FINAL SAMPLING AND ANALYSIS PLAN ADDENDUM FOR THE REMEDIAL INVESTIGATION OF LOAD LINE 9

RAVENNA ARMY AMMUNITION PLANT
RAVENNA, OHIO 44266

Prepared for

US ARMY JOINT MUNITIONS COMMAND
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DEFINITIONS

Action Plan (AP)	An annual plan submitted by U.S. Army installations showing the status of current and future planned environmental activities at the installations.
Ammatol	A mixture of ammonium nitrate and trinitrotoluene (TNT)
Area of Concern (AOC)	Under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), a site where contamination is known or suspected to exist
Defense Environmental Restoration Program (DERP)	A program established by Congress in 1984 to evaluate and clean up contamination from past U.S. Department of Defense (DoD) activities (Title 10 U.S. Code 2701-2707 and 2810).
Facility	All contiguous land and structures, other appurtenances, and improvements within the boundaries of a property or parcels
Facility-Wide	A term used to reference all land and structures comprising a facility.
Facility-Wide Sampling and Analysis Plan (SAP)	A submittal document comprised of the Field Sampling Plan (FSP) and Quality Assurance Project Plan (QAPP); used to define all aspects of sampling and analytical work expected to be common to an installation. Not implementable without an investigation-specific SAP Addendum.
Feasibility Study (FS)	Based on data collected during the remedial investigation, options for final cleanup actions are developed and evaluated in the FS. The FS is divided into two phases: (1) an initial screening of alternatives followed by (2) the detailed analysis of alternatives. The detailed analysis considers, among other things, cost-effectiveness, short- and long-term effectiveness, and the overall protection of human health and the environment.
Installation	A military facility or base
Interim Removal Action (IRA)	An early response action that is identified and implemented at any time during the study or design phase. IRAs are limited in scope, and they address only areas or media for which a final remedy will be developed by the remedial investigation (RI)/FS process. An IRA should be consistent with the final remedy for a site.
Investigation-Specific Sampling and Analysis Plan (SAP) Addendum	A submittal document comprised of the FSP and QAPP; used to define specific aspects of sampling and analytical work during the investigation of one or more AOCs. Tiered under the Facility-Wide SAP and not implementable without the FW SAP.
Phase I Remedial Investigation	Performed if the Preliminary Assessment (PA) recommends further investigation. Phase I investigations typically collect waste and environmental samples to determine the hazardous substances present at a site and whether they are being released to the environment.

Phase II Remedial Investigation (RI)	A field investigation that is more extensive than a Phase I RI. Its purpose is to characterize the nature and extent of contamination at a site. The Phase II RI also assesses the risks posed by on-site contamination to human health and the environment.
Removal Action	Taken to respond to a release, or threat of a release, of hazardous substances, pollutants or contaminants to prevent, minimize, or mitigate harm to human health or the environment. Such actions may be taken during any phase of the site cleanup.
Site	An area(s) of known or suspected release or source of contamination including all potentially affected media (soil, groundwater, surface water, sediment and air).
Strategic and Critical Materials	A government phrase referring to substances/materials essential to the effective conduct of war.

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ABBREVIATIONS

A&E	Architect and Engineer
AOC	Area of Concern
ASTM	American Society for Testing and Materials
BGS	Below Ground Surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COPC	Chemical of Potential Concern
CRREL	Cold Regions Research and Engineering Laboratory
D&D	Decontamination and Decommissioning
DQO	Data Quality Objective
FSP	Field Sampling Plan
FW QAPP	Facility Wide Quality Assurance Project Plan
FW SAP	Facility Wide Sample and Analysis Plan
FW SSHP	Facility Wide Site-Specific Safety and Health Plan
FID	Flame Ionization Detector
ID	Inside Diameter
IDW	Investigation-Derived Waste
IR	Industrial Readiness (Command)
MCL	Maximum Contaminant Level
OE	Ordnance and Explosives
Ohio EPA	Ohio Environmental Protection Agency
JMC	Joint Munitions Command
OVA	Organic Vapor Analyzer
PID	Photo-ionization Detector
PRG	Preliminary Remediation Goal
PVC	Polyvinyl Chloride
QA	Quality Assurance
OHARNG	Ohio Army National Guard
QAPP	Quality Assurance Project Plan
QC	Quality Control
RA	Removal Action
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
RVAAP	Ravenna Army Ammunition Plant
SAIC	Science Applications International Corporation
SAP	Sampling and Analysis Plan
SSHP	Site-Specific Safety and Health Plan
SVOC	Semi-Volatile Organic Compound
TAL	Target Analyte List
TCLP	Toxicity Characteristic Leaching Procedure
USACE	U.S. Army Corps of Engineers
USACHPPM	U.S. Army Center for Health Promotion and Preventative Medicine
USEPA	U.S. Environmental Protection Agency
USCS	Unified Soil Classification System
UXO	Unexploded Ordnance
VOC	Volatile Organic Compound

1.0 PROJECT DESCRIPTION

1.1 INTRODUCTION

This Sampling and Analysis Plan (SAP) Addendum has been developed under contract number DAAA 09-02-C-0070 with the US Army Joint Munitions Command (JMC). The initial scoping meeting, attended by representatives from the Ohio Environmental Protection Agency (Ohio EPA), Ravenna Army Ammunition Plant (RVAAP) and MKM Engineers, Inc. (MKM), was held at RVAAP during the week of November 19, 2001 to establish the requirements of the Load Line 9 (AOC 42) Remedial Investigation (RI). Comments were received from the participants during the scoping meeting and have been incorporated into the work plans.

A field effort was conducted to evaluate the hazard and occurrence for primary and secondary explosives during March 12, 13 and 14 2002 with United States Army Corps of Engineers (USACE). During the field effort multiple media samples were collected and analyzed as per the Revised 2001 Facility-Wide Sampling and Analysis Plan (FW SAP) for the Ravenna Army Ammunition Plant, Ravenna, Ohio (USACE 1996a). Lead azide and Jenkins screening was also conducted at biased locations at Load Lines 6, 9 and 10. Based upon the results of these analytical reports the Remedial Investigation (RI) analytical suite was adjusted to reduce the frequency of SW 846 8330 analysis and increase the frequency of Jenkins field screening (50% of soils to be Jenkins screened). The analytical results of the field effort are located in Appendix A. A comment resolution meeting was held on August 08, 2002 to discuss the issues. A position paper was written to address the issues regarding the analytical methods and frequency and is included in Appendix B. The USACE (Francis Zigmund) summary and rational of findings at Load Lines 6, 9, and 10 titled Rational behind the Azide Screening Investigation and data sheets are also included in Appendix B. The RI samples that were taken during the Azide screening are designated on the sample location figure (Figure 5) and the sample analytical spreadsheet presented in the Quality Assurance Project Plan (QAPP). Since the Load Line will be thermally treated and demolished prior to the initiation of RI field activities, various technical changes in the SAP may be required. These required changes will be addressed and discussed prior to implementation.

This plan is developed to tier under and supplements the Revised 2001 FW SAP for the Ravenna Army Ammunition Plant, Ravenna, Ohio (USACE 1996a). The purpose is to perform a RI at the Load Line 9 (AOC 42). The FW SAP provides the base documentation (i.e., technical and investigative protocols) for conducting a RI under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) at RVAAP, whereas this SAP includes all of the RI-specific sampling and analysis objectives, rationale, planned activities, and criteria. Consequently, both documents are necessary in order to perform this RI. Where appropriate, this SAP Addendum contains references to the FW SAP for base procedures and protocols.

The FW SAP and this SAP Addendum have been developed following the USACE guidance document, Requirements for the Preparation of Sampling and Analysis Plans, EM 200-1-3, September 1994 (USACE 1994a), to collectively meet the requirements established by the Ohio Environmental Protection Agency (Ohio EPA) Northeast District, and the U.S. Environmental Protection Agency (EPA).

1.2 FACILITY BACKGROUND

Past Department of Defense (DoD) activities at RVAAP date back to 1940 and include storage, handling, and packing of military ammunition and explosives. The site is located in northeastern Ohio in Portage and Trumbull Counties. RVAAP lies 23 miles east-northeast of Akron, Ohio and 30 miles west-northwest of Youngstown, Ohio (Figure 1). The installation includes 21,419 acres in a tract approximately 3.5 miles wide by 11 miles long. The RVAAP is a Government-Owned, Contractor-Operated (GOCO) military industrial installation.

The facility is under the control of the Joint Munitions Command (JMC) of the U.S. Army, and the current contractor on-site is TolTest, Inc. The land use surrounding the installation is primarily farmland, woodland, and low density housing. The industrial operations at RVAAP consisted of 12 munitions assembly facilities referred to as “load lines”. In addition, RVAAP also had several areas used for burning, demolition and testing of munitions and buildings/areas designated for clean up and decontamination activities for the production equipment (Figure 2). In May 1999, the National Guard Bureau assumed operational control of 16,164 acres of RVAAP and licensed Ohio Army National Guard to use the acreage for training and other activities. The JMC and the Ohio Army National Guard Bureau jointly operate the facility. The JMC controls environmental Areas of Concern (AOCs) and bulk explosives storage areas. A detailed history of process operations and waste processes for each AOC at RVAAP is presented in the Preliminary Assessment for the Ravenna Army Ammunition Plant, Ravenna, Ohio (USACE 1996b).

1.3 LOAD LINE 9 BACKGROUND

The U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM) conducted a Relative Risk Site Evaluation for Newly Added Sites at the RVAAP in 1998 (Hazardous and Medical Waste Study No. 37-EF-5360-99, 19 October – 23 October 1998). From the 13 sites that were evaluated, four sites were classified as high-priority AOC, seven sites scored medium and eight sites scored low. The four high-priority areas of concern listed in this report are:

- RVAAP 44 (LL-11/Artillery Primer),
- RVAAP 46 (Bldg F-15/Bldg F-16,
- RVAAP 47 (Bldg T-5301),
- RVAAP 49 (Central Burn Pits), and
- RVAAP 51 (Dump along Paris – Windham Rd).

  The seven areas that were ranked medium priority were:
- RVAAP 39 (Load Line -5/Fuze Line 1),

- RVAAP 40 (LL-7/Booster Line 1),
- RVAAP 41 (LL-8/Booster Line 2),
- RVAAP 42 (LL-9/Detonator Line),
- RVAAP 43 (LL-10/Percussion Element),
- RVAAP 45 (Wet Storage Area),
- RVAAP 48 (Anchor Test Area), and
- RVAAP 50 (Atlas Scrap Yard),

Load Line 9 is located at the intersection of Fuze and Booster Road and George Road in the south central region of the RVAAP (Figures 2 & 3). The site is approximately 69 acres in size. In 1945, the load line was deactivated and the equipment was removed. There are not any documented activities at LL-9 since closure in 1945.

1.4 SUMMARY OF EXISTING DATA

At LL-9, six surface soil samples were collected for evaluation of production and storage buildings. A subsurface soil sample was collected adjacent to the sump at Building DT-5 to score the groundwater pathway at the site. The samples were analyzed for Explosives and Metals. Based on sampling results, the 1998 USACHPPM Report identifies surface/subsurface soils and groundwater to be potential media for contaminant migration. Hunters and excessors are identified as potential receptors. Therefore, the Relative Risk Site Evaluation for the AOC was scored Medium. The proposed RI addresses these issues. Appendix D presents the LL-9 excerpt from the 1998 USACHPPM report for referencing as needed. As previously referenced in the Introduction biased sampling was conducted to evaluate the potential hazards associated with primary and secondary explosives at Load Line9 during the azide field screening effort. The results of the field effort are located in Appendices A and B.

1.5 REGULATORY AUTHORITIES

The approach to addressing environmental conditions at RVAAP is regulatory-based following the frameworks established by the primary regulatory drivers CERCLA, Resource Conservation and Recovery Act (RCRA), Toxic Substances Control Act (TSCA), etc. CERCLA activities are funded under the Installation Restoration Program (IRP).

1.6 RVAAP TEAM COORDINATION

All major activities of this investigation will be coordinated with the major parties involved including:

- Ravenna Army Ammunition Plant (RVAAP)
- Joint Munitions Command (JMC)
- U.S. Army Corps of Engineers (USACE)
- Ohio Environmental Protection Agency (Ohio EPA)

- U.S. Army Environmental Center (USAEC)
- U.S. Army Center for Health Promotion and Preventative Medicine (USACHPPM)
- Portage County Health Department (PCHD)
- Ohio Army National Guard (OHARNG)
- MKM Engineers, Inc. (MKM)

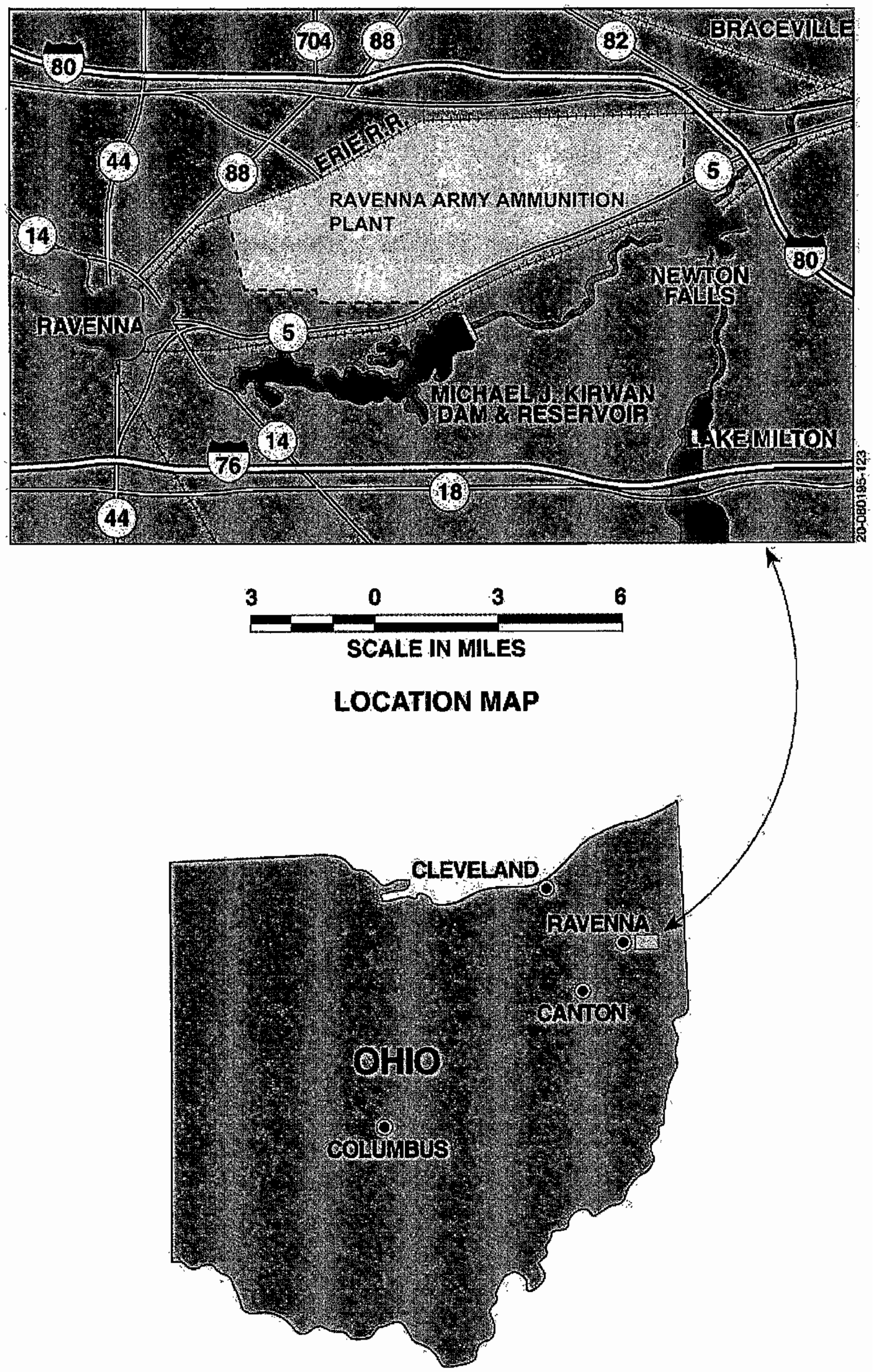

Figure 1. Ravenna Army Ammunition Plant Location Map

2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

The organization chart shown in Figure 4 outlines the management structure that will be used to implement the RI at Load Line 9. The functional responsibilities of key personnel are also described in brief.

2.1 PROGRAM MANAGER

The Program Manager ensures the overall management and quality of all projects performed at RVAAP under the general contract. This individual will ensure that all project goals and objectives are met in a high-quality and timely manner. This individual, in coordination with the Project Manager, will address quality assurance and non-conformance issues for corrective action.

2.2 PROJECT MANAGER

The Project Manager has direct responsibility for implementing a specific project, including all phases of work plan development, field activities, data management and report preparation. This individual will also provide the overall management of the project, and serve as the technical lead and principal point of contact with the RVAAP Environmental Coordinator. These activities will involve coordinating all personnel working on the project, interfacing with RVAAP personnel, and tracking project budgets and schedules. The Project Manager will also develop, monitor, and fill project staffing needs, delegate specific responsibilities to project team members, and coordinate with administrative staff to maintain a coordinated and timely flow of all project activities. The Project Manager will also serve in the capacity of Laboratory Coordinator for this project and will coordinate sample collection and subsequent laboratory analysis. The Project Manager reports directly to the Program Manager.

2.3 TECHNICAL MANAGER

The Technical Manager is responsible for the project QA/QC in accordance with the requirements of the Facility-Wide Quality Assurance Project Plan (FW QAPP), the project-specific QAPP addendum, and appropriate management guidance. This individual, in coordination with the Field Operations Manager, will be responsible for the technical aspects of all field operations; all field sampling activities; adherence to required sample custody and other related QA/QC field procedures; coordination of field subcontractor personnel activities; and management of project investigation-derived wastes (IDW). The Technical Manager is also responsible for coordinating the sampling activities with the Sampling Manager.

2.4 MKM RVAAP HEALTH AND SAFETY MANAGER

The MKM RVAAP Health and Safety Manager will ensure that health and safety procedures designed to protect personnel are maintained throughout all field activities conducted at RVAAP. This will be accomplished by strict adherence to the Facility Wide Site-Specific Safely and Health Plan (FW SSHP), which has been prepared as a companion document to this FW SAP, and the project-specific Site Safety and Health Plan (SSHP), which has been prepared as an addendum to the FW SSHP for each investigation. This individual will have the authority to halt field work if health and/or safety issues arise that are not immediately resolvable in accordance with the FW SSHP and the project-specific SSHP addendum. This individual will report to the Program and Project Managers.

2.5 FIELD OPERATIONS MANAGER

The Field Operations Manager is responsible for implementing all field activities in accordance with the FW FSP and QAPP. This individual will be responsible for ensuring technical performance of all field activities; coordination of field subcontractor personnel activities; and preparation of Field Change Orders (FCOs), if required. This individual reports directly to the Project Manager.

2.6 SAMPLING MANAGER

The Sampling Manager is responsible for planning and executing all sampling activities on site and coordinating the laboratory activities for sample analysis and associated QC parameters. This individual will be responsible for obtaining required sample containers from the laboratory for use during field sample collection, resolving questions the laboratory may have regarding QAPP requirements and deliverables, and preparing a quality assessment report for sample data package deliverables received from the laboratory. This individual reports directly to the Project Manager.

2.7 UXO TECHNICIANS

Two UXO Technicians (Technician II) will be responsible for conducting an initial field screening of work zones and assist during the entire project with ordnance and explosives related issues (if any). The UXO Team Leader will report directly to the Project Manager.

2.8 FIELD PERSONNEL

Other field personnel participating in the implementation of field activities, in coordination with field subcontractor personnel will be responsible for performing all field activities in accordance with the FW SAP and FSHP and their project-specific addenda. These individuals report directly to the Field Operations Manager.

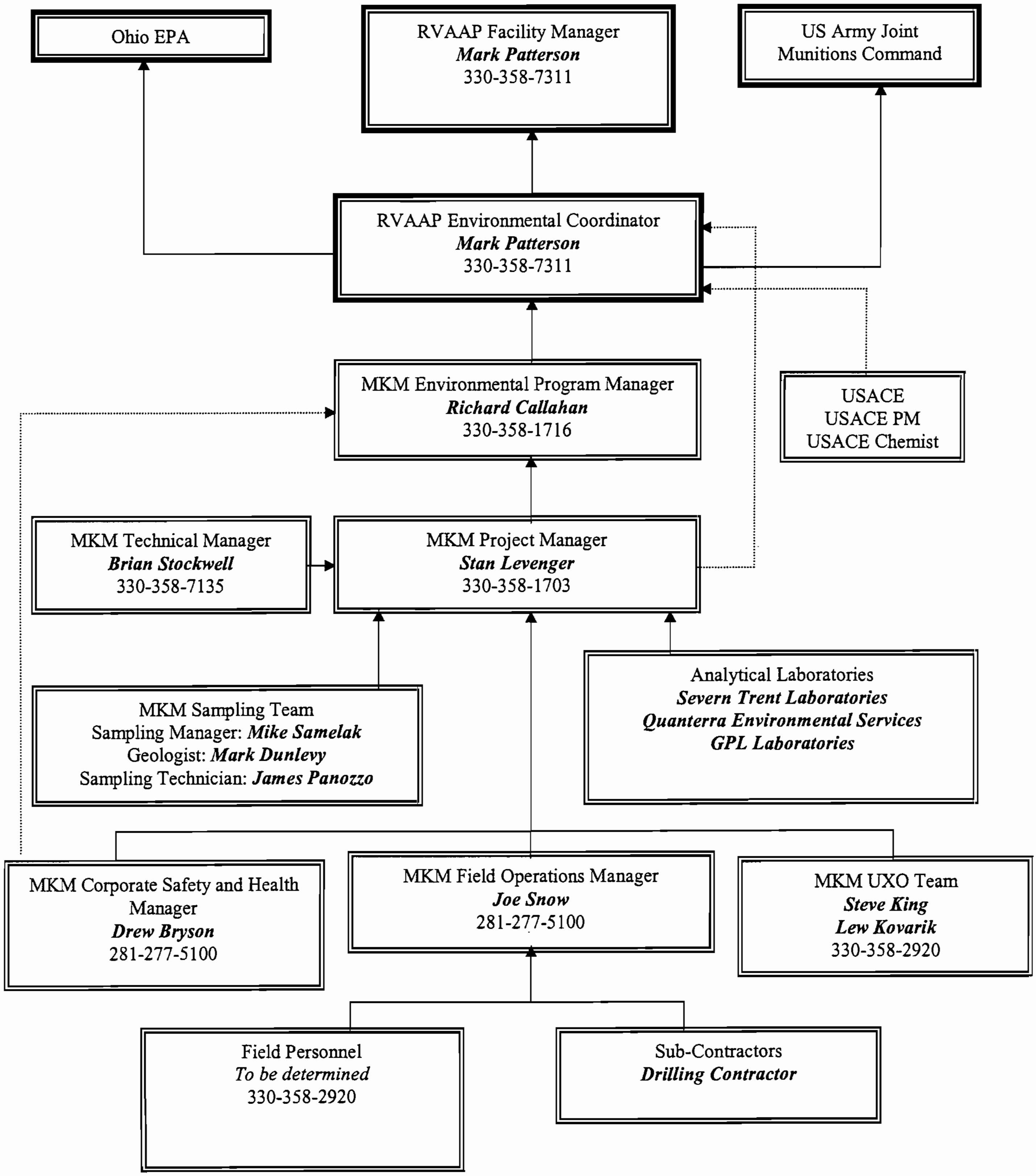

Figure 4 Project Organization Chart for the LL-9 RI

3.0 SCOPE AND OBJECTIVES

3.1 PROJECT OBJECTIVES

The primary objective of this remedial investigation is to expand on the USACHPPM and Azide Screening effort by further evaluating the shallow and deep soils, groundwater, surface water and sediment media associated with the AOC. The data from this RI will be folded into an evaluation of risk for the site followed by recommendations for remedial efforts, as necessary. During the Azide Screening field effort thirteen (13) shallow soils, two (2) surface waters, four (4) sediment samples, and two (2) sump waters were collected and screened for primary and/or secondary explosives. Six (6) shallow soil samples and the surface water/sediment samples and sump water samples were sent to the laboratory and analyzed for explosives and metal. The screening and laboratory data derived from these samples will be utilized in the RI. The RI involves the following field activities:

- Subsurface (soil boring) soil sampling and analysis;
- Monitoring well installation and development;
- Groundwater sampling;
- Sub-floor surface sampling and analysis;
- Surface water sampling and analysis;
- Shallow soil hand auger sampling and analysis;
- Sewer sediment and water sampling;
- Sump sediment and water sampling;
- Ditch sediment sampling and analysis, and
- VOC screening in selected areas with limited laboratory analysis.

