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# CLOSURE ACTIVITIES WORK PLAN
# OPEN BURNING GROUND FACILITY
# RAVENNA ARMY AMMUNITIONS PLANT
# RAVENNA, OHIO

**Contract No. DACA27-97-D-0005**
**Delivery Order No. 0009**

**Prepared for:**

**U.S. Army Corps of Engineers**
**Louisville District**
**Louisville, Kentucky**

**Prepared by:**

**IT Corporation**
**312 Directors Drive**
**Knoxville, Tennessee 37923**

**Rev. 2**
**August 1998**

INTERNATIONAL TECHNOLOGY CORPORATION

U.S. Army Corps of Engineers
Louisville District

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# ~~Draft~~FINAL
# Closure Activities Work Plan
# Open Burning Ground Facility
# Ravenna Army Ammunition Plant
# Ravenna, Ohio

**Contract Number DACA27-97-D-0005**
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**312 Directors Drive**
**Knoxville, Tennessee 37923**

**~~July~~AUGUST 1998**

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## List of Acronyms

| | |
|---|---|
| AR | analysis request |
| COC | chain of custody |
| DNT | dinitrotoluene |
| DOT | U.S. Department of Transportation |
| DQO | data quality objective |
| EDD | electronic data deliverables |
| EPA | Environmental Protection Agency |
| FSP | field sampling plan |
| HMX | octogen |
| H&S | health and safety |
| IDW | investigative-derived waste |
| IT | IT Corporation |
| MDL | maximum detection limit |
| MS/MSD | matrix spike/matrix spike duplicate |
| µg/kg | micrograms per kilogram |
| OBG | open burning ground |
| PCB | polychlorinated biphenyl |
| PPE | personal protective equipment |
| PRAC | Preplaced Remedial Action Contract |
| QA | Quality assurance |
| QAPP | quality assurance project plan |
| QC | quality control |
| Quanterra | Quanterra Environmental Services |
| RDX | royal demolition explosive |
| RL | reporting limit |
| RPD | relative percent difference |
| RVAAP | Ravenna Army Ammunition Plant |
| SAIC | Science Applications and International Corporation |
| SHP | facility-wide safety and health plan |
| SSHP | site-specific safety and health plan |
| SVOC | SEMIVOLATILE ORGANIC COMPOUND |
| TAL | target analyte list |
| TNT | trinitrotoluene |

## List of Acronyms *(Continued)*

| | |
|---|---|
| USACE | U.S. Army Corps of Engineers |
| UXO | unexploded ordnance |
| VOC | volatile organic compound |

# 1.0 Introduction

## 1.1 Facility Description

The Ravenna Army Ammunition Plant (RVAAP) is located in the northeast portion of the state of Ohio. The installation covers approximately 21,419 acres, and is 11 miles long and 3.5 miles wide. The facility is located within Portage and TRUMBULL~~cll~~ counties as shown on Figure 1-1. Activities for RVAAP began in August of 1940. During its operation the primary purpose of RVAAP was to load explosives into medium and major caliber artillery ammunition, bombs, mines, fuses and boosters, primers, and percussion elements. Land use surrounding the facility is primarily agricultural with sparse private residence. Currently RVAAP is in an inactive status.

Originally RVAAP was divided into two separate units; one was designated the Portage Ordinance Depot, with the primary mission as storage activity, while the other designated portion was known as the Ravenna Ordnance Plant with the primary mission of munitions loading. Over the years RVAAP has handled and stored strategic and critical materials for various government agencies as well as received, stored, and maintained the capabilities to load, assemble, and pack military ammunition. Currently these operations are inactive; however, as part of RVAAP's mission, the inactive facilities are maintained in a standby status by keeping equipment in a condition to resume production.

## 1.2 Site Description

The open burning ground (OBG) site is located along road C, approximately 1,000 feet north of Sand Creek (Figure 1-2). The OBG area is relatively level and encompasses roughly 100 square feet.

Eight burn trays used to dispose of explosive laden materials (Figure 1-3) are located at this facility. These trays are constructed of 1/4 inch boiler plate which are 16 feet long, 4 feet wide, and 12 inches deep, with a ceramic refractory liner. These trays are set on rails situated on top of crushed slag. Also located at the OBG site is a portable steel blast barrier which is roughly 7 feet high, 9 feet wide, 28 feet long, and composed of 1/8 inch steel along the front area and 1/4 inch steel along the bottom portion of the barrier.

RVAAP reportedly burned bulk propellants, explosives, and explosive contaminated material at the OBG site. Burns were conducted in the metal trays beginning in 1980. Presently no burning

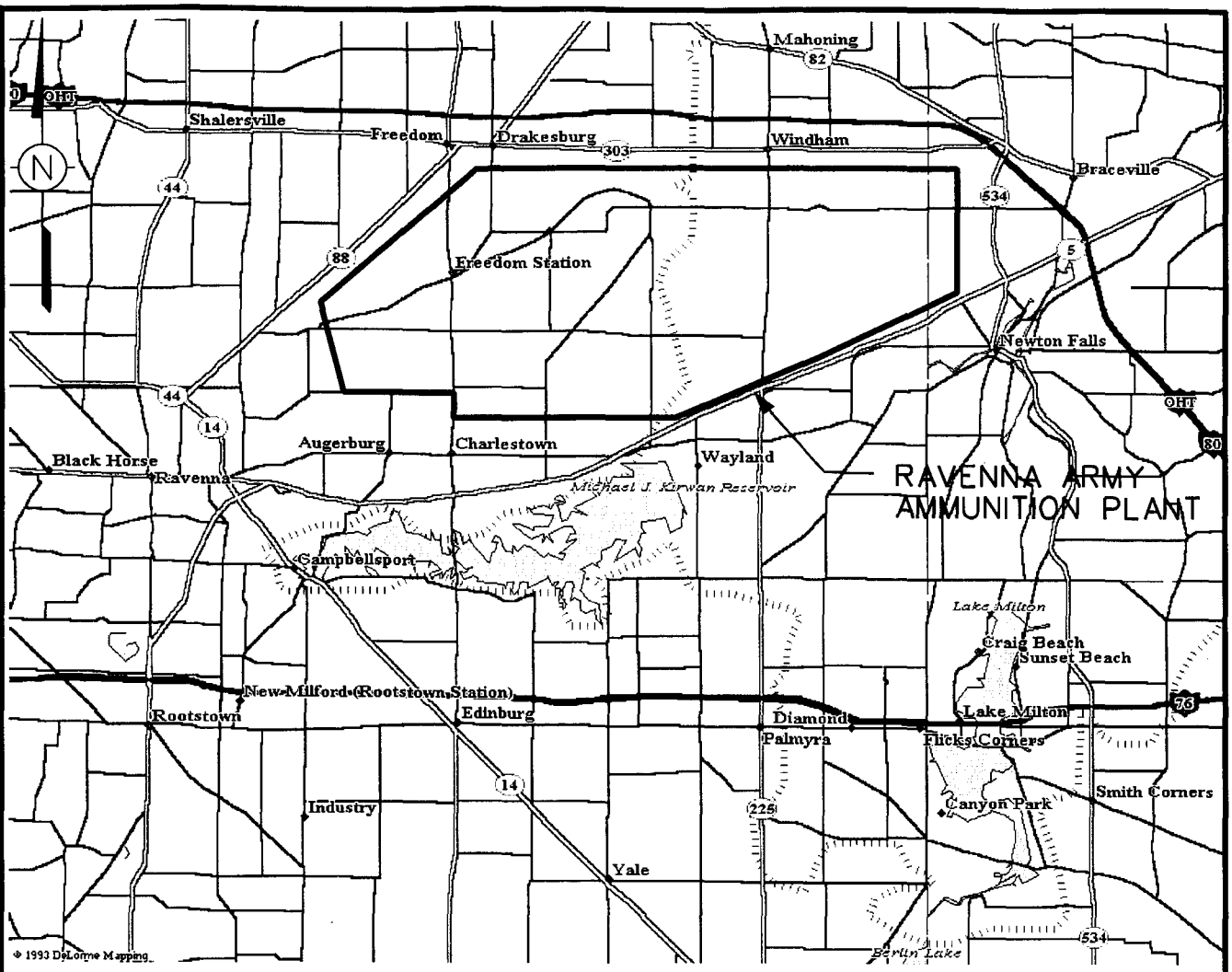



FIGURE 1-1
RAVENNA ARMY AMMUNITION PLANT & VACINITY

*U.S. ARMY CORPS OF ENGINEERS*
*NASHVILE DISTRICT*
*RAVENNA ARMY AMMUNITION PLANT*
*RAVENNA, OHIO*

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PROJ. NO.:775574
INITIATOR: C. WALLACE
PROJ. MGR.: C. SHAFER
DRAFT. CHCK. BY: C. TUMLIN
ENGR. CHCK. BY:
DATE LAST REV.:
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STARTING DATE: 6/18/98
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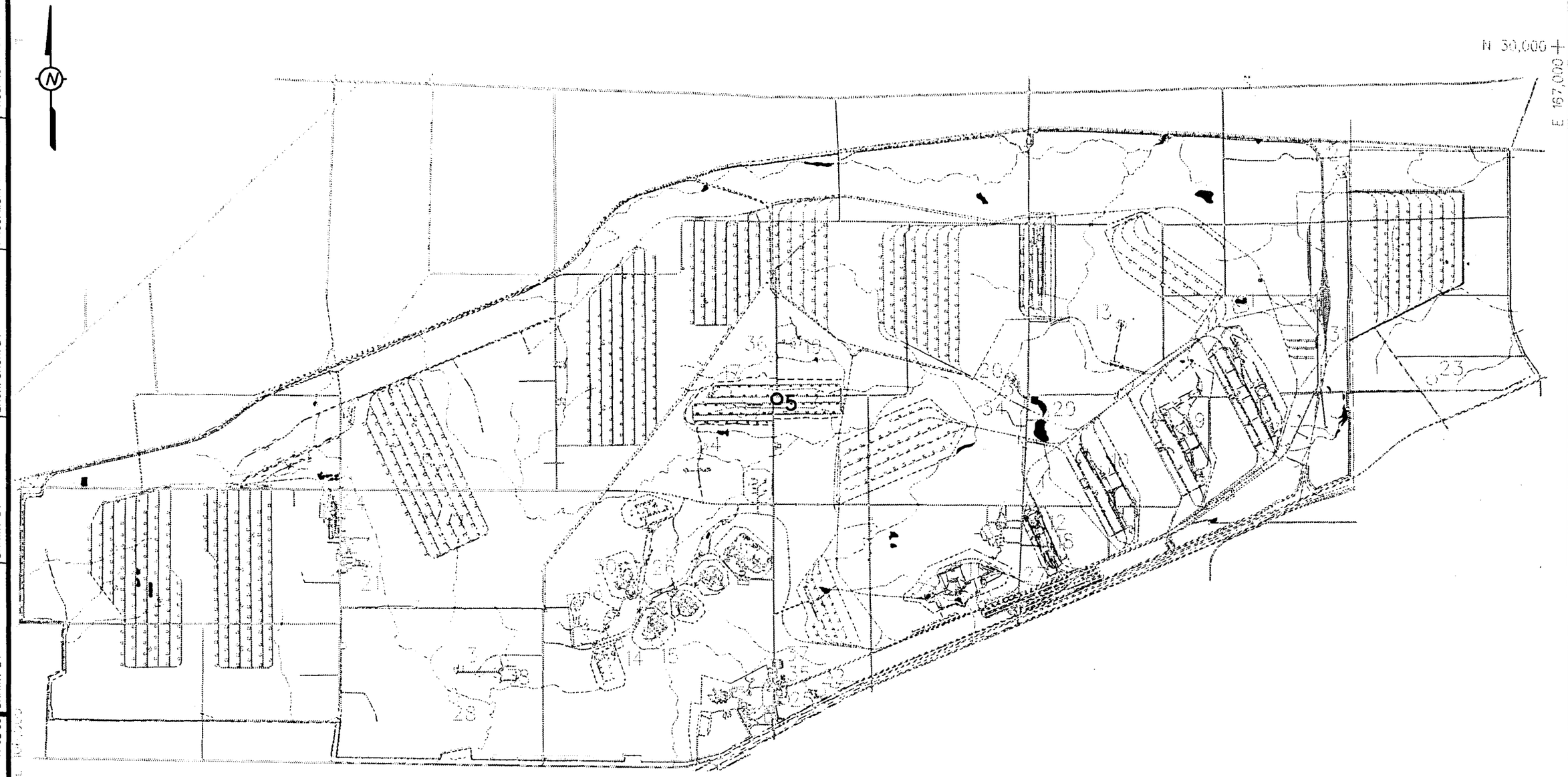


SCALE:

0 4000 8000 FEET

## LEGEND OF SITES:

1 .....RAMSDELL QUARRY LANDFILL
2 .....ERIE BURNING GROUNDS
3 .....DEMOLITIONS AREA #1
4 .....DEMOLITIONS 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
.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
QUARRY LANDFILL/FORMER
16 .....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 WATER 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 BUILDING S-44S2
38 .....NACA TEST AREA

**FIGURE 1-2**
**SITE LOCATION**
**OPEN BURNING GROUNDS**

*U.S. ARMY CORPS OF ENGINEERS*
*NASHVILLE DISTRICT*
*RAVENNA ARMY AMMUNITION PLANT*
*RAVENNA, OHIO*

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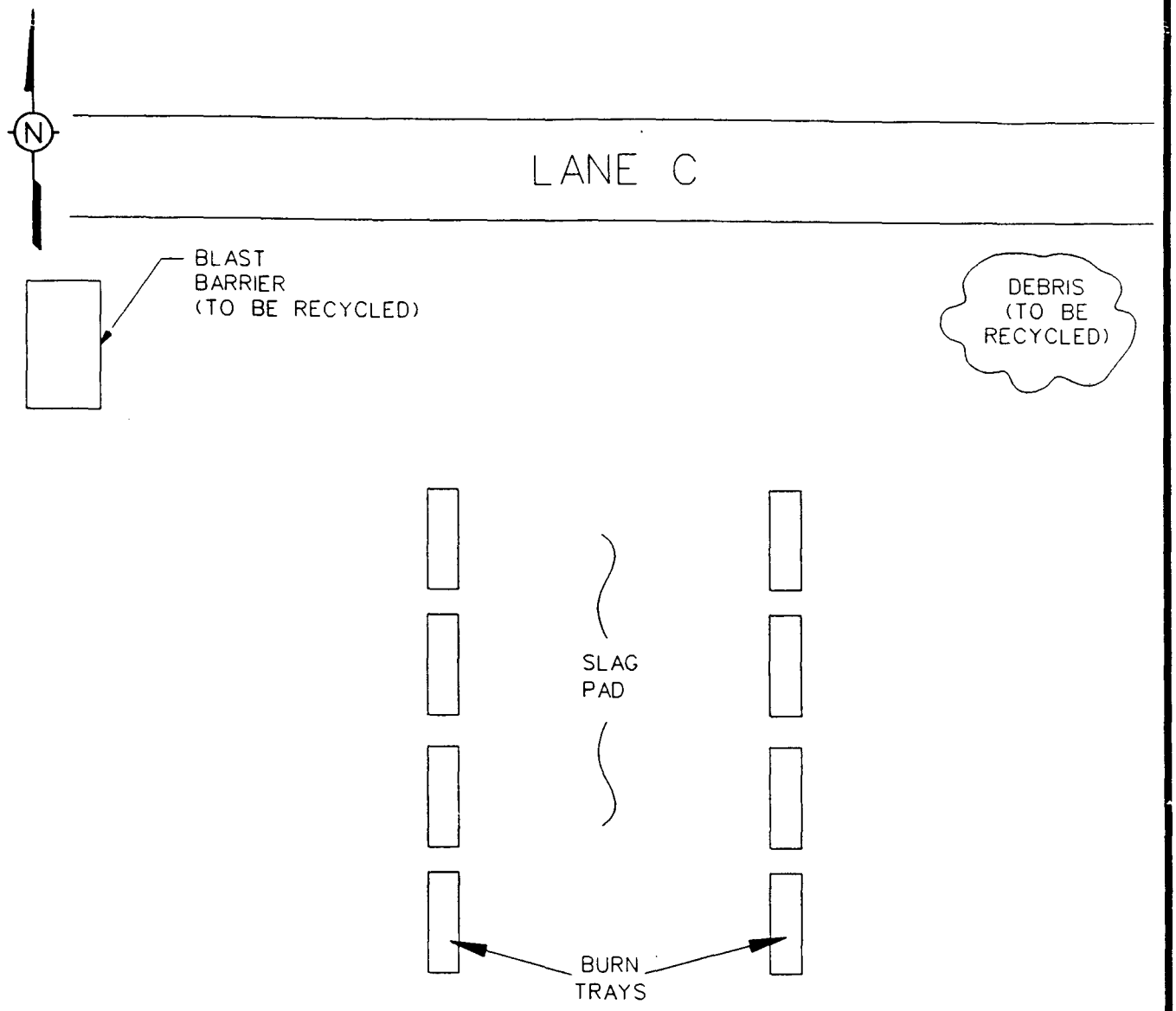


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**FIGURE 1-3**
**OPEN BURNING GROUNDS**

*U.S. ARMY CORPS OF ENGINEERS*
*NASHVILE DISTRICT*
*RAVENNA ARMY AMMUNITION PLANT*
*RAVENNA, OHIO*

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activities are being conducted at the facility. The exact date the burning activities ceased at this site is unavailable at this time.

