the MMRP since the parcel has been developed as an operational range (Mark 19 Range) by the OHARNG. As such, this site will no longer be addressed in this WP.

In addition to Winklepeck Burning Grounds, Open Demolition Area 1 will not be included in this SI. This site was improperly listed as part of a maneuver area and therefore was not eligible for the MMRP. In January 2007, OHARNG sent a memo to the National Guard Bureau (NGB) to have the site delisted as an active range, so it could be included in the MMRP. To date, the Army has not made a decision on the request. Once the site is approved for delisting by the Army, it will be entered into the MMRP. **Table 1** provides the names of the MRSs, their Army Environmental Database-Restoration (AEDB-R) numbers, and corresponding acreages that will be investigated under this SI.

INSTALLATION LOCATION
Ravenna Army Ammunition Plant, OH

Figure 1



Projection: UTM Zone 17
Datum : WGS 84
Units: Meters
Grid: 100,000 Meter

WORK PLAN
RAVENNA ARMY AMMUNITION PLANT, OH
Source: Produced for the U.S. Army Corps of Engineers by engineering-environmental Management, Inc. (e^{2}M)

Date: September 2007
Edition: Final

Table 1: List of MRSs at Ravenna

MRS	AEDB-R Number	HRR Acreage
Ramsdell Quarry Landfill	RVAAP-001-R-01	13.43
Erie Burning Grounds	RVAAP-002-R-01	33.93
Demolition Area #2	RVAAP-004-R-01	32.95
Load Line #1	RVAAP-008-R-01	4.63
Load Line #12	RVAAP-012-R-01	1.0
Fuze and Booster Quarry	RVAAP-016-R-01	12.74
Landfill North of Winklepeck	RVAAP-019-R-01	14.05
40mm Firing Range	RVAAP-032-R-01	5.17
Firestone Test Facility	RVAAP-033-R-01	0.91
Sand Creek Dump	RVAAP-034-R-01	0.85
Building #F-15 and F-16	RVAAP-046-R-01	12.23
Anchor Test Area	RVAAP-048-R-01	2.57
Atlas Scrap Yard	RVAAP-050-R-01	66.04
Block D Igloo	RVAAP-060-R-01	622.24
Block D Igloo–TD	RVAAP-061-R-01	19.25
Water Works #4 Dump	RVAAP-062-R-01	6.15
Group 8 MRS (formerly known as Area Between Buildings 846 and 849)	RVAAP-063-R-01	2.65

As previously mentioned, a number of the MRSs are co-located with sites that are covered under the IRP. At these sites, adequate chemical data exists to document the presence of MC, which can be used to populate the MRS-PP. This data is summarized and discussed in the RVAAP Final HRR. Below are summaries of the MRS descriptions as provided in the HRR. For further details and references please refer to the RVAAP Final HRR. See **Figure 2** for the MRS locations.

MRS LOCATIONS
Ravenna Army Ammunition Plant, OH

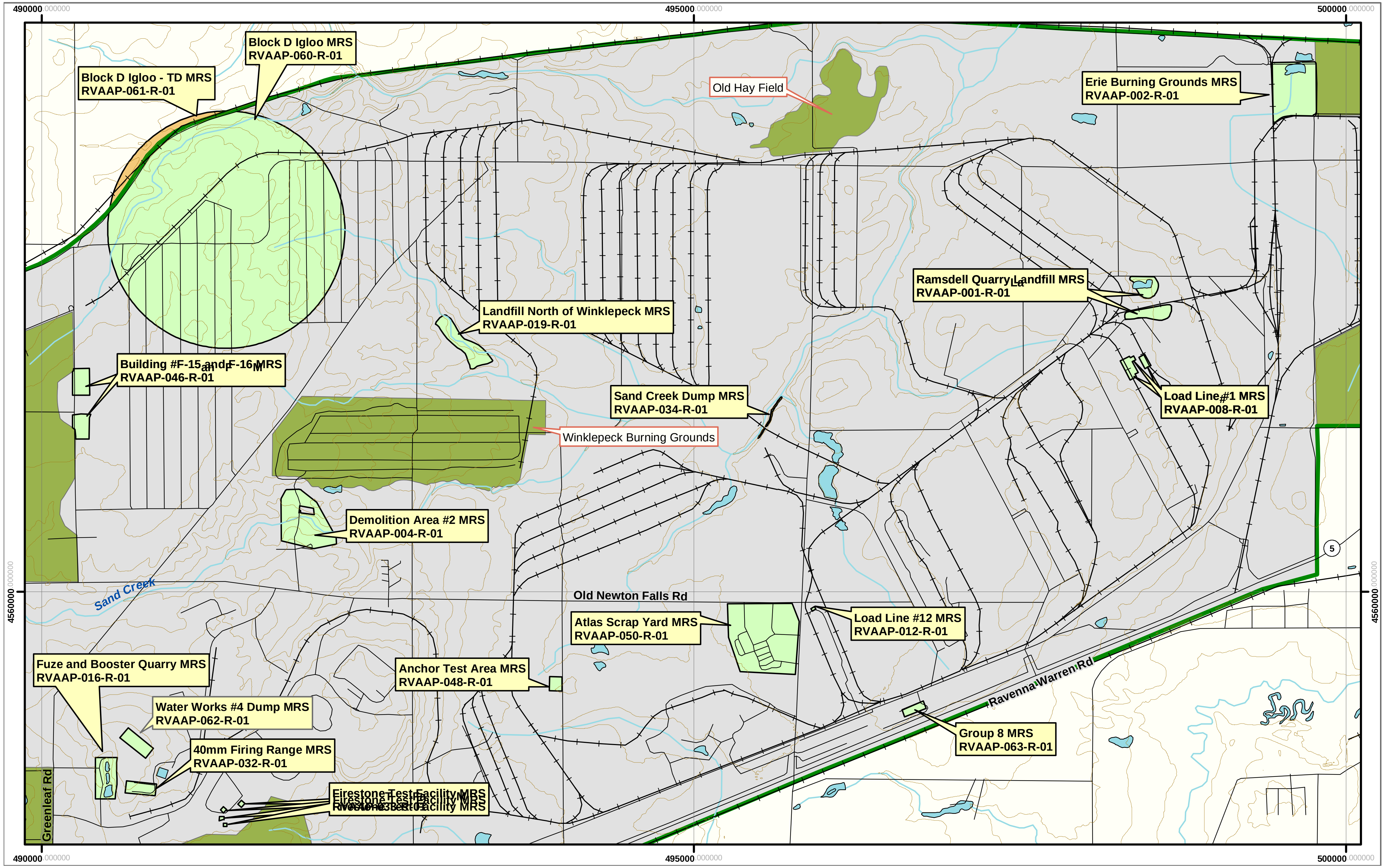


Figure 2

N
W E
S

Elevation Contour
Installation Boundary
Railroad
Road
Stream
Water

Area Status

🟩 Operational Range
⬜ Other than Operational Range
🟩 MRS, Closed
🟧 MRS, Transferred

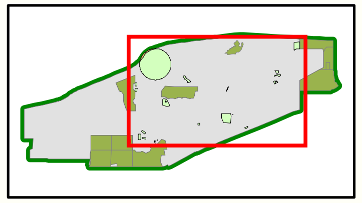
Data Source: e^2M, Final Military Munitions Response Program Historical Records Review, Ravenna Army Ammunition Plant, Ohio, October 2006.

Projection:	**UTM Zone 17**
Datum :	**WGS 84**
Units:	**Meters**
Grid:	**5,000 Meter**
Contour Interval:	**5 00 Meter**

1:32,000

0 0.2 0.4 0.6 Miles
0 0.25 0.5 0.75 1 Kilometers

Reference Location Map
RVAAP



WORK PLAN
RAVENNA ARMY AMMUNITION PLANT, OH

Source: Produced for the U.S. Army Corps of Engineers by engineering-environmental Management, Inc. (e^2M)

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2.1 Ramsdell Quarry Landfill (RVAAP-001-R-01)

The Ramsdell Quarry Landfill MRS is described in the US Army CTT Range/Site Inventory as a 3.79 acre unlined landfill situated along the southwestern edge of the quarry that is collocated with an IRP AOC. However, it was determined during research for the HRR that the original MRS footprint did not encompass the former open burning/open detonation (OB/OD) area in the bottom of the quarry and an area to the south of the quarry that was identified by the Installation as potentially containing MEC. Further, under the MMRP, any MEC that may be present in a capped and closed landfill is not eligible since this is considered a response complete action under the IRP. In such cases, the IRP action fully addressed all MEC/MC co-located at the IRP site. Therefore, the capped former landfill area was removed from the MRS footprint. Based on agreement among the Installation, Ohio EPA, OHARNG, US Army Environmental Command (USAEC), and USACE the MRS footprint was revised and now encompasses the entire quarry including the former OB/OD area and the area located to the south of the quarry. The MRS now encompasses 13.43 acres; the layout is provided in **Figure 3**.

Originally the quarry was mined to recover rock material, consisting of a quartz pebble conglomerate, which was used for road and construction ballast. It is reported that the excavation reached a depth of 30 to 40 feet (ft) below existing grade. After discontinuing quarry operations in 1941, the quarry was used (1946 through 1950) to thermally treat waste explosives from Load Line #1, and approximately 18,000 500-pound (lb) incendiary or napalm bombs through surface burning. Starting in 1976, the MRS was reported to have been used strictly as a non-hazardous solid waste landfill; and in 1978 to its closure in 1990, operated under a sanitary landfill permit issued by the State of Ohio. No information was available for the period from 1950-1976.

Adequate historical data determining the presence of MEC at the former OB/OD quarry area exists; however, little information is known concerning the activities that were conducted in the open quarry area to the south of the former OB/OD area or whether or not MEC or munitions debris are present. Therefore, a limited magnetometer assisted UXO survey will be conducted in the former OB/OD area in the northern quarry, while a more comprehensive magnetometer/metal detector assisted survey will be conducted within the southern quarry area. The surveys will be conducted to identify any MEC or munitions debris lying or protruding through the ground surface and any buried anomalies. The intent of the surveys is to:

- support future characterization work at the former OB/OD area;
- establish the presence/absence of MEC and munitions debris in the southern quarry;

- determine if southern quarry area can be eliminated from the MRS footprint or if further characterization is needed; and
- refine the MRS boundary.

Although adequate information exists establishing the presence of MEC at the former OB/OD quarry area, a magnetometer assisted UXO survey will be conducted to support further characterization that will be required at the quarry (by identifying presence of buried anomalies) and to refine the MRS boundary.

The presence of MC in the former quarry has been confirmed and will continue to be addressed under the IRP. Therefore, no samples will be collected in this area during this SI. However, the presence of MC at the southern quarry is not fully known and will require further investigation. Under this SI, four (4) multi-incremental (MI) surface soil samples will be collected from the area to the south and analyzed for explosives, propellants, and Target Analyte List (TAL) metals. Since very little is known about the historic activities conducted at the site, sample areas will be selected based on the physical layout of the area (i.e., areas of equal topographic elevation). The intent will be to establish the presence or absence of elevated levels of MC and to populate the MRS-PP. MC constituents will be compared to EPA Region 9 Residential Preliminary Remediation Goals (PRGs). MC constituents exceeding the PRGs will be defined as elevated. Specific details of the magnetometer assisted UXO survey methods, sample collection and handling protocols, sample analysis, and sample locations are provided in **Appendix A** (Field Sampling Plan [FSP]).

RAMSDELL QUARRY LANDFILL and LOAD LINE #1 MRS LOCATIONS
Ravenna Army Ammunition Plant, OH

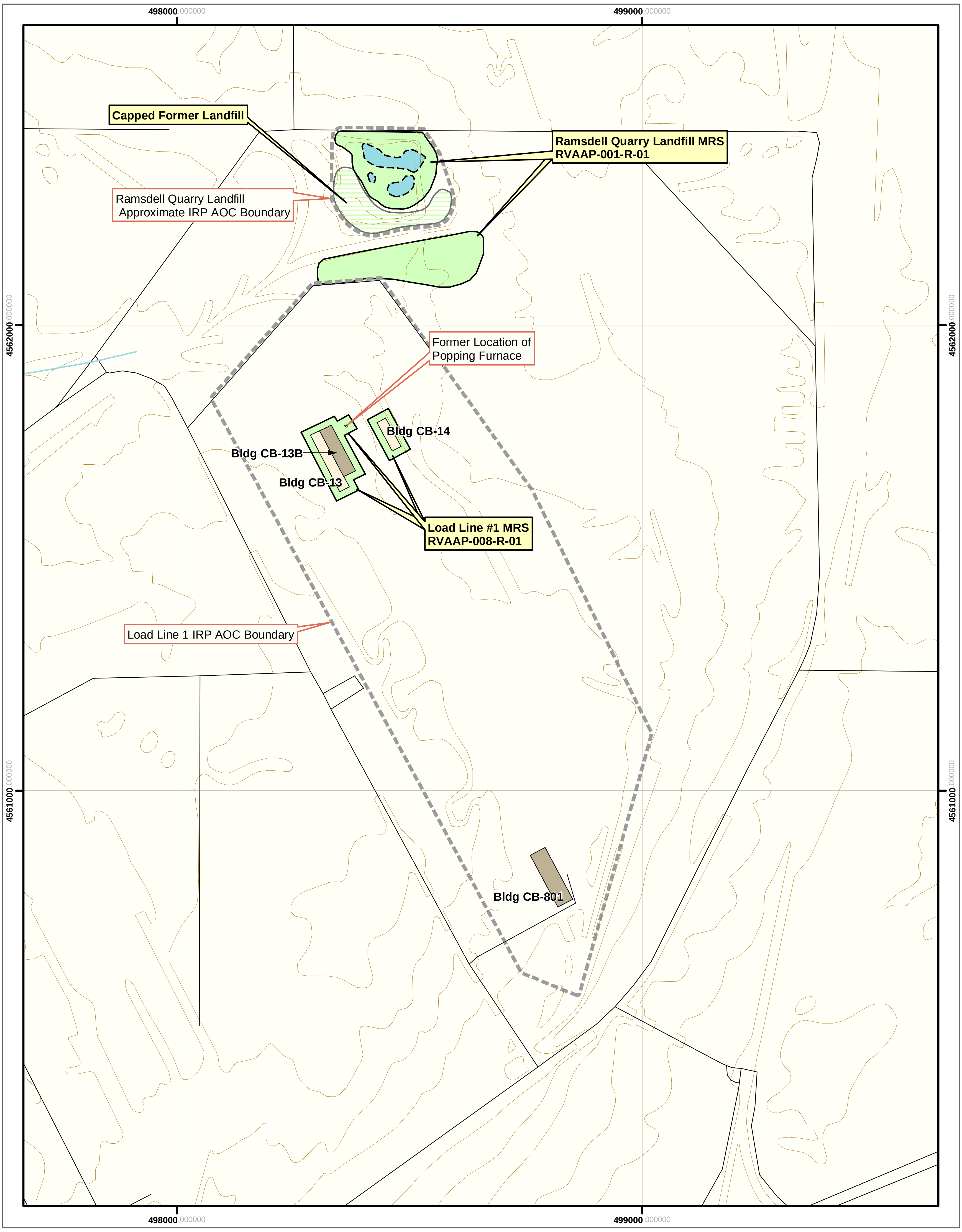


Figure 3

N
W E
S

Projection:	**UTM Zone 17**
Datum :	**WGS 84**
Units:	**Meters**
Grid:	**500 Meter**

1:9,000

0 250 500 750 1,000 Feet
Meters
0 80 160 240 320

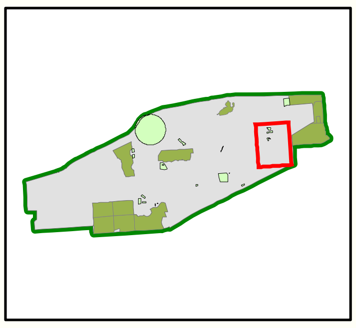
Elevation Contour
Road
Stream
Water (fluctuates in depth and extent)
▨ Building Locations, Existing
☐ Building Locations, Demolished

Area Status
🟩 MRS, Closed
▤ Capped Former Landfill
⬚ IRP Area of Concern

Data Source:

e^{2}M, Final Military Munitions Response Program Historical Records Review, Ravenna Army Ammunition Plant, Ohio, October 2006.

Reference Location Map
RVAAP



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2.2 Erie Burning Grounds (RVAAP-002-R-01)

The Erie Burning Grounds is described principally as an undeveloped wetland area that covers 33.93 acres located on the northeastern corner of the facility next to the Portage/Trumbull County line. The MRS is also collocated with an IRP site. The MRS, which operated between 1941 and 1951, was used to thermally treat bulk, obsolete, off-spec propellants, conventional explosives, rags, and large explosive contaminated items (e.g., railcars) through open burning on the ground surface. Prior to its acquisition by the US Army in 1940, the area may have been used for brick manufacturing. Aerial photos of the site from the 1940s and 1950s depict open boxcars staged at the end of the rail spur, known as Track 49. Presumably, materials were tipped out of the cars on either side of the embankment to be burned (See **Figure 4**, Burn Areas A&B). Ash residue was left on site after the burn. Engineering drawings from 1941 also identify two additional burning areas: one 200 ft to the northeast that was fed by a chute (See **Figure 4**, Burn Area C) and another (known as the "T-Area") to the south of the rail spur (See **Figure 4**, Burn Area D).

Adequate historic data determining the presence and density of MEC items has not fully been determined and will require further evaluation during the SI process. Therefore, a magnetometer assisted UXO survey will be conducted across the entire MRS within accessible dry areas. A survey of the submerged areas will not be undertaken during this SI; instead, these areas will require additional characterization under future CERCLA action. The survey will be conducted to identify any MEC or munitions debris lying on or protruding through the ground surface and any buried anomalies. The intent of the survey is to:

- establish the presence/type of MEC and munitions debris; and
- support further characterization efforts at the MRS.

Adequate analytical data identifying the presence of MC at the MRS has been collected under the IRP and will be used to populate the MRS-PP. Therefore, no samples will be collected from the MRS during this SI. However, MC at the MRS will require additional investigation under future CERCLA actions. Specific details of the magnetometer assisted UXO survey methods are provided in **Appendix A** (FSP).

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ERIE BURNING GROUNDS MRS LOCATION
Ravenna Army Ammunition Plant, OH

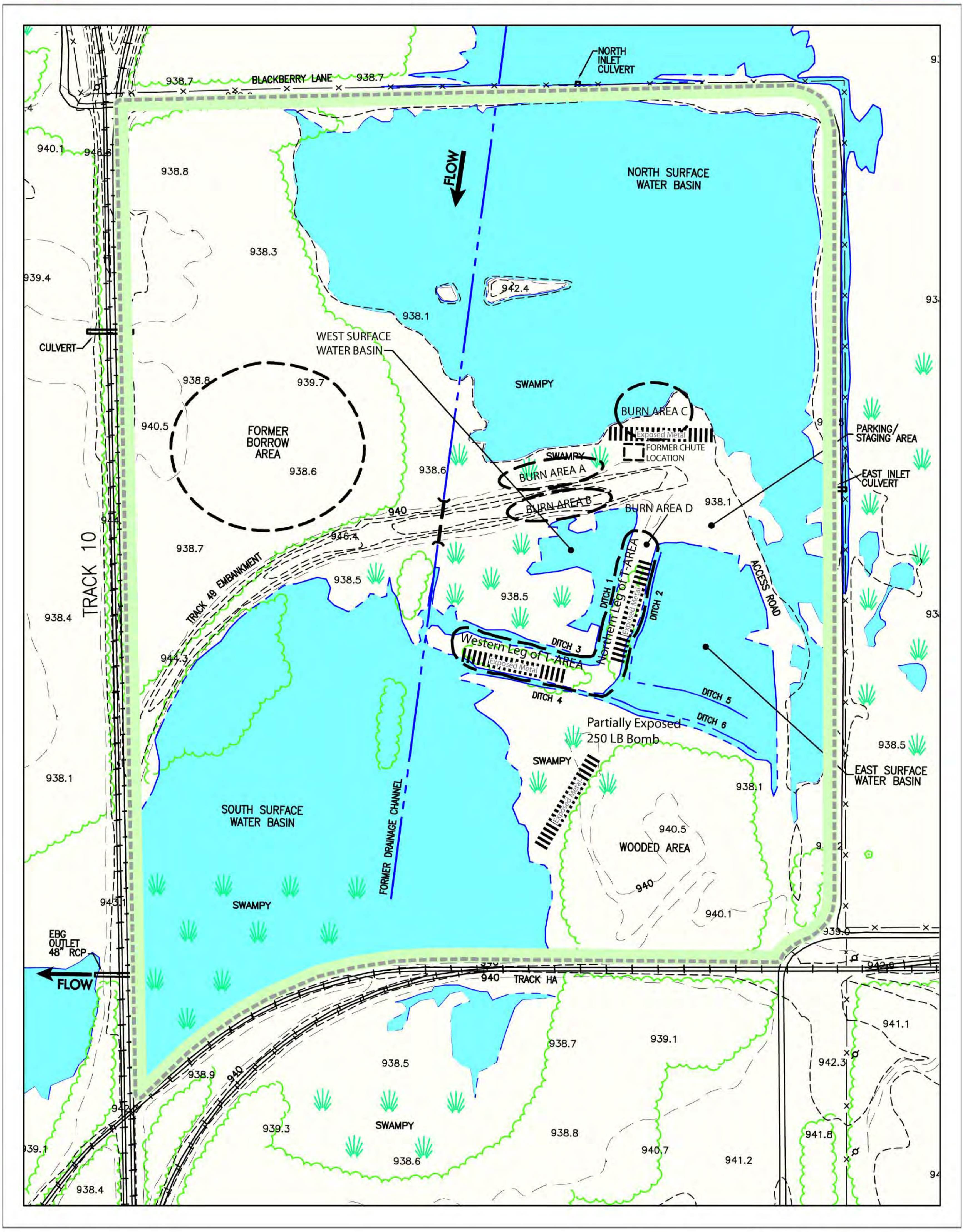

Figure 4

N
W E
S

Projection: UTM Zone 17
Datum : WGS 84
Units: Meters
Grid: 500 Meter

1:2,000

0 50 100 150 200 250 Feet
0 25 50 75 Meters

Road, Gravel
Railroad
Contour, 10-Foot Interval
Contour, 2-Foot Interval
923.8 Spot Elevation
Tributary
Stream
Treeline
MRS Boundary
IRP Area of Concern

Data Source:
e²M, Final Military Munitions Reponse Program Historical Records Review, Ravenna Army Munitions Plant, Ohio, October 2006.

Reference Location Map
RVAAP

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2.3 Demolition Area #2 (RVAAP-004-R-01)

The 2003 US Army CTT Range/Site Inventory reported that Demolition Area #2 encompassed approximately 14.91 acres, which included a 2.5 acre interim Resource, Conservation and Recovery Act (RCRA) unit that was permitted to demilitarize munitions, and a 40millimeter (mm) prototype test range. The MRS is also collocated with an IRP site. From 1948 until 1991, the MRS was used to detonate large caliber munitions and off-specification bulk explosives that could not be deactivated or demilitarized by any other means due to their condition. It was also reported that the MRS was used to bury white phosphorus and bombs. The types of bombs buried at the MRS were not disclosed. Detonation activities were conducted in pits excavated by a backhoe to a minimum depth of four ft below ground surface (bgs). After detonation, the area was policed and metal parts were picked up and removed, and the pit filled, mulched, and seeded. New pits were excavated for each activity.

During the HRR research additional areas were identified and the MRS boundary was expanded to encompass 32.95 acres. Based on the current information, the MRS consists of the following components:

- The former demolition area (excluding the non-MMRP eligible interim RCRA unit).
- The portion of the 40mm prototype test range that extends to the north and outside of the interim RCRA unit.
- Burial Sites 1 and 2 where MEC may have possibly been buried. Burial Site 1 is approximately two acres in size and located approximately 200 ft northeast of Building 1501 (explosives storage bunker). Burial Site 2 is approximately one acre in size and is located approximately 100 ft north of Building 1503 (explosives storage bunker).
- Rocket Ridge area where rocket bodies and various other items potentially representing MEC have been discarded on the ground surface and into Sand Creek. Rocket Ridge is located along a 70-foot embankment northeast of Building 1503 overlooking Sand Creek.
- Bomb disposal area located outside and adjacent to the northwestern section of the MRS. This area is outside the current MRS boundary but the Stakeholders agreed that it should be included in the SI.
- The MRS also includes all of the area located between the areas identified in the previous bullets.

Figure 5 depicts the new boundary of Demolition Area #2.

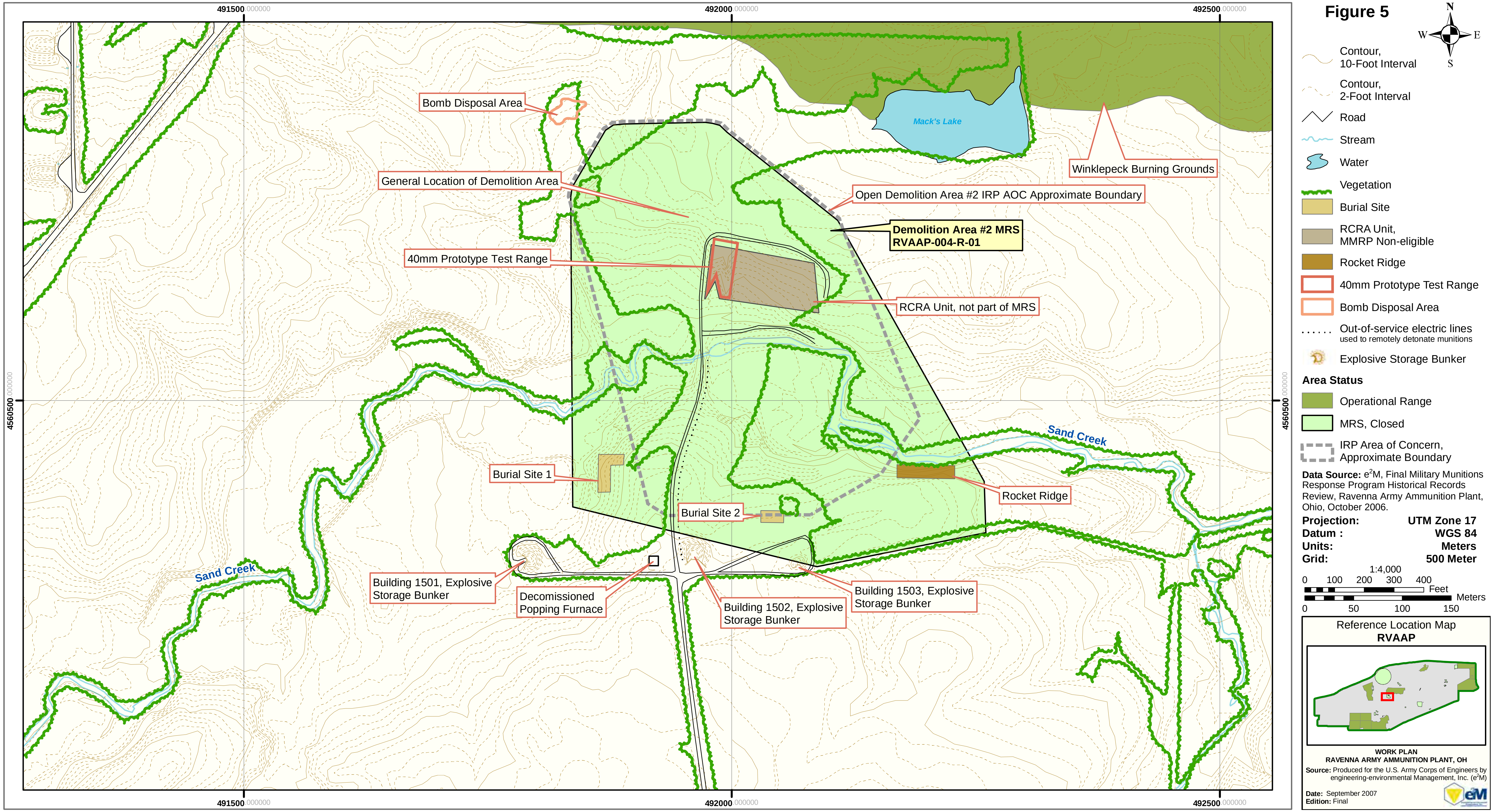
Adequate information exists documenting the presence of MEC at the MRS; however, additional information needs to be collected to further define the MRS boundaries, to the extent possible, at the Bomb Disposal Area outside the northwestern section of the site, at the two Burial Sites, and at Rocket Ridge. Therefore, a magnetometer assisted UXO survey will be conducted at these locations and surrounding areas. The survey will be conducted to identify MEC and munitions debris lying on or protruding through the ground surface and any buried anomalies. The intent of the survey is to:

- establish presence of MEC and munitions debris;
- refine the MRS boundary (i.e., increase/decrease); and
- support further characterization efforts at the MRS.

Further characterization work that is outside the scope of this SI will be required across the entire MRS to define the extent and density of MEC. These efforts will be conducted under additional CERCLA actions.

Adequate analytical data identifying the presence of MC at the MRS has been collected under the IRP and will be used to populate the MRS-PP. Therefore, no samples will be collected from the MRS during this SI. However, the investigation of MC at the MRS (especially at the burial sites, bomb disposal area, and Rocket Ridge area where no data exists) will require additional investigation under future CERCLA actions. Specific details of the magnetometer assisted UXO survey methods are provided in **Appendix A** (FSP).

DEMOLITION AREA #2 MRS
Ravenna Army Ammunition Plant, OH



Data Source: e^2M, Final Military Munitions Response Program Historical Records Review, Ravenna Army Ammunition Plant, Ohio, October 2006.

Projection: UTM Zone 17
Datum : WGS 84
Units: Meters
Grid: 500 Meter

WORK PLAN
RAVENNA ARMY AMMUNITION PLANT, OH

Source: Produced for the U.S. Army Corps of Engineers by engineering-environmental Management, Inc. (e^2M)

Date: September 2007
Edition: Final

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2.4 Load Line #1 (RVAAP-008-R-01)

Load Line #1 is described in the US Army CTT Range/Site Inventory as encompassing approximately 163.62 acres, which consisted of the industrial buildings (i.e., load lines), associated infrastructure (e.g., utilities, settling tanks, water tower, etc.), and a large wooded area to the east of the industrial area. The MRS is also collocated with an IRP site. Load Line 1 was used to melt and load trinitrotoluene (TNT) and Composition B explosives into large-caliber shells during World War II (WWII) and the Korean War. As a result of the load operation, explosive dust, spills, and vapors collected on the floors and walls of several buildings, which were periodically washed from the walls and floors with water and steam. In 1971, the load line was declared inactive when the buildings with residual explosive dust were washed down, and the freestanding equipment was removed. From 1996 through 1998, salvage operations continued with the removal of the overhead steam lines and major rail spurs, and the removal of all telephone lines. By FY 2000, the majority of the buildings were demolished and removed. Currently, the only remaining buildings include CB-13B and CB-801. Floor slabs of the demolished buildings, walkways, and all below-grade infrastructures remain on site. However, some of the manholes and storm/sanitary sewer access points were filled in or obstructed during the demolition activities.

Based on the findings of the HRR, the potential presence of MEC and/or MC can be restricted to several areas associated with Buildings CB-13, CB-13B, CB-14, CB-801 (where a 152mm shell is suspected to have been found), the former popping furnace, and to areas where triple base propellants still exist. As such, the total acreage of the MRS has been reduced to encompass approximately five acres. Shaw Environmental is under contract to complete an interim soil and dry sediment removal action that will address some of the propellant located at the MRS. Propellant that remains after completion of the interim removal action will be investigated under this SI. The revised MRS boundaries are presented in **Figure 3**.

Triple base propellants are known to exist lying on the ground surface at the MRS and will be investigated to confirm presence, location, and density. This will be achieved by performing a UXO survey of the entire MRS. The intent of the survey will be to:

- confirm presence, location, and density of propellants;
- refine the MRS boundary (i.e., increase/decrease); and
- support/identify need for further characterization.

Analytical data identifying the presence of MC resulting from the load line operations has been collected under the IRP. However, very little analytical data exists for those areas that contain propellants lying on the ground surface. Therefore, where propellant is found at the MRS, one (1) MI surface soil sample will be collected and analyzed for explosives, TAL metals, and propellants. The sample area will be selected based on the physical layout of the location. The intent will be to establish the presence of MC and to populate the MRS-PP. Specific details of the UXO survey methods, sample collection and handling protocols, sample analysis, and sample locations are provided in **Appendix A** (FSP).

2.5 Load Line #12 (RVAAP-012-R-01)

Load Line #12 is described in the US Army CTT Range/Site Inventory as encompassing approximately 77.58 acres. The MRS is also collocated with an IRP site. Multiple buildings were located at the MRS during its operational years which included a neutral liquor building (FE-19), seven evaporation/crystallization units (Buildings 900, 901, 902, 903, 904, 905, and 906), Water Works No. 2, Power House No. 3 (FE-17), a bagging and shipping building (FN-54), a compressor building (FA-20), an administration building (FE-53), a change house (FEWP-22), a laboratory (FE-52), and a clock house (4-51). Currently, no above-grade structures remain at the MRS, except for a small portion of the floor slab at Building FF-19. Buildings 901, 902, FF-19, and 906 were removed between 1973 and 1975 by open burning. Building FN-54 was demolished in the 1980s, and the remaining structures were removed between 1998 and 2000. During the recent demolition activities, a former blast berm at Building 903 was removed and placed as fill/groundcover around portions of Buildings FE-17 and 903. Structural features that remain on site include gravel access roads, man-made ditches, sanitary sewer lines, manholes, and the remains of three main rail tracks and several secondary tracks. Further, foundations remain buried 1 foot bgs at the MRS.

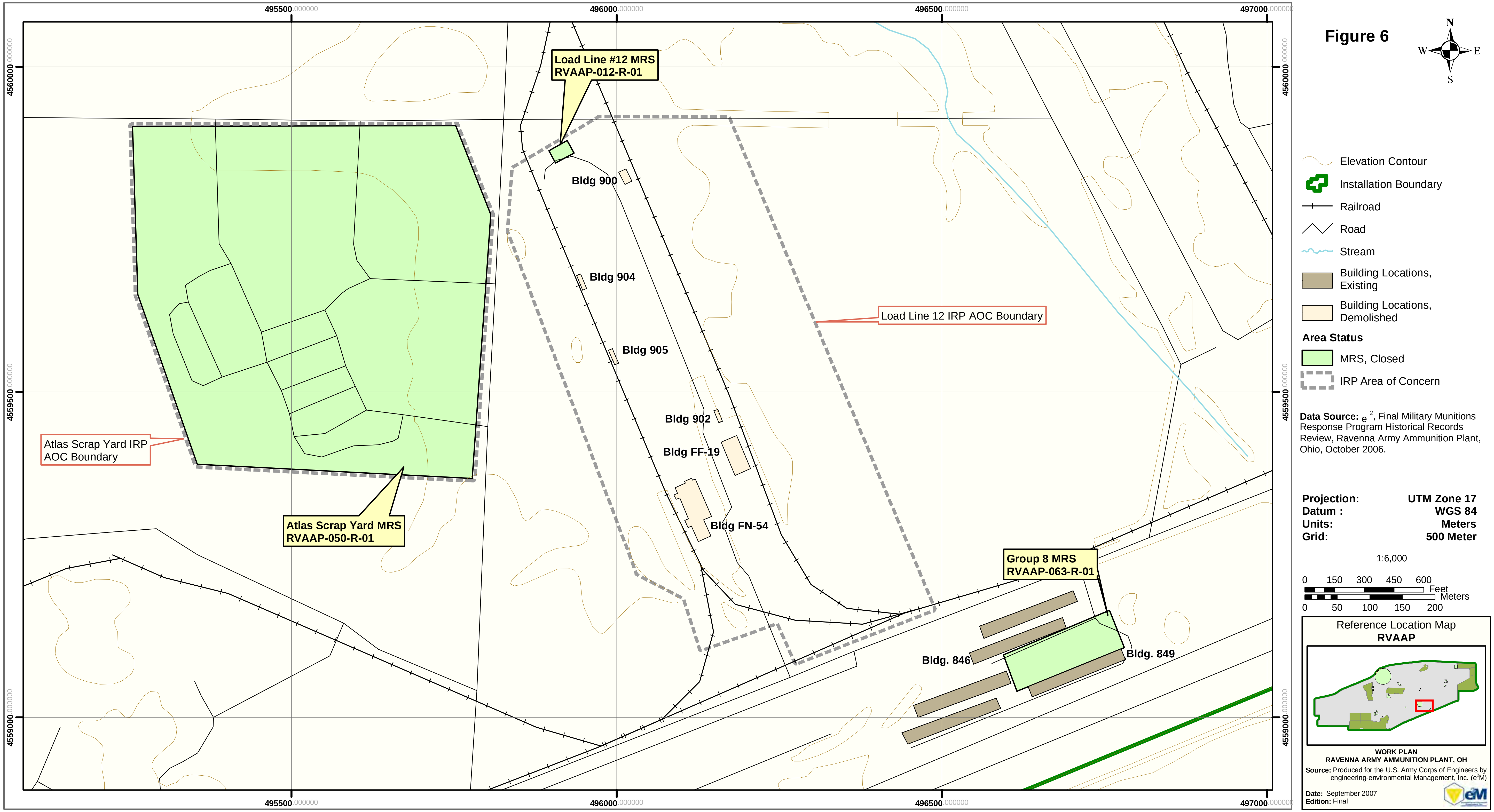
In 1999, 110 90mm rounds were discovered just below the ground surface (covered with a small amount of topsoil) just north of the access road in the northwest corner of the MRS. The rounds were each composed of a casing and projectile, but were void of high explosives (HE). The rounds were removed by MKM Engineers in March 2004 and placed in storage at Igloo 1500. It is unknown who was responsible for dumping and covering the items. On-site personnel indicate the contractor screened the immediate area where the projectiles were found for UXO/ordnance and explosives (OE), but did not extend this search any further. There are no other reports of munitions debris (or MEC) having been found at the MRS. Based on the one reported finding of munitions debris, the breadth of IRP investigations conducted to date at the load line, and input from Installation personnel, the size of the MRS boundary has been reduced to the area immediately surrounding the location where the 90mm projectiles were found (i.e., one acre). The layout of the MRS is provided in **Figure 6**.

Adequate historical data identifying the presence and density of MEC items has not been fully established and will require further evaluation during this SI. Therefore, a magnetometer assisted UXO survey will be conducted at the location and surrounding area where the 90mm projectiles were found. The survey will be conducted to identify any MEC or munitions debris lying on or protruding through the ground surface and any buried anomalies. The intent of the survey is to:

- establish presence/absence of MEC and munitions debris;
- refine the MRS boundary; and
- determine if the area can be eliminated from the MRS footprint or if further characterization is needed.

Adequate analytical data identifying the presence of MC at the MRS has been collected under the IRP and will be used to populate the MRS-PP. Therefore, no samples will be collected from the MRS during this SI. Specific details of the magnetometer assisted UXO survey methods are provided in **Appendix A** (FSP).

LOAD LINE #12, ATLAS SCRAP YARD, and GROUP 8 MRS LOCATIONS
Ravenna Army Ammunition Plant, OH



Data Source: e^2, Final Military Munitions Response Program Historical Records Review, Ravenna Army Ammunition Plant, Ohio, October 2006.

WORK PLAN
RAVENNA ARMY AMMUNITION PLANT, OH
Source: Produced for the U.S. Army Corps of Engineers by engineering-environmental Management, Inc. (e^2M)
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2.6 Fuze and Booster Quarry (RVAAP-016-R-01)

The Fuze and Booster Quarry is an undeveloped parcel that encompasses 12.74 acres located in the southwestern portion of RVAAP, approximately 1.25 miles southwest of Demolition Area #2. The MRS is also collocated with an IRP site. The MRS, which operated from 1945 to 1975, consists of three elongated ponds, situated end to end and separated by berms, which were constructed within an abandoned rock quarry. Prior to the construction of the ponds, the quarry was reported to have been used for open burning of munitions. According to information reported in the US Army CTT Range/Site Inventory, any munitions produced at the Installation could have been disposed at the MRS. This would include rockets, bombs, fuzes, detonators, flares, missiles, grenades, landmines, medium and large caliber ammunition, explosives, mortars, propellant, practice ordnance, pyrotechnics, and small arms. Installation personnel have stated that the northern and southern ponds contain MEC, while there is uncertainty about the contents of the middle pond. At the northern pond, MEC is reportedly visible when the water level is low. At the southern pond, MEC is apparently visible on the banks at all times. **Figure 7** shows the boundary for the Fuze and Booster Quarry MRS.

The presence of MEC and munitions debris on the banks of the ponds is not fully understood and will require further characterization during this SI. Therefore, a magnetometer and metal detector assisted UXO survey of the banks and immediate surrounding area will be conducted. The survey will be conducted to identify any MEC or munitions debris lying on or protruding through the ground surface and any buried anomalies. The intent of the survey is to:

- establish presence/absence of MEC and munitions debris; and
- refine the MRS boundary.

Further characterization work will be required at the ponds (i.e., for submerged MEC) to define the presence of MEC; however, this effort is outside the scope of this SI and will be conducted under additional CERCLA actions.

Chemical contamination at the MRS is being covered under the IRP and will not be investigated further under the MMRP. Therefore, no samples will be collected from the MRS during this SI. Existing analytical data identifying the presence of MC collected under the IRP will be used to populate the MRS-PP. Specific details of the magnetometer/metal detector assisted UXO survey methods are provided in **Appendix A** (FSP).

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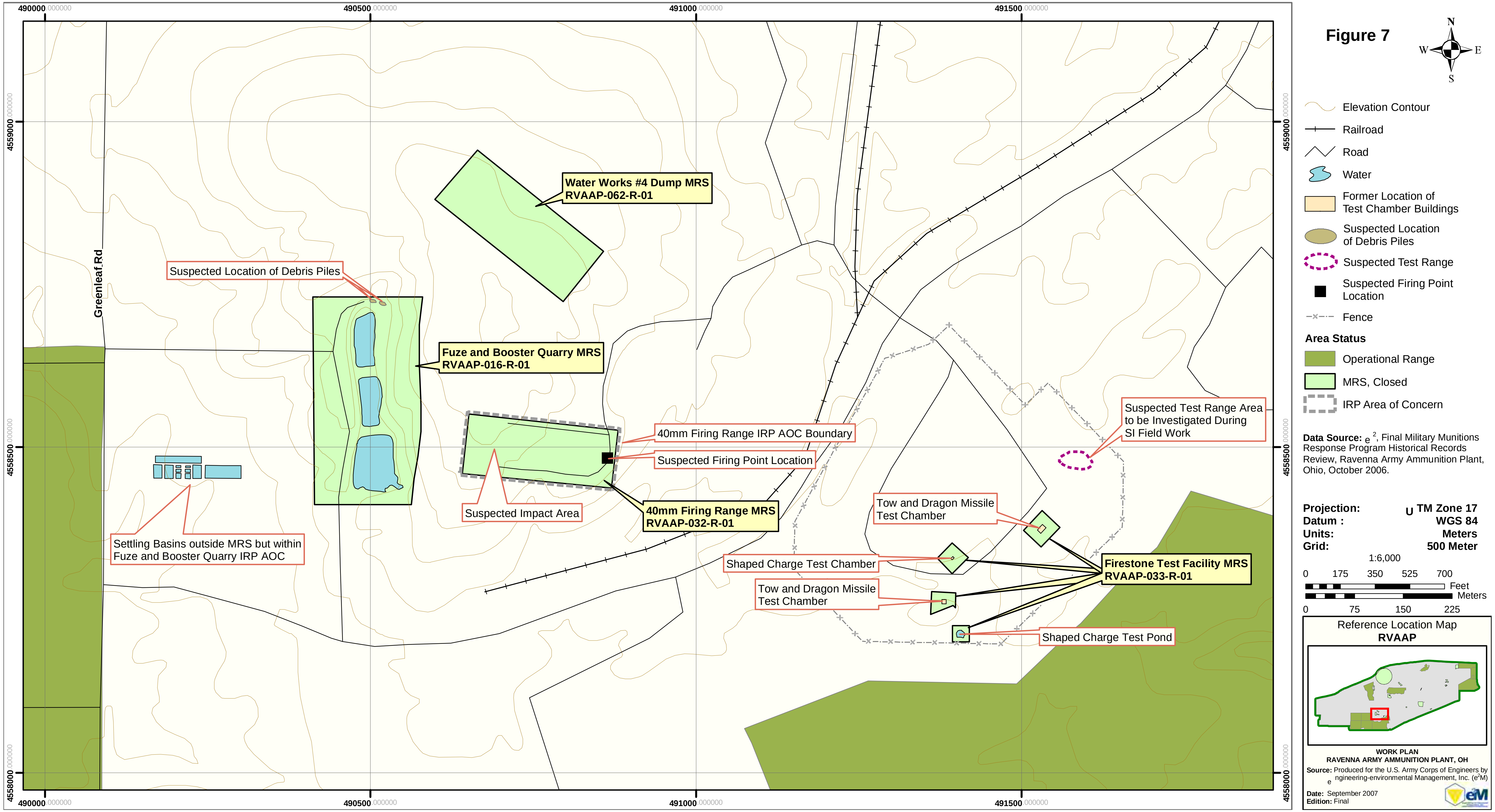
FUZE AND BOOSTER QUARRY, WATER WORKS #4 DUMP, 40mm FIRING RANGE, and FIRESTONE TEST FACILITY MRS LOCATIONS
Ravenna Army Ammunition Plant, OH



Data Source: e^2, Final Military Munitions Response Program Historical Records Review, Ravenna Army Ammunition Plant, Ohio, October 2006.

Projection: UTM Zone 17
Datum : WGS 84
Units: Meters
Grid: 500 Meter

WORK PLAN
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2.7 Landfill North of Winklepeck (RVAAP-019-R-01)

This MRS is described in the US Army CTT Range/Site Inventory as a 7.55 acre unlined landfill that accepted general plant refuse, explosive wastes residue, and open burn waste including flares and booster cups from Winklepeck Burning Grounds. The landfill, which is collocated with an IRP site, is situated on top of a small bluff that overlooks an unnamed stream to the east. Wetlands are associated with the small stream.

Based on information taken from the US Army CTT Range/Site Inventory, it was determined: 1) that MEC (booster cups) and munitions debris (aluminum liners and other nondescript items) are present on the slope leading down to the small stream and within the stream course, which is outside of the MRS boundary identified in the US Army CTT Range/Site Inventory; and 2) that the landfill has been excluded and will continue to be covered under the IRP. Therefore, the MRS boundary has been revised and expanded to 14.05 acres to include the slope area and the adjacent small stream. **Figure 8** shows the revised boundary for the Landfill North of Winklepeck MRS.

The presence of MEC and munitions debris along the slopes and within the stream course is not fully understood and will require further characterization during this SI. Therefore, a magnetometer and metal detector assisted UXO survey will be conducted along the hillside, creek bed, and downstream area. The survey will be conducted to identify any MEC or munitions debris lying on or protruding through the ground surface and any buried anomalies. The intent of the survey is to:

- establish presence and density of MEC and munitions debris; and
- refine the MRS boundary.

Any MEC items subsequently found at the former landfill, which is not covered under the MMRP, will be addressed under the IRP.

Adequate analytical data for the revised MRS does not exist. Therefore, one composite surface soil sample (via 7-wheel method) will be collected and analyzed for explosives, propellants, and TAL metals. The sample will be collected adjacent to a location where MEC and/or munitions debris is discovered. The intent will be to establish the presence of MC and to populate the MRS-PP. Specific details of the magnetometer/metal detector assisted UXO survey methods, sample collection and handling protocols, sample analysis, and sample locations are provided in **Appendix A** (FSP).

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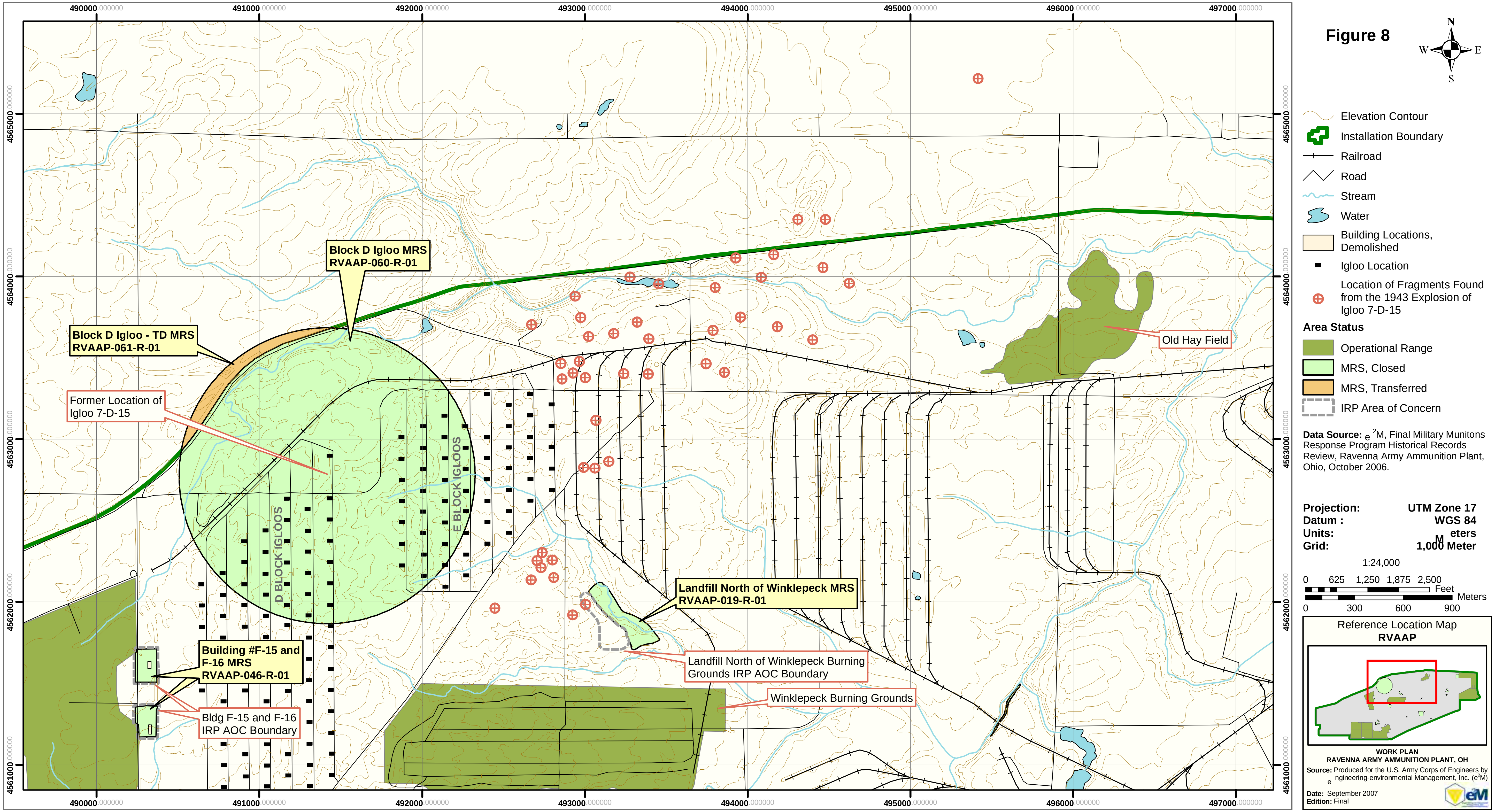
LANDFILL NORTH OF WINKLEPECK, BUILDING #F-15 AND F-16, BLOCK D IGLOO, and BLOCK D IGLOO - TD MRS LOCATIONS
Ravenna Army Ammunition Plant, OH



Data Source: e²M, Final Military Munitons Response Program Historical Records Review, Ravenna Army Ammunition Plant, Ohio, October 2006.

Projection: UTM Zone 17
Datum : WGS 84
Units: Meters
Grid: 1,000 Meter

Source: Produced for the U.S. Army Corps of Engineers by engineering-environmental Management, Inc. (e²M)
Date: September 2007
Edition: Final

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2.8 40mm Firing Range (RVAAP-032-R-01)

This undeveloped MRS encompasses an open field approximately 5.17 acres in size, which is surrounded by forest. The MRS is also collocated with an IRP site. A wooden structure located at the firing point believed to be the former storage shed, the gun mount foundation, and the chronograph foundation are the only remnants from the operational years still present at the MRS (RVAAP-8.A.1). The impact area was sited in the western portion of the MRS, just uphill from the ponds at the Fuze and Booster Quarry, which included a well defined impact area with a backstop. The backstop has since been removed from the MRS. **Figure 7** shows the current layout of the 40mm Firing Range MRS.

The MRS was used during the Viet Nam conflict (i.e., 1969 – 1971) to test the 40mm cartridge. During this period, the rounds tested may have included both the M407A1 practice round and the M406 HE round. The practice rounds contain yellow marker dye, M9 propellant, and royal demolition explosive (RDX) booster pellets, while the M406 HE round contains Composition B and M9 propellant. RVAAP personnel report that UXO is present beyond the impact point, on the slope that leads down to the Fuze and Booster Quarry MRS.

The presence of MEC and munitions debris at the former test range is not fully understood and will require further characterization during this SI. Therefore, a magnetometer and metal detector assisted UXO survey will be conducted at the firing point, impact area, and down range of the impact area. The survey will be conducted to identify any MEC or munitions debris lying on or protruding through the ground surface and any buried anomalies. The intent of the survey is to:

- establish presence/absence of MEC and munitions debris;
- refine the MRS boundary; and
- support the need for further characterization.

Chemical contamination at the MRS is being covered under the IRP and will not be investigated further under the MMRP. Therefore, no samples will be collected from the MRS during this SI. Existing analytical data identifying the presence of MC collected under the IRP will be used to populate the MRS-PP. Specific details of the magnetometer/metal detector assisted UXO survey methods are provided in **Appendix A** (FSP).

2.9 Firestone Test Facility (RVAAP-033-R-01)

The Firestone Test Facility MRS consisted of two buildings and a pond that were situated on the southeastern side of the Load Line 6 Fuze and Booster Area. Load Line 6 is an IRP AOC. The buildings were used as a test chamber for tube-launched, optically-tracked, wire-guided (TOW) missiles and Dragon missiles, while shaped charges were tested under water at the pond. It was also determined that there was an additional building located at the MRS that was used for testing shaped charges. The building, which measured 10 ft high and 10 ft square, was constructed of reinforced concrete and fitted with steel plates, and was surrounded by a barricade constructed of railroad ties. In addition, Installation personnel identified a suspected test range located northeast of the former test facility. The area comprises a small clearing and piles of dirt and large timbers. **Figure 7** shows the current layout of the Firestone Test Facility MRS.

The presence of MEC or munitions debris is not expected at or around the former test chambers since the buildings have been removed. Regardless, a magnetometer and metal detector assisted UXO survey will be conducted to determine if MEC or munitions debris is present. (Note: Magnetometer and metal detectors will only be used at locations that do not have an impervious surface [i.e., concrete or asphalt].) A magnetometer assisted UXO survey will also be conducted at the small clearing in the northeastern portion of the former test facility and the area immediately surrounding the pond. The surveys will be conducted to identify any MEC or munitions debris lying on or protruding through the ground surface and any buried anomalies. The intent of the surveys is to:

- establish presence/absence of MEC and munitions debris;
- refine the MRS boundary; and
- support the need for further characterization at the former test chambers, open field, and area surrounding the pond.

MEC may be present in the pond and will require further characterization under additional CERCLA action. Therefore, UXO surveys of the submerged portion of the pond will not be conducted.

Chemical contamination at the MRS is being investigated under the IRP. However, no data has been collected for the open field, which will be investigated further under this SI. Therefore, one (1) MI surface soil sample will be collected and analyzed for explosives, propellants, and TAL metals. The sample area will be selected based on distinct physical features (e.g., former structures, open areas, soil type). The intent will be to establish the presence of MC and to populate the MRS-PP. Specific details of the magnetometer/metal detector assisted UXO survey methods, sample collection and handling protocols, sample analysis, and sample locations are provided in **Appendix A** (FSP).

2.10 Sand Creek Dump (RVAAP-034-R-01)

The Sand Creek Dump MRS, which is collocated with an IRP AOC, encompasses approximately 0.85 acres of undeveloped land that stretches along the banks of Sand Creek for approximately 1,000 ft. The MRS is split into two sections by a railroad track. The area is heavily overgrown with trees, shrubs, and ground cover. Debris remains at the site and is reportedly entering Sand Creek due to erosion. The dump, which was in operation from 1950 to 1960, was reported by former workers to have been a construction landfill for concrete, wood, asbestos debris, lab bottles, 55-gallon drums, and fluorescent light tubes. During removal activities performed in October of 2003 under the IRP, two demilitarized 75mm projectiles were found at the MRS. The projectiles were removed by MKM Engineers and taken to Building 1501. No other discoveries of munitions debris (or MEC) at the MRS have been reported. **Figure 9** shows the current layout of the Sand Creek Dump MRS.

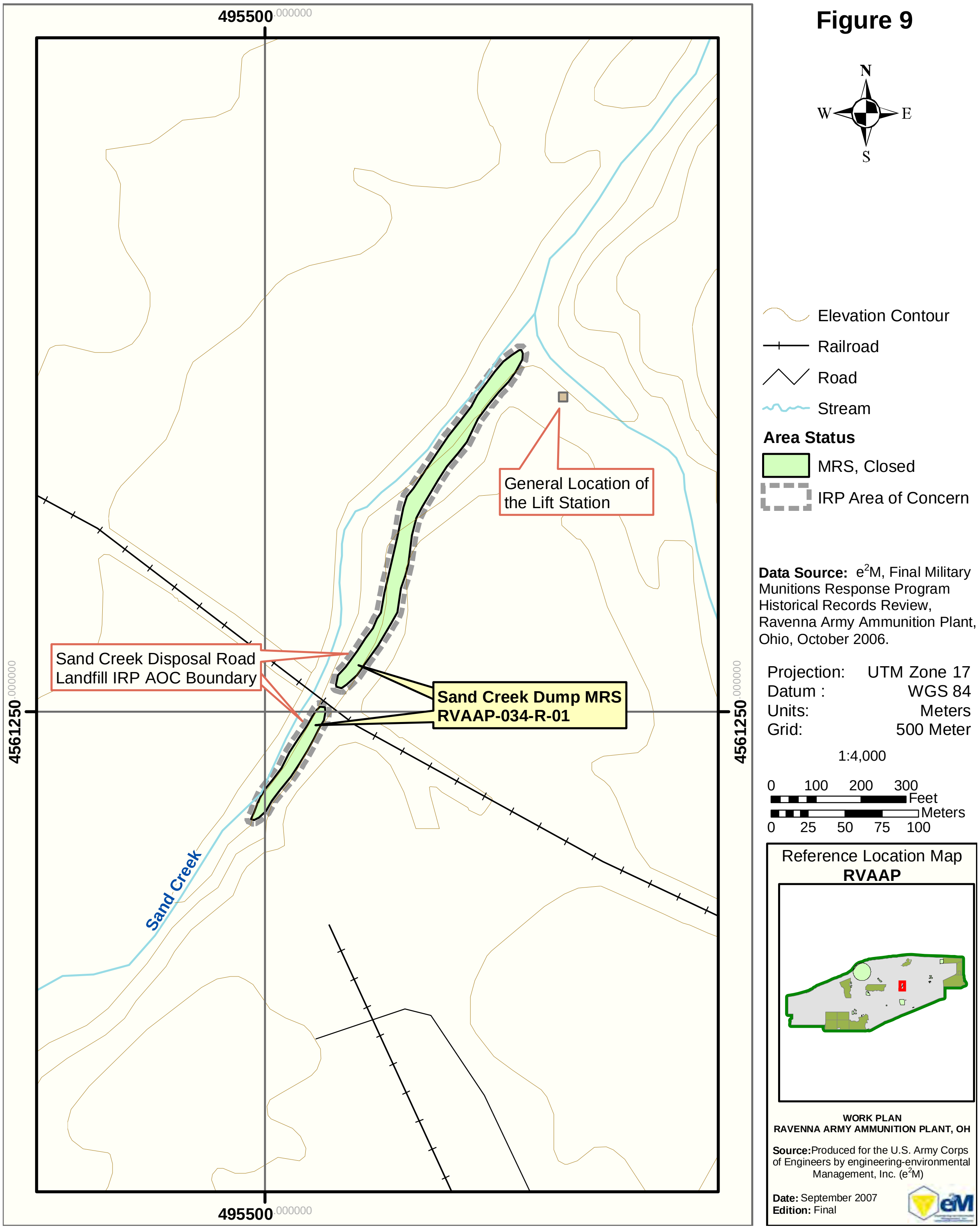
The presence of MEC and munitions debris at the MRS is not fully understood and will require further characterization during this SI. Therefore, a magnetometer assisted UXO survey will be conducted of all open areas surrounding the dump and a UXO survey conducted within accessible areas of the dump. The survey will be conducted to identify any MEC or munitions debris lying on or protruding through the ground surface and any buried anomalies. The intent of the survey is to:

- establish presence/absence of MEC and munitions debris;
- refine the MRS boundary; and
- support the need for further characterization, if necessary.

Chemical contamination at the MRS is being covered under the IRP and will not be investigated further under the MMRP. Therefore, no samples will be collected from the MRS during this SI. Existing analytical data will be used to populate the MRS-PP. Specific details of the magnetometer assisted UXO survey methods are provided in **Appendix A** (FSP).

SAND CREEK DUMP MRS
Ravenna Army Ammunition Plant, OH

Figure 9



Data Source: e^{2}M, Final Military Munitions Response Program Historical Records Review, Ravenna Army Ammunition Plant, Ohio, October 2006.

Projection:	UTM Zone 17
Datum :	WGS 84
Units:	Meters
Grid:	500 Meter

WORK PLAN
RAVENNA ARMY AMMUNITION PLANT, OH

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Date: September 2007
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2.11 Building #F-15 and F-16 (RVAAP-046-R-01)

The MRS, which is collocated with an IRP AOC, encompasses approximately 12.23 acres of undeveloped land. Since the completion of the US Army CTT Range/Site Inventory, the buildings at the MRS have been demolished. At Building F-15, the only remaining feature is the raised foundation. Both the foundation and building debris remain at Building F-16. Prior to their demolition, each building measured approximately 60 ft wide by 120 ft long. The area surrounding the buildings is forested land. The facility was used during WWII, the Korean War, and Vietnam War to test miscellaneous explosives and propellants. Buildings F-15 and F-16 were referred to as the Surveillance Work Shop, where large caliber artillery rounds (type not specified) were dismantled and inspected as part of a cyclic inspection procedure. The procedure involved the random selection of completed rounds from storage which were subsequently dismantled for inspection and testing of individual components (i.e., fuzes, primer, propellant, and HE). **Figure 8** provides the layout of the MRS.

The presence of MEC and munitions debris at the MRS is not fully understood and will require further characterization during this SI. Therefore, a magnetometer assisted UXO survey will be conducted of all accessible areas across the entire MRS. The survey will be conducted to identify any MEC or munitions debris lying on or protruding through the ground surface and any buried anomalies. The intent of the survey is to:

- establish presence/absence of MEC and munitions debris;
- refine the MRS boundary; and
- support the need for further characterization, if necessary.

Chemical contamination at the MRS is being covered under the IRP and will not be investigated further under the MMRP. Therefore, no samples will be collected from the MRS during this SI. Existing analytical data will be used to populate the MRS-PP. Specific details of the magnetometer assisted UXO survey methods are provided in **Appendix A** (FSP).

2.12 Anchor Test Area (RVAAP-048-R-01)

The Anchor Test Area, which is collocated with an IRP AOC, encompasses approximately 2.57 acres of heavily forested land located west and adjacent to Wilcox-Wayland Road. Due to the overgrown conditions, very few remnants of the original facility are visible at the MRS. Identifiable features at the MRS include several dirt mounds and a nearby sandpit. Little is known about the actual function of the MRS, but available information suggests that it was used to test fire experimental explosively-charged anchors into the ground. RVAAP personnel also believe the experimental munitions were used to drive anchors for ropes or cables into the ground. While some metal debris of unknown origin has been found in the area, the MRS has not been evaluated for the presence of MEC. **Figure 10** provides the layout of the Anchor Test Area MRS.

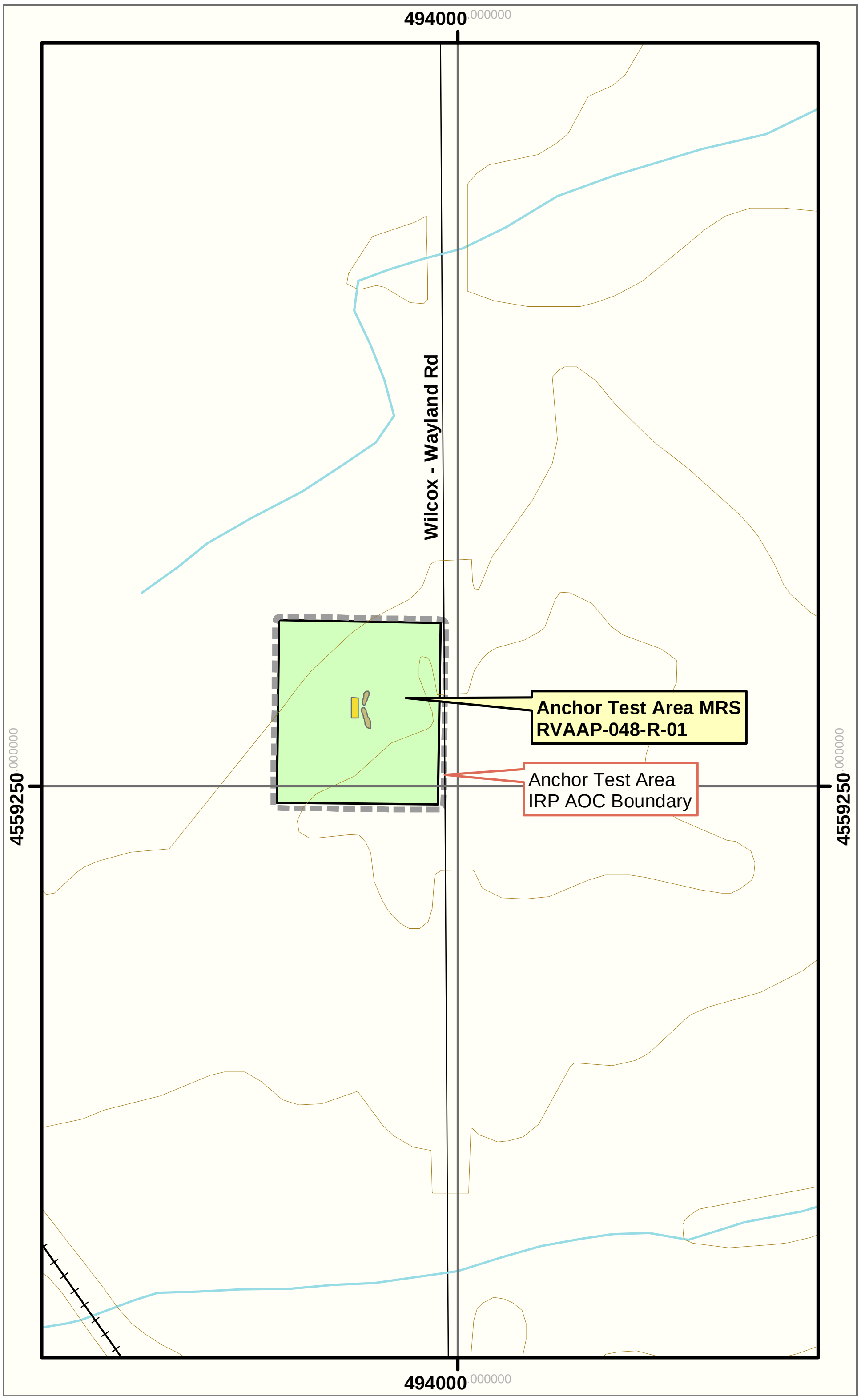
The presence of MEC and munitions debris at the MRS is not fully understood and will require further characterization during this SI. Therefore, a magnetometer assisted UXO survey will be conducted of the entire MRS. The survey will be conducted to identify any MEC or munitions debris lying on or protruding through the ground surface and any buried anomalies. The intent of the survey is to:

- establish presence/absence of MEC and munitions debris;
- refine the MRS boundary; and
- support the need for further characterization, if necessary.

Chemical contamination at the MRS is being covered under the IRP and will not be investigated further under the MMRP. Therefore, no samples will be collected from the MRS during this SI. Existing analytical data will be used to populate the MRS-PP. Specific details of the magnetometer assisted UXO survey methods are provided in **Appendix A** (FSP).

ANCHOR TEST AREA MRS
Ravenna Army Ammunition Plant, OH

Figure 10



N
W E
S

Elevation Contour
Railroad
Road
Stream
🟫 Dirt Mounds
🟨 Sand Pit

Area Status

🟩 MRS, Closed
▭ IRP Area of Concern

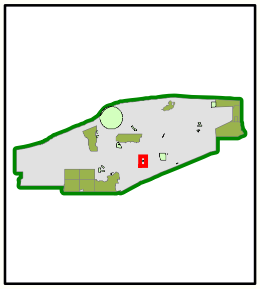
Data Source: e²M, Final Military Munitions Response Program Historical Records Review, Ravenna Army Ammunition Plant, Ohio, October 2006.

Projection:	UTM Zone 17
Datum :	WGS 84
Units:	Meters
Grid:	500 Meter

1:4,000

0 100 200 300 Feet
0 25 50 75 100 Meters

Reference Location Map
RVAAP



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2.13 Atlas Scrap Yard (RVAAP-050-R-01)

The Atlas Scrap Yard MRS, which is included in an IRP AOC, encompasses approximately 66.04 acres of mostly open land that contains a network of roads. Originally used as a construction camp, the MRS became a storage area for non-explosive scrap starting in 1969. Currently, the MRS is heavily overgrown with tall grasses, isolated stands of trees, and shrubs. There are scattered piles of debris located throughout the site that appear to be comprised of construction debris, dunnage, and metal scraps. The layout and general location of the MRS is provided in **Figure 6**.

According to interviews with various RVAAP personnel, any of the munitions made or stored at the plant may have been disposed of in this area including: small arms, explosives, pyrotechnics, propellants, mortars, medium and large caliber munitions, landmines, hand grenades, flares, bombs, detonators, or fuzes. The US Army CTT Range/Site Inventory reported that UXO had been uncovered in the southwest corner of the MRS. This disclosure was based on information provided in a removal report funded by the Joint Munitions Command (JMC); however, the name of the reference was not provided and could not be verified. Further, the report stated that the OE, OE scrap, and UXO had been sorted and removed from the site in 2003. Again, this information could not be verified.

The presence of MEC and munitions debris at the MRS is not fully understood and will require further characterization during this SI. Magnetometer assisted UXO surveys will be conducted in the south-central, north-central, and eastern portion of the MRS. These locations were selected based on available information presented in the US Army CTT Range/Site Inventory and HRR, and represent areas with the highest potential to contain MEC. The survey will be conducted to identify any MEC or munitions debris lying on or protruding through the ground surface and any buried anomalies. The intent of the survey is to:

- establish presence/absence of MEC and munitions debris;
- refine the MRS boundary; and
- support the need for further characterization, if necessary.

Chemical contamination at the MRS is being covered under the IRP and will not be investigated further under the MMRP. Therefore, no samples will be collected from the MRS during this SI. Existing analytical data will be used to populate the MRS-PP. Specific details of the magnetometer assisted UXO survey methods are provided in **Appendix A** (FSP).

2.14 Block D Igloo (RVAAP-060-R-01)

This MRS consists of the area (circle with a 3,000 ft radius) contained within the suspected debris field that resulted when Igloo 7-D-15 ("D" Block) accidentally exploded on 24 March 1943. The MRS boundary was established by the USACE, Huntsville District to capture the probable debris field resulting from the explosion and was based on the type of munitions stored in the bunker at the time of the explosion. The layout of the MRS is provided in **Figure 8**.

The explosion was attributed to a combination of rough handling and a faulty design of the M-110 fuze which left the fuze in the armed position. The result was the detonation of 2,516 clusters (M-1A1) of 20 lb fragmentation bombs (M-41) that were being loaded into the storage magazine. The igloo, which was 60 ft long and constructed of reinforced concrete, was filled to 95 percent capacity at the time of the detonation while a few of the bomb crates remained on the semi-trailer from which the bombs were being off loaded. The trailer completely disintegrated in the blast while remnants of the associated truck were hurled forward 500 to 600 feet. Other items found and the distances recorded included the igloo's steel door, which was propelled forward approximately 1,800 ft; a concrete fragment that was propelled 1,800 ft to the north striking a small sawmill; and a concrete fragment that hit igloo 2-E-6 located approximately 2,100 ft forward of igloo 7-D-15.

Observations made at the scene determined that the earthen embankments held the force of the explosion at the base so that the side-walls of the igloo sheared off at the footings. It was reported that the blast formed two fans: the first and smaller fan was roughly circular in shape and extended to the right, to the rear, and to the left of the igloo, while the larger fan extended forward from the igloo in an easterly direction toward the "E" block of igloos. The major force was directed along a median line in conjunction with the long axis of the igloo. Large sections of concrete were lifted up and over the earthen embankments, while smaller sections traveled in the fan shaped blast to the right and left of the median line on an approximate sixty to eighty degree angle. Some of the concrete fragments were propelled forward in the larger of the two fans up to 3,800 ft. There was no mention of the distance that the smaller fan stretched. After conducting searches of the Installation some time after the detonation, RVAAP personnel indicated that the site was considered clean of UXO. However, no documentation was found during the HRR to support this statement. Therefore, the entire MRS is considered to potentially contain MEC or munitions debris.

The presence of MEC and munitions debris at the MRS is not fully understood and will require additional investigation. However, the size (622 acres) and complexity (dense forest and understory) of this MRS precludes an exhaustive investigation. As such, the MRS will remain in the MMRP and will require additional site investigation before a final disposition can be determined. Therefore, a magnetometer assisted UXO survey will only be conducted in and around the area where the former igloo was located and at documented/mapped locations where debris from the March 1943 explosion were found. The total area to be surveyed surrounding the former igloo and the documented locations of debris will not exceed six (6) acres. A large number of the locations of documented/mapped debris were determined during the HRR to fall outside the MRS foot print; however, the Stakeholders agreed that these documented locations should be included in the SI field work. The survey will be conducted to identify any MEC or munitions debris lying on or protruding through the ground surface and any buried anomalies. The intent of the survey is to:

- establish presence/absence of MEC and munitions debris.

Due to the limited scope of the SI, the investigation of MEC at the MRS will require additional investigation under future CERCLA actions.

Analytical data for the MRS does not exist. Therefore, one composite surface soil sample (via 7-wheel method) will be collected from the former igloo area and analyzed for explosives and TAL metals. Propellants are not included in the analytical suite since the M-110 fuze contained an azide compound and the M-41 fragmentation bomb contained TNT. The intent of the sampling will solely be to populate the MRS-PP. Specific details of the magnetometer assisted UXO survey methods, sample collection and handling protocols, sample analysis, and sample locations are provided in **Appendix A** (FSP).

2.15 Block D Igloo–TD (RVAAP-061-R-01)

The Block D Igloo–TD consists of the portion of the circle centered on Igloo 7-D-15 (Block D Igloo MRS RVAAP-060-R-01) that exploded on 24 March 1943 that extends beyond the Installation boundary. This property, which encompasses 19.25 acres, is considered separately as a transferred site. The MRS is located to the northwest of Igloo 7-D-15 and consists of farm fields that are separated by stands of woodlands, railroad tracks, and a right-of-way. The right-of-way runs adjacent to the RVAAP property boundary, separating the wooded areas and farm fields from the Installation. This area represents the debris field of the smaller of the two fans (See **Section 2.14**) that resulted from the explosion. Additional information (USACE Rock Island District map) discovered during the HRR revealed that debris was also found off the installation to the north and east of the former igloo. This debris field is attributed to the larger of the two fans that resulted from the explosion. Since the initial findings, no additional discoveries of debris have been reported. **Figure 8** shows the layout of the Block D Igloo–TD MRS.

The presence of MEC and munitions debris at the MRS is not fully understood and will require additional investigation. However, the size (19.25) and complexity (topography and areas of dense forest and understory) of this MRS precludes an exhaustive investigation. As such, the MRS will remain in the MMRP and will require additional site investigation before a final disposition can be determined. Therefore, a magnetometer and metal detector assisted UXO survey will be conducted within the entire MRS foot print and at documented/mapped locations where debris from the March 1943 explosion were found. The locations of the documented/mapped debris were determined during the HRR to fall outside the MRS foot print; however, the Stakeholders agreed that these documented locations should be included in the SI field work. The survey will be conducted to identify any MEC or munitions debris lying on or protruding through the ground surface and any buried anomalies. The intent of the survey is to:

- establish presence/absence of MEC and munitions debris.

Analytical data for the MRS does not exist. Therefore, two (2) composite surface soil samples (via 7-wheel method) will be collected from the MRS and analyzed for explosives and TAL metals. Propellants are not included in the analytical suite since the M-110 fuze contained an azide compound and the M-41 fragmentation bomb contained TNT. The intent of the sampling will solely be to populate the MRS-PP. Specific details of the magnetometer/metal detector assisted UXO survey methods, sample collection and handling protocols, sample analysis, and sample locations are provided in **Appendix A** (FSP).

2.16 Water Works #4 Dump (RVAAP-062-R-01)

The Water Works #4 Dump is an approximate 6.15 acre wooded area located immediately west of Water Works #4 and Load Line 7, in the southwestern portion of RVAAP. Large caliber casings were found scattered throughout the MRS lying on the ground surface and partially buried, as were metal parts defined as ogives from WWI 155mm shrapnel projectiles. According to RVAAP personnel, the dates of disposal are estimated to be between 1941 and 1949. The type and origin of the casings is unknown. **Figure 7** provides the layout of the MRS.

The presence of MEC and munitions debris at the MRS is not fully understood and will require further characterization during this SI. Therefore, a magnetometer assisted UXO survey will be conducted of the entire MRS. The survey will be conducted to identify any MEC or munitions debris lying on or protruding through the ground surface and any buried anomalies. The intent of the survey is to:

- establish presence/absence of MEC and munitions debris;
- refine the MRS boundary; and
- support the need for further characterization, if necessary.

Analytical data identifying the presence or absence of MC at the MRS has not been collected. Therefore, one (1) composite surface soil sample (via the 7-wheel method) will be collected and analyzed for explosives, propellants, and TAL metals. The intent will be to establish the presence of MC and to populate the MRS-PP. Specific details of the magnetometer assisted UXO survey methods, sample collection and handling protocols, sample analysis, and sample locations are provided in **Appendix A** (FSP).

2.17 Group 8 MRS (formerly Area Between Buildings 846 and 849) (RVAAP-063-R-01)

Based on a request by the OHARNG, the name of the MRS was changed in the AEDB-R database on 29 March 2007 from the "Area Between Buildings 8446 and 849" to "Group 8 MRS". The MRS encompasses 2.65 acres and consists of most of the area between Buildings 846 and 849. This area is disturbed land currently being used as an OHARNG vehicle staging area. The land between the buildings may have been used for burning of construction debris and rubbish in the past. In 1996, one anti-personnel fragmentation bomb (referred to as a "hammerhead" anti-personnel bomb) loaded with HE was found at the MRS. The bomb was taken to Demolition Area #2 and detonated at the RCRA unit by a Ordnance Company that had been dispatched from Wright-Patterson Air Force Base. OHARNG personnel discovered the bomb. In addition, one demilitarized (i.e., cut into two halves) 175mm projectile was found on the ground surface at the MRS. The demilitarized projectile was removed and taken to Building 1501. **Figure 6** provides the layout of the MRS.

The presence of MEC and munitions debris at the MRS is not fully understood and will require further characterization during this SI. Therefore, a magnetometer and metal detector assisted UXO survey will be conducted of the entire MRS. The survey will be conducted to identify any MEC or munitions debris lying on or protruding through the ground surface and any buried anomalies. The intent of the survey is to:

- establish presence/absence of MEC and munitions debris;
- refine the MRS boundary; and
- support a NFA recommendation, if appropriate.

Analytical data identifying the presence or absence of MC at the MRS has not been collected. Therefore, five (5) MI surface soil samples will be collected and analyzed for explosives, propellants, and TAL metals. The sample areas will be selected based on the physical layout of the location (i.e., areas of equal topographic elevation, soil type, vegetation). The intent will be to establish the presence of MC and to populate the MRS-PP, and to provide information to support an NFA recommendation. Specific details of the magnetometer/metal detector assisted UXO survey methods, sample collection and handling protocols, sample analysis, and sample locations are provided in **Appendix A** (FSP).

3.0 SCOPE OF WORK

This MMRP SI includes the following three interrelated tasks:

- HRR – consists of identifying data gaps from the Phase 3 CTT Range/Site Inventory (Preliminary Assessment [PA]) and obtaining and reviewing historical records to fill these gaps;
- TPP Session – consists of planning activities to identify project objectives and design data collection programs to meet these objectives; and
- SI Field Sampling and Reporting – consists of performing field investigation activities at the MRSs and preparing an SI report of the findings, including scoring each MRS using the MRS-PP.

3.1 Historical Records Review

The intent of the HRR was to perform a records search to document historical and other known information for the MRSs identified at RVAAP, to supplement the US Army CTT Range/Site Inventory information, and to support the TPP process designed to facilitate decisions on those areas where more information is needed to determine the next step(s) in the CERCLA process.

A CSM was prepared and submitted with the HRR report to help determine current or reasonably anticipated human and environmental exposures to MEC and MC by identifying potential human and ecological receptors. The CSM provided a conceptualization of the following on site conditions:

- physical and ecological profiles;
- actual or the reasonably anticipated presence of MEC and MC;
- actual or reasonably anticipated points of exposure and exposure pathways; and
- actual or reasonably anticipated future human and ecological receptors.

The CSM is a flexible tool that can be used to assist and streamline the decision making process when developing an investigative approach used to characterize a site. In brief, the CSM allows for a focusing of the investigation tailored toward the current or reasonably anticipated exposure scenarios that are most critical to human health and the environment.

The Final HRR Report was submitted in January 2007 to the Stakeholders, USACE, and USAEC.

3.2 TPP Process

The TPP process is a comprehensive and systematic method that involves four phases of planning activities. It was developed to identify project objectives and design data collection programs for hazardous, toxic, and radioactive waste (HTRW) sites. Use of the TPP process is consistent with the philosophy of taking a gradual approach to planning that will produce the type and quality of results needed for site-specific decision making.

The TPP 2 session was held at RVAAP on 10 August 2006 and the minutes of this meeting are presented in **Appendix D**. While the TPP 2 session did not result in providing MRS-specific direction for planning the SI sampling/field activities, it did serve to identify Installation and Ohio EPA concerns for each MRS and convey the level of effort and robustness of investigations that typically are conducted at RVAAP. Further discussions were held between Ohio EPA, USACE, and e^{2}M on 13 March 2007 on proposed sampling and analytical methods, and the burden of proof required to characterize and eliminate a site for further action. Because of the known presence of MEC and MC at multiple sites, further characterization under additional CERCLA action will be required. At these sites, it was determined that the SI level of effort should only focus on collecting data that will further these additional investigations and/or the need for immediate action. **Table 2** provides a summary of the decisions made concerning the MRSs.

Table 2: Summary of MEC and MC Decisions

MRS	MEC	MC
Ramsdell Quarry Landfill	Perform magnetometer/metal detector assisted UXO survey.	Collect surface soil samples in south quarry to assess presence/absence of MC and populate the MRS-PP.
Erie Burning Grounds	Perform magnetometer assisted UXO survey.	Surface soil sampling will not be conducted. Existing analytical data will be used to populate MRS-PP.
Demolition Area #2	Perform magnetometer assisted UXO survey.	Surface soil sampling will not be conducted. Existing analytical data will be used to populate MRS-PP.
Load Line #1	Perform magnetometer assisted UXO survey.	Collect surface soil sample from propellant location to assess presence/absence of MC and populate the MRS-PP.
Load Line #12	Perform magnetometer assisted UXO survey.	Surface soil sampling will not be conducted, site covered under IRP. Existing analytical data will be used to populate MRS-PP.
Fuze and Booster Quarry	Perform magnetometer/metal detector assisted UXO survey.	Surface soil sampling will not be conducted, site covered under IRP. Existing analytical data will be used to populate MRS-PP.
Landfill North of Winklepeck	Perform magnetometer/metal detector assisted UXO survey.	Collect surface soil sample from within the footprint of the new MRS solely to assess preence/absence of MC and populate the MRS-PP.

Table 2: Summary of MEC and MC Decisions (continued)

MRS	MEC	MC
40mm Firing Range	Perform magnetometer/metal detector assisted UXO survey.	Surface soil sampling will not be conducted, site covered under IRP. Existing analytical data will be used to populate MRS-PP.
Firestone Test Facility	Perform magnetometer/metal detector assisted UXO survey.	Collect surface soil sample from the open field area to assess presence/absence of MC and populate the MRS-PP.
Sand Creek Dump	Perform magnetometer assisted UXO survey.	Surface soil sampling will not be conducted, site covered under IRP. Existing analytical data will be used to populate MRS-PP.
Building #F-15 and F-16	Perform magnetometer assisted UXO survey.	Surface soil sampling will not be conducted, site covered under IRP. Existing analytical data will be used to populate MRS-PP.
Anchor Test Area	Perform magnetometer assisted UXO survey.	Surface soil sampling will not be conducted, site covered under IRP. Existing analytical data will be used to populate MRS-PP.
Atlas Scrap Yard	Perform magnetometer assisted UXO survey.	Surface soil sampling will not be conducted, site covered under IRP. Existing analytical data will be used to populate MRS-PP.
Block D Igloo	Perform magnetometer assisted UXO survey of select areas.	Collect surface soil sample from former Igloo solely to populate MRS-PP.
Block D Igloo–TD	Perform magnetometer/metal detector assisted UXO survey.	Collect surface soil samples from MRS solely to populate MRS-PP.
Water Works #4 Dump	Perform magnetometer assisted UXO survey.	Collect surface soil sample from MRS to assess presence/absence of MC and populate the MRS-PP.
Group 8 MRS (formerly known as Area Between Buildings 846 and 849)	Perform magnetometer/metal detector assisted UXO survey.	Collect surface soil samples from MRS to assess presence/absence of MC and to populate the MRS-PP.

3.3 Field Activities

The intent of the field work is to collect the information necessary to assist in the determination of what actions, if any, are to be taken at the MRSs. Therefore, from the data collected a decision can be made on whether further investigation is required at the site(s), an immediate response is required, or the site(s) qualifies for a NFA. However, if new evidence should arise indicating that a potential problem exists at an "NFA" site, then the site would be reopened and investigated further under the MMRP. The information collected should also be sufficient to assist in refining the MRS CTC estimates and the MRS-

PP. To obtain the information necessary to make these determinations, magnetometer assisted (and metal detector assisted at selected MRSs) UXO surveys will be performed, along with the collection of surface soil samples. Again, at sites where further characterization is likely the SI field activities will be focused on collecting data that will aid future investigations (e.g., refining MRS boundaries) and/or the need for immediate action (i.e., presence of MPPEH).

3.3.1 MEC Field Activities

The primary goal of the MEC field activities is to find sufficient evidence to show if MEC are present at a site. In general, encountering just one MEC item is sufficient evidence to determine that additional work is necessary to characterize a particular MRS. A secondary goal is to use the MEC field activities to refine site boundaries. To make this determination, the SI field activities will consist of magnetometer UXO surveys (and metal detector assisted at select MRSs) of each MRS. The type of detector to be used, and at which MRSs, will be based on the historical data that was gathered during the HRR. At sites where ferrous munitions are known to be present, a magnetometer will be used to screen for MEC, while a magnetometer and metal detector will be used at sites that are know to contain both ferrous and non-ferrous munitions. Further, at MRSs that have data gaps concerning the type of munitions that are present, both devices will be used.

A handheld magnetic gradiometer (e.g., Schonstedt or equivalent) and/or metal detector (White Matrix M6 or equivalent) will be used by the UXO survey team to assist in locating buried ferrous and non-ferrous metallic items and items lying on the ground surface obscured by vegetation. The primary factors that affect the ability of magnetic gradiometers to detect objects or features include: size and mass of the object, orientation, distance from the sensor (depth) and the material properties contrast between the object or feature and the surrounding materials. However, the general operating capabilities of a Schonstedt GA-52Cx can detect a small nail (i.e., 1¼ inch PK nail) buried 12-inches and a 18-inch length of ¾-inch diameter pipe buried at 9 feet. The sweep team, consisting of two UXO Technicians, will use the line abreast and a random meandering method to conduct the surveys at the MRSs.

The line abreast method will be used to assess small areas (i.e., generally less than 10 acres) to achieve 100 percentage coverage of the area of concern. This method involves team members walking side by side; separated by a distance that does not exceed coverage of the adjoining person's field of view (approximately 5 to 6 feet in open areas). Each team member will visually examine and sweep his search area with a magnetometer and/or metal detector to locate metallic objects that may be MEC, munitions debris, or cultural debris. To assist the field teams in maintaining relatively straight survey lines and achieving 100 percent coverage of the survey area, GPS referenced end and intermediate points will be marked with pin flags, wooden stakes, or traffic cones.

In large open areas (i.e., greater than 10 acres), the random meandering survey method will be used to assess the site. This approach is performed by randomly walking across the MRS in an unsystematic pattern. Each team member will visually examine and sweep his search area with a magnetometer and/or metal detector to locate metallic objects that may be MEC, munitions debris, or cultural debris.

Visual surveys will be conducted in areas that inherently have significant cultural interference or are known only to contain propellant (i.e., Load Line #1). This can include areas that are covered with an impervious surface (e.g., reinforced concrete), have been altered and contain fill (e.g., road ways, railroad tracks, etc.), or have extensive buried utilities.

Items that are discovered lying on the ground surface or protruding through the ground surface will be identified, to the extent possible, and have their location recorded with a Global Positioning System (GPS) unit. For this SI effort, a Trimble GEO XT handheld sub-centimeter GPS unit will be used during the field investigation. Buried anomalies that are detected will be noted but not excavated to determine their identity. As MEC items are discovered, the team members will mark their location in the field with a pin flag for identification, take a digital photograph and record the finding in a bound notebook and record their location. At the end of each field day Daily Quality Control Reports (DQCRs) will be filled out recording each day's events and findings. Munitions debris items will be counted and reported on a per area basis. Munitions debris are defined as remnants of munitions, including fragments, penetrators, projectiles, shell casings, links, fins, etc. that remain after munitions use, demilitarization, or disposal. In general, munitions debris does not contain energetic material. The items will not be removed or have their geographic coordinates recorded. When MEC is encountered during the UXO surveys, it will be marked and the USACE, Omaha Project Manager, Installation point of contact (POC), Ohio EPA, and e^{2}M TPM will be notified, and a decision made on the next course of action. Under no circumstances will MEC be handled, moved, or disturbed during the SI field activities.

Table 3 summarizes the proposed UXO survey activities to be conducted at each MRS and the rationale to assess the presence of MEC.

Table 3: Proposed UXO Survey Activities

MRS	MEC Survey	Design/Rationale
Ramsdell Quarry Landfill	Perform meandering path UXO survey of old OB/OD area in quarry (~3 acres) and line abreast magnetometer/metal detector assisted UXO survey of the open northeastern section of the southern quarry area (~2 acres). A meandering path UXO survey will be performed within the remaining area at the southern quarry area. The NE quadrant of the southern quarry is the suspected former OB/OD area; as such, a line abreast survey method will be used to provide 100 percent coverage. A meandering path survey will be used in the remaining area of the southern quarry to identify kick-out of munitions resulting from OB/OD operations.	Identify presence/absence of MEC lying on the ground surface in southern quarry, and determine if area can be eliminated from MRS footprint or if further characterization is needed. UXO survey of OB/OD quarry area conducted to support further characterization and to substantiate MRS footprint. Presence of MEC at former OB/OD quarry area has been established and will require additional characterization under future CERCLA action, thus limited UXO survey efforts. Observation of one MEC item is sufficient to require further characterization at a MRS. Combination of UXO surveys in the OB/OD area and southern quarry is designed to provide greatest possible coverage.
Erie Burning Grounds	Perform meandering path magnetometer assisted UXO survey of all accessible dry areas (~14 acres). The presence of MEC in the flooded sections of EBG is expected. However, the investigation of the flooded area is outside the scope of this SI and will require additional characterization in future CERCLA investigations.	UXO survey to substantiate presence of MEC and to determine type, if possible. Survey will be conducted to support further characterization work under future CERCLA action. Presence of MEC within the flooded areas is suspected and will require additional characterization under future CERCLA action, thus limited UXO survey efforts. Observation of one MEC item is sufficient to require further characterization at a MRS. Planned UXO survey is designed to provide greatest possible coverage of dry areas within the MRS.

Table 3: Proposed UXO Survey Activities (continued)

MRS	MEC Survey	Design/Rationale
Demolition Area #2	Perform meandering path magnetometer assisted UXO survey of Bomb Disposal Area, 2 Burial Sites, and Rocket Ridge, and associated surrounding areas (~ 6–12 acres). Perform meandering path magnetometer assisted UXO survey along the current boundary of the MRS footprint.	Establish locations and substantiate boundaries of the four areas identified. Refine current boundary of the MRS footprint. Support MEC further action determination at these areas. MEC is known to exist throughout remainder of MRS and will require further investigation under additional CERCLA action. Observation of one MEC item is sufficient to require further characterization at a MRS. Planned UXO survey is designed to provide greatest possible coverage of subject areas within the MRS.
Load Line #1	Perform meandering path UXO survey within and surrounding the location where propellants are discovered, and include the areas around Buildings CB-13, CB-13B, CB-14, and the popping furnace (~ 1 acre).	Survey will be performed to confirm presence, density, and location of any remaining propellant, and to substantiate the MRS footprint. Site will require further characterization under future CERCLA action. Observation of one MEC item is sufficient to require further characterization at a MRS. Presence of triple base propellants has been established.
Load Line #12	Perform line abreast magnetometer assisted UXO survey of the location and surrounding area where the buried inert 90mm projectiles were recovered (~ 1 acre).	Presence and density of MEC and/or munitions debris is not fully understood. Survey will be conducted to identify presence/absence of MEC and substantiate the MRS footprint. Site may require further characterization under future CERCLA action. Observation of one MEC item is sufficient to require further characterization at a MRS. Planned UXO survey is designed to provide greatest possible coverage of subject area.

Table 3: Proposed UXO Survey Activities (continued)

MRS	MEC Survey	Design/Rationale
Fuze and Booster Quarry	Perform meandering path magnetometer/metal detector assisted UXO survey of the banks and surrounding area at all three ponds (~ 2 acres). Due to safety concerns (i.e., steep uneven terrain) a meandering path survey method has been selected for the MRS.	Presence of MEC or munitions debris on the banks of the ponds is not fully understood. Survey will be conducted to determine presence/absence of MEC and substantiate the MRS footprint. MEC in ponds is suspected and will require further characterization under future CERCLA action. Observation of one MEC item is sufficient to require further characterization at a MRS. Planned UXO survey is designed to provide greatest possible coverage of the banks to identify MEC.
Landfill North of Winklepeck	Perform meandering path magnetometer/metal detector assisted UXO survey of the hillside and creek bottom adjacent and down stream of the former landfill area (~ 15 acres).	Presence of MEC or munitions debris are known to exist, but not fully understood within the stream course. Survey will be conducted to determine presence/absence of MEC and to substantiate the MRS footprint. MEC uncovered in the former landfill area will be addressed under the IRP. Site will require further characterization under future CERCLA action. Observation of one MEC item is sufficient to require further characterization at a MRS. Planned UXO survey is designed to provide greatest possible coverage of the MRS.
40mm Firing Range	Perform meandering path magnetometer/metal detector assisted UXO survey of down range target area, overshot area, and firing point (~ 3 acres). Due to safety concerns (i.e., uneven steep terrain at the impact area) a meandering path survey method has been selected for the 40mm MRS.	Presence of MEC is not fully understood. Survey will be conducted to determine presence/absence of MEC and substantiate the MRS footprint. Site will require further characterization under future CERCLA action. Observation of one MEC item is sufficient to require further characterization at a MRS. Planned UXO survey is designed to provide greatest possible coverage of subject areas.

Table 3: Proposed UXO Survey Activities (continued)

MRS	MEC Survey	Design/Rationale
Firestone Test Facility	Perform line abreast magnetometer/metal detector assisted UXO survey around former test chambers and at the open field in the eastern end of the MRS (~ 0.5 acres). Perform meandering path magnetometer/metal detector assisted UXO survey around the pond area (~ 0.5 acres). Magnetometers/metal detectors will only be used on bare ground surfaces. No water surveys of the pond will be conducted. Line abreast methods were selected to provide 100 percent coverage of areas that have the greatest potential to contain MEC. A meandering path survey was selected for the area surrounding the pond since munitions were tested underwater and are not expected outside this area.	Presence of MEC is not expected at or around the former test chambers or open field. Survey will be conducted to determine presence/absence of MEC and substantiate the MRS footprint around the former test chambers, open field, and area surrounding the pond. MEC may be present in the pond and will require further characterization under additional CERCLA action. Observation of one MEC item is sufficient to require further characterization at a MRS. Combination of UXO surveys is designed to provide greatest possible coverage of subject areas.
Sand Creek Dump	Perform meandering path magnetometer assisted survey of all open areas and UXO survey within dump area (~ 1 acre). A meandering path survey method was selected to avoid vegetation and other obstructions located at the MRS.	Presence of MEC is not fully understood. Survey will be conducted to identify presence/absence of MEC and to substantiate the MRS footprint. Site may require additional characterization work under future CERCLA action. Observation of one MEC item is sufficient to require further characterization at a MRS. Planned UXO survey is designed to provide greatest possible coverage of the MRS.
Building #F-15 and F-16	Perform meandering path magnetometer assisted UXO survey of the entire MRS (~ 12 acres).	Presence of MEC and munitions debris lying on the ground surface and potentially buried are not fully understood. Survey will be conducted to determine presence/absence of MEC and to substantiate MRS footprint. Site may require additional characterization work under future CERCLA action. Observation of one MEC item is sufficient to require further characterization at a MRS. Planned UXO survey is designed to provide greatest possible coverage of the MRS.

Table 3: Proposed UXO Survey Activities (continued)

MRS	MEC Survey	Design/Rationale
Anchor Test Area	Perform line abreast magnetometer assisted UXO survey of entire MRS (~ 3 acres).	Presence of MEC and munitions debris lying on the ground surface and potentially buried are not fully understood. Survey will be conducted to determine presence/absence of MEC and substantiate the MRS footprint. Site may require additional characterization work under future CERCLA action. Observation of one MEC item is sufficient to require further characterization at a MRS. Planned UXO survey is designed to provide greatest possible coverage of the MRS.
Atlas Scrap Yard	Perform line abreast magnetometer assisted UXO survey in the south-central section of the MRS where MEC and munitions debris have reportedly been found and a meandering path magnetometer assisted UXO survey around debris piles that remain at the MRS (~ 12 acres).	Presence of MEC is not fully understood. Survey will be conducted to determine presence/absence of MEC and to substantiate the MRS footprint. Site may require additional characterization under future CERCLA action. Observation of one MEC item is sufficient to require further characterization at a MRS. Combination of UXO surveys is designed to provide greatest possible coverage of the MRS.
Block D Igloo	Perform meandering path magnetometer assisted UXO survey around former igloo and documented locations where debris were found. Area to be surveyed not to exceed 1 percent total of the MRS area (~ 6 acres).	Presence of MEC is not fully understood. Limited survey to identify the presence of MEC at areas where derbis has previously been found. Due to size and complexity of the MRS, further characterization under future CERCLA action will be required. Observation of one MEC item is sufficient to require further characterization at a MRS. Planned UXO survey is designed to target high probability areas where debris has been discovered.

Table 3: Proposed UXO Survey Activities (continued)

MRS	MEC Survey	Design/Rationale
Block D Igloo–TD	Perform meandering path magnetometer/metal detector assisted UXO survey of entire MRS (~ 19 acres) and of areas where debris historically was found (~ 10 acres) not included in the original MRS footprint. A meandering path survey method was selected to avoid vegetation and other obstructions located within the MRS.	Presence of MEC is not fully understood. Survey will be conducted to identify presence of MEC. Due to size and complexity of the MRS, further characterization under future CERCLA action will be required. Observation of one MEC item is sufficient to require further characterization at a MRS. Planned UXO survey is designed to target high probability areas where debris has been discovered.
Water Works #4 Dump	Perform line abreast magnetometer assisted UXO survey of open northeastern section of MRS and meandering path survey of remaining area (~ 6 acres). A line abreast survey method was selected for the open area to provide 100 percent coverage where munitions and munitions debris are known to exist. A meandering path survey method was selected for the remaining wooded area to avoid obstructions.	Presence of MEC lying on the ground surface and potentially buried are not fully understood. Survey will be conducted to determine presence/absence of MEC and to substantiate MRS footprint. Site will require further characterization under future CERCLA action. Observation of one MEC item is sufficient to require further characterization at a MRS. Combination of UXO surveys is designed to provide greatest possible coverage of the MRS.
Group 8 MRS (formerly known as Area Between Buildings 846 and 849)	Perform line abreast magnetometer/metal detector assisted UXO survey of entire MRS (~ 3 acres).	Presence of MEC and munitions debris lying on the ground surface is not fully understood. Survey will be conducted to determine presence/absence of MEC and provide data to obtain NFA or need for future work. Observation of one MEC item is sufficient to require further characterization at a MRS. Planned UXO survey is designed to provide greatest possible coverage of the MRS.

Footnote: The potential for MEC exists at each MRS; as such, magnetometer-assisted surveys will be performed for anomaly avoidance safety precautions and to identify buried metallic items.

3.3.2 MC Field Activities

Field activities for MC involve surface soil sampling to determine whether a site has been impacted by MC. A weight-of-evidence approach comparing analytical data to the EPA Region 9 Residential will be used to justify moving the site into the RI phase. For non-carcinogens, the analyte will be screened against 1/10 the residential PRG. As with the MEC, the MC decision point is whether MC is present at levels of concern in locations deemed most likely to contain MC. MC constituents will be compared to EPA Region 9 Residential PRGs on a point to point basis. MC constituents exceeding the PRGs will be defined as elevated. A straight comparison to the EPA Region 9 Residential PRGs will be made for carcinogenic analytes, while non-carcinogenic analytes will be compared to 1/10 the residential PRG value.

An MI sampling approach will be used to assess the presence of MC at selected MRSs. This method will be used because it will provide a repeatable and accurate measure of the average concentrations of explosives, metals, and propellants that may be present within a sample area. While it is not the intent of the SI to determine the nature and extent of all contaminants, the MI approach will be used to provide adequate data to confirm that MC is not present at an MRS. Composite (via 7-wheel method) surface soil samples will also be collected from those MRSs that do not have existing analytical and are too complex to fully characterize under the scope of this SI. In addition, three (3) composite surface soil samples will be kept in reserve as contingency samples. Composite surface soil samples will be collected using the 7-Sample Wheel method obtained from Cold Regions Research and Engineering Laboratory's (CRREL's) Special Report (SR) 96-15, *Assessment of Sampling Error Associated with Collection and Analysis of Soil Samples at Explosives-Contaminated Sites.*

One MI sample will consist of 30 sub-samples collected from a distinct sample area established at an MRS. The selection of sample areas will be done on a site by site basis and will depend on several factors including, the physical/chemical characteristics of a given MRS and the reasonably anticipated future land use and potential exposure scenario. Sub-sample locations will be selected using the same random meandering approach used during the UXO surveys of large MRS areas; that is, field personnel will randomly meander over the entire sample area randomly throwing out sample stakes. Composite surface soil samples will be collected from locations that have the greatest potential to have elevated levels of MC. These locations will be selected based on field observations and safety concerns. Procedures for MI sampling and composite sampling following the 7-Sample Wheel method are described in detail in the FSP. **Table 4** summarizes the proposed MC sampling activities to be conducted at each MRS and the rationale behind collecting the samples.

All fieldwork will be of sufficient quality to meet the data quality objectives (DQOs) for the project as dictated in the QAPP (**Appendix B**). Details of the planned MC field sampling activities are provided in the FSP included in **Appendix A**.

Table 4: Proposed MC Sampling Activities

MRS	MC Sampling	Design/Rationale
Ramsdell Quarry Landfill (RVAAP-001-R-01)	Collect four MI surface soil samples from distinct areas (1 per area) within the southern quarry area. MI samples will be analyzed for TAL metals, propellants, and explosives. Soil samples will not be collected from the former OB/OD quarry area.	Identify presence/absence of MC at the southern quarry and to populate the MRS-PP. Sample analytical data will be compared with EPA Region 9 Residential PRGs[1]. Samples will not be collected from former OB/OD quarry area since MC is covered under the IRP. Detection of MC greater than the PRGs is sufficient to require further characterization at a MRS. MI coverage is designed to provide greatest possible coverage of the MRS to attain NFA or need for further characterization.
Load Line #1 (RVAAP-008-R-01)	Collect one MI surface soil sample from area where propellant is found. MI sample will be analyzed for explosives, propellants, and TAL metals.	Identify presence/absence of MC at the location were propellant may be located and to populate the MRS-PP. Sample analytical data will be compared with EPA Region 9 Residential PRGs[1]. Detection of MC greater than the PRGs is sufficient to require further characterization at a MRS. MI coverage is designed to provide greatest possible coverage of the MRS to determine need for further characterization.
Landfill North of Winklepeck (RVAAP-019-R-01)	Collect one composite surface soil sample from the new MRS footprint. Surface soil sample will be analyzed for explosives, propellants, and TAL metals.	Identify presence/absence of MC at the MRS and to populate the MRS-PP. Sample analytical data will be compared with EPA Region 9 Residential PRGs[1]. Detection of MC greater than the PRGs is sufficient to require further characterization at a MRS. Composite sample designed to provide information for the MRS-PP, solely. Based on potential presence of MEC, site will require further characterization.

Table 4: Proposed MC Sampling Activities (continued)

MRS	MC Sampling	Design/Rationale
Firestone Test Facility (RVAAP-033-R-01)	Collect one MI surface soil sample from the open field in the eastern end of the Firestone Test Facility. MI sample to be analyzed for explosives, propellants, and TAL metals.	Identify presence/absence of MC at the open field and to populate the MRS-PP. Sample analytical data will be compared with EPA Region 9 Residential PRGs[1]. This area has not been sampled under the IRP; therefore, it will be sampled under the MMRP. Detection of MC greater than the PRGs is sufficient to require further characterization at a MRS. MI sample designed to provide greatest possible coverage of the open field to eliminate area from the MRS foot print and attain NFA or need for further characterization. Based on potential presence of MEC in the pond, the MRS will require further characterization.
Block D Igloo (RVAAP-060-R-01)	Collect one composite surface soil sample from former igloo area. Surface soil sample will be analyzed for explosives and TAL metals.	Surface soil sample to be collected solely to populate the MRS-PP. Site likely to require further characterization. Detection of MC greater than the PRGs is sufficient to require further characterization at a MRS. Composite sample designed to provide information for the MRS-PP, solely. Due to the complexity of the MRS, site will require further characterization.
Block D Igloo–TD (RVAAP-061-R-01)	Collect two composite surface soil samples from MRS. Surface soil sample will be analyzed for explosives and TAL metals.	Surface soil samples to be collected solely to populate the MRS-PP. Site likely to require further characterization, which falls outside the scope of the SI. Detection of MC greater than the PRGs is sufficient to require further characterization at a MRS. Composite samples designed to provide information for the MRS-PP, solely. Due to the complexity of the MRS, site will require further characterization.

Table 4: Proposed MC Sampling Activities (continued)

MRS	MC Sampling	Design/Rationale
Water Works #4 (RVAAP-062-R-01)	Collect one composite surface soil sample from the MRS. Surface soil sample will be analyzed for explosives, propellants, and TAL metals.	Identify presence/absence of MC at the MRS and to populate MRS-PP. Sample analytical data will be compared with EPA Region 9 Residential PRGs[1]. Detection of MC greater than the PRGs is sufficient to require further characterization at a MRS. Composite sample designed to provide information for the MRS-PP, solely. Based on potential presence of MEC, site will require further characterization.
Group 8 MRS (RVAAP-063-R-01)	Collect five MI surface soil samples from distinct areas (1 per area) within the MRS footprint. Surface soil samples will be analyzed for explosives, propellants, and TAL metals.	Identify presence/absence of MC at the MRS and to populate the MRS-PP. Sample analytical data will be compared with EPA Region 9 Residential PRGs[1]. Detection of MC greater than the PRGs is sufficient to require further characterization at a MRS. MI coverage is designed to provide greatest possible coverage of the MRS to attain NFA or need for further characterization.

[1] EPA Region 9 Residential Preliminary Remediation Goals. (Note: A straight comparison to the EPA Region 9 Residential PRGs will be made for carcinogenic analytes, while non-carcinogenic analytes will be compared to 1/10 the residential PRG value.

3.3.3 Laboratory Analysis

The total number of field investigative samples and replicates/duplicates that are planned and the selected laboratory analyses are presented in. The planned analytical methods were selected on the basis of the munitions items known to have been used or disposed at the site and include a standard suite of range-related analytical parameters to account for unknown items. The standard analytical methods include explosives (EPA Method 8330B), TAL metals (EPA Methods 6010C and 7471A), and propellants (EPA Methods 353.2). Bulk samples will be sent to the laboratory (i.e., Test America, North Canton) for method preparation. Method preparation will include drying, grinding and sieving. Once the samples have been prepped, Test America, North Canton will ship the samples to Test America, Sacramento for explosives and propellants analysis. Test America, North Canton will retain enough volume to perform the TAL metals analysis.

Table 5: Sample Summary

MRS	Number of Samples/Analytical Parameters			QA/QC Samples
	Explosives	Propellants	TAL Metals	Field Duplicates
Ramsdell Quarry Landfill	4	4	4	0
Load Line #1	1	1	1	1
Landfill North of Winklepeck[1]	1	1	1	0
Firestone Test Facility	1	1	1	1
Block D Igloo[1]	1	0	1	1
Block D Igloo–TD[1]	2	0	2	0
Water Works #4 Dump[1]	1	1	1	1
Group 8 MRS	5	5	5	0
Contingency Samples[3]	8	8	8	0
TOTAL	**24**	**21**	**24**	**4**

[1] Composite samples will be collected from these MRSs.

[2] Two duplicate samples will be collected for the MI sample group and two for the composite sample group.

[3] Contingency samples (7-wheel composite surface soil samples) will be collected at locations with unexpected field conditions (e.g., unexpected discovery of MEC).

Note: Field splits will be collected by Ohio EPA

As previously stated, the process for selecting a suite of analytes is based, in part, on the munitions known or suspected to have been used or disposed of at a particular MRS. e^{2}M will meet the project-specific DQOs for sampling, analysis, and quality assurance/quality control (QA/QC) objectives by collecting the proper quantities and types of samples, using the correct analytical methodologies, implementing field and laboratory QA/QC procedures, and using data validation and evaluation processes. The DQOs for each analytical method is based on the EPA Region 9 Residential PRGs for carcinogenic constituents and 1/10 the Residential PRGs for non-carcinogenic constituents and site-specific surface soil background values, which are provided in the QAPP (**Appendix B**). Laboratory requirements for the analytical methods being used for this project are provided in the FSP and in the QAPP. These procedures include requirements for sample preparation, sampling containers, preservation methods, and holding times.

The QAPP has been developed to support the sampling, analysis, and evaluation activities associated with this project. The QAPP consists of policies, procedures, specifications, standards, and documentation sufficient to produce data of quality adequate to meet the DQOs for the project. The QAPP has been prepared to ensure that this responsibility is met throughout the duration of this project. It addresses procedures to assure the precision, accuracy, representativeness, completeness, comparability and sensitivity (PARCCS) of field and laboratory data generated during the course of this project. The QAPP defines the first stage of the QA requirements for sample and data acquisition, handling, and assessment.

QA procedures such as tracking, reviewing, and auditing are implemented as necessary to ensure that all project work is performed in accordance with professional standards, EPA and Ohio EPA regulations (e.g., F&O) and guidelines, and the specific goals and requirements stated in this WP.

QC of sample collection, analysis, and assessment will be performed by technical project personnel. Laboratory equipment will be maintained and calibrated, and records of these activities will be kept in accordance with established procedures. This will include laboratory oversight by e^{2}M project personnel, as well as laboratory data and document review.

Per the EPA criteria for data quality for risk-based projects, at least 10% of the analytical data are required to meet a comprehensive data level of QA/QC related to sample collection, laboratory analysis, and data validation techniques. Following the process identified in the QAPP, final data usability will be determined by the e^{2}M Project Chemist in coordination with the e^{2}M Technical Project Manager (TPM) and independent Project Data Validator. Overall QA review of documentation, field sampling, and laboratory QC will allow determination of the acceptability of these data for use in this project. Chemical analyses are discussed in greater detail in the QAPP (**Appendix B**).

4.0 PROJECT MANAGEMENT

4.1 Project Schedule

The major project milestones and target dates are provided below:

- ✓ TPP 1 (Kick off meeting) – 20 October 2005
- ✓ Records Review – 12-14 December 2005
- ✓ Stakeholder Draft HRR – May 2006
- ✓ TPP 2 Meeting – 10 August 2006
- ✓ Final HRR – January 2007
- ✓ Stakeholder Draft SI WP – 27 April 2007
- ✓ Final SI WP – 12 September 2007
- SI Field Work – 1-12 October 2007
- Stakeholder Draft SI Report – 25 January 2008
- TPP 3 Meeting - May 2008
- Final SI Report – 8 April 2008

4.2 Project Personnel

The multi-disciplined Project Team is comprised of representatives from the Stakeholders and e²M, the SI Contractor, with each having clearly defined roles and responsibilities that are integral to the successful execution of the SI. USAEC is the overall program manager and is responsible for program management, project development, and providing guidance and oversight. The USACE, Omaha District is the executing agency for this SI and is responsible for contractor procurement and management, as well as providing technical oversight of the SI activities. Representatives from RVAAP, and USACE provide site-specific historical perspective relating to site use. Ohio EPA is the lead regulatory agency working with RVAAP under the IRP and provides regulatory oversight and approval of proposed actions to be taken at the installation, including those conducted during this SI. e²M is responsible for the development of the project work plans (e.g., FSP, QAPP, SSHP, etc.), execution of the SI field activities, and reporting of results. e²M is also responsible for subcontractor procurement and oversight.

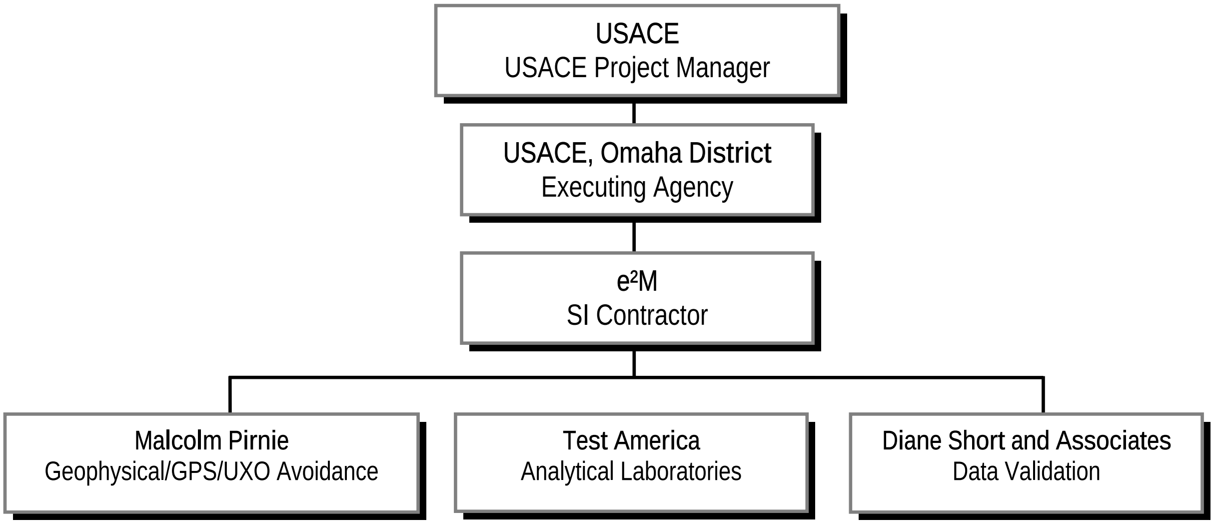
Contact information for representatives from each Stakeholder group is provided in **Table 6**.

Table 6: Stakeholder Representatives Contact Information

Mary Ellen Maly MMRP Project Manager US Army Environmental Center E4480 Beal Road Aberdeen Proving Ground, MD 21010-5401 Telephone: (410) 436-7083 Facsimile: 410-436-1548 E-mail: maryellen.h.maly@us.army.mil	Ms. Eileen T. Mohr Project Manager Ohio Environmental Protection Agency Division of Emergency and Remedial Response 2110 East Aurora Road Twinsburg, Ohio 44087 Telephone: 330-963-1221 E-mail: eileen.mohr@epa.state.oh.us
Mark Krivansky E4480 Beal Road Aberdeen Proving Ground, MD 21010-5401 Telephone: (410) 436-0542 Facsimile: 410-436-1548 E-mail: mark.krivansky@us.army.mil	Mr. Irving Venger Acting Facility Manager Ravenna Army Ammunition Plant 8451 State Route 5 Ravenna, OH 44266-9297 Telephone: (330) 358-7311 E-mail: irving.b.venger@us.army.mil
Ms. J. Kimberly Harriz NGB Project Manager NGB/EEI 111 S. George Mason Dr. Arlington, VA 22204 Telephone: 703-607-7991 E-mail: kim.harriz@us.army.mil	Ms. Katie Elgin Environmental Specialist 2, OHARNG - RTLS Ravenna Training and Logistics Site 1438 State Route 534 SW Newton Falls, Ohio 44444 Telephone: 614-336-6136 E-mail: katie.elgin@us.army.mil
Jerome Stolinski USACE Project Manager U.S. Army Corps of Engineers, Omaha District 106 South 15th Street Omaha, NE 68102 Phone: 402-221-7674 Fax: 402-221-7796 Email: jerome.f.stolinski@nwo02.usace.army.mil	

The Project Team organization chart (**Figure 11**) shows the lines of authority between the program, project, and subcontractor personnel.

Figure 11: Project Team Organization Chart



4.2.1 e^{2}M Personnel

e^{2}M is the MMRP SI Consultant and is under direct contract with the USACE, Omaha District to perform this SI for RVAAP. e^{2}M is responsible for completing this SI in accordance with USACE, Federal, State, and local rules, laws, and regulations, as appropriate. Project-specific e^{2}M personnel and their responsibilities are shown in **Figure 12** and are discussed below.

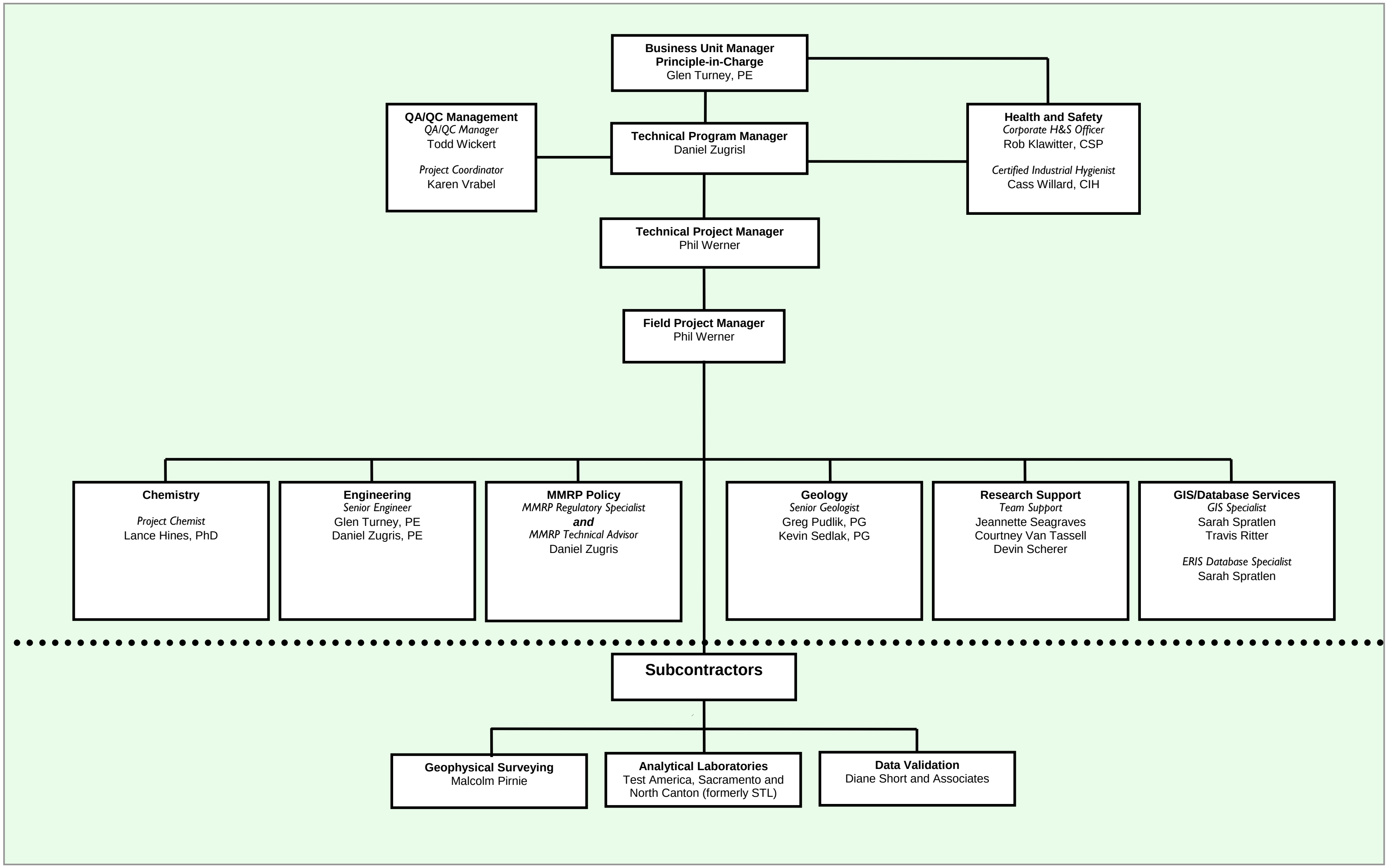
Principal-in-Charge – Glen Turney, PE

Mr. Turney is the Vice President of Restoration at e^{2}M and maintains the autonomy to direct or augment e^{2}M corporate resources to accommodate project needs. The e^{2}M Principal-in-Charge oversees the e^{2}M Technical Program Manager (TPgM) and reports directly to the USACE-PM and the USACE, Omaha District Contract Officer (CENWO-CT). Any issues or problems the USACE-PM or CENWO-CT may experience may be addressed to the e^{2}M Principal-in-Charge.

Corporate Health & Safety Director – Rob Klawitter, ASP

The e^{2}M Corporate Health and Safety (H&S) Director maintains the organizational freedom and authority for ensuring full implementation of e^{2}M's corporate H&S policies and the project SSHPs. Mr. Klawitter maintains a direct line of communication with the Principal-in-Charge and TPgM of e^{2}M and directs implementation of the SSHP. This includes the ability to delegate enforcement authority to other e^{2}M personnel and ensuring SSHP compliance, including removal of individuals from the project for non-compliance.

Figure 12: e²M Project Organization Chart



Technical Program Manager (TPgM) – Daniel Zugris

The e^2M TPgM has ultimate responsibility for all aspects of the project and reports directly to the e^2M Principal-in-Charge, e^2M Corporate H&S Director, and the USACE-PM. The e^2M TPgM is also responsible for management and oversight of project subcontractors and the e^2M TPM. As necessary, the TPgM will provide assistance to the TPM during project performance.

Technical Project Manager (TPM) – Phil Werner

The e^2M TPM is responsible for execution, coordination, and completion of the project and reports directly to the e^2M TPgM, e^2M Corporate H&S Director, and the USACE-PM. The e^2M TPM is also responsible for project personnel safety and health, including correction of all identified unsafe acts or conditions, and enforcement of procedures and regulations. The TPM is responsible for the implementation of the project plans, including project QA/QC requirements.

Field Project Manager – Phil Werner

The e^2M Field Project Manager (FPM) reports to the e^2M TPM for all aspects of the field work and is responsible for enforcing safety and health rules, policies, and procedures on behalf of e^2M. The e^2M FPM will oversee all field activities and is the primary contact during their performance. The FPM is responsible for implementing the project WP requirements, including the FSP, SSHP, and QAPP.

Project Chemist – Lance Hines, PhD

The Project Chemist is responsible for the day to day management of the data at all stages to ensure that all project activities related to analytical data are performed to meet the project DQOs. This includes implementing the QAPP and the individual site specific FSPs, reviewing additional project plans and procedures for quality issues, coordinating sample collection and analytical requirements with the contract laboratory(ies), and overseeing data review/validation and corrective actions processes.

Project Industrial Hygienist – Cass Willard, CIH

The e^2M Project Industrial Hygienist is responsible for the development, oversight and implementation of the project SSHPs. The e^2M Project Industrial Hygienist reports directly to the e^2M Corporate H&S director and the TPM. In addition, the e^2M Project Industrial Hygienist will oversee the development, characterization, and evaluation of significant contamination pathways to determine the level of UXO-DMM-MC related threats to human health and the environment associated with the MMRP ranges/sites.

Quality Assurance/Quality Control Manager – Todd Wickert

The QA/QC Manager reports to the TPgM and oversees procedures development, training, control checks, and process correction/improvement actions including those addressed in the Project Management Plan (PMP) and the QAPP to ensure that data are collected, processed, and prepared in the most accurate and timely method possible. Recognizing QA is inherently a government function and is being performed by USACE, Omaha District, the QA/QC Manager will perform an internal QA and overall qualification program. The QA/QC Manager will regularly coordinate with the TPgM and FPM to ensure that the US Army and e²M QA/QC programs are aligned and that project deliverables are meeting technical performance and accuracy standards.

Geographic Information System/Database Specialist – Sarah Spratlen

The e²M Geographic Information System (GIS)/Database Manager reports directly to the e²M TPM and is responsible for electronic project deliverables conforming to the requirements of the project SOW and the MMRP. Ms. Spratlen will provide guidance to the TPM on the requirements of GIS data to ensure conformance with National Mapping and National Spatial Data Infrastructure (NSDI) standards and Spatial Data Standards for Facilities Infrastructure and Environment (SDSFIE) where standards have been established. As directed by the TPM, the GIS/Database Specialist will oversee the development of electronic deliverable templates to be used for the SI project and provide QA/QC of files prior to submittal.

4.2.2 Subcontractor Personnel

The following have been hired as sub-contractors to e²M to help complete this project for RVAAP:

Malcolm Pirnie – will be responsible for performing magnetometer-assisted surveying for UXO avoidance. The Point of Contact (POC) is Al Larkins, Project Manager. Mr. Larkins can be contacted at:

300 East Lombard Street
Suite 610
Baltimore, MD 21202
(410) 230-9966
alarkins@pirnie.com

Test America (formerly Severn Trent Laboratories, Inc.[STL]) – will be responsible for analyzing samples using standard US EPA Methods. Test America will be the primary analytical laboratory for this project and will provide all data packages, including ERIS deliverables. The POC is the laboratory project manager Pat O'Meara. Mr. O'Meara can be contacted at:

Pat O'Meara
(330) 966-9725
Test America
4101 Shuffel Dr. NW
North Canton, OH 44720
patrick.omeara@testamericainc.com

Diane Short and Associates, Inc. (DSA) – Ms. Diane Short of Diane Short and Associates, Inc. will be responsible for data validation of the analytical sample results and will be working independently of e^{2}M. Ms. Short can be contacted at:

1978 South Garrison Street
Suite #9
Lakewood, CO 80227
303-271-9642
dsa@easy.net

The subcontractors will be under the direct supervision of e^{2}M's TPM.

5.0 PROJECT DELIVERABLES

In addition to this WP, e²M will develop and submit a preliminary-draft, draft, and final SI Report, which will include the following data elements/information:

- Final CSM;
- Analytical data;
- An assessment of the data collected with respect to the presence/absence of MEC and MC, and a recommendation for each MRS regarding NFA, immediate response, or the need for further investigation (i.e., RI); and
- Draft MRS-PP scoring.

In accordance with the SOW, all the analytical data generated during this field effort will be uploaded into the Army's ERIS web-based database. Both hard copy and electronic data will be available for USACE review upon request.

The data from the MMRP SI will be maintained in the database, which includes the following information for each sample collected: sample identification, preservation, date sampled, media type, site location, chemical analyses, and validation review.

6.0 REFERENCES

e^{2}M, 2003 engineering-environmental Management, Inc. (e^{2}M). Final U.S. Army Closed, Transferring, and Transferred Range/Site Inventory for Ravenna Army Ammunition Plant, Ohio. November 2003.

e^{2}M, 2007 engineering-environmental Management, Inc. (e^{2}M). Stakeholder Final Military Munitions Response Program Historical Records Review, Ravenna Army Ammunition Plant, Ohio, January 2007.

Ohio EPA, 2004 RVAAP Final Director's Findings and Orders. US Department of the Army. June 2004.

SAIC, 2001 Facility-Wide Sampling and Analysis Plan for Environmental Investigations at the Ravenna Army Ammunition Plant, Ravenna, Ohio. U.S. Army Corps of Engineers – Louisville District, Contract No. DACA 62-00-D-0001, Delivery Order CY02. March 2001.

Solutions Today for a Sustainable Tomorrow

FINAL

FIELD SAMPLING PLAN
MILITARY MUNITIONS RESPONSE PROGRAM
MUNITIONS RESPONSE SITES

RAVENNA ARMY AMMUNITION PLANT, OHIO

Submitted To:

US ARMY CORPS OF ENGINEERS
OMAHA DISTRICT
CENWO-PM-HC
106 SOUTH 15th STREET
OMAHA, NE 68102-1618

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Contract Number DACA-63-03-D0009
Task Order No.: DK01

SEPTEMBER 2007

SIGNATURE PAGE

engineering-environmental Management, Inc.

FINAL

FIELD SAMPLING PLAN
MILITARY MUNITIONS RESPONSE PROGRAM
MUNITIONS RESPONSE SITES

RAVENNA ARMY AMMUNITION PLANT, OHIO

SEPTEMBER 2007

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Phil Werner
e^{2}M Technical Project Manager

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Acronyms

°C	degrees Celsius
AEDB-R	Army Environmental Database-Restoration
AOC	Area of Concern
ASTM	American Society for Testing and Materials
bgs	Below Ground Surface
BIP	Blow in Place
CENWO-PM	USACE, Omaha District Project Manager
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	Chain of Custody
CRREL	Cold Regions Research and Engineering Laboratory
DMM	Discarded Military Munitions
DoD	Department of Defense
DOT	Department of Transportation
DQCR	Daily Quality Control Report
DQO	Data Quality Objectives
e^2M	engineering-environmental Management, Inc
EOD	Explosive Ordnance Disposal
EPA	United States Environmental Protection Agency
F&O	Final Findings and Orders
FPM	Field Project Manager
FSP	Field Sampling Plan
GPO	Geophysical Prove-Out
GPS	Global Positioning System
HRR	Historical Records Review
IRP	Installation Restoration Program
lb	Pound
m	meter
MC	Munitions Constituents
MEC	Munitions and Explosives of Concern
MI	Multi-Incremental
MMRP	Military Munitions Response Program
MRS	Munitions Response Site
MRS-PP	Munitions Response Site Prioritization Protocol
NFA	No Further Action
No.	Number

Acronyms

OB/OD	Open Burn/Open Detonation
OHARNG	Ohio Army National Guard
Ohio EPA	Ohio Environmental Protection Agency
PE	Professional Engineer
PM	Project Manager
PPE	Personal Protective Equipment
PRG	Preliminary Remediation Goal
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RI	Remedial Investigation
RTLS	Ravenna Training and Logistics Site
RVAAP	Ravenna Army Ammunition Plant
SARA	Superfund Amendments and Reauthorization Act
SDSFIE	Spatial Data Standards for Facilities Infrastructure and Environment
SI	Site Inspection
SOW	Scope of Work
SSHP	Site-Specific Safety and Health Plan
SR	Special Report
TAL	Target Analyte List
TNT	Trinitrotoluene
TPgM	Technical Program Manager
TPM	Technical Project Manager
TPP	Technical Project Planning
U.S.C.	United States Code
US	United States
USACE	United States Army Corps of Engineers
USAEC	United States Army Environmental Command
UXO	Unexploded Ordnance
WP	Work Plan

1.0 INTRODUCTION

engineering-environmental Management, Inc. (e²M) has prepared the following Field Sampling Plan (FSP) for the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Site Inspection (SI) of the other than operational ranges and other sites with known or suspected unexploded ordnance (UXO), discarded military munitions (DMM), or munitions constituents (MC) at Ravenna Army Ammunition Plant, Ohio (RVAAP). These Munitions Response Sites (MRSs) are being addressed under the Military Munitions Response Program (MMRP), Contract Number DACA63-03-D0009, Task Order Number DK01. This FSP is presented as an appendix to and is considered part of the Work Plan (WP) for RVAAP.

e²M has prepared this FSP to provide procedures that will be employed by e²M personnel during performance of the field activities for this SI. This FSP will be used with the understanding that field conditions may dictate a change in the plan as written, and any changes will be approved by the Ohio Environmental Protection Agency (Ohio EPA) and the United States Army Corps of Engineers (USACE), Omaha District, Project Manager (CENWO-PM). Field conditions that change this plan will be noted by the Field Project Manager (FPM) and addendum pages will be provided as appropriate.

2.0 PROJECT SCOPE AND OBJECTIVES

The general objective of this SI is to determine the presence or absence of Munitions and Explosives of Concern (MEC) and/or MC at the MRSs identified at RVAAP (see **Figure 1**). MEC and MC that may be present from activities conducted by the Department of Defense (DoD) during operation of these sites may pose a threat to human health and/or the environment; therefore, an evaluation of these MRSs is required.

Seventeen MRSs have been identified at RVAAP. They are listed below and are depicted in **Figure 2**.

- Ramsdell Quarry Landfill (RVAAP-001-R-01)[1]
- Erie Burning Grounds (RVAAP-002-R-01)
- Demolition Area #2 (RVAAP-004-R-01)
- Load Line #1 (RVAAP-008-R-01)
- Load Line #12 (RVAAP-012-R-01)
- Fuze and Booster Quarry (RVAAP-016-R-01)
- Landfill North of Winklepeck (RVAAP-019-R-01)
- 40mm Firing Range (RVAAP-032-R-01)
- Firestone Test Facility (RVAAP-033-R-01)
- Sand Creek Dump (RVAAP-034-R-01)
- Building #F-15 and F-16 (RVAAP-046-R-01)
- Anchor Test Area (RVAAP-048-R-01)
- Atlas Scrap Yard (RVAAP-050-R-01)
- Block D Igloo (RVAAP-060-R-01)
- Block D Igloo–TD (RVAAP-061-R-01)
- Water Works #4 Dump (RVAAP-062-R-01)
- Group 8 MRS (formerly Area Between Buildings 846 and 849) (RVAAP-063-R-01)

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[1] Army Environmental Database-Restoration (AEDB-R) Number

INSTALLATION LOCATION
Ravenna Army Ammunition Plant, OH

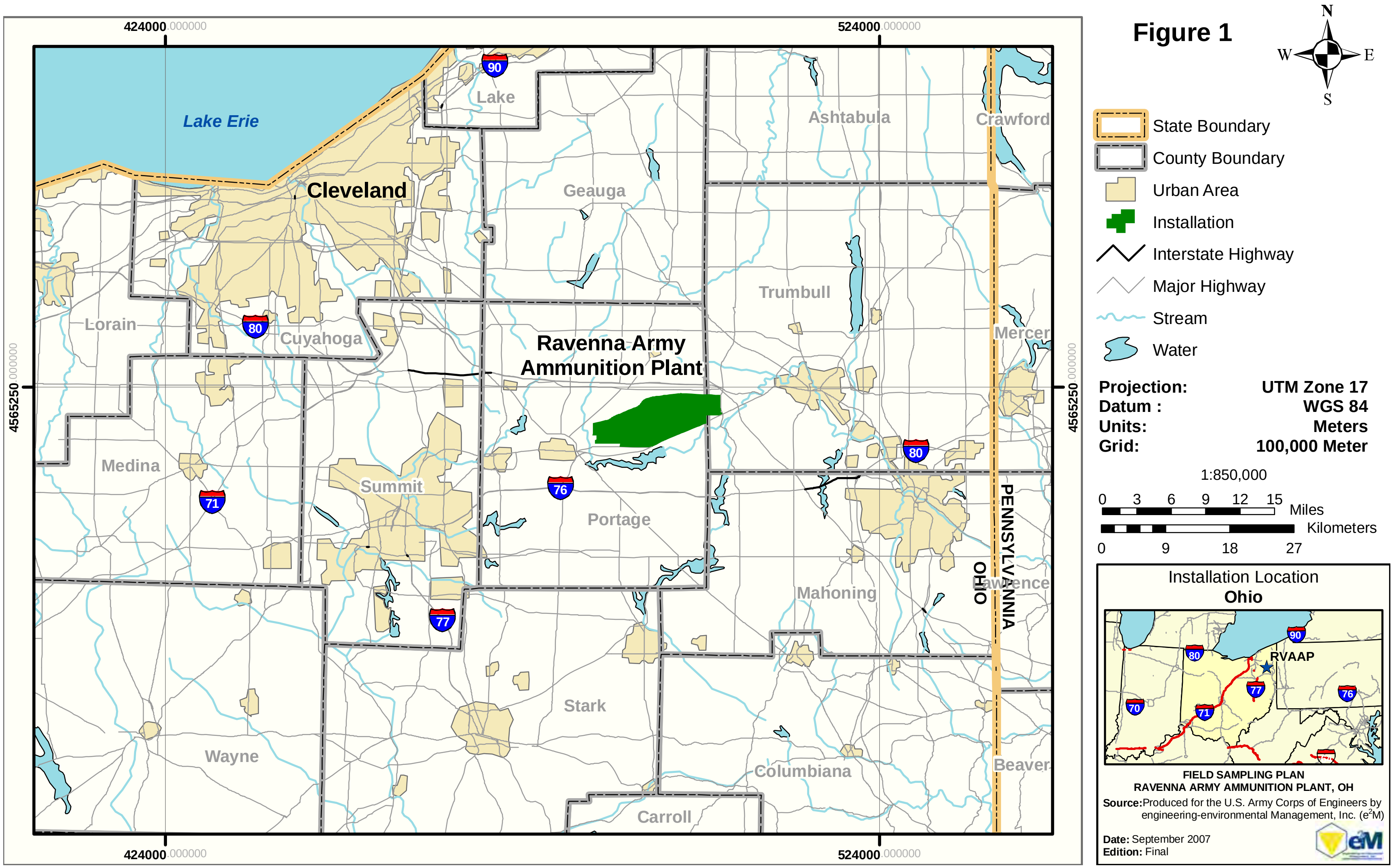


Figure 1

Projection:	**UTM Zone 17**
Datum :	**WGS 84**
Units:	**Meters**
Grid:	**100,000 Meter**

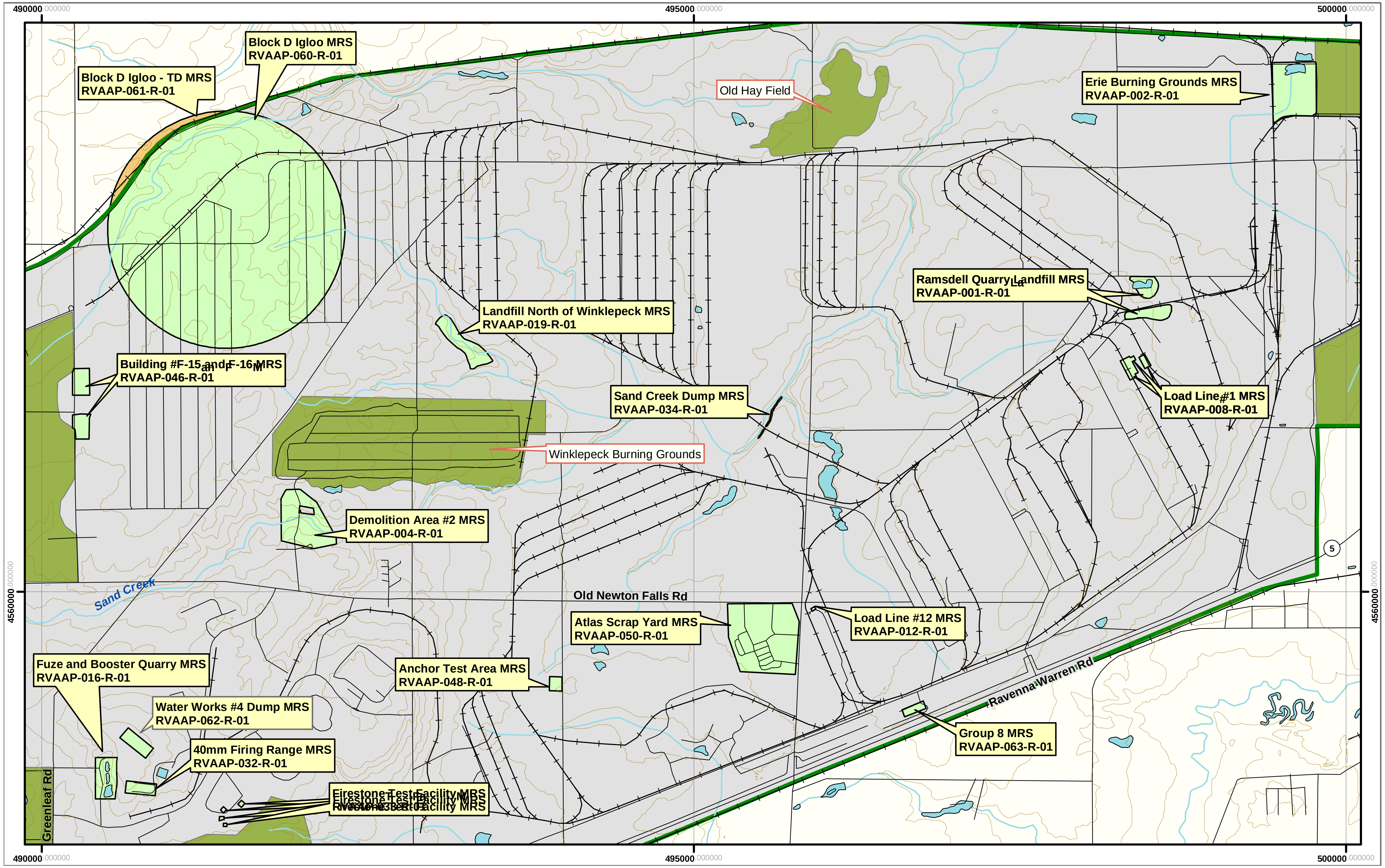
FIELD SAMPLING PLAN
RAVENNA ARMY AMMUNITION PLANT, OH

Source: Produced for the U.S. Army Corps of Engineers by engineering-environmental Management, Inc. (e^2M)

Date: September 2007
Edition: Final

MRS LOCATIONS
Ravenna Army Ammunition Plant, OH

Figure 2



- Elevation Contour
- Installation Boundary
- Railroad
- Road
- Stream
- Water

Area Status

- 🟩 Operational Range
- ▢ Other than Operational Range
- 🟩 MRS, Closed
- 🟧 MRS, Transferred

Data Source: e²M, Final Military Munitions Response Program Historical Records Review, Ravenna Army Ammunition Plant, Ohio, October 2006.