The specific methods and sampling procedures for the above listed activities are provided in Section 5 of this document.

3.2 DATA QUALITY OBJECTIVES

The project DQO is to provide sufficient high-quality data to confirm/refute the nature and extent of contamination within the process areas and surrounding areas, delineate the extent of contamination at the AOC, if any and lastly to determine if residual contamination, if any is a risk to human health or the environment. The specific DQO for Load Line 9 will be accomplished by performing the following activities:

- Implement the Site-Specific Plans for Load Line 9 by developing data of sufficient quality to assure Remedial Investigation requirements have been met;

- Drill 15 soil borings and collect two (2) soil samples shallow and subsurface from each boring (30 samples total) for TAL Metals analysis and 10% for explosive analysis (50% Jenkins screening);
- Install seven (7) ground water monitoring wells from soil borings;
- Collect four (4) sub-floor subsurface soil samples for TAL Metals and 10% for explosive analysis (50% Jenkins screening);
- Collect seven (7) ground water samples (one from each well) for VOCs, SVOCs, Explosives, Propellants, TAL Metals (filtered), Cyanide, and Pesticide/PCBs analysis;
- Collect five (5) surface water samples for Explosives, TAL Metals (unfiltered) and Cyanide analysis. Samples LL9SW-001 and LL9SW-005 were collected and sent to the laboratory for analysis during the Azide Screening;
- Collect thirteen (13) sediment samples from site ditches and drainage ways for TAL Metals, TOC, Grain Size and 10% for explosive analysis. Sample LL9SD-001, LL9SD-003, LL9SD-004, AND LL9SD-005 were collected during the Azide Screening and sent to the laboratory for analysis;
- Collect 2 sewer water samples and 2 sump water samples from the manholes and sumps for Explosives, TAL Metals (unfiltered) and Cyanide. Sump water samples LL9SW-007 and LL9SW-008 were collected during the Azide Screening and sent to the laboratory for analysis;
- Collect two (2) sewer sediment and 2 sump sediment samples from the manholes and sumps for Explosives, TAL Metals, TOC, and Grain Size analysis;
- Collect 31 total shallow soil samples with hand auger from 31 locations and 31 subsurface soil samples associated with the shallow soil samples for TAL Metals and 10% for explosives; (50% Jenkins screening). Samples LL9SS-001, LL9SS-003, LL9SS-005, LL9SS-007, LL9SS-009, and LL9SS-011 were collected and sent to the laboratory for explosives and metals analysis. Samples LL9SS-002, LL9SS-004, LL9SS-006, LL9SS-008, LL9SS-010, LL9SS-012 and LL9SS-013 were collected and screened for explosives using the Jenkins Test during the Azide Screening;
- Collect soil samples from 15 borings during the VOC screening to evaluate for potential VOCs from Load Line operations. Headspace all samples and submit four (4) samples total for VOCs, SVOCs and TPH;
- Provide data of sufficient quality for a data review on 100% of the data collected;
- Provide data of sufficient quality for third-party data validation on 10% of the data collected; and
- Provide data of sufficient quality to complete a baseline human health and ecological risk assessment.
- 10% of the samples from each medium will be analyzed for the RVAAP full suite of constituents (i.e., VOCs, SVOCs, TAL Metals, Explosives, Propellants, Pest/PCB and Cyanide).

3.3 CONCEPTUAL SITE MODEL

Based on current data, the conceptual site model presented in the FW SAP is applicable to this element of the RI. The samples collected during the RI will serve to update the site-specific conceptual model.

Soil Samples--During the RI, a total of one hundred (100) surface and subsurface soil samples will be collected from fifty nine (54) locations [23 soil boring drill rig/Geoprobe® sites (15 soil borings, 4 sub-floor locations and 4 VOC screening locations) and 31 hand auger soil sites] within Load Line 9 (AOC 42). Samples will be collected at various depth intervals using drill rigs, Geoprobe® and stainless steel hand augers.

Sediment Samples--Sediment samples will be collected from seventeen (17) locations within the main drainage ditches, sumps and manholes of the site to evaluate potential impact, if any.

Groundwater Samples--A total of seven (7) groundwater samples (1 sample per well) will be collected during the RI to assess the ground water quality associated with potential sources of contamination and establish upgradient water quality conditions.

Surface Water; Sump/Sewer Water Samples--During the RI, nine (9) water samples will be collected from the drainage ditches, sumps and manholes of the site. These samples will be collected to evaluate surface water quality in and around the AOC.

3.4 PROBLEM DEFINITION

Load Line 9 is located within what is now a heavily vegetated area of RVAAP, along Fuze and Booster Road. Load Line 9 operated primarily as a detonator assembly line until 1945 when it was deactivated. Fulminate, azide and tetryl mixing/processing was conducted in various load line buildings to support the detonator manufacturing process. Based on sampling results, the 1998 USACHPPM Report identifies surface/subsurface soils and groundwater to be potential media for contaminant migration. Therefore, the Relative Risk Site Evaluation for the AOC was scored Medium. The proposed RI addresses these issues. Appendix D presents the LL-9 excerpt from the 1996 USACHPPM report for referencing as needed.

The proposed RI addresses this issue through the comprehensive sampling and analysis of site soil, sediment, groundwater and surface water to further expand on the USACHPPM and Azide Screening efforts in order to more fully evaluate the environmental impact posed by past site operations. Additional samples will be collected outside side these areas to target other suspect locations throughout the 69 acre site. The data from this RI will be folded into an evaluation of risk for the site followed by recommendations for remedial efforts, as necessary.

3.5 RI OBJECTIVES

Section 3.2.3 of the FW SAP identifies the RI objectives.

3.6 IDENTIFY DECISIONS

The key decisions for all investigations at RVAAP have been identified in the FW SAP Section 3.2.4.

3.7 DEFINE THE STUDY BOUNDARIES

The investigation area boundary for Load Line 9 is that presented in Figure 3. The boundary was established to encompass all known or reported historical activities and potential surface water exit pathways.

3.8 IDENTIFY DECISION RULES

Decision rules used to guide remediation decisions are provided in Section 3.2.6 of the FW SAP. The data obtained through site visits were sufficient to define the potential environmental hazards associated with Load Line 9 and promote the implementation of this RI.

3.9 SPECIFY LIMITS ON DECISION ERROR

Limits on decision errors are addressed in Section 3.2.8 of the FW SAP.

3.10 OPTIMIZE SAMPLE DESIGN

The sample design for the RI is described in detail in Section 5.0 of this Work Plan.

3.11 DATA EVALUATION METHODS

Data reduction and validation will be performed in accordance with the FW SAP and QAPP. Data will be held in a database pending completion of field activities. Upon completion of the RI, data screening and evaluation processes will be implemented for the entire data set as part of the report preparation. All field data will be documented on field forms by the field sampling team, which will be reviewed on a daily basis by the Project Manager. Analytical data (laboratory) will undergo a 100% verification process followed by a 10% third-party validation. However, if the 10% validation process indicates that there are concerns with the data, additional validation (in accordance with the procedures specified in the site-wide plans) will be conducted. Field screening data, if performed will be compared to the laboratory data to provide information as to the effectiveness of the field methods as appropriate. The data will then be reduced and summarized for presentations in the RI report.

4.0 PROJECT ACTIVITIES

4.1 PRE STARTUP SAFETY

Prior to beginning the project, MKM's project manager, site superintendent, and UXO specialists will review all facility-wide baseline surveys and other site assessment reports to develop checklists for verification of site specific safety concerns and actual work activities to complete the Scope of Work. The Pre-Startup Safety Review will allow the field team to familiarize themselves with the project's safety requirements and activities before actual work begins.

4.2 REVIEW OF PAST ANALYTICAL DATA

The historical sampling and analytical data will be reviewed to identify any potential employee or environmental exposure concerns, waste disposal issues and work practices. The 1998 U.S. Army Center for Health Promotion and Preventive Medicine (USA CHPPM) Report will be reviewed with all team members to accomplish this task.

4.3 MOBILIZATION AND SITE PREPARATION

Once the Notice to Proceed has been issued for the RI, the project will be initiated by execution of the mobilization task. Completion of the mobilization will establish a level of organization and framework that will support the implementation of the remainder of the scope of work presented in this document. Mobilization includes any site preparation activities such as clearing the site (brush hogging), setup of site access roads and establishing specific work areas such as decontamination areas and excavation preparation areas as necessary. In addition, the final schedules will be prepared and coordination with JMC and subcontractors will be initiated. The field personnel will be briefed regarding the tasks and goals of the investigation. The following subsections discuss the specific mobilization sub-tasks to be conducted for this RI.

4.3.1 Ordnance and Explosives Survey

There is no definitive information available for the site regarding potential OE concerns. Therefore, the UXO team will screen all work zones for potential UXO items prior to entry by sample team members. Screening will be performed using a magnetometer. Additionally, soil boreholes will be screened with a down-hole magnetometer (Schonstedt GeoMag) until the geologist has determined that the boring has reached undisturbed soil. Refer to the Load Line 9 Ordnance Avoidance Plan in Appendix C for details on all ordnance and explosive screening operations.

4.3.2 Limited Site Clearing

It will be necessary during the site preparation activities to perform some limited clearing of ground level vegetation so personnel and equipment can safely access the designated sampling locations. Pathways will be established using gas powered weed eaters and a tractor mounted brush hog, as necessary.

4.3.3 Work Zone Setup

MKM does not anticipate the installation of any site facilities with the exception of work zones. The sample sites will be delineated into work zones (marked with yellow DO NOT ENTER caution tape) including the exclusion zone (EZ), the contamination reduction zone (CRZ) and support zone (SZ) for site access control during field operations. The work zones are further described and illustrated in the Load Line 9 RI Site-Specific Health and Safety Plan (SSHP).

Due to the relatively short duration of this project, as well as the proximity of the project site to the MKM RVAAP field office at Bldg 1038, services such as water, telephone, sanitary, and gas will not be installed at the work site. Potable water for the decontamination of personnel and equipment will be stored in portable poly containers. Cellular telephones will be used for communications and emergency notifications. Temporary sanitary facilities will be mobilized to the site and maintained by local vendors.

Upon delineation of the work zones, site access control points will be established and site control and security will be implemented. This will consist of establishing barriers such as warning cones, and yellow caution tape to control points of site access control. The Site Safety and Health Officer will be responsible for site access. Site access logs will be maintained for the duration of the project. The site control protocol is further described in the SSHP.

4.3.4 Waste Accumulation Area

A temporary waste accumulation area will be established adjacent the support zone to stage drums of Investigation Derived Waste (IDW). The exact location will be determined in the field by the SSHO. The storage area will be constructed using two layers of 6-mil plastic sheeting and straw bales for containment purposes. Both the storage area and waste containers will be inspected on a weekly basis using the Weekly Waste Storage Inspection Record. Upon waste acceptance by the TSDF, all drums will be loaded, manifested and transported to the designated disposal facility. The manifests will be verified and signed by the transporter and RVAAP Environmental Coordinator.

4.3.5 Temporary Decontamination Area

A temporary decontamination area will be constructed to facilitate decontamination of the drill rigs, augers, rods and other associated equipment and personnel. The location and layout of the decontamination area will be identified in the field by the SSHO and Project manager. The pad will be constructed of a double layer of 40-mil liner, approximately 20-feet wide and 40 feet long. The pad will be bermed using prefabricated sections of 36-inch high fiberglass walls. The liner will cover the walls and will be secured to metal stakes or equivalent installed in the asphalt/ground outside the berm. The pad will be constructed in a manner to ensure all waste fluids flow to a lined sump for collection. A sump pump will transfer any waste fluids to one 1,100-gallon polyethylene tank for subsequent waste characterization sampling and analysis. Equipment will be steam cleaned using a phosphate free detergent as needed.

4.3.6 Acquisition of Field Equipment

The equipment required for conducting the RI will be assembled in the Support Area at the site. This inventory of equipment includes materials ranging from heavy equipment, sampling and monitoring equipment, to sampling forms, logbooks, and files as well as personal protective equipment. Items, which must be rented or purchased, will require the longest lead-time. The equipment will be organized and calibrated at the field office or on site as appropriate, in preparation of field activities. Purchase, rental and acquisition of this equipment is expected to take approximately two weeks.

4.3.7 Subcontractor Coordination

Selected tasks during the RI (e.g., drilling operations, laboratory services and data validation) will require utilization of subcontractor services. The subcontractors identified for these tasks will be contacted to schedule and coordinate field activities. The day-by-day schedule of field activities will be completed with input from the subcontractors. MKM will work closely with all subcontractors to facilitate safe, efficient, and cost-effective field operations as well as laboratory services and data validation.

4.3.8 Personnel Training

All contractor personnel engaged in field activities will participate in a project kick-off meeting to receive project-specific training by the Project Manager and the Project Health and Safety Officer. During this time, goals, and objectives of the RI will be reviewed, the Load Line 9 RI FSP and QAPP will be reviewed in detail, work assignments will be reviewed and a complete discussion of the health and safety requirements of the investigation will be presented. Special emphasis will be placed on the roles of individuals on the project so that a clear understanding is achieved for lines of communication. Clear lines of communication will result in an effective decision making processes when field decisions are required as well as the achievement of quality assurance goals as field and analytical data are generated. In addition, any unique procedural or site-specific aspects of the investigation will be highlighted. Prior to a specific field task, a briefing will be conducted on-site for all contractor and subcontractor employees assigned to that task covering pertinent sections of the Load Line 9 RI FSP and QAPP. The briefing will include a complete discussion of the health and safety requirements for the task.

Employees of the contractor and their subcontractors involved with field activities will be required to attend a Load Line 9 RI safety briefing prior to participating in field activities. This will be documented by their signature to the SSHP. This training will be scheduled for all personnel, to the extent possible during the mobilization Task. Daily safety briefings will be conducted during the course of the field effort.

The project Health and Safety Officer will compile all pertinent OSHA training and medical monitoring records for employees of the contractor and their subcontractors involved with field activities. A copy of these records will be maintained at the MKM field office or on-site as needed. During field operations, a daily health and safety briefing will be conducted to evaluate established procedures and change them as required.

4.4 IDENTIFICATION AND SURVEY OF SAMPLING LOCATIONS

All sampling locations will be cleared for underground and overhead utilities prior to the commencement of any intrusive sampling activities by analyzing existing "As-Builts" and visual surveys. Sampling locations will be adjusted, as necessary to avoid both overhead and underground structures and utilities. Upon completion, all sampling locations will be surveyed for horizontal control in accordance with the FW SAP. Ground surface elevations (vertical control) will be measured at each sampling location borehole and monitoring well for the following reference points as applicable:

- Top of inner PVC well casing;
- Top of outer or protective casing; and
- Ground surface elevation.

Field reconnaissance will be conducted to identify any access problems or unusual sampling conditions. Surface water and sediment sampling locations may be adjusted in the field on the sampling day due to the variable accumulation patterns of sediment. At sediment sampling locations where standing water is not present, a shallow soil sample will be collected instead (at the location) to ensure evaluation of the targeted sample point.

4.5 LABORATORY ANALYSIS

The quality of the RI sample results becomes the cornerstone on which all site evaluations and data interpretations are based. It is essential that the laboratory conducting the analysis receive clear, detailed instructions on all aspects of the analytical task from sample receipt through sample analysis and on to data reporting and deliverables. All laboratory analysis will be conducted by an independent off-site laboratory subcontracted to the contractor. The laboratory analysis and reporting are critical path items, which directly affect the schedule for the subsequent tasks of data validation and final report preparation. The laboratory will use analytical methods and procedures based on USEPA SW-846 methods and Ohio EPA-approved methods for inorganic and organic analyses of multimedia, multi-concentration, environmental samples. These procedures are defined in the Load Line 9 RI QAPP. The types of samples that will be submitted for laboratory analysis include soil, groundwater, surface water, sediment and the associated field Quality Control samples.

In addition to the RI samples discussed in Section 3.2, a variety of field QA/QC samples are provided for analysis. These QA/QC samples provide information regarding the effectiveness of the equipment decontamination procedures, sample reproducibility and external influences on the samples during transport and handling. The following is a list of field QA/QC samples that are described in detail in the Load Line 9 RI QAPP and will be provided for analysis.

- Field Blanks;
- Equipment Blanks;
- Field Replicates;
- Trip Blanks; and
- Matrix Spike/Matrix Spike Duplicates.

4.6 DEMOBILIZATION

Upon completion of the RI activities, all areas will be restored as closely as possible to their pre-investigation condition. Accumulated trash and debris (non-IDW) will be collected and placed in on-site dumpsters. Any damage to the ground surface will be restored as closely as possible to its original condition. Concrete and asphalt surfaces will be patched and restored as necessary. All equipment that is no longer needed for the RI will be properly decontaminated as per the FW SAP and the FW SSHP and demobilized from the site. This includes trucks, drilling rigs, and sampling equipment.

IDW will be managed as discussed in Section 9.0. Purge water generated during monitoring development and sampling, drilling cuttings from boreholes and decontamination fluids will be containerized and transported to the waste accumulation area for waste characterization analysis and subsequent disposal.

4.7 REGULATORY NOTIFICATION

Upon receipt of regulatory approval of the work plans, MKM's technical team will prepare all required notifications for the Ohio EPA and as required by JMC, EPA and local agencies.

5.0 FIELD SAMPLING METHODS AND PROCEDURES

The RI field activities must be performed in a well-defined and consistent manner to ensure that the resulting data are comparable between sampling locations and can be validated against all applicable QA/QC requirements. This section defines field methods and/or procedures applicable to the following field activities.

- Subsurface (soil borings) Soil Sampling;
- Sub-floor Soil Sampling;
- Shallow Soil Sampling;
- Monitoring Well Installation and Development;
- Groundwater Sampling;
- Surface Water Sampling;
- Ditch Sediment Sampling;
- Sewer/Sump Water Sampling;
- Sewer/Sump Sediment Sampling;
- Contingency Sampling; and
- Decontamination Procedures

The methods and procedures are written with the intent of providing specific details so as to ensure consistent data quality, while providing sufficient flexibility to allow for unexpected or changing geologic, environmental, or sampling conditions. Occasionally, modifications to the field procedures are required for reasons of safety or practicality. Any modifications will be reviewed and approved by the MKM Program Manager and presented to the Ohio EPA for approval. All variances to the procedures presented in this Work Plan will be documented.

All field activities will be under the overall supervision of the Project Manager or his designees. Specific sampling activities will be performed or controlled by the Sampling Manager. Subcontractors performing specific activities will be required to comply with all project procedures and requirements. All sampling procedures will be consistent with the RVAAP Revised 2001 FW SAP.

Table 1-1 in the QAPP provides a summary of the RI sampling and analysis. The following sections discuss the field protocols and procedures to be used for the sampling activities to be conducted for this RI.

5.1 SOIL SAMPLING

Soil sampling will be conducted using the hollow-stem auger/split spoon, Direct Push (Geoprobe®), and hand auger methods. The actual soil sampling method used will be sample depth dependent. Each sampling method is further discussed is the following subsections. Fifty percent (50%) of the soil samples will be screened for explosives by running the Jenkins method.

5.1.1 Hollow Stem Auger

Seven (7) soil borings will be drilled during the Remedial Investigation to evaluate potential subsurface contamination (Figure 5). Each boring will be advanced until groundwater is encountered, which is estimated to be no deeper than thirty (30) feet below ground surface (bgs). Should bedrock be encountered prior to saturated conditions then the boring will be completed using air rotary technology detailed in sections 4.3.3.1.2 and 4.3.2.1.3 of the FW SAP. The boring location may also be moved to avoid bedrock drilling if it is believed that all proposed soil borings will not encounter bedrock prior to saturated conditions. Approval for any alternate locations will be acquired prior to commencement of drilling activities. The boring depth will be sufficient that the approximate middle of the well screen is at the stabilized groundwater depth. The soil borings will be completed as ground water monitoring wells.

Subsurface soil samples will be collected continuously from all HSA boreholes using standard 2-inch OD, 24 inch long split spoon samplers or 60 inch long continuous samplers. The samplers will be equipped with sand catchers to minimize loss of sample. Upon retrieval, each sampler will be screened with a PID to record headspace concentrations. Two soil samples will be collected from each of the seven borings (14 total) to characterize potential sources of contamination. The shallow sample will be collected from the top five- (5) feet. The actual sample depth will be selected based upon field screening results and visual observation. The deep soil sample will be collected from the interval just above the saturated zone or high volatile headspace. All soil boring and bedrock (if any) samples will be collected in accordance with sections 4.3.2.3.2, 4.4.2.4 and 4.4.2.5 of the FW SAP. Each of the soil boring samples will be sent the sub-contractor laboratory for TAL Metals analysis and 10% for explosives:

In addition, 10% (2 total) of the samples will be analyzed for VOCs, SVOCs, Explosives, Propellants, PCBs, Cyanide, and Pesticides.

Split spoon sampling will be conducted in accordance with ASTM D-1586-84; the drilling equipment will meet ASTM D 1586 for standard penetration tests. In addition, all soil boring sampling on-site will follow the procedures presented in Section 4.4.2.5.1 of the FW SAP.

5.1.2 Sub-floor Soil Sampling

Sub-floor samples will be collected beneath the concrete floor in buildings DT-18A, DT-16, DT-21, DT-8, DT-5 and DT-34 (soil floor) (1, 1, 2, 1, 1, and 1 samples respectively) totaling seven (7) samples (Figure 5). The sub-floor soil samples will be collected at the soil/sub-base interface to assess potential impact to the underlying soils. All sub-floor soil samples will be analyzed for Explosives and TAL Metals. In addition, 10% (one total) of the samples will be analyzed for VOCs, SVOCs, Propellants and Pesticides.

A coring machine equipped with a six-inch core barrel will be used to remove the concrete at each sample location. A wet/dry vacuum will be used to contain excess water during the coring operations to effectively minimize migration of potential contaminants. Once the concrete is removed, the remaining base course material will be taken out of the borehole using a stainless steel trowel or equivalent. One discreet soil sample (0 to 1 foot below base course material) will then be collected from each boring location using a clean, decontaminated, stainless steel hand auger. The sample will also be field screened for VOCs prior to sample collection using a hand-held photo-ionization detector (PID). No soil samples will be collected for additional headspace analysis. DT-34 has an earthen floor and will not require concrete coring.

5.1.3 Soil Sampling Adjacent to Sumps

One direct push soil boring will be advanced at the sumps adjacent to Buildings DT-2, and DT-5 to evaluate structural integrity (Figure 5). Two soil samples will be collected from the boring (4 total). The first sample will be collected from the surface to a depth of 1 foot bgs. The second sample will be collected from the 3 to 10 foot bgs (bottom of sump/basement) interval. A dual tube will be used when advancing holes below a depth of 4 feet, when field conditions are suitable. All sump soil samples will be analyzed for TAL Metals and 10% for explosives. In addition, 10% (one total) of the samples will be analyzed for Explosives, VOCs, SVOCs, Propellants, Cyanide and Pesticides.

The sump soils at LL-9 will be sampled for chemical analyses to characterize nature of contamination in soil, if any. The samples will also be field screened for VOCs prior to sample collection using a hand-held PID.

5.1.4 Soil Sampling Adjacent to Sewers

Four (4) sewer soil samples will be collected during the Remedial Investigation adjacent to buildings DT-33 and DT-20. The samples will be located at manholes and thrust points where sewer integrity is potentially suspect (Figure 5). Given the planned sample depth (>3 feet bgs), a direct push system will be used to expedite this sampling task. A dual tube will be used when advancing holes below a depth of 4 feet, when field conditions are suitable. All of the sewer soil samples will be analyzed for TAL Metals and 10% for explosives. The samples will also be field screened for VOCs prior to sample collection using a hand-held PID. In addition, 10% (one total) of the samples will be analyzed for Explosives, VOCs, SVOCs, Propellants and Pesticides.

The sewer soils at LL-9 will be sampled for chemical analyses to characterize nature of contamination in soil, if any. Two discreet samples (0 to 1 foot interval and below total manhole depth) will be collected from each boring.