### *1.3 Description of Work*

ALL SUBSTANTIVE WORK WILL PROCEED IN ACCORDANCE WITH THE APPROVED "REVISED CLOSURE PLAN FOR THE OPEN BURNING GROUND (OBG) HAZARDOUS WASTE TREATMENT UNIT (SCIENCE APPLICATIONS INTERNATIONAL CORPORATION [SAIC], OCTOBER 1997." MINOR AMENDMENTS TO THE APPROVED PLANS ARE REQUESTED AND ARE DETAILED HEREIN.

## 2.0 Closure Activities

Closure activities for the OBG site will consist of the following:

- Removal, containerization, and disposal of loose sediment from within the burn trays.
- Removal, containerization, and disposal of the refractory lining from each of the eight burn trays.
- Demolition, decontamination, transportation, and disposal of THE EIGHT BURN TRAYS, the portable blast barrier and scrap metal pile.
- Collection of confirmatory rinsate samples from the burn trays and portable blast barrier for chemical analysis.
- Collection, characterization, and disposal of investigation-derived waste (IDW).

UNEXPLODED ORDNANCE (UXO) IS NOT EXPECTED TO BE ENCOUNTERED AT THE OBG. HOWEVER, IF FIELD CONDITIONS EXIST THAT INDICATE THE POTENTIAL FOR UXO IN THE AREA, UXO AVOIDANCE MONITORING WILL BE PERFORMED.

***Decontamination Activities.*** Prior to decontamination each burn tray will be inspected for the presence of loose sediment (ash and other burned waste). This material will be collected by either brooming the material into small manageable piles or by using a portable wet/dry vacuum. The refractory lining will also be removed from each tray. This will be accomplished by hammering or chiseling the liner material free from the tray or another appropriate method. All loose material will be placed into 55-gallon U.S. Department of Transportation (DOT) rated drums for temporary storage on site. Composite samples will be collected from both the loose sediment and refractory liner material for waste characterization.

MINOR AMENDMENTS TO THE APPROVED CLOSURE PLAN ARE REQUESTED TO:

- DECONTAMINATE THE METALLIC MATERIALS AT THE SITE AS OPPOSED TO TRANSPORTING THEM TO BUILDING 1601 AND DECONTAMINATING THEM THERE.
- TREAT THE BURN TRAYS, LIDS, AND RAILS IN THE SAME MANNER, I.E., NOT THREE SEPARATE DECONTAMINATION EFFORTS AND THREE RINSATE SAMPLES.

Once the loose material and refractory lining has been removed from the burn trays a temporary decontamination facility will be constructed on site. THE DECONTAMINATION FACILITY WILL BE CONSTRUCTED AT THE SITE BY EXCAVATING A SHALLOW AREA OF A SIZE NECESSARY TO EXPEDITE DECONTAMINATION OF ALL METALLIC MATERIALS. THE FLOOR OF THE EXCAVATION WILL BE LINED WITH PLYWOOD SHEETING TO PROVIDE A SECURE BASE. THE PLYWOOD AND SIDES OF THE EXCAVATION WILL BE LINED WITH PLASTIC SHEETING. ALL DECONTAMINATION WASTEWATER WILL BE COLLECTED WITHIN THE DECONTAMINATION FACILITY AND TRANSFERRED TO POLYTANKS TO AWAIT DISPOSAL.

METALLIC MATERIALS ~~Each burn tray~~ will be decontaminated using a high-pressure, low-phosphate, detergent (Alconox® or equivalent) wash followed by a potable water rinse. The portable blast barrier will be decontaminated and disposed of off site. This will be accomplished by cutting the blast barrier into 8 foot long by 2-foot wide sections which will be decontaminated using a high-pressure wash with a potable water rinse. ALL METALLIC PIECES WILL BE TRIPLE WASHED AS SPECIFIED IN THE APPROVED CLOSURE PLAN. FINAL rinsate samples will be collected from the burn trays and sections of the blast furnace material in order to verify the decontamination efforts. FINAL RINSATE RESULTS WILL BE COMPARED TO THE APPROVED PERFORMANCE STANDARDS, TABLE 2-1 OF THE APPROVED CLOSURE PLAN, TO DETERMINE THE ADEQUACY OF DECONTAMINATION EFFORTS. DECONTAMINATION WILL CONTINUE UNTIL THESE STANDARDS ARE MET. Following receipt and approval of the rinsate analysis the burn trays will be cut into 8 foot by 2 foot sections for transportation and disposal. Both the portable blast barrier and burn tray material will be loaded and shipped to the Rock Island Arsenal for final disposal.

Excess liquids generated during the decontamination procedures will be transported to a temporary staging area which will be identified by RVAAP personnel. This material will be containerized in 1,500-gallon polyvinyl holding tanks which will be used to store IDW liquids from RVAAP's ongoing closure activities. Once all closure activities are completed, a composite sample will be collected from these tanks for disposal criteria.

Sample collection procedures and analytical methodologies for collection of confirmatory rinsate samples and IDW samples are presented in Chapter 4.0.

## 3.0 Project Schedule

~~A schedule for closure activities to be performed at the RVAAP facility is presented in Table 3-1. As indicated in the schedule, closure activities are to be ongoing at the RVAAP facility for a period of 6 months. During this time closure activities will be conducted on a total of 5 sites. The anticipated start date for field activities at the OBG site is **August 5, 1998** and will continue for approximately 5 days. However, the schedule is dependent upon regulatory review and approval of the closure activity work plan for each site and may be adjusted accordingly.~~A PROPOSED SCHEDULE FOR RVAAP IS PRESENTED ON TABLE 3-1. AS INDICATED IN THE SCHEDULE, CLOSURE ACTIVITIES ARE TO BE ONGOING FOR A PERIOD OF APPROXIMATELY 21 MONTHS, WITH A PERIOD OF INACTIVITY DURING THE WINTER MONTHS OF 1998-1999. THE PERIOD OF INACTIVITY HAS BEEN IMPOSED BY HUD REQUIREMENTS FOR SPECIAL PERMITS REQUIRED TO DEMOLISH STRUCTURES ON THE DEACTIVATION FURNACE AREA, AND THE PESTICIDE BUILDING T-4452, AND ALSO TO AVOID EXCAVATION AT THESE SITES DURING THE WET MONTHS. DURING THE 21 MONTH PERIOD, A TOTAL OF FIVE SITES WILL UNDERGO CLOSURE ACTIVITIES. THE ANTICIPATED STARTUP DATE FOR THE OPEN BURNING GROUND SITE IS 15 JULY, WITH FIELD WORK TO BE COMPLETED BY 7 SEPTEMBER, 1998. HOWEVER, THE SCHEDULE IS DEPENDANT UPON REGULATORY REVIEW AND APPROVAL OF THE CLOSURE ACTIVITY WORK PLANS FOR EACH SITE AND MAY BE ADJUSTED ACCORDINGLY.

| ACTIVITY ID | EARLY START | EARLY FINISH | ORIG DUR |
|---|---|---|---|
| 00000100 | 18FEB98A | 29SEP99 | 421 |
| 00000200 | 18FEB98A | 6MAR98A | 15 |
| 00000300 | 9MAR98A | 29MAY98A | 15 |
| 00000400 | 1JUN98A | | 0 |
| 00000500 | 1JUN98A | 2JUL98A | 20 |
| 00000600 | 3JUL98A | 7JUL98A | 15 |
| 00000700 | 8JUL98A | 24AUG98 | 10 |
| | | | |
| 01000000 | 15JUL98A | 21DEC98 | 114 |
| 01020100 | 8SEP98 | 5OCT98 | 20 |
| 01020200 | 6OCT98 | 26OCT98 | 15 |
| 01040000 | 15JUL98A | 7SEP98 | 39 |
| 01040010 | 15JUL98A | 24AUG98 | 27 |
| 01040110 | 24AUG98 | 28AUG98 | 5 |
| 01040120 | 31AUG98 | 31AUG98 | 1 |
| 01040210 | 1SEP98 | 4SEP98 | 4 |
| 01040220 | 1SEP98 | 4SEP98 | 4 |
| 01040230 | 7SEP98 | 7SEP98 | 1 |
| 01040240 | 7SEP98 | 7SEP98 | 1 |
| 01050100 | 6OCT98 | 21DEC98 | 55 |
| 01050110 | 6OCT98 | 2NOV98 | 20 |
| 01050120 | 3NOV98 | 30NOV98 | 20 |
| 01050130 | 1DEC98 | 21DEC98 | 15 |
| | | | |
| 02000000 | 3MAY99 | 27AUG99 | 85 |
| 02020100 | 17MAY99 | 11JUN99 | 20 |
| 02020200 | 14JUN99 | 2JUL99 | 15 |
| 02040000 | 3MAY99 | 14MAY99 | 10 |
| 02040100 | 3MAY99 | | 0 |
| 02040110 | 3MAY99 | 7MAY99 | 5 |
| 02040120 | 3MAY99 | 7MAY99 | 5 |
| 02040130 | 10MAY99 | 10MAY99 | 1 |
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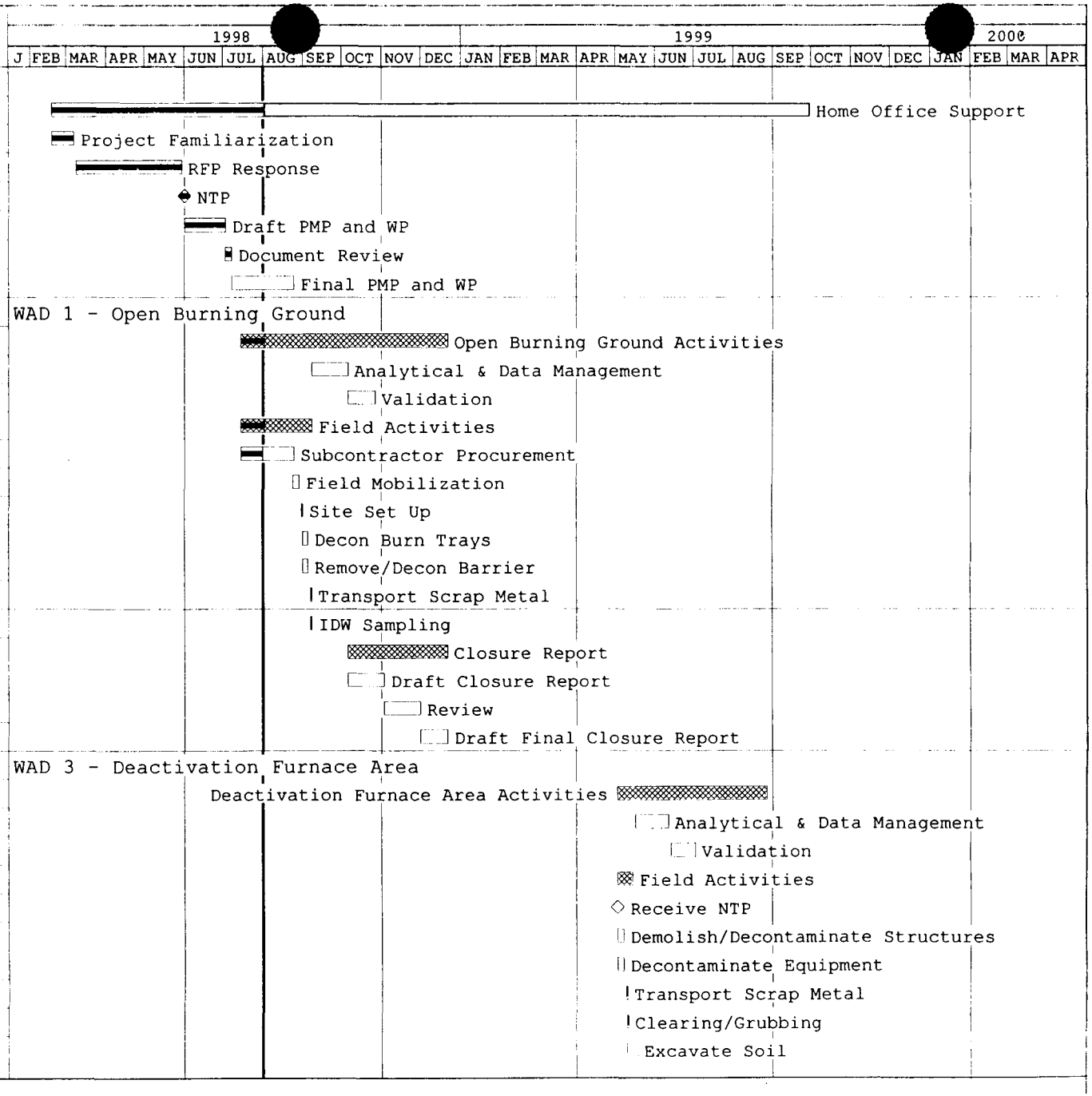


Activity Classification:Code
Hammock

Plot Date 24AUG98
Data Date 1AUG98
Project Start 16MAR98
Project Finish 29SEP99

(c) Primavera Systems, Inc.

