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14. ABSTRACT

The Work Plan describes activities to be performed by Prudent to conduct subsurface MI sampling at Load Lines 1, 2, 3, 4 and Other Areas of Concern, to prepare a land use control assessment / cost analysis report, to conduct additional remediation (should it be required), and to prepare a closure report including a ROD Addendum.

15. SUBJECT TERMS
Project Work Plan, Field Sampling Plan, Site Safety and Health Plan, Quality Assurance Project Plan, Storm Water Pollution Prevention Plan, Load Lines 1, 2, 3, 4, Subsurface MI Sampling, Land Use Controls, Unrestricted National Guard Scenario

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Final Work Plan for Sampling & Closure of Load Lines 1, 2, 3, 4, 12 (RVAAP- 08, 09, 10, 11, and 12) and Other Areas of Concern

Ravenna Army Ammunition Plant
Ravenna, Ohio

Contract No. W912QR-10-P-0037

Prepared for:

US Army Corps of Engineers

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July 30, 2010

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

Prudent Technologies, Incorporated (Prudent) has completed the Project Management Plan and Work Plan for the Sampling and Closure of Load Lines 1, 2, 3, 4, 12 and Others at the Ravenna Army Ammunition Plant, Ravenna, Ohio. Notice is hereby given that an independent technical review has been conducted that is appropriate to the level of risk and complexity inherent in the project. During the independent technical review, compliance with established policy principles and procedures, utilizing justified and valid assumptions, was verified. This included review of data quality objectives; technical assumptions; methods, procedures, and materials to be used; the appropriateness of data used and level of data obtained; and reasonableness of the results, including whether the product meets the customer's needs consistent with law and existing United States Army Corps of Engineers policy.

John P. Jent

John P. Jent, P.E. Project Manager	July 30, 2010 Date
Mark Snyder, P.E. Independent Technical Review Team Leader	July 30, 2010 Date
Prakash Raja, CHMM Program Manager	July 30, 2010 Date

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COR – Contracting Officer’s Representative
USACE – U.S. Army Corps of Engineers
RVAAP – Ravenna Army Ammunition Plant
OEPA – Ohio Environmental Protection Agency
OHARNG – Ohio Army National Guard
REIMS – Ravenna Environmental Information System
USAEC – U.S. Army Environmental Command

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ACRONYMS AND ABBREVIATIONS

ACSIM	Assistant Chief of Staff for Installation Management
AEC	Army Environmental Command
AOC	Area of Concern
bgs	Below ground surface
BRACD	Base Realignment and Closure Division
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COR	Contracting Officer Representative
CUG	Clean-up Goal
CUGadj	Cleanup Goal, adjusted
CUGIROD	Cleanup Goal from IROD
CPR	Cardio Pulmonary Resuscitation
DFFOs	Director's Final Findings and Orders
DNT	Dinitrotoluene, also 2,4-Dinitrotoluene
DOT	Department of Transportation
DMM	Discarded Military Munitions
EPA	Environmental Protection Agency
ESS	Explosives Safety Submission
FS	Feasibility Study
FSP	Field Sampling Plan
FWSAP	Facility-Wide Sampling and Analysis Plan
GPS	Global Positioning System
HASP	Health and Safety Plan (or Safety and Health Plan)
HAZWOPER	Hazardous Waste Operations and Emergency Response
IDW	Investigation-Derived Waste
IROD	Interim Record of Decision
JOAAP	Joliet Army Ammunition Plant
JSA	Job Safety Analysis
MEC	Munitions and Explosives of Concern
MI	Multi-increment
NGB	National Guard Bureau
OHARNG	Ohio Army National Guard
Ohio EPA	Ohio Environmental Protection Agency
OSHA	Occupational Safety and Health Administration
PAH	Polycyclic aromatic hydrocarbon
PCB	Polychlorinated biphenyl
PCP	Project Coordination Plan
PID	Photo ionization detector
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RAB	Restoration Advisory Board
RCRA	Resource Conservation and Recovery Act
RDX	Royal Demolition Explosive (1,3,5-Trinitroperhydro-1,3,5-triazine; Cyclotrimethylenetrinitramine)
REIMS	Ravenna Environmental Information Management System
RI	Remedial Investigation

RTLS	Ravenna Training and Logistics Site
RVAAP	Ravenna Army Ammunition Plant
SRC	Site-Related Contaminant
SWPPP	Storm Water Pollution Prevention Plan
TCLP	Toxicity Characteristic Leaching Procedure
TNT	Trinitrotoluene (2,4,6-Trinitrotoluene)
SOW	Scope of Work
USACE	United States Army Corps of Engineers
USATCES	United States Army Technical Center for Explosives Safety
USP&FO	United States Property and Fiscal Officer
UXO	Unexploded Ordnance
VOC	Volatile Organic Compound

1.0 – BACKGROUND

1.1 PROJECT BACKGROUND AND SUMMARY

About twelve years ago, the buildings at Load Lines 1-4 were demolished, but with massive elevated floor slabs and foundations left in place. About seven years ago, large-scale remediation began at Load Lines 1-4 with an assumed future land use of National Guard training and with the floor slabs assumed to be left in place. Remediation of areas outside of the building footprints was conducted to facilitate training of the Ohio Army National Guard under a set of exposure assumptions for that training. About the time that remediation was being completed, additional Army funding became available which allowed for the removal of the floor slabs and foundations; additionally, the set of assumptions associated with the National Guard training had to be modified to account for changes in mission and training. Within the past several years, the floor slabs and most of the foundations have been removed (by PIKA International, Inc., 2008-2009), and another contractor (URS Corporation, 2008-2010) tested, and where necessary, is remediating the soils beneath the former building slabs. Subsurface characterization was restricted to a depth of 4 feet due to the sampling method utilized. Remediation of all areas (both within and outside building areas) and all media except groundwater is currently taking place at Load Line 12.