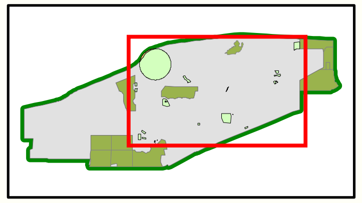
Projection:	**UTM Zone 17**
Datum :	**WGS 84**
Units:	**Meters**
Grid:	**5,000 Meter**
Contour Interval:	**500 Meter**

1:32,000

0 0.2 0.4 0.6 Miles

0 0.25 0.5 0.75 1 Kilometers

Reference Location Map
RVAAP



FIELD SAMPLING PLAN
RAVENNA ARMY AMMUNITION PLANT, OH

Source: Produced for the U.S. Army Corps of Engineers by engineering-environmental Management, Inc. (e²M)

Date: September 2007
Edition: Final

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Field activities will be performed in accordance with the USACE, Omaha District project Scope of Work (SOW) dated June 2005, the WP, Site-specific Safety and Health Plan (SSHP), Quality Assurance Project Plan (QAPP), this FSP, and comply with the "Final Findings and Orders" (F&O) issued June 10, 2004 by the Ohio Environmental Protection Agency (Ohio EPA). During the field sampling event, qualified team members (UXO Technicians) will visually inspect the surface at the appropriate MRSs for MEC. Surface soil samples will be collected to analyze for Target Analyte List (TAL) metals and explosives (and propellants at specific locations), as indicated by potential historical site activities. The fieldwork will take place during October 2007 and will last approximately 12 days.

Composite and multi-incremental surface soil samples will be collected for analytical laboratory testing. The analytical methods were selected on the basis of the types of munitions known to have been used or disposed at the site, and include the standard suite of range-related analytical parameters to account for unknown items. The standard analytical methods include TAL metals (U.S. Environmental Protection Agency [EPA] Method 6010C and 7471A), explosives (EPA Method 8330B) and propellants (EPA Methods 8330B and 353.2). Field and laboratory work will be of sufficient quality to support a weight-of-evidence screening approach that includes comparing the analytical data to EPA Region 9 Residential Preliminary Remediation Goals (PRGs) to justify a no further action (NFA) recommendation, immediate action, and/or recommendation for further characterization at the MRS. For carcinogenic analytes, a direct comparison to the EPA Region 9 Residential PRGs will be made, while non-carcinogenic analtyes will be screened at 1/10 the residential PRG value. The proposed field activities are based on concerns presented by the Stakeholders during the Technical Project Planning session (TPP 2) and discussions held on 13 March 2007.

Tables 1 and **2** provide a summary of MEC and MC decisions for activities to be completed at each MRS, respectively. The number of samples and associated field quality control samples to be collected at each MRS for each analysis is summarized in **Table 3**.

Table 1: Summary of MEC SI Decisions

MRS	MEC SI Activities	
	Activity	**Purpose/Rationale**
Ramsdell Quarry Landfill	Perform meandering path UXO survey of old Open Burn/Open Detonation (OB/OD) area in quarry (~3 acres) and line abreast magnetometer/metal detector assisted UXO survey of the open northeastern section of the southern quarry area (~2 acres). A meandering path UXO survey will be performed within the remaining area at the southern quarry area. The northeast quadrant of the southern quarry is the suspected former OB/OD area; as such, a line abreast survey method will be used to provide 100 percent coverage. A meandering path survey will be used in the remaining area of the southern quarry to identify kick-out of munitions resulting from OB/OD operations.	Identify buried anomalies in the southern quarry. Identify presence/absence of MEC lying on the ground surface, and determine if area can be eliminated from MRS footprint or if further characterization is needed. Presence of MEC at former OB/OD quarry area has been established and will require additional characterization under future CERCLA action. UXO survey of OB/OD quarry area conducted to support further characterization and to substantiate MRS footprint.
Erie Burning Grounds	Perform meandering path magnetometer assisted UXO survey of all accessible dry areas (~14 acres). The presence of MEC in the flooded sections of Erie Burning Grounds is expected. However, the investigation of the flooded area is outside the scope of this SI and will require additional characterization in future CERCLA investigations.	Presence of MEC has been established. UXO survey to substantiate presence of MEC and to determine type, if possible. Survey will be conducted to support further characterization work under future CERCLA action.
Demolition Area #2	Perform meandering path magnetometer assisted UXO survey of Bomb Disposal Area, 2 Burial Sites, and Rocket Ridge, and associated surrounding areas and MRS boundary (~ 6–12 acres).	Establish locations and substantiate boundaries of the four areas identified. Support MEC further action determination at these areas. MEC is known to exist throughout remainder of MRS and will require further investigation under additional CERCLA action.
Load Line #1	Perform meandering path UXO survey within and surrounding the location where propellants are discovered, and include the area around Bldgs CB-13, CB-13B, CB-14, and the popping furnace (~ 1 acre).	Presence of triple base propellants has been established. Survey will be performed to confirm presence, density, and location of any remaining propellant, and to substantiate the MRS footprint.

Table 1: Summary of MEC SI Decisions (continued)

MRS	MEC SI Activities	
	Activity	**Purpose/Rationale**
Load Line #12	Perform line abreast magnetometer assisted UXO survey of the location and surrounding area where the buried inert 90mm projectiles were recovered (~ 1 acre).	Presence and density of MEC and/or munitions debris is not fully understood. Survey will be conducted to identify presence/absence of MEC and substantiate the MRS footprint.
Fuze and Booster Quarry	Perform meandering path magnetometer/metal detector assisted UXO survey of the banks and surrounding area at all three ponds (~ 2 acres). Due to safety concerns (i.e., steep uneven terrain) a meandering path survey method has been selected for the FBQ.	Presence of MEC or munitions debris on the banks of the ponds is not fully understood. Survey will be conducted to determine presence/absence of MEC and substantiate the MRS footprint. Presence of MEC in ponds is suspected and will require further characterization under future CERCLA action.
Landfill North of Winklepeck	Perform meandering path magnetometer/metal detector assisted UXO survey of the hillside and creek bottom adjacent and downstream of the former landfill area (~ 15 acres).	Presence of MEC or munitions debris are known to exist, but not fully understood within the stream course. Survey will be conducted to determine presence/absence of MEC and to substantiate the MRS footprint. MEC uncovered in the former landfill area will be addressed under the Installation Restoration Program (IRP).
40mm Firing Range	Perform meandering path magnetometer/metal detector assisted UXO survey of down range target area, overshot area, and firing point (~ 3 acres). Due to safety concerns (i.e., uneven steep terrain at the impact area) a meandering path survey method has been selected for the 40mm MRS.	Presence of MEC is not fully understood. Survey will be conducted to determine presence/absence of MEC and substantiate the MRS footprint.

Table 1: Summary of MEC SI Decisions (continued)

MRS	MEC SI Activities	
	Activity	**Purpose/Rationale**
Firestone Test Facility	Perform line abreast magnetometer/metal detector assisted UXO survey around former test chambers and at the open field in the eastern end of the MRS (~ 0.5 acres). Perform meandering path magnetometer/metal detector assisted UXO survey around the pond area (~ 0.5 acres). Magnetometers/metal detectors will only be used on bare ground surfaces. No water surveys of the pond will be conducted. Line abreast methods were selected to provide 100 percent coverage of areas that have the greatest potential to contain MEC. A meandering path survey was selected for the area surrounding the pond since munitions were tested underwater and are not expected outside this area.	Presence of MEC is not expected at or around the former test chambers or open field. Survey will be conducted to determine presence/absence of MEC and substantiate the MRS footprint around the former test chambers, open field, and area surrounding the pond. MEC may be present in the pond and will require further characterization under additional CERCLA action.
Sand Creek Dump	Perform meandering path magnetometer assisted survey of all open areas and UXO survey within dump area (~ 1 acre). A meandering path survey method was selected to avoid vegetation and other obstructions located at the MRS.	Presence of MEC is not fully understood. Survey will be conducted to identify presence/absence of MEC and to substantiate the MRS footprint.
Building #F-15 and F-16	Perform meandering path magnetometer assisted UXO survey of the entire MRS (~ 12 acres).	Presence of MEC and munitions debris lying on the ground surface and potentially buried are not fully understood. Survey will be conducted to determine presence/absence of MEC and to substantiate MRS footprint.
Anchor Test Area	Perform line abreast magnetometer assisted UXO survey of entire MRS (~ 3 acres).	Presence of MEC and munitions debris lying on the ground surface and potentially buried are not fully understood. Survey will be conducted to determine presence/absence of MEC and substantiate the MRS footprint.

Table 1: Summary of MEC SI Decisions (continued)

MRS	MEC SI Activities	
	Activity	**Purpose/Rationale**
Atlas Scrap Yard	Perform line abreast magnetometer assisted UXO survey in the south-central section of the MRS where MEC and munitions debris have reportedly been found and a meandering path magnetometer assisted UXO survey around debris piles that remain at the MRS (~ 12 acres).	Presence of MEC is not fully understood. Survey will be conducted to determine presence/absence of MEC and to substantiate the MRS footprint.
Block D Igloo	Perform meandering path magnetometer assisted UXO survey around former igloo and documented locations where debris were found. Area to be surveyed not to exceed 1 percent total of the MRS area (~ 6 acres).	Presence of MEC is not fully understood. Limited survey to identify the presence of MEC. Survey of entire fall out zone (e.g., 622 acres) is outside the scope of an SI and will require further characterization under future CERCLA action.
Block D Igloo–TD	Perform meandering path magnetometer/metal detector assisted UXO survey of entire MRS (~ 19 acres) and of areas where debris historically was found (~ 10 acres) not included in the original MRS footprint. A meandering path survey method was selected to avoid vegetation and other obstructions located within the MRS.	Presence of MEC is not fully understood. Survey will be conducted to identify presence of MEC. Site will require further investigation under additional CERCLA action.
Water Works #4 Dump	Perform line abreast magnetometer assisted UXO survey of open northeastern section of MRS and meandering path survey of remaining area (~ 6 acres). A line abreast survey method was selected for the open area to provide 100 percent coverage where munitions and munitions debris are known to exist. A meandering path survey method was selected for the remaining wooded area to avoid obstructions.	Presence of MEC lying on the ground surface and potentially buried are not fully understood. Survey will be conducted to determine presence/absence of MEC and to substantiate MRS footprint.
Group 8 MRS (formerly known as Area Between Buildings 846 and 849)	Perform line abreast magnetometer/metal detector assisted UXO survey of entire MRS (~ 3 acres).	Presence of MEC and munitions debris lying on the ground surface and potentially buried are not fully understood. Survey will be conducted to determine presence/absence of MEC and substantiate MRS footprint.

Footnote: The potential for MEC exists at each MRS; as such, magnetometer-assisted surveys will be performed for anomaly avoidance safety precautions and to identify buried metallic items.

Table 2: Summary of MC SI Decisions

MRS	MC SI Activities	
	Activity	**Purpose/Rationale**
Ramsdell Quarry Landfill (RVAAP-001-R-01)	Collect four multi-incremental (MI) surface soil samples from distinct areas (1 per area) within the southern quarry area. MI samples will be analyzed for explosives, propellants, and TALmetals. Soil samples will not be collected from the former OB/OD quarry area.	Identify presence/absence of MC at the southern quarry and to populate the Munitions Response Site Prioritization Protocols (MRS-PP). Sample analytical data will be compared with EPA Region 9 Residential PRGs[1]. Samples will not be collected from former OB/OD quarry area since MC is covered under the IRP. Detection of MC greater than the PRGs is sufficient to require further characterization at a MRS. MI coverage is designed to provide greatest possible coverage of the MRS to attain NFA or need for further characterization.
Load Line #1 (RVAAP-008-R-01)	Collect one MI surface soil sample from area where propellant is found. MI sample will be analyzed for explosives, propellants, and TAL metals.	Identify presence/absence of MC at the location were propellant may be located and to populate the MRS-PP. Sample analytical data will be compared with EPA Region 9 Residential PRGs[1]. Detection of MC greater than the PRGs is sufficient to require further characterization at a MRS. MI coverage is designed to provide greatest possible coverage of the MRS to determine need for further characterization.
Landfill North of Winklepeck (RVAAP-019-R-01)	Collect one composite surface soil sample from the new MRS footprint. Surface soil sample will be analyzed for explosives, propellants, and TAL metals.	Identify presence/absence of MC at the MRS and to populate the MRS-PP. Sample analytical data will be compared with EPA Region 9 Residential PRGs[1]. Detection of MC greater than the PRGs is sufficient to require further characterization at a MRS. Composite sample designed to provide information for the MRS-PP, solely. Based on potential presence of MEC, site will require further characterization.

Table 2: Summary of MC SI Decisions (continued)

MRS	MC SI Activities	
	Activity	**Purpose/Rationale**
Firestone Test Facility (RVAAP-033-R-01)	Collect one MI surface soil sample from the open field in the eastern end of the Firestone Test Facility. MI sample to be analyzed for explosives, propellants, and TAL metals.	Identify presence/absence of MC at the open field and to populate the MRS-PP. Sample analytical data will be compared with EPA Region 9 Residential PRGs[1]. This area has not been sampled under the IRP; therefore, it will be sampled under the MMRP. Detection of MC greater than the PRGs is sufficient to require further characterization at a MRS. MI sample designed to provide greatest possible coverage of the open field to eliminate area from the MRS foot print and attain NFA or need for further characterization. Based on potential presence of MEC in the pond, the MRS will require further characterization.
Block D Igloo (RVAAP-060-R-01)	Collect one composite surface soil sample from former igloo area. Surface soil sample will be analyzed for explosives and TAL metals.	Surface soil sample to be collected solely to populate the MRS-PP. Site likely to require further characterization, which falls outside the scope of this SI. Detection of MC greater than the PRGs is sufficient to require further characterization at a MRS. Composite sample designed to provide information for the MRS-PP, solely. Due to the complexity of the MRS, site will require further characterization.
Block D Igloo–TD (RVAAP-061-R-01)	Collect two composite surface soil samples from MRS. Surface soil sample will be analyzed for explosives and TAL metals.	Surface soil samples to be collected solely to populate the MRS-PP. Site likely to require further characterization, which falls outside the scope of the SI. Detection of MC greater than the PRGs is sufficient to require further characterization at a MRS. Composite samples designed to provide information for the MRS-PP, solely. Due to the complexity of the MRS, site will require further characterization.

Table 2: Summary of MC SI Decisions (continued)

MRS	MC SI Activities	
	Activity	**Purpose/Rationale**
Water Works #4 (RVAAP-062-R-01)	Collect one composite surface soil sample from the MRS. Surface soil sample will be analyzed for explosives, propellants, and TAL metals.	Identify presence/absence of MC at the MRS and to populate MRS-PP. Sample analytical data will be compared with EPA Region 9 Residential PRGs[1]. Detection of MC greater than the PRGs is sufficient to require further characterization at a MRS. Composite sample designed to provide information for the MRS-PP, solely. Based on potential presence of MEC, site will require further characterization.
Group 8 MRS (RVAAP-063-R-01)	Collect five MI surface soil samples from distinct areas (1 per area) within the MRS footprint. Surface soil samples will be analyzed for explosives, propellants, and TAL metals.	Identify presence/absence of MC at the MRS and to populate the MRS-PP. Sample analytical data will be compared with EPA Region 9 Residential PRGs[1]. Detection of MC greater than the PRGs is sufficient to require further characterization at a MRS. MI coverage is designed to provide greatest possible coverage of the MRS to attain NFA or need for further characterization.

[1] EPA Region 9 Residential Preliminary Remediation Goals. (Note: A straight comparison to the EPA Region 9 Residential PRGs will be made for carcinogenic analytes, while non-carcinogenic analytes will be compared to 1/10 the residential PRG value.

Table 3: Sample Summary

MRS	Number of Samples/Analytical Parameters			QA/QC* Samples
	Explosives	**Propellants**	**TAL Metals**	**Field Duplicates**
Ramsdell Quarry Landfill	4	4	4	0
Load Line #1	1	1	1	1
Landfill North of Winklepeck[1]	1	1	1	0
Firestone Test Facility	1	1	1	1
Block D Igloo[1]	1	0	1	1
Block D Igloo–TD[1]	2	0	2	0
Water Works #4 Dump[1]	1	1	1	1
Group 8 MRS	5	5	5	0
Contingency Samples[3]	8	8	8	0
TOTAL	**24**	**21**	**24**	**4**

* Quality Assurance/Quality Control (QA/QC)

[1] Composite Samples will be collected from these MRSs.

[2] Two duplicate samples will be collected for the MI sample group and two for the composite sample group.

[3] Contingency samples (7-wheel composite surface soil samples) will be collected at locations with unexpected field conditions (e.g., unexpected discovery of MEC).

Note 1: Temperature Blanks will be added to each cooler submitted to the laboratory.
Note 2: Field splits will be collected by Ohio EPA.

3.0 FIELD ACTIVITIES

3.1 Rationale/Design

Due to the size and complexity of some of the MRSs additional characterization beyond the scope of this SI will be required and conducted under the next CERCLA phase. In general, these MRS have a known presence of MEC and/or MC. At these complex MRSs, the intent of the SI field activities will be to collect data to support further characterization under CERCLA. Therefore, at these sites the rationale is to collect data to refine the MRS footprint, identify/confirm types of munitions that are present, and determine if MEC may be present. These MRSs include:

- Ramsdell Quarry Landfill
- Erie Burning Grounds
- Demolition Area #2
- Load Line #1
- Fuze and Booster Quarry
- Landfill North of Winklepeck
- 40mm Firing Range
- Firestone Test Facility
- Atlas Scrap Yard
- Block D Igloo
- Block D Igloo–TD
- Water Works #4;

For the less complex MRSs (Load Line 12, Sand Creek Dump, Building #F-15 and F-16, Anchor Test Area, and Group 8 MRS), the sampling rationale is to collect sufficient data to confirm the presence and/or absence of MEC and/or MC.

Regarding the investigation of MC during this SI, 12 of the 17 MRSs are collocated with areas of concern (AOCs) that are being addressed under the IRP where analytical data has already been collected. In general, the existing IRP analytical data will be used to populate the Draft MRS-PP worksheets.

The sampling approach was developed based on input from the US Army Environmental Command (USAEC), USACE, Ohio EPA, and other Installation Stakeholders. Based on this input, the following sampling strategy is being implemented at the RVAAP MRSs.

3.2 MRS Field Activity Summaries

The following subsections provide brief summaries of the field activities that will be conducted at each MRS. **Figures 3** through **14** provide the proposed areas of investigation at each MRS. Brief summaries of the MRSs on which field work will be performed during this SI are provided in **Table 4**. For more site-specific details on the MRSs, please refer to the WP.

Table 4: Summaries of MRS Findings

MRS Name	HRR Acreage[1]	Presence of MEC/MC		Data Gaps
		MEC YES/NO/ UNKNOWN	**MC** YES/NO/ UNKNOWN	
Ramsdell Quarry Landfill (RVAAP-001-R-01)	13.43	Unknown	Yes	Presence and type of MEC at the former OB/OD area at the bottom of the quarry is expected. Data gaps exist for the area south of the quarry where presence/absence of MEC is not fully known. Presence of MC at the OB/OD area has been established. Presence of MEC and MC at the area south of the quarry is not fully known.
Erie Burning Grounds (RVAAP-002-R-01)	33.93	Unknown	IRP[2]/MMRP	Presence and type of MEC at the MRS is not fully known. Presence of MC has been established (exception: MC in wet sediments is not fully understood).
Demolition Area #2 (RVAAP-004-R-01)	32.95	Yes	Yes	Presence of MEC has been established, but type is not fully known. Presence of MEC at the two Burial Sites, Rocket Ridge, and the Northern Bomb Disposal area is not fully known. Presence of MC established, but not at the Burial Sites, Rocket Ridge, and the Northern Bomb Disposal area.
Load Line #1 (RVAAP-008-R-01)	4.63	Unknown	IRP[2]/MMRP	Shaw Environmental is under contract to complete an interim soil and dry sediment removal action that will address some of the propellant located at the MRS. Propellant that remains after completion of the interim removal action will be investigated under this SI.
Load Line #12 (RVAAP-012-R-01)	1.0	Unknown	IRP[2]	Presence and type of potentially buried MEC is not fully known. MC is covered under the IRP.
Fuze and Booster Quarry (RVAAP-016-R-01)	12.74	Unknown	Yes/IRP[2]	Presence and type of MEC in the three ponds is not fully known. Munitions debris is present. MC is being covered under the IRP.
Landfill North of Winklepeck (RVAAP-019-R-01)	14.05	Unknown	Yes	Presence and type of MEC at the revised MRS location is suspected but not fully known. Presence of MC is suspected but not fully known. Presence of munitions debris has been established.
40mm Firing Range (RVAAP-032-R-01)	5.17	Unknown	IRP[2]	Presence and type of MEC at the firing range is not fully known. MC is being covered under the IRP.

Table 4: Summaries of MRS Findings (continued)

MRS Name	HRR Acreage[1]	Presence of MEC/MC		Data Gaps
		MEC YES/NO/ UNKNOWN	MC YES/NO/ UNKNOWN	
Firestone Test Facility (RVAAP-033-R-01)	0.91	Unknown	IRP[2]	Presence and type of MEC at the shaped charge test pond, test chambers (3), and clearing is not fully known. MC is being covered under the IRP with the exception of the open field at the eastern boundary. Sediment samples have not been collected from the shaped charge test pond, which will require additional characterization.
Sand Creek Dump (RVAAP-034-R-01)	0.85	Unknown	IRP[2]	Presence and type of MEC at the MRS is not fully known. MC is being covered under the IRP.
Building #F-15 and F-16 (RVAAP-046-R-01)	12.23	Unknown	IRP[2]	Presence and type of MEC is not fully known. MC is being covered under the IRP.
Anchor Test Area (RVAAP-048-R-01)	2.57	Unknown	IRP[2]	Presence and type of MEC is not fully known. MC is being covered under the IRP.
Atlas Scrap Yard (RVAAP-050-R-01)	66.04	Unknown	Yes/IRP[2]	Presence of munitions debris has been established. However, presence and type of MEC is not fully known. MC is being covered under the IRP.
Block D Igloo (RVAAP-060-R-01)	622.24	Unknown	Unknown	Presence and type of MEC is not known. Presence of MC is not known.
Block D Igloo–TD (RVAAP-061-R-01)	19.25	Unknown	Unknown	Presence and type of MEC is not known. Presence of MC is not known.
Water Works #4 Dump (RVAAP-062-R-01)	6.15	Unknown	Unknown	Presence of munitions debris has been established. Presence and type of MEC is not fully known. Presence of MC is not known.
Group 8 MRS (RVAAP-063-R-01)	2.65	Unknown	Unknown	Presence and type of MEC is not known. Presence of MC is not known.

[1] = Historical Records Review (HRR)

[2] = MC will be covered under the IRP and will not be investigated further under the MMRP.

3.2.1 Ramsdell Quarry Landfill (RVAAP-001-R-01)

Summaries of the MRS and HRR findings are presented in **Table 4**.

MEC Activities: Adequate historic data determining the presence of MEC at the former OB/OD area exists; however, little information is known concerning the activities that were conducted in the open quarry area to the south of the former OB/OD area or whether or not MEC or munitions debris are present. Therefore, line abreast and meandering path magnetometer assisted UXO surveys will be conducted in the area south of the quarry. A line abreast survey will be performed in the open area located in the northeastern portion of the south quarry, while a meandering path survey will be performed in the remaining wooded area. The surveys will be conducted to identify any MEC or munitions debris lying or protruding through the ground surface. The intent of the survey is to:

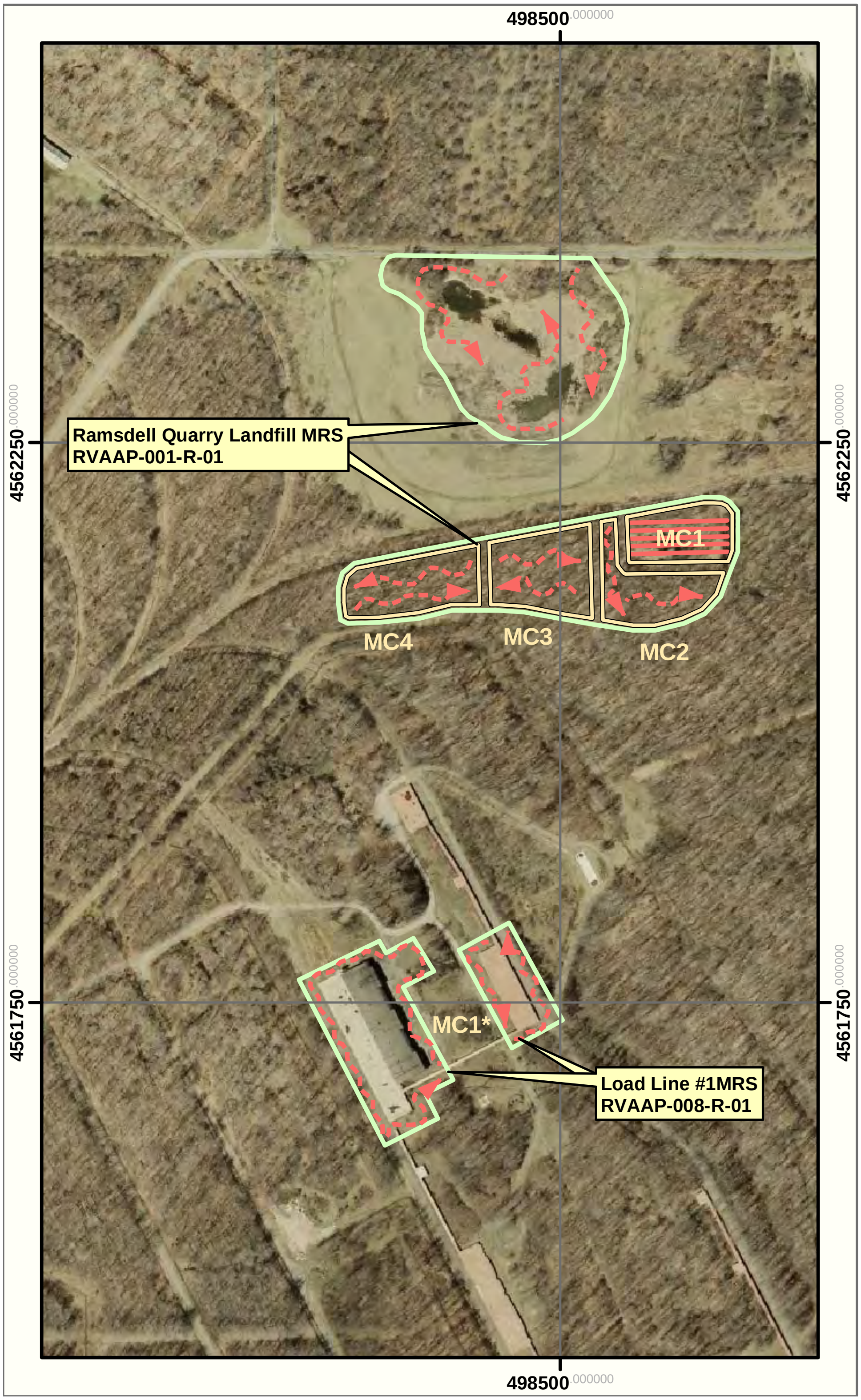
- establish the presence/absence of MEC and munitions debris;
- determine if southern quarry area can be eliminated from the MRS footprint or if further characterization is needed; and
- refine the MRS boundary.

Although adequate information exists establishing the presence of MEC at northern former OB/OD quarry area, a meandering path magnetometer assisted UXO survey will be conducted to support further characterization that will be required at the quarry (by identifying presence of buried anomalies) and to refine the MRS boundary.

MC Activities: The presence of MC in the former OB/OD area in the northern quarry has been confirmed and will continue to be addressed under the IRP. Therefore, no samples will be collected in this area during this SI. However, the presence of MC at the area south of the northern quarry is not fully known and will require further investigation. Under this SI, four (4) MI surface soil samples will be collected from the area to the south and analyzed for explosives, propellants, and TAL metals. Four distinct sample areas will be established based on the terrain, vegetation, and other physical conditions observed at the MRS. The intent will be to establish the presence or absence of elevated levels of MC and to populate the MRS-PP. MC constituents will be compared to EPA Region 9 Residential PRGs. MC constituents exceeding the PRGs will be defined as elevated. **Figure 3** provides the proposed sample areas and the location of the UXO surveys to be conducted.

RAMSDELL QUARRY LANDFILL and LOAD LINE #1 MRSs SI ACTIVITIES MAP
Ravenna Army Ammunition Plant, OH

Figure 3



MC	Multi-incremental Sample Area
▬	Line Abreast Survey Area
- - ►	Meandering Path Survey Area

Area Status

▭	MRS, Closed

***** Load Line #1 sample area dependent on location of propellant.

Data Source: e^{2}M, Final Military Munitions Response Program Historical Records Review, Ravenna Army Ammunition Plant, Ohio, October 2006.

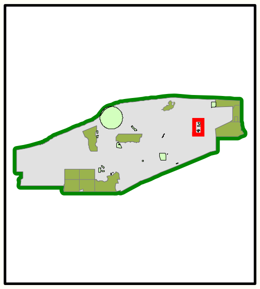
Projection:	UTM Zone 17
Datum :	WGS 84
Units:	Meters
Grid:	500 Meter

1:6,000

0 150 300 450 Feet

0 40 80 120 160 Meters

Reference Location Map
RVAAP



FIELD SAMPLING PLAN
RAVENNA ARMY AMMUNITION PLANT, OH

Source: Produced for the U.S. Army Corps of Engineers by engineering-environmental Management, Inc. (e^{2}M)

Date: September 2007
Edition: Final

3.2.2 Erie Burning Grounds (RVAAP-002-R-01)

Summaries of the MRS and HRR findings are presented in **Table 4**.

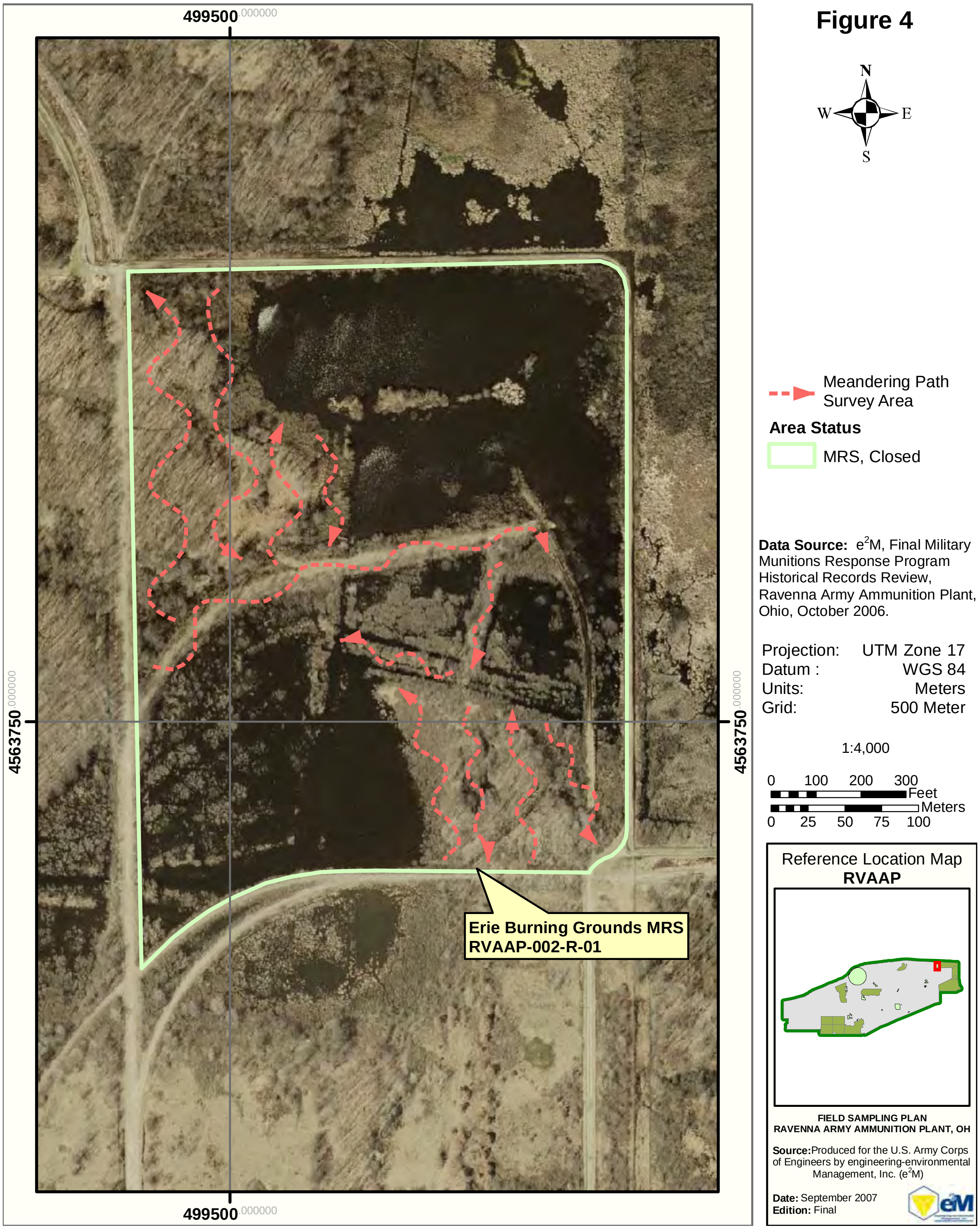
MEC Activities: Adequate historic data determining the presence and density of MEC items has not fully been determined and will require further evaluation during the SI process. Therefore, a meandering path magnetometer assisted UXO survey will be conducted across the entire MRS within accessible dry areas. Surveys of submerged areas will not be undertaken during this SI; instead, these areas will require additional characterization under future CERCLA action. The survey will be conducted to identify any MEC or munitions debris lying on or protruding through the ground surface and any buried anomalies. The intent of the survey is to:

- establish the presence/type of MEC and munitions debris; and
- support further characterization efforts at the MRS.

MC Activities: Adequate analytical data identifying the presence of MC at the MRS has been collected under the IRP and will be used to populate the MRS-PP. Therefore, no samples will be collected from the MRS during this SI. However, the investigation of MC in dry sediments at the MRS will require additional investigation under future CERCLA actions. **Figure 4** provides the areas where the UXO survey will be conducted.

ERIE BURNING GROUNDS MRS
SI ACTIVITIES MAP
Ravenna Army Ammunition Plant, OH

Figure 4



Meandering Path Survey Area

Area Status

MRS, Closed

Data Source: e^2M, Final Military Munitions Response Program Historical Records Review, Ravenna Army Ammunition Plant, Ohio, October 2006.

Projection:	UTM Zone 17
Datum :	WGS 84
Units:	Meters
Grid:	500 Meter

1:4,000

0 100 200 300 Feet
0 25 50 75 100 Meters

FIELD SAMPLING PLAN
RAVENNA ARMY AMMUNITION PLANT, OH

Source: Produced for the U.S. Army Corps of Engineers by engineering-environmental Management, Inc. (e^2M)

Date: September 2007
Edition: Final

3.2.3 Demolition Area #2 (RVAAP-004-R-01)

Summaries of the MRS and HRR findings are presented in **Table 4**.

MEC Activities: Adequate information exists documenting the presence of MEC at the MRS; however, additional information needs to be collected to further define the MEC boundaries, to the extent possible, at the Bomb Disposal Area outside the northwestern section of the site, at the two Burial Sites, and at Rocket Ridge. Furthermore, additional information needs to be collected along the current MRS boundary to verify/confirm the presence of MEC. Therefore, meandering path magnetometer assisted UXO surveys will be conducted in these locations and surrounding areas. The surveys will be conducted to identify MEC and munitions debris lying on or protruding through the ground surface and any buried anomalies. The intent of the surveys is to:

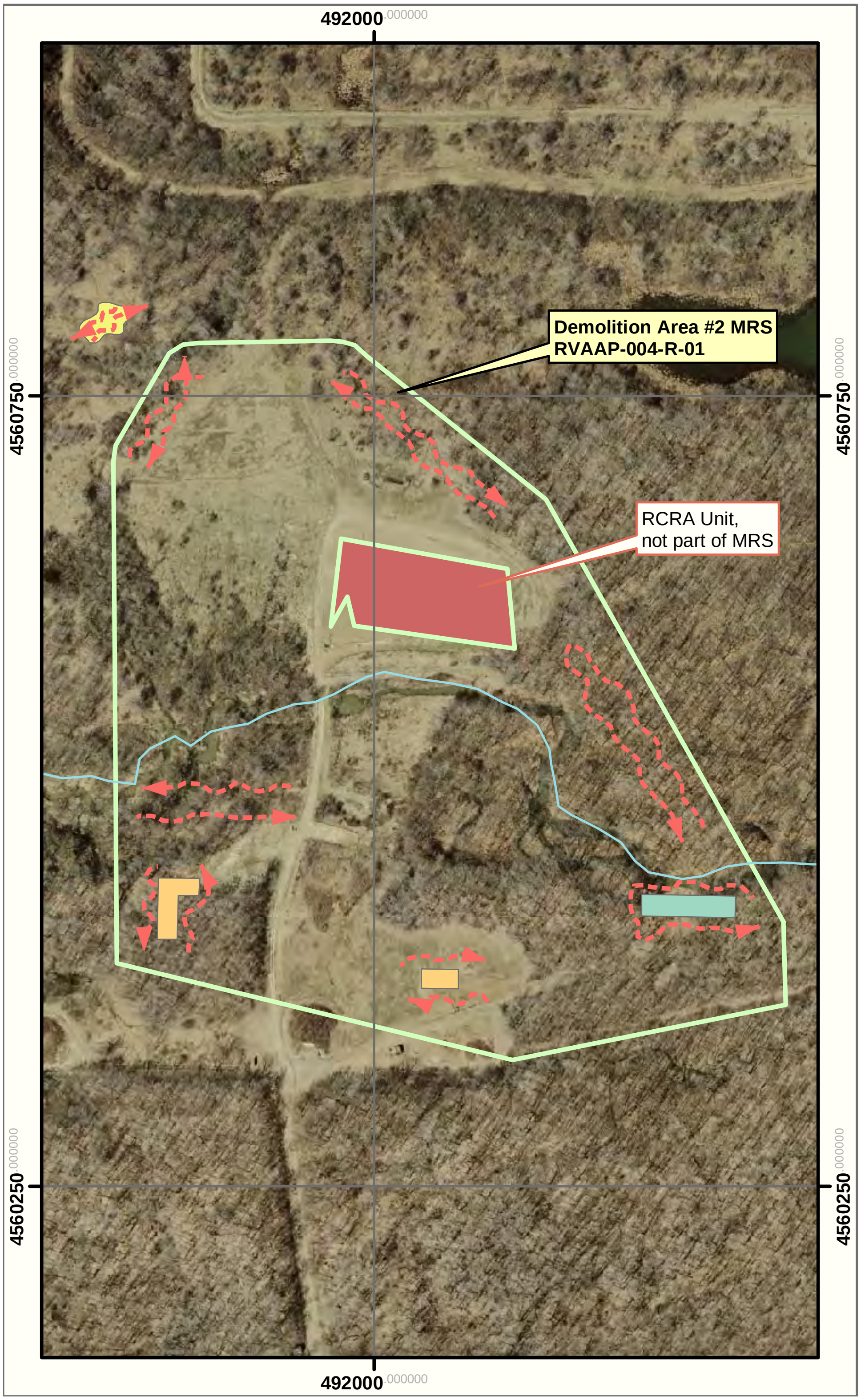
- establish presence of MEC and munitions debris;
- refine the MRS boundary (i.e., increase/decrease); and
- support further characterization efforts at the MRS.

Further characterization work that is outside the scope of this SI will be required across the entire MRS to define the extent and density of MEC. These efforts will be conducted under additional CERCLA actions.

MC Activities: Adequate analytical data identifying the presence of MC at the MRS has been collected under the IRP and will be used to populate the MRS-PP. Therefore, no samples will be collected from the MRS during this SI. However, the investigation of MC at the MRS (especially at the burial sites, bomb disposal area, and Rocket Ridge area where no data exists) will require additional investigation under future CERCLA actions. **Figure 5** provides the areas where the UXO surveys will be conducted.

DEMOLITION AREA #2 MRS
SI ACTIVITIES MAP
Ravenna Army Ammunition Plant, OH

Figure 5



〰 Stream
🟨 Bomb Disposal Area
🟧 Burial Site
🟥 RCRA Unit, MMRP Non-eligible
🟩 Rocket Ridge
- - ► Meandering Path Survey Area

Area Status

☐ MRS, Closed

Data Source: e^{2}M, Final Military Munitions Response Program Historical Records Review, Ravenna Army Ammunition Plant, Ohio, October 2006.

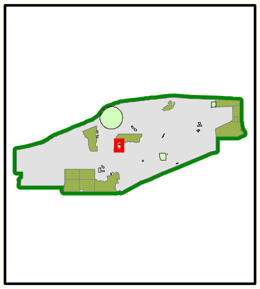
Projection:	UTM Zone 17
Datum :	WGS 84
Units:	Meters
Grid:	500 Meter

1:4,250

0 100 200 300 Feet

0 25 50 75 100 Meters

Reference Location Map
RVAAP



FIELD SAMPLING PLAN
RAVENNA ARMY AMMUNITION PLANT, OH

Source: Produced for the U.S. Army Corps of Engineers by engineering-environmental Management, Inc. (e^{2}M)

Date: September 2007
Edition: Final

3.2.4 Load Line #1 (RVAAP-008-R-01)

Summaries of the MRS and HRR findings are presented in **Table 4**.

MEC Activities: Triple base propellants are known to exist lying on the ground surface at the MRS and will be investigated to confirm presence, location, and density. This will be achieved by performing a meandering path UXO survey of all open areas within the MRS footprint. The intent of the survey will be to:

- confirm presence, location, and density of propellants;
- refine the MRS boundary (i.e., increase/decrease); and
- support/identify need for further characterization.

MC Activities: Analytical data identifying the presence of MC resulting from the load line operations has been collected under the IRP. However, very little analytical data exists for those areas that contain propellants lying on the ground surface. Therefore, where propellant is found at the MRS, one (1) MI surface soil sample will be collected and analyzed for explosives, propellants, and TAL metals. The sample area will be established around the area with the highest density of propellants and the coordinates of each corner recorded with a global positioning system (GPS) unit. The intent will be to establish the presence of MC and to populate the MRS-PP. Figure 3 provides the areas where the UXO surveys will be conducted.

3.2.5 Load Line #12 (RVAAP-012-R-01)

Summaries of the MRS and HRR findings are presented in **Table 4**.

MEC Activities: Adequate historic data identifying the presence and density of MEC has not been fully established and will require further evaluation during this SI. Therefore, a line abreast magnetometer assisted UXO survey will be conducted at the location and surrounding area where the 90mm projectiles were found. The survey will be conducted to identify any MEC or munitions debris lying on or protruding through the ground surface and any buried anomalies. The intent of the survey is to

- establish presence/absence of MEC and munitions debris;
- refine the MRS boundary; and
- determine if the area can be eliminated from the MRS footprint or if further characterization is needed.

MC Activities: Adequate analytical data identifying the presence of MC at the MRS has been collected under the IRP and will be used to populate the MRS-PP. Therefore, no samples will be collected from the MRS during this SI. **Figure 6** provides the area where the UXO survey will be conducted.

ATLAS SCRAP YARD and LOAD LINE #12 MRSs
Ravenna Army Ammunition Plant, OH

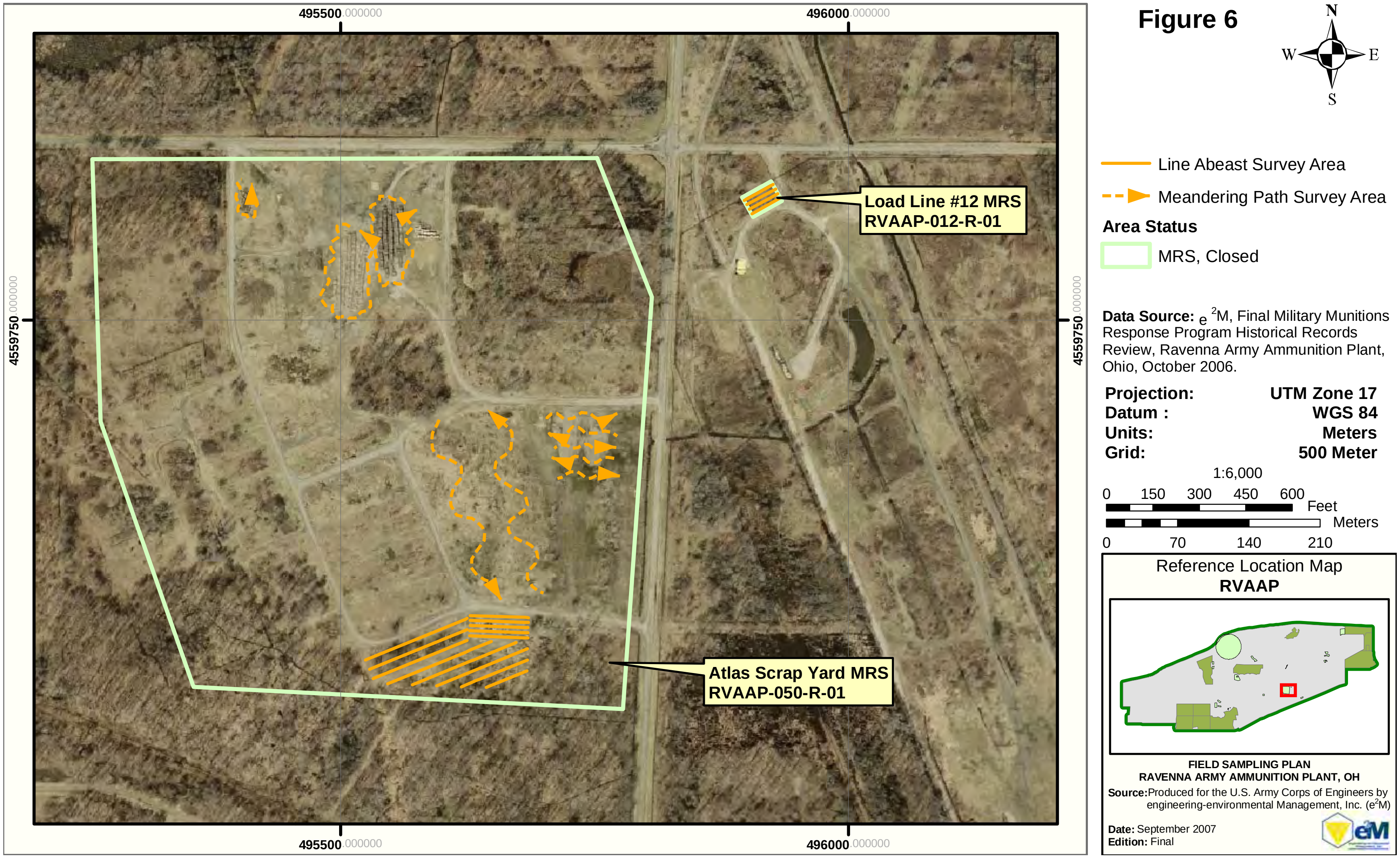


Figure 6

— Line Abeast Survey Area

- - ▶ Meandering Path Survey Area

Area Status

☐ MRS, Closed

Data Source: e^{2}M, Final Military Munitions Response Program Historical Records Review, Ravenna Army Ammunition Plant, Ohio, October 2006.

Projection:	**UTM Zone 17**
Datum :	**WGS 84**
Units:	**Meters**
Grid:	**500 Meter**

1:6,000

0 150 300 450 600 Feet

0 70 140 210 Meters

FIELD SAMPLING PLAN
RAVENNA ARMY AMMUNITION PLANT, OH
Source: Produced for the U.S. Army Corps of Engineers by engineering-environmental Management, Inc. (e^{2}M)

Date: September 2007
Edition: Final

3.2.6 Fuze and Booster Quarry (RVAAP-016-R-01)

Summaries of the MRS and HRR findings are presented in **Table 4**.

MEC Activities: The presence of MEC and munitions debris on the banks of the ponds is not fully understood and will require further characterization during this SI. Therefore, a meandering path magnetometer/metal detector assisted UXO survey of the banks and immediate surrounding area will be conducted. The survey will be conducted to identify any MEC or munitions debris lying on or protruding through the ground surface and any buried anomalies. The intent of the survey is to:

- establish presence/absence of MEC and munitions debris; and
- refine the MRS boundary.

Because the banks of the ponds are steep, the UXO team will do a perimeter walk around the top of the ponds to visually identify MEC or munitions debris, and to assess safety issues related to descending the banks. If the team identifies MEC during the perimeter walk, the UXO survey will be discontinued based on safety concerns. If the team does not identify MEC and determines that the banks can be descended safely, then the survey will be continued.

Further characterization work will be required at the ponds (i.e., for submerged MEC) to define the presence of MEC. This effort is outside the scope of this SI and will be conducted under additional CERCLA actions.

MC Activities: Chemical contamination at the MRS is being covered under the IRP and will not be investigated further under the MMRP. Therefore, no samples will be collected from the MRS during this SI. Existing analytical data identifying the presence of MC collected under the IRP will be used to populate the MRS-PP. **Figure 7** provides the area where the UXO surveys will be conducted.

FUZE AND BOOSTER QUARRY, WATER WORKS #4 DUMP, and 40mm FIRING RANGE MRSs SI ACTIVITIES MAP
Ravenna Army Ammunition Plant, OH

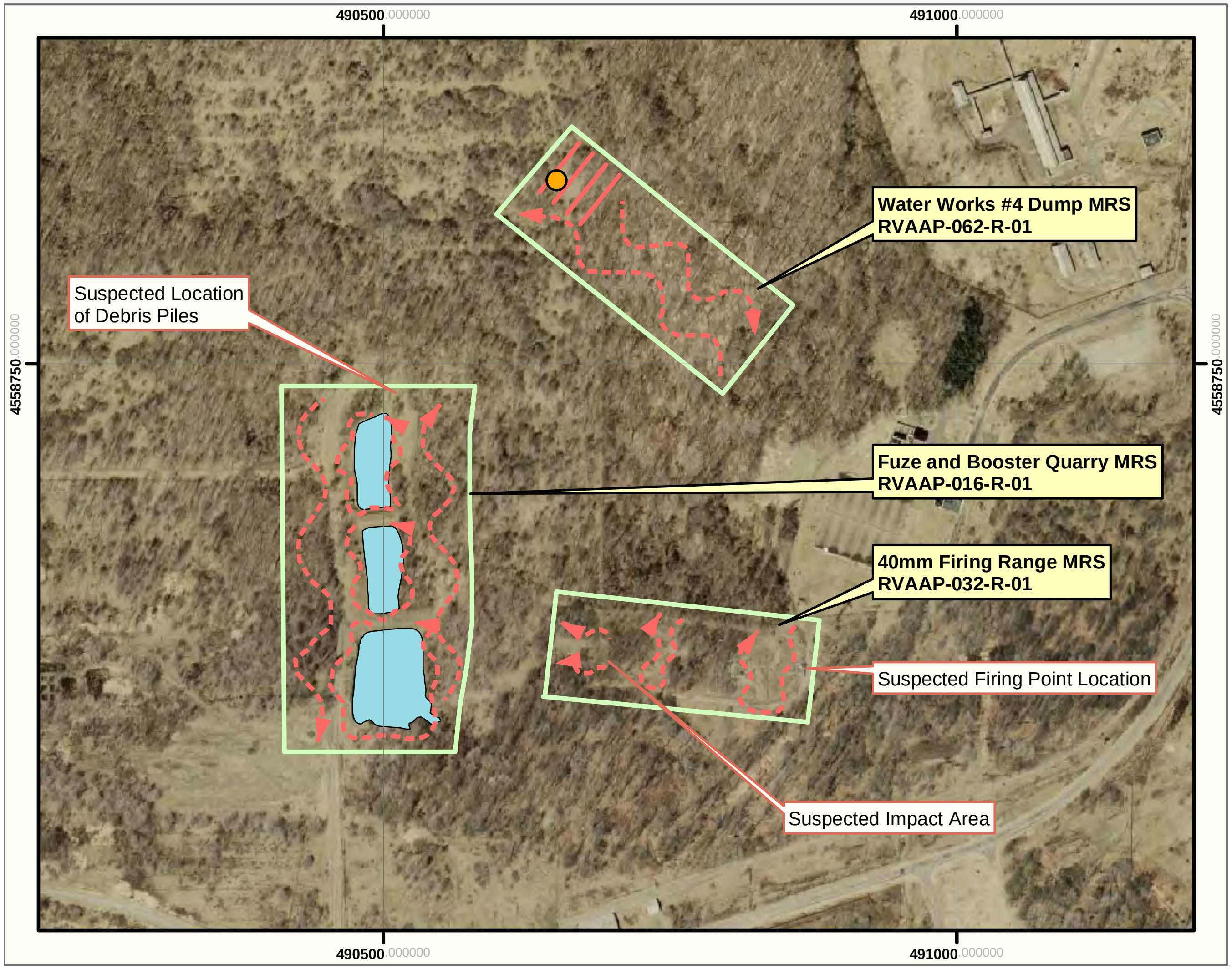


Figure 7

- 🟦 Water
- ● Discrete Sample Location *
- — Line Abreast Survey Area
- - - ▶ Meandering Path Survey Area

Area Status

☐ MRS, Closed

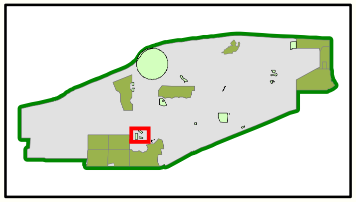
***** Discrete sample location will be determined in the field following the UXO survey.

Data Source: e ^{2}M, Final Military Munitions Response Program Historical Records Review, Ravenna Army Ammunition Plant, Ohio, October 2006.

Projection:	**UTM Zone 17**
Datum :	**WGS 84**
Units:	**Meters**
Grid:	**500 Meter**

1:6,000

Reference Location Map
RVAAP



FIELD SAMPLING PLAN
RAVENNA ARMY AMMUNITION PLANT, OH

Source: Produced for the U.S. Army Corps of Engineers by engineering-environmental Management, Inc. (e ^{2}M)

Date: September 2007
Edition: Final

3.2.7 Landfill North of Winklepeck (RVAAP-019-R-01)

Summaries of the MRS and HRR findings are presented in **Table 4**.

MEC Activities: The presence of MEC and munitions debris along the slopes and within the stream course is not fully understood and will require further characterization during this SI. Therefore, meandering path magnetometer/metal detector assisted UXO survey will be conducted along the hillside, creek bed, and downstream area. The survey will be conducted to identify any MEC or munitions debris lying on or protruding through the ground surface and any buried anomalies. The intent of the survey is to:

- establish presence and density of MEC and munitions debris; and
- refine the MRS boundary.

Any MEC subsequently found at the former landfill, which is not covered under the MMRP, will addressed under the IRP.

MC Activities: Adequate analytical data for the revised MRS does not exist. Therefore, one composite surface soil sample will be collected using the 7-wheel method (See **Section 3.4.2**) and analyzed for explosives, propellants, and TAL metals. The sample will be collected adjacent to an area that contains MEC or munitions debris following completion of a UXO anomaly avoidance survey. The intent will be to establish the presence of MC and to populate the MRS-PP. **Figure 8** provides the proposed sample areas and locations where the UXO surveys will be conducted.

LANDFILL NORTH of WINKLEPECK MRS SI ACTIVITIES MAP
Ravenna Army Ammunition Plant, OH

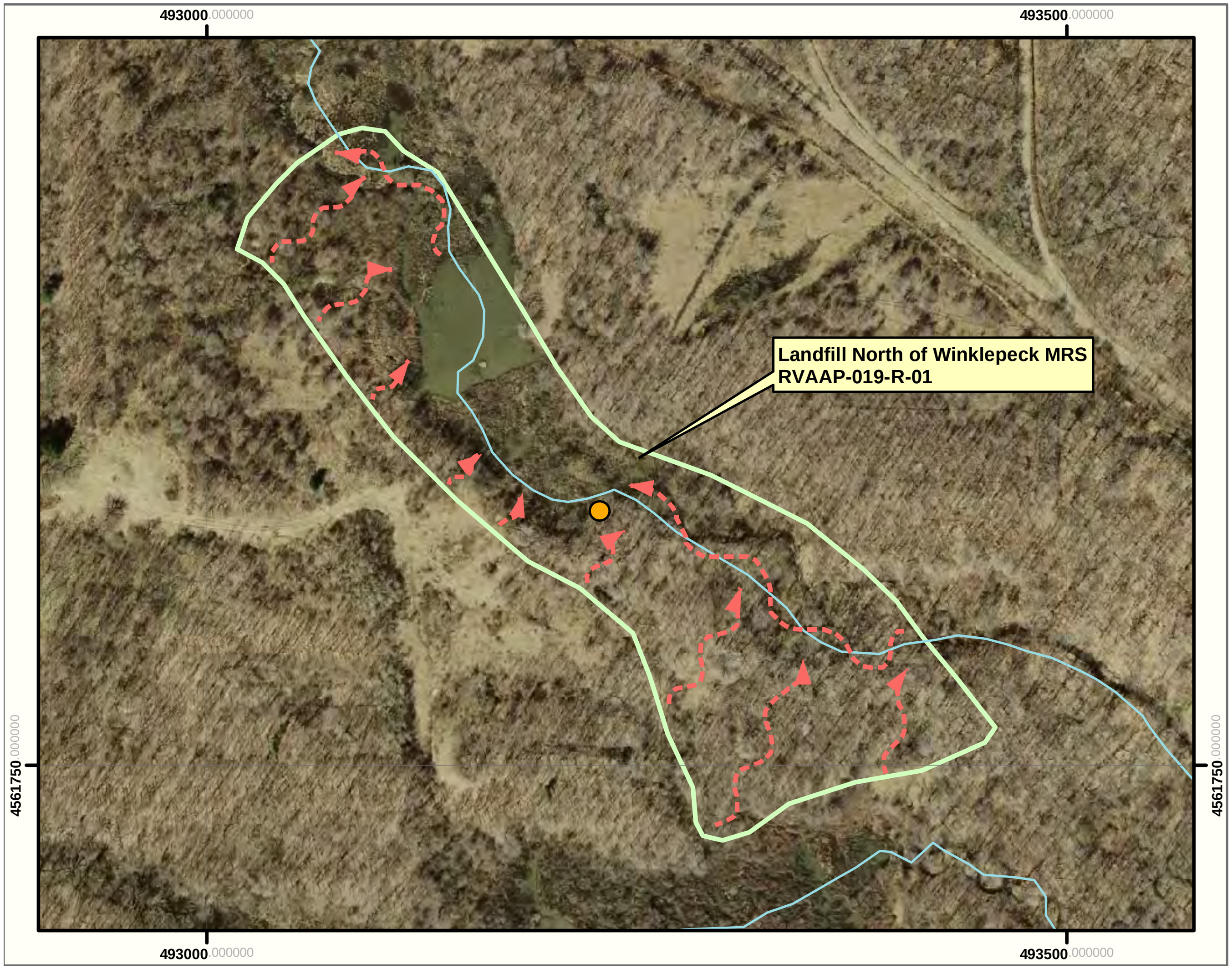


Figure 8

〰 Stream

▶ Meandering Path Survey Area

● Discrete Sample Location *

Area Status

☐ MRS, Closed

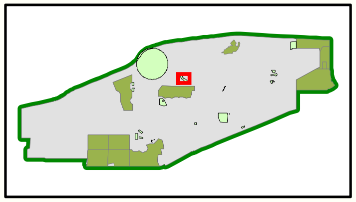
***** Discrete sample location will be determined in the field following the UXO survey.

Data Source: e ^{2}M, Final Military Munitions Response Program Historical Records Review, Ravenna Army Ammunition Plant, Ohio, October 2006.

Projection:	**UTM Zone 17**
Datum :	**WGS 84**
Units:	**Meters**
Grid:	**500 Meter**

1:4,000

Reference Location Map
RVAAP



FIELD SAMPLING PLAN
RAVENNA ARMY AMMUNITION PLANT, OH
Source: Produced for the U.S. Army Corps of Engineers by engineering-environmental Management, Inc. (e^{2}M)

Date: September 2007
Edition: Final

3.2.8 40mm Firing Range (RVAAP-032-R-01)

Summaries of the MRS and HRR findings are presented in **Table 4**.

MEC Activities: The presence of MEC and munitions debris at the former test range is not fully understood and will require further characterization during this SI. Therefore, a meandering path magnetometer/metal detector assisted UXO survey will be conducted at the firing point, impact area, and down range of the impact area. The survey will be conducted to identify any MEC or munitions debris lying on or protruding through the ground surface and any buried anomalies. The intent of the survey is to:

- establish presence/absence of MEC and munitions debris;
- refine the MRS boundary; and
- support the need for further characterization.

MC Activities: Chemical contamination at the MRS is being covered under the IRP and will not be investigated further under the MMRP. Therefore, no samples will be collected from the MRS during this SI. Existing analytical data identifying the presence of MC collected under the IRP will be used to populate the MRS-PP. **Figure 7** provides the area where the UXO survey will be conducted.

3.2.9 Firestone Test Facility (RVAAP-033-R-01)

Summaries of the MRS and HRR findings are presented in **Table 4**.

MEC Activities: The presence of MEC or munitions debris is not expected at or around the former test chambers since the buildings have been removed. Regardless, a line abreast UXO survey will be conducted to determine if MEC or munitions debris is present at the three former test chambers and at the small clearing located in the northeast section of the site. Magnetometers and metal detectors will only be used at locations that do not have an impervious surface (i.e., concrete or asphalt). At the former shaped charge test pond, a meandering path survey will be conducted in the immediate area surrounding the pond. The surveys will be conducted to identify any MEC or munitions debris lying on or protruding through the ground surface and any buried anomalies. The intent of the surveys is to:

- establish presence/absence of MEC and munitions debris;
- refine the MRS boundary; and
- support the need for further characterization at the former test chambers, open field, and area surrounding the pond, if.

MEC may be present in the pond and will require further characterization under additional CERCLA action. Therefore, UXO surveys of the submerged portion of the pond will not be conducted during this SI effort.

MC Activities: Chemical contamination at the MRS is being investigated under the IRP. However, no data has been collected for the suspected test range area, which will be investigated further under this SI. Therefore, one (1) MI surface soil sample will be collected and analyzed for explosives, propellants, and TAL metals. The sample area will be selected based on distinct physical features (e.g., former structures, open areas, soil type). The intent will be to establish the presence of MC and to populate the MRS-PP. **Figure 9** provides the proposed sample area and locations where the UXO surveys will be conducted.

FIRESTONE TEST FACILITY MRS SI ACTIVITIES MAP
Ravenna Army Ammunition Plant, OH

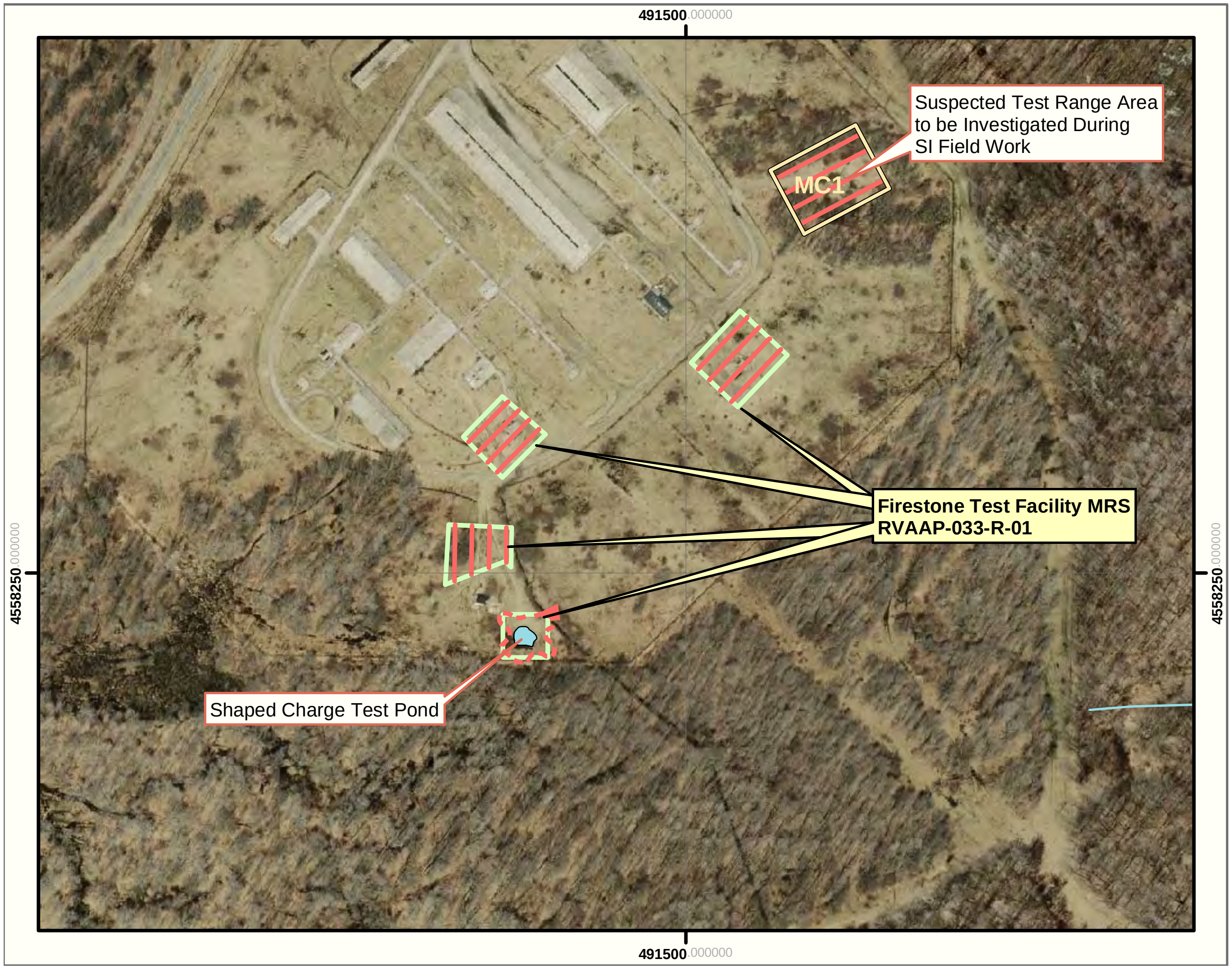


Figure 9

- Stream
- Water
- MC Multi-incremental Sample Area
- Line Abeast Survey Area
- Meandering Path Survey Area

Area Status

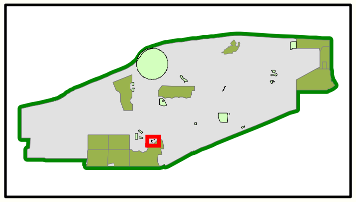
- MRS, Closed

Data Source: e^{2}M, Final Military Munitions Response Program Historical Records Review, Ravenna Army Ammunition Plant, Ohio, October 2006.

Projection:	**UTM Zone 17**
Datum :	**WGS 84**
Units:	**Meters**
Grid:	**500 Meter**

1:4,000

Reference Location Map
RVAAP



FIELD SAMPLING PLAN
RAVENNA ARMY AMMUNITION PLANT, OH

Source: Produced for the U.S. Army Corps of Engineers by engineering-environmental Management, Inc. (e^{2}M)

Date: September 2007
Edition: Final

3.2.10 Sand Creek Dump (RVAAP-034-R-01)

Summaries of the MRS and HRR findings are presented in **Table 4**.

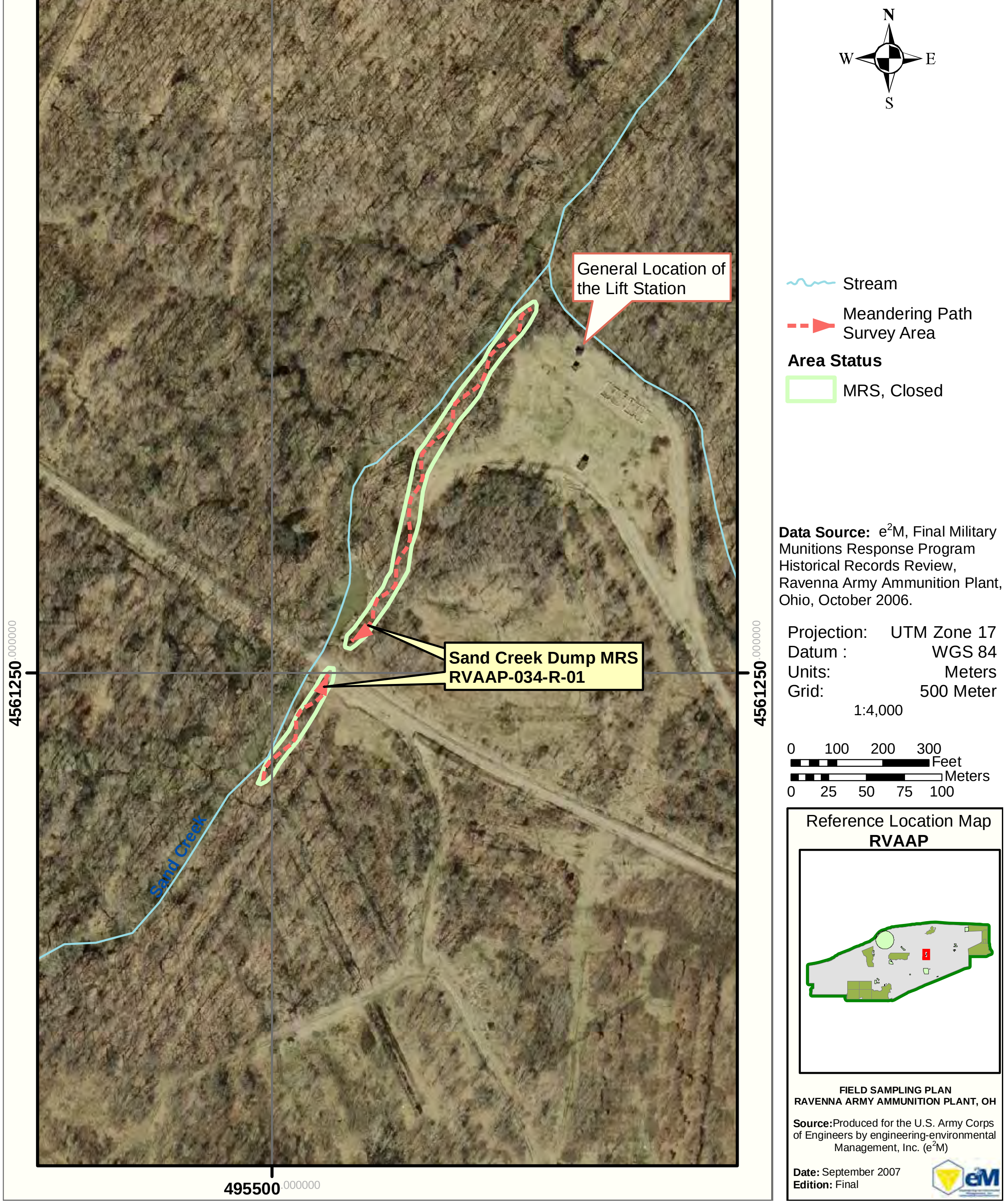
MEC Activities: The presence of MEC and munitions debris at the MRS is not fully understood and will require further characterization during this SI. Therefore, a meandering path magnetometer assisted UXO survey will be conducted within all open areas surrounding the former dump, while a UXO survey will be conducted within accessible areas of the dump. The surveys will be conducted to identify any MEC or munitions debris lying on or protruding through the ground surface and any buried anomalies. The intent of the survey is to:

- establish presence/absence of MEC and munitions debris;
- refine the MRS boundary; and
- support the need for further characterization, if necessary.

MC Activities: Chemical contamination at the MRS is being covered under the IRP and will not be investigated further under the MMRP. Therefore, no samples will be collected from the MRS during this SI. Existing analytical data will be used to populate the MRS-PP. **Figure 10** provides the location where the UXO survey will be conducted.

SAND CREEK DUMP MRS
SI ACTIVITIES MAP
Ravenna Army Ammunition Plant, OH

Figure 10



Data Source: e^{2}M, Final Military Munitions Response Program Historical Records Review, Ravenna Army Ammunition Plant, Ohio, October 2006.

Projection:	UTM Zone 17
Datum :	WGS 84
Units:	Meters
Grid:	500 Meter

FIELD SAMPLING PLAN
RAVENNA ARMY AMMUNITION PLANT, OH

Source: Produced for the U.S. Army Corps of Engineers by engineering-environmental Management, Inc. (e^{2}M)

Date: September 2007
Edition: Final

3.2.11 Building #F-15 and F-16 (RVAAP-046-R-01)

Summaries of the MRS and HRR findings are presented in **Table 4**.

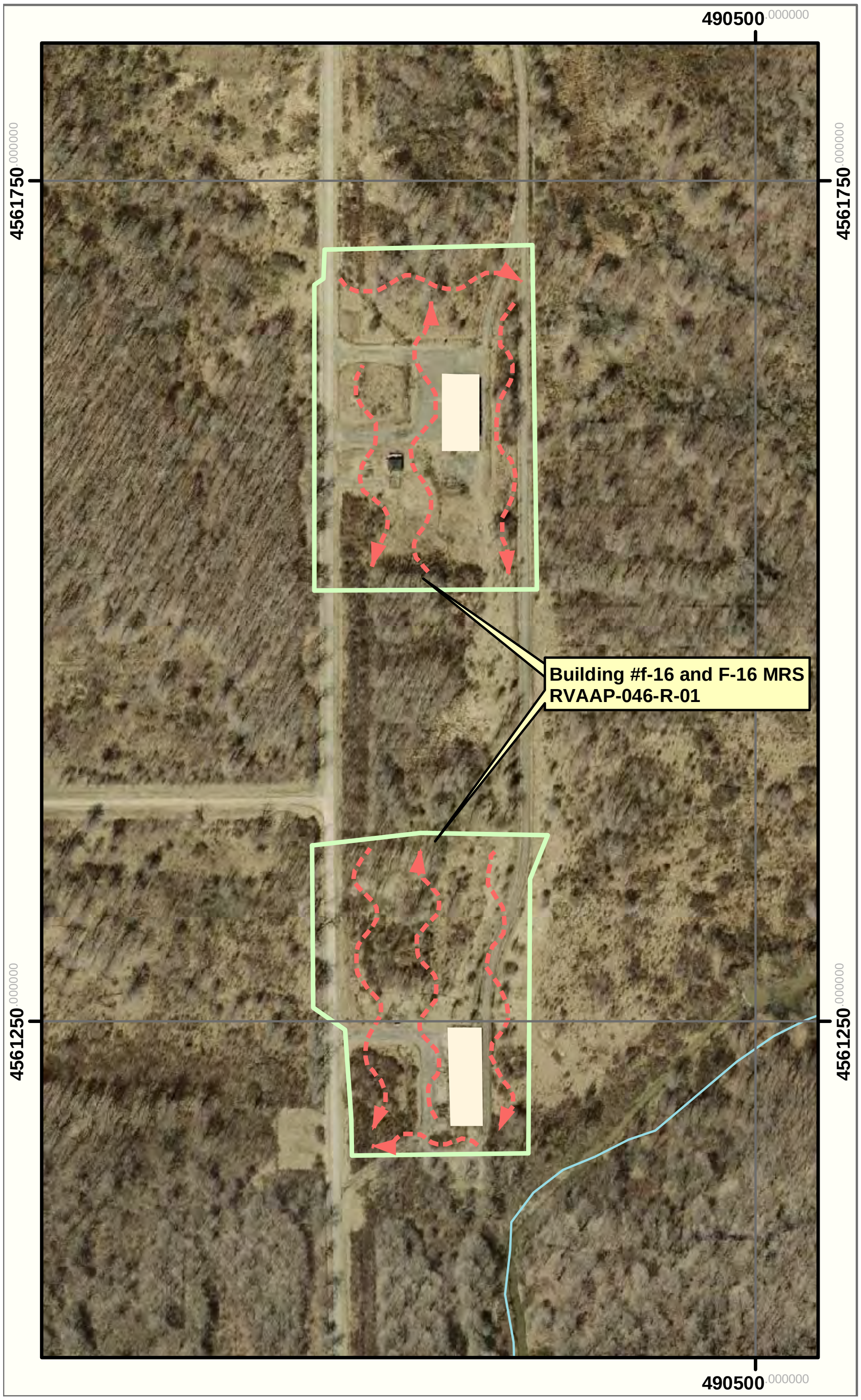
MEC Activities: The presence of MEC and munitions debris at the MRS is not fully understood and will require further characterization during this SI. Therefore, a meandering path magnetometer assisted UXO survey will be conducted of all accessible areas across the entire MRS. The survey will be conducted to identify any MEC or munitions debris lying on or protruding through the ground surface and any buried anomalies. The intent of the survey is to:

- establish presence/absence of MEC and munitions debris;
- refine the MRS boundary; and
- support the need for further characterization, if necessary.

MC Activities: Chemical contamination at the MRS is being covered under the IRP and will not be investigated further under the MMRP. Therefore, no samples will be collected from the MRS during this SI. Existing analytical data will be used to populate the MRS-PP. **Figure 11** provides the location where the UXO survey will be conducted.

BUILDING #F-15 and F-16 MRS
SI ACTIVITIES MAP
Ravenna Army Ammunition Plant, OH

Figure 11



Stream

🟧 Footprint of Former Building

Meandering Path Survey Area

Area Status

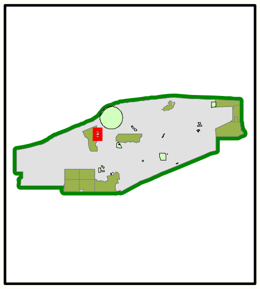
🟩 MRS, Closed

Data Source: e^2M, Final Military Munitions Response Program Historical Records Review, Ravenna Army Ammunition Plant, Ohio, October 2006.

Projection:	UTM Zone 17
Datum :	WGS 84
Units:	Meters
Grid:	500 Meter

1:4,000

Reference Location Map
RVAAP



FIELD SAMPLING PLAN
RAVENNA ARMY AMMUNITION PLANT, OH

Source: Produced for the U.S. Army Corps of Engineers by engineering-environmental Management, Inc. (e^2M)

Date: September 2007
Edition: Final

3.2.12 Anchor Test Area (RVAAP-048-R-01)

Summaries of the MRS and HRR findings are presented in **Table 4**.

MEC Activities: The presence of MEC and munitions debris at the MRS is not fully understood and will require further characterization during this SI. Therefore, a line abreast magnetometer assisted UXO survey will be conducted of the entire MRS. The survey will be conducted to identify any MEC or munitions debris lying on or protruding through the ground surface and any buried anomalies. The intent of the survey is to:

- establish presence/absence of MEC and munitions debris;
- refine the MRS boundary; and
- support the need for further characterization, if necessary.

MC Activities: Chemical contamination at the MRS is being covered under the IRP and will not be investigated further under the MMRP. Therefore, no samples will be collected from the MRS during this SI. Existing analytical data will be used to populate the MRS-PP. **Figure 12** provides the location where the UXO survey will be conducted.

ANCHOR TEST AREA MRS
SI ACTIVITIES MAP
Ravenna Army Ammunition Plant, OH

Figure 12

N
W E
S

- 〰 Stream
- ▨ Dirt Mounds
- 🟨 Sand Pit
- — Line Abreast Survey Area

Area Status

- ▭ MRS, Closed

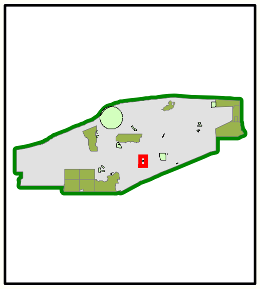
Data Source: e^{2}M, Final Military Munitions Response Program Historical Records Review, Ravenna Army Ammunition Plant, Ohio, October 2006.

Projection:	UTM Zone 17
Datum :	WGS 84
Units:	Meters
Grid:	500 Meter

1:4,000

0 100 200 300 Feet
0 25 50 75 100 Meters

Reference Location Map
RVAAP



FIELD SAMPLING PLAN
RAVENNA ARMY AMMUNITION PLANT, OH

Source: Produced for the U.S. Army Corps of Engineers by engineering-environmental Management, Inc. (e^{2}M)

Date: September 2007
Edition: Final

3.2.13 Atlas Scrap Yard (RVAAP-050-R-01)

Summaries of the MRS and HRR findings are presented in **Table 4**.

MEC Activities: The presence of MEC and munitions debris at the MRS is not fully understood and will require further characterization during this SI. Therefore, a line abreast magnetometer assisted UXO survey will be conducted within the former operations area located in the south-central portion of the MRS. In addition, a meandering path magnetometer assisted UXO survey will be conducted at areas where stockpiles of debris are located in the north-central portion of the MRS and at the former ammunition storage box area located in the eastern portion of the site. Areas with high grass or other vegetation that obscures sight of the ground surface will be avoided due to safety concerns. The surveys will be conducted to identify any MEC or munitions debris lying on or protruding through the ground surface and any buried anomalies. The intent of the survey is to:

- establish presence/absence of MEC and munitions debris;
- refine the MRS boundary; and
- support the need for further characterization, if necessary.

MC Activities: Chemical contamination at the MRS is being covered under the IRP and will not be investigated further under the MMRP. Therefore, no samples will be collected from the MRS during this SI. Existing analytical data will be used to populate the MRS-PP. **Figure 6** provides the locations where the UXO surveys will be conducted.

3.2.14 Block D Igloo (RVAAP-060-R-01)

Summaries of the MRS and HRR findings are presented in **Table 4**.

MEC Activities: The presence of MEC and munitions debris at the MRS is not fully understood and will require additional investigation. However, the size (622 acres) and complexity (dense forest and understory) of this MRS precludes an exhaustive investigation. As such, the MRS will remain in the MMRP and will require additional site investigation before a final disposition can be determined. Therefore, a meandering path magnetometer assisted UXO survey will only be conducted around the former igloo and five (5) locations where debris were found from the March 1943 explosion. The survey locations will be selected in the field based on accessibility, safety concerns, and at locations where the findings were the most concentrated. The total area to be surveyed surrounding the former igloo and the documented locations of debris will not exceed six (6) acres. The documented locations will be reacquired in the field using coordinates taken from existing maps. The survey will be conducted to identify any MEC or munitions debris lying on or protruding through the ground surface and any buried anomalies. The intent of the survey is to:

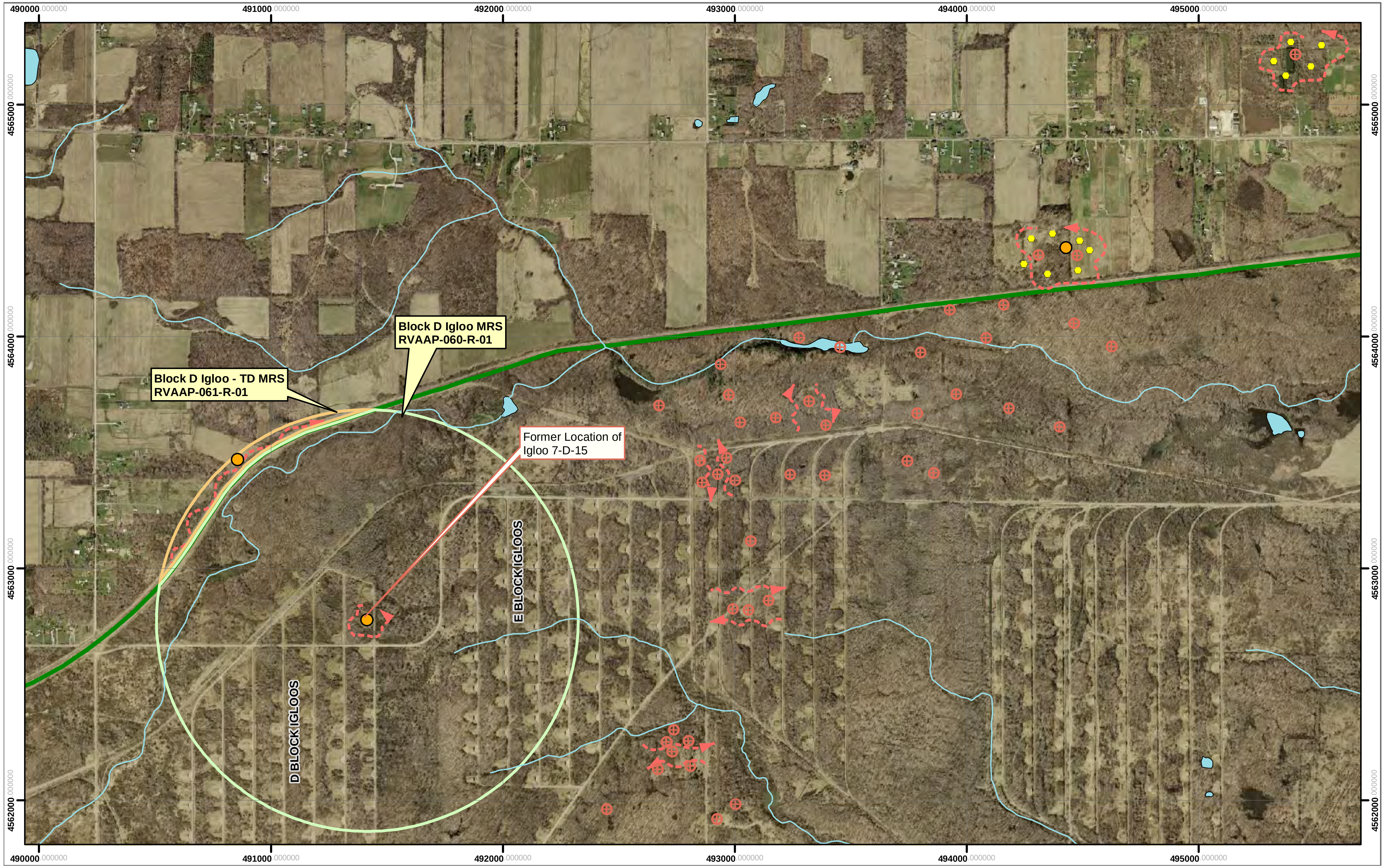
- establish presence/absence of MEC and munitions debris.

Due to the limited scope of the SI, the investigation of MEC at the MRS will require additional investigation under future CERCLA actions.

MC Activities: Analytical data for the MRS does not exist. Therefore, one composite surface soil sample using the 7-wheel method (See **Section 3.4.2**) will be collected from the former igloo area and analyzed for explosives and TAL metals. Propellants are not included in the analytical suite since the M-110 fuze contained an azide compound and the M-41 fragmentation bomb contained trinitrotoluene (TNT). The intent of the sampling will solely be to populate the MRS-PP. **Figure 13** provides the proposed location where the composite surface soil sample will be collected and where the UXO surveys will be conducted.

BLOCK D IGLOO and BLOCK D IGLOO - TD MRS SI ACTIVITIES MAP
Ravenna Army Ammunition Plant, OH

Figure 13

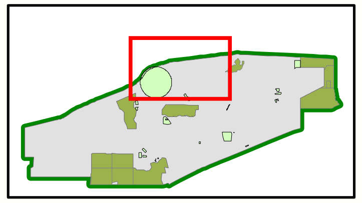


Data Source: e^{2}M, Final Military Munitons Response Program Historical Records Review, Ravenna Army Ammunition Plant, Ohio, October 2006.

Projection:	**UTM Zone 17**
Datum :	**WGS 84**
Units:	**Meters**
Grid:	**1,000 Meter**

1:18,000

Reference Location Map
RVAAP



FIELD SAMPLING PLAN
RAVENNA ARMY AMMUNITION PLANT, OH

Source: Produced for the U.S. Army Corps of Engineers by engineering-environmental Management, Inc. (e^{2}M)

Date: September 2007
Edition: Final

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3.2.15 Block D Igloo–TD (RVAAP-061-R-01)

Summaries of the MRS and HRR findings are presented in **Table 4**.

MEC Activities: The presence of MEC and munitions debris at the MRS is not fully understood and will require additional investigation. Therefore, a meandering path magnetometer/metal detector assisted UXO survey will be conducted across the entire MRS and within areas where debris had been found and mapped, but not included in the MRS footprint. At locations outside the MRS footprint, property maps will be obtained from the county assessor to determine property owners, who will be contacted to obtain rights-of-entry onto their property. The coordinates of the mapped debris will then be transferred and geo-referenced to obtain geographic coordinates. The meandering path UXO surveys will then be centered around these coordinates.

Because of the suspected abundance of slag potentially located at the railroad right-of-way, visual surveys will be conducted in this area. Magnetometers and metal detectors will be used outside of this area. The surveys will be conducted to identify any MEC or munitions debris lying on or protruding through the ground surface and any buried anomalies. The intent of the survey is to:

- establish presence/absence of MEC and munitions debris.

The size (19.25) and complexity (topography and areas of dense forest and understory) of this MRS precludes an exhaustive investigation. As such, the MRS will remain in the MMRP and will require additional site investigation before a final disposition can be determined.

MC Activities: Analytical data for the MRS does not exist. Therefore, two composite surface soil samples using the 7-wheel method (See **Section 3.4.2**) will be collected from the MRS and analyzed for explosives and TAL metals. Propellants are not included in the analytical suite since the M-110 fuze contained an azide compound and the M-41 fragmentation bomb contained TNT. One sample will be collected from MRS footprint, while the remaining sample will be collected from an area where debris was found and mapped. The intent of the sampling will solely be to populate the MRS-PP. **Figure 13** provides the proposed locations where the composite surface soil samples will be collected and where the UXO surveys will be conducted.

3.2.16 Water Works #4 Dump (RVAAP-062-R-01)

Summaries of the MRS and HRR findings are presented in **Table 4**.

MEC Activities: The presence of MEC and munitions debris at the MRS is not fully understood and will require further characterization during this SI. Therefore, a line abreast magnetometer assisted UXO survey will be conducted of the open area in the northern portion of the MRS and a meandering path magnetometer assisted UXO survey will be conducted through the remaining wooded area. The surveys will be conducted to identify any MEC or munitions debris lying on or protruding through the ground surface and any buried anomalies. The intent of the survey is to:

- establish presence/absence of MEC and munitions debris;
- refine the MRS boundary; and
- support the need for further characterization, if necessary.

MC Activities: Analytical data identifying the presence or absence of MC at the MRS has not been collected. Therefore, one (1) composite surface soil sample using the 7-wheel method (See **Section 3.4.2**) will be collected and analyzed for explosives, propellants, and TAL metals. The sample will be collected adjacent to an area that contains MEC or munitions debris following the completion of UXO anomaly avoidance survey. The intent will be to establish the presence of MC and to populate the MRS-PP. **Figure 7** provides the proposed location of the composite sample and where the UXO surveys will be conducted.

3.2.17 Group 8 MRS (formerly Area Between Buildings 846 and 849) (RVAAP-063-R-01)

Summaries of the MRS and HRR findings are presented in **Table 4**.

MEC Activities: The presence of MEC and munitions debris at the MRS is not fully understood and will require further characterization during this SI. Therefore, a line abreast magnetometer/metal detector assisted UXO survey will be conducted of the entire MRS. The survey will be conducted to identify any MEC or munitions debris lying on or protruding through the ground surface and any buried anomalies. The intent of the survey is to:

- establish presence/absence of MEC and munitions debris;
- refine the MRS boundary; and
- support a recommendation for no further action, if appropriate.

MC Activities: Analytical data identifying the presence or absence of MC at the MRS has not been collected. Therefore, five (5) MI surface soil samples will be collected and analyzed for explosives, propellants, and TAL metals. The five (5) sample areas will be selected based on the physical layout of the location (i.e., areas of equal topographic elevation, soil type, vegetation). The individual area of the five sample areas are as follow: MC1 equals 0.1 acres; MC2 equals 0.75 acres; MC3 equals 0.48 acres; MC4 equals 0.42 acres; and MC5 equals 0.34 acres. The intent will be to establish the presence of MC and to populate the MRS-PP. **Figure 14** provides the proposed locations of the sample areas and where the UXO survey will be conducted.

GROUP 8 MRS
Ravenna Army Ammunition Plant, OH

Figure 14

N
W E
S

MC	Multi-incremental Sample Area
🟥	Line Abreast Survey Area

Area Status

🟩	MRS, Closed

Data Source: e^2M, Final Military Munitions Response Program Historical Records Review, Ravenna Army Ammunition Plant, Ohio, October 2006.

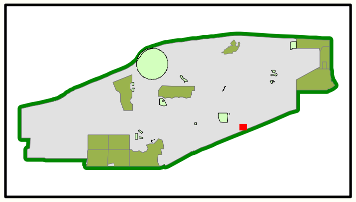
Projection:	**UTM Zone 17**
Datum :	**WGS 84**
Units:	**Meters**
Grid:	**100 Meter**

1:1,200

0 30 60 90 120 Feet

0 10 20 30 40 Meters

Reference Location Map
RVAAP



FIELD SAMPLING PLAN
RAVENNA ARMY AMMUNITION PLANT, OH

Source: Produced for the U.S. Army Corps of Engineers by engineering-environmental Management, Inc. (e^2M)

Date: September 2007
Edition: Final

3.3 MEC Activities

The goal of the MEC field activities at RVAAP is to determine the presence or absence of MEC. As such, the intent of the investigation is to focus on areas that have the greatest likelihood to contain MEC. It is the intent of the SI to determine the presence and not, per se, to determine the full extent and nature of MEC. At MRSs that will require additional MEC characterization due to the complexities of the site that are beyond the scope of this SI, the survey has been designed to locate MMPEH.

3.3.1 Instrument Assisted UXO Survey

A Schonstedt GA-52 Series Magnetic Locator (or equivalent) will be used to assist in locating ferrous metallic items on the ground surface, while a White Matrix M6 will be used at several MRSs where non-ferrous munitions are suspected. The sweep team, consisting of two UXO Technicians will use the line abreast and a meandering path survey method, recording the identification and locations of all MEC or munitions debris that are discovered. As items are discovered, the team members will mark their location in the field with a pin flag and the position will be recorded with a GPS unit. A Trimble GEO XT handheld sub-centimeter GPS unit will be used during the field investigation.

The sweep team will use the line abreast method at areas that have a high probability or have a known presence of MEC. This method involves team members walking side by side; separated by a distance that does not exceed coverage of the adjoining person's field of view (approximately 5 to 6 feet in open areas). Each team member will visually sweep his search area to locate metallic objects (that may be cultural debris), MEC, or munitions debris. GPS Navigators in conjunction with pin flags, wooden stakes, or traffic cones at the ends and intermediate points of the sampling lanes (or corner of the sampling grid) will be used to ensure the team is walking a relatively straight line through the survey area, achieving 100% coverage. Digital photos of all MEC items will be taken. Munitions debris are defined as remnants of munitions, including fragments, penetrators, projectiles, shell casings, links, fins, etc. that remain after munitions use, demilitarization, or disposal. In general, munitions debris does not contain energetic material. Under the MMRP, munitions debris does not warrant further action. As such, these areas will not be mapped.

A meandering path survey approach will be used to search expansive areas at MRSs. With this method, the UXO Technicians will walk in a random manner across the entire MRS visually sweeping the area in front of his path to locate metallic objects (that may be cultural debris), MEC, or munitions debris. As the UXO Technicians are conducting the meandering path survey walk, the coordinates will be continuously recorded (i.e., 5 – 10 second intervals) by the Trimble GEO XT using a line function command.

A Schonstedt magnetometer detects the magnetic field of any ferrous object even when covered by leaves, grass, soil, snow, etc. The instrument consists of two proton resonance magnetic field sensors approximately 0.5 meters (m) apart which balance out the effect of the earth's ambient magnetic field. As long as this balance exists, the frequency of the audio output signal remains at 40 Hertz. However, when the magnetic field becomes stronger at the lower sensor than it is at the upper sensor, the output signal frequency is increased. When the tip of the locator is positioned directly over the target (if the target magnetic dipole is oriented perpendicular to surface) the audio signal increases to its highest frequency where the magnetic field gradient is greatest. The primary factors that affect the ability of magnetic gradiometers to detect objects or features include: size and mass of the object, orientation, distance from the sensor (depth) and the material properties contrast between the object or feature and the surrounding materials. However, the general operating capabilities of a Schonstedt GA-52Cx can detect a small nail (i.e., 1-1/4 inch PK nail) buried 12-inches and a 18-inch length of ¾-inch diameter pipe buried at 9 feet.

The operation of a metal detector is based upon the principles of electromagnetic induction. Metal detectors contain one or more inductor coils that are used to interact with metallic elements on the ground. A pulsing current is applied to the coil, which then induces a magnetic field. When the magnetic field of the coil moves across metal, the field induces electric currents (called eddy currents) in the metal object that is detected. The eddy currents induce their own magnetic field, which generates an opposite current in the coil, which induces a signal indicating the presence of metal.

The following general steps will be practiced at each MRS:

- Tailgate safety briefings will be conducted on a daily basis and when conditions change that could potentially affect the safety of field team. This brief will cover emergency procedures, operations, and munitions avoidance procedures.
- The UXO technicians will then enter the site first and will conduct a surface sweep of the path as the survey team follows behind in a single file. The team will identify target areas containing MEC and munitions debris.
- Target areas containing MEC will be marked and documented.
- If MEC is discovered, the UXO technician will mark the item, GPS coordinates for the item will be recorded, and the item will be logged as to its description, size, color, and any other

distinguishable marks. Pertinent data will be entered in the field notes and on the Daily Quality Control Report (DQCR). A digital photograph of the item will be taken, and the photo number and item description will be noted in the logbook. At no time will the MECbe moved or disturbed. After collecting the necessary data, the team will proceed with its survey.

If MEC is encountered during the UXO surveys, they will be marked for positive identification, and an immediate response trigger evaluation described in **Section 3.3.3** will be performed.

3.3.2 Function Checks

The following procedures will be used to perform function tests on the equipment:

- Hand-held magnetometer and metal detectors (i.e., Schonstedt, White) will be swept across known selected items within an area outside of the site to demonstrate consistent effectiveness.
- GPS equipment will be checked against a known coordinate to check for accuracy.
- Instruments and equipment used to gather and generate data will be tested with sufficient frequency and in such a manner as to ensure that accuracy and reproducibility of results are consistent with the manufacturer's specifications. Instruments or equipment failing to meet the standard will be repaired, recalibrated, or replaced. Replaced instruments or equipment must meet the same specifications for accuracy and precision as the item removed from service.

(Note: Function tests are solely performed to test the piece of equipment and to demonstrate consistent effectiveness. A site-specific geophysical prove-out (GPO) will not be conducted since this procedure is conducted to test, evaluate, and demonstrate geophysical systems to analyze functionality and to evaluate which geophysical system can meet the performance requirements established for the geophysical survey.)

3.3.3 Triggers for Immediate Response

The field team may encounter MEC during the MEC survey. A UXO Technician II will be part of the field team and will provide UXO anomaly avoidance services (i.e., EP-75-1-2). Any MEC and range residue that is encountered will be identified (when possible) from visual observation. Under no circumstances will MEC be handled, moved, or disturbed during the survey.

If an explosives safety hazard is present, there are five basic courses of action that can be undertaken – an emergency response, a time-critical removal action, a non-time-critical removal action, a remedial action, or no further action. An emergency response action for MEC is typically conducted by active-duty Explosive Ordnance Disposal (EOD) personnel. A removal or response action can range from physical extraction (e.g., removal or Blow in Place [BIP] procedures) of the hazard to implementing institutional controls. Removal actions can be time critical in nature which requires that planning be completed in six months or less, or non-time critical. DoD has not issued any policy or guidance regarding the selection process for a response action at a MEC and/or MC site. Draft Directives and policy indicate that decisions should follow the CERCLA process. The decision is based on the overall threat to human health and the environment. The level of threat is based on an overall understanding of the situation and its risk based on site-specific data and the factors discussed in **Table 5**, below.

Table 5: MEC Factors for Immediate Response Actions

MEC Factors	Status Questions
Accessibility of the MEC	Is it in an area that is restricted to the public with engineering controls that preclude entry, such as fences, security guards, and posted hazards signs? Is the MEC in an area that is accessible to the public and does this create an imminent hazard to people or the environment?
Type of MEC	What are the condition, fuzing type, net explosive weight and specific hazards of the item? Does the MEC pose an immediate threat?
Site Assessment	Do the MEC and/or MC site conditions require using protective measures such as tamping, shielding, or focusing of the heat, blast, and shockwave to mitigate the explosive effects? What is the maximum fragmentation range and over-pressure distance of the MEC?
Other considerations	Can the hazard be moved? Can the area within the fragmentation and blast distance withstand a detonation and are there critical habitats or facilities located nearby?

The SI field work is not expected to include removal or disposal actions; however, if identified, the presence of MEC must be reported to Jerome Stolinski, USACE, Omaha District CENWO-PM; Irv Venger, RVAAP Facility Manager; MAJ Meade, Ohio Army National Guard (OHARNG); and the e^{2}M Technical Project Manager (TPM) for determination of the appropriate action to be taken. In addition, if the MEC is determined to present a danger to human health or the environment, the RVAAP Facility Manager will be responsible for contacting the appropriate Ordnance Company (e.g., at Wright-Patterson Air Force Base) for final disposition. Further, e^{2}M will also follow the Ohio EPA MEC notification procedures developed for the installation.

3.4 MC Activities

3.4.1 Multi-Incremental Surface Soil Sampling

MI surface soil samples (0 - 6 inches below ground surface [bgs]) will be collected for analyses using either a disposable trowel or scoop, or step probe, depending on the soil matrix. New trowels/scoops and gloves will be used at each sample area located within an MRS, and when necessary, a step probe. Sample collection, handling, and shipment will comply with the procedures established below and with those provided in the Facility-Wide Sampling and Analysis Plan for Environmental Investigations at Ravenna Army Ammunition Plant.

MC at four (4) of the MRSs will be assessed through the collection of MI surface soil samples. These MRSs include: Ramsdell Quarry Landfill; Load Line #1; Firestone Test Facility; and the Group 8 MRS. One MI sample will consist of 30 sub-samples collected from a distinct sample area established at an MRS. The selection of sample areas will be done on a site by site basis and will depend on several factors including, the physical characteristics of a given MRS, presence of MEC and/or munitions debris, and the reasonably anticipated future land use and potential exposure scenario. Sample collection, handling, and shipment will comply with the procedures established below and with those provided in the Facility-Wide Sampling and Analysis Plan for Environmental Investigations at Ravenna Army Ammunition Plant.

MI sample areas will be delineated by staking or otherwise delineating the area targeted for sample collection. At the beginning of the sampling exercise, a UXO technician will clear the path into the sample area and walk ahead of the sample team using the meandering path method. As the team progresses through the area, a field team member will randomly throw stakes out identifying 30 sub-sample locations. At each sub-sample location, a sample will be collected and placed into a plastic bag. Measures will be taken to ensure that equally weighted aliquots are collected from each sub-sample location. The entire sub-sample will then be submitted to Test America, North Canton for sample preparation, which will include air drying, grinding (with a coffee grinder), and sieving. Test America, North Canton will also be responsible for TAL metal analysis and shipment of the explosives and propellant samples to Test America, Sacramento, and shipment of the split samples to the Ohio EPA preferred laboratory. Field duplicates will be obtained by re-walking the sample area and collecting an additional 30 sub-sample set as previously described. The original and duplicate sample containers will then be labeled and placed in a cooler with ice. Field splits will be divided at the laboratory, after sample preparation has been completed. After all samples are collected the chain-of-custody (COC) form will be filled out (see **Section 5.5** for more details). Sample locations will be recorded using a hand-held GPS unit, as will the corners of the sample grid.

3.4.2 Composite Surface Soil Sampling

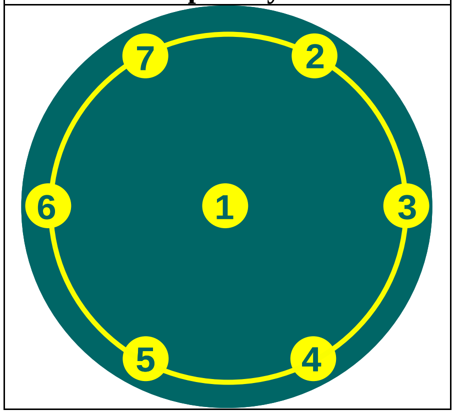
Composite surface soil samples (0 - 6 inches bgs) will be collected for analyses using a disposable trowel or scoop, and when necessary, a step probe. New scoops and gloves will be used at each sampling location and, when necessary, a new or cleaned step probe. Surface soil samples will be collected from locations selected after completion of the UXO surveys. Sample collection, handling, and shipment will comply with the procedures established below and with those provided in the Facility-Wide Sampling and Analysis Plan for Environmental Investigations at Ravenna Army Ammunition Plant.

Composite surface soil samples will be collected from four MRSs: Landfill North of Winklepeck; Block D Igloo; Block D Igloo – TD; and Water Works #4 Dump. Three composite surface soil samples will also be reserved as a contingency, should unexpected field conditions (e.g., discovery of MEC) be discovered. In general, the composite samples will be collected from locations where MEC or munitions debris are discovered. Proper anomaly avoidance procedures will be employed prior to the grid layout and collection of samples. The composite surface soil samples will be collected using the 7-Sample Wheel method obtained described in the Cold Regions Research and Engineering Laboratory's (CRREL's) Special Report (SR) 96-15, *Assessment of Sampling Error Associated with Collection and Analysis of Soil Samples at Explosives-Contaminated Sites.* This method is described below.

Six grab samples will be collected from a wheel-shaped layout and a seventh sample from the center of the wheel using a disposable plastic scoop/trowel and, when necessary, a new or clean step probe, and placed into a plastic bag. The intended sample location will be screened by a UXO technician and then laid out and recorded in the field logbook. The radius from the center sub-sample will be approximately one foot from the center sample.

An example of the sample layout is shown below.

Sample Layout



After collection, the entire sub-sample will then be submitted to Test America, North Canton for sample preparation, which will include air drying, grinding (with a coffee grinder), and sieving. Test America, North Canton will also be responsible for TAL metal analysis and shipment of the explosives and propellant samples to Test America, Sacramento, and shipment of the split samples, if collected, to the Ohio EPA preferred laboratory. Field duplicates will be collected from a separate sample grid established in close proximity to the original grid location. Duplicate samples will be assigned a different sample number and sent blind to the laboratory. The original and duplicate sample containers will then be labeled and placed in a cooler with ice. After all samples are collected the COC form will be filled out (see **Section 5.5** for more details). A description of the composite and MI soils sampled will be noted in the field notes. Any excess soil will be returned to the sample holes and used as backfill material (see **Section 7.0**). Sample locations will be recorded using a hand-held GPS unit.

3.5 GPS Surveying

MEC of potential concern, sample locations, and the paths of the magnetometer-assisted surface surveys will be recorded with a GPS unit to document the position coordinates. The GPS unit proposed for use is a Trimble GeoExplorer CE, Geo XT handheld unit. A Trimble GEO XT handheld sub-centimeter GPS unit will be used during the field investigation. Pathfinder Office software is used to download and post-process the data to achieve submeter horizontal accuracy. Field conditions, such as the number of satellites available at the reading time and density of the tree canopy dictate the amount of time needed to acquire a reading. Coordinates will be established for each MEC and sample location to an accuracy of one meter.

3.6 Field Equipment

As shown in **Table 6** below, a variety of equipment will be used to perform the field activities for this SI.

Table 6: Field Equipment

Category	Equipment
Surface Soil Sampling	Disposable scoops/trowels (or similar), stainless steel bowls, plastic buckets, coolers, ice, sample bottles, Trimble GeoExplorer CE or Geo XT, Camera, Schonstedt GA-52 Series Magnetic Locator, White Matrix M6
Health and Safety Equipment	First aid kit, fire extinguisher, protective clothing, latex or nitrile gloves (Conform brand or equivalent)
Shipping	Packaging tape, labels, seals, COC forms, ice, Ziploc bags, coolers, bubble wrap, packaging material
Documentation	DQCR forms, field log book, camera, all applicable health and safety forms

3.7 Laboratory Analysis

The analytical methods are selected on the basis of the munitions suspected to have been used or disposed at each MRS. The standard analytical methods for the surface soil samples include explosives (EPA Method 8330B), TAL metals (EPA Method 6010C and 7471A), and propellants (EPA Methods

8330B and 353.2). All analyses will be completed in accordance with EPA SW-846 methodology. Laboratory analytical procedures are discussed in greater detail in the QAPP (**Appendix B** of the **WP**).

Table 4 provides the sample container and preservation requirements. **Table 7** provides the number of discrete, MI, and QA/QC samples to be collected.

Table 7: Sample Containers and Preservation Requirements

Analysis	Sample Container	Holding Time	Preservative
MI Samples			
Explosives (EPA Modified 8330B)	Gallon sized plastic bag	14 days to extraction, 40 days for analysis	4°C
Propellants (EPA Method 8330B and 353.2)	Gallon sized plastic bag	14 days to extraction, 40 days for analysis	4°C
TAL Metals (EPA Method 6010C)/Mercury	Gallon sized plastic bag	180 Days/ 28 Days	4°C
Composite Samples			
Explosives (EPA Method 8330)	Gallon sized plastic bag	14 days to extraction, 40 days for analysis	4°C
Propellants (EPA Method 8330B and 353.2)	Gallon sized plastic bag	14 days to extraction, 40 days for analysis	4°C
TAL Metals (EPA Method 6010C)/Mercury	Gallon sized plastic bag	180 Days/ 28 Days	4°C

3.8 Quality Assurance/Quality Control (QA/QC)

e^{2}M will meet the project-specific Data Quality Objectives (DQOs) for sampling, analysis, and QA/QC by collecting the proper quantities and types of samples, using the correct analytical methodologies, implementing field and laboratory QA/QC procedures, and using various data validation and evaluation processes. Laboratory requirements for the analytical methods being used for this project and DQOs for each analytical method are included in the QAPP (**Appendix B of the WP**) and in the QAPP provided in the Facility-Wide Sampling and Analysis Plan for Environmental Investigations at Ravenna Army Ammunition Plant.

Field QC will be performed for sample collection, shipping, and handling. In an effort to achieve the highest level of QC, one-time use disposable sampling equipment will be used for surface soil sampling, where appropriate. This type of equipment includes sampling gloves, scoops/trowels, and gallon sized plastic bags. Reusable sampling equipment (step probes) will be decontaminated as described in **Section 3.9**.

Sample QC for the analytical samples will be assessed through the use of duplicate samples. Duplicate samples are used to evaluate field precision of the samples and will be taken at a rate of 10%. QA will be assessed using split samples. Split samples, at a rate of approximately 10%, are used to evaluate the contractor's laboratory performance. Split samples will be collected by Ohio EPA. To obtain a duplicate sample, the MI and composite field samples will be collected separately but from within the same sample area and placed in a gallon-sized plastic bag. The original and duplicate samples will then be containerized and sent to the laboratory for method preparation and analysis. Duplicate samples will be given a separate sample identification code to ensure that it is received by the laboratory as a blind sample. Split samples will undergo sample preparation and separation at Test America, North Canton, and subsequently sent to Ohio EPA's designated laboratory.

A temperature blank will be added to each cooler. The blank will consist of a 40 milliliter vial filled with distilled water. Upon arrival at the laboratory, the temperature will be measured to ensure that the samples were adequately cooled during shipment.

See **Table 3** for the quantities of QA & QC samples. All analytical data will be reviewed in accordance with the procedures provided in the QAPP (**Appendix B of the WP**).

3.9 Sampling Equipment Decontamination

In an effort to achieve the highest level of QC, one-time use, disposable sampling equipment will be used whenever feasible. This type of equipment includes sampling gloves, scoops, and sample collection bags.

Non-dedicated sampling equipment, such as step probes, will be decontaminated as follows:

- Remove visible contamination by washing/brushing with approved water and phosphate-free detergent;
- Thoroughly rinse with approved potable water, followed by rinse with ASTM Type 1 or equivalent water;
- Thoroughly rinse with reagent grade isopropyl alcohol;
- Thoroughly rinse with ASTM Type 1 or equivalent water;
- Thoroughly rinse with nitric or hydrochloric acid (2% solution);
- Thoroughly rinse with ASTM Type I or equivalent water;
- Air dry and wrap equipment in aluminum foil.

When generated, all decontamination fluids will be containerized, characterized, and disposed off-site in accordance with the RVAAP facility-wide procedures and all applicable State, Federal, and local rules, laws, and regulations. Additional information is provided **Section 7.0**.

4.0 FIELD PERSONNEL AND PROJECT CONTACTS

The Project Team, Stakeholders, Subcontractors, and e²M's Project Personnel and Project Organization Chart are depicted in the WP.

The Field Project Personnel and Project Contacts are listed in **Table 8** below, along with their contact information. If any MEC is found on the MRSs, the personnel listed under "Project Contacts" will be immediately notified.

Table 8: Field Personnel and Project Contacts

Name and Title	Contact Information
FIELD PERSONNEL	
Phil Werner, e²M FPM	Cell: (571) 215-0677 Office: (703) 752-7755 (ext. 108)
Devin Scherer, e²M Field Team Support	Cell: (540) 421-1811 Office: (703) 752-7755 (ext. 117)
Courtney Van Tassell, e²M Field Team Support	Cell: (281) 658-7125 Office: (703) 752-7755 (ext. 115)
Steven Burhans, UXO Technician III	Office: (410) 230-9966 Cell: 443-804-7448
David Sherer, UXO Technician II	Office: (410) 230-9966 Cell: 228-383-4385
PROJECT CONTACTS	
Irving Venger, RVAAP Facility Manager	Office: (330) 358-7311
MAJ Ed Meade, Base Operations Supervisor	Office: (614) 336-6560
Jerome Stolinski, U. S. Army Corps of Engineers CENWO-PM-HA	Office: (402) 221-7680
Daniel Zugris, PE, e²M Technical Program Manager (TPgM)	Office: (703) 752-7755 (ext. 126)

5.0 FIELD OPERATIONS DOCUMENTATION

Field documentation will include DQCRs, field notebooks, photographs, sample labels, and COC forms. All field documentation will be completed in indelible ink. Corrections will be made by drawing a single line through the text, legibly writing the correction, and placing the person's initials and date next to the correction.

5.1 Daily Reports

A DQCR will be prepared by the e^{2}M FPM each day that field efforts are conducted, commencing with the first day onsite. All workdays will be documented by this report throughout the duration of the field work. e^{2}M will provide DQCRs to the CENWO-PM and e^{2}M TPM by e-mail at the end of each day during the field work effort. A sample DQCR form can be found in **Attachment A**.

At a minimum, the DQCR will include:

a. Date,
b. Location of the work,
c. Weather information,
d. Sampling performed (including specifics such as location, type of samples, depth, etc.),
e. Problems encountered and corrective actions taken (including specifics regarding sampling problems and alternate sampling methods utilized),
f. Quality control activities,
g. Verbal or written instructions,
h. Types of tests performed, samples collected, and personnel involved,
i. Names of all personnel on-site including title and affiliation,
j. Equipment used,
k. Health and safety considerations,
l. Deviations from the work plan,
m. General and special remarks,
n. General observations, and
o. Signature and job title of the DQCR preparer.
p. Daily inspection log
q. Equipment maintenance log

5.2 Field Note Books

Field notes regarding all sampling and field activities will be kept in a bound notebook with pre-numbered pages. Indelible ink will be used for all entries. The field notes will be filled out while the field work is taking place, and will include all of the information that is reported on the DQCR forms.

5.3 Photographs

A photographic log will be kept in the field notebook during field activities. Photographs will be taken with a digital camera. The log will note the date and time of the photograph, the site name, and direction the photograph was taken (e.g., looking east). The photographer will review the saved electronic photographs and compare them with the photographic log to confirm that the log and photographs match. Differences shall be noted on the photographic log and initialed.

5.4 Sample Numbering Scheme

A sequential sample numbering scheme will be used at each MRS where soil samples are collected. Each sample number will identify the site, sample location, and a sequential number. The project sample numbers will follow the example below:

RVAAP-RQL-SS01

Where:

RVAAP – 5 character designation for Ravenna Army Ammunition Plant,

RQL – 3 (or 4) character designation for the specific MRS (**Ramsdell Quarry Landfill**), and

SS01 – 4 character designation of the sequential sample number; SS for surface soil sample, followed by the corresponding sample number.

Table 9 below shows the four character designations for the MRSs.

Table 9: MRS 4 Character Designation

MRS	4 character designation	MRS	MRS Site Designation
Ramsdell Quarry Landfill	RQL	Block D Igloo	BDI
Load Line #1	LL1	Block D Igloo–TD	BDTD
Landfill North of Winklepeck	LNW	Water Works #4 Dump	WWD
Firestone Test Facility	FTF	Group 8 MRS	G8M

5.5 Sample Labels

Correct sample labeling and the corresponding notation of the sample identification numbers in the field notebook, DQCR, and on the COC forms will be utilized to prevent misidentification of samples and their eventual results. All sample labels will be completed legibly with indelible ink. The labels will be affixed to the sample bottle and covered with clear tape.

The sample labels will include the following at a minimum:

a. Project name,
b. Company name,
c. Sample Identification,
d. Name/Initials of the collector,
e. Date and time of collection,
f. Sample location and depth,
g. Analysis required, and
h. Preservatives added.

5.6 Chain-of-Custody

The COC procedures will be in accordance with USACE Sample Handling Protocol and EPA procedures. COC procedures are used to document and track samples from collection through reporting of analytical results, and serve as permanent records of sample handling and shipment. Strict COC protocol will be maintained for all samples collected during this project. The COC forms will be filled out with indelible ink by the e^{2}M FPM, and any mistakes made will be crossed out with a single line and initialed and dated.

The information on the COC form will include the following:

a. Sample identification numbers,
b. Date and time of sample collection,
c. Project name and number,
d. Number of sample containers,
e. Matrix,
f. Analyses required,
g. Turn around time required,
h. Preservatives used, and
i. Signatures of all parties who had possession of the samples.

COC forms will be completed for every cooler, and will be sealed in a resealable bag and taped to the inside of the lid of the cooler. The e^{2}M FPM will keep one copy of the COC form. The laboratory will then sign the COC upon accepting the samples for analysis. Copies of the COC forms will be faxed or mailed to the CENWO-PM upon completion of the field sampling effort. Copies of the shipping waybill for each cooler will be included as part of the COC package and included in the SI Report. A sample COC form is included in **Attachment A**.

6.0 SAMPLE PACKAGING AND SHIPPING REQUIREMENTS

All of the analytical samples will be placed in the appropriate sample containers, preserved as required, and will meet the respective holding times as specified in **Table 4** of this FSP; in the QAPP (**Appendix B** to the **WP**); and in EPA SW-846, 3rd Edition.

For analytical samples, each sample collection bag will be placed into a separate re-sealable bag in order to minimize potential for cross-contamination. The sample collection bags will then be placed into a hard plastic cooler pre-chilled to 4°C or less with double-bagged ice. One temperature blank will be packed with each cooler. Each cooler will then be sealed shut with strapping tape, custody seals will be placed on the front and rear side of the cooler lid and covered with clear tape, "This Side Up" and "Fragile" labels will be put on the cooler, and the cooler will be sent via an overnight delivery service to the laboratory.

7.0 INVESTIGATIVE DERIVED WASTES

Investigative derived waste is expected to be kept to a minimum and include used personal protective equipment (PPE) and any other disposable sampling equipment. PPE and disposable sampling equipment will be containerized (i.e., double-bagged) and disposed as solid waste. Excess surface soil that is collected, but not submitted for sample preparation and analysis, will be returned to the sample hole immediately.

Decontamination water is not expected to be generated since disposable sampling equipment will be used if possible. Should decontamination rinse water be generated, it will be containerized in either labeled Department of Transportation (DOT) approved 55-gallon closed-top drums or in approved polyethylene storage containers, and be handled in accordance with the procedures provided in the Facility-Wide Sampling and Analysis Plan for Environmental Investigations at the Ravenna Army Ammunition Plant, Ravenna, Ohio.

Equipment Maintenance Log

Date:

Project Information	
Technical Project Manager:	
Project:	
Project Number:	
Personnel (include title and affiliation)	
e^{2}M Personnel:	
Visitors Present:	
Subcontractor Personnel:	
Others:	
Work Performed	

Preparer:

Signature:

Daily Inspection Log

Date:

Project Information	
Technical Project Manager:	
Project:	
Project Number:	
Environmental Conditions	
Weather Conditions (Bright Sun, Clear, Overcast, Rain, Snow):	
Temperature:	
Wind (Still, Moderate, High):	
Humidity (Dry, Moderate, Humid):	
Personnel (include title and affiliation)	
e^{2}M Personnel:	
Visitors Present:	
Subcontractor Personnel:	
Others:	
Work Performed	

Preparer:

Signature:

Solutions Today for a Sustainable Tomorrow

Daily Quality Control Report

Date:

Project Information	
Technical Project Manager:	
Project:	
Project Number:	
Environmental Conditions	
Weather Conditions (Bright Sun, Clear, Overcast, Rain, Snow):	
Temperature:	
Wind (Still, Moderate, High):	
Humidity (Dry, Moderate, Humid):	
Personnel (include title and affiliation)	
e^{2}M Personnel:	
Visitors Present:	
Subcontractor Personnel:	
Others:	
Work Performed	

Verbal and Written Instructions:

Work Performed/Sampling Activities (include location, type of samples, depth, etc.):

Types of Tests Performed/Samples Collected/ and Personnel Involved:

Quality Control Activities (including field calibrations):

Problems Encountered/Corrective Actions Taken (include specifics regarding sampling problems and alternate sampling methods utilized):

Deviations from the Work Plan:

Health and Safety Levels and Activities:

Equipment Used and Maintenance Performed:

General observations and Special Remarks:

Preparer:

Signature:

STL North Canton
4101 Shuffle Drive N.W.
North Canton, OH 44720
phone 330-497-9396 fax 330-497-0772

Chain of Custody Record

SEVERN TRENT STL

Severn Trent Laboratories, Inc.

Client Contact	**Project Manager:**	**Site Contact:**	**Date:**	COC No:
Your Company Name here	**Tel/Fax:**	**Lab Contact:**	**Carrier:**	_______ of ______ COCs
Address	**Analysis Turnaround Time**			Job No.
City/State/Zip	Calendar (C) or Work Days (W) __________			
(xxx) xxx-xxxx Phone	TAT if different from Below _________			
(xxx) xxx-xxxx FAX	☐ 2 weeks			SDG No.
Project Name:	☐ 1 week			
Site:	☐ 2 days			
P O #	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type	Matrix	# of Cont.	Filtered Sample																			Sample Specific Notes:

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other _____________

Possible Hazard Identification
☐ *Non-Hazard* ☐ *Flammable* ☐ *Skin Irritant* ☐ *Poison B* ☐ *Unknown*

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ *Return To Client* ☐ *Disposal By Lab* ☐ *Archive For __________ Months*

Special Instructions/QC Requirements & Comments:

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:

Final
Quality Assurance Project Plan
Army Military Munitions Response Program
Site Inspection
at
Ravenna Army Ammunition Plant, Ohio

Submitted To:

U.S. Army Corps of Engineers, Omaha District
CENWO-PM-HC
106 South 15th street
Omaha, NE 68102-1618

Prepared By:

engineering-environmental Management, Inc.
9563 South Kingston Court, Suite 200
Englewood, CO 80112

USACE, Omaha District Contract Number: DACA63-03-D-0009,
Task Order Numbers DK01, DK02, and DK03

Revised: September 2007

SIGNATURE PAGE

Lance Hines, Ph.D., e^{2}M Project Chemist

Lance A. Hines 04/26/07

Signature Date

Todd Wickert, e^{2}M MMRP QA/QC Manager

04/26/07

Signature Date

Courtney Ingersoll, e^{2}M Technical Program Manager

04/26/07

Signature Date

Phil Werner, e^{2}M Technical Project Manager

Phil Werner 09/6/07

Signature Date

ABBREVIATIONS and ACRONYMS

AAP	Army Ammunition Plant
ASCII	American Standard Code for Information Interchange
BER	Bureau of Environmental Remediation
°C	Degrees Celsius
CALM	Cleanup Levels for Missouri
CCB	Continuing Calibration Blank
CCV	Continuing Calibration Verification
CD	Compact Disc
CENWO-PM	USACE, Omaha District Project Manager
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CF	Calibration Factor
CLP	Contract Laboratory Protocol
COC	Chain-Of-Custody
CPRG	Closure Plan Review Guidance for RCRA Facilities
CTT	Closed/Transferring/Transferred
CVAA	Cold Vapor Atomic Absorption
D	Difference
DEP	Department of Environmental Protection
DERP	Defense Environmental Restoration Program
DNT	Dinitrotoluene
DoD	Department of Defense
DQCR	Data Quality Control Reports
DQI	Data Quality Indicators
DQOs	Data Quality Objectives
DSA	Diane Short & Associates, Inc.
e^{2}M	engineering-environmental Management, Inc.
IC	Initial Calibration or Ion Chromatography
ICAL	Initial Calibration
ICV	Initial Calibration Verification
ICS	Interference Check Sample
IES	Electrospray Ionization
IS	Internal Standard
RL	Reporting Limit
ECAS	Environmental Compliance and Analysis Services

ABBREVIATIONS and ACRONYMS

EDD	Electronic Data Deliverables
EPA	United States Environmental Protection Agency
ERIS	Environmental Restoration Information System
FPM	Field Project Manager
FSP	Field Sampling Plan
GCN	Residential Generic Cleanup Numbers
GFAA	Graphite Furnace Atomic Absorption Spectrometry
GPO	Geophysical Prove-out
GPS	Global Positioning System
GTARC	Groundwater Target Concentrations
HHMSSLs	Human Health Medium-Specific Screening Levels
HPLC	High Performance Liquid Chromatography
HRR	Historical Records Review
IC	Ion Chromatography
ICB	Initial Calibration Blank
ICP	Inductively Coupled Plasma Spectrometry
ICP-AES	Inductively Coupled Plasma-Atomic Emission Spectrometry
ICP-MS	Inductively Coupled Plasma-Mass Spectrometry
ICV	Initial Calibration Verification
IDL	Instrument Detection Limit
IPC	Instrument Performance Check
KDHE	Kansas Department of Health and the Environment
DEP	Department of Environmental Protection
KDNR	Kentucky Department of Natural Resources; Department of Environmental Protection
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
LDEQ	Louisiana Department of Environmental Quality
MC	Munitions Constituents
MCL	Maximum Contaminant Level
MCT	Matrix Conductivity Threshold
MD	Matrix Duplicate
MDL	Method Detection Limit
MoDNR	Missouri Department of Natural Resources
MEC	Munitions and Explosives of Concern
MMRP	Military Munitions Response Program

ABBREVIATIONS and ACRONYMS

MS	Mass Spectrometry
MS/MSD	Matrix Spike/Matrix Spike Duplicate
MSA	Method of Standard Additions
NFA	No Further Action
NFG	National Functional Guidelines
NG	Nitroglycerin
NIST	National Institute of Standards and Technology
OE	Ordnance and Explosives
OHEPA	Ohio Environmental Protection Agency
OSRTI	EPA Office of Superfund Remediation and Technology Innovation
PARCCS	Precision, Accuracy, Representativeness, Completeness, Comparability, and Sensitivity
PCL	Protective Concentration Level
PDA	Photo Diode Array
PE	Performance Evaluation
PETN	Pentaerythritol tetranitrate
PM	Project Manager
POC	Point of Contact
PRGs	Preliminary Remediation Goals
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
QCSR	Quality Control Summary Report
r	Correlation Coefficient
R	Recovery or Rejected
RCRA	Resource Conservation and Recovery Act
RECAP	Risk Evaluation/Corrective Action Program
RFA	RCRA Facility Assessment
RPD	Relative Percent Difference
RSD	Relative Standard Deviation
RT	Retention Time
SAP	Sampling and Analysis Plan
SDG	Sample Delivery Group
SI	Site Inspection
SOP	Standard Operating Procedure
SOW	Scope of Work

ABBREVIATIONS and ACRONYMS

SSHP	Site-Specific Safety and Health Plan
STARC	Soil Target Concentrations
STL	Severn-Trent Laboratories
TAL	Target Analyte List
TCEQ	Texas Commission on Environmental Quality
TPM	Technical Project Manager
TPP	Technical Project Planning
TRRP	Texas Risk Reduction Program
TSA	Technical Systems Audit
USAEC	United States Army Environmental Command
USACE	United States Army Corps of Engineers
UV	Ultraviolet Radiation
UXO	Unexploded Ordnance
WP	Work Plan

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Attachment B	Laboratory Certifications
Attachment C	Regulatory and Laboratory Limits
Attachment D	Standard Operating Procedures for Records Review
Attachment E	Data Validation Example Reports
Attachment F	Quality Assurance Project Plan for Environmental Investigations at the Ravenna Army Ammunition Plant, Ravenna

1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPP) has been developed by engineering-environmental Management, Inc. (e²M) in support of the United States (US) Army Military Munitions Response Program (MMRP) Site Inspections (SIs) at multiple installations in accordance with Department of Defense (DoD) and United States Environmental Protection Agency (EPA) Comprehensive Environmental Response Compensation and Liability Act (CERCLA), or in some cases Resource Conservation and Recovery Act (RCRA) guidance. This plan consists of policies, procedures, specifications, standards, and documentation necessary for the generation of data of known quality in support of decisions concerning response actions on military ranges as part of the US Army MMRP.

Guidance used in the development of this QAPP, included the *DoD Quality Systems Manual* (Final Version 3, January 2006), the *Uniform Federal Policy for Quality Assurance Project Plans* (Final Version 1, March 2005), *EPA Requirements for Quality Assurance Project Plans* (EPA QA/R-5, March 2001), *Guidance for Quality Assurance Project Plans* (EPA QA/G-5, December 2002), *Chemical Quality Assurance for HTRW [Hazardous, Toxic and Radioactive Waste] Projects* (USACE EM 200-1-6, 10 October 1997), and *Guidance for the Data Quality Objectives Process* (EPA QA/G-4, August 2000). For the Ravenna Army Ammunition Plant in Ohio, this QAPP also follows the guidance given in the facility-wide QAPP approved by the Ohio EPA titled: *Quality Assurance Project Plan for Environmental Investigations at the Ravenna Army Ammunition Plant, Ravenna, Ohio, March 2001*. This QAPP also provides a framework for evaluating existing data, which may be used in this project. This QAPP defines the quality assurance (QA) requirements for sample and data acquisition, handling, validation, and assessment. It is intended to guide project personnel, including field, and laboratory personnel in all relevant aspects of data collection, data review/validation, data assessment, and data management.

QA is an integrated program designed to assure reliability during the monitoring and measuring process of the data. Quality control (QC) is the routine application of procedures for attaining the prescribed standards of performance in the monitoring and measuring process. QA procedures such as tracking, reviewing, and auditing are implemented as necessary to ensure that all project work is performed in accordance with professional standards, EPA and US Army Corps of Engineers (USACE) regulations and guidelines (e.g., Louisville General Chemistry guidelines), and specific goals and requirements stated in the project-specific Work Plans (WP).

QC of sample collection, analysis, data review/validation and assessment will be completed by technical project personnel. This will include on-site and laboratory oversight by the e²M project personnel as well as laboratory data and document review. Field and laboratory equipment will be maintained and calibrated, and records of these activities will be kept in accordance with established procedures. QC of project deliverables will be provided by the e²M MMRP QA/QC Manager, e²M Technical Project Manager (TPM), and the e²M Project Chemist.

Document control procedures will be implemented to track documents generated during investigations or used as information/data sources. These documents will include study plans, field notes, daily QC reports (DQCRs), QC summary reports (QCSRs), chain-of-custody (COC) forms, laboratory data, and final reports. These procedures will be used for coding, storing, retrieving, reviewing, and distributing all information collected over the course of the project. Document control is necessary for building a defensible project record, and will be monitored by periodic evaluations. Please see **Section 6.0** Documents and Records, the Project WPs, and the site-specific WPs for more detail.

This QAPP presents a framework containing the elements of a sound QA/QC plan, and combined with the Field Sampling Plan (FSP) is generally known as the Sampling and Analysis Plan (SAP). It is intended to be used in conjunction with a project-specific WP and a Site-Specific Safety and Health Plan (SSHP). Each WP will document project procedures while FSPs will document site-specific field sample collection activities. They will include references to standard methods, Scopes of Work (SOWs), and standard operating procedures (SOPs) where appropriate. Site-specific SOPs for field sampling at Ravenna are included in **Attachment F**, while general SOPs are provided in **Attachment A**. Sample collection and analysis will be completed using approved USACE and Ohio EPA methodology. Alternative methods may be used or developed when approved or accepted methods do not meet the objectives of the assessment.

2.0 PROJECT SCOPE AND OBJECTIVES

Multiple Munitions Response Sites (MRSs) were identified at the Ravenna Army Ammunition Plant (RVAAP) during the performance of the US Army Closed, Transferring, and Transferred (CTT) Range/Site Inventory. Additional research conducted during the Historical Records Review (HRR) further refined the CTT Range/Site Inventory and identified the complexities and potential problems associated with the MRSs, including multiple MRSs that will require further characterization work under the MMRP.

The primary objective of this QAPP is to provide guidance to support the completion of this SI; while the overall objective of the SI is to determine whether the MRSs at RVAAP pose a threat to human health or the environment. The goal is to identify the nature of the threat, whether from explosive hazard (MEC – munitions and explosives of concern), munitions constituents (MC) contamination or both; and to set priorities for remedial investigations to include; MRSs that require No Further Action (NFA), immediate response, or further characterization.

The scope of this SI will be based on existing DoD guidance for performing response actions on military ranges and EPA guidance for conducting CERCLA SIs, existing facility-wide QAPP and SAP, and USACE guidance on Ordnance and Explosives (OE) response actions under the Defense Environmental Restoration Program (DERP), in accordance with current State, Federal, and local rules, laws, and regulations.

As provided in **Section 3.2** and **Table 3** in the Field Sampling Plan (FSP), samples collected from the MRSs will be analyzed for explosives, propellants (with the exception of 3 MRSs), and Target Analyte List (TAL) metals. Explosives will analyzed in accordance with EPA SW-846 Method 8330B (applying both 254 and 210nm wavelength as outlined in 8330B section 11.2); propellants will be analyzed in accordance with EPA SW-846 Method 353.2 (Note: nitroglycerin will be detected by Method 8330B via wavelength 210 nm); and TAL metals in accordance with SW-846 Method 6010C and 7471A. The data is being generated to support recommendations regarding the presence or absence of munitions constituents (MC) and to populate the Munitions Response Site – Prioritization Protocol (MRS-PP). The respective analytical methods are described in more detail in **Section 8.0**.