Activity Bar/Early Dates
Critical Activity
Progress Bar
Milestone/Flag Activity

Figure 3-1
Ravenna AAP
Louisville PRAC, DO 009 Schedule

Louisville PRAC, DO 09 Schedule

| Date | Revision | Checked | Approved |
|---|---|---|---|
| | | | |

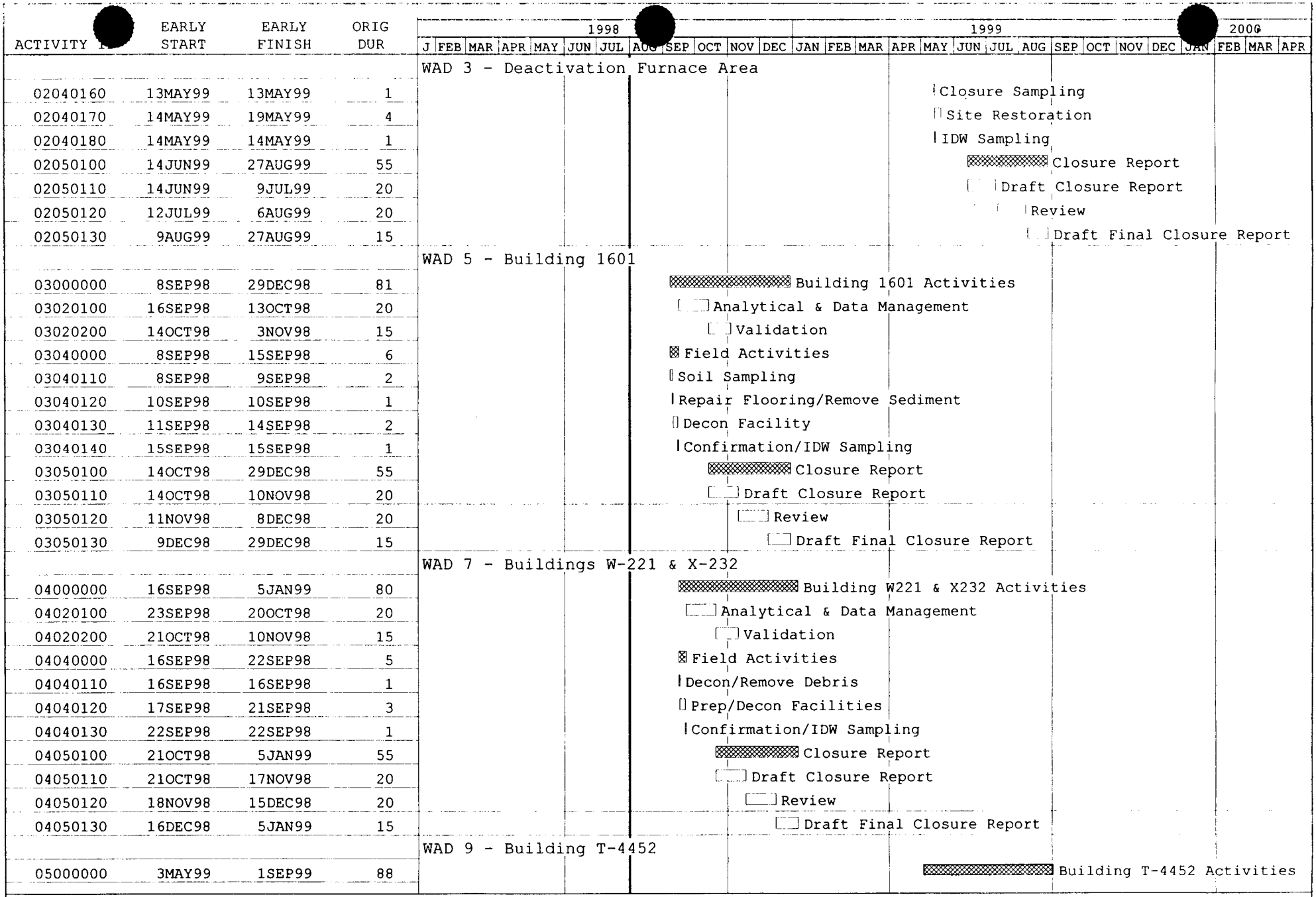


Figure 3-1
Ravenna AAP
Louisville PRAC, DO 009 Schedule

| ACTIVITY ID | EARLY START | EARLY FINISH | ORIG DUR |
|---|---|---|---|
| 05020100 | 20MAY99 | 16JUN99 | 20 |
| 05020200 | 17JUN99 | 7JUL99 | 15 |
| 05040000 | 3MAY99 | 19MAY99 | 13 |
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| 05040110 | 3MAY99 | 4MAY99 | 2 |
| 05040120 | 5MAY99 | 6MAY99 | 2 |
| 05040130 | 7MAY99 | 10MAY99 | 2 |
| 05040140 | 11MAY99 | 14MAY99 | 4 |
| 05040150 | 17MAY99 | 17MAY99 | 1 |
| 05040160 | 18MAY99 | 19MAY99 | 2 |
| 05050100 | 17JUN99 | 1SEP99 | 55 |
| 05050110 | 17JUN99 | 14JUL99 | 20 |
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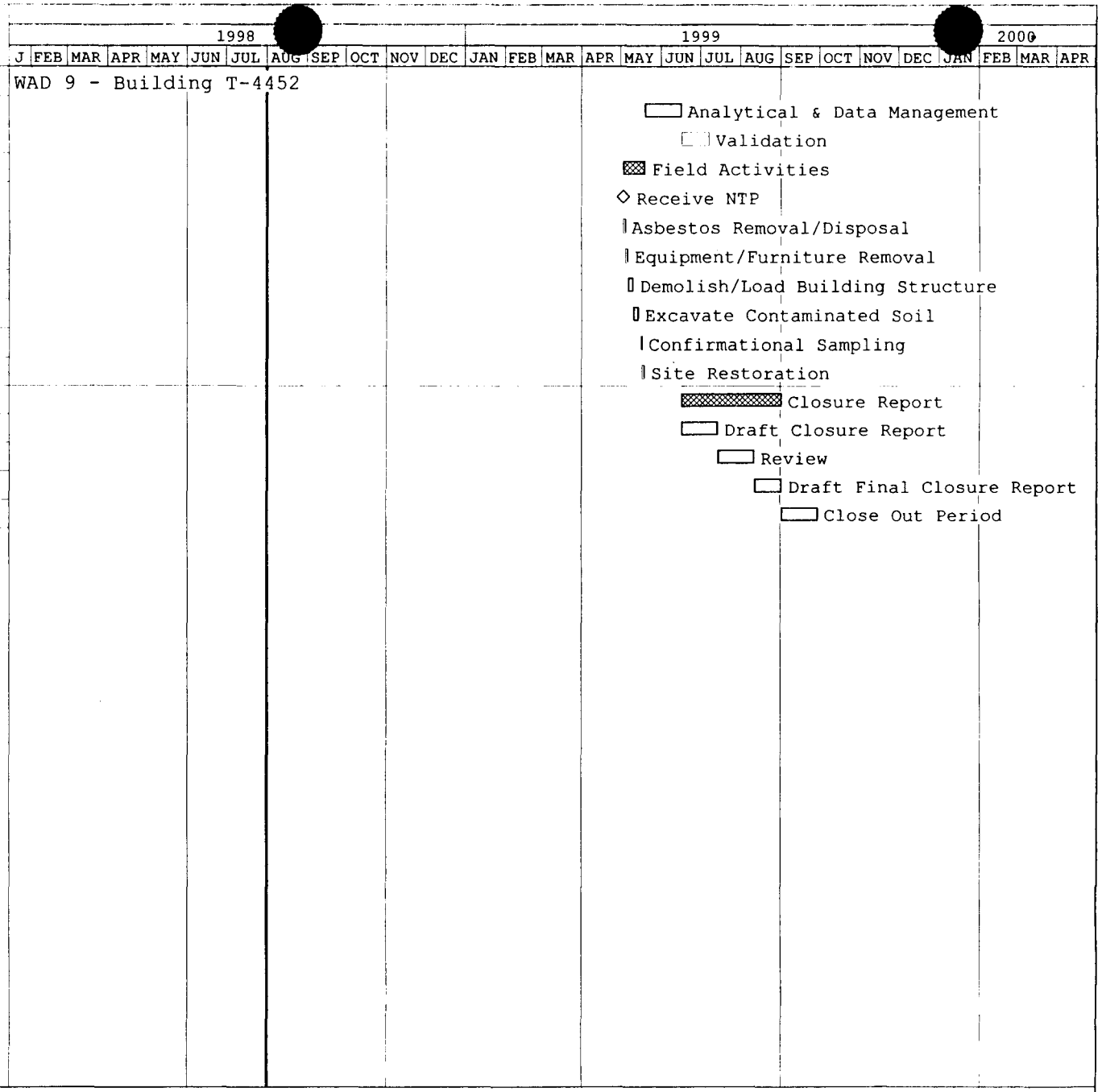


Activity Classification Code
Hammock

Plot Date 24AUG98
Data Date 1AUG98
Project Start 16MAR98
Project Finish 29SEP99

(c) Primavera Systems, Inc.

Activity Bar/Early Dates
Critical Activity
Progress Bar
Milestone/Flag Activity

Sheet

Figure 3-1
Ravenna AAP
Louisville PRAC, DO 009 Schedule

Louisville PRAC, DO 09 Schedule

| Date | Revision | Checked | Approved |
|---|---|---|---|
| | | | |

# 4.0 Site-Specific Sampling and Analysis Plan

The following text describes methods and procedures for accomplishing the sampling and analysis required for closure of the OBG site. Site closure requirements are specified in the revised closure plan for the OBG site (Science Applications International Corporation [SAIC], 1997). Sampling at the OBG site will consist of waste disposal characterization sampling and decontamination process confirmation sampling.

## 4.1 Waste Characterization Sampling

Waste characterization sampling will be performed on all collected/containerized IDW to facilitate proper disposal IN ACCORDANCE WITH ALL APPLICABLE STATE AND FEDERAL RULES, LAWS, AND REGULATIONS. Expected IDW includes ash and other debris currently contained within the eight metal/ ceramic burn trays at the OBG, the demolished burn tray ceramic liner, and waste water from decontamination of the burn trays and the blast barrier. Each of the IDW media will be segregated for sampling and disposal. Composite samples will be collected, handled, and shipped in accordance with the facility-wide sampling and analysis plan (SAP) (SAIC, 1996). Sample analysis will comply with methods and procedures provided in the site-specific quality assurance project plan (QAPP) for the OBG - burn trays project presented in Section 5.0. Sample collection equipment will be single-use disposable equipment or will be decontaminated as described in Section 5.4.

### 4.1.1 Residual Debris Sampling

Ash and debris removed from the burn trays will be collected into DOT-approved, 55-gallon, open-top drums. It is anticipated that the volume of ash/debris will not exceed one 55-gallon drum. One composite sample of the drummed debris will be collected and analyzed for low-level explosives and target analyte list (TAL) metals. In addition to procedures described in the facility-wide SAP, composite sampling of the debris will be performed as follows:

- In the event multiple drums are required to contain the debris from the burn trays, drums will be segregated into drum groups of not more than five drums per group.
- One composite debris sample will be compiled from each drum group.
- Each composite sample will consist of equal aliquots collected from each drum within an individual drum group. If only one drum is filled, the composite sample will consist of equal aliquots from four separate points within the drum.

- Aliquots will be composited for sampling in accordance with Section 7.4.1, Solid IDW Composite Sampling Procedure, from the facility-wide SAP.

- Each composite sample will be analyzed for parameters that are required by the subcontracted waste hauling/disposal facility and that meet Ohio Environmental Protection Agency (EPA) and other state and federal waste disposal regulations.

### *4.1.2 Ceramic Liner Sampling*

The burn trays are lined with a refractory (ceramic) material that will be removed, containerized, and disposed. The ceramic liner will be removed from the burn trays by breaking it into pieces sized to fit into 55-gallon drums. It is anticipated that five drums will be required to containerize the ceramic waste. After drumming the material, composite samples will be collected for disposal characterization as follows:

- Drums will be segregated into drum groups of not more than five drums (only one drum group is expected).

- One composite sample of the ceramic material will be compiled from each drum group.

- In the field, composite samples will be collected by gathering equal aliquots of small chips of the material from each drum within an individual drum group. These chip aliquots will be mixed thoroughly and placed in appropriate sample containers for shipment to the laboratory. Instructions will be provided to the laboratory to pulverize the chip samples prior to extraction and analysis.

- Each composite sample will be analyzed for parameters that are required by the subcontracted waste hauling/disposal facility and that meet Ohio EPA and other state and federal waste disposal regulations.

### *4.1.3 Decontamination Wastewater Sampling*

After removing the debris and ceramic liner from the burn trays, the remaining metal shells, LIDS, AND RAILS will be decontaminated. A metal blast shield will also be decontaminated along with the burn tray shells. As discussed in Chapter 2.0 above, the decontamination process will ~~utilize~~ INVOLVE TRIPLE RINSE USING high-pressure, low-phosphate, detergent (Alconox® or equivalent) washing. Decontamination wastewater will be collected and transferred to polytanks to await disposal. The polytanks will be used to containerize decontamination wastewater from each of the five sites under this delivery order (OBG, Deactivation Furnace Area [DFA], Building 1601, Buildings W-221 and X-232, and Building T-4452). After completing all decontamination/ demolition activities at these five sites, three composite samples will be collected as follows:

- Polytanks will be segregated into three groups representing initial, intermediate, and final wash water.

- Three composite waste water samples will be collected, one each from the initial, intermediate, and final polytank groups.

- Each composite sample will consist of equal aliquots collected from each polytank within an individual group.

- Aliquots will be composited for sampling in accordance with Section 7.4.2, of the facility-wide SAP.

- Each composite sample will be analyzed for parameters that are required by the subcontracted waste hauling/disposal facility and that meet Ohio EPA and other state and federal waste disposal regulations.

All temporary waste storage and off-site waste hauling/disposal will be coordinated through the RVAAP environmental coordinator, Mr. Mark Patterson.

### *4.2 Confirmation Sampling*

~~Sampling will be performed on the decontaminated metal burn tray shells and metal blast shield to confirm appropriate decontamination.~~ Confirmation samples will be collected from the final rinse water after decontamination has been accomplished. Sample collection procedures will follow those stated for equipment rinsate samples in Section 4.3.7 of the facility-wide SAP. Specifically, ASTM Type I (or equivalent) water be poured over sections of the decontaminated metal and collected directly into the appropriate prelabeled sample containers. Six confirmation rinsate samples will be collected and submitted for off-site laboratory analysis for low-level explosives and TAL metals in accordance with the site-specific QAPP presented in Section 5.0. The samples will be collected from four randomly selected burn tray shells and two representative pieces of the demolished metal blast shield. Excess rinsate will be collected and placed with the decontamination water in polytanks and handled as IDW. Sample collection equipment will be single-use disposable equipment or will be decontaminated as described in Section 5.4.

# 5.0 Site-Specific Quality Assurance Project Plan

This QAPP is being prepared as an investigation-specific addendum which will supplement the information summarized in the facility-wide QAPP and SAP. Where appropriate, sections of the facility-wide documents will be referenced and not repeated. This document will summarize the general specifications to be used during this field investigation. Each site to be investigated will be thoroughly discussed in a site-specific document prepared for each site.

This QAPP provides site-specific information for closure activities at the OGB site. Closure activities will consist of dismantling, decontaminating, and disposing of eight burn trays and an existing blast shield at the site. Rinsate samples will be collected to confirm the decontamination efforts while composite samples will be collected for IDW characterization and disposal purposes.

## 5.1 Past Data Collection Activities

This information is contained in Section 1.2 of the facility-wide SAP.