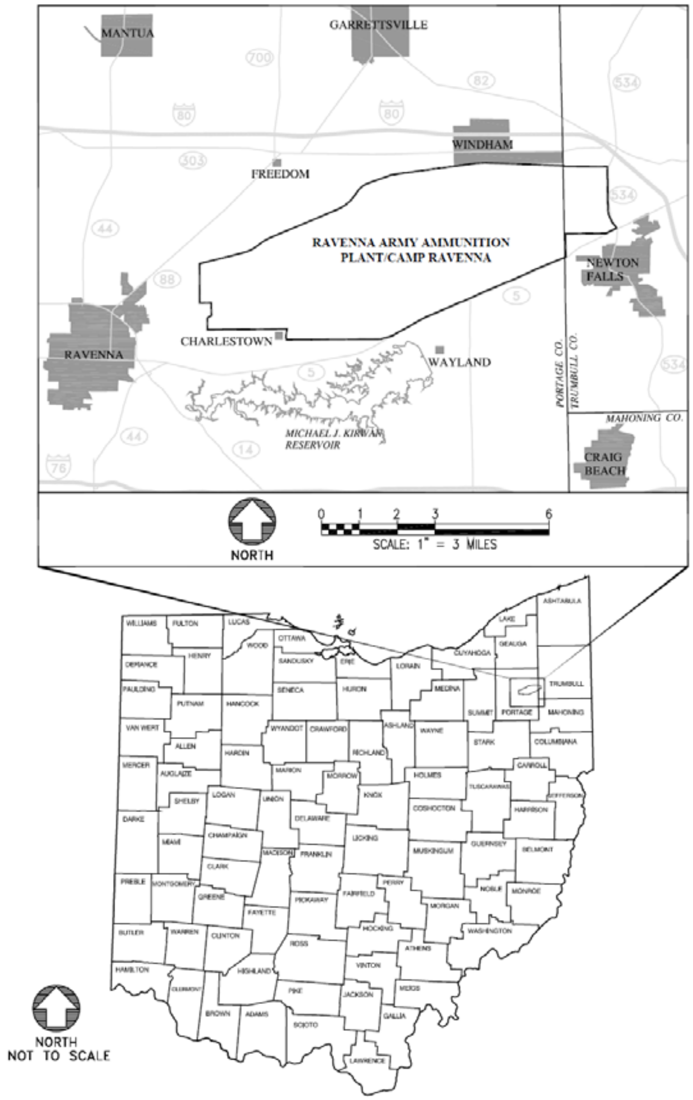
In this project, Prudent Technologies, Inc. (Prudent) is tasked with performing deeper characterization of the subsurface materials beneath the former building slabs via subsurface multi-increment sampling. Innovative means of performing this comprehensive sampling will be performed in an efficient and cost effective manner. Subsequent to that sampling, Prudent will compile all previous environmental sampling and evaluate that data against a more stringent set of cleanup goals that will reduce the land use restrictions for the OHARNG. Should additional remediation be required, Prudent will perform that work. The results of this work will be presented in a closure document, which will be adequate to transfer the property to the NGB with the goal of Unrestricted National Guard Trainee Use.

1.2 GENERAL FACILITY DESCRIPTION

When the RVAAP Installation Restoration Program (IRP) began in 1989, RVAAP was identified as a 21,419-acre installation. The property boundary was resurveyed by OHARNG over a 2-year period (2002 and 2003) and the total acreage of the property was found to be 21,683.289 acres. As of February 2006, a total of 20,403 acres of the former 21,683-acre RVAAP has been transferred to the National Guard Bureau (NGB) and subsequently licensed to OHARNG for use as a military training site.

The current RVAAP consists of 1,280 acres scattered throughout the OHARNG Camp Ravenna Joint Military Training Center (Camp Ravenna). Camp Ravenna is in northeastern Ohio within Portage and Trumbull Counties, approximately 3 miles (4.8 km) east-northeast of the City of Ravenna and approximately 1 mile (1.6 km) northwest of the City of Newton Falls. The RVAAP portions of the property are solely located within Portage County. RVAAP/Camp Ravenna is a parcel of property approximately 11 miles (17.7 km) long and 3.5 miles (5.6 km) wide bounded by State Route 5, the Michael J. Kirwan Reservoir, and the CSX System Railroad on the south; Garret, McCormick, and Berry roads on the west; the Norfolk Southern Railroad on the north; and State Route 534 on the east. Camp Ravenna is surrounded by several communities: Windham on the north; Garrettsville 6 miles (9.6 km) to the northwest; Newton Falls 1 mile (1.6 km) to the southeast; Charlestown to the southwest; and Wayland 3 miles (4.8 km) to the south. The property location is depicted in Figure 1-1.

Figure 1-1 RVAAP Location & General Vicinity Map



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

Industrial operations at the former RVAAP consisted of 12 munitions-assembly facilities referred to as "load lines." Load Lines 1 through 4 were used to melt and load 2,4,6-trinitrotoluene (TNT) and Composition B into large-caliber shells and bombs. The operations on the load lines produced explosive dust, spills, and vapors that collected on the floors and walls of each building. Periodically, the floors and walls were cleaned with water and steam. Following cleaning, the wastewater, containing TNT and Composition B, was known as "pink water" for its characteristic color. Scupper systems were used to collect pink water, which was contained in concrete holding tanks, filtered, and pumped into unlined ditches for transport to earthen settling ponds. However, in some instances, pink water was swept from doorways, or scupper systems overflowed onto the ground surface. Load Lines 5 through 11 were used to manufacture fuzes, primers, and boosters. Potential contaminants in these load lines include lead compounds, mercury compounds, and explosives. From 1946 to 1949, Load Line 12 was used to produce ammonium nitrate for explosives and fertilizers prior to use as a weapons demilitarization facility.

In 1950, the facility was placed in standby status and operations were limited to renovation, demilitarization, and normal maintenance of equipment, along with storage of munitions. Production activities were resumed from July 1954 to October 1957 and again from May 1968 to August 1972. In addition to production missions, various demilitarization activities were conducted at facilities constructed at Load Lines 1, 2, 3, and 12. Demilitarization activities included disassembly of munitions and explosives melt-out and recovery operations using hot water and steam processes. Periodic demilitarization of various munitions continued through 1992.

In addition to production and demilitarization activities at the load lines, other facilities at RVAAP include AOCs that were used for the burning, demolition, and testing of munitions. These burning and demolition grounds consist of large parcels of open space or abandoned quarries. Potential contaminants at these AOCs include explosives, propellants, metals, and waste oils. Other types of AOCs present at RVAAP include landfills, an aircraft fuel tank testing facility, and various general industrial support and maintenance facilities.

1.3 DESCRIPTIONS OF PROJECT AOCS AND PREVIOUS REMEDIATION

The areas of concern for this project are Load Lines 1, 2, 3, and 4 (Figures 1-2 through 1-5). Industrial operations at these locations consisted primarily of melting and loading trinitrotoluene (TNT) and Composition B (TNT and RDX) into large caliber shells.

From 1941 to 1971 building wash-down water and wastewater from load line operations was collected in concrete sumps, pumped through sawdust filtration units, and then discharged to either a settling pond or to drainage ditches leading to a settling pond.

The operations of these load lines produced explosive dust, spills, and vapors that collected on the floors and walls of the process buildings. Periodically, the floors and walls were cleaned with water and steam. The resulting liquid contained TNT and Composition B and was known as “pink water” because of its characteristic color.