3.0 PROJECT ORGANIZATION

The e²M Technical Program Manager (TPgM) is Mr. Daniel Zugris, PE who will be fully responsible and accountable for all project activities. The TPgM reports directly to the e²M Principal in Charge, the e²M Corporate Health and Safety Director, and the USACE Omaha District Project Manager (CENWO-PM). As appropriate, the TPgM will:

- Oversee project-specific issues relating to technical specifications, QA/QC, and health and safety,
- Monitor the overall quality of project planning documents,
- Assess the overall project for compliance with federal, state, and local regulations and laws,
- Interact with regulatory and public agencies and the USACE,
- Attend meetings and conferences,
- Issue project reports, as requested by the USACE,
- Prepare appropriate portions of project deliverables,
- Approve and implement project planning documents,
- Set project schedules, assign duties to project staff, and provide the resources necessary for staff to accomplish the project, and
- Assess final usability of data per results of field and data validation processes.

Mr. Todd Wickert will be the MMRP QA/QC Manager for this project. Mr. Wickert will be responsible for project activities related to data quality. The MMRP QA/QC Manager will report directly to the e²M TPgM. Where required, the Unexploded Ordnance (UXO) subcontractor will provide additional data quality expertise. As appropriate, the MMRP QA/QC Manager will:

- Provide oversight of procedures development, training, control checks, and process correction/improvement actions,
- Ensure that data are generated, processed, and prepared in the most accurate and timely method possible,
- Oversee the project to monitor compliance with procedures presented in this QAPP,
- Initiate internal QA activities, where needed,

- Make certain that project deliverables are meeting technical performance and accuracy standards, and
- Oversee document control functions to ensure current documents are in use.

Mr. Lance Hines, Ph.D. will be the Project Chemist for this project. Dr. Hines will ensure all QA/QC chemical data procedures are followed, while the UXO subcontractor provides the ordnance data expertise. The Project Chemist will report directly to the e²M TPgM. As appropriate, the Project Chemist will:

- Oversee the implementation of this QAPP and the individual site specific FSPs,
- Review site-specific project plans and procedures for quality issues,
- Assist the TPgM in the coordination of sample collection and analytical requirements with the contract laboratory(ies),
- Oversee and coordinate data review/validation and corrective actions processes with the data validation subcontractor,
- Ensure that all project activities related to analytical data are performed to meet the project data quality objectives (DQOs),
- Identify the need for corrective actions and recommend solutions for project QC problems or nonconformance,
- Be responsible for communicating QA issues to the MMRP QA/QC Manager and TPgM, and
- Address project-specific issues relating to QA/QC of the chemical data.

Mr. Phil Werner will serve as the Technical Project Manager (TPM) and Field Project Manager (FPM) for this project, and will be responsible and accountable for development of project scoping and planning, development of all project plans and deliverables, and, as the FPM, directing and overseeing all field project activities. While the FPM will ensure that all QA/QC procedures are followed in the field, the UXO subcontractor will provide the ordnance data expertise. The TPM/FPM will report directly to the e²M TPgM. As appropriate, the TPM/FPM will:

- Develop and implement SI work plans
- Monitor the overall quality of project planning documents,

- Assess the overall project for compliance with federal, state, and local regulations and laws,
- Interact with regulatory and public agencies and the USACE,
- Attend meetings and conferences,
- Issue project reports, as requested by the USACE,
- Prepare appropriate portions of project deliverables,
- Implement this QAPP and the individual site specific FSPs on site,
- Assign QA duties to appropriate project personnel including subcontractors,
- Provide oversight review of field QC as part of the field validation and data usability process,
- Interact with Installation and USACE personnel while on-site,
- Comply with applicable policies, procedures, and regulations during field work,
- Comply with procedures identified in the site specific FSPs and SSHPs,
- Assure a timely, safe progression of the field work,
- And be responsible for communicating QA issues to the Project Chemist, MMRP QA/QC Manager, and TPgM.

Data validation will be completed by Diane Short & Associates, Inc. (DSA) (303-271-9642). DSA will function independently of e²M staff and will be responsible for:

- Reviewing analytical data and preparing data validation reports in accordance with this QAPP,
- Providing recommendations pertaining to usability of the final data,
- Providing QA/QC support as needed to project personnel
- Working in cooperation with regulatory personnel,
- Reviewing and recommending updates of the QAPP for analytical chemistry and data validation criteria, and
- Providing documentation for the QCSRs.

The following laboratories have been subcontracted to support this project:

Severn-Trent Laboratories, Inc. (STL) – North Canton and **STL - Sacramento**, 4101 Shuffel Drive NW, North Canton, Ohio 44720. The laboratory project manager is Pat O'Meara, who can be reached at (330) 966-9725; email address patrick.omeara@testamericainc.com. (**Note:** STL is now Test America.) **STL – North Canton** will be responsible for sample preparation using a modified version of 8330B (specifically replacing the puck/ball mill, with grinding with a commercial coffee grinder), TAL metal analysis, shipment of explosives and propellants samples to **STL – Sacramento**, and shipment of the split samples to Ohio EP's preferred laboratory. **STL – North Canton** will be required to follow all pertinent EPA laboratory protocols (with the sample prep modification noted above) and LGC guidelines, and provide the TAL metal data package, including Environmental Restoration Information System (ERIS) deliverables. **STL – Sacramento** will be responsible for analyzing the samples for explosives and propellants, and will be required to follow all pertinent EPA laboratory protocols and LGC guidelines, and provide the explosives and propellant data packages, including ERIS deliverables. .

Other responsibilities include:

- Completing in process QC checks to ensure accurate results,
- Providing Electronic Data Deliverable (EDD) in the ERIS format,
- Completing 100% QC reviews which include automated QC checks and reviews by all Section Leaders and a Project Manager, and
- Providing a hard copy report of all test results which exactly matches the EDD.

All sample analysis and lab QC work will satisfy, as will data package, data level 4 requirements.

Attachment B contains the laboratory Army authorizations for STL. SOPs for TAL metals, explosives, and propellants are on file with the laboratories and are available for review if requested.

Malcolm Pirnie, Inc, will provide UXO avoidance, and Global Positioning System (GPS) services for this project: Malcolm Pirnie, Inc., 300 East Lombard Street, Suite 610, Baltimore, Maryland 21202. The Project Manager is Dan Hains at (813)242-7212.

4.0 DATA QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT OF ANALYTICAL DATA

The development of DQOs is a logical planning process which typically involves a sequence of seven steps used to determine the type, quantity, and adequacy of data needed to support project decisions. The output from each step of the process provides the foundation for making decisions with an acceptable level of uncertainty that can be agreed upon by all of the stakeholders. Briefly, the seven steps are:

1. **Stating or clearly defining the problem**. The problem is summarized requiring new environmental data, and the resources available to resolve the problem(s) are identified. The result of this step is a concise description of the problem and a conceptual model of the environmental problem to be investigated.

2. **Identifying decision(s) and alternative actions.** The result of this step is the identification of decisions that will be made using the data generated which are linked to specific alternative actions.

3. **Identifying the inputs to decisions, including the information and methodology needed.** The result of this step involves the identification of the information inputs needed to resolve the decision. Sources are identified for each information input, and potential sampling approaches and appropriate analytical methods are identified.

4. **Defining the spatial, temporal or other applicable boundaries.** The result of this step is clearly defining the constraints that the project is subjected to, including geographic limits, time constraints, and limitations of methodology, as well as other practical limitations such as cost.

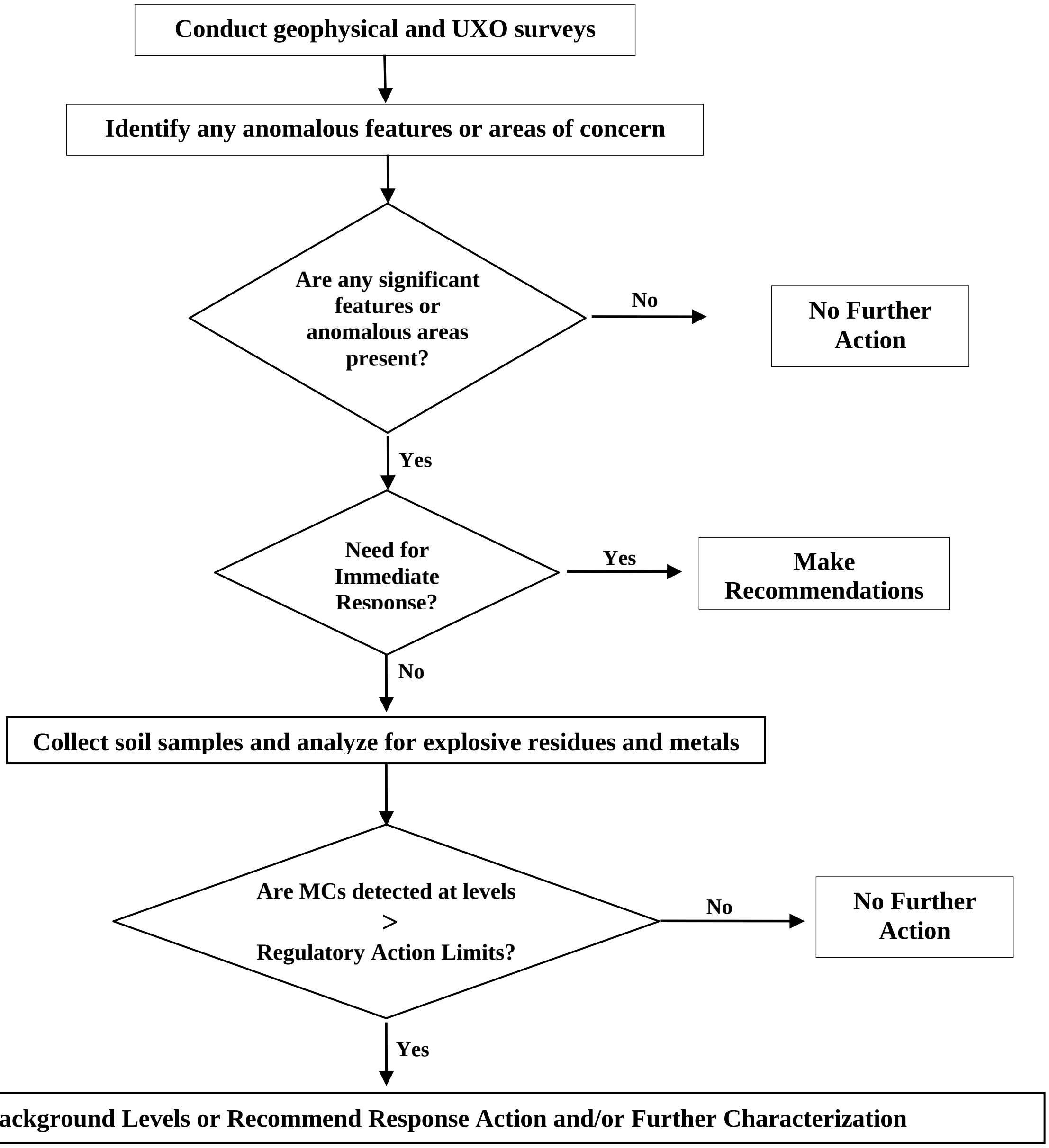
5. **Developing the decision rule which specifies the statistical parameters and action levels.** The outputs of the previous DQO steps are combined into an *if...then...* decision rule that includes the parameter of interest, the action levels, and the alternative actions. For example: “If MEC or MC are suspected or confirmed, then further characterization will be recommended”.

6. **Specifying acceptable Limits on Decision Errors in terms of consequences**. The result of this step is an understanding of the error associated with the measurements that will be used to make decisions. The decision-maker’s acceptable limits on decision errors are identified, which are used to establish appropriate performance goals for limiting uncertainty in the data.

7. **Optimizing the data collection or sampling design.** The result of this step is the identification of the most resource-effective sampling and analysis design for generating data that are expected to satisfy the DQOs. This step provides the documentation and key assumptions supporting the design.

As a result of the DQO process, decision diagrams can be developed which present the documented approach to making appropriate decisions based upon the available data and incorporates the alternatives and associated levels of uncertainty. This decision process can then be incorporated into the WP and can drive the sampling design as provided in the FSP. **Figure 1** shows an example of a decision diagram. Decision diagrams can be developed for each MMRP site or installation incorporating the appropriate decision alternatives.

FIGURE 1: EXAMPLE DECISION DIAGRAM
Identify the potential for explosive hazards of MEC at the MRS to pose an unacceptable risk to human health and the environment and to determine the appropriate response.



The following criteria, along with **Tables 1-4** found at the end of this QAPP, will be incorporated into the decision process for project DQOs.

Soil sample results will be used to support recommendations in the SI report, and will be compared against the following regulatory standards: surface soil sample results for carcinogens will be compared to EPA Region 9 Residential PRGs, while non-carcinogens will be screened at 1/10th the EPA Region 9 Residential PRG, well as installation-specific background values.

Attachment C provides STLs method detection and reporting limits, along with the applicable regulatory levels as stated above.

To ensure that quality data are produced throughout the duration of the project, specific measurement quality objectives have been defined and are systematically reviewed for compliance in meeting project goals. These QC checks or performance criteria have been established to verify the Data Quality Indicators (DQIs). The DQIs are described below:

<u>Precision</u> is the degree of the agreement between a set of replicate measurements without assumption or knowledge of the true value. It reflects random error and may be affected by systematic error. Precision limits are provided from the referenced EPA method for metals. All other methods are derived internally according to EPA guidelines using historical data. Field and matrix duplicates will be collected for metals as well as matrix spike duplicates for organic analyses to assess field and laboratory precision.

Precision is measured by calculating the Relative Percent Difference (RPD) of duplicate analytical results as follows:

$$\text{RPD} = \frac{\left|C_1 - C_2\right|}{\left(C_1 + C_2\right)/2} \text{ X } 100$$

where C_1 and C_2 are the concentrations of the duplicate results.

Accuracy is a measure of the nearness of a result to the true or theoretical value. It includes random error and systematic error (bias) resulting from the sampling and analytical processes. Accuracy limits are from the referenced EPA methods for metals. For organic methods, control chart limits are internally derived according to EPA guidelines using historical data. For like matrices, internally derived control limits can be compared to corresponding EPA method control limits to ensure statistical equivalence. Laboratory Control Samples, Matrix Spikes, and Surrogate Spikes will be collected to assess accuracy. Blanks will also be analyzed to ensure that cross-contamination is not affecting sample results.

Accuracy is measured by calculating the Percent Recovery (P) as follows:

$$P = \frac{\text{Observed Result}}{\text{Theoretical Value}} X100$$

or for spiked samples:

$$P = \frac{(\text{Observed Result - Sample Background Result})}{\text{Spike Value}} X100$$

Representativeness is a qualitative indicator which describes the extent to which data accurately and precisely represents the true characteristics of a sample. Representativeness is maximized through the use of appropriate and approved sample collection procedures, sample handling/storage procedures and standardized analytical methods. Efforts are made to ensure that analyses are performed on samples that are representative of the original source. This is accomplished, in part, by ensuring that samples are properly preserved, stored, and analyzed before the expiration of holding times. In addition, the samples chosen for field duplicates and the extra volume of samples collected for use as laboratory QC (matrix spikes and duplicates) will be chosen to best represent the current sampling event. This is done so that the QC samples are those most applicable to the matrix of the current sampling.

Comparability is another qualitative indicator which describes the effectiveness with which one set of data can be compared to another. Comparability is maintained through the use of standardized analytical methods, procedures, and reporting.

Completeness is described as the number of measurements judged to be usable (i.e. meeting project-specific objectives) compared to the total number of measurements planned, usually expressed as a percentage.

Completeness is determined using the following equation:

$$C = V/n \times 100$$

where:

C = Percent completeness
V = Number of complete, usuable measurements
n = Number of total expected measurements needed to achieve a specified level of confidence in decision making.

Rejected, 'R' qualified, data may not be valid. Careful planning and communication will be employed to attain the highest possible completeness percentages. These percentages can be affected by the size and complexity of the project, and attainment of 100% may be unrealistic. However, an actionable goal (below which results are examined with respect to meeting project-specific goals) is typically set at 95%.

Sensitivity is defined as the capability of a measurement system to discriminate between variable responses for the analytes of interest and is described in terms of method detection limits, quantitation limits, and reporting limits established to meet project-specific goals or action limits. These limits are provided in **Attachment C** for the respective parameters.

5.0 NON-LABORATORY QA/QC

5.1 General Project QA/QC

The following sections provide details and procedures on QA/QC, data validation, and data quality accuracy elements. These procedures apply to all aspects of the project. The QA/QC Manager is responsible for ensuring that all data collection and reporting requirements for this project are followed.

5.2 QC and Validation

QC is defined as the application of procedures to obtain prescribed standards of performance in the monitoring and measurement process. Data validation verifies and confirms that the data comply with appropriate specifications and standards, and that they are legitimate and defensible. The data collection and field teams will perform at a minimum the following QC and data validation procedures to ensure that the reported data are of sufficient quality.

5.2.1 Records Review (HRR-Specific)

The purpose of the records review is to locate and retrieve all documents regarding sites that are contaminated with MEC and/or MC. Data collected during the records review will be used to create a Historical Records Review (HRR) report that will be reviewed by installation stakeholders to determine whether or not the MRSs on the installation will require an NFA, an immediate response, or further characterization. The records review team will provide information that will support stakeholder decisions.

Team members will take thorough and accurate notes during all aspects of the research and interviews in order to document which files have been reviewed, the nature of the information found in those files, and the type of information selected for electronic entry or scanning. Identifying and documenting data sources in the research notes and the reference section of the HRR report, along with providing copies of the data sources, will also allow the data collection teams and USACE to assess the reliability of the various sources used to supply the data. Formal interview records will be written to ensure that the relevant information is documented in a consistent manner. Data supplied by the interviewees will be validated by reviewing the interview notes and comparing them to the information sources found on-site. Additionally, an attempt will be made to corroborate all significant data (e.g., identification of MRS locations or use) provided by interviewees with information from other interviewees. **Attachment D**, Standard Operating Procedures for Records Review, provides detailed procedures that will be used during records review.

Collected data will be reviewed by the e²M TPM and MMRP QA/QC Manager on an ongoing basis and also after the draft reports have been completed. Additional peer reviews may be done to ensure consistent and accurate results. In addition, the data will be reviewed by ordnance experts as necessary throughout the process. The ordnance experts will determine if the reported MRS areas and boundaries are appropriate for the type of weapon and ordnance reportedly used on the MRS for that time period. The MMRP QA/QC Manager will make sure that any discrepancies in the data will be corrected before final data delivery to USACE.

5.2.2 Plans and Reports

The MMRP QA/QC Manager will constantly monitor project deliverables for timeliness and quality using the procedures outlined in the Project WP and this QAPP.

5.3 QA Procedures

QA involves management review and oversight of the planning, implementation, and completion stages of an environmental data collection activity, so that work products are of the quality needed and claimed. e²M will have established internal QA procedures in place. A well-managed QA program assures that capable personnel trained in the appropriate scientific and engineering disciplines evaluate work products and deliverables. e²M QA procedures include the following types of performance standards:

- project issues will be communicated in an efficient and timely manner
- approved methods and procedures will be followed
- documentation will be free of grammatical, spelling, and typographical errors
- calculations will be appropriate and correct
- work products will be precise, accurate, and in the acceptable style

- immediate action will be taken to correct any quality problems

5.4 Validating Data

Validating data will take place throughout the SI process. The information collected from the HRR will be cross-referenced with the information collected from interviews and other sources. Ideally, the MRS SI data will be validated from multiple sources. During the second Technical Project Planning Meeting (TPP 2) e²M will coordinate with the Installation Point of Contact (POC) to ensure the team has collected all available information. These data will allow e²M to plot the strategy for the SI fieldwork in the areas of sampling and geophysical surveying. Following the SI fieldwork a third TPP Meeting (TPP 3) will be held to discuss the sampling and UXO survey results. The TPP meetings will assist the e²M TPM and MMRP QA/QC Manager in maintaining a high level of QA/QC and data QC.

5.5 UXO Surveys/Anomaly Avoidance

Process Quality procedures are planned during all UXO survey and anomaly avoidance activities. The Process Quality approach is used to identify, monitor, and continuously improve the core service and work performed during the investigation. Process QC is conducted using a three-phase control process consisting of preparatory phase inspections, initial phase inspections, and follow-up phase inspections. Product QA consists of inspection procedures that ensure the final product is of high quality before it is handed over to the client. This is a detection approach to Product QC that is based on acceptance sampling.

5.5.1 Project QC Procedures

For all UXO surveys and anomaly avoidance procedures, Process Quality is achieved by systematically controlling and implementing all components following guidelines outlined in the USACE EM 1110-1-4009 *Ordnance and Explosives Response,* DID MR-005-05 *Geophysical Investigation Plan,* and.

5.5.2 Process QC

Process QC procedures for the magnetometer surveys will include three equipment function tests. These tests are designed to ensure the equipment is performing as designed and is capable of meeting project objectives.

Test 1: The Equipment Warm-up Test is performed for at least 5 minutes and is intended to ensure all equipment is at a stable operating temperature and has an adequately charged battery. This test is performed each time the equipment is powered up.

Test 2: The Personnel Test is used to document project staff operating equipment have no measurable impact on sensor readings. This test is used to document that each operator has no adverse effects on equipment performance (e.g., impacts/influence on equipment operation due to watches, steel toed boots, jewelry, etc.).

Test 3: The Azimuthal and Octant Test are used to document the differences in readings based on orientation. only during surveys using magnetometers. Hand-held magnetometer and metal detectors (i.e., Schonstedt, White) will be swept across known selected items within an area outside of the site to demonstrate consistent effectiveness.

(Note: Function tests are solely performed to test the piece of equipment and to demonstrate consistent effectiveness. A site-specific geophysical prove-out (GPO) will not be conducted since this procedure is conducted to test, evaluate, and demonstrate geophysical systems to analyze functionality and to evaluate which geophysical system can meet the performance requirements established for the geophysical survey.)

6.0 DOCUMENTS AND RECORDS

Throughout the project, data will be collected and generated in both the field and the laboratory. All data will be compiled, organized, and summarized for use in report writing and decision-making. This section describes the methods and practices for the control of issuance, distribution, storage, and maintenance of quality related documents and records for this project including those supplied by subcontractors and vendors. See the Project WP, and the Site-specific WPs for additional detail.

6.1 Controlled Documents

The preparation, review, issuance, and revision of controlled documents will be in a manner that accounts for copies of the document issued. Obsolete documents will be tracked and removed from use as appropriate to the current tasks and personnel. The MMRP QA/QC Manager will be accountable for this function. The e^{2}M TPgM and TPM are responsible for controlling documents relating to project quality (i.e., QAPP, FSPs, WPs, SOPs, specifications, and drawings). Other documents (e.g., contracts, correspondence, etc.) are controlled in accordance with administrative procedures. A log of project-controlled documents will be maintained that includes:

- Number and title of the document
- Latest revision number
- Name of organization or individual to which the document was issued
- Status of revisions

Although this list may not be all-inclusive, the following documents will be controlled:

- SSHPs and Reports
- QAPPs
- FSPs
- WPs
- Conceptual Site Models
- Corrective action file
- Audit files as appropriate (by auditing agency of client)

- Certifications
- Vendor specifications and qualifications
- Subcontractor qualifications and certifications
- Personnel training files
- SOPs
- QC Reports
- Validated Analytical Data Reports

6.2 Field Operation Records

During field activities, information is obtained to document the collection of samples from the site. This information may include sample logs, field notes, DQCRs, health and safety reports, and COC forms (further discussed in **Section 7.0**). DQCRs will be faxed or e-mailed to the USACE-PM on a daily basis during field operations. Original field records will be maintained by e²M and copies will be incorporated in reports as appendices. Raw field data will be recorded in bound field notebooks, which include pre-numbered pages, using indelible ink. All changes to notebooks require a single line cross out which is initialed and dated. When completed, these are considered to be controlled documents.

The following summarizes the minimum information included in the field records:

- Names of people conducting field activities
- Sample collection points
- Sample identification
- Maps and diagrams
- Type of equipment used
- Sample collection method
- Climatic conditions
- Notes or unusual observations
- Date and time of activity
- QC sample generation
- Variations from WP, FSP, SSHP, or QAPP and corrective actions taken

- Calibration of field equipment
- A summary of daily activities

6.3 Analytical Laboratory Records

Information is generated to document the receipt, analysis, and reporting of analytical results. This information includes sample receipt forms, sample scheduling forms, bench sheets, QA/QC forms, data reduction forms, summary reporting forms, and case narratives. Original copies are retained by the laboratory, and can be obtained from the laboratory if requested by the USACE. The laboratory maintains SOPs that provide the procedures for documentation while generating the data report for each method of analysis they perform. Data will be sectioned by method with visible divisions between methods. These divisions or the introductory section will include QC summary forms, results forms, case narrative, and COCs with log-in receipt forms.

The laboratory is required to submit summary (definitive) data for the following items, as appropriate to required methods. These are also part of the 100% QC review:

- Copies of the COC forms with dates of sampling, laboratory receipt and signatures
- Data documenting preparation and analysis
- Laboratory cooler or sample receipt forms (temperatures, bottle integrity)
- Method blanks and any contaminants
- Calibration (initial and continuing): Inorganic % Recovery (R) and correlation coefficient of the multi-point curve (r); Organic % Relative Standard Deviation (RSD) and/or, calibration factor (CF), % difference or Drift (%D)
- Matrix Spike/Matrix Spike Duplicate (MS/MSD): % R, Relative Percent Difference (RPD) of % R; spike amount, spiked and unspiked sample result
- Matrix Duplicate (MD) (inorganic): RPD, original and duplicate sample results
- Laboratory Control Sample(s)/Laboratory Control Sample Duplicate(s) (LCS/LCSD): % R, RPD, spike amount
- Surrogates: % R
- Laboratory flags to denote dilutions, linear range exceedances, two column result %D > 40% and other approved flag notations

- Reporting limits and associated dilutions
- Case Narrative containing: deviations from SOPs, corrective actions and matrix effects or other information regarding sample data quality and data usability.

For the 10% review (comprehensive) the raw data from the laboratory are required in order to verify:

<u>Organic explosives data and explosives data</u>

- Retention times
- Second column confirmation
- Photo Diode Array confirmation may be requested for explosives, but is not required
- High Performance Liquid Chromatography (HPLC) chromatograms
- Gas Chromatography (GC) Chromatograms
- Gas Chromatography (GC)-Mass Spectrometry (MS) or GC/MS/MS chromatograms
- HPLC/ Electrospray Ionization (ESI)/MS or HPLC ESI MS/MS chromatograms
- Ion Chromatography (IC)/ESI/MS or IC/ESI/MS/MS chromatograms

<u>Metals</u>

- Metals Method of Standard Additions (MSA) correlation coefficient (r) and Graphite Furnace Atomic Absorption Spectrometry (GFAA) analytical spike data
- Inductively Coupled Plasma-Atomic Emission Spectrometry (ICP-AES) or Inductively Coupled Plasma-Mass Spectrometry (ICP-MS) and conductivity calibration blanks, ICP Interference Check Sample (ICS) and Serial dilution
- Data to verify the calculations as determined by the TPM

Where:

- %R is percent recovery of the spike
- r is the correlation coefficient of the multi-point curve
- CF is calibration factor
- % RSD is relative standard deviation
- % D is percent difference
- RPD is relative percent difference

Other data, which may be reviewed for verification of total sample integrity include:

- Sample handling and storage
- Sample preparation logs
- Instrument standards (primary and secondary records)
- Run logs for each instrument

6.3.1 Analytical Data Package

The analytical data packages for this project include the chemistry data deliverables from the laboratory, which are defined in **Section 14.0**, with the QC elements of those packages described in **Section 15.0**. Because the terms Level III and Level IV data are outdated, and the terms definitive and comprehensive data do not specifically define required criteria, the QAPP thoroughly defines the deliverables required from the laboratory which includes full raw data packages along with the results, laboratory log-in sheets, narrative reports, and summary QC tables. **Section 12.0** defines the items to be reviewed including COCs, QC data and calibration data. In addition, 10% of the organic data are reviewed at the raw data level for chromatograms, peak identification within retention times; second column verification; and linear regression of multi-point calibration. Metals data are reviewed for ICP Interference data and serial dilutions and for GFAA Method of Standard Additions data (if GFAA is performed instead of ICP analysis). Raw data may also be reviewed for transcription and calculations as determined by the TPM. The field notebooks are also a source of analytical data collection and they will be maintained and evaluated as described in the FSP.

6.4 Data Review Reports

Final data quality will be assessed from a total evaluation of field and laboratory documentation. This will include an assessment of the project DQOs in terms of meeting the measurement objectives or Precision, Accuracy, Representativeness, Completeness, Comparability, and Sensitivity (PARCCS) criteria. Initial data usability will be determined during the data validation process and will be documented in the data review reports for organic and inorganic analyses, by each method. Data quality will be further reviewed to assess completeness of sampling, the impact of equipment blanks on data, and any field measurements that could affect the integrity of the data. QCSRs will include these evaluations, the data review reports, and qualified data. The reports will be prepared in cooperation with the TPM, MMRP QA/QC Manager, Project Chemist, and Project Data Validator. The QCSR will be incorporated as part of the SI or RFA Report.

6.4.1 Data Reporting, Package Archiving, and Retrieval

Deliverables will be provided in both hard copy and electronic formats. Electronic Data Deliverables (EDDs) from the laboratory will meet the reporting requirements of ERIS and will be uploaded following the submittal of the Final SI Report. All records and documents will be preserved for a minimum of six years. Thereafter, the USACE will be notified at least 90 days before the documents are scheduled for destruction.

Copies of the Draft, Draft Final, and Final SI report will be submitted to the CENWO-PM, Ohio EPA (I hard/1 electronic copy), US Army Environmental Command (USAEC) (2 hard/2 electronic copies), RVAAP Installation Acting Facility Manager and Facility Archivist (3 hard/3 electronic copies), Ohio Army National Guard (1 hard/1 electronic copy), USACE-Louisville (1 hard/1 electronic copy), National Guard Bureau (1 hard/1 electronic copy), and the Restoration Advisory Board, Technical Assistance Public Participation Provider (1 hard copy/1 electronic copy). Electronic copies will include on compact disc (CD) versions of the document in Adobe Acrobat (pdf) format as well as the component pieces in raw form (e.g., MS Word, MS Excel, MS Access, etc.). One hard copy report will be used for the data validation process.

6.4.1.1 Electronic Data Deliverables

EDDs are produced following automated data QC checks and reviews by all STL Section Leaders and a STL Project Manager. Both the hard copy reports and EDDs are generated from the same source in the ERIS format so they match exactly. An Adobe Acrobat (.pdf) version of the hard copy report is digitally signed then burned onto a CD along with the EDDs. Copies of the report and EDDs are transferred to the secure STL web site and e²M will be automatically notified of the report’s availability. Hard copies will be delivered and EDDs will be e-mailed to e²M.

STL archives Adobe Acrobat .pdf copies of reports and EDDs on CDs. All historical data is available for every Sample Delivery Group (SDG) analyzed.

7.0 SAMPLE HANDLING AND CUSTODY

7.1 Field Custody

The COC procedures will be in accordance with USACE Sample Handling Protocol and EPA procedures. COC procedures are used to document and track samples from collection through reporting of analytical results. The COC forms serve as permanent records of sample handling and shipment. Strict COC will be maintained for all samples collected during this project. The FPM or designee will fill out the COC forms in the field with indelible ink, and any changes or mistakes made will be crossed out with a single line and initialed and dated.

The information on the COC form will include the following:

a. Project name
b. Project number
c. Samplers
d. Shipping information
e. Sample identification numbers
f. Date and time of sample collection
g. Media or matrix sampled
h. Number and type of containers
i. MS/MSD designation
j. Analytical Parameters
k. Remarks (preservatives used, turnaround times, etc.)
l. Signatures of all parties who had possession of samples
m. Special instructions (special handling, raw data package requests, sample/cooler condition etc.)

COC forms will be completed for every cooler, sealed in a resealable bag, and taped to the inside of the lid of the cooler. The FPM or designee will keep one copy of the COC form. Two dated and signed COC seals will be affixed to the outside of the cooler, one on the front right side and one on the back left side. The seals will be covered with wide clear tape. The cooler will be taped shut with packing tape prior to shipment.

7.2 Transfer of Custody

All samples will be sent via an overnight delivery service to the laboratory. A copy of the air bill will be retained by the FPM or designee for tracking purposes. The laboratory will sign the COC upon accepting the samples for analysis. Copies of the COCs will be included with the Laboratory Data in the Appendix. Copies of the shipping waybill for each cooler will be included as part of the COC package and included in the SI Report.

7.3 Sample Receipt and Laboratory Custody

Samples will be shipped to arrive as soon as possible following sample collection, due to short holding times for some analyses such as explosives. Sample shipping will proceed as follows:

- Samples collected and shipped on Fridays will be approved in advance if Saturday delivery is required.
- The laboratory will be notified prior to shipment of each sample set.
- The laboratory will be contacted each time a delivery is made to assure the samples were received in good condition
- Samples will be designated on the COC for MS/MSD

Sample containers will be inspected upon receipt by the laboratory to verify they are appropriate for the samples being collected. A laboratory custodian will verify the custody seals on the sample cooler or containers are intact, and the information on the COC matches the actual contents. Any anomalies, such as broken bottles, lack of chilling (where required), missing labels, etc., will be noted by the laboratory custodian. These anomalies will be immediately reported to the e²M FPM or Project Chemist via the laboratory chain of authority. The laboratory must have a formal system to track a sample from its receipt through analysis, to its final disposition. The laboratory will forward to e²M copies of all COC forms, sample identification tags, data sheets, original instrument output records, and logbooks as part of the final evidence file.

7.4 Sample and Data Identification

The laboratory must use a number of labeling mechanisms to ensure that raw data accurately identifies the samples received for analysis. The identifier used for all analytical data generated for a sample is the laboratory identification number (ID). This number is used to identify samples on all chromatograms, bench sheets, instrument run logs, laboratory worksheets, and internal COC forms. Other information, common to data production and review documents, includes date of analysis, analysis parameters, analyst performing the analysis, project name, project number, and all intermediate values used in the data calculations. Data production and review documents such as chromatograms or other raw instrument outputs will contain additional information (i.e., time of analysis, retention times, instrument conditions, and integration methods).

A printout of the information logged into the database will be generated and combined with the recorded results of sample inspection and the paperwork that arrived at the laboratory with the samples (e.g., purchase orders, COC documents, notes from the clients, etc.). This package will be subjected to a further review by the laboratory project director and any discrepancies resolved via communication with the client before analytical work will begin.

Unless specifically instructed to the contrary, the laboratory will be responsible for disposing of the unused sample portion according to applicable regulations after the analyses have been completed and any outstanding issues between the contractor/data user and the laboratory have been resolved.

8.0 ANALYTICAL METHOD REQUIREMENTS

Surface soil samples, as determined by the specific DQOs (EPA Region IX Residential PRGs and installation-specific background values), will be analyzed using EPA SW-846 Methods 6010C ICP (TAL metals), EPA Method 7471A (Mercury), HPLC Method 8330B (explosives), and EPA Method 353.2 (propellants).

Specifically, the samples will be analyzed for the following parameters as identified in the DQOs for each MRS, by the following methods:

Parameter	**Method**
Metals (w/o Hg)	Method 6010C (ICPES)
Mercury (Hg)	Method 7471A Cold Vapor Atomic Absorption (CVAA) includes prep.
Explosives	Method 8330B (HPLC) (Note: Nitroglycerine will be detected under 210 nm wavelength)
Propellants	Method 353.2 (Nitrocellulose as N) and Nitroguanidine UV/HPLC-SOP

QC criteria for each method along with sample container requirements, preservation methods, and holding times are described in the attached **Tables 1-4** found at the end of this QAPP. QC criteria are further discussed in **Section 8.0**. The laboratory's applicable SOPs have been reviewed by the Project Chemist, and are on file with the laboratories and available for review upon request.

9.0 QC REQUIREMENTS

9.1 Analytical QA/QC Program

The scope of this QA/QC program encompasses the policies, methods, and procedures issued from the following:

- EPA *SW-846 Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, third edition and its updates
- EPA, 1999, *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review* (EPA540/R-99/008) or current updates
- EPA, 2004, *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (EPA 540-R-04-004)
- EPA, 2001, *USEPA Contract Laboratory Program National Functional Guidelines for Low Concentration Organic Data Review* (EPA540-R-00-006)
- EPA, 2001, *EPA Requirements for Quality Assurance Project Plans* (EPA QA/R-5)
- USACE, June 2005, *Chemistry Scope of Services for Contracted Environmental Studies*

The analytical procedures performed by the laboratory include the analysis of environmental samples for organic and inorganic compounds and certain physical parameters. The QA objectives are to produce data of known precision, accuracy, representativeness, sensitivity, and overall comparability. The goal of the QA program for this QAPP is to produce defensible data that meets the EPA and USACE program guidelines. In order to accomplish these goals, the laboratory will have established analytical QC requirements based upon EPA SW-846, and internally derived control limit criteria. When those criteria are developed internally, they will follow EPA guidance from Chapter One of SW-846 and should be in statistical agreement with criteria from the referenced method given similar analytical applications.

The laboratory SOPs are based upon recognized EPA SW-846 methods. If the referenced method is revised (e.g., SW-846 Updates) during the course of a project and those changes reflect a change in calibration criteria, holding times, QC criteria, technological improvements, etc., the laboratory may incorporate those changes into the SOPs provided in the project specifications through approved amendment(s) to the initial documents. The laboratory's general QA program and custody protocol will always be followed to ensure sound laboratory operation. Any deviations from existing analytical procedures must first be approved by Ohio EPA, e²M and the CENWO-PM. Full laboratory SOPs are on file with the laboratories and are available for review upon request to define exact laboratory procedures and adherence to the established methods.

9.2 Laboratory QC Samples

This section defines the QC elements that the laboratory will use for this project. Field QC samples are discussed in **Section 9.3.6**. Precision and accuracy calculations are contained in **Section 4.0**, and QC criteria are presented in **Table 4**.

9.2.1 Batch

Many analytical laboratory processes are batch processes and these processes base their QC frequency on the batches. Two types of batches can be identified: the preparation batch and the instrument batch. A preparation batch (herein referred to as "batch") is defined as a group of 20 or less samples which are prepared (e.g., extracted or digested) within the same time period or in limited time periods. Samples in each batch should be of similar matrix (e.g., soil, sludge, liquid waste, water), be treated in the same manner, and use the same reagents. MS/MSD samples, LCS samples and method blanks are applied to these batches and must be identified with each batch.

The instrument batch is a group of 20 or less samples that are analyzed together within the same analytical run sequence or in continuous sequential time periods. Calibration, calibration blanks, instrument checks, organic tune QC and QC samples are applied to these batches. This is often the SDG. The SDG is comprised of all the analyses performed on the applicable samples. To the extent possible, the laboratory is requested to have the samples that are prepared together (batch) run in the same analytical run.

When the terms (preparation) batch or instrument batch (SDG) are used in this document, they are used as defined above. The laboratory is required to provide information to identify these batches for each sample. These distinctions are also useful as defined fields in the electronic deliverable.

9.2.2 Method Blank

A method blank is used to monitor the laboratory preparation and analysis systems for interferences and contamination from glassware, reagents, sample manipulations, and the general laboratory environment. The method blank is taken through the entire sample preparation process, and is included with each preparation batch of samples. Some inorganic (wet chemistry) methods do not have a distinct preparation. For these tests, the instrument blank, which contains reagents used with samples and is equivalent to the method blank, is considered to be the method blank.

9.2.3 Instrument Blank

An instrument blank is used to monitor the cleanliness of the instrument portion of a sample analysis process. Instrument blanks are usually the solvent or reagent solution of the standard used to calibrate the instrument. Instrument blanks bracket each 10 samples. Instrument blanks are also analyzed on an as-needed basis for troubleshooting.

9.2.4 Laboratory Control Samples (LCS)

LCSs are laboratory-generated samples spiked with a known quantity of specific analytes used to monitor the laboratory analytical process independent of matrix effects. The water LCS is also called a Method Blank Spike and is prepared in reagent water. For non-water samples, the LCS is a valid measure of method accuracy when the matrix of the LCS is matched as closely as possible to the matrix of the samples in the batch. The soil LCS is prepared in Ottawa sand or equivalent matrix for the explosives analyses and glass beads for the metals analyses.

For the SW-846 Methods, the full list of compounds is required for spiking. LCSs are taken through the entire sample preparation and analytical process and are evaluated to measure the accuracy of the process by measuring spiked target analyte recoveries in a controlled matrix or contaminant free sample. An LCS is prepared and analyzed with each preparation batch of samples. LCS results, together with matrix spike results, can establish the presence of matrix effects as distinct from method accuracy. For methods where there is no distinct preparation, a continuing calibration standard may be used as the LCS, if it meets LCS criteria. For SW-846 Methods, the laboratory defines matrix-specific limits from continuous control chart data. For the LCS; see **Table 4** and the laboratory control limits in **Attachment C**. The MS/MSD limits are routinely used as guidance, although the LCS limits should be tighter than the routine MS/MSD due to the lack of matrix effects in the reagent water LCS. For non-water LCSs, the standard will contain established acceptance limits.

9.2.5 Laboratory Control Sample Duplicates (LCSD)

Duplicate LCSs are two LCSs prepared and analyzed together. Accuracy (recovery) and batch may be determined when an LCS/LCSD pair is used. LCS/LCSDs may be used when matrix spikes are not amenable to the sample or method, e.g., pH and alkalinity, and are prepared and analyzed with each batch of samples. An LCSD may be used if there is insufficient volume for the required MS/MSD in a preparation batch. For methods that have no distinct preparation, two consecutive calibration standards may be used as a LCS/LCSD, if they meet other LCS/LCSD criteria. LCS/LCSDs will be used for this project.

9.2.6 Matrix Spikes and Matrix Spike Duplicates (MS/MSD)

Matrix spike and matrix spike duplicates will not be collected during this field effort.

9.2.7 Laboratory Sample Duplicates (SD)

For laboratory sample duplicate (or matrix duplicate) analyses, a sample is prepared in duplicate and analyzed in exactly the same manner. The matrix-specific method precision may be calculated by dividing the difference in the results by the average. Laboratory sample duplicates are prepared and analyzed with each batch of samples for most inorganic analyses. For metals analyses the matrix spike RPD limits found in **Table 4** and **Attachment C** will be applied to the sample duplicate results. Organic analyses use MSD to obtain precision data. As with spikes, which are duplicate samples, careful homogenization and sample preparation are necessary for these to provide useful information.

9.2.8 Surrogate Compounds

Organic analyses include the addition, subsequent quantitation, and ultimate recovery calculation of surrogate compounds.

Surrogate compounds are:

- Compounds that are generally not target analytes, except for Method 8330B which uses a target analyte in the analysis.
- Compounds that do not interfere with the determination of required analytes,
- Compounds that are not naturally occurring yet are chemically similar to the required analytes, and
- Compounds exhibiting similar response to analytes under determination.

Surrogate compounds are added to every sample and blank at the beginning of the sample preparation, and the surrogate recovery is used to assess matrix effects and method performance. Surrogate control criteria are applied to all samples, QC samples and method blanks, and re-analysis and re-extraction may be performed if surrogate criteria are not met. Specific method surrogates, their recovery acceptance windows, and their control logic are given in method-specific descriptions. For SW-846, the laboratory is allowed to establish surrogate limits for particular matrices. The EPA CLP limits may be referenced for guidance, but are not required to be used.

Surrogate used for explosives analysis:

- 1,2-Dinitrobenzene (1,2-DNB)

9.3 Corrective Action

This section describes general corrective actions that will be used for this project. These corrective actions are summarized in **Table 4**.

9.3.1 Frequency of Batch QC

For organics analyses, each preparation batch will contain a method blank, an LCS, and an MS/MSD pair. For inorganics, or wet chemistry analyses, each batch will contain a method blank, an LCS, a MS, and a laboratory sample duplicate as applicable to the method.

9.3.2 Blanks

The method blank measures contamination introduced by the laboratory for the sample batch. Batch corrective action will be initiated if contamination is found. Corrective actions may include re-analysis of the blank; re-analysis of the samples; re-preparation and re-analysis of the blank, QC, and samples; and assessment of the impact of the contamination on batch sample data. Although the goal is to have no detected target analytes in the method blanks, analytes may be periodically detected in blanks due to the nature of the analysis or the reporting limit for the analyte. The professional judgment of the laboratory in determining the need for re-analysis will be documented in the case narrative. The exception is the common organic laboratory contaminants, which may be present at low levels. Estimated results (J-flagged) are being requested below the Reporting Limit (RL) and above the Method Detection Limit (MDL) whenever possible. Only blanks reported at greater than the RL are subject to corrective action by the laboratory.

The laboratory batch QC described above will also be applied to equipment blanks. Field QC samples are collected to confirm the reliability of field sampling procedures and materials and can be used to measure field sampling precision and accuracy. The field QC sampling program is designed to provide confidence that samples collected during field activities adequately represent the environmental conditions of the sampling site. QC samples are collected or prepared for each matrix sampled, each sample shipment, and each sampling event. A sampling event is a continuous, uninterrupted (excluding weekends and holidays) sampling effort. QC sample definitions and collection procedures are in accordance with the procedures outlined in *Data Quality Objectives for Remedial Response Activities Development Process* (EPA, 1987). Field QC samples for this project will include field replicates for MS/MSD (and splits to the QA laboratory if necessary), equipment blanks (if applicable), and temperature blanks (measured for temperature only); the frequency of these field QC samples by media is shown in **Table 3**.

Equipment (or rinsate) blanks measure the cleanliness of field sampling equipment to verify the absence of any cross-contamination of samples. They are collected by pouring reagent water, or water known to be free of target analytes, over the decontaminated sampling equipment and into sampling jars. If detected levels of a compound are reported in the blank, samples associated with that blank must be evaluated to determine the extent of contamination. If the compound is not reported in the majority of the samples or reported at greater than five times the blank value, no further action is required and the sample values are acceptable as reported. If the blank contaminated compound(s) is reported in associated samples at less than five times the blank value, these results are considered to be due to blank contamination and the data are used as undetected values. The data validation code for this is “UB#”, where # is the value of the blank. These data are considered to be undetected values for data usability. However, for the SI field sampling exercise at Ravenna, equipment blanks will not be collected.

Temperature blanks are also to be included for each sample cooler. If required temperatures are exceeded, data will be qualified J.,

Blank corrective action is based on the project requirements. The following general rules apply to all batches unless an exception is explicitly stated in the method-specific descriptions. The blank should have no target analytes above the RL. If a blank has a target analyte above the RL or a non-target contaminant interfering with the accurate quantitation or identification of target analytes, corrective action must be initiated. The client will be contacted if batch re-preparations do not result in contaminant-free method blanks.

The first step of corrective action is to assess the effect on the samples. For example, if an analyte is found only in the blank but not in any batch samples, or if the analyte in the blank is less than one-tenth the value in the sample, no further corrective action (other than documenting the evaluation in the report narrative) may be necessary. During analysis, the method blank, and any samples containing the same contaminant, would be re-analyzed, and if the contamination remains, the contaminated samples of the batch would be re-extracted and re-analyzed with a new blank and QC.

9.3.3 LCS/LCSD

LCSs must be acceptable for the batch to be considered acceptable. LCSs are evaluated by comparing the recovery of spiked target analytes to the recovery windows given in the method-specific tables. It is required that for all analyses, the LCSs are spiked with the appropriate set of compounds identified for the respective method. For soils, an approved vendor may be used to obtain the standard that is appropriate to the method. When a full spike list is used, a batch may be considered acceptable only for those analytes which had acceptable recoveries in the LCS. If analytes are outside of the acceptance windows, corrective action must be initiated. At a minimum, the compounds of concern must meet acceptance criteria. The compounds of concern are found in the laboratory SOPS which are on file at the laboratories and available for review upon request.

The first step of the corrective action process is to evaluate the effect on the samples. For example, if an analyte in the LCS has a recovery above the upper acceptance window, and other QC elements of the batch and sample analysis indicate that this is an aberration, no further corrective action (other than documenting the corrective action analysis in the laboratory report narrative) will be necessary. This would be applicable when sample results are undetected or if the MS/MSD and Continuing Calibration Verification (CCV) are within limits.

In general, if a compound spiked into the LCS has an unacceptable recovery, the LCS, blank, and associated samples must be re-extracted and re-analyzed when the LCS has a limited spike list. If LCS recoveries are out of the laboratory limits for any other reason, and no re-analysis is performed, the narrative must contain a full justification for acceptance of the associated data.

For those analyses that do not allow matrix spikes, two LCS (LCS/LCSD) of similar matrix will be analyzed with each batch of samples. LCS/LCSD batch control will be the same as that described for LCS, except batches will be additionally controlled by the precision of the LCS/LCSD analyses. The batch precision will be measured by calculating the RPD of the recovery of a spiked analyte in the first and second LCS. The acceptance windows are determined from laboratory control charts.

9.3.4 MS/MSD

For those methods that are amenable to matrix spikes, an MS/MSD pair is analyzed with each preparation batch of samples for organic analyses. For this effort, MS/MSD samples will not be collected in the field.

9.3.5 Organic Surrogates

For organic analyses, surrogate compounds are added to every environmental and QC sample as noted in previous sections. For explosives and propellants, if the surrogate is out of control, the sample is to be re-analyzed. The HPLC or IC chromatograms should also be examined to determine potential interference, and results from both columns examined for patterns of matrix effects. If a surrogate is high and all associated results are non-detect, no re-analysis is required. If the second analysis has acceptable surrogate recoveries and is analyzed within holding times, it should be reported and the original result will be noted in the case narrative. If the second analysis confirms the original analysis, the matrix effect will be noted in the case narrative and both results will be reported.

9.4 Other QC Elements

This section addresses QC elements not described in previous sections. Included are discussions concerning reagents and establishment and use of control limits.

9.4.1 Reagents

Laboratory reagent water that meets the resistivity requirements of Type II water, as described in Standard Methods, is checked daily. The resistivity of the water is measured and recorded in a logbook. Method blanks are routinely analyzed for purity and accompany each batch tested.

Information regarding High-purity reagents, such as whether it was purchased as required by each test method, the date it was received, its batch or lot number, its supplier, and the date it was opened, are all documented.

9.4.2 Establishment and Use of Control Limits

The laboratory will monitor the percent spike recovery in LCS, MS and MSD, and the surrogate recovery in samples where surrogates are used. The relative percent differences of MS/MSD, or sample/duplicates depending on the method, are also monitored. From these results, in-house control limits are calculated. Spikes and duplicates or spike duplicates are run for each different matrix and at least once for every 20 samples and batch. Surrogates are used in every sample of applicable test methods.

For this project, the laboratories will use in-house control chart limits for many of the methods. In-house control limits for matrix spike compounds and surrogates are based on real world soil samples. The laboratory will also have established in-house control limits for matrix and surrogate spike compounds in laboratory control samples, which are based on reagent water or reagent soil (See **Attachment C**). These limits are updated periodically. The control limits for this project will be updated only after the client and the EPA have approved the new limits.

If, at any time during the analysis, the process is out of control as indicated by unacceptable QC sample accuracy or precision, corrective action must be taken and documented. The following issues are addressed:

- Actions taken to bring the process back into control
- Actions taken to prevent reoccurrence of the out-of-control situation
- Data collected while the process was out of control

Results of performance evaluation samples can also be used as an indicator of laboratory data quality, and help in evaluating the impact of out-of-control situations.

9.4.3 Field Replicate and Split Samples

Field replicate (duplicate, triplicate, etc.) and split samples are QC samples that are collected as closely in time and space to the original sample as possible. The field replicate should mirror the sampling and analytical profile of the original sample. The purpose of the field replicate is to measure matrix homogeneity, sampling and analytical precision. Multi-incremental surface soil duplicate samples will be obtained by re-walking the sample area and collecting an additional 30 sub-sample set as described in the FSP. Composite duplicate surface soil samples will be collected from a separate sample grid established in close proximity to the original grid location. Duplicate samples will be assigned a different sample number and sent blind to the laboratory. The original and duplicate sample containers will then be labeled and placed in a cooler with ice. It is anticipated that field duplicates will be collected for every 10 samples of similar matrix unless otherwise specified in the FSP in accordance with the project DQOs.

There are no defined QC limits for the field duplicates. A general precedent for soils in the field is less than 50% RPD. For low-level samples (results less than five times RL), a difference of two to four times RL is usually used to assess acceptable precision. The field duplicates will be evaluated in light of the types of matrices and degree of homogeneity. The field replicates are chosen to best represent the matrix of the samples of the particular batch.

A field replicate is called a split sample if it is shipped to an alternative laboratory for the same analysis as the primary laboratory. Split samples will be divided at STL – North Canton after sample preparation, which will include air drying, grinding (with a coffee grinder), and sieving. STL- North Canton will then ship the split samples to the Ohio EPA preferred laboratory. The two laboratories then analyze the samples for identical parameters using identical methods. Split samples will be evaluated to determine whether any potential problems may have arisen during the analyses of the primary samples.

9.4.4 Holding Times, Preservation and Temperature

Table 2 lists the required containers, preservatives and holding times for each method. If holding times are exceeded, the laboratory is to contact the e²M FPM and discuss whether samples should be analyzed outside of the holding time. Sample results are considered to be biased low as the time increases over the required holding time. When samples arrive at the laboratory, if temperatures are above the required limit, the samples haven’t been properly preserved, or bottles are leaking, the laboratory is to contact the e²M FPM immediately. The e²M FPM will, in turn, consult the Ohio EPA PM to determine a decision. The e²M FPM in consultation with the TPgM and Ohio EPA will determine if re-sampling is required.

10.0 LABORATORY INSTRUMENT CALIBRATION AND FREQUENCY

This section discusses the general requirements for laboratory instrument calibration and standards preparation and traceability. The field of chromatography involves a variety of instrumentation and detection systems. Calibration requirements vary depending on the type of the analytical system and its methodology. Instrumentation calibration is necessary for an accurate sample quantitation. Calibrations establish the dynamic range of an instrument, establish response factors to be used for quantitation, and demonstrate instrument sensitivity. Criteria for calibrations are method-specific, are taken from the published analytical methods, and are executed as described in each method SOP. The laboratories SOPs are on file with the laboratories and are available for review upon request. The SOPs are verified as being followed by the contract laboratories and must meet or exceed the requirements of the specific EPA reference method.

The following principles of calibration generally apply:

- Calibration occurs before any sample quantitation
- Initial multipoint calibrations are performed periodically
- Daily standards are analyzed before sample analysis
- Continuing calibration standards are analyzed at a specific frequency throughout the sample analysis.

Sample quantitation may be based on either the initial, daily, or continuing calibration. Methods of calibration are specified in the following sections.

10.1 Standards

Accurate sample quantitation also relies on accurate standards. Standard accuracy may be established by tracing the quantitation standard to a source of known and documented quality or by comparison of standards from different sources. Instrument calibrations and standards are unambiguously documented so that the process of calibration can be recreated. The accuracy of sample target analyte quantitation is directly related to the accuracy of the standards used for the instrument calibration. To obtain the highest quality standard, the primary reference standards used by the laboratory are obtained from the NIST, or other reliable commercial sources. When the laboratory receives the standards, the date it was received, its supplier, its lot number, its purity and concentration, and its expiration date are recorded in a standards logbook. The vendor certifications sent with the standards are also filed.

Standards purchased by the laboratory may be in a pure form or in a stock or working standard solution. Often dilutions are made from the vendor standards. Standards made are given a standard identification number and have the following information recorded in a standards logbook:

- Source of standard used to prepare dilution
- Expiration date of standard
- Preparer's initials
- Date
- Initial and final concentration
- Type, source, and lot number of solvent
- Volume of final solution
- Volume of standard diluted.

The standard label must contain the identification number, concentration of the stock, and the expiration date. Standards are validated after preparation and before routine use. Validation procedures range from a check for chromatographic purity to a verification of the concentration of the standard using a standard prepared at a different time or obtained from a different source. Reagents are also examined for purity by subjecting an aliquot or a sub-sample to the analytical method in which it will be used. Expiration dates may be taken from the vendor recommendation, the analytical methods, or from internal research. STOPPED

11.0 DATA TRANSMITTAL, TRACKING, ANALYSIS, STORAGE, AND RETRIEVAL

Analytical data can be presented in a number of formats. These formats are generally based on either the needs of the client or the DQOs specified for the project. For analytical data generated under this QAPP, the reports will contain the following information:

- Client name
- Project number
- Report date
- Analysis method
- Client sample identification
- Laboratory sample ID
- Date of sample collection
- Date of sample receipt
- Date of sample preparation
- Date of sample analysis
- Analyst identification
- Analyte list
- Analytical quantitation limits
- Analytes detected, and
- Report-specific data flags.

The QC preparation and analysis batches must be clearly identified either on the result forms (Form I) and/or in the QC summary section of the data package. Analytical results will be transmitted electronically from the laboratory to e²M. To meet the environmental data management needs of this project, all site-related analytical data will be entered into e²M's data management system, which is used to verify, store, analyze and report the project environmental data. Use of this system will ensure the accuracy and integrity of the data stored in the database.

The data management system is designed for data quality assessment, storage, analysis, and graphical output for the following types of data:

- Site data;
- Monitoring well data;
- Sample collection information; and
- Field and laboratory measurement results.

The system flexibility can also be used in many cases to transfer data into the database from already existing project tables. e^{2}M personnel are experienced at such transfers, and all data entry is done by persons with both environmental and computer experience to allow for an added quality check on the data being input. In addition, the EDD from the laboratory will meet the data requirements of ERIS.

12.0 DATA REDUCTION, REVIEW, VERIFICATION AND VALIDATION

12.1 Laboratory Data Reduction

Data reduction calculations used for this project are typically included on the standard reporting forms developed by the laboratories and are associated with each individual method or groups of methods. Calculations that are not present on standard reporting forms include computer-based data reduction programs. The laboratory is responsible for maintaining a list of these data reduction programs and for being able to demonstrate their validity. The complete calculation procedures used in computer-based data reduction programs (e.g., HPLC analyses) are based on the calculation procedures specified in each method and will not be covered here.

Some instruments are configured to operate without computers. For these, the signal is recorded as a strip chart trace, numerical output on a printer strip, or direct reading from a digital or analog dial. In such cases, additional work is required by the analyst to reduce the data to a reportable format. These data are recorded in a dedicated lab notebook or bench sheet for the particular determination in question. Results for single or multiple component tests are hand entered by the analyst in the assigned book.

Some laboratory tests, such as titrations or sensory evaluations, do not have instrumental raw data. For these, the assigned analyst records the quantitative result or observation directly on a bench sheet in a bound lab notebook. Calculations like those described above may be needed; these are recorded in the same lab notebook.

Data storage and documentation will be maintained using logbooks and data sheets that will be kept on file. Computer acquired data are stored on magnetic tape, floppy disks, or other media. Paper hard copies of raw data are kept on file for seven years.

The analyst performing the test or preparation task records all appropriate quantities, pH, volumes, readings, instrument conditions, calibration data, sample results, and QC sample results on parameter-specific laboratory bench sheets or computer log files. Furthermore, the analyst checks to ensure that all method and QC criteria have been met. The recorded information must be sufficient so that, should it be necessary, the analysis can be repeated or the analytical process can be reconstructed.

All original laboratory bench sheets are included in the raw data packages for review by senior personnel. Analysts also maintain logbooks associated with sample preparation and/or analysis. Those logbooks, notebooks, or file logs are organized on a functional basis. All log entries are dated and signed by the analyst(s) responsible for the associated activity. All data generated by HPLC, GFAA, specific conductivity detector, and ICP instrumentation are transferred to magnetic tapes for long-term storage. Logbooks are maintained to document the tape location of the archived data and to permit retrieval of the data at a later date. All logbooks are periodically reviewed by the Group Leader/Laboratory Supervisor to ensure that they are kept up to date and that the procedures followed are consistent with standard operating procedures.

To facilitate proper checks on instrument data, which have been electronically transferred to a computer text, spreadsheet, or ASCII file, data review is performed by the analyst prior to that transfer. In addition, analysts and preparation personnel check their calculations to ensure that the correct formulae were used and that no mathematical errors were made. Calibration data are scrutinized and verified by the analyst to ensure that the calibration data are valid and they meet the method criteria.

12.2 Laboratory Data Review and Verification

The laboratory system for providing valid data includes several levels of review. Each level demands a specific action to prevent the unqualified release of erroneous data and to correct any problems discovered during the review process. Analytical data generated at the laboratory are extensively checked for accuracy and completeness. The laboratory verification process consists of data generation, data reduction, and data review. The data review process is comprised of three levels, as described below. These laboratory levels are distinct from, and not to be compared to, the external validation levels.

The analyst who generates the analytical data has the primary responsibility for the accuracy and completeness of the data. The Data are generated and reduced following the protocols specified in laboratory SOPs. Each analyst reviews the quality of his or her work based on an established set of guidelines. The analyst reviews the data package to document that:

- Sample preparation information is correct and complete
- Analysis information is correct and complete
- The appropriate SOPs have been followed
- Analytical results are correct and complete
- QC samples are within established control limits; blanks are acceptable
- Special sample preparation and analytical requirements have been met
- Documentation is complete (e.g., anomalies in the preparation and analysis have been documented, out of control forms, if required, are complete, holding times are documented, etc.).

This initial review step, performed by the analyst is designated Level I review. The analyst then passes the data package to an independent reviewer who performs a Level II review.

A group leader or data review specialist whose function is to provide an independent review of the data package performs Level II review. This review is structured to document that:

- Calibration data are scientifically sound, appropriate to the method, and completely documented
- QC samples are within established guidelines
- Qualitative identification of sample components is correct
- Quantitative results are correct
- Documentation is complete and correct (e.g., anomalies in the preparation and analysis have been documented, out-of-control forms, if required, are complete, holding times are documented, etc.)
- The data are ready for incorporation into the final report
- The data package is complete and ready for data archive.

Level II review is structured so that calibration data and QC sample results are reviewed and analytical results from 10 percent of the samples are checked back to the bench sheet. If no issues are found with the data package, the review is considered complete. If issues are found with the data package, an additional 10 percent of the samples are checked to the bench sheet. The process continues until no errors are found or until the data package has been reviewed in its entirety. Level II data review is documented and the signature of the reviewer and the date of review recorded. The reviewed data are then approved for release and a final report is prepared.

Before the report is released to the client, the laboratory PM reviews the report to check that the data meets the overall objectives of the project. This review is the Level III review.

Each step of this review process involves evaluation of data quality based on both the results of the QC data and the professional judgment of those conducting the review. This application of technical knowledge and experience to the evaluation of the data is essential in assuring that data are consistently of high quality.

12.3 Corrective Action

The laboratory’s established or reference method QC acceptance criteria are available to the analyst at all times and are provided in **Table 4** and **Attachment C**. It is the responsibility of the analyst and preparation personnel to ensure that the established criteria are met. If they are not, the analyst documents the non-compliance and notifies the laboratory supervisor. The appropriate action may be initiated at any time during or after analysis. Resolution of the problem is also noted on the Analysis Corrective Action form. The situation may ultimately be brought to the attention of the department manager, project director, and/or QA Manager. Any additional corrective action will be performed at the discretion of these individuals. The project director may also be advised, depending upon the nature of the non-compliance.

Laboratory narratives are generated as a requirement of this QAPP. Narratives provide a text summary of the important aspects of the sample analysis and include an assessment of sample receipt, QC results, and corrective action as necessary.

12.4 External Data Review/Validation

Independent validation of data is required by the USACE. The laboratory will produce the necessary information in hard copy and acceptable electronic format. This type of validation is performed using e²M or USACE specified procedures. These data review/validation guidelines are typically based on client-specific DQOs, the following documents, or their updates:

- EPA Contract Laboratory Program National Functional Guidelines for Organic Data Review Draft Final. Prepared by the Office of Superfund Remediation and Technology Innovation (OSRTI), EPA-540-R-04-009, January 2005

- EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review. Prepared by the Office of Superfund Remediation and Technology Innovation (OSRTI), U.S. Environmental Protection Agency, EPA 540-R-04-004, October 2004

- Method-specific Review/Validation SOP that has been developed directly from the method. When a QC limit is not defined in the method, or the laboratory limit exceeds the CLP limits, the EPA NFG or USACE SOW limits will apply. The intent of the review/validation process from the NFG is used in determining the placement of qualifiers. Examples of data review/validation reports are attached in **Attachment E**.

The data review/validation procedures and qualifiers have been generally accepted for most EPA projects. The laboratory is required to provide CLP-like or equivalent summary forms as noted below and electronic deliverables in the format required for data management. The data management system may be used as an oversight check of accuracy and precision QC. As required for definitive data, all of the laboratory calibrations and QC for each method will be fully validated. COCs will also be reviewed for completeness, holding times and sample integrity. An additional ten percent of the data will be reviewed for all method calibrations, organic chromatographic quality and accuracy and two column confirmation; for inorganic Graphite furnace analyses MSA correlation coefficients ‘r’; ICP Interference Check Sample, serial dilution and calibration blanks and the quantitation calculation algorithms for all methods (as required for the project). If problems are found, the Project Manager will be contacted to determine if further review is required.

Data generated by the laboratory will be reviewed by the e^2M MMRP QA/QC Manager and Project Chemist, before being validated by a qualified third-party chemist who is not affiliated with the project (e^2M's subcontracted Project Data Validator). This validation is a thorough review of the analyses to confirm that they are performed in accordance with the project-specific requirements. Validation is normally performed at two levels:

- A review of analytical report forms, calibrations and QC summary tables (similar to the CLP-type forms) without raw data. This also includes chain of custody review.
- A review of analyses including raw data

For this project, the validation will consist of a review of the QC summary forms and calibrations for all samples without the raw data. The raw data will be submitted by the laboratory and reviewed if a laboratory problem is suspected. If a problem is suspected, 10 percent of the raw data would be reviewed and evaluated. If the data reviewed is rejected, another 10 percent of the raw data will be reviewed and evaluated.

QC review includes holding times, sample integrity, method blanks, LCS, MS/MSD (or MD) and surrogates. Ten percent of the data will be further reviewed at the raw data level for quality of the HPLC chromatograms and two-column confirmation. For inorganics, the 10% review includes the ICP interference samples and calibration blanks. The Project Data Validator or her designee will conduct the validation. If problems arise, the reviewing chemist will be in communication with the Project Chemist to recommend further raw data review or corrective action. The e^2M TPM, MMRP QA/QC Manager, Project Chemist, and Project Data Validator will work in cooperation with USACE and regulatory agencies to determine the required Level of Effort and extent of the corrective action.

13.0 RECONCILIATION WITH USER REQUIREMENTS

Attainment of the measurement objectives will help check that data are sufficient and of adequate quality to meet the criteria set forth in the project DQOs. Data for this assessment are intended to be comparable in quality to EPA CLP-type data, using SW-846 methodology. Failure to meet these objectives may result in the re-preparation and/or reanalysis of samples. Data that ultimately do not meet the QC criteria will be qualified during data validation and their limitations will be noted. Qualified data (data that do not meet all the limits defined in the measurement objectives tables) may be fully usable for project purposes and will be used with any associated bias determined during the validation process. Based upon professional judgment, QC limits may be expanded to account for complex matrices.

13.1 Data Usability

Data usability is defined in the following categories:

- Data that follow the EPA CLP, SW-846, approved laboratory SOP or instrument operation protocols, and fully meet the QC limits established for the project are considered to be fully usable for any project’s intended use.

- Data which do not fully meet the EPA or project QC limits but can be justified in terms of complex matrices or statistical review may be considered to be fully usable for any project’s intended use. These include data which have been qualified "J" during data validation.

- Data that have limited QC (i.e. calibrations and instrument checks) are considered to be usable for screening and presence or absence determinations or per the objective of the method (e.g. pH).

- Data that are unacceptable per the data validation criteria will be qualified as “R” (rejected) and considered unusable for project purposes.

Data will be qualified using the EPA CLP qualifiers “U”, “J”, and “R”. In addition, EPA-approved qualifier codes are added which define the exact reason for the qualification. The numeric value of the qualification is also included. For example, a spike recovery of 30 percent for arsenic would qualify associated compounds as “JS30” and indicate a possible low bias of up to 70 percent to the data due to low recovery. These codes have been implemented to expedite the data usability determination by end users of the data. These codes are on the analytical report forms as well as entered into the electronic deliverable. These are not to be confused with laboratory flags, which are often process notes not related to data quality.

The data validation qualifiers are as follows:

1. The EPA CLP data validation (SOP) qualifiers "U", "J", and "R":

“J"	indicates data are estimated
"U"	indicates that the data are considered to be undetected at the reporting limit; data are usable as undetected values
"R"	indicates rejected, unusable data

2. The following qualifier "descriptors" give further detail of the type and amount of qualification a given data point has received:

“H”	indicates holding time or sample preservation violation
“E”	indicates interference problems or exceedence of instrument range
“I”	indicates interference check sample exceedence (inorganic)
“D”	indicates exceedence of duplicate or MSD RPD control limits
“*”	indicates exceed duplicate ± RL (2xRL soils) limits for values less than 5 times RL
“S”	indicates matrix spike, surrogate outside control limits
“C”	indicates instrument calibration exceed limits
“L”	indicates laboratory control standard outside control limits
“B”	indicates blank contamination exceeding MDL
“K”	indicates negative blank contamination exceeding 2 x MDL (inorganic)
“N”	indicates tentatively identified compound
“M”	indicates the GFAA MSA correlation coefficient is < 0.995
“P”	indicates the HPLC 2 column results differ by > 25% (value > 5 x RL)
“T”	indicates temperature exceedence during shipping
“Q”	indicates for reasons not stated above - see text of review

13.2 Reconciliation Responsibilities

The laboratory QC manager is responsible for review of the data before it leaves the laboratory to check compliance with the measurement objectives as provided in this QAPP. The QAPP therefore will be part of the contract information supplied to the laboratory by e^{2}M. The laboratory QC manager will notify the Project Manager of any problems associated with meeting the QC criteria. The Project Chemist and Project Data Validator will be responsible for checking field and laboratory data to ensure they meet the PARCCS parameter requirements. The e^{2}M TPM, MMRP QA/QC Manager, Project Chemist, and Project Data Validator will work in cooperation to evaluate final data quality referencing the field and the laboratory QC deliverables.

14.0 DATA DELIVERABLES

The laboratory will be responsible for providing paper and electronic deliverables that meet the requirements of the Ohio EPA, USEPA, USACE, and USAEC.

14.1 Chemistry Data Package

The following sections define the minimal requirements for the analytical data package. The final data for all sample analyses will be included in the Final Data Report along with the Data Review Reports and qualified analytical data forms.

14.1.1 Minimum Data Reporting Requirements

Certificate of analyses are required - with QC results reported for QC samples. For all samples, QC summary tables in EPA CLP-like or equivalent format are required.

EDD- ASCII or Excel format containing the samples identified by the laboratory and client number and the analytical results by compound, method, analysis date, method detection or reporting limit; laboratory ‘U’ flag for non-detected data; and preparation batch identification. In addition, the EDD provided by the laboratory will meet the requirements of ERIS.

Full raw data packages will be required for all samples. Raw data will be reviewed for a minimum of 10% of the samples in the initial reports along with all the QC criteria defined in **Section 9.0** and **Table 4**.

The laboratory report will contain acceptance limits for calibration, surrogates, LCS, and MS/MSD and will document method blanks wherever they are used. The laboratory report will unambiguously link batch QC and instruments with the samples of that batch. Each laboratory report has a narrative section that summarizes comments pertinent to the batch of sample reported. The narrative section will be used to document corrective actions.

14.1.2 Cover Letter

The cover letter usually includes the case narrative as noted in the previous section. Dates of sample collection, receipt and analysis should be tabulated or noted in narrative form if dates are the same for all samples.

14.1.3 Sample Identification

A table will be provided that will link the client identification to the laboratory numbers. The list will include all QC samples and identified field samples.

14.1.4 Sample Receipt

The laboratory login sheets will be submitted for all data packages to verify the integrity of samples upon their receipt at the laboratory. This form will be used in conjunction with the field sampling shipping notes to track the condition of the samples.

14.1.5 General Organic and Inorganic Reporting

Final reporting of the data will include all sample identifications, sample results, dilutions, laboratory QC flags (optional), and percent moisture values for soils. When undetected values are reported, the minimum reporting limit will be noted either as a separate MDL field or as the MDL value followed by a ‘U’ to indicate undetected. The QC batches, instruments used, dates of collection, preparation, and analysis must be clearly presented either on the results form or in a relational table for each SDG.

15.0 INTERNAL QC REPORTING

This section details project-specific QC requirements that will be reported for field samples and laboratory analyses as applicable to the requested data package: definitive or comprehensive. Descriptions of QC samples, QC limits, calculations and corrective actions are contained in previous sections and in attached tables.

15.1 Laboratory Method QC

Method QC evaluates whether a method is performing within acceptable limits of precision and accuracy. There is a laboratory component and a "matrix" component to this determination. The laboratory component measures the performance of the laboratory analytical processes during the sample analyses. The matrix component measures the method performance on a specific matrix.

Method blanks and laboratory control samples uniquely measure the laboratory component of method performance. Instrumentation accuracy is measured by instrument calibrations. Matrix spikes, matrix spike duplicates, laboratory sample duplicates, surrogates, and ICP serial dilutions and interference check samples measure the matrix component of method performance.

15.1.1 Laboratory Blanks

As applicable to the level of the data package, the laboratory is required to submit summary tables with associated samples or SDGs of the following blanks:

<u>Inorganic:</u>

- Initial and continuing blanks
- Preparation blanks

<u>Organic</u>:

- Method blanks

Blanks are a measure of laboratory contamination. If an analyte is detected in the blanks, all data with reported values less than (5 x the blank value) are considered to be suspect and are used as undetected values.

15.1.2 Surrogates

The laboratory is required to report the HPLC surrogate compounds, their percent recovery and the applicable QC limits for each sample. For the comprehensive review, the retention times and the associated continuing calibration standard areas and retention times are required to be summarized by sample for each SDG or batch of samples. The surrogates are a measure of the method accuracy and matrix interferences for each sample. When surrogate recoveries are high, there is a possibility of high bias to the reported positive data. Low recoveries can indicate possible low bias to reported data or reporting of false undetected values. Samples exceeding the surrogate control limits are required to be re-analyzed and the results of the re-analysis are to be recorded in the case narrative. Note that a high surrogate recovery for non-detected data is not required to be re-analyzed.

15.1.3 MS/MSD Samples

The laboratory is required to provide summary tables of the MS and MSD samples, their identification, percent recovery, spike concentration and relative percent difference of the percent recoveries for every preparation batch and/or SDG as applicable. The matrix spikes are a measure of method accuracy for a particular matrix. MS/MSD pairs are usually required for organic analyses. For inorganic analysis, only the MS is required. When spike recoveries are high, there is a possibility of high bias to the reported positive data. Low recoveries can indicate possible low bias to reported data or reporting of false undetected values.

15.1.4 MS/MSD Pairs

The laboratory is required to provide summary tables of inorganic matrix duplicate samples, their identification, original sample value and RPD between the duplicate pair. If an MS/MSD is used, the RPD is between the percent recoveries. Accuracy (recovery) and batch precision may also be determined using an LCS/LCSD pair if an insufficient or inappropriate MS/MSD sample is provided. When the RPD for waters is greater than 20% or the RPD for soils is greater than 35% there is a potential variability to the reported data due to non-homogeneity of the sample matrix or poor sample preparation. For low level samples (results less than 5 x RL) a difference of 2 x RL (soils) is usually used to assess acceptable precision. In order for the MS/MSD to give valid information regarding matrix factors, these samples must best represent the matrix of the samples being collected in the batch. If a sample is re-analyzed for MS/MSD matrix concerns, the results are reported in the case narrative.

15.1.5 LCS/LCSD

The laboratory is required to report the LCS, percent recoveries and applicable QC limits for each preparation batch and/or SDG as applicable. The LCS is a measure of laboratory accuracy for a particular method and type of matrix (reagent water, soil or matrix-matched sample). When spike recoveries are high, there is a possibility of high bias to the reported positive data. Low recoveries can indicate possible low bias to reported data or reporting of false undetected values.

15.1.6 Calibrations

The laboratory is required to report the initial and continuing calibration data for all comprehensive analyses. For organic analyses, the applicable initial CF, average CF and %RSD of the response factors are presented in a summary table. If linear curves are generated, the correlation coefficient is reported for each compound. A similar table is reported for the continuing calibration RFs and percent difference of the RFs from the initial calibration. For inorganic data, the GFAA correlation coefficient for the 3 to 5 point curve is reported for each analyte as well as the percent recoveries of the ICV and continuing calibration verification CCV standards. The ICV for the organic analyses may also be required as a raw data deliverable. There are several compounds, which routinely demonstrate variability in calibration factors. The data are evaluated referencing the calibration used for quantitation to determine if there is a possible bias that needs to be considered in using the data for project decisions.

15.1.7 Chromatograms for HPLC Explosives

The laboratory is required to provide the raw data containing chromatograms and two-column confirmation (HPLC only) for the organic analyses. The chromatograms provide information about the ability of the laboratory to adequately detect and resolve compounds of concern. The two-column confirmation provides verification of the accuracy of identification of the reported compounds and the presence of interfering compounds. These items are to be reviewed by a qualified analytical chemist who is familiar with the analytical methods and instrument raw data.

If reported data are not verified by the chromatography, the Project Data Validator will notify the TPgM or MMRP QA/QC Manager to determine whether the sample is to be re-analyzed or if the reported result is to be rejected as unusable for project decisions.

15.1.8 Method of Standard Additions and Analytical Spikes

If ICP is not performed and GFAA is required, the laboratory is required to provide the analytical spike recoveries and MSA correlation coefficients for all GFAA analyses. These calculations may be in table format or provided on the individual run log sheets as long as there is a clear identification of each client sample. If the correlation coefficient does not meet the ≥0.995 criteria, it is possible that there is a variability to the reported data due to inherent matrix effects. This is reported in the case narrative.

15.1.9 ICP Serial Dilution

At the request of the TPM, MMRP QA/QC Manager, or Project Chemist, the laboratory may be required to provide a table of the serial dilution percent difference values or clearly identify these samples in the raw data and provide the required %D calculations. When a %D is greater than 10%, there could be variability to the reported data due to matrix effects that are not linear and are not diluted out proportionate to the dilution ratio. The serial dilution assessment applies only to analytes whose reported values are greater than 50 times the IDL.

15.1.10 ICP Interference Check Sample (ICS)

At the request of the TPM, MMRP QA/QC Manager, or Project Chemist, the laboratory may be required to report the ICS percent recoveries. The two ICS solutions measure the ability of the instrument to account for interfering wavelengths of high concentration analytes. If an ICS is out of control and there are concentrations of aluminum, iron, magnesium or calcium in the sample at high concentrations, associated data could be biased high due to overlap of wavelengths.

15.1.11 Inorganic Raw Data

The inorganic raw data may be required if the above information is not supplied in summary or tabular form. For example, EPA CLP-like forms are fully acceptable for the summary QC review.

15.1.12 Calculation Check

Ten percent of the data are proposed for a check of the quantitation algorithms. Raw data are to be supplied for this task. The TPM, MMRP QA/QC Manager, or Project Chemist, will determine if this check is required for this project.

16.0 REFERENCES

EPA, 2000, *Data Quality Objectives Process for Hazardous Waste Site Investigations*, EPA QA/G-4HW, (EPA/600/R-00/007)

EPA, 2005, *EPA Contract Laboratory Program National Functional Guidelines for Organic Data Review* (EPA540/R-04/009) and current updates

EPA, 2004, *EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (EPA 540-R-04-004)

EPA, 1996, *Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods, SW-846*, Third edition and updates

EPA, 2002, *Guidance for Quality Assurance Project Plans*, EPA QA/G-5

EPA, 2001, *EPA Requirements for Quality Assurance Project Plans,* EPA QA/R-5

EPA, 2000, *Guidance for the Data Quality Objectives Process*, EPA QA/G-4

USACE Omaha District, Statement of Work for Site Inspection, Ravenna AAP, OH. Contract number DACA63-03-D-0009. June 2005.

USACE Omaha District, Statement of Work for Site Inspection, Fort Bliss, TX; Fort Sam Houston, TX. Contract number DACA63-03-D-0009. September 2005.

USACE Omaha District, Statement of Work for MMRP Site Inspections, Fort Campbell, KY; Fort Polk, LA; Fort Knox, KY; Fort Leavenworth, KS; Fort Leonard Wood, MO. Contract number DACA63-03-D-0009. November 2005

USACE, 1997, *Chemical Quality Assurance for HTRW [Hazardous, Toxic and Radioactive Waste] Projects* (EM 200-1-6)

USACE, 2001, *Requirements for the Preparation of Sampling and Analysis Plans* including Appendix I *Shell for Analytical Chemistry* (EM-200-1-3)

USACE, June 2005, *Chemistry Scope of Services for Contracted Environmental Studies*

Table 1: Analytical Method Summary

ANALYTE	METHOD (SW-846 unless noted)
Metals (except for Mercury)	Method 6010C (ICP)
Mercury	Method 7471A (CVAA)
Explosives	Method 8330B (HPLC)
Propellants	EPA Method 353.2

Table 2: Soil Sample Container, Holding Time, And Preservation Requirements

ANALYSIS	SAMPLE CONTAINER	HOLDING TIME	PRESERVATIVE
Explosives (EPA Method 8330B)	Gallon sized plastic bag	14 days to extraction, 40 days for analysis	4°C
Propellants (EPA Method 353.2)	Gallon sized plastic bag	14 days to extraction, 40 days for analysis	4°C
TAL Metals By ICP (EPA Method 6010C), Mercury 7471A	Gallon sized plastic bag	180 Days (Mercury 28 days)	4°C

Table 3: Laboratory QC Minimum Frequency Summary

TYPE	DESCRIPTION	METALS	EXPLOSIVES	PROPELLANTS
Blank	Method or Preparation	One per prep or analytical batch[1]	One per prep or analytical batch[1]	One per prep or analytical batch[1]
Laboratory (Matrix) Duplicate	Duplicate of sample	One per analytical batch[1]	N/A	N/A
Laboratory Control Sample	Analyte-fortified blank	One per analytical batch[1]	One per analytical batch[1]	One per analytical batch[1]
Laboratory Control Sample Duplicate	Duplicate of analyte-fortified blank	One per analytical batch[1]	One per analytical batch[1]	One per analytical batch[1]
Field Duplicate	Duplicate of field sample	1/10 samples	1/10 samples	1/10 samples

[1] An analytical batch consists of a maximum of 20 samples or samples run on one day for one method, on one instrument

Table 4: QC Criteria and Corrective Actions

EXPLOSIVES METHOD 8330B (HPLC)/PROPELLANTS METHOD 353.2		
QC ITEM	**QC CRITERIA**	**CORRECTIVE ACTION**
IC (≥5 points), performed initially and when continuing calibration cannot be met. Includes a point at or near the reporting limit.	%RSD for ≤ 20%, or linear curve with r > 0.995, or r2 > 0.99.	Correct problem then repeat IC. Samples may not be analyzed until there is valid IC.
ICV – a second source verification standard must be analyzed with each initial calibration.	All analytes within ± 30% of expected value.	Correct problem then repeat ICV. If this fails repeat IC.
CCV – at the beginning, after every 10 samples, and at the end of a sample sequence.	All analytes within ± 20% of expected value from the ICAL	Correct problem then repeat CCV. If this fails use a third source ICV.
Method Blank; one per QC batch.	No analytes detected > ½ RL. For common laboratory contaminants, no analytes detected > RL.	Apply B flag to positive results.
LCS; 1/20 samples or per SDG.	Within historical approved laboratory acceptance limits for each analyte (see **Attachment C**).	Correct problem and then reanalyze. If still out, reprep and reanalyze all samples in the affected SDG.
Surrogate: every sample	Approved lab limit or 50 - 150% in samples and soil LCS; 60 - 140% in water LCS.	Correct problem then re-extract and reanalyze. Note if matrix effect verified.
Second column confirmation	All positive measurements above the reporting limit.	Apply J flag for estimated if RPD >40%.
RT	0.5 min ± 0.06 min of expected RT.	Correct problem and reanalyze all samples since last acceptable RT check.
Field duplicate 1/10 samples.	< 50% RPD (± 4x RL for values < 5 x RL) for duplicates. Results can be evaluated for precision, but this criterion will be considered as advisory only as the results are highly dependent on sample homogeneity and sampling technique.	Field duplicates are evaluated in context with the project DQOs to determine potential impact to data usability.

METALS METHOD 6010C, MERCURY METHOD 7471A (CVAA)		
QC ITEM	**QC CRITERIA**	**CORRECTIVE ACTION**
IC (3 points ICP, 5 Points CVAA and GFAA), performed initially and when continuing calibration cannot be met. Includes a point at or near the reporting limit.	r > 0.995 for each analyte	Correct problem then repeat IC. Samples may not be analyzed until there is valid IC.
ICV: Daily before sample analysis.	All analytes within 10% of expected value.	Correct problem then repeat ICV. If this fails repeat IC.
CCV; 1/10 samples and at end of analysis sequence.	All analytes within ± 10% of expected value and RSD of replicate integrations <5%.	Qualify all results for analytes >10% D for all samples associated with calibration verification.
Calibration blank: before sample run and after every calibration verification.	No analytes > MDL.	Apply B flag to positive results.
Method blank; one per SDG.	< ½ RL	Apply B flag to positive results.
MS/MSD; 1/20 samples or per prep batch.	Lab control limits or 75 - 125 % R for MD and MSD RPD ≤ 25%; if (spike x 4) > sample result (see **Attachment C**).	Investigate whether there is matrix effect or analytical error. Note in case narrative.
LCS 1/20 or per prep batch.	Laboratory limits or 80 - 120% or control chart limits for soil sample LCS (see **Attachment C**).	Correct problem and then reanalyze. If still out, reprep and reanalyze all samples in the affected SDG.
Serial Dilutions, 1/20 or per prep batch.	± 10 %D when analyte conc. > 50 X IDL.	Perform post-digestion spike addition and apply estimated J-flag to results if ≥ 50X MDL or % D > 10 and post digestion spike not performed.
Post-digestion spike addition; when dilution test fails, 1 per sample batch on MS sample for ICP, every sample for GFAA/CVAA.	75-125 %R for ICP; 85-115 %R for GFAA and CVAA.	Apply estimated J-flag to all associated results.
GFAA Method of Standard Additions (MSA) correlation coefficient.	r > 0.995	Apply estimate J-flag to associated results and note matrix effect in case narrative.
ICP Interference Check Sample daily begin and end.	80 – 120 % R	Correct the problem and reanalyze.
Field duplicate 1/10 samples.	< 50% RPD (± 4x RL for values < 5 x RL) for co-located duplicates. Results can be evaluated for precision, but this criterion will be considered as advisory only as the results are highly dependent on sample homogeneity and sampling technique.	Field duplicates are evaluated in context with the project DQOs to determine potential impact to data usability.

IC = Initial Calibration
ICV = Initial Calibration Verification
CCV = Continuing Calibration Verification
% R = Percent Recovery
%D = Percent Difference
RPD = Relative Percent Difference
SDG = Sample Delivery Group
%RSD = Percent Relative Standard Deviation
r = correlation coefficient
MDL = Method Detection Limit
MS/MSD = Matrix Spike/Matrix Spike Duplicate
RT = Retention Time

TECHNICAL STANDARD OPERATING PROCEDURE

GROUNDWATER SAMPLING

1.0 PURPOSE

The purpose of this procedure is to describe the equipment and operations for sampling groundwater monitor wells. This procedure outlines methods for well purging, sample collection, and filtration, when using bailers, submergible pumps and bladder pumps.

This procedure provides guidance for routine field operations on environmental projects. Site-specific deviations from the methods presented herein must be approved by the e²M Field Project Manager.

2.0 DEFINITIONS AND ABBREVIATIONS

2.1 Definitions

Blank: An artificial sample designed to monitor the introduction of contaminants into a process. For aqueous samples, reagent water is used as a blank matrix.

Field Blanks: Blanks used to assess potential contamination resulting from exposure to ambient field conditions.

Trip Blanks: Blanks obtained from the laboratory or prepared by the field sampling team with reagent grade water at a designated clean location prior to sampling activities. Trip blanks are not opened in the field and act as a check for sample contamination originating from sample transport and site conditions.

Rinsate Blanks: Blanks prepared in the field from reagent-grade water that is poured over or passed through the sample collection device after the device has been decontaminated, then collected in a sample container and returned to the laboratory for analysis. Rinsate blanks check the effectiveness of decontamination procedures. Rinsate blanks can also serve as field blanks if they are prepared at the site.

Specific Capacity: The discharge of a well expressed as rate of yield per unit drawdown.

2.2 Abbreviations

FID	Flame ionization detector
PID	Photo ionization detector
POC	Purgeable organic carbon
POX	Purgeable organic halogens
TSOP	Technical Standard Operating Procedures
TOC	Total organic carbon
TOX	Total organic halogens
VOC	Volatile organic compound

3.0 RESPONSIBILITIES

Sampling personnel are responsible for performing the applicable tasks and procedures outlined herein when conducting work related to environmental projects.

The e²M Field Project Manager or an approved designee is responsible for checking all work performance and verifying that the work satisfies the applicable tasks required by this procedure. This will be accomplished by reviewing all documents and data produced during work performance.

4.0 PROCEDURES

- Read and follow the specific Manufacturer's Operating Instructions before using any equipment.
- Prior to initiating sampling of a groundwater well, check that all equipment to be used is in good operating condition.
- If possible and where applicable, start at those wells that are the least contaminated and proceed to those wells that are the most contaminated.
- Clean all equipment entering the well by professionally excepted method of decontamination.
- Remove well casing cap, noting in the log book the following: personnel, well number, date, time and weather conditions, as well as any evidence of damage or disturbance to the well. (This information may also be recorded on the groundwater sampling data form.
- If required by site specific condition, monitor headspace of well with a photo ionization detector (PID), a flame ionization detector (FID), or other appropriate monitoring instrument and record in the log book. (This information may also be recorded on the groundwater sampling data form.
- Check water level
- Purge well.
- Sample well as per Section 4.2, Sampling Procedures.
- Filter and preserve samples as per Section 4.4, Sample Filtration and Preservation.

4.1 Well Purging

In order to obtain a representative sample of groundwater from a monitoring well, the water that has stagnated and/or thermally stratified within the well casing and filter pack must be purged. This procedure allows representative formation water to enter the well. The preferred method of ensuring representative formation water is to monitor groundwater parameters during purging.

Measure pH, temperature and specific conductance at regular volumetric intervals (i.e., one-half casing volume) during well purging using the methods outlined in “Water Sample Field Measurements”.

The purge volume of static water can be calculated by using the following formula:

$V = T\ (0.163)$

Where:
V = Static volume of well in gallons
T = Linear <u>feet</u> of static water in well
0.163 = A constant conversion factor for a 2" diameter well. For a 4" diameter well, use 0.653.

The well should be sampled within two hours of purging. Record the results on Monitoring Well Sampling Data sheet. When these parameters vary less than ±10% (pH will vary less than 0.2 pH units) over three consecutive measurements, the well is adequately purged (stabilized). In wells with poor recovery, purge to near dryness and allow the well to recover prior to sampling. In wells with slow recharge rates, it may be necessary to wait several hours or until the next day to collect the sample.

When well water parameters do not stabilize within six purge volumes, then the well should be considered unstablized and can be sampled after six purge volumes have been purged. This phenomenon often occurs when the groundwater is highly contaminated.

Prior to initiating well purging, record the following groundwater parameters on Monitoring Well Sampling Data sheet:

- Static water level;
- Depth of well bottom;
- Height of water column;
- Volume of water in borehole;
- Time;
- Temperature;
- Conductivity;
- pH;
- Approximate Purge Flow Rate;
- Visual appearance; and
- Monitoring equipment (HNu/OVA) readings.

4.2 Sampling Procedures

After purging the required volume of water from the well, sample within two hours. Do not exceed two hours between purging and sampling, except in cases when a slow recharge rate requires more time between well purging and sample collection. To ensure the groundwater sample is representative of formation water, it is important to minimize the possibility of cross-contamination by performing the following steps:

- Use only Teflon®, stainless steel or disposable sampling devices which have been decontaminated prior to use.

- Use dedicated sampling equipment. If dedicated sampling equipment is not available, thoroughly decontaminate the equipment prior to any sampling and between sampling events. Collect rinsate blanks as outlined in the Project Plans to verify that cross-contamination has not occurred.

- Specify the order in which the samples are to be collected. Collect samples in the order of volatilization sensitivity. Volatile organics should be collected when flow rate is less than 100 ml/minute. Fill sampling vial(s) completely making sure that there is no head space. The collection order for most common groundwater parameters is as follows:

    - Volatile organic compound (VOC);
    - Purgeable organic carbon (POC);
    - Purgeable organic halogens (POX);
    - Total organic halogens (TOX);
    - Total organic carbon (TOC);
    - Extractable organics;
    - Total metals;
    - Dissolved metals;
    - Phenols;
    - Cyanide;
    - Sulfate and chloride;
    - Turbidity;
    - Nitrate and ammonia; and
    - Radionuclides.

Transfer the groundwater sample to a sample container in such a manner that will minimize agitation and aeration. Samples should also be immediately placed in a cool place out of direct sunlight, such as a cooler. The cooler should be kept at an appropriate temperature for preservation requirements for the applicable analyses.

Immediately after the sample is collected, record applicable information in the field log book.

4.2.1 Sample Containers

The proper sample containers to be used for specific analysis and sample preservation are outlined in e²M guidance document, “Sample Containers, Preservation, and Maximum Holding Times”.

4.3 Sampling Methods

4.3.1 Bailer Method

Collect groundwater samples with a bailer by lowering the bailer into the well using a disposable nylon line. Avoid contacting the ground or any other surface with the decontaminated line and bailer. A plastic sheet can be used as an apron. Lower the bailer into the well in a controlled manner to avoid plopping, as this may cause outgassing of the water from the bailer's impact.

After the desired depth is reached, raise the bailer to the surface and empty it through the bottom by a clamp valve. If the bailer is not equipped with a clamp valve, pour the sample from the bailer into the appropriate container. Empty the bailer at a slow, controlled rate to minimize sample aeration. After all sample containers have been filled, measure sample pH, temperature, and conductivity. Record applicable information on a Monitoring Well Sampling Data sheet.

The advantages to bailers are that they are portable, easily cleaned, and do not require an outside power source. The disadvantage to bailer sampling is that this method is slow when large volumes of water are required or when the well is deep.

4.3.2 Bailer Decontamination

Decontaminate bailers prior to use in each well. Equipment Decontamination. In all cases, the bailer cord should be replaced prior to each sampling. Disposable bailers may be used in place of Teflon® or stainless steel bailers. Disposable bailers do not require decontamination after sampling but should be rinsed prior to use.

4.3.3 Bladder Pump Method

The bladder pump consists of a stainless steel housing that encloses a flexible membrane or bladder made of Teflon®. A screen is attached below the bladder to filter any material that may clog the bladder check valves. The pump may be operated by using an air compressor, compressed air, or compressed nitrogen.

The pump is lowered into the well to the desired depth. The air supply line is attached to the controller and the discharge line is placed into a suitable receptacle. When collecting samples for analysis of volatile constituents, do not exceed a pumping rate of 100 milliliters/minute. Higher pumping rates may increase the loss of volatile constituents and may cause fluctuation in pH and pH-sensitive analytes. For non-sensitive analysis, higher pumping rates may be used. Do not allow the sampling flow rate to exceed the flow rate used while purging. Place the samples in proper sample containers. Record applicable sampling information on Monitoring Well Sampling Data sheet and Chain-of-Custody form.

The advantages to bladder pumps include ease of operation, ability to pump larger volumes of water, and lift the water higher. The disadvantages are that a power source is needed, some loss of volatile constituents is possible, and the decontamination process is difficult.

4.3.4 Bladder Pump Decontamination

Decontaminate the bladder pump prior to use in each well. Disassemble and inspect the pump prior to cleaning. Decontamination is completed by the methods outlined in the owner's manual for the specific type of bladder pump.

4.3.5 Submerged Electrical Pump

The electrical pump is constructed of stainless steel. Consult the specific Manufacturer's Operating Instructions before operation. The pump is lowered into the well to the desired depth. The purge volume calculations should be determined prior to placing the pump in the well. Purge rates should not cause drastic drawdown which results in water cascading into the well. When collecting samples for analysis of volatile constituents, do not exceed a pumping rate of 100 milliliters/minute. Higher pumping rates may increase the loss of volatile constituents and may cause fluctuation in pH and pH-sensitive analytes. For non-sensitive analysis, higher pumping rates may be used. Do not allow the sampling flow rate to exceed the flow rate used while purging. Place the samples in their proper sample containers. Record applicable sampling information on Monitoring Well Sampling Data sheet.

4.4 Sample Filtering

Some samples require field filtering within four hours of collection from the well. Filter samples by using a disposable in-line filter housing equipped with a 0.45 micron glass fibre filter. Change filters for each sample. Collect the sample water directly into the sample container.

After the samples have been filtered and placed in appropriate containers, preserve samples as stated by laboratory direction or in the Work Plan.

4.5 Chain-of-Custody

All samples shall be accompanied by an appropriate Chain-of-Custody form at the time of transfer.

4.6 Sample Labeling

Label all samples accordingly as per the Work Plan.

4.7 Potable Water Sampling

During certain phases of field investigations, it may be necessary to collect samples from existing domestic or municipal water supply systems.

When samples are collected from domestic wells, the wells should be purged before the sample is collected. Residential wells often have holding tanks which must be evacuated. Evacuation of the holding tank volume helps assure that representative samples are being collected from the aquifer. Information about well construction (casing diameter, depth to water, total depth, screened interval, and holding tank volume) should be obtained, if possible, in order to determine the appropriate volume of water to purge before sampling. If specific well information is not available, a 15-minute evacuation period is the minimum acceptable time. In all cases, temperature pH, conductivity and flow rate should be measured during purging. The well is considered purged when field parameters stabilize.

The name, mailing address, and the resident's home and work telephone numbers are always entered into the sampling log book. This information will assist in informing the owner/operator of the water supply the results of the sampling program.

Potable water samples must be representative of water quality within a given segment of the distribution network. Taps selected for sampling should be supplied with water from a service pipe connected directly to a water main in the segment of interest and should not be separated from the segment of interest by holding or storage tanks.

All taps should be opened for sufficient time to allow for clearing of the service line. Water samples can then be collected directly from this line into the appropriate sample containers.

4.8 Review

The reviewer shall check Monitoring Well Sampling Data sheets, for completeness and accuracy. Any discrepancies will be noted and will be returned to the originator for correction. The reviewer will acknowledge that the review comments have been incorporated by signing and dating the “checked by” and “date” blanks on Monitoring Well Sampling Data sheets.

5.0 REFERENCES

Scalf, R. D. 1980. “Manual of Groundwater Sampling Procedures.” National Water Well Association and the U.S. Environmental Protection Agency (EPA) Robert S. Kerr Environmental Research Laboratory.

U.S. Environmental Protection Agency (EPA). 1991. “A Compendium of ERT Groundwater Sampling Procedures.” OSWER Directive 9360.4-06, January 1991. U.S. Environmental Protection Agency.

e²M 2004. Guidance document, “Sample Containers, Preservation, and Maximum Holding Times.”

TECHNICAL STANDARD OPERATING PROCEDURE

SEDIMENT SAMPLING

1.0 PURPOSE

The purpose of this procedure is to describe the equipment and operations used for sampling sediment within wadeable surface water bodies. This procedure outlines the methods for sediment sampling with routine field operations on environmental projects. Site-specific deviations from the methods presented herein must be approved by the e^{2}M Field Project Manager.

2.0 DEFINITIONS AND ABBREVIATIONS

2.1 Definition

Sediment: All transported or precipitated unconsolidated materials that accumulate, typically in lose layers, as of sand or mud.

2.2 Abbreviations

POC	Purgeable organic compound
POX	Purgeable organic halogens
PRP	Potentially Responsible Party
SVOC	Semivolatile organic compounds
TOC	Total organic carbon
TOX	Total organic halogens
TSOP	Technical Standard Operating Procedure
VOC	Volatile organic compound

3.0 RESPONSIBILITIES

Sampling personnel are responsible for performing the applicable tasks and procedures outlined here when conducting work related to environmental projects.

The e^{2}M Field Project Manager or an approved designee is responsible for ensuring that performance standards specified by this Technical Standard Operating Procedure (TSOP) are achieved. This will be accomplished by reviewing all documents and field procedures.

4.0 PROCEDURES

4.1 Introduction

The objective of sediment sampling is to ascertain the type, degree, and extent of sediment contamination at a site. The data can be used to evaluate potential threats to human health or the environment, to evaluate potential exposure pathways, or to calculate environmental risks.

4.2 Sampling Equipment

Sediment sampling equipment may include:

- Stainless steel mixing bowl;
- Stainless steel trowels;
- Stainless steel spoon or disposable plastic spoons (w/extensions);
- Stainless steel core sampler which uses stainless steel or Lexan® liners (optional);
- Stainless steel shovel; and
- Appropriate sample containers.

4.3 Decontamination

Before initial use, and after each subsequent use, all re-usable sampling equipment must be decontaminated.

4.4 Sampling Location/Site Selection

Follow the sample design criteria outlined in the Work Plan for each sampling event. Relocate the sample sites when conditions dictate - such as natural or artificial obstructions at the proposed sample location (e.g., boulders, drift wood, etc.). Document the actual sample locations on a topographic map, site sketch or collect coordinates by using a global positioning system (GPS) and photograph all sample locations.

4.5 Sampling Approaches

It is important to select an appropriate sampling approach for accurate characterization of site conditions. Prior to undertaking any sediment sampling program, it is necessary to establish appropriate measurement and system Data Quality Objectives. Refer to the U.S. Environmental Protection Agency (EPA) Environmental Investigations Standard Operating Procedures and Quality Assurance Manual for guidance in establishing Data Quality Objectives, statistical sampling methodologies and protocols for each of the sampling approaches. Each approach is defined below.

4.5.1 Judgmental or Biased Sampling

Judgmental or Biased sampling is used primarily for documenting an observed release to either the groundwater, surface water, air or soil exposure pathways. This form of sampling is based on the subjective selection of sampling locations where contamination is most likely to occur. Locations are based on relative historical site information and on-site investigation (site walk-over) where contamination is most likely to occur.

There is no randomization associated with this sampling approach because samples are primarily collected at areas of suspected highest contaminant concentrations. Any statistical calculations based on the results of this sampling technique will be biased.

4.5.2 Random Sampling

Random sampling, used for the characterization of a heterogeneous non-stratified waste, involves arbitrary collection of samples within a defined area. This method is most effective and accurate if the chemical heterogeneity of the waste remains constant from batch to batch. The easiest method for Random Sampling is to divide the area for sampling into an imaginary grid, assign a series of numbers to the units of the grid, and select the numbers or units to be sampled through the use of a random-numbers table which can be found in the text of any basic statistics book. Note that haphazardly selecting sample numbers or units is not a suitable substitute for a randomly selected sample.

4.5.3 Stratified Random Sampling

Stratified random sampling, used for the characterization of a heterogeneous stratified waste, involves arbitrary collection of samples within a defined area and strata. This method is most effective and accurate if the chemical heterogeneity of the waste remains constant from batch to batch. The easiest method for stratified random sampling is to divide the area for sampling into an imaginary grid, assign a series of numbers to the units of the grid, and select the numbers or units to be sampled through the use of a random-numbers table which can be found in the text of any basic statistics book. A random sample is then collected from each strata at the selected numbers or units on the grid. Note that haphazardly selecting sample numbers or units is not a suitable substitute for a randomly selected sample.

4.5.4 Systematic Grid Sampling

Systematic grid sampling involves dividing the area of concern into smaller sampling areas using a square or triangular grid. Samples are then collected from the intersection of the grid lines or “Nodes.” The origin and direction for placement of the grid should be selected by using an initial random point. The distance between nodes is dependent upon the size of the site or area of concern and the number of samples to be collected. Generally, a larger distance is used for a large area of concern.

4.5.5 Systematic Random Sampling

Systematic random sampling involves dividing the area of concern into smaller sampling areas. Samples are collected within each individual grid cell using random selection procedures.

4.5.6 Search Sampling

Search sampling utilizes a systematic grid or systematic random sampling approach to define areas where contaminants exceed clean-up criteria. The distance between the grid lines and number of samples to be collected are dependent upon the acceptable level of error (i.e., the chance of missing a hot spot). This sampling approach requires that assumptions be made regarding the size, shape, and depth of hot spots.

4.5.7 Transect Sampling

Transect sampling involves establishing one or more transect lines, parallel or non-parallel, across the area of concern. If the lines are parallel, this sampling approach is similar to systematic grid sampling. The advantage of transect sampling over systematic grid sampling is the relative ease of establishing and relocation transect lines versus an entire grid. Samples are collected at regular intervals along the transect line at the surface and/or at a specified depth(s). The distance between the sample locations is determined by the length of the line and the number of samples to be collected.

4.6 General

4.6.1 Homogenizing Samples

Homogenizing is the mixing of a sample to provide a uniform distribution of the contaminants. Proper homogenization ensures that the containerized samples are representative of the total sediment sample collected. All samples to be composited or split should be homogenized after all aliquots have been combined. Special care will be taken to limit the loss of fine grain particulates that may be present. **DO NOT HOMOGENIZE (MIX OR STIR) SAMPLES FOR VOLATILE COMPOUND ANALYSIS.**

4.6.2 Compositing Samples

Compositing is the process of physically combining and homogenizing several individual sediment aliquot of the same volume or weight. Compositing samples provides an average concentration of contaminants over a certain number of sampling points.

4.6.3 Splitting Samples

Splitting samples (after preparation) is performed when multiple portions of the same samples are required to be analyzed separately. Fill the sample containers for the same analyses one after another in a consistent manner (i.e., fill USACE volatile organic compound (VOC) container, fill Potentially Responsible Party's (PRP) VOC container, fill USACE semi volatile organic compounds (SVOC) container, fill PRP SVOC container).

4.7 Sediment Sampling

Perform the following steps for sediment sampling (wadeable surface water body):

- Prior to sampling, remove any debris using decontaminated stainless steel trowel or disposable scoop;

- Label the lid of the sample container with an indelible pen or affix the sample label to the side of the jar and tape as to make it impervious to water prior to filling the container with sediment.

- When the surface body water is wadeable the easiest way to collect a sediment sample is by using a decontaminated stainless steel trowel, spoon or hand auger and transferring to a decontaminated stainless steel bowl for homogenizing. However, prior to transferring to the stainless steel bowl, excess water should be removed from the scoop or spoon. This may result in the loss of fine particle sized material associated with the bottom of the surface water body. Care should be taken to minimize the loss of fine particle sizes. Furthermore, if site conditions make it difficult to safely collect the sediment sample by wading and using a stainless steel trowel, spoon or plastic scoop, then a polyethylene long handled dipper will be used. If VOC analyses are to be conducted, fill the appropriate VOC sample containers first before homogenizing, then proceed to transfer the appropriate aliquot of sediment to the decontaminated stainless steel bowl for homogenizing;

- Collect samples in the order of volatilization sensitivity. The most common collection order is as follows:

    - Volatile organic compounds (VOC);
    - Purgeable organic carbon (POC);
    - Purgeable organic halogens (POX);
    - Total organic halogens (TOX);
    - Total organic carbon (TOC);
    - Extractable organics;
    - Total metals;
    - Dissolved metals;
    - Phenols;
    - Cyanide;
    - Sulfate and chloride;
    - Turbidity;
    - Nitrate and ammonia; and
    - Radionuclides.

- Immediately transfer the sample into a container appropriate to the analysis being performed (e²M Guidance “Sample Preservation, Containers and Maximum Holding Times”;

- Place the samples in a cooler with ice which must be maintained at approximately 4°C (if appropriate for analyses) for transport to an analytical laboratory;

- Immediately after the sample is collected, record applicable information in the field log book.

- Excess sediment will placed back into the surface water body that it was collected from.

- Decontaminate all sampling equipment

- Complete the Chain-of-Custody and associated documentation

4.10 Abandonment Procedures

No abandonment procedure is typically required for sediment sampling.

4.11 Review

The e²M Field Project Manager or an approved designee shall check all figures and field log books used to record information during sampling for completeness and accuracy. Any discrepancies will be noted and the documents will be returned to the originator for correction. The reviewer will acknowledge that these review comments have been incorporated by signing and dating the “checked by” and “date” blanks on the figures and at the applicable places in the log book.

5.0 REFERENCES

U.S. Environmental Protection Agency (EPA). 2001. “Environmental Investigations Standard Operating Procedures and Quality Assurance Manual” Section 11, “Sediment Sampling” U.S. Environmental Protection Agency, Washington, DC.

e²M 2004. Guidance document “Operating Procedure for Chain of Custody.”

e²M 2005. Guidance document “Sample Identification, Labeling, and Packaging.”

e²M 2005. Guidance document “Equipment Decontamination.”

TECHNICAL STANDARD OPERATING PROCEDURE

SURFACE AND SHALLOW DEPTH SOIL SAMPLING

1.0 PURPOSE

The purpose of this procedure is to describe the equipment and operations used for sampling surface and shallow depth soils. This procedure outlines the methods for soil sampling with routine field operations on environmental projects. Site-specific deviations from the methods presented herein must be approved by the e²M Field Project Manager.

2.0 DEFINITIONS AND ABBREVIATIONS

2.1 Definitions

Soil: All unconsolidated materials above bedrock.

Surface Soils: Soils located zero to six inches below ground surface.

Shallow Depth Soils: Soils located above the bedrock surface and from six inches to six feet below ground surface.

2.2 Abbreviations

POC	Purgeable organic compound
POX	Purgeable organic halogens
PRP	Potentially Responsible Party
SVOC	Semivolatile organic compounds
TOC	Total organic carbon
TOX	Total organic halogens
TSOP	Technical Standard Operating Procedure
VOC	Volatile organic compound

3.0 RESPONSIBILITIES

Sampling personnel are responsible for performing the applicable tasks and procedures outlined herein when conducting work related to environmental projects.

The e²M Field Project Manager or an approved designee is responsible for ensuring that performance standards specified by this TSOP are achieved. This will be accomplished by reviewing all documents and field procedures.

4.0 PROCEDURES

4.1 Introduction

The objective of surface and shallow depth soil sampling is to ascertain the type, degree, and extent of soil contamination at a site. The data can be used to evaluate potential threats to human health or the environment, to evaluate potential exposure pathways, or to calculate environmental risks.

4.2 Sampling Equipment

Surface and shallow soil sampling equipment may include:

- Stainless steel mixing bowl;
- Stainless steel trowels or spoons;
- Stainless steel hand auger;
- Stainless steel core sampler which uses stainless steel or Lexan® liners (optional);
- Stainless steel shovel; and
- Appropriate sample containers.

4.3 Decontamination

Before initial use, and after each subsequent use, all re-usable sampling equipment must be decontaminated.

4.4 Sampling Location/Site Selection

Follow the sample design criteria outlined in the Work Plan for each sampling event. Relocate the sample sites when conditions dictate - such as natural or artificial obstructions at the proposed sample location (e.g., boulders, asphalt, etc.). Document the actual sample locations on a topographic map or site sketch and photograph all sample locations.

4.5 Sampling Approaches

It is important to select an appropriate sampling approach for accurate characterization of site conditions. Prior to undertaking any soil sampling program, it is necessary to establish appropriate measurement and system Data Quality Objectives. Refer to the U.S. Environmental Protection Agency (EPA) Soil Sampling Quality Assurance User's Guide (listed in Section 5.0, References) for guidance in establishing Data Quality Objectives, statistical sampling methodologies and protocols for each of the sampling approaches. Each approach is defined below.

4.5.1 Judgmental or Biased Sampling

Judgmental or Biased sampling is used primarily for documenting an observed release to either the groundwater, surface water, air or soil exposure pathways. This form of sampling is based on the subjective selection of sampling locations where contamination is most likely to occur. Locations are based on relative historical site information and on-site investigation (site walk-over) where contamination is most likely to occur.

There is no randomization associated with this sampling approach because samples are primarily collected at areas of suspected highest contaminant concentrations. Any statistical calculations based on the results of this sampling technique will be biased.

4.5.2 Random Sampling

Random sampling, used for the characterization of a heterogeneous non-stratified waste, involves arbitrary collection of samples within a defined area. This method is most effective and accurate if the chemical heterogeneity of the waste remains constant from batch to batch. The easiest method for Random Sampling is to divide the area for sampling into an imaginary grid, assign a series of numbers to the units of the grid, and select the numbers or units to be sampled through the use of a random-numbers table which can be found in the text of any basic statistics book. Note that haphazardly selecting sample numbers or units is not a suitable substitute for a randomly selected sample.

4.5.3 Stratified Random Sampling

Stratified random sampling, used for the characterization of a heterogeneous stratified waste, involves arbitrary collection of samples within a defined area and strata. This method is most effective and accurate if the chemical heterogeneity of the waste remains constant from batch to batch. The easiest method for stratified random sampling is to divide the area for sampling into an imaginary grid, assign a series of numbers to the units of the grid, and select the numbers or units to be sampled through the use of a random-numbers table which can be found in the text of any basic statistics book. A random sample is then collected from each strata at the selected numbers or units on the grid. Note that haphazardly selecting sample numbers or units is not a suitable substitute for a randomly selected sample.

4.5.4 Systematic Grid Sampling

Systematic grid sampling involves dividing the area of concern into smaller sampling areas using a square or triangular grid. Samples are then collected from the intersection of the grid lines or “Nodes.” The origin and direction for placement of the grid should be selected by using an initial random point. The distance between nodes is dependent upon the size of the site or area of concern and the number of samples to be collected. Generally, a larger distance is used for a large area of concern.

4.5.5 Systematic Random Sampling

Systematic random sampling involves dividing the area of concern into smaller sampling areas. Samples are collected within each individual grid cell using random selection procedures.

4.5.6 Search Sampling

Search sampling utilizes a systematic grid or systematic random sampling approach to define areas where contaminants exceed clean-up criteria. The distance between the grid lines and number of samples to be collected are dependent upon the acceptable level of error (i.e., the chance of missing a hot spot). This sampling approach requires that assumptions be made regarding the size, shape, and depth of hot spots.

4.5.7 Transect Sampling

Transect sampling involves establishing one or more transect lines, parallel or non-parallel, across the area of concern. If the lines are parallel, this sampling approach is similar to systematic grid sampling. The advantage of transect sampling over systematic grid sampling is the relative ease of establishing and relocation transect lines versus an entire grid. Samples are collected at regular intervals along the transect line at the surface and/or at a specified depth(s). The distance between the sample locations is determined by the length of the line and the number of samples to be collected.

4.6 General

All boreholes and pits will be filled in with the material removed during sampling unless otherwise specified in the Work Plan. Where a vegetative turf has been established, fill in with native soil or potting soil and replace the turf if practical in all holes or trenches when sampling is completed.

4.6.1 Homogenizing Samples

Homogenizing is the mixing of a sample to provide a uniform distribution of the contaminants. Proper homogenization ensures that the containerized samples are representative of the total soil sample collected. All samples to be composited or split should be homogenized after all aliquots have been combined. **DO NOT HOMOGENIZE (MIX OR STIR) SAMPLES FOR VOLATILE COMPOUND ANALYSIS.**

4.6.2 Compositing Samples

Compositing is the process of physically combining and homogenizing several individual soil aliquot of the same volume or weight. Compositing samples provides an average concentration of contaminants over a certain number of sampling points.

4.6.3 Splitting Samples

Splitting samples (after preparation) is performed when multiple portions of the same samples are required to be analyzed separately. Fill the sample containers for the same analyses one after another in a consistent manner (i.e., fill USACE volatile organic compound (VOC) container, fill Potentially Responsible Party's (PRP) VOC container, fill USACE semivolatile organic compounds (SVOC) container, fill PRP SVOC container).

4.7 Surface Soil Sampling

Perform the following steps for surface soil sampling:

- Prior to sampling, remove leaves, grass, and surface debris using decontaminated stainless steel trowel;
- Label the lid of the sample container with an indelible pen or affix the sample label to the side of the jar and tape as to make it impervious to water prior to filling the container with soil.
- Collect surface soil samples with a decontaminated stainless steel trowel, spoon or hand auger and transfer to a decontaminated stainless steel bowl for homogenizing. If VOC analyses are to be conducted, fill the appropriate VOC sample containers first before homogenizing, then proceed to transfer the appropriate aliquot of soil to the decontaminated stainless steel bowl for homogenizing;
- Collect samples in the order of volatilization sensitivity. The most common collection order is as follows:
  - Volatile organic compounds (VOC);
  - Purgeable organic carbon (POC);
  - Purgeable organic halogens (POX);
  - Total organic halogens (TOX);
  - Total organic carbon (TOC);
  - Extractable organics;
  - Total metals;
  - Dissolved metals;
  - Phenols;
  - Cyanide;
  - Sulfate and chloride;
  - Turbidity;
  - Nitrate and ammonia; and
  - Radionuclides.
- Immediately transfer the sample into a container appropriate to the analysis being performed (e^{2}M Guidance “Sample Preservation, Containers and Maximum Holding Times”;
- Place the samples in a cooler with ice which must be maintained at approximately 4°C (if appropriate for analyses) for transport to an analytical laboratory;
- Immediately after the sample is collected, record applicable information in the field log book.
- Excess soil sample media shall be placed back in the soil boring or pit and filled to grade with native soil.
- Decontaminate all sampling equipment
- Complete the Chain-of-Custody and associated documentation

4.8 Surface Soil Sampling (Composite Samples Only)

- Perform the following steps for surface soil (composite) sampling:
- Prior to sampling, remove leaves, grass, and surface debris using decontaminated stainless steel trowel;
- Collect surface soil aliquots with a decontaminated stainless steel spoon, trowel or hand auger and add to a stainless steel bowl and homogenize. Prior to homogenizing, remove an aliquot for VOC analysis (if appropriate) and then homogenize;
- Samples will be identified and label as per e²M Guidance “Sample Identification, Labeling, and Packaging”;
- Samples will be preserved and held as per e²M Guidance “Sample Containers, Preservation and Maximum Holding Times”;
- Complete the Chain-of-Custody Record and associated documentation;
- Record applicable information in the field log book;
- Decontaminate all sampling equipment

4.9 Shallow Depth Soil Sampling

Perform the following steps to collect shallow depth soil samples:

- Use a decontaminated stainless steel shovel to remove the top layer of soil;
- Remove leaves, grass, and surface debris that may have contacted the shovel using a decontaminated stainless steel trowel;
- Excavate soil to the pre-determined sampling depth by using a decontaminated hand auger. Periodically, remove the cuttings from the auger;
- When the proper sample depth is reached, remove the hand auger and all cuttings from the hole;
- Lower the decontaminated core sampler or hand auger to the bottom of the hole. When using a core sampler, it must contain a decontaminated liner appropriate for the constituents to be analyzed;
- Mark the sample interval (i.e., one foot above ground level) on the hammer stem or auger;
- Operate the slide hammer on the core sampler to drive the sampler head into the soil, or advance the auger until it is flush with the interval mark at ground level;

- Record weight of hammer, length of slide, blow counts and geologic soil data for all samples collected with a core sampler in the field log book;
- When the core sampler liner or auger has been advanced the total depth of the required sample, remove it from the bottom of the hole;
- Immediately remove the liner from the core sampler and transfer the sample into a container or stainless steel bowl for compositing and homogenizing as specified in the project-specific Field Sampling Plan appropriate to the analysis being performed using a stainless steel spoon or trowel. Prior to compositing and homogenizing, fill the appropriate aliquot for VOC analysis (if conducted) and then composite and homogenize;
- Samples will be identified and label as per e²M Guidance "Sample Identification, Labeling, and Packaging";
- Samples will be preserved and held as per e²M Guidance document "Sample Containers, Preservation and Maximum Holding Times";
- Complete the Chain-of-Custody Record and associated;
- Record applicable information in the field log book. This information can also be entered on the Surface/Shallow Soil Sampling Log sheet;

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- Decontaminate all sampling equipment per e²M guidance "Equipment Decontamination".

4.10 Abandonment Procedures

Abandon boreholes and fill to grade by filling in with the material removed for sampling or clean fill (i.e., potting soil or sand).

4.11 Review

The e²M Field Project Manager or an approved designee shall check all figures and field log books used to record information during sampling for completeness and accuracy. Any discrepancies will be noted and the documents will be returned to the originator for correction. The reviewer will acknowledge that these review comments have been incorporated by signing and dating the "checked by" and "date" blanks on the figures and at the applicable places in the log book.

5.0 REFERENCES

U.S. Environmental Protection Agency (EPA). 1989. "Soil Sampling Quality Assurance User's Guide." EPA/600/8-89/046, U.S. Environmental Protection Agency, Washington, DC.

e2M 2004, Guidance document "Technical Standard Operating Procedure 4.2, Sample Preservation, Containers, and Maximum Holding Times."

e^{2}M 2004. Guidance document "Operating Procedure for Chain of Custody."

e^{2}M 2005. Guidance document "Sample Identification, Labeling, and Packaging."

e^{2}M 2005. Guidance document "Equipment Decontamination."

TECHNICAL STANDARD OPERATING PROCEDURE

SURFACE WATER SAMPLING

1.0 PURPOSE

The purpose of this procedure is to describe the methods for surface water sampling. It describes the procedures and equipment to be used to obtain representative surface water samples that are capable of producing accurate quantification of water quality.

This procedure provides guidance for routine field operations on environmental projects. Site-specific deviations from the methods presented herein must be approved by the e^{2}M Field Project Manager.

2.0 DEFINITIONS AND ABBREVIATIONS

2.1 Definitions

Aliquot: Fractional amount.

Composite Samples: Samples composed of more than one aliquot collected at various sampling sites and/or at different times.

Epilimnetic zone: The uppermost layer of water in a lake, characterized by an essentially uniform temperature that is generally warmer than elsewhere in the lake and by a relatively uniform mixing caused by wind and wave action. Specifically, the light (less dense), oxygen-rich layer of water in a thermally stratified lake.

Grab Samples: Samples that are collected at one particular point and time.

Hypolimnetic zone: The lowermost layer of water in a lake, characterized by an essentially uniform temperature (except during turnover) that is generally colder than elsewhere in the lake and often characterized by relatively stagnant or oxygen-deficient water.

Rinsate: Waste-water generated as a result of rinsing sampling equipment during decontamination procedures.

Surface water samples: Samples of water collected from streams, ponds, rivers, lakes, or other impoundments open to the atmosphere.

2.2 Abbreviations

ERB	Emergency Response Branch
PA	Preliminary Assessment
SI	Site Inspection
TSOP	Technical Standard Operating Procedures

3.0 RESPONSIBILITIES

Field personnel are responsible for performing the applicable tasks in accordance with this procedure when conducting work related to environmental projects.

The e²M Field Project Manager or an approved designee is responsible for checking all work performance and verifying that the work satisfies the applicable tasks required by this procedure. This will be accomplished by reviewing all documents and data produced during work performance.

4.0 PROCEDURE

4.1 Introduction

The objective of surface water sampling is to evaluate the surface water quality entering and/or leaving a site. It is also used to obtain data on waste loads, water quality and characteristics that will permit prediction or modeling of the water system (to describe probable water quality), and effects on uses under a variety of conditions.

4.2 Sampling Equipment

There is a variety of equipment available for surface water sampling. Because each site may contain varied surface water conditions, collection of a representative sample may be difficult. In general, a sampling device will include the following characteristics:

- Be constructed of disposable or non-reactive material (Teflon® or stainless steel); and
- Have a minimum capacity of 500 ml to minimize sample disturbance.

All surface water sampling equipment will be designed to maintain sample integrity and to provide the desired level of quality in achieving desired analytical results.

Sampling equipment includes all sampling devices and containers that are used to collect or contain a sample prior to final sample analysis.

4.3 Decontamination

Prior to and after each sampling event, all sampling equipment must be thoroughly decontaminated following the methods outlined in e²M Guidance document ”Equipment Decontamination”. The primary purpose of equipment decontamination is to prevent the potential of cross-contamination within the samples collected.

4.4 Sampling Location/Site Selection

Prior to sampling, consideration must be given to the specific sampling locations in order to provide a representative sample. This and other considerations are detailed in the Work Plan.

The general determining factors in the selection of a sampling device for sampling liquids in lakes, ponds, lagoons, and surface impoundments are listed below:

- Accessibility:
  - Boat: If the water is navigable, any sampling location is accessible by boat.
  - Bridges: Provide ready access, are readily identifiable, and permit water sampling at any point across the width of the water body.
  - Wading: Personnel safety must be paramount. Wading is not recommended in areas where bottom deposits are easily disturbed, thereby increasing the possibility of increased sediment in the samples.
- Rivers, streams, and creeks:
  - Sampling stations will be located wherever a marked physical change occurs in the stream channel. For example, between a rapids/deep water transition, as well as at both ends of the reach (only applicable for PA/SI, not ERB).
  - Sampling stations will be located short distances above and below dams and weirs, to determine the artificial increase in dissolved oxygen (only applicable for PA/SI, not ERB).
  - A minimum of three sampling locations will be established between any two points of major change in a stream (only applicable for PA/SI, not ERB).
  - Sampling stations will be located upstream and downstream of any waste discharge site. Since the inflow frequently hugs the stream bank with very little lateral mixing, care must be taken to establish the sampling station after complete mixing with the main stream.
  - A tributary sampling station will be established near the mouth and upstream of any effects from the main stream. The station on the main stream will be just upstream from the confluence.
  - Sample as close as is practical to areas or points of important water uses.
  - At stations where wastes and tributary waters are well-mixed, one sampling point near mid-channel is usually adequate. At stations where mixing is inadequate, the station will be sampled at quarter points across the width of the station.
- Lakes, ponds, and impoundments:
  - A single station at the deepest point may be sufficient for naturally-formed ponds (near the center) and for impoundments (near the dam or spillway).
  - A sampling grid is the most representative for lakes and large impoundments.
  - In lakes with irregular shapes and with several bays and coves that are protected from the wind, sampling stations should be established in these areas.

- A control station above a waste source is usually necessary to compare background water quality. It should be carefully selected and it may be necessary to have two or three control stations to establish the rate at which unstable material is changing. The time of travel between stations should be sufficient to permit accurate measurement of the change in the constituents under consideration.

4.5 Sampling Methods

4.5.1 General

The specific sampling method utilized will depend on the accessibility to, the size, and the depth of the water body, as well as the type of samples being collected.

In most ambient water quality studies, grab samples will be collected. However, the objectives of the study will dictate the sampling method.

For rivers, streams and creeks, the type of samples collected will be dependent upon the size and the amount of turbulence in the water body. Approximate the depth and location of samples in order to assure consistency. Flow rates will be measured using an appropriate method.

- With small streams less than 20 feet wide, a single grab sample collected at mid-depth in the center of the channel is usually adequate to represent the entire cross-section. In small streams and creeks less than 10 feet wide, a single grab sample can be collected by immersing the bottle directly under the surface of the water as close to the center of the channel as possible. This method reduces the potential for cross contamination as it does not require the decontamination of equipment. Clean non-reactive surgical or nitrile gloves are worn while the sample jar is immersed and filled in the sample media.

- or slightly larger streams, a vertical composite sample in the center of the channel may be required. The composite sample consists of samples taken just below the surface, at mid-depth and just above the bottom.

- For rivers, several vertical composite samples are collected across the water body. The vertical composite samples will be collected at points in the cross-section approximately proportional to flow. The number of vertical composites required and the number of depths sampled for each are usually determined in the field. This determination is based on a reasonable balance between two considerations:

  - The larger the number of sub-samples, the more nearly the composite sample will represent the water body; but

  - Taking many sub-samples is time-consuming and increases the chance of cross-contamination.

- For lakes, ponds and impoundments, the greater tendency to stratify and the relative lack of adequate mixing usually requires that more sub-samples be collected. The flow rate of impoundments will be measured.
    - In ponds and small impoundments, a single vertical composite sample at the deepest point is usually adequate.
    - In lakes and larger impoundments, several vertical composites should be combined into a single sample. In some cases, it may be useful to form several composites of the epilimnetic and hypolimnetic zones. Normally, however, a composite consists of several verticals with subsamples collected at various depths.

4.5.2 Weighted Bottle Sampler

Collecting a representative sample from a larger body of water requires the gathering of samples from various depths and locations. For this type of sampling a weighted bottle sampler is used. The sampler consists of a Teflon® bottle, a weighted sinker, a bottle stopper and a wire cord used to raise, lower and open the samples. This type of sampler can be fabricated or purchased. The following procedures will be followed when sampling with a weighted bottle sampler.

- Decontaminate all equipment in accordance with the procedures described e²M Guidance document “Equipment Decontamination”;
- Assemble the weighted bottle sampler in accordance with the sampler instruction manual;
- Gently lower the sampler to the desired depth so as not to remove the stopper prematurely. Do not let sampler disturb bottom sediments;
- Pull out the stopper with a sharp jerk of the sampler line;
- Allow the bottle to fill completely, as evidenced by the cessation of air bubbles;
- Raise the sampler, seal, wipe clean, label or identify and prepare the bottle for transport in accordance with project guidelines;
- Record the applicable information in the field log book; and
- Mark sample location and approximate depth, if possible, and note on maps and in field log book.

One additional grab sample from each location may be collected if required in the Work Plan for pH, conductivity, temperature, turbidity, odors and other significant characteristics. This sample will not be used for laboratory analysis.

4.5.3 Pond Sampler

The pond or dip sampler consists of a scoop or container attached to the end of a telescoping or solid pole. The sampler will be of non-reactive material such as wood, plastic, or metal. The sample will be collected in a jar or beaker made of stainless steel or Teflon®. Preferably, a disposable beaker that can be replaced prior to each sampling will be used at each station. Liquid wastes from water courses, ponds, pits, lagoons or open vessels will be "ladled" into a sample container.

Perform the following procedures when sampling with a pond sampler:

- Decontaminate all sampling equipment in accordance with the procedures described in e²M Guidance document "Equipment Decontamination";
- Assemble pond sampler in accordance with manufacturer's instructions;
- Extend pole to length that will allow safe access to desired sample location;
- Submerge pond sampler to desired sample depth. Submerge the sampler very slowly to minimize surface disturbance;
- Allow the sampler to fill very slowly;
- Retrieve the sampling device with minimal surface water disturbance;
- Remove the cap from the sample bottle and slightly tilt the mouth of the bottle below the sampler edge;
- Empty the sampler slowly, allowing the sample stream to flow gently down the side of the bottle with minimal entry turbulence. Fill sample bottle to appropriate head space, if any;
- Seal sample bottle, wipe clean, label or identify and prepare for transport in accordance with project guidelines;
- Collect additional grab samples to acquire field measurements such as temperature, pH, conductivity, turbidity and other significant characteristics;
- Record applicable data in the field log book.
- Mark sample location and approximate depth, if possible, and note location on maps and in field log book.
- Decontaminate equipment in accordance with procedures described in e²M Guidance document "Equipment Decontamination".

4.5.4 Manual Hand Pumps

Manual pumps are available in various sizes and configurations. Manual hand pumps are commonly operated by peristaltic, bellows or diaphragm, and siphon action. Manual hand pumps that operate by a bellows or diaphragm, and siphon action should not be used to collect samples that will be analyzed for volatile organics. These types of pumps should be constructed out of inert materials; i.e., Teflon® or stainless steel.

Perform the following procedures when collecting surface water samples with a manual hand pump:

- Assemble and operate the pump in accordance with the manufacturer's instructions;
- The inlet hose and any surface of the pump used for sampling will be constructed of materials that are operable and non-reactive;
- To avoid agitation, insert the sampling tube into the liquid sample prior to pump activation;
- Insert a liquid trap (preferably the sample container) into the sample inlet hose to collect the sample and to prevent pump contamination;
- Sample bottles will be sealed, wiped clean, labeled or identified and prepared for transport in accordance with appropriate TSOPs;
- Record applicable data in the field log book.
- Decontaminate equipment in accordance with procedures described in e²M Guidance document “Equipment Decontamination”; and
- Mark sample locations and approximate depth, where possible, and note location on map and in field log book.

4.5.5 Peristaltic Pump

Gathering surface water samples with the assistance of a peristaltic pump is another commonly used sampling technique. In this method the sample is drawn through heavy-walled tubing and pumped directly into the sample container. This system allows the operator to extend into the liquid body to sample from depth, or sweep the width of narrow streams. Medical-grade silicon tubing is often used in the peristaltic pump and the system is suitable for sampling almost any parameter, including most organics.

Peristaltic pumps are available with a range of power sources. For field use the battery-operated units have proven most convenient and very reliable.

Perform the following procedures when sampling with a peristaltic pump:

- Prepare the peristaltic pump in accordance with manufacturer's instructions. When using a battery-operated pump, be sure battery is fully charged prior to entering the field.

- In most situations, it is necessary to change the Teflon® suction line and the silicon pump tubing between sample locations to avoid cross-contamination. This action requires maintaining a sufficiently large stock of tubing material to avoid having to decontaminate the tubing in the field.

- Gently lower the pump intake tube to the desired sample depth. Avoid unnecessary agitation (aeration) of the liquid to be sampled and bottom sediments.

- Prior to activating the pump, note in which direction the pump will be rotating. (Most peristaltic pumps are capable of rotating in two directions.) Accidental reverse rotation of the pump will cause aeration of the liquid to be sampled.

- Run the pump until no air bubbles are noted in the discharge.

- Discharge water shall be released down stream from sampling area during sampling event.

- To prevent excess agitation and/or aeration of the sampler, fill the sample containers by tilting the container and flow the sample water down the side of sampling container.

- Record applicable data in the field log book (i.e. color, turbidity, pH, degree of turbulence, and weather conditions).

- In most cases, no specific decontamination procedures are required due to the use of disposable tubing. However, site-specific sample procedures may require additional decontamination. Check with the e²M Field Project Manager prior to commencing field operations.

- Mark sample location and approximate depth, if possible, and note location on map and in field log book.

It may sometimes be necessary to sample large bodies of water where a near-surface sample will not sufficiently characterize the body as a whole. In this instance, the above-mentioned pump is appropriate. It is capable of lifting water from slightly deeper than six meters. It should be noted that this lift ability decreases somewhat with higher density fluids and with increased wear on the silicone pump tubing. Similarly, increases in altitude will decrease the pump's ability to lift from depth. When sampling a liquid stream that exhibits a considerable flow rate, it may be necessary to weight the bottom of the suction line.

4.5.6 Optional Sampling Methods

The above-mentioned methods of surface water sampling will be used most often on e2M environmental projects; however, choice of sampling equipment depends on site specific conditions. Additional types of samplers available are:

- Kemmerer sampler;
- Wheaton sampler;
- Bacon Bomb sampler;
- Open tube sampler;
- D.O. Punker sampler; and
- Bailer.

Prior to any field work, the e²M Field Project Manager will review the available sampling equipment and choose the sampler that will best suit the project requirements.

4.6 Sample Collection Records

All surface water samples gathered in the field will be labeled, shipped and documented in accordance with the site-specific requirements set forth in the Work Plan and in the following:

- Samples will be transported in accordance with the procedures outlined in the e²M Guidance document "Procedures for Chain-of-Custody";

- All samples will be labeled or identified in accordance with procedures outlined in the e²M Guidance document "Sample Identification, Labeling, and Packaging";

- Quality assurance and quality control procedures outlined in the site-specific Work Plan; and

- Detailed Field Log Books documenting the sampling event must be kept.

4.7 Review

The e²M Field Project Manager and an approved designee shall check all documents and field log books used to record information during sampling for completeness and accuracy. Any discrepancies will be noted and the documents will be returned to the originator for correction.

The reviewer will acknowledge that these review comments have been incorporated by signing and dating the "checked by" and "date" blanks on the documents and at the applicable places in the log books.

5.0 REFERENCES

e²M, 2004. Guidance document "Technical Standard Operating Procedure 4.3, Chain-of-Custody."

e²M, 2004. Guidance document "Sample Identification, Labeling, and Packaging."

e^{2}M, 2004. Guidance document “Equipment Decontamination.”

TECHNICAL STANDARD OPERATING PROCEDURE

WATER SAMPLE FIELD MEASUREMENTS

1.0 PURPOSE

This procedure outlines the types of measurements and data requirements associated with the collection of either groundwater or surface water samples. Accurate measurement of water parameters is required when collecting water samples so that baseline conditions can be established, thus allowing later evaluations of how these parameters may have affected the sample results.

Site-specific deviations from the methods presented in this procedure must be approved by the e²M Field Project Manager.

2.0 DEFINITIONS AND ABBREVIATIONS

2.1 Definitions

Not applicable.

2.2 Abbreviations

Not applicable.

3.0 RESPONSIBILITIES

Sampling personnel are responsible for performing the applicable tasks and procedures outlined herein when conducting work related to environmental projects.

The e²M Field Project Manager or an approved designee is responsible for checking all work performance and verifying that the work satisfies the applicable tasks required by this procedure. This will be accomplished by reviewing all documents and data produced during work performance.

4.0 PROCEDURE

- Read and follow the specific Manufacturer's Operating Instructions before using any equipment.
- Calibrate all equipment as specified below. Additionally, calibrate all equipment prior to and at the commencement of sampling activities to ensure proper equipment operation. Record these measurements in the field log book or in an instrument log book.

4.1 Temperature

- Decontaminate the thermometer according to manufacturers instructions. Calibrate electronic thermometers (if applicable) according to their manufacturer's specifications.

- Collect the sample in a clean flask or beaker and insert the temperature probe into the water as per the manufacturer's specifications.

- Read the temperature from the meter and record it in the field log book and on either Monitoring Well Sampling Data sheets or Surface Water Sampling Data sheets.

- Discard the sample and rinse the probe with distilled water.

4.2 pH

- The pH probe must be thoroughly decontaminated prior to use. Calibrate the pH meter according to the manufacturer's specifications.

- Collect the sample in a clean flask or beaker and insert the pH probe into the water according to the manufacturer's specifications.

- Read the pH measurement from the meter approximately one minute from the time the sample was collected and record it in the field log book and on either the Monitoring Well Sampling Data sheets, or the Surface Water Sampling Data sheet.

- Discard the sample and decontaminate the probe.

4.3 Conductivity

- The conductivity probe must be thoroughly decontaminated prior to use. Calibrate the conductivity meter according to the manufacturer's specifications.

- Collect the water sample in a clean flask or beaker and insert the conductivity probe into the water according to the manufacturer's specifications.

- Wait for the reading to stabilize and record the conductivity reading from the meter in the field log book and on either Monitoring Well Sampling Data sheets or Surface Water Sampling Data sheets. Check the conductivity meter settings to be sure the desired scale is being used.

- Discard the sample and decontaminate the electrode.

4.4 Dissolved Oxygen Measurement

- Decontaminate the dissolved oxygen meter according to the manufacturer's specifications. Because the probe membrane is very fragile and susceptible to dryness, keep it moist at all times.

- Calibrate the dissolved oxygen meter according to the manufacturer's specifications. At a minimum, calibrate twice daily to correct for instrument drift.

- Collect the water sample as close to the source as possible and place it in a clean flask or beaker.