### 5.1.1 Project Objectives and Scope of Work

The primary objective of this task will be to remove potential contaminants from the site. IT Corporation (IT) will confirm that this task objective has been met by establishing and implementing a sample collection and analysis program which verifies that these objectives have been met. Overall project objectives are discussed in the facility-wide SAP.

### 5.1.2 Project Schedule

The project schedule for this site is presented in Chapter 3.0.

## 5.2 Project Personnel and Organization

This project will be executed as a part of the Louisville Preplaced Remedial Action Contract (PRAC) Program, under the direction of Program Manager, John Razor. The PRAC Program maintains a small, focused program staff dedicated to Louisville PRAC delivery orders, which provides cost/schedule support, and client invoicing services for active PRAC June 29, 1998 delivery orders. In addition, IT maintains numerous technical resource groups, from which the Project Manager draws technical resources for project execution. This section identifies key members of the project staff and their respective roles in this project.

### 5.2.1 Personnel, Roles, and Responsibilities

This project will be executed under the technical direction of the IT Project Manager, who reports directly to the Program Manager. The following key project positions have been identified and assigned for the execution of this delivery order.

- ***Program Manger:*** The Program Manager serves as a point of contact for the U.S. Army Corps of Engineers (USACE) on all program issues, as well as delivery order -specific problems or issues as they may arise. The Program Manager is Mr. John Razor. Mr. Razor will ensure that contractual obligations are observed. In addition, Mr. Razor will conduct monthly review of project costs, schedule, and general progress.

- ***Project Manager:*** The Project Manager reports directly to the Program Manager. W. Charles Shafer will serve as the Project Manager for this delivery order. Responsibilities of this position include initial project setup and ongoing maintenance of cost and schedule reporting systems; preparation of monthly status reports; and general management of all project documentation preparation, field execution efforts, and analytical services required to execute this delivery order. In addition, the Project Manager is responsible for ensuring that all applicable USACE and IT policies and procedures are followed, including health and safety (H&S) requirements, QA procedures, and existing site-wide documentation. Finally, the Project Manger serves as the single point of contact for the USACE contracting office's representative and technical manager on delivery order related issues.

- ***Field Superintendent:*** The field superintendent reports directly to the project manager and will be responsible for all procurement, mobilization, field execution, and demobilization activity. Mr. Tom Randolph will serve as the field superintendent, and will be active in the month leading up to mobilization, accomplishing procurement, and identifying field and operating personnel. Mr. Randolph will also manage and direct all field activity.

- ***Project Engineer:*** The project engineer will direct all work plan preparation, assist the field superintendent in identifying field personnel, review the field activity as several points during execution, and direct preparation of the closure reports. Mr. Bill Norton will serve as the project engineer and will report to the Project Manager.

- ***Project Geologist:*** The project geologist role will be filled by Mr. David Kessler. The project geologist will be responsible for execution of all drilling and sampling conducted in the field, including confirmation sampling and field screening, and for directing and logging soil borings. The project geologist will also support the project engineer in supervision of excavation activity, including initial locations, mapping, sample locations, etc. This position will report to the project engineer and the Project Manager.

- ***Analytical Coordinator:*** Ms. Joyce Dishner will serve as the analytical coordinator and will report directly to the Project Manager. The analytical coordinator is responsible for all aspects of analytical support, including procurement of laboratory services, coordination of field sampling personnel with the analytical laboratory, quality control (QC) and management, review of data deliverables, and all data management functions to include validation and reporting.

- ***H&S Officer:*** Mr. Mike Henderson will serve as the H&S officer and will report to the Project Manager. The H&S officer is responsible for preparation of all H&S plans and documentation, and for establishing and maintaining the H&S program on the site during field execution. The H&S officer will be assisted by field H&S staff on a full-time basis when the project is in the field.

- ***Contract Administrator:*** Mr. Frank Haseltine is the contract administrator, reporting to the Program Manager. Mr. Haseltine is responsible for all contract communications and issues regarding the PRAC contract.

### *5.3 Project Quality Assurance Objectives*

Data quality objectives (DQO) are qualitative and quantitative statements that specify the quality of data required to support decisions during investigation and remedial activities. DQOs are applicable to all data collection activities, and the level of detail and data quality are based on the overall needs of the project and the intended uses of the data produced.

The DQO process helps to define the purpose for which environmental data will be used and sets guidelines for designing a data collection program that meets the regulatory objectives. This process also provides a logical and quantitative framework for determining the time and resources that will be used to generate data of the desired level of quality.

The overall quality assurance (QA) objective is to develop and implement procedures for the field sampling and laboratory analysis which will provide results to be used in assessing the sites of interest. The data produced will be used to determine the presence or absence of contamination found at the deactivated furnace area. The analytical DQOs established in Tables 3-1 and 3-2 of the facility-wide QAPP will be used to evaluate the precision and accuracy of the analytical data collected from the site. A general description of the DQO process is defined in Section 3.0 of the facility-wide QAPP.

### *5.4 Sampling Procedures*

Specific sampling procedures will be described in each site-specific FSP as necessary to facilitate sample collection. Table 5-1 summarizes the sample containers, preservation, and holding time

## Table 5-1

### Sample Containers, Preservatives, and Holding Times for Potential Analyses
### Open Burning Ground Facility
### Ravenna Army Ammunition Plant, Ravenna, Ohio

| Matrix | Analytical Parameter | Analytical Reference | Container Type and Quantity | Preservative | Holding Time |
|---|---|---|---|---|---|
| Water | Explosives | SW-8330 | 2 x 1 Liter Amber glass | Cool to 4°C | 7 days to extraction, 40 days from extract to analysis |
| | TAL Metals | SW-6010/7000 | 1 x 1 Liter Poly | Cool to 4°C, $HNO_3$ to pH<2 | 6 months |
| | RCRA Metals | SW-6010/7000 | 1 x 1 Liter Poly | Cool to 4°C, $HNO_3$ to pH<2 | 6 months |
| | Cyanide | SW-9010A | 1 x 1 Liter Poly | Cool to 4°C, NaOH to pH>12 | 14 days |
| | Pesticides | SW-8081 | 2 x 1 Liter Amber glass | Cool to 4°C | 7 days to extraction, 40 days from extract to analysis |
| | Herbicides | SW-8151 | 2 x 1 Liter Amber glass | Cool to 4°C | 7 days to extraction, 40 days from extract to analysis |
| Soils | Explosives | SW-8330 | 4 oz wide-mouth glass | Cool to 4°C | 14 days to extraction, 40 days from extract to analysis |
| | TAL Metals | SW-6010/7000 | 4 oz wide-mouth glass | Cool to 4°C | 6 months |
| | Cyanide | SW-9010A | 4 oz wide-mouth glass | Cool to 4°C | 14 days |
| | Pesticides | SW-8081 | 4 oz wide-mouth glass | Cool to 4°C | 14 days to extraction, 40 days from extract to analysis |
| | Herbicides | SW-8151 | 4 oz wide-mouth glass | Cool to 4°C | 14 days to extraction, 40 days from extract to analysis |
| | TCLP Volatiles | SW-1311/8260A | 4 oz wide-mouth glass | Cool to 4°C | 7 days to extraction, 14 days from extract to analysis |
| | TCLP Semivolatiles | SW-1311/8270B | 4 oz wide-mouth glass | Cool to 4°C | 7 days to extraction, 40 days from extract to analysis |
| | TCLP Metals | SW-1311/6010 | 4 oz wide-mouth glass | Cool to 4°C | 7 days to extraction, 6 months from extraction to analysis |
| | TCLP Mercury | SW-1311/7471 | 4 oz wide-mouth glass | Cool to 4°C | 7 days to extraction, 40 days from extract to analysis |
| | TCLP Pesticides | SW-1311/8081 | 4 oz wide-mouth glass | Cool to 4°C | 7 days to extraction, 40 days from extract to analysis |
| | TCLP Herbicides | SW-1311/8151 | 4 oz wide-mouth glass | Cool to 4°C | 7 days to extraction, 40 days from extract to analysis |

Method Reference as follows: U.S. Environmental Protection Agency (EPA), 1986, *Test Methods for Evaluation of Solid Waste, Physical/Chemical Methods,* SW-846, 3rd Edition and Its Updates, EPA, Office of Solid Waste.

requirements for the expected parameters of interest during this investigation for both solid and aqueous matrices. Table 5-2 summarizes the total number of field and QA/QC samples to be collected at the open burning grounds and the analytical parameters of interest at the site.

***Decontamination of Equipment and Supplies.*** One purpose for defining an equipment decontamination procedure is to ensure adequate steps are taken to remove residual chemical contamination before the equipment is used to collect a sample for environmental analysis. Decontamination procedures are also important in reducing the risk of cross contamination and worker exposure when removing contaminated nonsampling equipment from a contaminated area, as discussed in the H&S plans. Different levels of decontamination stringency are applied for the different types of equipment used. For sampling equipment used to collect environmental samples, the most stringent program will be required, and it is this program that is the focus of this discussion. For sampling equipment used to collect samples for geotechnical analysis or soil classification and general nonsampling equipment, a simple soap and water rinse or a high-pressure steam cleaning with soap and water should be sufficient to remove contamination. IT specific H&S requirements are imposed that require a further level of decontamination for grossly contaminated equipment, additional decontamination steps may be required. Usually in both cases, an area of the site will be designated as the decontamination area and decontamination supplies, water, and solvents will be staged in the area for use.

Any field instruments, such as water level meters and pH and temperature probes that come in direct contact with the sample matrix, will be adequately decontaminated between measurements by detergent solution wash, deionized (DI) water rinsing, wiping, and final rinsing with DI water.

To minimize the possible contribution of even trace levels of contamination from sampling equipment, adequate equipment decontamination must be completed prior to the first use of the equipment (if new) or reuse at a different sampling location. The decontamination procedure may vary depending on the sample matrix, the analytical program, or the materials or construction of the sampling equipment used. The following general guidelines will be followed for decontamination of sampling equipment:

- ***Post-Sample Collection Cleanup.*** After the required samples have been properly prepared at a given sampling location, residual visible soil will be removed as much as possible from the sampling equipment by scraping or shaking. These residues will be handled as IDW. For water sampling equipment, residual water should be drained and placed into a waste container.

Table 5-2

## Total Number of Field and QA/QC Samples to be Collected from the Open Burning Ground
## Ravenna Army Ammunition Plant, Ravenna, Ohio

| Parameters | Analytical Method | Matrix | Number of Sampling Events | Total Number of Samples | Field Duplicate (10%) | MS (5%) | MSD (5%) | Field Blank (1/event) | Equip Rinsate (1/event) | Trip Blank (1/cooler) | TAT Needed | Total Number of Samples |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **OBG- BURN TRAYS, LIDS, RAILS** | | | | | | | | | | | | |
| **Trays - Rinsate** | | | | | | | | | | | | |
| EXPLOSIVES (LOW LEVEL) | SW8330M | Rinsates | 1 | 4 | 1 | 0 | 0 | 1 | 0 | | Normal | 6 |
| METALS (Al, As, Ba, Cd, Cr, Pb, Mn, Se, Ag, Zn) | SW6010A | Rinsates | 1 | 4 | 1 | 0 | 0 | 1 | 0 | | Normal | 6 |
| MERCURY | SW7470 | Rinsates | 1 | 4 | 1 | 0 | 0 | 1 | 0 | | Normal | 6 |
| **Blast Barrier - Rinsate** | | | | | | | | | | | | |
| EXPLOSIVES (LOW LEVEL) | SW8330M | Rinsates | 1 | 2 | 0 | 1 | 1 | 0 | 0 | | Normal | 4 |
| METALS (Al, As, Ba, Cd, Cr, Pb, Mn, Se, Ag, Zn) | SW6010A | Rinsates | 1 | 2 | 0 | 1 | 1 | 0 | 0 | | Normal | 4 |
| MERCURY | SW7470 | Rinsates | 1 | 2 | 0 | 1 | 1 | 0 | 0 | | Normal | 4 |
| **IDW - Waste water** | | | | | | | | | | | | |
| EXPLOSIVES (LOW LEVEL) | SW8330M | water | 1 | 1 | 0 | 0 | 0 | 0 | 0 | | Normal | 1 |
| METALS (Al, As, Ba, Cd, Cr, Pb, Mn, Se, Ag, Zn) | SW6010A | water | 1 | 1 | 0 | 0 | 0 | 0 | 0 | | Normal | 1 |
| MERCURY | SW7470 | water | 1 | 1 | 0 | 0 | 0 | 0 | 0 | | Normal | 1 |
| **IDW - Water soil/sediments** | | | | | | | | | | | | |
| Full TCLP | SW1311/various | soil/sediment | 1 | 1 | | | | | | | | |
| **Totals** | | | | 22 | 3 | 3 | 3 | 3 | 0 | 0 | | 33 |

- ***Gross Wash and Water Rinse***. Following the recovery of the sampling equipment to the decon area, the equipment will undergo a vigorous brushing with laboratory-grade, phosphate-free detergent in water and will then be rinsed with tap water to remove visible particulate.

- ***Analyte-Free Water Rinse***. Rinse decontaminated equipment with DI analyte-free water. The water used should be certified as analyte-free by the manufacturer and prepared using filters, an activated carbon bed filtration apparatus, and deionizing resin columns. Water that has been field or laboratory prepared using this equipment and has been sampled, analyzed for target parameters, and verified to contain less than detectable quantities may also be used. For all water sources, verify that the same lot or batch that has been documented as analyte free is consistently used or that documentation exists for multiple lots.

- ***Solvent Rinse***. Depending on the target contaminants of concern and sampling matrix, rinse the sample with isopropanol and air dry. This rinse is optional. If testing for pesticides or PCB, perform an additional rinse with hexane.

  All solvents should be certified by the American Chemical Society as "pesticide-grade" or equivalent where such specifications exist. Better grades such as "nano-grade" are also acceptable. Solvents must be stored in a secured, health and safety approved storage cabinet. Each solvent container must be tagged with the date of receipt, date opened, and expiration date(s). The expiration date of the solvent will be calculated as 180 days from the date received or 30 days from the date opened.

- ***Second, Analyte-Free Water Rinse***. Rinse the equipment following the solvent rinse again with analyte-free water. Analyte-free water for this rinse is drawn from a second source (such as a squeeze bottle). (This rinse water may be collected as the equipment rinse sample when such a sample is required.)

- ***Protective Wrap***. Prepare decontaminated equipment for storage by draining all residual DI water from the equipment then allowing equipment to air dry (if possible) or towel dry. Wrap sampling surfaces in layers of aluminum foil and store in a designated storage location, free from sources of contamination. Apply outer protection such as sealing in a ziplock bag or plastic basin/tub with a lid to avoid dust.

When sampling equipment is used to collect samples that contain high concentration organic compounds, oil, grease, or other hard to remove materials, it may be necessary to rinse the equipment several times with pesticide-grade acetone or hexane to remove the materials before proceeding with the soap and water wash. In extreme cases, it may be necessary to steam-clean the field equipment before washing. If the field equipment cannot be adequately cleaned using these procedures, it should be discarded and possibly substituted with equipment constructed from a more resistant material.

### 5.5 Sample Custody

General sample custody and transportation procedures are described in Section 5.0 of the facility-wide QAPP. Copies of all field forms are attached to this site-specific QAPP as they apply to the sampling program.

### 5.6 Calibration Procedures and Frequencies

Instrument calibration is described in detail in Section 6.0 of the facility-wide QAPP.