A performance-based contract was awarded to Shaw E & I in September 2003 to complete an interim soil and dry sediment removal at areas outside the building footprints at Load Lines 1 through 4. The Remedial Investigations/Feasibility Studies (RIs/FSs), as well as remedial actions (RAs), are complete; an Interim Record of Decision (IROD) has been signed. The IROD included a provision to periodically inspect remaining slabs and foundations to ensure their integrity until their removal. In January, 2008, BRACD sent correspondence detailing the agreed upon approach for slab removal (US Army, 2008). The Army will document the slab removal and any removal actions of contaminated soil in the final Record of Decision (US Army, 2008).

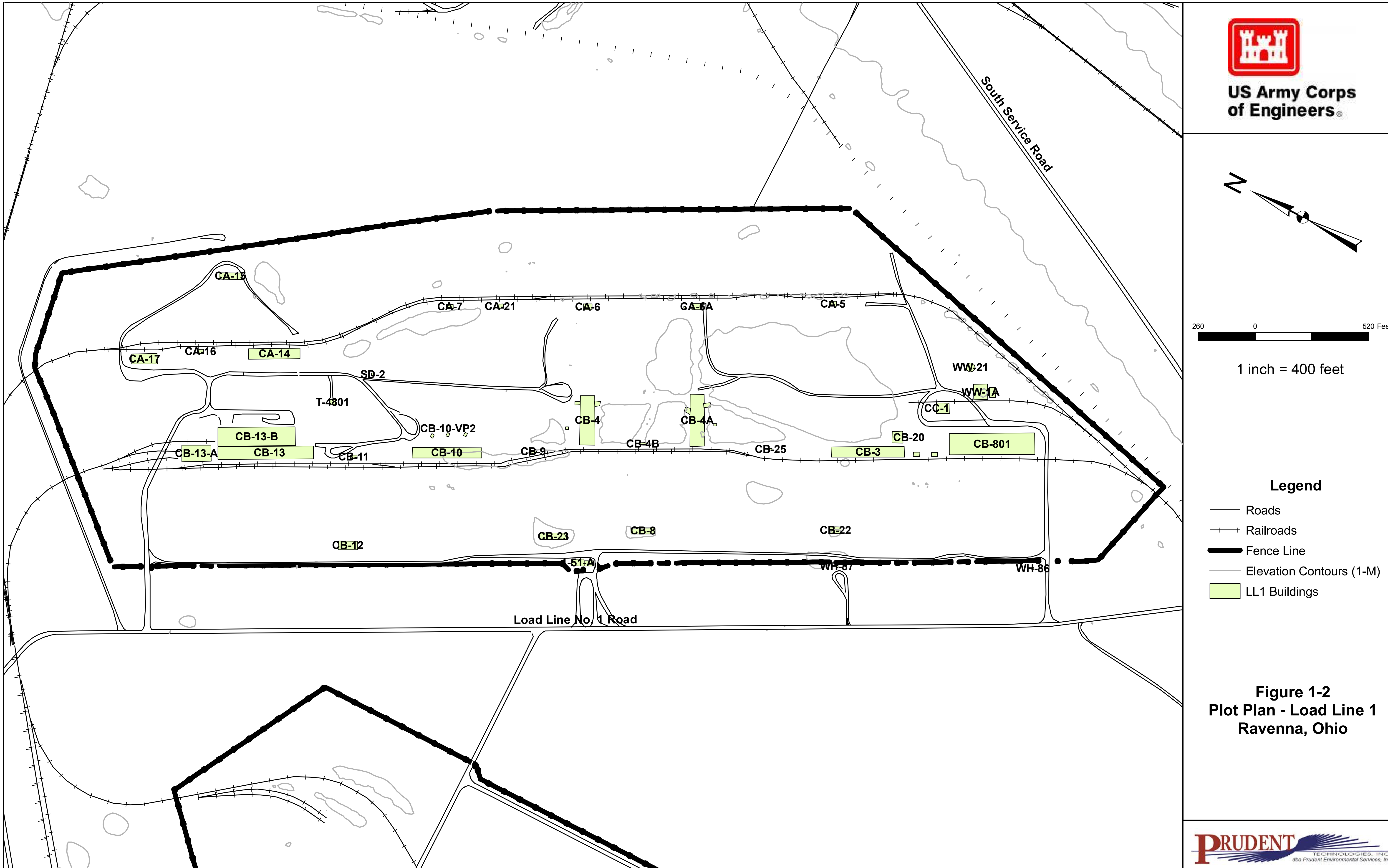


Figure 1-2
Plot Plan - Load Line 1
Ravenna, Ohio

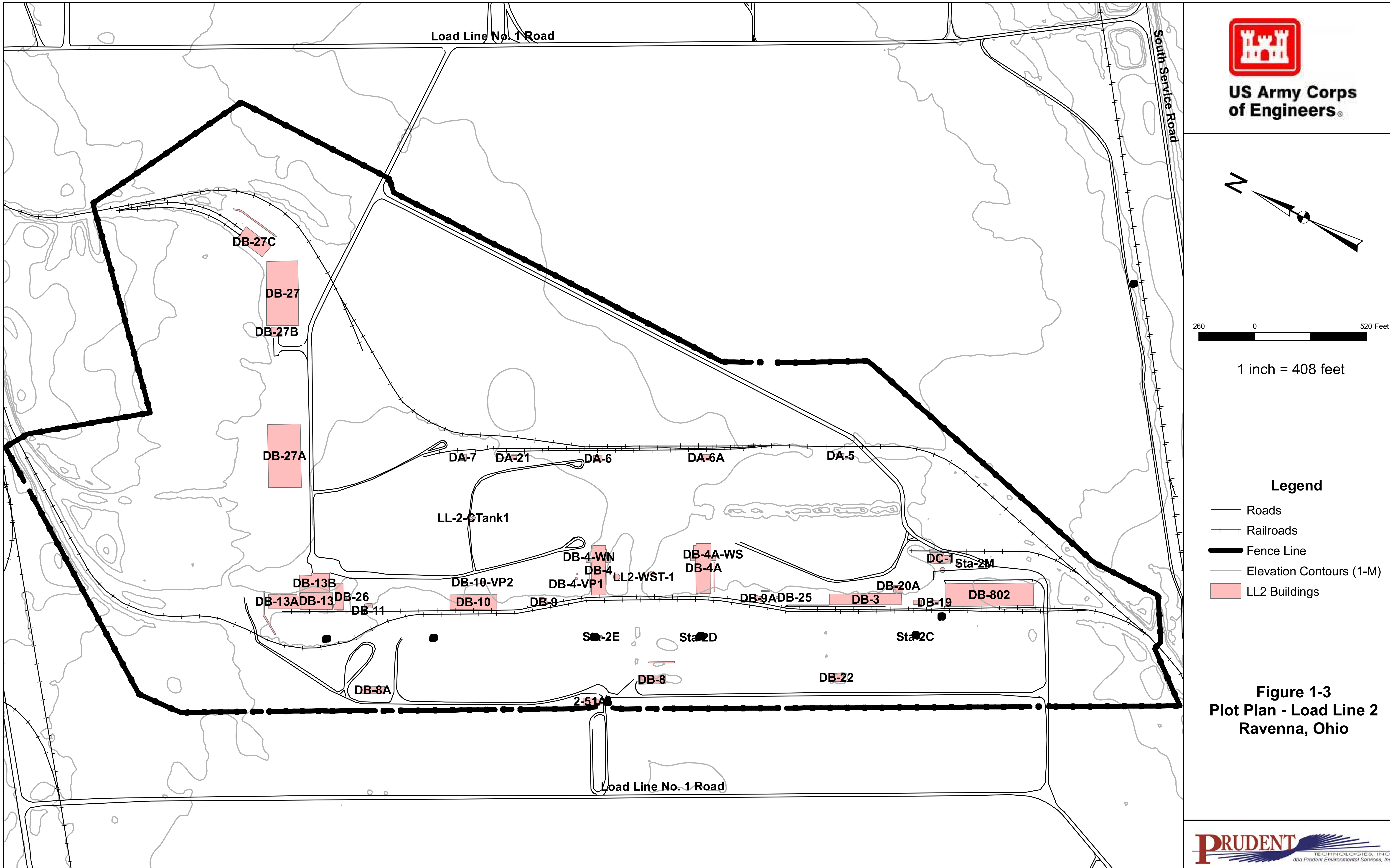


Figure 1-3
Plot Plan - Load Line 2
Ravenna, Ohio

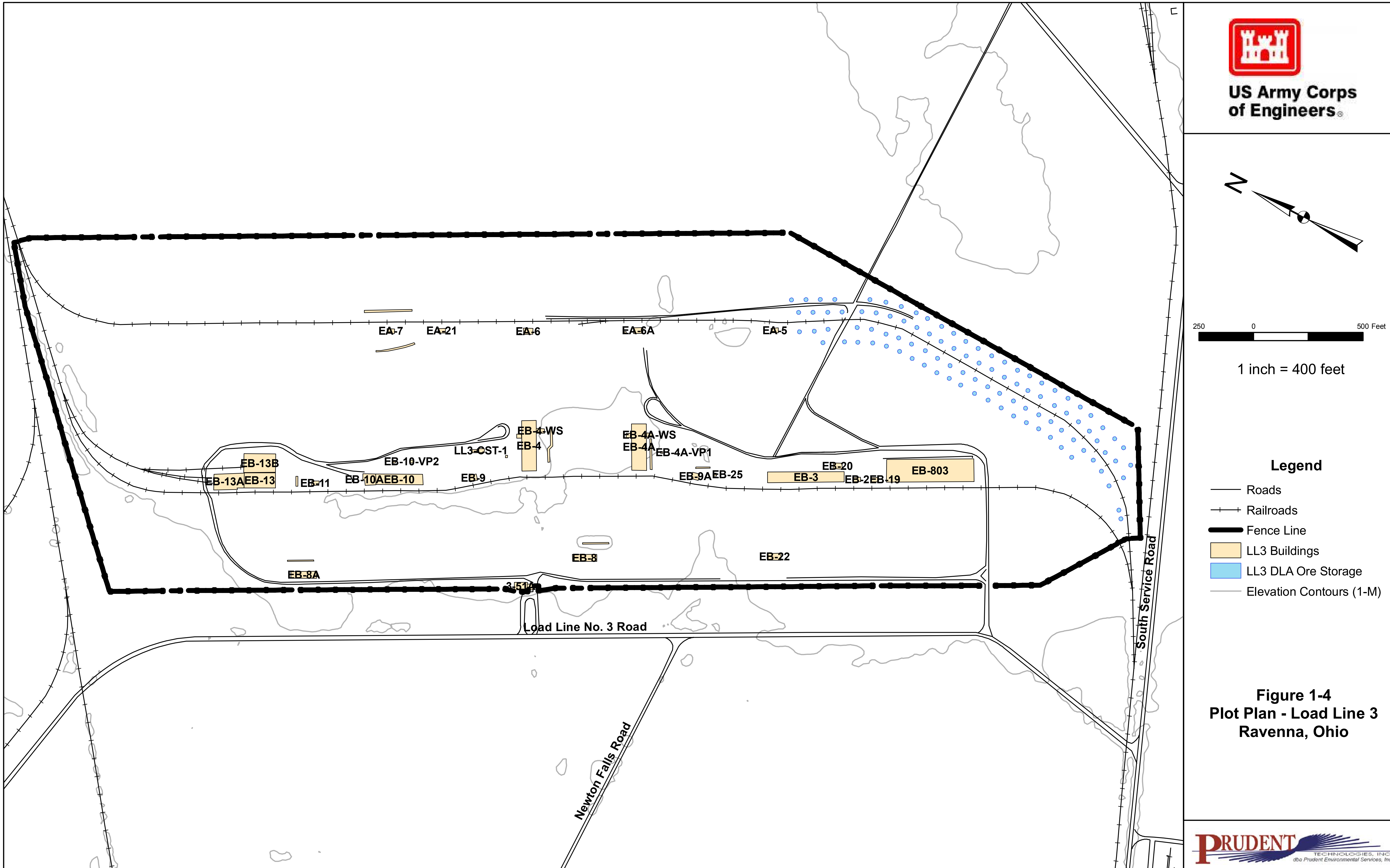


Figure 1-4
Plot Plan - Load Line 3
Ravenna, Ohio

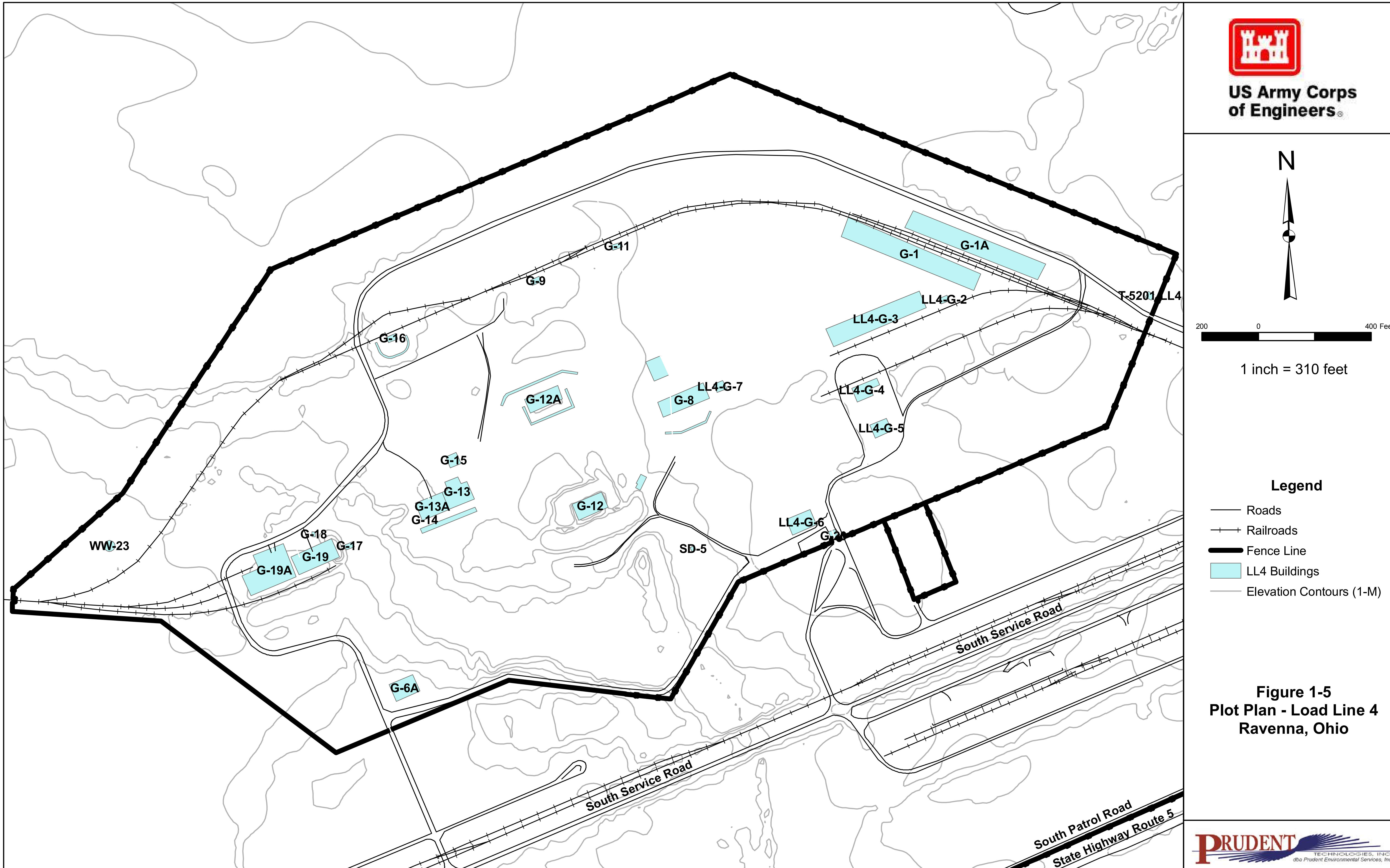


Figure 1-5
Plot Plan - Load Line 4
Ravenna, Ohio

Site-related contaminants (SRCs) identified in soils at the load lines included the following: inorganics (aluminum, antimony, arsenic, barium, cadmium, hexavalent chromium, and manganese), explosives (TNT and RDX), polychlorinated biphenyls (PCBs), and semivolatile organic compounds (SVOCs). The semivolatile SRCs included the following polycyclic aromatic hydrocarbons (PAHs): benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and dibenz(a,h)anthracene. Based on assessments completed during the RIs for the four load lines, explosives are mobile in water and may potentially leach from soils. Inorganics, PCBs, and the PAHs are not expected to readily leach from soils; however, such contaminates may extend into the subsurface via discrete cracks in natural ground, in man-made fill areas, and in pervious backfill surrounding structures,such as manholes or pipes, buried in the ground. The RI analytical data indicated that Load Line 1 is the most contaminated of the four load lines as evidenced by the widest variety of contaminants detected, the highest frequencies of detection, and the highest COC concentrations. Load Line 4 is the least contaminated of the four load lines (Shaw, 2007).