- Insert the dissolved oxygen probe into the sample so that the membrane is fully submerged. Very gently stir the probe through the sample. Do not agitate the probe as air bubbles cause erroneous measurements.

- When the reading stabilizes, record it in the field log book and on either a Monitoring Well Sampling Data sheet or a Surface Water Sampling Data sheet.

- Discard sample and decontaminate the probe.

4.5 Review

The e²M Field Project Manager or an approved designee shall check the field log book as well as Monitoring Well Sampling Data sheets or Surface Water Sampling Data sheets, for completeness and accuracy. Any discrepancies will be noted and the data will be returned to the originator for correction. The reviewer will acknowledge that review comments have been incorporated by signing and dating the “checked by” and “date” blanks on the Monitoring Well Sampling Data sheet or Surface Water Sampling Data sheet.

5.0 REFERENCES

U.S. Geological Survey (USGS). 1984. National Handbook of Recommended Methods for Water-Data Acquisition.

OHIO E.P.A.
AUG - 1 2007
ENTERED DIRECTOR'S JOURNAL

OhioEPA

Ohio Environmental Protection Agency
Division of Emergency and Remedial Response
Voluntary Action Program

Under the authority of Ohio Revised Code Section 3746.04(B)(6) and Ohio Administrative Code Rule 3745-300-04

Certifies

TestAmerica Laboratories, Inc.

4101 Shuffel Drive, NW
North Canton, OH 44720

as a

Certified Laboratory

(Number CL0024)

for the following analytes, parameter groups, and methods:

- Aluminum/6010B
- Antimony/6010B, 6020
- Arsenic/6010B
- Barium/6010B, 6020
- Beryllium/6010B, 6020
- Cadmium/6010B, 6020
- Calcium/6010B
- Chromium/6010B, 6020
- Cobalt/6010B, 6020
- Copper/6010B, 6020
- Cyanide, Total/335.2(CLP-M)
- Iron/6010B
- Lead/6010B, 6020
- Manganese/6010B, 6020
- Nickel/6010B, 6020
- Hexavalent Chromium/7196A
- Silver/6010B, 6020
- Sodium/6010B
- Thallium/6010B, 6020
- Vanadium/6010B
- Zinc/6010B
- Selenium/6010B
- Potassium/6010B
- Polychlorinated Biphenyls/8082
- Mercury/7470A*, 7471A
- Chloride/300.0
- Phosphate/365.2*
- Orthophosphate/300.0
- Sulfate/300.0
- Nitrate/300.0
- Chlorinated Herbicides/8151A
- Phosphorus/365.2*
- Phenols/9065*
- Organochlorine Pesticides/8081A
- Polynuclear Aromatic Hydrocarbons/ 8310
- Semi-Volatile Organic Compounds/8270C
- Volatile Organic Compounds/8260A, 8260B, 8021B
- N-Hexane/8260A-Modified, 8260B-Modified
- Polychlorinated Biphenyls, Aroclor 1268/8082-Modified
- Total Petroleum Hydrocarbons Only, Diesel Range Organics/8015B
- Total Petroleum Hydrocarbons, Gasoline Range Organics/8015A-Modified
- n-Hexane Extractable Material/1664A*

*Water Only

AUG 01 2007
Date of Certification

Director, Ohio Environmental Protection Agency

MAY 18 2008
Date of Expiration

Manager, Voluntary Action Program

SCOPE, LIMITATION, OBLIGATIONS AND RESPONSIBILITIES OF CERTIFICATION ON REVERSE SIDE

Scope. This certificate applies only to the Ohio EPA Voluntary Action Program. The certified laboratory identified herein is authorized to perform analyses in support of no further action letters for the analytes, parameter groups, and methods which are identified on the face of this certificate, so long as this certificate remains effective. The laboratory is prohibited from performing any analyses in support of a no further action letter for any analyte or parameter group, or using any method that is not identified in this certificate. This certificate hereby modifies and supersedes any other Voluntary Action Program certificate issued to the laboratory prior to the date of this certificate. For parameter groups, this certificate authorizes analysis of only those compounds listed in the methods identified herein. This certificate does not authorize analysis of compounds which may meet a general criteria or description provided for in such methods, but are not listed.

Limitation. This certificate does not apply to any other Ohio EPA program nor does it serve any purpose other than that described in the "Scope" section. This certificate is subject to renewal under OAC rule 3745-300-04.

Obligations and Responsibilities. As a condition of certification, the certified laboratory accepts all obligations and responsibilities of a certified laboratory in the Voluntary Action Program, as set forth in ORC Chapter 3746, and OAC Chapter 3745-300, including but not limited to compliance with the standards of performance and conduct for maintaining certification under paragraph (I) of rule 3745-300-04. The certified laboratory must display the original certificate in a prominent location on its premises.

Revocation or Suspension. This certificate is subject to suspension or revocation in accordance with OAC Chapter 3745-300. The authorization provided by this certificate ceases upon the effective date of the suspension or revocation.

This certificate is the property of Ohio EPA and must be surrendered to Ohio EPA upon expiration, revocation, or suspension of the laboratory's certification.

State of Florida
Department of Health, Bureau of Laboratories

This is to certify that

E87225
TESTAMERICA - NORTH CANTON
4101 SHUFFEL DRIVE NW
NORTH CANTON, OH 44720-6961

has complied with Florida Administrative Code 64E-1,
for the examination of Environmental samples in the following categories

NON-POTABLE WATER - EXTRACTABLE ORGANICS, NON-POTABLE WATER - GENERAL CHEMISTRY, NON-POTABLE WATER - METALS, NON-POTABLE WATER - PESTICIDES-HERBICIDES-PCB'S, NON-POTABLE WATER - VOLATILE ORGANICS, SOLID AND CHEMICAL MATERIALS - EXTRACTABLE ORGANICS, SOLID AND CHEMICAL MATERIALS - GENERAL CHEMISTRY, SOLID AND CHEMICAL MATERIALS - METALS, SOLID AND CHEMICAL MATERIALS - PESTICIDES-HERBICIDES-PCB'S, SOLID AND CHEMICAL MATERIALS - VOLATILE ORGANICS

Continued certification is contingent upon successful on-going compliance with the NELAC Standards and FAC Rule 64E-1 regulations. Specific methods and analytes certified are cited on the Laboratory Scope of Accreditation for this laboratory and are on file at the Bureau of Laboratories, P. O. Box 210, Jacksonville, Florida 32231. Clients and customers are urged to verify with this agency the laboratory's certification status in Florida for particular methods and analytes.

EFFECTIVE July 02, 2007 THROUGH June 30, 2008

Max Salfinger

Max Salfinger, M.D.
Chief, Bureau of Laboratories
Florida Department of Health
DH Form 1697, 7/04
NON-TRANSFERABLE E87225-12-7/2/2007
Supersedes all previously issued certificates

Charlie Crist
Governor

FLORIDA DEPARTMENT OF HEALTH

Ana M. Viamonte Ros, M.D., M.P.H.
Secretary of Health

Laboratory Scope of Accreditation

Attachment to Certificate #: E87225-12, expiration date June 30, 2008. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87225 **EPA Lab Code: OH00048** **(330) 497-9396**

E87225
TestAmerica - North Canton
4101 Shuffel Drive NW
North Canton, OH 44720-6961

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
1,1,1,2-Tetrachloroethane	EPA 8021	Volatile Organics	NELAP	7/1/2003
1,1,1,2-Tetrachloroethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,1,1-Trichloroethane	EPA 601	Volatile Organics	NELAP	3/18/2004
1,1,1-Trichloroethane	EPA 624	Volatile Organics	NELAP	3/18/2004
1,1,1-Trichloroethane	EPA 8021	Volatile Organics	NELAP	3/18/2004
1,1,1-Trichloroethane	EPA 8260	Volatile Organics	NELAP	3/18/2004
1,1,2,2-Tetrachloroethane	EPA 601	Volatile Organics	NELAP	9/1/2004
1,1,2,2-Tetrachloroethane	EPA 624	Volatile Organics	NELAP	3/18/2004
1,1,2,2-Tetrachloroethane	EPA 8021	Volatile Organics	NELAP	9/1/2004
1,1,2,2-Tetrachloroethane	EPA 8260	Volatile Organics	NELAP	3/18/2004
1,1,2-Trichloroethane	EPA 601	Volatile Organics	NELAP	3/18/2004
1,1,2-Trichloroethane	EPA 624	Volatile Organics	NELAP	3/18/2004
1,1,2-Trichloroethane	EPA 8021	Volatile Organics	NELAP	3/18/2004
1,1,2-Trichloroethane	EPA 8260	Volatile Organics	NELAP	3/18/2004
1,1-Dichloroethane	EPA 601	Volatile Organics	NELAP	3/18/2004
1,1-Dichloroethane	EPA 624	Volatile Organics	NELAP	3/18/2004
1,1-Dichloroethane	EPA 8021	Volatile Organics	NELAP	3/18/2004
1,1-Dichloroethane	EPA 8260	Volatile Organics	NELAP	3/18/2004
1,1-Dichloroethylene	EPA 601	Volatile Organics	NELAP	9/1/2004
1,1-Dichloroethylene	EPA 624	Volatile Organics	NELAP	3/18/2004
1,1-Dichloroethylene	EPA 8021	Volatile Organics	NELAP	9/1/2004
1,1-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	3/18/2004
1,1-Dichloropropene	EPA 8021	Volatile Organics	NELAP	7/1/2003
1,1-Dichloropropene	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,2,3-Trichlorobenzene	EPA 8021	Volatile Organics	NELAP	7/1/2003
1,2,3-Trichloropropane	EPA 8021	Volatile Organics	NELAP	7/1/2003
1,2,3-Trichloropropane	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,2,4,5-Tetrachlorobenzene	EPA 8270	Extractable Organics	NELAP	7/1/2003
1,2,4-Trichlorobenzene	EPA 625	Extractable Organics	NELAP	3/18/2004
1,2,4-Trichlorobenzene	EPA 8021	Volatile Organics	NELAP	7/1/2003
1,2,4-Trichlorobenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,2,4-Trichlorobenzene	EPA 8270	Extractable Organics	NELAP	3/18/2004
1,2,4-Trimethylbenzene	EPA 8021	Volatile Organics	NELAP	7/1/2003
1,2,4-Trimethylbenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,2-Dibromo-3-chloropropane (DBCP)	EPA 8021	Volatile Organics	NELAP	7/1/2003
1,2-Dibromo-3-chloropropane (DBCP)	EPA 8260	Volatile Organics	NELAP	7/1/2003

Clients and Customers are urged to verify the laboratory's current certification status with the Environmental Laboratory Certification Program. **Issue Date: 7/2/2007** **Expiration Date: 6/30/2008**

Laboratory Scope of Accreditation

Attachment to Certificate #: E87225-12, expiration date June 30, 2008. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87225 **EPA Lab Code: OH00048** **(330) 497-9396**

E87225
TestAmerica - North Canton
4101 Shuffel Drive NW
North Canton, OH 44720-6961

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 8021	Volatile Organics	NELAP	7/1/2003
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,2-Dichlorobenzene	EPA 601	Volatile Organics	NELAP	3/18/2004
1,2-Dichlorobenzene	EPA 602	Volatile Organics	NELAP	4/29/2004
1,2-Dichlorobenzene	EPA 624	Volatile Organics	NELAP	3/18/2004
1,2-Dichlorobenzene	EPA 625	Extractable Organics	NELAP	3/18/2004
1,2-Dichlorobenzene	EPA 8021	Volatile Organics	NELAP	3/18/2004
1,2-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	3/18/2004
1,2-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	7/1/2003
1,2-Dichloroethane	EPA 601	Volatile Organics	NELAP	3/18/2004
1,2-Dichloroethane	EPA 624	Volatile Organics	NELAP	3/18/2004
1,2-Dichloroethane	EPA 8021	Volatile Organics	NELAP	3/18/2004
1,2-Dichloroethane	EPA 8260	Volatile Organics	NELAP	3/18/2004
1,2-Dichloropropane	EPA 601	Volatile Organics	NELAP	3/18/2004
1,2-Dichloropropane	EPA 624	Volatile Organics	NELAP	3/18/2004
1,2-Dichloropropane	EPA 8021	Volatile Organics	NELAP	3/18/2004
1,2-Dichloropropane	EPA 8260	Volatile Organics	NELAP	3/18/2004
1,2-Dinitrobenzene	EPA 8270	Extractable Organics	NELAP	7/1/2003
1,2-Diphenylhydrazine	EPA 8270	Extractable Organics	NELAP	7/1/2003
1,3,5-Trimethylbenzene	EPA 8021	Volatile Organics	NELAP	7/1/2003
1,3,5-Trimethylbenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,3,5-Trinitrobenzene (1,3,5-TNB)	EPA 8270	Extractable Organics	NELAP	7/1/2003
1,3-Dichlorobenzene	EPA 601	Volatile Organics	NELAP	3/18/2004
1,3-Dichlorobenzene	EPA 602	Volatile Organics	NELAP	4/29/2004
1,3-Dichlorobenzene	EPA 624	Volatile Organics	NELAP	3/18/2004
1,3-Dichlorobenzene	EPA 625	Extractable Organics	NELAP	3/18/2004
1,3-Dichlorobenzene	EPA 8021	Volatile Organics	NELAP	3/18/2004
1,3-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	3/18/2004
1,3-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	7/1/2003
1,3-Dichloropropane	EPA 8021	Volatile Organics	NELAP	7/1/2003
1,3-Dichloropropane	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,3-Dinitrobenzene (1,3-DNB)	EPA 8270	Extractable Organics	NELAP	7/1/2003
1,4-Dichlorobenzene	EPA 601	Volatile Organics	NELAP	3/18/2004
1,4-Dichlorobenzene	EPA 602	Volatile Organics	NELAP	4/29/2004
1,4-Dichlorobenzene	EPA 624	Volatile Organics	NELAP	3/18/2004
1,4-Dichlorobenzene	EPA 625	Extractable Organics	NELAP	3/18/2004

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E87225
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Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
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1,4-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	3/18/2004
1,4-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	7/1/2003
1,4-Dinitrobenzene	EPA 8270	Extractable Organics	NELAP	7/1/2003
1,4-Dioxane (1,4-Diethyleneoxide)	EPA 8015	Volatile Organics	NELAP	7/1/2003
1,4-Dioxane (1,4-Diethyleneoxide)	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,4-Naphthoquinone	EPA 8270	Extractable Organics	NELAP	7/1/2003
1,4-Phenylenediamine	EPA 8270	Extractable Organics	NELAP	7/1/2003
1-Naphthylamine	EPA 8270	Extractable Organics	NELAP	7/1/2003
2,2-Dichloropropane	EPA 8021	Volatile Organics	NELAP	7/1/2003
2,2-Dichloropropane	EPA 8260	Volatile Organics	NELAP	7/1/2003
2,3,4,6-Tetrachlorophenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
2,4,5-T	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	3/18/2004
2,4,5-Trichlorophenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
2,4,6-Trichlorophenol	EPA 625	Extractable Organics	NELAP	3/18/2004
2,4,6-Trichlorophenol	EPA 8270	Extractable Organics	NELAP	3/18/2004
2,4-D	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	3/18/2004
2,4-DB	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,4-Dichlorophenol	EPA 625	Extractable Organics	NELAP	3/18/2004
2,4-Dichlorophenol	EPA 8270	Extractable Organics	NELAP	3/18/2004
2,4-Dimethylphenol	EPA 625	Extractable Organics	NELAP	3/18/2004
2,4-Dimethylphenol	EPA 8270	Extractable Organics	NELAP	3/18/2004
2,4-Dinitrophenol	EPA 625	Extractable Organics	NELAP	3/18/2004
2,4-Dinitrophenol	EPA 8270	Extractable Organics	NELAP	3/18/2004
2,4-Dinitrotoluene (2,4-DNT)	EPA 625	Extractable Organics	NELAP	3/18/2004
2,4-Dinitrotoluene (2,4-DNT)	EPA 8270	Extractable Organics	NELAP	3/18/2004
2,6-Dichlorophenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
2,6-Dinitrotoluene (2,6-DNT)	EPA 625	Extractable Organics	NELAP	3/18/2004
2,6-Dinitrotoluene (2,6-DNT)	EPA 8270	Extractable Organics	NELAP	3/18/2004
2-Acetylaminofluorene	EPA 8270	Extractable Organics	NELAP	7/1/2003
2-Butanone (Methyl ethyl ketone, MEK)	EPA 8260	Volatile Organics	NELAP	7/1/2003
2-Chloroethyl vinyl ether	EPA 601	Volatile Organics	NELAP	3/18/2004
2-Chloroethyl vinyl ether	EPA 624	Volatile Organics	NELAP	3/18/2004
2-Chloroethyl vinyl ether	EPA 8021	Volatile Organics	NELAP	3/18/2004
2-Chloroethyl vinyl ether	EPA 8260	Volatile Organics	NELAP	3/18/2004
2-Chloronaphthalene	EPA 625	Extractable Organics	NELAP	3/18/2004

Attachment to Certificate #: E87225-12, expiration date June 30, 2008. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87225 **EPA Lab Code:** OH00048 (330) 497-9396

E87225
TestAmerica - North Canton
4101 Shuffel Drive NW
North Canton, OH 44720-6961

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
2-Chloronaphthalene	EPA 8270	Extractable Organics	NELAP	3/18/2004
2-Chlorophenol	EPA 625	Extractable Organics	NELAP	3/18/2004
2-Chlorophenol	EPA 8270	Extractable Organics	NELAP	3/18/2004
2-Chlorotoluene	EPA 8021	Volatile Organics	NELAP	7/1/2003
2-Chlorotoluene	EPA 8260	Volatile Organics	NELAP	7/1/2003
2-Hexanone	EPA 8260	Volatile Organics	NELAP	7/1/2003
2-Methyl-4,6-dinitrophenol	EPA 625	Extractable Organics	NELAP	3/18/2004
2-Methyl-4,6-dinitrophenol	EPA 8270	Extractable Organics	NELAP	3/18/2004
2-Methylnaphthalene	EPA 8270	Extractable Organics	NELAP	7/1/2003
2-Methylphenol (o-Cresol)	EPA 8270	Extractable Organics	NELAP	7/1/2003
2-Nitroaniline	EPA 8270	Extractable Organics	NELAP	7/1/2003
2-Nitrophenol	EPA 625	Extractable Organics	NELAP	3/18/2004
2-Nitrophenol	EPA 8270	Extractable Organics	NELAP	3/18/2004
2-Picoline (2-Methylpyridine)	EPA 8270	Extractable Organics	NELAP	7/1/2003
3,3'-Dichlorobenzidine	EPA 625	Extractable Organics	NELAP	3/18/2004
3,3'-Dichlorobenzidine	EPA 8270	Extractable Organics	NELAP	7/1/2003
3,3'-Dimethylbenzidine	EPA 8270	Extractable Organics	NELAP	7/1/2003
3-Methylcholanthrene	EPA 8270	Extractable Organics	NELAP	7/1/2003
3-Methylphenol (m-Cresol)	EPA 8270	Extractable Organics	NELAP	7/1/2003
3-Nitroaniline	EPA 8270	Extractable Organics	NELAP	7/1/2003
4,4'-DDD	EPA 608	Pesticides-Herbicides-PCB's	NELAP	3/18/2004
4,4'-DDD	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	3/18/2004
4,4'-DDE	EPA 608	Pesticides-Herbicides-PCB's	NELAP	3/18/2004
4,4'-DDE	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	3/18/2004
4,4'-DDT	EPA 608	Pesticides-Herbicides-PCB's	NELAP	3/18/2004
4,4'-DDT	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	3/18/2004
4,4'-Methylenebis(n, n-dimethylaniline)	EPA 8270	Extractable Organics	NELAP	7/1/2003
4-Aminobiphenyl	EPA 8270	Extractable Organics	NELAP	7/1/2003
4-Bromophenyl phenyl ether	EPA 625	Extractable Organics	NELAP	3/18/2004
4-Bromophenyl phenyl ether	EPA 8270	Extractable Organics	NELAP	7/1/2003
4-Chloro-3-methylphenol	EPA 625	Extractable Organics	NELAP	3/18/2004
4-Chloro-3-methylphenol	EPA 8270	Extractable Organics	NELAP	3/18/2004
4-Chloroaniline	EPA 8270	Extractable Organics	NELAP	7/1/2003
4-Chlorophenyl phenylether	EPA 625	Extractable Organics	NELAP	3/18/2004
4-Chlorophenyl phenylether	EPA 8270	Extractable Organics	NELAP	7/1/2003
4-Chlorotoluene	EPA 8021	Volatile Organics	NELAP	7/1/2003

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**E87225
TestAmerica - North Canton
4101 Shuffel Drive NW
North Canton, OH 44720-6961**

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
4-Chlorotoluene	EPA 8260	Volatile Organics	NELAP	7/1/2003
4-Dimethyl aminoazobenzene	EPA 8270	Extractable Organics	NELAP	7/1/2003
4-Methyl-2-pentanone (MIBK)	EPA 8260	Volatile Organics	NELAP	7/1/2003
4-Methylphenol (p-Cresol)	EPA 8270	Extractable Organics	NELAP	7/1/2003
4-Methylphenol (p-Cresol)	NC-CORP-MS-0001	Extractable Organics	NELAP	4/9/2003
4-Nitroaniline	EPA 8270	Extractable Organics	NELAP	7/1/2003
4-Nitrophenol	EPA 625	Extractable Organics	NELAP	3/18/2004
4-Nitrophenol	EPA 8270	Extractable Organics	NELAP	3/18/2004
5-Nitro-o-toluidine	EPA 8270	Extractable Organics	NELAP	7/1/2003
7,12-Dimethylbenz(a) anthracene	EPA 8270	Extractable Organics	NELAP	7/1/2003
a-a-Dimethylphenethylamine	EPA 8270	Extractable Organics	NELAP	7/1/2003
Acenaphthene	EPA 610	Extractable Organics	NELAP	3/18/2004
Acenaphthene	EPA 625	Extractable Organics	NELAP	3/18/2004
Acenaphthene	EPA 8270	Extractable Organics	NELAP	3/18/2004
Acenaphthene	EPA 8310	Extractable Organics	NELAP	3/18/2004
Acenaphthylene	EPA 610	Extractable Organics	NELAP	3/18/2004
Acenaphthylene	EPA 625	Extractable Organics	NELAP	3/18/2004
Acenaphthylene	EPA 8270	Extractable Organics	NELAP	3/18/2004
Acenaphthylene	EPA 8310	Extractable Organics	NELAP	3/18/2004
Acetone	EPA 8260	Volatile Organics	NELAP	7/1/2003
Acetonitrile	EPA 8260	Volatile Organics	NELAP	7/1/2003
Acetophenone	EPA 8270	Extractable Organics	NELAP	7/1/2003
Acetophenone	NC-CORP-MS-0001	Extractable Organics	NELAP	4/9/2003
Acrolein (Propenal)	EPA 624	Volatile Organics	NELAP	3/18/2004
Acrolein (Propenal)	EPA 8260	Volatile Organics	NELAP	3/18/2004
Acrylonitrile	EPA 624	Volatile Organics	NELAP	3/18/2004
Acrylonitrile	EPA 8260	Volatile Organics	NELAP	3/18/2004
Aldrin	EPA 608	Pesticides-Herbicides-PCB's	NELAP	3/18/2004
Aldrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	3/18/2004
Alkalinity as CaCO3	EPA 310.1	General Chemistry	NELAP	4/29/2004
Alkalinity as CaCO3	SM 2320 B	General Chemistry	NELAP	10/7/2002
Allyl chloride (3-Chloropropene)	EPA 8260	Volatile Organics	NELAP	7/1/2003
alpha-BHC (alpha-Hexachlorocyclohexane)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	3/18/2004
alpha-BHC (alpha-Hexachlorocyclohexane)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	3/18/2004
alpha-Chlordane	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Aluminum	EPA 200.7	Metals	NELAP	3/18/2004

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TestAmerica - North Canton
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Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Aluminum	EPA 200.8	Metals	NELAP	3/18/2004
Aluminum	EPA 6010	Metals	NELAP	7/1/2003
Aluminum	EPA 6020	Metals	NELAP	7/1/2003
Amenable cyanide	EPA 9012	General Chemistry	NELAP	7/1/2003
Ammonia as N	EPA 350.2	General Chemistry	NELAP	4/29/2004
Ammonia as N	EPA 350.3	General Chemistry	NELAP	4/29/2004
Aniline	EPA 8270	Extractable Organics	NELAP	7/1/2003
Aniline	NC-CORP-MS-0001	Extractable Organics	NELAP	4/9/2003
Anthracene	EPA 610	Extractable Organics	NELAP	3/18/2004
Anthracene	EPA 625	Extractable Organics	NELAP	3/18/2004
Anthracene	EPA 8270	Extractable Organics	NELAP	3/18/2004
Anthracene	EPA 8310	Extractable Organics	NELAP	3/18/2004
Antimony	EPA 200.7	Metals	NELAP	3/18/2004
Antimony	EPA 200.8	Metals	NELAP	3/18/2004
Antimony	EPA 6010	Metals	NELAP	4/29/2004
Antimony	EPA 6020	Metals	NELAP	4/29/2004
Aramite	EPA 8270	Extractable Organics	NELAP	7/1/2003
Aroclor-1016 (PCB-1016)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	3/18/2004
Aroclor-1016 (PCB-1016)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	3/18/2004
Aroclor-1221 (PCB-1221)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	5/15/2004
Aroclor-1221 (PCB-1221)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	5/15/2004
Aroclor-1232 (PCB-1232)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	3/18/2004
Aroclor-1232 (PCB-1232)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	3/18/2004
Aroclor-1242 (PCB-1242)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	3/18/2004
Aroclor-1242 (PCB-1242)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	3/18/2004
Aroclor-1248 (PCB-1248)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	3/18/2004
Aroclor-1248 (PCB-1248)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	3/18/2004
Aroclor-1254 (PCB-1254)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	3/18/2004
Aroclor-1254 (PCB-1254)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	3/18/2004
Aroclor-1260 (PCB-1260)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	3/18/2004
Aroclor-1260 (PCB-1260)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	3/18/2004
Arsenic	EPA 200.7	Metals	NELAP	3/18/2004
Arsenic	EPA 200.8	Metals	NELAP	5/15/2007
Arsenic	EPA 6010	Metals	NELAP	4/29/2004
Arsenic	EPA 6020	Metals	NELAP	5/15/2007
Azinphos-methyl (Guthion)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003

Laboratory Scope of Accreditation

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E87225
TestAmerica - North Canton
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North Canton, OH 44720-6961

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Barium	EPA 200.7	Metals	NELAP	3/18/2004
Barium	EPA 200.8	Metals	NELAP	3/18/2004
Barium	EPA 6010	Metals	NELAP	4/29/2004
Barium	EPA 6020	Metals	NELAP	4/29/2004
Benzene	EPA 602	Volatile Organics	NELAP	3/18/2004
Benzene	EPA 624	Volatile Organics	NELAP	3/18/2004
Benzene	EPA 8021	Volatile Organics	NELAP	3/18/2004
Benzene	EPA 8260	Volatile Organics	NELAP	3/18/2004
Benzidine	EPA 625	Extractable Organics	NELAP	3/18/2004
Benzidine	EPA 8270	Extractable Organics	NELAP	7/1/2003
Benzo(a)anthracene	EPA 610	Extractable Organics	NELAP	3/18/2004
Benzo(a)anthracene	EPA 625	Extractable Organics	NELAP	3/18/2004
Benzo(a)anthracene	EPA 8270	Extractable Organics	NELAP	3/18/2004
Benzo(a)anthracene	EPA 8310	Extractable Organics	NELAP	3/18/2004
Benzo(a)pyrene	EPA 610	Extractable Organics	NELAP	3/18/2004
Benzo(a)pyrene	EPA 625	Extractable Organics	NELAP	3/18/2004
Benzo(a)pyrene	EPA 8270	Extractable Organics	NELAP	3/18/2004
Benzo(a)pyrene	EPA 8310	Extractable Organics	NELAP	3/18/2004
Benzo(b)fluoranthene	EPA 610	Extractable Organics	NELAP	3/18/2004
Benzo(b)fluoranthene	EPA 625	Extractable Organics	NELAP	3/18/2004
Benzo(b)fluoranthene	EPA 8270	Extractable Organics	NELAP	3/18/2004
Benzo(b)fluoranthene	EPA 8310	Extractable Organics	NELAP	3/18/2004
Benzo(g,h,i)perylene	EPA 610	Extractable Organics	NELAP	3/18/2004
Benzo(g,h,i)perylene	EPA 625	Extractable Organics	NELAP	3/18/2004
Benzo(g,h,i)perylene	EPA 8270	Extractable Organics	NELAP	3/18/2004
Benzo(g,h,i)perylene	EPA 8310	Extractable Organics	NELAP	3/18/2004
Benzo(k)fluoranthene	EPA 610	Extractable Organics	NELAP	3/18/2004
Benzo(k)fluoranthene	EPA 625	Extractable Organics	NELAP	3/18/2004
Benzo(k)fluoranthene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Benzo(k)fluoranthene	EPA 8310	Extractable Organics	NELAP	7/1/2003
Benzoic acid	EPA 8270	Extractable Organics	NELAP	7/1/2003
Benzoic acid	NC-CORP-MS-0001	Extractable Organics	NELAP	4/9/2003
Benzyl alcohol	EPA 8270	Extractable Organics	NELAP	7/1/2003
Beryllium	EPA 200.7	Metals	NELAP	3/18/2004
Beryllium	EPA 200.8	Metals	NELAP	3/18/2004
Beryllium	EPA 6010	Metals	NELAP	7/1/2003

Laboratory Scope of Accreditation

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TestAmerica - North Canton
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North Canton, OH 44720-6961

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Beryllium	EPA 6020	Metals	NELAP	7/1/2003
beta-BHC (beta-Hexachlorocyclohexane)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	3/18/2004
beta-BHC (beta-Hexachlorocyclohexane)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	3/18/2004
beta-Naphthylamine	EPA 8270	Extractable Organics	NELAP	7/1/2003
Biochemical oxygen demand	EPA 405.1	General Chemistry	NELAP	4/29/2004
bis(2-Chloroethoxy)methane	EPA 625	Extractable Organics	NELAP	3/18/2004
bis(2-Chloroethoxy)methane	EPA 8270	Extractable Organics	NELAP	3/18/2004
bis(2-Chloroethyl) ether	EPA 625	Extractable Organics	NELAP	3/18/2004
bis(2-Chloroethyl) ether	EPA 8270	Extractable Organics	NELAP	7/1/2003
bis(2-Chloroisopropyl) ether (2,2'-Oxybis(1-chloropropane))	EPA 625	Extractable Organics	NELAP	3/18/2004
bis(2-Chloroisopropyl) ether (2,2'-Oxybis(1-chloropropane))	EPA 8270	Extractable Organics	NELAP	3/18/2004
bis(2-Ethylhexyl) phthalate (DEHP)	EPA 625	Extractable Organics	NELAP	3/18/2004
bis(2-Ethylhexyl) phthalate (DEHP)	EPA 8270	Extractable Organics	NELAP	3/18/2004
Bolstar (Sulprofos)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Boron	EPA 200.7	Metals	NELAP	10/7/2002
Boron	EPA 6010	Metals	NELAP	7/1/2003
Boron	EPA 6020	Metals	NELAP	8/3/2005
Bromide	EPA 300.0	General Chemistry	NELAP	10/7/2002
Bromide	EPA 9056	General Chemistry	NELAP	7/1/2003
Bromobenzene	EPA 8021	Volatile Organics	NELAP	7/1/2003
Bromobenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Bromochloromethane	EPA 8021	Volatile Organics	NELAP	7/1/2003
Bromochloromethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
Bromodichloromethane	EPA 601	Volatile Organics	NELAP	3/18/2004
Bromodichloromethane	EPA 624	Volatile Organics	NELAP	3/18/2004
Bromodichloromethane	EPA 8021	Volatile Organics	NELAP	3/18/2004
Bromodichloromethane	EPA 8260	Volatile Organics	NELAP	3/18/2004
Bromoform	EPA 601	Volatile Organics	NELAP	3/18/2004
Bromoform	EPA 624	Volatile Organics	NELAP	3/18/2004
Bromoform	EPA 8021	Volatile Organics	NELAP	3/18/2004
Bromoform	EPA 8260	Volatile Organics	NELAP	3/18/2004
Butyl benzyl phthalate	EPA 625	Extractable Organics	NELAP	3/18/2004
Butyl benzyl phthalate	EPA 8270	Extractable Organics	NELAP	3/18/2004
Cadmium	EPA 200.7	Metals	NELAP	3/18/2004
Cadmium	EPA 200.8	Metals	NELAP	3/18/2004

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E87225
TestAmerica - North Canton
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Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Cadmium	EPA 6010	Metals	NELAP	4/29/2004
Cadmium	EPA 6020	Metals	NELAP	4/29/2004
Calcium	EPA 200.7	Metals	NELAP	5/15/2004
Calcium	EPA 6010	Metals	NELAP	7/1/2003
Calcium	EPA 6020	Metals	NELAP	8/3/2005
Carbazole	EPA 8270	Extractable Organics	NELAP	7/1/2003
Carbazole	NC-CORP-MS-0001	Extractable Organics	NELAP	4/9/2003
Carbon disulfide	EPA 8260	Volatile Organics	NELAP	7/1/2003
Carbon tetrachloride	EPA 601	Volatile Organics	NELAP	6/16/2004
Carbon tetrachloride	EPA 624	Volatile Organics	NELAP	3/18/2004
Carbon tetrachloride	EPA 8021	Volatile Organics	NELAP	6/16/2004
Carbon tetrachloride	EPA 8260	Volatile Organics	NELAP	3/18/2004
Carbonaceous BOD (CBOD)	SM 5210 B	General Chemistry	NELAP	10/7/2002
Chemical oxygen demand	EPA 410.4	General Chemistry	NELAP	4/29/2004
Chlordane (tech.)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	3/18/2004
Chlordane (tech.)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	3/18/2004
Chloride	EPA 300.0	General Chemistry	NELAP	4/29/2004
Chloride	EPA 325.2	General Chemistry	NELAP	4/29/2004
Chloride	EPA 9056	General Chemistry	NELAP	7/1/2003
Chloride	EPA 9251	General Chemistry	NELAP	7/1/2003
Chlorobenzene	EPA 601	Volatile Organics	NELAP	3/18/2004
Chlorobenzene	EPA 602	Volatile Organics	NELAP	4/29/2004
Chlorobenzene	EPA 624	Volatile Organics	NELAP	3/18/2004
Chlorobenzene	EPA 8021	Volatile Organics	NELAP	6/16/2004
Chlorobenzene	EPA 8260	Volatile Organics	NELAP	3/18/2004
Chlorobenzilate	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Chlorobenzilate	EPA 8270	Extractable Organics	NELAP	7/1/2003
Chloroethane	EPA 601	Volatile Organics	NELAP	3/18/2004
Chloroethane	EPA 624	Volatile Organics	NELAP	3/18/2004
Chloroethane	EPA 8021	Volatile Organics	NELAP	3/18/2004
Chloroethane	EPA 8260	Volatile Organics	NELAP	3/18/2004
Chloroform	EPA 601	Volatile Organics	NELAP	3/18/2004
Chloroform	EPA 624	Volatile Organics	NELAP	3/18/2004
Chloroform	EPA 8021	Volatile Organics	NELAP	3/18/2004
Chloroform	EPA 8260	Volatile Organics	NELAP	3/18/2004
Chloroprene	EPA 8260	Volatile Organics	NELAP	7/1/2003

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E87225
TestAmerica - North Canton
4101 Shuffel Drive NW
North Canton, OH 44720-6961

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Chlorpyrifos	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Chromium	EPA 200.7	Metals	NELAP	3/18/2004
Chromium	EPA 200.8	Metals	NELAP	3/18/2004
Chromium	EPA 6010	Metals	NELAP	4/29/2004
Chromium	EPA 6020	Metals	NELAP	4/29/2004
Chromium VI	EPA 7196	General Chemistry	NELAP	4/29/2004
Chromium VI	SM 3500-Cr D (18th/19th Ed.)/COLOR	General Chemistry	NELAP	4/29/2004
Chrysene	EPA 610	Extractable Organics	NELAP	3/18/2004
Chrysene	EPA 625	Extractable Organics	NELAP	3/18/2004
Chrysene	EPA 8270	Extractable Organics	NELAP	3/18/2004
Chrysene	EPA 8310	Extractable Organics	NELAP	3/18/2004
cis-1,2-Dichloroethylene	EPA 8021	Volatile Organics	NELAP	7/1/2003
cis-1,2-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	7/1/2003
cis-1,3-Dichloropropene	EPA 601	Volatile Organics	NELAP	3/18/2004
cis-1,3-Dichloropropene	EPA 624	Volatile Organics	NELAP	3/18/2004
cis-1,3-Dichloropropene	EPA 8021	Volatile Organics	NELAP	3/18/2004
cis-1,3-Dichloropropene	EPA 8260	Volatile Organics	NELAP	3/18/2004
Cobalt	EPA 200.7	Metals	NELAP	3/18/2004
Cobalt	EPA 200.8	Metals	NELAP	3/18/2004
Cobalt	EPA 6010	Metals	NELAP	7/1/2003
Cobalt	EPA 6020	Metals	NELAP	7/1/2003
Conductivity	EPA 120.1	General Chemistry	NELAP	4/29/2004
Conductivity	EPA 9050	General Chemistry	NELAP	7/1/2003
Copper	EPA 200.7	Metals	NELAP	3/18/2004
Copper	EPA 200.8	Metals	NELAP	3/18/2004
Copper	EPA 6010	Metals	NELAP	7/1/2003
Copper	NC-MT-0002	Metals	NELAP	7/1/2003
Coumaphos	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Cyanide	SM 4500-CN E	General Chemistry	NELAP	8/31/2002
Dalapon	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
delta-BHC	EPA 608	Pesticides-Herbicides-PCB's	NELAP	3/18/2004
delta-BHC	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	3/18/2004
Demeton-s	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Diallate	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Diallate	EPA 8270	Extractable Organics	NELAP	7/1/2003
Diazinon	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003

Laboratory Scope of Accreditation

Attachment to Certificate #: E87225-12, expiration date June 30, 2008. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: E87225 **EPA Lab Code: OH00048** **(330) 497-9396**

E87225
TestAmerica - North Canton
4101 Shuffel Drive NW
North Canton, OH 44720-6961

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Dibenz(a,h) anthracene	EPA 610	Extractable Organics	NELAP	3/18/2004
Dibenz(a,h) anthracene	EPA 625	Extractable Organics	NELAP	3/18/2004
Dibenz(a,h) anthracene	EPA 8270	Extractable Organics	NELAP	3/18/2004
Dibenz(a,h) anthracene	EPA 8310	Extractable Organics	NELAP	3/18/2004
Dibenzofuran	EPA 8270	Extractable Organics	NELAP	7/1/2003
Dibromochloromethane	EPA 601	Volatile Organics	NELAP	3/18/2004
Dibromochloromethane	EPA 624	Volatile Organics	NELAP	3/18/2004
Dibromochloromethane	EPA 8021	Volatile Organics	NELAP	3/18/2004
Dibromochloromethane	EPA 8260	Volatile Organics	NELAP	3/18/2004
Dibromomethane	EPA 8021	Volatile Organics	NELAP	7/1/2003
Dibromomethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
Dicamba	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	3/18/2004
Dichlorodifluoromethane	EPA 601	Volatile Organics	NELAP	3/18/2004
Dichlorodifluoromethane	EPA 8021	Volatile Organics	NELAP	3/18/2004
Dichlorodifluoromethane	EPA 8260	Volatile Organics	NELAP	3/18/2004
Dichloroprop (Dichlorprop)	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Dichlorovos (DDVP, Dichlorvos)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Dieldrin	EPA 608	Pesticides-Herbicides-PCB's	NELAP	3/18/2004
Dieldrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	3/18/2004
Diesel range organics (DRO)	EPA 8015	Extractable Organics	NELAP	7/1/2003
Diethyl phthalate	EPA 625	Extractable Organics	NELAP	3/18/2004
Diethyl phthalate	EPA 8270	Extractable Organics	NELAP	3/18/2004
Dimethoate	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Dimethoate	EPA 8270	Extractable Organics	NELAP	7/1/2003
Dimethyl phthalate	EPA 625	Extractable Organics	NELAP	3/18/2004
Dimethyl phthalate	EPA 8270	Extractable Organics	NELAP	3/18/2004
Di-n-butyl phthalate	EPA 625	Extractable Organics	NELAP	3/18/2004
Di-n-butyl phthalate	EPA 8270	Extractable Organics	NELAP	3/18/2004
Di-n-octyl phthalate	EPA 625	Extractable Organics	NELAP	3/18/2004
Di-n-octyl phthalate	EPA 8270	Extractable Organics	NELAP	3/18/2004
Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	EPA 8270	Extractable Organics	NELAP	7/1/2003
Diphenylamine	EPA 8270	Extractable Organics	NELAP	7/1/2003
Disulfoton	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Disulfoton	EPA 8270	Extractable Organics	NELAP	7/1/2003
Endosulfan I	EPA 608	Pesticides-Herbicides-PCB's	NELAP	3/18/2004

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State Laboratory ID: E87225 EPA Lab Code: OH00048 (330) 497-9396

**E87225
TestAmerica - North Canton
4101 Shuffel Drive NW
North Canton, OH 44720-6961**

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Endosulfan I	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	3/18/2004
Endosulfan II	EPA 608	Pesticides-Herbicides-PCB's	NELAP	3/18/2004
Endosulfan II	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	3/18/2004
Endosulfan sulfate	EPA 608	Pesticides-Herbicides-PCB's	NELAP	3/18/2004
Endosulfan sulfate	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	3/18/2004
Endrin	EPA 608	Pesticides-Herbicides-PCB's	NELAP	3/18/2004
Endrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	3/18/2004
Endrin aldehyde	EPA 608	Pesticides-Herbicides-PCB's	NELAP	3/18/2004
Endrin aldehyde	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	3/18/2004
Endrin ketone	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Ethoprop	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Ethyl methacrylate	EPA 8260	Volatile Organics	NELAP	7/1/2003
Ethyl methanesulfonate	EPA 8270	Extractable Organics	NELAP	7/1/2003
Ethylbenzene	EPA 602	Volatile Organics	NELAP	3/18/2004
Ethylbenzene	EPA 624	Volatile Organics	NELAP	3/18/2004
Ethylbenzene	EPA 8021	Volatile Organics	NELAP	3/18/2004
Ethylbenzene	EPA 8260	Volatile Organics	NELAP	3/18/2004
Ethylene oxide	EPA 8015	Volatile Organics	NELAP	7/1/2003
Famphur	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Famphur	EPA 8270	Extractable Organics	NELAP	7/1/2003
Fensulfothion	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Fenthion	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Fluoranthene	EPA 610	Extractable Organics	NELAP	3/18/2004
Fluoranthene	EPA 625	Extractable Organics	NELAP	3/18/2004
Fluoranthene	EPA 8270	Extractable Organics	NELAP	3/18/2004
Fluoranthene	EPA 8310	Extractable Organics	NELAP	3/18/2004
Fluorene	EPA 610	Extractable Organics	NELAP	3/18/2004
Fluorene	EPA 625	Extractable Organics	NELAP	3/18/2004
Fluorene	EPA 8270	Extractable Organics	NELAP	3/18/2004
Fluorene	EPA 8310	Extractable Organics	NELAP	3/18/2004
Fluoride	EPA 300.0	General Chemistry	NELAP	10/7/2002
Fluoride	EPA 9056	General Chemistry	NELAP	7/1/2003
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	3/18/2004
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	3/18/2004
gamma-Chlordane	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003

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E87225
TestAmerica - North Canton
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Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Gasoline range organics (GRO)	EPA 8015	Extractable Organics	NELAP	7/1/2003
Hardness	EPA 130.2	General Chemistry	NELAP	4/29/2004
Heptachlor	EPA 608	Pesticides-Herbicides-PCB's	NELAP	3/18/2004
Heptachlor	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	3/18/2004
Heptachlor epoxide	EPA 608	Pesticides-Herbicides-PCB's	NELAP	3/18/2004
Heptachlor epoxide	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	3/18/2004
Hexachlorobenzene	EPA 625	Extractable Organics	NELAP	3/18/2004
Hexachlorobenzene	EPA 8270	Extractable Organics	NELAP	3/18/2004
Hexachlorobutadiene	EPA 625	Extractable Organics	NELAP	3/18/2004
Hexachlorobutadiene	EPA 8021	Volatile Organics	NELAP	7/1/2003
Hexachlorobutadiene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Hexachlorobutadiene	EPA 8270	Extractable Organics	NELAP	3/18/2004
Hexachlorocyclopentadiene	EPA 625	Extractable Organics	NELAP	3/18/2004
Hexachlorocyclopentadiene	EPA 8270	Extractable Organics	NELAP	3/18/2004
Hexachloroethane	EPA 625	Extractable Organics	NELAP	3/18/2004
Hexachloroethane	EPA 8270	Extractable Organics	NELAP	3/18/2004
Hexachloropropene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Ignitability	EPA 1010	General Chemistry	NELAP	7/1/2003
Indeno(1,2,3-cd)pyrene	EPA 610	Extractable Organics	NELAP	3/18/2004
Indeno(1,2,3-cd)pyrene	EPA 625	Extractable Organics	NELAP	3/18/2004
Indeno(1,2,3-cd)pyrene	EPA 8270	Extractable Organics	NELAP	3/18/2004
Indeno(1,2,3-cd)pyrene	EPA 8310	Extractable Organics	NELAP	3/18/2004
Iodomethane (Methyl iodide)	EPA 8260	Volatile Organics	NELAP	7/1/2003
Iron	EPA 200.7	Metals	NELAP	3/18/2004
Iron	EPA 6010	Metals	NELAP	7/1/2003
Iron	EPA 6020	Metals	NELAP	5/15/2007
Iron	NC-MT-0002	Metals	NELAP	5/15/2007
Isobutyl alcohol (2-Methyl-1-propanol)	EPA 8015	Volatile Organics	NELAP	7/1/2003
Isobutyl alcohol (2-Methyl-1-propanol)	EPA 8260	Volatile Organics	NELAP	7/1/2003
Isodrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Isophorone	EPA 625	Extractable Organics	NELAP	3/18/2004
Isophorone	EPA 8270	Extractable Organics	NELAP	3/18/2004
Isopropylbenzene	EPA 8021	Volatile Organics	NELAP	7/1/2003
Isopropylbenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Isosafrole	EPA 8270	Extractable Organics	NELAP	7/1/2003
Kepone	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003

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Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Kjeldahl nitrogen - total	EPA 351.3	General Chemistry	NELAP	4/29/2004
Lead	EPA 200.7	Metals	NELAP	3/18/2004
Lead	EPA 200.8	Metals	NELAP	3/18/2004
Lead	EPA 6010	Metals	NELAP	4/29/2004
Lead	EPA 6020	Metals	NELAP	4/29/2004
Magnesium	EPA 200.7	Metals	NELAP	5/15/2004
Magnesium	EPA 6010	Metals	NELAP	7/1/2003
Magnesium	EPA 6020	Metals	NELAP	8/3/2005
Malathion	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Manganese	EPA 200.7	Metals	NELAP	3/18/2004
Manganese	EPA 200.8	Metals	NELAP	3/18/2004
Manganese	EPA 6010	Metals	NELAP	7/1/2003
Manganese	EPA 6020	Metals	NELAP	7/1/2003
MCPA	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
MCPP	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Mercury	EPA 1631	Metals	NELAP	3/18/2004
Mercury	EPA 245.1	Metals	NELAP	3/18/2004
Mercury	EPA 7470	Metals	NELAP	3/18/2004
Merphos	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Methacrylonitrile	EPA 8260	Volatile Organics	NELAP	7/1/2003
Methapyrilene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Methoxychlor	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	4/29/2004
Methyl bromide (Bromomethane)	EPA 601	Volatile Organics	NELAP	3/18/2004
Methyl bromide (Bromomethane)	EPA 624	Volatile Organics	NELAP	3/18/2004
Methyl bromide (Bromomethane)	EPA 8021	Volatile Organics	NELAP	3/18/2004
Methyl bromide (Bromomethane)	EPA 8260	Volatile Organics	NELAP	3/18/2004
Methyl chloride (Chloromethane)	EPA 601	Volatile Organics	NELAP	3/18/2004
Methyl chloride (Chloromethane)	EPA 624	Volatile Organics	NELAP	3/18/2004
Methyl chloride (Chloromethane)	EPA 8021	Volatile Organics	NELAP	3/18/2004
Methyl chloride (Chloromethane)	EPA 8260	Volatile Organics	NELAP	3/18/2004
Methyl methacrylate	EPA 8260	Volatile Organics	NELAP	7/1/2003
Methyl methanesulfonate	EPA 8270	Extractable Organics	NELAP	7/1/2003
Methyl parathion (Parathion, methyl)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Methyl tert-butyl ether (MTBE)	EPA 8021	Volatile Organics	NELAP	7/1/2003
Methyl tert-butyl ether (MTBE)	EPA 8260	Volatile Organics	NELAP	7/1/2003
Methylene chloride	EPA 601	Volatile Organics	NELAP	3/18/2004

Laboratory Scope of Accreditation

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TestAmerica - North Canton
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North Canton, OH 44720-6961

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Methylene chloride	EPA 624	Volatile Organics	NELAP	3/18/2004
Methylene chloride	EPA 8021	Volatile Organics	NELAP	3/18/2004
Methylene chloride	EPA 8260	Volatile Organics	NELAP	3/18/2004
Mevinphos	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Molybdenum	EPA 200.7	Metals	NELAP	3/18/2004
Molybdenum	EPA 200.8	Metals	NELAP	10/7/2002
Molybdenum	EPA 6010	Metals	NELAP	7/1/2003
Molybdenum	EPA 6020	Metals	NELAP	7/1/2003
Naled	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Naphthalene	EPA 610	Extractable Organics	NELAP	3/18/2004
Naphthalene	EPA 625	Extractable Organics	NELAP	3/18/2004
Naphthalene	EPA 8021	Volatile Organics	NELAP	7/1/2003
Naphthalene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Naphthalene	EPA 8270	Extractable Organics	NELAP	3/18/2004
Naphthalene	EPA 8310	Extractable Organics	NELAP	3/18/2004
n-Butylbenzene	EPA 8021	Volatile Organics	NELAP	7/1/2003
n-Butylbenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Nickel	EPA 200.7	Metals	NELAP	3/18/2004
Nickel	EPA 200.8	Metals	NELAP	3/18/2004
Nickel	EPA 6010	Metals	NELAP	4/29/2004
Nickel	EPA 6020	Metals	NELAP	4/29/2004
Nitrate	EPA 300.0	General Chemistry	NELAP	4/29/2004
Nitrate	EPA 9056	General Chemistry	NELAP	7/1/2003
Nitrate as N	EPA 353.2	General Chemistry	NELAP	10/7/2002
Nitrate-nitrite	EPA 353.2	General Chemistry	NELAP	10/7/2002
Nitrite	EPA 300.0	General Chemistry	NELAP	4/29/2004
Nitrite	EPA 9056	General Chemistry	NELAP	7/1/2003
Nitrite as N	EPA 353.2	General Chemistry	NELAP	10/7/2002
Nitrobenzene	EPA 625	Extractable Organics	NELAP	3/18/2004
Nitrobenzene	EPA 8270	Extractable Organics	NELAP	3/18/2004
Nitroquinoline-1-oxide	EPA 8270	Extractable Organics	NELAP	7/1/2003
n-Nitrosodiethylamine	EPA 8270	Extractable Organics	NELAP	7/1/2003
n-Nitrosodimethylamine	EPA 625	Extractable Organics	NELAP	3/18/2004
n-Nitrosodimethylamine	EPA 8270	Extractable Organics	NELAP	7/1/2003
n-Nitroso-di-n-butylamine	EPA 8270	Extractable Organics	NELAP	7/1/2003
n-Nitrosodi-n-propylamine	EPA 625	Extractable Organics	NELAP	3/18/2004

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TestAmerica - North Canton
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Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
n-Nitrosodi-n-propylamine	EPA 8270	Extractable Organics	NELAP	7/1/2003
n-Nitrosodiphenylamine	EPA 625	Extractable Organics	NELAP	3/18/2004
n-Nitrosodiphenylamine	EPA 8270	Extractable Organics	NELAP	7/1/2003
n-Nitrosomethylethylamine	EPA 8270	Extractable Organics	NELAP	7/1/2003
n-Nitrosomorpholine	EPA 8270	Extractable Organics	NELAP	7/1/2003
n-Nitrosopiperidine	EPA 8270	Extractable Organics	NELAP	7/1/2003
n-Nitrosopyrrolidine	EPA 8270	Extractable Organics	NELAP	7/1/2003
n-Propylbenzene	EPA 8021	Volatile Organics	NELAP	7/1/2003
n-Propylbenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
o,o,o-Triethyl phosphorothioate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Oil & Grease	EPA 1664	General Chemistry	NELAP	12/5/2006
Organic nitrogen	EPA 351.3 - EPA 350.2	General Chemistry	NELAP	10/7/2002
Orthophosphate as P	EPA 300.0	General Chemistry	NELAP	10/7/2002
Orthophosphate as P	EPA 365.1	General Chemistry	NELAP	8/3/2005
Orthophosphate as P	EPA 365.2	General Chemistry	NELAP	10/7/2002
Orthophosphate as P	EPA 9056	General Chemistry	NELAP	7/1/2003
o-Toluidine	EPA 8270	Extractable Organics	NELAP	7/1/2003
Parathion, ethyl	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Pentachlorobenzene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Pentachloronitrobenzene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Pentachlorophenol	EPA 625	Extractable Organics	NELAP	3/18/2004
Pentachlorophenol	EPA 8270	Extractable Organics	NELAP	3/18/2004
pH	EPA 150.1	General Chemistry	NELAP	10/7/2002
pH	EPA 9040	General Chemistry	NELAP	4/29/2004
Phenacetin	EPA 8270	Extractable Organics	NELAP	7/1/2003
Phenanthrene	EPA 610	Extractable Organics	NELAP	10/7/2002
Phenanthrene	EPA 625	Extractable Organics	NELAP	3/18/2004
Phenanthrene	EPA 8270	Extractable Organics	NELAP	3/18/2004
Phenanthrene	EPA 8310	Extractable Organics	NELAP	3/18/2004
Phenol	EPA 625	Extractable Organics	NELAP	3/18/2004
Phenol	EPA 8270	Extractable Organics	NELAP	3/18/2004
Phorate	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Phorate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Phosphorus, total	EPA 365.1	General Chemistry	NELAP	8/3/2005
Phosphorus, total	EPA 365.2	General Chemistry	NELAP	10/7/2002
p-Isopropyltoluene	EPA 8021	Volatile Organics	NELAP	7/1/2003

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E87225
TestAmerica - North Canton
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Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
p-Isopropyltoluene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Potassium	EPA 200.7	Metals	NELAP	5/15/2004
Potassium	EPA 6010	Metals	NELAP	7/1/2003
Pronamide (Kerb)	EPA 8270	Extractable Organics	NELAP	7/1/2003
Propionitrile (Ethyl cyanide)	EPA 8260	Volatile Organics	NELAP	7/1/2003
Pyrene	EPA 610	Extractable Organics	NELAP	3/18/2004
Pyrene	EPA 625	Extractable Organics	NELAP	3/18/2004
Pyrene	EPA 8270	Extractable Organics	NELAP	3/18/2004
Pyrene	EPA 8310	Extractable Organics	NELAP	3/18/2004
Pyridine	EPA 8270	Extractable Organics	NELAP	7/1/2003
Residue-filterable (TDS)	EPA 160.1	General Chemistry	NELAP	4/29/2004
Residue-nonfilterable (TSS)	EPA 160.2	General Chemistry	NELAP	4/29/2004
Residue-total	EPA 160.3	General Chemistry	NELAP	4/29/2004
Residue-volatile	EPA 160.4	General Chemistry	NELAP	10/7/2002
Ronnel	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Safrole	EPA 8270	Extractable Organics	NELAP	7/1/2003
sec-Butylbenzene	EPA 8021	Volatile Organics	NELAP	7/1/2003
sec-Butylbenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Selenium	EPA 200.7	Metals	NELAP	3/18/2004
Selenium	EPA 200.8	Metals	NELAP	5/15/2007
Selenium	EPA 6010	Metals	NELAP	4/29/2004
Selenium	EPA 6020	Metals	NELAP	5/15/2007
Silver	EPA 200.7	Metals	NELAP	3/18/2004
Silver	EPA 200.8	Metals	NELAP	3/18/2004
Silver	EPA 6010	Metals	NELAP	4/29/2004
Silver	EPA 6020	Metals	NELAP	4/29/2004
Silvex (2,4,5-TP)	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	3/18/2004
Sodium	EPA 200.7	Metals	NELAP	5/15/2004
Sodium	EPA 6010	Metals	NELAP	7/1/2003
Sodium	EPA 6020	Metals	NELAP	8/3/2005
Stirofos	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Strontium	EPA 6020	Metals	NELAP	8/3/2005
Styrene	EPA 8021	Volatile Organics	NELAP	7/1/2003
Styrene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Sulfate	EPA 300.0	General Chemistry	NELAP	10/7/2002
Sulfate	EPA 375.4	General Chemistry	NELAP	4/29/2004

Laboratory Scope of Accreditation

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State Laboratory ID: E87225 **EPA Lab Code:** OH00048 (330) 497-9396

E87225
TestAmerica - North Canton
4101 Shuffel Drive NW
North Canton, OH 44720-6961

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Sulfate	EPA 9056	General Chemistry	NELAP	7/1/2003
Sulfide	EPA 376.1	General Chemistry	NELAP	4/29/2004
Sulfide	EPA 9030/9034	General Chemistry	NELAP	4/29/2004
Sulfotepp	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Sulfotepp	EPA 8270	Extractable Organics	NELAP	7/1/2003
tert-Butylbenzene	EPA 8021	Volatile Organics	NELAP	7/1/2003
tert-Butylbenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Tetrachloroethylene (Perchloroethylene)	EPA 601	Volatile Organics	NELAP	3/18/2004
Tetrachloroethylene (Perchloroethylene)	EPA 624	Volatile Organics	NELAP	3/18/2004
Tetrachloroethylene (Perchloroethylene)	EPA 8021	Volatile Organics	NELAP	3/18/2004
Tetrachloroethylene (Perchloroethylene)	EPA 8260	Volatile Organics	NELAP	3/18/2004
Thallium	EPA 200.7	Metals	NELAP	3/18/2004
Thallium	EPA 200.8	Metals	NELAP	3/18/2004
Thallium	EPA 6010	Metals	NELAP	7/1/2003
Thallium	EPA 6020	Metals	NELAP	7/1/2003
Thionazin (Zinophos)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Thionazin (Zinophos)	EPA 8270	Extractable Organics	NELAP	7/1/2003
Tin	EPA 200.7	Metals	NELAP	3/18/2004
Tin	EPA 200.8	Metals	NELAP	10/7/2002
Tin	EPA 6010	Metals	NELAP	7/1/2003
Tin	EPA 6020	Metals	NELAP	8/3/2005
Tin	NC-MT-0002	Metals	NELAP	7/1/2003
Titanium	EPA 200.7	Metals	NELAP	5/15/2004
Titanium	EPA 6010	Metals	NELAP	7/1/2003
Titanium	EPA 6020	Metals	NELAP	8/3/2005
Tokuthion (Prothiophos)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Toluene	EPA 602	Volatile Organics	NELAP	3/18/2004
Toluene	EPA 624	Volatile Organics	NELAP	3/18/2004
Toluene	EPA 8021	Volatile Organics	NELAP	3/18/2004
Toluene	EPA 8260	Volatile Organics	NELAP	3/18/2004
Total cyanide	EPA 335.4	General Chemistry	NELAP	10/7/2002
Total cyanide	EPA 9012	General Chemistry	NELAP	4/29/2004
Total nitrate-nitrite	EPA 9056	General Chemistry	NELAP	7/1/2003
Total organic carbon	EPA 415.1	General Chemistry	NELAP	10/7/2002
Total organic carbon	EPA 9060	General Chemistry	NELAP	7/1/2003
Total Petroleum Hydrocarbons (TPH)	EPA 1664	General Chemistry	NELAP	4/29/2004

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E87225
TestAmerica - North Canton
4101 Shuffel Drive NW
North Canton, OH 44720-6961

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Total phenolics	EPA 420.1	General Chemistry	NELAP	4/29/2004
Total phenolics	EPA 9065	General Chemistry	NELAP	7/1/2003
Toxaphene (Chlorinated camphene)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	3/18/2004
Toxaphene (Chlorinated camphene)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	3/18/2004
trans-1,2-Dichloroethylene	EPA 601	Volatile Organics	NELAP	10/7/2002
trans-1,2-Dichloroethylene	EPA 624	Volatile Organics	NELAP	10/7/2002
trans-1,2-Dichloroethylene	EPA 8021	Volatile Organics	NELAP	7/1/2003
trans-1,2-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	7/1/2003
trans-1,3-Dichloropropylene	EPA 601	Volatile Organics	NELAP	9/1/2004
trans-1,3-Dichloropropylene	EPA 624	Volatile Organics	NELAP	3/18/2004
trans-1,3-Dichloropropylene	EPA 8021	Volatile Organics	NELAP	9/1/2004
trans-1,3-Dichloropropylene	EPA 8260	Volatile Organics	NELAP	3/18/2004
trans-1,4-Dichloro-2-butene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Trichloroethene (Trichloroethylene)	EPA 601	Volatile Organics	NELAP	3/18/2004
Trichloroethene (Trichloroethylene)	EPA 624	Volatile Organics	NELAP	3/18/2004
Trichloroethene (Trichloroethylene)	EPA 8021	Volatile Organics	NELAP	3/18/2004
Trichloroethene (Trichloroethylene)	EPA 8260	Volatile Organics	NELAP	3/18/2004
Trichlorofluoromethane	EPA 601	Volatile Organics	NELAP	3/18/2004
Trichlorofluoromethane	EPA 624	Volatile Organics	NELAP	3/18/2004
Trichlorofluoromethane	EPA 8021	Volatile Organics	NELAP	3/18/2004
Trichlorofluoromethane	EPA 8260	Volatile Organics	NELAP	3/18/2004
Trichloronate	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Turbidity	EPA 180.1	General Chemistry	NELAP	10/7/2002
Vanadium	EPA 200.7	Metals	NELAP	3/18/2004
Vanadium	EPA 200.8	Metals	NELAP	5/15/2007
Vanadium	EPA 6010	Metals	NELAP	7/1/2003
Vanadium	EPA 6020	Metals	NELAP	5/15/2007
Vanadium	NC-MT-0002	Metals	NELAP	5/15/2007
Vinyl acetate	EPA 8260	Volatile Organics	NELAP	7/1/2003
Vinyl chloride	EPA 601	Volatile Organics	NELAP	3/18/2004
Vinyl chloride	EPA 624	Volatile Organics	NELAP	3/18/2004
Vinyl chloride	EPA 8021	Volatile Organics	NELAP	3/18/2004
Vinyl chloride	EPA 8260	Volatile Organics	NELAP	6/16/2004
Xylene (total)	EPA 602	Volatile Organics	NELAP	10/7/2002
Xylene (total)	EPA 624	Volatile Organics	NELAP	9/1/2004
Xylene (total)	EPA 8021	Volatile Organics	NELAP	3/18/2004

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North Canton, OH 44720-6961

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Xylene (total)	EPA 8260	Volatile Organics	NELAP	9/1/2004
Zinc	EPA 200.7	Metals	NELAP	3/18/2004
Zinc	EPA 200.8	Metals	NELAP	5/15/2007
Zinc	EPA 6010	Metals	NELAP	7/1/2003
Zinc	EPA 6020	Metals	NELAP	5/15/2007

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E87225
TestAmerica - North Canton
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North Canton, OH 44720-6961

Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
1,1,1,2-Tetrachloroethane	EPA 8260	Volatile Organics	NELAP	10/7/2002
1,1,1-Trichloroethane	EPA 8260	Volatile Organics	NELAP	3/18/2004
1,1,2,2-Tetrachloroethane	EPA 8260	Volatile Organics	NELAP	3/18/2004
1,1,2-Trichloroethane	EPA 8260	Volatile Organics	NELAP	3/18/2004
1,1-Dichloroethane	EPA 8260	Volatile Organics	NELAP	3/18/2004
1,1-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	3/18/2004
1,1-Dichloropropene	EPA 8260	Volatile Organics	NELAP	10/7/2002
1,2,3-Trichloropropane	EPA 8260	Volatile Organics	NELAP	10/7/2002
1,2,4,5-Tetrachlorobenzene	EPA 8270	Extractable Organics	NELAP	10/7/2002
1,2,4-Trichlorobenzene	EPA 8260	Volatile Organics	NELAP	10/7/2002
1,2,4-Trichlorobenzene	EPA 8270	Extractable Organics	NELAP	3/18/2004
1,2,4-Trimethylbenzene	EPA 8021	Volatile Organics	NELAP	10/7/2002
1,2,4-Trimethylbenzene	EPA 8260	Volatile Organics	NELAP	10/7/2002
1,2-Dibromo-3-chloropropane (DBCP)	EPA 8260	Volatile Organics	NELAP	10/7/2002
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 8260	Volatile Organics	NELAP	10/7/2002
1,2-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	3/18/2004
1,2-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	10/7/2002
1,2-Dichloroethane	EPA 8260	Volatile Organics	NELAP	3/18/2004
1,2-Dichloropropane	EPA 8260	Volatile Organics	NELAP	3/18/2004
1,2-Dinitrobenzene	EPA 8270	Extractable Organics	NELAP	10/7/2002
1,2-Diphenylhydrazine	EPA 8270	Extractable Organics	NELAP	10/7/2002
1,3,5-Trimethylbenzene	EPA 8021	Volatile Organics	NELAP	10/7/2002
1,3,5-Trimethylbenzene	EPA 8260	Volatile Organics	NELAP	10/7/2002
1,3,5-Trinitrobenzene (1,3,5-TNB)	EPA 8270	Extractable Organics	NELAP	10/7/2002
1,3-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	3/18/2004
1,3-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	10/7/2002
1,3-Dichloropropane	EPA 8260	Volatile Organics	NELAP	10/7/2002
1,3-Dinitrobenzene (1,3-DNB)	EPA 8270	Extractable Organics	NELAP	10/7/2002
1,4-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	3/18/2004
1,4-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	10/7/2002
1,4-Dinitrobenzene	EPA 8270	Extractable Organics	NELAP	10/7/2002
1,4-Dioxane (1,4-Diethyleneoxide)	EPA 8015	Volatile Organics	NELAP	10/7/2002
1,4-Dioxane (1,4-Diethyleneoxide)	EPA 8260	Volatile Organics	NELAP	10/7/2002
1,4-Naphthoquinone	EPA 8270	Extractable Organics	NELAP	10/7/2002
1,4-Phenylenediamine	EPA 8270	Extractable Organics	NELAP	10/7/2002
1-Naphthylamine	EPA 8270	Extractable Organics	NELAP	10/7/2002

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**E87225
TestAmerica - North Canton
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North Canton, OH 44720-6961**

Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,2-Dichloropropane	EPA 8260	Volatile Organics	NELAP	10/7/2002
2,3,4,6-Tetrachlorophenol	EPA 8270	Extractable Organics	NELAP	10/7/2002
2,4,5-T	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	3/18/2004
2,4,5-Trichlorophenol	EPA 8270	Extractable Organics	NELAP	10/7/2002
2,4,6-Trichlorophenol	EPA 8270	Extractable Organics	NELAP	3/18/2004
2,4-D	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	3/18/2004
2,4-DB	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	10/7/2002
2,4-Dichlorophenol	EPA 8270	Extractable Organics	NELAP	3/18/2004
2,4-Dimethylphenol	EPA 8270	Extractable Organics	NELAP	3/18/2004
2,4-Dinitrophenol	EPA 8270	Extractable Organics	NELAP	3/18/2004
2,4-Dinitrotoluene (2,4-DNT)	EPA 8270	Extractable Organics	NELAP	3/18/2004
2,6-Dichlorophenol	EPA 8270	Extractable Organics	NELAP	10/7/2002
2,6-Dinitrotoluene (2,6-DNT)	EPA 8270	Extractable Organics	NELAP	3/18/2004
2-Acetylaminofluorene	EPA 8270	Extractable Organics	NELAP	10/7/2002
2-Butanone (Methyl ethyl ketone, MEK)	EPA 8260	Volatile Organics	NELAP	10/7/2002
2-Chloroethyl vinyl ether	EPA 8260	Volatile Organics	NELAP	3/18/2004
2-Chloronaphthalene	EPA 8270	Extractable Organics	NELAP	3/18/2004
2-Chlorophenol	EPA 8270	Extractable Organics	NELAP	3/18/2004
2-Chlorotoluene	EPA 8260	Volatile Organics	NELAP	10/7/2002
2-Hexanone	EPA 8260	Volatile Organics	NELAP	10/7/2002
2-Methyl-4,6-dinitrophenol	EPA 8270	Extractable Organics	NELAP	3/18/2004
2-Methylnaphthalene	EPA 8270	Extractable Organics	NELAP	10/7/2002
2-Methylphenol (o-Cresol)	EPA 8270	Extractable Organics	NELAP	10/7/2002
2-Nitroaniline	EPA 8270	Extractable Organics	NELAP	10/7/2002
2-Nitrophenol	EPA 8270	Extractable Organics	NELAP	3/18/2004
2-Picoline (2-Methylpyridine)	EPA 8270	Extractable Organics	NELAP	10/7/2002
3,3'-Dichlorobenzidine	EPA 8270	Extractable Organics	NELAP	10/7/2002
3,3'-Dimethylbenzidine	EPA 8270	Extractable Organics	NELAP	10/7/2002
3-Methylcholanthrene	EPA 8270	Extractable Organics	NELAP	10/7/2002
3-Methylphenol (m-Cresol)	EPA 8270	Extractable Organics	NELAP	10/7/2002
3-Nitroaniline	EPA 8270	Extractable Organics	NELAP	10/7/2002
4,4'-DDD	EPA 8081	Volatile Organics	NELAP	3/18/2004
4,4'-DDE	EPA 8081	Volatile Organics	NELAP	3/18/2004
4,4'-DDT	EPA 8081	Volatile Organics	NELAP	3/18/2004
4,4'-Methylenebis(2-chloroaniline)	EPA 8270	Extractable Organics	NELAP	10/7/2002
4-Aminobiphenyl	EPA 8270	Extractable Organics	NELAP	10/7/2002

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E87225
TestAmerica - North Canton
4101 Shuffel Drive NW
North Canton, OH 44720-6961

Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
4-Bromophenyl phenyl ether	EPA 8270	Extractable Organics	NELAP	10/7/2002
4-Chloro-3-methylphenol	EPA 8270	Extractable Organics	NELAP	3/18/2004
4-Chloroaniline	EPA 8270	Extractable Organics	NELAP	10/7/2002
4-Chlorophenyl phenylether	EPA 8270	Extractable Organics	NELAP	10/7/2002
4-Chlorotoluene	EPA 8260	Volatile Organics	NELAP	10/7/2002
4-Dimethyl aminoazobenzene	EPA 8270	Extractable Organics	NELAP	10/7/2002
4-Methyl-2-pentanone (MIBK)	EPA 8260	Volatile Organics	NELAP	10/7/2002
4-Methylphenol (p-Cresol)	EPA 8270	Extractable Organics	NELAP	10/7/2002
4-Nitroaniline	EPA 8270	Extractable Organics	NELAP	10/7/2002
4-Nitrophenol	EPA 8270	Extractable Organics	NELAP	3/18/2004
5-Nitro-o-toluidine	EPA 8270	Extractable Organics	NELAP	10/7/2002
7,12-Dimethylbenz(a) anthracene	EPA 8270	Extractable Organics	NELAP	10/7/2002
a-a-Dimethylphenethylamine	EPA 8270	Extractable Organics	NELAP	10/7/2002
Acenaphthene	EPA 8270	Extractable Organics	NELAP	3/18/2004
Acenaphthene	EPA 8310	Extractable Organics	NELAP	3/18/2004
Acenaphthylene	EPA 8270	Extractable Organics	NELAP	3/18/2004
Acenaphthylene	EPA 8310	Extractable Organics	NELAP	3/18/2004
Acetone	EPA 8260	Volatile Organics	NELAP	10/7/2002
Acetonitrile	EPA 8260	Volatile Organics	NELAP	10/7/2002
Acetophenone	EPA 8270	Extractable Organics	NELAP	10/7/2002
Acrolein (Propenal)	EPA 8260	Volatile Organics	NELAP	3/18/2004
Acrylonitrile	EPA 8260	Volatile Organics	NELAP	3/18/2004
Aldrin	EPA 8081	Volatile Organics	NELAP	3/18/2004
Allyl chloride (3-Chloropropene)	EPA 8260	Volatile Organics	NELAP	10/7/2002
alpha-BHC (alpha-Hexachlorocyclohexane)	EPA 8081	Volatile Organics	NELAP	3/18/2004
alpha-Chlordane	EPA 8081	Extractable Organics	NELAP	10/7/2002
Aluminum	EPA 6010	Metals	NELAP	10/7/2002
Aluminum	EPA 6020	Metals	NELAP	10/7/2002
Amenable cyanide	EPA 9012	General Chemistry	NELAP	10/7/2002
Ammonia as N	EPA 350.2	General Chemistry	NELAP	8/3/2005
Ammonia as N	EPA 350.3	General Chemistry	NELAP	8/3/2005
Aniline	EPA 8270	Extractable Organics	NELAP	10/7/2002
Anthracene	EPA 8270	Extractable Organics	NELAP	3/18/2004
Anthracene	EPA 8310	Extractable Organics	NELAP	3/18/2004
Antimony	EPA 6010	Metals	NELAP	3/18/2004
Antimony	EPA 6020	Metals	NELAP	3/18/2004

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E87225
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Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
Aramite	EPA 8270	Extractable Organics	NELAP	10/7/2002
Aroclor-1016 (PCB-1016)	EPA 8082	Extractable Organics	NELAP	3/18/2004
Aroclor-1221 (PCB-1221)	EPA 8082	Extractable Organics	NELAP	3/18/2004
Aroclor-1232 (PCB-1232)	EPA 8082	Extractable Organics	NELAP	3/18/2004
Aroclor-1242 (PCB-1242)	EPA 8082	Extractable Organics	NELAP	3/18/2004
Aroclor-1248 (PCB-1248)	EPA 8082	Extractable Organics	NELAP	3/18/2004
Aroclor-1254 (PCB-1254)	EPA 8082	Extractable Organics	NELAP	3/18/2004
Aroclor-1260 (PCB-1260)	EPA 8082	Extractable Organics	NELAP	3/18/2004
Arsenic	EPA 6010	Metals	NELAP	3/18/2004
Arsenic	EPA 6020	Metals	NELAP	3/18/2004
Azinphos-methyl (Guthion)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/7/2002
Barium	EPA 6010	Metals	NELAP	3/18/2004
Barium	EPA 6020	Metals	NELAP	3/18/2004
Benzene	EPA 8021	Volatile Organics	NELAP	3/18/2004
Benzene	EPA 8260	Volatile Organics	NELAP	3/18/2004
Benzidine	EPA 8270	Extractable Organics	NELAP	10/7/2002
Benzo(a)anthracene	EPA 8270	Extractable Organics	NELAP	3/18/2004
Benzo(a)anthracene	EPA 8310	Extractable Organics	NELAP	3/18/2004
Benzo(a)pyrene	EPA 8270	Extractable Organics	NELAP	3/18/2004
Benzo(a)pyrene	EPA 8310	Extractable Organics	NELAP	3/18/2004
Benzo(b)fluoranthene	EPA 8270	Extractable Organics	NELAP	3/18/2004
Benzo(b)fluoranthene	EPA 8310	Extractable Organics	NELAP	3/18/2004
Benzo(g,h,i)perylene	EPA 8270	Extractable Organics	NELAP	3/18/2004
Benzo(g,h,i)perylene	EPA 8310	Extractable Organics	NELAP	3/18/2004
Benzo(k)fluoranthene	EPA 8270	Extractable Organics	NELAP	10/7/2002
Benzo(k)fluoranthene	EPA 8310	Extractable Organics	NELAP	10/7/2002
Benzoic acid	EPA 8270	Extractable Organics	NELAP	10/7/2002
Benzyl alcohol	EPA 8270	Extractable Organics	NELAP	10/7/2002
Beryllium	EPA 6010	Metals	NELAP	10/7/2002
Beryllium	EPA 6020	Metals	NELAP	10/7/2002
beta-BHC (beta-Hexachlorocyclohexane)	EPA 8081	Volatile Organics	NELAP	3/18/2004
beta-Naphthylamine	EPA 8270	Extractable Organics	NELAP	10/7/2002
Biochemical oxygen demand	EPA 405.1	General Chemistry	NELAP	8/3/2005
Biochemical oxygen demand	SM 5210 B	General Chemistry	NELAP	8/3/2005
bis(2-Chloroethoxy)methane	EPA 8270	Extractable Organics	NELAP	6/16/2004
bis(2-Chloroethyl) ether	EPA 8270	Extractable Organics	NELAP	10/7/2002

Laboratory Scope of Accreditation

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State Laboratory ID: E87225 **EPA Lab Code: OH00048** **(330) 497-9396**

E87225
TestAmerica - North Canton
4101 Shuffel Drive NW
North Canton, OH 44720-6961

Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
bis(2-Chloroisopropyl) ether (2,2'-Oxybis(1-chloropropane))	EPA 8270	Extractable Organics	NELAP	3/18/2004
bis(2-Ethylhexyl) phthalate (DEHP)	EPA 8270	Extractable Organics	NELAP	12/18/2006
Bolstar (Sulprofos)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/7/2002
Boron	EPA 6010	Metals	NELAP	10/7/2002
Boron	EPA 6020	Metals	NELAP	8/3/2005
Bromide	EPA 9056	General Chemistry	NELAP	10/7/2002
Bromobenzene	EPA 8260	Volatile Organics	NELAP	10/7/2002
Bromochloromethane	EPA 8260	Volatile Organics	NELAP	10/7/2002
Bromodichloromethane	EPA 8260	Volatile Organics	NELAP	3/18/2004
Bromoform	EPA 8260	Volatile Organics	NELAP	3/18/2004
Butyl benzyl phthalate	EPA 8270	Extractable Organics	NELAP	3/18/2004
Cadmium	EPA 6010	Metals	NELAP	3/18/2004
Cadmium	EPA 6020	Metals	NELAP	6/10/2004
Calcium	EPA 6010	Metals	NELAP	10/7/2002
Calcium	EPA 6020	Metals	NELAP	8/3/2005
Carbazole	EPA 8270	Extractable Organics	NELAP	10/7/2002
Carbon disulfide	EPA 8260	Volatile Organics	NELAP	10/7/2002
Carbon tetrachloride	EPA 8260	Volatile Organics	NELAP	3/18/2004
Carbonaceous BOD (CBOD)	SM 5210 B	General Chemistry	NELAP	8/3/2005
Chlordane (tech.)	EPA 8081	Volatile Organics	NELAP	3/18/2004
Chloride	EPA 9056	General Chemistry	NELAP	10/7/2002
Chloride	EPA 9251	General Chemistry	NELAP	10/7/2002
Chlorobenzene	EPA 8260	Volatile Organics	NELAP	3/18/2004
Chlorobenzilate	EPA 8081	Extractable Organics	NELAP	10/7/2002
Chlorobenzilate	EPA 8270	Extractable Organics	NELAP	10/7/2002
Chloroethane	EPA 8260	Volatile Organics	NELAP	3/18/2004
Chloroform	EPA 8260	Volatile Organics	NELAP	3/18/2004
Chloroprene	EPA 8260	Volatile Organics	NELAP	10/7/2002
Chlorpyrifos	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/7/2002
Chromium	EPA 6010	Metals	NELAP	3/18/2004
Chromium	EPA 6020	Metals	NELAP	3/18/2004
Chromium VI	EPA 7196	General Chemistry	NELAP	4/29/2004
Chrysene	EPA 8270	Extractable Organics	NELAP	3/18/2004
Chrysene	EPA 8310	Extractable Organics	NELAP	3/18/2004
cis-1,2-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	10/7/2002
cis-1,3-Dichloropropene	EPA 8260	Volatile Organics	NELAP	3/18/2004

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Analyte	Method/Tech	Category	Certification Type	Effective Date
Cobalt	EPA 6010	Metals	NELAP	10/7/2002
Cobalt	EPA 6020	Metals	NELAP	10/7/2002
Conductivity	EPA 9050	General Chemistry	NELAP	10/7/2002
Copper	EPA 6010	Metals	NELAP	10/7/2002
Copper	EPA 6020	Metals	NELAP	3/18/2004
Coumaphos	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/7/2002
Dalapon	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	10/7/2002
delta-BHC	EPA 8081	Volatile Organics	NELAP	3/18/2004
Demeton-s	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/7/2002
Diallate	EPA 8081	Extractable Organics	NELAP	10/7/2002
Diallate	EPA 8270	Extractable Organics	NELAP	10/7/2002
Diazinon	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/7/2002
Dibenz(a,h) anthracene	EPA 8270	Extractable Organics	NELAP	3/18/2004
Dibenz(a,h) anthracene	EPA 8310	Extractable Organics	NELAP	3/18/2004
Dibenzofuran	EPA 8270	Extractable Organics	NELAP	10/7/2002
Dibromochloromethane	EPA 8260	Volatile Organics	NELAP	3/18/2004
Dibromomethane	EPA 8260	Volatile Organics	NELAP	10/7/2002
Dicamba	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	3/18/2004
Dichlorodifluoromethane	EPA 8260	Volatile Organics	NELAP	3/18/2004
Dichloroprop (Dichlorprop)	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	10/7/2002
Dichlorovos (DDVP, Dichlorvos)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/7/2002
Dieldrin	EPA 8081	Volatile Organics	NELAP	3/18/2004
Diesel range organics (DRO)	EPA 8015	Extractable Organics	NELAP	10/7/2002
Diethyl phthalate	EPA 8270	Extractable Organics	NELAP	3/18/2004
Dimethoate	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/7/2002
Dimethoate	EPA 8270	Extractable Organics	NELAP	10/7/2002
Dimethyl phthalate	EPA 8270	Extractable Organics	NELAP	3/18/2004
Di-n-butyl phthalate	EPA 8270	Extractable Organics	NELAP	3/18/2004
Di-n-octyl phthalate	EPA 8270	Extractable Organics	NELAP	3/18/2004
Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	10/7/2002
Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	EPA 8270	Extractable Organics	NELAP	10/7/2002
Diphenylamine	EPA 8270	Extractable Organics	NELAP	10/7/2002
Disulfoton	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	3/17/2003
Disulfoton	EPA 8270	Extractable Organics	NELAP	3/17/2003
Endosulfan I	EPA 8081	Volatile Organics	NELAP	3/18/2004
Endosulfan II	EPA 8081	Volatile Organics	NELAP	3/18/2004

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TestAmerica - North Canton
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Matrix: **Solid and Chemical Materials**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Endosulfan sulfate	EPA 8081	Volatile Organics	NELAP	3/18/2004
Endrin	EPA 8081	Volatile Organics	NELAP	3/18/2004
Endrin aldehyde	EPA 8081	Volatile Organics	NELAP	3/18/2004
Endrin ketone	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/7/2002
Ethoprop	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/7/2002
Ethyl methacrylate	EPA 8260	Volatile Organics	NELAP	10/7/2002
Ethyl methanesulfonate	EPA 8270	Extractable Organics	NELAP	10/7/2002
Ethylbenzene	EPA 8021	Volatile Organics	NELAP	3/18/2004
Ethylbenzene	EPA 8260	Volatile Organics	NELAP	3/18/2004
Ethylene oxide	EPA 8015	Volatile Organics	NELAP	10/7/2002
Famphur	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/7/2002
Famphur	EPA 8270	Extractable Organics	NELAP	10/7/2002
Fensulfothion	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/7/2002
Fenthion	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/7/2002
Fluoranthene	EPA 8270	Extractable Organics	NELAP	3/18/2004
Fluoranthene	EPA 8310	Extractable Organics	NELAP	3/18/2004
Fluorene	EPA 8270	Extractable Organics	NELAP	3/18/2004
Fluorene	EPA 8310	Extractable Organics	NELAP	3/18/2004
Fluoride	EPA 9056	General Chemistry	NELAP	10/7/2002
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	EPA 8081	Volatile Organics	NELAP	3/18/2004
gamma-Chlordane	EPA 8081	Extractable Organics	NELAP	10/7/2002
Gasoline range organics (GRO)	EPA 8015	Extractable Organics	NELAP	10/7/2002
Heptachlor	EPA 8081	Volatile Organics	NELAP	3/18/2004
Heptachlor epoxide	EPA 8081	Volatile Organics	NELAP	3/18/2004
Hexachlorobenzene	EPA 8270	Extractable Organics	NELAP	3/18/2004
Hexachlorobutadiene	EPA 8260	Volatile Organics	NELAP	10/7/2002
Hexachlorobutadiene	EPA 8270	Extractable Organics	NELAP	3/18/2004
Hexachlorocyclopentadiene	EPA 8270	Extractable Organics	NELAP	3/18/2004
Hexachloroethane	EPA 8270	Extractable Organics	NELAP	3/18/2004
Hexachloropropene	EPA 8270	Extractable Organics	NELAP	10/7/2002
Ignitability	EPA 1010	General Chemistry	NELAP	10/7/2002
Indeno(1,2,3-cd)pyrene	EPA 8270	Extractable Organics	NELAP	3/18/2004
Indeno(1,2,3-cd)pyrene	EPA 8310	Extractable Organics	NELAP	3/18/2004
Iodomethane (Methyl iodide)	EPA 8260	Volatile Organics	NELAP	10/7/2002
Iron	EPA 6010	Metals	NELAP	10/7/2002
Isobutyl alcohol (2-Methyl-1-propanol)	EPA 8015	Volatile Organics	NELAP	10/7/2002

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Analyte	Method/Tech	Category	Certification Type	Effective Date
Isobutyl alcohol (2-Methyl-1-propanol)	EPA 8260	Volatile Organics	NELAP	10/7/2002
Isodrin	EPA 8081	Extractable Organics	NELAP	10/7/2002
Isophorone	EPA 8270	Extractable Organics	NELAP	3/18/2004
Isopropylbenzene	EPA 8260	Volatile Organics	NELAP	10/7/2002
Isosafrole	EPA 8270	Extractable Organics	NELAP	10/7/2002
Kepone	EPA 8081	Extractable Organics	NELAP	10/7/2002
Kjeldahl nitrogen - total	EPA 351.3	General Chemistry	NELAP	8/3/2005
Lead	EPA 6010	Metals	NELAP	3/18/2004
Lead	EPA 6020	Metals	NELAP	3/18/2004
Magnesium	EPA 6010	Metals	NELAP	10/7/2002
Magnesium	EPA 6020	Metals	NELAP	8/3/2005
Malathion	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/7/2002
Manganese	EPA 6010	Metals	NELAP	10/7/2002
Manganese	EPA 6020	Metals	NELAP	10/7/2002
MCPA	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	10/7/2002
MCPP	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	10/7/2002
Mercury	EPA 7471	Metals	NELAP	4/29/2004
Merphos	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/7/2002
Methacrylonitrile	EPA 8260	Volatile Organics	NELAP	10/7/2002
Methapyrilene	EPA 8270	Extractable Organics	NELAP	10/7/2002
Methoxychlor	EPA 8081	Volatile Organics	NELAP	4/29/2004
Methyl bromide (Bromomethane)	EPA 8260	Volatile Organics	NELAP	3/18/2004
Methyl chloride (Chloromethane)	EPA 8260	Volatile Organics	NELAP	3/18/2004
Methyl methacrylate	EPA 8260	Volatile Organics	NELAP	10/7/2002
Methyl methanesulfonate	EPA 8270	Extractable Organics	NELAP	10/7/2002
Methyl parathion (Parathion, methyl)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/7/2002
Methyl tert-butyl ether (MTBE)	EPA 8021	Volatile Organics	NELAP	10/7/2002
Methyl tert-butyl ether (MTBE)	EPA 8260	Volatile Organics	NELAP	10/7/2002
Methylene chloride	EPA 8260	Volatile Organics	NELAP	3/18/2004
Mevinphos	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/7/2002
Molybdenum	EPA 6010	Metals	NELAP	10/7/2002
Molybdenum	EPA 6020	Metals	NELAP	10/7/2002
Naled	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/7/2002
Naphthalene	EPA 8021	Volatile Organics	NELAP	10/7/2002
Naphthalene	EPA 8260	Volatile Organics	NELAP	10/7/2002
Naphthalene	EPA 8270	Extractable Organics	NELAP	3/18/2004

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Matrix: **Solid and Chemical Materials**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Naphthalene	EPA 8310	Extractable Organics	NELAP	3/18/2004
n-Butylbenzene	EPA 8260	Volatile Organics	NELAP	10/7/2002
Nickel	EPA 6010	Metals	NELAP	3/18/2004
Nickel	EPA 6020	Metals	NELAP	3/18/2004
Nitrate	EPA 9056	General Chemistry	NELAP	10/7/2002
Nitrate as N	EPA 353.2	General Chemistry	NELAP	8/3/2005
Nitrite	EPA 9056	General Chemistry	NELAP	10/7/2002
Nitrite as N	EPA 353.2	General Chemistry	NELAP	8/3/2005
Nitrobenzene	EPA 8270	Extractable Organics	NELAP	3/18/2004
Nitroquinoline-1-oxide	EPA 8270	Extractable Organics	NELAP	10/7/2002
n-Nitrosodiethylamine	EPA 8270	Extractable Organics	NELAP	10/7/2002
n-Nitrosodimethylamine	EPA 8270	Extractable Organics	NELAP	10/7/2002
n-Nitroso-di-n-butylamine	EPA 8270	Extractable Organics	NELAP	10/7/2002
n-Nitrosodi-n-propylamine	EPA 8270	Extractable Organics	NELAP	10/7/2002
n-Nitrosodiphenylamine	EPA 8270	Extractable Organics	NELAP	10/7/2002
n-Nitrosomethylethylamine	EPA 8270	Extractable Organics	NELAP	10/7/2002
n-Nitrosomorpholine	EPA 8270	Extractable Organics	NELAP	10/7/2002
n-Nitrosopiperidine	EPA 8270	Extractable Organics	NELAP	10/7/2002
n-Nitrosopyrrolidine	EPA 8270	Extractable Organics	NELAP	10/7/2002
n-Propylbenzene	EPA 8260	Volatile Organics	NELAP	10/7/2002
o,o,o-Triethyl phosphorothioate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	10/7/2002
Orthophosphate as P	EPA 365.1	General Chemistry	NELAP	8/3/2005
Orthophosphate as P	EPA 365.2	General Chemistry	NELAP	8/3/2005
Orthophosphate as P	EPA 9056	General Chemistry	NELAP	10/7/2002
o-Toluidine	EPA 8270	Extractable Organics	NELAP	10/7/2002
Parathion, ethyl	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/7/2002
Pentachlorobenzene	EPA 8270	Extractable Organics	NELAP	10/7/2002
Pentachloronitrobenzene	EPA 8270	Extractable Organics	NELAP	10/7/2002
Pentachlorophenol	EPA 8270	Extractable Organics	NELAP	3/18/2004
pH	EPA 9040	General Chemistry	NELAP	4/29/2004
pH	EPA 9045	General Chemistry	NELAP	4/29/2004
Phenacetin	EPA 8270	Extractable Organics	NELAP	10/7/2002
Phenanthrene	EPA 8270	Extractable Organics	NELAP	3/18/2004
Phenanthrene	EPA 8310	Extractable Organics	NELAP	3/18/2004
Phenol	EPA 8270	Extractable Organics	NELAP	3/18/2004
Phorate	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/7/2002

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Analyte	Method/Tech	Category	Certification Type	Effective Date
Phorate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	10/7/2002
Phosphorus, total	EPA 365.2	General Chemistry	NELAP	8/3/2005
p-Isopropyltoluene	EPA 8260	Volatile Organics	NELAP	10/7/2002
Potassium	EPA 6010	Metals	NELAP	10/7/2002
Pronamide (Kerb)	EPA 8270	Extractable Organics	NELAP	10/7/2002
Propionitrile (Ethyl cyanide)	EPA 8260	Volatile Organics	NELAP	10/7/2002
Pyrene	EPA 8270	Extractable Organics	NELAP	3/18/2004
Pyrene	EPA 8310	Extractable Organics	NELAP	3/18/2004
Pyridine	EPA 8270	Extractable Organics	NELAP	10/7/2002
Residue-filterable (TDS)	EPA 160.1	General Chemistry	NELAP	8/3/2005
Residue-nonfilterable (TSS)	EPA 160.2	General Chemistry	NELAP	8/3/2005
Residue-total	EPA 160.3	General Chemistry	NELAP	8/3/2005
Residue-volatile	EPA 160.4	General Chemistry	NELAP	8/3/2005
Ronnel	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/7/2002
Safrole	EPA 8270	Extractable Organics	NELAP	10/7/2002
sec-Butylbenzene	EPA 8260	Volatile Organics	NELAP	10/7/2002
Selenium	EPA 6010	Metals	NELAP	3/18/2004
Selenium	EPA 6020	Metals	NELAP	3/18/2004
Silver	EPA 6010	Metals	NELAP	3/18/2004
Silver	EPA 6020	Metals	NELAP	3/18/2004
Silvex (2,4,5-TP)	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	3/18/2004
Sodium	EPA 6010	Metals	NELAP	10/7/2002
Sodium	EPA 6020	Metals	NELAP	8/3/2005
Stirofos	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/7/2002
Strontium	EPA 6020	Metals	NELAP	8/3/2005
Styrene	EPA 8260	Volatile Organics	NELAP	10/7/2002
Sulfate	EPA 9056	General Chemistry	NELAP	10/7/2002
Sulfide	EPA 9030/9034	General Chemistry	NELAP	6/16/2004
Sulfotepp	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/7/2002
Sulfotepp	EPA 8270	Extractable Organics	NELAP	10/7/2002
Synthetic Precipitation Leaching Procedure	EPA 1312	General Chemistry	NELAP	8/3/2005
tert-Butylbenzene	EPA 8260	Volatile Organics	NELAP	10/7/2002
Tetrachloroethylene (Perchloroethylene)	EPA 8260	Volatile Organics	NELAP	3/18/2004
Thallium	EPA 6010	Metals	NELAP	10/7/2002
Thallium	EPA 6020	Metals	NELAP	10/7/2002
Thionazin (Zinophos)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/7/2002

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Analyte	Method/Tech	Category	Certification Type	Effective Date
Thionazin (Zinophos)	EPA 8270	Extractable Organics	NELAP	10/7/2002
Tin	EPA 6010	Metals	NELAP	10/7/2002
Titanium	EPA 6010	Metals	NELAP	10/7/2002
Titanium	EPA 6020	Metals	NELAP	8/3/2005
Tokuthion (Prothiophos)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/7/2002
Toluene	EPA 8021	Volatile Organics	NELAP	3/18/2004
Toluene	EPA 8260	Volatile Organics	NELAP	3/18/2004
Total cyanide	EPA 9012	General Chemistry	NELAP	4/29/2004
Total nitrate-nitrite	EPA 353.2	General Chemistry	NELAP	8/3/2005
Total nitrate-nitrite	EPA 9056	General Chemistry	NELAP	10/7/2002
Total organic carbon	EPA 9060	General Chemistry	NELAP	10/7/2002
Total phenolics	EPA 9065	General Chemistry	NELAP	10/7/2002
Toxaphene (Chlorinated camphene)	EPA 8081	Volatile Organics	NELAP	3/18/2004
Toxicity Characteristic Leaching Procedure	EPA 1311	General Chemistry	NELAP	4/29/2004
trans-1,2-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	10/7/2002
trans-1,3-Dichloropropylene	EPA 8260	Volatile Organics	NELAP	3/18/2004
trans-1,4-Dichloro-2-butene	EPA 8260	Volatile Organics	NELAP	10/7/2002
Trichloroethene (Trichloroethylene)	EPA 8260	Volatile Organics	NELAP	3/18/2004
Trichlorofluoromethane	EPA 8260	Volatile Organics	NELAP	3/18/2004
Trichloronate	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/7/2002
Vanadium	EPA 6010	Metals	NELAP	10/7/2002
Vanadium	EPA 6020	Metals	NELAP	8/3/2005
Vinyl acetate	EPA 8260	Volatile Organics	NELAP	10/7/2002
Vinyl chloride	EPA 8260	Volatile Organics	NELAP	3/18/2004
Xylene (total)	EPA 8021	Volatile Organics	NELAP	3/18/2004
Xylene (total)	EPA 8260	Volatile Organics	NELAP	3/18/2004
Zinc	EPA 6010	Metals	NELAP	10/7/2002
Zinc	EPA 6020	Metals	NELAP	10/7/2002

Regulatory and Lab Limits Soil

Analyte (mg/kg)	STL MDL	STL RL	**USEPA Region 9** Preliminary Remdiation Goals (residential, soil)	RVAAP Installation-Wide Background Values
METALS (All analyzed with 6010C except where noted)				
Aluminum	5	20	76000	17700
Antimony	0.33	10	31	0.96_{e}
Arsenic	0.34	1	0.39	15.4
Barium	0.2	1	5400	88.4
Beryllium	0.029	1	150	0.88
Cadmium	0.027	1	37	0
Calcium	8.4	100	N/A	15800
Chromium (total)	0.13	2	210	17.4
Cobalt	0.34	2	900	10.4
Copper	0.33	2	3100	17.7
Iron	8.7	20	23000	23100
Lead	0.24	1	400	26.1
Magnesium	2.1	100	N/A	3030
Manganese	0.042	1	1800	1450
Mercury (7471A)	0.013	0.1	23	0.04
Nickel	0.28	2	1600	21.1
Potassium	3.1	500	N/A	927
Selenium	0.3	1	390	1.4
Silver	0.29	2	390	0
Sodium	33	100	N/A	123
Thallium	0.53	2	5.2	0
Vanadium	0.097	2	78	31.1
Zinc	0.56	4	23000	61.8

EXPLOSIVES (CAS number) (All analyzed with 8330B)				
1,3,5-Trinitrobenzene (99-35-4)	0.02	0.25	1800	N/A
1,3-Dinitrobenzene (99-65-0)	0.05	0.25	6.1	N/A
2,4,6-Trinitrotoluene (118-96-7)	0.02	0.25	16	N/A
2,4-Dinitrotoluene (121-14-2)	0.02	0.25	120	N/A
2,6-Dinitrotoluene (606-20-2)	0.03	0.25	61	N/A
2-Amino-4,6-dinitrotoluene (355-72-78-2)	0.1	0.25	N/A	N/A
2-Nitrotoluene (88-72-2)	0.08	0.25	0.88	N/A
3-Nitrotoluene (99-08-1)	0.07	0.25	730	N/A
4-Amino-2,6-dinitrotoluene (1946-51-0)	0.02	0.25	N/A	N/A
4-Nitrotoluene (99-99-0)	0.08	4	12	N/A
Hexachloroethane (67-72-1)			35	N/A
HMX (2691-41-0)	0.03	0.25	3100	N/A
Nitrobenzene (98-95-3)	0.05	0.25	20	N/A
PETN (78-11-5)	0.16	0.5	N/A	N/A
RDX (121-82-4)	0.04	0.25	4.4	N/A
Tetryl (479-45-8)	0.05	0.25	610	N/A

PROPELLANTS (CAS Number) (Method Number)				
Nitroglycerine (55-63-0) (8330)	0.13	0.5	35	N/A
Nitroguanidine (556-88-7) (UV-HPLC)	0.03161	0.25	6100	N/A
Nitrocellulose (N/A) (353.2)	0.124	0.5	N/A	N/A

N/A - Not Applicable

CAS - Chemical Abstracts Service Registry Number

Standard Operating Procedure for Records Review

1.0 INTRODUCTION

This document is intended for records review researchers in the Military Munitions Response Program (MMRP). In addition to documenting the records review process, this procedure also includes checklists and data collection records that are used for quality assurance and verification.

When data reviewers use the information collected during the records review they will be able to create an accurate picture of the military munitions-related activities that occurred at the site. The data will be analyzed and used to determine the type of expected munitions and explosives of concern (MEC) at various sites, general conditions and distribution (surface and subsurface), and other relevant factors (endangered species, terrain, vegetation, etc.) during subsequent munitions response activities.

The purpose of the records review is to locate and retrieve all documents regarding sites that are contaminated with MEC. Data collected during the records review will be used to create a historical records report (HRR) and a Conceptual Site Model (CSM) that will be reviewed by the stakeholders to determine whether or not the MMRP site(s) on the installation will require further characterization, immediate response or no further action (NFA). The records review team will provide information that is crucial to the decision makers.

1.1 Purpose

The purpose of this procedure is to document engineering-environmental Management's (e^2M) MMRP Site Inspection (SI) Records Review process and to establish a quality control record for process verification. This procedure was designed using guidance from the Interstate Technology & Regulatory Council (ITRC) *Munitions Response Historical Records Review*, dated November 2003 and the United States Army Corps of Engineers (USACE) *Ordnance and Explosives Response*, EP1110-1-18, published April 2000.

2.0 RECORDS REVIEW TEAM

The primary research team is comprised of a team leader, archivist, GIS specialist, and researchers. Managers involved in the records review process include the program manager, technical project manager (TPM) and quality control (QC) manager. The roles and responsibilities of individuals in these positions include:

- Program Manager: The Program Manager oversees the TPM and reports directly to the Vice President, Restoration, and the USACE Project Manager. The Program Manager has full authority over the performance of the project and can direct changes in project implementation.
- Technical Project Manager: The TPM for the project is fully responsible and accountable for all project activities. The TPM reports directly to the Program Manager. The TPM is the primary contact with the regulators and USACE for project-specific activities.

- Quality Assurance/Quality Control Manager (QA/QC): The QA/QC Manager reports directly to the TPM. As appropriate, the QA/QC Manager will provide oversight for training, control checks, and process correction/improvement actions.

- Team Leader: The Team Leader reports directly to the TPM and is responsible for coordinating the research team’s field activities.

- Archivist: The research team archivist ensures that all data collected is properly archived and uploaded to the secured site for review.

- GIS Specialist: The GIS Specialist creates and modifies GIS documents based on data collected by research teams.

- Researcher: Researcher responsibilities include the review and collection of all relevant data during site visits.

3.0 DEVELOP A RECORDS REVIEW PLAN

A records search involves examining and collecting data from several sources. By developing and following a detailed plan researchers ensure that the objectives of the search are accomplished. During the implementation phase of the records review process researchers will use checklists developed during the planning phase to document the completion of tasks and to quickly identify data gaps and data conflicts. The most effective and efficient time to address these issues is during the data collection process.

3.1 Review and Summarize Known Information

The team leader will work with the project manager to review and summarize the data collected during the CTT Inventory and include any information that may have become available after the Inventory's completion. The summary will be used to brief the research team and to develop checklists that will guide the team through the records review process.

3.1.1 Review Key Data Items

Table 3.1 shows examples of key data items and their relevance to the HRR and the subsequent decision-making process.

Table 3.1

Data Item	Relevance
Explosive Ordnance (OD) response reports	Indicates the type of munitions potentially present and shows where and when EOD personnel conducted a munitions or explosives emergency response.
Firing orders	Authorization for unit commanders to conduct live-fire training. Provides the date and location of range use and the type and amount of military munitions used.
Munitions storage records	Records stockpile actions (e.g., receipt, issue, shipment, destruction) and movement of munitions on records such as Form 4508.
Facility maps	Frequently show the locations of training areas, firing ranges, magazines and open burning/open detonation (OB/OD) sites, munitions-related facilities, etc.
Command and unit history	All services require individual units to write yearly histories that can contain valuable training information including the dates and location of live-fire training or testing.

Data Item	Relevance
Aerial photographs	When analyzed by a professional, aerial photographs from successive years can form a record of changing land use. Experienced analysts can frequently identify firing points, target impact areas, magazine storage areas, and OB/OD areas.
Personal interviews	Can provide first-hand knowledge of the location and dates of military munitions-related activities. Whenever possible, information derived from personal interviews should be verified with other sources.
Newspaper articles (installation and local)	Frequently cover major training activities and troop movements.
Land transfer records (particularly for FUDS)	Help determine the use of the property after its transfer from DoD control.
Weather records	May indicate likelihood that MEC will surface over time by frost heave, erosion, etc. Can also help determine the best time for site investigations.
Topography and vegetation data	Assists future planning of the required munitions response actions.
Geological data	Helps determine the most appropriate technologies for use at the MRS.
Surface water, wetland, endangered species and cultural resources	Assists future planning of the required munitions responses, particularly site characterization. Also helps to identify potential receptors likely to be impacted that can be included in the CSM.
Groundwater data	Helps address potential groundwater contamination from MC if that is a potential concern at the site.

Source: ITRC

3.2 Complete the Data Inventory Checklist

Use the key data items to complete the data inventory checklist.

YES	NO	CHECKLIST ITEM
		Have the Installation's known years of operation been defined?
		Have the Installation's known uses been correctly identified?
		Are the Command and Unit Histories known?
		If an Archive Search Report (ASR) is available, has it been collected?
		Has all archival information been collected?
		Have all firing points been identified?
		Have EOD reports been collected?
		Have types of munitions used been identified?
		Is the probable penetration depth and density of munitions known?
		Have munitions storage records been reviewed?
		Has an accurate facility map been found?
		Have pertinent aerial photographs been collected?
		Are personal interviews complete?
		Have local newspaper offices been visited?
		Have the Installation's newspaper archives been searched?
		Have pertinent land transfer records been reviewed and collected?
		Has all relevant geology, soil, hydrogeology, and hydrology data been collected?
		Has pertinent surface water information been collected?
		Has information on wetlands been gathered?
		Have any endangered species, threatened species or species of concern been identified?
		Have data on known cultural resources been collected?
		Has all relevant groundwater data been collected?
		Have all relevant Records of Decision (ROD) been collected?
		Have all relevant Environmental Baseline Surveys (EBS) been located?
		Has the local Military Museum been visited?
		Has the local area Museum been visited?
		Has the local law enforcement office been visted?
Outstanding Issues:		

3.3 Identify Data Gaps and Conflicting Data

The data inventory checklist will provide the research team a good overview of their data collection status. A “no” response to checklist questions identifies an information source that must be examined or eliminated as not applicable (NA). Additional examples of data gaps include:

- Missing aerial photos from periods of time where significant military munitions activities were known to have taken place.

- No record of range usage during a time of suspected significant military munitions activity.

- Missing documentation of known activities. For example, validated evidence of EOD activities exists, yet no EOD incident reports are found.

- Munitions or old firing points are observed at the site, but records do not show that these munitions or firing points were used. Data gaps related to the munitions and firing point are the number and type of munitions used, locations of all firing points, locations of impact areas, and the types of use (training, testing, maneuvers, demilitarization, etc.).

It is also during this review and planning phase that potential data conflicts could become apparent. The records review team should identify all data conflicts and missing data gaps and note them on the data inventory checklist. These steps will ensure that missing information and data conflicts are addressed during the records review implementation phase.

4.0 IMPLEMENTING THE RECORDS REVIEW

Now that a plan has been developed, the records review process is ready for implementation. One of the first steps in this second phase is for the team leader to brief the records review research team before they begin their field work. This briefing will include:

- A summary of known data
- Any identified data gaps
- All checklists
- Installation maps
- A review of data collection protocol including filling out data collection forms

4.1 Research Methods

Methods that researchers can use on their mission to find all the relevant data available include:

- Keeping an open mind and being prepared to look for leads to other sources of information. One document could reference several additional sources of information that were not originally selected or available for review.

- Updating the source checklist when potential sources of information are identified.

- Assigning an experienced researcher to oversee the archive searches. The larger archive organizations, such as the National Archives system, have a specific procedure for accessing their documents that must be requested ahead of time. Experienced researchers are familiar with the system and can provide realistic time estimates for accessing the historical records and completing the research.

- Assigning a person experienced in dealing with the public to perform personal interviews. The amount of information acquired from personal interviews can be limited by the relationship between the interviewer and the interviewee.

    - Site maps and photos are helpful to identify specific areas where munitions-related activities took place, and the interviewer should have them available during personal interviews.

    - Consider conducting a second personal interview with potentially valuable interviewees on the site(s) if necessary. Visits to the site(s) by knowledgeable persons have triggered additional recollections that have yielded valuable information.

4.2 Records Review Team Communications

It is important for everyone involved in the records review process to understand that the accumulation and analysis of historical research is a continuous process. The records review team members should be sensitive to new sources of historical information that need to be addressed during the implementation phase.

Frequent communication within the records review team is essential to the success of the project. Topics discussed during the records review team's daily out-briefings will include a summary of the data collected during the course of the day, new information and leads to new information, and assessments of progress made toward resolving data gaps or data conflicts. This is also an opportune time to revise or make new research assignments for the following day.

5.0 EVALUATING THE RECORDS REVIEW

- Have the appropriate archives been thoroughly checked?

- Have the correct record groups been adequately researched? If a negative response is received from the National Archives system regarding a site, the record groups inspected should be examined to see whether the information is possibly located elsewhere within the system.

- Have adequate efforts been made to contact personnel that have worked or been stationed at the site?

- Are checklists closed out and signed off?

- Have data collection forms been properly filled out?

- Is QC adequately addressed in the document?

Establish a regular schedule of data QC checks. At a minimum, the assigned QC representative should inspect the data archive monthly to ensure that each data item has an assigned data item number, the data management form is completely and properly filled out, and the data item is recorded on the master data log.

ORGANIC DATA QUALITY REVIEW REPORT **(EXAMPLE)**

EXPLOSIVES EPA SW-846 Method 8330 Modified

SDG NO: EBC22

PROJECT: WXY site, ABC client

LABORATORY: Severn Trent Laboratories, VT

SAMPLE MATRIX: 12 Water SAMPLING DATE (Month/Year) 04/2003

ANALYSES REQUESTED: SW-846 Method 8330 modified for expanded list

DATA REVIEWER: Diane Short

QA REVIEWER: Diane Short & Associates, Inc. INITIALS/DATE

Telephone Logs included Yes____ No__X_

Contractual Violations Yes____ No__X_

The EPA Contract Laboratory Program National Functional Guidelines for Organic Review, 1999, SW-846 Method 8330 modified, the STL Standard Operating Procedure for the expanded list compounds and the project Quality Assurance Project Plan (QAPP) have been referenced by the reviewer to perform this data validation review. The EPA qualifiers have been expanded to include a descriptor code and value to define QC violations and their values, per the approval of the Project Manager. Per the Scope of Work, the review includes validation of all QC forms referencing the above documents. All of the data are further reviewed for the submitted chromatograms and PDA determinations. General comments regarding the data/ analytical quality are part of the review when raw data are submitted.

I. DELIVERABLES

A. All deliverables were present as specified in the Statement of Work (SOW) or in the project contract.

Yes__X_ No____

II. ANALYTICAL REPORT FORMS

A. The Analytical Report or Data Sheets are present and complete for all requested analyses.

Yes__X__ No____

B. Holding Times

1. The contract holding times were met for all analyses (Time of sample receipt to time of analysis or extraction and from extraction to analysis)

Yes__X__ No____

2. The Clean Water Act (40 CFR 136) holding times were met for all analyses (From time of sample collection).

Yes__X__ No___

III. INSTRUMENT CALIBRATION - HPLC

A. Initial Calibration

1. The relative standard deviation (RSD) or r^2 factor for the multi-point calibration was within the contract QC limits or a linear curve was used.

Yes__X__ No____

Linear curves are used.

B. Continuing Calibration

1. A continuing calibration standard was analyzed for each analysis at the required frequency and the QC criteria were met.

Yes__X__ No____

The azo compounds were greater than the 20% difference limit, but these compounds were not detected nor quantitated and no qualification is required.

IV. SURROGATE

A. Surrogate spikes were analyzed with every sample.

Yes__X__ No____

The surrogate is nitrobenzene.

B. And met the recovery limits defined in the current contract

Yes__X__ No____

V. MATRIX SPIKE/MATRIX SPIKE DUPLICATE

A. Matrix spike (MS) and matrix spike duplicates (MSD) were analyzed for every analysis performed and for every 20 samples or for every matrix whichever is more frequent.

Yes __X__ No____

B. The MS and MSD percent recoveries were within the limits defined in the contract.
Yes____ No__X_
PYX was recovered at 58%, the lab limit is 70%. Data for the parent sample MW02-0403 are qualified JS58 and could be biased slightly low. It is possible that false undetected data could be reported below the Method Detection Limit (MDL), but low level ‘J’ values are reported and data would be true undetected values at the reporting limit (RL).

C. The MSD relative percent differences (RPD) were within the defined contract limits.
Yes __X__ No____

D. The MS/MSD is a client sample.
Yes__X___ No_____

VI. LABORATORY CONTROL SAMPLE

A. Laboratory Control Sample (LCS) was analyzed for every analysis performed and for every 20 samples or for every matrix whichever is more frequent.
Yes__X__ No____

B. The LCS percent recoveries were within the limits defined in the contract.
Yes____ No__X__
There were LCS recoveries that were out of limits for several di- and trinitrotoluenes. These were all on the confirmation column and data are not impacted. No qualification is required.

VII. BLANKS

A. Method Blanks were analyzed at the required frequency and for each matrix and analysis
Yes__X__ No____

B. Blank contamination was not found in the Method Blank
Yes__X__ No____

C. If Field Blanks were identified, blank contamination was not found
Yes____ No____NA__X__
Field Blanks have not been identified.

VIII. FIELD QC

If Field duplicates or Performance Check Compounds were identified, they met the RPD or % recovery criteria for the project.
Yes_X___ No____ NA____
Field duplicates are MW08 and MW-09 and are acceptable at < 35% RPD or ± 2x reporting limit for low level results.

IX. TCL COMPOUNDS

A. The identification is accurate and all retention times, chromatograms (RIC) were evaluated for all detected compounds
Yes____ No__X__
In order to increase the accuracy of detection of the method 8330 full suite of compounds, the laboratory has been contracted to perform method 8330 analysis using Photo Diode Array (PDA) confirmation. Second column confirmation has also been performed. The compounds that are more reliably identified by PDA are RDX, HMX, 2,6 and 2,4-dinitrotoluene, 2,4,6-TNT.

The lab narrative notes that there have been some shifts in retention time (RT) due to high concentrations of RDX or other matrix effects. The chromatograms do indicate numerous extraneous peaks and a large ‘hump’ from about 11 to 22 minutes of the analytical run in many of the samples, especially MW02, MW04T, MW08 and MW09. A review of the RT relative to the identified peaks and the surrogate, however, do not verify the identification of the following compounds. In addition, the second column confirmation does not match and the reviewer recommends that the reported values are interference peaks and not the reported compounds. These data have been qualified RQ to indicate lack of verification of compound identity.

Sample	Compound	Full Qualifier
MW07	2-amino-4,6-DNT	RQP
MW08	2 A-4,6-DNT	RQP
	Nitrobenzene	RQP90
MW08DL	Nitrobenzene	RQP62
MW09	2A-4,6-DNT	RQP
	Nitrobenzene	RQP88
MW09DL	Nitrobenzene	RQP28

B. Quantitation was checked to determine the accuracy of calculations for representative compounds in each internal standards quantitation set.
Yes____ No__X__
Not part of this task.

C. The Reporting Limits (RL) for the project is met.
Yes__X__ No____
Note that the extremely high levels of RDX, HMX and some of the other compounds has required dilution of the samples. The lab has reported the data from the lowest dilution for each compound.

D. Two column confirmation was performed and results agree within 25% for values > 5 x RL.
Yes____ No__X_
See Section A above. In addition, the low level result for 4-amino-2,6-DNT was out of limit and data have been qualified JP. The lowest value is reported in order to minimize reporting falsely elevated values.

GENERAL COMMENTS

The laboratory has met the method and QAPP requirements The quality of the data is acceptable and usable per the validation process with the clarification or qualification noted below.

Matrix Spike

PYX was recovered at 58%, the lab limit is 70%. Data for the parent sample MW02-0403 are qualified JS58 and could be biased slightly low. It is possible that false undetected data could be reported below the Method Detection Limit (MDL), but low level 'J' values are reported and data would be true undetected values at the reporting limit (RL).

Compound Identification

In order to increase the accuracy of detection of the method 8330 full suite of compounds, the laboratory has been contracted to perform method 8330 analysis using Photo Diode Array (PDA) confirmation. Second column confirmation has also been performed. The compounds that are more reliably identified by PDA are RDX, HMX, 2,6 and 2,4-dinitrotoluene, 2,4,6-TNT.

The lab narrative notes that there have been some shifts in retention time (RT) due to high concentrations of RDX or other matrix effects. The chromatograms do indicate numerous extraneous peaks and a large 'hump' from about 11 to 22 minutes of the analytical run in many of the samples, especially MW02, MW04T, MW08 and MW09. A review of the RT relative to the identified peaks and the surrogate, however, do not verify the identification of the following compounds. In addition, the second column confirmation does not match and the reviewer recommends that the reported values are interference peaks and not the reported compounds. PDA spectra were submitted and do not verify these identifications. These data have been qualified RQ to indicate lack of verification of compound identity.

Sample	Compound	Full Qualifier
MW07	2-amino-4,6-DNT	RQP
MW08	2 A-4,6-DNT	RQP
	Nitrobenzene	RQP90
MW08DL	Nitrobenzene	RQP62
MW09	2A-4,6-DNT	RQP
	Nitrobenzene	RQP88
MW09DL	Nitrobenzene	RQP28

In addition, the low level result for 4-amino-2,6-DNT was out of limit and data have been qualified JP for MW04T. It was confirmed by PDA. The lowest value is reported in order to minimize reporting falsely elevated values.

INORGANIC DATA QUALITY REVIEW REPORT **(EXAMPLE)**
Method 6010B ICP Metals and CVAA Mercury

SAMPLE DIGEST NUMBER: 255671

PROJECT: XYZ site for ABC client

LABORATORY: Severn-Trent Laboratory, Houston, TX

SAMPLE MATRIX: Water

SAMPLING DATE (Mo/Yr) 6/03 NO. OF SAMPLES: 10 (W)

ANALYSES REQUESTED: SW-846 Method 6010 Metals, 7470 Mercury

SAMPLE NO. See Attached

DATA REVIEWER: William Berning INITIALS/DATE:__________

QA REVIEWER: Diane Short & Associates, Inc.

Telephone Logs included Yes____ No X

Contractual Violations Yes____ No X

The project QAPP, the EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, 2000 (SOP) and the requested SW-846 methods have been used by the reviewer to perform this data validation review. The EPA qualifiers have been expanded to include a descriptor code and value to define QC violations and their values, per the approval of the Project Manager. The review includes review of the holding times, summary table QC data, initial calibration and continuing calibration verification, Ten percent of the data are reviewed from the raw data for one calculation algorithm and any QC which is not in summary format. General comments regarding the data/analytical quality are part of the review when raw data are submitted.

I. DELIVERABLES

All deliverables were present as specified in the Statement of Work or project contract.

Yes__X__ No____

II. CALIBRATIONS

A. All initial instrument calibrations were performed as defined in the contract or Statement of Work (SOW). All correlation coefficients of the 3 point curve were > 0.995.

Yes__X__ No____ NA____

B. The initial calibration verification (ICV) and continuing calibration verification (CCV) standards were analyzed at the required frequency.

Yes__X__ No____

Sequencing was not required, but sufficient calibrations were present to verify that the frequencies were met for client samples.

And the ICV and CCV standard percent recovery results were within the required control limits of 90 – 110% (Mercury 80-120%).

Yes__X__ No____

III. PREPARATION BLANKS

A. Preparation blanks were prepared and analyzed at the required frequency.

Yes__X__ No____

And all analytes in the preparation blank were less than the CRDL, or less than the instrument detection limit (IDL), whichever is lower.

Yes__X_No____

B. Field, trip, decon rinse or other field blanks are contained and identified in the package.

Yes __X__ No____ NA____

And the reported results are less than the CRDL or less than the IDL, whichever is lower.

Yes ____ No __X__ NA____

Barium was present in the rinsate blank RINS, but all sample results were >5x the blank value, so no qualifiers were applied.

IV. SPIKE SAMPLE RECOVERY

A. A matrix (pre-digestion) spike sample was analyzed for each digestion group and/or matrix or as required in the SOW.

Yes __X__ No____

And the Matrix spike percent recoveries were within the required control limits of 75 – 125%.

Yes ____ No__X_

The following SDGs had matrix spike results that resulted in sample qualification.

SDG	**SAMPLE ID**	**ANALYTE**	**QUALIFICATION**
255671	all	Mercury	JS71

The samples were qualified JS#, where the # is the percent recovery of that particular analyte. A low matrix spike recovery indicates a possible low bias to the reported result proportional to the recovery. Please see the summary table at the end of this report.

B. A Post-digest spike was analyzed if required.
Yes____No____ NA___X_

C. The MS/MSD samples were client samples
Yes ___X_ No____

V. DUPLICATES
A. Matrix (pre-digestion) duplicate samples were analyzed at the required frequency
Yes __X__ No____
MS/MSD samples were also run.

And the Matrix duplicate relative percent differences (RPD) were within the required control limits (Water 20%, Soil 35%) or the RL limits were met if the duplicate values are < 5 x RL. If the either one of the duplicate results are < 5 X RL, the RPD is not used. The QC limit is less than the difference between the original and the duplicate results ± the RL for water and ± 2X the RL for soils.
Yes ___X_ No ___
The laboratory did not report the MS/MSD relative percent difference results. The reviewer made this determination based on the sample and spike results reported on the percent recovery QC summary forms.

VI. LABORATORY CONTROL SAMPLE
A. Laboratory control samples (LCS) were analyzed at the required frequency.
Yes _X___ No____

And LCS recoveries were within the required control limits of 80 to 120%.
Yes __X___ No____

VII. INSTRUMENT DETECTION LIMITS
A. The Instrument Detection Limits have met the Quarterly reporting requirements.
Yes ____ No____ NA__X_
Not applicable to COD.

And all sample results have met the required detection limits (CRDL).
Yes__X__ No____ NA___
Per the contract, the project limits have been met.

XIII. PREPARATION AND ANALYSIS LOGS
A. All samples were prepared or analyzed within the required holding times referencing the SOW (time of sample receipt to preparation/distillation).
Yes__X_ No____

B. All samples were analyzed within the 40 CFR 136 (Clean Water Act) recommended holding times (time of sample collection to date of analysis).
Yes__X_ No____

C. Chains of Custody (COC)

1. Chains of Custody (COC) were reviewed and all fields were complete, signatures were present and cross outs were clean and initialed.
Yes____ No__X__

The COC had uninitialed and undated crossouts and/or overwrites.

2. Samples were received at the required temperature and preservation.
Yes__X_ No____

XIV. FIELD QC
Field QC samples (duplicates, SRMs) were identified.
Yes ___X_ No____

Samples 27B1011 and DUP A were field duplicates.

Field duplicates were within a guidance limit of < 35% RPD limit for water or <50% RPD limit for soil. If values are < 5 x RL, the water limit is ± 2 x RL and the soil limit is ±4 x RL. Final determination will be made by the project manager.
Yes __X__ No____ NA____

XV. GENERAL COMMENTS
The quality of the data is acceptable and usable with consideration of the following qualifications.

<u>Blanks</u>

The following calibration blank results caused sample qualification.

SDG	SAMPLE ID	ANALYTE	QUALIFICATION
255671	all water detects <5x 3.3 ug/l	Arsenic	UB3.3
	all water detects <5x 5.7 ug/l	Selenium	UB5.7

Analytes reported as contaminants in the calibration blank are qualified UB# in the affected samples, where # is the value of the blank corrected to the units of the sample. Sample detects whose values are less than 5x blank are qualified UB and are fully usable as undetected values at that level.

<u>Matrix Spikes</u>

The following SDGs had matrix spike results that resulted in sample qualification.

SDG	SAMPLE ID	ANALYTE	QUALIFICATION
255671	all	Mercury	JS71

The samples were qualified JS#, where the # is the percent recovery of that particular analyte. A low matrix spike recovery indicates a possible low bias to the reported result proportional to the recovery.

INORGANIC DATA QUALITY REVIEW REPORT **(EXAMPLE)**
PERCHLORATE BY EPA METHOD 314 (Modified)

SDG: ____

PROJECT:____________________________

LABORATORY:______Severn Trent Laboratories, Denver CO__________________

SAMPLE MATRIX:__________Water__________________________________

SAMPLING DATE (Mo/Yr)____04/04________________NO. OF SAMPLES:___(W)___ ______

ANALYSES REQUESTED:____EPA Method 314 (STL SOP DEN-WC-0057) Perchlorate________

SAMPLE NO.__See Attached Data Result Forms

DATA REVIEWER:____

QA REVIEWER:______Diane Short & Associates, Inc.__________INITIALS/DATE:___________________

Telephone Logs included Yes____ No__X_

Contractual Violations Yes____ No__X__

The project deliverable criteria, the project QAPP, the EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, 2000 (SOP) and the requested EPA methods have been used by the reviewer to perform this data validation review. The EPA qualifiers have been expanded to include a descriptor code and value to define QC violations and their values, per the approval of the Project Manager. The review includes review of the chains of custody, the QC data and the initial calibration and calibration verification and blanks. Ten percent of the data are further reviewed for chromatograms and method of standard additions. General comments regarding the data/analytical quality are part of the review when raw data are submitted.

I. DELIVERABLEs
All deliverables were present as specified in the Statement of Work or project contract.
Yes__X__   No___

II. CALIBRATIONS
A. All initial instrument calibrations were performed as defined in the contract or Statement of Work (SOW). All correlation coefficients of the 3 point curve were > 0.995.
Yes__X__ No____ NA____

B. The initial calibration verification (ICV) and continuing calibration verification (CCV) standards were analyzed at the required frequency.
Yes__X__ No____

And the ICV and CCV standard percent recovery results were within the required control limits of 90 – 110% (ICV) and 85 – 115% (CCV).
Yes__X__ No____

III. INSTRUMENT PERFORMANCE CHECKS
A. The Instrument Performance Check (IPC) of the conductance criteria was analyzed at the beginning of each day and met the recovery limit of 80 to 120%.
Yes ___ No____ NA__

B. The perchlorate retention times remained within 5% of the IPC with no sudden time shifts.
Yes___ No____

C. The Matrix Conductivity Threshhold (MCT) is reported and the percent difference of the area/height (PDA/H) value is below 20%
Yes___ No____

D. A standard with conductance that is within 10% of the MCT is analyzed and is within 70 – 130% of the spiked value.
Yes ____ No____

E. all sample conductivity is within the MCT range.
Yes ____ No_______

F If the sample conductivity exceeds the MCT, appropriate dilution or corrective action has been applied.
Yes _____ No_____

IV. BLANKS
Note: the highest blank associated with any particular analyte is used for the qualification process and is the value entered after the "B" blank descriptor.

The initial calibration blanks (ICB) and continuing calibration blanks (CCB) were analyzed at the required frequency.
Yes___X_   No____ NA____
For the client samples.

And the ICB and CCB results were within the required control limits.
Yes____ No__X__ NA_____

Analytes reported as contaminants in the calibration blank are qualified JB# in the affected samples, where # is the value of the blank corrected to the units of the sample. Sample detects whose values are less than 5x blank are qualified as are all undetected values. There could be a low bias associated with reported data and false undetected data could be reported.

V. PREPARATION BLANKS
A. Preparation blanks were prepared and analyzed at the required frequency.
Yes__X__ No____

And all analytes in the preparation blank were less than the CRDL, or less than the instrument detection limit (IDL), whichever is lower.
Yes_X___No____

B. Field, trip, decon rinse or other field blanks are contained and identified in the package.
Yes ___ No_X___ NA____

And the reported results are less than the CRDL or less than the IDL, whichever is lower.
Yes ____ No ____ NA___X_

VI. SPIKE SAMPLE RECOVERY
A. A matrix (pre-digestion) spike sample was analyzed for each digestion group and/or matrix or as required in the SOW.
Yes __X__ No____

And the Matrix spike percent recoveries were within the required control limits of 75 – 125%.
Yes __X__ No____

B. The MS/MSD samples were client samples
Yes __X__ No_____

VII. DUPLICATES
A. Matrix (pre-digestion) duplicate samples were analyzed at the required frequency
Yes ____ No__X__

And the Matrix duplicate relative percent differences (RPD) were within the required control limits (Water 20%, Soil 35%) or the RL limits were met if the duplicate values are < 5 x RL. If the either one of the duplicate results are < 5 X RL, the RPD is not used. The QC limit is less than the difference between the original and the duplicate results ± the RL for water and ± 2X the RL for soils.
Yes ___X_ No ____

VIII. LABORATORY CONTROL SAMPLE
A. Laboratory control samples (LCS) were analyzed at the required frequency.
Yes _X___ No____

And LCS recoveries were within the required control limits of 85 to 115%.

Yes __X___ No____

IX. METHOD OF STANDARD ADDITIONS

A. Method of Standard Additions (MSA) was required and performed for samples with questionable retention times.
Yes____No____ NA______

B. The retention time of perchlorate has been verified by the MSA standard RT.
Yes____ No____

X. INSTRUMENT DETECTION LIMITS

A. The Instrument Detection Limits have met the Quarterly reporting requirements.
Yes ____ No____ NA__X_
No IDL or MDL study was required. These limits are part of the initial contractual agreement.

And all sample results have met the required detection limits (CRDL).
Yes___X_ No____ NA___
EPA RLs have been met.

XI. SAMPLE INTEGRITY AND ANALYSIS LOGS

A. All samples were prepared or analyzed within the required holding times referencing the SOW (time of sample receipt to preparation/distillation).
Yes__X__ No___

And samples have been correctly prepared for analysis.
Yes ____ No____

B. All samples were analyzed within the 40 CFR 136 (Clean Water Act) recommended holding times (time of sample collection to date of analysis) or the method holding time of 28 days.
Yes__X__ No___

C. Chains of Custody (COC)
1. Chains of Custody (COC) were reviewed and all fields were complete, signatures were present and cross outs were clean and initialed.
Yes___X_ No____
The gap in time from relinquishment to receipt is accounted for by the FedEx air bill.

2. Samples were received at the required temperature and preservation.
Yes__X_ No___

XII. CHROMATOGRAPHY AND RESULT VERIFICATION

For 10% of the data (or per the client request), chromatography has been reviewed for peak tailing and peak width and possible interferences.
Yes ____ No_____

XIII. FIELD QC
Field QC samples (duplicates, SRMs) were identified.
Yes ____ No__X_
There is a field duplicate for both soils and waters. The parent sample is not identified. Per the project manager, field precision will be determined by the client.

Field duplicates were within a guidance limit of < 35% RPD limit for water or <50% RPD limit for soil. If values are < 5 x RL, the water limit is ± 2 x RL and the soil limit is ±4 x RL. Final determination will be made by the project manager.
Yes ____ No____ NA__X__

XIV. GENERAL COMMENTS
The quality of the data is acceptable and usable with consideration of the following qualifications.

FINAL

FACILITY-WIDE
SAMPLING AND ANALYSIS PLAN

FOR

ENVIRONMENTAL INVESTIGATIONS

AT THE

RAVENNA ARMY AMMUNITION PLANT
RAVENNA, OHIO

Prepared for

U.S. Army Corps of Engineers – Louisville District
Contract No. DACA 62-00-D-0001
Delivery Order CY02

March 2001

FINAL

Facility-Wide
Sampling and Analysis Plan
for
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Prepared by

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SCIENCE APPLICATIONS INTERNATIONAL CORPORATION

contributed to the preparation of this document and should not
be considered an eligible contractor for its review.

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FIELD SAMPLING PLAN

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FIELD SAMPLING PLAN
FOR ENVIRONMENTAL INVESTIGATIONS
AT THE
RAVENNA ARMY AMMUNITION PLANT
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FIELD SAMPLING PLAN

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ACRONYMS

AOC	Area of Concern
ARAR	applicable or relevant and appropriate requirement
ASTM	American Society for Testing and Materials
bgs	below ground surface
CAR	Corrective Action Report
CCQC	Contractor Chemical Quality Control
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	*Code of Federal Regulations*
COC	chain of custody
COPC	chemicals of potential concern
CQC	Contractor Quality Control
DCQCR	Daily Chemical Quality Control Report
DNT	dinitrotoluene
DOT	U.S. Department of Transportation
DQOs	Data Quality Objectives
DSMOA	Defense-State Memorandum of Agreement
EPA	Environmental Protection Agency
FCO	Field Change Order
FSA	Field Staging Area
FSAP	Facility-Wide Sampling and Analysis Plan
FSHP	Facility-Wide Safety and Health Plan
GOCO	Government-Owned, Contractor-Operated
GPD	gallons per day
GPM	gallons per minute
HMX	octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
HQ	Hazard Quotient
IDW	investigation-derived waste
IRA	Interim Removal Action
IRP	Installation Restoration Program
LCS	laboratory control sample
LIMS	Laboratory Information Management System
LPD	liters per day
LPM	liters per minute
MDL	method detection limit
MS	matrix spike
MSD	matrix spike duplicate
NCR	Nonconformance Report
NFA	no further action
NSF	National Sanitation Foundation
OAC	Ohio Administrative Code
OB/OD	Open Burning/Open Detonation
OE	ordnance explosive waste
Ohio EPA	Ohio Environmental Protection Agency
OSC	Operations Support Command
OSP	Ohio State Plane
PAS	Preliminary Assessment Screening
PCB	polychlorinated biphenyl

PPE	personal protective equipment
PVC	polyvinyl chloride
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RAI	Ravenna Arsenal Inc.
RCRA	Resource Conservation and Recovery Act
RDX	cyclonite
RFA	RCRA Facility Assessment
RMIS	Restoration Management Information System
RVAAP	Ravenna Army Ammunition Plant
SAIC	Science Applications International Corporation
SAP	Sampling and Analysis Plan
SDWA	Safe Drinking Water Act
SHP	Safety and Health Plan
SHSO	Site Health and Safety Officer
SOP	Standard Operating Procedure
SSHP	Site Safety and Health Plan
SWMUs	Solid Waste Management Units
TCLP	Toxicity Characteristic Leaching Procedure
TNT	trinitrotoluene
TSCA	Toxic Substances Control Act
TSDF	Treatment, Storage, and Disposal Facility
USACE	U.S. Army Corps of Engineers
USACHPPM	U.S. Army Center for Health Promotion and Preventive Medicine
USAEHA	U.S. Army Environmental Hygiene Agency
USATHAMA	U.S. Army Toxic and Hazardous Materials Agency
UXO	unexploded ordnance
XRF	X-ray fluorescence

INTRODUCTION

This Facility-Wide Sampling and Analysis Plan (FSAP) for Environmental Investigations at Ravenna Army Ammunition Plant (RVAAP), Ravenna, Ohio, has been prepared by Science Applications International Corporation (SAIC), under contract DACA 62-00-D-0001, Delivery Order #CY02, with the U.S. Army Corps of Engineers (USACE) Louisville District. The FSAP was developed in accordance with USACE and Ohio Environmental Protection Agency (Ohio EPA) guidance documents, to meet the requirements for the investigation of known or suspected contaminated sites regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), the Resource Conservation and Recovery Act (RCRA), and other federal or state regulations that govern environmental restoration activities at RVAAP.

This FSAP is intended to:

- establish standards for the performance of all environmental field sampling and data handling efforts that take place at RVAAP;
- incorporate improvements and modifications to the original facility-wide plans;
- serve as the master Standard Operation Procedure (SOP), with the realization that new information and new technologies may result in changes to these procedures; and
- be available to regulators, managers, and contracted firms in easily accessible electronic format.

The standards of performance are necessary to ensure consistency and defensibility of the large amounts of environmental data expected to be gathered at RVAAP, regardless of Area of Concern (AOC), funding source, U.S. Army project manager, or contracted firm performing the work. All environmental data will be archived in a central Environmental Information Management System, and must be consistent across all programs. The requirements for consistency among investigation programs include not only detailed procedures for sample collection and handling, but also for documentation, data validation, and quality assurance (QA)/quality control (QC). These protocols, along with the project organization presented here, have proven successful in the foregoing U.S. Department of Defense Installation Restoration Program (IRP) work administered by Operations Support Command (OSC) and USACE at RVAAP.