5.1.5 Soil Sampling for Potential VOCs Screening Adjacent to Bldg DT-33

A maximum of fifteen direct push soil borings will be advanced at a grid established east of the solvent building at Load Line 9 (Bldg DT-33). The borings will be continuously sampled and head spaced for VOCs. A total of four soil samples will be collected from the borings exhibiting the highest head space readings and or strongest VOC odors.

Each soil sample will be described in the detail set forth in the FW SAP section 4.3.2.4. The sample will be submitted to the laboratory for analysis of the following parameters:

- VOCs, SVOCs, and TPH (DRO, GRO) according to EPA SW-846 laboratory methods.

The samples *will not* be analyzed for a full suite of analytical parameters as per the 10% full suite protocol because this is a screening procedure.

5.1.6 Hand Auger Shallow and Subsurface Soil Sampling

Shallow soil and subsurface soil sampling will be conducted to assess the potential impact from previous site operations (Figure 5). The bucket hand auger method will be used during most of the Load Line 6 RI shallow soil and subsurface soil sampling operations. The depth interval over which soils will be collected using this method will be 0.0 to 1.0 feet for shallow soils and 1.0 to 3.0 feet for subsurface soils. The maximum practical sampling depth for this device at RVAAP is 5.0 feet bgs. This method will be implemented as described in Section 4.5.2.1.1 of the FW SAP. Depending upon actual field conditions, several different sampling techniques may need to be incorporated for collecting shallow soil and subsurface soil samples. These methods are described in Section 4.5.2.1 of the FW SAP. All shallow soil samples will be screened for ordnance as described in section 4.10.

The Load Line 9 shallow soil samples will be collected from thirty one (31) separate locations as shown in Figure 5. The shallow sample interval will be from the surface to a depth of one-foot (0-1') bgs. The second sample interval or subsurface sample for the designated location will be from one-foot to three feet (1-3') bgs. Sample locations, including QC samples, will be verified with Ohio EPA prior to sampling and field checked based on visual survey of the area conditions. Each sample will be field screened for VOCs prior to sample collection using a hand-held PID. No samples will be collected for additional headspace analysis. Each soil sample will be described in the detail set forth in the FW SAP section 4.3.2.4. The sample will be submitted to the laboratory for analysis of the following parameters:

- TAL Metals and 10% for explosives according to EPA SW-846 laboratory methods; and
- In addition, 10% of all the shallow soil and subsurface samples will be analyzed for VOCs as per EPA Method 8260B, SVOCs as per EPA Method 8270C, Explosives as per EPA Method 8330; Cyanides as per EPA Method 9010/9012, Propellants as per modified EPA Method 8330, and Pest/PCBs as per EPA Method 8081A/8082.

The explosive aliquots for the surface sample will be composited and homogenized from three sub-samples collected about 0.9 M (3 feet) from one another in a roughly equilateral triangle pattern. The sample aliquots for all other analyses will be collected as discrete samples from the midpoint of the three samples. The volatile organic compound (VOC) fraction will not be homogenized, but instead will be placed directly into the sample jar in order to minimize potential loss of volatiles, if any.

MKM will follow the guidelines set forth in the Revised 2001 FW SAP for project document requirements and QA/QC Sampling Requirements.

5.2 MONITORING WELL INSTALLATION

The seven (7) soil borings at Load Line 9 will be converted to ground water monitoring wells during the investigation. These monitoring wells will be installed to assess the ground water quality associated with potential sources of contamination and establish upgradient water-quality conditions at this AOC. All monitoring well installations on-site will follow the procedures presented in the FW SAP: 4.3.2.2 Materials, 4.3.2.3 Installation. The completed monitoring wells will be secured using facility locks equipped with common keys.

Each monitoring well will be installed to monitor the first aquifer at a maximum planned depth of thirty (30) feet. Due to the configuration of the bedrock high under the site, the determination of shallow groundwater flow and gradient is not possible prior to monitor well installation. Based on field observation, site topography suggests that groundwater flow possibly trends south or north. Boring/monitoring wells SB/MW-001 and SB/MW-007 will be placed at potential down-gradient or up-gradient locations at Load Line 9.

5.3 MONITORING WELL DEVELOPMENT

Monitoring well development is the process by which fine soil materials disrupted by the drilling process are removed from in and around the screen and filter pack to allow groundwater to flow freely into the well. This process is accomplished by moving water through the well screen into and out of the surrounding material. The goal of the well development process is the following:

- Remove materials that have accumulated in the openings of the screen and along the sides of the boreholes during the drilling and installation process;
- Increase the hydraulic conductivity of the adjacent geologic materials and the filter pack by removing fine materials; and
- Stabilize the fine materials that remain near the well and retard their movement into the well.

The benefits of well development are increased yields, reduced pumping of fines during sampling activities, which can damage pumps and affects analytical results, and reduce corrosion and encrustation of the screen. All monitoring well development operations will be performed in accordance with Section 4.3.2.3.11 of the FW SAP.

5.4 GROUNDWATER SAMPLING

During the RI, one (1) ground water sample will be collected from each of the seven (7) monitoring wells installed at the site. Prior to conducting the ground water sampling activities, the field team will evaluate the well to determine its condition, depth to water, depth to the bottom of the well casing, etc. If the well is determined to be acceptable (i.e., not collapsed, has a measurable water level) the well will be purged and a groundwater sample will be collected for laboratory analysis. Groundwater sampling operations will commence no sooner than 48 hours after well development. The locations of the proposed monitor wells are shown in Figure 5.

The groundwater at Load Line 9 will be sampled for chemical analyses to assess the ground water quality associated with potential sources of contamination, if any. Additionally the wells will be used to establish the upgradient water-quality conditions at the AOC. The wells will also be field screened for VOCs prior to sample collection using a hand-held PID. No samples will be collected for additional headspace analysis. Field measurement of pH, temperature and conductivity will be recorded for the sample. Water level measurements will be collected immediately prior to groundwater sampling. If the integrity of the well is intact, one ground water sample will be submitted to the laboratory for analysis of the following parameters:

- VOCs as per EPA Method 8260B;
- SVOCs as per EPA Method 8270C;
- Pesticides as per EPA Method 8081A;
- PCBs as per EPA Method 8082;
- Explosives as per EPA Method 8330;
- Propellants as per modified EPA Method 8330;
- TAL Dissolved Metals according to EPA SW-846 laboratory methods (on filtered samples); and
- Cyanide as per EPA Methods 9014/9010B.

5.4.1 Well Purging Methods

In order to manage the liquid IDW generated as a result of well purging, the purge water will be containerized in a poly tank or hazardous waste steel drum and staged for characterization and disposal. In most cases, the following methods will be used to purge the on-site well:

- A dedicated bladder or submersible pump will be used for purging;
- The purge rate will not exceed the rate of recharge in the well, to the extent possible.

- The volume purged will be 3 to 5 well volumes and stabilization of water quality indicators such as pH, temperature, and conductivity will be consistent with FW SAP Sections 4.3.3.2, 4.3.4.1 and 4.3.4.2; and
- Sample collection shall occur as soon as possible after purging based upon the rate of recharge, but within 24 hours.

All well purging protocol listed in section 4.3.4 of the FW SAP will be followed.

5.4.2 Sampling Methods for Groundwater

Groundwater sampling from the on-site wells will follow the procedures presented in Section 4.3.4 through 4.3.8 of the FW SAP. The integrity of the well will be checked by visual inspection of the surface casing and riser pipe and by performing an alignment test in accordance with Section 4.3.2.3.13 of the FW SAP. If the integrity of the well is questioned, the RVAAP environmental coordinator will be notified.

5.4.3 In-situ Permeability Sampling

Rising-head slug test will be performed on the seven (7) monitoring wells installed during the RI at Load Line 9 to determine the hydraulic conductivity of the unconsolidated overburden adjacent to the well screen. Initial water levels will be recorded prior to the insertion of the pressure transducer/data logger into each well. The transducer/data logger will be initialized. A slug will be lowered into each well and the water level will be monitored and allowed to stabilize. Once the water level is stabilized, the slug will then be quickly withdrawn. The water level will be monitored until groundwater re-equilibrates to within 90% of the initial/pretest water level, and then the transducer/data logger will be turned off. Therefore, both rising head and falling head slug tests will be available for analysis.

Data from the slug tests will be used to interpret hydraulic conductivities using the Bower & Rice method (1989):

$$K = \frac{R_c \ln (R_e / R)}{2L_e} \quad \frac{1}{t} \quad \ln (H_0/H_t)$$

Where:

K is the hydraulic conductivity
R_c is the radius of the well casing
R is the radius of the filter pack
R_e is the distance away from the well K is being measured
L_e is the length of screen
H_0 is the draw down at t = 0
H_t is the draw down at t = t
t is the time since H = H

5.5 SURFACE WATER

A projected five (5) surface water samples will be collected during the RI (Figure 5). Surface water sampling will evaluate surface water within the main flow ways of the site. All IDW will be containerized for characterization and disposal.

Several different sampling techniques may be utilized for collection of the surface water samples. However, it is anticipated that the samples will be collected using the hand-held bottle method during this RI. These methods are described in Sections 4.6.2.1.1 and 4.6.2.1.2 of the FW SAP. The sample will also be field screened for VOCs prior to sample collection using a hand-held PID. Field measurement of pH, temperature, dissolved oxygen, and conductivity will be recorded for the sample. Each of the surface water samples will be analyzed for following parameters:

- Explosives as per EPA Method 8330;
- TAL Metals according to EPA SW-846 laboratory methods (on unfiltered samples); and
- Cyanide as per EPA Methods 9014/9010B.

In addition, 10% (1 total) of the surface water samples will also be analyzed for VOCs as per EPA Method 8260B, SVOCs as per EPA Method 8270, Propellants as per modified EPA Method 8330, and Pest/PCBs as per EPA Method 8081A/8082.

5.6 SUMP/SEWER WATER SAMPLING

A projected four (4) sump/sewer water samples (Sewer near buildings DT-33 and DT-20 and sumps near DT-2 and DT-5) will be collected during the RI (Figure 5). This sampling will evaluate water within the site sewers/sump. All IDW will be containerized for characterization and disposal.

Several different sampling techniques may be utilized for collection of the sump/sewer water samples. However, it is anticipated that the samples will be collected using the Teflon® scoop or bailer method during this RI. These methods are described in Sections 4.6.2.1.1 and 4.6.2.1.2 of the FW SAP. The sample will also be field screened for VOCs prior to sample collection using a hand-held PID. Field measurement of pH, temperature, dissolved oxygen, and conductivity will be recorded for the sample. Each of the sump/sewer water samples will be analyzed for following parameters:

- Explosives as per EPA Method 8330;
- TAL Metals according to EPA SW-846 laboratory methods (on unfiltered samples); and
- Cyanide as per EPA Methods 9014/9010B.

In addition, 10% (1 total) of the surface water samples will also be analyzed for VOCs as per EPA Method 8260B, SVOCs as per EPA Method 8270, Propellants as per modified EPA Method 8330, and Pest/PCBs as per EPA Method 8081A/8082.

5.7 SEDIMENT SAMPLING

Sediment samples will be collected from seventeen (17) sample locations throughout Load Line 9. The locations and sample methods are described in the following sections.

5.7.1 Ditch Sediment Sampling

Ditch sediment samples will be collected from thirteen (13) separate proposed locations as shown in Figure 5. Five (5) of the sediment samples will be co-located with the surface water samples. The remaining sediment samples will be collected from within the intermittent drainage ditch system on site. Sediment samples will be collected to characterize potential impact within the main drainage ditches of the site. The location of the sediment samples will be verified with Ohio EPA prior to sampling. At locations where standing water is not present, a shallow soil sample will be collected instead (at this location) to ensure evaluation of the targeted sample point. Several different sampling techniques may be utilized for collection of the sediment samples. However, it is anticipated that the trowel/spoon will be used at the Load Line 9 site. These methods are described in Sections 4.5.2.1.1 and 4.5.2.1.2 of the FW SAP. The samples will also be field screened for VOCs prior to sample collection using a hand-held PID. No samples will be collected for additional headspace analysis. Each sample will be submitted to the laboratory for analysis of the following parameters:

- TAL Metals and 10% for explosives according to EPA SW-846 laboratory methods;
- TOC as per Walkely/Black Method; and
- Grain size as per ASTM D-422-63
- In addition, 10% (2 total) of the sediment samples will be analyzed for SVOCs as per EPA Method 8270, VOCs as per EPA Method 8260B, Explosives as per EPA Method 8330; Cyanide as per EPA Methods 9014/9010B, Propellants as per modified EPA Method 8330, and Pest/PCBs as per EPA Method 8081A/8082.

5.7.2 Sump Sediment Sampling

Sump sediment samples will be collected from two (2) locations as shown in Figure 5. The sedimentation sumps are located on the south sides of Buildings DT-2 and DT-5. The sediment sample will be collected to characterize the potential impact within the drainage system coming directly from the building drains.

Several different sampling techniques may be utilized for collection of the sediment sample. However, it is anticipated that the dredge/trowel/spoon will be used at the Load Line 9 site. These methods are described in Sections 4.5.2.1.1 and 4.5.2.1.2 of the FW SAP. The sample will also be field screened for VOCs prior to sample collection using a hand-held PID. No samples will be collected for additional headspace analysis. Each sample will be submitted to the laboratory for analysis of the following parameters:

- Explosives as per EPA Method 8330;
- TAL Metals according to EPA SW-846 laboratory methods;
- TOC as per Walkely/Black Method; and
- Grain size as per ASTM D-422-63

In addition, 10% (1 total) of the sediment samples will be analyzed for SVOCs as per EPA Method 8270, VOCs as per EPA Method 8260B, Cyanide as per EPA Methods 9014/9010B, Propellants as per modified EPA Method 8330, and Pest/PCBs as per EPA Method 8081A/8082.

5.7.3 Sewer Sediment Sampling

Sewer sediment samples will be collected from two (2) separate locations as shown in Figure 5. The manholes are located at Buildings DT-20 and DT-33. Sediment samples will be collected to characterize the potential impact within the sewer system coming directly from the buildings.

Several different sampling techniques may be utilized for collection of the sediment samples. These methods are described in Sections 4.5.2.1.1 and 4.5.2.1.2 of the FW SAP. The samples will also be field screened for VOCs prior to sample collection using a hand-held PID. No samples will be collected for additional headspace analysis. Each sample will be submitted to the laboratory for analysis of the following parameters:

- Explosives as per EPA Method 8330;
- TAL Metals according to EPA SW-846 laboratory methods;
- TOC as per Walkely/Black Method; and
- Grain size as per ASTM D-422-63
- In addition, 10% (1 total) of the sediment samples will be analyzed for SVOCs as per EPA Method 8270, VOCs as per EPA Method 8260B, Cyanide as per EPA Methods 9014/9010B, Propellants as per modified EPA Method 8330, and Pest/PCBs as per EPA Method 8081A/8082.

In addition, 10% (1 total) of the sediment samples will be analyzed for SVOCs as per EPA Method 8270, VOCs as per EPA Method 8260B, Cyanide as per EPA Methods 9014/9010B, Propellants as per modified EPA Method 8330, and Pest/PCBs as per EPA Method 8081A/8082.

5.8 CONTINGENCY SAMPLING

Contingency samples (10% of the hand auger samples) have been incorporated into the sampling scheme to provide flexibility. Including contingency samples in the sampling plan will allow for further delineation of the nature and extent of contamination at the AOC as needed, without the need for additional field efforts.

5.9 POTABLE WATER SAMPLING AND ANALYSIS

One (1) potable water sample will be collected to satisfy the Ohio EPA's requirement for laboratory data on any source of potable water used at RVAAP for decontamination water or make up water during drilling activities. As agreed, if a single source of water is identified and used for the project, then just a single sample is required to determine the suitability of the water source for use at RVAAP. The potable water sample will be submitted to the laboratory for analysis of the following parameters:

- Explosives as per EPA Method 8330;
- TAL Dissolved Metals according to EPA SW-846 laboratory methods (on filtered samples);
- Propellants as per modified EPA Method 8330;
- VOCs as per EPA Method 8260B;
- SVOCs as per EPA Method 8270C;
- Pesticides as per EPA Method 8081A;
- PCBs as per EPA Method 8082; and
- Cyanide as per EPA Methods 9014/9010B.

5.10 DECONTAMINATION PROCEDURES

Decontamination of equipment associated with groundwater sampling (if any) will be in accordance with the procedure presented in Section 4.3.8 of the FW SAP.

5.11 FIELD MEASUREMENT PROCEDURES AND CRITERIA

All field measurement procedures and criteria will follow Section 4.3.3 of the FW SAP. The monitoring wells will be field screened for VOCs using a PID during groundwater sample collection. Screening will be accomplished by monitoring the headspace vapors at the top of the riser pipes. Conductivity, pH and temperature will be monitored as per the FW SAP.

5.12 WASTE DISPOSAL CHARACTERIZATION

One representative sample will be collected from each IDW stream including purge water from the monitoring wells, decontamination water used on large equipment (i.e. drill rigs, augers, etc.), decontamination fluids such as acid and methanol rinses for small sampling equipment (i.e. hand augers, bowls, and trowels) and soil cuttings from the hand auger and drilling operations; and analyzed per requirements of the disposal facility. Each composite waste-stream sample will be collected to facilitate waste characterization and proper identification of disposal facilities. The purge water sample will be collected using a disposable Teflon® bailer. Decontamination fluid samples will be collected directly from the safety cans. Representative samples of soil cuttings will be collected using stainless steel hand auger, trowels and bowls. All IDW will be managed and disposed of in accordance with federal, state and local rules, regulations and laws. Refer to Section 9.0 of this document for additional information on handling IDW.

5.13 ORDNANCE AND EXPLOSIVE SCREENING

There is no definitive information available for the site regarding potential OE concerns. Therefore, the UXO Technicians will screen all work zones for potential UXO items prior to entry by sample team members. Screening will be performed using a magnetometer. Additionally, the soil boreholes will be screened with a down-hole magnetometer (Schonstedt GeoMag) to total depth of 20 feet (or less) or at the depth where undisturbed soils are encountered, as determined by the geologist in consultation with the UXO technician. Refer to the Load Line 9 RI Ordnance Avoidance Plan in Appendix C for details on the entire ordinance and explosive screening operations for this project.

6.0 SAMPLE CHAIN OF CUSTODY/DOCUMENTATION

MKM will follow the guidelines set forth in the Revised 2001 FW Sampling and Analysis Plan for project document requirements and QA/QC Sampling Requirements.

6.1 FIELD LOG BOOK

All field logbook information will follow structures identified in Section 5.1 of the FW SAP, where appropriate, field forms will be used to record specific sampling or investigational data to ensure consistency across sampling locations.

6.2 PHOTOGRAPHS

Photographic documentation of field efforts will be performed in accordance with Section 4.3.2.4.3 of the FW SAP. Representative photographs of field activities and any significant observations will be taken during RI field operations. Photographs will be suitable for presentation in a public forum, as well as for documenting scientific information.

6.3 SAMPLE NUMBERING SYSTEM

The sample numbering system that will be used to identify samples collected during the RI is explained in Section 5.3 of the FW SAP.

6.4 SAMPLE DOCUMENTATION

All sample label, logbook, field records, chain of custody forms and field form information will follow procedures identified in Section 5.4 of the FW SAP.

6.5 DOCUMENTATION PROCEDURES

Documentation involves the tracking of samples through the receipt of a final laboratory data package for the RI. Documentation procedures will be performed in accordance with Section 5.5 of the FW SAP.

6.6 CORRECTIONS TO DOCUMENT

This procedure is required to ensure that all field/sampling records are correct and legally defensible. Corrections to documentation will follow the protocol established in Section 5.6 of the FW SAP.

6.7 REPORTS

Reports will be submitted during the field and analytical investigation tasks for the RI on a regular basis and will meet the requirements as presented in Section 5.7 of the FW SAP.

6.8 FIELD QUALITY CONTROL

The Project Manager will monitor the quality control of the data collection activities on a daily basis. This process will ensure that data is collected in a manner, which is consistent with the Load Line 9 RI Site-Specific and FW SAPs. Field quality control will be maintained as follows:

- Review of all Project Plans by project personnel;
- Training of project personnel on the sampling documentation and field procedures;
- Daily safety and technical briefings of project staff;
- Daily review of all field data collection forms by the Project Manager;
- Enter the Environmental and Quality Control into the sample tracking spreadsheet daily;
- Confirm laboratory receipt, integrity and login with the laboratory Project Manager;
- Daily monitoring and management of subcontractors;
- Conduct ongoing field audits of the data collection procedures and implement corrective measures; and
- Complete daily reports summarizing the work completed and decision points.

7.0 SAMPLE PACKAGING AND SHIPPING REQUIREMENTS

Sample packaging and shipping will generally follow the protocols in Section 6.0 of the FW SAP. Exceptions to the FW SAP procedures include:

- No tape of any kind will be placed on the volatile sample containers;
- All VOC sample containers will be placed in either foam bubble wrap or paper towels to reduce the potential for breakage during shipping; and
- The field laboratory (if used) will comply with the procedural requirements presented in the forms in Figures 6-2 and 6-3 of the FW SAP.

8.0 DELIVERABLES

Prior to start-up of the work, the Work Plan, Health and Safety Plan, and Sampling and Analysis Plan will be submitted to JMC for necessary approvals. The Sampling and Analysis Plan and Quality Assurance Project Plan for this site will follow the guidelines established in the FW Plans established for the RVAAP.

Daily field reports and Weekly reports will be submitted to the RVAAP at regular intervals. Photo Documentation of the work will also be furnished to the RVAAP at regular intervals. Analytical results will be tabulated and conclusions will be provided.

8.1 SURVEY DATA

The Load Line 9 structures have been surveyed in anticipation of thermal decontamination and demolition operations prior to the RI field effort. This survey was conducted by a registered professional surveyor who will use the survey to reestablish the precise locations of the Load Line structures so that the proposed sample locations can be accurately established. After investigation activities, MKM will subcontract a registered professional land surveyor to conduct a survey at the Load Line 9 site. The purpose is to establish the latitude, longitude and elevation of the key locations. The surveyor will prepare a separate report providing all field forms as well as site plans showing the survey locations, and electronic version of the survey data that will be incorporated into the final report.

8.2 ORDNANCE AND EXPLOSIVE SURVEY REPORT

UXO staff will conduct a field survey of the entire area prior\to the start-up of the project and throughout all sampling operations. Using a magnetometer, the UXO team will screen the soil in work zones for potential UXO items. Additionally, the soil boreholes will be screened with a down-hole magnetometer (Schonstedt GeoMag) to total depth of 20 feet or less. Refer to the Load Line 9 RI Ordnance Avoidance Plan in Appendix A for details on all ordnance and explosive screening operations. Upon completion of the project, a report will be prepared describing the ordnance and explosive screening activities, and will be a part of the final report.

8.3 DATA VALIDATION

The laboratory analysis for all of the samples from the RI will be reviewed and or validated. As per the FW SAP, 100% of the laboratory reports will be verified for completeness of the data collected. Additionally, as per the FW SAP, data validation will be performed on 10% of the analytical data by a third party subcontractor.

8.4 RISK ASSESSMENT

A risk assessment for the Load Line 9 will be conducted using the data collected during the RI. The methodologies, assumptions and procedures for conducting risk assessments will be consistent with both the Final Facility-Wide Human Health Risk Assessment Work Plan and the Final Facility-Wide Ecological Risk Assessment Work Plan.

8.5 FINAL REPORT

Following data validation, a RI report will be submitted to the JMC and Ohio EPA for review. The report will summarize and present all pertinent results, observations, analytical results data validation, conclusions and recommendations. The report will be prepared in accordance with project specifications and will include all project documentation including field reports and logs, analytical results from the subcontractor laboratory, as well as the field laboratory, ordnance and explosive screening, certificates of disposal (as required) and photographs documenting the major tasks of this RI.