### 5.7 Analytical Program and Procedures

The purpose of the analytical program is to produce data of known quality that accurately represents the composition of the matrices sampled at each site and that satisfy or exceed the requirements of the site-specific DQOs. To meet the analytical objective, samples will be prepared and analyzed by standard U.S. EPA SW-846 methodologies.

All laboratory personnel will be trained in the correct implementation of the laboratory standard operating procedures and the analytical methods referenced in this plan, as well as general laboratory procedures and sound laboratory practices, prior to analyzing samples from RVAAP. The laboratory will be responsible for documenting and maintaining personnel training records, which will be required to be available for review in the event of a laboratory audit.

IT has selected Quanterra Environmental Services (Quanterra), to be the primary supplier of analytical laboratory services for the RVAAP project. Quanterra's North Canton and Knoxville offices will analyze the majority of samples collected from RVAAP. Some tasks or situations may require the procurement of analytical services from another vendor and, in those cases, the qualifications of those vendors will be reviewed by IT and discussed with a USACE project representative before approval is given. The addresses for the Quanterra laboratories to be used are as follows:

Quanterra – North Canton
4101 Shuffle Drive NW
North Canton, OH 44720
(216) 497-9396

Quanterra – Knoxville
5815 Middlebrook Pike
Knoxville, TN 37921
(423) 588-6401.

All samples associated with the OBG will be sent to the Quanterra North Canton location and all analyses will be performed by Quanterra. Tables 5-3 and 5-4 present the standard lists of compounds reported for TAL metals, and low-level explosives by the method of analysis expected to be used during this investigation, respectively. These tables also summarize the reporting limits (RL) for each compound as statistically determined by Quanterra. The limits provided in the tables may change based on dilution and purge volumes.

### 5.7.1 Reporting Limits

***Reporting Limits vs. Method Detection Limits.*** Method detection limits (MDL) are determined as required in 40 CFR Part 136, Appendix B or SW-846, Chapter 1 for each method, instrument, project-specified analyte, and applicable matrix (soil/water). The MDLs are recorded and documented and updated annually. After the MDLs are generated, the laboratory establishes its RLs, which are higher than the MDL by a factor of 2 to 5 times the MDL. The factor is applied to account for matrix differences. As the MDLs are re-evaluated, the RLs may be adjusted to reflect the new MDL.

As a rule, the RL cannot be lower than the lowest calibration standard for a given analysis. At a minimum, a verification standard at or near the RL is required to technically support the degree of accuracy indicated by the RL.

The RL for a given analysis will be those listed in Table 5-3 and Table 5-4 of this site-specific QAPP. In the absence of matrix interferences, the sample RL should be equal to the values listed in Table 5-3 and Table 5-4, but in the presence of matrix interferences that require sample dilutions, these RL often cannot be met. When a dilution of a sample is performed, the RL is elevated by multiplying the RL by the dilution factor, and the sensitivity of the measurement is decreased by that same factor. When a dilution of a sample is required, because of confirmed matrix interference or to bring targets into the working calibration range of an instrument, the lowest possible dilution of that sample is to be reported by the laboratory in order to meet or closely meet the project objectives.

### 5.7.2 Laboratory Sample Custody and Tracking Procedures

Shipments of samples from the field to the laboratory will be typically within 24 hours of collection. Samples requiring analyses with short holding times will be identified and designated as

## Table 5-3

## Summary of Analytes and Reporting Limits for Metals Analysis by Method SW-6010A/7000 Series
## Open Burning Ground Facility
## Ravenna Army Ammunition Plant, Ravenna, Ohio

| Parameter Group | SOIL | | WATER | |
|---|---|---|---|---|
| | RL | Units | RL | Units |
| Aluminum | 20 | mg/kg | 200 | µg/L |
| Antimony | 1 | mg/kg | 5 | µg/L |
| Arsenic | 1 | mg/kg | 10 | µg/L |
| Barium | 20 | mg/kg | 200 | µg/L |
| Beryllium | 0.5 | mg/kg | 5 | µg/L |
| Cadmium | 0.2 | mg/kg | 2 | µg/L |
| Calcium | 500 | mg/kg | 5000 | µg/L |
| Chromium | 0.5 | mg/kg | 5 | µg/L |
| Cobalt | 5 | mg/kg | 7 | µg/L |
| Copper | 2.5 | mg/kg | 25 | µg/L |
| Iron | 10 | mg/kg | 100 | µg/L |
| Lead | 0.3 | mg/kg | 3 | µg/L |
| Magnesium | 500 | mg/kg | 5000 | µg/L |
| Manganese | 1.5 | mg/kg | 15 | µg/L |
| Nickel | 4 | mg/kg | 40 | µg/L |
| Potassium | 500 | mg/kg | 5000 | µg/L |
| Selenium | 0.5 | mg/kg | 5 | µg/L |
| Silver | 0.5 | mg/kg | 5 | µg/L |
| Sodium | 500 | mg/kg | 5000 | µg/L |
| Thallium | 1 | mg/kg | 10 | µg/L |
| Vanadium | 5 | mg/kg | 50 | µg/L |
| Zinc | 5 | mg/kg | 20 | µg/L |
| Mercury | 0.1 | mg/kg | 0.2 | µg/L |

## Table 5-4

## Summary of Compounds and Reporting Limits for Nitroaromatics and Nitramines (Low-Level Explosives) by Method SW-8330 Open Burning Ground Facility Ravenna Army Ammunition Plant, Ravenna, Ohio

| Parameter Group | Water | | Soil | |
|---|---|---|---|---|
| | RL | Units | RL | Units |
| HMX | 0.5 | µg/L | 0.5 | mg/kg |
| RDX | 0.5 | µg/L | 0.5 | mg/kg |
| 1,3,5-Trinitrobenzene | 0.2 | µg/L | 0.25 | mg/kg |
| 1,3-Dinitrobenzene | 0.2 | µg/L | 0.25 | mg/kg |
| Tetryl | 0.2 | µg/L | 0.25 | mg/kg |
| Nitrobenzene | 0.2 | µg/L | 0.25 | mg/kg |
| 2,4,6-Trinitrotoluene | 0.2 | µg/L | 0.25 | mg/kg |
| 4-Amino-2,6-dinitrotoluene | 0.2 | µg/L | 0.25 | mg/kg |
| 2-Amino-4,6-dinitrotoluene | 0.2 | µg/L | 0.25 | mg/kg |
| 2,6-Dinitrotoluene | 0.2 | µg/L | 0.25 | mg/kg |
| 2,4-Dinitrotolune | 0.2 | µg/L | 0.25 | mg/kg |
| 2-Nitrotoluene | 0.2 | µg/L | 0.25 | mg/kg |
| 4-Nitrotoluene | 0.2 | µg/L | 0.25 | mg/kg |
| 3-Nitrotoluene | 0.2 | µg/L | 0.25 | mg/kg |

such on the analysis request/chain of custody (AR/COC) forms and will be shipped on the date of collection, if possible.

Upon receipt of the samples at the laboratory, the laboratory sample custodian will note the condition and temperature of the cooler received, as well as any questions or observations concerning sample integrity. The laboratory sample custodian will record the condition and verify the presence of each sample named on the AR/COC record. Any nonconformance noted which concerns the sample identifications, type of analysis, or condition upon receipt will be noted and project management will be notified. The laboratory project manager will notify the analytical coordinator and a corrective action will be implemented. The laboratory will maintain an internal sample-tracking record that will document the date of sample removal from storage, extraction, preparation, and analysis, as well as the laboratory-assigned sample number, which is affixed to each sample container upon sample receipt.

Field samples may be held for a reasonable time, such that the required method extraction and analysis holding times are not exceeded or jeopardized. They may be accumulated at the laboratory to form an analytical batch consisting of a maximum of 20 field samples that are of the same matrix or of similar composition. Associated field QC samples, including trip blanks, equipment rinsates, field duplicates, and project-specific matrix spike/matrix spike duplicate (MS/MSD), are to be designated on the AR/COC forms and may be included in the analytical batch.

As part of the information on the AR/COC record, the samples will be marked for laboratory disposal. The laboratory project manager will authorize and oversee the disposal of samples when the project is complete and the samples are no longer needed. The disposal of samples will be performed in accordance with laboratory standard operating procedures and be in compliance with all U.S. EPA and state requirements.

### *5.7.3 Laboratory Document Storage*

All original laboratory documents are to be stored by the laboratory in a safe controlled environment for a period of not less than 7 years. All original documents should be available for review upon request.

## 5.8 Quality Assurance/Quality Control Program

### 5.8.1 Intra-Laboratory Quality Control

The contracted laboratory will have a written QA program that provides rules and guidelines to ensure the reliability and validity of the work conducted at the laboratory. Compliance with the QA program is coordinated, monitored, and updated by the laboratory's QA department.

The established QA/QC procedures are implemented to provide the quality of data suitable for their intended purpose and to ensure that the project DQOs are satisfactorily met. Laboratory and field check samples are used to confirm that laboratory as well as field practices are in control. Laboratory checks are performed to verify that the sampling and analytical accuracy and precision of the data are within the target criteria limits established in the analytical method and the QAPP. Laboratory QC check samples consist of the following types of samples: Laboratory control samples (LCS), MS/MSD, method blanks, and surrogate and internal standard spikes. The purposes of these sample types are defined in the facility-wide QAPP.

### 5.8.2 Field Quality Control Samples

Field QC samples are collected to check the sampling and analytical accuracy and precision of field data and to determine the origin of contamination originating from the collection, transport, or storage of samples. The purpose of the field QC data is to provide important information about field operations. Analytical data are not changed or altered in any way based on the field QC results. Types of field QC samples are as follows: field duplicates, trip blanks, equipment blanks, and material/source blanks. The requirements and frequencies of collection for these field QC samples are those listed in Table 5-5 of this site-specific QAPP and as specified in the facility-wide QAPP. The following sections provide brief discussions of these sample types.

#### 5.8.2.1 Field Duplicates

Field duplicates are used to assess the precision of the sample collection procedures for a specific matrix. No data are qualified based solely on the results of field duplicate analyses.

Field duplicate sample analysis will be performed on a task-specific frequency to address the variability of contaminant concentrations in the sample matrix. Because of the variability introduced during sampling and analysis of soils, the target acceptance criteria for soil will be less than or equal to 50 percent relative percent difference (RPD) (whereas, analytical duplicates for waters target acceptance criteria is less than or equal to 30 percent RPD). Target acceptance criteria for soils and waters are summarized in Tables 3-1 and 3-2 of the facility-wide QAPP,

## Table 5-5

## Frequency of Field QA/QC Samples to be Collected at the Open Burning Ground Ravenna Army Ammunition Plant, Ravenna, Ohio

| QA/QC Sample Type | Matrix and Area to be Samples | Frequency of Collection | Est. No.[a] Collected |
|---|---|---|---|
| Field Duplicate | Burn Trays - rinsate | 10% (1 in 10 sampes) | 1 |
| Equipment Rinse[b] | | None required | 0 |
| Field/Material Blank | Burn Trays - rinsate | One per source water | 1 |

[a]Estimated number of samples collected will change if the overall number of samples collected changes.

[b]Equipment rinsates will not be required for samples collected using disposable or dedicated sampling equipment. These samples will not be counted when calculating percentages.

respectively. Field duplicates will be collected at a frequency of 10 percent (1 in 10 samples) during this task.

#### 5.8.2.2 Trip Blanks

Trip blanks are used to evaluate contamination from volatile organic compounds (VOC) originating from the transport of the samples. In the event of trip blank contamination, the associated sample data are evaluated for false positive results. A trip blank will be included in each shipment of coolers containing aqueous VOC samples. Based on the planned analytical program at the open burning grounds, no trip blanks will be required.

#### 5.8.2.3 Equipment Blanks

Equipment blanks are used to check the adequacy of the decontamination procedures applied to the sampling equipment used for the samples collected. In the event of equipment blank contamination, the associated sample data are evaluated for false positive results. Equipment rinsates will be collected at a frequency of 5 percent of all samples collected during this task. Samples, which are collected using disposable or dedicated sampling equipment, will not require associated equipment rinsate samples and will not be counted where frequency is concerned.

#### 5.8.2.4 Material Blanks

Material blanks are used to assess the purity of the source water and to determine whether contamination originated from the source water on-site or from the decontamination process. One material blank will be collected from each source water used during sampling and decontamination procedures at open burning grounds. In the event of material blank contamination, the associated sample data are evaluated for false positive results.

### 5.9 Data Reduction, Validation and Reporting

#### 5.9.1 Data Reduction

The general data reduction procedures outlined in Section 9.0 of the facility-wide QAPP will be followed by IT and their subcontracted laboratory.

#### 5.9.2 Data Validation

The data validation procedures outlined in the facility-wide QAPP will be followed by IT and their subcontracted data validator service. All data collected in the field and submitted to an off-

site analytical laboratory for definitive analysis will be subjected to a Level III data validation as described in Section 9.2 of the facility-wide QAPP.

### 5.9.3 Data Reporting

The analytical laboratories will prepare and submit analytical data deliverables in hard copy and electronic formats. It will be the laboratory's responsibility to verify that the two versions of data are identical prior to delivery. Electronic data deliverables (EDD) will be submitted to IT from the laboratory in the format outlined in Table 5-6. Level IV hard copy data packages will be supplied by the laboratory so that the required Level III data validation effort can be completed with ease allowing for a raw data verification of any detected analytes if necessary.

EDDs should be verified by the laboratory to be free of defects and in agreement with the hard copy data. All disks should be scanned for viruses before submittal. Information should comply with specified ITEMS format and valid values provided in Table 5-6. EDDs found to have significant defects in format or information will be returned to the laboratory for correction and re-submittal. It is the responsibility of the laboratory to perform corrective action to prevent reoccurrence of errors, and to provide the documentation necessary to support the review and correction of the errors.

## 5.10 Performance and System Audits

Audits will be completed as specified in the facility-wide QAPP.

## 5.11 Preventative Maintenance Procedures

The preventative maintenance procedures outlined in the facility-wide QAPP will be followed for this task.

## 5.12 Specific Routine Procedures to Assess Data Precision, Accuracy, and Completeness

The procedures outlined in Section 12.0 of the facility-wide QAPP will be followed.

## 5.13 Corrective Actions

The procedures outlined for corrective actions in the facility-wide QAPP will be followed for this task.

# Table 5-6. ITEMS EDT Format Specifications

**File Structure**: ITEMS uses a standard file format for transmitting analytical data. Each file should be in standard DOS format and consist of:

- A variable number of records containing analytical data
- A trailer record containing three dollar signs (i.e., $$$) followed by 358 blanks.