The original FSAP (USACE 1996) presumed that all environmental activities carried out at RVAAP would be administered by the OSC and USACE under the IRP, a process that parallels CERCLA (see Figure Intro-1). Indeed, the IRP/CERCLA model for ensuring the sufficiency, integrity, and defensibility of data on environmental contamination has been applied to the majority of environmental investigations conducted by the U.S. Army to date at RVAAP. USACE recognizes that not all environmental investigation activity is IRP-driven, and that the requirements under CERCLA may be more rigorous than required for some AOCs. However, the CERCLA model will continue to be used in this FSAP update for all environmental data collection and analysis at RVAAP, for all currently identified 51 AOCs at RVAAP (including the non-IRP sites; see Table Intro-1; see Figure Intro-2). This model provides consistency with all previous IRP data collected at RVAAP, and provides high-quality data on which to base cleanup decisions. The foundations set forth in this FSAP will apply to several possible types of IRP and non-IRP environmental investigations, e.g.:

Phase I and Phase II Remedial Investigations (CERCLA),
Feasibility Studies (CERCLA),
Groundwater Investigations (Ohio Solid Waste Regulations),
Confirmatory Sampling of Removal Actions (CERCLA),

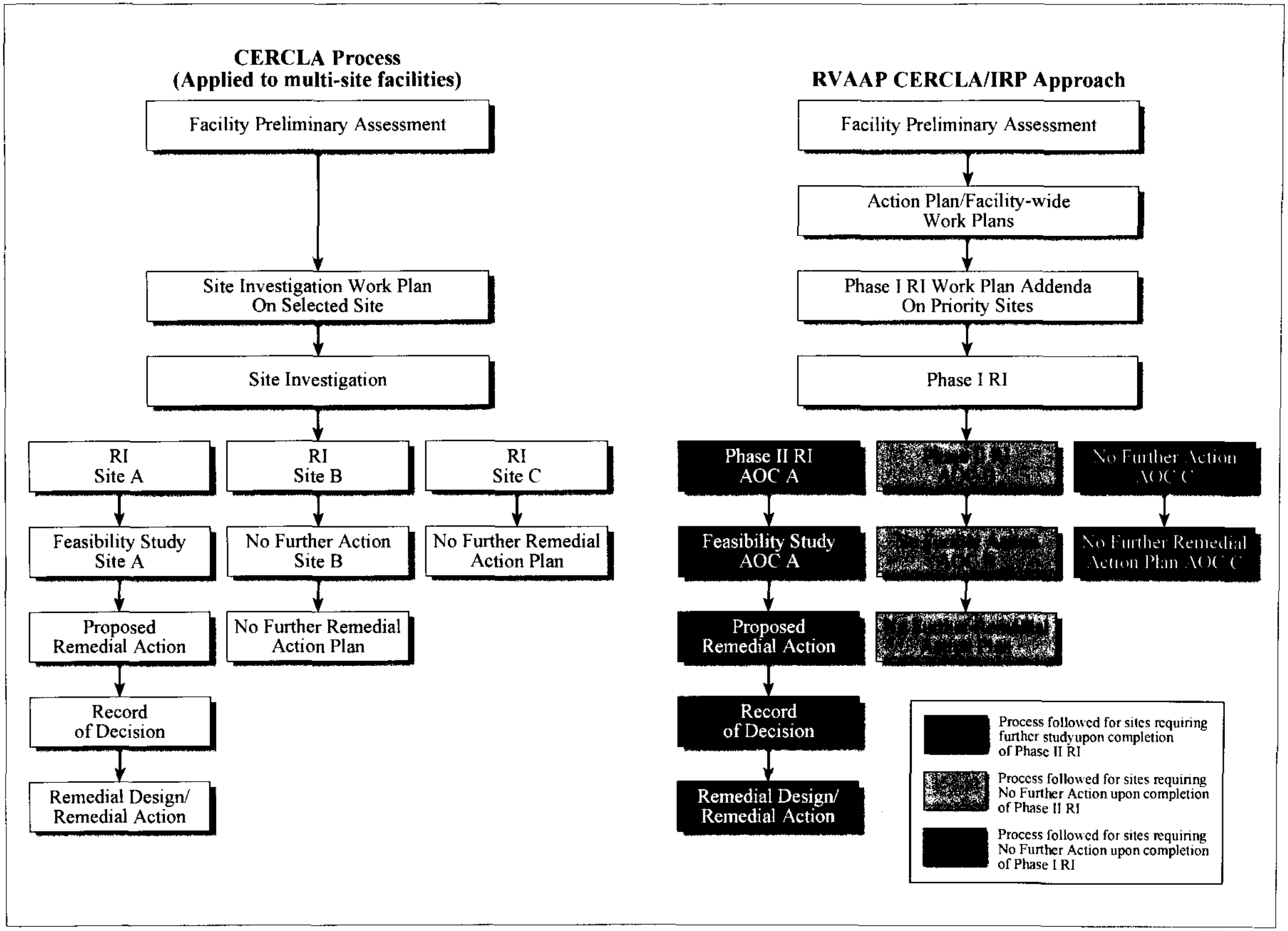

Figure Intro-1. CERCLA Approach at RVAAP

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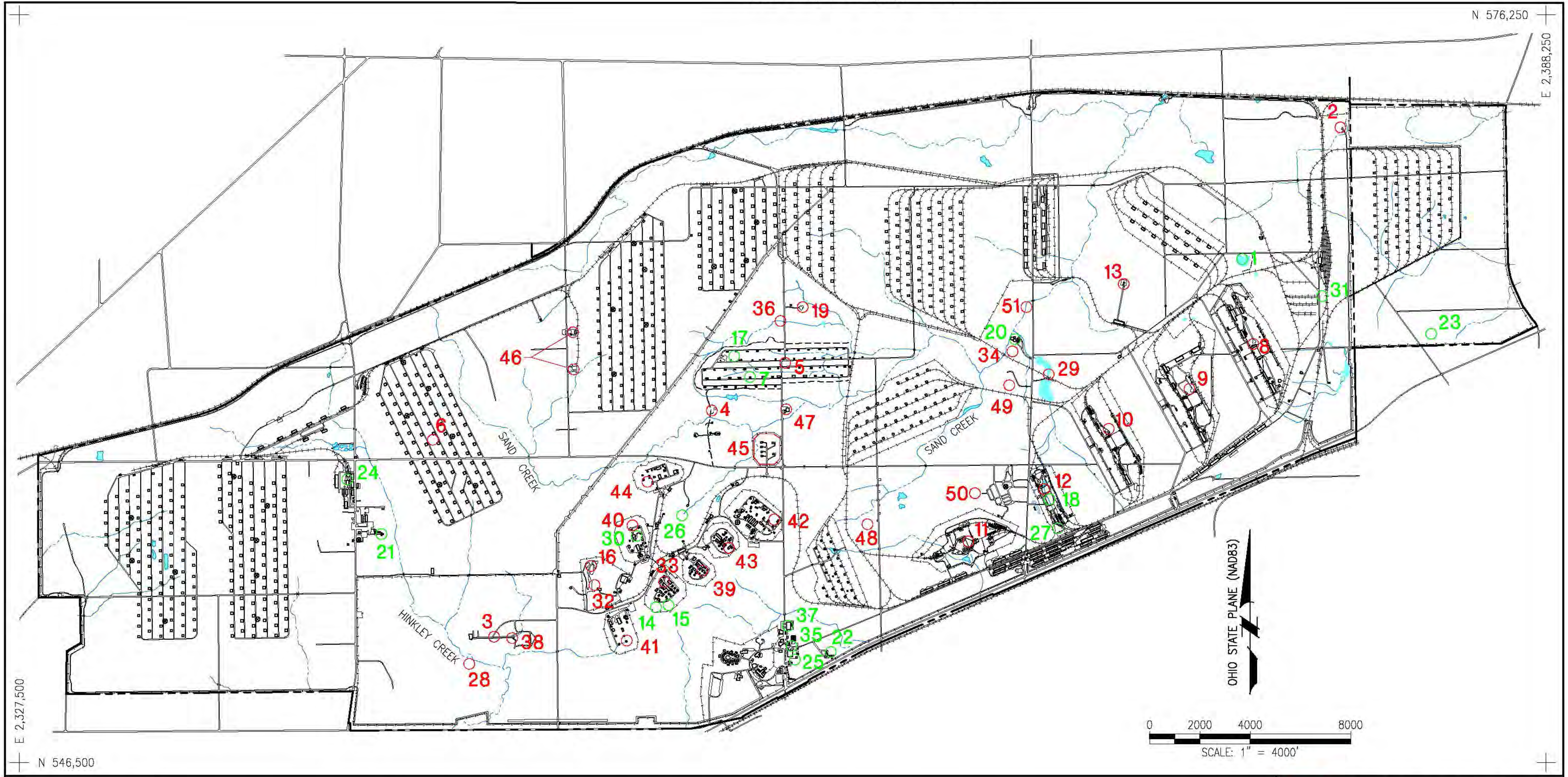

LEGEND OF SITES·

1	RAMSDELL QUARRY LANDFILL
2	ERIE BURNING GROUNDS
3	DEMOLITION AREA 1
4	DEMOLITION AREA 2
5	WINKLEPECK BURNING GROUNDS
6	C BLOCK QUARRY
7	BLDG 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 AND DILUTION/SETTLING POND
13	BLDG 1200 AND DILUTION/SETTLING POND
14	LOAD LINE 6, EVAPORATION UNIT
15	LOAD LINE 6, TREATMENT PLANT
16	QUARRY LANDFILL/FORMER FUZE & BOOSTER BURNING PITS
17	DEACTIVATION FURNACE
18	LOAD LINE 12 PINK WASTE WATER 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	BLDG 1034 MOTOR POOL WASTE OIL TANK
26	FUZE BOOSTER AREA SETTLING TANKS
27	BLDG 854-PCB STORAGE
28	MUSTARD AGENT BURIAL SITE
29	UPPER AND LOWER COBBS 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	1037 BUILDING-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

US Army Corps
of Engineers
Louisville District

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

RAVENNA ARMY AMMUNITION PLANT
RAVENNA, OHIO
FACILITY MAP

DRAWN BY:	REV. NO./DATE:	CAD FILE:
R. BEELER	REV. 0 / 03-14-01	/99035/DWGS/L70RVAP1

Fig. Intro-2. RVAAP Installation Map

Table Intro-1. Areas of Concern at RVAAP

AOC Name		Regulations
1	Ramsdell Quarry Landfill	Other Regulations
2	Erie Burning Grounds	CERCLA
3	Demolition Area #1	CERCLA
4	Demolition Area #2	RCRA/CERCLA
5	Winklepeck Burning Grounds	CERCLA
6	C Block Quarry	CERCLA
7	Bldg 1601 Hazardous Waste Storage	RCRA
8	Load Line 1 and Dilution/Settling Pond	CERCLA
9	Load Line 2 and Dilution/Settling Pond	CERCLA
10	Load Line 3 and Dilution/Settling Pond	CERCLA
11	Load Line 4 and Dilution/Settling Pond	CERCLA
12	Load Line 12 and Dilution/Settling Pond	CERCLA
13	Bldg 1200 and Dilution/Settling Pond	CERCLA
14	Load Line 6, Evaporation Unit	Other Regulations
15	Load Line 6, Treatment Plant	Other Regulations
16	Quarry Landfill/Former Fuze & Booster Burning Pits	CERCLA
17	Deactivation Furnace	RCRA
18	Load Line 12 Pink Waste Water Treatment	Other Regulations
19	Landfill North of Winklepeck Burning Ground	CERCLA
20	Sand Creek Sewage Treatment Plant	Other Regulations
21	Depot Sewage Treatment Plant	Other Regulations
22	George Road Sewage Treatment Plant	Other Regulations
23	Unit Training Site Waste Oil Tank	Other Regulations
24	Reserve Unit Maintenance Area Waste Oil Tank	Other Regulations
25	Building 1034 Motor Pool Waste Oil Tank	Other Regulations
26	Fuze Booster Area Settling Tanks	Other Regulations
27	Bldg 854-PCB Storage	Other Regulations
28	Mustard Agent Burial Site	CERCLA
29	Upper and Lower Cobbs Pond Complex	CERCLA
30	Load Line 7 Pink Wastewater Treatment Plant	Other Regulations
31	ORE Pile Retention Pond	Other Regulations
32	40 and 60 MM Firing Range	CERCLA
33	Load Line 6	CERCLA
34	Sand Creek Disposal Road Landfill	CERCLA
35	1037 Building-Laundry Wastewater Sump	Other Regulations
36	Pistol Range	CERCLA
37	Pesticide Storage Building T-4452	Other Regulations
38	NACA Test Area	CERCLA
39	Load Line 5/Fuze Line 1	CERCLA
40	Load Line 7/Booster Line 1	CERCLA
41	Load Line 8/Booster Line 2	CERCLA
42	Load Line 9/Detonator Line	CERCLA
43	Load Line 10/Percussion Element	CERCLA
44	Load Line 11/Artillery Primer	CERCLA
45	Wet Storage Area	CERCLA
46	Buildings F-15 and F-16	CERCLA
47	Building T-5301 Decontamination	CERCLA
48	Anchor Test Area	CERCLA
49	Central Burn Pits	CERCLA
50	Atlas Scrap Yard	CERCLA
51	Dump along Paris-Windham Road	CERCLA

Confirmatory Sampling of RCRA Closures (RCRA),
Unexploded Ordnance/Ordnance Explosive Waste (UXO/OE) Removal Engineering Evaluation/Cost Analyses, and
Sampling of non-AOC Areas Before Placement of Clean Fill.

The characterization of AOCs at RVAAP will be accomplished using the facility-wide plans that can be customized with addenda for only those elements of the work that are project-specific. This approach reduces costs associated with creating redundant work plan information and accelerates the review of work plans for individual projects. The facility-wide plans address work elements that are expected to be integral to the investigations of all AOCs. The elements of the facility-wide plans are the following:

- **Sampling and Analysis Plan (SAP):** This document details the expected sampling methods, equipment, and procedures; sample custody/documentation requirements; sample packaging, shipping, and handling requirements; generic management of investigation-derived wastes; chemical QC requirements; field documentation; data reporting; and corrective actions. The SAP contains a generic request for authorization under Ohio Administrative Code (OAC) 3745-27-13 to conduct investigative activities necessary to characterize an AOC.

- **Safety and Health Plan (SHP):** This plan identifies the potential hazards and presents a risk analysis for each expected chemical, physical, and biological hazard expected at RVAAP during the performance of the common field tasks. The SHP defines provisions for personal protective equipment, hazard and emergency communication, training, and general safe work practices to be observed by field personnel at RVAAP during environmental investigations.

- **Quality Assurance Project Plan (QAPP):** The QAPP addresses analytical data quality objectives (DQOs) and specific QA/QC procedures to be used in the collection and analyses of anticipated samples. The document identifies the roles and responsibilities of each element of the QA/QC team for a project. The QAPP addresses sampling quality control procedures (e.g., preservation, handling, and custody); analytical holding times; calibration; preventive maintenance; laboratory QC; data quality assessment, data precision, accuracy completeness, sensitivity, representativeness, and compatibility requirements; and data reporting. Because the USACE will continue to fulfill the role of QA administrator for RVAAP, specific USACE guidance will be adopted for environmental investigations at RVAAP.

- The **Environmental Information Management Plan** addresses work elements that follow the field components of IRP and other environmental investigations.

The facility-wide plans cannot be implemented without the accompaniment of investigation-specific addenda (to the FSAP, QAPP, and FSHP, at a minimum). The addenda will contain specific project scope and objectives, sampling rationale and locations, analytical DQOs, analytical laboratory specifications, and the project schedule, as well as specific health and safety precautions and protocols. Sampling procedures not addressed in the FSAP will also be included as appropriate. The addenda will be tiered under the facility-wide plans and used in conjunction with them, to the extent practical. It should be noted that nothing in these facility-wide work plans prevents a user (such as a contracted consulting firm) from modifying specific procedures and standards, according to the goals of the specific investigation, in an RVAAP- and Ohio-EPA reviewed addendum to the FSAP, Facility-wide QAPP, or FSHP, etc.

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1.0 PROJECT DESCRIPTION

1.1 SITE HISTORY AND CONTAMINANTS

The Ravenna Army Ammunition Plant (RVAAP) is located in northeastern Ohio within Portage and Trumbull counties, approximately 4.8 km (3 miles) east–northeast of the town of Ravenna and approximately 1.6 km (1 mile) northwest of the town of Newton Falls. The installation consists of 8668.3 ha (21,419 acres) contained in a 17.7-km (11-mile)-long, 5.6-km (3.5-mile)-wide tract bounded by State Route 5, the Michael J. Kirwan Reservoir, and the CSX System Railroad on the south; State Route 534 on the east; Garrettsville and Berry Roads on the west; and the CONRAIL Railroad on the north. The land use surrounding the installation is primarily farmland with occasional private residences. The installation is surrounded by several local communities: Windham, which borders the installation to the north; Garrettsville, located 9.6 km (6 miles) to the northwest; Newton Falls, 1.6 km (1 mile) to the east; Charleston, bordering the southwest; and Wayland, 4.8 km (3 miles) to the southeast.

RVAAP was established on August 26, 1940 for the primary purpose of loading conventional medium- and large-caliber artillery ammunition; bombs; mines; fuzes and boosters; primers and percussion elements; and for the storage of finished ammunition components. Originally, the installation was divided into two separate units; one was designated the Portage Ordnance Depot with the primary mission of the depot's storage activity, and the other was designated as the Ravenna Ordnance Plant with the primary mission of the ammunition-loading activities.

Over the years, RVAAP handled and stored strategic and critical materials for various government agencies and received, stored, maintained, transported, and demilitarized military ammunition and explosive items. RVAAP maintained the capabilities to load, assemble, and pack military ammunition; however, these operations are inactive. As part of the RVAAP mission, the inactive facilities were maintained in a standby status by keeping equipment in a condition to permit resumption of production within the prescribed time limitations.

RVAAP is a Government-Owned, Contractor-Operated (GOCO) U.S. Army Operations Support Command (OSC) facility. Currently, RVAAP is an inactive facility maintained by a contracted caretaker, Tol-Test, Inc. of Toledo, Ohio. The Atlas Powder Company was the original GOCO manager of the Ravenna Ordnance Depot and operated the plant from 1940 to 1945; the government operated the Portage Ordnance Depot. The last production for World War II was in August 1945. The government assumed operations of both areas from 1945 to 1951 when Ravenna Arsenal Inc. (RAI), a subsidiary of the Firestone Tire and Rubber Co., Akron, Ohio, was contracted to operate the entire facility. In 1982, Physics International Co., a subsidiary of Rockcor Inc., purchased RAI from Firestone. Rockcor Inc. was purchased by Olin Corporation in June 1985. In May 1999, the Ohio Army National Guard assumed administrative control over ~6,880 of the 8,903 ha (~17,000 of the ~22,000 acres) at RVAAP. However, the Areas of Concern (AOCs) and munitions storage areas remain under the control of the U.S. Army OSC.

A brief overview of the history of RVAAP is provided in chronological order to provide a summary of the site's history.

Date	Description of Activity/Facility Status
1940	10,117.5 ha (25,000 acres) purchased by United States Government. Began construction of the plant.
Sep 1940	Operated by Atlas Powder Company.

Dec 1941 to Jan 1942	Facility completed and began operations. Primary mission was depot storage and ammunition ammunition loading. Divided installation into two separate units: Portage Ordnance Depot – depot storage of munitions and components. Ravenna Ordnance Plant – loading ammunition.
Aug 1943	Redesignated as the Ravenna Ordnance Center.
Nov 1945	Redesignated as the Ravenna Arsenal.
1945	Turned over to Ordnance Department.
1946 to 1949	Silas Mason Co. operated the ammonium nitrate line for the production of ammonium nitrate fertilizer.
1950	Plant placed on standby status. Operations limited to renovation, demilitarization, and normal maintenance of equipment and stored ammunition and components.
Apr 1951	RAI contracted to run facility. Subsidiary of Firestone Tire and Rubber Co.
Jul 1954	Plum Brook Ordnance Works of Sandusky, Ohio, and the Keystone Ordnance Works of Meadville, Pennsylvania, were made satellites of Ravenna.
Aug 1957	All at-plant production ended.
Oct 1957	The installation was placed on standby status.
Mar 1958	Plum Brook Ordnance Works ceased to be under the jurisdiction of Ravenna.
Jul 1959	Keystone Ordnance Works was transferred to the General Services Administration.
Oct 1960	Began rehabilitation work to replace facilities in the ammonium nitrate line for the processing and explosive melt-out of bombs.
Jan 1961	Began operations of the processing and explosive melt-out of bombs. First operation of this type in the ammunition industry.
Jul 1961	Plant again deactivated.
Nov 1961	Installation was divided into the Ravenna Ordnance Plant and an industrial section. Entire facility was designated as the RVAAP.
May 1968	RVAAP reactivated in support of the Southeast Asian Conflict for loading, assembling, and packing munitions on three load lines and two component lines.
1971	Operations ceased at Load Lines 1, 2, 3, and 4.
Jun 1973 to Mar 1974	Deactivated major load lines and component line to demilitarization of the M71A1 90MM projectile.
Oct 1982	Physics International Company (a subsidiary of Rockcor Inc.) purchased Ravenna Arsenal Inc. from Firestone.

Jun 1985	Rockcor Inc. was purchased by Olin Corporation.
1992	The RVAAP mission was discontinued, placing the installation on the “Inactive Maintained” status.
Mar 1993	Transfer of RVAAP from “Inactive Maintained” to “Inactive Modified-Caretaker” Status.
Sep 1993	RVAAP was placed in “Modified-Caretaker” Status.
Sep 1993	A Report of Excess determined the load lines and associated real estate as excess to the U.S. Army. The excess area includes approximately 2006.0 ha (4957 acres) and 362 buildings in Load Lines 1 through 12 (excluding 7 and 11), Area 4, and Area 8.
Oct 1993	Mason & Hanger-Silas Mason Co., Inc. took over as the installation’s contractor modified caretaker.
Oct 1997	R+R International became the installation’s contractor modified caretaker.
1998	Salvage and demolition operations commenced at RVAAP. Removal of railroad ties and rails, copper wire, and excess metal for salvage was completed. Demolition of Load Lines 1, 2, and 12 commenced with the removal of all transite (friable asbestos and concrete) siding and roofing.
May 1999	Administrative control of 6,541 ha (16,164 acres) of RVAAP was transferred to the Ohio Army National Guard for use in training and related activities. Seventeen CERCLA AOCs were included in this transfer.
Feb 2000	Tol-Test, Inc. replaced R+R International as contractor-modified caretaker.

Although currently inactive, RVAAP has historically handled hazardous wastes and operated several waste management units in support of their operations (Figure Intro-2). Materials of potentially hazardous nature were stored, treated, deposited in landfills, or burned at the site.

The industrial operations at RVAAP consisted of 12 load lines. Load Lines 1 through 4 were used to melt and load trinitrotoluene (TNT) and Composition B into large-caliber shells and bombs. The operations on Load Lines 1 through 4 produced explosive dust, spills, and vapors that collected on the floor and walls of each building. Periodically, the floor and walls would be hosed down with water and steam. The liquid, containing TNT and Composition B constituents, would be collected in holding tanks, filtered, and pumped to one of four settling ponds. Load Lines 5 through 11 were used to assemble fuzes, primers, and boosters while Load Line 12 housed the ammonium nitrate plant. Potential contaminants in Lines 5 through 11 included lead azide, lead styphnate, black powder, TNT, mercury fulminate, perchlorate, and Composition B. Load Line 12 was operated to produce ammonium nitrate for explosives and fertilizers. According to plant documentation, all residual dusts and spills were washed into the storm drainage system. Demilitarization of munitions later took place at Lead Lines 1 and 12.

Landfills at RVAAP were used to bury waste from industrial operations and sanitary sources. In addition, other burial sites may be located on-site based on historical information. Potential contaminants from these areas include, but are not limited to, explosives, explosive wastes, mustard agent, metals, sodium chloride, and calcium chloride.

Settling and retention ponds at the site collected waste water from munitions washdown operations at various facilities. Potential contaminants associated with the settling and retention ponds include, but are not limited to, explosive compounds, aluminum chloride, and metals.

RVAAP had several areas associated with the burning, demolition, and testing of various munitions. These burning grounds and demolition areas consisted of large areas of land or abandoned quarries for these activities. Potential contaminants at these sites include, but are not limited to, explosives [cyclonite (RDX), HMX, Composition B, TNT, black powder] white phosphorous, antimony sulfide, lead azide, propellant, waste oils, metals, sludge from load lines, various laboratory chemicals, and sanitary waste.

RVAAP has various industrial operations that have been identified as potential sources of contaminants. These operations include sewage treatment, waste water treatment, vehicle maintenance, storage tanks, waste storage areas, equipment storage areas, furnaces, and evaporation units. Contaminants associated with these operations include, but are not limited to, explosives, lead azide, lead styphnate, metals, polychlorinated biphenyls (PCBs), waste oil, and petroleum.

1.2 ENVIRONMENTAL SETTING

1.2.1 Climatic Conditions

The general climate of the RVAAP area is continental and is characterized by moderately warm and humid summers, reasonably cold and cloudy winters, and wide variations in precipitation from year to year. The following climatological data were obtained from the National Weather Service Office (NWS 1995) at the Youngstown-Warren Regional Airport located in Trumbull County and are based on a 30-year average.

Total annual rainfall in the RVAAP area is approximately 93.25 cm (37.3 inches), with the highest monthly average occurring in July [10.2 cm (4.07 inches)] and the lowest monthly average occurring in February [5.0 cm (2.03 inches)]. Average annual snowfall totals approximately 140.5 cm (56.2 inches) with the highest monthly average occurring in January [32.2 cm (12.9 inches)]. It should be noted that due to the influence of lake-effect snowfall events associated with Lake Erie [located approximately 56.3 km (35 miles) to the northwest of RVAAP], snowfall totals vary widely throughout northeastern Ohio.

The average annual daily temperature in the RVAAP area is 48.3 ºF, with an average daily high temperature of 57.7 ºF and an average daily low temperature of 38.7 ºF. The record high temperature of 100 ºF occurred in July 1988, and the record low temperature of -22 ºF occurred in January 1994. The prevailing wind direction at RVAAP is from the southwest, with the highest average wind speed occurring in January [18.7 km (11.6 miles) per hour] and the lowest average wind speed occurring in August [11.9 km (7.4 miles) per hour].

Thunderstorms occur on approximately 35 days per year and are most abundant from April through August. The RVAAP area is susceptible to tornadoes; minor structural damage to several buildings on facility property occurred as the result of a tornado in 1985.

1.2.2 Geologic Setting

1.2.2.1 Unconsolidated deposits

Two glacial advances during the Wisconsin Age of the Pleistocene Epoch resulted in the deposition of glacial till over the entire RVAAP installation. The first glacial advance deposited the Lavery Till over the facility. The Lavery Till consists mostly of clay and silt with a few cobbles and sporadic boulders. The second glacial advance deposited the Hiram Till over the eastern two-thirds of the facility only. The Hiram Till consists of 12 percent sand, 41 percent silt, and 47 percent illite and chlorite clay minerals, and ranges in depth from 1.5 to 4.6 m (5 to 15 feet) below ground surface (bgs). The Hiram Till overlies thin beds of sandy outwash material in the far northeastern corner of the facility. Field observations indicate that overall till thickness is less than 0.6 m (2 feet) in some areas of the RVAAP facility. The reduced till thickness may be due to natural erosion or construction grading operations and is not necessarily the result of deposition.

A buried glacial valley, oriented in a southwest–northeast direction is suspected to occur in the central portion of the facility. This valley is filled with glacial outwash consisting of poorly sorted clay, till, gravel, and silty sand. Depths of unconsolidated sediments in the valley range from 30.5 to 61 m (from 100 to 200 feet) BGS. However, bedrock outcrops have been documented in the same area, so the existence of a buried valley in this location cannot be confirmed.

1.2.2.2 Bedrock

The bedrock geology of RVAAP consists of Carboniferous Age sedimentary rocks that lie stratigraphically beneath the glacial deposits of the Lavery and Hiram tills. The oldest bedrock within the facility is the Cuyahoga Formation of the Mississippian Age. Three members comprise this formation: (1) the Orangeville Shale, (2) the Sharpsville Sandstone, and (3) the Meadville Shale. The Cuyahoga outcrops in the far northeastern corner of the facility and generally consists of a blue-gray silty shale with interbedded sandstone. The regional dip of the Cuyahoga strata is between 1.5 and 3.0 m (5 and 10 feet) per mile to the south.

The remainder of the facility is underlain by bedrock associated with the Pottsville Formation of Pennsylvanian Age. The Pottsville Formation, which lies unconformably on an erosional surface of the Cuyahoga Formation, is divided into four members: (1) the Sharon, (2) the Connoquenessing Sandstone, (3) the Mercer, and (4) the Homewood Sandstone. The Sharon Member consists of two individual units: the Sharon Conglomerate and the Sharon Shale. The Sharon Conglomerate is a porous, coarse-grained, gray-white sandstone that often exhibits thin layers of milky white quartz pebbles. The Sharon Conglomerate also has locally occurring thin shale lenses in the upper portion of the unit. Due to the differences in lithology between the Sharon Conglomerate and the underlying shales of the Cuyahoga Formation, the contact between the Pottsville and Cuyahoga Formations usually is quite distinct. The Sharon Shale overlies the Sharon Conglomerate and consists of sandy, gray-black, fissile shale with some plant fragments and thin flagstone beds. Sharon sandstones are exposed on the ground surface at Load Line 1 and the former Ramsdell Quarry.

The Connoquenessing Sandstone member of the Pottsville Formation unconformably overlies the Sharon Member and is a medium- to coarse-grained, gray-white sandstone with more feldspar and clay than the Sharon Conglomerate. Thin interbeds and partings of sandy shale also are common in the Connoquenessing. The Mercer member of Pottsville Formation overlies the Connoquenessing and consists of silty to carbonaceous shale with abundant thin, discontinuous sandstone lenses in the upper portion. Regionally, the Mercer also has been noted to contain interbeds of coal. The Homewood Member of the Pottsville Formation unconformably overlies the Mercer member and consists of coarse-grained crossbedded sandstones that contain discontinuous shale lenses.

The Connoquenessing, Mercer, and Homewood members are present only in the western half of the RVAAP facility. The Sharon Conglomerate unit is the upper bedrock surface in most of the eastern half. The regional dip of the Pottsville Formation strata is between 1.5 and 3.5 m (5 and 10 feet) per 1.6 km (1.0 mile) to the south.

1.2.3 Hydrologic Setting

1.2.3.1 Unconsolidated sediments

The largest groundwater supplies within Portage County come from two buried valleys that underlie Franklin, Brimfield, and Suffield townships and Streetsboro, Shalersville, and Mantua townships, respectively. The sand and gravel within these buried valleys are favorably situated to receive recharge from surface streams and surface infiltration. The water-bearing characteristics for the sand and gravel aquifers in the vicinity of the RVAAP installation are poorly documented. Wells that penetrate these aquifers can yield up to 6,080 liters per minute (LPM) [1,600 gallons per minute (GPM)]. However, yields from wells penetrating silty or clay till materials are significantly lower. In general, the Lavery and Hiram tills are too thin and impermeable to produce useful quantities of water.

1.2.3.2 Bedrock

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

The Sharon Conglomerate is the primary source of groundwater at RVAAP and maintains the most significant well yields of the Pottsville Formation members with hydraulic conductivity values of from 19 to 7,600 liters per day per meter (LPD/m) [from 5 to 2,000 gallons per day per foot (GPD/ft)]. Past studies of the Sharon Conglomerate indicate that the highest yields are associated with the true conglomerate phase (coarse-grained sandstone with abundant quartz pebbles) and with joints and fractures in the bedrock; however, there is no facility-specific information available regarding variations in aquifer properties due to these factors. Where present, the overlying Sharon Shale acts as a relatively impermeable confining layer for the Sharon Conglomerate. Several flowing artesian production wells have been noted at the facility.

The Connoquenessing Sandstone and the Homewood Sandstone are the remaining aquifers of the Pottsville Formation and exhibit hydraulic conductivities of from 19 to 1,140 LPD/m (from 5 to 300 GPD/ft) and from 19 to 760 LPD/m (from 5 to 200 GPD/ft), respectively. Well yields in the Connoquenessing and Homewood sandstones, although lower than the Sharon Conglomerate, are high enough to provide significant quantities of water. Several wells at the RVAAP facility have penetrated both the Sharon Conglomerate and the Connoquenessing Sandstone and reportedly produced water from both units.

In general, hydraulic conductivities in the shales of the Sharon and Mercer members of the Pottsville Formation are low and result in insignificant groundwater yields. The primary porosity of the shales is likely secondary, owing to joints and fractures in the bedrock; however, there is no facility-specific information available regarding the occurrence of joints and fractures in these units.

1.2.3.3 Surface water

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

The western and northern portions of the RVAAP facility display low hills and a dendritic surface drainage pattern. The eastern and southern portions are characterized by an undulating to moderately level surface, with less dissection of the surface drainage. The facility is marked with marshy areas and flowing and intermittent streams whose headwaters are located in the facility's hills. Three primary water courses drain RVAAP: (1) the South Fork of Eagle Creek, (2) Sand Creek, and (3) Hinkley Creek (see Figure Intro-2). All of these water courses have many associated tributaries.

Sand Creek, with a drainage area of 36 km^2 (13.9 $miles^2$), flows generally in a northeast direction to its confluence with the South Fork of Eagle Creek. In turn, the South Fork of Eagle Creek then continues in a northerly direction for 4.3 km (2.7 miles) to its confluence with Eagle Creek. The drainage area of the South Fork of Eagle Creek is 67.8 km^2 (26.2 $miles^2$), including the area drained by Sand Creek. Hinkley Creek originates just southeast of the intersection between State Routes 88 and 303 to the north of the facility. Hinkley Creek, with a drainage area of 28.5 km^2 (11.0 $miles^2$), flows in a southerly direction through the installation to its confluence with the West Branch of the Mahoning River south of the facility.

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

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

1.2.3.4 Groundwater utilization

All groundwater utilized at the RVAAP facility during past operations was obtained from on-site production wells, with the majority of wells screened in the Sharon Conglomerate. Production wells scattered throughout the facility provided necessary sanitary and process water for RVAAP operations. All remaining process production wells were permanently abandoned in 1992. Currently, only two groundwater production wells remain in operation. These wells, located in the central portion of the facility, provide sanitary water to the remaining site personnel.

Residential groundwater use in the surrounding area is similar to that for RVAAP, with the Sharon Sandstone acting as the major producing aquifer in the area. The Connoquenessing Sandstone and the Homewood Sandstone also provide limited groundwater resources, primarily near the western half of the RVAAP facility. Many of the local residential wells surrounding RVAAP are completed in the unconsolidated glacial material.

The *Ground Water Pollution Potential of Portage County* published by the Ohio Department of Natural Resources (1991) provides additional insight into the groundwater characteristics of the RVAAP area. This map indicates the relative vulnerability of groundwater in a specific area to contamination from surface sources. Intended primarily as a groundwater resource management and planning tool, the Ground Water Pollution Potential Map presents index values based on several hydrogeologic criteria including depth to water, hydraulic conductivity, topography, and others. Resulting index values range from a low pollution potential (zero) to a high pollution potential (200+).

Based on this mapping system, the majority of the RVAAP facility has a moderate pollution potential that ranges between 100 and 159, depending on location. In addition, three general hydrogeologic settings are defined for RVAAP and include: (1) glacial till overlying bedded sedimentary rock, (2) glacial till overlying sandstone, (3) and alluvium overlying bedded sedimentary rock. In general, the highest pollution potential values at RVAAP occur in the areas where alluvium overlies bedded sedimentary rock (index range of from 140 to 159); these areas occur primarily in the northeast portion of the facility. The majority of RVAAP has pollution potential indices that range between 100 and 139.

1.2.3.5 Surface water utilization

Past and present surface water utilization at RVAAP generally was limited to use by wildlife and recreational users. Although some surface water may have been used intermittently for various facility operations, the vast majority of process water was provided by on-site groundwater production wells. There is no available documentation that indicates any past irrigation or other agricultural use of surface water sources on facility property. It is likely that some agricultural use of surface water was conducted in this area before facility construction due to the presence of homesteads and farms at that time. On-site recreational surface water use was limited to managed fishing programs conducted in the past. RVAAP has recently re-instituted a catch-and-release fishing program. Based on conversations with site personnel, it is likely that some recreational trespasser use of surface water does occur on a limited basis.

The major surface water drainages at RVAAP all exit facility property and eventually flow into the Mahoning River to the east. Surface water from Sand Creek, which flows to the northeast across the facility, joins the South Fork of Eagle Creek, which flows to the east inside the northern property boundary. The South Fork of Eagle Creek continues to the east until it eventually discharges to the Mahoning River. It is possible that limited agricultural and recreational use of the South Fork of Eagle Creek does occur off of facility property, although no data are available to allow a more detailed study. Hinkley Creek, which enters facility property from the north and flows to the south across the western portion of RVAAP, eventually discharges to the West Branch of the Mahoning River (and the West Branch Reservoir) south of State Route 5. It is doubtful that Hinkley Creek is used for any agricultural purposes, although limited recreational use may occur.

1.2.4 Air Quality for Surrounding Area

The RVAAP facility is located in a rural area and has air quality that generally can be described as good. Based on a southwesterly prevailing wind direction, the city of Akron [located 37 km (23 miles) to the south-southwest] is the nearest significant upwind urban area. Currently, there are no significant airborne emissions from RVAAP due to its inactive status. In addition, there is no operating air monitoring program in place at the facility at this time. There are no significant documented air pollution sources in close proximity to facility property that would affect air quality at RVAAP.

1.2.5 Ecological Setting

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

The flora and fauna present at RVAAP are varied and widespread. A total of 18 plant communities have been identified on facility property, including marsh, swamp, and forest communities. Twelve plant types listed as State Potentially Threatened have been identified at RVAAP including:

- Gray Birch,
- Round-leaved Sundew,
- Closed Gentian,
- Butternut,
- Blunt Mountain-mint,
- Northern Rose Azalea,
- Large Cranberry,
- Hobblebush,
- Fox Grape,
- Woodland Horsetail,
- Long Beech Fern, and
- Eel Grass.

In addition to being listed as a State Potentially Threatened Plant species, the Butternut also is listed as a Federal Candidate (Category 2) species.

A large number of animal species have been identified on facility property, including 26 species of mammals, 143 species of birds, and 41 species of fish. Animal species listed as Ohio State Endangered (1993 inventory) include the Northern Harrier, the Common Barn Owl, the Yellow-bellied Sapsucker, the Mountain Brook Lamprey, and the Graceful Underwing. Several animal species present at RVAAP also are listed as Ohio State Special Concern:

- Woodland Jumping Mouse,
- Solitary Vireo,
- Sharp-shinned Hawk,
- Sora,
- Virginia Rail,
- Four-toed Salamander,
- Smooth Green Snake,
- River Otter,
- Pygmy Shrew,
- Star-Nosed Mole,
- Red-Shouldered Hawk,
- Henslow’s Sparrow,
- Cerulean Warbler,
- Common Moorhen, and
- Eastern Box Turtle.

There is no documentation available to determine if any of the above animal or plant species have been affected by past facility operations. Future Installation Restoration Program (IRP) activities will require consideration of these species to ensure that detrimental effects on threatened or endangered RVAAP flora and fauna do not occur. There are no federal, state, or local parks or protected areas on RVAAP facility property.

1.3 SUMMARY OF EXISTING SITE DATA

During the last 30 years, multiple environmental-related investigations were conducted at RVAAP. A brief summary of these investigations is provided below.

Date	Description of Investigation
1978	U.S. Army Toxic and Hazardous Materials Agency (USATHAMA) conducted an Installation Assessment of RVAAP and concluded that no migration of contamination to groundwater had occurred at the installation (USATHAMA 1978).
1982	Reassessment by USATHAMA also concluded that no migration of contamination to groundwater had occurred (USATHAMA 1982).
1988	The U.S. Army Environmental Hygiene Agency (USAEHA) conducted a groundwater contamination survey and an evaluation of Solid Waste Management Units (SWMUs). Twenty-nine potentially contaminated SWMUs were identified. Further investigation was recommended for 15 of the 29 SWMUs to determine if contaminants had migrated from these units.
1989	The U.S. Environmental Protection Agency (EPA) contracted Jacobs Engineering to perform a Resource Conservation and Recovery Act (RCRA) Facility Assessment (RFA) – Preliminary Review and Visual Site Inspection (USEPA 1989). The report identified 31 SWMUs, 13 of which were recommended for no further action (NFA). These 31 SWMUs are listed as sites in the Restoration Management Information System (RMIS).
1992	USAEHA conducted a hydrogeologic study of the Open Burning/Open Detonation (OB/OD) areas as part of a response to a Notice of Deficiency issued by Ohio EPA regarding the installation's RCRA Part B permit application. Minor amounts of contamination were reported at these areas.
1994	USAEHA performed a Preliminary Assessment Screening (PAS) of the Boundary Load Line areas at RVAAP and provided a Statement of Findings to support a Record of Environmental Considerations along with recommendations for additional activities at these sites.
1996	The U.S. Army Corps of Engineers (USACE) performed a facility-wide preliminary assessment covering all known environmental sites at RVAAP.
1996	USACE developed a Facility-wide Sampling and Analysis Plan (FSAP) and Facility-wide Safety and Health Plan (FSHP) for conducting investigations at Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) AOCs at RVAAP.
1996	USACE conducted Phase I Remedial Investigations of 11 areas of concern. These AOCs were Load Lines 1–4, Load Line 12, Winklepeck Burning Grounds, Landfill North of Winklepeck Burning Grounds, Building 1200, Demolition Area #2, Upper and Lower Cobbs Ponds, and Load Line 12 Pink Wastewater Treatment Plant.
1997	USACE conducted a field investigation to support RCRA and other clean closures at the following SWMUs: Building 1601, Open Burning Area (Pad #37 at Winklepeck Burning Grounds), Open Detonation Area (in Demolition Area #2), Deactivation Furnace Area (Pad #45 at WBG), and the Pesticides Building S-4452.

1998 USACE conducted a Phase II Remedial Investigation at Winklepeck Burning Grounds, including baseline human health and ecological risk assessments.

1998 USACE performed a groundwater investigation at Ramsdell Quarry Landfill.

1998 USACHPPM performed Relative Risk Site Evaluations at several known or suspected former waste disposal sites. These included Erie Burning Grounds, NACA Test Area, and Demolition Area #1, among others, and resulted in the establishment of 13 additional AOCs.

1999 USACE performed Phase I Remedial Investigations at Erie Burning Grounds, NACA Test Area, and Demolition Area #1. They also completed the installation of monitoring wells for the Phase II RI at Load Line 1.

2000 U.S. Army OSC performed a Phase I Remedial Investigation and Interim Removal Action (IRA) at Load Line 11.

2000 U.S. Army OSC performed an Unexploded Ordnance (UXO) Removal and Site Restoration at a portion of Demolition Area #2.

2000 USACE performed Phase II Remedial Investigations at Load Line 12 and Load Line 1.

2000 USACE performed a biological assessment at Winklepeck Burning Grounds to support a feasibility study.

2000 An IRA of Building T-5301 was conducted, and the Pesticide Building was closed.

2000 USACE performed a field investigation to support the Feasibility Study at Winklepeck Burning Grounds.

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2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

This Facility-wide Field Sampling Plan (FSAP) presents project organization and responsibility from a generic perspective because of the global nature of the plan with respect to the anticipated multiple investigations that are expected to be performed under the FSAP at RVAAP. The project organization and responsibilities identified here are based on the generic functional roles necessary to implement the field activities described in the FSAP and do not include specific names of organizations or individuals. Project-specific organization and responsibilities will be included in each investigation-specific SAP addendum to identify individual responsibilities and any new roles that may be appropriate for a specific investigation. It is expected, however, that USACE Louisville District will continue to fulfill the role of laboratory data Quality Assurance Administrator for all environmental projects.

The organization chart shown in Figure 2-1 outlines the generic management structure that will be used to implement field investigations at RVAAP. The functional responsibilities of key personnel are described in the following parts of this section. Specific assignment of personnel to each of these positions will be made before each specific investigation and will be based on a combination of (1) experience in the type of work to be performed, (2) experience working with government personnel and procedures, (3) a demonstrated commitment to high quality, and (4) staff availability.

2.1 CONTRACTOR PROGRAM MANAGER

The Contractor Program Manager ensures the overall management and quality of all projects performed at RVAAP under the general contract. This individual will ensure that all project goals and objectives are met in a high-quality and timely manner. Quality assurance and nonconformance issues will be addressed by this individual, in coordination with the Project Manager, for corrective action.

2.2 CONTRACTOR PROJECT MANAGER

The Contractor Project Manager has direct responsibility for implementing a specific project, including all phases of work plan development, field activities, data management, and report preparation. This individual will also provide the overall management of the project, and serve as the technical lead and principal point of contact with the USACE Louisville District, RVAAP, or other U.S. Army Project Manager. These activities will involve coordinating all personnel working on the project, interfacing with U.S. Army project personnel, and tracking project budgets and schedules. The Contractor Project Manager will also develop, monitor, and fill project staffing needs, delegate specific responsibilities to project team members, and coordinate with administrative staff to maintain a coordinated and timely flow of all project activities. The Project Manager reports directly to the Program Manager.

2.3 CONTRACTOR QA/QC OFFICER

The Contractor Quality Assurance/Quality Control (QA/QC) Officer is responsible for the project QA/QC in accordance with the requirements of the Facility-wide Quality Assurance Project Plan (QAPP), the project-specific QAPP addendum, and appropriate management guidance. This individual, in coordination with the Contractor Field Contractor Quality Control (CQC) Officer, will be responsible for participating in the project field activity readiness review; approving variances before work proceeds; approving, evaluating, and documenting the disposition of Nonconformance Reports (NCRs); overseeing and

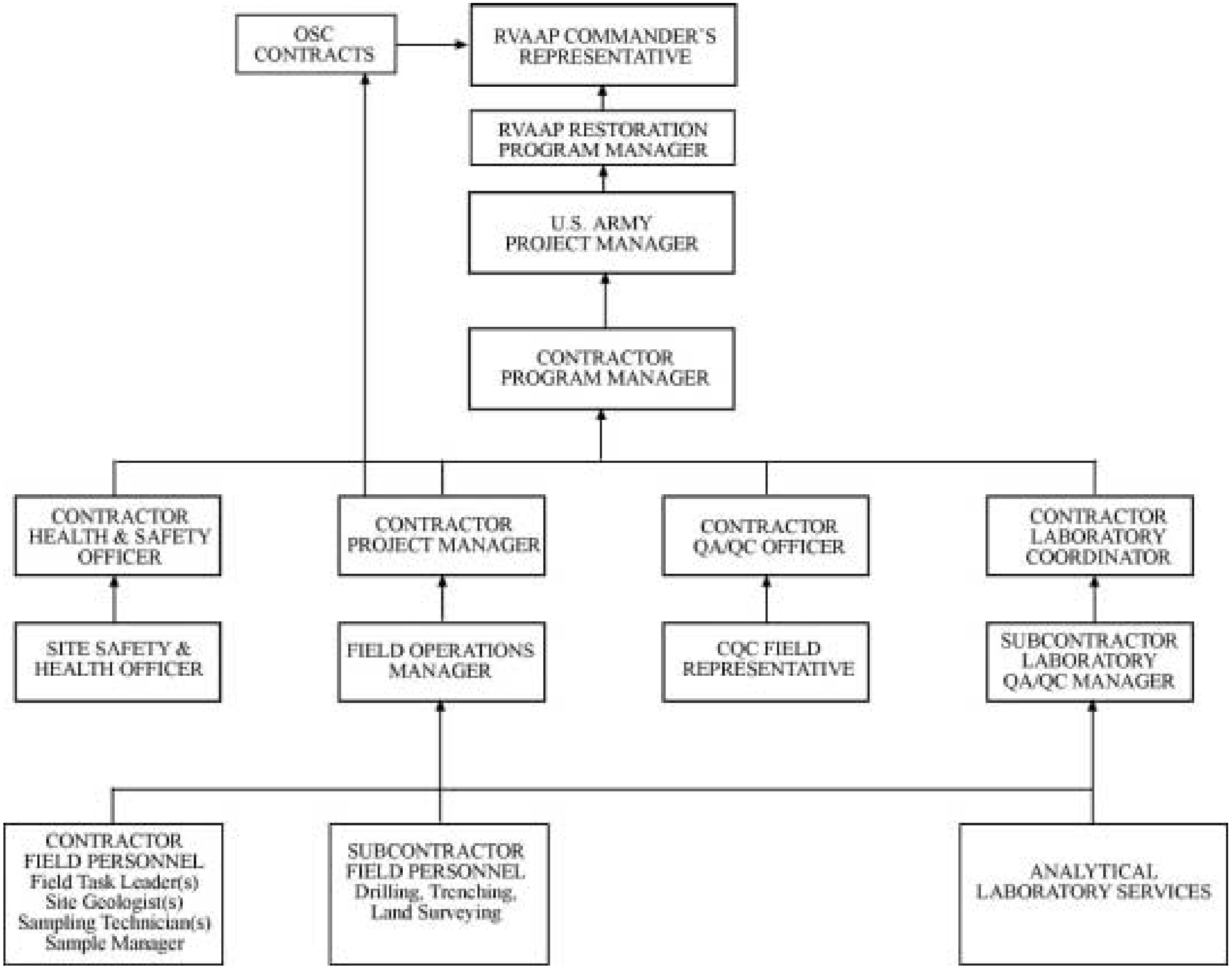

Figure 2-1. Generic Project Organization Chart for RVAAP AOC-Specific Investigations

approving any required project training; and designing audit and surveillance plans followed by supervision of these activities. This individual and the field CQC officer report directly to the Program Manager, but they will inform the Project Manager of all information and decisions reported.

2.4 CONTRACTOR HEALTH AND SAFETY OFFICER

The Contractor Health and Safety Officer (HSO) will ensure that health and safety procedures designed to protect personnel are maintained throughout all field activities conducted at RVAAP. This will be accomplished by strict adherence to the FSHP, which has been prepared as a companion document to this FSAP, and the project-specific Site Safety and Health Plan (SSHP), which has been prepared as an addendum to the FSHP for each investigation. This individual, in coordination with the Site Health and Safety Officer (SHSO), will have the authority to halt field work if health and/or safety issues arise that are not immediately resolvable in accordance with the FSHP and the project-specific SSHP addendum. This individual and the SHSO report directly to the Contractor Program Manager, but they will inform the Contractor Project Manager of all information and decisions reported.

2.5 SUBCONTRACTOR LABORATORY QA/QC MANAGER

Analytical laboratories will be subcontracted for each investigation to perform off-site chemical analysis for media sampled. All subcontract laboratory support shall be USACE Ohio River District validated. The subcontracted laboratory’s QA/QC Manager is responsible for the laboratory QA/QC in accordance with the requirements of the Facility-wide QAPP and the project-specific addendum. In coordination with the Contractor Laboratory Coordinator, this individual will be responsible for handling and documenting samples received by the laboratory, ensuring that all samples are analyzed in accordance with required and approved methodologies, ensuring that instrument calibration is performed properly and documented, ensuring that field and internal laboratory QC samples are analyzed and documented, and ensuring that all analytical results for both field and QC samples are reported in the format required in the QAPP. The subcontracted laboratory QA/QC Manager is also responsible for ensuring that laboratory NCRs are processed in a timely manner and for making decisions regarding cost and schedule related to processing of NCRs and implementation of Corrective Action Report (CAR) recommendations and/or requirements. This individual reports directly to the Laboratory Coordinator, but he or she will inform the Project Manager of all information and decisions reported.

2.6 CONTRACTOR LABORATORY COORDINATOR

The Contractor Laboratory Coordinator is responsible for coordination of sample collection and subsequent laboratory analysis in accordance with the requirements of the FSAP and Facility-wide QAPP and their project-specific addenda. This individual will be responsible for obtaining required sample containers from the laboratory for use during field sample collection, resolving questions the laboratory may have regarding QAPP requirements and deliverables, and preparing a quality assessment report for sample data package deliverables received from the laboratory. This individual reports directly to the Contactor Program Manager, but he or she will inform the Contractor Project Manager of all information and decisions reported.

2.7 CONTRACTOR FIELD OPERATIONS MANAGER

The Contractor Field Operations Manager is responsible for implementing all field activities for a specific investigation in accordance with the FSAP and Facility-wide QAPP and their project-specific addenda. This individual will be responsible for ensuring technical performance of all field sampling activities; adherence to required sample custody and other related QA/QC field procedures; coordination of field subcontractor personnel activities; management of project investigation-derived wastes (IDW); QA checks of all field documentation; and preparation of Field Change Orders (FCOs), if required. This individual reports directly to the Contractor Project Manager except with regard to QA/QC matters that are reported directly to the Contractor QA/QC Officer.

2.8 CONTRACTOR FIELD PERSONNEL

In addition to the Field Operations Manager, other contractor field personnel participating in the implementation of field activities will be the Field Team Leader(s), Site Geologist(s), Sampling Technician(s), and Sample Manager. These individuals, in coordination with field subcontractor personnel, will be responsible for performing all field sampling activities in accordance with the FSAP and FSHP and their project-specific addenda. These individuals report directly to the Field Operations Manager.

2.9 SUBCONTRACTOR FIELD PERSONNEL

Contractors will subcontract various companies to provide field support services during the implementation of specific investigations at RVAAP. The primary support services anticipated will be drilling (soil borings and monitoring wells), trenching, and land surveying. Subcontractor field personnel, in coordination with contractor field personnel, will be responsible for performing their specific scope of services as identified in the project-specific SAP addenda. Field personnel assigned by the subcontractors to each project will be qualified and experienced to perform the scope of their work, and these personnel will be required to review and comply with both the FSAP and FSHP and their project-specific addenda. The scope of work to be performed by each subcontractor will be documented in the subcontract agreements with each organization along with equipment and material requirements and experience and qualifications of the assigned personnel. All subcontractor field personnel report directly to the Field Operations Manager, who will be responsible for ensuring that all subcontractor activities comply with project requirements.

3.0 SCOPE AND OBJECTIVES

3.1 FACILITY-WIDE SCOPE AND OBJECTIVES

The scope of the FSAP is to define, to the extent practical, generic methods and procedures for field sampling activities that are expected to be used during the investigation of all AOCs at RVAAP. Based on the similarity of the former waste-generating operations, the chemicals of potential concern (COPCs), and the media of concern expected at each AOC to be investigated, it is anticipated that several field sampling methodologies will be utilized repeatedly during the investigation of all AOCs. Consequently, these sampling activities are addressed in the FSAP and will be applied, as appropriate and with the use of project-specific SAP addenda, during the investigation of all AOCs. Based on the current understanding of AOCs at RVAAP, the primary media of concern will be soil (surface and subsurface) and sediment, groundwater, and surface water. The FSAP will address sampling methods and procedures for monitoring well installation and groundwater sampling (Section 4.3); subsurface soil sampling (Section 4.4); surface soil and sediment sampling (Section 4.5); and surface water sampling (Section 4.6). The FSAP also defines generic protocols for sample chain of custody/documentation (Section 5.0); sample packaging and shipping (Section 6.0); IDW (Section 7.0); contractor chemical quality control (Section 8.0); daily chemical quality control reports (Section 9.0); corrective actions (Section 10.0); and project schedule (Section 11.0), which can be applied to all investigations at RVAAP. The FSAP contains two supporting appendices: Appendix A, Data Standards for Corps Environmental Restoration; and Appendix B, Ohio Administrative Code (OAC) 3745-27-13 Generic Authorization Request.

This FSAP has been developed in accordance with requirements established in the USACE guidance documents *Requirements for the Preparation of Sampling Analysis Plans*, EM 200-1-3, September 1994, *Monitoring Well Design, Installation, and Documentation at Hazardous and/or Toxic Waste Sites*, EM 1110-1-4000, August 1994 (USACE 1994b; USACE 1994a), and Ohio EPA's *Technical Guidance Manual for Hydrogeologic Investigations and Groundwater Monitoring* (1995). Requirements for environmental sampling of various media are contained in EM 200-1-3, Appendices C, E, and F, and were used as general guidelines for developing sampling methods and procedures (environmental and field QC), sample handling (preparation and shipping), field and sample documentation, and equipment decontamination procedures. Requirements for monitoring well installation, including drilling, construction, development, purging/sampling, documentation, and abandonment, are contained in EM 1110-1-4000 and were used as general guidelines for developing these procedures.

The objective of the FSAP is to provide overall guidance for the performance of types of sampling activities identified herein; however, because of the generic nature of the FSAP, its use relative to a project-specific investigation must be accompanied by an investigation-specific FSP addendum to ensure the successful implementation of each project-specific work plan. The FSP addenda will be tiered under the FSAP and will address project-specific scope and objectives, sampling approach and rationale, data uses, project-specific sampling methods and procedures or deviations not covered in the FSAP, specific IDW requirements, and any project-specific details not included in the FSAP. Each project-specific SAP addendum will be developed following EM 200-1-3 and will be approved by the Ohio EPA and the U.S. Army before implementation. The Ohio EPA has review and comment authority on all documents submitted under the Defense-State Memorandum of Agreement (DSMOA).

The scope and objectives of each AOC-specific investigation will be developed based on EPA guidance for data quality objectives (DQOs) specified in *Data Quality Objectives Process For Superfund, Interim Final Guidance,* EPA/540/G-93/071, September, 1993 (USEPA 1993). The SAP addenda will define project-specific scope and objectives, sampling rationale and approach, and data quality needs to support decisions to be made using the data collected during each investigation. Project DQOs will be developed to tier under the Facility-wide DQOs presented in the following paragraphs.

3.2 FACILITY-WIDE DATA QUALITY OBJECTIVES

As part of the Facility-wide approach to environmental investigation activities at RVAAP, Facility-wide DQOs have been developed. The DQO process is a tool to guide investigations at CERCLA sites. Although not all AOCs at RVAAP are CERCLA sites, this model still has relevance for decision-makers. The DQOs serve two major purposes: (1) to present the facility-wide approach to sampling at the installation, and (2) to present the process that will be used to develop AOC-specific sampling and analysis plans. The stages of the DQO development process are:

- develop the conceptual site model,
- state the problem,
- identify decisions to be made,
- define the study boundaries,
- develop the decision rule (if/then),
- identify inputs to the decision (data uses and data needs),
- specify limits on uncertainty, and
- optimize the sample design.

3.2.1 Conceptual Site Model

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

A preliminary conceptual model for RVAAP has been developed using available information. Portions of the conceptual model are described in detail in other sections of this plan. Aspects of the conceptual model that are important for sampling design are noted below. Perhaps of more importance than what is known, are the uncertainties that must be addressed by the field sampling efforts. Available information indicates:

- Surface geology across the site is highly variable. Glacial overburden ranges in depth from approximately 1.5 m (5 feet) (Hiram Till in the eastern portion of the installation) to 12.2 m (40 feet) (Lavery Till in the western portion). Bedrock outcroppings have been noted in the southeastern portion of the site. The till is reported to be somewhat impermeable, with hydraulic conductivities thought to be greater than 10^{-6} cm/sec. Additional hydraulic conductivity testing is needed to evaluate the highly variable conditions of the surficial material.

- A burial glacial valley filled with sand and gravel potentially exists in the central portion of the installation, oriented in a southwest-northeast direction. The presumed depth of the valley ranges from 30.5 to 60.7 m (100 to 200 feet).

- The variable nature of the till combined with the topography of the site results in a complex surface water system on the installation.

  - The South Fork of Eagle Creek and Sand Creek drain much of the installation. The creeks converge and exit the installation in the northeast. AOCs in the central portion of the site (e.g., Demolition Area #2) and upper and lower Cobbs Ponds likely feed this drainage system. This system flows east to the West Branch of the Mahoning River, which eventually flows south to the M.J. Kirwan Reservoir.

  - Hinkley Creek in the western potion of the site drains due south. The AOC of greatest concern along Hinkley Creek is Demolition Area #1.

  - Drainage from the main load lines appears to flow east and southeast. The southeastern portion of the site is swampy, even in the summer months. Drainages to the south flow into the M.J. Kirwan Reservoir.

  - Approximately 50 ponds are scattered throughout the installation. Many of these ponds have acted as settling basins over the years. The ponds appear to support an abundance of wildlife and fish.

- Because of the somewhat impermeable nature of the till, it is suspected that a large percentage of rainfall exits the installation via the surface drainages.

- Information is sparse on the exact nature of the groundwater underlying the AOCs at the installation, with the exception of areas managed under RCRA [e.g., open detonation (OD) and former open burning (OB) Areas], Ohio Solid Waste Regulations (Ramsdell Quarry Landfill), AOCs with monitoring wells (Winklepeck Burning Grounds, Load Line 1), and the 14 background monitoring wells installed across the RVAAP facility. Groundwater as shallow as 0.61 m (2 feet) bgs has been detected in portions of the site. It is not known whether shallow groundwater is perched or continuous.

- The sand and gravel aquifers associated with the buried valleys are a major source of potable water in the local area and can yield up to 6,080 liters (1,600 gallons) per minute. Little is known about the precise connection between the AOCs at RVAAP and these valleys.

- Bedrock formations in the area are also a source of potable water, with the Pottsville Formation representing the largest bedrock aquifer. Hydraulic conductivities range from 19 to 760 LPD/m (5 to 2000 GPD/ft) in the bedrock aquifers. Sandstone of the Pottsville Formation is exposed at Ramsdell Quarry Landfill and Load Line 1, and underlies much of the eastern and northeastern portion of the facility.

- Major COPCs include explosive-related chemicals [TNT, dinitrotoluene (DNT), RDX], propellants (nitroglycerine, nitroguanidine, and nitrocellulose) and metals (arsenic, aluminum , barium, cadmium, chromium, lead, mercury, silver, selenium, and zinc). Additional chemicals have been identified at some AOCs, including PCBs and manganese. Most of the COPCs are relatively insoluble, tend to adsorb to soil particles rather than dissolve into water, and are relatively long-lived.

- Currently, the facility is not accessible to the public. The Ohio National Guard controls and regularly uses approximately 6,541 ha (16,164 acres) of the site for training exercises and are negotiating for the remaining acreage. The most likely pathway of exposure to off-site receptors is via chemical migration through the surface water and groundwater systems.

3.2.2 Define the Problem

The problem to be addressed at RVAAP is that hazardous contaminants from past waste disposal activities may be posing a current or future risk on-site via direct contact with environmental media; off-site receptors via contaminant migration to off-site receptors; and ecological receptors.

3.2.3 Remedial Action Objectives

A major goal of implementing the DQO process is to ensure that all data critical for decision making are collected as part of the field investigations. This should include data necessary for selecting and implementing a cost-effective remedial action if such an action is required. For example, if an impermeable cap is a probable remedial technology, data should be collected to characterize the potential for subsurface lateral groundwater flow. During the planning for investigation of each AOC, potential remedies will be identified. This will ensure that all data necessary for a Feasibility Study, should one be necessary, are available.

3.2.4 Identify Decisions

Table 3-1 presents key decisions that need to be made with regard to investigation data collection at RVAAP. Primary decisions are upper-tier decisions that drive subsequent field investigations. Secondary decisions are more specific to the RVAAP site. In planning for each AOC, specific decisions for that AOC will be identified.

Table 3-1. Key Decisions for RVAAP Investigations

Decision Number	Primary Decisions	Secondary Decisions
D1	Determine the Need for Additional Action at Ravenna	
	Do waste sources at Ravenna pose unacceptable human health or ecological risk (e.g., 10^{-6} to 10^{-4}) to: 1. Current on-site or off site receptors? 2. Future on-site or off-site receptors?	D1-1 What are the residual concentrations of contaminants at the sources? D1-2 Are wastes leaving the site via surface water/sediment? D1-3 Are wastes leaving the site via groundwater? D1-4 Are wastes posing a threat to ecological receptors? D1-5 Is there a risk to humans from consumption of ecological receptors (fish and deer)? D1-6 What is the current and future land use?
D2	Determine the Best Response Actions from a Facility-wide Perspective	
	What are effective ways of reducing risk to achieve threshold criteria as set by stakeholders?	D2-1 What are the priority sites for addressing off-site releases via surface water? groundwater? D2-2 What sites may need remediation to mitigate current and potential future on-site exposures? D2-3 What technologies are effective at reducing off-site risk, given the Facility-wide understanding of surface water/groundwater hydrologic conditions and potential future on-site exposures?

3.2.5 Define Study Boundaries

The spatial boundary for initial field work at an AOC is the fence line or other boundary (including railroad tracks, drainage divides, or other defined features) for each individual AOC. The potential for off-site migration will be addressed by sampling at the boundary (e.g., in drainages at the fence line), and as necessary and appropriate at selected locations beyond the boundary.

The spatial boundary for any follow-up field investigation work will be determined based on the results of initial field efforts. If warranted, the spatial boundary for follow-up work may extend beyond the facility boundary to include off-post sampling.

3.2.6 Identify Decision Rules

Decision rules guide the sampling effort, which in turn, defines the level of characterization necessary for decision making. For example, by specifying specific risk goals (e.g., 10^{-6}) in the decision rule, planners can identify the analytical levels needed for the sampling effort. The primary decision rules governing early work at RVAAP are:

- Initial phase: If levels of contamination detected in soils, sediment, surface water, or groundwater are greater than permissible risk-based [at a 10^{-6} risk level or Hazard Quotient (HQ) equals 1] or applicable or relevant and appropriate requirement (ARAR)-based concentrations, then perform additional sampling to characterize the risk; otherwise, no additional action is required.

- Follow-up phase: If contamination detected in soils, sediment, surface water, or groundwater results in an estimated current or future risk is less than 10^{-6} or toxic effects where HQ is less than 1, then no additional action is required.

- If contamination detected in soils, sediment, surface water or groundwater results in an estimated current risk is greater than 10^{-4} or toxic effects where HQ is greater than 1, then consider a removal action to address the risk.

- If contamination detected in soils, sediment, surface water or groundwater results in an estimated current risk of 10^{-6} to 10^{-4} (i.e., the risk management range) or toxic effects where HQ is greater than 1, then weigh the cost benefit and other factors before implementing an action (e.g., perform a Feasibility Study).

3.2.7 Identify Inputs to the Decision

"Inputs to the decision" include results of the field investigation and data analysis, modeling, and risk estimates, etc. The data needed to provide decision inputs vary from site to site, depending on the waste type, site setting, and other AOC-specific factors, and the data needs will be defined on an AOC-specific basis.

3.2.8 Specify Limits on Decision Error

Remedial action decisions may eventually need to be made for RVAAP AOCs based on the results of the data assessment and baseline risk assessment. Controlling the potential for making a wrong decision begins in the DQO process by identifying what types of errors may be introduced during sample collection and data assessment and attempting to limit those errors. Although DQO guidance provides some methods for attempting to limit error by designing statistically based sampling plans (USEPA 1993; USEPA 1994), most practitioners have found the methods generally account for only single factors (e.g., how a single contaminant is distributed in a single medium), when, in fact, response action decisions are based on understanding multiple factors (multi-media distribution and partitioning, multiple chemicals of varying degrees of toxicity, and risk modeling output and the various parameter required for that effort).

EPA specifies two types of decision error that should be addressed during DQOs: sampling errors and measurement errors (USEPA 1993). A third type of error, modeling error, is an important consideration when interpreting risk assessment results. Provided below is a summary of errors that may contribute to decision error and ways to minimize the potential for error during sample collection and reporting.

3.2.8.1 Sampling errors

Most sampling plans attempt to avoid the potential of a false positive error (e.g., avoid concluding that wastes do not pose a risk when they actually do). During the planning for each AOC, sample locations and frequencies will be identified using the knowledge of the AOC (conceptual model) and the requirements of the risk assessment. For example, if the conceptual model suggests that surface water is the major contaminant migration pathway for the AOC, more sampling resources will be directed toward characterizing this potential for the pathway to pose a current or future risk. Screening tools (e.g., geophysical surveys, geoprobe sampling, etc.) may also be used to determine optimum sampling locations where analytical data can be collected using definitive sampling methods to define the nature and extent of contamination. Screening tools cannot be used to define the nature and extent of contamination, but their use can be effective in reducing the number of confirmatory samples collected to characterize an AOC.

3.2.8.2 Measurement errors

Measurement errors in laboratory data can be minimized through proper planning, implementation of applicable laboratory QC, and programmatic data verification and validation procedures. Proposed processes and procedures are provided in the Facility-Wide QAPP. A primary focus of the review, verification, and validation process will be to avoid the potential for false positive errors (e.g., avoiding the potential of finding no risk when a risk actually exists). Analytical project-reporting levels established to meet the needs of risk assessment are presented in the Facility-Wide QAPP, Tables 3-3 through 3-9. Associated risk level concentrations for the major COPCs are presented in this FSAP in Table 3-2.

Analytical data will be generated using EPA SW-846 Methods, EPA Water and Wastewater Methods, and American Society for Testing and Materials (ASTM) Methods. Alternate or supplemental methods may be added as the need arises through specification in an approved addendum to the FSAP. Analytical data will receive its initial review by the laboratory generating the information prior to the results being reported as definitive data as identified in the Facility-Wide QAPP.

Verification of the analytical data will be performed independently of the analytical laboratory by the Contractor. This verification will ensure that precision, accuracy, sensitivity, and completeness of the analytical data are adequate for their intended use. Because the greatest uncertainty in a measurement is often a result of the sampling process, the inherent variability of the matrix, or the environmental population, verification will focus at a level necessary to minimize the potential of using false positive or false negative concentrations in the decision-making process (i.e., first priority will be to assure accurate identification of detected versus non-detected analytes).

Additionally, 10 percent of the project data will undergo comprehensive data validation through an organization independent of both the laboratory and the Contractor. This review combined with the U.S. Army QA split sample analyses and documentation will form the basis for an overall data quality assessment by the U.S. Army.

Table 3-2. Required Detection Limits for Performing the Baseline Risk Assessment for Primary Chemicals of Potential Concern at RVAAP

Chemical	Detection Limit Requirements[a]	
	Soil (mg/kg)	Water (mg/L)
Primary Chemicals of Potential Concern		
Dinitrotoluene-2,4 (DNT)	0.9 (1)	0.0001 (3)
Dinitrotoluene-2,6	0.9 (1)	0.0001 (3)
Trinitrotoluene-2,4,6 (TNT)	21 (1)	0.003 (3)
RDX	5.8 (1)	0.0008 (3)
Composition B (RDX+TNT)	see limits for individual constituents	
HMX	3900 (2)	2 (4)
Nitrocellulose	best available[d]	best available
Nitroglycerine	best available	best available
Nitroguanidine	7800 (2)	4 (4)
Aluminum	best available	best available
Arsenic	0.4 (1)	0.0001 (3)
Barium	5500 (2)	2 (5)
Cadmium	78 (2)	0.005 (5)
Chromium	230 (2)	0.1 (4)
Lead	400 [b]	0.015 [c]
Mercury	23 (2)	0.002 (5)
Selenium	390 (2)	0.05 (5)
Silver	390 (2)	0.2 (4)
Zinc	24000 (2)	11 (4)
Other COPCs		
1,3,5-Trinitrobenzene	2300 (2)	1 (4)
1,3-Dinitrobenzene	7.8 (2)	0.004 (4)
Nitrobenzene	39 (2)	0.02 (4)
o-Nitrotoluene	780 (2)	0.4 (4)
n-Nitrotoluene	780 (2)	0.4 (4)
p-Nitrotoluene	780 (2)	0.4 (4)
Manganese	3600 (2)	2 (5)
VOCs		
SVOCs		
PCBs	0.3 (1)	0.00004 (3)

[a] Basis for requirement: achieve a concentration at least equivalent to (1) 10^{-6} risk goal assuming soil ingestion by children and adults, (2) HQ=1 assuming child soil ingestion, (3) 10^{-6} risk goal assuming adult drinking water ingestion, (4) HQ=1 assuming adult drinking water ingestion, (5) Federal Maximum Contaminant Level (MCL) for drinking water.
[b] Proposed soil action level for lead (USEPA 1994)
[c] Proposed technology action level for lead in drinking water (USEPA, 1993).
[d] Compounds considered not to be toxic at environmental levels.

Verification and validation will be accomplished by comparing the contents of the data packages and QA/QC results to requirements contained in the requested analytical methods. In general, verification and validation support staff will conduct a systematic review of data for compliance with the established QC criteria based on the following categories:

- holding times,
- blanks,
- laboratory control samples (LCSs),
- calibration,
- surrogate recovery (organic methods),
- internal standards (primarily organic methods),
- matrix spike/matrix spike duplicate (MS/MSD) and duplicate results,
- sample reanalysis,
- secondary dilutions, and
- laboratory case narrative.

The protocol for analyte data verification and validation is presented in:

- Shell Analytical Chemistry Requirements, version 1.0, 2 November 1998;
- Environmental Data Assurance Guideline, USACE Louisville, May 2000;
- EPA National Functional Guidelines for Organic Data Review (EPA 1994b); and
- EPA National Functional Guidelines for Inorganic Data Review (EPA 1994c).

Consistent with the data quality requirements as defined in the DQOs, all project data and associated QC will be evaluated and qualified as per the outcome of the review.

3.2.9 Optimize Sample Design

3.2.9.1 Purposes of sampling

Sampling and analysis for the RVAAP field investigations will focus on the following:

- determination of the presence of contamination,
- determination of the nature and extent of contamination,
- identification of the connections between contaminant sources and pathway media, and
- thorough characterization of an AOC using a comprehensive sampling methodology.

3.2.9.2 Selection of sample locations

In order to accomplish the purposes described above, biased sampling will be used. That is, process history, topography, geology, and other information specific to an individual AOC will be used to identify locations where residual contamination would most probably remain Field screen for explosives on composited soil samples and allow 100 percent of all detects and 15 percent of all non-detects to have corresponding laboratory analyses performed. In addition, 10 percent of all the samples will be subjected to the full suite of analyses (this standard also applies to all random-grid sampling). Given the non-uniform horizontal distributions of contaminated areas on ammunition plants such as RVAAP (e.g., former burning pads separated by apparently unused, uncontaminated land), the investigation of a given AOC may require characterization of the spaces between contaminated areas as well. For this purpose, non-biased, or random grid, sampling will be used to acquire representative information on areas between known or suspected sources within individual AOCs.

Random grid sampling will be conducted as follows:

- Select a representative area or exposure unit that most reflects the future land use (e.g., a 300 × 300-foot plot).

- Use the Gilbert (1987) statistical approach to determine an appropriate triangular grid spacing (e.g., 60-foot spacing).

- Lay out exposure units outside or beyond the areas of biased sampling, and label each grid sampling location with a grid sampling number.

- At each exposure unit, randomly select a grid sampling number.

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4.0 FIELD ACTIVITIES

All CERCLA AOCs regulated under the Ohio Administrative Code (OAC) 3745-27-13 (Authorization to Engage in Filling, Grading, Excavating, Building, Drilling, or Mining on Land Where a Hazardous Waste Facility or Solid Waste Was Operated) must have a written request for authorization from Ohio EPA to conduct invasive environmental investigations. The request for authorization under the OAC statute (hereinafter referred to as Rule 13) addresses measures required to ensure that investigative activities necessary to characterize individual AOCs under CERCLA are protective of human health and the environment.

A generic request for authorization under Rule 13 for RVAAP is provided in Appendix B of this FSAP, and it addresses the general requirements for planned activities, e.g., drilling, trenching, monitoring well installation, surface water and sediment sampling, excavation, etc. Should it be determined by Ohio EPA and RVAAP that additional safeguards are necessary for specific activities at individual AOCs, a supplemental request must be submitted for those AOCs.

4.1 GEOPHYSICS

Geophysical analysis is not anticipated to be routinely necessary for the AOC-specific investigations. In the event that geophysical analysis is required, the rationale and procedures for this activity will be presented in the AOC-specific investigation addendum to the FSAP.

4.2 SOIL GAS SURVEY

Soil gas surveys are not anticipated to be routinely necessary for AOC-specific investigations. In the event that a soil gas survey is required, the rationale and procedures for this activity will be presented in the AOC-specific investigation addendum to the FSAP.

4.3 GROUNDWATER

4.3.1 Rationales

As defined in Section 3.0 of this FSAP, AOC-specific investigation addenda to the FSAP will be developed for the purpose of identifying unique elements of each investigation not addressed in the FSAP. Therefore, the rationales related to monitoring well locations and installation, sample collection, field and laboratory analyses, determination of background values, and QA/QC sample collection and frequency will be addressed within each of the AOC investigation-specific addenda as appropriate.

4.3.2 Monitoring Well Installation

4.3.2.1 Drilling methods and equipment

4.3.2.1.1 Equipment condition and cleaning

All drilling and support equipment used for monitoring well installation during each AOC-specific investigation will be in operable condition and free of leaks in the hydraulic, lubrication, fuel, and other fluid systems where fluid leakage would or could be detrimental to the project effort. All switches (including two functioning safety switches); gages; and other electrical, mechanical, pneumatic, and hydraulic systems will be in a safe and operable condition before arrival and during operation. The Drill Rig Operational Checklist presented in Figure 4-1 will be completed before commencement of drilling at each monitoring well borehole location, typically once per week.

All drilling equipment will be cleaned with steam or pressurized hot water before arriving for each AOC-specific investigation. After arrival, but before commencement of drilling activities, all drilling equipment [including the rig, support vehicles, water tanks (interior and exterior), augers, drill casings, rods, samplers, and tools] will be cleaned with steam or pressurized hot water using approved water at a decontamination pad. Sampling devices will also be decontaminated in accordance with Section 4.4.2.8.

Similar decontamination of drilling and sampling equipment will be conducted upon completion of each monitoring well borehole. However, only the equipment used or soiled during the drilling and sampling activities at each borehole location will undergo decontamination. All drilling and sampling equipment used during the course of each AOC-specific investigation will be decontaminated.

The temporary decontamination pad to be used for equipment cleaning will be located, to the greatest extent possible, in an area surficially crossgradient or downgradient from the monitoring well borehole locations. The pad will be constructed in such a manner to allow for containment and collection of decontamination solid and liquid wastes and to minimize loss of overspray water during decontamination activities. Solid and liquid wastes generated from the decontamination process [investigation-derived waste (IDW)] will be managed in accordance with the procedures defined in Section 7.0 of this FSAP.

4.3.2.1.2 Drilling methods

Two different types of drilling methods are anticipated to be used for installation of groundwater monitoring wells during the AOC-specific investigations, based on the assumption that monitoring wells for the initial AOC-specific investigations are anticipated to be installed for the purpose of subsurface contaminant characterization. The two methods are hollow stem auger drilling and air rotary drilling. These methods, when used during investigations, will be implemented as dry drilling methods.

Either the hollow stem auger or air rotary method will be used to drill soil portions of monitoring well boreholes, provided that collection of soil samples for physical and/or chemical analyses is not required. In the event that collection of environmental soil samples is required, only the hollow stem auger method will be utilized. Regardless of the drilling method, lithologic samples will be collected from the surface to total depth in each borehole. Information regarding the methods and equipment to be used for collection of subsurface soil samples from boreholes drilled using the hollow stem auger method is presented in Sections 4.4.2.4 and 4.4.2.5 of this FSAP. Drilling of bedrock portions of monitoring well boreholes will be accomplished using the air rotary method. In the event that collection of bedrock cores is required as part of the borehole drilling, information regarding the methods and equipment for this procedure is presented in Section 4.3.2.3.2 of this FSAP.

Soil drilling using the hollow stem auger method will be accomplished using a truck-mounted auger rig of sufficient size and power to advance augers to the required drilling depth. Soil and bedrock drilling using the air rotary method will be accomplished using a truck-mounted air rotary rig, which will advance a tricone roller bit to the required drilling depth. The total depth of each monitoring well borehole will be dictated by the depth of local groundwater and will be contingent upon the constraints of the maximum drilling depth for boreholes defined by the U.S. Army for each AOC-specific investigation. A discussion of these constraints and the decision criteria associated with installation of monitoring wells in boreholes will be presented in the AOC-specific investigation addenda to the RVAAP FSAP.

DRILL RIG OPERATIONAL CHECKLIST

Site Name:___________________________

Rig
Model: ______________________________ Manufacturer:____

Serial Number: ________________________ Rig Owner: ____

Inspection Performed
by: ____
(Driller's Signature) (Date)

Checklist Reviewed and
Emergency Shutdown Observed
by: ____
(Signature) (Date)

Place an X in each appropriate ( )

1.0 GENERAL

1.1 Check all safety devices which are part of drill rig and which can be verified (see note).
Is (are all) device(s) intact and operating as designed?

Emergency Interrupt System

A.	Kill Switch 1	Yes ( ) No ( ) NA ( )
B.	Kill Switch 2	Yes ( ) No ( ) NA ( )
C.	Kill Switch 3	Yes ( ) No ( ) NA ( )
D.	Kill Switch 4	Yes ( ) No ( ) NA ( )
E.	Kill Switch 5	Yes ( ) No ( ) NA ( )
F.	Other ________________________________	Yes ( ) No ( ) NA ( )
G.	Other ________________________________	Yes ( ) No ( ) NA ( )
H.	Other ________________________________	Yes ( ) No ( ) NA ( )

Note: All safety devices (not otherwise listed in this checklist) should be identified for each drill rig at the beginning of each project and subsequently checked at each inspection. Testing of all safety devices must be observed by health and safety personnel. List only safety devices which can be checked without disassembly or without rendering the device ineffective. This checklist does not cover United States Department of Transportation requirements.

Figure 4-1. Drill Rig Operational Checklist for RVAAP AOC-Specific Investigations

1.2	Is the proper type and capacity of fire extinguisher(s) present, properly charged, and inspected?	Yes ( ) No ( ) NA ( )
1.3	Is rig properly grounded?	Yes ( ) No ( ) NA ( )
1.4	Are rig and mast a safe distance from electrical lines?	Yes ( ) No ( ) NA ( )
1.5	Can mast be raised without encountering overhead obstructions?	Yes ( ) No ( ) NA ( )
1.6	Have spill prevention materials been placed under rig (i.e., plastic sheeting)?	Yes ( ) No ( ) NA ( )
1.7	Is a spill kit present?	Yes ( ) No ( ) NA ( )
1.8	Is the safe operating zone/exclusion zone posted (minimum radius at least equal to height of raised drill mast)?	Yes ( ) No ( ) NA ( )
1.9	Do all modifications made to the drill rig permit it to operate in a safe manner and allow the drill to operate within the manufacturer's specifications?	Yes ( ) No ( ) NA ( )
1.10	Are moving parts (excluding cathead and other moving parts normally used during operations) properly guarded?	Yes ( ) No ( ) NA ( )
1.11	Are all exhaust pipes, which would come in contact with personnel during normal operation properly guarded?	Yes ( ) No ( ) NA ( )
1.12	Are tank(s) and lines free of leakage?	Yes ( ) No ( ) NA ( )
1.13	Are all normal or manufacturer-recommended maintenance activities or schedules performed at the required frequency?	Yes ( ) No ( ) NA ( )
1.14	Are walking and standing surfaces, steps, rungs, etc., free of excess grease, oil, or mud which could create a hazard?	Yes ( ) No ( ) NA ( )

2.0 CONTROL MECHANISMS

Are all control mechanisms and gauges on the drill rig functional and free of oil, grease, and ice (checked while running)?	Yes ( ) No ( ) NA ( )

3.0 HYDRAULICS AND PNEUMATICS

Note: The mast should be lowered during the completion of this section to allow inspection of portions of the lifting mechanisms normally out of reach during operation.

3.1	Do all hydraulic reservoirs exhibit proper fluid levels?	Yes ( ) No ( ) NA ( )
3.2	Are hydraulic and/or pneumatic systems in good condition and functioning correctly (checked while running)?	Yes ( ) No ( ) NA ( )

Figure 4-1 (continued)

4.0 LIFTING MECHANISMS

Note: The mast should be lowered during the completion of this section to allow inspection of portions of the lifting mechanisms normally out of reach during operation.

4.1	Have all wires, ropes, cables, and lines that are kinked, worn, corroded, cracked, bent, crushed, frayed, stretched, birdcaged, or otherwise damaged been replaced and the defective equipment removed from the site?	Yes ( ) No ( ) NA ( )
4.2	Have all wires, ropes, cables, and lines been wrapped around winch drums without excessive pinching or binding?	Yes ( ) No ( ) NA ( )
4.3	Are all pulleys undamaged and functional?	Yes ( ) No ( ) NA ( )
4.4	Are all clips, clamps, clevises, hooks, and other hardware used to rig wires, ropes, cables, or lines undamaged and attached properly?	Yes ( ) No ( ) NA ( )
4.5	Do all eyes formed in wires, ropes, cables, or lines attached to the rig use a thimble to retain the shape of the eye?	Yes ( ) No ( ) NA ( )
4.6	Do all hooks having functioning safety gates/latches?	Yes ( ) No ( ) NA ( )

5.0 NONCONFORMING ITEMS

5.1 When did the last operation checklist inspection take place for this drill rig at this site?

Date: ____________________________

5.2 Have any nonconforming items been carried over from the last inspection? List any such items and dates or original nonconformance.

A. ____

Date: ____________________________

B. ____

Date: ____________________________

C. ____

Date: ____________________________

D. ____

Date: ____________________________

Figure 4-1 (continued)

Any nonconforming items must be documented in the following remarks section and reported to the field operations manager for the project prior to operating the drill ring. Reference all remarks to the item numbers noted above.

Remarks:

____

____

____

____

Figure 4-1 (continued)

With regard to the air rotary method, soil and bedrock cuttings will be removed from the borehole during drilling using high-pressure air, and they will be directed to the surface through the borehole annulus or through a borehole casing (if installed) in bedrock sections. Drill cuttings traveling up to the ground surface will be directed into a diverter sealed to the top of the borehole or the borehole casing. The drill cuttings will then exit from the diverter through a discharge vent and will be directed into a container located next to the borehole. Using this procedure, field personnel will be protected from any adverse effects caused by site contaminants in the returned air and blown particles.

The air compressor used for the air rotary method will be equipped with an air-line oil filter. This oil filter will be changed in accordance with manufacturer's recommendations; however, if oil is visibly detected in the filtered air, the filter will be changed more frequently. The air filter will be examined daily for breakthrough. Sufficient samples of the air compressor initial reservoir oil will be collected and retained until completion of the AOC investigation. These samples will be evaluated in the event that oil from the unit is suspected to have contributed to contamination detected in samples collected for chemical analysis. Logs completed for each borehole will be used to record the following information regarding air usage:

- equipment description,
- manufacturer and model,
- air pressure used,
- frequency of oil filter change,
- evaluation of system performance, and
- record of any oil loss from the unit.

Information regarding procedures to be used for mitigation of adverse subsurface effects resulting from the implementation of the air rotary method and procedures to be used for management of IDW generated at borehole locations during hollow stem auger or air rotary drilling will be presented in the AOC-specific investigation addenda to the FSAP.

Various drilling scenarios for the completion of monitoring well boreholes may be implemented during the course of the AOC investigations due to specific site conditions. Therefore, the type of drilling method required (i.e., hollow stem auger or air rotary) and size(s) of augers or tricone roller bits will be dictated by the scenario that is applicable for a particular AOC investigation. Details regarding the drilling method, approach, and rationale for each investigation will be presented in the AOC-specific investigation addenda to the FSAP. Several monitoring well borehole drilling scenarios that may be implemented during the AOC investigations are discussed in Section 4.3.2.1.3 of this FSAP.

4.3.2.1.3 Drilling scenarios

Based on the assumption that monitoring wells for the initial AOC-specific investigations are anticipated to be installed for the purpose of subsurface contaminant characterization, it is assumed that a majority of these wells will be installed using 5.0-cm (2.0-inch)-diameter well screen and casing. Furthermore, it is assumed that some monitoring wells for the investigations will be drilled to relatively shallow depths and completed in overlying soil material, while other monitoring wells will be drilled to greater depths and completed in the upper 3.0 to 6.0 m (10.0 to 20.0 feet) of the underlying bedrock. Based on these assumptions, four different drilling scenarios may be used for completion of the boreholes for these monitoring wells.

In circumstances where wells are to be completed in bedrock, coring may be necessary to determine lithologies and degree and nature of weathering and fracturing in bedrock. N-series coring shall be performed in the bedrock interval prior to 15.2-cm (6.0-inch)-diameter air-rotary overdrilling to install the monitoring well.

The first drilling scenario would be implemented for monitoring well boreholes required to be drilled through overlying soil material known to be contaminated and into the underlying bedrock. For this scenario, the well borehole would initially be drilled down to the soil-bedrock interface using either the hollow stem auger method if soil sampling is required, or the air rotary method if soil sampling is not required. The borehole will then be additionally advanced into the top of the bedrock approximately 0.9 to 1.5 m (3 to 5 feet). A hole-opening device may be utilized to increase the diameter of the borehole soil section to the required size if the standard-sized auger lead or tricone roller bits are not adequate. Next, steel surface casing extending from the ground surface to the bottom of the borehole would be installed and the annulus between the casing and borehole grouted. After curing of the grout for at least 12 hours, drilling of the bedrock portion of the borehole would be completed using the air rotary method. The surface casing used for this scenario would not be removed during subsequent installation of the monitoring well.

The second drilling scenario would be implemented for monitoring well boreholes required to be drilled through overlying soil material not requiring isolation but known to be unstable (i.e., prone to caving) and into the underlying bedrock. For this scenario, initial drilling of the well borehole would be conducted in the same manner as described for the first drilling scenario. Immediately after installation of the surface casing, drilling of the bedrock portion of the borehole would be completed using the air rotary method. Monitoring wells installed within boreholes drilled using this scenario would be constructed inside the surface casing that would be removed during grouting of the well.

The third drilling scenario would be implemented for monitoring well boreholes required to be drilled into overlying soil material not requiring isolation and known to be stable, or required to be drilled through this material and into the underlying bedrock. For this scenario, drilling of the soil portion of the borehole would be conducted in the same manner as described for the initial drilling in the first drilling scenario. If required, drilling of the bedrock portion of the borehole would be completed using the air rotary method. No surface casing would be used during implementation of this drilling scenario.

The fourth drilling scenario would be implemented for monitoring well boreholes required to be drilled into overlying soil material not requiring isolation and known to be unstable. For this scenario, borehole drilling using the hollow stem auger method would be accomplished by advancing the augers to the required depth. Monitoring wells installed within boreholes drilled using this method would be constructed inside the augers that would be removed during grouting of the well. Borehole drilling using the air rotary method would be accomplished by advancing the tricone roller bit to the required depth. A hole opening device would be utilized to increase the diameter of the borehole soil section to the required size if the standard-sized tricone roller bits are not adequate. Following completion of the borehole, temporary surface casing would be installed. Monitoring wells installed within boreholes drilled using this method would be constructed inside the surface casing that would be removed during grouting of the well.

In each of these drilling scenarios, the need may exist to isolate overlying soil material if heaving sands are encountered. In these instances, steel surface casing would be installed from the surface to within the confining interval immediately above the heaving sand. The annulus between the casing and borehole would be grouted. After curing the grout for at least 12 hours, a closed-end (temporarily plugged) auger would be used to drill the heaving sand interval. The temporary plug would then be knocked and drilling continue or the well completed, as outlined in the above drilling scenarios.

A summary of the four drilling scenarios described above and the types of standard hollow stem augers, tricone roller bits, and surface casings that may be used during implementation of these scenarios is presented in Table 4-1.

4.3.2.2 Materials

The following discussion regarding materials to be used for construction of monitoring wells during the AOC-specific investigations is based upon the assumption that the wells will be installed for the purpose of subsurface contaminant characterization and thus will be 5.0 cm (2.0 inches) in diameter. Furthermore, it is anticipated that two different types of monitoring wells may be constructed during the investigations, above-grade installations and flush-mounted installations.

Details regarding the installation of monitoring wells are presented in Section 4.3.2.3 of this FSAP. Information regarding the materials to be used for installation of monitoring wells within investigation boreholes, and the type of well to be constructed (i.e., above-grade or flush-mounted) will be presented in the AOC-specific investigation addenda to the FSAP.

4.3.2.2.1 Casing/screen

The casing, screen, and fitting materials to be used for construction of monitoring wells during the AOC-specific investigations will be composed of new, precleaned, 5.0-cm (2.0-inch) Schedule 40 polyvinyl chloride (PVC). Screen sections will be commercially fabricated and slotted with openings equal to 0.025 cm (0.010 inches). Screen and casing sections will be flush threaded, and thermal or solvent welded couplings will not be used. Gaskets, pop rivets, and screws will also not be used during monitoring well construction. Pre-packed screens will be used for intervals that cannot be filter packed conventionally.

All materials used for monitoring well construction will be as chemically inert as technically practical with respect to the site environment. All PVC screens, casings, and fittings will conform to National Sanitation Foundation (NSF) Standard 14 (NSF 1994) for potable water usage or Annual Book of ASTM Standards: Volume 08.04; F 480 (ASTM 1995) and will bear the appropriate rating logo.

The well caps and centralizers to be used for construction of monitoring wells will be composed of new, precleaned PVC. The tops of all monitoring well casings associated with above-grade well installations will be covered with slip-joint type well caps. The tops of all monitoring well casings associated with flush-mounted well installations will be covered with water-tight expandable-flange locking well caps. Both types of caps will be fitted to the casings and will be designed to preclude binding to the casing resulting from tightness of fit, unclean surface, or frost and to allow for equilibration between hydrostatic and atmospheric pressures. The caps will also be designed to fit securely enough to preclude debris and insects from entering the monitoring well.

Well centralizers will be used for construction of all monitoring wells that are installed within open boreholes exceeding approximately 6.1 m (20.0 feet) in depth. They will be attached to the well casing at regular intervals by means of stainless steel fasteners or strapping. The placement of centralizers will be determined in the field at the time of monitoring well installation based on the total depth of each well. Centralizers will not be attached to well screens or to that part of well casings exposed to the granular filter pack or bentonite seal. Centralizers will also be oriented to allow for the unrestricted passage of tremie pipes used for placement of monitoring well construction materials within the annular space between the well and the borehole wall.

4.3.2.2.2 Filter pack, bentonite, and grout

Granular filter pack material used during the AOC-specific investigations for monitoring well installation will be approved by the U.S. Army Project Manager before commencement of field activities

Table 4-1. Summary of Drilling Scenarios for RVAAP AOC-Specific Investigations

Scenario Summary	Soil Drilling	Surface Casing Placement	Bedrock Drilling	Monitoring Well Size	Protective Casing Size
Borehole through overlying contaminated soil and into underlying bedrock	Hollow Stem Auger Method 12.0-inch OD augers; borehole diameter increased to 14.0 inches using hole opening device	10.0-inch ID casing grouted in place	Air Rotary Method 6.5-inch tricone bit Bedrock Coring N-series core	2.0-inch ID PVC screen and casing	6.0-inch ID iron or steel casing
	Air Rotary Method 10.75-inch tricone bit; borehole diameter increased to 14.0 inches using hole opening device	10.0-inch ID casing grouted in place			
Borehole through overlying unstable soil and into underlying bedrock	Hollow Stem Auger Method 8.0- to 8.5-inch OD augers; borehole diameter increased to 9.5 inches using hole opening device	8.0-inch ID casing	Air Rotary Method 6.5-inch tricone bit Bedrock Coring N-series core	2.0-inch ID PVC screen and casing	6.0-inch ID iron or steel casing
	Air Rotary Method 9.62-inch tricone bit	8.0-inch ID casing			
Borehole into overlying stable soil and into underlying bedrock	Hollow Stem Auger Method 6.0-to 6.5-inch OD augers	Not required	Air Rotary Method 6.5-inch tricone bit Bedrock Coring N-series core	2.0-inch ID PVC screen and casing	6.0-inch ID iron or steel casing
	Air Rotary Method 6.5-inch tricone bit	Not Required			
Borehole into overlying unstable soil	Hollow Stem Auger Method 8.0- to 8.5-inch OD augers	Not Required	Not Required	2.0-inch ID PVC screen and casing	6.0-inch ID iron or steel casing
	Air Rotary Method 6.5-inch tricone bit; borehole diameter increased to 7.0 inches using hole opening device	6.0-inch ID casing grouted in place			

(Figure 4-2). A 500-cm^3 (1-pint) representative sample of the granular filter pack material proposed for use will be submitted to the USACE-Louisville District, RVAAP, or other U.S. Army Project Manager for approval, if requested. Based on the screen slot size of 0.025 cm (0.010 inches) to be used for monitoring well construction, the granular filter pack material used will generally be Global Supply No. 7 [size equals 0.047 cm (0.0188 inches)] sand. Global Supply No. 5 may alternately be used with prior approval from the Army Project Manager and Ohio EPA if conditions warrant.

The granular filter pack material will be visually clean (as seen through a 10-power hand lens), free of material that would pass through a No. 200 sieve, inert, siliceous, and composed of rounded grains. The filter material will be packaged in bags or buckets by the supplier and delivered therein to the site. Filter pack material in pre-packed screens will also meet these criteria.

Bentonite will be used during the AOC-specific investigations for one or more of the following purposes:

- creation of an annular seal during monitoring well construction between the lower granular filter pack and upper grout seal,

- additive in grout mixture used for creation of upper grout seal during monitoring well construction, and/or

- additive in grout mixture used for abandonment of boreholes not converted into monitoring wells.

Bentonite material used during the investigations for monitoring well installation will be approved by the U.S. Army Project Manager before commencement of field activities (Figure 4-3). A 500-cm^3 (1-pint) representative sample of each type of bentonite material proposed for use will be submitted to the U.S. Army Project Manager for approval, if requested. Compressed powdered bentonite pellets or chips, generally measuring 0.63 cm (0.25 inches) in size, will be used for annular seal applications. Powdered bentonite will be used for grout additive applications.

Grout used during AOC-specific investigations for monitoring well installation or borehole abandonment will be composed of Type I portland cement, approximately 6 pounds dry weight bentonite per 42.6-kilogram (94-pound) sack of dry cement, and a maximum of 0.02 to 0.03 m^3 (6 to 7 gallons) of approved water per sack of cement. The amount of water used to prepare grout mixtures will be minimized to the greatest extent possible.

All grout materials will be combined in an above-ground rigid container or mixer and mechanically blended onsite to produce a thick, lump-free mixture throughout the mixing vessel. The grout will be placed using a tremie pipe of rigid construction for vertical control of pipe placement. The tremie pipe will be equipped with side discharge holes rather than an open end to help maintain the integrity of the underlying material onto which the grout is placed.

4.3.2.2.3 Surface completion

The well protection assembly to be used for construction of monitoring wells during AOC-specific investigations will be composed of new iron/steel protective casing. All monitoring wells should be constructed as above-grade installations, where possible (see Section 4.3.2.3). Protective casings associated with above-grade well installations will be equipped with locking iron/steel covers, while those associated with flush-mounted installations will be equipped with flush (not threaded) manhole-type iron/steel covers. Covers on the protective casings will be such that the possibility of water leakage is minimized. Protective casings installed as flush-mounts or above grade will be surrounded by a minimum of three new iron/steel guard posts to help in location and avoidance

GRANULAR FILTER PACK APPROVAL

Project for intended use:

1. Filter Material Brand Name:
2. Lithology:
3. Grain Size Distribution:
4. Source:
   Company that made product:
   Location of pit/quarry origin:
5. Processing method:
6. Slot Size of Intended Screen:

SUBMITTED BY:

Company:

Person:

Telephone Number:

Date

FOA APPROVAL (A)/DISAPPROVAL (D)	(check one)	
Project Officer/Date	A	D
Project Geologist/Date:	A	D

Figure 4-2. Granular Filter Pack Description and Approval Form

BENTONITE APPROVAL

Project for intended use:

1. Bentonite Material Brand Name:
   Annular seal:

   Grout additive:
2. Manufacturer:
   Annular seal:

   Grout additive:
3. Manufacturer's Address and Telephone Number(s):
   Annular seal:

   Grout additive:
4. Product Description:
   Annular seal:

   Grout additive:
5. Intended Use of Product:
   Annular seal:

   Grout additive:

6. Potential Effects on Subsequent Chemical Analyses:
   Annular seal:

   Grout additive:

SUBMITTED BY:

Company:
Person:
Telephone Number:
Date

FOA APPROVAL (A)/DISAPPROVAL (D)	(check one)	
Project Officer/Date	A	D
Project Geologist/Date:	A	D

Figure 4-3. Bentonite Description and Approval Form

All locks on protective casings installed during each investigation will be opened by a single key and, if possible, will match the locks present on existing monitoring wells within the AOC. If this is not possible, the locks on the existing wells may be replaced with the type used for the new monitoring wells installed during the investigation. Currently all wells installed and sampled under the IRP, as well as those at Ramsdell Quarry Landfill, have a common key. All well locks will be issued by RVAAP.

The diameter of all protective casings will be 15.2 cm (6.0 inches). The length of protective casing used for above-grade well installations will be 2.4 m (8.0 feet), approximately 1.5 m (5.0 feet) of which will extend below the ground surface. The length of protective casing used for flush-mounted well installations will be 1.5 m (5.0 feet), the entire length of which will extend below the ground surface. The guard posts installed around above-grade protective casings will be at least 7.6 cm (3.0 inches) in diameter and the top of each post modified to preclude the entry of water. The guard post length will be 1.8 m (6.0 feet), approximately 0.6 m (2.0 feet) of which will extend below the ground surface.

4.3.2.2.4 Water Source

Water will be used during the AOC-specific investigations for the following purposes:

- preparation of grout mixture used for monitoring well installation or borehole abandonment,
- preparation of cement mixture used for construction of monitoring well surface completions, and
- decontamination of drilling and sampling equipment.

Evaluation of the water source used for each investigation will be accomplished by collecting a sample from each potable source used before starting field activities. Procedures for the collection, preservation, shipping, and documentation of this sample and other related requirements, are defined in the subsequent sections of this FSAP and in Appendix C, Section C-4, of USACE Procedure EM 200-1-3. One QC trip blank will placed into the cooler used for transport of the sample from the field to the contracted laboratory. The water sample will be submitted to the contracted laboratory for analysis of the contaminants to be evaluated during the investigation. The water source will only be used if analytical results indicate that the source is free of contaminants.

In the event an approved water supply is available and analytical data document its suitability, this water source may be used without additional analyses.

The water source used for the project will also comply with other requirements defined in Section 3-9, Subsection b, Item #1a through #1f of USACE Procedure EM 1110-1-4000 (August 31, 1994) and will be approved by the U.S. Army Project Manager before use (Figure 4-4). Field personnel will be responsible for transport and storage of the approved water required for investigation needs in a manner to avoid the chemical contamination or degradation of the approved water once obtained.

4.3.2.2.5 Delivery, storage, and handling of materials

All monitoring well construction materials will be supplied and delivered to the AOC investigation sites by the subcontracted drilling company retained for each AOC-specific investigation. Upon delivery to the site, the Field Operations Manager will inspect all of the materials to ensure that the required types of materials have been delivered and that the materials have not been damaged or contaminated during transport to the site. During this inspection, the Field Operations Manager will collect and file any material certification documentation attached to or accompanying the materials. All material certification documentation will be maintained on site until completion of the project, at which time the documentation will be transferred to the project evidence file. All materials will be stored in a dry and secure location until used for monitoring well construction.

WATER APPROVAL

Project for intended use:

1. Water Source:
   Owner:
   Address:
   Telephone Number
2. Water tap location:
   Operator:
   Address:
3. Type of source:
   Aquifer:
   Well depth:
   Static water level from ground surface:
   Date measured:
4. Type of treatment prior to tap:
5. Type of access:
6. Cost per cubic gallon charged for use:
7. Results and dates of chemical analyses for past 2 years:
8. Results and dates of chemical analyses for project analytes:

SUBMITTED BY:

Company:
Person:

Figure 4-4. Water Description and Approval Form

All well screens and well casings used for monitoring well construction will be free of foreign matter (e.g., adhesive tape, labels, soil, grease, etc.) and will be washed with approved water before use. However, if the materials have been packaged by the manufacturer and have their packaging intact up to the time of installation, no prewashing will be conducted. Pipe nomenclature stamped or stenciled directly on well screens and/or solid casing to be located within and below the bentonite seal will be removed by sanding, unless removable by approved water washing. Washed screens and casing will be stored in plastic sheeting until immediately before insertion into the borehole. All well screens and casings used for construction will be free of unsecured couplings, ruptures, and other physical breakage and/or defects.

All protective casing materials will be steam cleaned before placement; free of extraneous openings; and devoid of any asphaltic, bituminous, encrusting, and/or coating materials (with the exception of black paint or primer applied by the manufacturer). Washed protective casing materials will be stored in plastic sheeting until immediately before placement around monitoring well casings.

4.3.2.3 Installation

Monitoring wells installed as part of the AOC-specific investigations are anticipated to be constructed above-grade installations. Flush-mounted installations may be preferable in some circumstances. Furthermore, boreholes for both types of installation may be completed in either overlying soil material or the underlying bedrock. The criteria that will guide the type of construction will be the depth of local groundwater encountered at each monitoring well borehole location and the type of area (i.e., remote area versus traffic area) where each well is to be installed. All wells installed at RVAAP should be constructed as above-grade installations, where possible. Figures 4-5 and 4-6 conceptually illustrate two types of monitoring well construction that may be completed during the AOC investigations. A discussion of the monitoring well installation process to be used is presented below.

4.3.2.3.1 Test holes

In the event that test holes are required to be drilled before the installation of monitoring wells during the AOC-specific investigations, these holes will be drilled in accordance with the procedures defined in Section 4.3.2.1.2 of this FSAP.

4.3.2.3.2 Soil sampling and rock coring during drilling

Collection of soil samples for physical, geotechnical, and/or chemical analyses during monitoring well installation activities conducted during AOC-specific investigations will be performed in accordance with the procedures defined in Sections 4.4.2.4 and 4.4.2.5 of this FSAP.

All rock coring will be conducted in a manner to obtain maximum intact recovery of bedrock. The minimum core size will be an “N” series, which is 50.0 millimeter (2.0 inches) in diameter.

To the extent possible, bedrock coring will be accomplished without the addition of potable water. However, coring in unsaturated bedrock may require the addition of potable water to the formation to cool the cutting surface and facilitate the extension of the borehole. Circulation of this water may be lost to surrounding formation if it is porous and permeable. If the monitoring well installed in this borehole is a low-yield well, the potable water volume lost is generally not recoverable during well development. During the course of bedrock coring to advance a monitoring well boring, the Field Operations Manager will contact the U.S. Army Project Manager and the Ohio EPA Division of Drinking and Ground Waters in the event that drilling and coring conditions result in a loss of circulation of potable water.

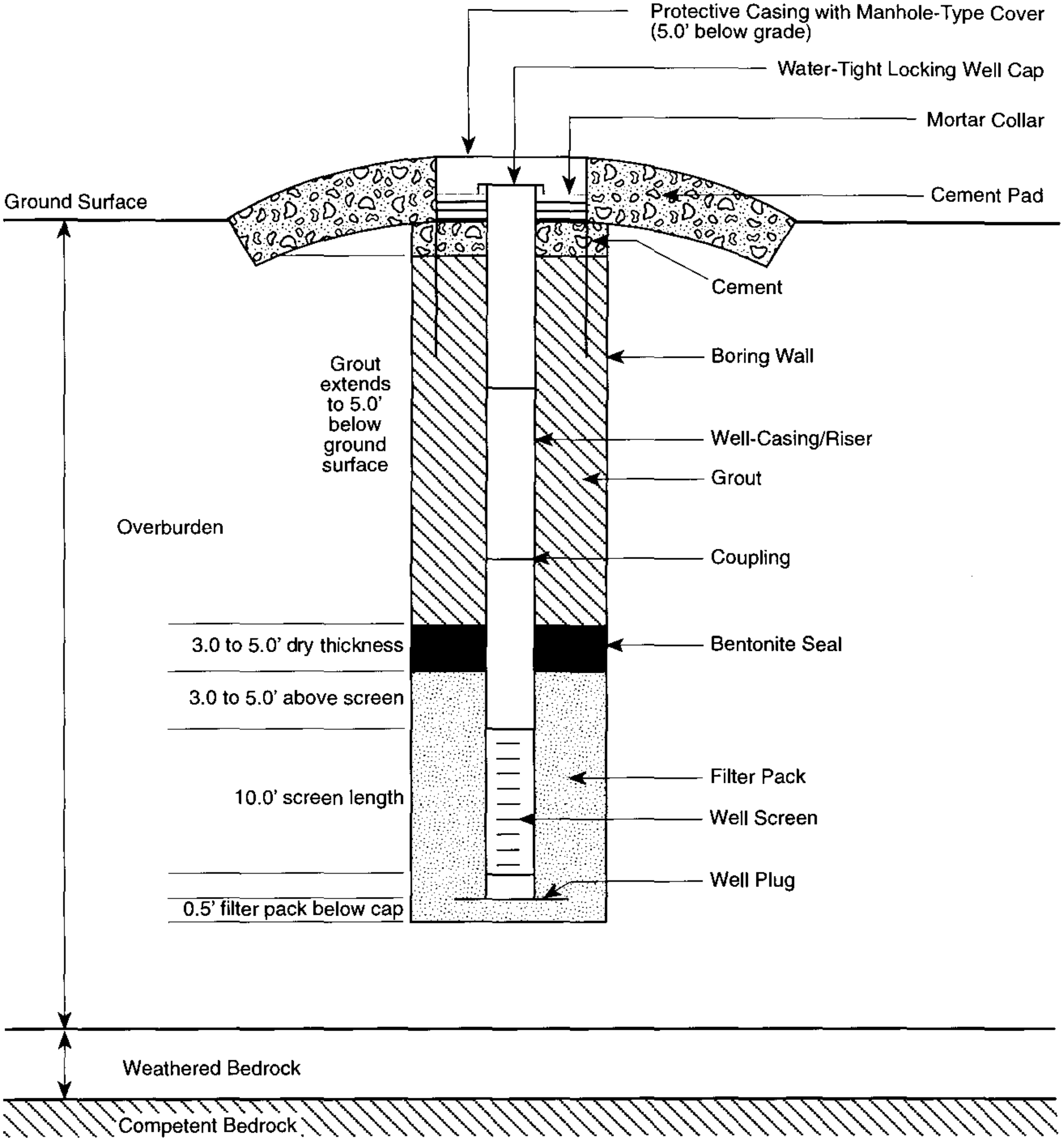


Figure 4-5. Example of a Monitoring Well Completed in Overlying Unstable Soil (Overburden) with a Flush-mount Installation

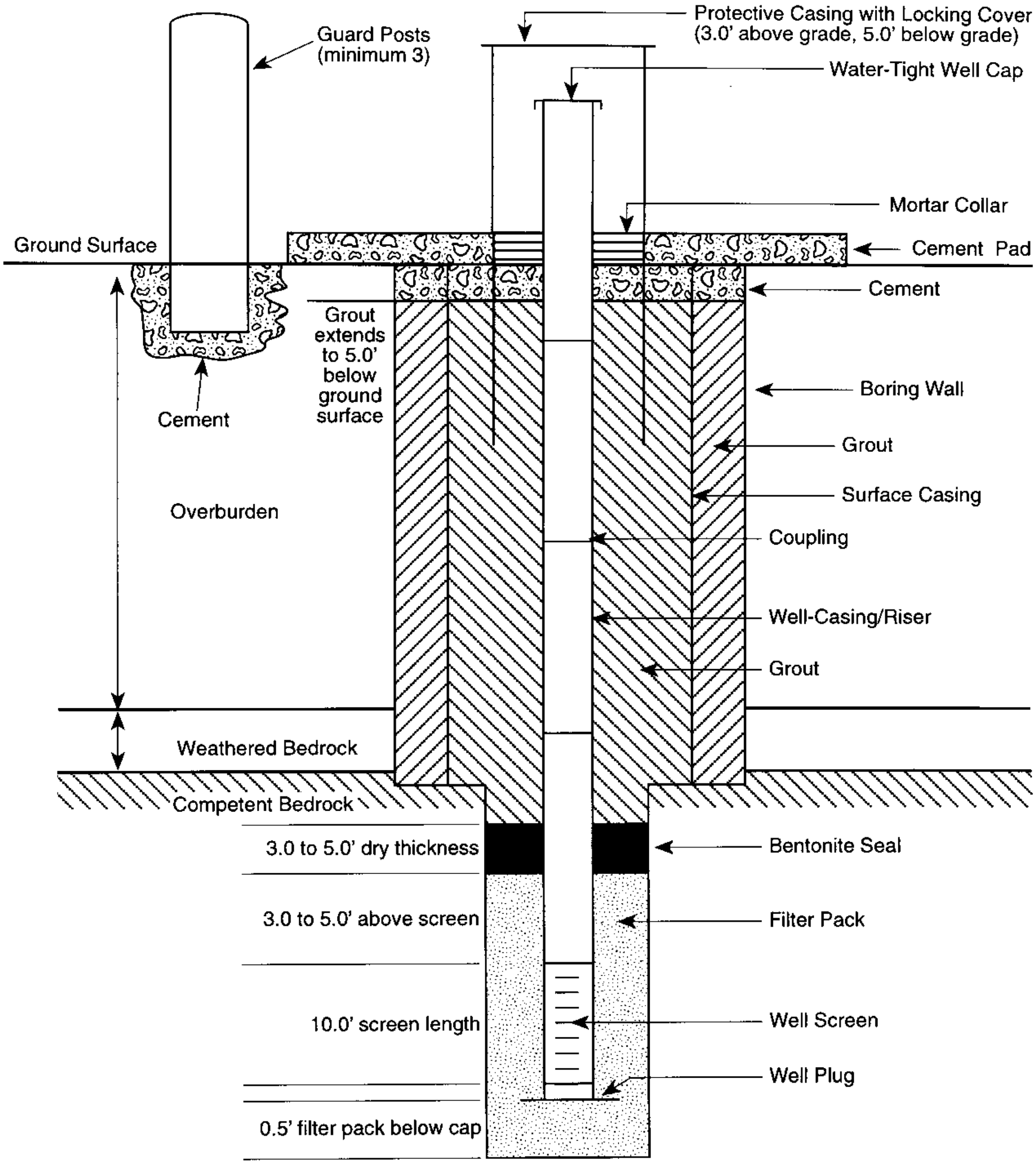


Figure 4-6. Example of a Monitoring Well Completed in Underlying Bedrock with an Above-grade Installation. Overlying Unstable Soil (Overburden) is Contaminated

Rock cores will be stored in covered core boxes to preserve their relative position by depth. Intervals of lost core will be noted in the core sequence. Boxes will be marked on the cover (both inside and outside) and on the ends to provide project name, borehole number, cored interval, and box number in cases of multiple boxes. Any core box known or suspected to contain contaminated core material will be appropriately marked on the borehole log and the core box cover and ends. The weight of each fully loaded box will not exceed 34.0 kilograms (75.0 pounds).

The core within each completed box will be photographed after the core surface has been cleaned and wetted. Each core box will be photographed close-up with a 35-millimeter camera loaded with color print film and will contain a legible scale for reference. Each core box will be oriented so that the top of the core is at the top of the photograph. These photographs, minimally 12.7 by 17.8 cm (5 by 7 inches) in size and annotated on the back with project name, well/borehole number, core box number, cored depths illustrated, and photograph date, will be provided to the U.S. Army Project Manager after coring activities have been completed. The film negatives or data disks will also be provided to the U.S. Army Project Manager after receipt of the photograph prints.

After the core boxes have been photographed, the samples will be disposed of in the same manner as other solid IDW generated during the investigation, except for those designated for laboratory analyses. Details regarding the disposal of rock cores and the storage, packaging, and method of shipment for core samples designated for laboratory analyses will be defined in the AOC-specific investigation addenda to the FSAP. Currently all IRP and other rock cores are in temporary storage at RVAAP. Rock cores will not be disposed of without RVAAP and USACE approval.

4.3.2.3.3 Borehole diameter and depth

It is anticipated that monitoring wells installed for the purpose of contaminant characterization during the AOC-specific investigations will be constructed using 5.0-cm (2.0-inch) PVC casing and screen. For monitoring wells of this size, the borehole drilled will be of sufficient diameter to permit at least 5.0 cm (2.0 inches) of annular space between the borehole wall and all sides of the well (centered screen and casing). Additional information regarding borehole drilling scenarios that may be implemented during the AOC investigations are discussed in Section 4.3.2.1.3 of this FSAP.

The anticipated depths of boreholes for monitoring wells will be defined in the AOC-specific investigation addenda to the FSAP. However, the monitoring well boreholes to be drilled for the initial AOC-specific investigations to be conducted at the RVAAP are currently estimated to be from approximately 6.0 to 12.1 m (from 20.0 to 40.0 feet) in depth.

Each borehole will be advanced through the overlying soil material, and into the underlying bedrock if required, until groundwater is encountered. Drilling will be terminated at a depth of from 1.5 to 2.1 m (from 5.0 to 7.0 feet) below the groundwater table. If sufficient groundwater to support a functional monitoring well is found to be present in the borehole, a monitoring well will be constructed. However, if insufficient groundwater is found to present, the borehole will be abandoned unless additional drilling is authorized by the U.S. Army Project Manager.

4.3.2.3.4 Screen and well casing placement

All screens used for monitoring well construction will be installed such that the bottom of each well screen is placed no more than 0.9 m (3.0 feet) above the bottom of the drilled borehole. The screen bottom will be securely fitted with a threaded PVC cap or plug. The cap/plug will be within 15.2 cm (6.0 inches) of the open portion of the screen. The standard length of screen to be used for all monitoring wells will be 3.0 m (10.0 feet). The casing used for construction of above-grade monitoring well installations will be of sufficient length to allow for 0.7 m (2.5 feet) of the casing to extend above the ground surface. The casing used for construction of flush-mounted monitoring well installations will be of sufficient length to allow for location of the casing top 5.0 cm (2.0 inches) bgs. The top of each installed monitoring well casing will be level so that the difference in elevation between the highest and lowest points on the top of the well casing is less than or equal to 0.6 cm (0.2 inches).

4.3.2.3.5 Filter pack placement

Granular filter pack material used for monitoring well construction will be placed within the annular space around the monitoring well screen using a tremie pipe. If approved water is used to place the filter pack, the amount of this water will be recorded and added to the volume of water to be removed during well development. The filter pack will extend from the bottom of the borehole to 0.9 to 1.5 m (3.0 to 5.0 feet) above the top of the well screen. In addition, 15.2 cm (6.0 inches) of filter pack will be placed under the bottom of the well screen to provide a firm footing. The final depth to the top of the filter pack will be measured directly with a weighted tape and recorded.

4.3.2.3.6 Bentonite Seal

The type of bentonite material to be used for construction of monitoring well seals will be composed of commercially available pellets or chips. Bentonite seals will be from 0.9 to 1.5 m (from 3.0 to 5.0 feet) thick as measured immediately after placement, without allowance for swelling. A tremie pipe will be used for placement of the pellets to prevent bridging. In addition, a weighted tape will be used to prevent bridging and to measure the placement of bentonite. After placement of the bentonite pellets, a small volume of approved water will be used to hydrate the pellets, and the hydration time for the pellets will be a minimum of 1 hour. The final depth to the top of the bentonite seal will be measured directly with a weighted tape and recorded.

4.3.2.3.7 Cement/bentonite grout placement

All prescribed portions of grout material to be used for monitoring well construction will be combined in an above-ground rigid container and mechanically blended to produce a thick, lump-free mixture throughout the mixing vessel. The grout will be placed from within a rigid grout pipe initially located just over the top of the bentonite seal in such a manner as to minimize disturbance of the seal.

Before exposing any portion of the borehole above the seal by removal of any surface casing (to include hollow-stem augers), the annulus between the surface casing and well casing will be filled with sufficient grout to allow for planned surface casing removal. If all surface casing is to be removed in one operation, the grout will be pumped through the grout pipe until undiluted grout flows from the annulus at the ground surface. During the surface casing removal, the grout pipe will be periodically reinserted as needed for additional grouting.

If the surface casing is to be incrementally removed with intermittent grout addition, the grout will be pumped through the grout pipe until it reaches a level that will permit at least 3.0 m (10.0 feet) of grout to remain in the annulus after removing the selected length of surface casing. Using this method, the grout pipe will only be reinserted to the base of the casing yet to be removed before repeating the process. After grouting has been completed to within approximately 3.0 m (10.0 feet) of the ground surface, the remaining surface casing will be removed from the borehole and the remaining annulus will be grouted to 1.5 m (5 feet) below the ground surface.

Grout for monitoring wells to be completed both as above-grade well installations and flush-mounted well installations will be added until it is present at 1.5 m (5 feet) below the ground surface.

Upon initiation of the grouting operation, the process will be conducted continuously until all of the surface casing or hollow stem augers, if present, have been removed and all annular spaces are grouted to the required levels as noted above. After 24 hours, the site will be checked for grout settlement and more grout will be added at that time to fill any depression. This process will be repeated until firm grout remains within 1.5 m (5 feet) of the ground surface. Incremental quantities of grout added in this manner will be recorded on the well construction diagram.

4.3.2.3.8 Concrete/gravel pad placement

Information regarding the placement of concrete pads around monitoring wells is presented in Section 4.3.2.3.9 of this FSAP.

4.3.2.3.9 Protective cover placement

Protective iron/steel casing will be installed around each monitoring well the same day as initial grout placement around the well. The protective casing's exterior will be pre-primed before being brought to RVAAP. The protective casing used for above-grade well installations will be set approximately 1.5 m (5 feet) below grade and will extend approximately 0.9 m (3 feet) above the ground surface. The protective casing used for flush-mounted well installations will be set approximately 1.5 m (5 feet) bgs with the top of the casing flush to grade. All protective casings will be installed so that the distance between the top of the protective casing and the top of the well casing is no more than 6.0 cm (2.4 inches).

For monitoring wells constructed as flush-mounted well installations, the remaining annulus formed between the outside of the protective casing and borehole, or permanent surface casing if present, will be filled to the ground surface with concrete on the day that firm grout is found to be present in the borehole. A sloping concrete pad measuring approximately 0.76 by 0.76 m square (30 by 30 inches square) will be poured around the exterior of the protective flush mount casing. Concurrently, an internal mortar collar will be poured within the annulus between the protective casing and well casing from the top of the firm grout to approximately 2.5 cm (1.0 inch) below the top of the well casing. The mortar mix will be (by weight) one part cement to two parts sand, with minimal approved water for placement.

For monitoring wells constructed as above-grade well installations, the mortar collar will be poured on the day firm grout is found in the borehole. The mortar collar will be poured within the annulus between the protective casing and well casing from the ground surface to approximately 15.2 cm (6.0 inches) above the ground surface. After the placement of the mortar collar, the remaining annulus formed between the outside of the protective casing and borehole, or permanent casing, if present, will be filled with concrete to the ground surface and extending onto the apron around the well head to form a square-cornered concrete pad measuring approximately 0.76 by 0.76 m square (30 by 30 inches square). For flush-mounted installations, the pad will be sloped away from the casing and recessed into the ground approximately 12 cm (0.5 ft). For both types of installations, the thickness of each concrete pad will be uniform and no less than 10.2 cm (4.0 inches). Following placement and curing of the concrete pad, a drainage port measuring approximately 0.6 cm (0.25 inches) in diameter will be drilled into the protective casing 0.3 cm (0.12 inches) above the top of the internal mortar collar.

Upon completion of protective cover placement for above-grade well installations, a minimum of three and preferably four steel guard posts will be radially located 1.2 m (4.0 feet) around each monitoring well. The guard post length will be 1.8 m (6.0 feet), approximately 0.6 m (2.0 feet) of which will be set in cement below ground level. All of the guard posts, as well as the protective casing including the hinges and cover/cap, will be painted orange with a paint brush and will be completely dry before sampling of the well.

4.3.2.3.10 Well identification

For each monitoring well installed during the AOC-specific investigations, the well designation number will be painted, using white paint, on the outside of the protective casing (after application and drying of the orange paint), and/or a metal tag bearing the designation will be attached to the protective casing or well casing depending upon the type of installation (i.e., above-grade or flush-mounted).

At AOC sites where no existing monitoring wells are present, wells installed during the investigations will be numbered consecutively beginning with the designation XXXmw-001 (XXX = AOC Designator). At sites where existing monitoring wells are present, wells installed during the investigations will be numbered consecutively beginning with the next highest unused number (for example, if four existing wells designated as XXXmw-001 through XXXmw-004 are present, numbering of the new investigation wells would begin with XXXmw-005). Boreholes drilled for purpose of monitoring well installation, but subsequently abandoned, will also be numbered consecutively beginning with the designation XXXSB-001. In the event that boreholes have been previously drilled at the site, numbering will again begin with the next highest unused number. The well identification system will be consistent with the location/sample identification naming convention specified in Section 5.3 of the FSAP.

4.3.2.3.11 Well development

The development of monitoring wells installed at the AOC will be initiated not sooner than 48 hours after nor longer than 7 days beyond internal mortar collar placement or the final grouting of the wells. If it is necessary to develop existing monitoring wells at one AOC, the integrity of the well will be checked prior to development. In the event that the integrity of the well is questionable, the well will not be developed. The integrity of the well will be checked by visual inspection of the surface casing and riser pipe, and by performing an alignment test in accordance with Section 4.3.2.3.13, of the FSAP.

4.3.2.3.11.1 Pump and bailer usage

Development of monitoring wells will be accomplished using one of the following nondedicated devices: a bottom discharge/filling Teflon or stainless steel bailer, a submersible pump, or a peristaltic pump. During development operations utilizing a bailer, the bailer will be rapidly surged up and down within the screen section of the well to agitate and mobilize particulates around the well screen during removal of groundwater from the well. During development operations utilizing a pump, the pump will be alternately started and stopped during groundwater removal, allowing the well to equilibrate and creating a surging action. In situations where a high percentage of fine material is suspended in the groundwater, a surge block may be used in coordination with the noted devices to mobilize particulates drawn into the granular filter pack.

4.3.2.3.11.2 Development criteria

Development of each monitoring well will proceed until each of the following criteria are achieved.

- A turbidity reading of 5 NTU or less is achieved using a turbidity meter, or the water is clear to the unaided eye.

- The sediment thickness remaining within the well is less than 3.0 cm (0.1 foot).

- A minimum removal of five times the standing water volume in the well (to include the well screen and casing plus saturated annulus, assuming 30% annular porosity) has been achieved.

- Indicator parameters (pH, specific conductivity, temperature, e.g.) have stabilized to within 10 percent on three consecutive readings.

- In addition to the “five times the standing water volume” criteria, five times the amount of any water unrecovered from the well during installation will also be removed. Under specific circumstances, such as bedrock coring in dry rock, potable water may be introduced to the formation.

During the course of well development, the U.S. Army Project Manager will be contacted for guidance if well recharge is so slow that the required volume of water cannot be removed during 48 consecutive hours of development, if persistent water discoloration is observed after completion of the required volume removal, or if excessive sediment remains after completion of the required volume removal.

4.3.2.3.11.3 Development water sample

For each monitoring well developed at an AOC site, a 500-cm^3 (1-pint) sample of the last water to be removed during development will be placed into a clear glass jar and labeled with the well number and date. Each sample will be individually agitated and immediately photographed close up with a 35-millimeter camera loaded with color print film, using a back-lit setup to show water clarity. These photographs, minimally 12.7 by 17.8 cm (5 by 7 inches) in size and individually identified with project name, well number, and photograph date, will be provided to the U.S. Army Project Manager after development of all AOC wells. The film negatives or data disks will also be provided to the U.S. Army Project Manager after receipt of the photograph prints. After the development water samples have been photographed, the samples will be disposed of in the same manner as the other water removed from the monitoring wells during the development operation. All well development water must be containerized, characterized, stored, and disposed of in accordance with Section 7.0 of the FSAP.

4.3.2.3.11.4 Monitoring well washing

As part of each monitoring well development operation, the entire well cap and the interior of the well casing between the water table and the ground surface will be washed using water from the well. The purpose of this activity will be to remove extraneous materials (grout, bentonite, sand, etc.) from the interior of the well. The monitoring well washing activity will be conducted during the overall development operation.

4.3.2.3.12 Well survey

A topographic survey of the horizontal and vertical locations of all groundwater monitoring wells at the AOC sites will be conducted after completion of well installation. The topographic survey will be lead/conducted by an individual licensed in an appropriate classification within the State of Ohio for the specific work anticipated to be conducted. This license will be current and active throughout the term of performance during the project.

4.3.2.3.12.1 Horizontal control

Each required survey element will be topographically surveyed to determine its map coordinates referenced to the Ohio State Plane (OSP) Coordinate System . The survey will be connected to the OSP by third-order, Class II control surveys in accordance with the Standards and Specifications for Geodetic Control Networks (Federal Geodetic Control Committee 1984). All elements surveyed will have an accuracy of at least 0.3 m (1.0 foot) within the chosen system. Specific projects may require greater accuracy. Locations of monitoring wells will be measured at the rim of the uncapped well casing (not the protective casing).

4.3.2.3.12.2 Vertical control

Each required survey element will be topographically surveyed at the notched point on the solid well casing (not the protective casing). The ground surface elevation (not the pad surface) adjacent to each well will also be measured. The location of the ground surface point surveyed will be marked using a driven hub with a nail and flagging affixed. The survey will be connected by third-order leveling to the National Geodetic Vertical Datum of 1929 in accordance with the Standards and Specifications for Geodetic Control Networks (Federal Geodetic Control Committee 1984). All elements surveyed will have an accuracy of at least 0.3 cm (0.01 foot). Specific projects may require greater accuracy.

4.3.2.3.12.3 Field data

The topographic survey will be completed as near as possible to the time when the last monitoring well is installed at the AOC site. Survey field data (as corrected), to include loop closures and other statistical data in accordance with the standards and specifications referenced above, will be provided to the U.S. Army Project Manager. Closure will be within the horizontal and vertical limits referenced above. The following data will be clearly listed in tabular form: coordinates (and system) and elevation (ground surface and top of well) as appropriate, for all boreholes, wells, and reference marks. All permanent and semipermanent reference marks used for horizontal and vertical control (i.e., benchmarks, caps, plates, chiseled cuts, rail spikes, etc.) will be described in terms of their name, character, physical location, and reference value.

4.3.2.3.13 Alignment testing

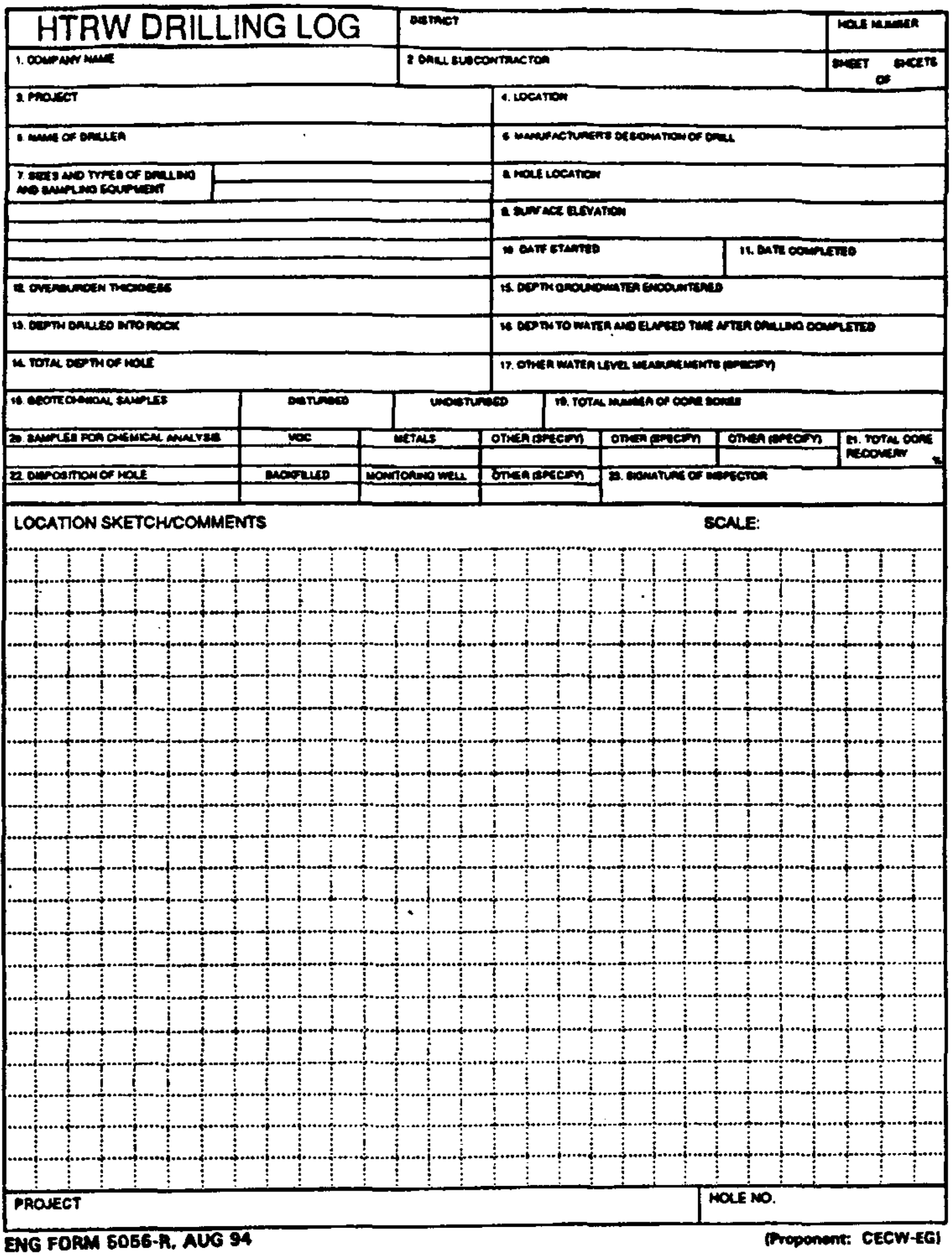
Alignment tests will be conducted on each monitoring well installed during the AOC-specific investigations. This testing will be conducted to ensure that deformation and/or bending of the PVC well casing and screen is minimal. The testing will be performed using a pump or bailer with a diameter no less than 2.5 cm (1.0 inch) smaller than the well casing and screen diameter. A nylon rope will be attached to the pump/bailer, and the unit will be lowered to the bottom of the well and retrieved. The alignment test will be considered successful if the pump/bailer can be lowered and retrieved without bridging within the well. If a monitoring well fails an alignment test as described, the well will be abandoned in accordance with Section 4.3.2.5 of the FSAP.

4.3.2.4 Documentation

4.3.2.4.1 Logs and well installation diagrams

4.3.2.4.1.1 Boring logs

Each borehole log generated during the AOC-specific investigations will fully describe the subsurface environment and the procedures used to gain that description. All borehole data will be recorded in the field by the site geologist on Engineer Form 5056-R and 5056A-R (Figure 4-7). A scale of 2.5 cm (1.0-inch) on the log equaling 0.3 m (1.0 foot) of borehole will be used during borehole log preparation. Each original borehole log will be submitted to the U.S. Army Project Manager, along with the corresponding original well construction diagram, as soon as the field effort has been completed. Original borehole logs and well construction diagrams will be of sufficient legibility and contrast so as to provide comparable quality in reproduction and will be recorded directly in the field without transcribing from a field book or other document.



HTRW DRILLING LOG

DISTRICT

HOLE NUMBER

1. COMPANY NAME

2. DRILL SUBCONTRACTOR

SHEET OF SHEETS

3. PROJECT

4. LOCATION

5. NAME OF DRILLER

6. MANUFACTURER'S DESIGNATION OF DRILL

7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT

8. HOLE LOCATION

9. SURFACE ELEVATION

10. DATE STARTED

11. DATE COMPLETED

12. OVERBURDEN THICKNESS

15. DEPTH GROUNDWATER ENCOUNTERED

13. DEPTH DRILLED INTO ROCK

16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED

14. TOTAL DEPTH OF HOLE

17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)

18. GEOTECHNICAL SAMPLES | DISTURBED | UNDISTURBED

19. TOTAL NUMBER OF CORE BOXES

20. SAMPLES FOR CHEMICAL ANALYSIS | VOC | METALS | OTHER (SPECIFY) | OTHER (SPECIFY) | OTHER (SPECIFY)

21. TOTAL CORE RECOVERY %

22. DISPOSITION OF HOLE | BACKFILLED | MONITORING WELL | OTHER (SPECIFY)

23. SIGNATURE OF INSPECTOR

LOCATION SKETCH/COMMENTS

SCALE:

PROJECT

HOLE NO.

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG)

Figure 4-7. Engineer Forms 5056-R and 5056A-R for Borehole Logging

HTRW DRILLING LOG

HOLE NUMBER

PROJECT

INSPECTOR

SHEET

OF SHEETS

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	REMARKS (g)

PROJECT

HOLE NO.

Figure 4-7 (continued)

All borehole logs generated during the AOC-specific investigations will routinely contain the following information:

- Unique borehole/monitoring well number and location denoted on a sketch map as part of the log.
- Depths or heights recorded in feet and decimal fractions thereof (tenths of feet).
- Field estimates of soil classification (USCS) in accordance with the Annual Book of ASTM Standards, Volume 04.08, D 2488 (ASTM 1995) prepared in the field at the time of sampling by the site geologist.
- Full description of each soil sample collected, including the parameters noted in Table 4-2.

Table 4-2. Soil and Rock Parameters to be Recorded on Borehole Logs

Soil Parameters	Rock Parameters
USCS Classification	Rock type
Depositional environment and formation, if known	Formation
ASTM D 2488 group symbol	Modifier denoting variety
Secondary components and estimated percentages	Bedding/banding characteristics
Color (using Munsell Soil or GSA Rock Color Chart). Give both narrative and numerical description and note which chart was used.	Color (same as for soil)
	Hardness
	Degree of cementation
Plasticity	Texture
Consistency (cohesive soil; very soft, soft, medium stiff, stiff, very stiff, hard)	Structure of orientation
Density (noncohesive soil, loose, medium dense, dense, very dense)	Degree of weathering
Moisture content in relative terms: Dry – crumbly Damp – between crumbly and plastic limit Moist – between plastic limit and liquid limit Wet – greater than liquid limit Saturated – runny, all voids filled with water	Solution or void conditions
Structure and orientation	Primary and secondary permeability, include estimates and rationale
Grain angularity	Lost core interval and reason for loss

ASTM = American Society for Testing and Materials.
GSA = Geological Society of America.

- Visual numeric estimates of secondary soil constituents and quantitative definitions of description terms (i.e., trace, some, several, etc.) recorded on the log.
- Full description, to the greatest extent practical, of bedrock material encountered, including the parameters noted in Table 4-2.
- Description of disturbed samples (if used to supplement subsurface description) in terms of the appropriate soil/rock parameter, to the extent practical. At a minimum, classification along with a description of drill action for the corresponding depth will be recorded. Notations will be made on the log that these descriptions are based on observations of disturbed material rather than intact samples.

- Description of drilling equipment, including such information as auger size (inner and outer diameter), bit types, compressor type, rig manufacturer, and model.

- Sequence of drilling activities.

- Any special problems encountered during drilling and their resolution.

- Dates and times for the start and completion of the borehole along with notation by depth for drill crew shifts and individual days.

- Each sequential boundary between various soil types and individual lithologies.

- The depth of first-encountered free water along with the method of determination and any subsequent distinct water level(s) encountered thereafter. Before proceeding, the first encountered water will be allowed to partially stabilize (from 5 to 10 minutes) and recorded along with the time between measurements.

- Interval by depth for each sample collected, including the length of sampled interval, length of sample recovery, and the sampler type and size (diameter and length).

- Total depth of drilling and sampling.

- Results of soil core organic vapor scan readings and soil sample organic vapor headspace readings. Notation will include interval sampled, corresponding vapor readings, and key to the specific instrument used to obtain readings. A general note will be made on the log indicating the manufacturer, model, serial number, and calibration information for each instrument used.

- Definition of any special abbreviations used at the first occurrence of their usage.

In addition to the original borehole logs prepared for each AOC-specific investigation, the contractor will also create an electronic geological database. Information will be entered into this database in accordance with the USACE-Louisville District Data Standards for Environmental Restoration Sites (Appendix A). Information required to complete the database that is not recorded on original borehole logs will be recorded in the project logbook. The geological database will be submitted to the U.S. Army Project Manager in ASCII format.