9.0 INVESTIGATION-DERIVED WASTE

All IDW, including auger cuttings, personal protective equipment, disposable sampling equipment, and decontamination fluids, will be properly segregated handled, labeled, characterized, managed and disposed in accordance with the federal, state, and local rules, regulations and laws. At the conclusion of the field activities for the RI, all IDW will be documented as to characterization, classification and disposition of all IDW. All shipments of IDW off site will be coordinated through the RVAAP Environmental Coordinator. The following specific protocols will be followed during the Load Line 9 RI:

General: The IDW from the RI will be managed in accordance with Section 7.0 of the FW SAP. The following types of IDW are anticipated. The different types of IDW will be contained separately:

- Saturated auger cuttings – Containerize in a DOT approved 55-gallon steel drum(s) or 20 yard roll offs and stage at the temporary waste accumulation area pending sample analysis. Disposition will be based on the results of the laboratory analyses for the bulk quantity in accordance with all federal, state and local rules, laws and regulations;
- Unsaturated auger cuttings – Containerize in a DOT approved 55-gallon steel drum(s) or 20 yard roll offs and stage at the temporary waste accumulation area pending sample analysis. Disposition will be based on the results of the laboratory analyses for the bulk quantity in accordance with all federal, state and local rules, laws and regulations;
- Residual sediments – Containerize in a DOT approved 55-gallon steel drum(s) and stage at the temporary waste accumulation area pending sample analysis. Disposition will be based on the results of the laboratory analyses for the bulk quantity in accordance with all federal, state and local rules, laws and regulations;
- Personal protective equipment and disposable sampling equipment – Containerize up to two DOT approved 55-gallon steel drums and stage at the temporary waste accumulation area pending sample analysis. Disposition will be based on the results of the laboratory analyses for the bulk quantity in accordance with all federal, state and local rules, laws and regulations;
- IDW water (monitoring well purge water) – Containerized in 55-gallon steel drum(s) or one poly tank. Disposition will be based on the results of the laboratory analyses for the bulk quantity in accordance with all federal, state and local rules, laws and regulations;
- IDW water (decon water used on large equipment) – Containerize in one poly tank. Disposition will be based on the results of the laboratory analyses for the bulk quantity in accordance with all federal, state and local rules, laws and regulations;
- Decontamination fluids – (acid and methanol rinseates etc. used on small sampling equipment) – Containerize in approved safety cans. Disposition will be based on the results of the laboratory analyses for the bulk quantity in accordance with all federal, state and local rules, laws and regulations.

Should environmental sample data indicate that an IDW stream is potentially hazardous, then Toxicity Characteristic Leaching Procedure (TCLP) samples will be collected for additional characterization purposes.

Labeling of all IDW containers will be in accordance with Section 7.2 of the FW SAP. All field staging, characterization, classification, sampling, transportation and disposal will comply with federal, state and local rules laws and regulations, as well as the permit requirements for the receiving facility as applicable.

10.0 REFERENCES

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4. Revised 2001 Facility-Wide Sampling and Analysis Plan for the Ravenna Army Ammunition Plant, Ravenna, OH. Prepared by SAIC for The US Army Corps of Engineers, Nashville District.

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16. USACE. 1997b. Remedial Investigation of High-Priority Areas of Concern at the Ravenna Army Ammunition Plant, Ravenna Ohio, DACA62-94-D-0029, D.O. 0010 and 0022.

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19. USATHAMA 1988-1992. Ravenna Army Ammunition Plant Water Quality Surveillance Program (data only).

20. USACE (U.S. Army Corps of Engineers). 2003. Facility Wide Human Health and Ecological Risk Assessment Work Plans at the Ravenna Army Ammunition Plant, Ravenna, Ohio.

APPENDIX A

JENKINS SCREENING RESULTS FROM AZIDE SCREENING

TABLE 1
AZIDE SCREENING RESULTS - SURFACE WATER
MARCH 2002 SAMPLE SCREENING

Sample No.	Conc. Mg/Kg	% Azide Ion	% Lead Azide *
LL9SW-001-0001-SW	3.32	0.0003	0.0005
LL9SW-002-0001-SW **	0.00	N/A	N/A
LL9SW-003-0001-SW	7.39	0.007	0.001
LL9SW-004-0001-SW **	0.00	N/A	N/A
LL9SW-005-0001-SW	22.16	0.002	0.003
LL9SW-006-0001-SW **	0.00	N/A	N/A
LL9SW-007-0001-SW	3.69	0.0004	0.0005
LL9SW-008-0001-SW **	0.00	N/A	N/A
LL10SW-001-0001-SW	7.76	0.0008	0.001
LL10SW-002-0001-SW	3.69	0.0004	0.0005
LL10SW-003-0001-SW	4.43	0.0004	0.0006
LL10SW-004-0001-SW	7.39	0.0007	0.001
LL10SW-005-0001-SW	3.32	0.0003	0.0005
LL10SW-005-0001-SW-DUP	3.32	0.0003	0.0005

* Lead Azide Equivalent calculated from the Azide ion concentration

** No Samples were taken

*** No Explosion Limit Defined for Aqueous Media

TABLE 2
MODIFIED JENKINS RESULTS
MARCH 2002 SAMPLE SCREENING

				NAT MOISTURE				AIR DRIED		
SAMPLE ID	JENKINS RESULT			JENKINS DUPLICATE RESULT				JENKINS SPLITDUPLICATE RESULT		
SHALLOW SOILS										
	TNT	RDX		TNT	RDX			TNT	RDX	
Load Line 9										
LL9SS-001-0001-SO	ND	ND		--	--			--	--	
LL9SS-002-0001-SO	ND	ND		--	--			--	--	
LL9SS-003-0001-SO	ND	ND		--	--			--	--	
LL9SS-004-0001-SO	ND	ND		--	--			--	--	
LL9SS-005-0001-SO	ND	ND		--	--			--	--	
LL9SS-006-0001-SO	ND	ND		--	--			--	--	
LL9SS-007-0001-SO	ND	ND		--	--			--	--	
LL9SS-008-0001-SO	ND	ND		--	--			--	--	
LL9SS-009-0001-SO	ND	ND		--	--			--	--	
LL9SS-010-0001-SO	ND	ND		--	--			--	--	
LL9SS-011-0001-SO	ND	ND		--	--			--	--	
Load Line 6										
LL6SS-001-0001-SO	ND	ND		ND	ND			ND	ND	
LL6SS-002-0001-SO	ND	ND		ND	ND			ND	ND	
LL6SS-003-0001-SO	ND	ND		ND	1.2			ND	ND	
LL6SS-004-0001-SO	ND	ND		--	--			--	--	
Load Line 10										
LL10SS-001-0001-SO	ND	ND		--	--			--	--	
LL10SS-002-0001-SO	ND	ND		--	--			--	--	
LL10SS-003-0001-SO	ND	5.07		ND	14.4			ND	14.5	
Load Line 2										
LL2SS-001-0001-SS	>30 ppm	>30 ppm		>30 ppm	>30 ppm			>30 ppm	>30 ppm	
LL2SS-002-0001-SS	24.2 ppm	>30 ppm		27 ppm	>30 ppm			22.7 ppm	>30 ppm	
LL2SS-003-0001-SS	2.04 ppm	>30 ppm		7.21 ppm	>30 ppm			10.9 ppm	>30 ppm	
LL2SS-004-0001-SS	11.9 ppm	>30 ppm		16.9 ppm	>30 ppm			18.9 ppm	ND	
LL2SS-005-0001-SS	12.4 ppm	>30 ppm		17.6 ppm	>30 ppm			>30 ppm	>30 ppm	
MKM 10 ADDITIONAL SAMPLES										
LL10SS-005	ND	ND		--	--			--	--	
LL10SS-004	ND	ND		--	--			--	--	
LL9SS-012	ND	ND		--	--			--	--	
LL9SS-013	ND	ND		--	--			--	--	
LL6SS-005	ND	ND		--	--			--	--	
LL6SS-006	ND	ND		--	--			--	--	
LL6SS-007	ND	ND		--	--			--	--	
LL6SS-008	ND	ND		--	--			--	--	
LL6SS-009	ND	ND		--	--			--	--	
LL9SD-001	ND	ND		--	--			--	--	

TABLE 2
MODIFIED JENKINS RESULTS
MARCH 2002 SAMPLE SCREENING

			NAT MOISTURE				AIR DRIED			
SAMPLE ID	JENKINS RESULT			JENKINS DUPLICATE RESULT				JENKINS SPLITDUPLICATE RESULT		
DITCH AND SUMP SEDIMENT										
Load Line 9										
LL9SD-001-0001-SD	ND	ND		ND	ND			ND	ND	
LL9SD-002-0001-SD	ND	ND		--	--			--	--	
LL9SD-003-0001-SD	ND	ND		--	--			--	--	
LL9SD-004-0001-SD	ND	ND		--	--			--	--	
LL9SD-005-0001-SD	ND	ND		--	--			--	--	
LL9SD-006-0001-SD	ND	ND		--	--			--	--	
LL9SD-007-0001-SD	ND	ND		--	--			--	--	
LL9SD-008-0001-SD	ND	ND		--	--			--	--	
Load Line 10										
LL10SD-001-0001-SD	--	--		--	--			--	--	
LL10SD-002-0001-SD	--	--		--	--			--	--	
LL10SD-003-0001-SD	--	--		--	--			--	--	
LL10SD-004-0001-SD	ND	ND		--	--			--	--	
LL10SD-005-0001-SD	ND	ND		--	--			--	--	
SURFACE AND SUMP WATER										
Load Line 9										
LL9SW-001-0001-SW	NA	NA		NA	NA			NA	NA	
LL9SW-002-0001-SW	NA	NA		NA	NA			NA	NA	
LL9SW-003-0001-SW	NA	NA		NA	NA			NA	NA	
LL9SW-004-0001-SW	NA	NA		NA	NA			NA	NA	
LL9SW-005-0001-SW	NA	NA		NA	NA			NA	NA	
LL9SW-006-0001-SW	NA	NA		NA	NA			NA	NA	
LL9SW-007-0001-SW	NA	NA		NA	NA			NA	NA	
LL9SW-008-0001-SW	NA	NA		NA	NA			NA	NA	
Load Line 10										
LL10SW-001-0001-SW	NA	NA		NA	NA			NA	NA	
LL10SW-001-0001-SW	NA	NA		NA	NA			NA	NA	
LL10SW-001-0001-SW	NA	NA		NA	NA			NA	NA	
LL10SW-001-0001-SW	NA	NA		NA	NA			NA	NA	
LL10SW-001-0001-SW	NA	NA		NA	NA			NA	NA	
Load Line 6										
LL6 SW-001-0001-SW	NA	NA		NA	NA			NA	NA	

ND '= Non Detect
NA '= Not Applicable
-- '= Not tested

LABORATORY ANALYTICAL RESULTS FROM AZIDE SCREENING

TABLE 3
LL-6 SURFACE WATER RESULTS
MARCH 2002 SAMPLE SCREENING

ANALYTE**, UNITS, METHOD NO.	Surface Water Background Criteria ug/L	Region 9 PRG Data (Tap Water)	LL6SW-001-0001-SW	LL6SW-001-0001-FD
Sample Date			3/14/2002	3/14/2002
Explosives 8330 ug/L				
HMX	--	1800.00	BRL	BRL
RDX	--	0.61	BRL	BRL
1,3,5-Trinitrotoluene	--	--	BRL	BRL
1,3-Dinitrobenzene	--	3.60	BRL	BRL
Nitrobenzene	--	3.40	BRL	BRL
2,4,6-Trinitrtoluene	--	2.20	BRL	BRL
Tetryl	--	360.00	BRL	BRL
2,4-Dinitrotoluene	--	73.00	BRL	BRL
2,6-Dinitrotoluene	--	36.00	BRL	BRL
2-Nitrotoluene	--	61.00	BRL	BRL
4-Nitrtoluene	--	61.00	BRL	BRL
3-Nitrotoluene	--	61.00	BRL	BRL
TAL Metals 6010B ug/L				
Antimony	0.00	15.00	BRL	BRL
Arsenic	3.20	0.05	BRL	BRL
Lead	0.00	--	BRL	BRL
Thallium	0.00	2.40	BRL	BRL
Mercury	0.00	11.00	BRL	BRL
Aluminum	3370.00	36000.00	107 (B)	97.2 (B)
Barium	47.50	2600.00	BRL	15.4
Beryllium	0.00	73.00	BRL	BRL
Cadmium	0.00	18.00	BRL	BRL
Calcium	41400.00	--	29400 (H)	29500 (H)
Chromium	0.00	--	BRL	BRL
Cobolt	0.00	2200.00	BRL	BRL
Copper	7.90	1400.00	1240	BRL
Iron	2560.00	11000.00	5400	1210
Magnesium	10800.00	--	88.4	5440
Manganese	391.00	880.00	BRL	86.6
Nickel	0.00	730.00	BRL	BRL
Potassium	3170.00	--	2530	2520
Selenium	0.00	180.00	BRL	BRL
Silver	0.00	180.00	BRL	BRL
Sodium	21300.00	--	795 (B)	780 (B)
Vanadium	0.00	260.00	BRL	BRL
Zinc	42.00	11000.00	4.7 (B)	10.0 (B)

** = Only detected compounds listed
-- = Data not available
BRL = Below Reporting Limit
ND = Not detected
NT = Not Tested

PRGs = Preliminary Remediation Goals
mg/kg = milligrams per kilogram (parts per million - ppm)
ug/L = micrograms per Liter (parts per billion - ppb)
= concentration greater than background
BOLD = concentration greater than Region 9 PRG data

TABLE 4
LL-6 SEDIMENT RESULTS
MARCH 2002 SAMPLE SCREENING

ANALYTE**, UNITS, METHOD NO.	Sediment Background Criteria mg/kg	Region 9 PRG Data (Residential Soil)	LL6SD-001-0001-SD
Sample Date			3/14/2002
Explosives 8330 ug/kg			
HMX	0.0	3100.00	BRL
RDX	0.0	4.40	BRL
1,3,5-Trinitrotoluene	0.0	--	BRL
1,3-Dinitrobenzene	0.0	6.10	BRL
Nitrobenzene	0.0	20.00	BRL
2,4,6-Trinitrtoluene	0.0	16.00	BRL
Tetryl	0.0	610.00	BRL
2,4-Dinitrotoluene	0.0	120.00	BRL
2,6-Dinitrotoluene	0.0	61.00	BRL
2-Nitrotoluene	0.0	370.00	BRL
4-Nitrtoluene	0.0	370.00	BRL
3-Nitrotoluene	0.0	370.00	BRL
TAL Metals 6010B mg/kg			
Antimony	0.00	31.00	0.6
Arsenic	19.50	2.70	**11.6**
Lead	27.40	400.00	156
Thallium	0.89	5.20	BRL
Mercury	0.06	23.00	0.020 (B)
Aluminum	13900.00	76000.00	16200
Barium	123.00	5400.00	91.3
Beryllium	0.38	150.00	0.71
Cadmium	0.00	37.00	BRL
Calcium	5510.00	--	4110
Chromium	18.10	210.00	23.2
Cobolt	9.10	4700.00	10.2
Copper	27.60	2900.00	68.4
Iron	28200.00	23000.00	**27500 (H)**
Magnesium	2760.00	--	3880
Manganese	1950.00	1800.00	315
Nickel	17.70	1600.00	28.4
Potassium	1950.00	--	1820
Selenium	1.70	390.00	BRL
Silver	0.00	390.00	BRL
Sodium	112.00	--	243
Vanadium	26.10	550.00	27.2
Zinc	532.00	23000.00	72.1
Grain Size mm			
Maximum Particle Size	--	--	NT
Total Organic Carbon			
Organic Carbon	--	--	NT

** = Only detected compounds listed
-- = Data not available
BRL = Below Reporting Limit
ND = Not detected
NT = Not Tested

PRGs = Preliminary Remediation Goals
mg/kg = milligrams per kilogram (parts per million - ppm)
ug/L = micrograms per Liter (parts per billion - ppb)
= concentration greater than background
BOLD = concentration greater than Region 9 PRG data

TABLE 5
LL-6 SHALLOW SOIL RESULTS (0-1' Sample)
MARCH 2002 SAMPLE SCREENING

ANALYTE**, UNITS, METHOD NO.	Soil Background Criteria (0-1 ft) mg/kg	Region 9 PRG Data (Residential Soil) mg/kg	LL6SS-001-0001-SO	W-12S	D-12S	LL6SS-002-0001-SO
Sample Date			3/12/2002	3/15/2002	3/15/2002	3/12/2002
Explosives 8330 ug/kg						
HMX	0.0	3100.00	BRL	BRL	BRL	BRL
RDX	0.0	4.40	BRL	BRL	BRL	BRL
1,3,5-Trinitrotoluene	0.0	--	BRL	BRL	BRL	BRL
1,3-Dinitrobenzene	0.0	6.10	BRL	BRL	BRL	BRL
Nitrobenzene	0.0	20.00	BRL	BRL	BRL	BRL
2,4,6-Trinitrtoluene	0.0	16.00	BRL	BRL	BRL	BRL
Tetryl	0.0	610.00	BRL	BRL	BRL	BRL
2,4-Dinitrotoluene	0.0	120.00	BRL	BRL	BRL	BRL
2,6-Dinitrotoluene	0.0	61.00	BRL	BRL	BRL	BRL
2-Nitrotoluene	0.0	370.00	BRL	BRL	BRL	BRL
4-Nitrtoluene	0.0	370.00	BRL	BRL	BRL	BRL
3-Nitrotoluene	0.0	370.00	BRL	BRL	BRL	BRL
Metals 6010B mg/kg						
Antimony	0.96	31.00	0.30	NT	NT	BRL
Arsenic	15.40	2.70	**3.2**	NT	NT	**3.3**
Lead	26.10	400.00	17.8	NT	NT	33.8
Thallium	0.00	5.20	BRL	NT	NT	BRL
Mercury	0.04	23.00	0.039	NT	NT	0.063
Aluminum	17700.00	76000.00	6500	NT	NT	1990
Barium	88.40	5400.00	95.9	NT	NT	150
Beryllium	0.88	150.00	0.44	NT	NT	0.20 (B)
Cadmium	0.00	37.00	0.22	NT	NT	6.8
Calcium	15800.00	--	89100 (H)	NT	NT	184000 (H)
Chromium	17.40	210.00	9.2	NT	NT	5.8
Cobolt	10.40	4700.00	5.8	NT	NT	3.6
Copper	17.70	2900.00	17.8	NT	NT	627
Iron	23100.00	23000.00	14100 (H)	NT	NT	9940 (H)
Magnesium	3030.00	--	2240	NT	NT	1650
Manganese	1450.00	1800.00	452	NT	NT	574
Nickel	21.10	1600.00	13.7	NT	NT	12.0
Potassium	927.00	--	1050	NT	NT	531
Selenium	1.40	390.00	BRL	NT	NT	BRL
Silver	0.00	390.00	BRL	NT	NT	BRL
Sodium	123.00	--	196	NT	NT	119
Vanadium	31.10	550.00	11.8	NT	NT	5.6
Zinc	61.80	23000.00	46.0	NT	NT	160

** = Only detected compounds listed
-- = Data not available
BRL = Below Reporting Limit
ND = Not detected
NT = Not Tested

PRGs = Preliminary Remediation Goals
mg/kg = milligrams per kilogram (parts per million - ppm)
ug/kg = micrograms per kilogram (parts per billion - ppb)
= concentration greater than background
BOLD = concentration greater than Region 9 PRG data

INORGANIC FLAGS/QUALIFIERS

(B) = result is < CRDL/RL, but ≥ IDL/MDL
(H) = MB, EB1, EB2, EB3: Batch QC is > RL or had a negative instrument reading lower than the absolute value of the RL

ORGANIC FLAGS/QUALIFIERS

(B) = MB: Batch QC is greater than the RL
(J) = Result is an estimated value below the RL or a TIC
(a) = Concentration is below the method Reporting Limit (RL)

TABLE 5
LL-6 SHALLOW SOIL RESULTS (0-1' Sample)
MARCH 2002 SAMPLE SCREENING

ANALYTE**, UNITS, METHOD NO.	Soil Background Criteria (0-1 ft) mg/kg	Region 9 PRG Data (Residential Soil) mg/kg	W-13S	D-13S	LL6SS-003-0001-SO	W-14S	D-14S
Sample Date			3/15/2002	3/15/2002	3/12/2002	3/15/2002	3/15/2002
Explosives 8330 ug/kg							
HMX	0.0	3100.00	BRL	BRL	190 (J) (a)	170 (J) (a)	200 (J) (a)
RDX	0.0	4.40	BRL	BRL	BRL	BRL	BRL
1,3,5-Trinitrotoluene	0.0	--	BRL	BRL	BRL	BRL	BRL
1,3-Dinitrobenzene	0.0	6.10	BRL	BRL	BRL	BRL	BRL
Nitrobenzene	0.0	20.00	BRL	BRL	BRL	BRL	BRL
2,4,6-Trinitrtoluene	0.0	16.00	BRL	BRL	BRL	BRL	BRL
Tetryl	0.0	610.00	BRL	BRL	BRL	BRL	BRL
2,4-Dinitrotoluene	0.0	120.00	BRL	BRL	BRL	BRL	BRL
2,6-Dinitrotoluene	0.0	61.00	BRL	BRL	BRL	BRL	BRL
2-Nitrotoluene	0.0	370.00	BRL	BRL	BRL	BRL	BRL
4-Nitrtoluene	0.0	370.00	BRL	BRL	BRL	BRL	BRL
3-Nitrotoluene	0.0	370.00	BRL	BRL	BRL	BRL	BRL
Metals 6010B mg/kg							
Antimony	0.96	31.00	0.22 (B)	NT	BRL	NT	NT
Arsenic	15.40	2.70	**3.8**	NT	**5.6**	NT	NT
Lead	26.10	400.00	40.4	NT	65.1	NT	NT
Thallium	0.00	5.20	BRL	NT	BRL	NT	NT
Mercury	0.04	23.00	0.063	NT	0.039	NT	NT
Aluminum	17700.00	76000.00	2270	NT	4960	NT	NT
Barium	88.40	5400.00	89.9	NT	84.6	NT	NT
Beryllium	0.88	150.00	0.25 (B)	NT	0.30 (B)	NT	NT
Cadmium	0.00	37.00	5.9	NT	0.68	NT	NT
Calcium	15800.00	--	116000 (H)	NT	138000 (H)	NT	NT
Chromium	17.40	210.00	6.9	NT	8.7	NT	NT
Cobolt	10.40	4700.00	3.9	NT	3.9	NT	NT
Copper	17.70	2900.00	145	NT	15.7	NT	NT
Iron	23100.00	23000.00	13900 (H)	NT	13000 (H)	NT	NT
Magnesium	3030.00	--	1780	NT	1980	NT	NT
Manganese	1450.00	1800.00	558	NT	451	NT	NT
Nickel	21.10	1600.00	13.4	NT	11.1	NT	NT
Potassium	927.00	--	535	NT	930	NT	NT
Selenium	1.40	390.00	BRL	NT	BRL	NT	NT
Silver	0.00	390.00	BRL	NT	BRL	NT	NT
Sodium	123.00	--	152	NT	146	NT	NT
Vanadium	31.10	550.00	6.7	NT	11.1	NT	NT
Zinc	61.80	23000.00	180	NT	101	NT	NT

** = Only detected compounds listed
-- = Data not available
BRL = Below Reporting Limit
ND = Not detected
NT = Not Tested

PRGs = Preliminary Remediation Goals
mg/kg = milligrams per kilogram (parts per million - ppm)
ug/kg = micrograms per kilogram (parts per billion - ppb)
= concentration greater than background
BOLD = concentration greater than Region 9 PRG data

INORGANIC FLAGS/QUALIFIERS

(B) = result is < CRDL/RL, but ≥ IDL/MDL
(H) = MB, EB1, EB2, EB3: Batch QC is > RL or had a negative instrument reading lower than the absolute value of the RL

ORGANIC FLAGS/QUALIFIERS

(B) = MB: Batch QC is greater than the RL
(J) = Result is an estimated value below the RL or a TIC
(a) = Concentration is below the method Reporting Limit (RL)

USACE LEAD AZIDE SCREENING RESULTS

RAVENNA ARMY AMMUNITION PLANT
AZIDE INVESTIGATION

Date:		Mar. 13, 2002				mg/Kg	
Sample No.	Type	Wt. Or Vol.	Dilution	Absorbance	Cal Factor	Concentration	% R
Blank				0.004			
50 ug Std				0.031	1612.90		
100 ug Std				0.057	1754.39		
250 ug Std				0.130	1923.08		
750 ug Std				0.378	1984.13		
1500 ug Std				0.766	1958.22		
Reagent Blank				0.004			
CCV1 (250)		1.00	1.00	0.129	1846.54	238.20	95%
CCV2 (750)		1.00	1.00	0.372	1846.54	686.91	92%
LL9SS-001-0001SO		5.00	5.00	0.030	1846.54	55.40	
LL9SS-001-0001SO-MS		5.00	5.00	0.082	1846.54	151.42	96%
LL9SS-001-0001SO-MSD		5.10	5.00	0.080	1846.54	144.83	90%
LL9SS-001-0001SO-DUP		5.00	5.00	0.037	1846.54	68.32	
LL9SS-002-0001SO		5.40	5.00	0.000	1846.54	63.26	
LL9SS-003-0001-SO		5.10	5.00	0.041	1846.54	74.22	
LL9SS-004-0001-SO		5.10	5.00	0.036	1846.54	65.17	
LL9SS-005-0001-SO		5.30	5.00	0.049	1846.54	85.36	
LL9SS-005-0001-SO-MS		5.30	5.00	0.094	1846.54	163.75	79%
LL9SS-005-0001-SO-MSD		5.20	5.00	0.085	1846.54	150.92	66%
LL9SS-006-0001-SO		5.00	5.00	0.023	1846.54	42.47	
LL9SS-007-0001-SO		5.40	5.00	0.028	1846.54	47.87	
LL9SS-008-0001-SO		5.00	5.00	0.022	1846.54	40.62	
LL9SS-009-0001-SO		5.20	5.00	0.022	1846.54	39.06	
LL9SS-010-0001-SO		5.40	5.00	0.024	1846.54	41.03	