Each individual analytical record must be 361 bytes long, contain only ASCII characters and be terminated by a carriage return. ITEMS identifies the information included in each record by position. Each value should be left-justified within the defined column. The specific format ITEMS requires is as follows:

| Position | Field Length | Content | Required | Comments |
|---|---|---|---|---|
| 1-20 | 20 | Project Sample Number | Y | a |
| 21-28 | 8 | Sample Date (as MM/DD/YY) | Y | b |
| 29-33 | 5 | Sample Time (as HH24:MI) | Y | b |
| 34-48 | 15 | Sample Delivery Group | N | |
| 49-58 | 10 | Lab Matrix | Y | |
| 59-78 | 20 | Lab Sample No | Y | |
| 79-83 | 5 | Laboratory Identification Code | Y | c |
| 84-91 | 8 | Analysis Date (as MM/DD/YY) | Y | |
| 92-96 | 5 | Analysis Time (as HH24:MI) | Y | |
| 97-116 | 20 | QC Batch Number | N | |
| 117-120 | 4 | Result Type | Y | ꕥ |
| 121-131 | 11 | CAS Number | Y | • |
| 132-141 | 10 | Result | Y | |
| 142-148 | 7 | Result Qualifier | N | ꕥ |
| 149-158 | 10 | 2-Sigma Error (for Radiological results only) | N | |
| 159-168 | 10 | Units of Measure | Y | |
| 169-176 | 8 | Retention Time | Y/N | d |
| 177-236 | 60 | Parameter Name | Y | |
| 237-246 | 10 | Detection Limit | Y | e |
| 247-256 | 10 | Method Detection Limit | N | f |
| 257-263 | 7 | Dilution Factor | Y | g |
| 264-269 | 6 | Extraction Method Code | N | h |
| 270-271 | 2 | Result Classification Code | N | h |
| 272-285 | 14 | Expected Result | N | h |
| 286-295 | 10 | Analytical Method Code | N | h |
| 296-299 | 4 | Sample Purpose | N | bꕥ |
| 300-303 | 4 | Sample Prep Code | Y | iꕥ |
| 304-311 | 8 | Sample Leachate Date (as MM/DD/YY) | N | |
| 312-319 | 8 | Extraction Date (as MM/DD/YY) | Y | I |
| 320-324 | 5 | Extraction Time (as HH24:MI) | N | |
| 325-359 | 35 | Lab Method | Y | |
| 360 | 1 | Sample Filtered | Y | j |
| 361 | 1 | Re-extraction Number | Y | k |

Comments:

ꕥValid value tables are provided.

• If no valid CAS registry number exists, use code assigned by IT Corporation.

# Table 5-6. ITEMS EDT Format Specifications (Continued)

a. The lab should enter the lab sample number in both the project and lab sample number fields when the sample is a laboratory QC sample.
b. The sample date, time are required for all samples, sample purpose for laboratory QC samples only.
c. The code reported by the lab is assigned by IT Corporation.
d. Retention time is required for Tentatively Identified Compounds (TICs) only. For target compounds and surrogates, leave this field blank.
e. The detection limit reported in this field is the actual detection limit that the lab experienced for the particular sample and analysis.
f. The detection limit reported in this field is the limit for the method as reported in the literature.
g. If sample is not diluted, report a value of 1.
h. These fields are intended to be used only by projects that must eventually upload their data from ITEMS into IRPIMS.
I. Sample Prep Code and Extraction Date are required fields.
j. Valid entries are Y/N.
k. Valid entries are 0 - 9. Zero (0) should be reported for normal sample results.

**Table 1.** Result Types

| Result Type | Category | Description |
|---|---|---|
| TRG | NF | Target parameter for analysis |
| TIC | NF | Tentatively identified compound |
| IS | LQ | Internal Standard added to the sample by the laboratory |
| SUR | LQ | Surrogate compound added to the sample by the laboratory |

**Table 2.** Result Qualifiers

| Qualifier | Qualifier Category | Nondetect Qualifier | Description |
|---|---|---|---|
| U | O | Y | Compound was analyzed for but was not detected ("Non-detect") |
| J | O | N | Estimated value less than the CRDL |
| C | O | N | Pesticides only. Presence confirmed by GC/MS |
| B | O | N | Analyte found in both sample and associated blank |
| E | O | N | Estimate: result outside linear range of instrument. |
| D | O | N | Dilution run. Initial run outside linear range of instrument. |
| A | O | N | Indicates that the TIC is a suspected aldol condensation product. |
| X | O | N | Indicates manual modification of result or EPA qualifier. |
| JX | O | N | Result is less than SQL that would have been displayed for "U". |
| B | I | N | Value less than the CRDL but greater than or equal to the IDL. |
| E | I | N | Value estimated due to interference. |
| M | I | N | Duplicate inject precision did not agree (GFAA). |
| N | I | N | Spiked sample recovery not within control limits. |
| S | I | N | Reported value determined by Method of Standard Additions (MSA). |
| W | I | N | Post-digestion spike out of control limits (GFAA). |
| * | I | N | Duplicate analysis not within control limits. |
| + | I | N | Correlation coefficient for the MSA is less than 0.995. |

## Table 5-6. ITEMS EDT Format Specifications (Continued)

| Qualifier | Qualifier Category | Nondetect Qualifier | Description |
|---|---|---|---|
| P | I | N | Method qualifier - ICP. |
| A | I | N | Method qualifier - Flame AA. |
| F | I | N | Method qualifier - Furnace AA. |
| CV | I | N | Method qualifier- Manual cold vapor. |
| AV | I | N | Method qualifier - Automated cold vapor. |
| NR | I | N | Method qualifier - Analyte was not required. |
| C | I | N | Method qualifier - Manual spectrophotometric |

**Table 3**. Sample Purpose

| Sample Purpose | Category | Description |
|---|---|---|
| BKS | LQ | Blank spike |
| BLK | LQ | Blank |
| BSD | LQ | Blank spike duplicate |
| CB | LQ | Calibration blank |
| LCS | LQ | Laboratory control sample |
| LR | LQ | Laboratory replicate |
| MB | LQ | Method blank |
| MS | LQ | Matrix spike |
| MSD | LQ | Matrix spike duplicate |
| REG | NF | Regular environmental field sample |
| AB | FQ | Ambient condition blank (HAZWRAP definition) |
| ER | FQ | Equipment rinsate |
| FB | FQ | Field blank (EPA definition) |
| FD | FQ | Field duplicate |
| RD | FQ | Regulatory duplicate collected in the field by a regulator |
| SMQC | FQ | Source material quality control |
| SPLT | FQ | Regular sample split in two; each half is sent to a different lab |
| TB | FQ | Trip blank |

**Table 4.** Sample Prep Codes

| Prep Code | Description |
|---|---|
| CIT | Waste extraction test using sodium citrate |
| CON1 | Confirmation Analysis - First |
| CON2 | Confirmation Analysis - Second |
| DION | Waste extraction test using de-ionized water |
| NORM | Normal preparation associated with analytical method used |

# 6.0 Site-Specific Safety and Health Plan

## 6.1 Site Work Plan Summary

***Project Objective.*** The objective of these activities at Ravenna Army Ammunition Plant (RVAAP), Ravenna, Ohio is to perform closure activities for the Open Burning Ground Facility (OBG).

***Project Tasks.*** Closure activities for the OBG will consist of the following:

- Removal, containerization, and disposal of loose sediment from within the burn trays.
- Removal, containerization, and disposal of the refractory lining from each of the eight burn trays.
- Demolition, decontamination, transportation, and disposal of the portable blast barrier.
- Collection of confirmatory rinsate samples from the burn trays and potable blast barrier for chemical analysis.
- Collection, characterization, and disposal of IDW.

***Personnel Requirements.*** Up to 15 employees

Note: All personnel on this site shall have received training, informational programs, and medical surveillance as outlined in the IT facility-wide safety and health plan (SHP) for RVAAP, and be familiar with the requirements of this site-specific SHP (SSHP).

The IT office will have documentation of training and medical surveillance for all personnel on site.

## 6.2 Site Characterization and Analysis

### 6.2.1 Anticipated Hazards

The Activity Hazard Analysis in Chapter 5.0 contains project specific practices utilized to reduce or eliminate anticipated site hazards. The Activity Hazard Analysis indicates specific chemical

and physical hazards that may be present and encountered during each task from on-site operations. Below each task is a list of hazards and specific actions that will be taken to control the respective hazards. These control measures may include work practice controls, engineering controls, and/or use of appropriate personal protective equipment (PPE).

Based on a review of the field activities defined in the scope of work for the OBG and contamination information provided in the following sections, the potential for significant exposure of project personnel to hazardous conditions arising from chemical contamination is low. During the work tasks, the most likely mechanism for chemical exposure is through skin contact with soil and rinse water. Chemical exposure through inhalation is unlikely; however, air monitoring of volatile organic compounds (VOC) and particulate will be performed.

Table 6-1 contains chemicals anticipated and those to be used at the OBG facility.

Unexploded ordnance (UXO) have not been observed at this site. Based upon the previous use of the OBG, however, UXO avoidance monitoring will be conducted prior to starting work activities at the site.

### *6.2.2 General Site Information*

### *Open Burning Ground Facility*

***Site Location and Description.*** The OBG site is located along road C, approximately 1000 feet north of Sand Creek. The OBG area is relatively level and encompasses roughly 100 square feet. Located at this facility are eight burn trays used to dispose of explosive laden materials. These trays are constructed of 1/4 inch boiler plate which are 16 feet long, 4 feet wide, and 12 inches deep and refractory lined. These trays set on rails situated on top of crushed slag. Also located at the OBG site is a portable steel blast barrier which is roughly 7 feet high, 9 feet wide, and 28 feet long composed of 1/8 inch steel along the front area and 1/4 inch steel along the bottom portion of the barrier.

RVAAP reportedly burned bulk propellants, explosives, and explosive contaminated material at the OBG site. Burns were conducted in the metal trays beginning 1980. Presently no burning activities are being conducted at the facility, the exact date the burning activities ceased at this site is unavailable at this time.

# Table 6-1

## Toxicological and Physical Properties of Chemicals
## Open Burning Ground Facility
## Ravenna Army Ammunition Plant, Ravenna, Ohio



| Substance [CAS] | IP[a] (eV) | Odor Threshold (ppm) | Route[b] | Symptoms of Exposure | Treatment | TWA[c] | STEL[d] | Source[e] | IDLH (NIOSH)[f] |
|---|---|---|---|---|---|---|---|---|---|
| Aluminum powder<br><br>[7429-90-5] | NA | NA | Inh<br>Ing<br>Con | Irritated eyes, skin, and respiratory system; pulmonary fibrosis | Eye: Irrigate immediately<br>Skin: Water flush promptly<br>Breath: Respiratory support<br>Swallow: Immediate medical attention | 5 mg/m$^3$ | -- | PEL<br>TLV<br>REL | |
| Chromium<br><br>[7440-47-3 | NA | NA | Inh<br>Ing<br>Con | Irritated eyes and skin; lung fibrosis. | Eye: Irrigate immediately<br>Skin: Soap wash promptly<br>Breath: Respiratory support<br>Swallow: Immediate medical attention | 1 mg/m$^3$<br>0.5 mg/m$^3$<br>0.5 mg/m$^3$ | | PEL<br>TLV<br><br>REL | 250 mg/m$^3$ |
| Cyclotetramethylene-tetramine (Octogen) (HMX)<br><br>[2691-41-0] | | | Ing | | Eye: Irrigate immediately<br>Skin: Water flush promptly<br>Breath: Respiratory support<br>Swallow: Immediate medical attention | | | | |
| Dinitrotoluene<br><br>[25321-14-6] | ? | NA | Inh<br>Abs<br>Ing<br>Con | Anoxia, anemia, jaundice, reproductive effects; reproductive effects. Carcinogenic. | Eye: Irrigate immediately<br>Skin: Soap wash promptly<br>Breath: Respiratory support<br>Swallow: Immediate medical attention | 1.5 mg/m$^3$ (skin)<br>0.2 mg/m$^3$ (skin)<br>1.5 mg/m$^3$ (skin) | | PEL<br>TLV<br><br>REL | Ca<br>50 mg/m$^3$ |
| Fuel oil<br>(diesel oil, medium) | ? | ? | Ing<br>Inh<br>Con | Ingestion causes nausea, vomiting, and cramps; depressed central nervous system, headache, coma, death; pulmonary irritation; kidney and liver damage; aspiration causes severe lung irritation, coughing, gagging, dyspnea, substernal stress, pulmonary edema; bronchopneumonia; excited, then depressed, central nervous system. | Eye: Irrigate promptly<br>Skin: Soap wash<br>Breath: Respiratory support<br>Swallow: Immediate medical attention<br>Aspiration: Immediate medical attention | | | PEL<br>TLV<br>REL | |

# Table 6-1

## Toxicological and Physical Properties of Chemicals
## Open Burning Ground Facility
## Ravenna Army Ammunition Plant, Ravenna, Ohio



| Substance [CAS] | IP[a] (eV) | Odor Threshold (ppm) | Route[b] | Symptoms of Exposure | Treatment | TWA[c] | STEL[d] | Source[e] | IDLH (NIOSH)[f] |
|---|---|---|---|---|---|---|---|---|---|
| Gasoline<br><br>[8006-61-9] | ? | 0.3 | Inh<br>Ing<br>Con | Intoxication, headaches, blurred vision, dizziness, nausea; eye, nose throat irritation; potential kidney and other cancers. Carcinogenic. | Eye: Irrigate immediately (15 min)<br>Skin: Soap wash promptly<br>Breath: Respiratory support<br>Swallow: Immediate medical attention | 300 ppm<br>300 ppm<br>Ca, lowest feasible conc.<br>(LOQ 15 ppm) | 500 ppm<br>500 ppm | PEL<br>TLV<br>REL | ? |
| Hydrogen chloride (hydrochloric acid)<br><br>[74-90-8] | 12.74 | 0.255–10.6 | Inh<br>Ing<br>Con | Inflamed nose, throat, larynx; cough, burns throat, choking; burns eyes, skin; dermatitis; in animals; laryngeal spasm; pulmonary edema. | Eye: Irrigate immediately<br>Skin: Water flush immediately<br>Breath: Respiratory support<br>Swallow: Immediate medical attention | | C5 ppm<br>C5 ppm<br>C5 ppm | | |
| Hydraulic oil<br><br>[NA] | ? | ? | | | | | | PEL<br>TLV<br>REL | |
| Lead | NA | NA | Inh<br>Ing<br>Con | Weak, insomnia, facial pallor, constipated, abdominal pain, colic, anemia, irritated eyes, paralysis of wrists and ankles, encephalopathy. | Eye: Irrigate immediately<br>Skin: Soap wash promptly<br>Breath: Respiratory support<br>Swallow: Immediate medical attention | | | | |
| Methanol | 10.85 | 4.2-5960 | Inh<br>Abs<br>Ing<br>Con | Irritated eyes, headache, drowsiness, lightheadedness, nausea, vomiting, disturbance in vision, blindness. | Eye: Irrigate immediately<br>Skin: Water flush promptly<br>Breath: Fresh air<br>Swallow: Immediate medical attention | | 200 ppm (skin)<br>200 ppm (skin)<br>200 ppm | PEL<br>TLV<br>REL | 6,000 ppm |
| Methyl chloride (chloromethane)<br><br>[74-87-3] | 11.28 | >10 | Inh<br>Con | Dizziness, nausea, vomiting; visual disturbances, stagger, slurred speech, convulsions; liver and kidney damage reproductive and teratogenic defects | Eye: Irrigate immediately<br>Skin: Water flush promptly<br>Breath: Fresh air<br>Swallow: Immediate medical attention | 100 ppm<br>50 ppm (skin)<br>lowest feasible | C 200 ppm<br>100 ppm (skin)<br>-- | PEL<br>TLV<br>REL | Ca<br>(2,000 ppm) |