The planned future land use utilized for the IROD for Load Lines 1 through 4 and Load Line 12 was for the National Guard Trainee. A new, more versatile land use, “Unrestricted National Guard Trainee” is now under consideration.

Under contract to the Army Environmental Command (AEC), Shaw E & I completed its remediation of surface soils and dry sediments outside the footprints of the buildings at Load Lines 1, 2, 3, and 4. Demolition of building superstructures at Load Lines 2, 3, and 4 was completed in winter 2007. A contract line item to remove the building slabs was exercised in winter 2007. As required by the IROD for soil remediation at Load Lines 1 through 4, the Army committed to performing periodic inspections of the concrete building slabs and building foundations to ensure their integrity had not been compromised. This was done to prevent infiltration to potentially contaminated soil underlying the slabs and foundations. However, the IROD also recognized that the Army would eventually remove the building slabs (Shaw, 2007).

The Ohio EPA raised questions regarding how the slabs would be removed, identification of associated environmental controls to minimize the potential spread of contamination, and soil sampling protocols. The Ohio EPA also identified that further remedial action might be needed for soil under the slabs, depending on the analytical results.

In late 2007, BRACD funded an option to its demolition contractor (PIKA International, Inc.) for removal of slabs at Load Lines 2, 3, and 4. In order to proceed with removal of the slabs and foundations at this time, the Army funded URS to address the issues raised by the Ohio EPA. URS evaluated potential contamination, via field screening, below the