RAVENNA ARMY AMMUNITION PLANT
AZIDE INVESTIGATION

Sample No.	Type	Wt. Or Vol.	Dilution	Absorbance	Cal Factor	Concentration	% R
LL9SS-011-0001-SO		5.30	5.00	0.022	1846.54	38.32	
CCV3 (250)		1.00	1.00	0.130	1846.54	240.05	96%
LL6SS-001-0001-SO		5.00	5.00	0.021	1846.54	38.78	
LL6SS-002-0001-SO		5.20	5.00	0.040	1846.54	71.02	
LL6SS-003-0001-SO		5.40	5.00	0.044	1846.54	75.23	
LL6SS-004-0001-SO		4.80	5.00	0.027	1846.54	51.93	
LL10SS-001-0001-SO		5.00	5.00	0.023	1846.54	49.86	
LL10SS-002-0001-SO		5.00	5.00	0.027	1846.54	49.86	
LL10SS-003-0001-SO		5.20	5.00	0.026	1846.54	47.94	
LL9SS-001-0001-SO		1.00	1.00	0.026	1846.54	48.01	
LL9SS-001-0001-SO-AS		1.00	1.04	0.069	1846.54	132.51	85%
CCV4 (250)		1.00	1.00	0.128	1846.54	236.36	94%
LL9SS-001-0001-SO		1.00	1.00	0.032	1846.54	59.09	
LL9SS-001-0001-SO-AS		1.00	1.12	0.157	1846.54	324.70	89%
CCV5 (1500)		1.00	1.00	0.781	1846.54	1442.15	96%
DT34		5.10	5.00	0.032	1846.54	57.93	
DT34-MS		5.00	5.00	0.074	1846.54	136.64	79%
DT34-MSD		5.00	5.00	0.082	1846.54	151.42	93%
CCV6 (750)		1	1	0.392	1846.54	723.85	97%
Reagent Blank		1	1	0.009	1846.54	16.62	

RAVENNA ARMY AMMUNITION PLANT
AZIDE INVESTIGATION
Surface Soil Samples **
March 12 - 14, 2002

Sample No.	Conc. Mg/Kg	% Azide Ion	% Lead Azide *
LL9SS-001-0001SO	55.40	0.006	0.008
LL9SS-001-0001SO-DUP	68.32	0.007	0.01
LL9SS-002-0001SO	63.26	0.006	0.008
LL9SS-003-0001-SO	74.22	0.007	0.01
LL9SS-004-0001-SO	65.17	0.007	0.01
LL9SS-005-0001-SO	85.36	0.009	0.12
LL9SS-006-0001-SO	42.47	0.004	0.006
LL9SS-007-0001-SO	47.87	0.005	0.007
LL9SS-008-0001-SO	40.62	0.004	0.006
LL9SS-009-0001-SO	39.06	0.004	0.006
LL9SS-010-0001-SO	41.03	0.004	0.006
LL9SS-011-0001-SO	38.32	0.004	0.006
LL6SS-001-0001-SO	38.78	0.004	0.006
LL6SS-002-0001-SO	71.02	0.007	0.01
LL6SS-003-0001-SO	75.23	0.008	0.011
LL6SS-004-0001-SO	51.93	0.005	0.007
LL10SS-001-0001-SO	49.86	0.005	0.007
LL10SS-002-0001-SO	49.86	0.005	0.007
LL10SS-003-0001-SO	47.94	0.005	0.007
LL9SS-001-0001-SO	48.01	0.005	0.007
LL9SS-001-0001-SO	59.09	0.006	0.008
DT34	57.93	0.006	0.008

* Lead Azide Equivalent calculated from the Azide ion concentration

** Explosion Limit = 2.0% (20,000 Mg/Kg)

RAVENNA ARMY AMMUNITION PLANT
AZIDE INVESTIGATION

Date:	3/14/2002					mg/Kg	
Sample No.	Type	Wt. Or Vol.	Dilution	Absorbance	Cal Factor	Concentration	%R
Blank				0.005			
50 ug Std				0.031	1612.90		
100 ug Std				0.057	1754.39		
250 ug Std				0.130	1923.08		
750 ug Std				0.378	1984.13		
1500 ug Std				0.766	1958.22		
CCV4 (500)		1.00	1.00	0.267	1846.54	493.03	99%
LL9SD-001-0001-SD		5.30	5.00	0.063	1846.54	109.75	
LL9SD-002-0001-SD		5.50	5.00	0.036	1846.54	60.43	
LL9SD-003-0001-SD		5.00	5.00	0.019	1846.54	35.08	
LL9SD-004-0001-SD		5.00	5.00	0.032	1846.54	59.09	
LL9SD-004-0001-SD-MS		5.40	5.00	0.249	1846.54	425.73	61%
LL9SD-004-0001-SD-MSD		5.00	5.00	0.272	1846.54	502.26	74%
LL9SD-005-0001-SD		5.10	5.00	0.023	1846.54	41.64	
LL9SD-006-0001-SD		5.40	5.00	0.017	1846.54	29.07	
LL9SD-007-0001-SD		5.10	5.00	0.045	1846.54	81.47	
LL9SD-008-0001-SD		5.60	5.00	0.000	1846.54	0.00	
LL9SD-008-0001-SD-DUP		5.00	5.00	0.000	1846.54	0.00	
CCV4 (500)		1.00	1.00	0.259	1846.54	478.25	96%
LL10SD-001-0001-SD		5.00	5.00	0.209	1846.54	385.93	
LL10SD-002-0001-SD		5.00	5.00	0.137	1846.54	252.98	
LL10SD-003-0001-SD		5.00	5.00	0.128	1846.54	236.36	
LL10SD-004-0001-SD		5.20	5.00	0.025	1846.54	44.39	

RAVENNA ARMY AMMUNITION PLANT
AZIDE INVESTIGATION

Sample No.	Type	Wt. Or Vol.	Dilution	Absorbance	Cal Factor	Concentration	%R
LL10SD-004-0001-SD-DUP		5.20	5.00	0.023	1893.27	41.87	
LL10SD-005-0001-SD		5.20	5.00	0.112	1846.54	198.86	
CCV4 (500)		1.00	1.00	0.267	1846.54	493.03	99%
Reagent Blank		1.00	1.00	0.005	1846.54	9.23	
25 ug/g		1.00	1.00	0.018	1846.54	33.24	1.33/1

RAVENNA ARMY AMMUNITION PLANT
AZIDE INVESTIGATION
Sediment Samples ***
March 12 - 14, 2002

Sample No.	Conc. Mg/Kg	% Azide Ion	% Lead Azide *
LL9SD-001-0001-SD	109.75	0.011	0.028
LL9SD-002-0001-SD	60.43	0.006	0.008
LL9SD-003-0001-SD	35.08	0.004	0.005
LL9SD-004-0001-SD	59.09	0.006	0.008
LL9SD-005-0001-SD	41.64	0.004	0.006
LL9SD-006-0001-SD	29.07	0.003	0.004
LL9SD-007-0001-SD	81.47	0.008	0.011
LL9SD-008-0001-SD **	0.00	N/A	N/A
LL9SD-008-0001-SD-DUP **	0.00	N/A	N/A
LL10SD-001-0001-SD	385.93	0.039	0.054
LL10SD-002-0001-SD	252.98	0.025	0.036
LL10SD-003-0001-SD	236.36	0.024	0.033
LL10SD-004-0001-SD	44.39	0.004	0.006
LL10SD-004-0001-SD-DUP	41.87	0.004	0.006
LL10SD-005-0001-SD	198.86	0.02	0.028

* Lead Azide Equivalent calculated from the Azide ion concentration

** Explosion Limit = 2.0% (20,000 Mg/Kg)

*** No Explosion Limit Defined for Aqueous Media

RAVENNA ARMY AMMUNITION PLANT
AZIDE INVESTIGATION

Date:	3/14/2002						
Sample No.	Type	Wt. Or Vol.	Dilution	Absorbance	Cal Factor	Concentration	%R
Blank	0			0.005			
10 ug/ml Std	10			0.031	322.58		
20 ug/ml Std	20			0.057	350.88		
50 ug/ml Std	50			0.130	384.62		
150 ug/ml Std	150			0.378	396.83		
300 ug/ml Std	300			0.766	391.64		
CCV1 (100)		1.00	1.00	0.224	369.31	82.73	82%
CCV2 (250)		1.00	1.00	0.670	369.31	247.44	99%
CCV3 (150)		1.00	1.00	0.380	369.31	140.34	93%
LL9SW-001-0001-SW		1.00	1.00	0.009	369.31	3.32	
LL9SW-001-0001-SW-MS		1.00	1.00	0.291	369.31	107.47	104%
LL9SW-001-0001-SW-MSD		1.00	1.00	0.279	369.31	103.04	100%
LL9SW-002-0001-SW		1.00	1.00	0.000	369.31	0.00	
LL9SW-003-0001-SW		1.00	1.00	0.020	369.31	7.39	
LL9SW-004-0001-SW		1.00	1.00	0.000	369.31	0.00	
LL9SW-005-0001-SW		1.00	1.00	0.060	369.31	22.16	
LL9SW-006-0001-SW		1.00	1.00	0.000	369.31	0.00	
LL9SW-007-0001-SW		1.00	1.00	0.010	369.31	3.69	
LL9SW-008-0001-SW		1.00	1.00	0.000	369.31	0.00	
CCV3		1.00	1.00	0.000	369.31	0.00	
LL10SW-001-0001-SW		1.00	1.00	0.021	369.31	7.76	
LL10SW-002-0001-SW		1.00	1.00	0.010	369.31	3.69	
LL10SW-003-0001-SW		1.00	1.00	0.012	369.31	4.43	

RAVENNA ARMY AMMUNITION PLANT
AZIDE INVESTIGATION

Sample No.	Type	Wt. Or Vol.	Dilution	Absorbance	Cal Factor	Concentration	%R
LL10SW-004-0001-SW		1.00	1.00	0.020	369.31	7.39	
LL10SW-005-0001-SW		1.00	1.00	0.009	369.31	3.32	
LL10SW-005-0001-SW-DUP		1.00	1.00	0.009	369.31	3.32	
CCV3 (150)		1.00	1.00	0.378	369.31	139.60	93%
Reagent Blank		1.00	1.00	0.006	369.31	2.22	
5 ug/ml		1.00	1.00	0.018	369.31	6.65	1.33/1

RAVENNA ARMY AMMUNITION PLANT
AZIDE INVESTIGATION
Surface Water Samples ***
March 12 - 14, 2002

Sample No.	Conc. Mg/Kg	% Azide Ion	% Lead Azide *
LL9SW-001-0001-SW	3.32	0.0003	0.0005
LL9SW-002-0001-SW **	0.00	N/A	N/A
LL9SW-003-0001-SW	7.39	0.007	0.001
LL9SW-004-0001-SW **	0.00	N/A	N/A
LL9SW-005-0001-SW	22.16	0.002	0.003
LL9SW-006-0001-SW **	0.00	N/A	N/A
LL9SW-007-0001-SW	3.69	0.0004	0.0005
LL9SW-008-0001-SW **	0.00	N/A	N/A
LL10SW-001-0001-SW	7.76	0.0008	0.001
LL10SW-002-0001-SW	3.69	0.0004	0.0005
LL10SW-003-0001-SW	4.43	0.0004	0.0006
LL10SW-004-0001-SW	7.39	0.0007	0.001
LL10SW-005-0001-SW	3.32	0.0003	0.0005
LL10SW-005-0001-SW-DUP	3.32	0.0003	0.0005

* Lead Azide Equivalent calculated from the Azide ion concentration

** No Samples were taken

*** No Explosion Limit Defined for Aqueous Media

APPENDIX B

AZIDE SCREENING SOW/OEPA LETTER

MKM

MKM Engineers, Inc.

Geotechnical, Environmental and Remediation Services

March 08, 2002

Mr. Todd Fisher
Environmental Coordinator
Ohio Environmental Protection Agency
2110 E. Aurora Rd.
Twinsburg, Ohio 44087

**Subject: Scope of Work for Azide Screening at
Ravenna Army Ammunition Plant**

Dear Mr. Fisher:

The OSC-RVAAP in conjunction with the USACE is conducting an Azide Screening operation at Load Lines 6, 9, and 10. On behalf of OSC, MKM is providing the scope of work for this task which is detailed in this letter for your use. As discussed during the March 4, 2002 conference call with representatives from OSC, USACE, OEPA, and MKM, the USACE (with field support from MKM) will be collecting samples from strategic locations within Load Lines 6, 9 and 10 in order to screen for primary (azide) and secondary (TNT & RDX) explosives. The purpose of this screening operation is three fold:

1.) Provide necessary data to ensure the safety of site workers during future Remedial Investigation sampling activities.
2.) Use screening data, in conjunction with historical data, to help determine the appropriate analytical suite, location and number of samples required for completion of subsequent Remedial Investigations at the load lines.
3.) Substantiate the accuracy of new GPL screening method for explosives (modified 8330).

In an effort to maximize the time and resources allocated for this screening activity, all sampling activities will be performed in accordance with the Revised 2001 Facility-Wide Sampling and Analysis Plan (FW SAP) for the Ravenna Army Ammunition Plant, Ravenna, Ohio. By following the requirements of the FW SAP, the validated data obtained during the screening operations can be folded into the subsequent remedial investigations at the load lines. The Scope of Work for the Azide Screening operation is provided in the subsections that follow.

Ravenna Army Ammunition Plant, Building 1038, 8451 St. Rt. 5, Ravenna, OH 44266
Phone: (330) 358-2920 Fax: (330) 358-2924

MKM

MKM Engineers, Inc.

Geotechnical, Environmental and Remediation Services

SCOPE OF WORK

Load Line 6

- Collect a total of four (4) shallow samples (0 to 1 ft. bgs) in and around bulk handling and process buildings (see site map). The bucket hand auger (stainless steel) will be used to collect shallow soil samples.
- Field screen each of the 4 samples for azides using USACE Screening Method and TNT and RDX using Jenkins Method.
- Submit a split of each Jenkins detect samples to STL laboratory for the following analysis:

- Explosives
- TAL Metals

- Submit a split of each Jenkins detect samples to GPL laboratory for explosive screening using their new modified 8330 method.

Load Line 10

- Collect a total of three (3) shallow samples (0 to 1 ft. bgs) in and around bulk handling and process buildings (see site map). The bucket hand auger (stainless steel) will be used to collect shallow soil samples.
- Collect a total of five (5) sump water and five (5) sump sediment samples from the dry house and primer storage building sumps (see site map).
- Sump water samples will be collected using disposable Teflon® bailers. The sump sediment samples will be collected using a Teflon® sample cup attached to an extendable handle.
- Field screen each of the 3 shallow soil samples and each of the five (5) sump sediment samples for azides and thiocyanate using USACE Screening Method and TNT and

Ravenna Army Ammunition Plant, Building 1038, 8451 St. Rt. 5, Ravenna, OH 44266
Phone: (330) 358-2920 Fax: (330) 358-2924

- Collect a total of six (6) surface water (direct fill) and six (6) sediment samples (trowel/spoon method) from locations within LL-9 drainage ways as shown on site map.
- At sediment sample locations where standing water is not present, a shallow soil sample (0-1 ft. bgs) will be collected (using a stainless steel hand auger) to ensure appropriate evaluation of the main flow ways.
- Field screen each of the 11 shallow soil samples, each of the 2 sump sediment samples and each of the 6 ditch sediment samples for azides using USACE Screening Method and TNT and RDX using Jenkins Method. Also, field screen each of the 2 sump water samples and each of the 6 surface water (ditch) for azides USACE Screening Method.
- Submit both of the sump water samples to STL for the following analysis:

  - Explosives
  - TAL Metals

- Submit a split of each of the Jenkins detect shallow soil samples, each of the Jenkins detect sump sediment and each of the Jenkins detect ditch sediment samples to STL laboratory for the following analysis:

  - Explosives
  - TAL Metals
  - Grain size (sediment)
  - TOC (sediment)

- Submit a split of each of the Jenkins detect shallow soil samples, each of the Jenkins detect sump sediment and each of the Jenkins detect ditch sediment samples to GPL laboratory for explosive screening using their new modified 8330 method.

RDX using Jenkins Method. Additionally, field screen each of the five (5) sump water samples for azides and thiocyanate using USACE Screening Method.

- Submit each of the sump water samples to STL for the following analysis:

- Explosives
- TAL Metals

- Submit a split of each of the Jenkins detect shallow soil and each of the Jenkins detect sump sediment samples to STL laboratory for the following analysis:

- Explosives
- TAL Metals

- Submit a split of each of the Jenkins detect shallow soil and each of the Jenkins detect sump sediment samples to GPL laboratory for explosive screening using their new method.

Load Line 9

- Collect a total of eleven (11) shallow samples (0 to 1 ft. bgs) in and around bulk handling and process buildings (see site map). The bucket hand auger (stainless steel) will be used to collect shallow soil samples.
- Collect a total of two (2) sump water and two (2) sump sediment samples from the sumps associated with the fulminate and azide mix house buildings (see site map).
- Sump water samples will be collected using disposable Teflon® bailers. The sump sediment samples will be collected using a Teflon® sample cup attached to an extendable handle.

Supplemental Sampling

- A total of 10 of the Jenkins non-detect samples will be submitted to STL for explosives and TAL metals analysis and a split from these samples will be sent to GPL for explosive screening using their new modified 8330 method.
- In addition to the Azide screening samples described above, ten (10) more shallow soil samples will be collected from locations (within the load lines) to be determined in the field. These samples will be targeted for secondary explosives only. Each of the 10 samples will be field screened for TNT and RDX by Jenkins Method. Each of the Jenkins detect samples and 2 of the Jenkins non-detect samples will be submitted to STL laboratory for the following analysis:

- Explosives
- TAL Metals

- In order to ensure an accurate correlation between the explosives screening methods and Laboratory analysis, five (5) other shallow soil samples will be collected from previously sampled locations (explosives contaminated) at Load Line No. 2. Each of these samples will be field screened for explosives by Jenkins Method with split samples being submitted to STL for explosive analysis by Method 8330 and to GPL for explosive screening using their new modified 8330 method.

QA/QC Sampling

- A duplicate and duplicate split sample will be submitted for analysis by both STL and GPL for the five (5) samples (soil and /or sediment) from LL 6, LL 9 and LL 10 which exhibit the highest Jenkins screening results.
- Additionally, a duplicate and duplicate split sample will be submitted for explosives (only) analysis by both STL and GPL for the five (5) samples collected at LL 2.

MKM Engineers, Inc.

Geotechnical, Environmental and Remediation Services

Presently, we are planning to commence with the azide screening operations on 11 March 2002. MKM will keep you informed of any issues or specifics regarding this work as they arise.

Should you have any questions or comments regarding these issues, then please do not hesitate to either myself or Brian Stockwell at 330-358-2920.

Respectfully,
MKM ENGINEERS, INC.

Stan Levenger,
Project Manager

Attachments
cc: Mark Patterson, RVAAP Environmental Coordinator

USACE NOTE: "RATIONAL BEHIND THE AZIDE SCREENING"

RATIONALE BEHIND THE AZIDE INVESTIGATION:

The primary reason behind the azide screening method was Safety, since Lead Azide, a primary explosive, is subject impact, electrostatic and heat detonation. The test is designed to detect the active portion of the compound in preference to its metal constitute, Lead (Pb). Because of the poor solubility of Lead Azide in aqueous media, it is necessary to convert the Lead Azide to a more soluble form. This was accomplished by converting the Lead Azide to Sodium Azide with Sodium Hydroxide. Once the azide is in solution as the azide ion, it is reacted with Ferric Nitrate that forms a colored complex that can be measured at 460 nm with a spectrophotometer. Even though the method detection limit is fairly high (approximately 6.6 to 50 mg/L depending on the sample weight), it can be used to detect gross concentrations of active azide that might constitute a safety hazard. Care was taken during the intrusive sampling to ensure the safety of the sampling teams. The test was employed to determine if significant concentrations of azide existed around buildings, in ditches or within surface water, which would constitute safety problems during any remedial activities. Work done at the Aberdeen Proving Grounds indicated that concentration of 20,000 mg/Kg (2 %) in soil was necessary for Lead Azide to exhibit impact sensitivity. It was known from the beginning that the test was subject to rendering false positives for the azide anion. Sulfide, sulfites, thiosulfates, cyanates and thiocyanate all interfere with the test. The potential for interferences from sulfide (anaerobic conditions in sump sediments), and thiocyanate from Lead Thiocyanate used in the manufacture of primers at Load Line #10 does exist at the facility. Because of these interferences, it was advocated that if screening showed a significant positive concentration for azide, that approaching a concentration that would constitute safety problems, further work using a more definitive method (Ion Chromatography) would be employed if deemed necessary. It has always been the intent to use lead concentrations as the primary indicator for any remedial action.

The data has not been corrected for any background absorbance do to reagents or chromaphores that might be inherent to the sample matrices. In addition, samples were collected using the Jenkins method. The sampling method is designed to accounts for wholesale contamination along with any variation in distribution of the contamination.

Samples locations for all load lines investigated were selected on the basis of the processes used at these lines. For example, building, ditches in the proxicimity and down gradient, where the handling of bulk Lead Azide for screening, blending and storage were targeted in Load Line #9. Even though the historical records and the processes indicated that azide were not used in the processes at Load Line #10, screening was accomplished anyway. No bulk handling of azide occurred in Load Line

#6, but component (i.e. detonators, lead cups, etc.) used in the assembling of fuzes were stored prior to transfer into the process. Those buildings along with potential areas along the assembly buildings were investigated

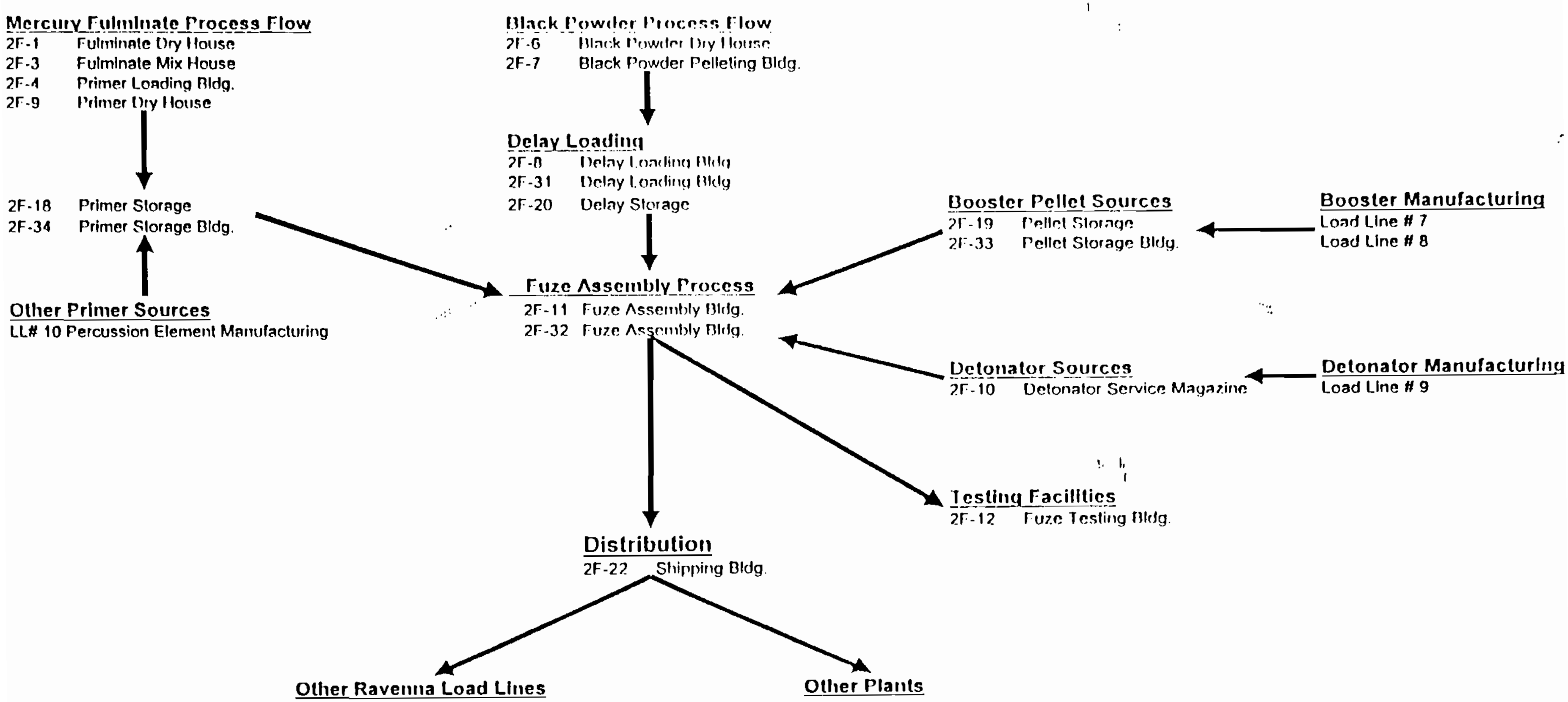
Those areas in Load Line # 6 where screening has already been accomplished for secondary explosive need no further investigation. Areas that are associated with operation that occurred after the shutdown of the normal assembly processes, still need further investigation (i.e. toes and dragon, sharp charge and other related areas).