4.3.2.4.1.2 Well construction diagrams

Each monitoring well installed during the AOC-specific investigations will be depicted in an as-built well construction diagram (Figure 4.8). Each diagram will be attached to the original borehole log for that installation and will graphically denote, by depth from the ground surface, the following information:

- location of the borehole bottom and borehole diameter(s);
- location of the well screen;
- location of any joints;
- location of the granular filter pack;
- location of the bentonite seal;
- location of grout;
- location of centralizers;
- height of riser (stickup), without cap/plug, above the ground surface;

MONITORING WELL [illegible]

PROJECT NAME: **DELIVERY ORDER NO:**

WELL NUMBER:	**BEGIN:**	**END:**
COORDINATES: N: E:	**REFERENCE POINT:**	**ELEVATION:**

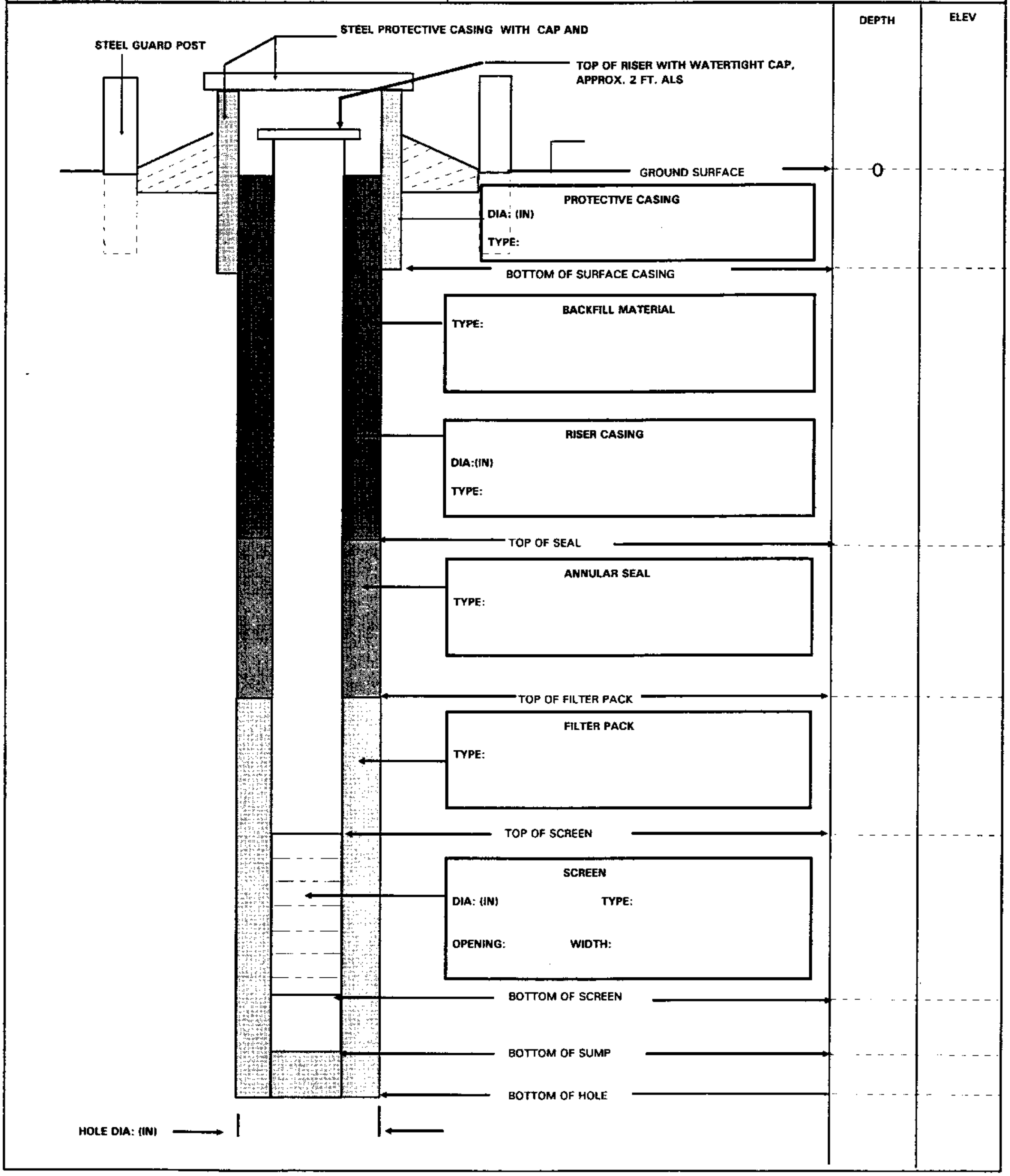


Figure 4.8. Example of Well Construction Diagram Used in Logbooks

- height of the protective casing, without cap/cover, above the ground surface;
- depth of protective casing base below the ground surface;
- location and size of drainage port;
- location of the internal mortar collar;
- sloped concrete pad height and diameter;
- protective post configuration; and
- water level 24 hours after completion of installation with date and time of measurement.

Additional information to be described on each as-built well construction diagram will include the following:

- actual quantity and composition of the grout, bentonite seal, and granular filter pack used for construction of the monitoring well;

- the screen slot size in inches, slot configuration, total open area per foot of screen, outside diameter; nominal inside diameter, schedule/thickness, composition, and manufacturer;

- type of material located between the bottom of the borehole and the bottom of the screen;

- the outside diameter, nominal inside diameter, schedule/thickness, composition, and manufacturer of the well casing;

- the joint design and composition;

- the design and composition and centralizers;

- depth and description of any permanent pump or sampling device installed within the monitoring well;

- the composition and nominal inside diameter of protective casing;

- any special problems encountered during well construction and their resolution;

- dates and times for the start and completion of monitoring well installation; and

- definition of any special abbreviations used at the first occurrence of their usage.

Each original well construction diagram will be submitted to the U.S. Army Project Manager as soon as the field effort has been completed. Each diagram will be attached to the corresponding original borehole log for that location. In addition to the original well construction diagrams prepared for each AOC-specific investigation, the Contractor will also enter well information into the electronic geological database in accordance with the USACE-Louisville District Data Standards for Environmental Restoration Sites (Appendix A). Information required to complete the database that is not recorded on original well construction diagrams will be recorded in the project logbook.

4.3.2.4.2 Development record

For each monitoring well developed during the AOC-specific investigations, a record will be prepared to include the following information:

- project name and location;

- well designation and location;
- date(s) and time(s) of monitoring well installation;
- date(s) and time(s) of monitoring well development;
- static water level from top of well casing before and 24 hours after completion of well development with dates and times of measurements;
- quantity of water lost during drilling, removed before well insertion, and added during granular filter placement;
- quantity of standing water contained with the well, and contained within the saturated annulus (assuming 30 percent porosity), before well development;
- field readings of pH, conductivity, turbidity, and temperature measured before, twice during, and after completion of well development using an appropriate device and method in accordance with EPA Procedure 600/4-79-020 (see Section 4.3.3 of this FSP for description of instrument and procedure to the utilized for field measurements);
- depth from top of well casing to bottom of well;
- length of the well screen;
- depth from top of the well casing to the top of sediment inside the well, both before and after development, as measured directly at the time of development;
- physical character of the removed water, including changes during development in clarity, color, particulates, and any noted odor;
- type and size/capacity of the bailer or pump used for development;
- description of the surge technique used during development;
- height of the well casing above ground surface as measured directly at the time of development;
- estimated recharge rate into the well at the time of development; and
- quantity of water removed from the well during the development operation and the time for removal, present as both incremental and total values).

4.3.2.4.3 Photographs

For each photograph taken during the AOC-specific investigations, the following items will be noted in the field logbook:

- date and time,
- photographer (name and signature),
- name of the AOC site,

- general direction faced and description of the subject taken, and
- sequential number of the photograph and the roll number.

Photographs taken to document sampling points will include two or more permanent reference points within the photograph to facilitate relocating the point at a later date. In addition to the information recorded in the field logbook, one or more site photograph reference maps will be prepared as required. An example of this map type is presented in Figure 4-9.

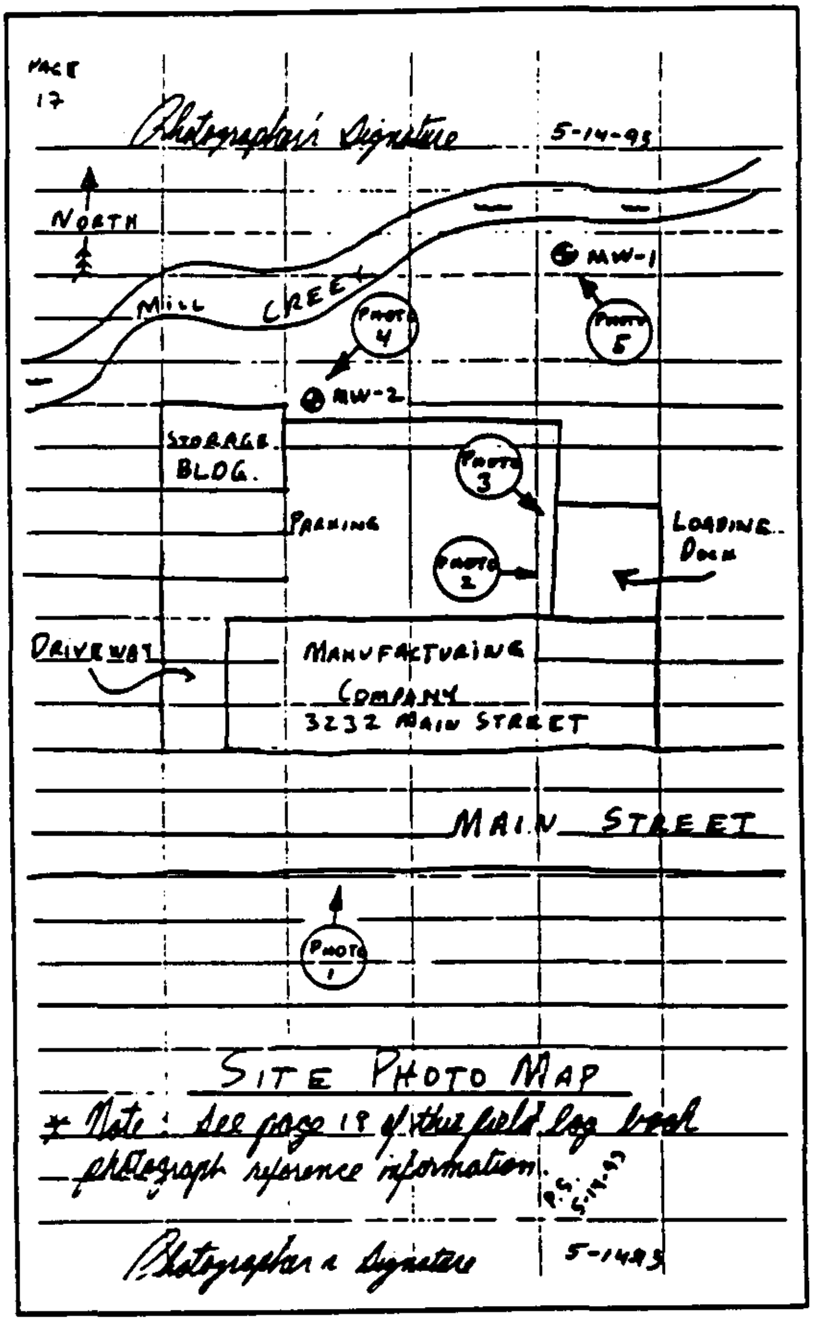
4.3.2.5 Well abandonment

Abandonment of monitoring wells and soil boreholes during the AOC-specific investigations will be conducted in a manner precluding any current or subsequent fluid media from entering or migrating within the subsurface environment along the axis or from the endpoint of the well/borehole. Abandonment will be accomplished by filling the entire volume of the well/borehole with grout composed of Type I portland cement, 6 pounds dry bentonite per 42.6-kilogram (94-pound) sack of dry cement, and a maximum of 0.02 to 0.03 m^3 (6 to 7 gallons) of approved water per sack of cement.

The abandonment of each well/borehole will follow field procedures outlined in Chapter 9 of Ohio EPA's *Technical Guidance Manual for Hydrogeologic Investigations and Ground Water Monitoring* (Ohio EPA 1995). Well abandonment will include removal of casing and screen, overdrilling of the well borehole, and grouting to the surface.

For each abandoned well/borehole, a record will be prepared and submitted to U.S. Army Project Manager including the following information:

- project and well/borehole designation;
- location with respect to the replacement well or borehole (if any);
- open depth of well/borehole before grouting;
- casing or items left in borehole by depth, description, composition, and size (if applicable);
- copy of the borehole log;
- copy of construction diagram for abandoned well (if applicable);
- reason for abandonment;
- description and total quantity of grout used initially;
- description and daily quantities of grout used to compensate for settlement;
- dates of grouting;
- water or mud level prior to grouting and date measured; and
- remaining casing above ground surface: type (well, drill, protective), height above ground, size, and composition of each (if applicable).



* Note: See page 19 of this field log book photograph reference information.

Figure 4-9. Example of the Photograph Map to be Recorded in Field Logbooks

All depths reported in the borehole abandonment record will be designated in feet from ground surface. Original borehole abandonment records will be submitted to the U.S. Army Project Manager. Any replacement wells/boreholes installed during the AOC-specific investigations will be offset at least 6.0 m (20.0 feet) from any abandoned site in a presumed upgradient or cross-gradient groundwater direction.

4.3.2.6 Water level measurement

Measurement of one complete set of initial static groundwater levels within all monitoring wells located at any given AOC site will be made over a single, consecutive 10 to 12-hour period at least 24 hours after development and sampling of the monitoring wells. The depth to groundwater will be measured and recorded to the nearest 0.3 cm (0.01 foot). Measurements will be made from a notch filed into the solid well casing and will not be referenced to the rim of the protective casing. The point on the well casing will be surveyed for vertical control. All measured groundwater level data will be presented in subsequent reports in tabular form, which will include: (1) well location; (2) total depth; (3) top of casing elevation; (4) measure water depth; and (5) groundwater elevation. Groundwater elevation data will be contoured to denote flow directions and gradients provided that sufficient data points exist.

4.3.3 Field Measurement Procedures and Criteria

Groundwater field measurements to be performed during the AOC-specific investigations will include determination of static water level, pH, conductivity, dissolved oxygen concentration, and temperature. A description of each field instrument and associated calibration requirements and performance checks to be used for field measurements is presented in Table 4-3. A summary of the procedures and criteria to be used for field measurements is presented below.

Table 4-3. Summary of Field Instruments and Calibration/Performance Requirements for RVAAP AOC-Specific Investigations

Instrument and Use	Calibration	Performance
Solinst Water Level Meter, used for determination of static water level	Calibrated by manufacturer	± 0.01 feet
HyDAC Conductivity – Temp.-pH Tester, used for determination of groundwater pH	2 points using pH 4.0 and 7.0 standard solutions on a daily basis	± 0.1 units
HyDAC Conductivity – Temp. – pH Tester, used for determination of groundwater conductivity	1 point using 0.01 m KCL standard solution on a daily basis	± µmhos/cm
Mercury thermometer, used for determination of groundwater temperature	Calibration by manufacturer	± 1°C
HNu HW-101 PID, used for determination of organic vapor concentrations emitted from subsurface soil material	1 point using 100 ppm isobutylene calibration gas on a daily basis	± 0.1 ppm

KCL = potassium chloride (solution)
PID = photoionization detector
ppm = parts per million

4.3.3.1 Static water level

Static water level measurements will be made using an electronic water level indicator. Initially, the indicator probe will be lowered into each monitoring well without touching the probe to the well casing until the alarm sounds and/or the indicator light illuminates. The probe will then be withdrawn several feet and slowly lowered again until the groundwater surface is contacted as noted by the alarm and/or indicator light. All probe cords used for measurement will be incrementally marked at 0.006-meter

(0.02-feet) intervals. Water level measurements will be estimated to the nearest 0.003 m (0.01 feet) based on the difference between the nearest probe cord mark to the top of the well casing.

The distance between the top of casing and the groundwater surface will be recorded to within 0.3 cm (0.01 foot). The static water level measurement procedure will be repeated two or three times to ensure that the water level measurements are consistent (± 0.3 cm or 0.01 foot). If this is the case, then the first measured level will be recorded as the depth to groundwater. If this is not the case, the procedure will be repeated until consistent readings are obtained from three consecutive measurements.

4.3.3.2 pH, conductivity, dissolved oxygen, and temperature

pH, conductivity, dissolved oxygen, and temperature measurements will be made using a combination meter designed to measure these parameters. A groundwater sample will be retrieved from each monitoring well and immediately poured into a clean container placed onto a stable surface at the well. With the combination meter set in the appropriate mode, the meter electrode will be swirled at a slow constant rate within the sample until the meter reading reaches equilibrium.

Sample pH will be recorded to the nearest 0.1 pH unit. The pH measurement is considered stable when 3 consecutive readings produce less than 0.2 pH units variation. All recorded conductivity values will be converted to conductance at 25 ºC. Sample conductivity will be recorded to the nearest 10 μmhos/cm, and the temperature to the nearest 0.1 ºC, with stable measurements consisting of less than 10 percent variation for conductance and less than 0.5 ºC variation for temperature. Dissolved oxygen content will be recorded to the nearest 0.01 mg/L. Dissolved oxygen readings will be considered stable when three consecutive readings produce less than 10 percent variation.

4.3.4 Sampling Methods for Groundwater – General

USACE guidance in EM-1110-1-4000 (USACE 1994) recommends that well development be completed at least 14 days prior to sampling. This hiatus theoretically allows time for the chemical equilibrium between the aquifer and the filter pack to be established. However, this rule of thumb is unsubstantiated by scientific data. If a different duration is proposed, based on technical data or overall project considerations, it should be used as deemed appropriate, and such proposal should be included in the site-specific addendum to this FSAP.

Collection of groundwater samples from monitoring wells during the AOC-specific investigations will involve three general steps: (1) measurement of field parameters, (2) well purging, and (3) groundwater sample collection. All of the activities would normally be accomplished within a 2- to 4-hour period per monitoring well. Procedures and criteria for the measurement of field parameter were previously discussed in Section 4.3.3 of this FSAP. Purging and sampling of monitoring wells will be accomplished using either a Teflon® or stainless steel bailer or a bladder or peristaltic pump. If it is necessary to sample an existing monitoring well, the integrity of the well will be checked prior to purging. Alignment testing is recommended to ensure that the well has not been obstructed or otherwise damaged since the previous sampling event. The integrity of the well will be checked by visual inspection of the surface casing and riser pipe, and by performing an alignment test in accordance with Section 4.3.2.3.13 of the FSAP. In the event that the monitoring well is questionable, the well will not be purged and sampled. If required, a new well will be installed as directed by the U.S. Army Project Manager.

4.3.4.1 Conventional well purging

After initial measurement of field parameters, purging of each monitoring well will commence until pH, conductivity, dissolved oxygen concentration, and temperature have reached equilibrium as described in

Section 4.3.3.2. Equilibrium will be established by three consecutive readings, where one well casing volume is purged between each reading. However, purging will be terminated before establishment of equilibrium if one of the following conditions is met: (1) five well volumes, including the saturated filter pack assuming a porosity of 30%, have been removed from the well; or (2) the well is purged to dryness. Each bailer used for purging/sampling will be equipped with a nylon retrieval cord that will be properly discarded upon completion of the purging and sampling activities. Each bladder pump used for purging/sampling will be equipped with a Teflon®-coated retrieval wire that will be decontaminated upon completion of the purging and sampling activities.

If a monitoring well is purged to dryness, sampling will be delayed for a time period of up to 24 hours to allow for recharge. During the delay period, the atmosphere of the well will be isolated to the greatest extent possible from the surface atmosphere. Upon sufficient recharge of groundwater into the well, i.e., if the well recharges to 90% of its initial water level within 4 hours, a sample will be collected without additional well purging. If sufficient well recharge does not occur within 24 hours after the initial purging, the U.S. Army Project Manager will be contacted for guidance.

4.3.4.2 Micro-purging

In order to minimize the quantity of liquid IDW generated as a result of well purging, wells will be micro-purged where conditions permit, in accordance with Ohio EPA technical guidance (1995), as follows:

- A bladder or submersible pump will be used for purging;
- The purge rate will not exceed 100 mL/minute unless it can be shown that higher rates will not disturb the stagnant water column above the well screen (i.e., will not result in drawdown);
- The volume purged will be either two pump and tubing volumes or a volume established through in-line monitoring and stabilization of water quality parameters such as dissolved oxygen and specific conductance; and
- Sample collection shall occur immediately after micro-purging.

When micro-purging cannot be accomplished for any reason, then purging of all monitoring wells in the AOC will be conducted in accordance with the procedures for conventional purging described above.

Sampling of the monitoring well will begin immediately after purging. When a bailer is used, the device will be lowered slowly until it contacts the groundwater surface, allowed to sink and fill with a minimum of surface disturbance, and raised slowly to the surface. The sample will then be transferred to appropriate sample bottles by tipping the bailer so that a slow discharge of sample from the bailer top flows gently down the side of the sample bottle with minimum entry disturbance. Bottles designated for volatile organic analysis will be filled first and in a manner so that no headspace remains. Immediately after collection of each sample and completion of bottle label information, each sample container will be placed into a sealable plastic bag and then will be placed in an ice-filled cooler to ensure preservation.

When a bladder pump is used, the device will be lowered slowly until it contacts the groundwater surface, and then will continue to be lowered until the pump intake is located at the midpoint of the monitoring well screen. The pump will then be activated and allowed to operate until a steady flow of groundwater is expelled from the Teflon® return line at the ground surface. The discharge line will not be allowed to touch any part of the interior of the sample container or the sample matrix within the container. The sample will be collected and preserved in the same manner as described above. Details regarding the general groundwater sampling methods to be used for investigations will be presented in the AOC-specific investigation addenda to the FSAP.

4.3.5 Sampling Methods for Groundwater – Filtration

The method used for collection of filtered groundwater samples from monitoring wells will depend on whether a bailer or bladder pump is used for the sample collection. Regardless of which of the two sampling devices is used, the measurement of field parameters and purging of the well will be conducted in the same manner as described in Section 4.3.4 of this FSAP.

When a bailer is used for groundwater sampling, the device will be lowered into the monitoring well, filled with groundwater, and raised to the surface. The collected sample will then be slowly poured into a decontaminated holding vessel. The groundwater sample will be filtered using a hand-operated pump equipped with Teflon® intake and discharge tubing. A disposable, pre-sterilized 0.45-µm pore size filter assembly will be attached to the end of the Teflon® discharge tubing. The Teflon® intake tubing will be placed into the holding vessel and the groundwater sample will be pumped through the tubing and disposable filter. Sample bottles will be filled with discharge exiting the disposable filter. Filters will be replaced as they become restricted by solids buildup, and between sample collection sites. Immediately after collection of the sample and completion of bottle label information, each sample container will be placed into a sealable plastic bag and then will be placed in an ice-filled cooler to ensure preservation.

When a bladder pump is used for groundwater sampling, a disposable, pre-sterilized 0.45-µm pore size filter will be attached to the end of the pump's Teflon® return line. After the pump has been placed into the monitoring well, groundwater will be pumped through the tubing and disposable filter. During this flushing operation, the pumping rate will be adjusted as necessary to minimize turbulence. After flushing of the system has been completed, sample bottles will be filled with discharge exiting the disposable filter. The sample bottles will be packaged and preserved in the same manner as described above. The disposable filters used for collection of filtered groundwater samples will be discarded after each use.

4.3.6 Sample Containers and Preservation Techniques

Information regarding sample containers and preservation techniques for groundwater samples collected for chemical analyses during the AOC-specific investigations is presented in Section 4.0 of the QAPP portion of this FSAP. All sample containers will be provided by contracted laboratories, who will place into the containers or provide separately the required types and quantities of chemical preservatives. With regard to temperature preservation, all groundwater sample containers will be stored at 4 °C (± 2°C) immediately after sample collection and will be maintained at this temperature until the samples are received at the contracted laboratory.

4.3.7 Field Quality Control Sampling Procedures

Generally, three different types of QA/QC samples will be collected during performance of the AOC-specific investigation groundwater sampling activities. These sample types will be duplicates, equipment rinsate blanks, and trip blanks. QC samples collected will be sent to the contracted laboratory to provide data for use in determining the quality of the analytical results reported for the associated environmental samples. QA samples collected will be sent to a U.S. Army QA laboratory for independent analysis and evaluation of analytical results reported by the contracted laboratory.

A duplicate sample is collected along with a field sample at the same sampling location and is placed into a separate container labeled with a unique sample number. The duplicate is submitted as "blind" to the laboratory and is used to determine whether the field sampling technique is reproducible and to check the accuracy of reported laboratory results. Duplicate groundwater samples will be collected during the AOC-specific investigations using the same procedures defined for field groundwater samples as discussed in Sections 4.3.4 and 4.3.5 of this FSAP. Information regarding the total number, collection frequency, and analytical parameter for duplicate samples will be defined in the AOC-specific addenda to the FSAP. However, it is anticipated that the number of duplicate samples will represent 10% of the total number of field samples collected for each AOC-specific investigation. This applies also to matrix spike/matrix spike duplicates (MS/MSDs), as discussed in Section 8.0 of the Facility-wide QAPP.

An equipment rinsate blank is collected in the field from the final decontamination water rinse of field sampling equipment. The rinsate blank is used to determine the effectiveness of the decontamination process in avoiding carryover of contamination from one sampling location to the next. A rinsate blank will be collected from the device used to collect groundwater samples from monitoring wells after it has undergone decontamination. Upon completion of the decontamination procedure, ASTM Type I or equivalent water will be poured over and through the device and collected directly into appropriate sample containers. Information regarding the total number, collection frequency, and analytical parameter for equipment rinsate blanks will be defined in the AOC-specific addenda to the FSAP. Typically, rinsate blanks are collected at a frequency of 10 percent or one per day per matrix. When dedicated sampling equipment is used, equipment rinstate blanks are not required. AOC-specific addenda to the QAPP will list any equipment rinsates to be collected.

A trip blank consists of a sealed container of ASTM Type I or equivalent water that travels from the field to the laboratory with field samples to be analyzed for volatile organic compounds. The trip blank receives the same treatment as field sample containers and is used to identify contamination that may have been contributed to the field samples during transport. Trip blanks will be prepared by the contracted laboratory and shipped with sample bottles to be used for collection of field, duplicate, and rinsate samples. Therefore, no sampling procedures are applicable to these blanks. One trip blank will be placed into each cooler used to transport groundwater samples designated for volatile organic compound analysis. Information regarding the total number and analytical parameter for trip blanks will be defined in the AOC-specific addenda to the QAPP. Typically, one trip blank is collected per day per matrix, when volatile organic compounds are analyzed (the AOC-specific addendum will specify exceptions).

4.3.8 Decontamination Procedures

Decontamination of nondedicated equipment used for static water level measurement and for the development and purging of monitoring wells and collection of groundwater samples during the AOC-specific investigations will be conducted within a temporary decontamination pad to be constructed at each decontamination site. The decontamination pad will be designed so that all decontamination liquids are contained from the surrounding environment and can be recovered for disposal as IDW. Nondedicated equipment will be decontaminated after the development of each well and again after purging and sampling of each well. The procedure for decontamination of equipment will be as follows:

1. Wash with approved water and phosphate-free detergent using various types of brushes required to remove particulate matter and surface films.

2. Rinse thoroughly with approved potable water.

3. Rinse thoroughly with ASTM Type I or equivalent water.

4. Rinse thoroughly with methanol.

5. Rinse thoroughly with ASTM Type I or equivalent water.

6. Rinse thoroughly with hydrochloric acid (2% solution).

7. Rinse thoroughly with ASTM Type I or equivalent water.

8. Allow equipment to air dry as long as possible.

9. Place equipment on clean plastic if immediate use is anticipated or wrap in aluminum foil to prevent contamination if longer-term storage is required.

In addition to the well development and sampling equipment, field measurement instruments will also be decontaminated between monitoring well locations. Only those portions of each instrument that come into contact with potentially contaminated environmental media will be decontaminated. Due to the delicate nature of these instruments, the decontamination procedure will only involve initial rinsing of the instruments with approved water, followed by a final rinse using ASTM Type I or equivalent water. Decontamination of non-dedicated bladder pumps and other equipment with stainless steel components will be accomplished using only steps 1 through 4 above.

4.4 SUBSURFACE SOIL

4.4.1 Rationales

As defined in Section 3.0 of this FSAP, AOC-specific investigation addenda to the FSAP will be developed for the purpose of identifying unique elements of each investigation not addressed in the FSAP. Therefore, rationales related to soil borehole locations, discrete or composite soil sampling requirements, sample collection, field and laboratory analyses, determination of background values, and QA/QC sample collection and frequency will be addressed within each of the AOC investigation addenda as appropriate.

4.4.2 Procedures

4.4.2.1 Drilling Methods

4.4.2.1.1 Equipment condition and cleaning

The condition of all drilling, trenching, sampling, and support equipment used for subsurface soil sampling associated with each AOC-specific investigation and the equipment cleaning procedures will be the same as defined in Section 4.3.2.1.1 of this FSAP. Additional information regarding the decontamination of drilling and sampling equipment used for soil sample collection is presented in Section 4.4.2.8 of this FSAP.

4.4.2.1.2 Hollow stem auger drilling method

The hollow stem auger drilling method is to be used during the AOC-specific investigations for drilling of subsurface soil boreholes from which soil samples are to be collected for physical and/or chemical analyses. This method will be implemented as a dry drilling method for the investigations. The standard equipment used for borehole drilling will be 15.2 to 16.5 cm (6.0 to 6.5 inches) in outside diameter hollow stem auger. Information regarding the methods and equipment to be used for collection of subsurface soil samples from boreholes drilled using the hollow stem auger method is presented in Sections 4.4.2.4 and 4.4.2.5 of this FSAP.

Soil drilling using the hollow stem auger method will be accomplished using a truck-mounted auger rig of sufficient size and power to advance augers to the required drilling depth. The total depth of each subsurface borehole will be dictated by the target depth(s) for sampling and will be contingent upon the constraints of the maximum drilling depth for boreholes defined by the U.S. Army for each AOC-specific investigation. A discussion of these constraints will be presented in the AOC-specific investigation addenda to the FSAP.

4.4.2.1.3 Trenching method

The trenching method is anticipated to be used to collect subsurface soil samples and examine buried waste materials to characterize landfills during AOC-specific investigations. Authorization under OAC 3745-27-13 (Rule 13), as presented in Appendix B of the FSAP, must be granted by the Ohio EPA prior to commencement of any trenching activities. Further, it must be determined, to the extent practical, prior to trenching that no potential exists for unexploded ordnance and that adequate provisions for worker health and safety are addressed in the AOC-specific SSHP. Groundwater elevation must be known, and concurrence from Ohio EPA must be obtained before trenching begins.

The depth interval over which material will be collected using this method is expected to be limited to the interval located from the land surface (after removal of surface debris) to a depth of 4.5 m (15.0 feet) bgs. However, trenches will not be excavated below the local groundwater table to avoid the potential for contaminating groundwater and the hazard of collapse caused by digging into saturated material. Trenching will be stopped at the first indication of groundwater, and the trench will be immediately backfilled with at least 0.6 m (2 feet) of material. In the event that subsurface soil samples are required to be collected at depths greater than 4.5 m (15.0 feet), or below the local groundwater table, these samples will be obtained using the hollow stem auger drilling method.

Trenches will be excavated using a backhoe or other type of excavation equipment (i.e., clam shell, trench excavator, etc.). Soil material in each trench will be removed in layers measuring approximately 0.6 to 0.9 m (2.0 to 3.0 feet) in thickness. Soil will be removed in this fashion until the trench has been excavated to the required depth designated for the sampling location. The total depth of each trench will be dictated by the target depth(s) for sampling and will be contingent upon the depth of groundwater constraints of the maximum excavation depth for trenches defined by the U.S. Army for each AOC-specific investigation.

Under no circumstances will project personnel enter trenches deeper than 1.22 m (4 feet) unless sloping and/or benching is provided as discussed in the FSHP.

All soil and solid waste removed from trenches will be placed beside each trench on plastic sheeting and segregated by the layers in which it was excavated, if necessary, so that potentially hazardous materials are not commingled with non-hazardous materials. Segregation of the materials by layers will also allow for placement of the material back into the trench in the position that it was excavated. All soil and buried materials, except for materials determined to be hazardous, will be returned to the excavation of its origin immediately after each trench is completed. Any hazardous material encountered will not be placed back into the excavation, but will be containerized for treatment, storage, and disposal in accordance with Section 7 of the FSAP and the AOC-specific investigation SAP addendum. If as a result of trenching operations a release of contamination occurs, corrective measures will be initiated immediately to abate the release.

A discussion of these constraints and the equipment to be used for trench excavation will be presented in the AOC-specific investigation addenda to the FSAP.

4.4.2.1.4 Bucket hand auger method

The bucket hand auger method is a third method to be used during the AOC-specific investigations for collection of subsurface soil samples. This method will be implemented in the same manner as described in Section 4.5.2.1.1 of this FSAP.

4.4.2.1.5 Hydraulic direct-push method

Subsurface soil samples may also be collected by means of hydraulic direct-push samplers (e.g., Geoprobe). The hydraulic device may be used where continuous shallow-subsurface lithologic and stratigraphic information is needed in order to characterize an AOC. It may be used to advance Shelby tubes for the collection of undisturbed geotechnical samples. In some circumstances, it may be used to collect discrete or composite samples for chemical analyses. The standard equipment for subsurface sample collection will be a 5-cm (2-inch) outside-diameter macro-core sampling device, advanced using 2.54-cm (1-inch)-diameter steel rods attached to the hydraulic device. Each macro-core section is approximately 1.22 m (4 feet) long. The borehole is advanced by attaching additional lengths of extension rod to the macro-core barrel and pushing the entire pipe string downward. The macro-core sampler may be fitted with a clear acetate sleeve for ease of retrieving samples.

Hydraulic-push borings will be created using a truck-mounted hydraulic system of sufficient size and power to advance the macro-core to the required depth. The total depth of each borehole will be determined by the target depth(s) for sampling for each AOC. These parameters will be discussed in the AOC-specific addendum to this FSAP.

4.4.2.2 Boring logs

Information regarding the preparation and contents of borehole logs for the AOC-specific investigations is presented in Section 4.3.2.4.1.1 of this FSAP.

4.4.2.3 Field Measurement Procedures and Criteria

Field measurements to be performed on subsurface soil samples during the AOC-specific investigations may include determination of volatile organic headspace gas concentrations, field screening for the presence of TNT and other explosives, and field determinations of metals concentrations.

A description of the field instrument and associated calibration requirements and performance checks to be used for headspace gas measurements is presented in Table 4-3. Headspace gas concentration measurements will be made using a field organic vapor analyzer. Each soil sample collected from an investigation borehole will be placed into a glass jar, leaving some air space, and the jar will be covered with plastic cling wrap or aluminum foil to create an air-tight seal. The sample will then be immediately placed into an empty cooler and allowed to volatilize for a minimum of 15 minutes. The sealed jar will then be punctured with the organic vapor analyzer probe and headspace gas will be drawn until the meter reading is stable. The concentration of the headspace gas will be recorded to the nearest 0.1 part per million. All soil samples utilized for field measurements will be allowed to volatilize for an equal period of time before screening.

Field screening for explosives will be performed using RVAAP's Standard Operating Procedure (SOP) for Field Colorimetry Determination of Explosives in Soils. Field screening for metals will be conducted with the X-ray fluorescence (XRF) method detailed in RVAAP's SOP for XRF Determination of Metals Concentrations in Soils.

4.4.2.4 Sampling for physical/geotechnical analyses

4.4.2.4.1 Hollow stem auger drilling method

Soil samples designated for physical and geotechnical analyses will be collected from AOC investigation boreholes using a thin-walled (Shelby) tube sampler device. Samples will be collected using this device as part of hollow stem auger drilling of boreholes. The size (both diameter and length) of the Shelby tube sampler to be used, and the intervals over which soil samples will be collected will be defined in the AOC-specific investigation addenda to the FSAP.

During the drilling of investigation boreholes, the lead hollow stem auger will be advanced to the top of the soil interval to be sampled. The Shelby tube sampler will then be inserted into the auger string and hydraulically pushed to the bottom of the soil interval to be sampled. Upon retrieval of the sampler, the percentage of recovery will be recorded and the ends of the sampler will be sealed with wax or rubber packers to preserve moisture content. The preparation of Shelby tube samplers for shipment will be conducted in accordance with ASTM Method K1587-83.

4.4.2.4.2 Trenching and bucket hand auger methods

Subsurface soil samples collected using the trenching or bucket hand auger methods would be classified as disturbed sample types. Therefore, physical and geotechnical analyses of samples collected using these methods would be limited to those analyses for disturbed samples (i.e., grain size, Atterberg limits, moisture content, etc.). Samples collected using these methods would not be utilized for the determination of in-situ permeability values.

A sample will be collected from the required depth using either trench excavation equipment or a bucket hand auger as described in Section 4.4.2.1.3 or 4.5.2.1.1 of this FSAP. When trench excavation equipment is used, the sample will be placed onto polyethylene sheeting located at least 1.22 m (4.0 feet) from the edge of the collection trench. When a bucket hand auger is used, the sample will be placed into a decontaminated stainless steel bowl at the sampling location. The quantity of the sample required for physical and geotechnical analyses will be collected from the soil stockpile or stainless steel bowl using a stainless steel spoon and placed into sample containers.

4.4.2.5 Sampling for chemical analyses

4.4.2.5.1 Hollow stem auger drilling method

Subsurface soil samples designated for chemical analyses will be collected from AOC investigation boreholes using either split-spoon or split-barrel sampling devices. Samples will be collected using these devices as part of hollow stem auger drilling of boreholes. The size (both diameter and length) of the split-spoon or split-barrel device to be used and the intervals over which soil samples will be collected using one or both of these devices will be defined in the AOC-specific investigation addenda to the FSAP.

During the drilling of investigation boreholes, the lead hollow stem auger will be advanced to the top of the soil interval to be sampled. The selected soil sampling device will then be inserted into the auger string and advanced to the bottom of the soil interval. When using a split-spoon sampler, this device will be advanced to the required depth using a 63.5 kilogram (140-pound) hammer or continuously advanced with the auger string. When using a split-barrel sampler, this device will be hydraulically pushed to the required depth. A clean sampling device will be used to collect soil core from each sampled interval of the investigation boreholes.

Upon retrieval of the sampling device, the percentage of recovery will be recorded and the contained soil core will be split in half lengthwise using a stainless steel knife. Samples designated for laboratory analysis will be collected from the core using a stainless steel scoop. The scoop will either be used to retrieve an isolated section(s) of the soil core or will be run lengthwise down the core to collect a sample representative of the entire core interval. The portion of the sample designated for volatile organic analyses will be placed into laboratory sample containers first, followed by placement of the remaining portion of the sample into containers designated for other types of chemical analyses. Sample containers designated for volatile organic analyses will be filled so that minimal headspace in present in the containers. No portion of the soil core that was in contact with the sampling device wall will be included in the sample collected for laboratory analysis.

In the event that composite subsurface soil samples are to be collected as part of an AOC investigation, the first step of the compositing process will involve assembly of the bottles containing the discrete samples as collected above to be composited. At this point, samples for volatile organic analysis have been previously collected. No samples for volatile organic analysis will be collected from composited or homogenized sample volumes. Next, an equal quantity of each discrete sample will be placed into a decontaminated stainless steel bowl. The total quantity of the discrete samples selected for compositing will be sufficient to perform all required laboratory analyses. The soil placed into the bowl will initially be split into quarters, and each quarter will be mixed thoroughly in the center in the bowl using a stainless steel spoon. All four quarters will then be mixed together until the single composite sample has a consistent physical appearance. Upon completion of the compositing process, the sample will be divided in half and containers filled by scooping sample material alternately from each half.

Immediately after collection of discrete or composite samples and completion of bottle label information, each sample container will be placed into a sealable plastic bag and then will be placed into an ice-filled cooler to ensure preservation.

4.4.2.5.2 Trenching and bucket hand auger methods

Subsurface soil samples designated for chemical analyses will be collected using either trenching equipment or bucket hand augers in the same manner as described in Section 4.4.2.4.2 of this FSAP. When subsurface samples are collected at a location where a composite surface soil sample was collected (for explosives and propellants), the subsurface sample location will be in the approximate center of the three surface soil composite samples. All VOC samples will be collected as discrete aliquots from the middle of the subsurface interval without homogenization, using a stainless steel spoon. All remaining samples will be collected from homogenized soil from the bucket hand auger over the depth interval. No portion of the sample that was in contact with the sampling equipment or device will be included in the sample collected for laboratory analysis.

Immediately after collection of discrete or composite samples and completion of bottle label information each sample container will be placed into a sealable plastic bag and then will be placed into an ice-filled cooler to ensure preservation.

4.4.2.6 Sample containers and preservation techniques

Information regarding sample containers and preservation techniques for subsurface soil samples collected for chemical analyses during the AOC-specific investigations is presented in Section 4.0 of the QAPP portion of this FSAP. All sample containers will be provided by contracted laboratories. With regard to temperature preservation, all sample containers will be stored at 4 ºC (±2ºC) immediately after collection and will be maintained at this temperature until the samples are received at the contracted laboratory.

4.4.2.7 Field quality control sampling procedures

Duplicate QC samples will be collected in association with the collection of subsurface soil samples during the AOC-specific investigations. Duplicate subsurface soil samples will be collected during the investigations using the same procedures defined for field subsurface soil samples in Section 4.4.2.5 of this FSAP. Information regarding the total number, collection frequency, and analytical parameters for duplicate samples will be defined in the AOC-specific investigation addenda to the FSAP and in Section 8.0 of the QAPP.

4.4.2.8 Decontamination procedures

Decontamination of equipment used for the drilling of boreholes and collection of subsurface soil samples during the AOC-specific investigations will be conducted within a temporary decontamination pad to be constructed at the site. The decontamination pad will be designed so that all decontamination liquids are contained from the surrounding environment and can be recovered for disposal as IDW. Drilling equipment will be decontaminated after completion of each borehole. The procedure for decontamination of drilling equipment will be as follows:

1. Remove caked soil material from the exterior of augers and cutting heads using a rod and/or brush.

2. Steam clean interior and exterior of equipment using approved water, using a brush where steam cleaning is not sufficient to remove all soil material.

3. Rinse thoroughly with approved potable water.

4. Allow equipment to air dry as long as possible.

5. Place equipment on clean plastic if immediate use is anticipated, or wrap in plastic to prevent contamination if longer-term storage is required.

Nondedicated sampling equipment will be decontaminated after each use during borehole interval sampling. The procedure for decontamination of sampling equipment will be as follows:

1. Steam clean (hollow-stem auger equipment only) and wash with approved water and phosphate-free detergent using various types of brushes required to remove particulate matter and surface films.

2. Rinse thoroughly with approved potable water.

3. Rinse thoroughly with ASTM Type I or equivalent water.

4. Rinse thoroughly with methanol.

5. Rinse thoroughly with ASTM Type I or equivalent water.

6. Rinse thoroughly with hydrochloric acid (2% solution).

7. Rinse thoroughly with ASTM Type I or equivalent water.

8. Allow equipment to air dry as long as possible.

9. Place equipment on clean plastic if immediate use is anticipated, or wrap in aluminum foil to prevent contamination if longer-term storage is required.

4.5 SURFACE SOIL AND SEDIMENT

4.5.1 Rationales

As defined in Section 3.0 of this FSAP, AOC-specific investigation addenda to the FSAP will be developed for the purpose of identifying unique elements of each investigation not addressed in the FSAP. Therefore, rationales related to surface soil and sediment sample locations, discrete or composite sampling requirements, sample collection, field and laboratory analyses, determination of background values, and QA/QC sample collection and frequency will be addressed within each of the AOC investigation addenda as appropriate.

4.5.2 Procedures

4.5.2.1 Sampling methods for surface soil/dry sediments

4.5.2.1.1 Bucket hand auger method

The bucket hand auger method is anticipated to be one method used during the AOC-specific investigations for collection of surface soil and sediment samples. Surface soil samples will be collected from the ground surface to a depth of 30.5 cm (12 inches), unless otherwise specified in the project-specific addenda.

The bucket hand auger collection method will be accomplished using a stainless steel bucket auger head attached to an extension rod and T-shaped bar. The auger will be advanced continuously over 10.1- to 15.2-cm (4.0- to 6.0-inch) intervals into the soil to the required depth designated for the sampling location. Material collected in the bucket cylinder in each interval will be removed to the greatest extent possible using a stainless steel spoon.

Where explosives and propellants samples are to be collected from surface soils, a specific augering procedure must be used to collect representative samples. All surface soil [0 to 0.3-m (0- to 1-ft)] samples collected for explosives and propellants analyses will be composited and homogenized from three subsamples collected with the hand auger about 0.9 m (3 ft) from one another in a roughly equilateral triangle pattern. Equal portions of soil from each of the three subsamples will be homogenized in a stainless steel bowl. Remaining surface soil samples (e.g., metals, semi-volatile organics, and others) will be collected with the hand auger from a point located in the approximate center of the triangle. Discrete samples for VOC analyses will be taken from the middle of the sample interval from the center of the triangle without being homogenized.

The bucket auger will be decontaminated after completion of augering at each sampling location; however, the auger will not be decontaminated after removal of material from each interval augered at a location unless multiple discrete samples are collected from a single location at different depth intervals.

The diameter of the bucket hand auger to be used for the investigations will depend upon the quantity of soil or sediment sample required to be collected from each sampling location to fulfill chemical analyses requirements. Therefore, the specifications for the bucket hand auger to be used for surface soil and sediment sampling will be presented in the AOC-specific investigation addenda to the FSAP. Additional information regarding methods to be used for collection of surface soil and sediment samples using the bucket hand auger method is presented in Sections 4.5.2.4 and 4.5.2.5 of this FSAP.

4.5.2.1.2 Trowel/spoon method

The trowel/spoon method is anticipated to be a second method used for collection of surface soil and sediment samples during the AOC-specific investigations. The depth interval over which material will be collected using this method will be limited to the interval located from the land surface (after removal of surface debris) to a depth of 15.2 cm (6.0 inches) below ground level.

The trowel collection method will be accomplished using a stainless steel trowel or spoon. This instrument will be used to manually dig into the subsurface material to the required depth designated for the sampling location. The trowel may be necessary to collect composite samples as described in Section 4.5.2.1.1. The trowel will be decontaminated after completion of digging at each sampling location. Additional information regarding methods to be used for collection of surface soil and sediment samples using the trowel method is presented in Sections 4.5.2.4 and 4.5.2.5 of this FSAP.

4.5.2.2 Sampling methods for underwater sediments from ponds, lakes, streams, and lagoons

4.5.2.2.1 Trowel/spoon method

The trowel/spoon method is anticipated to be one method used during the AOC-specific investigations for collection of sediment samples located underwater. This method will be used in situations where the water depth is less than 15.2 cm (6.0 inches), and it will be implemented in the same manner as described in Section 4.5.2.1.2 of this FSAP. Sediment samples will be collected from the sediment-water interface to a depth of 15 cm (6 inches), unless otherwise specified in the project-specific addenda.

4.5.2.2.2 Hand core sampler method

The hand core sampler method is anticipated to be a second method used for collection of sediment samples located underwater during the AOC-specific investigations. This method will be used in situations where the water depth is greater than 15.2 cm (6.0 inches) but less than 3.0 m (10.0 feet) in depth. In the event that a particular AOC investigation requires sediment sampling to be conducted where water depths are greater than 3.0 m (10.0 feet), the method to be implemented to accomplish this sampling will be presented in the addendum to the FSAP for that investigation.

Hand core sediment samplers will consist of a stainless steel sample barrel with either an auger bit or core tip mounted on the leading end of the device. In either configuration, a self-closing valve and/or core catcher will be installed to retain the sample obtained with the device. Extension rods will be attached to the core sampler and used to lower the device through the body of water to the sample point. Upon reaching the top of the sediment, the core sampler will be pushed or augered into the sediment to the required depth designated for the sampling location. The core sampler and extension rods will be decontaminated after completion of coring at each sampling location.

The diameter of the core sampler to be used for the investigations will depend upon the quantity of sediment sample required to be collected from each sampling location to fulfill chemical analyses requirements. Therefore, the specifications for the core sampler to be used for sediment sampling will be presented in the AOC-specific investigation addenda to the FSAP. Additional information regarding methods to be used for collection of sediment samples using the hand core sampler method is presented in Sections 4.5.2.4 and 4.5.2.5 of this FSAP.

4.5.2.3 Field measurement procedures and criteria

Field measurements to be performed on surface soil and dry sediment samples during the AOC-specific investigations may include determination of volatile organic headspace gas concentrations, field screening for the presence of TNT and other explosives, and field determinations of metals concentrations.

Headspace measurements will be performed in the same manner as described in Section 4.4.2.3 of this FSAP. Field measurement of volatile organic headspace gas concentrations will not be performed on sediment samples collected at underwater locations due to interferences resulting from the saturated condition of these samples.

Field screening for explosives will be performed using RVAAP's SOP for Field Colorimetry Determination of Explosives in Soils. Field screening for metals will be conducted with the XRF method detailed in RVAAP's SOP for XRF Determination of Metals Concentrations in Soils.

4.5.2.4 Sampling for physical/geotechnical analyses

4.5.2.4.1 Bucket hand auger and trowel methods

Surface soil and sediment samples collected using the bucket hand auger or trowel/spoon methods are classified as disturbed samples. Therefore, physical and geotechnical analyses would be limited to those analyses for disturbed samples (i.e., grain size, Atterburg limits, moisture content, etc.). Samples collected using these methods would not be utilized for the determination of in-situ permeability values.

A sample will be collected from the required depth using either a bucket hand auger or trowel as described in Section 4.5.2.1.1 or 4.5.2.1.2 of this FSAP. The sample will then be placed into a decontaminated stainless steel bowl, and the quantity of the sample required for physical and geotechnical analyses will be placed into sample containers using a stainless steel spoon.

4.5.2.4.2 Hand core sampler method

Sediment samples collected using the hand core sampler are classified as undisturbed samples. Physical and geotechnical analyses would include those for disturbed samples (i.e., grain size, Atterberg limits, moisture content, etc.) and analyses for undisturbed samples (i.e., in situ permeability).

A stainless steel retaining liner will be placed into the core sampler device. Next, the device will be pushed rapidly into the sediment material to a depth sufficient to completely fill the retaining liner. The device will then be rotated to shear off the sample at the leading edge of the sampler and retrieved from the sampling location. Upon retrieval, the retaining liner will be removed from the sampler device, and the ends of the liner sealed with wax or rubber packers to preserve moisture content. The preparation of liners for shipment will be conducted in accordance with ASTM Method K1587-83.

4.5.2.5 Sampling for chemical analyses

Surface soil and sediment samples designated for chemical analyses will be collected using either bucket hand auger, trowel, or hand core sampler devices in the same manner as described in Section 4.5.2.1.1 of this FSAP.

Where explosives and propellants samples are to be collected from surface soils, a specific augering procedure must be used to collect representative samples. All surface soil [0 to 0.3-m (0- to 1-feet)] samples collected for explosives and propellants analyses will be composited and homogenized from three subsamples collected with the hand auger about 0.9 m (3 feet) from one another in a roughly equilateral triangle pattern. Equal portions of soil from each of the three subsamples will be homogenized in a stainless steel bowl. Remaining surface soil samples (e.g., metals, semi-volatile organics, and others) will be collected from a point located in the approximate center of the triangle. Discrete samples for VOC analyses will be taken from the middle of the sample interval from the center of the triangle without being homogenized. Sample containers designated for volatile organic analyses will be filled so that minimal headspace is present in the containers. No portion of the sample that is in contact with the sampling device will be included in the sample collected for laboratory analysis.

Immediately after collection of discrete or composite samples and completion of bottle label information each sample container will be placed into a sealable plastic bag and then into an ice-filled cooler to ensure preservation.

4.5.2.6 Sample containers and preservation techniques

Information regarding sample containers and preservation techniques for surface soil and sediment samples collected for chemical analyses during the AOC-specific investigations is presented in Section 4 of the QAPP portion of this FSAP. All chemical sample containers will be provided by contracted laboratories. With regard to temperature preservation, all sample containers will be stored at 4ºC (±2ºC) immediately after collection and will be maintained at this temperature until the samples are received at the contracted laboratory.

4.5.2.7 Field quality control sampling procedures

Duplicate QC samples will be collected in association with the collection of surface soil and sediment samples during the AOC-specific investigations. Duplicate surface soil and sediment samples will be collected during the investigations using the same procedures defined for field surface soil and sediment samples in Section 4.5.2.5 of this FSAP and in Section 8.0 of the Facility-wide QAPP. Information regarding the total number, collection frequency, and analytical parameter for surface soil and sediment duplicate samples will be defined in the AOC-specific investigation addenda to the FSAP.

4.5.2.8 Decontamination procedures

Decontamination of equipment used for collection of surface soil and sediment samples during the AOC-specific investigations will be conducted in the same manner as described for nondedicated sampling equipment in Section 4.4.2.8 of this FSAP. This equipment will be decontaminated after completion of sampling activities at each surface soil or sediment sampling location.

4.6 SURFACE WATER

4.6.1 Rationales

As defined in Section 3.0 of this FSAP, AOC-specific investigation addenda to the FSAP will be developed for the purpose of identifying unique elements of each investigation not addressed in the FSAP. Therefore, rationales related to surface water sample locations, discrete or composite sampling requirements, sample collection, field and laboratory analyses, determination of upgradient sample locations, and QA/QC sample collection and frequency will be addressed within each of the AOC-specific investigation addenda as appropriate.

4.6.2 Procedures

4.6.2.1 Sampling methods for surface water – general

4.6.2.1.1 Hand-held bottle method

Directly filling a sample container is one of the most efficient methods of surface water collection. It is the preferred method if the samples are being collected for volatile organic analyses. Collection of surface water samples using the hand-held bottle method will be accomplished by submerging the appropriate sample container with the cap in place into the body of water. The container will then be slowly and continuously filled using the cap to regulate the rate of sample entry into the container. The sample container should be filled such that a minimum of bubbling (and volatilization) occurs. The sample container will be retrieved from the water body with minimal disturbance to the sample. Immediately after collection of the sample and completion of bottle label information each sample container will be placed into a sealable plastic bag and then will be placed into an ice-filled cooler to ensure preservation.

4.6.2.1.2 Dipper and pond sampler method

Dipper and pond samplers perform similar functions and vary only in the length of the handle attached to the sampling vessel (usually a beaker). Before beginning sampling, a handle of appropriate length is attached to the dipper or pond sampler. Collection of surface water samples using the dipper or pond sampler method will then be accomplished by slowly submerging the device into the water so that the open end of the device is facing upstream. The sampler device will be retrieved from the water body with minimal disturbance to the sample, which will then be transferred into appropriate sample containers. Immediately after collection of the sample and completion of bottle label information each sample container will be placed into a sealable plastic bag and then will be placed into an ice-filled cooler to ensure preservation.

4.6.2.1.3 Kemmerer sampler method

The Kemmerer sampler is a messenger-activated water sampling device that is used to sample water from a specific depth. Figure 4-10 illustrates a standard Kemmerer sampler assembly. Collection of surface water samples using the Kemmerer sampler method will be accomplished by removing the upper and lower stoppers and lowering the sampler to the designated sampling depth. Upon reaching this depth, the messenger will be used to close the lower stopper and the sampler will be retrieved. Upon recovery of the sampler, the water sample will be transferred into appropriate sample containers using the lower stopper drain. Immediately after collection of the sample and completion of bottle label information each sample container will be placed into a sealable plastic bag and then will be placed into an ice-filled cooler to ensure preservation.

4.6.2.2 Sampling methods for surface water – filtration

The equipment used for collection of filtered surface water samples will be a hand-operated pump and disposable 0.45-μm barrel filters described in Section 4.3.5 of this FSAP. Immediately after collection of the sample and completion of bottle label information, each sample container will be placed into a sealable plastic bag and then into an ice-filled cooler to ensure preservation.

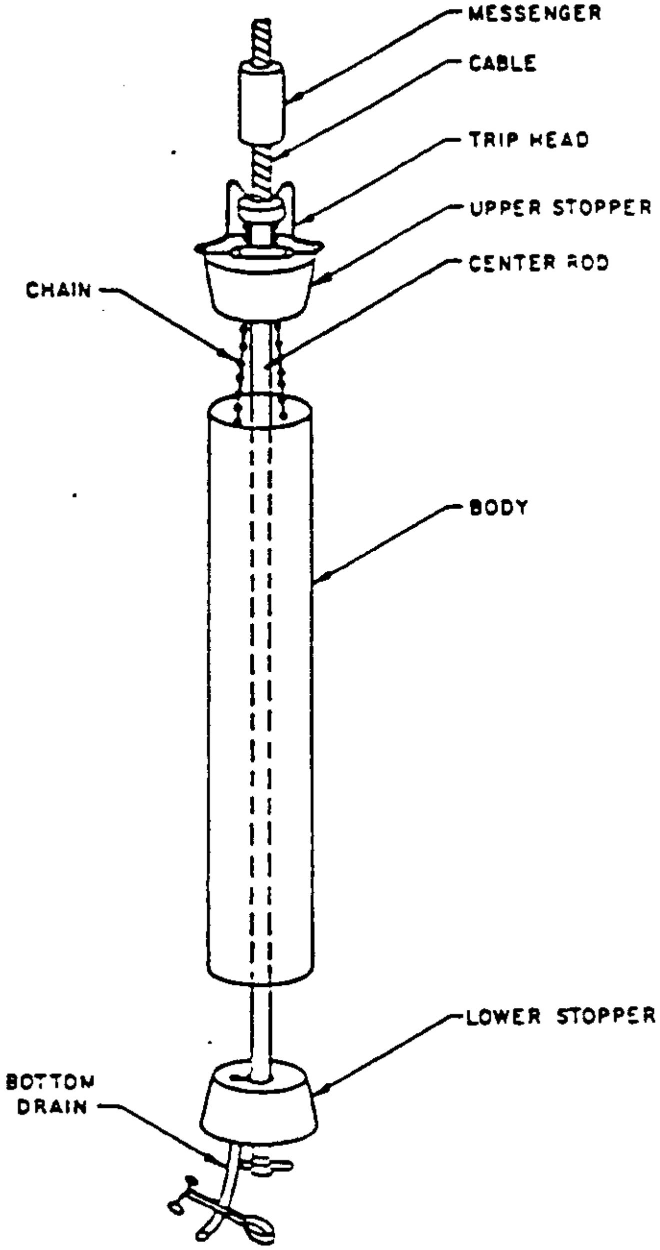


Figure 4-10. Illustration of the Kemmerer Sampler Device

4.6.2.3 Field Measurement Procedures and Criteria

Surface water field measurements to be performed during the AOC-specific investigations will include determination of pH, conductivity, dissolved oxygen, turbidity, and temperature. These measurements will be performed in the same manner as described in Section 4.3.3 of this FSAP.

4.6.2.4 Sample Containers and Preservation Techniques

Information regarding sample containers and preservation techniques for surface water samples collected for chemical analyses during the AOC-specific investigations is presented in Section 4.0 of the QAPP portion of this FSAP. All sample containers will be provided by contracted laboratories that will place into the containers or provide separately the required types and quantities of chemical preservatives. With regard to temperature preservation, all sample containers will be stored at 4° C (±2° C) immediately after collection and will be maintained at this temperature until the samples are received at the contracted laboratory.

4.6.2.5 Field Quality Control Sampling Procedures

Three types of field QC samples will be collected or used during in association with the collection of surface water samples during the AOC-specific investigations. The three types of field QC samples are (1) duplicates, (2) equipment rinsate blanks, and (3) trip blanks. Duplicate surface water samples will be collected during the investigations using the same procedures defined for field surface water samples in Section 4.6.2.1 of this FSAP. Equipment rinsate blanks will be collected and trip blanks used in the same manner as described in Section 4.3.7 of this FSAP and in Section 8.0 of the Facility-wide QAPP. Information regarding the total number, collection frequency, and analytical parameter for surface water QC samples will be defined in the AOC-specific investigation addenda to the FSAP.

4.6.2.6 Decontamination Procedures

Decontamination of equipment used for collection of surface water samples during the AOC-specific investigations will be conducted in the same manner as described for nondedicated sampling equipment in Section 4.3.8 of this FSAP. This equipment will be decontaminated after completion of sampling activities at each surface water sampling location.

In addition to the surface water sampling equipment, field measurement instruments will also be decontaminated between sampling locations. Only those portions of each instrument which come into contact with potentially contaminated environmental media will be decontaminated.

4.7 OTHER MATRICES

Sampling of other matrices not addressed in this FSAP is not anticipated to be routinely included within the scopes of work for the AOC-specific investigations. If sampling of other matrices is required, rationales and procedures for these activities will be presented in the AOC-specific investigation addenda to the FSAP.

4.8 OE ANOMALY AVOIDANCE

Contractors will employ fully qualified unexploded ordnance (UXO) subcontractors approved by the USACE Huntsville OE MCX for investigations in areas potentially contaminated with ordnance explosive waste (OE). The UXO specialists will employ Schonstedt Models GA-52 and GA-72 (or equivalent) magnetometers for surface anomaly surveys and Schonstedt Model MG-220 magnetic gradiometers for any downhole surveys. UXO technician support will be present during all field operations. The UXO Team Leader will train all field personnel to recognize and stay away from propellants and OE. Safety briefings for OE avoidance will also be provided to all site personnel and site visitors. All sample locations and access routes into soil sampling locations will be cleared for potential OE and clearly defined prior to entry, using visual and magnetometer surveys. Access routes will be at least twice as wide as the widest vehicle using the route. The UXO technician will clearly mark the boundaries of the cleared soil sampling locations and access routes. If surface OE is encountered, the approach path will be diverted away from the OE, the area will be clearly marked, and the area will be avoided. Any identified magnetic anomaly will also be clearly marked, and the anomaly will be avoided. The cleared approach paths will be the only ingress/egress routes to a particular sampling location.

Contractor sampling personnel must be escorted by UXO personnel at all times in areas potentially contaminated with OE until the UXO team has completed access surveys and the cleared areas are marked. Escorted sampling personnel will follow behind the UXO technician. If anomalies or OE are detected, the UXO technician will halt escorted personnel in place, select a course around the item, and instruct escorted personnel to follow.

Downhole magnetometer surveys will be performed at 2-foot intervals to a depth of 2 feet below the top of native, undisturbed material. Should OE be discovered, the UXO team will not be tasked with the mission of recovery and disposal. In the event of UXO or bulk explosives discovery, the Field Operations Manager will contact the RVAAP Environmental Coordinator, who will initiate the appropriate response actions. More specific requirements for anomaly avoidance will be provided, as required, in the site-specific addenda to this FSAP.

OE technical staff are responsible for decontaminating all non-dedicated downhole equipment or for providing disposable covers for downhole equipment. Specific requirements for minimizing the potential for cross-contamination via non-dedicated anomaly avoidance equipment will be provided in the site-specific addenda to this FSAP.

5.0 SAMPLE CHAIN OF CUSTODY/DOCUMENTATION

5.1 FIELD LOGBOOK

All information pertinent to drilling and sampling activities, including field instrument calibration data, will be recorded in field logbooks. The logbooks will be bound and the pages will be consecutively numbered. Entries in the logbooks will be made in black waterproof ink and will include, at a minimum, a description of all activities, individuals involved in drilling and sampling activities, data and time of drilling and sampling, weather conditions, any problems encountered, and all field measurements. Lot numbers, manufacturer name, and expiration dates of standard solutions used for field instrument calibration will be recorded in the field logbooks. A summary of each day's activities will also be recorded in the logbooks.

Sufficient information will be recorded in the logbooks to permit reconstruction of all drilling and sampling activities conducted. Information recorded on other project documents (e.g., boring logs, well construction diagrams, well development records, etc.) will not be repeated in the logbooks except in summary form where determined necessary. All field logbooks will be kept in the possession of field personnel responsible for completing the logbooks, or in a secure place when not being used during field work. Upon completion of the field activities, all logbooks will become part of the project evidence file. The title page of each logbook will be labeled with the following information:

- logbook title,
- project name,
- USACE-Louisville District/other Army contract number and project delivery order number,
- start date for field activities, and
- end date for field activities.

Entries recorded in logbooks will include, but not be limited to, the following information:

- name and title of author, date, and times of arrival at and departure from the work site;

- purpose of the drilling and/or sampling activity;

- name and address of the field contact;

- names and responsibilities of field crew members;

- names and titles of any site visitors;

- type, matrix, and containerization method for IDW generated;

- sample collection method;

- number and volume of sample(s) collected;

- location, description, and log of sampling point photographs;

- references for all maps and photographs of the sampling site(s);

- information regarding sampling changes, scheduling modifications, and change orders;
- information regarding drilling decisions, not recorded on the boring log;
- information regarding access agreements, if applicable;
- details of the sampling location, including a sketch map illustrating the sampling location;
- date and time of sample collection, and name of collector;
- field observations;
- types of field instruments used and purpose of use, including calibration methods and results;
- any field measurements made (e.g., pH, conductivity, temperature, and static water level);
- sample identification number(s);
- information from containers, labels of reagents used, deionized and organic-free water used, etc.;
- sampling type and methodology, including distinction between grab and composite samples;
- sample preservation methods;
- sample distribution and transportation (e.g., name and address of the laboratory and courier);
- name and address of the government QA laboratory for the project and the associated project Laboratory Information Management System (LIMS) number, where applicable;
- sample documentation information, including:
  - chain-of-custody (COC) record numbers;
  - description of the number of shipping containers packaged (including contained COC records) and the shipping method employed (noting applicable tracking numbers);
- decontamination procedures;
- IDW documentation information, including:
  - types of containers/drums;
  - contents, type, and approximate volume of waste;
  - type of contamination and predicted level of contamination based on available information;
- summary of daily task (including costs where appropriate) and documentation on any cost or scope or work changes required by field conditions.; and
- signature and date entered by personnel responsible for observations recorded.

5.2 PHOTOGRAPHS

Information regarding the documentation of photographs for the AOC-specific investigations is presented in Section 4.3.2.4.3 of this FSAP.

5.3 SAMPLE NUMBERING SYSTEM

A unique sample numbering scheme will be used to identify each sample designated for laboratory analysis. The purpose of this numbering scheme is to provide a tracking system for the retrieval of analytical and field data on each sample. Sample identification numbers will be used on all sample labels or tags, field data sheets and/or logbooks, COC records, and all other applicable documentation used during the AOC-specific investigations. A listing of all sample identification numbers will be maintained in the field logbook.

The sample numbering scheme used for field samples will also be used for duplicate samples so that these type of samples will not be discernible by the laboratory. However, other types of field QC samples (i.e., equipment rinsate, trip blank, etc.) will be numbered so that they can be readily identified from other sample types. The USACE-Louisville District location/sample identification naming conventions will be used for all AOC-specific investigations. A summary of these naming conventions is presented in Figure 5-1. The sample number scheme used for each project will be presented in the AOC-specific investigation addenda to the FSAP. Follow-up sampling at a given AOC will begin with sample numbers that follow the last number in the sequence from the initial phase of work.

5.4 SAMPLE DOCUMENTATION

5.4.1 Sample Labels and/or Tags

All sample containers provided by the contracted analytical laboratory for use during the AOC-specific investigations will be shipped with sample labels pre-affixed to the containers, or the labels will be affixed to the bottles upon delivery to the investigation site (Figure 5-2). Information will be recorded on each sample container label at the time of sample collection. However, if preprinted labels are used, only field-specific information not already on the labels will be recorded at the time of sample collection. The information to be recorded on the labels will be as follows:

- contractor name,
- sample identification number,
- sample type (discrete or composite),
- site name and sampling station number,
- analysis to be performed,
- type of chemical preservative present in container,
- date and time of sample collection, and
- sampler’s name and initials.

Sampling Location Identification: XXXmm-NNN(n)

XXX = Area Designator

Examples
TNT - TNT Manufacturing Area
P11 - Pond #11

mm = Sample Location Type

Examples
MW - Groundwater Monitoring Well
SB - Soil Boring
SW - Surface Water Location
SD - Sediment Sample Location
SS - Surface Soil Location
TR - Trench Location
SP - Seep Sample
WP - Groundwater Well Point

NNN(n) = Sequential Sample Location Number
[must be unique for each designator]

Examples
004
012
099

(n) can be used as a special identifier and is optional. For example:

Use a D to identify the well as an adjacent deep zone/aquifer well (004D)
Use a B to identify the well as a background location (012B)
Use an A to identify an abandoned well (099A)

Sample Identification: XXXmm-NNN(n)-####-tt

= Sequential Sample Number
[must be unique for entire project site]

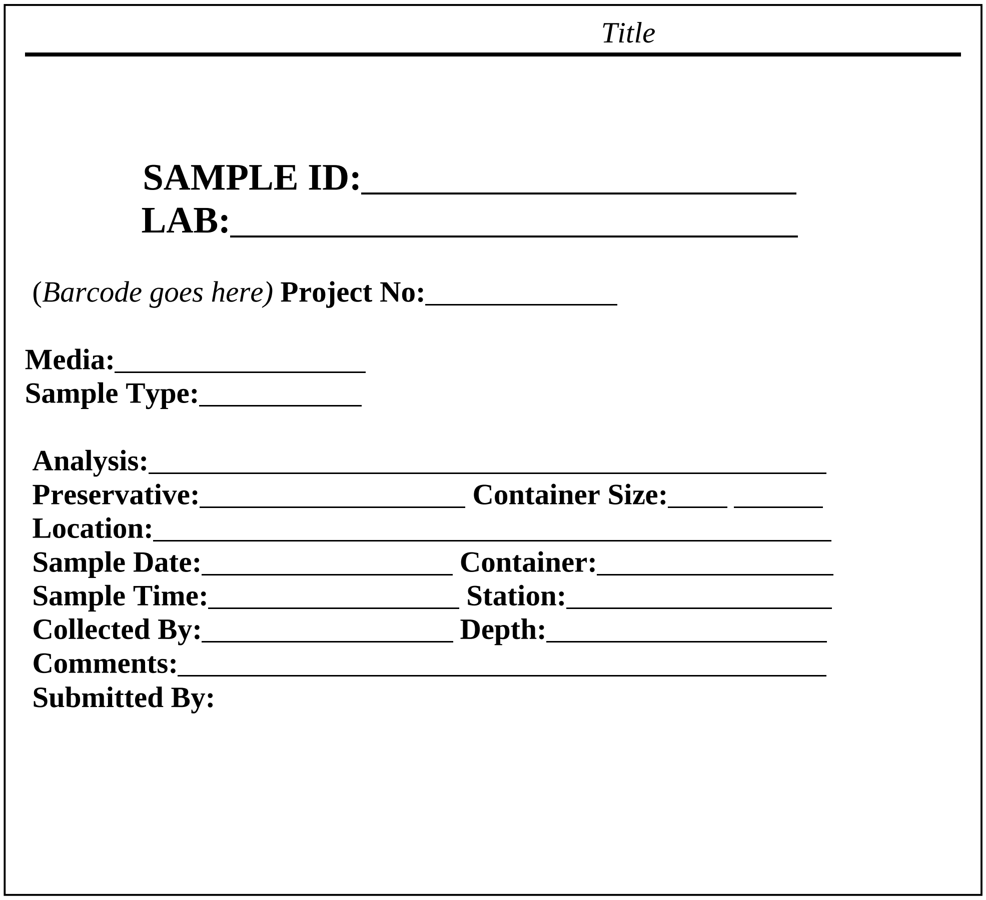
Examples
0001
0002
0003

tt = Sample Type

Examples
GW - Groundwater Sample (unfiltered)
GF - Groundwater Sample (filtered)
SO - Soil Sample
SW - Surface Water Sample
SD - Sediment Sample
PR - Free Product Sample
SP - Seep Sample
TB - Trip Blank
FB - Field Blank
ER - Equipment Rinsate

Figure 5-1. USACE-Louisville District Location/Sample Identification Naming Conventions

Sample Label



Title

SAMPLE ID:________________________
LAB:_______________________________

(*Barcode goes here)* **Project No:_____________**

Media:_________________
Sample Type:___________

Analysis:____
Preservative:__________________ Container Size:____ ______
Location:____
Sample Date:_________________ Container:________________
Sample Time:_________________ Station:__________________
Collected By:_________________ Depth:___________________
Comments:____
Submitted By:

Figure 5-2. Example of a Sample Container Label

5.4.2 Sample Analysis Request Form

A separate sample analysis request form will not be utilized. Sample analysis request information will be recorded on a single combination analysis request and COC form, which is discussed in Section 5.4.3 of this FSAP.

5.4.3 Chain-of-Custody Records

RVAAP will utilize EPA Region 5 COC protocols for the AOC-specific investigations, as described in EPA Procedure 330/9-78DDI-R "NEIC Policies and Procedures" (USEPA 1985). COC procedures implemented for the investigations will provide documentation of the handling of each sample from the time of collection until completion of laboratory analysis. The COC form serves as a legal record of possession of the sample. A sample is considered to be under custody if one or more of the following criteria are met:

1. The sample is in the sampler's possession.

2. This sample is in the sampler's view after being in possession.

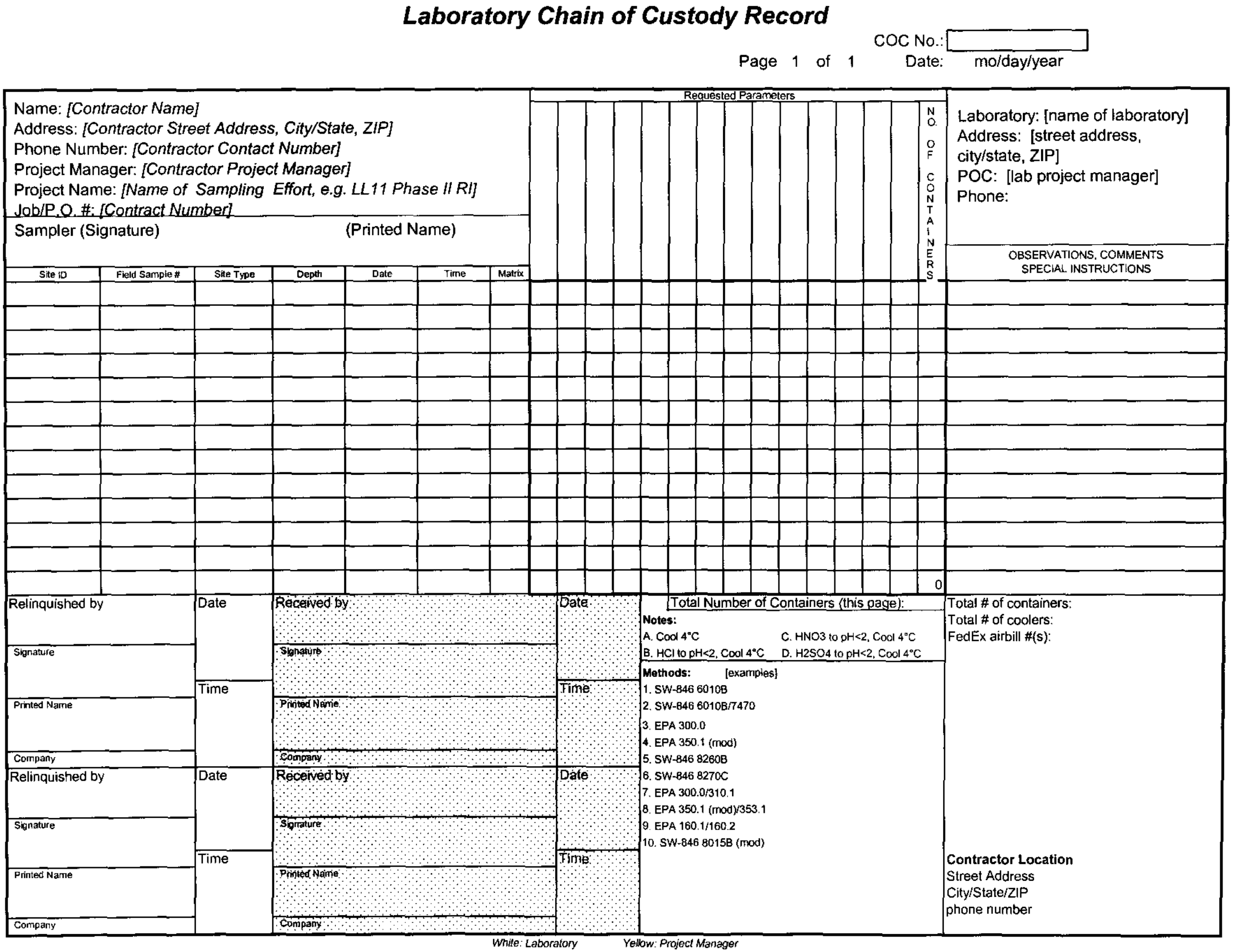
3. The sample was in the sampler's possession and then was placed into a locked area to prevent tampering.

4. The sample is in a designated secure area.

Custody will be documented throughout the AOC-specific investigation field sampling activities by the COC form initiated for each day during which samples are collected. This record will accompany the samples from the site to the laboratory and will be returned to the Contractor Laboratory Coordinator with the final analytical report. All personnel with sample custody responsibilities will be required to sign, date, and note the time on the COC form when relinquishing samples from their immediate custody (except in the cases where samples are placed into designated secure areas for temporary storage before shipment). Bills of lading or airbills will be used as custody documentation during times when the samples are being shipped from the site to the laboratory, and they will be retained as part of the permanent sample custody documentation.

COC forms will be used to document the integrity of all samples collected. To maintain a record of sample collection, transfer between personnel, shipment, and receipt by the laboratory, COC forms will be filled out for sample sets as determined appropriate during the course of field work. An example of the COC form to be used for the AOC-specific investigations is illustrated in Figure 5-3. The following information will be recorded on all COC forms:

- sample number (for each sample in shipment);
- collection date and time (for each sample in shipment);
- number of containers for each sample;
- sample description (i.e., environmental medium);
- sample type (discrete or composite);
- analyses required for each sample;
- sample preservation technique(s);
- COC or shipment number;
- USACE LIMS number (only on COC records for government QA sample shipments);
- shipping address of the laboratory;



Laboratory Chain of Custody Record

COC No.: ☐

Page 1 of 1 Date: mo/day/year

Name: *[Contractor Name]*
Address: *[Contractor Street Address, City/State, ZIP]*
Phone Number: *[Contractor Contact Number]*
Project Manager: *[Contractor Project Manager]*
Project Name: *[Name of Sampling Effort, e.g. LL11 Phase II RI]*
Job/P.O. #: *[Contract Number]*

Sampler (Signature) (Printed Name)

Laboratory: [name of laboratory]
Address: [street address, city/state, ZIP]
POC: [lab project manager]
Phone:

							Requested Parameters															
Site ID	Field Sample #	Site Type	Depth	Date	Time	Matrix															NO. OF CONTAINERS	OBSERVATIONS, COMMENTS SPECIAL INSTRUCTIONS
																					0	

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

Total Number of Containers (this page):

Notes:
A. Cool 4°C
B. HCl to pH<2, Cool 4°C
C. HNO3 to pH<2, Cool 4°C
D. H2SO4 to pH<2, Cool 4°C

Methods: [examples]
1. SW-846 6010B
2. SW-846 6010B/7470
3. EPA 300.0
4. EPA 350.1 (mod)
5. SW-846 8260B
6. SW-846 8270C
7. EPA 300.0/310.1
8. EPA 350.1 (mod)/353.1
9. EPA 160.1/160.2
10. SW-846 8015B (mod)

Total # of containers:
Total # of coolers:
FedEx airbill #(s):

Contractor Location
Street Address
City/State/ZIP
phone number

White: Laboratory *Yellow: Project Manager*

Figure 5-3. Example of a Chain-of-Custody Form

- date, time, method of shipment, courier, and airbill number; and
- spaces to be signed as custody is transferred between individuals.

The individual responsible for shipping the samples from the field to the laboratory will be responsible for completing the COC form and noting the date and time of shipment. This individual will also inspect the form for completeness and accuracy. In addition, this individual is responsible for determining the shipping classification for samples under U.S. Department of Transportation (DOT) HM126F. After the form has been inspected and determined to be satisfactorily complete, the responsible individual will sign, date, and note the time of transfer to the approved shipping company on the form. In the event that samples are shipped to a laboratory in the local area, samples just collected and stored on ice may not have sufficient time to cool to the required temperature of 4° C (± 2° C). The responsible individual will make note of this on the COC form. The COC form will then be placed in a sealable plastic bag and placed inside the cooler used for sample transport after the field copy of the form has been detached. If local courier service is used, the documentation can be given to the courier directly. The field copy of the form will be appropriately filed and kept at the site for the duration of the site activities.

In addition to the COC form, custody seals will also be placed on each cooler used for sample transport. These seals will consist of a tamper-proof adhesive material placed across the lid and body of the coolers in such a manner that if the cooler is opened, the seals will be broken. The custody seals will be used to ensure that no sample tampering occurs between the time the samples are placed into the coolers and the time the coolers are opened for analysis at the laboratory. Cooler custody seals will be signed and dated by the individual responsible for completing the COC form contained within the cooler. The signature and date will be written on both the cooler lid and cooler body portions of the seals.

5.4.4 Receipt of Sample Forms

The contracted laboratory will document the receipt of environmental samples by accepting custody of the samples from the approved shipping company. In addition, the contracted laboratory will document the condition of the environmental samples upon receipt as outlined in Section 6.0 of this FSAP. For samples sent to a U.S. Army QA laboratory that are suspected or known to be hazardous, a sample characterization form (Section 6.0) will be included with other required laboratory paperwork.

5.5 DOCUMENTATION PROCEDURES

The tracking procedure to be utilized for documentation of all samples collected during the AOC-specific investigations will involve the following series of steps:

1. Collection and placement of samples into laboratory sample containers as defined in Section 4 of this FSAP.

2. Completion of sample container label information as defined in Section 5.4.1 of this FSAP.

3. Placement of sample containers into an ice-filled cooler.

4. Completion of sample documentation information in the field logbook as defined in Section 5.1 of this FSAP.

5. Completion of project and sampling information sections of the COC form(s) as defined in Section 5.4.3 of this FSAP for all samples to be transported in a single cooler.

6. Completion of the airbill for the cooler to be shipped (if necessary).

7. Performance of a completeness and accuracy check of the COC form(s).

8. Completion of the sample relinquishment section of the COC form(s) as defined in Section 5.4.3 of this FSAP and placement of the form(s) into the cooler.

9. Placement of COC seals on the exterior of the cooler as defined in Section 5.4.3 of this FSAP.

10. Packaging and shipment of the cooler to the laboratory as defined in Section 6.0 of this FSAP.

11. Receipt of cooler at the laboratory, inspection of contents, and transmittal via fax of contained COC form(s) and cooler receipt form(s) as defined in Sections 5.4.4 and 6.0 of this FSAP. Each cooler must have a separate cooler receipt form.

12. Transmittal of original COC form(s) with final analytical results from laboratory.

5.6 CORRECTIONS TO DOCUMENTATION

All original information and data in field logbooks, on sample labels, on COC forms, and on any other project-related documentation will be recorded in black waterproof ink and in a completely legible manner. Errors made on any accountable document will be corrected by crossing out the error and entering the correct information or data. Any error discovered on a document will be corrected in the field by the individual responsible for the entry. Erroneous information or data will be corrected in a manner which will not obliterate the original entry, and all corrections will be initialed and dated by the individual responsible for the entry.

5.7 MONTHLY REPORTS

Monthly reports will be submitted during implementation of field investigations at AOCs as contracts require. The Monthly Reports will focus on the progress to date of an AOC-specific investigation and will be submitted directly to the U.S. Army Project Manager by the 10th day of the month following the reporting period. Copies of the Monthly Report will subsequently be submitted to the Ohio EPA-Northeast District Site Coordinator. The Monthly Reports will contain the following information: (1) site identification and activities; (2) status, (3) percent complete; (4) data collected to date (excluding analytical results); (5) difficulties encountered; (6) corrective actions; and (7) planned activities.

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6.0 SAMPLE PACKAGING AND SHIPPING REQUIREMENTS

Sample containers must be packaged according to requirements for preservation in transit to laboratories. Samples requiring cooling will be packaged thermally insulated rigid-body coolers. Samples not requiring cooling (i.e., geotechnical soil samples) will be packaged in heavy cardboard shipping boxes. Sample packaging and shipping will be conducted in accordance with applicable DOT specifications. Packaging and shipping procedures to be utilized for environmental samples collected during the AOC-specific investigations will include the following:

- Sample containers will be adequately identified with sample labels placed onto each container.

- All bottles, except those containing samples designated for volatile organic analyses, will be taped shut with electrical tape.

- All glass sample bottles will be placed in bubble wrap sleeves or styrofoam forms.

- Each sample bottle will be placed into a separate plastic bag that will then be sealed. For groundwater samples, each the vials for an individual sample will be placed into the same plastic bag. Trip blank containers will be wrapped and placed in the bag with the volatile organic analyte vials. As much air as possible will be squeezed from the sample container bags before sealing.

- All of the sample containers will be placed upright in the shipping coolers along with ice, which will be placed around, among, and on top of the sample containers. Before initial placement of samples into a rigid-body cooler, the cooler drain plug will be taped shut from both the inside and outside, and the cooler will be lined with a large plastic bag.

- Additional inert packing material will be placed into the cooler, if required, to prevent shifting of the sample containers during transport.

- All required laboratory paperwork, including the COC form(s) will be placed inside a plastic bag and taped to the inside of the cooler lid.

- Upon completion of the packing process, the cooler lid will be closed and two signed/dated custody seals will be placed on the cooler, one across the front and one across the side.

- Rigid-body coolers will be sealed by applying strapping tape directly to the cooler body.

- The airbill, if required for the shipment, will be completed and attached to the top of the shipping box/cooler, which will then be transferred to the courier for delivery to the laboratory.

Packaging and shipping procedures to be utilized for hazardous samples collected during the AOC-specific investigations will include the following:

- Sample containers will be adequately identified with sample labels placed onto each container.

- All bottles, except those containing samples designated for volatile organic analyses, will be taped shut with electrical tape.

- Each sample bottle will be placed into a separate plastic bag that will then be sealed. For liquid samples, volatile organic vials for an individual sample will be placed into the same plastic bag. Trip blank containers will be wrapped and placed in the bag with the volatile organic analyte vials. As much air as possible will be squeezed from the sample container bags before sealing.

- Each bagged sample bottle will be placed upright into a separate paint-type can, the can filled with vermiculite or a similar packing material, and the lid secured to the can. The lid will be sealed with metal clips or with strapping tape.

- Arrows will be placed on each can indicating which end is up.

- The outside of each can will be labeled with the proper DOT shipping name and identification number for the sample. This information will be recorded on a sticker affixed to the can, or it will be printed legibly directly on the can.

- The cans containing samples will be placed upright in a rigid-body cooler that has had its drain plug taped shut inside and out and has been lined with a large plastic bag. Vermiculite or a similar packing material will be placed into the bottom of the cooler.

- All hazardous samples will be shipped to the laboratory on ice, which will be contained in double plastic bags placed around, among, and on top of the sample container cans.

- Additional inert packing material will be placed around and on top of cans in the cooler to prevent shifting during transport. Following the placement of this material, the plastic liner inside the cooler will be taped shut.

- All required laboratory paperwork, including the COC form(s) and sample characterization information, will be placed inside a plastic bag and taped to the inside of the cooler lid.

- Upon completion of the packing process, the cooler lid will be closed and two signed/dated custody seals will be placed on the cooler, one across the front and one across the side.

- Rigid-body coolers will be sealed by applying strapping tape directly to the cooler body.

- The following markings will be placed on the top of the cooler:

    - proper shipping name,
    - DOT identification number,
    - shipper’s or consignee’s name and address, and
    - “This End Up” legibly written if shipment contains hazardous liquid materials.

- The following labels will be placed on the top of the cooler:

    - appropriate hazard class label (placed next to the proper shipping name), and
    - “Cargo Aircraft Only,” if applicable.

- The airbill, if necessary for the shipment, will be completed and attached to the top of the cooler, which will then be transferred to the courier for delivery to the laboratory. Restricted-article airbills will be used for the shipment, and the “Shipper Certification for Restricted Articles” section of the airbills will be completed in accordance with instruction defined in Appendix F of USACE Procedure EM 200-1-3 (September 1994).

The checklist presented in Figure 6-1 will be used by the individual responsible for packaging environmental samples to verify completeness of sample shipment preparations. In addition, the contracted laboratory will document the condition of the environmental samples upon receipt at the laboratory. This documentation will be accomplished using the cooler receipt checklist presented in Figure 6-2. For samples sent to a USACE QA laboratory that are suspected or known to be hazardous, a sample characterization form will be included with other required laboratory paperwork. An example of this form is presented in Figure 6-3.

The contracted analytical laboratory name and address and laboratory point of contact to be used for each project will be identified in the AOC-specific investigation addenda to the FSAP. If QA samples are collected as part of an investigation, the addendum for that AOC-specific investigation will also identify the name, address, and point of contact for the USACE QA laboratory to be used for the investigation.

All environmental, QA, and QC samples collected during the project will be shipped no later than 48 hours after the time of collection. During the time period between collection and shipment, all samples will be stored in ice-filled coolers or refrigerators and maintained in a secure area. All coolers containing investigation samples will be shipped overnight to the laboratory by Federal Express or a similar courier.

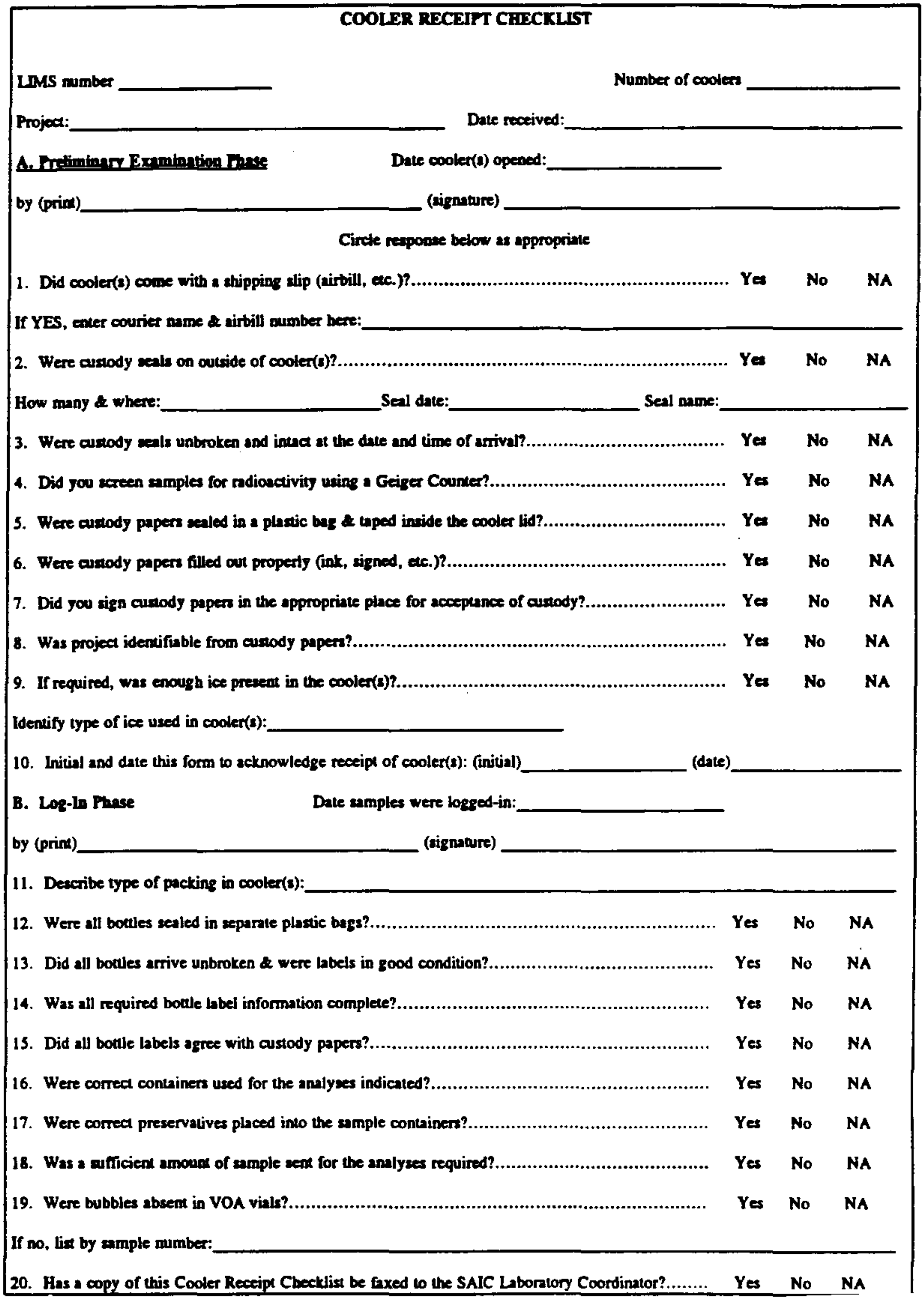
Each cooler containing environmental samples for organic analysis will contain a trip blank from the time those environmental samples are placed in the cooler for storage and/or shipment. The contracted analytical laboratory will analyze this trip blank for volatile organics upon receipt and compare results to analyses of corresponding environmental samples.

SAMPLE PACKAGING CHECKLIST

ATTN: Failure to properly handle or document the project samples could jeopardize the useability of the sample results and ultimately the project objectives. Prior to sending this cooler to the analytical laboratory at the address indicated on the chain-of-custody form, please check the following items:

- Is the project clearly identified on the chain-of-custody form (including the USACE delivery order number)?
- Are all enclosed sample containers clearly labelled with waterproof (permanent) ink?
- Are the required analyses indicated on the bottle labels and chain-of-custody form, and are the metals to be analyzed individually noted on the chain-of-custody form?
- Does the information on the chain-of-custody form match the information on the sample container labels?
- Has the chain-of-custody form been placed into a plastic bag and attached to the inside of the cooler lid?
- Have the samples been properly preserved (acid or base and cooling to 4°C)?
- Is the client information, including point of contact and telephone number, complete on the chain-of-custody form?
- Is there sufficient ice (double bagged in sealable plastic bags) in the cooler to ensure preservation of the samples during shipment?

Figure 6-1. Checklist for Sample Packaging



COOLER RECEIPT CHECKLIST

LIMS number ____________ Number of coolers ____________

Project: ______________________ Date received: ______________________

A. Preliminary Examination Phase Date cooler(s) opened: ____________

by (print) ______________________ (signature) ______________________

Circle response below as appropriate

1. Did cooler(s) come with a shipping slip (airbill, etc.)?........ Yes No NA

If YES, enter courier name & airbill number here: ______________________

2. Were custody seals on outside of cooler(s)?........ Yes No NA

How many & where: ____________ Seal date: ____________ Seal name: ____________

3. Were custody seals unbroken and intact at the date and time of arrival?........ Yes No NA

4. Did you screen samples for radioactivity using a Geiger Counter?........ Yes No NA

5. Were custody papers sealed in a plastic bag & taped inside the cooler lid?........ Yes No NA

6. Were custody papers filled out properly (ink, signed, etc.)?........ Yes No NA

7. Did you sign custody papers in the appropriate place for acceptance of custody?........ Yes No NA

8. Was project identifiable from custody papers?........ Yes No NA

9. If required, was enough ice present in the cooler(s)?........ Yes No NA

Identify type of ice used in cooler(s): ______________________

10. Initial and date this form to acknowledge receipt of cooler(s): (initial) ____________ (date) ____________

B. Log-In Phase Date samples were logged-in: ____________

by (print) ______________________ (signature) ______________________

11. Describe type of packing in cooler(s): ______________________

12. Were all bottles sealed in separate plastic bags?........ Yes No NA

13. Did all bottles arrive unbroken & were labels in good condition?........ Yes No NA

14. Was all required bottle label information complete?........ Yes No NA

15. Did all bottle labels agree with custody papers?........ Yes No NA

16. Were correct containers used for the analyses indicated?........ Yes No NA

17. Were correct preservatives placed into the sample containers?........ Yes No NA

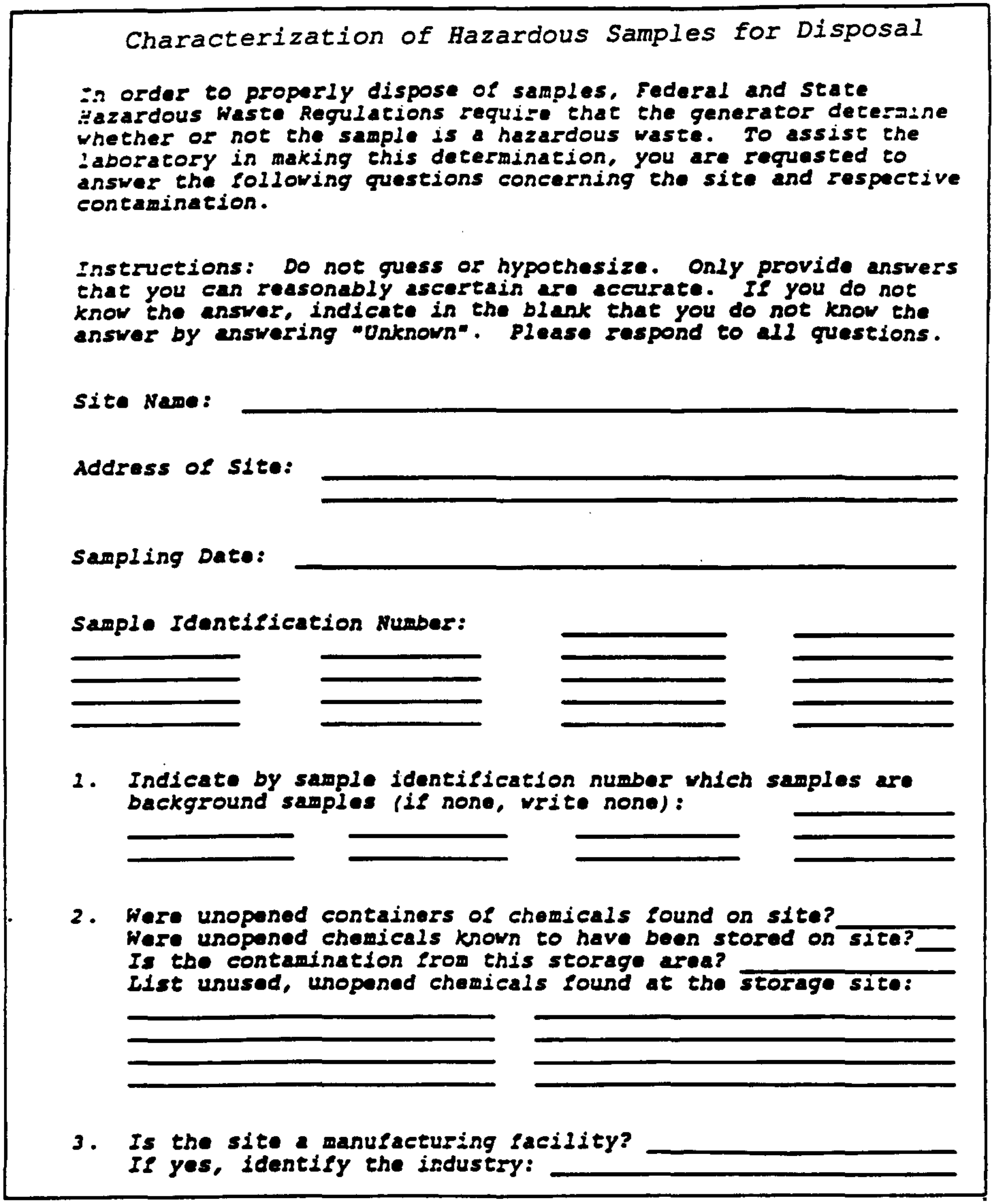
18. Was a sufficient amount of sample sent for the analyses required?........ Yes No NA

19. Were bubbles absent in VOA vials?........ Yes No NA

If no, list by sample number: ______________________

20. Has a copy of this Cooler Receipt Checklist be faxed to the SAIC Laboratory Coordinator?........ Yes No NA

Figure 6-2. Example of a Cooler Receipt Checklist



Characterization of Hazardous Samples for Disposal

In order to properly dispose of samples, Federal and State Hazardous Waste Regulations require that the generator determine whether or not the sample is a hazardous waste. To assist the laboratory in making this determination, you are requested to answer the following questions concerning the site and respective contamination.

Instructions: Do not guess or hypothesize. Only provide answers that you can reasonably ascertain are accurate. If you do not know the answer, indicate in the blank that you do not know the answer by answering "Unknown". Please respond to all questions.

Site Name: ____________________

Address of Site: ____________________

Sampling Date: ____________________

Sample Identification Number: ____________________

1. Indicate by sample identification number which samples are background samples (if none, write none): ____________________

2. Were unopened containers of chemicals found on site? ________
   Were unopened chemicals known to have been stored on site? ________
   Is the contamination from this storage area? ________
   List unused, unopened chemicals found at the storage site: ____________________

3. Is the site a manufacturing facility? ________
   If yes, identify the industry: ____________________

Figure 6-3. Example of Characterization Form for Hazardous Sample Disposal

Characterization of Hazardous Samples for Disposal
(Continued)

4. Is the contamination at the site from the use of solvents? ___
If yes, identify the solvents: ______________________________

5. Is a process such as parts degreasing, electroplating, etc. the suspected cause of the contamination? ______________
If yes, identify the process: ______________________________

6. Do you suspect the sample to have any of the following contaminants? Circle all that you suspect.

Asbestos PCBs Jet Fuel POL

7. What other contaminants do you expect to find in this sample?

______________________ ______________________
______________________ ______________________
______________________ ______________________

8. Briefly describe how this site was contaminated: __________
____
____
____
____
____
____
____
____

9. Your Name: ____________________ Telephone: __________

Thank You!

Figure 6-3 (continued)

Explanation of Characterization Questionnaire

Site Name: Indicate the name of the site where the samples were taken. For example, Fire Training Pit FTP 001, Landfill #10 Ft. Dix, etc.

Site Address: Write the address of the site.

Sampling Date: Indicate the date these samples were taken at the site.

Sample Identification Number: Identify each sample. This number in most cases should be the same as the identification number on the chain of custody form. Each sample should have a unique number. Be sure to identify each sample.

Question number 1 will assist us in segregating potentially clean samples - the background samples from the contaminated samples.

Question number 2 has been asked to determine whether the sample would be P or U-listed. If the sample is contaminated with a commercial chemical product or an off-specification chemical, the chemical itself would be P-listed or U-listed. This chemical would have to be a virgin chemical, i.e. a chemical that was manufactured, however it had not yet been used for its intended purpose. For example, if the just manufactured chemicals were all stored on a particular concrete pad, and analysis of the pad showed trace amounts of that chemical, then the pad would be considered a P or U-listed waste. Once the listed waste contaminated the soil or water, the entire mixture would also become P or U-listed.

Question number 3 will help us to identify whether the waste is K-listed. If the manufacturing process can be defined, the sample may be considered to be waste from a process listed on the K-list. If for example you are investigating a landfill and you know that the waste in the landfill came from a certain manufacturing process, that waste may also be K-listed as well as the contaminated soil and water.

Question number 4 will assist us in determining if the sample contains a F-listed waste.

Question number 5 will assist us in determining if the sample contains a K or F-listed waste. If the answer to the question is yes, then we will check to see if that process has been identified on the K or F-list.

Question number 6 will assist us in identifying any other contaminants that may require that special handling provisions be employed during disposal.

Figure 6-3 (continued)

Explanation of Characterization Questionnaire
(Continued)

Question number 7 requests that you identify any contaminants you may expect to find in the sample that would impact the characterization of the sample as a RCRA hazardous waste.

Question number 8 asks you to describe how the site was contaminated. Identify any processes or procedures which led to the resultant contamination.

Question number 9 asks for your name and telephone number. If we have questions concerning the information on this form, we will contact you.

Figure 6-3 (continued)

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7.0 INVESTIGATION-DERIVED WASTE

IDW includes all materials generated during performance of an investigation that cannot be effectively reused, recycled, or decontaminated in the field. IDW consists of materials that could potentially pose a risk to human health and the environment (e.g., sampling and decontamination wastes) as well as materials that have little potential to pose risk to human health and the environment (e.g., sanitary solid wastes). Two types of IDW will be generated during the implementation of field activities: indigenous and non-indigenous. Indigenous IDW expected to be generated during the investigations of AOCs at RVAAP includes soil and bedrock drill cuttings; residual soil samples; soil and buried waste materials from trenching; residual sediment samples; and groundwater from well point installation, monitoring well development, and purging. Non-indigenous IDW is expected to consist of decontamination rinse fluids and compactible and miscellaneous trash. Procedures to be utilized for managing IDW are described below. The FSAP addresses generic waste collection, characterization, storage, and disposal procedures to be used to implement multiple investigations at RVAAP; however, it will be necessary to address project-specific waste management practices in each investigation-specific SAP addendum tiered under the FSAP.

All hazardous wastes generated during environmental investigations at RVAAP must be managed in accordance with federal and state of Ohio large-quantity generator requirements as discussed in the following subsections. All hazardous waste activities must comply with RVAAP's Installation Hazardous Waste Management Plan, now in preparation.

7.1 IDW COLLECTION AND CONTAINERIZATION

All indigenous solid IDW (soil and rock cuttings) generated from borehole installations >1.8 m (6 feet) in depth will be collected and segregated by borehole location. Additionally, all unsaturated soils will be segregated from saturated soils within each borehole. The segregation of unsaturated and saturated soils is expected only to be necessary in boreholes that are drilled below the water table for completion as monitoring wells because all boreholes drilled for soil characterization are expected to be terminated at or above the water table. All indigenous solid IDW (soil and sediment) from borehole installations <1.8 m (6 feet) will be collected and segregated by the AOC from which they were generated. Segregation by AOC from shallow boreholes/sediment sampling stations is necessary because of the small volume of soil and sediment expected to be generated from individual locations. The segregation of unsaturated from saturated soils in shallow boreholes <1.8 m (6 feet) and sediment sampling stations is not anticipated because it is expected that none of the shallow boreholes will encounter the water table and sediment sampling stations will yield either totally saturated or unsaturated solid IDW. All indigenous solid IDW will be contained in labeled DOT approved open-top 55-gallon drums equipped with plastic drum liners and sealed with bung-top lids.

All indigenous solid IDW (soil and waste material) generated from trenching operations will be segregated by trench location and staged temporarily on plastic sheeting (minimum 6-mil thickness) at the trenching site until the trench is completed. The temporary staging of trench IDW will be in a manner that is protective of human health and the environment. All potentially hazardous solid IDW recovered from a trench will be segregated from potentially non-hazardous IDW and will be contained immediately in labeled DOT approved open-top 55-gallon drums equipped with plastic drum liners and sealed with bung-top lids. Potentially hazardous solid IDW from trenching will be identified in the field on the basis of visual inspection of the soil and waste materials (i.e., heavy discoloration, oil saturated, etc.), the types of waste materials unearthed (i.e., drum containers, paint or aerosol cans, munitions wastes, etc.), and screening using field instruments (e.g., organic vapor analyzer). All non-hazardous solid (soil and buried material) IDW will be immediately returned to the trench upon completion in the order that the material was excavated.

All liquid indigenous (groundwater) IDW generated from well point and monitoring well installation, development, and purging will be segregated by sample station. All liquid indigenous IDW will be collected in either labeled DOT approved 55-gallon closed-top drums or in labeled polyethylene storage tanks.

All solid non-indigenous (expendable sampling equipment and trash) IDW will be segregated as non-contaminated and potentially contaminated material. Potentially contaminated and non-contaminated solid non-indigenous IDW will be identified in the field on the basis of visual inspection (e.g., soiled versus non-soiled), usage of the waste material (e.g., outer sampling gloves versus glove liners), and field screening of the material using available field instrumentation (e.g., organic vapor analyzer). All non-indigenous IDW will be contained in trash bags with potentially contaminated non-indigenous IDW being additionally contained in labeled DOT approved open-top 55-gallon drums equipped with plastic drum liners and sealed with bung-top lids. All liquid non-indigenous (decontamination rinse water) IDW will be segregated by waste stream (e.g., soap and water/water rinses from methanol and hydrochloric acid rinses) and contained in either labeled DOT approved 55-gallon closed-top drums or in approved polyethylene storage tanks. All known potentially hazardous liquid non-indigenous IDW streams, such as methanol, hydrochloric acid rinses, and acetone waste from field laboratories, will be contained separately in labeled DOT approved closed top 55-gallon drums.

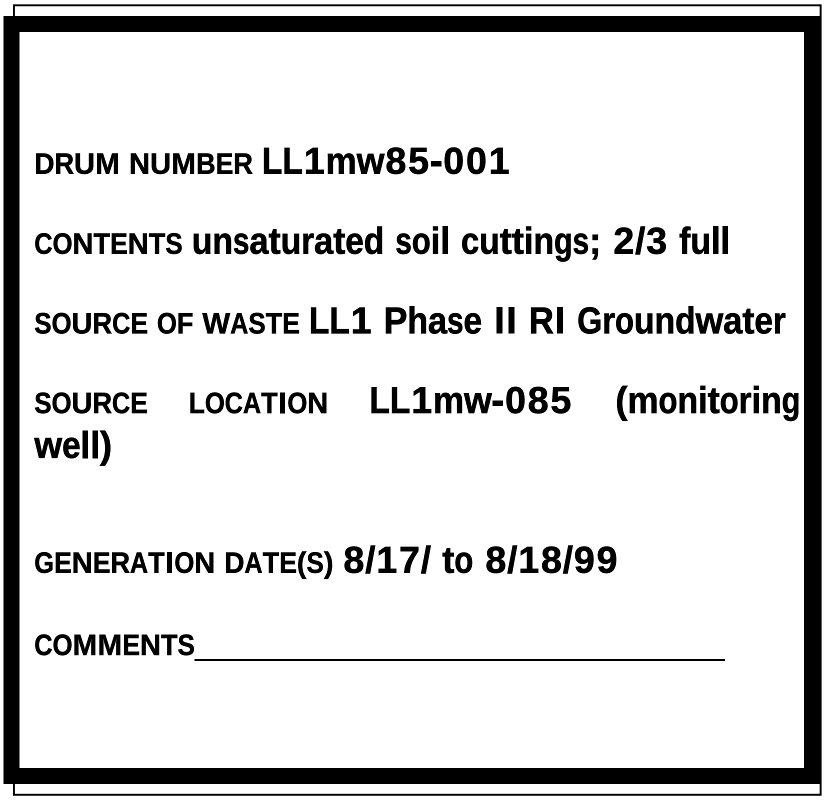
As an alternative to off-site disposal following field activities, temporary storage of non-hazardous soils may be permitted on site, with the prior approval of Ohio EPA. Storage of soils within their AOC of origin represents a lower-cost option for non-hazardous waste disposal, compared to containerizing and off-site disposal. Such storage requires placement of soil materials known to be non-hazardous (i.e., chemical analyses already complete) on polyethylene sheeting, inside the AOC where it originated. The soil pile must be stabilized and its boundary marked with flagging or other visible labels. The final disposition of any such soil will take place after site-specific cleanup levels are established. If contaminant concentrations in the soils are below cleanup levels, the soil may be spread and seeded (using RVAAP-approved seed mixes) or used for fill at the AOC after remediation. If the contaminant concentrations are generally higher than cleanup levels, the soils will be removed from the site with any soil excavated during the cleanup.

The method(s) used to containerize each waste stream during each investigation will be identified in the investigation-specific SAP addenda based on the appropriate waste containment option, as defined above, to meet the investigation-specific criteria. Section 7.2 of this FSAP addresses container labeling requirements, Section 7.3 describes IDW field staging, and Section 7.4 addresses IDW characterization.

7.2 WASTE CONTAINER LABELING

All waste storage containers (drums and poly-tanks) will be labeled immediately before and continuously during their use to ensure proper management of the contained wastes. An example of the waste storage container labels that will be used is shown in Figure 7-1. The following procedure will be used for waste container labeling:

- Weather-resistant commercial hazardous or non-hazardous labels will be affixed and located on the top and two sides on the upper one-third of each storage container. Additional label information may be recorded directly on a clean, dry drum surface using an indelible white or silver paint marker. All containers, including empty ones, must be labeled.



DRUM NUMBER LL1mw85-001

CONTENTS unsaturated soil cuttings; 2/3 full

SOURCE OF WASTE LL1 Phase II RI Groundwater

SOURCE LOCATION LL1mw-085 (monitoring well)

GENERATION DATE(S) 8/17/ to 8/18/99

COMMENTS___________________________________

Figure 7-1. Example Waste Storage Container Label

- Each label will be placed on a smooth part of the container and will not be affixed across drum bungs, seams, ridges, or dents.

- Information to be recorded on each label will include the following:

    - container number,
    - contents,
    - source of waste,
    - source location,
    - project name and site identification,
    - physical characteristic of the waste, and
    - generation date(s).

- All information documented on container labels will be recorded with a permanent marker or paint pen and recorded in the field logbook.

- All container labels will be protected in a manner to prevent damage or degradation of the recorded information.

7.3 IDW FIELD STAGING

Subject to the review and approval of RVAAP staff before the start of a project, each Contractor Field Operations Manager will designate a Field Staging Area (FSA) for each project. The FSA will be established within each AOC during investigations to store IDW generated from each AOC pending characterization and disposal. If a centralized decontamination area is utilized (outside of an AOC) to support the investigation of multiple AOCs, an FSA will also be established and co-located with the decontamination facility to store non-indigenous liquid and solid IDW resulting from decontamination activities. All indigenous (solid and liquid) IDW will be stored at the point of generation within the AOC or in the FSA until such time that the IDW is characterized for disposal in accordance with Section 7.4. After characterization of the IDW, the wastes will be disposed of according to Section 7.5 or moved to the appropriate FSA and stored pending disposal.

All non-indigenous (decontamination rinse and expendable material) IDW will be stored in the appropriate (AOC or central decontamination area) FSA until such time that it is characterized for disposal in accordance with Section 7.4. After characterization of the non-indigenous IDW, the wastes will be disposed of according to Section 7.5 or moved to the appropriate FSA and stored pending disposal. All non-contaminated, non-indigenous IDW will be staged in a sanitary trash container (dumpster) pending disposal.

Each FSA will be visibly marked and all waste containers (drums and polyethylene tanks) will be placed on top of plastic sheeting or pallets and covered. Because of the large number of vacant buildings at many of the AOCs at RVAAP, FSAs will be established, where possible based on availability and approval of the facility, adjacent to or inside designated, currently unused buildings to protect the waste containers from the weather and safeguard the integrity of the stored wastes over time. All IDW will be segregated by location and type (e.g., soil and rock cuttings, decontamination water, alcohol and acid decontamination rinses, well development and purge water, etc.) so that all IDW generated can be identified with a given location or operation. All waste containers will be stored in a manner to accommodate inspection and sampling, if necessary, and to facilitate safe handling of the containers. All RCRA hazardous wastes will be managed in accordance with the appropriate technical requirements establish in the Ohio Administrative Code, Chapter 3745-55, Management of Hazardous Waste [40 Code of Federal Regulations (CFR) 264, Subparts I (containers) and J (tanks)]. If RCRA wastes are suspected at an AOC, they will be identified in the investigation-specific SAP addenda.

Hazardous and non-hazardous IDWs staged and stored at RVAAP are subject to the requirements of RVAAP's Installation Hazardous Waste Management Plan, now in preparation. All contractors conducting environmental investigations at the facility must comply with the following minimum requirements of that plan:

- No 90-day hazardous waste storage areas will be permitted within an AOC. Hazardous waste will be stored at a centralized 90-day storage area designated by the RVAAP Environmental Coordinator.

- Satellite accumulation areas may be used for hazardous waste storage, but all state and federal management rules must be followed. An inventory and a location map of the waste must be given to RVAAP staff as soon as waste is generated; this information must be updated on a daily basis if changes occur.

- Any containers in a satellite accumulation area must be moved to the designated 90-day storage area within 72 hours of the decision to dispose of them.

- Both hazardous and non-hazardous waste (except for municipal waste) must be manifested.

- All contractors must obtain an RVAAP tracking number from the RVAAP operating contractor when shipping waste and write it on the top of the front page of the manifest.

- The source of the waste (project name, activity, area within the AOC, etc.) and the weight must be written on the manifest.

- The contractor must give the state's copy of the manifest to the RVAAP operating contractor, who will submit it on behalf of the installation.

- All non-hazardous containerized waste not transported off-post within 30 days following project completion must be consolidated at an RVAAP-approved storage area near Post 1. Any non-hazardous liquid waste will require secondary containment at this time.

- All liquid hazardous waste must have secondary containment.

- All contractors must confirm that the disposal facility has received the hazardous waste shipment within the required time frames. This will be accomplished by contacting the RVAAP operating contractor to verify that the disposal facility signed and returned a copy of the manifest to RVAAP. If the copy has not been returned within 35 days of the pickup date, the contractor must immediately notify the RVAAP Environmental Coordinator and begin corrective actions.

7.4 IDW CHARACTERIZATION AND CLASSIFICATION FOR DISPOSAL

All indigenous IDW (soil, rock cuttings, and groundwater) will be characterized for disposal on the basis of analytical results from environmental samples or from direct analysis of composite IDW samples. Because all indigenous IDW will be segregated by sample station for boreholes >1.8 m (6 feet) in depth, trenches, and monitoring wells, the results of environmental samples collected from each sampling station can be used to determine the chemical composition of the wastes generated from that station and used to characterize the waste for disposal. In boreholes where it is necessary to segregate unsaturated and saturated solid indigenous (soil and rock cuttings) IDW (i.e., boreholes drilled below the water table for completion as monitoring wells), the results from environmental soil samples will be used to characterize the unsaturated soil and rock cuttings, and samples of saturated soil or rock from each borehole will be used to characterize the saturated soil and rock cuttings. Where it is necessary to segregate solid indigenous (soil) IDW by AOC [i.e., boreholes <1.8 m (6 feet) in depth], the results of environmental soil samples from all boreholes where wastes are commingled will be used to characterize the waste in each container.

Non-indigenous IDW, except for personal protective equipment (PPE) and expendable sampling equipment, will be characterized for disposal on the basis of composite samples collected from segregated waste stream storage containers. Composite waste samples will be submitted for laboratory analysis to characterize each waste stream for disposal. Procedures for composite waste sampling are presented in Sections 7.4.1 and 7.4.2 of this FSAP. PPE and expendable sampling equipment will be visually inspected and screened for contaminants on site using available field screening instruments after each use to determine if residual levels of contamination exist that may exceed contaminant action levels. PPE and expendable sampling equipment will be segregated by sampling stations as clean or potentially contaminated trash based on the results of field screening and visual inspection. Potentially contaminated PPE and expendable sampling equipment will be containerized in accordance with Section 7.1 and characterized based on the results of environmental samples collected from the sample station with which the wastes are associated.

Upon receipt of analytical results from the subcontracted laboratory (approximately 30 days after submission of sample delivery groups), the analytical results will be reviewed to determine if any potentially hazardous wastes exist. This review will include a comparison of the analytical results against the Toxicity Characteristic Leaching Procedure (TCLP) criteria for liquids, and a 20-fold TCLP dilution factor for soils. Table 7-1 presents the maximum concentration of contaminants for toxicity characterization of hazardous wastes as specified in 40 CFR 261.24. After all analytical results have been received for each investigation and prior to the disposal of any potentially contaminated or hazardous waste, an IDW Characterization and Disposal Plan will be prepared and submitted to RVAAP, the Army, and Ohio EPA. The IDW Characterization and Disposal Plan will present an inventory of all stored IDW, document the analytical results and IDW characterization, and make recommendations for the disposal of all IDW based on Facility-wide ARARs [Ohio EPA regulatory criteria, RCRA, Toxic Substances Control Act (TSCA), and Safe Drinking Water Act (SDWA)] and contaminant risk-based action levels. The recommendations for IDW disposal presented in the IDW Characterization and Disposal Plan will be submitted to the Army, the Ohio EPA Division of Emergency and Remedial Response and Division of Solid and Infectious Waste Management, and upon approval, implemented.

7.4.1 Solid IDW Composite Sampling Procedure

All solid IDW will be characterized on the basis of analytical results from correlative environmental samples; however, should it become necessary to characterize soil IDW by composite sampling, the following procedure will be used.

Composite sampling of solid IDW (soil and rock cuttings) for disposal characterization will be performed using a composite grab sampling technique. The equipment used in solid IDW sampling will consist of stainless steel bowls and mixing instruments (e.g., knives and spoons) and decontaminated following the procedure presented in Section 4.4.2.8 of this FSP. The handling, storage and shipping of IDW composite grab samples will follow the procedures for soil samples described in Section 4.4.2.6 and Section 5.0 of this FSAP. Composite grab sample collection will be performed as follows:

Table 7-1. Maximum Concentration of Contaminants for the Toxicity Characteristic (40 CFR 261.24)

EPA HW No.[a]	Contaminant	CAS No.[b]	Regulatory Level (mg/L)
D004	Arsenic	7440-38-2	5.0
D005	Barium	7440-39-3	100.0
D018	Benzene	71-43-9	0.5
D006	Cadmium	7440-43-2	1.0
D019	Carbon tetrachloride	56-23-5	0.5
D020	Chlordane	57-74-9	0.03
D021	Chlorobenzene	108-90-7	100.0
D022	Chloroform	67-66-3	6.0
D007	Chromium	7440-47-3	5.0
D023	o-Cresol	95-48-7	200.0[d]
D024	m-Cresol	108-39-4	200.0[d]
D025	p-Cresol	106-44-5	200.0[d]
D026	Cresol	--	200.0[d]
D016	2,4-D	94-75-7	10.0
D027	1,4-Dichlorobenzene	106-46-7	7.5
D028	1,2-Dichloroethane	107-06-2	0.5
D029	1,1-Dichloroethylene	75-35-4	0.7
D030	2,4-Dinitrotoluene	121-14-2	0.13[c]
D012	Endrin	72-20-8	0.02
D031	Heptachlor (and its epoxide)	76-44-8	0.008
D032	Hexachlorobenzene	118-74-1	0.13[c]
D033	Hexachlorobutadiene	87-68-3	0.5
D034	Hexachloroethane	67-72-1	3.0
D008	Lead	7439-92-1	5.0
D013	Lindane	58-89-9	0.4
D009	Mercury	7439-97-6	0.2
D014	Methoxychlor	72-43-5	10.0
D035	Methyl ethyl ketone	78-93-3	200.0
D036	Nitrobenzene	98-95-3	2.0
D037	Pentrachlorophenol	87-86-5	100.0
D038	Pyridine	110-86-1	5.0[c]
D010	Selenium	7782-49-2	1.0
D011	Silver	7440-22-4	5.0
D039	Tetrachloroethylene	127-18-4	0.7
D015	Toxaphene	8001-35-2	0.5
D040	Trichloroethylene	79-01-6	0.5
D041	2,4,5-Trichlorophenol	95-95-4	400.0
D042	2,4,6-Trichlorophenol	88-06-2	2.0
D017	2,4,5-TP (Silvex)	93-72-1	1.0
D043	Vinyl chloride	75-01-4	0.2

[a] Hazardous waste number.

[b] Chemical abstracts service number.

[c] Quantitation limit is greater than the calculated regulatory level. The quantitation limit therefore becomes the regulatory level.

[d] If o-, m-, and p-Cresol concentrations cannot be differentiated, the total cresol (D026) concentration is used. The regulatory level of total cresol is 200 mg/L.

1. Collect discrete grab samples from each segregated IDW waste container. Each discrete grab sample should be collected in an identical fashion.
    a. For volatile organic characterization, grab samples of equal proportions will be transferred directly from each IDW waste container to the sample container with minimum head space for laboratory analysis.
    b. For all analyses other than volatile organic compounds, individual grab samples will be transferred into a sample bowl for homogenizing.
2. Homogenize individual grab samples using a sampling bowl and mixing instrument by stirring and turning over the sample until the mixture is adequately homogenized. The mixture is then divided by half and equal portions from each half will be used to fill sample containers.
3. Assemble the sample containers that contain the homogenized grab samples that will make up a specific composite sample.
4. Remove an aliquot of sample from each sample container and place it in a decontaminated stainless steel mixing bowl. Each aliquot amount is to be as identical as possible to facilitate representativeness.
5. Homogenize the aliquots as described in Step (2).
6. Remove sample amounts from the homogenized composite sample and place them into the proper containers for shipment to the laboratory.

7.4.2 Liquid IDW Composite Sampling Procedure

Sampling of liquid IDW (groundwater and decontamination water) for disposal characterization will be performed using a composite grab sampling technique. The equipment used in liquid IDW sampling will consist of sample containers and pipets. The handling, storage, and shipping of IDW samples will follow procedures for water samples described in Section 5.0 of this FSAP. Liquid IDW (i.e., groundwater and decontamination rinse water) will be sampled and analyzed separately. Composite grab sample collection will be performed as follows:

1. Collect discrete grab samples in a sample container from each segregated IDW waste container. Each discrete grab sample should be collected in identical fashion.
2. Shake or stir the individual grab sample containers to homogenize.
3. Using a clean pipet, deliver aliquots of the homogenized grab samples directly into a sample container to be sent to the laboratory. Correlate the number of grab samples and sample volume required by the laboratory to determine the volume needed to provide equal amounts of aliquot from each grab sample at the recommended sample volume (e.g., five 20-ml pipettings from five discrete grab samples to generate a 100-ml composite sample).
4. Seal the sample container and shake well to mix. Prepare container for shipment to the laboratory.

7.5 IDW DISPOSAL

Table 7-2 identifies the disposal options for all expected waste streams from environmental investigations at RVAAP, based on past efforts. All indigenous and non-indigenous wastes generated are subject to disposal protocols outlined Ohio EPA guidance (Ohio EPA November 1997). Waste disposal options recommended in the Contractor's IDW Characterization and Disposal Plan are subject to the approval of the RVAAP Environmental Coordinator, the U.S. Army, and Ohio EPA. The RVAAP Environmental Coordinator will sign all waste manifests and other shipping documents, and oversee the disposition of all IDW at RVAAP. Transportation of all IDW for storage and/or disposal will be in accordance with applicable State of Ohio and Federal regulations.

There is no means for disposal of contaminated IDW at RVAAP. All IDW determined to be a hazardous waste will be disposed according to applicable State of Ohio and Federal regulations at an approved off-site hazardous waste facility. Non-hazardous, contaminated waste contains contaminants but does not meet the criteria for hazardous waste. This waste will either be stored in the FSA pending remediation of the AOC where it originated, or will be disposed off site. Non-hazardous, non-contaminated waste contains contaminants at concentrations at or below acceptable criteria (e.g., background concentrations), and may be disposed on site with prior approval from the RVAAP Environmental Coordinator, the Ohio EPA, and the U.S. Army.

Any contaminated or potentially contaminated liquid IDW or saturated-soil IDW that is stored in an FSA during winter months will require special management to prevent accidental releases due to freezing. The Contractor's foremost responsibility is to manage IDW so that, if possible, disposal can be completed before freezing conditions arise. If disposal cannot be executed before the onset of such conditions, or if long-term storage of liquids is anticipated, secondary containment is required. Secondary containment is the responsibility of the Contractor and is subject to the requirements of RCRA.

Table 7-2. IDW Disposal Options for Potential Waste Streams in RVAAP Environmental Investigations

Waste Stream	Non-Hazardous, Non-Contaminated	Non-Hazardous, Contaminated	Hazardous, Contaminated
Solid (soil, rock cuttings)	Spread, seed, and mulch at designated area within the AOC (RVAAP-approved seed mix)	Dispose off site at permitted waste facility	Dispose off-site at permitted hazardous-waste facility
		Store in field staging area until remediation of contaminated media in the AOC	
Liquid (groundwater, decontamination fluids, laboratory reagents and residues)	Discharge on ground surface at designated area	Dispose off-site at permitted waste facility (most likely scenario for these wastes)	Dispose off-site at permitted hazardous-waste facility
		Store in field staging area until remediation of contaminated media in the AOC (**Requires Secondary Containment**)	
Expendable sampling equipment and trash	Dispose as sanitary trash	Dispose off site at permitted facility	Dispose off-site at permitted hazardous-waste facility

All non-indigenous solid (expendable sampling equipment and trash) IDW will be disposed of as either sanitary trash or, if determined to be potentially contaminated, stored in an FSA located within the AOC boundary and maintained there in accordance with Section 7.3 until such time that it can be disposed at an approved facility. All expendable sampling equipment determined to be potentially contaminated will be decontaminated according to Section 4.3.8 and then disposed of as sanitary trash.

All treatment, storage, and disposal facilities (TSDFs) must be in good standing with environmental regulatory agencies. The RVAAP Environmental Coordinator must be notified in advance of waste disposal which disposal facility is to be used. The Environmental Coordinator has the authority to refuse use of a particular disposal facility based on his/her review of their ability to protect the interests of OSC.

8.0 CONTRACTOR CHEMICAL QUALITY CONTROL

The Contractor Chemical Quality Control (CCQC) program to be utilized for the AOC-specific investigations will consist of three phases. The three CCQC phases will be the preparatory phase, the initial phase, and the follow-up phase, all of which will be performed by contractors whether or not an U.S. Army representative is present. The CCQC representative responsible for implementation and documentation of the CCQC program and definable features of work that will comprise the CCQC program will be identified in the AOC-specific investigation addenda to the FSAP.

The preparatory phase of the CCQC program will be conducted by the CCQC representative before beginning each definable feature of work. A summary of all activities performed during each preparatory phase meeting will be documented by the CCQC representative in a meeting minutes record. Each preparatory phase meeting will address the following:

- Review of all pertinent sections of the FSAP and SAP addendum in order to ensure that all field personnel are cognizant of the overall project DQOs, specific project activities to be accomplished, and specific sampling and analysis requirements.

- Actual calibration of all instruments to be used for measurement of field parameter using certified calibration standards, gases, etc.

- Physical examination of all materials and equipment required to accomplish the specific project activities.

- Demonstration of equipment decontamination procedures in accordance with FSAP and SAP addendum requirements.

- Demonstration of how each sample type is to be collected, containerized, documented, and packaged.

- Demonstration of proper IDW management and documentation.

- Demonstration of the procedure for completing all required information to be recorded on sample custody forms and discussion of the project sample numbering system. Completed examples of a COC form, sample container label, and IDW drum label will be provided to the field personnel for reference.

- Demonstration/discussion of any other activities to be performed as deemed necessary by the CCQC representative.

- Examination of the work area(s) to ascertain if all preliminary work is complete.

- Review of preparatory phase field equipment and support materials checklists. The contents of the field equipment checklist and supporting materials checklist will be presented in the AOC-specific investigation addenda. An example of the QA table that will be used to match up primary and QC samples is presented in Figure 8-1.

	Contractor Laboratory					Government Laboratory				Requested Laboratory Analyses					
Sample Location	Sample Type	Sample Number	Associated QC Duplicate Number	Associated QC Rinsate Number	Associated QC Trip Blank Number	Sample Number	Associated QA Duplicate Number	Associated QA Rinsate Number	Associated QA Trip Blank Number	VOCs	SVOCs	RCRA Metals	TPH, Oil, and Grease	Ignitability, Corrosivity, RCRA Metals	TCLP VOAs TCLP Metals

Figure 8-1. Example of the QA Table to be Used for the RVAAP AOC-Specific Investigations

In addition to the activities noted above, the CCQC representative will ensure that the USACE QA laboratory has been contacted to schedule receipt and analysis of the government QA samples. This will be accomplished by review of the telephone log used to document the laboratory contact.

The initial phase of the CCQC program will be conducted by the CCQC representative and will include the following:

- oversight of drilling, monitoring well installation construction and development, and/or sampling activities and review of this work to ensure compliance with delivery order requirements;
- inspection of individual sample labels and COC forms for accuracy, completeness, and consistency;
- inspection of sample packaging and shipping activities;
- observation, verification, and documentation of initial and ongoing field instrument calibration;
- inspection of field logbooks and other field records/sketches to ensure that all pertinent data are recorded in accordance with delivery order requirements; and
- inspection of the QA sample match-up table to ensure that all samples collected during each day are documented properly.

The follow-up phase of the CCQC program will be conducted by the CCQC representative and will involve performing the various activities noted for the initial phase on a daily basis until completion of the particular definable feature of work.

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9.0 DAILY CHEMICAL QUALITY CONTROL REPORTS

During the field activities preformed for the AOC-specific investigations, Daily Chemical Quality Control Reports (DCQCRs) will be prepared, signed, and dated by the Contractor CQC representative. An example of the DCQCR format to be used is illustrated in Figure 9-1. These reports will be submitted to the U.S. Army Project Manager on a weekly basis. The contents of each DCQCR will include a summary of activities performed at the project site, weather information at the time of sampling, results of measurements made with field instruments, results of CCQC activities performed including field instrument calibrations, departures from the approved FSAP and/or AOC-specific SAP addendum, problems encountered during field activities, and any instructions received from government personnel. Any deviations that may affect the project DQOs will be immediately conveyed to the U.S. Army Project Manager. The following will be attached to each DCQCR submittal, as appropriate:

- the QA sample table that matches up primary and QC samples collected,
- a summary of field-generated analytical results,
- any other project-related forms utilized, and
- a copy of the CCQC preparatory phase meeting minutes (unless bound in a logbook).

A copy of the COC form(s) is sent to the Contractor Laboratory Coordinator weekly.

DATE________________

DAY

S	M	T	W	T	F	S

DAILY QUALITY CONTROL REPORT

COE PROJECT MANAGER____________________

PROJECT______________________________

JOB NO._______________________________

CONTRACT NO.__________________________

WEATHER	Bright Sun	Clear	Over-cast	Rain	Snow
TEMP	To 32	32-50	50-70	70-85	85 up
WIND	Still	Moder.	High	Report No.	
HUMIDITY	Dry	Moder.	Humid		

SUB-CONTRACTORS ON SITE:

EQUIUPMENT ON SITE:

WORK PERFORMED (INCLUDING SAMPLING):

Figure 9-1. Example of the Daily Chemical Quality Control Report to be Used for the RVAAP AOC-Specific Investigations

PROJECT____________________ REPORT NO.____________

JOB NO.____________________ DATE:____________

QUALITY CONTROL ACTIVITIES (INCLUDING FIELD CALIBRATIONS):

HEALTH AND SAFETY LEVELS AND ACTIVITIES:

PROBLEMS ENCOUNTERED/CORRECTIVE ACTION TAKEN:

SPECIAL NOTES:

TOMORROW'S EXPECTATIONS:

By:____________________
(Signature and date)

QA Check by:____________________
(Signature and date)

Figure 9-1 (continued)

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10.0 CORRECTIVE ACTIONS

10.1 SAMPLE COLLECTION AND FIELD MEASUREMENTS

Corrective actions will be implemented in the event that a discrepancy is discovered by field personnel, laboratory personnel, and/or during a field or desk audit. The initial responsibility for monitoring the quality of field activities and measurements lies with the field personnel. These personnel are responsible for following QA procedures, while the CCQC representative is responsible for verifying that the these procedures are being followed. This verification requires that the CCQC representative assess the correctness of the field methods and the ability of the field team to meet the QA objectives and to make a subjective assessment of the impact that a procedure has on the field objective and resulting data quality.

If a field problem occurs that might jeopardize the integrity of the project, cause a QA objective not to be met, or affect data quality, the first action taken will be an assessment of the severity of the problem by the CCQC representative. If the problem is determined to be minor, the CCQC representative will initiate an appropriate corrective action, which will be recorded in the field logbook. If the problem is determined to be significant or subject to reoccurrence, the CQC representative will initiate an NCR that will be submitted to the Contractor QA/QC Officer. An example of the NCR to be used for the AOC-specific investigations is illustrated in Figure 10-1. The Contractor QA/QC Officer will then propose and implement an appropriate corrective action as documented on the NCR.

The Contractor QA/QC Officer will be responsible for ensuring that corrective action for nonconformances are initiated by:

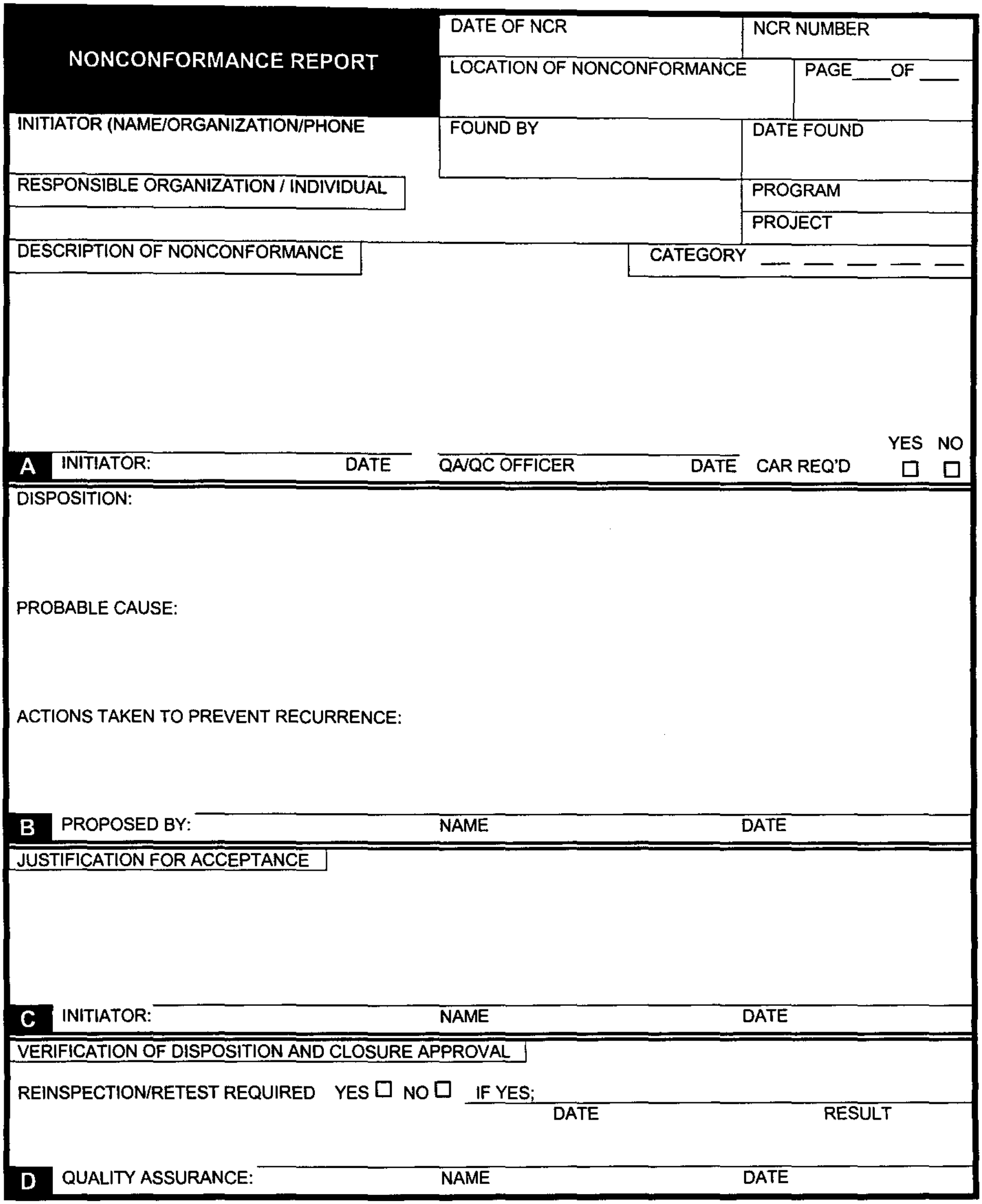
- evaluating all reported nonconformances,
- controlling additional work on nonconforming items,
- determining disposition or action to be taken,
- maintaining a log of nonconformances,
- reviewing nonconformance reports and corrective actions taken, and
- ensuring that nonconformance reports are included in the project evidence file.

If appropriate, the Contractor CQC representative or QA/QC Officer will ensure that no additional work that depends on the nonconforming activity is performed until corrective actions are implemented, and the nonconforming activity is corrected. Corrective actions for field measurements may include the following:

- repeat measurement to check errors,
- check proper instrument adjustments for ambient conditions such as temperature,
- check battery charge and connections,
- check instrument calibration and recalibrate as necessary,
- replace instrument or measurement devices, and
- stop work (if necessary).