# Table 6-1

## Toxicological and Physical Properties of Chemicals
## Open Burning Ground Facility
## Ravenna Army Ammunition Plant, Ravenna, Ohio



| Substance [CAS] | IP[a] (eV) | Odor Threshold (ppm) | Route[b] | Symptoms of Exposure | Treatment | TWA[c] | STEL[d] | Source[e] | IDLH (NIOSH)[f] |
|---|---|---|---|---|---|---|---|---|---|
| Motor oil<br><br>[NA] | ? | ? | Inh<br>Ing | See oil mist; usually only a problem if misted or ingested. | Eye: Irrigate immediately (15 mins)<br>Skin: Soap wash immediately<br>Swallow: Immediate medical attention | | | PEL<br>TLV<br>REL | |
| Nitric acid<br><br>[7697-37-2] | 11.95 | 0.3–1 | Inh<br>Ing<br>Con | Irritated eyes, mucous membranes, and skin; delayed pulmonary edema, pneumonitis, bronchitis; dental erosion. | Eye: Irrigate immediately<br>Skin: Water flush promptly<br>Breath: Respiratory support<br>Swallow: Immediate medical attention | 2 ppm<br>2 ppm<br>2 ppm | 4 ppm<br>4 ppm<br>4 ppm | PEL<br>TLV<br>REL | 25 ppm |
| Nitroglycerine<br>[55-63-0] | ? | | Inh<br>Abs<br>Ing<br>Con | Throbbing headache, dizziness, nausea, vomiting, abdominal pain; hypotension; delirium; CNS depression; angina, skin irritation. | Eye: Irrigate immediately<br>Skin: Water flush promptly<br>Breath: Respiratory support<br>Swallow: Immediate medical attention | C0.2 ppm (skin)<br>0.005 ppm (skin)<br>--- | ---<br><br>0.1 mg/m$^3$ | PEL<br>TLV<br>REL | 75 mg/m$^3$ |
| Portland cement | | | Inh | Fine gray powder that can be irritating if inhaled or in eyes. | Eye: Irrigate immediately<br>Skin: Soap wash immediately<br>Breath: Respiratory support<br>Swallow: Immediate medical attention | | 10 mg/m$^3$<br>10 mg/m$^3$/ total dust<br>5 mg/m$^3$<br>respirable fraction | TLV<br>PEL/REL | |
| RDX (Cyclonite)<br>(Cyclotrimethylene trinitramine)<br><br>[121-82-4] | | | Inh<br>Con | Nausea, convulsion, chronic CNS effects. (Explosive material) | Eye: Irrigate immediately<br>Skin: Water flush immediately<br>Breath: Respiratory support<br>Swallow: Immediate medical attention | 1.5 mg/m$^3$ (skin)<br>1.5 mg/mg$^3$ (skin) | --<br>3 mg/m$^3$ (skin) | TLV<br>REL | |

# Table 6-1

## Toxicological and Physical Properties of Chemicals
## Open Burning Ground Facility
## Ravenna Army Ammunition Plant, Ravenna, Ohio



| Substance [CAS] | IP[a] (eV) | Odor Threshold (ppm) | Route[b] | Symptoms of Exposure | Treatment | TWA[c] | STEL[d] | Source[e] | IDLH (NIOSH)[f] |
|---|---|---|---|---|---|---|---|---|---|
| Sodium hydroxide<br><br>[1310-73-2] | NA | NA | Inh<br>Ing<br>Con | Irritated nose; pneumonitis; burns eyes, and skin; temporary loss of hair. | Eye: Irrigate immediately<br>Skin: Water flush immediately<br>Breath: Respiratory support<br>Swallow: Immediate medical attention | | C2 mg/m$^3$<br>C2 mg/m$^3$<br>C2 mg/m$^3$ | PEL<br>TLV<br>REL | 10 mg/m$^3$ |
| Sulfuric acid<br><br>[7664-93-9] | ? | 0.15 | Inh<br>Ing<br>Con | Irritated eyes, nose, and throat; pulmonary edema, bronchitis; emphysema; conjunctivitis; stomatitis; dental erosion; tracheobronchitis; skin and eye burns; dermatitis. | Eye: Irrigate immediately<br>Skin: Water flush immediately<br>Breath: Respiratory support<br>Swallow: Immediate medical attention | 1 mg/m$^3$<br>1 mg/m$^3$<br>1 mg/m$^3$ | 3 mg/m$^3$ | PEL<br>TLV<br>REL | 15 mg/m$^3$ |
| 2,4,6-Trinitrotoluene<br><br>[118-96-7] | | | | Explosive material | Eye: Irrigate immediately<br>Skin: Soap wash promptly<br>Breath: Respiratory support<br>Swallow: Immediate medical attention | 1.5 mg/m$^3$ (skin)<br>0.1 mg/m$^3$ (skin)<br>0.5 mg/m$^3$ (skin) | ---<br>---<br>--- | PEL<br>TLV<br>REL | 500 mg/m$^3$ |

[a]IP = Ionization potential (electron volts).
[b]Route = Inh, Inhalation; Abs, Skin absorption; Ing, Ingestion; Con, Skin and/or eye contact.
[c]TWA = Time-weighted average. The TWA concentration for a normal work day (usually 8 or 10 hours) and a 40-hour work week, to which nearly all workers may be repeatedly exposed, day after day without adverse effect.
[d]STEL = Short-term exposure limit. A 15-minute TWA exposure that should not be exceeded at any time during a workday, even if the TWA is not exceeded.
[e]PEL = Occupational Safety and Health Administration (OSHA) permissible exposure limit (29 CFR 1910.1000, Table Z).
AEL = Airborne Exposure Limit.
TLV = American Conference of Governmental Industrial Hygiene (ACGIH) threshold limit value—TWA.
REL = National Institute for Occupational Safety and Health (NIOSH) recommended exposure limit.
[f]IDLH (NIOSH)—Immediately dangerous to life or health (NIOSH). Represents the maximum concentration from which, in the event of respirator failure, one could escape within 30 minutes without a respirator and without experiencing any escape-impairing or irreversible health effects.
NE = No evidence could be found for the existence of an IDLH (NIOSH Pocket Guide to Chemical Hazards, Pub. No. 97-140, June 1997).
C = Ceiling limit value which should not be exceeded at any time.
Ca = Carcinogen.
NA = Not applicable.
? = Unknown.

## Table 6-1

## Toxicological and Physical Properties of Chemicals
## Open Burning Ground Facility
## Ravenna Army Ammunition Plant, Ravenna, Ohio



LEL = Lower explosive limits.
$LC_{50}$ = Lethal concentration for 50 percent of population tested.
$LD_{50}$ = Lethal dose for 50 percent of population tested.
NIC = Notice of intended change (ACGIH).
NR = No recommendation.

***Site Accessibility (by road).*** The OBG is accessible by Road C.

***Site Contaminants of Concern.*** The primary contaminants of concern for employee exposure at the OBG are chromium, dinitrotoluene (DNT), octogen (HMK), lead, cyclonite (RDK), and trinitrotoluene (TNT). The maximum soil contaminants found in previous field investigation at the OBG are as follows: chromium, 118 µg/g; DNT, 25.5 mg/kg; HMX, 2,000 mg/kg; lead, 916 mg/kg; RDX, 9,500 mg/kg; TNT, 4,000 mg/kg.

### *6.3 Personal Protective Equipment*

The work activities will begin in the following levels of protection.

| Location | Task | Initial Level of PPE |
|---|---|---|
| W-221 | - Removal, containerization, and disposal of loose sediment from within the burn trays. | Modified Level D[a] |
| | - Removal, containerization and disposal of the refractory lining from each of the eight burn trays. | Modified Level D[a] |
| | - Demolition, decontamination, transportation, and disposal of the portable blast barrier. | Modified Level D[a] |
| | - Collection of confirmatory rinsate samples from the burn trays and portable blast barrier for chemical analysis. | Modified Level D[a] |
| | - Collection, characterization, and disposal of IDW. | Level D |

[a]Initial level will be raised to Level C or higher if air monitoring results in the worker's breathing zone are greater than action levels.

A complete description of Level D, Modified Level D, and Level C follows.

***Level D.*** The following equipment will be used for Level D protection:

- Coveralls or work clothing
- Steel-toed safety boots
- Safety glasses
- Hard hat
- Hearing protection (when working near/adjacent to operating equipment).

***Modified Level D.*** The following equipment will be used for Modified Level D protection:

- Saran-coated Tyvek, Kleenguard, or its equivalent taped at gloves and boots

- Latex boot covers
- Nitrile gloves (outer)
- Latex or lightweight nitrile gloves (inner)
- Steel-toed safety boots
- Safety glasses
- Hard hat
- Hearing protection (when working near/adjacent to operating equipment).

***Level C.*** Level C protection will no be used unless air monitoring data indicate the need for upgrade; however, the equipment shall be readily available on site. The following equipment will be used for Level C protection:

- National Institute of Occupational Safety and Health approved self-contained breathing full-face, air-purifying respirators equipped with organic vapor/acid gas cartridge in combination with high-efficiency particulate air filter
- Hooded, saran-coated Tyvek, taped at gloves, boots, and respirator
- Nitrile gloves (outer)
- Latex or lightweight nitrile gloves (inner)
- Neoprene steel-toed boots or polyvinyl chloride overbooties/steel-toed safety boots
- Hard hat
- Hearing protection (when working near/adjacent to operating equipment).

Note: In addition to Level C PPE, the operator of high-pressure water jetting equipment shall wear metatarsal guards for the legs and feet.

### *6.4 Site Monitoring*

The primary contaminants of concern resulting from operations at the OBG are chromium, DNT, HMX, lead, RDX, and TNT. Table 6-2 contains action levels for site monitoring at these two building sites.

***UXO.*** The presence of UXO is suspected at the OBG facility.

***Chemical.*** Monitoring will be conducted by the site safety and health officer during the performance of staging and cleanup activities. A calibrated flame ionization detector (i.e., OVA 128 or equivalent) or photoionization detector (i.e., HNu, Microtip, or equivalent) organic vapor

## Table 6-2

## Action Levels
## Open Burning Ground Facility
## Ravenna Army Ammunition Plan, Ravenna, Ohio

When in Level C PPE

| Analyte | Action Level | Required Action[a] |
|---|---|---|
| VOHs | ≥ 10 ppm above background in breathing zone (BZ) | Stop work, evacuate work area, upgrade to Level B. |
| Oxygen | ≥ 20%, < 23%<br>< 20%, > 23% | Normal operations.<br>Stop work, evacuate work area. |
| Flammable vapors | ≥ 10% LEL<br>≤ 10% LEL | Stop work, evacuate work area. Notify project manager and H&S manager. Continue operations, monitor for VOCs. |
| Dust | ≥ 5 $mg/m^3$ | Stop work/initiate dust suppression |

When in Level D Modified PPE

| Analyte | Action Level | Required Action[b] |
|---|---|---|
| VOHs | ≥ 5 ppm above background in BZ | Stop work, suspend work activities for 15 to 30 minutes; if readings are sustained, then upgrade to Level C PPE. |
| Oxygen | ≥ 20%, < 23%<br>< 20%, > 23% | Normal operations.<br>Stop work, evacuate work area. |
| Flammable vapors | ≥ 10% LEL<br>≤ 10% LEL | Stop work, evacuate work area. Notify project manager and H&S manager. Continue operations, monitor for VOCs. |
| Dust | ≥ 5 $mg/m^3$ | Level C PPE/initiate dust suppression |

When in Support Zone

| Analyte | Action Level | Required Action[b] |
|---|---|---|
| VOHs | ≥ 1 ppm above background in BZ | Evacuate support zone and re-establish perimeter of exclusion zone. |
| Dust | ≥ 5 $mg/m^3$ | Initiate dust suppression. |

[a]Four instantaneous peaks in any 15-minute period or a sustained reading for 5 minutes in excess of the action level will trigger a response.
[b]Contact with the health and safety manager (H&S) manager must be made prior to continuance of work. The H&S manager may then initiate perimeter/integrated air sampling along with additional engineering controls.

**No one is permitted to downgrade levels of PPE without authorization from the H&S manager.**

analyzer will be utilized to determine if any organic material may be present that would necessitate upgrading of protection level. Table 6-3 contains the air monitoring frequency and location for site monitoring at the OBG facility.

***Particulate.*** Ambient air monitoring for dust will be employed during the removal of soil and debris. Particulate monitoring will not be conducted during pressure-washing operations. In the event of excessive airborne dust, dust suppression shall be implemented. Table 6-3 contains the air monitoring frequency and location for site monitoring at the OBG Facility.

### *6.5 Activity Hazard Analysis*

The attached activity hazard analysis (Table 6-4) is provided for the following activities:

- Setup of equipment and general field activities
- Removal, containerization, and disposal of loose sediment from within the burn trays.
- Removal, containerization, and disposal of the refractory lining from each of the eight burn trays.
- Demolition, decontamination, transportation, and disposal of the potable blast barrier.
- Collection of confirmatory rinsate samples from the burn trays and portable blast barrier for chemical analysis.
- Collection, characterization, and disposal of IDW.

IF HOSPITAL CARE MUST BE PROVIDED, THE VICTIM SHALL BE TREATED AT ROBINSON MEMORIAL HOSPITAL. DIRECTIONS TO THE HOSPITAL ARE PROVIDED IN FIGURE 6-1.

### *Ravenna Army Ammunition Project Emergency Contacts*

Fire Department (City of Ravenna) ..... (330) 297-5738
Emergency Medical Service (Borowski Funeral Home, Ravenna) ..... (330) 872-5050
Robinson Memorial Hospital (Ravenna) ..... (330) 297-2449
(330) 297-0811
Hazardous Materials Response (Silas Mason Company, Inc.. ..... (330) 358-7406

## Table 6-3

## Air Monitoring Frequency and Location
## Open Burning Ground Facility
## Ravenna Army Ammunition Plan, Ravenna, Ohio

| Work Activity | Instrument | Frequency | Location |
|---|---|---|---|
| Staging Equipment | OV Monitor | Initially for area | Breathing zone (BZ) of employees |
| Removal of Burn Tray Sediment and Refractory Lining | OV Monitor<br>LEL/$O_2$ Monitor<br>Particulate Monitor | Continuously<br>Initially for Area<br>Continuously | BZ of employees<br>Work area<br>BZ of employees |
| Demolition, Decontamination, and Disposal of Blast Barrier | OV Monitor<br>Particulate Monitor | Periodically<br>Continuously | BZ of employees<br>BZ of employees |

OV - Organic vapor.

LEL/$O_2$ - Lower explosive level/oxygen.