The Region III, Region IX screening guidelines, ATSDR and IRIS were checked to ensure there are no environmental drivers for lead azide. The data was never intended for making decisions with respect to any environmental remedial activities.

Remediation of soils and the removal of concrete and stainless steel sumps at the Detonator Loading Line (700 Area) at the Kansas Army Ammunition Plant, Parsons Kansas have been accomplished using standard backhoes, jack hammers adapted to backhoes and front loaders. The remedial activities were based on the lead concentrations found in the soil in the proximity of the sumps. The sumps areas were the areas that potentially would contain the highest concentrations of azide. Equivalent concentrations of lead azide were calculated based on the lead concentrations. In some areas the concentration was greater than 2 %. The 700 area is still in operation. Load Line #9 at RVAAP was only operated from 1941 to 1946.

LL#6 EXPLOSIVE MATERIAL HANDLING FLOW

RAVENNA ARMY AMMUNITION PLANT
Load Line # 6 [Fuze Assembly]



LL#6 EXPLOSIVE PROCESS SUMMARY

LOAD LINE # 6 PROCESS SUMMARY
[ONLY APPLIES TO THE ERA WHEN OPERATED AS A FUSE LINE]

Rationale: By eliminating pathways into the process, testing can be minimized for azide. There are no indications that any type of bulk azide handling took place on LL #6. LL # 6 was a Fuze Assembly Line with the exception of the Fulminate Mixing at 2F-4. Any contamination would be due to handling, spillage and should be minimal.

FOR INCOMING MATERIALS. EXPLOSIVES COMPONENTS:

Bldgs. 2F-19 & 33 - Booster Storage and Handling
Potential Explosives – Secondary, mostly like Tetryl, Possibly RDX in the later years of operation.

Bldg. # 2F-10 – Finished Detonator Staging and Storage
Potential for minimal Azide, Fulminate Contamination

Bldgs. 2F- 6,7,8,20 & 31 – Black Powder Process and Delay Loading
Potential for Potassium Nitrate, Carbon and Sulfur [Comparable to Bldgs # 1 – 7 at LL #11]

Bldgs. 2F- 1,3,4 & 9 – Fulminate Processing and Primer Mixing Area
Potential for Mercury contamination.

Bldgs. 2F-18 & 34 – Storage for Finished Primers from LL #10 or external sources.
Potential for TNT, PETN, Antimony Sulfide, Lead Thiocyanate, & Potassium Chlorate

Bldgs. 2F-11 & 32 – Fuze Assembly
Potential for all previous compounds. Estimated to be very minimal.

FOR PROCESSES NOT RELATED TO NORMAL OPERATION.
Bldgs. ????? –
Potential for secondary explosive residuals (RDX, PETN, HMX, etc.), metals (Pb, Cd, Ba, etc.)
Would not expect to fine any primary explosive residuals.

MKM POSITION PAPER FOR RI ANALYTICAL SUITE AT LL#6

In March 2002, the OSC-RVAAP in conjunction with the USACE performed a sample screening operation at LL-6, LL-9 and LL-10. Samples were collected from strategic locations within the load lines to screen for primary (azide) and secondary (TNT & RDX) explosives. The locations were selected based upon historical production records. The objective of this exercise was three fold:

1) Determine if significant concentrations of azide exist at the load lines in order to ensure the safety of site workers during RI sampling activities (e.g., azide concentrations > 20,000 ppm).
2) Use screening data, in conjunction with historical data, to help determine the appropriate analytical suite, location and number of samples required for completion of subsequent Remedial Investigations at the load lines.
3) Substantiate the accuracy of new GPL screening method for explosives (modified 8330).

In an effort to maximize the time and resources allocated for this operation, all the March 2002 sampling activities were performed in accordance with the Revised 2001 Facility-Wide Sampling and Analysis Plan for the RVAAP. By following the requirements of the FW SAP, the validated laboratory data obtained during the sampling exercise can be folded into the respective RIs.

A total of nine (9) shallow soil samples, one sediment sample and one surface water sample were collected from LL-6 during the March 2002 sampling event. Four (4) of the soil samples were screened for lead azide and each of the nine (9) soil samples were field screened for TNT and RDX. Additionally, three of the soil samples, the sediment sample and the surface water sample were submitted to the laboratory for explosives and metals analysis.

Based upon historical research of the LL-6 fuze assembly operations, the azide screening samples were located next to process buildings where lead azide and other explosives were processed as well as where any other primary or secondary explosives were handled at LL-6. The Modified Jenkins and laboratory soil samples were located adjacent to buildings where secondary explosives or components containing secondary explosives may have been handled. The surface water and sediment samples were collected from the site pond formerly used for underwater detonation testing. This biased sampling approach was employed to ensure identification of potentially dangerous areas at LL-6 and also as a means to confirm/refute the existence of secondary explosive contamination at the load line. Refer to Figure 1 for all the March 2002 field screening and laboratory sample locations.

The screening results for azides showed no significant positive concentrations that would constitute a safety concern at LL-6 (see Table 1). The screening results for the Modified Jenkins tests showed no detectable concentrations of TNT at any of the nine sample locations and only one sample showed detectable concentrations of RDX (1.2 ppm at Building 2F-18). Additionally, none of the samples that were submitted for laboratory analysis (3 total) reported explosives in excess of laboratory reporting limits. However, metals were reported in excess of the RVAAP background values in each of the three soil samples, the surface water sample, and the sediment sample submitted for laboratory analysis. In soil, barium, cadmium, calcium, copper, lead, mercury, potassium, selenium, sodium, vanadium and zinc were detected at concentrations in excess of the RVAAP background values. In sediment, antimony, lead, aluminum, beryllium, chromium, cobalt, copper, magnesium, nickel, sodium and vanadium were detected above the RVAAP background values. In surface water, copper and iron were detected above the RVAAP background values. Table 2 provides a summary of all the Modified Jenkins screening results. Table Tables 3 through 5 provide summaries of the March 2002 laboratory results.

Results from the March 2002 sample screening operation indicate there is no detectable safety concern relative to azide contamination at LL-6. As such, RI sampling operations can be performed in a manner consistent with past RIs at the RVAAP and in accordance with both the FW SAP and FW SSHP. The March 2002 sample screening results also confirm that there is no wholesale contamination of secondary explosives at LL-6. Therefore, it is concluded that it is not necessary to include Explosives analysis (by Method 8330) as part of the analytical suite for all samples during the RI. However, as a final confirmation, 20 percent of all soil, surface water and sediment samples (10% of all sample points plus the 10% full suite samples) at LL-6 will include Explosives analysis by Method 8330, and each of these samples will be targeted in and around the most suspect areas as executed during the March 2002 sample screening operation. Explosives will be included as part of the full suite list of analytes for all groundwater samples.

In addition to Explosives analysis, all RI samples will be analyzed for TAL Metals. This will provide the data required to expand on both the 1996 USACHPPM and March 2002 findings, particularly for lead as it relates to potential residual azide contamination. In the event significant concentrations of lead are identified during the RI, specific sampling and analysis for azides using Ion Chromatography will be performed as necessary. However given the fact that there are no environmental drivers for lead azide and that analysis for lead, which is an environmental driver, will be included for all RI samples, specific sampling and analysis for lead azide will not be included as part of the analytical suite at LL-6.

The tables that were discussed in the MKM Position Paper for RI Analytical Suite at LL#6, from the previous pages have been inserted into Appendix A, in this document.

OEPA COMMENTS TO LL#6 SOW AND RESPONSE TO COMMENTS

RAVENNA ARMY AMMUNITION PLANT
SCOPE OF WORK
LOAD LINE (AOC 33) 6 RI

Comments to the LL-6 RI Scope of Work (SOW) were received from the Ohio EPA Northeast District Office on 19 November 2001 and have been incorporated into the following final scope, as noted. All changes to the original text are marked in ***Italics***.

SITE DESCRIPTION

During the 1941 to 1945 time frame Load Line 6 (LL-6) operated as a Fuze Assembly Line with exception of Fulminate Mixing at Building 2F-4. In 1950 LL-6 was used by Firestone Tire and Rubber Company to perform research and development efforts on shape charges under DOD contracts. Later, LL-6 was used by the Firestone Defense Research, a subsidiary of Firestone Tire and Rubber Company, for defense work under contract to Picatinny Arsenal. Firestone Defense Research used the load line for research and development of various kinds of charges (e.g., shaped, fragmenting disc) for armor penetration.

OEPA Comment #16 – Is any historical information available regarding the work that was conducted at this load line by Firestone, or is it still classified? The nature of the work conducted at these areas utilized by Firestone will have an impact on not only the number of samples but also the analytical suite that is looked for in these areas of the load lie (especially the three test areas – under water chamber, concrete chamber and the area in the woods).

MKM Response – The shaped charge work is still classified.

OEPA Comment #17 – In one of the buildings of Load Line 6, it looked like there was some sort of x-ray equipment present. This needs to be investigated further, i.e., is there a source, (if not where was the source removed to), and the equipment should be removed and residual testing should be conducted.

MKM Response – Investigation into this matter will be included as part of RI. The disposition of the x-ray source tube is unknown. Surrounding materials that were irradiated during the survey process may be exhibit slightly elevated background levels.

OEPA Comment #18 – The flash-bang that is taped to one of the catwalk support beams should be removed.

MKM Response – The flash-bang has been removed by the OHARNG.

OEPA Comment #1 – On the SOWs, for the majority of environmental media, there is a reduced analytical constituent suite from the "full suite" that is specified in the facility-wide work plans. The Agency will consider the potential reduction of the constituents only after reviewing the additional historical and process knowledge that will be supplied by USACE and MKM. This comment is also applicable to the proposed reduced number of Jenkins field screening tests.

MKM Response – Base upon the azide screening results and the process research conducted by Francis Zigmund (USACOE), a reduced analytical suite appears to be applicable.

OEPA Comment #2 – It is the Agency's request that the work plans that are prepared for various AOC's contain all the requirements for conducting a Remedial Investigation (RI). That is, the plans should include issues such as ecological and human health risk assessments (etc.), even though in a one-year budget cycle there may only be sufficient enough funding to conduct the field investigations.

MKM Response – Noted.

OEPA Comment #3 – Based upon the work that is currently proposed in the SOWs, it is the Ohio EPA's opinion that the proposed work represents a Phase I effort and that a second phase of work will need to be conducted to more completely determine the nature and extent of contamination at the various AOCs. For example, even at the process buildings where contamination is more likely to have occurred, there are a minimal number of samples scoped.

MKM Response – The sample volume and frequency is consistent with previous RIs at RVAAP. This issue needs to be discussed further at the final scooping meeting. >>>

OEPA Comment #4 – Will USACE's testing for lead azide in the sumps be conducted solely for safety purposes, or is it intended to provide more definitive analytical data? If the purpose is to also provide analytical data, additional discussion regarding the method, the detection limits, how the data will be incorporated into the RI (etc.) would be needed.

This comment is also applicable to mercury fulminate if a method is devised for that constituent.

MKM Response – During the March 11 to 15, 2002 screening operations, samples were collected from strategic locations within Load Lines 6, 9 and 10 in order to screen for primary (azide) and secondary (TNT & RDX) explosives. The purpose of this screening operation was three fold:

1.) Provide necessary data to ensure the safety of site workers during future Remedial Investigation sampling activities.
2.) Use screening data, in conjunction with historical data, to help determine the appropriate analytical suite, location and number of samples required for completion of subsequent Remedial Investigations at the load lines.
3.) Substantiate the accuracy of new GPL screening method for explosives (modified 8330).

A brief summary of the findings is provided below:

In March 2002, MKM collected nine shallow soil samples, one sediment sample and one surface water sample from LL-6 as part of an Azide screening operation. The samples were located adjacent to key process buildings to ensure success of the sampling program. Each of the soil samples were field screened for lead azide, TNT and RDX. Additionally, three of the soil samples, as well as the sediment and surface water samples were submitted to the laboratory for explosives and metals analysis. Screening results showed no detectable concentrations of lead azide or TNT, and only one sample reported detectable concentrations of RDX (1.2 ppm). None of the samples that were submitted for laboratory analysis reported explosives in excess of laboratory reporting limits. Additionally, all metals were reported below the RVAAP background values. In sediment, antimony, lead, aluminum, beryllium, chromium, cobalt, copper, magnesium, nickel, sodium and vanadium were detected above the RVAAP background values. In surface water, copper and iron were detected above the RVAAP background values.

RAVENNA ARMY AMMUNITION PLANT
SCOPE OF WORK
LOAD LINE (AOC 33) 6 RI

USACHPPM DATA

- Seven (7) soil samples, one surface water sample, and one sediment sample were taken and analyzed for explosives and metals.
- Report identifies surface soil to be potential media for contaminant migration due to lack of any physical barriers around the site.
- Surface soil samples indicate maximum elevated concentrations of copper at 2800 mg/kg.
- Potential receptor pathway as access to the site is not restricted.
- Relative Risk Site Evaluation for this AOC was scored HIGH.

RI OBJECTIVES

- Perform a Phase I RI by collecting samples from shallow and deep soils, groundwater, surface water and sediment media at LL-6 to determine if hazardous substances are present at the site and whether they are being released into the environment.
- Furnish data for subsequent risk assessment.

LL-6 SCOPE OF WORK

Task 1 – Subsurface Soil Sampling (Monitor well borings)

- This task includes the drilling and sampling seven (7) soil borings within the LL-6 site area to evaluate potential subsurface contamination (see site map).
- Each boring will be advanced until groundwater is encountered, which is estimated to be no deeper than thirty (30) feet below ground surface (bgs).
- Bedrock may be encountered prior to saturated conditions, therefore, borings may be completed using air rotary technology as per the Facility-Wide Sampling and Analysis Plan.
- All IDW, including auger cuttings, PPE, and decontamination fluids will be properly handled, labeled, characterized, managed and disposed in accordance with the federal, state, and local rules, regulations and laws.

<u>OEPA Comment #20</u> – The SOW indicates that in the subsurface soil borings that the shallow sample will be obtained from the 0-5' interval and that the sample depth will be based on field screening and visual observation. What field screening tests will be utilized? Will the sampled intervals be such that they can be incorporated into the resulting risk assessment.

MKM Response – As indicated below, field screening will be performed using a PID. This procedure is consistent with previous RIs performed at the RVAAP.

> Two (2) soil samples will be collected from each soil boring (14 total). The shallow sample will be collected from the top 5 feet (***based on field screening (PID)*** and visual observation).

> The deep monitor well sample will be collected from the unconsolidated interval just above the saturated zone or high volatile headspace. Subsurface soil samples will be submitted to the laboratory for analysis of the following parameters:

- 2 Samples explosives + TAL metals
- 14 Samples TAL Metals

Additionally, 10% of the subsurface soil samples (2 total) will also be analyzed for VOCs, SVOCs, Cyanide, Propellants (without nitrocellulose), and Pest/PCBs.

OEPA Comment #5. UXO support should be referenced in the SOWs.

MKM Response: Agreed. It is standard procedure for MKM to have a UXO Technician present during all intrusive operations at the RVAAP. See below.

> *UXO personnel will be present during all LL-6 RI intrusive sampling operations.*

Task 2 – Monitoring Well Installation and Sampling

OEPA Comment #6 – With respect to monitor well locations, the Agency's stated preference at the RVAAP is to locate wells in potential source areas and then (if needed) move out from there, rather than having wells located at a great distance from potential sources. Monitor well locations can be discussed in more detail after the additional historical and process information is provided. (At load Lines that are proposed for investigation, the Agency is aware that AOCs are located on bedrock highs and as such a mix of wells, i.e. those close to the source areas and those located further away may be necessary.

MKM Response – Noted. Proposed monitor wells 2, 3, 4, 5, and 6 are all located near potential source areas. Monitor wells 1 and 7 are the potential up and down gradient wells to load line 6. Monitor wells 2 and 6 are also located to establish the gradient(s) across load line 6.

> Each of the seven (7) soil borings will be completed as a monitoring well for sampling (see site map).

> Each monitoring well will be installed to monitor the first aquifer at a maximum planned depth of 30-feet.

> Load Lines 9, 10, 5, 6, and 8 are located on a bedrock high. Based on field observation, site topography, and published bedrock maps groundwater flow trends NW and SE. Monitoring wells will be located so that potential groundwater flow directions will be evaluated.

> Groundwater at LL-6 will be sampled to assess the water quality associated with potential sources of contamination. Additionally, the monitor wells will be used to establish up-gradient water quality conditions at the AOC. Groundwater samples will be submitted to the laboratory for analysis of following parameters:

- Explosives
- TAL Metals (filtered)
- Cyanide
- VOCs
- SVOCs
- Propellants (without nitrocellulose)
- Pest/PCBs

- Task 3 – In-situ Permeability Sampling

OEPA Comment #11 Please confirm that only rising-head slug tests are being conducted on a facility-wide basis.

> Rising-head slug tests will be performed on the monitoring wells installed during the RI at LL-6 to determine the hydraulic conductivity of the unconsolidated overburden adjacent to the well screen.

Task 4 – Shallow Soil Sampling (including subfloor sampling)

OEPA Comment #7 – the number of surface and subsurface soil samples originally scoped will necessarily need to change as the additional historical and process information is received. In addition, the number of samples around the sumps will need to be increased, as more sumps are field located. As such, comments regarding the specific number of soil samples originally scoped will not be made.

MKM Response – Given the findings of the March 2002 screening and sampling activities, the number of samples has not been changed. Two sumps were located in the field and have been incorporated in to the scope (see Task 7).

OEPA Comment #19 – In Task 4 – revise the first bullet to indicate that shallow soil sampling will be conducted to determine nature and extent of contamination.

MKM Response – Noted. Please see change below.

> This task includes the collection of fifty-four (54) soil samples from twenty-seven (27) biased shallow soil locations in and around key process buildings (see site map). ***Shallow soil sampling will be conducted to determine the nature and extent of contamination, if any.***

> Four (4) of the samples will be collected beneath the floors of Buildings 2F-11 (2 samples), 2F-4 (1 sample), and 2F-3 (1 sample).

> Twelve (12) additional samples from 6 unbiased locations will be collected from grids outside of the production area but within the perimeter fence of the load line to ensure that the lateral extent of the site has been defined.

> The bucket hand auger (stainless steel) will be used to collect shallow soil samples. The four subfloor samples will be collected using Geoprobe.

> Samples will be collected from two depth intervals, 0 to 1 and 1 to 3 ft. bgs.

> 3 Samples submitted to laboratory under Azide screening task for 8330 and 6010

> Shallow soil samples will be submitted to the laboratory for analysis of the following parameters:

- 7 Samples Explosives and TAL metals
- 60 Samples TAL Metals

Additionally, 10% of the shallow soil samples (7 total) will also be analyzed for VOCs, SVOCs, Cyanide, Propellants (without nitrocellulose), and Pest/PCBs.

OEPA Comment #22 – Is any Jenkins testing proposed for this AOC? If not, please justify.

MKM Response – Jenkins testing has been incorporated in to the scope.

Task 5 – Surface Water and Sediment Sampling

> A total of five (5) surface water samples will be collected from within the main effluent drainage ways on site and the settling pond on the south end of the LL-6 (see site map). Surface water samples will be collected to evaluate the quality of surface water on site as well as the quality of surface water exiting the site.

> A total of eleven (11) sediment samples will be collected from locations within LL-6 drainage ways and settling pond as shown on site map. Sediment samples will be collected to evaluate potential impact associated with site run-off.

> The direct fill method will be used to collect the majority of surface water samples at LL-6.

> The ditch sediment samples will most likely be collected using the trowel/spoon method. The sediment sample from the settling pond will be collected using a two-foot hand core sampler.

> At sediment sample locations where standing water is not present, a shallow soil sample (0-1 ft. bgs) will be collected (using a stainless steel hand auger) to ensure appropriate evaluation of the main flow ways.

> 1 SW sample submitted to the laboratory during Azide screening task for 8330 and 6010

> The surface water and sediment samples will be submitted to the laboratory for analysis of the following parameters:

- Explosives
- TAL Metals (unfiltered for surface water)
- Cyanide (surface water)
- Grain Size (sediment)
- TOC (sediment)

Additionally, 10% of the surface water (1 total) and sediment samples (2 total) will also be analyzed for VOCs, SVOCs, Cyanide, Propellants (without nitrocellulose) and Pest/PCBs.

Task 6 – Sewer Water and Sewer Sediment Sampling

➢ A total of two (2) sewer water and two (2) sewer sediment samples will be collected from the manholes immediately down-gradient to LL-6 process buildings (see site map). Sediment samples will be collected to evaluate potential impact associated with site run-off.

➢ The sewer water and sewer sediment samples will be collected to characterize the nature of contamination within the sewer system, if any.

➢ Sewer water samples will be collected using disposable Teflon® bailers. The sewer sediment samples will be collected using a Teflon® sample cup attached to an extendable handle.

➢ The sewer water and sediment samples will be submitted to the laboratory for analysis of the following parameters:

- Explosives (1 sediment, 1 water)
- TAL Metals (1 sewer, 1 water) (unfiltered for sewer water)
- Cyanide (1 sewer water)

Additionally, 10% of the sewer water (1 total) and sediment samples (1 total) will also be analyzed for VOCs, SVOCs, Cyanide, Propellants (without nitrocellulose) and Pest/PCBs.

<u>OEPA Comment #21</u> – Are any sumps located at this Load Line? If so, the applicable tasks should be added to the SOW.

<u>MKM Response</u> – Two sumps have been located at this load line, one at Building2F-3 and one at Building 2F-31. As a result, Task 7 and Task 8 have been incorporated into the SOW.

Task 7 – Sump Contents Sampling

➢ Two (2) sump water and two (2) sump sediment samples will be collected to evaluate potential contamination (see site map).

➢ Sump water samples will be collected using disposable Teflon® bailers. The sump sediment samples will be collected using a Teflon® sample cup attached to an extendable handle.

➢ The sump water and sediment samples will be submitted to the laboratory for analysis of the following parameters:

- Explosives (1 sediment, 1 water)
- TAL Metals (1 sediment, 1 water) (unfiltered for sump water)
- Cyanide (1 sump water)

Additionally, 10% of the sewer water (1 total) and sediment samples (1 total) will also be analyzed for VOCs, SVOCs, Cyanide, Propellants (without nitrocellulose) and Pest/PCBs.

Task 8 – Sewer and Sump Soil Sampling

➢ Two (2) sewer soil and two (2) sump soil samples will be collected adjacent to LL-6 manholes and sumps to provide information on potential contamination associated with the sewer system (see site map).

➢ Sewer and sump soil samples will be collected using direct push technology.

➢ Two discrete samples will be collected from the sewer and sump soil borings (8 samples total – 4 locations at 2 intervals). The first sample interval will be from the surface to 1 foot bgs (1'). The second interval will be from total depth of the structures to one foot below the bottom.