10.2 LABORATORY ANALYSES

In the event that a laboratory problem occurs that might jeopardize the integrity of the project analytical results, cause a QA objective not to be met, or affect data quality, the first action taken will be an assessment of the severity of the problem by the Contractor Laboratory Coordinator. If the problem is



NONCONFORMANCE REPORT

DATE OF NCR

NCR NUMBER

LOCATION OF NONCONFORMANCE

PAGE____OF ____

INITIATOR (NAME/ORGANIZATION/PHONE

FOUND BY

DATE FOUND

RESPONSIBLE ORGANIZATION / INDIVIDUAL

PROGRAM

PROJECT

DESCRIPTION OF NONCONFORMANCE

CATEGORY __ __ __ __ __

A INITIATOR: ________ DATE ________ QA/QC OFFICER ________ DATE CAR REQ'D YES ☐ NO ☐

DISPOSITION:

PROBABLE CAUSE:

ACTIONS TAKEN TO PREVENT RECURRENCE:

B PROPOSED BY: ________ NAME ________ DATE

JUSTIFICATION FOR ACCEPTANCE

C INITIATOR: ________ NAME ________ DATE

VERIFICATION OF DISPOSITION AND CLOSURE APPROVAL

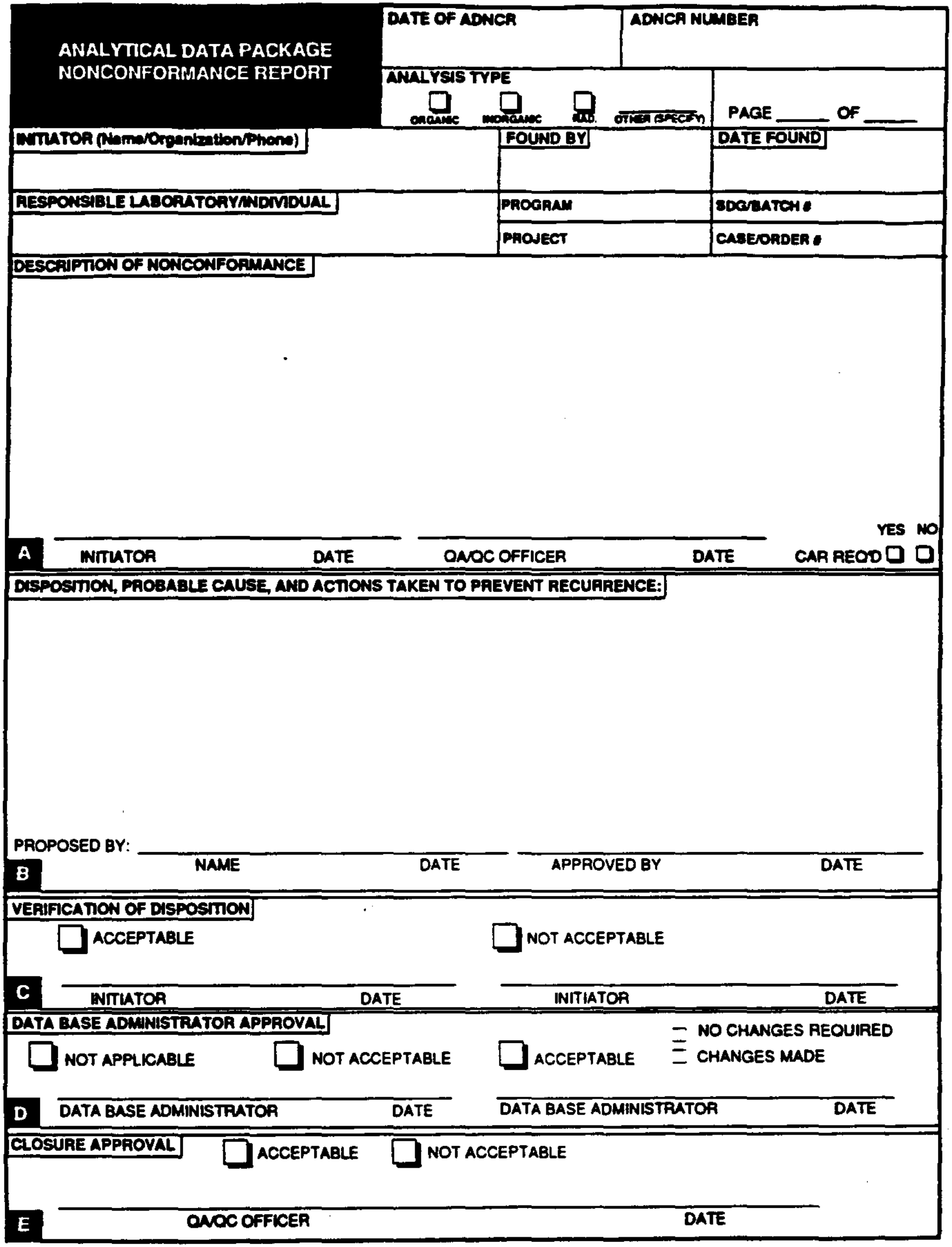
REINSPECTION/RETEST REQUIRED YES ☐ NO ☐ IF YES; ________ DATE ________ RESULT

D QUALITY ASSURANCE: ________ NAME ________ DATE

Figure 10-1. Example of the Nonconformance Report to be Used for the RVAAP AOC-Specific Investigations determined to be minor, the Contractor Laboratory Coordinator will initiate an appropriate corrective action, which will be recorded in a memorandum submitted to the Contractor Project Manager. The Contractor Project Manager will then relate the corrective action to be implemented to the Contractor CQC representative and/or Contractor QA/QC Officer if the problem is associated with activities being performed in the field. If the problem is determined to be significant, the Contractor Laboratory Coordinator will initiate an Analytical Data Package Nonconformance Report, illustrated in Figure 10-2, which will be submitted to the Contractor QA/QC Officer and addressed in the same manner as described in Section 10.1 of this FSP. Analytical nonconformance reports will be copied to the U.S. Army Project Manager.

Laboratory personnel will be alerted that corrective actions may be necessary if:

- QC data are outside the warning or acceptable windows for precision and accuracy.
- Blanks contain target analytes above acceptable levels.
- Undesirable trends are detected in spike recoveries or relative percent differences between duplicates.
- Unusual changes in detection limits are encountered.
- Deficiencies are detected during internal or external audits or from the results of performance evaluation samples.
- Inquiries concerning data quality are received.



ANALYTICAL DATA PACKAGE NONCONFORMANCE REPORT

DATE OF ADNCR

ADNCR NUMBER

ANALYSIS TYPE
☐ ORGANIC ☐ INORGANIC ☐ RAD. ______ OTHER (SPECIFY)

PAGE ______ OF ______

INITIATOR (Name/Organization/Phone)

FOUND BY

DATE FOUND

RESPONSIBLE LABORATORY/INDIVIDUAL

PROGRAM

SDG/BATCH #

PROJECT

CASE/ORDER #

DESCRIPTION OF NONCONFORMANCE

A
INITIATOR DATE QA/QC OFFICER DATE
CAR REQ'D YES ☐ NO ☐

DISPOSITION, PROBABLE CAUSE, AND ACTIONS TAKEN TO PREVENT RECURRENCE:

PROPOSED BY: ______

B
NAME DATE APPROVED BY DATE

VERIFICATION OF DISPOSITION
☐ ACCEPTABLE ☐ NOT ACCEPTABLE

C
INITIATOR DATE INITIATOR DATE

DATA BASE ADMINISTRATOR APPROVAL
☐ NOT APPLICABLE ☐ NOT ACCEPTABLE ☐ ACCEPTABLE
_ NO CHANGES REQUIRED
_ CHANGES MADE

D
DATA BASE ADMINISTRATOR DATE DATA BASE ADMINISTRATOR DATE

CLOSURE APPROVAL ☐ ACCEPTABLE ☐ NOT ACCEPTABLE

E
QA/QC OFFICER DATE

REVISION 0

Figure 10-2. Example of the Analytical Data Package Nonconformance Report to be Used for the RVAAP AOC-Specific Investigations

11.0 PROJECT SCHEDULE

Because of the generic nature of the FSAP, the inclusion of a schedule is not practical. Project schedules will be developed for each AOC-specific investigation and included in the AOC-specific investigation SAP addenda.

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12.0 REFERENCES

ASTM (American Society for Testing and Materials) 1995. Annual Book of ASTM Standards, Volume 08.04: Plastic Pipe and Building Products, Philadelphia, Pa.

Federal Geodetic Control Committee 1984. Standards and Specifications for Geodetic Control Networks. National Oceanic and Atmospheric Administration, Rockville, Md.

Gilbert, R.O. 1987. Statistical Methods for Environmental Pollution Monitoring. Van Nostrand Reinhold.

National Sanitation Foundation 1994. NSF Standard 14: Plastics Piping System Components and Related Materials. Ann Arbor, Mich.

Ohio Department of Natural Resources 1991. Groundwater Pollution Potential of Portage County, Ohio. Ohio DNR Division of Water, Ground Water Resources Section, 1939 Fountain Square, Columbus, Oh.

Ohio EPA 1995. Technical Guidance Manual for Hydrogeologic Investigations and Groundwater Monitoring.

Ohio EPA 1997. Letter to RVAAP/USACE regarding IDW disposal guidance (November 3, 1997).

Ohio EPA 1998. Letter to IOC regarding use of composite sampling of soils for explosives determination (Sept. 22, 1998).

USACE 1994a. Monitoring Well Design, Installation, and Documentation at Hazardous and/or Toxic Waste Sites, EM 1110-1-4000.

USACE 1994b. Requirements for the Preparation of Sampling and Analysis Plans, EM 200-1-3.

USACE 1996a. Preliminary Assessment for the Ravenna Army Ammunition Plant, Ohio.

USACE 1996b. Facility-wide Sampling and Analysis Plan for the Ravenna Army Ammunition Plant, Ohio.

USACE 1998. Phase I Remedial Investigation of High-Priority Areas of Concern at the Ravenna Army Ammunition Plant, Ravenna, Ohio.

USACE 1999. Phase II Remedial Investigation for Report for the Winklepeck Burning Grounds at Ravenna Army Ammunition Plant, Ravenna, Ohio.

USACHPPM 1996. Relative Risk Site Evaluation, Ravenna Army Ammunition Plant, 28 October-1 November 1996. Hazardous and Medical Waste Study No. 37-EF-5360-97.

USATHAMA 1982. Reassessment of Ravenna Army Ammunition Plant, Ohio.

USATHAMA 1978. Installation Assessment of Ravenna Army Ammunition Plant. Report No. 132.

USEPA 1985. NEIC Policies and Procedures. EPA 330/9-78DDI-R.

USEPA 1989. RCRA Facility Assessment, Preliminary Review/Visual Site Inspection Report.

USEPA 1991. Management of Investigation-Derived Wastes During Site Inspections. PB91-9213311.

USEPA 1993. Data Quality Objectives Process for Superfund, Interior Final Guidance, EPA/5401G-93/071.

USEPA 1996. Field Sampling and Selecting On-Site Analytical Methods for Explosives in Soil.

USEPA 2000. Data Quality Objectives Process for Hazardous Waste Site Investigations. EPA/600/R-00/007.

APPENDIX A

ELECTRONIC DATA DELIVERABLE FILE SPECIFICATIONS

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General Guidelines

All data collected to characterize the environmental conditions at RVAAP must be submitted to the RVAAP Environmental Site Coordinator at the conclusion of the project or at regular intervals specified by the site manager for ongoing monitoring projects.

Information that that is best presented as drawings (such as boring logs and well construction logs) or on maps (such as geophysical data or UXO locations) should be submitted to RVAAP Environmental Site Coordinator in electronic format. Drawings should be submitted in PDF format. Maps should be submitted in an ArcView compatible format. Map formats such as ESRI shape files, ArcInfo coverages, or AutoCad drawings (.DWG files) are acceptable. Electronic files containing the maps or drawings should be submitted on 3.5 inch diskettes or CDs.

Field and laboratory measurements of discrete media such as soil, sediment, surface water, groundwater, air, building materials, biological tissues, etc. must be submitted in a standardized electronic format described below. A standardized electronic format facilitates the storage, retrieval and exchange of information.

Data must be submitted in tabular format (rows and columns). Each column is called a field. The name of each field and a description of its contents may be found in the tables below. Some fields are required and some are optional as indicated. If the field is marked as required (“Y”), then the field must have a valid value. Fields marked as Y* are required conditionally as indicated in the field description. Fields that do not have values should be left blank.

Entries in each field should be limited to the maximum length indicated. Numeric fields indicated with an ‘N’ after the length should contain only numeric entries. Data qualifier fields and comment fields are available for annotation of results. Dates should be written in mm/dd/yyyy format. Time is represented in HH:MM format. Coded fields should include entries chosen from codes tables provided by the RVAAP Environmental Site Coordinator. New codes may be added with the approval of RVAAP Environmental Site Coordinator.

Tables should include a header line with the name of each field. Tables should be submitted on 3.5 inch diskettes or CDs in tab-delimited ASCII format.

Four different table formats are available for data submittal. The Station Table contains information that describes each location that was sampled. The Well Construction Table includes information on the location, depth and type of well developed. The Sample Table includes measurements made on discrete samples. The Field Measurement Table includes information about measurements made directly in the environment. Data should be submitted using the appropriate table or tables.

The tables are related to each other by common fields indicated in bold type in the table formats. Entries for the common fields must match exactly for related records. For example, the STATION field relates the Station Table to the Well Construction, Sample, and Field Measurement Tables. The Station Table must have an entry for each station that was included in one of the other tables.

Station Table

Field #/ Column	Field Name	Maximum Width/ Type	Definition/Comments	Required
Link to Well Construction, Sample, and Field Measurement Tables				
1 A	Station	**50**	**The station name should be unique within a project, although it may be shared between projects. See Figure 5-1 in the Facility-wide Sampling and Analysis Plan for naming conventions.**	**Y**
Sampling Station Information				
2 B	**Project Name**	**50**	**Name to describe sampling effort associated with establishing the station**	**Y**
3 C	**Functional Area**	**50**	**A name that describes the general area where the station is located. (For example: building number, stream name, pad number, etc.)**	
4 D	**Easting**	**14N**	**The numeric horizontal plane coordinate. *Required for any location that can be mapped at the RVAAP site.**	**Y***
5 E	**Northing**	**14N**	**The numeric vertical plane coordinate. *Required for any location that can be mapped at the RVAAP site.**	**Y***
6 F	**Grid Units**	**3**	**The measurement units for the coordinates (e.g., ft, m, yd). *Must be present if coordinates are present.**	**Y***
7 G	**Grid System**	**15**	**Identifier for grid system. Geographic data should be in Ohio State Plane NAD83 meters.**	
8 H	**Coord Method**	**15**	**Method identifying how the coordinates were obtained (e.g., Global Positioning System, survey, estimated)**	
9 I	**Coord Accuracy**	**10N**	**Estimation of the accuracy of the coordinates in the units reported**	
10 J	**Elevation**	**10N**	**The ground surface elevation for the station.**	
11 K	**Elevation units**	**2**	**Units for measuring elevation (FT, M, etc.). Must be present if the elevation is present.**	**Y***
12 L	**Elevation Method**	**10**	**The method identifying how the elevation was determined (e.g., survey, estimate, contours).**	
13 M	**Elevation Accuracy**	**10N**	**Estimation of the elevation accuracy in the units reported.**	
14 N	**Station Type**	**20**	**The station type: well, borehole, surface, etc.**	
15 O	**Station Description**	**50**	**Additional information about the station.**	
16 P	**Comments**	**254**	**Any desired comments.**	

Well Construction Table

Field #/ Column	Field Name	Maximum Width/ Type	Definition/Comments	Required
Link To Station Table				
1 A	Station	50	The station name should be unique within a project, although it may be shared between projects. This is the name that will be used to identify the well. This entry must exactly match an entry in the Station Table which contains the location information.	Y
Well Construction Information				
2 B	Project Name	50	Name to describe sampling effort associated the well development	Y
3 C	Functional Area	50	A name that describes the general area where the station in located. (For example: building number, stream name, pad number, etc.)	
4 D	Well Type	20	The well type: monitoring well, piezometer, recovery well, etc.	Y
5 E	Vertical RP	20	Vertical reference point (RP) for vertical measurements. For example, top of well casing, top of pad, ground surface, etc. *Required for monitoring wells.	Y*
6 F	RP Elevation	10N	Elevation of vertical reference point (RP). *Required for monitoring wells.	Y*
7 G	Elevation units	5	Units for measuring elevation (FT, M, etc.). *Must be present if the elevation is present.	Y*
8 H	Elevation Method	10	The method identifying how the elevation was determined (e.g., survey, estimate, contours).	
9 I	Protective Casing Height	10N	Distance of highest point of well protective casing (outer casing) below RP. (Value is negative if above RP.)	
10 J	Well Casing Height	10N	Distance of highest point of well casing (inner casing) below RP. (Value is negative if above RP.)	
11 K	Total Depth	10	Distance from RP to bottom of well. *Required for monitoring wells.	Y*
12 L	Depth Units	5	Units for measurement of vertical distance (FT, M). *Required if depth or heights are reported.	Y*
13 M	Screen Top	10N	Distance from RP to screen top. *Required for screened monitoring wells.	Y*
14 N	Screen Bottom	10N	Distance from RP to screen bottom. *Required for screened monitoring wells.	Y*
15 O	Screen Material	20	Material of which screen is constructed (stainless steel, PVC, etc.) *Required for screened monitoring wells.	Y*
16 P	Diameter Units	5	Units for diameter measurements (IN, CM, FT, etc.).	Y
17 Q	Screen Diameter	10N	Inside diameter of screen. *Required for screened monitoring wells. . (Use units from Diameter Units field.)	Y*
18 R	Screen Opening Size	10N	Screen slot size or opening size. (Use units from Diameter Units field.)	Y
19 S	Well Casing Material	20	The inner well casing/riser material (stainless steel, PVC, etc). *Required for monitoring wells.	Y*

Field #/ Column	Field Name	Maximum Width/ Type	Definition/Comments	Required
20 T	Well Casing Diameter	10N	Inside diameter of the inner well casing/riser. . (Use units from Diameter Units field.)	Y
21 U	Protective Casing Material	20	Material of which the protective (outer) casing is constructed (stainless steel, PVC, etc.)	
22 V	Protective Casing Diameter	10N	Inside diameter of protective casing.	
23 W	Borehole Diameter	10N	Diameter of well boring. (Use units from Diameter Units field.)	
24 X	Completion Date	10	Date of completion of the well (mm/dd/yyyy).	Y
25 Y	Date Abandoned	10	Date that well was plugged and abandoned (mm/dd/yyyy). *Required if well is plugged.	Y*
26 Z	Aquifer Zone	20	Name used to describe aquifer intercepted by screened interval. *Required for monitoring wells.	Y*
27 AA	Comments	254	Any desired comments.	

Sample Table

This format is used to transfer information from sample analyses. It is meant to capture as much information as possible, however, it is recognized that not all fields may be relevant or available. Therefore, only a limited number of the fields are required. It is recognized that files in this format may be significantly empty. The format specification has been broken into subsections relating to the basic types of information.

The file should not contain laboratory quality control (QC) samples (e.g., method blanks, surrogates). It may contain field QC data such as field duplicates, results from split samples, trip blanks and equipment rinsates.

Field names marked with an asterisk are coded fields. Codes for these fields should be chosen from the attached codes table. Codes may be added with the approval of the RVAAP Data Manager.

Field #/ Column	Field Name	Maximum Width	Definition/Comments	Required
Link to Station Table				
1 **A**	Station	**50**	**The station name should be unique within a project, although it may be shared between projects. This entry must exactly match an entry in the Station Table.**	**Y**
Link to Field Measurement Table				
2 **B**	Client Sample ID	**22**	**The client's sample identification number. See Figure 5-1 in the Facility-wide Sampling and Analysis Plan for naming conventions.**	**Y**
Field Sample Information				
3 **C**	**Alternate Sample ID**	**15**	**A shorter sample ID used if needed to facilitate field recording and processing by laboratory information management systems.**	
4 **D**	**Project Name**	**50**	**Identifies sampling effort associated with the data.**	**Y**
5 **E**	**Sample Group**	**50**	**A name used to group samples into related subsets. For example: 'LL-x Random Grid Samples', 'Waste Characterization Samples', 'Bldg. x Exposure Characterization'.**	
6 **F**	**Date Collected**	**10**	**The date the sample was collected. Should be reported as MM/DD/YYYY. If reported as MM/DD/YY, the year will be interpreted as 20YY.**	
7 **G**	**Time Collected**	**5**	**The time the sample was collected in HH:MM format.**	
8 **H**	**Field Sample Type***	**10**	**The sample type: regular, field duplicate, trip blank, split, source blank, etc.**	**Y**
9 **I**	**Sampling Method***	**20**	**The sampling method: grab, grab composite, flow composite, etc.**	
10 **J**	**Starting Depth**	**8N**	**The beginning depth (smaller number) for the sampling interval. For soil samples this is the depth below ground surface. For groundwater samples this may be used to indicate the top of the screened interval.**	

Field #/ Column	Field Name	Maximum Width	Definition/Comments	Required
11 **K**	**Ending Depth**	**8N**	**The ending depth (larger number) for the sampling interval. For soil samples this is the depth below ground surface. For groundwater samples this may be used to indicate the bottom of the screened interval.**	
12 **L**	**Depth Units***	**5**	**The measurement units for the sampling interval. Must be present if depth interval is specified.**	**Y***
13 **M**	**Media***	**15**	**The medium from which the sample was collected (e.g., soil, groundwater).**	**Y**
14 **N**	**Sampling Device***	**20**	**The sampling device used to collect the sample (e.g., auger, bailer, bucket, split spoon).**	
15 **O**	**Comment**	**50**	**Short comment about the sample.**	
Laboratory Method				
16 **P**	**Laboratory**	**50**	**The laboratory performing the analysis.**	
17 **Q**	**Matrix***	**10**	**Code for the analytical matrix. Valid values are solid, water, biota, air.**	
18 **R**	**Analysis Type***	**20**	**Code or description for the type of analysis (organic, inorganic, rad, pesticide, TCLP).**	
19 **S**	**Method***	**21**	**Analysis method identification reported as the method number from the statement of work (e.g., SW846-6010).**	
20 **T**	**SDG Number**	**15**	**The sample delivery group number assigned by the laboratory.**	
21 **U**	**Lab Sample ID**	**15**	**The laboratory sample ID.**	
22 **V**	**Date Received**	**10**	**The date the sample was received by the laboratory. Format as MM/DD/YYYY. If formatted as MM/DD/YY, the year will be interpreted as 20YY.**	
23 **W**	**Date Extracted**	**10**	**The date the sample was extracted or prepared by the laboratory. Format as MM/DD/YYYY. If formatted as MM/DD/YY, the year will be interpreted as 20YY.**	
24 **X**	**Date Analyzed**	**10**	**The date the sample was analyzed by the laboratory. Format as MM/DD/YYYY. If formatted as MM/DD/YY, the year will be interpreted as 20YY.**	
25 **Y**	**Percent Solids**	**8N**	**The percent solids for the sample. Represented as a percentage (25% = 25, not 0.25).**	
26 **Z**	**Sample Weight or Volume**	**8N**	**The sample weight for solid samples or volume for liquid samples.**	
27 **AA**	**Weight Units**	**5**	**The units associated with the sample weight. *Must be present if weight or volume is present.**	**Y***
28 **AB**	**Reported Basis***	**5**	**A flag indicating basis of reported concentration: “DRY”=concentration corrected to dry weight; “WET”=concentration reported on an “as received” reporting basis.”**	
29 **AC**	**Analysis Level**	**4**	**EPA–specified analysis level (e.g. ‘LOW”, ‘MED’).**	
Analytical Results				

Field #/ Column	Field Name	Maximum Width	Definition/Comments	Required
30 AD	Result Type*	5	Flag to indicate if a result is a regular sample (REG) or a secondary or QC result.	Y
31 AE	CAS Number	15	The CAS number for the analyte. Leave blank if unknown or uncertain.	
32 AF	Chemical	50	The chemical or analyte name.	Y
33 AG	Result	15N	Reportable numeric result for the analyte.	Y
34 AH	Units	15	Units for the result.	Y
35 AI	MDL	15N	Method detection limit for chemicals or minimum detectable activity for radionuclides reported in the same units as the result.	
36 AJ	SQL	15	Sample quantitation limit reported in the same units as the result.	
37 AK	Counting Error	15N	The 2 sigma counting error for radionuclide analyses reported in the same units as the result. *Required for when radionuclide results are reported.	Y*
38 AL	Dilution	8N	The overall dilution of the sample aliquot as a factor of the initial sample size. A value of 1 should correspond to nominal conditions for the method. Values less than 1 correspond to concentrations. Blank will be interpreted as 1.	
39 AM	Lab Qualifier	6	The laboratory qualifier originally assigned to the result by laboratory. *Blank is a valid value; hence, the data should contain laboratory qualifiers, but the field may correctly be blank.	Y*
40 AN	Data Qualifier	6	The qualifier assigned based on data validation. This qualifier should be one of the following: J, UJ, U, R, =. The "=" indicates that the sample was detected at the concentration reported.	
41 AO	Validated	1	Flag indicating if the data were validated ("Y/N"). Blank means "N."	
42 AP	Val Code	20	List of codes identifying why data qualifiers were applied. Separate documentation should contain definitions of codes.	
43 AQ	Filtered/Unfiltered	1	*F = Sample filtered in the field or at the laboratory. U or blank means sample was not filtered.	Y*
44 AR	TCLP	1	*T=TCLP (Toxicity Characteristic Leaching Procedure) or extractable/reactivity analysis. Blank means sample is not a TCLP/reactivity analysis. Used to differentiate between analyses that may have been performed with the same method.	Y*
45 AS	TIC Retention Time	10	Any value present indicates the analyte is a TIC (tentatively identified compound). Value may be numeral or character.	Y*

Field Measurement Table

Field #/ Column	Field Name	Maximum Width	Definition/Comments	Required
Link to Station Table				
1 A	Station	50	The station name should be unique within a project, although it may be shared between projects. This entry must exactly match an entry in the Station Table.	Y
Link to Sample Table (if applicable)				
2 B	Client Sample ID	22	*If the measurement is associated with the collection of a sample, this should refer to the related sample ID from the Sample Table.	Y*
Field Measurement Information				
3 C	Field Measurement ID	15	ID used if needed to facilitate field recording and processing by field information management systems.	
4 D	Project Name	50	Identifies sampling effort associated with the data..	Y
5 E	Date Collected	10	Date the measurement was collected formatted as MM/DD/YYYY. If formatted as MM/DD/YY, the year will be interpreted as 20YY.	Y
6 F	Time Collected	5	The time the measurement was made in HH:MM format.	
7 G	Measurement Name	50	The measurement that was performed (e.g., turbidity, conductivity, depth to water)	Y
8 H	CAS Number	15	CAS number if the measurement is a chemical concentration.	
9 I	Result	15N	The numeric value for the measurement.	Y
10 J	Units	15	The units for the measurement.	Y
11 K	Detection Limit	15N	Detection limit reported in the same units as the result.	
12 L	Result Qualifier	6	Indicates qualifications on the result such as less than detection limit or off scale. *Blank is a valid entry indicating no qualification.	Y*
13 M	Validation Qualifier	6	Indicates qualification of result based on QC review.	
14 N	Method	21	The method number or instrument name used for making the measurement.	
15 O	Comment	50	Comment on measurement.	

APPENDIX B

OAC RULE 13 AUTHORIZATION
RAVENNA ARMY AMMUNITION PLANT

US Army Corps of Engineers
Louisville District

OAC Rule 13 Authorization

Ravenna Army Ammunition Plant
Ravenna, Ohio

Prepared by:
U.S. Army Corps of Engineers

July 2000

1. INTRODUCTION

This is a generic request for authorization from the Ohio Environmental Protection Agency (Ohio EPA) to conduct investigative activities at known and to-be-discovered Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Areas of Concern (AOCs) at Ravenna Army Ammunition Plant (RVAAP) that are regulated under the Ohio Administrative Code (OAC) 3745-27-13 (Authorization to Engage in Filling, Grading, Excavating, Building, Drilling, or Mining on Land Where a Hazardous Waste Facility or Solid Waste Facility Was Operated), hereinafter referred to as OAC Rule 13. An agreement between RVAAP and the Ohio EPA Northeast District, dated January 4, 1996, stipulates that a generic OAC Rule 13 authorization request be developed according to the requirements of the rule and presented in the Facility-wide Sampling and Analysis Plan (SAP). The original Facility-wide SAP (USACE 1996a) contained a request for authorization for only four AOCs. This document supercedes the 1996 request with more current site knowledge and more generalized requirements for conducting investigations at RVAAP.

Investigation activities at RVAAP commonly include processes such as those named in the OAC statute, i.e., filling, grading, excavating, and drilling. The request for authorization under OAC Rule 13 addresses measures required to ensure that investigative activities necessary to characterize individual AOCs under the Comprehensive Enviromental Response, Compensation, and Liability Act (CERCLA) are protective of human health and the environment.

This generic request for OAC Rule 13 authorization applies only to AOCs being addressed under CERCLA at RVAAP. Where there is no reasonable expectation that solid or hazardous wastes have been deposited, AOCs will not require OAC Rule 13 authorization. At this writing, there are 36 known CERCLA AOCs at RVAAP. It is possible that several more remain to be identified Should it be determined by Ohio EPA and RVAAP that additional AOCs require Rule 13 authorization, a formal request for authorization under this generic request will be submitted to the Ohio EPA. Additional safeguards, if necessary, will be addressed in the supplemental request for an individual AOC. The status, plans, and schedules for current characterization and removal activities at RVAAP AOCs are presented in the Installation Action Plan for the Ravenna Army Ammunition Plant, Ravenna, Ohio (Operations Support Command [OSC], March 2000). The Action Plan is revised annually to reflect current, planned, and completed environmental activities at RVAAP.

Table 1-1 lists all the current CERCLA AOCs at RVAAP. It is possible that several more remain to be identified.

The following sections provide the information required under OAC Rule 13. Much of the information required under the provisions of OAC Rule 13 is contained in existing facility documents and CERCLA work plans. Therefore, references to existing documentation are used where appropriate to meet the requirements of the rule.

2. OAC 3745-27-13(C)(1) – LOCATION AND DESCRIPTION

The location of RVAAP on a 7.5-minute USGS topographic quadrangle map is provided in the Preliminary Assessment for the Ravenna Army Ammunition Plant, Ravenna, Ohio (USACE 1996b). The locations, descriptions, and operating histories of individual AOCs are also included in the Preliminary Assessment.

RVAAP is located in northeastern Ohio, within Portage and Trumbull Counties. The facility lies 4.8km (3 mi) east-northeast of the Town of Ravenna and approximately 1.61 km (1 mi) northwest of the Town of Newton Falls. The installation consists of 8,668 ha (21,419 acres) bounded by State Route 5 and the CSX System Railroad on the south; State Route 534 on the east; Garrettsville and Berry Roads on the west; and the CONRAIL Railroad on the north. The Michael J. Kirwan Reservoir is located immediately south of the facility. Land use surrounding the installation is primarily agricultural, open space, and residential.

TABLE 1-1. CERCLA AOCs at RVAAP

RVAAP-02 Erie Burning Grounds	RVAAP-34 Sand Creek Disposal Road Landfill
RVAAP-03 Demolition Area #1	RVAAP-36 Pistol Range
RVAAP-04 Demolition Area #2	RVAAP-38 NACA Test Area
RVAAP-05 Winklepeck Burning Grounds	RVAAP-39 Load Line 5 Fuze Line 1
RVAAP-06 C Block Quarry	RVAAP-40 Load Line 7 Booster Line 1
RVAAP-08 Load Line 1 and Settling Pond	RVAAP-41 Load Line 8 Booster Line 2
RVAAP-09 Load Line 2 and Settling Pond	RVAAP-42 Load Line 9 Detonator Line
RVAAP-10 Load Line 3 and Settling Pond	RVAAP-43 Load Line 10 Percussion Element
RVAAP-11 Load Line 4 and Settling Pond	RVAAP-44 Load Line 11 Artillery Primer
RVAAP-12 Load Line 12 and Settling Pond	RVAAP-45 Wet Storage Area
RVAAP-13 Building 1200 and Settling Pond	RVAAP-46 Buildings F-15 and F-16
RVAAP-16 Quarry Landfill	RVAAP-47 Building T-5301
RVAAP-19 Landfill North of Winklepeck	RVAAP-48 Anchor Test Area
RVAAP-28 Mustard Agent Burial Site	RVAAP-49 Central Burn Pits
RVAAP-29 Upper and Lower Cobbs Ponds	RVAAP-50 Atlas Scrap Yard
RVAAP-32 40- and 60-mm Firing Range	RVAAP-51 Dump Along Paris-Windham Road
RVAAP-33 Load Line 6	

RVAAP is a government-owned, contractor-operated U.S. Army Operations Support Command (OSC) facility. Currently, RVAAP is an inactive facility maintained by a contracted caretaker, TolTest, Inc. Table 2-1 provides the RVAAP Command Organization, Department of Defense (DoD) Installation Restoration Program (IRP) executing agency, and lead regulatory agencies.

TABLE 2-1 RVAAP Organizational Responsibilities

Command Organization
Major Command: U.S. Army Materiel Command Major Subordinate Command: U.S. Army OSC Installation: RVAAP, Commander's Representative Installation Contractor: TolTest, Inc.
Installation Restoration Program Executing Agency
U.S. Army Corps of Engineers, Louisville District U.S. Army Operations Support Command
Regulatory Agencies
Ohio Environmental Protection Agency, Northeast District U.S. Environmental Protection Agency, Region 5

RVAAP had the capabilities to load, assemble, and pack military ammunition. These operations have been inactive since 1992. As part of RVAAP's mission, the inactive facilities were maintained in standby status for a number of years, by keeping equipment in a condition sufficient to permit resumption of production. Over the years, RVAAP also handled and stored strategic and critical materials for various government agencies. The facility also received, stored, maintained, transported, and demilitarized military ammunition and explosive items. The only activities still being carried out are the storage of bulk explosives and the infrequent demolition of unexploded ordnance (UXO) and ordnance explosive waste (OE) found at the installation. The Army is also overseeing the reclamation of railroad track, telephone line, and steel for reuse or recycling. The Army has begun the demolition of excess buildings at Load Lines 1, 2, and 12, which includes the removal of friable and non-friable asbestos.

In 1998, much of the land at RVAAP was transferred from the Army to the National Guard Bureau. Roughly 6,544 ha (16,164 acres) of land is now under the administrative control of the Ohio Army National Guard (OHARNG). The Guard uses RVAAP land and facilities for training, maintenance, and storage of heavy equipment.

3. OAC 3745-27-13(C)(2) – INVESTIGATION ACTIVITIES

The planned investigation activities for which authorization is requested are as follows:

- Drilling
- Trenching
- Monitoring well installation
- Piezometer and well point installation
- Surface water and sediment sampling
- Excavation
- Surgical removal/other removal of UXO and suspected UXO
- Grading
- Placement of clean fill material.

These activities are necessary to characterize the AOCs under CERCLA and effect their restoration under the IRP. The approach to implementing CERCLA under the IRP is described in Section 1 of the Facility-wide SAP (USACE 2000a) and in the Installation Action Plan. The characterization of the AOCs under this generic authorization request is expected to include investigations to evaluate the nature of buried solid waste materials and the potential impact from leaching of contaminants on adjacent soils, groundwater, surface water, and sediment. The specific investigation activities for each AOC will be defined in an investigation-specific addendum to the Facility-wide SAP. The addendum will be submitted in draft form for Ohio EPA review and comment, and as a final document for Ohio EPA review, prior to the commencement of any investigative activities at an AOC.

Table 2-2 presents the descriptions of the planned investigation activities listed above.

TABLE 2-2. Descriptions of Planned Investigation Activities for AOCs at RVAAP

ACTVITY	DESCRIPTION
Drilling	Soil borings may be drilled in and adjacent to former disposal areas in order to collect surface and subsurface soil samples for laboratory analysis to characterize potential contaminants, or to characterize lithology.
Monitoring well installation	Boreholes may be drilled to install monitoring wells in and adjacent to an AOC to collect groundwater samples for characterization of contaminants and subsurface geology.
Piezometer and well point installation	Piezometer and well points may be installed to determine the depth to shallow groundwater and the potentiometric surface at an AOC, and to collect screening groundwater samples. This information will be used to locate monitoring wells in the correct orientation to monitor downgradient water quality and flow. It may also be used to determine the maximum allowable depths of trenches and other excavations so that the water table is not penetrated during these operations. This will mitigate the potential for cross-media contamination and creation of preferential flow paths.
Trenching	Trenches may be excavated in some disposal areas to evaluate the nature of buried waste in former landfills for which records are limited or unavailable. Samples of waste materials and adjacent subsurface soils may be collected for laboratory analysis to characterize potential source materials and any contamination resulting from leaching. Trenches will not penetrate groundwater zones (perched or water table).
Surface water and sediment sampling	Samples may be collected from streams and other drainage features (culverts, ponds, sumps, and pits) adjacent to former disposal areas and submitted for laboratory analysis to characterize the potential impact of disposal practices on these media.
Excavation and removal of UXO and suspected UXO	Interim and emergency removals of hazardous or solid waste materials (including UXO and OE) in soils may require the excavation and disposal of contaminated soils and associated materials. UXO and suspected UXO may represent a significant safety hazard requiring surgical removals as well.
Placement of clean fill	Removals of contaminated soils and/or UXO may require the placement of clean soil (fill) in order to restore the site.
Grading	Removal of contaminated soils during interim or emergency actions will require the proper grading of the ground surface.

4. OAC 3745-27-13(C)(3) – PREVIOUS AND EXISTING PERMITS, APPROVALS, AND ORDERS

There are no previous or existing permits, approvals, or orders pertaining to the CERCLA AOCs at RVAAP for which authorization under this rule is being requested. The regulatory history of RVAAP is presented in the Preliminary Assessment; additionally, the Installation Action Plan contains information on the installation's regulatory history.

5. OAC 3745-27-13(C)(4) – LETTERS OF ACKNOWLEDGEMENT

All parcels of land to which this generic request for authorization pertains are owned by the U.S. Army. Because of the interior locations of the CERCLA AOCs within the boundaries of the facility, all adjacent parcels are similarly the property of the Army. Consequently, no letters of acknowledgement are included in this request for authorization under OAC Rule 13.

6. OAC 3745-27-13(C)(5) – LETTERS OF NOTICE

Letters of notice of this generic request for authorization are required, under the provisions of OAC Rule 13, to be sent to the board of health for the health district and the local zoning authority for the area where the facility is located. The Departments of Health for both Trumbull and Portage Counties, Ohio, were notified in 1996 and 1998. Additional notification of these agencies will be required for this generic request for authorization. Because the federal government owns RVAAP, local zoning authorities do not have jurisdiction over the facility. Therefore, notices of this revised request were not sent to these agencies. The Boards of Health for Trumbull and Portage Counties will be notified of this generic request.

7. OAC 3745-27-13(C)(6) – HISTORY OF HAZARDOUS WASTE OR SOLID WASTE TREATMENT, STORAGE, OR DISPOSAL OPERATIONS

A summary of all known hazardous and solid waste treatment, storage, and disposal facilities at RVAAP was presented in the Preliminary Assessment in 1996. Since that time, several additional CERCLA AOCs have been added to the original list of 23, resulting in a total of 36 CERCLA AOCs. The additional 13 AOCs and their histories are described in the Installation Action Plan or the Relative Risk Site Evaluation (RRSE) Report (USACHPPM 1998).

8. OAC 3745-27-13(C)(7) – CLOSURE ACTIVITIES

Hazardous waste and solid waste TSD operations have ceased at all AOCs at RVAAP. Formal closure activities have been conducted at selected AOCs in conjunction with RCRA-regulated portions of the AOCs. Section 1 of the Facility-wide SAP (USACE 2000) shows that the investigation of potential contamination is the first step in the remediation process, which leads to eventual closure. A summary of all known previous closure activities for AOCs at RVAAP is presented in the Preliminary Assessment, with additional information in the Annual Installation Action Plan for RVAAP.

9. OAC 3745-27-13(C)(8) – INVESTIGATION METHODS AND PROCEDURES

The investigation of CERCLA AOCs at RVAAP will be conducted in accordance with the Facility-wide SAP, HASP, and QAPP, as well as the investigation-specific SAP addenda developed to meet the CERCLA requirements. These plans contain detailed methods and procedures for performing the described investigation activities. The intent of the facility-wide documents is to guide the investigation activities, to the extent practical, expected to be common to the investigation of all CERCLA AOCs at RVAAP. For each AOC-specific investigation, addenda to the facility-wide plans will be developed that will contain additional project-specific information regarding activities, methods, and procedures. The investigation of an AOC cannot be implemented without the Facility-wide SAP, HASP, and investigation-specific addenda. The contents and relationship of the facility-wide plans and investigation-specific addenda are addressed in greater detail in Section 1 of the Facility-wide SAP. The facility-wide plans and their addenda will be reviewed and commented on by the Ohio EPA before the commencement of field activities.

Detailed procedures describing the investigative methods are contained in the Sampling and Analysis Plan (SAP) portion of either the Facility-wide SAP, or the investigation-specific addenda for drilling, monitoring well installation, piezometer and well point installation, trenching, surface water and sediment sampling, excavating, UXO removal, placing clean fill, and grading.

10. OAC 3745-27-13(C)(9) – ENVIRONMENTAL PROTECTION

As previously described in Section 9 of this generic request for authorization, the investigation of CERCLA AOCs at RVAAP will be conducted in accordance with facility-wide work plans and investigation-specific work plan addenda developed to meet the requirements developed by the Ohio EPA and the Army, under CERCLA. These plans contain detailed methods and procedures for performing the described work. The primary focus of these documents is to produce legally defensible investigation results and ensure protection of human health and the environment in the process. Consequently, the investigation methods and procedures cited in Section 9 are in compliance with applicable state and federal rules, laws, and regulations for conducting CERCLA investigations. These procedures contain provisions for protection of the environment during and as a consequence of field activities. In addition, the Facility-wide SAP and its addenda contain provisions (Section 7, Facility-wide SAP) for the management of Investigation-Derived Waste (IDW) in accordance with applicable state and federal rules, laws, and regulations. Provisions are included for the temporary storage or disposal of IDW in accordance with rules, laws, and regulations.

11. OAC 3745-27-13(C)(10) – REMOVAL OF SOLID OR HAZARDOUS WASTE, OR POTENTIALLY CONTAMINATED SOILS

During the investigation of CERCLA AOCs at RVAAP, it is expected that IDW will be generated as a result of characterization activities. Excess soil and drill cuttings from soil borings, purged groundwater, and equipment decontamination water could be removed from an individual AOC. These materials may be hazardous, contaminated but non-hazardous, or not contaminated. Section 7 of the Facility-wide SAP and the investigation-specific addenda contain provisions for representative sampling and analysis of IDW in accordance with applicable state and federal rules, laws, and regulations. The Facility-wide SAP also requires submittal of a copy of a letter of acceptance from a permitted disposal facility to the Ohio EPA prior to removal of IDW from an AOC for off-site disposal. IDW management is accomplished in conjunction with the RVAAP Environmental Coordinator.

12. OAC 3745-27-13(C)(11) – CLOSURE PROCEDURES

The formal process for completing regulatory closure of AOCs at RVAAP regulated under CERCLA is described in Section 1 of the Facility-wide SAP, and additional information is provided in the Installation Action Plan (OSC, March 2000). Because the CERCLA process is iterative and therefore requires a considerable amount of time in which to implement a remediation, the Facility-wide SAP and investigation-specific addenda contain provisions for reestablishing AOC conditions following completion of characterization activities. This is done in order to mitigate the impact on human health and the environment from these activities until such time as the AOC can be remediated (if necessary) under the CERCLA process. These reestablishment measures are described for each investigative activity presented in the Facility-wide SAP and investigation-specific addenda.

13. OAC 3745-27-13(C)(12) – GENERIC AUTHORIZATION REQUEST SIGNATURES

The statements and assertions of fact made in this application are true and complete to my knowledge and comply fully with the applicable state requirements as stated in OAC Rule 3745-27-13

John A. Cicero, Jr.
Commander’s Representative
Ravenna Army Ammunition Plant

Notary Public

REFERENCES

Operations Support Command, March 2000. Installation Action Plan for the Ravenna Army Ammunition Plant, Ravenna, Ohio.

USACE 1996a. Facility-Wide Sampling and Analysis Plan for the Ravenna Army Ammunition Plant, Ravenna, Ohio.

USACE 1996b. Preliminary Assessment for the Ravenna Army Ammunition Plant, Ravenna, Ohio.

USACHPPM 1998. Relative Risk Site Evaluation Report, Ravenna Army Ammunition Plant, Ravenna, Ohio.

USACE 2000. Facility-Wide Sampling and Analysis Plan for Environmental Investigations at the Ravenna Army Ammunition Plant, Ravenna, Ohio (in prep.).

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QUALITY ASSURANCE PROJECT PLAN FOR ENVIRONMENTAL INVESTIGATIONS AT THE RAVENNA ARMY AMMUNITION PLANT RAVENNA, OHIO

March 2001

Quality Assurance Project Plan for Environmental Investigations at the Ravenna Army Ammunition Plant Ravenna, Ohio

March 2001

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(U.S. Army Project Manager)

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(U.S. Army Project Chemist)

QUALITY ASSURANCE PROJECT PLAN
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ACRONYMS

AOC	Area of Concern
ASTM	American Society of Testing and Materials
CFR	*Code of Federal Regulations*
CDQR	Chemical Data Quality Assurance Report
COC	chain of custody
CQAR	Chemical Quality Assurance Report
CX	Center of Expertise
DQO	data quality objective
EDD	electronic data deliverable
EPA	U.S. Environmental Protection Agency
FCR	field change request
FID	flame ionization detector
FSAP	Facility-Wide Sampling and Analysis Plan
FSP	Field Sampling Plan
GC/MS	gas chromatograph/mass spectrometer
HTRW	Hazardous, Toxic, and Radioactive Waste
ICP	inductively coupled plasma
IDW	investigation-derived waste
LCS	laboratory control sample
MDL	Method Detection Limits
MS	matrix spike
MSD	matrix spike duplicate
M&TE	Material and Testing Equipment
NCR	Nonconformance Report
NIOSH	National Institute for Occupational Safety and Health
NIST	National Institute of Standards and Testing
Ohio EPA	Ohio Environmental Protection Agency
PAH	polycylic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PID	photoionization detector
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
QCSR	Quality Control Summary Report
RPD	relative percent difference
RVAAP	Ravenna Army Ammunition Plant
SOP	standard operating procedure
SVOC	semivolatile organic compound
USACE	U.S. Army Corps of Engineers
VOC	volatile organic compound

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INTRODUCTION

It is expected that the U.S. Army Corps of Engineers (USACE) will continue to fulfill the role of laboratory data Quality Assurance Administrator for all environmental projects at the Ravenna Army Ammunition Plant (RVAAP). The USACE and the U.S. Environmental Protection Agency (EPA) require that all environmental monitoring and measurement efforts mandated or supported by these organizations participate in a centrally managed quality assurance (QA) program.

Any party generating data under this program has the responsibility to implement minimum procedures to ensure that the precision, accuracy, completeness, and representativeness of its data are known and documented. To ensure that the responsibility is met uniformly, each party must prepare a written Quality Assurance Project Plan (QAPP) covering each project it is to perform.

This QAPP presents the organization, objectives, functional activities, and specific QA and quality control (QC) activities associated with the Facility-wide Sampling and Analysis Plan (FSAP) for the RVAAP in Ravenna, Ohio. This QAPP also describes the specific protocols that will be followed for sampling, sample handling and storage, chain of custody, and laboratory analysis.

All QA/QC procedures will be in accordance with applicable professional technical standards, EPA requirements, government regulations and guidelines, and specific project goals and requirements. This QAPP is prepared by Science Applications International Corporation in accordance with EPA QAPP and USACE guidance documents, Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans (EPA 1991a), the Region V Model QAPP (EPA 1991b), EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations (EPA 1994a), and Requirements for the Preparation of Sampling and Analysis Plans (USACE 1994). Concurrence with the USACE Shell Document for Analytical Chemistry Requirements, version 1.0, 2 NOV 98 and Environmental Data Assurance Guideline, USACE–Louisville District, May 2000 is expected.

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1.0 PROJECT DESCRIPTION

This Quality Assurance Project Plan (QAPP) is prepared as part of the Facility-wide Sampling and Analysis Plan (FSAP) for the Ravenna Army Ammunition Plant (RVAAP) in Ravenna, Ohio. Investigation-specific addendum will supplement this plan as required when individual AOC investigations are implemented. The FSAP contains the primary project description and background information for the FSAP and, as such, the information contained in the FSAP shall be referenced here and not repeated.

1.1 SITE HISTORY/BACKGROUND INFORMATION

This information is contained in Section 1.1 of the FSAP. Individual tasks at RVAAP will address specific area history and background as needed in investigation-specific addenda.

1.2 PAST DATA COLLECTION ACTIVITY/CURRENT STATUS

This information is contained in Section 1.2 of the FSAP. Individual tasks at RVAAP will address specific area past and current data collection activities as needed in investigation-specific addenda.

1.3 PROJECT OBJECTIVES AND SCOPE

This information is contained in Section 3.0 of the FSAP. Individual tasks at RVAAP will address unique objectives and scope for specific areas as needed in investigation-specific addenda.

1.4 SAMPLE NETWORK DESIGN AND RATIONALE

This information is contained in Section 4.0 of the FSAP. Individual tasks at RVAAP will present sampling designs and sampling rationales as required in investigation-specific addenda.

1.5 PARAMETERS TO BE TESTED AND FREQUENCY

General sample matrix types, analytical parameters, and analytical methods can be found in Section 4.0 of the FSAP and Table 1-1 of this QAPP. Specific delineation of sample numbers, quality assurance (QA) sample frequencies and field quality control (QC) sample frequencies will be provided for each investigation in each specific addendum.

1.6 PROJECT SCHEDULE

Project schedule is discussed in Section 11.0 of the FSAP. Individual task schedules will be developed and defined in investigation-specific addenda.

Table 1-1. Soil, Sediment, Surface Water, and Groundwater Sampling, RVAAP

Parameter	Methods	No. of Field Samples	No. of Fld. Dup. Samples[a]	No. of Sampler Rinsates	No. of Trip Blanks[b]	Total A-E Samples	QA Dups./ Splits	QA Trip Blanks	Total QA Samples
Soil/Sediment									
Volatile Organics	SW-846, 8260B/5030								
Semivolatile Organics	SW-846, 8270C/3540								
Pesticides	SW-846, 8081A/3540								
PCBs	SW-846, 8082/3540								
Explosives	SW-846, 8330								
Nitroquanidine	SW846, 8330 Mod.								
Nitrocellulose	SW846, 9056 Mod.								
Polyaromatic Hydrocarbons	SW846, 8310								
Metals (TAL)	SW-846, 6010B/6020/7471								
Cyanide	SW-846, 9011/9012								
Geotech Analysis[c]	ASTM Methods								
Surface Water/ Groundwater									
Volatile Organics	SW-846, 8260B								
Semivolatile Organics	SW-846, 8270C/3520								
Pesticides	SW-846, 8081A/3520								
PCBs	8082/3520								
Explosives	SW-846, 8330								
Nitroquanidine	SW846, 8330 Mod.								
Nitrocellulose	SW846, 9056 Mod.								
Polyaromatic Hydrocarbons	SW846, 8310								
Metals (TAL)	SW-846, 6010B/6020/7471								
Cyanide	SW-846, 9010/9012								

[a] Field duplicates should be collected from areas having the highest potential for contamination.

[b] A trip blank is to accompany each cooler shipped with samples for volatile organic analysis in water.

[c] Geotechnical analysis may include: moisture content (ASTM D2216); grain size (ASTM D422, seive); Atterberg limits (ASTM D4318); Permeability (D2434); and USCS classification.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITY

The generic functional project organization and responsibilities are described in Section 2.0 of the FSAP. Individual task assignments and responsibilities will be delineated in investigation-specific addenda.

Analytical laboratory support for specific investigations will be designated to a single subcontractor based on a competitive bidding process, unless otherwise specified in the scope of work. The selected subcontract laboratory will be validated by the U.S. Army Corps of Engineers (USACE) Hazardous, Toxic, and Radioactive Waste (HTRW) Center of Expertise (CX), Omaha, Nebraska. Relevant QA Manual, laboratory qualification statements, certifications, and license documentation will be provided to Ohio Environmental Protection Agency (Ohio EPA) and U.S. Environmental Protection Agency (EPA) organizations, when the subcontractor has been identified for each individual Area of Concern (AOC) task.

The investigative Contractor firm is responsible for the coordination and collection of all samples and analyses. All personnel participating in U.S. Army projects must sign an Ethics and Integrity Agreement.

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3.0 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA

The overall QA objective is to develop and implement procedures for field sampling, chain of custody (COC), laboratory analysis, and reporting, which will provide results to be used in risk evaluation and assessment and that are technically and legally defensible. Specific procedures for sampling, COC, laboratory instrument calibration, laboratory analysis, reporting of data, internal QC, audits, preventive maintenance of field equipment, and corrective action are described in other sections of this QAPP. The purpose of this section is to address the specific objectives for analytical accuracy, precision, completeness, representativeness, and comparability.

3.1 DATA QUALITY OBJECTIVES

Data Quality Objectives (DQOs) are qualitative and quantitative statements that specify the quality of data required to support decisions made during investigation activities, and are based on the end uses of the data being collected. The primary concern is to develop and implement procedures for field sampling, COC, laboratory analysis, and reporting that will provide results which are acceptable for submission to EPA Region 5 and the Ohio EPA programs.

An analytical DQO summary generic to the investigations of all AOCs at RVAAP is presented in Tables 3-1 and 3-2. All QC parameters stated in the specific SW-846 methods (i.e., percent recoveries) will be adhered to for each chemical listed. Laboratories are required to comply with all methods as written; recommendations are considered requirements. In addition, analyses will be completed according to USACE requirements found in the Shell for Analytical Chemistry Requirements and USACE–Louisville Chemistry Guideline, Rev. 1, January 2001.

Table 3-1. Investigative DQO Summary, Ravenna Army Ammunition Plant - Soil/Sediment[a]

Data Use	Sample Type	Analytical Method	Precision (RPD[b]) Field	Precision (RPD[b]) Lab	Accuracy Laboratory	Completeness
Screening for sample site selection	Discrete	FID/PID Volatile Organics	+/- comparison	NA	NA	95%
Confirmation of contamination extent	Discrete	SW-8060B Volatile Organics	<50 RPD	<40 RPD	70-130% recovery	90%
	Discrete or composite	SW-8270C Semivolatile Organics	<50 RPD	<35 RPD	45-135% recovery	90%
		SW-8081B Pesticides	<50 RPD	<35 RPD	40-140% recovery	90%
		8082 PCBs	<50 RPD	<35 RPD	40-140% recovery	90%
		SW-8330 Explosives	<50 RPD	<35 RPD	40-140% recovery	90%
		SW-8310 PAHs	<50 RPD	<35 RPD	40-140% recovery	90%
		SW-6010B/7000 Metals	<50 RPD	<25 RPD	75-125% recovery	90%
		SW-9012 Cyanide	<50 RPD	<20 RPD	80-120% recovery	90%
Determination of Geological Regimes	Discrete	ASTM-D2216 Moisture Content	NA	<20 RPD	NA	90%
		ASTM-D422 Grain Size	NA	<20 RPD	NA	90%
		ASTM-D4318 Atterberg Limits	NA	<40 RPD	NA	90%
		ASTM-D2434 Permeability	NA	<40 RPD	NA	90%
IDW Characterization	Composite	SW-1311 TCLP analytes	NA	<40 RPD	75-125% recovery	80%

[a] Sample numbers and QC sample numbers are identified in Table 1-1, analytical deliverables are identified in Tables 9-1 and 9-2, and analyte sensitivity goals are identified in Tables 3-3 through 3-9 of this QAPP.

[b] RPD = Relative Percent Difference, at values within five times the reporting level comparison is acceptable if values are plus or minus the reporting level.

Table 3-2. Investigative DQO Summary, Ravenna Army Ammunition Plant - Surface Water/Groundwater[a]

Data Use	Sample Type	Analytical Method	Precision (RPD[b])		Accuracy Laboratory (MS)	Completeness
			Field Dups	Lab (MS)		
Screening for sample site selection	Discrete	FID/PID Volatile Organics	NA	NA	NA	95%
Determination of basic water characteristics	Discrete	EPA-120.1 Conductivity	<10 RPD	NA	NA	95%
		EPA-150.1 pH	<10 RPD	NA	NA	95%
		EPA-170.1 Temperature	<10 RPD	NA	NA	95%
		Turbidometer	<10 RPD	NA	NA	95%
		EPA-360.1 Dissolved Oxygen	<10 RPD	NA	NA	95%
Confirmation of contamination extent	Discrete	SW-8060B Volatile Organics	<30 RPD	<20 RPD	70-130% recovery	90%
	Discrete or composite	SW-8270C Semivolatile Organics	<30 RPD	<20 RPD	45-135% recovery	90%
		SW-8081B Pesticides	<30 RPD	<20 RPD	40-140% recovery	90%
		8082 PCBs	<30 RPD	<20 RPDq	40-140% recovery	90%
		SW-8330 Explosives	<30 RPD	<20 RPD	40-140% recovery	90%
		SW-8310 PAHs	<30 RPD	<20 RPD	40-140% recovery	90%
		SW-6010B/7000 Metals	<30 RPD	<20 RPD	75-125% recovery	90%
		SW-9010 Cyanide	<30 RPD	<20 RPD	75-125% recovery	90%
IDW Characterization	Composite	SW-1311 TCLP analytes	NA	<30 RPD	75-125% recovery	80%

[a] Sample numbers and QC sample numbers are identified in Table 1-1, analytical deliverables are identified in Tables 9-1 and 9-2, and analyte sensitivity goals are identified in Tables 3-3 through 3-9 of this QAPP.

[b] RPD = Relative Percent Difference, at values within five times the reporting level comparison is acceptable if values are plus or minus the reporting level.

3.2 LEVEL OF QUALITY CONTROL EFFORT

To assess whether QA objectives have been achieved, analyses of specific field and laboratory QC samples will be required. These QC samples include field blanks, trip blanks, field duplicates, laboratory method blanks, laboratory control samples, laboratory duplicates, and matrix spike/matrix spike duplicate (MS/MSD) samples will be analyzed to assess the quality of the data resulting from the sampling program.

Field blanks, consisting of potable water used in the decontamination process, equipment rinsate blanks and trip blanks, will be submitted for analysis along with field duplicate (co-located) samples to provide a means to assess the quality of the data resulting from the field sampling program. Field blank samples are analyzed to determine procedural contamination at the site that may contribute to sample contamination. Equipment rinsate blanks are used to assess the adequacy of equipment decontamination processes. Trip blanks are used to assess the potential for contamination of samples due to contaminant migration during sample shipment and storage. Criteria and evaluation of blank determinations are provided in Section 9.2.2.3 and will be based on analytical method detection limits (MDLs) and project quantitation levels. Field duplicate samples are analyzed to determine sample heterogeneity and sampling methodology reproducibility.

Laboratory method blanks and laboratory control samples are employed to determine the accuracy and precision of the analytical method as implemented by the laboratory. MS samples spikes provide information about the effect of the sample matrix on the measurement methodology. Laboratory sample duplicates and MSDs assist in determining the analytical reproducibility and precision of the analysis for the samples of interest.

The general level of the QC effort will be at least one field duplicate for every ten investigative samples. One volatile organic compound (VOC) analysis trip blank consisting of analyte-free water will be included along with each shipment of VOC water samples. Field blank samples will be collected from each water source employed. The anticipated number of duplicate and field blank samples are specified in each site-specific addendum.

MS/MSD samples must be investigative samples. Soil MS/MSD samples require no extra volume for VOCs or extractable organics. However, aqueous MS/MSD samples must be collected at double the volume for VOCs and triple the volume for extractable organics. One MS/MSD sample will be designated in the field and collected for at least every 20 investigative samples per sample matrix (i.e., groundwater, soil).

The level of QC effort provided by the laboratory will be equivalent to the level of QC specified in each site-specific work plan. The facility-wide goal is to provide a level of QC effort in conformance with the protocols of the USACE Shell for Analytical Chemistry Requirements. The level of QC effort for testing and analysis of parameters beyond the scope of the Shell Document protocols will conform to accepted methods, such as EPA SW-846 protocols (Update 3, 1998), American Society for Testing and Materials (ASTM) protocols, and National Institute for Occupational Safety and Health (NIOSH) protocols.

The QC effort for in-field measurements, including conductivity, pH, organic vapors, dissolved oxygen, etc., will include daily calibration of the instrument using traceable standards and documented instrument manufacturer procedures. Field instruments and their method of calibration are discussed in the FSAP and will be further identified in task-specific documentation.

3.3 ACCURACY, PRECISION, AND SENSITIVITY OF ANALYSIS

The fundamental QA objectives for accuracy, precision, and sensitivity of laboratory analytical data are the QC acceptance criteria of the analytical protocols. The accuracy and precision required for the specified analytical parameters are incorporated in Tables 3-1 and 3-2 and are consistent with the analytical requirements found in the USACE Shell Document. The sensitivities required for the possible analyses conducted at RVAAP are identified in Tables 3-3 through 3-9 as project quantitation levels. Note that laboratories may obtain permission to use the ultrasonic extraction method EPA 3550B if necessary, due to sample matrix and performance issues. In addition, should lower detection limits than those in Table 3-7 be required, alternative methods (e.g., method 8095 for explosives in soil) may be specified in the site-specific SAP addendum.

Accuracy and precision goals for field measurements of pH, conductivity, turbidity, dissolved oxygen, and temperature are listed in Table 3-2.

Analytical accuracy is expressed as the percent recovery of an analyte that has been added to a blank sample or environmental sample at a known concentration before analysis. Accuracy will be determined in the laboratory through the use of MS analyses, laboratory control sample (LCS) analyses, and/or blank spike analyses. The percent recoveries for specific target analytes will be calculated and used as an indication of the accuracy of the analyses performed.

Precision will be determined through the use of spike analyses conducted on duplicate pairs of environmental samples (MS/MSD) or comparison of positive duplicate pair responses. The relative percent difference (RPD) between the two results will be calculated and used as an indication of the precision of the analyses performed.

Sample collection precision will be assessed through the analyses of field duplicates. Precision will be reported as the RPD for two measurements.

3.4 COMPLETENESS, REPRESENTATIVENESS, AND COMPARABILITY

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount expected to be obtained under ideal conditions. It is expected that laboratories will provide data meeting QC acceptance criteria for all samples tested. Overall project completeness goals are identified in Tables 3-1 and 3-2.

Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. Representativeness is a qualitative parameter that depends upon the proper design of the sampling program and proper laboratory protocol. The sampling network was designed to provide data representative of site conditions. During development of this FSAP, consideration was given to site history, past waste disposal practices, existing analytical data, physical setting and processes, and constraints inherent to the investigation of all AOCs at RVAAP. The rationale of the sampling design is discussed in detail for each specific AOC investigation in the SAP addenda.

Representativeness will be satisfied by ensuring that the FSAP and its addenda are followed, proper sampling techniques are used, proper analytical procedures are followed, and holding times of the samples are not exceeded. Representativeness will be determined by assessing the combined aspects of the QA program, QC measures, and data evaluations.

Table 3.3. Project Quantitation Levels for Volatile Organic Compounds in Soils and Waters Using SW-846 Methods 8260B/5030 and 8260B/5035 (GC/MS)

Compound	CAS Number	Project Quanitation Levels[a]	
		Water (μg/L)	Soil/Sediment (μg/kg)
1,1,1-Trichloroethane	71-55-6	1	5
1,1,2,2-Tetrachloroethane	79-34-5	1	5
1,1,2-Trichloroethane	79-00-5	1	5
1,1-Dichloroethane	75-35-3	1	5
1,1-Dichloroethene	75-34-4	1	5
1,2-Dibromoethane	106-93-4	1	5
1,2-Dichloroethane	107-06-2	1	5
1,2-Dichloroethene (total)	540-59-0	1	5
1,2-Dichloropropane	78-87-5	1	5
2-Butanone	78-93-3	10	20
2-Hexanone	591-78-6	10	20
4-Methyl-2-pentanone	108-10-1	10	20
Acetone	67-64-17	10	20
Benzene	71-43-2	1	5
Bromochloromethane	74-97-5	1	5
Bromodichloromethane	75-27-4	1	5
Bromoform	75-25-2	1	5
Bromomethane	74-83-9	1	5
Carbon disulfide	75-15-0	1	5
Carbon tetrachloride	56-23-5	1	5
Chlorobenzene	108-90-7	1	5
Chloroethane	75-00-3	1	5
Chloroform	67-66-3	1	5
Chloromethane	74-87-3	1	5
Cis-1,3-dichloropropene	10061-01-5	1	5
Dibromochloromethane	124-48-1	1	5
Ethyl benzene	100-41-4	1	5
Methylene chloride	75-09-2	1	5
Styrene	100-42-5	1	5
Tetrachloroethene	127-18-4	1	5
Toluene	108-88-3	1	5
Trans-1,3-dichloropropene	10061-02-6	1	5
Trichloroethene	79-01-6	1	5
Vinyl chloride	75-01-4	1	5
Xylenes (total)	1330-2-7	2	10

[a] Specific quantitation limits are highly matrix dependent; project quantitation levels listed here are goals and may not always be achievable.

Table 3.4. Project Quantitation Levels for Semivolatile Organic Compounds in Soils and Waters Using SW-846 Methods 8270C/3510C or 3520C and 8270C/3540C, 3541C or 3550B (GC/MS)[a]

Compound	CAS Number	Project Quantitation Levels[b] Water (μg/L)	Project Quantitation Levels[b] Soil/Sediment (μg/kg)
1,2,4-Trichlorobenzene	120-82-1	10	330
1,2-Dichlorobenzene	95-50-1	10	330
1,3-Dichlorobenzene	541-73-1	10	330
1,4-Dichlorobenzene	106-46-7	10	330
2,4,5-Trichlorophenol	95-95-4	25	800
2,4,6-Trichlorophenol	88-06-2	10	330
2,4-Dichlorophenol	120-83-2	10	330
2,4-Dimethylphenol	150-67-9	10	330
2,4-Dinitrophenol	51-28-5	25	800
2,4-Dinitrotoluene	121-14-2	10	330
2,6-Dinitrotoluene	606-20-2	10	330
2-Chloronaphthalene	91-58-7	10	330
2-Chlorophenol	95-57-8	10	330
2-Methylnaphthalene	91-57-6	10	330
2-Methylphenol	95-48-7	10	330
2-Nitroaniline	88-74-4	25	800
2-Nitrophenol	88-75-5	10	330
3 & 4-Methylphenol	106-44-5	10	330
3,3'-Dichlorobenzidine	91-94-1	10	330
3-Nitroaniline	99-09-2	25	800
4,6-Dinitro-2-methylphenol	534-52-1	25	800
4-Bromophenylphenyl ether	101-55-3	10	330
4-Chloro-3-methylphenol	59-50-7	10	330
4-Chloroaniline	106-47-8	10	330
4-Chlorophenylphenyl ether	7005-72-36	10	330
4-Nitroaniline	100-01-6	25	800
4-Nitrophenol	100-02-7	25	800
Acenaphthene	83-32-9	10	50
Acenaphthylene	208-96-8	10	50
Anthracene	120-12-7	10	50
Benzo(a)anthracene	56-55-3	10	50
Benzo(a)pyrene	50-32-8	10	50
Benzo(b)fluoranthene	205-99-2	10	50
Benzo(g,h,i)perylene	191-24-2	10	50
Benzo(k)fluoranthene	207-08-9	10	50
Benzoic acid	65-85-0	25	800
Benzyl alcohol	100-51-6	10	330
Bis(2-chloroisopropyl)ether	108-60-1	10	330
Bis(2-chloroethoxy)methane	111-91-1	10	330
Bis(2-chloroethyl)ether	111-44-4	10	330
Bis(2-ethylhexyl)phthalate	117-81-7	10	330
Butylbenzylphthalate	85-68-7	10	330
Carbazole	86-74-8	10	50
Chrysene	218-01-9	10	50

Table 3.4. Project Quantitation Levels for Semivolatile Organic Compounds in Soils and Waters Using SW-846 Methods 8270C/3510C or 3520C and 8270C/3540C, 3541C or 3550B (GC/MS)[a] (continued)

Compound	CAS Number	Project Quantitation Levels[b]	
		Water (μg/L)	Soil/Sediment (μg/kg)
Di-n-butylphthalate	84-74-2	10	330
Di-n-octylphthlalate	117-84-0	10	330
Dibenzo(a,h)anthrancene	53-70-3	10	50
Dibenzofuran	132-64-9	10	330
Diethylphthalate	84-66-2	10	330
Dimethylphthalate	31-11-3	10	330
Fluoranthene	206-44-0	10	50
Fluorene	96-73-7	10	50
Hexachlorobenzene	118-74-1	10	330
Hexachlorobutadiene	87-68-3	10	330
Hexachlorocyclopentadiene	77-47-4	10	330
Hexchloroethane	67-72-1	10	330
Indeno(1,2,3-cd)pyrene	193-39-5	10	50
Isophorone	78-59-1	10	330
n-Nitroso-di-n-propylamine	621-64-7	10	330
n-Nitroso-diphenylamine	96-30-6	10	330
Napthalene	91-20-3	10	50
Nitrobenzene	98-95-1	10	330
Pentachlorophenol	87-86-5	25	800
Phenanthrene	85-01-8	10	50
Phenol	108-95-2	10	330
Pyrene	129-00-0	10	50

[a] The primary solid sample preparation procedure will be Method 3540C or 3541C, Soxhlet Extraction. However, when it is demonstrated these methods cannot be employed effectively for specific matrices, analytical laboratories may obtain permission to utilize the Ultrasonic Extraction Method 3550B.

[b] Specific quantitation limits are highly matrix dependent; project quantitation levels listed here are goals and may not always be achievable.

Table 3.5. Project Quantitation Levels for Pesticide and PCB Compounds in Soils and Waters Using SW-846 Methods 8081A and 8082A (GC)[a]

Compound	CAS Number	Project Quantitation Levels[b] Water (µg/L)	Project Quantitation Levels[b] Soil/Sediment (µg/kg)
Method 8081A			
Alpha-BHC	319-84-6	0.05	1.7
Beta-BHC	319-85-7	0.05	1.7
Delta-BHC	319-86-8	0.05	1.7
Gamma-BHC (Lindane)	58-89-9	0.05	1.7
Heptachlor	76-44-8	0.05	1.7
Aldrin	309-00-2	0.05	1.7
Heptachlor epoxide	1024-57-3	0.05	1.7
Endosulfan I	959-98-8	0.05	1.7
Dieldrin	60-57-1	0.05	1.7
4,4'-DDE	72-55-9	0.05	1.7
Endrin	72-20-8	0.05	1.7
Endosulfan II	33213-65-9	0.05	1.7
4,4'-DDD	72-54-8	0.05	1.7
Endosulfan sulfate	1031-07-8	0.05	1.7
4,4'-DDT	50-29-3	0.05	1.7
Methoxychlor	72-43-5	0.10	17
Endrin ketone	53494-70-5	0.05	1.7
Endrin aldehyde	7421-93-4	0.05	1.7
alpha-Chlordane	5103-71-9	0.05	1.7
gamma-Chlordane	5103-74-2	0.05	1.7
Toxaphene	8001-35-2	2.0	170
Method 8082A			
Arochlor-1016	12674-11-2	0.5	33
Arochlor-1221	11104-28-2	0.5	33
Arochlor-1232	11141-16-5	0.5	33
Arochlor-1242	53469-21-9	0.5	33
Arochlor-1248	12672-29-6	0.5	33
Arochlor-1254	11097-69-1	0.5	33
Arochlor-1260	11096-82-5	0.5	33

[a] The primary solid sample preparation procedure will be Method 3540C or 3541C, Soxhlet Extraction. However, when it is demonstrated these methods can not be employed effectively for specific matrices, analytical laboratories may obtain permission to utilize the Ultrasonic Extraction Method 3550B.

[b] Specific quantitation limits are highly matrix dependent; project quantitation levels listed here are goals and may not always be achievable.

Table 3.6. Project Quantitation Levels for Polyaromatic Hydrocarbons (PAH compounds) in Soils and Waters Using SW-846 Methods 8310 (HPLC)

Compound	CAS Number	Project Quantitation Levels[a] Water (μg/L)	Soil/Sediment (μg/kg)
Acenaphthene	83-32-9	5	150
Acenaphthylene	208-96-8	5	150
Anthracene	120-12-7	2	60
Benzo(a)anthracene	56-55-3	0.1	3
Benzo(a)pyrene	50-32-8	0.1	3
Benzo(b)fluoranthene	205-99-2	0.1	3
Benzo(k)fluoranthene	207-08-9	0.1	3
Benzo(g,h,i)perylene	191-24-2	0.5	15
Chrysene	218-01-9	0.5	15
Dibenzo(a,h)anthrancene	53-70-3	0.1	3
Fluoranthene	206-44-0	0.5	15
Fluorene	96-73-7	0.5	15
Indeno(1,2,3-cd)pyrene	193-39-5	0.1	3
Napthalene	91-20-3	5	150
Phenanthrene	85-01-8	2	60
Pyrene	129-00-0	0.5	15

[a] Specific quantitation limits are highly matrix dependent; project quantitation levels listed here are goals and may not always be achievable. All "J" values less than laboratory reporting limits will be reported and evaluated.

Table 3.7. Project Quantitation Levels for Explosives (nitroaromatics) in Soils and Waters Using SW-846 Method 8330

Compound	CAS Number	Project Quantitation Levels[a]	
		Water (µg/L)	Soil/Sediment (mg/kg)
2-Amino-4,6-dinitrotoluene	355-72-78-2	0.2	0.25
4-Amino-2,6-dinitrotoluene	1946-51-0	0.2	0.25
1,3-Dinitrobenzene	99-65-0	0.2	0.25
2,4-Dinitrotoluene	121-14-2	0.1	0.25
2,6-Dinitrotoluene	606-20-2	0.1	0.25
HMX	2691-41-0	0.5	1.0
Nitrobenzene	98-95-3	0.2	0.25
2-Nitrotoluene	88-72-2	0.2	0.25
3-Nitrotoluene	99-08-1	0.2	0.25
4-Nitrotoluene	99-99-0	0.2	0.25
RDX	121-82-4	0.5	1.0
Tetryl	479-45-8	0.2	1.0
1,3,5-Trinitrobenzene	99-35-4	0.2	0.25
2,4,6-Trinitrotoluene	118-96-7	0.2	0.25
PETN	78-11-5	3	3
Nitroglycerin (8330 modified)	55-63-0	3	3
Nitroguanidine (8330 modified)	556-88-7	20	0.25
Perchlorate (by IC)	7601-90-3	25	0.05
Nitrocellulose (to EPA 9056)	9004-70-0	500	5

[a] Specific quantitation limits are highly matrix dependent; project quantitation levels listed here are goals and may not always be achievable. All "J" values less than laboratory reporting limits will be reported and evaluated.

Table 3.8. Project Quantitation Levels for Metals in Soils and Waters Using SW-846 Methods 6010B, 6020, or 7000 Series

Compound	CAS Number	Project Quantitation Levels[a]	
		Water (μg/L)	Soil/Sediment (mg/kg)
Aluminum	7429-90-5	100	10
Antimony	7440-36-0	5	0.5
Arsenic	7440-38-2	5	0.5
Barium	7440-39-3	10	1
Beryllium	7440-41-7	1	0.1
Cadmium	7440-43-9	1	0.1
Calcium	7440-70-2	100	10
Chromium	7440-47-3	5	0.5
Cobalt	7440-48-4	5	0.5
Copper	7440-50-8	5	0.5
Iron	7439-89-6	100	10
Lead	7439-92-1	3	0.3
Magnesium	7439-95-4	100	10
Manganese	7439-96-5	10	1
Mercury	7439-97-6	0.2	0.1
Nickel	7440-02-0	10	1
Potassium	7440-09-7	200	20
Selenium	7782-49-2	5	0.5
Silver	7440-22-4	5	0.5
Sodium	7440-22-4	200	20
Thallium	7440-28-0	2	0.2
Vanadium	7440-62-2	10	1
Zinc	7440-66-6	10	1

[a] Specific quantitation limits are highly matrix dependent; project quantitation levels listed here are goals and may not always be achievable.

Table 3.9. Project Quantitation Levels for Miscellaneous Parameters in Soils and Waters Using EPA Water and Wastewater Methods, SW846 Methods, or ASTM Methods

Compound	CAS Number	Project Quantitation Levels[a]	
		Water (mg/L)	Soil/Sediment (mg/kg)
Bicarbonate Alkalinity (310.1)		1.0	--
Carbonate Alkalinity (310.1)		1.0	--
Ammonia-N (350.2)		0.1	--
Chloride (300.0)		0.2	--
Bromide (300.0)		0.2	--
Fluoride (340.2)		0.1	--
Nitrate-N (300.0)		0.1	--
Nitrite-N (300.0)		0.1	--
Ortho-phosphate (300.0)		0.1	--
Phosphorous (total) (365.1)		0.1	--
Sulfate (300.0)		1.0	--
Sulfide (376.2)		1.0	--
Cyanide, total (9012)		0.01	0.5
Total Dissolved Solids (160.1)		1.0	--
Total Suspended Solids (160.2)		1.0	--
Settleable Solids (160.5)		1.0	--
pH (150.1)		--	--
Conductivity (120.1)		--	--
Temperature (170.1)		--	--
Turbidity (180.1)		0.1 NTU	--
Dissolved Oxygen (360.1)		0.2	--
Biological Oxygen Demand (405.1)		2.0	--
Chemical Oxygen Demand (410.1)		10	--
Oil & Grease (413.2)		1.0	10
Total Organic Carbon (415.2)		1.0	10
Total Petroleum Hydrocarbons (418.1)		1.0	10
Total Phenols (420.1)		0.1	1.0
Moisture Content (ASTM D2216)		--	NA
Grain Size (ASTM D422)		--	NA
Atterberg Limits (ASTM D4318)		--	NA
USCS Classification (ASTM D2487)		--	NA
Permeability (ASTM D2434)		--	NA

[a] Specific quantitation limits are highly matrix dependent; project quantitation levels listed here are goals and may not always be achievable.

Comparability expresses the confidence with which one data set can be compared with another. The extent to which existing and planned analytical data will be comparable depends upon the similarity of sampling and analytical methods. The procedures used to obtain the planned analytical data are expected to provide comparable data. These new analytical data, however, may not be directly comparable to existing data because of differences in procedures and QA objectives.

4.0 SAMPLING PROCEDURES

Sampling procedures are described in the FSAP and SAP addenda for each investigation. It is anticipated that investigations performed at RVAAP will produce surface soil, subsurface soil, sediment, surface water, groundwater and investigation-derived waste (IDW) samples for analysis. Additional samples will be collected to complete field QC duplicate and field blank and QA laboratory split sample analyses. Specific sample numbers (including anticipated parameters and methods) will be incorporated into tables similar to Table 1-1. Investigation samples may require VOC, semivolatile organic compound (SVOC), pesticide, polychlorinated biphenyl (PCB), metal, or miscellaneous analyte determinations, as represented in Tables 1-1, 3-1, and 3-2.

Tables 4-1 and 4-2 summarize sample container, preservation, and holding time requirements for soil/sediment and surface water/groundwater matrices associated with investigations at RVAAP. The specific number of containers required for each AOC investigation will be included in each investigation-specific QAPP addenda. Additional sample volumes will be provided, when necessary, for the express purpose of performing associated laboratory QC (laboratory duplicates, MS/MSD). These QC samples will be designated by the field and identified for the laboratory on the respective COCs. Field duplicate samples will be labeled and numbered in manner that does not allow the analytical facility to compare information with primary sample data.

Table 4-1. Container Requirements for Soil and Sediment Samples at Ravenna Army Ammunition Plant, Ravenna, Ohio

Analyte Group	Container	Minimum Sample Size	Preservative	Holding Time
Volatile Organic Compounds	2 - 2 oz glass jar with septum cap (no headspace)	20 g	Cool, 4°C	14 d
Semivolatile Organic Compounds	1 - 16 oz glass jar[a] with Teflon®-lined cap	60 g	Cool, 4°C	14 d (extraction) 40 d (analysis)
Pesticide Compounds	Include in SVOC container	60 g	Cool, 4°C	14 d (extraction) 40 d (analysis)
PCBs	Include in SVOC container	60 g	Cool, 4°C	14 d (extraction) 40 d (analysis)
PAH Compounds	Include in SVOC container	60 g	Cool, 4°C	14 d (extraction) 40 d (analysis)
Explosive Compounds	1 - 4 oz glass jar with Teflon®-lined cap	60 g	Cool, 4°C	14 d (extraction) 40 d (analysis)
Propellant Compounds	1 - 4 oz glass jar with Teflon®-lined cap	60 g	Cool, 4°C	14 d (extraction) 40 d (analysis)
Petroleum Hydrocarbons (gasoline range)	2 - 2 oz glass jar with septum cap	20 g	Cool, 4°C	14 d
Petroleum Hydrocarbons (diesel range)	1 - 4 oz glass jar with Teflon®-lined cap	60 g	Cool, 4°C	14 d (extraction) 40 d (analysis)
Metals	Include in SVOC container	50 g	Cool, 4°C	180 d; Hg @ 28 d
Cyanide	Include in SVOC container	25 g	Cool, 4°C	14 d

[a] When all fractions are being collected and shipped to the same analytical facility, one 16 oz. jar should cover all requirements. If analytical groups are sent to separate facilities, individual containers will be required.

Table 4-2. Container Requirements for Water Samples at Ravenna Army Ammunition Plant, Ravenna, Ohio

Analyte Group	Container	Minimum Sample Size	Preservative	Holding Time
Volatile Organic Compounds	3 -40 mL glass vials with Teflon®-lined septum (no headspace)	80 mL	HCl to pH <2 Cool, 4°C	14 d
Semivolatile Organic Compounds	2 - 1L amber glass bottle with Teflon®-lined lid	1000 mL	Cool, 4°C	7 d (extraction) 40 d (analysis)
Pesticide Compounds	2 - 1L amber glass bottle with Teflon®-lined lid	1000 mL	Cool, 4°C	7 d (extraction) 40 d (analysis)
PCBs	2 - 1L amber glass bottle with Teflon®-lined lid	1000 mL	Cool, 4°C	7 d (extraction) 40 d (analysis)
PAH Compounds	2 - 1L amber glass bottle with Teflon®-lined lid	1000 mL	Cool, 4°C	7 d (extraction) 40 d (analysis)
Explosive Compounds	1 - 1L amber glass bottle with Teflon®-lined lid	1000 mL	Cool, 4°C	7 d (extraction) 40 d (analysis)
Propellant Compounds	1 - 1L amber glass bottle with Teflon®-lined lid	1000 mL	Cool, 4°C	7 d (extraction) 40 d (analysis)
Petroleum Hydrocarbons (gasoline range)	2 -40 mL glass vials with Teflon®-lined septum (no headspace)	80 mL	Cool, 4°C	14 d
Petroleum Hydrocarbons (diesel range)	2 - 1L amber glass bottle with septum lid	1000 mL	Cool, 4°C	7 d (extraction) 40 d (analysis)
Metals	1 - 1L polybottle	500 mL	HNO_3 to pH <2 Cool, 4°C	180 d; Hg @ 28 d
Cyanide	500 mL polybottle	500 mL	NaOH to pH >12 Cool, 4°C	14 d
Anions (Br, Cl, F, SO4)	250 mL polybottle	250 mL	Cool, 4°C	28 d
Nitrate-Nitrite	250 mL polybottle	100 mL	H_2SO_4 to pH <2 Cool, 4°C	28 d
TSS/TDS	500 mL polybottle	100 mL ea.	Cool, 4°C	28 d

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5.0 SAMPLE CUSTODY

It is the policy of the U.S. Army and will be the intent of this investigation to follow EPA policy regarding sample custody and COC protocols as described in "NEIC Policies and Procedures," EPA-330/9-78DDI-R, Revised June 1985. This custody is in three parts: sample collection, laboratory analysis, and final evidence files. Final evidence files, including originals of laboratory reports and electronic files, are maintained under document control in a secure area. A sample or evidence file is under your custody when it is:

- in your possession;
- in your view, after being in your possession;
- in your possession and you place them in a secured location; or
- in a designated secure area.

5.1 FIELD CHAIN-OF-CUSTODY PROCEDURES

The sample packaging and shipment procedures summarized below will ensure that samples will arrive at the laboratory with the COC intact. The protocol for specific sample numbering using case numbers and traffic report numbers (if applicable) and other sample designations are included in the FSAP.

5.1.1 Field Procedures

The field sampler is responsible for the care and custody of the samples until they are transferred or properly dispatched. As few people as possible should handle the samples. Each sample container will be labeled with a sample number, date and time of collection, sampler, and sampling location. Sample labels are to be completed for each sample using indelible ink, unless prohibited by weather conditions (e.g., a logbook notation would explain that a pencil was used to fill out the sample label, due to the non-functionality of ballpoint pens in freezing weather). The Contractor Project Manager, in conjunction with the U.S. Army, will review all field activities to determine whether proper custody procedures were followed during the field work and to decide if additional samples are required.

5.1.2 Field Logbooks/Documentation

The field logbook will provide a means of recording data collection activities performed. Entries will be described in as much detail as possible so that persons going to the site could reconstruct a particular situation without reliance on memory. Field logbooks will be bound field survey books or notebooks. Logbooks will be assigned to field personnel but stored in the document control center when not in use. Each logbook will be identified by a project-specific document number. The title page of each logbook will contain the name of the person to whom the logbook is assigned, the logbook number, the project name, and the project start and end dates.

Entries into the logbook will contain a variety of information. At the beginning of each entry, the date, start time, weather, names of all sampling team members present, level of personal protection being used, and the signature of the person making the entry will be entered. The names of visitors to the site, field sampling or investigation team personnel, and the purpose of their visit will also be recorded in the field logbook. Measurements made and samples collected will be recorded. All entries will be made in ink and no erasures will be made. If an incorrect entry is made, the information will be crossed out with a single strike mark and the entry will be initialed and dated.

Samples will be collected following the sampling procedures documented in the FSAP and its addenda. When a sample is collected or a measurement is made, a detailed description of the location shall be recorded. The equipment used to collect samples will be noted, along with the time of sampling, sample description, depth at which the sample was collected, volume, and number of containers. A sample identification number will be assigned before sample collection. Field duplicate samples, which will receive an entirely separate sample identification number, will be noted under sample description. Equipment employed to make field measurement will be identified along with their calibration dates.

5.1.3 Transfer of Custody and Shipment Procedures

Samples are accompanied by a properly completed COC form. The sample numbers and locations will be listed on the COC form. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. This record will document transfer of custody of samples from the sampler to another person, to a mobile laboratory, to the permanent laboratory, or to/from a secure storage area.

Samples will be properly packaged for shipment and dispatched to the appropriate laboratory for analysis. A separate signed custody record will be enclosed in each sample box or cooler. Shipping containers will be secured with strapping tape and custody seals for shipment to the laboratory. The preferred procedure also includes using a custody seal attached to the front right and back left of the cooler. The custody seals are covered with clear plastic tape. The cooler is strapped shut with strapping tape in at least two locations. When the samples are sent by common carrier, a bill of lading should be used. Receipts or bills of lading will be retained as part of the permanent documentation. When sent by mail, the package will be registered with return receipt requested. Commercial carriers are not required to sign off on the custody form as long as the custody forms are sealed inside the sample cooler and the custody seals remain intact.

All shipments will be accompanied by the COC record identifying the contents. The original record will accompany the shipment, and copies will be retained by the sampler for return to project management and the project file. Whenever co-located or split samples are collected for comparison analysis by the U.S. Army QA Laboratory or a government agency, a separate COC is prepared for those samples and marked to indicate with whom the samples are being split.

All shipments will be in compliance with applicable U.S. Department of Transportation regulations for environmental samples.

5.2 LABORATORY COC PROCEDURES

Custody procedures along with the holding time and sample preservative requirements for samples will be described in laboratory QA Plans. These documents will identify the laboratory custody procedures for sample receipt and log-in, sample storage, tracking during sample preparation and analysis, and laboratory storage of data.

5.3 FINAL EVIDENCE FILES CUSTODY PROCEDURES

The Contractor is the custodian of the evidence file and will maintain the contents of evidence files for each investigation, including all relevant records, reports, logs, field notebooks, pictures, subcontractor reports, correspondence, laboratory logbooks, and COC forms. Each project evidence file will be stored in a secure, limited-access area and under custody of the Contractor Project Manager.

Analytical laboratories will retain all original raw data information (both hard copy and electronic) in a secure, limited-access area and under custody of the Laboratory Project Manager.

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6.0 CALIBRATION PROCEDURES AND FREQUENCY

This section describes procedures for maintaining the accuracy of all the instruments and measuring equipment that are used for conducting field tests and laboratory analyses. These instruments and equipment shall be calibrated before each use or on a scheduled, periodic basis according to manufacturer instructions.

6.1 FIELD INSTRUMENTS/EQUIPMENT

Instruments and equipment used to gather, generate, or measure environmental data will be calibrated with sufficient frequency and in such a manner that accuracy and reproducibility of results are consistent with the manufacturer's specifications. All field instruments for this purpose will have unique identifiers, and each instrument will be logged in the Material and Testing Equipment (M&TE) Log Book before use in the field. The site safety and health officer or his/her designate will be responsible for performing and documenting daily calibration/checkout records for instruments used in the field.

Equipment to be used during the field sampling will be examined to certify that it is in operating condition. This will include checking the manufacturer's operating manual and instructions for each instrument to ensure that all maintenance requirements are being observed. Field notes from previous sampling trips will be reviewed so that the notation on any prior equipment problems will not be overlooked, and all necessary repairs to equipment will be carried out. Spare parts or duplication of equipment will be available to the sampling effort.

Calibration of field instruments is governed by the specific standard operating procedure (SOP) for the applicable field analysis method, and it will be performed at the intervals specified in the SOP. If no SOP is available, calibration of field instruments will be performed at intervals specified by the manufacturer or more frequently as conditions dictate. Calibration procedures and frequency will be recorded in a field logbook.

Field instruments will include a pH meter, thermometer, specific conductivity meter, turbidity meter, flame ionization detector (FID) or photoionization detector (PID) for organic vapor detection, and a combustible gas detection meter capable of determining lower explosive limits, upper explosive limits, and/or oxygen levels. If an internally calibrated field instrument fails to meet calibration/checkout procedures, it will be returned to the manufacturer for service and a back-up instrument will be calibrated and used in its place.

Detailed instructions on the proper calibration and use of each field instrument follow the guidelines established by the manufacturer. The technical procedures for each instrument used on this project include the manufacturer's instructions detailing the proper use and calibration of each instrument. Project personnel responsible for calibrating and operating field instruments will receive training in the proper use of each instrument. Documentation of current training records for all project field personnel will be maintained in the training records data base for the project.

6.1.1 pH Meter Calibration

The pH meter will be calibrated according to the manufacturer's instructions using traceable standard buffer solutions before work in the field. Before use in the field, calibration of the pH meter will be checked against two standard buffer solutions. Calibration procedures, lot numbers of buffer solutions, and other pertinent calibration or checkout information will be recorded in the M&TE Log Book for the project. The calibrations performed, standard used, and sample pH values are to be recorded in the field notebook. Appropriate new batteries will be purchased and kept with the meters to facilitate immediate replacement in the field as necessary.

6.1.2 Temperature Calibration

Temperature measurements are carried out using a thermometer. Mercury thermometers must be inspected before use to ensure that there is no mercury separation. Thermometers should be rechecked in the field before and after each use to see if the readings are logical and the mercury is still intact. Thermometers should be checked biannually for calibration by immersing them in a bath of known temperature until equilibrium is reached. Thermometers should be discarded in an appropriate manner if found to have more than 10 percent error. The reference thermometer used for bath calibration should be National Institute of Standards and Testing (NIST) traceable. Temperatures will be recorded in the M&TE Log Book, the Sample Log Book, or the Cooler Log Book, as appropriate.

6.1.3 Conductivity Meter Calibration

The conductivity cells of the specific conductivity meter will be cleaned according to manufacturer's recommendations and specifications and checked against known conductivity standard solutions before each sampling event. The instrument will be checked daily with NIST-traceable standard solutions. If the instrument is more than 10 percent out of calibration when compared with standard solutions, the instrument will be recalibrated. If this cannot be done in the field, the instrument will be returned to the manufacturer or supplier for recalibration and a back-up instrument will be used in its place. Daily calibration readings and other relevant information will be recorded daily in the M&TE Log Book.

6.1.4 Turbidity Calibration

The turbidity meter will be calibrated each day against a known and traceable standard supplied by the manufacturer prior to use in the field. In the field the instrument will be checked against the standard and adjusted each time the instrument is turned on. Calibration information will be recorded in the M&TE Log Book; checks made in the field will be recorded in the Sample Log Book.

6.1.5 Organic Vapor Detection

Organic vapor detectors will be checked daily according to the manufacturer's instructions. FIDs will be checked daily by using the internal calibration mechanism. PIDs will be calibrated daily with a gas of known concentration. All daily calibration information will be recorded in the M&TE Log Book.

6.1.6 Combustible Gas and Oxygen Detection

Combustible gas calibration checks should be made daily using the gas recommended by the manufacturer. Calibration of the oxygen system should be checked daily while the combustible gas sensor is being checked. Record all appropriate calibration check data in the M&TE Log Book.

6.1.7 Dissolved Oxygen Calibration

The dissolved oxygen meter will be calibrated against a known standard according to the manufacturer's instructions. Calibration checks will be performed each day prior to use in the field. Calibration information will be recorded daily in the M&TE Log Book.

6.1.8 Geophysical Instruments

Geophysical instruments such as magnetometers, electromagnetic conductivity meters, and ground-penetrating radar equipment will be calibrated per manufacturer's instructions. Calibration procedures and equipment used should also be described in area-specific documentation.

6.2 LABORATORY INSTRUMENTS

Calibration of laboratory equipment will be based on approved written procedures. Records of calibration, repairs, or replacement will be filed and maintained by laboratory personnel performing QC activities. These records will be filed at the location where the work is performed and will be subject to QA audit. Procedures and records of calibration will follow USACE direction as stated in the Shell for Analytical Chemistry Requirements and the Louisville District–Corp Environmental Data Assurance Guideline.

In all cases where analyses are conducted according to SW 846 methods, the calibration procedures and frequencies specified in the applicable SW 846 method and the Shell Document will be followed exactly. For analyses governed by SOPs, refer to the appropriate SOP for the required calibration procedures and frequencies.

Records of calibration will be kept as follows:

- Each instrument will have a record of calibration with an assigned record number.

- Instrument identification numbers, manufacturer, model numbers, date of last calibration, signature of calibrating analyst, and due date for next calibration will be documented. Reports and compensation or correction figures will be maintained with each instrument.

- A written step-wise calibration procedure will be available for each piece of test and measurement equipment.

- Any instrument that is not calibrated to the manufacturer's original specification will display a warning tag to alert the analyst that the device carries only a "Limited Calibration."

6.2.1 Organic Analyses

For all analyses, the laboratory will follow directions provided in the USACE Shell Document and individual analytical procedures for initial calibration, initial calibration checks, and continuing calibration checks. Before calibration, the instrument(s) used for gas chromatograph/mass spectrometer (GC/MS) analyses are tuned by analysis of p-bromofluorobenzene (BFB) for volatile analyses and decafluorotriphenyl phosphine (DFTPP) for semivolatile analyses. Once the tuning criteria for these reference compounds are met, the instrument should be initially calibrated by using a five-point calibration curve. The instrument tune will be verified each 12 hours of operation.

Calibration standards will be EPA- or NIST-traceable (when existent) and are spiked with internal standards and surrogate compounds. Calibration and continuing calibration verification of instruments will be performed at approved intervals as specified by the analytical method and the Shell Document.

6.2.2 Metals Analysis

For all analyses, the laboratory will follow directions provided in the USACE Shell Document and individual analytical procedures for initial calibration, initial calibration checks, and continuing calibration checks. Atomic Absorption Spectrophotometer instruments are calibrated by use of a minimum of three calibration standards prepared by dilution of certified stock solutions. Inductively coupled plasma (ICP) emission spectrophotometer instruments are calibrated by using a minimum of two calibration standards prepared by dilution of certified stock solutions. One calibration standard will be at the approximate method quantitation limit for the metal. Other standards bracket the concentration range of the samples. Calibration standards will contain acids at the same concentration as the digestates. An analysis blank is prepared as well.

Two continuing calibration standards (one mid-level and one low-level), prepared from a different stock solution than that used for preparation of the calibration standards, are analyzed after each ten samples or each two hours of continuous operation. The value of the continuing calibration standard concentration must agree within plus or minus 10% of the initial value.

For the ICP, linearity near the quantitation limit will be verified with a standard prepared at a concentration of two times the quantitation limit. This standard must be run at the beginning and end of each sample analysis run or a minimum of twice per 8-hour period.

7.0 ANALYTICAL PROCEDURES

All samples collected during the investigation activities will be analyzed by laboratories reviewed and certified by the USACE HTRW CX, Omaha, Nebraska. QA samples shall be collected of groundwater, surface water, and soil and analyzed by a project identified QA Laboratory. Designated QA laboratory facilities may be arranged through the auspices of the Ohio EPA or the USACE Louisville District office at the time of project-specific coordination efforts. Selected QA Laboratories will be logistically and corporately distinct from the primary Contractor’s subcontract laboratory facility. Each laboratory supporting this work shall provide statements of qualifications including organizational structure, QA Manual, and SOPs, which will be appended to this Facility-wide QAPP.

7.1 LABORATORY ANALYSIS

Analytical parameters and project quantitation levels are listed in Tables 3-3 through 3-9.

Principal laboratory facilities will not subcontract or transfer any portion of this work to another facility, unless expressly permitted to do so in writing by the project Contractor with the concurrence of Ravenna Program Management.

If contaminant concentrations are high, or for matrices other than normal waters and soils, analytical protocols may be inadequate. In these cases, sample analysis may require modifications to defined methodology. Any proposed changes to analytical methods specified requires written approval from the Contractor and U.S. Army. All analytical method variations will be identified in investigation-specific addenda. These will be submitted for regulatory review and approval. All variations from standard SW-846 methods must be approved by both the U.S. Army and Ohio EPA prior to sample analysis.

These SOPs must be adapted from and reference standard EPA SW-846 methods and thereby specify:

- procedures for sample preparation,
- instrument start-up and performance check,
- procedures to establish the method detection limits for each parameter,
- initial and continuing calibration check requirements,
- specific methods for each sample matrix type, and
- required analyses and QC requirements.

All VOC, SVOC, pesticide, and PCB results will be expressed in μg/L for water samples and μg/kg (dry weight) for soil/sediment samples. Metal and explosive results will be expressed in μg/L for water samples and mg/kg (dry weight) for soil/sediment samples.

All reasonable effort must be made on the part of the laboratory to meet project quantitation levels for all analyses. Elevated reporting levels dues to dilution should be avoided by reporting both diluted and undiluted analyses. Attempts to limit elevated reporting levels such as sample clean-up steps should be documented and reported.

In addition, efforts must be made to analyze samples within the first half of the analytical holding time, to allow potential repeat analyses to be conducted within analytical holding time windows.

7.2 FIELD SCREENING ANALYTICAL PROTOCOLS

Procedures for field measurement of pH, specific conductivity, and temperature are described in the FSAP and Section 6.0 of this document. Tabulation of the methodologies appears in Tables 3-1 and 3-2.

8.0 INTERNAL QUALITY CONTROL CHECKS

8.1 FIELD SAMPLE COLLECTION

The assessment of field sampling precision and accuracy will be made by collecting field duplicates and field blanks in accordance with the procedures described in the FSAP and at the frequency indicated in the investigation-specific SAP addenda.

8.2 FIELD MEASUREMENT

QC procedures for most field measurements (i.e., pH, conductivity, temperature, etc.) are limited to checking the reproducibility of the measurement by obtaining multiple readings on a single sample or standard and by calibrating the instruments. Refer to the FSAP and its addenda for more detail regarding these measurements.

8.3 LABORATORY ANALYSIS

Analytical QC procedures for investigations at RVAAP are specified in the method descriptions, the USACE Shell Document, and the USACE Louisville District Environmental Data Assurance Guideline. These specifications include the types of QC checks normally required; method blanks, LCS, MS, MSD, calibration standards, internal standards, surrogate standards, calibration check standards, and laboratory duplicate analysis. Calibration compounds and concentrations to be used and the method of QC acceptance criteria for these parameters have been identified.

To ensure the production of analytical data of known and documented quality, laboratories associated with the investigations at RVAAP will implement QA program and QC checks.

8.3.1 QA Program

All subcontracted analytical laboratories will have a written QA program that provides rules and guidelines to ensure the reliability and validity of work conducted at the laboratory. Compliance with the QA program is coordinated and monitored by the laboratory's QA department, which is independent of the operating departments.

The stated objectives of the laboratory QA program are to

- properly receive, preserve, and store all samples;
- maintain adequate custody records from sample receipt through reporting and archiving of results;
- use properly trained analysts to analyze all samples by approved methods within holding times;
- produce defensible data with associated documentation to show that each system was calibrated and operating within precision and accuracy control limits;

- accurately calculate, check, report, and archive all data using the Laboratory Information Management System; and

- document all the above activities so that all data can be independently validated.

All laboratory procedures are documented in writing as SOPs, which are edited and controlled by the QA department. Internal QC measures for analysis will be conducted with their SOPs and the individual method requirements specified.

External QA shall be provided by the designated Ohio EPA or USACE–Louisville District QA laboratory. The external QA laboratory shall receive QA sample splits as identified in each task specific set of documentation.

8.3.2 QC Checks

Implementation of QC procedures during sample collection, analysis, and reporting ensures that the data obtained are consistent with its intended use. Both field QC and laboratory QC checks are performed throughout the work effort to generate data confidence. Analytical QC measures are used to determine if the analytical process is in control, as well as to determine the sample matrix effects on the data being generated.

Specifications include the types of QC required (duplicates, sample spikes, surrogate spikes, reference samples, controls, blanks, etc.), the frequency for implementation of each QC measure, the compounds to be used for sample spikes and surrogate spikes, and the acceptance criteria for this QC.

Laboratories will provide documentation in each data package that both initial and ongoing instrument and analytical QC functions have been met. Any non-conforming analysis will be reanalyzed by the laboratory, if sufficient sample volume is available. It is expected that sufficient sample volumes will be collected to provide for reanalyses, if required.

8.3.2.1 Analytical process QC

8.3.2.1.1 *Method blanks*

A method blank is a sample of a non-contaminated substance of the matrix of interest (usually distilled/de-ionized water or silica sand) that is then subjected to all of the sample preparation (digestion, distillation, extraction) and analytical methodology applied to the samples. The purpose of the method blank is to check for contamination from within the laboratory that might be introduced during sample preparation and analysis that would adversely affect analytical results. One in 20 samples will be method blanks, with fractions rounded to the next whole number.

Analytical sensitivity goals are identified in Tables 3-3 through 3-9 as project quantitation levels. Method blank levels should be below these levels for all analytes, and below 2× the associated method detection levels.

8.3.2.1.2 *Laboratory control samples*

The LCS contains known concentrations of all target analytes to be determined and is carried through the entire preparation and analysis process. Commercially available LCSs or those from EPA may be used.

LCS standards that are prepared in-house must be made from a source independent of that of the calibration standards. In addition to a mid-level LCS, laboratories will include a low-level LCS check at 3× the MDL. This Quality Control Method Reporting Limit check will contain all target analytes and be reported similarly to standard LCS information.

The primary purpose of the LCS is to establish and monitor the laboratory's analytical process control. An LCS must be analyzed with each analytical sample batch. LCS information must contain the theoretical concentrations of analytes, measured concentrations, percent recoveries, and relative percent differences, if duplicate LCS samples are analyzed. Refer to direction provided by the USACE Shell Document and the USACE–Louisville District Guidance.

8.3.2.2 Matrix and sample-specific QC

8.3.2.2.1 *Laboratory duplicates*

Laboratory duplicates are separate aliquots of a single sample that are prepared and analyzed concurrently at the laboratory. This duplicate sample should not be a method blank, trip blank, or field blank. The primary purpose of the laboratory duplicate is to check the precision of the laboratory analyst, the sample preparation methodology, and the analytical methodology. If there are significant differences between the duplicates, the affected analytical results will be re-examined. One in 20 samples will be a laboratory duplicate, with fractions rounded to the next whole number.

8.3.2.2.2 *Surrogate spikes*

A surrogate spike is prepared by adding a pure compound to a sample before extraction. The compound in the surrogate spike should be of a similar type to that being assayed in the sample. The purpose of a surrogate spike is to determine the efficiency of recovery of analytes in the sample preparation and analysis. The percent of recovery of the surrogate spike is then used to gauge the total accuracy of the analytical method for that sample.

8.3.2.2.3 *Matrix spikes and matrix spike duplicates*

An MS is an aliquot of a sample spiked with known quantities of analytes and subjected to the entire analytical procedure. It is used to indicate the appropriateness of the method for the matrix by measuring recovery or accuracy. Accuracy is the nearness of a result or the mean of a set of results to the true or accepted value. An MSD is a second aliquot of the same sample with known quantities of compounds added. The purpose of the MSD, when compared to the MS, is to determine method precision. Precision is the measure of the reproducibility of a set of replicate results among themselves or the agreement among repeat observations made under the same conditions. MSs and MSDs are performed per 20 samples of similar matrix.

The MS must contain all analytes being determined in the sample set. In any batch of RVAAP samples, the MS/MSD must be performed on a RVAAP site sample. MS and MSD information must contain the theoretical concentrations of analytes spiked into the sample, concentrations of analytes present in the original sample, measured concentrations determined in the spiked sample, calculated percent recoveries, and relative percent differences for each MS/MSD pair.

8.3.2.2.4 *Method-specific QC*

The laboratory must follow specific quality processes as defined by the method. These will include measures such as calibration verification samples; instrument blank analysis; internal standards implementation; tracer analysis; and method of standard additions utilization, serial dilution analysis, post-digestion spike analysis, chemical carrier evaluation, etc.

9.0 DATA REDUCTION, VALIDATION, AND REPORTING

9.1 DATA REDUCTION

9.1.1 Field Measurements and Sample Collection

Raw data from field measurements and sample collection activities will be appropriately recorded in field logbooks. Data to be used in project reports will be reduced and summarized. The methods of data reduction will be documented.

The Contractor Project Manager or his/her designee is responsible for data review of all field-generated data. This includes verifying that all field descriptive data are recorded properly, that all field instrument calibration requirements have been met, that all field QC data have met frequency and criteria goals, and that field data are entered accurately in all logbooks and worksheets.

9.1.2 Laboratory Services

All samples collected for investigations at RVAAP will be sent to USACE CX qualified laboratories. Data reduction, evaluation, and reporting for samples analyzed by the laboratory will be performed according to specifications outlined in the laboratory's QA plan, this Facility-wide QAPP and any project specific addenda. Laboratory reports will include documentation verifying analytical holding time compliance.

Laboratories will perform in-house analytical data reduction under the direction of the Laboratory QA Officer. The Laboratory QA Officer is responsible for assessing data quality and informing the Contractor and U.S. Army of any data which are considered "unacceptable" or require caution on the part of the data user in terms of its reliability. Data will be reduced, evaluated, and reported as described in the laboratory QA plan. Data reduction, review, and reporting by the laboratory will be conducted as follows:

- Raw data are produced by the analyst who has primary responsibility for the correctness and completeness of the data. All data will be generated and reduced following the QAPP-defined methods and implementing laboratory SOP protocols.

- Level 1 technical data review is completed relative to an established set of guidelines by a peer analyst. The review shall ensure the completeness and correctness of the data while assuring all method QC measures have been implemented and were within appropriate criteria.

- Level 2 technical review is completed by the area supervisor or data review specialist. This reviews the data for attainment of QC criteria as outlined in the established methods and for overall reasonableness. It will ensure all calibration and QC data are in compliance and check at least 10% of the data calculations. This review shall document that the data package is complete and ready for reporting and archival.

- Upon acceptance of the raw data by the area supervisor, the report is generated and sent to the Laboratory Project Manager for Level 3 administrative data review. This review will ensure consistency and compliance with all laboratory instructions, the laboratory QA plan, the project laboratory SOW, and the project QAPP.

- The Laboratory Project Manager will complete a thorough review of all reports.

- Final reports will be generated and signed by the Laboratory Project Manager and Quality Assurance Officer.

- Data will then be delivered to the Contractor for data verification and validation.

The data review process will include identification of any out-of-control data points and data omissions, as well as interactions with the laboratory to correct data deficiencies. Decisions to repeat sample collection and analyses may be made by the Contractor Project Manager based on the extent of the deficiencies and their importance in the overall context of the project. The laboratory will provide flagged data to include such items as: (1) concentration below project quantitation levels, (2) estimated concentration due to poor spike recovery, and (3) concentration of chemical also found in laboratory blank.

Laboratories will prepare and retain full analytical and QC documentation for the project. Such retained documentation will be both hard (paper) copy and electronic storage media (e.g., magnetic tape) as dictated by the analytical methodologies employed. As needed, laboratories will supply hard copies of the retained information.

Laboratories will provide the following information to the Contractor in each analytical data package submitted:

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

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

- analytical results for QC sample spikes, sample duplicates, initial and continuous calibration verifications of standards and blanks, standard procedural blanks, LCSs and other deliverables as identified in Section 9.3; and

- tabulation of method detection levels and instrument detection limits determined in pure water.

9.2 DATA VERIFICATION/VALIDATION

Analytical data for this project will be verified and validated by qualified chemists. Flags signifying the usability of data will be noted and entered into an analytical data base. Data discrepancies noted during the verification and validation processes will be recorded as nonconformance reports, which are sent to the laboratory for clarification and/or correction. Decisions to repeat sample collection and analyses may be made by the Contractor Project Manager or U.S. Army Project Manager based on the extent of the deficiencies and their importance in the overall context of the project.

All data generated for investigations will be computerized in a format organized to facilitate data review and evaluation. The electronic data set will include data flags in accordance with referenced protocols as well as additional comments from the data review process. Associated data flags will include such items as: (1) concentration below project quantitation levels, (2) estimated concentration due to poor below-required detection limit, (3) estimated concentration due to poor spike recovery, and (4) concentration of chemical also found in laboratory blank. RVAAP investigation data sets will be available for controlled access by the Contractor Project Manager and authorized personnel. Each data set will be incorporated into investigation reports as required.

9.2.1 Data Verification/Validation Approach

A systematic process for data verification and validation will be performed to ensure that the precision and accuracy of the analytical data are adequate for their intended use. The greatest uncertainty in a measurement is often a result of the sampling process and inherent variability in the environmental media rather than the analytical measurement. Therefore, analytical data validation will be performed only to the level necessary to minimize the potential of using false positive or false negative results in the decision-making process (i.e., to ensure accurate identification of detected versus non-detected compounds). This approach is consistent with the objectives for the program, with the analytical methods, and for determining contaminants of concern and calculating risk.

Samples will be analyzed through implementation of “definitive” analytical methods. “Definitive Data” will be reported consistent with the deliverables identified in Section 9.3. This report content is consistent with what is understood as an EPA Level III deliverable (data forms including laboratory QC and calibration information). DQOs identified in Section 3.0 and method-specified criteria will be verified and validated. Comprehensive analytical information will be retained by the subcontract laboratory.

This “Definitive Data” will then be verified and validated through the review process presented in Figure 9-1. Primary, field duplicate and QA split samples will be collected for each project. All primary and field duplicate samples will be analyzed at the Contractor’s primary laboratory, and resultant data will receive primary review (STEP-1) by the analyzing facility. All primary laboratory data will be subjected to data verification (STEP-2) by the Contractor. Ten percent of the primary data will receive comprehensive validation (STEP-3a). This 10 percent will be selected to conform with the 10 percent of the samples randomly selected for field duplicate determinations. QA split sample analyses will be performed by the QA laboratory designated by either the Ohio EPA or the USACE–Louisville District. This data will receive primary review by the analyzing facility with subsequent verification and comprehensive validation (STEP-2 and -3b) by the USACE–Louisville District. Validation reports from STEP-3a and STEP-3b will be combined with QA-split samples comparison by the USACE–Louisville District into sequentially generated Chemical Quality Assurance Reports (CQARs) (STEP-4). At the end of a project, this information will form the basis for the Chemical Data Quality Assessment Report (CDQAR) produced by the USACE–Louisville District (STEP-5).

Verification support staff will conduct a systematic review of all primary data for compliance with the established QC criteria based on the following categories:

- holding times,
- blanks,
- LCSs,
- calibration,
- surrogate recovery (organic methods),
- internal standards (primarily organic methods),
- MS/MSD and duplicate results,
- sample reanalysis,
- secondary dilutions, and
- laboratory case narrative.

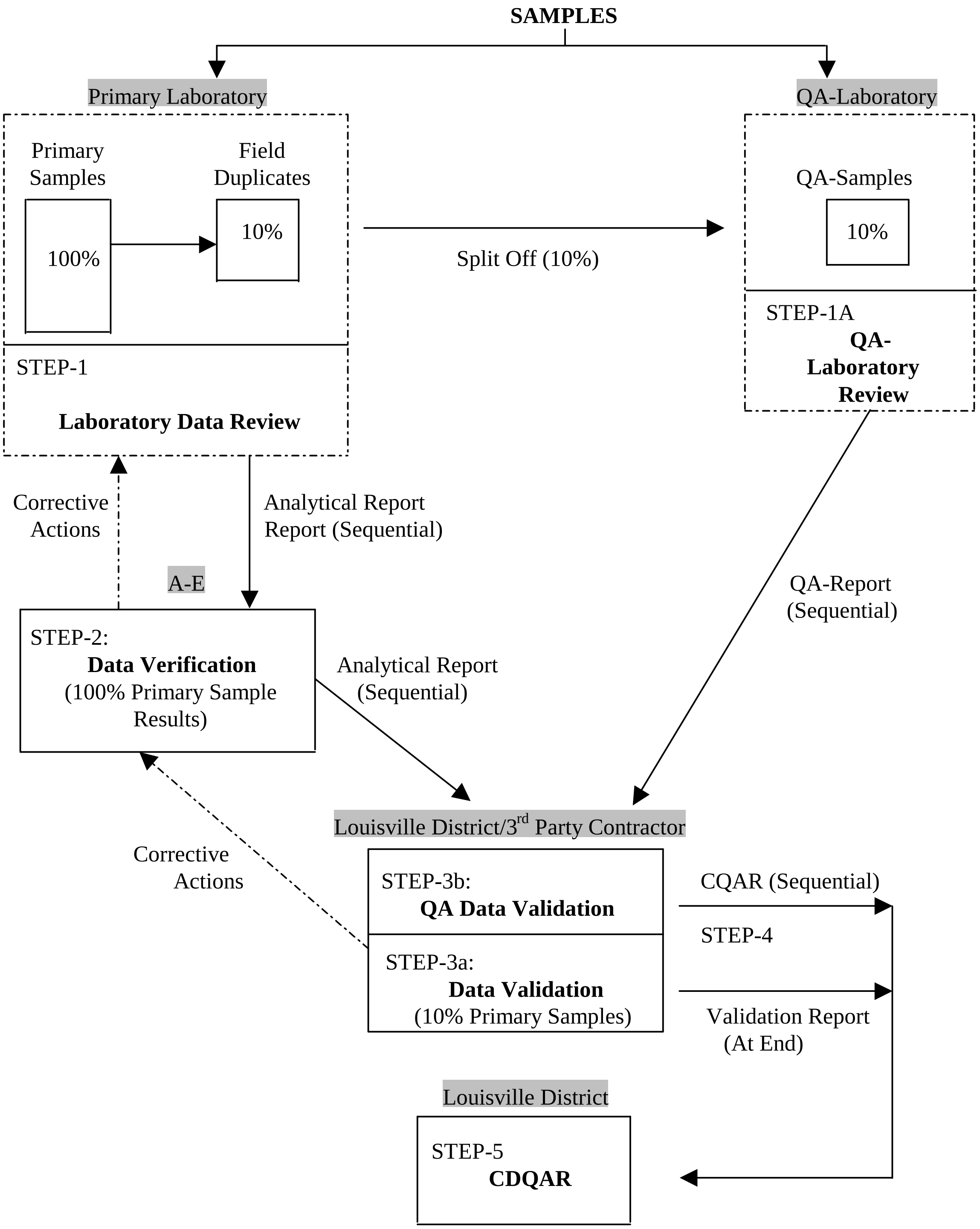

Figure 9-1. Definitive Data Review Process

Validation will be accomplished by comparing the contents of the data packages and QA/QC results to requirements contained in the requested analytical methods. The USACE's subcontracted validation support staff will be responsible for these activities. All validation staff will be independent of both the analytical laboratory and the Contractor, and all validation staff must be contracted by the USACE Louisville District. The protocol for analyte data validation is presented in:

- USACE Louisville Chemistry Guideline, Rev. 1.0, January 2001;
- Shell Analytical Chemistry Requirements, version 1.0, 2 November, 1998;
- Environmental Data Assurance Guideline, USACE Louisville, May 2000;
- EPA National Functional Guidelines for Organic Data Review (EPA 1994b); and
- EPA National Functional Guidelines for Inorganic Data Review (EPA 1994c).

Consistent with the data quality requirements as defined in the DQOs, all project data and associated QC will be evaluated and qualified as per the outcome of the review.

9.2.2 Primary Analytical Data Verification/Validation Categories

9.2.2.1 Holding times

Evaluation of holding times ascertains the validity of results based on the length of time from sample collection to sample preparation or sample analysis. Verification of sample preservation must be confirmed and accounted for in the evaluation of sample holding times. The evaluation of holding times is essential to establishing sample integrity and representativeness. Concerns regarding physical, chemical, or biochemical alteration of analyte concentrations can be eliminated or qualified through this evaluation.

9.2.2.2 Calibration

The purpose of initial and continuing calibration verification analyses is to verify the linear dynamic range and stability of instrument response. Relative instrument response is used to quantitate the analyte results. If the relative response factor is outside acceptable limits, the data quantification is uncertain and requires appropriate qualification.

9.2.2.3 Blanks

The assessment of blank analyses is performed to determine the existence and magnitude of contamination problems. The criteria for evaluation of blanks applies to any blank associated with the samples, including field, trip, equipment, and method blanks. Contamination during sampling or analysis, if not discovered, results in false-positive data.

Blanks will be evaluated against project quantitation levels as specified in Tables 3-3 through 3-9 and laboratory method detection limits. Analytical method blanks should be below 2× their respective method detection limits. Field, trip, and equipment rinsate blanks will be evaluated against their project quantitation levels. Sample data will be qualified relative to any blank contamination observed.

9.2.2.4 Laboratory control samples

The LCS serves as a monitor of the overall performance of the analytical process, including sample preparation, for a given set of samples. Evaluation of this standard provides confidence in or allows qualification of results based on a measurement of process control during each sample analysis.

9.2.2.5 Surrogate recovery

System monitoring compounds are added to every sample, blank, LCS, MS, MSD, and standard. They are used to evaluate extraction, cleanup, and analytical efficiency by measuring recovery on a sample-specific basis. Poor system performance as indicated by low surrogate recoveries is one of the most common reasons for data qualification. Evaluation of surrogate recovery is critical to the provision of reliable sample-specific analytical results.

9.2.2.6 Internal standards

Internal standards are utilized to evaluate and compensate for sample-specific influences on the analyte quantification. They are evaluated to determine if data require qualification due to excessive variation in acceptable internal standard quantitative or qualitative performance measures. For example, a decrease or increase in internal standard area counts for organics may reflect a change in sensitivity that can be attributed to the sample matrix. Because quantitative determination of analytes is based on the use of internal standards, evaluation is critical to the provision of reliable analytical results.

9.2.2.7 Matrix spike, matrix spike duplicate, and duplicate

MS, MSD, and duplicate results serve as an indicator of individual sample and matrix type influence over the analytical values. Evaluation of these measures provides confidence that the sample matrix has not impacted results or allows qualification of results based on the percent spike recovery or imprecision indicated by the duplicate comparison.

9.2.2.8 Post digestion spikes

Metal post-digestion spikes are evaluated to establish precision and accuracy of individual analytical determinations. Because of the nature of some elemental analytical techniques and because of the detailed decision tree and analysis scheme required for quantitation of the elements, evaluation of this QC is critical to ensuring reliable analytical results.

9.2.2.9 Sample reanalysis

When instrument performance-monitoring standards indicate an analysis is out of control, the laboratory is required to reanalyze the sample. If the reanalysis does not solve the problem (i.e., surrogate compound recoveries are outside the limits for both analyses), the laboratory is required to submit data from both analyses. An independent review is required to determine which is the appropriate sample result.

9.2.2.10 Secondary dilutions

When the concentration of any analyte in any sample exceeds the initial calibration range, a new aliquot of that sample must be diluted and reanalyzed. The laboratory is required to report data from both analyses. When this occurs, an independent review of the data is required to determine the appropriate results to be used for that sample. An evaluation of each analyte exceeding the calibration range must be made, including a review of the dilution analysis performed. Results chosen in this situation may be a combination of both the original results (i.e., analytes within initial calibration range) and the secondary dilution results.

9.2.2.11 Laboratory case narratives

Analytical laboratory case narratives are reviewed for specific information concerning the analytical process. This information is used to direct the data validator to potential problems with the data.

9.3 DATA REPORTING

Laboratories will prepare and submit analytical and QC data reports to the Contractor or the U.S. Army (QA split sample data) in compliance with the requirements of this QAPP, including data forms listed in Table 9-1 and will be considered a definitive data package. The definitive data package will include a cover sheet, table of contents, case narrative, the analytical results, sample management records, and internal laboratory QA/QC information. The laboratory data package should be organized so that the analytical results are reported on a per batch basis. A general outline is presented below:

Cover Sheet

- Title of report
- Name and location of laboratory
- Name and location of all subcontract laboratories
- Contract number
- Client name and address
- Project name and site location
- Statement of data authenticity with official signatures
- Amendments, if applicable

Table of Contents

Case Narrative

Analytical Results

- Laboratory name and location
- Project name and ID number
- Field sample ID number
- Laboratory sample ID number
- Matrix
- Sample description
- Sample preservation or condition at receipt
- Date sample collected
- Date sample received by the laboratory
- Date sample extracted or prepared
- Date sample analyzed
- Analysis time when holding time is <48 hours
- Analytical method numbers, including preparation numbers
- Preparation and analytical batch numbers
- Analyte or parameter
- Method reporting limits
- Method quantitation limits
- Method detection limits
- Analytical results
- Confirmation data
- Laboratory assigned data qualifiers
- Concentration units
- Dilution factors

- Percent moisture or percent solids
- Chromatograms, as needed
- Sample aliquot size analyzed
- Final extract volume

Laboratory Reporting Limits
Sample Management Records
QA/QC Information

Table 9-1. Standard Data Deliverables (Hard Copy), Ravenna Army Ammunition Plant, Ravenna, Ohio

Method Requirements	Deliverables
Requirements for all methods:	
- Holding time information and methods requested	Signed chain-of-custody forms
- Discussion of laboratory analysis, including any laboratory problems	Case narratives
- LCS (run with each batch of samples processed)	Results (control charts when available)
Organics: GC/MS analysis	
- Sample results, including TICs	EPA Form 1 or equivalent
- Surrogate recoveries	EPA Form 2 or equivalent
- Matrix spike/spike duplicate data	EPA Form 3 or equivalent
- Method blank data	EPA Form 4 or equivalent
- GC/MS tune	EPA Form 5 or equivalent
- GC/MS initial calibration data	EPA Form 6 or equivalent
- GC/MS continuing calibration data	EPA Form 7 or equivalent
- GC/MS internal standard area data	EPA Form 8 or equivalent
Organics: GC analysis	
- Sample results	EPA Form 1 or equivalent
- Surrogate recoveries	EPA Form 2 or equivalent
- Matrix spike/spike duplicate data	EPA Form 3 or equivalent
- Method blank data	EPA Form 4 or equivalent
- Initial calibration data	EPA Form 6 or equivalent
If calibration factors are used	A form listing each analyte, the concentration of each standard, the relative calibration factor, the mean calibration factor, and the %RSD
- Calibration curve if used	Calibration curve and correlation coefficient
- Continuing calibration data	EPA Form 9 or equivalent
- Positive identification (second column confirmation)	EPA Form 10 or equivalent
Metals	
- Sample results	EPA Form 1 or equivalent
- Initial and continuing calibration	EPA Form 2 or equivalent, dates of analyses and calibration curve, and the correlation coefficient factor
- Method blank	EPA Form 3 or equivalent and dates of analyses
- ICP interference check sample	EPA Form 4 or equivalent and dates of analyses
- Spike sample recovery	EPA Form 5A or equivalent

Table 9-1. Standard Data Deliverables (Hard Copy), Ravenna Army Ammunition Plant, Ravenna, Ohio (continued)

Method Requirements	Deliverables
- Postdigestion spike sample recovery for ICP metals	EPA Form 5B or equivalent
- Postdigestion spike for GFAA	EPA Form 5B or equivalent
- Duplicates	EPA Form 6 or equivalent
- LCS	EPA Form 7 or equivalent
- Standard additions (when implemented)	EPA Form 8 or equivalent
- Holding times	EPA Form 13 or equivalent
- Run log	EPA Form 14 or equivalent
Wet Chemistry	
- Sample results	Report result
- Matrix spike recovery	% Recovery
- Matrix spike duplicate or duplicate	% Recovery and % RPD
- Method blank	Report results
- Initial calibration	Calibration curve and correlation coefficient
- Continuing calibration check	Recovery and % difference
- LCS	LCS result and control criteria

GC = gas chromatography
GFAA = graphite furnace atomic absorption
ICP = inductively coupled plasma
LCS = laboratory control standard
MS = mass spectrometry
PCB = polychlorinated biphenyl
RPD = relative percent difference
RSD = relative standard deviation
TIC = tentatively identified compound

Electronic data deliverables (EDDs) will contain the same information as described for the hard copy deliverables. EDDs should use common syntax for terms; provide sufficient input to link analytical data; provide traceability of data; and allow a mechanism to report complex analytical relationships. Examples of EDDs are referenced in the Shell Document and may be obtained from USACE HTRW CX, Chemical data Quality Management Branch. An acceptable configuration is presented in Table 9-2.

The laboratory will be required to confirm sample receipt and log-in information. The laboratory will return a copy of the completed COC and confirmation of the laboratory’s analytical log-in to the Contractor within two days of sample receipt.

The subcontract analytical laboratory will prepare and retain full analytical and QC documentation. Such retained documentation will include all hard copies and other storage media (e.g., disc storage). As needed, the subcontract analytical laboratory will make available all retained analytical data information.

Table 9-2. Standard Electronic Data Deliverables (EDD), Ravenna Army Ammunition Plant, Ravenna, Ohio[a]

EDD Fields (Max Length)	Description
SMP_ID (15)	The original client sample identification number. For Lab QC samples this field may be left empty or filled with a place holder like 'QC' or 'NA' for LCS and blanks. The original client sample ID should be used for MS, MSD, and SUR samples.
LAB_ID (15)	The laboratory's sample identification number.
DATE_REC (10)	The date the sample was received by the laboratory (MM/DD/YYYY).
DATE_EXT (10)	The date the sample was extracted (MM/DD/YYYY). The extraction refers to any preparatory techniques such as extraction, digestion, and separation.
DATE_ANA(10)	The date the sample was analyzed (MM/DD/YYYY).
TIME_ANA(5)	The time the sample was analyzed (HH:MM).
MATRIX (10)	The sample matrix. Valid values are Water, Solid, or Air.
METHOD (21)	The method requested by the client (e.g., SW846 8080). This should not be the lab method number.
RES_TYPE (4)	The laboratory result type. Currently the loading routine only handles the following values:
	REG-results of a primary analysis of a client sample
	REA- results of a reanalysis of a client sample
	DIL- results of an analysis of a diluted client sample
	LCS-results of a laboratory control sample as % recovery
	LCST-expected (true) result of a laboratory control sample as a concentration
	LCSF-actual (final) result of a laboratory control sample as a concentration
	SUR-surrogate recovery as % recovery
	MS-matrix spike recovery as a % recovery
	MST- expected (true) result of a matrix spike sample as a concentration
	MSF- actual (final) result of a matrix spike sample as a concentration
	MSD-matrix spike duplicate recovery as relative percent difference
	MSDT- expected (true) result of a matrix spike duplicate sample as a concentration
	MSDF- actual (final) result of a matrix spike duplicate sample as a concentration
	BLK-result of a laboratory blank sample.
CAS_NUM (15)	The CAS number or blank if no CAS number is available.
PARAMTR (50)	Chemical name for the analytic parameter.
RESULTS (N)	The analytic result.
UNITS (15)	The units for the result.
LABQUAL (6)	The qualifiers assigned by the laboratory.
DET_LIMIT (N)	The Contract-Required Detection Limit for the analyte being measured. It should be reported in the same units as the result.
UNC (N)	The 2 sigma error in the net count rate for radiological analyses. Should be expressed in the same units as the analytic result.
DILUTION (N)	The overall dilution of the sample aliquot. A value of one should correspond to nominal conditions for the method. Values less than one correspond to concentrations.
SMP_WT (N)	The weight or volume of the sample used for the analysis.
WT_UNITS (2)	The units for the sample weight or volume.
FILTERED (1)	Must have 'F' if the sample was filtered either by the lab or in the field.
PCT_SOL (N)	Percent solids.
TIC (10)	Enter 'TIC' or retention time for tentatively identified compound. Blank if not a TIC.

[a] The laboratory EDD may be delivered either as an Excel spreadsheet or as a comma or tab delimited file readable by Excel. The file name must include the SDG number or equivalent. For example, if multiple files were submitted for the same SDG, the filename could be the SDG number followed by a sequential number for each file in the SDG. A file cannot contain more than one SDG. Multiple analytic fractions may be present in the file. he first row of the file should contain the field names. The expected field names and comments about them are listed below. Fields do not have to be present in the order specified and additional fields may be included; however, columns must be present for all fields identified below.

N-Indicates that the field requires a numeric entry.

9.4 DATA QUALITY ASSESSMENT

The Contractor data assessment will be accomplished by the joint efforts of the data validator, the data assessor, and the Contractor Project Manager. Data assessment by data management will be based on the criteria that the sample was properly collected and handled according to the FSAP and Section 5.0 of this QAPP. An evaluation of data accuracy, precision, sensitivity and completeness, based on criteria in Section 12.0, will be performed by a data assessor and presented in the project report. This Quality Control Summary Report (QCSR) will indicate that data are: (1) usable as a quantitative concentration, (2) usable with caution as an estimated concentration, or (3) unusable due to out-of-control QC results.

As part of the on-going data quality assessment the U.S. Army chemist will compile information and provide CQARs and at the conclusion of the project assemble a CDQAR.

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10.0 PERFORMANCE AND SYSTEM AUDITS

Performance and system audits of both field and laboratory activities will be conducted to verify that sampling and analysis are performed in accordance with the procedures established in the FSP and QAPP. Audits of field and laboratory activities will include both internal and external audits.

10.1 FIELD AUDITS

Internal audits of field activities (sampling and measurements) will be conducted by the Contractor's QA Officer and/or Field Team Leader. The audits will include examination of field sampling records, field instrument operating records, sample collection, handling and packaging in compliance with the established procedures, maintenance of QA procedures, COC, etc. These audits will occur at the onset of a project to verify that all established procedures are followed (systems audit).

Performance audits will follow to ensure deficiencies have been corrected and to verify that QA practices/procedures are being maintained throughout the duration of the project work effort. These audits will involve reviewing field measurement records, instrumentation calibration records, and sample documentation.

External audits may be conducted at the discretion of the U.S. Army, EPA Region 5, or Ohio EPA.

10.2 LABORATORY AUDITS

The USACE HTRW CX conducts on-site audits and certifies laboratories on a regular basis. These independent on-site systems audits in conjunction with performance evaluation samples (performance audits) qualify laboratories to perform U.S. Army environmental analysis every 18 months.

These system audits include examining laboratory documentation of sample receiving, sample log-in, sample storage, COC procedures, sample preparation and analysis, instrument operating records, etc. Performance audits consist of sending performance evaluation samples to U.S. Army laboratories for on-going assessment of laboratory precision and accuracy. The analytical results of the analysis of performance evaluation samples are evaluated by USACE HTRW CX to ensure that laboratories maintain an acceptable performance.

Internal performance and system audits of laboratories will be conducted by the Laboratory QA Officer as directed in the laboratory QA plan. These system audits will include examination of laboratory documentation of sample receiving, sample log-in, sample storage, COC procedures, sample preparation and analysis, instrument operating records, etc. Internal performance audits are also conducted on a regular basis. Single-blind performance samples are prepared and submitted along with project samples to the laboratory for analysis. The Laboratory QA Officer will evaluate the analytical results of these single-blind performance samples to ensure that the laboratory maintains acceptable performance.

Additional audits of laboratories may be planned and budgeted within specific RVAAP task scopes. These project-specific laboratory performance review audits would be conducted by the Contractor at the direction of and in conjunction with the U.S. Army, when requested.

External audits may be conducted in conjunction with or at the direction of EPA Region 5 or the Ohio EPA.

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11.0 PREVENTIVE MAINTENANCE PROCEDURES

11.1 FIELD INSTRUMENTS AND EQUIPMENT

The field equipment for this project may include thermometers; pH meters; conductivity meters; turbidity meters; organic vapor detectors (FID or PID); combustible gas detectors capable of measuring the lower explosive limit, upper explosive limit, and/or oxygen levels; and geophysical testing equipment. Specific preventative maintenance procedures to be followed for field equipment are those recommended by the manufacturers. These procedures are included in the technical procedures governing the use of these instruments.

Field instruments will be checked and/or calibrated before they are shipped or carried to the field. Each field instrument will be checked daily against a traceable standard or reference with a known value to ensure that the instrument is in proper calibration. Instruments found to be out of calibration will be recalibrated before use in the field. If the instrument cannot be calibrated, it will be returned to the supplier or manufacturer for recalibration, and a back-up instrument will be used in its place. Calibration checks and calibrations will be documented on the Field Meter/Calibration Log Sheets in the M&TE Log Book. Any maintenance conducted on field equipment must be documented in the M&TE Log Book.

Critical spare parts such as tapes, papers, pH probes, electrodes, and batteries will be kept on site to minimize down time of malfunctioning instruments. Back-up instruments and equipment should be available on site or within 1-day shipment to avoid delays in the field schedules.

11.2 LABORATORY INSTRUMENTS

As part of their QA/QC Program, a routine preventive maintenance program will be conducted by all RVAAP investigation-associated laboratories to minimize the occurrence of instrument failure and other system malfunctions. All laboratory instruments will be maintained in accordance with manufacturers' specifications and the requirements of the specific method employed. This maintenance will be carried out on a regular, scheduled basis and will be documented in the laboratory instrument service log book for each instrument. Emergency repair or scheduled manufacturer's maintenance will be provided under a repair and maintenance contract with factory representatives.

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12.0 SPECIFIC ROUTINE PROCEDURES TO ASSESS DATA PRECISION, ACCURACY, AND COMPLETENESS

12.1 FIELD MEASUREMENTS DATA

Field data will be assessed by the site QC Officer. The site QC Officer will review the field results for compliance with the established QC criteria that are specified in the QAPP and FSAP. Accuracy of the field measurements will be assessed using daily instrument calibration, calibration check, and analysis of blanks. Precision will be assessed on the basis of reproducibility by multiple reading of a single sample.

Field data completeness will be calculated using Equations (1a) and (1b).

Sample Collection (1a):

$$\text{Completeness} = \frac{\text{Number of Sample Points Sampled}}{\text{Number of Sample Points Planned}} \times 100\% \qquad \textbf{(1a)}$$

Field Measurements (1b):

$$\text{Completeness} = \frac{\text{Number of Valid Field Measurements Made}}{\text{Number of Field Measurements Planned}} \times 100\% \qquad \textbf{(1b)}$$

12.2 LABORATORY DATA

Laboratory results will be assessed for compliance with required precision, accuracy, completeness, and sensitivity as follows.

12.2.1 Precision

The precision of the laboratory analytical process will be determined through evaluation of LCS analyses. The standard deviation of these measurements over time will provide confidence that implementation of the analytical protocols was consistent and acceptable. These measurements will establish the precision of the laboratory analytical process.

Investigative sample matrix precision will be assessed by comparing the analytical results between MS/MSD for organic analysis and laboratory duplicate analyses for inorganic analysis. The RPD will be calculated for each pair of duplicate analysis using Equation (2). This precision measurement will include variables associated with the analytical process, influences related to sample matrix interferences, and sample heterogeneity.

$$\text{RPD} = \frac{|S - D|}{\frac{(S + D)}{2}} \text{ x } 100 \qquad \textbf{(2)}$$

where

S = First sample value (original or MS value),
D = Second sample value (duplicate or MSD value).

12.2.2 Accuracy

The accuracy of the laboratory analytical measurement process will be determined by comparing the percent recovery for the LCS versus its documented true value.

Investigative sample accuracy will be assessed for compliance with the established QC criteria that are described in Section 3.0 of this QAPP using the analytical results of method blanks, reagent/preparation blank, MS/MSD samples, field blank, and bottle blanks. The percent recovery (%R) of MS samples will be calculated using Equation (3). This accuracy will include variables associated with the analytical process, influences related to sample matrix interferences, and sample heterogeneity.

$$\%R = \frac{A - B}{C} x\ 100 \tag{3}$$

where

A = The analyte concentration determined experimentally from the spiked sample,
B = The background level determined by a separate analysis of the unspiked sample,
C = The amount of the spike added.

12.2.3 Completeness

Data completeness of laboratory analyses will be assessed for compliance with the amount of data required for decision making. The completeness is calculated using Equation (4).

$$\text{Completeness} = \frac{\text{Number of Valid Laboratory Measurements Made}}{\text{Number of Laboratory Measurements Planned}} \times 100\% \tag{4}$$

12.2.4 Sensitivity

Achieving method detection limits depends on sample preparation techniques, instrumental sensitivity, and matrix effects. Therefore, it is important to determine actual MDLs through the procedures outlined in 40 *Code of Federal Regulations* (*CFR*) 136, Appendix B. MDLs should be established for each major matrix under investigation (i.e., water, soil) through multiple determinations, leading to a statistical evaluation of the MDL.

It is important to monitor instrument sensitivity through calibration blanks and low concentration standards to ensure consistent instrument performance. It is also critical to monitor the analytical method sensitivity through analysis of method blanks, calibration check samples, and LCSs, etc.

12.3 PROJECT COMPLETENESS

Project completeness will be determined by evaluating the planned versus actual data. Consideration will be given for project changes and alterations during implementation. All data not flagged as rejected by the review, verification, validation, or assessment processes will be considered valid. Overall, the project completeness will be assessed relative to media, analyte, and area of investigation.

12.4 REPRESENTATIVENESS/COMPARABILITY

Representativeness expresses the degree to which data accurately reflect the analyte or parameter of interest for the environmental media examined at the site. It is a qualitative term most concerned with the proper design of the sampling program. Factors that affect the representativeness of analytical data include appropriate sample population definitions, proper sample collection and preservation techniques, analytical holding times, use of standard analytical methods, and determination of matrix or analyte interferences. Sample collection, preservation, analytical holding time, analytical method application, and matrix interferences will be evaluated by reviewing project documentation and QC analyses.

Comparability, like representativeness, is a qualitative term relative to a project data set as an individual. Investigations at RVAAP will employ narrowly defined sampling methodologies, site audits/surveillances, 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 proper implementation and documentation of these standard practices, the project will establish confidence that data will be comparable to other project and programmatic information.

Additional input to determine representativeness and comparability may be gained through statistical evaluation of data populations, chemical charge balances, compound evaluations, or dual measurement comparisons (e.g., total versus dissolved water analysis, field versus fixed laboratory analyses, etc.).

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13.0 CORRECTIVE ACTIONS

Corrective actions may be required for two major types of problems: analytical/equipment problems and noncompliance with criteria. Analytical and equipment problems may occur during sampling, sample handling, sample preparation, laboratory instrumental analysis, and data review.