floor slabs and excavated and transported contaminated earth fill materials above the chemical-specific cleanup levels for TNT and RDX. After removal of the contaminated materials identified in the early stage of the project, final MI sampling over all excavated floor slab areas was performed and where results indicated exceedances of clean-up levels, additional soil excavation is to be performed with approval from the USACE and Ohio EPA.

1.4 PREVIOUS CHARACTERIZATIONS

1.4.1 Outside Building Footprints

Environmental conditions outside of or beyond the building footprints at Load Lines 1-4, and 12 have been documented in the following documents,

- RIs of Load Lines 1-4; SAIC 2003, Shaw 2004(a,b,c)

- Final Remedial Action Completion Report for the Remediation of Soils and Dry Sediments at Load Lines 1-4, Shaw 2008.
- Site Inspection Report Ravenna Army Ammunition Plant Ohio, Military Munitions Response Program, May 2008.

1.4.2 Within Building Footprints

1.4.2.1 RI Information

A limited number of soil samples were collected from locations beneath the building slabs and analyzed for SRCs during the completion of the RIs conducted for these load lines (SAIC 2003,Shaw, 2004a; b; c). Results of this sampling indicated that soil beneath the building sub-floors was generally uncontaminated. However, this conclusion was somewhat unsubstantiated as it was based on a limited data set. Details of the sampling performed are described as follows:

Load Line 1

Minimal sub-slab sampling was performed at Load Line 1 during the Phase II RI (SAIC, 2003). Soil samples were collected from beneath the floor slabs at six buildings (CB-4, CB-4A, CA-6, CA-6A, CB-10, and CB-13). The RI report concluded that the areas under the floor slabs showed little contamination. However, based upon data review and Ohio EPA comments regarding the RI, no firm conclusions could be drawn from the limited amount of data obtained. The nature and extent of sub-slab contamination was not fully delineated during the course of the RI.