## Table 6-4

## Activity Hazard Analysis
## Open Burning Ground Facility
## Ravenna Army Ammunition Plant, Ravenna, Ohio



| Activity | Potential Hazards | Recommended Controls |
|---|---|---|
| Staging Equipment | Unexploded ordnance (UXO) | • Prior to staging equipment, UXO avoidance operations will be conducted.<br>• If UXO is found, cease all activities, mark area, and notify the site manager. |
| | Slip, trip, and fall hazards | • Determine best access route before transporting equipment.<br>• Practice good housekeeping; keep work area picked up and clean as feasible.<br>• Continually inspect the work area for slip, trip, and fall hazards.<br>• Look before you step; ensure safe and secure footing. |
| | Heavy lifting | • Use proper lifting techniques. Lifts greater than 60 pounds require assistance or mechanical equipment. |
| | Falling objects | • Stay alert and clear of materials suspended overhead; wear hard hat and steel-toed boots. |
| | Flying debris, dirt, dust, etc. | • Wear safety glasses/goggles; ensure that eye wash is in proper working condition |
| | Pinch points | • Keep hands, fingers, and feet clear of moving/suspended materials and equipment.<br>• Beware of contact points.<br>• Stay alert at all times! |
| | Cuts/bruises | • Use cotton or leather work gloves for material handling. |
| | Bees, spiders, and snakes | • Inspect work area carefully and avoid placing hands and feet into concealed areas. |
| | Fire | • Fire extinguishers shall be suitably placed, distinctly marked, readily accessible, and maintained in a fully charged and operable condition. |
| | Contact with moving equipment/vehicles | • Work area will be barricaded/demarcated.<br>• Equipment will be laid out in an area free of traffic flow. |
| | Hazard communication | • Label all containers as to contents and dispose of properly.<br>• Ensure Material Safety Data Sheets (MSDS) are available for hazardous chemicals used on site. |
| | Noise | • Sound levels above 85 A-weighted decibels (dBA) mandates hearing protection. |

## Table 6-4

## Activity Hazard Analysis
## Open Burning Ground Facility
## Ravenna Army Ammunition Plant, Ravenna, Ohio



| Activity | Potential Hazards | Recommended Controls |
|---|---|---|
| Staging Equipment (continued) | Lighting | • Adequate lighting will be provided to ensure a safe working environment. |
| | Poison ivy/oak/sumac | • Avoid plant areas if possible.<br>• Wear long sleeves and long pants.<br>• Promptly wash clothing that has contacted poisonous plants.<br>• Wash affected areas immediately with soap and water. |
| | Ticks | • Wear light colored clothing (can see ticks better).<br>• Mow vegetated and small brush areas.<br>• Wear insect repellant.<br>• Wear long sleeves and long pants.<br>• Visually check oneself promptly and frequently after exiting the work area. |
| | Heat rash | • Keep the skin clean and dry.<br>• Change perspiration-soaked clothing, as necessary.<br>• Bathe at end of work shift or day.<br>• Apply powder to affected area. |
| | Heat cramps | • Drink plenty of cool fluids even when not thirsty.<br>• Provide cool fluid for work crews.<br>• Move victim to shaded, cool area. |
| | Heat exhaustion | • Conduct physiological worker monitoring as needed (i.e., heart rate, oral temperature)<br>• Set up work/rest periods.<br>• Use the buddy system.<br>• Allow workers time to acclimate.<br>• Have ice packs available for use.<br>• Take frequent breaks. |
| | Heat stroke | • Evaluate possibility of night work.<br>• Perform physiological monitoring on workers during breaks.<br>• Wear body cooling devices. |

## Table 6-4

## Activity Hazard Analysis
## Open Burning Ground Facility
## Ravenna Army Ammunition Plant, Ravenna, Ohio



| Activity | Potential Hazards | Recommended Controls |
|---|---|---|
| Staging Equipment (continued) | Contact with moving equipment/vehicles | • Work area will be barricaded/demarcated.<br>• Equipment will be laid out in an area free of traffic flow.<br>• Barricades shall be used on or around work areas when it is necessary to prevent the inadvertent intrusion of pedestrian traffic.<br>• Barriers shall be used to protect workers from vehicular traffic.<br>• Barriers shall be used to guard excavations adjacent to streets or roadways.<br>• Flagging shall be used for the short term (less than 24 hours) to identify hazards until proper barricades or barriers are provided.<br>• Heavy equipment shall have backup alarms. |
| | Forklift operations | • Use qualified and trained forklift operators.<br>• The operator shall not exceed the load capacity rating for the forklift.<br>• The load capacity shall be clearly visible on the forklift.<br>• Forklift operators shall inform their supervisor of any prescribed medication that they are taking that would impair their judgement. |
| | Portable electric tools | • Portable electric tools that are unsafe due to faulty plugs, damaged cords, or other reason, shall be tagged (do not use) and be removed from service.<br>• Portable electric tools and all cord and plug connected equipment shall be protected by a ground-fault circuit interrupter (GFCI) device.<br>• Electrical tools shall be inspected daily prior to use. |
| | Extension cords | • Extension cords that have faulty plugs, damaged insulation, or are unsafe in any way shall be removed from service.<br>• Cords shall be protected from damage from sharp edges, projections, pinch points (doorways), and vehicular traffic.<br>• Cords shall be suspended with a nonconductive support (rope, plastic ties, etc,).<br>• Cords shall be designed for hard duty.<br>• Cords shall be inspected daily. |

## Table 6-4

## Activity Hazard Analysis
## Open Burning Ground Facility
## Ravenna Army Ammunition Plant, Ravenna, Ohio



| Activity | Potential Hazards | Recommended Controls |
|---|---|---|
| Staging Equipment (continued) | Lightning strikes | • Whenever possible, halt activities and take cover.<br>• If outdoors, stay low to the ground.<br>• Limit the body surface area that is in contact with the ground (i.e., kneeling on one knee is better than laying on the ground).<br>• Seek shelter in a building if possible.<br>• Stay away from windows.<br>• If available, crouch under a group of trees instead of one single tree.<br>• Keep all body parts in contact with the ground as close as possible.<br>• Remain 6 feet away from tree trunk if seeking shelter beneath tree(s).<br>• If in a group, keep 6 feet of distance between people. |
| | Thunderstorms, tornadoes | • Listen to radio or TV announcements for pending weather information.<br>• Cease field activities during thunderstorm or tornado warnings.<br>• Seek shelter. Do not try to outrun a tornado. |
| Demolition, Decontamination, and Disposal of Portable Blast Barrier | Fueling | • Only approved safety cans shall be used to store fuel.<br>• Do not refuel equipment while it is operating.<br>• Fire extinguishers shall be suitably placed, distinctly marked, readily accessible, and maintained in a fully charged and operable condition. |
| | Faulty or damaged equipment | • Equipment shall be inspected before being placed into service and at the beginning of each shift.<br>• Preventive maintenance procedures recommended by the manufacturer shall be followed.<br>• A lockout/tagout procedure shall be used for equipment found to be faulty or undergoing maintenance. |
| | High-pressure water | • Jetting gun operator must wear appropriate PPE including hard hat, impact-resistant safety glasses with side shields, water-resistant clothing, metatarsal guards for feet and legs, and hearing protection (if appropriate).<br>• One standby person shall be available within the vicinity of the pump during jetting operation.<br>• The work area shall be isolated and adequate barriers will be used to warn other site personnel. |
| | Unqualified operators | • Only qualified and trained personnel are permitted to operate machinery and mechanized equipment associated with water jet cutting and cleaning. |
| | Out-of-control equipment | • No machinery or equipment is permitted to run unattended.<br>• Machinery or equipment will not be operated in a manner that will endanger persons or property nor will the safe operating speeds or loads be exceeded. |

## Table 6-4

## Activity Hazard Analysis
## Open Burning Ground Facility
## Ravenna Army Ammunition Plant, Ravenna, Ohio



| Activity | Potential Hazards | Recommended Controls |
|---|---|---|
| Demolition, Decontamination, and Disposal of Portable Blast Barrier (continued) | Activation during repairs | • All machinery or equipment will be shut down and positive means taken to prevent its operation while repairs or manual lubrications are being done. |
| Confirmatory Rinsate Sampling | Cross-contamination and contact with potentially contaminated materials | • Sampling technicians will wear proper clothing and equipment to safeguard against potential contamination.<br>• Avoid skin contact with water.<br>• Handle samples with care.<br>• only essential personnel will be in the work area.<br>• All personnel will follow good hygiene practices.<br>• Proper decontamination procedures will be followed.<br>• All liquids and materials used for decontamination will be contained and disposed of in accordance with federal, state, and local regulations. |
| | Cut hazards | • Use care when handling glassware.<br>• Wear adequate hand protection. |
| | Hazard communication | • MSDSs shall be obtained for chemicals brought on site.<br>• Label all containers as to contents. |
| | Strains/sprains | • Use the proper tool for the job being performed.<br>• Get assistance if needed.<br>• Avoid twisting/turning while pulling on tools, moving equipment, etc. |
| | Spills/residual materials | • Absorbent material and containers will be kept available where leaks or spills may occur. |
| | Lighting | • Adequate lighting will be provided to ensure a safe working environment. |
| | Unattended worker | • Use "buddy system" - visual contact will be maintained with the sampling technician during sampling activities. |

# Table 6-4

## Activity Hazard Analysis
## Open Burning Ground Facility
## Ravenna Army Ammunition Plant, Ravenna, Ohio



| Activity | Potential Hazards | Recommended Controls |
|---|---|---|
| Moving and Shipping Collected Samples | Heavy lifting | • Use proper lifting techniques. Lifts greater than 60 pounds require assistance or mechanical equipment; size-up the lift. |
| | Pinch points | • Keep hands, fingers, and feet clear of moving/suspended materials and equipment.<br>• Beware of contact points.<br>• Stay alert at all times! |
| | Cut hazards | • Wear adequate hand protection. Use care when handling glassware. |
| | Hazard communication | • Label all containers as to contents and associated |
| Material Storage | Flammable and combustible liquids | • Store in NO SMOKING AREA.<br>• Fire extinguisher readily available.<br>• Transfer only when properly grounded and bonded. |
| Collection and Disposal of IDW (Forklift Operation) | Personnel injury, property damage, and/or equipment damage | • Use qualified and trained forklift operators.<br>• The operator shall not exceed the load capacity rating for the forklift.<br>• The load capacity shall be clearly visible on the forklift.<br>• Forklift operators shall inform their supervisor of any prescribed medication that they are taking that would impair their judgement. |
| | Cross-contamination and contact with potentially contaminated materials | • Stop immediately at any sign of obstruction.<br>• Sampling technicians will wear proper protective clothing and equipment to safeguard against potential contamination.<br>• Only essential personnel will be in the work area.<br>• Real-time air monitoring will take place before and during sampling activities.<br>• All personnel will follow good hygiene practices.<br>• Proper decontamination procedures will be followed.<br>• All liquids and materials used for decontamination will be contained and disposed of in accordance with federal, state, and local regulations. |
| | Cut hazards | • Use care when handling glassware.<br>• Wear adequate hand protection. |

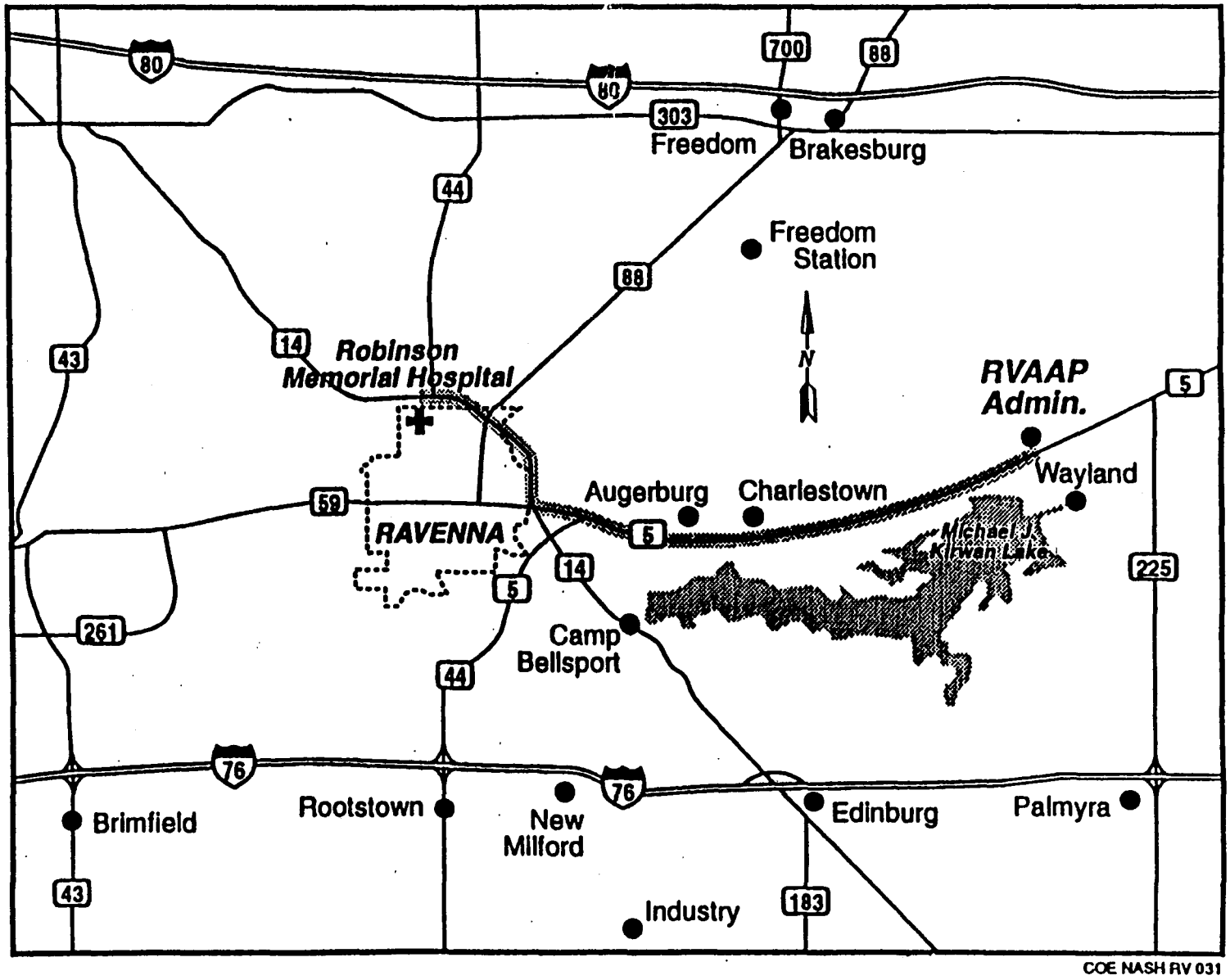


FIGURE 6-1

HOSPITAL ROUTE MAP

| | |
|---|---|
| | (330) 358-7409 |
| USACE, Louisville District | (502) 582-5424 |
| National Response Center | (800) 424-8802 |
| Poison Control Center | (800) 462-0800 |
| U.S. EPA Region V | (312) 353-2000 |
| John Gent, USACE Technical Manager | (502) 582-5424 |
| W. Charles Shafer, IT Project Manager | (423) 690-3211 |
| Tom Randolph, IT Field Superintendent | (423) 690-3211 |
| Bill Norton, IT Project Engineer | (423) 690-3211 |
| Michael Henderson, IT H&S Officer | (423) 690-3211 |
| Warren Houseman | (412) 372-7701 |
| Dr. Elaine Theriault, IT Occupational Physician | (800) 229-3674 |

# 7.0 References

Science Applications International Corporation (SAIC), 1997, ***Revised Closure Plan for the Open Burning Ground (OBG) Hazardous Waste Treatment Unit, Ravenna Army Ammunition Plant, Ravenna, Ohio***, prepared for the U.S. Army Corps of Engineers, Nashville District, October.

Science Applications International Corporation (SAIC), 1996, ***Facility-Wide Sampling and Analysis Plan for the Ravenna Army Ammunition Plant, Ravenna, Ohio***, prepared for the U.S. Army Corps of Engineers, Nashville District, April.

Science Applications International Corporation (SAIC), 1996, ***Facility-Wide Quality Assurance Project Plan for the Ravenna Army Ammunition Plant, Ravenna, Ohio***, prepared for the U.S. Army Corps of Engineers, Nashville District, April.

U.S. Environmental Protection Agency (EPA), 1986, ***Test Methods for the Evaluation of Solid Waste, Physical Chemical Methods***, SW-846, 3rd Edition and its Updates, EPA, Office of Solid Waste.