Noncompliance with specified criteria and analytical/equipment problems will be documented through a formal corrective action program at the time the problem is identified. The person identifying the problem is responsible for notifying the Contractor Project Manager and the U.S. Army Project Manager. When the problem is analytical in nature, information on these problems will be promptly communicated to the Contractor Analytical Laboratory Coordinator and the U.S. Army Chemist. Implementation of corrective action will be confirmed in writing.

Any nonconformance with the established QC procedures in the QAPP or FSAP will be identified and corrected in accordance with the QAPP. The Contractor Project Manager or his/her designee will issue a Nonconformance Report (NCR) for each nonconformance condition.

Corrective actions will be implemented and documented in the field record book. No staff member will initiate corrective action without prior communication of findings through the proper channels. If corrective actions are deemed insufficient, work may be stopped through a stop-work order issued by the Contractor Project Manager and the U.S. Army Project Manager.

13.1 SAMPLE COLLECTION/FIELD MEASUREMENTS

Technical staff and project personnel will be responsible for reporting all suspected technical and QA nonconformances or suspected deficiencies of any activity or issued document by reporting the situation to the Contractor Project Manager or his/her designee. The manager will be responsible for assessing the suspected problems in consultation with the Contractor Project QA Manager to make a decision based on the potential for the situation to impact the quality of the data. When it is determined that the situation warrants a reportable nonconformance and corrective action, then an NCR will be initiated by the manager.

The manager will be responsible for ensuring that corrective action for nonconformances are initiated by:

- evaluating all reported nonconformances,
- controlling additional work on nonconforming items,
- determining disposition or action to be taken,
- maintaining a log of nonconformances,
- reviewing NCRs and corrective actions taken, and
- ensuring that NCRs are included in the final site documentation project files.

If appropriate, the Contractor Project Manager will ensure that no additional work dependent on the nonconforming activity is performed until the corrective actions are completed.

Corrective action for field measurements may include:

- repeating the measurement to check the error;
- checking for all proper adjustments for ambient conditions such as temperature;
- checking the batteries;
- re-calibrating equipment;
- checking the calibration;
- modification of the analytical method including documentation and notification (i.e., standard additions);
- replacing the instrument or measurement devices; and
- stopping work (if necessary).

The Contractor Project Manager or his/her designee is responsible for all site activities. In this role, he/she may at times be required to adjust the site activities to accommodate site-specific needs. When it becomes necessary to modify a program, the responsible person notifies the Contractor Project Manager of the anticipated change and implements the necessary changes after obtaining the approval of the Contractor Program Manager and the U.S. Army Program Manager. All changes in the program will be documented on the field change request (FCR) that will be signed by the initiators and the Contractor Project Manager. The FCR for each document will be numbered serially as required. The FCR shall be attached to the file copy of the affected document. The Contractor Project Manager must approve the change in writing or verbally before field implementation. If unacceptable, the action taken during the period of deviation will be evaluated in order to determine the significance of any departure from established program practices and action taken.

The Contractor Project Manager for the site is responsible for the controlling, tracking, and implementation of the identified changes. Reports on all changes will be distributed to all affected parties, including the U.S. Army Project Manager. The U.S. Army will be notified whenever program changes in the field are made.

13.2 LABORATORY ANALYSES

Each RVAAP investigation laboratory QA plan provides systematic procedures to identify out-of-control situations and corrective actions. Corrective actions shall be implemented to resolve problems and restore malfunctioning analytical systems. Laboratory personnel have received QA training and are aware that corrective actions are necessary when:

- QC data are outside warning or control windows for precision and accuracy.
- Blanks contain target analytes above acceptable levels and must be investigated (see Table 3-3 and Section 9.2.2.2).
- Undesirable trends are detected in spike recoveries or RPD between duplicates.

- There are unusual changes in detection limits.

- Deficiencies are detected by internal audits, external audits, or from performance evaluation samples results.

- Inquiries concerning data quality are received.

Corrective action procedures are often handled at the bench level by the analyst, who reviews the preparation or extraction procedure for possible errors, checks the instrument calibration, spike and calibration mixes, instrument sensitivity, and so on. If the problem persists or cannot be identified, the matter is referred to the Laboratory Supervisor, Manager, and/or QA Department for further investigation. Once resolved, full documentation of the corrective action procedure is filed with project records and the QA Department, and the information is summarized within case narratives.

Corrective actions may include:

- re-analyzing the samples, if holding time criteria permit;

- evaluation of blank contaminant sources, elimination of these sources, and reanalysis;

- modification of the analytical method (i.e., standard additions) with appropriate notification and documentation;

- resampling and analyzing;

- evaluating and amending sampling procedures; or

- accepting data and acknowledging the level of uncertainty.

If resampling is deemed necessary due to laboratory problems, the Contractor Project Manager will identify the necessary cost recovery approach to implement the additional sampling effort.

The following corrective action procedures will be required:

- Problems noted during sample receipt will be documented in the appropriate laboratory Letter of Receipt. The Contractor and U.S. Army will be contacted immediately to determine problem resolution. All corrective actions will be thoroughly documented.

- When sample extraction/digestion or analytical holding times are not within method required specifications, the Contractor and U.S. Army will be notified immediately to determine problem resolution. All corrective actions will be thoroughly documented.

- All initial and continuing calibration sequences that do not meet method requirements will result in a review of the calibration. When appropriate, re-analysis of the standards or re-analysis of the affected samples back to the previous acceptable calibration check is warranted.

- All appropriate measures will be taken to prepare and clean up samples in an attempt to achieve the practical quantitation limits as stated. When difficulties arise in achieving these limits, the laboratory will notify the Contractor and the U.S. Army to determine problem resolution. All corrective actions will be thoroughly documented.

- Any dilutions impacting the practical quantitation limits will be documented in case narratives along with revised quantitation limits for those analytes affected. Analytes detected above the method detection limits, but below the practical quantitation limits, will be reported as estimated values.

- Failure of method-required QC to meet the requirements specified in this project QAPP shall result in review of all affected data. Resulting corrective actions may encompass those identified earlier. The Contractor and U.S. Army will be notified as soon as possible to discuss possible corrective actions, particularly when unusual or difficult sample matrices are encountered.

- When calculation and reporting errors are noted within any given data package, reports will be reissued with applicable corrections. Case narratives will clearly state the reasons for reissuance of reports.

14.0 QA REPORTS TO MANAGEMENT

All performance and system audits of laboratory and field operations will be reported directly to project management, program management, and USACE in accordance with Section 10.0 of this document. In addition to these audit reports, laboratory LORs, and analytical case narratives will be required from the laboratory.

The laboratory will provide status reports, as requested, to the Contractor point of contact for analytical activities. These status reports will contain the status of each sample received for the project and may be presented from established laboratory information system electronic databases or spreadsheets. Information to be provided may include:

- project name and contract number;
- laboratory sample number, project sample identification number, matrix type, and location of samples received during the monthly reporting period;
- description of and justification for alternative methods used or modifications of existing methods (any proposed changes to analytical methods in approved sampling and analysis plans requires written approval from the Contractor and U.S. Army);
- control charts for all LCS or MS analyses applicable to the project;
- a summary of all out-of-control events during the monthly reporting period, including references to documentation and corrective action reports;
- changes in laboratory QA personnel and other key technical staff, including resumes of new personnel;
- changes in business affiliation or status; and
- changes in the laboratory QA plan, SOPs, or applicable operating licenses.

All COC forms will be compared with samples received by the laboratory and a Letter of Receipt will be prepared and sent to the Contractor describing any differences in the COC forms and the sample labels or tags. All deviations will be identified on the receiving report, such as broken or otherwise damaged containers. This report will be forwarded to the Contractor within two days of sample receipt and will include a signed copy of the COC form, itemized project sample numbers, laboratory sample numbers, cooler temperature upon receipt, and itemization of analyses to be performed.

Case narrative statements will accompany analytical results from the laboratory. These reports, in conjunction with evaluation of field QC and any significant problems/corrective actions, will form the basis for the project data quality assessment. Final project reports will contain QA sections that summarize data quality information collected during the project.

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15.0 REFERENCES

ASTM (American Society of Testing and Materials) 1995. Annual Book of ASTM Standards, Volume 04.08, Soil and Rock.

EPA (United States Environmental Protection Agency) 1985. NEIC Policies and Procedures, EPA-300/9-78DDI-R, Revised June 1985.

EPA 1990. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Third Edition, Update 1, Revision 1.

EPA 1991a. Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans, QAMS-005180.

EPA 1991b. Model Quality Assurance Project Plan, Region V, Office of Superfund.

EPA 1994a. EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations, EPA QA/R-5, January.

EPA 1994b. US EPA Contract Laboratory Program National Functional Guidelines for Organic Data Review, EPA-540/R-94/012, February.

EPA 1994c. US EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, EPA-540/R-94/013, February.

EPA 1995. Methods for Chemical Analysis of Water and Wastes, EPA Manuals, 600/4-79-020, current edition.

EPA. US EPA Contract Laboratory Program Statement of Work for Inorganic Analysis, Document No. ILM03.0.

EPA. US EPA Contract Laboratory Program Statement of Work for Organic Analysis, Document No. OLM01.8.

USACE (United States Army Corps of Engineers) 1990. Chemical Data Quality Management for Hazardous Waste Remedial Activities, US ACE, ER 1110-1-263, October.

USACE 1994. Requirements for the Preparation of Sampling and Analysis Plans, EM 200-1-3, September.

USACE 1998. Shell for Analytical Chemistry Requirements, version 1.0, November.

USACE 2000. Environmental Data Assurance Guideline, USACE-Louisville, May.

USACE 2001. Chemistry Guideline, Rev 1.0. January

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FINAL

SITE-SPECIFIC SAFETY AND HEALTH PLAN
MILITARY MUNITIONS RESPONSE PROGRAM
MUNITIONS RESPONSE SITES
SITE INSPECTION

RAVENNA ARMY AMMUNITION PLANT, OHIO

Submitted To:

US ARMY CORPS OF ENGINEERS
OMAHA DISTRICT
CENWO-PM-HC
106 SOUTH 15th STREET
OMAHA, NE 68102-1618

Prepared By:

engineering-environmental, Management, Inc.
2751 Prosperity Avenue, Suite 200
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Contract Number DACA-63-03-D0009
Task Order No.: DK01

September 2007

SIGNATURE PAGE

engineering-environmental Management, Inc.

FINAL

SITE-SPECIFIC SAFETY AND HEALTH PLAN MILITARY MUNITIONS RESPONSE PROGRAM MUNITIONS RESPONSE SITES

RAVENNA ARMY AMMUNITION PLANT, OHIO

September 2007

Prepared by: ______________________________
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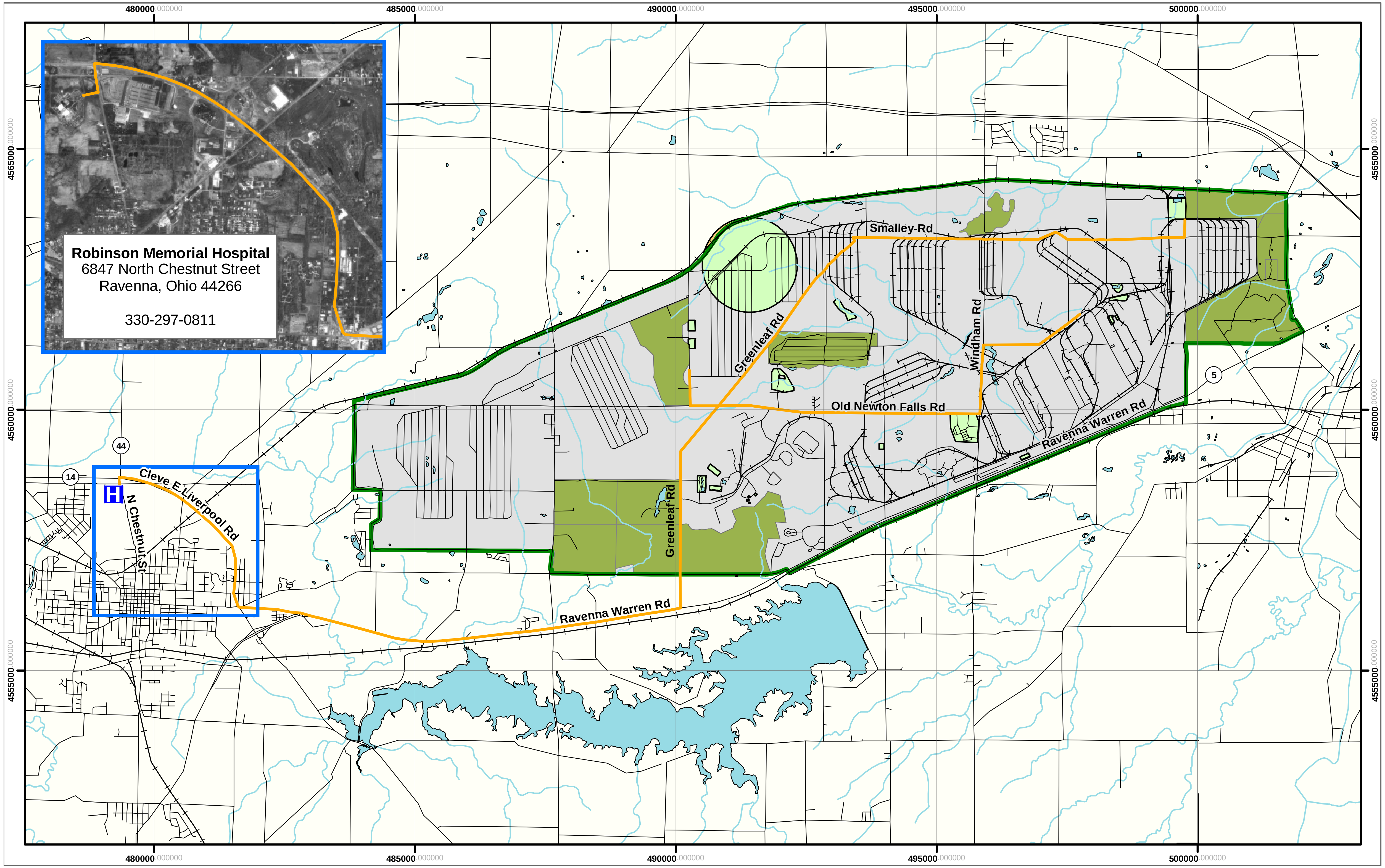
e^{2}M MMRP QA/QC Manager

Approved by: ______________________________
Phil Werner
e^{2}M Technical Project Manager

HOSPITAL LOCATION
Ravenna Army Ammunition Plant, OH



Robinson Memorial Hospital
6847 North Chestnut Street
Ravenna, Ohio 44266

330-297-0811

Figure 1

N
W E
S

- 🟩 Installation Boundary
- Railroad
- Road
- Stream
- Water
- Primary Route to Hospital

Area Status

- 🟩 Operational Range
- ⬜ Other than Operational Range
- 🟩 MRS, Closed
- 🟧 MRS, Transferred

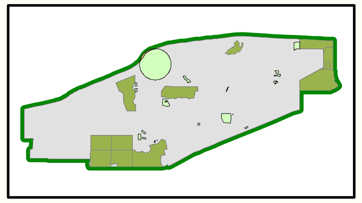
Data Source: e²M, Final Military Munitions Response Program Historical Records Review, Ravenna Army Ammunition Plant, Ohio, October 2006.

Projection:	**UTM Zone 17**
Datum :	**WGS 84**
Units:	**Meters**
Grid:	**5,000 Meter**
Contour Interval:	**500 Meter**

1:80,000

0 0.5 1 1.5 Miles
Kilometers
0 0.5 1 1.5 2 2.5

Reference Location Map
RVAAP



SITE SPECIFIC SAFETY AND HEALTH PLAN
RAVENNA ARMY AMMUNITION PLANT, OH

Source: Produced for the U.S. Army Corps of Engineers by engineering-environmental Management, Inc. (e²M)

Date: September 2007
Edition: Final

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EMERGENCY REFERENCE LIST

Medical Emergencies:

Hospital Name:
Robinson Memorial Hospital
6847 North Chestnut Street
Ravenna, OH 44266
330-297-0811 Distance: 11.8 Miles - **See Attached Map (Figure 1)**

Emergency Services

Ambulance / Fire Department / Police (Emergency):	**911**
Ravenna Police Department:	**330-296-6486**
Ravenna Fire Department:	**330-296-6422**
Post 1	**330-358-2017**
National Response Center:	**800-424-8802**

Project Contact List:

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ACRONYMS

°C	Degrees Celsius
°F	Degrees Fahrenheit
ACGIH	American Conference of Governmental Industrial Hygienists
AEDB-R	Army Environmental Database-Restoration
AOC	Area of Concern
ARDS	Adult Respiratory Distress Syndrome
BBP	Bloodborne Pathogens
Bgs	Below Ground Surface
BRAC	Base Realignment and Closure
CDC	Center for Disease Control
CENWO-PM	USACE, Omaha District Project Manager
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CIH	Certified Industrial Hygienist
CPR	Cardiopulmonary Resuscitation
CTC	Cost to Complete
CTT	Closed, Transferring, and Transferred
dBA	Decibel
DID	Data Item Description
DMM	Discarded Military Munitions
DQCR	Data Quality Control Report
E^2M	engineering-environmental Management, Inc
EM	USACE Safety and Health Requirements Manual
EOD	Explosive Ordnance Disposal
FPM	Field Project Manager
FSP	Field Sampling Plan
Ft	Feet
FWSHP	2001 SAIC Facility-Wide Safety and Health Plan
GPS	Global Positioning System
H&S	Health and Safety
HAZWOPER	Hazardous Waste Operations and Emergency Response
HBV	Hepatitis B Virus
HE	High Explosives
HIV	Human Immunodeficiency Virus
HRR	Historical Records Review
HTRW	Hazardous, Toxic and Radioactive Waste
IDLH	Immediately Dangerous to Life and Health
IRP	Installation Restoration Program
lb	Pound
MC	Munitions Constituents
MEC	Munitions and Explosives of Concern
mg/kg	Milligram/kilogram
mg/m^3	Milligram/cubic meter

ACRONYMS

Mm	Millimeter
MMRP	Military Munitions Response Program
MR	Munitions Response
MRS	Munitions Response Site
MRS-PP	Munitions Response Site Prioritization Protocol
MSDS	Material Safety Data Sheets
N/A	Not Applicable
NGB	National Guard Bureau
NIOSH	National Institute of Occupational Safety and Health
OE	Ordnance and Explosives
OEPA	Ohio Environmental Protection Agency
OHARNG	Ohio Army National Guard
OSHA	Occupational Safety and Health Administration
PEL	Permissible Exposure Limit
PM	Project Manager
PPE	Personal Protective Equipment
PRG	Preliminary Remediation Goal
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RCRA	Resource Conservation and Recovery Act
REL	Recommended Exposure Limit
RMSF	Rocky Mountain Spotted Fever
RTLS	Ravenna Training and Logistics Site
RVAAP	Ravenna Army Ammunition Plant
SI	Site Inspection
SOW	Scope of Work
SSC	Site Safety Coordinator
SSHP	Site-Specific Safety and Health Plan
SVOC	Semi-Volatile Organic Compound
TAL	Target Analyte List
TLV	Threshold Limit Value
TOW	Tube-Launched, Optically Tracked, Wire-Guided Missile
TPM	Technical Project Manager
TWA	Time Weighted Average
US	United States
USACE	United States Army Corps of Engineers
USAEC	United States Army Environmental Command
USEPA	United States Environmental Protection Agency
UXO	Unexploded Ordnance
VOC	Volatile Organic Compound
WP	Work Plan

1.0 INTRODUCTION

1.1 Project Description

engineering-environmental Management, Inc. (e²M) has prepared the following Site-specific Safety and Health Plan (SSHP) for the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Site Inspection (SI) of the other than operational ranges and other sites with known or suspected unexploded ordnance (UXO), discarded military munitions (DMM), or munitions constituents (MC) at Ravenna Army Ammunition Plant, Ohio (RVAAP). These Munitions Response Sites (MRSs) are being addressed under the Military Munitions Response Program (MMRP). e²M is under contract with the United States Army Corps of Engineers (USACE), Omaha District through Contract Number DACA63-03-D0009, Task Order Number DK01. This SSHP is presented as an appendix to and is considered part of the Work Plan (WP) for RVAAP.

The purpose of this SSHP is to ensure safe and healthy working conditions for all team members. The safety and health organization and procedures contained in this SSHP have been established based upon an analysis of the potential hazards. Personnel protection measures are based on the risks associated with these hazards. This SSHP provides detailed descriptions of safety and health procedures to be followed in the field during the performance of this project to minimize the risk of injury to project personnel. The content of this SSHP is based upon and tiers under the 2001 SAIC Facility-Wide Safety and Health Plan (the FWSHP) and may change or undergo revision based upon additional information made available to safety and health personnel or due to changes in the technical scope of work.

This SSHP has been prepared in conformance with: e²M's Health and Safety program, policies and procedures, as well as the guidelines established in the following documents: Data Item Description (DID) MR-005-06 Accident Prevention Plan; USACE Safety and Health Requirements Manual, EM 385-1-1; USACE Safety and Occupational Health Document Requirements for Hazardous, Toxic and Radioactive Waste (HTRW), ER 385-1-92; USACE OM 385-1-1; and applicable sections of 29 Code of Federal Regulations (CFR) 1910.120 and 29 CFR 1926.65.

This SSHP contains the requirements for protection of site personnel and the general public during work activities at RVAAP and will be implemented by the e²M Site Safety Coordinator (SSC) during site work. Specific tasks that will be conducted at RVAAP include:

- Mobilization/Demobilization,

- Surface soil sampling for primary MC (metals, propellants, and explosives), and
- Magnetometer and metal detector assisted UXO surveying.

No excavation activities will be performed; if any suspect munitions and explosives of concern (MEC) (which includes UXO, DMM, or MC at explosive concentrations) at the surface are discovered, the field work will be suspended. Any MEC discovery will be reported to Jerome Stolinski, USACE, Omaha District Project Manager (CENWO-PM); Irving Venger, Acting Facility Manager at RVAAP; Mary Ellen Maly, United States Army Environmental Command (USAEC) MMRP Project Manager; Ohio EPA; Major Ed Meade, OHARNG; and the e^{2}M Technical Project Manager (TPM) for determination of the appropriate action to be taken. In addition, if the MEC is determined to present a danger to human health or the environment, the UXO Technicians present on site (listed on Page iii) will determine procedures for eliminating the danger. e^{2}M will also follow the Ohio EPA MEC notification procedures developed for the installation. The field work will be resumed after the UXO Technicians determine continuation of field work is safe. The UXO Technicians will be present during all field work, providing anomaly avoidance for soil sampling activities and conducting magnetometer and metal detector assisted UXO surveys.

All e^{2}M employees, subcontractors, and visitors who may participate in activities at RVAAP are required to comply with this SSHP. Refusal or failure to comply with the SSHP or violation of any safety procedures by field personnel, including subcontractors, may result in their immediate removal from the site following consultation with the e^{2}M TPM.

This SSHP will be used with the understanding that site-specific conditions may dictate a change in the plan as written; however, any necessary deviations from the plan will be reported to the CENWO-PM and e^{2}M TPM, documented, and maintained as an attachment to this plan. Any changes made to this plan in the field will be documented on the e^{2}M Record of Change form (**Attachment A**).

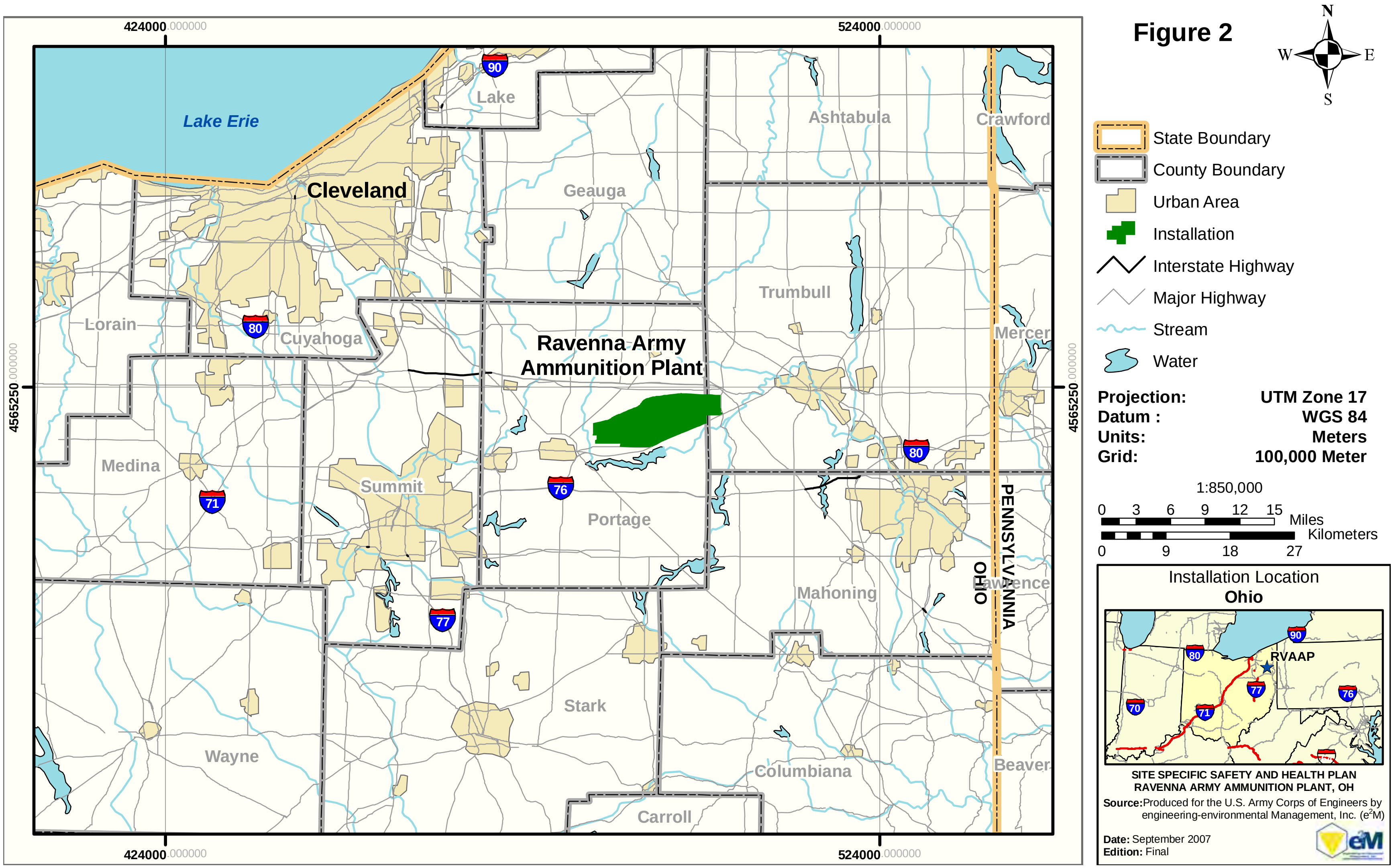
Field activities will be performed in accordance with the USACE, Omaha District project Scope of Work (SOW) dated June 2005, the WP, Field Sampling Plan (FSP), Quality Assurance Project Plan (QAPP), and this SSHP. The field work is planned for 1 through 12 October 2007.

1.2 Installation and MRSs

RVAAP (Federal Facility Identification number: OH213820736) is located in northeastern Ohio within Portage and Trumbull Counties, approximately 4.8 kilometers (3 miles) east northeast of the city of Ravenna and approximately 1.6 kilometers (1 mile) northwest of the city of Newton Falls (see **Figure 2**).

INSTALLATION LOCATION
Ravenna Army Ammunition Plant, OH

Figure 2



Projection: UTM Zone 17
Datum : WGS 84
Units: Meters
Grid: 100,000 Meter

1:850,000

0 3 6 9 12 15 Miles
Kilometers
0 9 18 27

SITE SPECIFIC SAFETY AND HEALTH PLAN
RAVENNA ARMY AMMUNITION PLANT, OH

Source: Produced for the U.S. Army Corps of Engineers by engineering-environmental Management, Inc. (e^2M)

Date: September 2007
Edition: Final

The Installation is approximately 17.7 kilometers (11 miles) long and 5.6 kilometers (3.5 miles) wide. It is 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. Several communities surround the Installation, including: Windham on the north; Garrettsville 9.6 kilometers (6 miles) to the northwest; Newton Falls 1.6 kilometers (1 mile) to the southeast; Charlestown to the southwest; and Wayland 4.8 kilometers (3 miles) to the south.

The Installation is currently known as the Ravenna Training and Logistics Site (RTLS). During operational years the entire 21,683-acre parcel was a government-owned, contractor-operated industrial facility. The RVAAP MMRP encompasses investigation and cleanup of historical activities over the entire 21,683 acres of the former RVAAP. As of February 2006, a total of 20,403 acres of the former 21,683 acre RVAAP were transferred to the National Guard Bureau and have been subsequently licensed to the Ohio Army National Guard (OHARNG) for use as a military training site. The current RVAAP consists of 1,280 acres scattered throughout the OHARNG RTLS. These 1,280 acres consist of former industrial facilities that are being remediated and managed by the Base Realignment and Closure (BRAC) Office.

A complete history of RVAAP including the investigation of each MRS, is in the **Historical Records Review (HRR) Report** under separate cover. Seventeen MRSs have been identified at RVAAP and field work will be conducted on all of them. The following is a list of the MRSs:

- Ramsdell Quarry Landfill (RVAAP-001-R-01)[1]
- Erie Burning Grounds (RVAAP-002-R-01)
- Demolition Area #2 (RVAAP-004-R-01)
- Load Line #1 (RVAAP-008-R-01)
- Load Line #12 (RVAAP-012-R-01)
- Fuze and Booster Quarry (RVAAP-016-R-01)
- Landfill North of Winklepeck (RVAAP-019-R-01)
- 40mm Firing Range (RVAAP-032-R-01)
- Firestone Test Facility (RVAAP-033-R-01)
- Sand Creek Dump (RVAAP-034-R-01)
- Building #F-15 and F-16 (RVAAP-046-R-01)

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[1] Army Environmental Database-Restoration (AEDB-R) Number

- Anchor Test Area (RVAAP-048-R-01)
- Atlas Scrap Yard (RVAAP-050-R-01)
- Block D Igloo (RVAAP-060-R-01)
- Block D Igloo – TD (RVAAP-061-R-01)
- Water Works #4 Dump (RVAAP-062-R-01)
- Group 8 MRS (formerly known as Area Between Buildings 846 and 849) (RVAAP-063-R-01)

2.0 SITE CHARACTERIZATION

Table 1 summarizes the information for each site as well as the sampling scheme for the field work proposed for each MRS. MC and MEC survey activities are being conducted for this SI at RVAAP. Results from each sample analysis will be compared to the United States Environmental Protection Agency (USEPA) Region 9 Residential Preliminary Remediation Goals (PRGs). Upon comparison of the results to the PRGs, the Cost to Complete (CTC) and site prioritization will be determined, followed by the completion of the Draft MRS-Prioritization Protocol (MRS-PP).

Table 1: Proposed Field Work

MRS	Proposed Activity	Physical Profile	Rationale
Ramsdell Quarry Landfill	Meandering path UXO survey of old OB/OD area in quarry (~3 acres) and line abreast magnetometer/metal detector assisted UXO survey of the open northeastern section of the southern quarry area (~2 acres). A meandering path UXO survey will be performed within the remaining area at the southern quarry area. The NE quadrant of the southern quarry is the suspected former OB/OD area; as such, a line abreast survey method will be used to provide 100 percent coverage. A meandering path survey will be used in the remaining area of the southern quarry to identify kick-out of munitions resulting from OB/OD operations. Collect four MI surface soil samples from distinct areas (1 per area) within the southern quarry area. MI samples will be analyzed for Target Analyte List (TAL) metals, propellants, and explosives. Soil samples will not be collected from the former OB/OD quarry area. Specific sampling locations will be determined in the field based on site conditions.	The sites are moderately accessible, but are formerly operational quarry areas and are expected to consist of moderate to difficult terrain. The MRS is currently undeveloped with a capped landfill.	The MRS was used for the thermal treatment of waste explosives and munitions. MEC is associated with treatment of explosives and munitions and MEC is anticipated at the MRS. Populate the MRS-PP and compare MC data to EPA Region 9 Residential PRGs for characterization.
Erie Burning Grounds	Meandering path magnetometer assisted UXO survey of all accessible dry areas (~14 acres). The presence of MEC in the flooded sections of EBG is expected. However, the investigation of the flooded area is outside the scope of this SI and will require additional characterization in future CERCLA investigations. Surface soil sampling will not be conducted.	The MRS is an easily accessible undeveloped wetland area.	The MRS was used for the thermal treatment of bulk propellants and explosives. MEC is associated with explosives treatment activities and is anticipated at the MRS. Existing data will be used to populate the MRS-PP.
Demolition Area #2	Meandering path magnetometer assisted UXO survey of Bomb Disposal Area, 2 Burial Sites, and Rocket Ridge, and associated surrounding areas (~ 6 - 12 acres). Perform meandering path magnetometer assisted survey along the current boundary of the MRS footprint. Surface soil sampling will not be conducted.	The MRS is currently undeveloped and is easily accessible. The terrain varies between gentle slopes and flat areas, to steep slopes adjacent to creek beds.	The MRS was used for demolition, burial, and testing of munitions. MEC is associated with munitions demolition activities and is anticipated at the MRS. Existing data will be used to populate the MRS-PP.

Table 1: Proposed Field Work (continued)

MRS	Proposed Activity	Physical Profile	Rationale
Load Line #1	Meandering path UXO survey within and surrounding the location where propellants are discovered, and including the area around Bldgs CB-13, CB-13B, CB-14, and the popping furnace (~ 1 acre). Collect one MI surface soil sample from area where propellant is found. MI sample will be analyzed for explosives, propellants, and TAL metals. Specific sampling locations will be determined in the field based on site conditions.	The MRS was formerly developed with industrial buildings and infrastructure. Floor slabs of two site buildings remain, but the site is easily accessible with relatively flat terrain.	The MRS was used for projectile loading. MEC is associated with loading activities and is anticipated at the MRS. Populate the MRS-PP and compare MC data to EPA Region 9 Residential PRGs for characterization.
Load Line #12	Line abreast magnetometer assisted UXO survey of the location and surrounding area where the buried inert 90mm projectiles were recovered (~ 1 acre). Surface soil sampling will not be conducted.	The MRS was formerly developed with industrial buildings and infrastructure. A small portion of the floor slab of one site building remains, but the site is easily accessible with relatively flat terrain.	The MRS was used for ammonium nitrate production and demilitarization of artillery rounds. MEC is associated with demilitarization activities and is anticipated at the MRS. Existing data will be used to populate the MRS-PP.
Fuze and Booster Quarry	Meandering path magnetometer/metal detector assisted UXO survey of the banks and surrounding area at all three ponds (~ 2 acres). Due to safety concerns (i.e., steep uneven terrain), a meandering path survey method has been selected. Surface soil sampling will not be conducted.	The MRS is currently undeveloped and consists of three elongated ponds. It was formerly a quarry used for open burning. The MRS is easily accessible with steep banks leading to the ponds.	The MRS was used for treatment/disposal of waste and munitions. MEC is associated with munitions treatment and disposal activities and is anticipated at the MRS. Existing data will be used to populate the MRS-PP.
Landfill North of Winklepeck	Meandering path magnetometer/metal detector assisted UXO survey of the hillside and creek bottom adjacent and downstream of the former landfill area (~ 15 acres). Collect one composite surface soil samples from the new MRS footprint. Surface soil sample will be analyzed for explosives, propellants, and TAL metals. Specific sampling locations will be determined in the field based on site conditions.	The MRS consists of the bluff hillside, the adjacent small stream, and the wetlands associated with the stream. The MRS is easily accessible, but with stream and hillside terrain.	The MRS was used for the disposal of refuse and explosives waste. MEC is associated with such disposal activities and is anticipated at the MRS. Populate the MRS-PP and compare MC data to EPA Region 9 Residential PRGs for characterization.
40mm Firing Range	Meandering path magnetometer/metal detector assisted UXO survey of down range target area, overshot area, and firing point (~ 3 acres). Due to safety concerns (i.e., steep uneven terrain at the impact area), a meandering path survey method has been selected. Surface soil sampling will not be conducted.	The MRS is an undeveloped open field that is easily accessible with relatively flat terrain. A few structures associated with the firing range remain onsite.	The MRS was used for test firing of munitions. MEC is associated with munitions test firing and is anticipated at the MRS. Existing data will be used to populate the MRS-PP.

Table 1: Proposed Field Work (continued)

MRS	Proposed Activity	Physical Profile	Rationale
Firestone Test Facility	Line abreast magnetometer/metal detector assisted UXO survey around former test chambers and at the open field in the eastern end of the MRS (~ 0.5 acres). Perform meandering path magnetometer/metal detector assisted UXO survey around the pond area (~ 0.5 acres). Magnetometers/metal detectors will only be used on bare ground surfaces. Line abreast methods were selected to provide 100 percent coverage of areas that have the greatest potential to contain MEC. A meandering path survey was selected for the area surrounding the pond since munitions were test underwater and are not expected outside this area. No water surveys of the pond will be conducted. Collect one MI surface soil sample from the open field in the eastern end of the Firestone Test Facility. MI sample to be analyzed for explosives, propellants, and TAL metals. Specific sampling locations will be determined in the field based on site conditions.	The former MRS buildings have been removed and the site currently consists only of an open field and a flat area surrounding the former testing pond. The terrain is relatively flat and easily accessible.	The MRS was used for the testing of missiles and shaped charges. MEC is associated with such testing activity and is anticipated at the MRS. Populate the MRS-PP and compare MC data to EPA Region 9 Residential PRGs for characterization.
Sand Creek Dump	Meandering path magnetometer assisted survey of all open areas and UXO survey within dump area (~ 1 acre). A meandering path survey method was selected to avoid vegetation and other obstructions located at the MRS. Surface soil sampling will not be conducted.	The MRS is an undeveloped stretch of land along the banks of Sand Creek. The MRS is split into two sections by a railroad track and the area is heavily overgrown with trees, shrubs, and ground cover. Accessibility and terrain at the MRS are expected to be relatively difficult.	The MRS was used for disposal of construction debris. MEC is potentially associated with this disposal activity and is anticipated at the MRS. Existing data will be used to populate the MRS-PP.
Building #F-15 and F-16	Meandering path magnetometer assisted UXO survey of the entire MRS (~ 12 acres). Surface soil sampling will not be conducted.	The MRS is an undeveloped parcel with two former building foundations and debris remaining. The former building areas are surrounded by forest. The terrain is relatively flat and easily accessible.	The MRS was used for the testing of explosives and propellants. MEC is potentially associated with explosives testing and is anticipated at the MRS. Existing data will be used to populate the MRS-PP.
Anchor Test Area	Line abreast magnetometer assisted UXO survey of entire MRS (~ 3 acres). Surface soil sampling will not be conducted.	The MRS is a heavily forested tract of land that is undeveloped and overgrown. The only site structures remaining are dirt mounds and a sand pit. The terrain is relatively flat (save mounds and pit) and moderately accessible.	The MRS was used for test firing of experimental munitions. Presence of MEC is not fully understood and is anticipated at the MRS. Existing data will be used to populate the MRS-PP.

Table 1: Proposed Field Work (continued)

MRS	Proposed Activity	Physical Profile	Rationale
Atlas Scrap Yard	Line abreast magnetometer assisted UXO survey in the south-central section of the MRS where MEC and munitions debris have reportedly been found and a meandering path magnetometer assisted UXO survey around debris piles that remain at the MRS (~ 12 acres). Surface soil sampling will not be conducted.	The MRS is an open area developed with a network of roads. The MRS is heavily overgrown with tall grasses, isolated stands of trees, and shrubs. The terrain is relatively flat and easily accessible.	The MRS was used for scrap storage. MEC has reportedly been observed and is anticipated at the MRS. Existing data will be used to populate the MRS-PP.
Block D Igloo	Meandering path magnetometer assisted UXO survey around former igloo and documented locations where debris were found. Area to be surveyed not to exceed 1 percent total of the MRS area (~ 6 acres). Collect one composite surface soil sample from former igloo area. Surface soil sample will be analyzed for explosives and TAL metals. Specific sampling locations will be determined in the field based on site conditions.	The MRS is the blast radius around the Block D Igloo and consists of land developed with igloo buildings surrounded by woodlands. The terrain varies between relatively flat areas to areas dissected by creeks.	The MRS was used for ordnance and explosives (OE) storage. MEC is associated with OE storage and is anticipated at the MRS. MC data is being collected solely to populate the MRS-PP.
Block D Igloo–TD	Meandering path magnetometer/metal detector assisted UXO survey of entire MRS (~ 19 acres) and of areas where debris historically was found (~ 10 acres) not included in the original MRS footprint. A meandering path survey method was selected to avoid vegetation and other obstructions located within the MRS. Collect two discrete surface soil samples from MRS. Surface soil sample will be analyzed for TAL metals and explosives. Specific sampling locations will be determined in the field based on site conditions.	The MRS is the off-Installation portion of the blast radius from the Block D Igloo explosion. The MRS consists of farm fields that are separated by stands of woodlands, railroad tracks, and a right-of-way. The terrain is relatively flat and easily accessible.	The MRS was the off-installation radius for the Block D Igloo explosion. MEC is associated with the explosion incident and is anticipated at the MRS. MC data is being collected solely to populate the MRS-PP.
Water Works #4	Line abreast magnetometer assisted UXO survey of open northeastern section of MRS and meandering path survey of remaining area (~ 6 acres). A line abreast survey method was selected for the open area to provide 100 percent coverage where munitions and munitions debris are known to exist. A meandering path survey method was selected for the remaining wooded area to avoid obstructions. Collect one composite surface soil sample from the MRS. Surface soil sample will be analyzed for explosives and TAL metals. Specific sampling locations will be determined in the field based on site conditions.	The MRS is an undeveloped wooded area with a small clearing where munitions have been observed. The terrain is relatively flat and moderately accessible.	The MRS was a disposal site. Presence of MEC is not fully understood but is anticipated at the disposal MRS. Populate the MRS-PP and compare MC data to EPA Region 9 Residential PRGs for characterization.

Table 1: Proposed Field Work (continued)

MRS	Proposed Activity	Physical Profile	Rationale
Group 8 MRS (formerly known as Area Between Buildings 846 and 849)	Line abreast magnetometer/metal detector assisted UXO survey of entire MRS (~ 3 acres). Collect five MI surface soil samples from distinct areas (1 per area) within the MRS footprint. Surface soil samples will be analyzed for explosives, propellants, and TAL metals. Specific sampling locations will be determined in the field based on site conditions.	The MRS is the undeveloped open area between buildings 846 and 849. The terrain is relatively flat and easily accessible.	The MRS was used for burning of construction debris and rubbish. MEC is potentially associated with burning activities and is anticipated at the MRS. Populate the MRS-PP and compare MC data to EPA Region 9 Residential PRGs for characterization.

EPA Region 9 Residential Preliminary Remediation Goals. (Note: A straight comparison to the EPA Region 9 Residential PRGs will be made for carcinogenic analytes, while non-carcinogenic analytes will be compared to 1/10 the residential PRG value.

3.0 HAZARD/RISK ANALYSIS OF FIELD ACTIVITIES

A hazard analysis was performed for the field work activities that will be conducted during the course of this project. Based upon review of the project scope, these include mobilization/demobilization, surface soil sampling for primary MC (metals, propellants, and explosives), and magnetometer and metal detector assisted UXO surveying. The potential hazards associated with the site activities include contact with MEC, chemical hazards, biological hazards, and injury from general physical hazards. The potential for encountering various physical hazards is dependent upon the work activity being performed and the location of that activity. Physical hazards such as cold stress, heat stress, noise, and/or hazard due to operation of a motor vehicle, use of heavy equipment, power tools, etc., may be present depending upon the work being performed. (**Note: No excavation activities are planned for RVAAP. Heavy equipment and power tools will not be used under the proposed field work activities.**) Biological hazards may vary depending on the time of year. **Table 2** below summarizes the potential hazards that may be encountered during the course of the field work.

Table 2: Potential Hazards

Chemical Hazards					
x	Munitions Constituents (MC)		Volatile Organic Compounds (VOCs)	x	Decontamination Fluids/Cleaners
x	Metals	x	Semi-Volatile Organic Compounds (SVOCs)		Unknown Compounds
	Chemical Agents	x	Fuels (gas, diesel, etc.)		Other
Physical Hazards					
x	MEC		Fire and Explosion		Heavy Equipment
x	Adverse Weather Conditions		Battery Charging and Storage	x	Hand Tools
x	Heat Stress	x	Slips, Trips, and Falls		Excavation Operations
x	Cold Stress	x	Manual Lifting		Hazardous Atmospheres
	Noise (>85 Decibels [dBA])		Electrical Hazards		Other
Biological Hazards					
x	Insect/Arachnid Bites & Stings	x	Wild Animals	x	Snake Bites
x	Plants	x	Bloodborne Pathogens (BBP)		Other

3.1 Chemical Hazards

3.1.1 Chemical Hazard Identification

Because of the wide range of potential MC and other chemical constituents that could be present at the MRSs, caution will be taken to provide the highest level of personnel protection for any type of MC.

Table 3 below summarizes the potential exposure pathway(s) for chemical constituents that may be encountered during the course of performing the field work.

Table 3: Summary of Chemical Exposure Pathways

Anticipated Physical State Of Contaminant(s):			
(x) Liquid	( ) Sludge	(x) Dust or Fiber	
(x) Solid	( ) Gas/Vapors	( ) Other	
Notes: MC are anticipated to be a fractional component of the soil or sediment matrix.			
Matrix:			
(x) Surface soils	( ) Surface water	( ) Free product	(x) Decon Fluids
( ) Soils at depth	( ) Ground water	( ) Sediment	
Notes: Surface soils may contain concentrations of MC. Groundwater, surface water, sediment, and subsurface soil may have been impacted but will not be encountered during the course of performing the field work.			
Potential Hazardous Properties:			
( ) Corrosive	(x) Flammable/Combust.	( ) Radioactive	
(x) Toxic	(x) Volatile	( ) Reactive	
( ) Compressed gas	(x) Carcinogenic	(x) Unknown	
( ) Asphyxiant	(x) Explosive	( ) Other	
Notes:			
Container/Storage System Information:			
( ) Tanks	( ) Landfills/Dumps	( ) Subsurface	
( ) Drums	( ) Impoundments	( ) Un-containerized	
( ) Pipes	( ) Size/capacity	(x) In-Service	
( ) Quantity	(x) Surface	( ) Other	
Notes:			
Condition Of Container/Storage System(s):			
(x) Sound/Undamaged	( ) Confirmed leaks	( ) N/A	
( ) Deteriorated/Unsound	( ) Suspected leaks	( ) Unknown	
( ) Other			
Notes:			

Table 3: Summary of Chemical Exposure Pathways, continued

Chemicals Used or Identified:			
() Acids	(x) Metals	( ) Petroleum	( ) PCBs
( ) Caustics	( ) Pesticides	( ) Paints	( ) N/A
( ) Halogen	(x) Explosive Residues	() Solvents	
Notes: The presence of metals and explosives is possible.			
Oils/Fuels:			
( ) Fuel Oil	( ) AVGAS	(x) Gasoline	
( ) Waste Oil	( ) MOGAS	(x) Diesel	
(x) Hydraulic Oil	( ) Jet Fuel	( ) N/A	
Notes: Gasoline, diesel, and hydraulic oil are contained within vehicles that are anticipated to be brought on site.			
Sludges:			
( ) Metal sludge	( ) Oily sludge	( ) Septic sludge	
( ) Other	(x) N/A		
Notes:			
Solids:			
(x) Asbestos	( ) Sandblast grit	(x) Landfill refuse (anomalies)	
( ) Silica Sand	( ) N/A		
Notes:			

Table 4 below provides risk-based exposure limits for suspected potential chemicals of concern that may be encountered at the MRSs, as well as routes of exposure and the resultant symptoms.

Table 4: Potential Chemical Hazards of Concern

Contaminant	OSHA PEL^1	NIOSH REL^2	ACGIH TLV^3	IDLH^4	Route of Exposure	Symptoms of Exposure
Chromium	1 mg/m^3	0.5 mg/m^3	0.5 mg/m^3	250 mg/m^3	Inhalation, ingestion, Skin contact	Eye irritation, sensitization
Lead	0.050 mg/m^3	0.100 mg/m^3	0.15 mg/m^3	100 mg/m^3	Inhalation, ingestion, Skin contact	Symptoms include nausea, fatigue, headache, and fine tremors of the hand. Prolonged exposure can affect the brain, kidneys and liver and has been shown to cause anemia, hearing loss and high blood pressure.

Table 4: Potential Chemical Hazards of Concern (continued)

Contaminant	OSHA PEL[1]	NIOSH REL[2]	ACGIH TLV[3]	IDLH[4]	Route of Exposure	Symptoms of Exposure
Mercury	0.1 mg/m^3	0.1 mg/m^3	0.025 mg/m	10 mg/m^3	Inhalation, ingestion, Skin contact	Irritation of eyes and skin; coughing, GI disturbance, anorexia
Arsenic	0.010 mg/m^3	0.002 mg/m^3	0.01 mg/m^3	5 mg/m^3	Inhalation, ingestion, skin contact	Dermatitis, nasal tissue damage, upset stomach, possible human carcinogen
Asbestos	100,000 fibers/ m^3	100,000 fibers/ m^3	N/A	N/A	Inhalation, ingestion, skin and eye contact	Dyspnea (breathing difficulty), restricted pulmonary function, finger clubbing, irritated eyes
Cadmium	0.005 mg/m^3	N/A	0.01 mg/m^3	9 mg/m^3	Inhalation, ingestion, skin contact	Difficulty breathing, cough, tightness of chest, pain beneath sternum, headache, chills, aches, vomiting
Selenium	0.2 mg/m^3	0.2 mg/m^3	0.2 mg/m^3	1 mg/m^3	Inhalation, ingestion, skin contact	Irritation of eyes, skin, and throat; liver and/or spleen damage
DNT (dinitrotoluene)	1.5 mg/m^3	1.5 mg/m^3	0.2 mg/m^3	50 mg/m^3	Inhalation, ingestion, skin contact	Possible human carcinogen, cyanosis, reproductive defects, anorexia
TNT (2,4,6-trinitrotoluene)	1.5 mg/m^3	0.5 mg/m^3	0.1 mg/m^3	500 mg/m^3	Inhalation, ingestion, skin contact	Bitter taste, burning eyes, discolored skin and hari, sneezing, sore thoat, skin irritation, possible human carcinogen, targets liver, cataracts
RDX (Hexahydro-1,3,5-trinitro-1,3,5-triazine)	0.5 mg/m^3	1.5 mg/m^3	1.5 mg/m^3	N/A	Inhalation, ingestion, skin contact	Bitter taste, burning eyes, discolored skin and eyes, seizures, muscle twitching, vomiting, possible human carcinogen, prostate problems, nervous system problems
Propellant (containing nitrocellulose and potentially nitroglycerin)	2 mg/m^3	0.1 mg/m^3	0.5 mg/m^3	75 mg/m^3	Inhalation, ingestion, skin contact	Faintness, rapid pulse, dizziness, muscle twitch, damage to blood cells, vomiting
Nitroguanidine	N/A	N/A	N/A	N/A	Inhalation, ingestion, skin contact	N/A

(1) Occupational Safety and Health Administration Permissible Exposure Limit
(2) National Institute of Occupational Safety and Health Recommended Exposure Level
(3) American Conference of Governmental Industrial Hygienists Threshold Limit Value
(4) Immediately Dangerous to Life and Health
mg/m^3 = milligrams per cubic meter.
ppm = parts per million
N/A= not available

3.1.2 Chemical Hazard Mitigation/Prevention

On site, the primary entry routes for the potential chemical contaminants include inhalation of dust, absorption of chemicals through skin or eye contact, and ingestion of airborne dusts or chemicals through hand-to-mouth contact. To minimize these exposure pathways, all field personnel will be required to don personal protective equipment (PPE) including gloves, safety glasses, and sleeved shirts when the potential for incidental contact with contaminated media is anticipated. Smoking, drinking, and eating will not be allowed within the work area. Due to the types of potential contaminants or the proposed controls being implemented during the field work, air-borne contaminants are not anticipated to be encountered.

3.2 Physical Hazards

3.2.1 Munitions and Explosives of Concern (MEC)

Per the 2001 FWSHP, work that may involve exposure to ordnance will be conducted in compliance with LTR 385-98-1, June 1998, "Explosives Safety Policy for Real Property Containing Conventional Ordnance and Explosives." MEC activities planned for this SI include magnetometer and metal detector assisted UXO surveys. All MRSs included in the SI field work have the potential for MEC on-site. The following MEC physical hazard descriptions are included to provide guidance for the safe avoidance of MEC at the RVAAP MRSs.

3.2.1.1 MEC Hazard Identification

All on-site workers will be trained in the recognition and avoidance of potential ordnance.

3.2.1.2 MEC Hazard Mitigation/Prevention

Only UXO trained personnel are authorized to investigate and handle MEC. The hazards presented by MEC have the potential to kill or cause serious injury if improperly handled. Operations involving MEC are inherently dangerous and require strict adherence to safe practices, safety procedures, and positive control of personnel. Recognition and avoidance training of MEC will be provided to all on-site personnel. Due to the variety of MEC items that may be encountered, all site workers must be vigilant in identifying hazards at the work site and bringing them to the attention of supervisory personnel. As additional hazards are identified, appropriate protective measures will be implemented.

If any suspect MEC are discovered during the UXO surveys, the field work will be suspended. Any MEC discovery will be reported to Jerome Stolinski, USACE, CENWO-PM; Irving Venger, Acting Facility Manager at RVAAP; Mary Ellen Maly, USAEC MMRP Project Manager; and the e^{2}M TPM for determination of the appropriate action to be taken. Contact information for these personnel can be found on **Page iii**. e^{2}M will also follow the Ohio EPA MEC notification procedures developed for the installation.

If any MEC is determined to present a danger to human health or the environment, the UXO Technicians present on site (listed on **Page iii**) will determine procedures for eliminating the danger.

The field work will be resumed after the UXO Technicians determine continuation of field work is safe. A Schonstedt handheld magnetic gradiometer (or similar device) will be used to assist in locating ferrous metallic items on the ground surface. The UXO Technicians will visually sweep the area to locate metallic objects that may be metallic debris, MEC or munitions debris.

When a suspect MEC item is located, the item will be marked with a pin flag and examined by a UXO Technician to determine its identity and condition. The position of the suspect MEC item will be determined using the Global Positioning System (GPS) navigation system. Digital photos of all live MEC and significant inert MEC or munitions debris will be taken. All discovered MEC will be reported to Jerome Stolinski, USACE, CENWO-PM; Irving Venger, Acting Facility Manager at RVAAP; Mary Ellen Maly, USAEC MMRP Project Manager; and the e^{2}M TPM. Contact information for these personnel can be found on **Page iii**. e^{2}M will also follow the Ohio EPA MEC notification procedures developed for the installation. If the MEC is determined to present a danger to human health or the environment, the UXO Technicians present on site will determine procedures for eliminating the danger. Only visual inspection and limited identification of potentially hazardous surface items will be conducted by project personnel.

Soil samples will be collected if the UXO Technicians dictate site conditions to be safe for sampling. In the instance it is not safe, samples will be collected at the next best location.

3.2.1.3 Encountering MEC

Ordnance/Explosives Site work practices include:

(1) Do not touch or move any ordnance items regardless of the marking or apparent condition.
(2) Do not visit an ordnance site if an electrical storm is occurring or approaching. If a storm approaches during a site visit leave the site immediately and seek shelter.
(3) Do not use radio or cellular phones in the vicinity of suspect ordnance items.
(4) Do not walk across an area where the ground cannot be seen. If dead vegetation or animals are observed; leave the area immediately due to the potential contamination of chemical agent.
(5) Do not drive vehicles into a suspected MEC area; use clearly marked lanes.
(6) Do not carry matches, cigarettes, lighters or other flame producing devices into an MEC site.
(7) Do not rely on color code for positive identification of ordnance items or their contents.
(8) If necessary, approach ordnance items from the side, avoid approaching the front and rear areas.
(9) Always assume ordnance items contain a live charge until it can be determined otherwise.

Specific actions to be taken upon locating ordnance include:

(1) Do not be misled by markings on the ordnance item stating practice bomb, a dummy or inert. Even practice bombs have explosive charges that are used to mark/spot the point of impact; or the item could be mismarked.

(2) Do not roll the item over or scrape the item to identify the markings.

(3) The location of any ordnance items found during site investigation should be clearly marked so it can be easily located and avoided.

(4) If a UXO item is discovered on private property, the property owner or individual granting rights of entry will be notified of the hazard and advised to call the local emergency response authority. The individual will also be informed that if he/she does not call the local response authority within 1 hour, the individual who identified the UXO item will notify the local emergency response authority. The individual who identified the item or his/her designee will generally remain in the area until the local response authority arrives, unless specifically indicated by the appropriate response authority that the individual may leave the area.

(5) If a UXO item is discovered on the Installation, the Installation point of contact will be notified of the hazard and requested to notify Explosive Ordnance Disposal (EOD) through the installation's channels. If the installation/EOD decides to respond, the individual who identified the item or his/her designee will mark the location and provide accurate location information to the installation/EOD unit and will remain in the area unless the installation/EOD unit requests otherwise.

3.2.2 Adverse Weather Conditions

3.2.2.1 Adverse Weather Hazard Identification

In the event of adverse weather conditions, the SSC or designee will determine if work can continue without potentially risking the safety of all field workers. Some of the items considered prior to determining if work should continue include:

- Extreme temperatures (> 100 degrees Fahrenheit [°F] or < 0°F);
- Treacherous weather-related working conditions such as hail, rain and high winds (> 30 miles per hour);
- Visible lightning within 10 miles;
- Limited visibility (fog); and
- High winds and tornadoes.

3.2.2.2 Adverse Weather Hazard Mitigation/Prevention

The SSC or designee is responsible for deciding if the contractor/subcontractor field activities should cease due to severe weather. In the event that work is suspended, the SSC will notify field personnel via radios or cellular telephones and inform them of suspended operations. The individuals in possession of the radio or cellular phone will be responsible for relaying the work suspension orders to other personnel assigned to their areas. All personnel will render the work place temporarily closed and proceed to the designated assembly areas for further instruction. Site activities will be limited to daylight hours and acceptable weather conditions.

3.2.3 Cold Stress

3.2.3.1 Cold Stress Hazard Identification

Exposure to low temperatures presents a risk to employee safety and health through the direct effect of the low temperature on the body and collateral effects such as slipping on ice, decreased dexterity and reduced dependability of equipment. Work conducted in the winter months can become a hazard for field personnel due to cold exposure. All personnel must exercise increased care when working in cold environments to prevent accidents that may result from the cold. The effects of cold exposure include frostbite and hypothermia. Wind increases the impact of cold on a person's body. Systemic cold exposure is referred to as hypothermia. Recognition of the symptoms of cold-related illnesses will be discussed during the health and safety briefing conducted prior to the onset of Site activities. Local cold exposure is generally labeled frostbite.

Hypothermia is a life-threatening condition in which the core body temperature falls below 95°F. Hypothermia can occur at temperatures above freezing particularly when the skin or clothing becomes wet. During exposure to cold, maximum shivering occurs when the core temperature falls to approach 95°F. As hypothermia progresses, depression of the central nervous system becomes increasingly more severe.

Frostbite is both the general and medical term given to areas of cold injury. Unlike hypothermia, frostbite rarely occurs unless environmental temperatures are less than freezing and usually less than 20°F. Frostbite injuries occur most commonly on the distal parts of the body (nose, earlobes, hands, and feet) that are subject to intense vasoconstriction. The three general categories of frostbite are:

- *Frostnip* - A whitened area of the skin that is slightly burning or painful.
- *Superficial frostbite* - Waxy, white skin with a firm sensation but with some resiliency. Symptomatically feels “warm” to the victim with a notable cessation of pain.

- *Deep frostbite* - Tissue damage deeper than the skin and at times, down to the bone. The skin is cold, numb and hard.

3.2.3.2 Cold Stress Hazard Mitigation/Prevention

In preventing cold stress, the SSC or designee must consider factors relating both to the worker and the environment. Training, medical screening, establishment of administrative controls, selecting proper work clothing and wind-chill monitoring all contribute to the prevention of hypothermia and frostbite. The following prevention methods should be implemented on-site to reduce cold stress exposure:

- Recognizing the early signs and symptoms of cold stress can help prevent serious injury. Thus, workers will be trained to recognize the symptoms of hypothermia and frostbite and have appropriate first-aid instruction. When the air temperature is below 50°F, the SSC or designee will inform workers of the proper clothing requirements and any work practices that are in effect to reduce cold exposure;
- Cold injury and illness recognition and prevention measures will be emphasized during daily safety briefings when the potential for cold injuries and illnesses exists;
- Work will cease under unusually hazardous conditions;
- A heated area will be available;
- Daily temperatures will be monitored;
- Warm beverages will be available; and
- Workers will be encouraged to layer clothing when air temperature is below 50°F. Clothing that has a high insulation value will be worn under protective garments. Insulated gloves will be worn when the wind chill index is below 32°F. Insulating dry clothes will be made available.

3.2.4 Heat Stress

3.2.4.1 Heat Stress Hazard Identification

There is a potential for heat stress and related injuries during work activities. Specific potential hazards include:

- Heat rash,
- Fainting,
- Heat cramps,
- Heat Exhaustion, and
- Heat Stroke.

Heat rash occurs because sweat is not evaporating, causing irritation and vesicular inflammation. Standing erect and immobile in the heat allows blood to pool in the lower extremities. As a result, blood does not return to the heart to be pumped back to the brain and fainting may occur. Heat cramps are painful spasms of the muscles due to excessive water and salt loss from profuse sweating. Similarly, heat exhaustion occurs due to the large fluid and salt loss from profuse sweating. Heat exhaustion is characterized by clammy and moist skin, nausea, dizziness, headaches and low blood pressure.

Heat stroke occurs when the body's temperature regulatory system has failed. Skin is hot, dry, red, and spotted. The effected person may be mentally confused, delirious and convulsions may occur. A person exhibiting signs of heat stroke should be immediately removed from the work area and placed in a shaded area. The injured person should be soaked with water and fanned to promote evaporation. Medical attention must be obtained immediately.

EARLY RECOGNITION AND TREATMENT OF HEAT STROKE ARE THE ONLY MEANS OF PREVENTING BRAIN DAMAGE OR DEATH.

Early symptoms of heat stress related problems include the following:

- Decline in task performance,
- Lack of coordination,
- Decline in alertness,
- Unsteady walk,
- Excessive fatigue,
- Muscle cramps, and
- Dizziness.

3.2.4.2 Heat Stress Hazard Mitigation/Prevention

Proper training and preventive measures will aid in averting loss of worker productivity and serious illness. Heat stress prevention is particularly important because once a person suffers from heat stroke or heat exhaustion, that person may be predisposed to additional heat related illnesses. To avoid heat stress, the following steps will be implemented:

- Adjust work schedules.
    - ➢ Modify work/rest schedules according to monitoring requirements.
    - ➢ Mandate work slowdowns as needed.
    - ➢ Perform work during cooler hours of the day, if possible.
- Perform physiological monitoring.
- Provide shelter (air-conditioned, if possible) or shaded areas to protect personnel during rest periods.

- Maintain worker's body fluids at normal levels. This is necessary to ensure the cardiovascular system functions adequately. Daily fluid intake must approximately equal the amount of water lost in sweat; for example; 8 fluid ounces (0.23 liters) of water must be ingested for approximately every 8 ounces (0.23 kilogram) of weight loss. The normal thirst mechanism is not sensitive enough to ensure enough water will be consumed to replace lost sweat. When heavy sweating occurs, encourage the worker to drink more. The following strategies may be useful:
    - ➢ Maintain water temperature at 50° to 60°F (10°-16.6 °Celsius (°C)).
    - ➢ Provide small disposable cups that hold about 4 ounces (0.1 liter).
    - ➢ Have workers drink 16 ounces (0.5 liters) of fluid, preferably water or diluted drinks, before beginning work.
    - ➢ Urge workers to drink a cup or two every 15 to 20 minutes, or at each monitoring break. A total of 1 to 1.6 gallons (4 to 6 liters) of fluid per day are recommended, but more may be necessary to maintain body weight.
- Train workers to recognize the symptoms of heat-related illnesses.
- Rotate personnel and alternate job functions.

3.2.5 Noise

3.2.5.1 Noise Hazard Identification

Noise is a potential hazard associated with the operation of heavy equipment, detonations, power tools, pumps and generators. Excessive noise presents two potential problems at the site. First, it hinders communication between workers. Second, excessive noise exposures, both continuous and impact noise, can have adverse effects on a person's hearing. These adverse effects include both temporary and permanent hearing damage.

Note: No heavy equipment, power tool, pumps, or generators will be used during the field work, and noise is not anticipated to be a hazard; however, ear protection in the form of disposable ear plugs will be available for use if needed.

3.2.6 Fire and Explosion

3.2.6.1 Fire and Explosion Hazard Identification

In cases involving MEC, unintended movement can cause accidental ignition and explosion. It is imperative to positively identify MEC by type and function prior to any movement. MEC should also be isolated from ignition sources to reduce the possibility of an explosion or fire. Although fires and explosions may arise spontaneously, they are more commonly the result of carelessness, such as moving drums, mixing/bulking of site chemicals and during refueling of heavy or hand held equipment. Some potential causes of explosions and fires include:

- Mixing of incompatible chemicals, causing reactions that spontaneously ignite due to the production of both flammable vapors and heat,
- Ignition of explosive or flammable chemical gas/ vapors by external ignition sources,
- Ignition of materials due to oxygen enrichment,
- Agitation of shock or friction-sensitive compounds, and
- Sudden release of materials under pressure.

Note: Suspected MEC will not be moved and mixing of chemicals will not take place. The only proposed fuel on the MRSs will be fuel contained in vehicles.

3.2.6.2 Fire and Explosion Hazard Mitigation/Prevention

<u>Immediate Action</u>

Upon detecting a fire, employees will determine whether the fire is small enough to readily extinguish with immediately available portable extinguishers or water, or if other fire-fighting methods are necessary. Non-essential personnel will be directed away from the area of the fire. If it is judged that a fire is small enough to fight with available extinguishing media, employees will attempt to extinguish the fire provided that:

- They are able to approach the fire from the upwind side, or opposite to the direction of the fire's progress;
- The correct extinguisher for the potential fire is readily available; and
- No known complicating factors are present, such as the likelihood of rapid spread, imminent risk of explosion or gross contamination.

Personnel leaving a fire area will account for all employees in that work area as soon as possible, and report to the SSC or designee performing a head count. At this point, the SSC or designee will contact the appropriate authorities.

In the case of an explosion, all personnel will immediately leave the area and assemble at the pre-designated assembly area. At this point, a head count of all site personnel will be conducted and the appropriate authorities notified.

Notification

The SSC, e²M TPM, Ohio EPA, and CENWO-PM will be notified as soon as possible of the location, size, and nature of the fire/explosion. As conditions dictate, the SSC or the TPM will declare an emergency, initiate remedial procedures and request assistance from Post 1, who will then contact emergency services. Outside personnel responding to the fire/explosion may seek assistance from the SSC with regard to the routing of equipment within the incident site to the most favorable and safe position while minimizing and/or avoiding exposure to any site contaminants.

Rescue

If an employee(s) is unable to evacuate themselves from a fire/explosion area for any reason, their rescue will be the first priority of responders. The SSC will determine whether on-site resources are sufficient to proceed or if rescue must be delayed until the Fire Department responders arrive.

Fire Protection

To ensure adequate fire protection, the SSC will inspect the Sites to ensure all flammable and combustible materials are being safely stored in appropriately configured storage areas and containers. The SSC will also ensure no flammable/combustible materials are stored near any sources of ignition and that sources of ignition are removed a safe distance from storage areas. If needed, storage areas will be segregated from the remainder of the Sites through the use of flagging.

Note: The use of storage areas and containers are not anticipated.

Explosions and fires not only pose the obvious hazards of intense heat, open flames, smoke inhalation and flying objects, but may also cause the release of toxic chemicals into the environment. Such releases can threaten both personnel on-site and members of the general public living or working nearby. Site personnel involved with potentially flammable material or operations will follow the guidelines listed in EM 385-1-1, Section 9, to prevent fires and explosions. Because the storage or use of combustible, flammable, or explosive materials is not included in the project scope, the requirements of EM 385-1-1, Section 9, are not summarized in this SSHP.

Decontamination

At the conclusion of fire fighting activities, the SSC will:

- Determine, to the extent practical, the nature of the contaminants encountered during the incident.

- SSC will provide information to the emergency responders on the nature of potential contaminants present so that appropriate decontamination measures can be taken.
- Equipment not easily decontaminated will be labeled and isolated for further action, such as determining specific contaminants by wipe sampling or awaiting the delivery of specific decontamination media and supplies.

Fire Extinguisher Information

The four classes of fire, along with their constituents and respective proper extinguishing agents, are as follows:

Table 5: Fire Classes

Class	Constituents	Proper Extinguishing Agents
Class A	Wood, cloth, paper, rubber, many plastics, and ordinary combustible materials.	Water or ABC Dry Chemical
Class B	Flammable liquids, gases, and greases.	ABC Dry Chemical
Class C	Energized electrical equipment.	ABC Dry Chemical
Class D	Combustible metals such as magnesium, titanium, sodium, and potassium.	Metal-X Dry Chemical (not anticipated and not onsite.)

At least one portable fire extinguisher having a rating of not less than 2A:20:B-C will be located at each MRS in a vehicle.

3.2.7 Battery Charging and Storage

3.2.7.1 Battery Hazard Identification

Lead-acid batteries (12 volt wet cell) are used in cars, trucks, motorcycles, boats, and other motorized equipment. Each battery consists of a polypropylene plastic case containing lead plates immersed in a sulfuric acid electrolyte.

Two primary hazards associated with lead-acid batteries are the formation of hydrogen gas when charging the battery and the sulfuric acid contained in the battery fluid. Failure to follow safe procedures for the charging and storage of batteries can be extremely hazardous.

Lead-acid batteries contain sulfuric acid, a corrosive that can burn and destroy the skin or other body tissues upon contact. Potential exposure may occur when pouring sulfuric acid or handling a leaking battery. Additionally, the eyes, respiratory tract or digestive system can be severely harmed if a worker gets a splash in the eyes, inhales sulfuric acid mist or accidentally ingests sulfuric acid.

Note: The only lead-acid batteries to be used during the field work are located on the vehicles. Charging of these batteries will not take place during the field work.

3.2.8 Slips, Trips and Falls

3.2.8.1 Slips, Trips and Falls Hazard Identification

Working in and around the MRSs may pose slip, trip, and fall hazards due to slippery surfaces that are wet from rain, snow, or water. Slips, trips, and falls are a leading cause of injuries in field-related work settings, therefore, a concerted effort is needed to identify, control, and eliminate these hazards and ensure the measures needed to reduce or eliminate the possibility of injury are communicated to all Site personnel. Potential adverse health effects include falling to the ground and becoming injured or twisting an ankle.

3.2.8.2 Slips, Trips, and Falls Hazard Mitigation/Prevention

Site personnel will be instructed to look for potential safety hazards and immediately inform the SSC or designee about any new hazards. If the hazard cannot be immediately removed, action must be taken to warn site workers about the hazard.

3.2.9 Manual Lifting

Failure to follow proper lifting techniques can result in back injuries and strains. Back injuries are a serious concern as they are the most common workplace injury, often resulting in lost or restricted work time and long treatment and recovery periods.

Note: Manual lifting of heavy objects is not expected to occur during the course of the field work.

3.2.10 Electrical Hazards

Overhead power lines and downed electrical wires all pose a danger of shock or electrocution if workers contact or sever them during site operations. Electrical equipment and extension cords used on-site may also pose a hazard to workers. Potential adverse effects of electrical hazards include burns and electrocution, which could result in death. Care will be taken to avoid all power lines. Per the FWSHP, 29 CFR 1910 Subpart S and EM 385-1-1 Section 11 will be used as guidance for the conduct of work involving electrical hazards:

> All portable electrical equipment will be double insulated or grounded and connected through a ground fault circuit interrupter. Conductive materials (drill rigs) will be kept clear of energized power lines. The following minimum distances will be observed: 0 to 50 kV (10 feet); 51 to 100 kV (12 feet); 101 to 200 kV (15 feet); 201 to 300 kV (20 feet); 301 to 500 kV (25 feet); 501 to 750 kV (35 feet); 750 to 1000 kV (45 feet).

Note: No intrusive activities other than the surface sampling will be performed during the course of the field work. Therefore, site personnel should not come into contact with buried electrical utilities; however, personnel should be aware of overhead power lines.

3.2.11 Heavy Equipment

Certain site investigations require the use of heavy equipment. However, heavy equipment will not be used during the course of the RVAAP SI field work and does not present a concern.

3.2.12 Hand and Power Tools

Hand and power tools can present many hazards including: flying objects and particles, cuts and punctures, having a body part caught in or between, electrocution, noise, fire and explosion and exposure to vapors, aerosols and dusts from exhaust. However, the use of power tools is not anticipated during the course of the field work.

3.2.13 Excavation Operations

Excavation operations will not be performed during the course of the field work.

3.3 Biological Hazards

The following biological hazards may be present at each site. The SSC will instruct the field crew in recognition and procedures for encountering biological hazards.

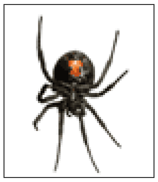
3.3.1 Insect/Arachnid Bites and Stings

3.3.1.1 Bites and Stings Hazard Identification

Insects, including bees, wasps, hornets, and spiders may be present at each MRS making the chance of a bite very possible. Some individuals may have a severe allergic reaction to insect or arachnid bites or stings that can result in a life threatening condition. Personnel with severe allergic reactions to insect or arachnid bites or stings will notify the field team of their allergy prior to the conduct of field work. Various spiders may be encountered at RVAAP, however, only two spiders in the area are poisonous – the Black Widow and the Brown Recluse.

Both Lyme disease and Rocky Mountain Spotted Fever (RMSF) are caused by bites from infected ticks that are common in and near wooded areas, tall grass and brush. Ticks vary in size from the size of a comma up to about one-quarter inch in diameter. When embedded into the skin, they may resemble a small freckle. Tick season spans from spring through summer, but may extend year-round in areas without significant cold weather.

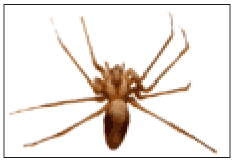
Black Widow



The Black Widow spider varies from dark brown to black in color. Its body is ¼ inch wide and overall size is 1-½ inches with legs extended. Only the female is poisonous and can be determined by the red or yellow hourglass marking the underside of the abdomen. The victim will experience the following if a Black Widow spider has bitten them:

- The spider's bite will feel like a sharp pinprick or may not even be noticed at all. In 15 minutes or less, the person will feel a dull, numbing pain in the bitten area. A faint red bite mark appears;
- If the bite is in the lower part of the body or legs, the victim will have muscle stiffness or cramps in their abdomen. If the bite is on the upper body or arms, the victim will have muscle stiffness or cramps affecting the shoulders, back or chest; and
- The victim may also experience headache, chills, fever, heavy sweating, dizziness, nausea, and vomiting and severe abdominal pain.

Brown Recluse



The Brown or Violin spider (also referred to as the Brown Recluse) is light tan to brown in color and has a violin-shaped figure on its back. It is approximately the size of a quarter with its legs extended. The victim will experience the following if a Brown Recluse has bitten them:

- The initial pain of a Brown Recluse bite may be slight enough to be overlooked;
- Several hours after the bite, a blister will appear along with redness and swelling;
- Within 2 to 8 hours, pain will occur. Initially it may be mild, but can become severe;
- The victim may also experience fever, weakness, vomiting, joint pain or a rash; and
- Within a week, an ulcer will form and in some cases gangrene may develop.

Ticks

Lyme Disease

Lyme disease is caused by an infection from a deer tick carrying a spirochete. During the painless tick bite, the spirochete may be transmitted into the bloodstream, which could lead to the worker contracting Lyme disease. Lyme disease may cause a variety of medical conditions including arthritis, which can be treated successfully if the symptoms are recognized early and medical attention is received. Treatment with antibiotics has been successful in preventing more serious symptoms from developing. Early signs may include a flu-like illness, an expanding skin rash and joint pain. If left untreated, Lyme disease can cause serious nerve or heart problems as well as a disabling type of arthritis.

Symptoms can include a stiff neck, chills, fever, sore throat, headache, fatigue and joint pain. This flu-like illness is out of season, commonly happening between May and October when ticks are most active. A large expanding skin rash usually develops around the area of the bite. More than one rash may occur. The rash may feel hot to the touch and may be painful. Rashes vary in size, shape and color, but often look like a red ring with a clear center. The outer edges expand in size. It's easy to miss the rash and the connection between the rash and a tick bite. The rash develops from three days to as long as a month after the tick bites. Almost one third of those with Lyme disease never get the rash. Joint or muscle pain may be an early sign of Lyme disease. These aches and pains may be easy to confuse with pain that comes with other types of arthritis; however, unlike many other types of arthritis, this pain seems to move or travel from joint to joint.

Lyme disease can affect the nervous system. Symptoms include stiff neck, severe headache and fatigue usually linked to meningitis. Symptoms may also include pain and drooping of the muscles on the face, called Bell's Palsy. Lyme disease may also mimic symptoms of multiple sclerosis or other types of paralysis. Lyme disease can also cause serious but reversible heart problems, such as irregular heartbeat. Finally, Lyme disease can result in a disabling, chronic type of arthritis that most often affects the knees. Treatment is more difficult and less successful in later stages. Often, the effects of Lyme disease may be confused with other medical problems.

Rocky Mountain Spotted Fever

Rocky Mountain Spotted Fever (RMSF) is an infection caused by *Rickettsia* sp. bacteria carried by the dog tick in the eastern United States and by the wood tick in the Rocky Mountain States. The lone star tick is also a rare carrier in the West. The signs and symptoms of RMSF may follow within 1-14 days of a tick bite, but in many cases, the person does not remember being bitten by a tick. Symptoms of RMSF usually begin suddenly. There is a high fever, often 103 °F (39 °C) to 105 °F (40 °C); chills; muscle aches and a severe headache that may center in the forehead area. Eyes may become red, muscles may be tender to the touch, and there may be generalized body swelling.

The rash may begin anytime between 1-10 days after the fever and headache start, but it most often appears on the third to fifth day. The rash looks like small red spots or blotches that begin on the wrists, ankles, palms and soles. It spreads up the arms and legs toward the trunk, but often spares the face. As the infection progresses, the original red spots may change in appearance to look more like bruises or bloody patches under the skin. Rarely, RMSF may cause either mild symptoms or no symptoms at all. Usually it causes a moderate to severe illness that can damage the liver, kidneys and lungs.

3.3.1.2 Bites and Stings Hazard Mitigation/Prevention

The SSC will instruct the field crew in the recognition and procedures for encountering poisonous insects at the Sites. Additionally, any individuals who have been bitten or stung by an insect will notify the SSC. The following is a list of preventive measures:

- Apply insect repellent prior to fieldwork and as often as needed throughout the work day;
- Wear proper protective clothing (work boots, socks and pants);
- When walking in wooded areas, avoid contact with bushes, tall grass or brush as much as possible; and
- Field personnel who may have insect allergies will provide this information to the SSC prior to commencing work and shall have allergy medication on each Site.

Mild insect bites should be treated by applying a baking soda paste or ice wrapped in a wet cloth. Bee stingers should be gently scraped off the skin, working from the side of the stinger. The suction device in commercially available snakebite kits can also be used to remove the stinger. If insect bites become red or inflamed or symptoms such as nausea, dizziness, shortness of breath, etc., appear, medical care will be sought. Immediate medical care is required if a person is allergic to insect bites/stings. If an allergic person receives a spider bite or insect bite/sting, seek immediate medical attention, keep the victim calm, and check vital signs frequently. Rescue breathing should be given, if necessary, to supply oxygen to the victim.

First aid procedures for a Black Widow or Brown Recluse bite are as follows:

- Clean the bitten area with soap and water or rubbing alcohol. Do not apply a constricting band because the black widow venom's action is swift; there is little to be gained by trying to slow absorption with a constriction band;
- To relieve pain, place an ice pack over the bite;
- Keep the victim quiet and monitor breathing;
- Seek immediate medical attention; and
- If possible, catch the spider to confirm its identity, even if the body is crushed.

It is recommended that personnel in areas that could harbor deer ticks wear light color clothing and visually check themselves and their buddy when coming from wooded or vegetated areas. If a tick is found biting an individual, the SSC will be contacted immediately. The tick can be removed by pulling gently at the head with tweezers. The affected area should then be disinfected with an antiseptic wipe. The employee will be offered the option for medical treatment by a physician, which typically involves prophylactic antibiotics. If personnel feel sick or have signs similar to those above, they will notify the SSC immediately.

3.3.2 Wild Animals

3.3.2.1 Animal Hazard Identification

During site operations, wild animals such as stray dogs or cats, raccoons and mice may be encountered. Other potentially hazardous mammals that may be present at RVAAP include: coyote, opossum, bobcat, skunk, gray fox, red fox, and bats. These animals may carry rabies and should be avoided. In addition, Hanta Virus is also a concern when coming into contact with rats, mice and bats. Hanta Virus is a disease spread primarily from infected rodent droppings and results from intimate contact with rodents, such as may occur in agricultural areas with dense human and rodent populations or during soil excavation. Hanta virus is not transferred from person to person. The overwhelming evidence is that the virus is spread from rodent to humans through contact with infected rodent secretions or airborne transmission by infected dust particles. Avoid touching urine and droppings, or places where these animals have nested. Also, avoid disturbing dried droppings or urine, which can be stirred up in dust and inhaled. Hanta Virus is of particular concern in the southwestern US.

Acute illness may be characterized by the abrupt onset of fever, myalgias, headache, and cough, followed by the rapid development of respiratory failure. Anyone with a potential exposure, who develops a rapidly progressing, severe viral illness or unexplained adult respiratory distress syndrome (ARDS) should be evaluated for possible Hanta Virus infection.

3.3.2.2 Animal Hazard Mitigation/Prevention

Workers shall use discretion and avoid all contact with wild animals. If these animals present a problem, the SSC or designee will be notified and will develop a plan to alleviate the problem. Measures to protect against the Hanta Virus should focus on cleaning all cuts and scratches with soap and water, followed by rinsing with hydrogen peroxide. Put liquid skin on the affected areas. The best preventive measure is to avoid all rodent nests. If rodent nests are discovered, field team members should be apprised of their locations and avoid working adjacent to the nests.

3.3.3 Snake Bites

3.3.3.1 Snake Bite Hazard Identification

Various reptiles, including poisonous snakes, may potentially be encountered at RVAAP. Poisonous snakes common to Ohio are the Copperhead, and various species of rattlesnake (Timber and Massauga Rattlesnake).

3.3.3.2 Snake Bite Hazard Mitigation/Prevention

The following precautions should be used when working in areas potentially containing snakes:

- Wear appropriate protective equipment (e.g., work boots, snake chaps, etc.);
- Be alert and aware of your surroundings;
- Avoid walking in wooded areas, rock piles, and stacks of old boards, heavy brush or tall grass if possible;
- Never handle a "dead snake," they may not be completely dead and can bite due to reflex action; and
- If a snake is encountered, do not attempt to catch or kill it. This is a major safety violation and grounds for dismissal from the site.

Immediately following a snake bite:

- Try to safely and quickly identify the species of snake if practical. DO NOT TRY TO CATCH OR KILL THE SNAKE. Move victim to safety. Try to keep the victim calm and comfortable. Remain calm and competent, as this will reassure the victim that the appropriate actions are being taken.;
- Remove any jewelry or tight fitting clothing. Immobilize the bitten area and keep it lower than the heart;
- Without cutting, apply strong suction using a commercial bite kit, preferably within seconds of the bite, directly on the main or deepest puncture/bite marks. Time is critical, as any venom present will become destructive very quickly;
- Apply antiseptic cleanser to the entire area and place a cold compress as close as possible to the wound without interfering with the suction process;
- Continue strong suction and alternate the location of compress to avoid injury from severe cold;
- Monitor for symptoms of shock and be prepared to administer appropriate treatment. At any sign of major stress, shock or unusual/unexplained discomfort, check for the need to apply other first aid techniques – elevate legs from lying down position, keep warm, etc.;

- Keep victim warm and immobilize as practical. Movement to proper treatment facility is more crucial than maintaining immobile status. Maintain above treatment functions throughout; and
- Transport safely at the earliest possible time to competent medical service. Ideally, all of the above steps can be administered concurrently with the transport phase.

3.3.4 Poisonous Plants

3.3.4.1 Poisonous Plant Hazard Identification

The potential for contact with poisonous plants exists when performing field work in undeveloped and wooded areas. Poison ivy or oak may be present on the Sites. Poison ivy can be found as vines on tree trunks or as upright bushes. Poison ivy consists of three leaflets with notched edges. Two leaflets form a pair on opposite sides of the stalk, and the third leaflet stands by itself at the tip. Poison ivy is red in the early spring and turns shiny green later in the spring. Poison oak can be present as a sparingly branched shrub. Poison oak is similar to poison ivy in that it has the same leaflet configuration; however, the leaves have slightly deeper notches.

Contact with poison ivy or oak may lead to a skin rash in susceptible individuals. A rash results from a toxin found in the sap that is extruded from the leaves and contained in the stems and roots. The rash is characterized by reddened, itchy, blistering skin that needs first aid treatment. If you believe you have contacted one of these plants, immediately wash skin thoroughly with soap and water, taking care not to touch your face or other body parts.

3.3.4.2 Poisonous Plant Hazard Mitigation/Prevention

Avoidance of plant/sap contact is the only effective means of preventing the poisoning. A person experiencing symptoms of poisoning should remove contaminated clothing; wash all exposed areas thoroughly with soap and water, taking care not to touch the face or other body parts. Apply calamine or other poison ivy/oak lotion if the rash is mild. Seek medical advice if a severe reaction occurs or if there is a known history of previous sensitivity. Employees will be trained in the identification of these species and will be advised to wear protective clothing such as gloves and long sleeve shirts when working conditions permit. Employees should also consider applying barrier lotions to the skin if they have the potential to come into contact with these species.

3.3.5 Histoplasmosis

The following information on Histoplasmosis is taken from the FWSHP:

> Hisoplasmosis is an infectious disease caused by inhaling the spores of a fungus called *Histoplasma capsulatum*. Histoplasmosis is not contagious; it cannot be transmitted from an

infected person or animal to someone else. Histoplasmosis primarily affects a person's lungs, and its symptoms vary greatly. The vast majority of infected people are asymptomatic (have no apparent ill effects), or they experience symptoms so mild they do not seek medical attention and may not even realize that their illness was histoplasmosis. If symptoms do occur, they will usually start within 3 to 17 days after exposure, with an average of 10 days. Histoplasmosis can appear as a mild, flu-like respiratory illness and has a combination of symptoms, including malaise (a general ill feeling), fever, chest pain, dry or nonproductive cough, headache, loss of appetite, shortness of breath, joint and muscle pains, chills, and hoarseness. Chronic lung disease due to histoplasmosis resembles tuberculosis and can worsen over months or years. Special antifungal medications are needed to arrest the disease. The most severe and rarest form of this disease is disseminated histoplasmosis, which involves spreading of the fungus to other organs outside the lungs. Disseminated histoplasmosis is fatal if untreated, but death can also occur in some patients even when medical treatment is received.

H. capsulatum grows in soils throughout the world. In the United States, the fungus is endemic (more prevalent) and the proportion of people infected by *H. capsulatum* is higher in central and eastern states, especially along the valleys of the Ohio, Mississippi, St. Lawrence rivers, and the Rio Grande. The fungus seems to grow best in soils having a high nitrogen content, especially those enriched with bat droppings or bird manure. Disturbances of contaminated material cause small H. capsulatum spores to become airborne or aerosolized. Once airborne, spores can easily be carried by wind currents over long distances.

The following actions must be taken to minimize the potential for infection.

- Workers who will disturb collections of bird or bat droppings must be trained in the potential hazard and control measures.
- Avoid disturbing collections of bird or bat droppings in any way that causes airborne dust.
- If collections of bird or bat droppings will be disturbed, wet droppings with water and surfactant before disturbing and continuously during disturbance.
- Stop work and take additional corrective action if visible airborne dust is observed.
- Use particulate respirators and disposable coveralls for work that may involve potentially significant or uncontrolled exposure to collections of droppings.

3.3.6 Bloodborne Pathogens (BBP)

3.3.6.1 Bloodborne Pathogen (BBP) Hazard Identification

Bloodborne pathogens (BBP) enter the human body and blood circulation system through punctures, cuts or abrasions of the skin or mucous membranes. They are not transmitted through ingestion (swallowing), through the lungs (breathing) or by contact with whole, healthy skin. However, under the principle of universal precautions, all blood should be considered infectious and all skin and mucous membranes should be considered to have possible points of entry for pathogens. "Universal precautions," as defined by the Centers for Disease Control and Prevention (CDC), are a set of precautions designed to prevent transmission of Human Immunodeficiency Virus (HIV), Hepatitis B virus (HBV), and other BBP when providing first aid or health care. Under universal precautions, blood and certain body fluids of all patients are considered potentially infectious for HIV, HBV and other BBP.

There are a number of infections transmitted by insects and arthropods where the infection cycle includes the human blood system. Examples include malaria and Lyme disease, which are transmitted by mosquitoes and ticks, respectively. These diseases are serious and the possibility for infection should be considered. However, these diseases cannot be transmitted through personal contact with human blood, and are not covered by the OSHA BBP Standard. Potential BBP exposure includes:

- Contact with contaminated medical equipment, medical waste or sharps,
- Medical emergency response operations such as administering first aid or cardiopulmonary resuscitation (CPR), and
- Contact with human wastes such as domestic sewage.

Two primary BPP include HBV and HIV.

3.3.6.2 BBP Hazard Mitigation/Prevention

To reduce the risk of contracting a BBP, take the following precautions:

- Universal precautions;
- Avoid contact with blood and other bodily fluids;
- Use protective equipment when giving First Aid/CPR, such as disposable gloves and breathing barriers; and
- Thoroughly wash hands with soap and water immediately after giving aid.

A vaccine exists for Hepatitis B. Should employees desire the vaccine, their employer will arrange to have the employee receive the series of inoculations. While less efficient, the HBV vaccine is also effective when administered after exposure to blood containing the HBV virus.

The SSC should be notified of any potential contact with blood or bodily fluids resulting from first aid or CPR administered on the job. Site personnel will be given BBP training. This hazard is also discussed below in **Section 9.1**.

4.0 FIELD STAFF

The Project Team, Stakeholders, Subcontractors, and e²M's Project Personnel and Project Organization Chart are provided in the WP.

The Field Project Personnel and Project Contacts are listed below in **Table 6**, along with their contact information. The e²M Field Project Manager (FPM)/SSC (Phil Werner), another member of the field personnel team, and two Malcolm Pirnie UXO Technicians are the only project personnel anticipated to be present on the MRSs during the performance of the field effort. Site visitors expected to be on site during the field work include personnel from Ohio EPA. If any MEC is found on the MRSs, the personnel listed under "Project Contacts" will be immediately notified and they in turn will contact other appropriate personnel as previously stated.

Table 6: Contact Information

Name and Title	Contact Information
FIELD PERSONNEL	
Phil Werner, e²M TPM,SSC	Cell: (571) 215-0677 Office: (703) 752-7755 (ext. 108)
Devin Scherer, e²M Field Team Support	Cell: (540) 421-1811 Office: (703) 752-7755 (ext. 117)
Courtney Van Tassell, e²M Field Team Support	Cell: (281) 658-7125 Office: (703) 752-7755 (ext. 115)
Steven Burhans, UXO Technician III	Office: (410) 230-9966 Cell: 443-804-7448
David Sherer, UXO Technician II	Office: (410) 230-9966 Cell: 228-383-4385
PROJECT CONTACTS	
Irving Venger, RVAAP Acting Facility Manager	Office: (330) 358-7311
Tom Lederle, RVAAP	Office: (330)
Katie Elgin, Environmental Specialist 2, OHARNG–RTLS	Office: (614) 336-6136
Mary Ellen Maly, MMRP Project Manager	Office: (410) 436-7083
Eileen T. Mohr, Ohio EPA Project Manager	Office: (330) 963-1221
Jerome Stolinski, U. S. Army Corps of Engineers CENWO-PM-HC	Office: (402) 221-7680
Major Ed Meade, OHARNG Base Operations Supervisor	Office: (614) 336-6560

4.1 Subcontractor - Malcolm Pirnie

Subcontractors are responsible for the safe conduct of their personnel while on Site and ensuring their compliance with the project SSHP. In addition, they are responsible for notifying the SSC of any special medical conditions, and are responsible for correcting any unsafe acts or conditions that are identified by the SSC or FPM. Specialized subcontractor personnel are described below (the UXO PM/UXO Technicians) may be responsible for all three of the following roles and meets the respective requirements for those roles in accordance with Department of Defense Explosives Safety Board Technical Paper 18:

<u>UXO PM</u>

The UXO PM reports directly to the e^{2}M TPM and it is the responsibility of the UXO PM to:

- Ensure implementation of this program through coordination with the site manager,
- Conduct monthly safety audits or delegate this responsibility to the Senior UXO Supervisor when not able to conduct the inspection on site,
- Participate in major incident investigations,
- Ensure the SSHP has all the required approvals before any site work is conducted,
- Ensure that the UXO Site Safety Officer (UXOSO) and e^{2}M SSC are informed of project scope changes that require modifications of the SSHP,
- Ensure overall project responsibility for UXO related health and safety, and
- Ensure adequate resources are provided to the field staff to carry out their responsibilities as outlined below.

UXO Supervisor/Field Team Leader

The UXO supervisor is responsible for the following:

- Acts as the Field Team Leader for the UXO investigation,
- Ensures site personnel comply with the SSHP,
- Directs the surface inspection and sweeps,
- Ensures overall direct supervisory responsibility for specific UXO procedures,
- Coordinates with the UXOSO on matters regarding UXO,
- Stops or modifies any work conditions or removes personnel from the site if the conditions are unsafe,
- Ensures all site personnel understand and comply with all UXO safety requirements,
- Monitors team leader and team member performance including safety and quality control,
- Responsible for the day-to-day UXO-related work at the site,
- Responsible for implementing and enforcing all work plans related to UXO operations,
- Conducts daily activities such as: supervising employees in site-specific UXO operations, overseeing the implementation of specified levels of personal protective equipment, identifying potential problem areas and making corrective action recommendations to the UXO PM, implementing all corrective actions, and maintaining a daily log of work activities including noting any extraordinary occurrences,
- Conducts incident investigations,
- Initiates corrective actions for observed safety violations, and
- Assists the UXOSO and e^2M SSC with the daily safety meeting.

<u>UXO Site Safety Officer (UXOSO)</u>

The UXOSO is responsible for the following:

- Works as a member of the project team to ensure implementation of this SSHP,
- Ensures all health and safety activities identified in this SSHP are conducted and/or implemented,
- Conducts UXO recognition and avoidance training,
- Identifies operational changes that require modifications to health and safety procedures and the SSHP, and ensures the procedure modifications are implemented and documented through changes to the SSHP,
- Conducts daily informal inspections,
- Directs and coordinates health and safety monitoring activities,
- Ensures site personnel are trained in the proper use of PPE,
- Ensures field teams utilize proper PPE,
- Assists in conducting daily safety briefings,
- Conducts and documents inspection of equipment brought on site,
- Monitors compliance with this SSHP,
- Notifies the e^{2}M SSC of all accidents/incidents by email or phone call the day of the accident/incident,
- Ensures all personnel are evacuated safely in the event of a UXO related evacuation,
- Coordinates with the e^{2}M SSC, UXO PM, Senior UXO Supervisor, and USACE OE Safety Specialist in any incident investigation,
- Maintains Accident/Incident Report Forms and Investigation Reports,
- Determines upgrades or downgrades of PPE based on site conditions and/or real-time monitoring results,
- Ensures monitoring instruments are calibrated before use (if required),
- Maintains health and safety field log books,
- Prepares and submits weekly and monthly Health and Safety reports to the e^{2}M SSC, and
- Monitors quality control for UXO related work.

5.0 TRAINING

Training requirements for field personnel at RVAAP are also provided in **Section 4.0 of the FWSHP**.

All workers on Site during performance of the field work portion of this project will be required to have 40-Hour Occupational Safety and Health Administration hazardous waste operations and emergency response (OSHA HAZWOPER 29 CFR 1910.120) training with a current 8-hour refresher course. The supervisor's course may also be needed if applicable. Site personnel will have fire extinguisher use training, and at least two members of the crew will be trained and current in first aid and CPR. In addition, all first aid responders will be trained in accordance with the requirements of 29 CFR 1910.1030 and specifically 29 CFR 1910.1030(g)(2) on the occupational exposure to BBP and other potentially infectious materials.

Prior to initiating Site activities, the e^{2}M FPM/SSC will conduct a safety and health "Kick-off Tailgate Safety" meeting. At this time, pertinent e^{2}M procedures and the SSHP will be discussed in detail with special attention being given to Site chemical and physical hazards, PPE, emergency procedures, etc. Upon completion of this briefing, all routine field personnel, including subcontractors, will be required to read and sign the acceptance sheet of this SSHP (Site-Specific Safety and Health Orientation Log). Applicable field forms/documents can be found in **Attachment A**.

Site visitors and non-routine subcontractors who do not attend this meeting will be required to undergo a specialized health and safety orientation, as documented on the Site-Specific Safety and Health Orientation Log. All employees and visitors who enter the Site must sign in on the Employee/Visitor Daily Sign-in Roster (See **Attachment A**).

The e^{2}M FPM/SSC will maintain on-site a copy of the certifications certifying that all e^{2}M and subcontracted personnel have satisfied the minimum training requirements. Supporting documentation and certificates will remain on file with the FPM/SSC. A copy of the SSHP will also be kept on site in a location known to all on-site personnel. Field projects will not be allowed to take place in the absence of adequate documentation.

Additional site-specific training covering Site hazards, procedures, and all contents of the approved SSHP will be conducted by the e^{2}M FPM/SSC for all on-site employees, prior to the commencement of work, and for visitors prior to entering the MRSs.

6.0 PERSONAL PROTECTIVE EQUIPMENT (PPE)

The PPE to be used for field work activities is in accordance with that specified in **Section 5.0 of the FWSHP**.

The PPE specified in this plan represents the PPE selection required by 29 CFR 1910.132. For the purposes of PPE selection, the e²M Certified Industrial Hygienist (CIH) and the e²M Corporate Health and Safety (H&S) Director will evaluate the proposed field activities, along with the chemicals and MEC, to determine the appropriate level of PPE. This will be conducted by performing a hazard assessment and by taking into consideration the following:

- Potential chemical and physical hazards present or suspected;
- Published exposure limits (OSHA and ACGIH);
- Work operations to be performed;
- Potential routes of exposure; and
- Characteristics, capabilities, and limitations of PPE, and any hazards that the PPE presents or magnifies.

Types of Equipment

The types of protective clothing and levels of protection that may be used at the MRSs include:

- Level D+ Protective Equipment
  - Tyvek or equivalent coveralls
  - Nitrile gloves
  - Heavy duty leather or equivalent gloves (in addition to chemical resistant gloves)
  - Steel-toed boots
  - Hard hat (if overhead hazards are present)
  - Safety glasses with side shields

- Level D Protective Equipment
  - Coveralls/field clothes
  - Steel-toed boots
  - Safety glasses with side shields
  - Hard hat (if overhead hazards are present)
  - Nitrile gloves for handling of contaminated materials
  - Heavy duty leather or equivalent gloves (in addition to chemical resistant gloves)

Cleaning, Storage, and Program Verification

If chemical protective clothing is required for field work tasks, disposable clothing will be used and disposed of as general waste. Clean chemical protective clothing will be stored in staging areas until needed. The SSC will verify that the PPE in use is appropriate and is being used properly.

6.1 Adjustment of Protection Levels

It should be noted that this SSHP makes provisions for adjustment of protection levels to a more protective or less protective level based on site conditions. The type of equipment used and the overall level of protection should be reevaluated periodically as the amount of information about the work activity increases and as workers are required to perform different tasks. The level of protection appropriate for the tasks and working conditions will be determined by the SSC, but at a minimum will be level D. Protection levels may be upgraded based on physical or other conditions (e.g., generation of dust) on-site with prior approval of the e^{2}M Corporate H&S Director and notification to the CENWO-PM.

Considerations for the upgrade of protection levels include:

- Known or suspected presence of dermal hazards,
- Occurrence or likely occurrence of gas or vapor emission,
- Change in a work task that will increase contact or potential contact with hazardous materials, and
- Request of the individual performing the task.

6.2 Personnel Hygiene and Decontamination

Should decontamination become necessary, the following steps will apply for Level D and Level D+ decontamination.

6.2.1 Level D Protection Decontamination

Step 1: Remove disposable gloves and boot covers, if worn

Deposit disposable gloves and boot covers in a designated container.

Step 2: Field wash

Wash face and hands using soap and water or disposable disinfectant towels. This step is especially important prior to any food or other item contacting the face or mouth.

6.2.2 Level D+ Protection Decontamination

Step 1: Remove tape

Remove all tape (if used) from outer clothing and place in appropriate waste container.

Step 2: Remove disposable outer clothing, gloves, and boot covers, if worn

Carefully remove boot covers, outer contamination-resistant garment, and gloves.

Step 3: Field wash

Wash hands and face with soap and water or disposable disinfectant wipes prior to eating, drinking, smoking, etc.

7.0 MEDICAL SURVEILLANCE

Medical surveillance is not required for this project.

In the event of a potential respirator hazard, identified by smell, visually, or biological (worker) exposure symptoms, workers will cease operations and evacuate the potentially hazardous atmosphere. No air monitoring will be conducted.

If it becomes necessary to institute medical surveillance, Site staff will have medical clearance for respirators that are to be worn, following protocols at least as stringent as those defined in the e^{2}M Medical Surveillance Program. If necessary, medical certifications will also be submitted to the e^{2}M FPM/SSC by the subcontractors prior to the mobilization of field crews. The FPM/SSC will maintain an on-site copy of the certificates certifying that all e^{2}M and subcontracted personnel have satisfied the minimum medical requirements. Supporting documentation and certificates will remain on file with the FPM/SSC. Field projects will not be allowed to take place in the absence of adequate documentation.

8.0 STANDARD OPERATING SAFETY PROCEDURES, ENGINEERING CONTROLS, AND WORK PRACTICES

8.1 Safe Work Practices and General Work Rules

The following are general Site safe work practices and rules in addition to the specific requirements addressed under **Section 3.0** Hazard Analysis of Field Work Activities and **Section 9.0 of the FWSHP**.

- Unauthorized personnel are not allowed onsite.
- Work groups will always consist of at least two (2) team members.
- A high standard of personal hygiene will be observed. Smoking, eating, and drinking will not be permitted within the work areas.
- While not anticipated for the performance of this project, open flames (such as for welding) are not allowed onsite without a signed hot-work permit.
- Personnel under the influence of alcohol or controlled substances will not be allowed onsite. Persons taking medications must notify the site supervisor.
- Personnel will avoid skin contact with contaminated or potentially contaminated media. If such contact occurs, the affected areas must be washed immediately with soap and water.
- Personnel will discard and replace any damaged or soiled protective clothing.
- Personnel must notify the site supervisor of any defective emergency or protective equipment.
- A supply of potable water, electrolyte replacement solutions, shaded break area, and sufficient lighting will be maintained. Sanitary facilities will be accessible to personnel.
- All unsafe conditions will be corrected immediately. All unsafe conditions not previously anticipated and documented in the scope of this project will be reported to the site supervisor.
- All site personnel will familiarize themselves with these rules and the emergency procedures during pre-work safety meetings.
- Workers who are passengers or drivers of vehicles (both offsite and onsite) will wear their seat belts anytime the vehicle is in motion.
- Vehicles will not be fueled while vehicle is running.
- Protective gloves will be worn to protect hands from cuts and abrasions of sharp and rough objects being handled.
- Mechanical lifting aides will be used wherever possible to avoid dead-lifting awkward or heavy items.
- Work in pairs to free and handle difficult materials.

- Use shovels and hand tools rather than hands to carry materials.
- Before handling materials, be sure the object is not connected to other materials that could impede the removal of the single object.
- Plan each step to avoid tripping or falling on uneven footing.
- Where it is necessary to use force or move a heavy object a distance, use heavy equipment to minimize personal energy and exertion.
- If applicable, cut large objects into smaller, easier to handle pieces to reduce an object's individual weight or length.
- Apply generally accepted lifting and material handling safe work practices when transporting materials. Keep objects in close proximity to the body, keep straight back posture, and avoid twisting the upper body. Do not reach for overhead objects and know their weight before attempting to handle them.
- Mechanical devices such as wheelbarrows and construction equipment should be used to lift or move awkward or heavy materials.

8.2 Permit Requirements

e^{2}M will obtain any permits necessary for the safe execution of this project. However, it is not anticipated that SI field work activities will require permitting.

8.3 Drum/Container Handling

Per the FWSHP, work to address drums of unknown materials will be performed in accordance with 29 CFR 1910.120(j) and EM 385-1-1 Section 28.H. **Note: Drums of unknown materials, if discovered, will not be addressed during the course of the SI field work.**

8.4 Confined Space Entry

The minimum applicable requirements for confined space entry, per the FWSHP and 29 CFR 1910.146 and EM 385-1-1 Section O6I are: completion of an entry permit, atmospheric testing for oxygen (must be 19.5 to 22%), atmospheric testing for toxic gases (must be less than 5 parts per million (ppm) or chemical-specific limit), atmospheric testing for flammable gases (must be less than 10% of the lower explosive limit, and stationing an attendant nearby but outside the excavation. **Note: Confined space entry is not anticipated for the proposed SI field work activities.**

8.5 Excavation and Trench Safety

The following information on excavation and trench safety is taken from the FWSHP. **Note: No excavation or trench work is anticipated for the SI field activities.**

8.6 Machine Guarding

Any equipment used will be operated with safety guards provided by the manufacturer. If any guarding must be removed for servicing, the equipment will be disabled to preclude movement or release of energy. **Note: No guarded machinery is expected to be used during the course of field work activities.**

8.7 Lockout/Tagout

Per the FWSHP, all potentially hazardous servicing or equipment repair will be governed by 29 CFR 1910.147 and EM 385-1-1 Section 12. **Note: No such activities are anticipated for this project.**

8.8 Fall Protection

The following requirements for fall protection are taken from the FWSHP:

> Work areas with the potential for a fall of 1.2 meters (4 feet) or more will be provided with fall protection in compliance with EM 385-1-1 Section 21.A.15. This fall protection will consist of guardrails or personal fall protection. Personal fall protection will be used if it is necessary for drilling personnel to climb the upright mast or derrick.

Note: It is not anticipated that fall protection will be required during the course of field work, as no elevated work areas are expected.

8.9 Hazard Communication

Any hazardous materials on-site will be clearly identified and labeled. Contents will be clearly labeled, including the appropriate hazard warning and name and address of the manufacturer. Material Safety Data Sheets (MSDSs) will be made available for any hazardous materials present on-site. Hazards posed by site chemicals, protective measures, and emergency procedures will be covered in the site-specific training.

8.10 Illumination

All work is to be performed during daylight hours, when natural visibility is optimized (no earlier than 15 minutes after sunrise and no later than 15 minutes before sunset). The FPM/SSC will consider task travel distance and time requirements when establishing field work schedules to permit the safe travel to and from work locations during daylight hours. If circumstances arise in which field work is to be extended before or after daylight, or when sunlight conditions are obstructed, temporary illumination will be maintained for transport vehicles and general site areas.

Note: It is not anticipated that illumination will not be required during the course of field work, as work will not be conducted in low-light conditions.

8.11 Personal Hygiene

Potable drinking water and health and safety drinks will be supplied in tightly closed containers and will be clearly marked for their intended use. Restrooms and a washing area with potable water will be available at a central point within a reasonable distance from the work Sites. Due to the uncertainties of site conditions, high personal hygiene standards will be observed.

8.12 Ionizing Radiation

According to the FWSHP, any work involving a regulated radiation source must be conducted in accordance with the requirements of EM 385-1-1, Section 06.E, Ionizing Radiation. Requirements include:

- Completion and approval by RVAAP of Department of Defense form 3337, Application for Army Radiation Authorization, prior to bringing a source onto RVAAP.
- Observation of regulatory requirements (including source security) during the time the source is on RVAAP.
- Notification of RVAAP when the source is removed from the Installation.

8.13 Fuel or Hazardous Material Spills

Upon a release of a fuel or hazardous material, personnel should take precautions for personal safety, and if possible contain the spill with onsite equipment, to the extent that the responder's training capability allows. If necessary, the FPM/SSC will evacuate all non-response personnel and visitors to the refuge area. Fuels or hazardous materials must be properly containerized, labeled, and handled. Clean-up materials will be disposed of at an approved disposal facility. The e^{2}M TPM will notify the CENWO-PM, and the Ohio EPAwill be notified within 24 hours after occurrence, if the spill is greater than the reportable quantity (25 gallons).

9.0 SITE CONTROL MEASURES

RVAAP is surrounded by a perimeter fence that has one entry point for contractors, which is located at Post 1. Those with valid identification are permitted access. Once on site, individual movement is not restricted; however, some portions of the MRSs are fenced.

Two-way radios and cell phones will be used for on-site and off-site communications for Site personnel to monitor activities; however, cell phones will not be used while operating vehicles.

The following site control information is adapted from **Section 10.0 of the FWSHP**.

The SSC will establish site control zones, if necessary, around areas that present a potential hazard. Site control zone implementation will minimize the number of employees potentially exposed and minimize the potential for spread of contamination. Site control zone locations will vary depending on site conditions; therefore, it is not possible to predetermine the size or exact locations of site control zones. In general, an exclusion zone will be established around any task or area that poses a risk to spread contamination or injure personnel.

Visitors will not be allowed inside controlled areas without approval of the SSC and Field Manager. Visitors must meet all regulatory and H&S requirements to be permitted entry into controlled areas. Visitors will sign in and receive a health and safety briefing prior to entry into controlled areas.

10.0 EMERGENCY RESPONSE AND CONTINGENCY PROCEDURES

First Aid Response Procedure - Summon the e²M FPM/SSC in person or via radio. The SSC FPM/will then assess the situation, after first taking necessary precautions for personnel safety. If the injury is more serious than first aid that can be administered at the site (e.g. cut requiring stitches, sprained ankle), the affected person will be taken to the nearest hospital identified in **Figure 1**. If the accident is serious enough to endanger life or limb, the e²M FPM/SSC is to contact Post 1 to summon the appropriate emergency personnel and immediately begin life-saving measures. A vehicle will be available at all times in the event that immediate transportation to a hospital or emergency care center is necessary for injured person(s). For more serious injuries requiring advanced life support services, Post 1 will be contacted to summon the necessary emergency services. First aid will be administered to the extent possible while waiting for emergency responders. **The map to the nearest hospital is provided as Figure 1**.

During the emergency, e²M personnel will take reasonable measures to ensure that no further injury occurs, including the following:

- stopping all operations,
- isolating the area where hazard exists, and
- keeping a fire extinguisher close at hand for preventive purposes.

Injured persons will be treated at the place they suffered the injury whenever possible. Where it becomes necessary to move a victim, care must be taken not to cause further harm. Victims will be instructed to remain calm until more advanced treatment arrives at their location. While waiting for advanced medical treatment the worker will be monitored and treated for shock symptoms. A first-aid kit located in a company vehicle will be available during all field operations at all times to treat minor cuts, scrapes, and other minor injuries. The first aid kit will contain: Emergency thermal blanket, electrolyte tablets, instant cold packs, instruments, purified drinking water, insect sting pads, lip ointment, burn cream, butterfly wound closures, OTC pain relief medication, first aid guide, large and varied quantities of bandages, and bandaging materials. The first aid kit will be checked for completeness prior to mobilization to the installation.

In the event of an accident or incident the e²M TPM and CENWO-PM will be notified immediately, and within 2 working days an accident report will be sent to the CENWO-PM. It will be the responsibility of the e²M FPM/SSC to investigate any accident and complete the e²M First Report of Accident form (see **Attachment A**), as appropriate. The e²M Corporate H&S Director will assist in these duties as appropriate. All accidents, no matter how big or small and including near misses are to be reported to the e²M Corporate H&S Director within 24 hours. The reporting procedure will be as follows:

- Following an injury accident involving any employee or subcontractor at any e²M/USACE jobsite, the e²M TPM and CENWO-PM will be notified immediately. The e²M FPM/SSC will then complete an e²M First Report of Accident form (**Attachment A**). Following notification of the CENWO-PM, USACE - Omaha District personnel will contact knowledgeable e²M safety personnel and complete ENG Form 3394 (**Attachment A**), which will be submitted to the CENWO Safety Officer within 7 days of the incident.

See the first page of this document for a map to the nearest hospital (Figure 1) and the third page of this document for the Emergency Reference List.

10.1 BBP Exposure Control Plan

The e²M Corporate Exposure Control Plan provides detailed procedures for controlling exposure to BBP. Procedures are summarized herein.

Exposure Determination: Any field person trained in first-aid response has the potential to be exposed to BBP. Tasks where exposures could occur include response to a bleeding injury and CPR.

Exposure Control - PPE: While rendering first aid where exposure to blood may occur, e²M employees will don protective gloves (N-Dex undergloves or Nitrile overgloves) and use a Rescue Breather Device (with one-way valve) if administering CPR. The gloves and Rescue Breather Device should be readily available in all first-aid kits.

Hepatitis B Vaccination: First-aid providers whose primary job assignment is not first aid administration do not need to receive a pre-exposure HBV vaccine. All first-aid providers assisting in any situation involving an exposure incident must be offered the full HBV immunization series no later than 24 hours after the incident.

Exposure Incident Evaluation: All first-aid incidents involving exposures must be reported to the e²M FPM/SSC before the end of the work shift in which the incident occurs. A First-Aid Incident Report must be completed describing the circumstances of the accident and response. Following a report of an exposure incident, e²M will make immediately available to the employee a confidential medical evaluation follow-up.

11.0 ACCIDENT PREVENTION

As part of the implementation of this SSHP, the e^{2}M FPM/SSC will conduct a "Kick-off Tailgate Safety" meeting at the beginning of the field work and daily "tailgate" safety meetings. Topics of discussion will include work tasks, potential hazards, designated PPE, emergency procedures, evacuation routes, recognition of signs and symptoms of medical conditions, importance of proper decontamination, personal hygiene, etc. See **Attachment A** for a copy of the Tailgate Safety Meeting form, and the Site-Specific Safety and Health Orientation Log.

12.0 LOGS, REPORTS, AND RECORDKEEPING

The following logs, reports, and records will be maintained onsite and submitted to the CENWO-PM with the project completion documentation:

- *Training Logs:* Prior to mobilization of field crews, proof of safety and health training and medical certifications (if applicable) must be submitted to the e²M FPM/SSC by the subcontractor. The SSC will maintain on-site copies of the certifications certifying that all e²M and subcontractor personnel have satisfied the minimum training and medical requirements listed above. Supporting documentation and certificates will remain on file with the e²M FPM/SSC. Field work will not be allowed to take place in the absence of adequate documentation.
- *Daily Safety Inspection Logs (will be included on the Daily Quality Control Reports [DQCRs]and in the field notes):* The health and safety field files maintained by the e²M FPM/SSC, or his/her designee, will be the primary form of record keeping and documentation of Site health and safety activities. These documents will be completed in sufficient detail to document the work performed; any unusual or significant circumstances under which the work was performed; any unanticipated/unplanned action taken to mitigate or to otherwise cope with unexpected field conditions; and pertinent comments about site-specific conditions that could have a bearing on the work performed. Documentation is required for all phases of work.
- *Equipment Maintenance Logs (will be included on the DQCRs and in the field notes):* Equipment will be maintained in good working order and maintenance will be documented.
- *Employee/Visitor Register:* All employees and visitors who enter the Site must sign in on the Employee/Visitor Daily Sign-in Roster. Site visitors and non-routine subcontractors will be required to undergo a specialized safety and health orientation, as documented on the Site-Specific Safety and Health Orientation Log (See **Attachment A**).

In addition, e²M will maintain a Safety and Health Binder that will contain applicable documents from the following list:

- Copies of 40-HR HAZWOPER Certification and current 8-HR Refresher Documentation
- Certification of medical and training requirements,
- Signed acceptance sheet of this SSHP (Site-Specific Safety and Health Orientation Log, see **Attachment A**),
- Health and safety notations made in the Field Note Book that is held by the e²M FPM/SSC,
- Safety inspection records including violations and remedial action plans, and
- OSHA Form #300 and corresponding OSHA 301s (e²M First Report of Accident Form acts in this capacity, see **Attachment A**).

e^2M RECORD OF CHANGE
SITE-SPECIFIC SAFETY AND HEALTH PLAN

GENERAL SITE INFORMATION

Site Name:	Date:
Project Number:	Site H&S Coordinator:
Project Manager:	Site Manager:

DESCRIPTION OF AND JUSTIFICATION FOR CHANGE:

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SSC Signature: .... Date: ....

Authorization: .... Title: .... Date: ....

TAILGATE SAFETY MEETING

PROJECT: ____________________ PROJECT NO. ____________
DATE: ____________________ TIME: ____________
CLIENT: ____________________

SPECIFIC SITE LOCATION: ______________________________

TYPE OF WORK: ______________________________
CHEMICAL USED: ______________________________

SAFETY TOPICS PRESENTED

PPE ______________________________

Chemical Hazards ______________________________

Physical Hazards ______________________________

Health and Safety Plan ______________________________

Emergency Procedures ______________________________
Hospital ____________ Hospital Phone #, or 911
Hospital Address ______________________________

Special Equipment ______________________________

Other ______________________________

ATTENDEES

Name (Print)	Signature

Meeting Conducted by: ______________________________

TAILGATE SAFETY MEETING
PAGE 2 of 2

ATTENDEES

Name (Print)	Signature

SITE-SPECIFIC SAFETY AND HEALTH ORIENTATION LOG*

The undersigned acknowledge, understand, and agree with the following:

I have been briefed as to the nature of work in this project, its potential hazards, required PPE, and the route to the nearest hospital.

The Site-specific Safety and Health Plan (SSHP) has been explained to me, and is available to be referenced on site at all times.

I agree to abide by the SSHP and all procedures outlined in the SSHP. I understand that noncompliance with the SSHP may lead to my removal from the site.

Date	Name	Signature	40 Hr OSHA Cert. No/Expiration (If applicable)	Company

Date	Name	Signature	40 Hr OSHA Cert. No/Expiration (If applicable)	Company

EMPLOYEE/VISITOR DAILY SIGN-IN ROSTER*

PROJECT NO.

SITE NAME:

DATE:

FIELD PROJECT MANAGER:

DATE	NAME	COMPANY	TIME ONSITE	OFFSITE

*This roster is required for emergency response planning. All personnel arriving to and from the site must sign this roster. This Log does not replace the S&H Orientation.

FIRST REPORT OF ACCIDENT

engineering-environmental Management, Inc (303) 721-9219

Project Site

Date of incident

Time of incident

Hrs. at work before incident

Location of incident / Supervisor

Date incident became restricted duty or lost-time

Job title of injured

Contractor Name.

Body part injured

Nature of injury

Type of accident

Lost Time

Rest.'d Duty

OSHA Recordable

Severity class of incident

Severe 1

Mod. 2

Minor 3

SEQUENCE OF EVENTS

Describe the physical situation plus pertinent events before, during, and after the incident.

APPARENT CAUSES

List causes that appear to have directly contributed to the incident – unsafe acts and conditions.

IMMEDIATE ACTIONS TAKEN

List actions that will successfully prevent recurrence, as understood at this early stage of the investigation.

LONG TERM CORRECTIVE ACTIONS TAKEN

List actions that will successfully prevent recurrence, as understood at this early stage of the investigation.

engineering – environmental Management, Inc.
9563 S. Kingston Court, Suite 200
Englewood, CO 80112

(For Safety Staff only)	REPORT NO.	EROC CODE	**UNITED STATES ARMY CORPS OF ENGINEERS ACCIDENT INVESTIGATION REPORT** *(For Use of this Form See Help Menu and USACE Suppl to AR 385-40)*	**REQUIREMENT CONTROL SYMBOL: CEEC-S-8(R2)**

1. **ACCIDENT CLASSIFICATION**

PERSONNEL CLASSIFICATION	INJURY/ILLNESS/FATAL	PROPERTY DAMAGE	MOTOR VEHICLE INVOLVED	DIVING
GOVERNMENT ☐ CIVILIAN ☐ MILITARY	☐	☐ FIRE INVOLVED ☐ OTHER	☐	☐
☐ CONTRACTOR	☐	☐ FIRE INVOLVED ☐ OTHER	☐	☐
☐ PUBLIC	☐ FATAL ☐ OTHER		☐	

2. **PERSONAL DATA**

a. Name *(Last, First, MI)*	b. AGE	c. SEX ☐ MALE ☐ FEMALE	d. SOCIAL SECURITY NUMBER	e. GRADE

f. JOB SERIES/TITLE	g. DUTY STATUS AT TIME OF ACCIDENT ☐ ON DUTY ☐ TDY ☐ OFF DUTY	h. EMPLOYMENT STATUS AT TIME OF ACCIDENT ☐ ARMY ACTIVE ☐ ARMY RESERVE ☐ VOLUNTEER ☐ PERMANENT ☐ FOREIGN NATIONAL ☐ SEASONAL ☐ TEMPORARY ☐ STUDENT ☐ OTHER *(Specify)* ______

3. **GENERAL INFORMATION**

a. DATE OF ACCIDENT *(month/day/year)*	b. TIME OF ACCIDENT *(Military time)* hrs	c. EXACT LOCATION OF ACCIDENT	d. CONTRACTOR'S NAME (1) PRIME: (2) SUBCONTRACTOR:
e. CONTRACT NUMBER ______ ☐ CIVIL WORKS ☐ MILITARY ☐ OTHER *(Specify)* ______	f. TYPE OF CONTRACT ☐ CONSTRUCTION ☐ SERVICE ☐ A/E ☐ DREDGE ☐ OTHER *(Specify)* ______	g. HAZARDOUS/TOXIC WASTE ACTIVITY ☐ SUPERFUND ☐ DERP ☐ IRP ☐ OTHER *(Specify)* ______	

4. **CONSTRUCTION ACTIVITIES ONLY** *(Fill in line and corresponding code number in box from list - see help menu)*

a. CONSTRUCTION ACTIVITY ______ (CODE) #	b. TYPE OF CONSTRUCTION EQUIPMENT ______ (CODE) #

5. INJURY/ILLNESS INFORMATION *(Include name on line and corresponding code number in box for items e, f & g - see help menu)*

a. SEVERITY OF ILLNESS/INJURY ______ (CODE) #	B. ESTIMATED DAYS LOST	C. ESTIMATED DAYS HOSPITALIZED	D. ESTIMATED DAYS RESTRICTED DUTY

e. BODY PART AFFECTED PRIMARY ______ (CODE) # SECONDARY ______ (CODE) #	g. TYPE AND SOURCE OF INJURY/ILLNESS TYPE ______ (CODE) # SOURCE ______ (CODE) #
f. NATURE OF ILLNESS / INJURY ______ (CODE) #	

6. PUBLIC FATALITY *(Fill in line and correspondence code number in box - see help menu)*

a. ACTIVITY AT TIME OF ACCIDENT ______ (CODE) #	b. PERSONAL FLOATATION DEVICE USED? ☐ YES ☐ NO ☐ N/A

7. MOTOR VEHICLE ACCIDENT

a. TYPE OF VEHICLE	b. TYPE OF COLLISION	c. SEAT BELTS	USED	NOT USED	NOT AVAILABLE
☐☐ PICKUP/VAN ☐☐ AUTOMOBILE ☐☐ TRUCK ☐☐ OTHER *(Specify)* ______	☐ SIDE SWIPE ☐ HEAD ON ☐ REAR END ☐ BROADSIDE ☐ ROLL OVER ☐ BACKING ☐ OTHER *(Specify)* ______	(1) FRONT SEAT			
		(2) REAR SEAT			

8. PROPERTY/MATERIAL INVOLVED

a. NAME OF ITEM	B. OWNERSHIP	C. $ AMOUNT OF DAMAGE
(1)		
(2)		
(3)		

9. VESSEL/FLOATING PLANT ACCIDENT *(Fill in line and correspondence code number in box from list - see help menu)*

a. TYPE OF VESSEI/FLOATING PLANT ______ (CODE) #	b. TYPE OF COLLISION/MISHAP ______ (CODE) #

10. ACCIDENT DESCRIPTION *(Use additional paper, if necessary)*

See attached page.

11. **CAUSAL FACTOR(S)** *(Read Instruction Before Completing)*

a. (Explain YES answers in item 13)

	YES	NO
DESIGN: Was design of facility, workplace or equipment a factor?	☐	☐
INSPECTION/MAINTENANCE: Were inspection & maintenance procedures a factor?	☐	☐
PERSON'S PHYSICAL CONDITION: In your opinion, was the physical condition of the person a factor?	☐	☐
OPERATING PROCEDURES: Were operating procedures a factor?	☐	☐
JOB PRACTICES: Were any job safety/health practices not followed when the accident occurred?	☐	☐
HUMAN FACTORS: Did any human factors such as, size or strength of person, etc., contribute to accident?	☐	☐
ENVIRONMENTAL FACTORS: Did heat, cold, dust, sun, glare, etc., contribute to the accident?	☐	☐

a. *(CONTINUED)*

	YES	NO
CHEMICAL AND PHYSICAL AGENT FACTORS: Did exposure to chemical agents, such as dust, fumes, mists, vapors or physical agents, such as, noise, radiation, etc., contribute to accident?	☐	☐
OFFICE FACTORS: Did office setting such as, lifting office furniture, carrying, stooping, etc., contribute to the accident?	☐	☐
SUPPORT FACTORS: Were inappropriate tools/resources provided to properly perform the activity/task?	☐	☐
PERSONAL PROTECTIVE EQUIPMENT: Did the improper selection, use or maintenance of personal protective equipment contribute to the accident?	☐	☐
DRUGS/ALCOHOL: In your opinion, was drugs or alcohol a factor to the accident	☐	☐

b. WAS A WRITTEN JOB/ACTIVITY HAZARD ANALYSIS COMPLETED FOR TASK BEING PERFORMED AT TIME OF ACCIDENT?

☐ YES *(If yes, attach a copy.)* ☐ NO

12. **TRAINING**

a. WAS PERSON TRAINED TO PERFORM ACTIVITY/TASK? ☐ YES ☐ NO	b. TYPE OF TRAINING. ☐ CLASSROOM ☐ ON JOB	c. DATE OF MOST RECENT FORMAL TRAINING. (Month) (Day) (Year)

13. **FULLY EXPLAIN WHAT ALLOWED OR CAUSED THE ACCIDENT; INCLUDE DIRECT AND INDIRECT CAUSES** *(See instruction for definition of direct and indirect causes.) (Use additional paper, if necessary)*

a. DIRECT CAUSE

See attached page.

b. INDIRECT CAUSE(S)

See attached page.

14. **ACTION(S) TAKEN, ANTICIPATED OR RECOMMENDED TO ELIMINATE CAUSE(S).**

DESCRIBE FULLY:

See attached page.

15. **DATES FOR ACTIONS IDENTIFIED IN BLOCK 14.**

a. BEGINNING (Month/Day/Year)	b. ANTICIPATED COMPLETION (Month/Day/Year)

c. SIGNATURE AND TITLE OF SUPERVISOR COMPLETING REPORT CORPS ____________ CONTRACTOR ____________	d. DATE *(Mo/Da/Yr)*	e. ORGANIZATION IDENTIFIER *(Div, Br, Sect)*	f. OFFICE SYMBOL

16. **MANAGEMENT REVIEW** *(1st)*

a. ☐ CONCUR b. ☐ NON CONCUR c. COMMENTS

SIGNATURE	TITLE	DATE

17. **MANAGEMENT REVIEW** *(2nd - Chief Operations, Construction, Engineering, etc.)*

a. ☐ CONCUR b. ☐ NON CONCUR c. COMMENTS

SIGNATURE	TITLE	DATE

18. **SAFETY AND OCCUPATIONAL HEALTH OFFICE REVIEW**

a. ☐ CONCUR b. ☐ NON CONCUR c. ADDITIONAL ACTIONS/COMMENTS

SIGNATURE	TITLE	DATE

19. **COMMAND APPROVAL**

COMMENTS

COMMANDER SIGNATURE	DATE

10. ACCIDENT DESCRIPTION *(Continuation)*

13a. DIRECT CAUSE *(Continuation)*

13b. **INDIRECT CAUSES** *(Continuation)*

14. **ACTION(S) TAKEN, ANTICIPATED, OR RECOMMENDED TO ELIMINATE CAUSE(S)** *(Continuation)*

Military Munitions Response Program Site Inspection
Ravenna Army Ammunition Plant
Ravenna, Ohio
TPP 2 Meeting Minutes
10 August 2006

The 10 August 2006 Technical Project Planning (TPP) meeting for the Military Munitions Response Program (MMRP) Site Inspection (SI) for Ravenna Army Ammunition Plant (RVAAP) was conducted by the United States Army Environmental Center (USAEC), US Army Corps of Engineers (USACE), Omaha District and engineering-environmental Management, Inc. (e^2M) at the installation in Ravenna, Ohio. The purpose of the meeting was to discuss the Ohio Environmental Protection Agency (Ohio EPA) comments on the draft Historical Records Review (HRR) report, as well as to discuss strategy for the MMRP SI field work at the RVAAP MRSs. The meeting was also requested as permitted by Section XVIII, Line Item Number 42, of the Director's Final Findings and Orders (F&O) to provide further clarification of the Ohio EPA comments. Prior to the comment resolution meeting, a request for an extension to address the comments was submitted to the Ohio EPA via email and US Postal Service 11 July 2006. Official notice granting the request for an extension was sent to the installation on 17 July 2006.

Introduction

All TPP meeting attendees provided personal introductions and explained their role as it relates to the project. Please see attached sign-in sheet for attendees contact information.

MMRP Site Inspection Briefing

The MMRP SI Presentation was given by Ms. Mary Ellen Maly, USAEC, Ms. Courtney Ingersoll, e^2M, and Mr. Phil Werner, e^2M, which covered the day's agenda and a brief review of the MMRP process. Two handouts were provided to attendees: one outlining the Meeting Objectives; Review of the MMRP; MMRP Implementation and Summary; MMRP Goals and Processes; RVAAP MRS Data Gaps; Proposed MMRP SI Field Work; and Tentative Project Schedule; while the second handout contained draft responses to the Ohio EPA comments on the Draft HRR.

The remainder of these meeting minutes depicts salient points from the discussion of the proposed SI field work at the RVAAP MRSs.

- After discussion by Ms. Maly of how the US Army CTT Inventory Report fulfills the requirement of a Preliminary Assessment under CERCLA, Ms. Eileen Mohr, Ohio EPA, responded that this puts the installation and Ohio EPA in a challenging situation since the report had not been reviewed or approved by Ohio EPA prior to final submittal. Ms. Mohr continued stating that the report contained multiple errors and inaccurate information. Ohio EPA received the CTT Inventory Report a year after it was final. Ms. Maly responded the US Army CTT Inventory Report is final and the RVAAP MMRP is moving forward. Any errors in the CTT Inventory Report will be corrected during the SI, specifically within the HRR, SI field work, and SI report.

- Ms. Maly was asked whether or not she would be available to present a synopsis of the MMRP program at the September 2006 RAB meeting. Ms. Maly acknowledged that she would be willing to attend and present to the RAB.
- Mr. Kevin Tiemeier, USAEC, asked if Environmental Baseline Study (EBS) data is used during the SI. Ms. Maly responded that yes, data from an EBS is used when applicable. Ms. Maly stressed that the MMRP is not NEPA, but rather follows CERCLA and, therefore, does not include performing Environmental Impact Statements (EISs), EBSs, and/or Environmental Assessments (EAs).
- LTC Tom Tadsen, Garrison Commander, asked if other contractors are cited when photographs and maps are used from their reports. e^{2}M responded that yes, when other contractors data, maps, and/or figures are used that they are cited in both the body of the HRR text, on the figure/map, as well as in an appendix that covers archival data that was researched.
- LTC Tadsen asked if the MRSs collocated with IRP sites have the same name. Mr. Werner responded that collocated IRP and MRSs do not share the same exact name, in most cases. LTC Tadsen responded that the installation would like the MRSs and IRP sites that are collocated to have the same name. Ms. Maly stated the MRS names are up to the installation and can be changed. The installation agreed to review the names of the MRS and IRP sites and indicate the changes to be made. Once this list is received by e^{2}M, the appropriate changes will be made in the Final HRR report.
- Ohio EPA is fearful ODA1 will slip through the cracks. Currently the site overlays operational range area and is not MMRP eligible. Ms. Maly explained the procedure that needs to be completed to reclassify operational range to other than operational range, by going through G3. After G3 approves the reclassification, USAEC will then evaluate the area for MMRP eligibility; should it qualify it will be added to the MMRP. Ms. Maly continued by stating that should ODA1 become MMRP-eligible that it would not be included under this SI effort. Rather, the installation will be responsible for performing a Preliminary Assessment of ODA1 after reclassification acceptance by G3. The OHARNG will pursue requesting the ODA1 reclassification. Throughout the course of the meeting, the question was continually raised by Ohio EPA how and what (e.g., MEC and MC) would be addressed at collocated IRP and MMRP sites. Ohio EPA's concerns were that sites not slip through the cracks, and that all known sites be addressed by either one program or another. For the identified MRS's, the consensus was reached that MEC or MC concerns not addressed by the IRP would be addressed under the MMRP.
- There was discussion regarding MC clean up and whether it will occur under IRP or MMRP. Since the last IAP meeting, MC clean up programmatic responsibility has changed on some sites. Please refer to the final comment response matrix under separate cover for more detail on the sites discussed.
- LTC Tadsen stated the fence line GIS shape file layer can be used to assist in mapping IRP site boundaries. e^{2}M will request this additional layer from the USACE, Louisville District.
- The installation and Ohio EPA requested the introduction to Section 2 be updated to reflect revised acreages and descriptions. Ms. Katie Elgin, RTLS, will provide text for this updated section.

- Ms. Mohr requested that e^{2}M draft and includes a statement in the introductory paragraph in Section 2.2 stating "text in this section is taken directly from the US Army CTT Inventory Report and does not accurately represent current site conditions." e^{2}M will draft proposed language and email to meeting attendees for input and approval. It was also suggested the text copied directly from the US Army CTT Inventory Report be indented and italicized. e^{2}M will do this for the final HRR.
- Much discussion occurred concerning the text related to Land Use Controls (LUCs) for each of the MRSs. Currently, no LUCs exist at RVAAP. The consensus of the attendee's was to insert a general statement throughout Section 5 addressing Land Use Restrictions, such as "There are no formal CERCLA land use controls enforced at the MRS". Text referring to LUCs would be removed.
- Ohio EPA stated that they prefer that the SI Conceptual Site Model section (Section 5) include an analysis of release mechanisms, activities, and receptors be performed for current use scenarios at each MRS. Ms. Maly stated all references to any future land use, activity, or receptor will be removed from the CSM.
- Ohio EPA disagreed with a number of the "incomplete" assessments for both the MEC and MC pathway exposure analysis. In each case discussed, the assessment will be changed to reflect either a "potential" or "complete" exposure pathway scenario exists at the MRS. The changes will be noted in the responses to comments document.
- Ohio EPA prefers multi-increment sampling be performed per the MI Sampling and Processing Plan developed by MKM. It was stated that all contractors follow this guidance for sampling at RVAAP. e^{2}M will obtain a copy of this plan prior to development of the SI work plans and incorporate the guidance and strategies stated within. (Note: After a review of the meeting minutes, Ohio EPA has indicated that MI sampling can be used for confirmation purposes. However, it cannot be used for investigative or risk assessment purposes. Depending upon where the locations are and how the samples will be used may dictate sample type [i.e., discrete vs. MI].)
- Ohio EPA informed the group that USEPA Region 9 residential PRGs and the RVAAP Background data as provided in the Winklepeck Burning Ground Phase II RI can be used for screening purposes.
- Ms. Maly asked Ohio EPA's definition of surface soil. Surface soil is 0-12" bgs and surface sediment is 0-6" bgs.
- The Installation QAPP and SAP, dated March 2001 will be included by reference in the MMRP SI Work Plan. The installation Health and Safety Plan will also be incorporated by reference into the MMRP SI Work Plan.
- An IDW for the MI samples must be established by the contractor per the Facility Wide Plan. e^{2}M will obtain a copy of this plan for incorporation by reference in the MMRP SI Work Plan.
- LTC Tadsen indicated that he will be retiring at the end of August and that future correspondence and coordination with the OHARNG should be done through Katie Elgin.

Action Items

Item	Responsible Party
Obtain copy of IRP site names from Installation.	e^{2}M and RVAAP
Coordinate with USACE, Louisville to obtain GIS shape files for fence layer to delineate IRP site boundaries.	e^{2}M
Distribute Meeting Minutes	e^{2}M
Draft revised introduction text for section 2.2 and send to stakeholders for review and comment.	e^{2}M
Obtain copy of MI Sampling and Processing Plan from MKM.	e^{2}M
Final comment responses to the Ohio EPA and other stakeholder comments will be provided under separate cover from these meeting minutes.	e^{2}M
A teleconference or meeting will be scheduled to resolve any outstanding comment issues, should it be necessary.	Ohio EPA/OHARNG/USAEC/USACE

TPP 2 Meeting Attendees
RVAAP, OH
10 August 2006

NAME	ORGANIZATION	PHONE	EMAIL
Courtney Ingersoll	e^{2}M	757-643-7886	cingersoll@e2m.net
Phil Werner	e^{2}M	703-273-7171	pwerner@e2m.net
Mary Ellen Maly	USAEC	410-436-7083	maryellen.h.maly@us.army.mil
Robert Zaruba	USACE, Omaha District	402-221-7659	robert.k.zaruba@nwo02.usace.army.mil
Eileen Mohr	Ohio EPA	330-963-1221	eileen.mohr@epa.state.oh.us
Bonnie Buthker (via teleconference)	Ohio EPA	937-285-6469	bonnie.buthker@epa.state.oh.us
Todd Fisher	Ohio EPA	330-963-1148	todd.fisher@epa.state.oh.us
Timothy Morgan	RTLS, Environmental	614-336-6568	timothy.m.morgan@us.army.mil
Katie Elgin	RTLS, Environmental	614-336-6136	katie.elgin@us.army.mil
LTC Tom Tadsen	OHARNG – RTLS	614-336-6790	thomas.tadsen@oh.ngb.army.mil
Irv Venger	US Army, RVAAP Facility Manager	330-358-7304	Irving.b.venger@us.army.mil
Kevin Tiemeier	USAEC	563-359-3314	kevin.tiemeier@us.army.mil