Load Line 2

Seventeen samples of soil beneath building floor slabs were collected and analyzed for field explosives and target analyte list (TAL) metals. All soil field results for TNT and RDX were at concentrations less than 1 mg/kg; thus, no sub-floor soil samples were submitted for fixed-base laboratory analysis of explosives. The TAL metal concentrations in all samples generally reflected an absence of inorganic contamination that may be attributed to facility operations. Maximum detected concentrations of six metals (aluminum, barium, chromium, iron, manganese, vanadium) were below the installation-specific background criteria. Concentrations of antimony, arsenic, beryllium, cadmium, calcium, cobalt, copper, lead, magnesium, mercury, nickel, potassium, selenium, sodium, thallium, and zinc were generally below background criteria. For these metals, only a few detections (no more than two out of 17) were above their respective background criteria. Thallium was detected in almost all samples, but was not detected in background. The detections of thallium were all less than 1 mg/kg. Copper was also detected in most (10 of 17) of the samples above the background criteria. The highest concentration of copper detected was 25.9 mg/kg, a result slightly above the background criteria of 17.7 mg/kg.

Load Line 3

Twelve samples of soil beneath building floor slabs were collected and analyzed for field explosives and TAL metals. The TAL metal concentrations in all samples generally reflected an absence of inorganic contamination that may be attributed to facility operations. Maximum detected concentrations of twelve metals (aluminum, arsenic, barium, beryllium, chromium, cobalt, manganese, mercury, nickel, selenium, sodium, vanadium) were below the installation specific background criteria. Concentrations of calcium, iron, lead, magnesium, potassium, and zinc were generally below background criteria. For these metals, only a few detections (no more than four out of 12) were above their respective criteria. Copper was detected in most (nine of 12) of the samples above the background criteria. The highest concentration of copper detected was 25.5 mg/kg, a result slightly above the background criteria of 17.7 mg/kg. Cadmium was detected in all 12 samples, but was not detected in background samples. The highest concentration of cadmium detected was 0.42 mg/kg. Low detectable concentrations of thallium were also observed in some samples (thallium was not detected in background).

Four samples were analyzed for explosives. Field analytical results were 8.9 mg/kg for RDX at sample LL3-069 and 1.3 mg/kg for station LL3-123; thus, these samples were submitted for fixed-base laboratory analysis for explosives. Trace levels of 2, 4-dinitroluene (DNT) (0.38 mg/kg) and TNT (0.98 mg/kg) were detected in the sample collected from station LL3-123 (Building EB-4A). Two additional samples from station LL3-061 and LL3-094 were also submitted for laboratory analysis of explosives for confirmation purposes; trace levels of DNT (0.31 to 0.35 mg/kg) and TNT (0.063 to 0.13 mg/kg) were also detected in these samples.

Load Line 4

Nine samples of soil beneath building floor slabs were collected and analyzed for field explosives and TAL metals. All field results for TNT and RDX were nondetect; thus, no subfloor soil samples were submitted for fixed-base laboratory analysis of explosives. Most TAL metal concentrations in sub-floor soil samples were less than RVAAP background values. Copper, magnesium, and zinc were generally greater than background concentrations.

1.4.2.2 Data from Floor Slab Removal Monitoring

1.4.2.2.A Rationales for Building Classification

Information received from the USACE Technical Manager for the Joliet Army Ammunition Plant (JOAAP) remediation project (Mr. Andrew B. Evens) indicated that buildings at Joliet that had direct contact with the handling of explosive powder, melting, and loading were the buildings that represented the highest impact. Very little impact was observed at the remainder of the buildings. In addition, any location that presented a mechanism to move the explosives material could be of concern. At the load lines, that mechanism would be water; therefore, sumps would represent a higher concern for residual explosives contamination. The remediation information for the JOAAP revealed that minimal to no soil excavation (i.e., excavation to no greater than 1-foot below ground surface (bgs)) was required at some areas of concern, while extensive soil excavation (up to 9 feet bgs) was required at other areas of concern. Review of the remediation closure report for JOAAP revealed that areas requiring extensive excavation and removal were clustered near the melt-pour buildings (MHW, 2006). Table 1-1 provides a summary of soil excavation depths for the various areas of concern at JOAAP.

Although only a limited amount of data representative of the sub-slab environmental conditions at Load Lines 1, 2, 3, and 4 at RVAAP are available, the complete RI data set provides valuable insight for the purpose of planning a sub-slab soil sampling plan. It can be hypothesized for planning purposes that contamination outside and near buildings may be predicative of sub-slab contamination, and those areas should be sampled accordingly. The RI data highlight areas of highest concentrations of the SRCs, the extent of migration from surface to subsurface soils, areas of highest frequencies of SRC detections (e.g., near specific aggregate areas or along directional building perimeters), and the presence or absence of specific classes of SRCs (such as explosives, propellants, VOCs, SVOCs, PCBs or pesticides). Tables summarizing this information for each load line were prepared by (Shaw, 2004 a,b,c).

Table 1-1 Summary of Soil Excavation Depths at Joliet Army Ammunition Plant

Building #	Building Description	No Soil Excavation	Shallow Surface Contamination Only (i.e., < 1 ft.)	Contamination Deeper than 1.0 ft. (i.e. 2 to 9 ft)(1)
L7, 1-5A	Service Magazine	X		
L7, 1-7	TNT Screening Magazine	X		
L8, 2-7	TNT Service Magazine	X		
L8, 2-37	Washout Building	X		
L8, 2-12	Assembling & Shipping	X		
L9, 3-45	Washout Building	X		
L9, 3-3	Receiving & Painting Building	X		
L9, 3-3A	Inert Storage Building	X		
L10, 3A-10	Assembly, Packing & Shipping	X		
L10, 3A-7B	TNT Service Magazine	X		
L10, 3A-16A	Cooling Building	X		
L7, 1-5B	Service Magazine		X	
L9, 3-38F	Barricade		X	
L9, 3-7	TNT Screening Magazine		X	
L7, 1-10	Drilling & Boostering and X-Ray			X
L10, 3A-13	H.E. Screening Building			X
L10, 3A-5	N.A. Service Magazine			X
L7, 1-40C	Sump Platform & Washout Building			X
L8, 2-4	Melt Load Building			X
L8, 2-16	Cooling & Loading Building			X
L7, 1-4	Melt Load Building			X
L7, 1-16	Cooling Building			X
L9, 3-4	Melt Load Building			X
L9, 3-5A	Supplementary Charge			X
L10, 3A-47	Sump Building & Pump House			X
L9, 3-4 (2)	Melt Load Building			X
L10, 3A-12	Topping Building			X
L8, 2-40B	Settling Chamber			X
L7, 1-40A	Sump Platform & Washout			X
L9, 3-37	Washout Building 7 Sump			X
L10, 3A-41	Pelleting Building			X
L10, 3A-44	Screen & Blend Building			X
L10, 3A-45	Wash & Dry Building			X
L8, 2-6	TNT Screening			X
L9, 3-6	TNT Screening Building			X
L10, 3A-43	Vacuum Collection Building			X
L7, 1-6	TNT Screening			X
L10, 3A-4	Melting & Pour Building			X