➢ The sewer and sump soil samples will be submitted to the laboratory for analysis of the following parameters:

- 1 Samples for Explosives
- 8 Samples for TAL Metals

Additionally, 10% of the sewer and sump soil samples (1 total) will also be analyzed for VOCs, SVOCs, Cyanide, Propellants, and Pest/PCBs.

Task 9 – Contingency Sampling

➢ Contingency samples (20 total samples; 2 intervals at 10 locations or 1 interval @ ~~20~~ 5 locations) will be incorporated into the sampling scheme to ensure success of the LL-6 RI.

➢ Contingency samples will allow for further delineation of the nature and extent of contamination at the AOC as needed, without the need for additional field efforts.

Task 10 – Final Report

➢ Following data validation, a final report will be submitted to the OSC and OEPA for review. The report will summarize and present all pertinent results, observations, analytical results, data validation, conclusions and recommendations.

STATEMENT OF WORK FOR ORDNANCE AVOIDANCE AT LOAD LINE 9, RAVENNA ARMY AMMUNITION PLANT, RAVENNA, OHIO

1. **General.** MKM Engineers, Inc. Unexploded Ordnance (UXO) staff personnel will provide a two-person Unexploded Ordnance (UXO) team to provide on-site UXO support during all sampling activities. The UXO team will not destroy any UXO encountered. The UXO team will mark and report all located UXO to Mark Patterson, Environmental Manager, Ravenna Army Ammunition Plant, Ravenna, Ohio, for disposition and guidance

2. **Definitions.**

    a. **Ordnance and Explosive (OE).** Bombs and warheads, guided and ballistic missiles, artillery, rocket and mortar ammunition, small arms ammunition, anti-personnel and anti-tank mines, demolition charges, pyrotechnics, grenades, containerized and uncontainerized explosives and propellants, military chemical agents and all similar and related items or components, explosive in nature or otherwise designed to cause damage to personnel or material. Soils with explosive constituents are considered to be OE if the concentration is sufficient to be reactive and present an imminent safety hazard.

    b. **Unexploded Ordnance (UXO).** An item of explosive ordnance that has failed to function as designed or has been abandoned, discarded or improperly disposed of and is still capable of functioning and causing damage to personnel or materials.

    c. **Inert Ordnance.** An item that has functioned as designed, leaving an inert carrier. An item manufactured to serve a specific training purpose. Fragments from UXO.

    d. **Explosive Ordnance Disposal (EOD) Personnel.** Active duty military EOD personnel.

    e. **UXO Personnel.** Former EOD personnel employed by a contractor.

    f. **Recovered Chemical Warfare Materiel (RCWM).** RCWM is defined as chemical agent material and/or associated equipment and surrounding contaminated media discovered either by chance or during deliberate real estate recover/restoration operations that was previously disposed of as waste. RCWM is classified as hazardous waste by the Army and not within the scope of the Army Chemical Surety Program.

    g. **Chemical Event.** Discovery of an actual or suspected chemical agent or container that may require emergency transportation or disposal.

3. UXO Team Composition and Qualifications. UXO Team shall consist of two members with the following qualifications:

a. **UXO Team Leader.** The UXO supervisor for this project will be Mr. Steven King. He will be the technical lead for all UXO operations on the site. Mr. King is qualified for this project by virtue of training and experience. He has over 25 years of military and civilian experience. He has served as a Senior UXO Supervisor, UXO Supervisor, Safety Officer and Quality Control Specialist. Duties and assignments include range clearances as EOD Range Control Officer and Range Supervisor of multiple team operations and civilian UXO experience including performance as a Senior UXO Supervisor for OE removal operations.

b. **UXO Specialist.** The UXO specialist for this project will be Mr. Lew Kovarik. Mr. Kovarik has over 10 years military and civilian experience. He has served as EOD Demolition Supervisor, Safety Officer and UXO Supervisor for OE removal operations.

4. Responsibilities and Authority. The UXO Team will provide the explosive ordnance recognition, location and safety functions for the operation. The UXO team leader has the final authority for on-site personnel regarding all matters concerning UXO.

5. Work and Safety Plans. The UXO team will assist in the development of the site safety and health plan and the work plan. The UXO team leader will conduct UXO safety briefings for all site-personnel and visitors.

6. Access Routes to Sampling Locations.

a. Prior to commencement of operations at specific sites, the UXO team will conduct a reconnaissance of the sampling area. The reconnaissance shall include locating a clear path for the sampling crews, vehicles and equipment to approach the site. The approach path, at a minimum, will be twice the width of the widest vehicle. MKM UXO personnel will clearly mark all boundaries of the cleared approach path to prevent personnel from straying into uncleared areas. The path will be marked utilizing pin flags spaced no more than fifteen (15) feet apart or as visibility dictates. No personnel shall be allowed outside the cleared paths.

b. If UXO is encountered on the surface, divert the approach path around the UXO, clearly mark the area and report the UXO.

c. A Schonstedt model GA-72cd magnetometer will be used to insure there is no subsurface UXO within the approach path. If a magnetic anomaly is encountered, assume it to be a UXO mark it and divert the path around the anomaly.

7. Soil Sampling and Well Drilling Sites

a. The UXO team will locate magnetic anomaly free areas for soil samples and GEOPROBE operations. If a pre-selected area indicates magnetic anomalies, a new sampling site will be chosen.

b. The UXO team will clearly mark the boundaries of the cleared soil sampling or well drilling sites. Personnel will not go outside the cleared areas. As a minimum, the cleared area will be square, with a side dimension equal to twice the length of the largest vehicle or piece of equipment to be brought on site.

c. Prior to drilling equipment being moved to the proposed drilling site, the UXO team will locate a magnetic anomaly free site. This shall be accomplished using a Schonstedt GEOMAG. The UXO team shall start the borehole with a hand held or portable auger. At the two-foot depth, the auger will be withdrawn and the magnetometer probe will be lowered into the hole. This procedure will be used to ensure that smaller items of UXO, undetectable from the surface can be detected. If no magnetic anomalies are found, the procedure will be repeated at two-foot intervals until native soil is encountered.

1. **Site Name: RVAAP-42, LL-9/Detonator Line.**

2. **Site Summary:** This AOC operated from 1941 to 1945 to produce detonators. Load Line 9 was deactivated and its equipment removed in 1945. The surface soil and ground-water pathways are considered complete at this site. Six surface samples were collected from outside of the production buildings and analyzed for explosives and metals. The buildings were selected based on the production use. Emphasis was placed on those buildings that were used to produce and store the lead azide and Tetryl. One sediment sample was originally going to be collected from one of the settling ponds at the AOC, but no settling ponds or other sediment pathways were evident. Subsurface soil data collected for RVAAP-26, Fuze and Booster Area Settling Tanks during the first RRSE (reference 11), will be used to score the ground-water pathway at the AOC. The subsurface soil used to estimate the ground-water pathway was collected adjacent to the settling tank on the east side of Building DT-5.

3. **Pathway Evaluation:**

a. Ground Water: *Medium.* Ground water concentrations were estimated from subsurface soil data from a soil sample collected from 6 to 8 feet (refusal of sampling equipment at 8 feet due to a sandstone formation) using a standard linear equilibrium soil/water partition equation developed by the USEPA (to estimate contaminant release as a soil leachate) and a dilution factor (to account for dilution of the leachate as it enters the aquifer). This method is consistent with the derivation of soil screening levels and the investigation and modeling efforts conducted at Superfund sites to develop soil cleanup goals and ground-water protection goals (references 6, 7, and 8). A sample equation is shown for RVAAP-41 on page D-11.

(1) Contaminant Hazard Factor: *4.88 = Moderate*

Contaminant	Max Soil Concentration (mg/kg)	pH	K_d	q_w/r_b	Max Ground-Water Concentration (µg/L)	Standard (µg/L)	Ratio
arsenic	11	7.2	30	0.2	18.2	4.5	4.05
barium	39.3	7.2	44	0.2	44.5	2600	0.02
chromium	15.4	7.2	17	0.2	44.8	180	0.25
copper	14.5	7.2	unkn	0.2		1400	
lead	27.2	7.2	600	0.2	2.27	4	0.57
zinc	63.6	7.2	95	0.2	33.4	11000	0.00

unkn – K_d value for copper is not provided in references 6 or 8, so ground-water concentration could not be calculated.

(2) **Migration Pathway Factor:** *Potential.* There is no evidence that site contaminants are migrating. However, there are no physical barriers in place to prevent migration.

(3) **Receptor Pathway Factor:** *Potential.* It is unknown if any wells are directly down gradient from this AOC; however, ground water from near this AOC may be used for irrigation or drinking water.

b. **Surface Water/Human Endpoint:** *Not Evaluated.* There was no surface water identified during the RRSE at this AOC.

c. **Sediment/Human Endpoint:** *Not Evaluated.* There was no sediment identified during the RRSE at this AOC.

d. **Surface Water/Ecological Endpoint:** *Not Evaluated.* There was no surface water identified during the RRSE at this AOC.

e. **Sediment/Ecological Endpoint:** *Not Evaluated.* There was no sediment identified during the RRSE at this AOC.

f. **Surface Soil:** *Medium.*

(1) Contaminant Hazard Factor: *20.7 = Moderate.*

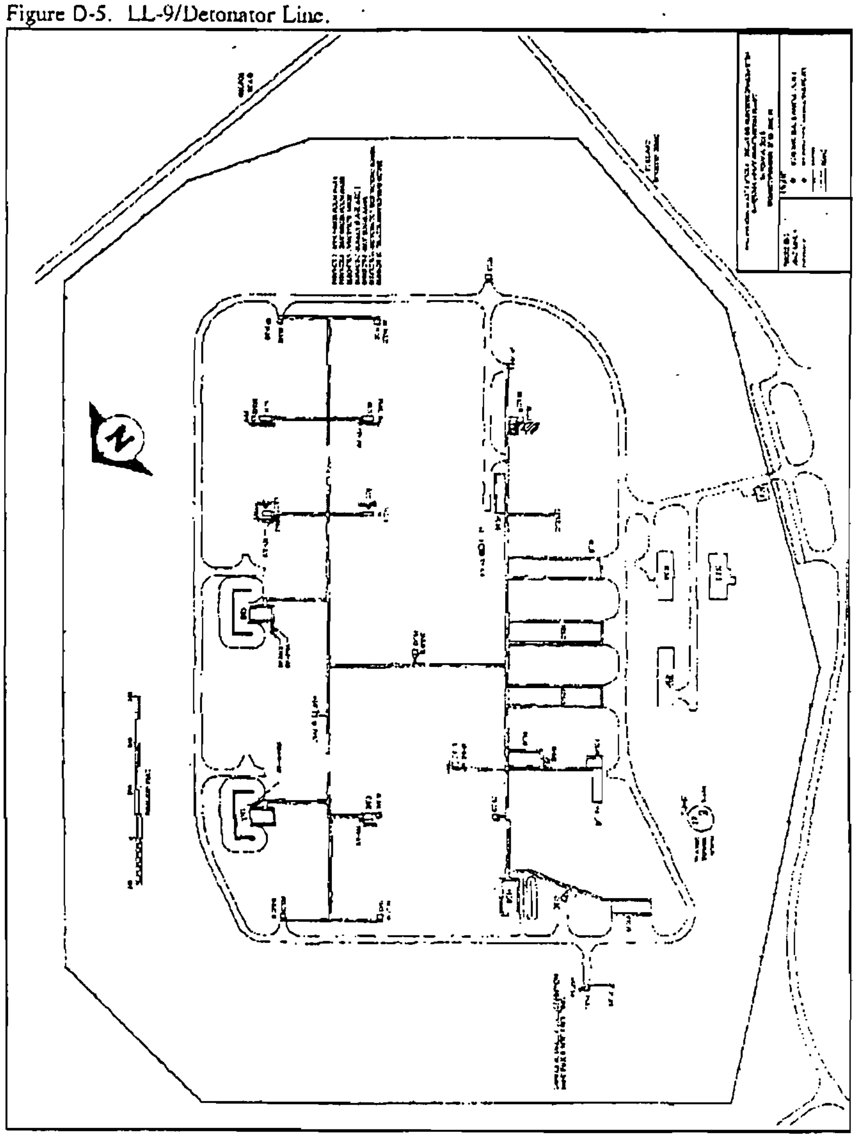
Contaminant	Max Concentration (mg/kg)	Standard (mg/kg)	Ratio
Aluminum	22000	77000	0.29
Antimony	13	31	0.42
Arsenic	12	22	0.55
Barium	1400	5300	0.26
Cadmium	12	38	0.32
Chromium	160	3000	0.05
Cobalt	10	4600	0.00
Copper	270	2800	0.10
Iron	52000	23000	2.26
Lead	2700	400	6.75
Manganese	3200	380	8.42
Mercury	21	23	0.91
Nickel	270	1500	0.18
Selenium	2.2	380	0.01
Vanadium	24	540	0.04
Zinc	3700	23000	0.16

(2) **Migration Pathway Factor:** *Potential.* There is no evidence that site contaminants are migrating. However, there are no physical barriers in place to prevent migration.

(3) **Receptor Pathway Factor:** *Potential.* While this area is surrounded by a fence with locked gates, hunters, scrappers, and fire wood cutters may have access to the site.

4. **Final Score.** Medium (2), two Media of Concern.

Figure D-5. LL-9/Detonator Line.



Part II

Final
Quality Assurance Project Plan Addendum for the Remedial Investigation at the Load Line 9 (AOC 42) at the Ravenna Army Ammunition Plant, Ravenna, Ohio

September 2003

Prepared for

Joint Munitions Command
AMSIO – ACE – D
Procurement Directorate
Rock Island, IL 61299-6000

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PART II – QUALITY ASSURANCE PROJECT PLAN ADDENDUM

LIST OF TABLES

ABBREVIATIONS

COC	Chain of Custody
CX	Center of Excellence
DQO	Data Quality Objective
EPA	U.S. Environmental Protection Agency
HTRW	Hazardous, Toxic, and Radioactive Waste
LCS	Laboratory Control Sample
MS	Matrix Spike
MSD	Matrix Spike Duplicate
PCB	Polychlorinated Biphenyl
QA	Quality Assurance
QC	Quality Control
QAMP	Quality Assurance Management Plan
QAPP	Quality Assurance Project Plan
RI	Remedial Investigation
RVAAP	Ravenna Army Ammunition Plant
SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedure
TAL	Target Analyte List
TCL	Target Compound List
USACE	U.S. Army Corps of Engineers

INTRODUCTION

This Quality Assurance Project Plan (QAPP) addendum addresses supplemental project-specific information in relation to the Revised 2001 Facility Wide QAPP for the Ravenna Army Ammunition Plant (RVAAP), Ravenna, Ohio. Each QAPP section is presented documenting adherence to the Facility Wide QAPP or stipulating project-specific addendum requirements.

1.0 PROJECT DESCRIPTION

1.1 SITE HISTORY/BACKGROUND INFORMATION

This information is presented in Section 1.3 of the Word Plan (WP) Addendum for the Load Line 9 Remedial Investigation (AOC 42).

1.2 PAST DATA COLLECTION ACTIVITY/CURRENT STATUS

This information is presented in Section 1.1 through 1.4 of the Work Plan (WP) Addendum for the Load Line 9 Remedial Investigation (AOC 42).

1.3 PROJECT OBJECTIVES AND SCOPE

This information is presented in Section 3.0 of the Work Plan (WP) Addendum for the Load Line 9 Remedial Investigation (AOC 42).

1.4 SAMPLE NETWORK DESIGN AND RATIONALE

This information is presented in Section 4.0 of the Work Plan (WP) Addendum for Load Line 9 Remedial Investigation (AOC 42).

1.5 PARAMETERS TO BE TESTED AND FREQUENCY

Sample matrix types, analytical parameters, and analytical methods are discussed in Section 4.0 of the Work Plan (WP) Addendum for the Load Line 9 Remedial Investigation (AOC 42). These analyses are summarized in Table 1-1 of this QAPP addendum, in conjunction with anticipated sample numbers, quality assurance (QA) sample frequencies, field quality control (QC) sample frequencies and the 10% OEPA QA Split sample frequencies. All QA split samples will be submitted to a separate Laboratory (OEPA funded) for analysis.

1.6 PROJECT ORGANIZATION

The project organization for this RI is discussed in Section 2.0 of the Work Plan (WP) Addendum for the Load Line 9 Remedial Investigation (AOC 42).

2.0 PROJECT ORGANIZATION AND RESPONSIBILITY

The functional project organization and responsibilities are described in Section 2.0 of the Revised 2001 Facility-Wide Sampling and Analysis Plan (FW SAP) and Load Line 9 Remedial Investigation (AOC 42) WP. Analytical support for this work has been assigned to Severn Trent Laboratories, Inc. All of the analysis will be performed by Severn Trent's Chicago, Illinois laboratory with the exception of the propellant analysis (nitroglycerin, nitrocellulose & nitroguanidine). Severn Trent Laboratories, Inc. at their West Sacramento California facility will analyze the propellants. The QA lab, which will receive splits of 10% of the environmental samples, is GPL Laboratories in Gaithersburg, Maryland. The U.S. Army Corp of Engineers (USACE) Hazardous, Toxic, and Radioactive Waste (HTRW) Center of Excellence (CX), Omaha, Nebraska has certified these laboratories. Severn Trent Chicago's, Severn Trent Laboratories, Inc./Sacramento Services' and GPL's Quality Assurance Management Plans (QAMP) are available for review upon request. The laboratories' organizational structure, roles, and responsibilities are identified in their QAMP and facility-specific appendices. Addresses and telephone numbers for the laboratories' facilities are as follows:

Analytical Facilities
Severn Trent Laboratories, Inc. – general analytical and explosive analytical services:
2417 Bond Street, University Park
Chicago, IL 60466
Tel: (708) 534-5200
Fax: (708) 534-5211

Severn Trent Laboratories, Inc./Sacramento – Propellants (nitroglycerin, nitrocellulose & nitroguanidine):
Sacramento, CA
880 Riverside Parkway
West Sacramento, CA 95605
Tel: (916) 373-5600
Fax: (916) 372-1059.

GPL Laboratories – asbestos analysis as well as general analytical and explosive analytical services for the 10% QA Split samples:
202 Perry Parkway
Gaithersburg, MD 20877
Tel: (301) 926-6802
Fax: (301) 840-1209

3.0 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT

3.1 DATA QUALITY OBJECTIVES

Analytical Data Quality Objectives (DQO) summaries for this investigation will follow Tables 3-1 and 3-2 in the FW QAPP. All QC parameters stated in the specific U.S. Environmental Protection Agency (EPA) SW-846 methods will be adhered to for each chemical listed. SW-846 Method references found in the FW QAPP have been revised to the Update III Methods (i.e., 8260A is now 8260B, 8270B is now 8270C, etc.). Laboratories are required to comply with all methods as written; recommendations are considered requirements.

3.2 LEVEL OF QUALITY CONTROL EFFORT

QC efforts will follow Section 3.2 of the FW QAPP. Field QC measurements will include field source water blanks, trip blanks, field duplicates, and equipment rinseate blanks. Laboratory QC measurements will include method blanks, laboratory control samples (LCS), laboratory duplicates, and matrix spike/matrix spike duplicate (MS/MSD) samples, as dictated by the individual methods.

3.3 ACCURACY, PRECISION, AND SENSITIVITY OF ANALYSIS

Accuracy, precision, and sensitivity goals identified in Section 3.3 and Tables 3-1 and 3-2 of the FW QAPP and Table 3-1 of this document will be utilized for this investigation.

3.4 COMPLETENESS, REPRESENTATIVENESS, AND COMPARABILITY

Completeness, representativeness, and comparability goals identified in Section 3.4 and Tables 3-1 and 3-2 of the FW QAPP will be utilized for this investigation.

Table 3-1
Load Line 9 – RVAAP
Analytical Methods Parameters and Projects Quantitation Levels
September 2003 Remedial Investigation

	Analytical Methods		Project Quantitation[a]	
Parameters	**Water**	**Soil/Sediment**	**Water**	**Soil/Sediment**
Volatile Organic Compounds	SW-846-5030/8260B	SW-846-5030/8260B	(μg/L)	(μg/kg)
Chloromethane			1	5
Bromomethane			1	5
Vinyl chloride			1	5
Chloroethane			1	5
Methylene chloride			1	5
Acetone			10	20
Carbon disulfide			1	5
1,1-Dichloroethene			1	5
1,1-Dichloroethane			1	5
1,2-Dichloroethene (total)			1	5
Chloroform			1	5
1,2-Dibromomethane			1	5
1,2-Dichloroethane			1	5
2-Butanone			10	20
1,1,1-Trichloroethane			1	5
Carbon tetrachloride			1	5
Bromodichloromethane			1	5
1,2-Dichloropropane			1	5
1,3-*cis*-Dichloropropene			1	5
Trichloroethene			1	5
Dibromochloromethane			1	5
1,1,2-Trichloroethane			1	5
Benzene			1	5
1,3-*trans*-Dichloropropene			1	5
Tribromomethane			1	5
4-Methyl-2-pentanone			10	20
2-Hexanone			10	20
Tetrachloroethane			1	5
Toluene			1	5
1,1,2,2-Tetrachloroethane			1	5
Chlorobenzene			1	5
Ethylbenzene			1	5
Styrene			1	5
Xylenes (total)			2	10

	Analytical Methods		Project Quantitation[a]	
Parameters	**Water**	**Soil/Sediment**	**Water**	**Soil/Sediment**
Semivolatile Organic Compounds	SW-846-3520/8270C	SW-846-3550/8270C	(µg/L)	(µg/kg)[c]
Phenol			10	330
bis(2-Chloroethyl) ether			10	330
2-Chlorophenol			10	330
1,3-Dichlorobenzene			10	330
1,4-Dichlorobenzene			10	330
1,2-Dichlorobenzene			10	330
2-Methylphenol			10	330
2,2'-Oxybis (1-chloropropane)			10	330
4-Methylphenol			10	330
N-nitroso-di-n-dipropylamine			10	330
Hexachloroethane			10	330
Nitrobenzene			10	330
Isophorone			10	330
2-Nitrophenol			10	330
2,4-Dimethylphenol			10	330
bis (2-Chloroethoxy) methane			10	330
2,4-Dichlorophenol			10	330
1,2,4-Trichlorobenzene			10	330
Naphthalene			10	50
4-Chloroaniline			10	330
Hexachlorobutadiene			10	330
4-Chloro-3-methylphenol			10	330
2-Methylnaphthalene			10	330
Hexachlorocyclopentadiene			10	330
2,4,6-Trichlorophenol			10	330
2,4,5-Trichlorophenol			25	800
2-Chloronaphthalene			10	330
2-Nirtoaniline			25	800
Dimethylphthalate			10	330
Acenaphthylene			10	50
2,6 Dinitrotoluene			10	330
3-Nitroaniline			25	800
Acenaphthene			10	50
2,4-Dinitrophenol			25	800
4-Nitrophenol			25	800
Dibenzofuran			10	330
2,4-Dinitrotoluene			10	330
Diethylphthalate			10	330
4-Chlorophenyl-phenyl ether			10	330
Fluorene			10	50
4-Nitroaniline			25	800
4,6-Dinitro-2-methylphenol			25	800
N-nitrosodiphenylamine			10	330

	Analytical Methods		Project Quantitation[a]	
Parameters	**Water**	**Soil/Sediment**	**Water**	**Soil/Sediment**
Semivolatile Organic Compounds (continued)	SW-846-3520/8270C	SW-846-3550/8270C	(µg/L)	(µg/kg)[c]
4-Bromophenyl-phenylether			10	330
Hexachlorobenzene			10	330
Pentachlorophenol			25	800
Phenanthrene			10	50
Anthracene			10	50
Carbazole			10	50
di-N-butylphthalate			10	330
Fluoranthene			10	50
Pyrene			10	50
Butylbenzylphthalate			10	330
3,3'-Dichlorobenzidine			10	330
Benzo(a)anthracene			10	50
Chrysene			10	50
bis(2-Ethylhexyl)phthalate			10	330
di-N-octylphthalate			10	330
Benzo(*b*)fluoranthene			10	50
Benzo(*k*)fluoranthene			10	50
Benzo(*a*)pyrene			10	50
Indenol(*1,2,3-cd*)pyrene			10	50
Dibenzo(*a,h*)anthracene			10	50
Benzo(*g,h,I*)perylene			10	50
Pesticides/PCBs	SW-846-8081[b]/8082	SW-846-8081[b]/8082	(µg/L)	(µg/kg)[c]
alpha-BHC			0.05	1.7
beta-BHC			0.05	1.7
delta-BHC			0.05	1.7
gamma-BHC (Lindane)			0.05	1.7
Heptachlor			0.05	1.7
Aldrin			0.05	1.7
Heptachlor epoxide			0.05	1.7
Endosulfan I			0.05	1.7
Dieldrin			0.05	1.7
4,4-DDE			0.05	1.7
Endrin			0.05	1.7
Endosulfan II			0.05	1.7
4,4-DDD			0.05	1.7
Endosulfan sulfate			0.05	1.7
4,4-DDT			0.05	1.7
Methoxychlor			0.1	17
Endrin ketone			0.05	1.7
Endrin aldehyde			0.05	1.7
alpha-Chlorodane			0.05	1.7
gamma-Chlorodane			0.05	1.7