(1) Depths to 9 feet were at sumps and manways

Table 1-2 Classification of Buildings at Load Line 1
Ravenna, Ohio

High Potential for Explosives Contamination Sampling Regime: Field Screening (4' Cores) and MI Confirmatory Sampling[(1,2)]	Medium Potential for Explosives Contamination Sampling Regime: 1 Field Screening Sample, MI Confirmatory Sampling	Low Potential for Explosives Contamination Sampling Regime: 1 Field Screening Sample, MI Confirmatory Sampling
CB-4 Melt Load (Propellants) (PCBs)	CB-2 Truck Maintenance (SVOCs)	CC-1 Powerhouse No.1
CB-4A Melt Load (Propellants, PCBs, SVOCs)	CB-3 Shell Receiving (SVOCs, PCBs) (3)	CB-8 Change House
CA-6 Explosive Preparation (Propellants)	CB-4B Conveyor Drive House	CA-15 Change House
CA-6A Explosive Preparation (Propellants)	CA-5 Service	CB-20 Tool Storage
CB-4 WN Washout Annex for Bldg. CB-4 (Propellants)	CA-7 Service	CB-801 Inert Storage
CB-4 WS Washout Annex for Bldg. CB-4 (Propellants)	CB-9 Service	1-51 Clock Alley
CB-4 AWN Washout Annex for Bldg. CB-4A (Propellants)	CB-11 Service	1-51A Line Office
CB-4 AWS Washout Annex for Bldg. CB-4A (Propellants)	CA-16 Service	T-4801 Boiler House
CB-10 Drill & Assembly and Munitions Rehabilitation (Propellants, PCBs)	CB-19 Electric Locomotive Service	
CB-13/13A Packing & Shipping (Propellants)	CA-21 Service	G-1 Inert Storage
CB-13B Shipping Warehouse Annex (Propellants)	CB-25 Washout (to unknown source) (3)	G-1A Inert Storage
CA-14 Propellant Charge (Propellants)	CA-28 Elevator Machine House	G-3 Receive and Paint
CA-17 Propellant Charge Receiving (Propellants)	CA-28A Elevator Machine House	
CB-10 VP1 Vacuum Pump House		
CB-10 VP2 Vacuum Pump House	EB-803 Inert Storage	
CB-10 VP3 Vacuum Pump House		
CB-4 VP1 Vacuum Pump House		
CB-4A VP1 Vacuum Pump House		
F-15 Explosive and Propellant Testing (Propellants)		
F-16 Explosive and Propellant Testing (Propellants)		

(1) All confirmatory MI samples to be analyzed for explosives and metals. Additional analyses shown in parentheses on a building-by-building basis. Additional analyses to meet 10% full suite requirement are included in Table 3-5. Buildings not located at Load Line 1 are *italicized*.
(2) VOCs: Volatile organic compounds, SVOCs: Semivolatile organic compounds, PCBs: Polychlorinated biphenyls
(3) Multiple field screening samples will be collected from this building footprint as described in Section 3.6.3
(4) Inspections conducted during slab removal (April 21, 2009 through June 25, 2009) indicated that Buildings CA-6VP1 are not separate buildings, but were incorporated as one slab with Building VA-6 and CA-6A. Buildings CB-12, CB-22 and CB-23 were not included in the slab removal project. Their footprints have been covered with hard fill. These five building footprints have been removed from the sampling scope.

Table 1-3 Classification of Buildings at Load Line 2
Ravenna, Ohio

High Potential for Explosives Contamination Sampling Regime: Field Screening (4' Cores) and MI Confirmatory Sampling(1)	Medium Potential for Explosives Contamination Sampling Regime: 1 Field Screening Sample, MI Confirmatory Sampling(1)	Low Potential for Explosives Contamination Sampling Regime: 1 Field Screening Sample, MI Confirmatory Sampling(1)
DB-4 Melt Load	DC-1 Powerhouse No. 2 (SVOCs)	DB-802 Inert Storage (SVOCs)
DB-4A Melt Load (PCBs, SVOCs)	DB-2 Service	DB-4A VP1 Vacuum Pump House
DA-6 Explosive Preparation	DB-3 Shell Receiving (VOCs, SVOCs, PCBs)	DB-4 VP1 Vacuum Pump House
DA-6 A Explosive Preparation	DB-4WM Washout Annex (PCB's)	DB-8 Change House
	DB-4A WM Washout Annex (PCBs, SVOCs)	DB-8A Change House
	DB-4A WS Washout Annex (PCBs, SVOCs, VOCs, Propellants)	DB-10VP2 Vacuum Pump House
	DA-5 Ammonium Nitrate Service	DB-13 Packing & Shipping
	DA-7 TNT Service	DB-13A Barricade Shipping
	DB-9A Booster Service	DB-13B Shipping Warehouse Annex
	DB-9A Booster Service	DB-22 Change House
	DB-11 Fuze Service	DB-27 Cyclic Heat Building #2
	DB-19 Electric Motor Service	DB-27A Cyclic Heat Building #1 (SVOCs)
	DB-20 Gage Laboratory	DB-27B Boiler Plant
	DA-21 TNT Box/Service	DB-27C Shipping Building
	DB-25 Washout for Composition B and TNT	DA-28 Elevator Machine House
	DB-26 Radiographic (PCBs)	DA-28 Elevator Machine House
		DB-29 Elevator Machine House
		DB-30 Elevator Machine House
		2-51 Clock Alley
		2-51A Line Office

(1) All confirmatory samples to be analyzed for explosives and metals. Additional analyses shown in parentheses on a building-by-building basis. Additional analyses to meet 10% full suite requirement are included in Table 3-9. VOCs: Volatile organic compounds, SVOCs: Semivolatile organic compounds, PCBs: Polychlorinated biphenyls