	Analytical Methods		Project Quantitation[a]	
Parameters	**Water**	**Soil/Sediment**	**Water**	**Soil/Sediment**
Pesticides/PCBs (Continued)	SW-846-8081[b]/8082	SW-846-8081[b]/8082	(μg/L)	(μg/kg)[c]
Toxaphene			2.0	33
Arochlor-1016			0.5	33
Arochlor-1221			0.5	33
Arochlor-1232			0.5	33
Arochlor-1242			0.5	33
Arochlor-1248			0.5	33
Arochlor-1254			0.5	33
Arochlor-1260			0.5	33
Explosive Compounds	SW-846-8330	SW-846-8330	(μg/L)	(μg/kg)[c]
HMX [Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocinel]			0.5	1
RDX (cyclonite) [Hexahydro-1,3,5-trinitro-1,3,5-triazine]			0.5	1
1,3,5,-Trinitrobenzine			0.2	0.25
1,3-Dinitrobenzene			0.2	0.25
Tetryl			0.2	0.25
Nitrobenzene			0.2	0.25
2,4,6-Trinitroltoluene			0.2	0.25
2,4-Dinitrotoluene			0.2	0.25
2,6-Dinitrotoluene			0.2	0.25
o-Nitrotoluene			0.2	0.25
m-Nitrotoluene			0.2	0.25
p-Nitrotoluene			0.2	0.25
Propellant Compounds	SW-846-8330 Modified	SW-846-8330 Modified	(μg/L)	(μg/kg)[c]
Nitroglycerin			3	3
Nitroquanidine			3	3
Nitrocellulose	EPA 353.2 Modified	EPA 353.2 Modified	500	5
Metals (Target Analyte List)	SW-846-3010A/6010B, 6020, or 7000 Series	SW-846-3010A/6010B, 6020, or 7000 Series	(μg/L)	(μg/kg)[ce]
Aluminum			100	10
Antimony			5	0.5
Arsenic			5	0.5
Barium			10	1
Beryllium			1	0.1
Cadmium			1	0.1
Calcium			100	10
Chromium			5	0.5
Cobalt			5	0.5
Copper			5	0.5

	Analytical Methods		Project Quantitation[a]	
Parameters	**Water**	**Soil/Sediment**	**Water**	**Soil/Sediment**
Metals (Target Analyte List) (Continued)	SW-846-3010A/6010B, 6020, or 7000 Series	SW-846-3010A/6010B, 6020, or 7000 Series	(µg/L)	(µg/kg)[ce]
Iron			100	10
Lead			3	0.3
Magnesium			100	10
Manganese			10	1
Mercury (CVAA)	SW-846-7470A	SW-846-7471A	0.2	0.1
Nickel			10	1
Potassium			200	20
Selenium			5	0.5
Silver			5	0.5
Sodium			200	20
Thallium			2	0.2
Vanadium			10	1
Zinc			10	1
Cyanide	SW-846-9010B	SW-846-9014	0.01	0.5
Anions				
Sulfate	EPA 300.00[c]	--	1.0	--
Nitrate/Nitrite	EPA 352.2 or 352.3	--	0.1	--

a These are expected quantitation limits based on reagent-grade water or a purified solid matrix. Actual quantitation limits may be higher depending upon the nature of the sample matrix. The limit reported on final laboratory reports will take into account the actual sample volume or weight, percent solids (where applicable), and the dilution factor, if any. The quantitation limits for additional analytes to this list may vary, depending upon the results of laboratory studies

b Values determined between the laboratory method detection levels and the project quantitation levels will be reported as estimated ('J').

c Soils and sediment analysis will be reported on a dry-weight basis.

d Modification of the SW-846 preparation and analysis procedures may be required to achieve these quantitation levels.

e Estimated detection limits for metals in soil are based on a 2-gram sample diluted to 200 milliliters.

CVAA = Cold vapor atomic absorption.

RI = remedial Investigation

4.0 SAMPLING PROCEDURES

Sampling procedures are discussed in Section 4.0 of the FW SAP and WP Addendum for the Load Line 9 Remedial Investigation (AOC 42). Tables 4-1 and 4-2 summarize sample container, preservation, and holding time requirements for the groundwater and soil matrices for this investigation. The number of containers required is estimated in these tables.

Table 4-1
Load Line 9 – RVAAP
Container Requirements for Soil and Sediment Samples
September 2003 Remedial Investigation

Analyte Group	Approx. No. of Bottles incl. Field QC	Container	Minimum Sample Size	Preservative	Holding Time
Volatile Organic Compounds	14	One 2-ounce glass jar with Teflon® - lined cap (no headspace)	20 grams	Cool, 4° C	14 days
Semivolatile Organic Compounds	14	One 4-ounce glass jar with Teflon® - lined cap (no headspace)	100 grams	Cool, 4° C	14 days (extraction) 40 days (analysis)
Pesticides/PCBs	14	One 4-ounce glass jar with Teflon® - lined cap (no headspace)	100 grams	Cool, 4° C	14 days (extraction) 40 days (analysis)
Explosive Compounds	100	One 4-ounce glass jar with Teflon® - lined cap (no headspace)	100 grams	Cool, 4° C	14 days (extraction) 40 days (analysis)
Propellant Compounds	14	One 4-ounce glass jar with Teflon® - lined cap (no headspace)	100 grams	Cool, 4° C	14 days (extraction) 40 days (analysis)
Metals	100	One 4-ounce wide mouth poly bottle	50 grams	Cool, 4° C	180 days
Cyanide	--	Use same container as metals	25 grams	Cool, 4° C	14 days
Asbestos	13	One 4-ounce glass jar with Teflon® - lined cap (no headspace)	25 grams	Cool, 4° C	None
Total Organic Carbon	10	One 4-ounce glass jar with Teflon® - lined cap (no headspace)	10 grams	Cool, 4° C	28 days
Grain Size	10	One 8-ounce wide mouth container	100 grams	None	None

QC = Quality Control

Table 4-2
Load Line 9 (AOC 33) - RVAAP
Container Requirements for Groundwater And All RI Rinseate Samples
September 2003 Remedial Investigation

Analyte Group	Approx. No. of Bottles incl. Field QC	Container	Minimum Sample Size	Preservative	Holding Time
Volatile Organic	54	Three 40-mililiter glass vials with Teflon® -	80 Milliliters	Cool, 4° C	14 days
Compounds		lined septum (no headspace)		HCL to pH < 2	
Semivolatile Organic	30	Two 1-liter amber glass bottles with	1000 Milliliters	Cool, 4° C	14 days (extraction)
Compounds		Teflon® - lined lid			40 days (analysis)
Pesticides/PCBs	76	Two 1-liter amber glass bottles with	1000 Milliliters	Cool, 4° C	7 days
		Teflon® - lined lid			
Explosive Compounds	46	Two 1-liter amber glass bottles with	1000 Milliliters	Cool, 4° C	14 days (extraction)
		Teflon® - lined lid			40 days (analysis)
Propellant Compounds	60	Four 1-liter amber glass bottles with	1000 Milliliters	Cool, 4° C	14 days (extraction)
		Teflon® - lined lid			40 days (analysis)
Metals	23	One 1-liter poly bottle	500 Milliliters	Cool, 4° C	180 days
				HNO_3 to pH < 2	
Cyanide	23	One 1-liter poly bottle	500 Milliliters	Cool, 4° C	14 days

[a] Additional sample volume will be collected for one sample in order for the laboratory to perform appropriate laboratory quality control (QC) analysis

5.0 SAMPLE CUSTODY

5.1 FIELD CHAIN-OF-CUSTODY PROCEDURES

Sample handling, packaging, and shipment procedures will follow those identified in Section 6.0 of the FW FSP and as amended in the Load Line 9 Remedial Investigation (AOC 42) WP Addendum.

5.2 LABORATORY CHAIN-OF-CUSTODY PROCEDURES

Laboratory chain of custody (COC) will follow handling and custody procedures identified in the Site Wide WP and laboratories QAMP.

5.3 FINAL EVIDENCE FILES CUSTODY PROCEDURES

Custody of evidence files will follow those criteria defined in Section 5.3 of the FW QAPP.

6.0 CALIBRATION PROCEDURES AND FREQUENCY

6.1 FIELD INSTRUMENTS/EQUIPMENT

Field instruments and equipment calibrations will follow those set forth in Section 6.1 of the FW QAPP. This will be amended only as specified by the manufacturer's operating instructions.

6.2 LABORATORY INSTRUMENTS

Calibration of laboratory equipment will follow procedures identified in the laboratories' QAMP, corporate, and facility-specific operating procedures.

6.0 CALIBRATION PROCEDURES AND FREQUENCY

6.1 FIELD INSTRUMENTS/EQUIPMENT

Field instruments and equipment calibrations will follow those set forth in Section 6.1 of the FW QAPP. This will be amended only as specified by the manufacturer's operating instructions.

6.2 LABORATORY INSTRUMENTS

Calibration of laboratory equipment will follow procedures identified in the laboratories' QAMP, corporate, and facility-specific operating procedures.

7.0 ANALYTICAL PROCEDURES

7.1 LABORATORY ANALYSIS

Analytical methods, parameters and quantitation or reporting limits are those listed in Table 3-1 of this document and applicable amendments. The laboratories QAMP will be followed during the analysis of these samples. The following laboratory Standard Operating Procedures (SOP) will implement the defined EPA methods.

- GC/MS Volatile Organics Analysis Based on Method 8260B, SW-846, UMV-SOP-8260, 03/10/99.
- GC/MS Semi-volatile Analysis Based on Methods 8270B and 8270C, SW-846, UMB-SOP-8270, 07/23/99.
- Gas Chromatographic Analysis Based on Method 8000A, 8010B, 8020A, 8021A, 8080A, 8081, 8082, 8150B, and 8051, SW-846, UGE-SOP-8081A, 03/01/99 and UGE-SOP-8082, 03/01/99.
- Extraction and Cleanup of Organic Compounds from Waters and Soils, Based on SW-846 3500 Series, 3600 Series, 8150, 8151, and 600 Series Methods, CORP-OP-0001, Rev. 3.4, 4/15/99.
- Analysis of Nitroaromatic and Nitramine Explosives in water and soil by HPLC/UV and Liquid Chromatography/Thermospray/Mass Spectrometry, SAC-LC-0001.
- Total Organic Carbon and Total Inorganic Carbon, UWC-SOP-415.1, 06/25/99.
- Inductively Coupled Plasma-Atomic Emission Spectroscopy, Spectrometric Method for Trace Element Analysis, Methods 6010B, UME-SOP-6010B-1T, 02/05/99.
- Graphite Furnace Atomic Absorption Spectroscopy, SW-846 Methods 7000A, UME-SOP-ILM GF, 04/19/99.
- Mercury in Aqueous Samples by Cold Vapor Atomic Absorption, SW-846 7470A and MCAWW 245.1, UME-SOP-245.1, 04/19/99.
- Preparation and analysis of Nitrocellulose in Aqueous, Soil, and Sediments by Colorimetric Autoanalyzer, SAC-WC-0050, Rev. 0.
- Determination of nitroaromatics, nitramines, and specialty explosives in water and soil by high performance liquid chromatography/ultraviolet detector (HPLC/UV) and liquid chromatography/thermospray/mass spectrometry (LC/TSP/MS), SAC-LC-0001, Rev. 5.0.

Additional analytical methods to be used for this RI include:

- Asbestos (water) by Transmission Electron Microscopy.
- Asbestos (soil) by Polarized Light Microscopy.

The laboratories will at all times maintain a safe and contaminant free environment for the analysis of samples. The laboratories will demonstrate, through instrument blanks, holding blanks, and analytical method blanks, that the laboratory environment and procedures will not and do not impact analytical results.

The laboratories will also implement all reasonable procedures to maintain project-reporting levels for all sample analyses. Where contaminant and sample matrix analytical interferences impact the laboratories' ability to obtain project-reporting levels, the laboratory will institute sample clean-up processes, minimize dilutions, adjust instrument operational parameters, or propose alternative analytical methods or procedures. Elevated reporting levels will be kept to a minimum throughout the execution of this work.

7.2 FIELD SCREENING ANALYTICAL PROTOCOLS

Procedures for field analysis are identified in Section 6.0 of the FW SAP and in Section 4.0 of the WP Addendum for the Load Line 9 Remedial Investigation (AOC 42).

8.0 INTERNAL QUALITY CONTROL CHECKS

8.1 FIELD SAMPLE COLLECTION

Field QC/QA sample types, numbers, and frequencies are identified in Section 1.5 of this document. In general, field duplicates will be collected at a frequency of 10 percent, field equipment rinseates at a frequency of 10 percent for samples collected with non-dedicated equipment, and volatile organic trip blanks will accompany all shipments containing volatile organic water samples. MS/MSDs will be collected at a frequency of 5 percent. In addition, one field blank will be collected upon initiation of the RI sampling activities.

8.2 FIELD MEASUREMENT

Field measurements for VOCs will be recorded for each RI sample using a hand held photo-ionization detector (PID). Field measurements for pH, temperature, dissolved oxygen (surface water) and conductivity will be recorded for each groundwater and surface water sample. All field measurement procedures and criteria will follow Section 4.4.4 of the FW SAP.

8.3 LABORATORY ANALYSIS

Analytical QC/QA procedures will follow those identified in the referenced EPA methodologies. These will include method blanks, LCS, MS, MSD, laboratory duplicate analysis, calibration standards, internal standards, surrogate standards, and calibration check standards as required by specific methods. The laboratories' facilities will conform to their QAMP, facility-specific appendices, and implement their established SOP to perform the various analytical methods required by the project. QC/QA frequencies will follow those identified in Section 8.3 of the FW QAPP.

9.0 DATA REDUCTION, VALIDATION, AND REPORTING

9.1 DATA REDUCTION

Sample collection and field measurements will follow the established protocols defined in the FW QAPP, FW SAP, and the Load Line 9 Remedial Investigation (AOC 42) WP Addendum. Laboratory data reduction will follow the laboratories' QAMP guidance and conform to general direction provided by the FW QAPP.

9.2 DATA VALIDATION

An independent third party will provide laboratory data verification and validation as follows:

- 100% USEPA verification
- 10% USEPA full validation

Following the 10% USEPA full validation, the sample, 10% duplicate and 10% duplicate split will be forwarded to the USACE for review. The USACE will complete its' Chemical Quality Assurance Report (CQAR) in conjunction with receipt of the QA sample analyses as a secondary validation step to the RI program. If there is a failure in the 100% verification, an additional 10% of the data will be validated.

The data validation report will be provided for incorporation into the RI final report.

The address and telephone number for the third party contractor providing data validation services for the Load Line 9 Remedial Investigation RI is as follows:

Purves Environmental
7484 Woodspring Lane
Hudson, OH 44236
Contact: William Purves
Tel: (330) 650-2918
Fax (330) 650-0463

9.3 DATA REPORTING

Analytical data reports will follow the direction provided in the FW QAPP.

10.0 PERFORMANCE AND SYSTEM AUDITS

10.1 FIELD AUDITS

Informal field audits will be conducted on an on-going basis to ensure the consistency of implementation. This includes field training, daily review of field forms and observing field procedures. The MKM QA Officer and/or the MKM Field Team Leader will perform a minimum of one formal field audit for the media being sampled during the investigation. This audit will encompass the sampling of groundwater from the wells, surface water, soils and sediment. USACE, EPA Region V, or Ohio EPA audits may be conducted at the discretion of the respective agency.

10.2 LABORATORY AUDITS

Routine Missouri River Division HTRW CX on-site laboratory audits will be conducted at the discretion of the USACE. EPA Region V or Ohio EPA audits may be conducted at the discretion of the respective agency. Internal performance and systems audits will be conducted by the laboratories QA staff as defined in the laboratories QAMP.

11.0 PREVENTIVE MAINTENANCE PROCEDURES

11.1 FIELD INSTRUMENTS AND EQUIPMENT

Maintenance of all field analytical and sampling equipment will follow direction provided in Section 11.1 of the FW QAPP.

11.2 LABORATORY INSTRUMENTS

Routine and preventive maintenance for all laboratory instruments and equipment will follow the direction of the laboratories QAMP.

12.0 SPECIFIC ROUTINE PROCEDURES TO ASSESS DATA PRECISION, ACCURACY, AND COMPLETENESS

12.1 FIELD MEASUREMENTS DATA

Field data will be assessed as outlined in Section 12.1 of the FW QAPP.

12.2 LABORATORY DATA

Laboratory data will be assessed as outlined in Section 12.2 of the FW QAPP.

13.0 CORRECTIVE ACTIONS

13.1 SAMPLE COLLECTION/FIELD MEASUREMENTS

Field activity corrective action protocol will follow directions provided in Section 13.1 of the FW QAPP.

13.2 LABORATORY ANALYSES

Laboratory activity corrective action protocol will follow directions provided in Section 13.2 of the FW QAPP and the laboratories QAMPs.

14.0 QA REPORTS TO MANAGEMENT

Procedures and reports will follow the protocol identified in Section 14 of the FW QAPP and those directed by the laboratories QAMP.

15.0 REFERENCES

Additional references to the FW QAPP are:

Severn Trent Laboratories, Inc. /Sacramento 1998. *Quality Assurance Management Plan* (QAMP), and Severn Trent Laboratories Laboratory Standard Operating Procedures/QAMP.

GPL Laboratories. *Quality SOP's and Assurance Management Plan* (QAMP),

Draft SAP Addendum for the Remedial Investigation at Load Line 9
Ravenna Army Ammunition Plant
MKM Engineers, Inc. April 2003

Cmt. No.	Comment	Recommendation	Response
	Reviewer Organization (Todd Fisher Ohio EPA)		
1	Ohio Environmental Protection Agency should be abbreviated "Ohio EPA".	Please change "OEPA" to "Ohio EPA" in the abbreviations section and throughout the text where needed.	Noted and changed
2	Section 3.2, Data Quality Objectives, and Section 3.3, Conceptual Site Model – There are several inconsistencies between the stated number of samples in the Section 3.2 when compared to Section 3.3. For example, in Section 3.2, page 3-2, it is stated that 15 soil borings will be drilled and two samples from each boring will be submitted for analysis (30 samples total). But in Section 3.3, under soil samples, it stated that a total of 19 borings will be preformed and 107 surface and subsurface soil samples will be collected.	Please check both sections for consistency, and make the appropriate changes.	Noted and changed to reflect that the 19 samples in Section 3.3 represents 15 soil borings <u>and</u> 4 sub-floor samples.
3	Section 3.7, Define the Study Boundaries, page 3-4 – The spelling of the word "Boundaries" is incorrect in the section heading.	Please correct this heading in the text.	The typographical errors have been corrected.
4	Section 5.1.5, Soil Sampling for Potential VOCs Screening Adjacent to Bldg. DT-33, page 5-5, bulleted item – Please change "THP" to "TPH" in the text.`		Noted and changed
5	Section 5.7, Sediment Sampling, page 5-10 – The first sentence states that "sediment samples will be collected from eleven (11) sample locations throughout Load Line 9," however, in the preceding subsections 5.7.1 through 5.7.3, the sum of all sample locations equal 17.	Please check all sections dealing with sediment collection for consistency, and make the appropriate changes to the text.	Noted and changed total in first sentence of 5.7 to reflect 17 samples.

6	Section 8.4, Risk Assessment, page 8-2 – The text states that "a risk assessment for the Load Line 9 will be conducted using the data collected during the RI. The methodologies, assumptions, and procedures for conduction risk assessments will be consistent with the procedures established at other areas of concern (AOCs)." This statement is incorrect.	This section should be revised to state that "The methodologies, assumptions, and procedures for conducting risk assessments will be consistent with both the Final Facility-Wide Human Health Risk Assessment Work Plan and the Final Facility-Wide Ecological Risk Assessment Work Plan."	Noted and the text has been changed to reflect the use of the FW Documents.
7	Section 9.0, Investigation-Derived waste, page 9-1, second paragraph – the text states that "the investigation derived waste (IDW) from the RI will generally be managed in accordance with Section 7.0 of the FW SAP." What is meant by the word "generally"?	The text should be changed to read "(IDW) from the RI will be managed in accordance with Section 7.0 of the FW SAP."	Noted, the word "generally" has been taken out of the sentence.
8	Appendix B, MKM Position Paper for RI Analytical Suite at LL#9 – The text refers to Table 1 through Table 5. These tables have been omitted from the Appendix.	Please include all tables and figures.	Noted, the tables are located in Appendix A, a reference to this is now included in the text.

Draft SAP Addendum for the Remedial Investigation at Load Line 9
Ravenna Army Ammunition Plant, Ravenna Ohio
MKM Engineers, Inc. April 2003

Cmt. No.	Comment	Recommendation	Response
Reviewer Organization (Paul Zorko, CELRL-ED-E-E)			
1	Page vi: Ms. JoAnn Watson is the new USAEC RM (Restoration Manager)	Replace Derek Romitti with JoAnn Watson and correct spelling of Army.	Noted and changed.
2	Page 1-3, sec 1.6: Add USAEC (U.S. Army Environmental Center) and USACHPPM (U.S. Army Center for Health Promotion and Preventative Medicine) to the list of major parties.		Noted and changed.
3	Page 3-2, sec 3.2, Bullets 11&12: Revise per language in the FWSAP	Delete reference to obsolete CLP procedures and revise.	Noted and deleted.
4	Page 3-4, sec. 3.11Revise Data verification/validation language to reflect the current FWSAP.		Noted and changed.
5	Page 4-3, sec 4.3.5: The FW SAP specifies steam cleaning of drill tools (page 4-44, sec 4.4.2.8). Can you define exactly what a "non-chemical biodegradable agent" is.	Specify steam cleaning of down hole drill equipment and use of a phosphate free detergent as needed.	Noted and changed.
6	Page 4-4, sec. 4.4. The FWSAP specifies top of riser pipe and ground surface as vertical control measurement points. TOC has been used almost exclusively in the past to designate the top of the well casing and not the pro-cover.	To avoid confusion down the road, suggest referencing the top of well casing (TOC) and ground surface elevations only. Delete measurement of the top of the pro-cover.	Noted, however on all field forms TOC is designated as top of outer protective casing and TIC is described as top of inner casing PVC well riser.
7	Figure 5: Is it possible to designate on the plan the area where the VOC screening is		Question 1: The area of the VOC screening will vary based upon the screening results.

	intended in the vicinity of DT-33. Question? What is the possibility of using a Geoprobe with MIP capability for this area?		The initial plan is to begin in the topographically low area to the east of DT-33. Question 2: When the project budget was negotiated, MIP Technology was not available. However, if volatiles are detected during the scoped work, we may approach JMC for additional funding to use this technology.
8	Page 5-4, Sec 5.1.3. Geoprobe use should specify that either a "closed tip" macrocore or the newer dual tube tooling be used when advancing holes below a depth of 4 feet. Below this depth, the risk of cross contaminating a sample from the overlying material is too great.	Suggest specifying dual tube or closed tip tooling for depths in excess of 4 feet.	Noted and added.
9	Page 5-8, sec 5.4.3: The text describing the performance of the slug test implies that the "slug will be lowered into each well and withdrawn quickly" which is not correct.	Rewrite the first paragraph describing the slug in /slug out method intended and the intervening equilibration periods.	Noted and changed. Note that MKM performs falling and rising head slug tests.
10	Page 8-1, sec 8.3 Same as comment 2.	A reference to the revised FWSAP and QAPP would be sufficient.	Noted, the reference has been included.
11	Page 8-2, sec 8.4 The risk assessment section that the completed RVAAP Eco Risk Plan and the Draft final HH Risk Work Plan.	Reference that the RA's will be completed using the FW guidance	Noted and added.
12	Sec 10.0 Add references to the HH and Eco risk work plans.		Noted and added.

13	QAPP addendum, Table 1-1 The planned analytical suites are absent from the QC section	Footnote Table 1-1 to indicate which lab methods each QA/QC sample type will be subjected to.	Noted, the table has been footnoted.