Table 1-4 Classification of Buildings at Load Line 3
Ravenna, Ohio

High Potential for Explosives Contamination Sampling Regime: Field Screening (4' Cores) and MI Confirmatory Sampling(1)	Medium Potential for Explosives Contamination Sampling Regime: 1 Field Screening Sample, MI Confirmatory Sampling(1)	Low Potential for Explosives Contamination Sampling Regime: 1 Field Screening Sample, MI Confirmatory Sampling(1)
EB-4 Melt Load (PCBs)	EB-2 Service	EB-4VP1 Vacuum Pump House
EB-4A Melt Load (Propellants, VOCs, SVOCs, PCBs)	EB-3 Shell Receiving (SVOCs, VOCs, Propellants, PCBS)	EB-4A VP1 Vacuum Pump House
EA-6 Explosive Preparation (PCBs, SVOCs)	EB-4 WN Washout Annex for Bldg. EB-4	EB-8 Change House
EA-6A Explosive Preparation	EB-4WS Washout Annex for Bldg. EB-4	EB-8A Change House
EB-10 Drill & Assemble (VOCs, PCBs)	EB-4A WN Washout Annex for Bldg. EB-4A	EB-10 VP1 Vacuum Pump House
	EB-4A WS Washout Annex for Bldg. EB-4A (SVOCs)	EB-10 VP2 Vacuum Pump House
	EA-5 Ammonium Nitrate Service	EB-13 Packing & Shipping
	EA-7 TNT Service	EB-13A Barricade Shipping
	EB-9 Booster Service	EB-13B Shipping Warehouse Annex
	DB-9A Booster Service	EB-20 Line Office
	EB-10A Radiographic (PCBs)	EB-22 Change House
	EB-11 Fuze Service (PCBs)	EA-28 Elevator Machine House
	EB-19 Electric Locomotive Service	EA-28A Elevator Machine House
	EA-21 TNT Box/Service (PCBs, Propellants)	EB-26 Elevator Machine House
	EB-25 Washout-unknown source	3-51 Clock Alley
		3-51A Line Office

(1) All confirmatory samples to be analyzed for explosives and metals. Additional analyses shown in parentheses on a building-by-building basis. Additional analyses to meet 10% full suite requirement are included in Table 3-10. VOCs: Volatile organic compounds, SVOCs: Semivolatile organic compounds, PCBs: Polychlorinated biphenyls.

Table 1-5 Classification of Buildings at Load Line 4
Ravenna, Ohio

High Potential for Explosives Contamination Sampling Regime: Field Screening (4' Cores) and MI Confirmatory Sampling(1)	Medium Potential for Explosives Contamination Sampling Regime: 1 Field Screening Sample, MI Confirmatory Sampling(1)	Low Potential for Explosives Contamination Sampling Regime: 1 Field Screening Sample, MI Confirmatory Sampling(1)
G-8 Melt Pour (SVOCs)	G-2 Paint Storage (VOCs)	G-5 Line Offices
G-9 TNT Services	G-4 Powerhouse No. 7 (VOCs, SVOCs, Propellants, PCBs)	G-6 Change House
G-15 Explosives Preparation (Propellants)	G-11 Nitrate Service	G-6A Change House
	G-12 Cooling (SVOCs, PCBs)	G-7 Booster Service
	G-12A Cooling	G-8 VP1 Vacuum Pump House
	G-13 Top Pour(2)	G-10 Nitrate Screening
	G-13A X-Ray	G-12VP1 Vacuum Pump House
	G-16 TNT Screening	G-13VP1 Vacuum Pump House
	G-17 Component Service	G-13 VP2 Vacuum Pump House
	G-18 Paint Storage (VOCs, SVOC, PCB, Propellant)	G-14 Booster Service
	G-19 Assembly & Shipping (Propellants)	G-19A Shipping
		G-20 Time Clock Alley

(1) All confirmatory samples to be analyzed for explosives and metals. Additional analyses shown in parentheses on a building-by-building basis. Additional analyses to meet 10% full suite requirement are included in Table 3-11. VOCs: Volatile organic compounds, SVOCs: Semivolatile organic compounds, PCBs: Polychlorinated biphenyls
(2) Top pour is a process in the drill out and assembly building.

Based on both the RVAAP RI data and the JOAAP project information, it was decided that buildings could be grouped into three categories based upon their potential for the presence of contamination in earth fill beneath the building floor slabs. The three categories are described below:

High potential buildings are those that are believed to have the highest potential for the presence of sub-slab soil contamination, based on notation of the highest historically detected concentrations and/or frequencies of SRCs in the RI, and/or soil remediation excavation volumes to greater than 1-foot bgs in the JOAAP information. Buildings in this category are slated for RDX/TNT field screening of multiple discrete core samples collected from depths up to 4 feet bgs, followed by final MI sampling.

Medium potential buildings are those that are believed to have some potential for the presence of sub-slab soil contamination, but to a lesser extent than buildings in the high potential category. Buildings in this category are generally those for which SRCs have been detected during the RI, but at lower concentrations and/or frequencies, and for which available data reveal that migration from surface to subsurface soils is unlikely. Soil remediation volumes for buildings in this category are hypothesized to be minimal, e.g., to depths not greater than 1-foot bgs. Buildings in this category are slated for RDX/TNT field screening of one biased discrete sample, followed by final MI sampling. If any field screen sample contains RDX or TNT above the cleanup level, then additional, 4-foot contingency cores will be used to define the extent of explosive contamination.

Low potential buildings are those that are not believed to have presence of sub-slab soil contamination, based on review of available RI data. These data revealed few to no detections of SRCs, and/or remediation information from the JOAAP project indicating minimal to no excavation of soil. Buildings in this grouping are slated for field screening of one biased discrete sample followed by final MI sampling either individually or combined with other buildings based on area, use, and proximity. If field screen samples contained RDX or TNT above the cleanup level, then additional 4-foot contingency cores were used to define the extent of explosive contamination.

Based on the above RI information and the pattern of results of the sub-slab sampling at Load Lines 2, 3, and 4, the 19 buildings previously associated with explosives production are assigned the high potential sampling category. The service, storage, and maintenance buildings are assigned the medium potential.

With respect to Load Line 2, the Phase II RI revealed that the Explosives Handling Areas aggregate contained the highest concentrations and most extensive SRCs within the load line (Shaw, 2004a). The highest overall concentrations of explosive and propellant compounds were identified in the vicinity of the melt-pour buildings, Buildings DB-4/-4A, and the explosive preparation buildings, Buildings DB-6/-6A. Table 3-2 summarizes the Phase II RI findings for Load Line 2. Metals, explosives, PAHs, and PCBs were the most pervasive SRCs in the explosives handling areas; metals, PAHs, and PCBs were the most pervasive SRCs in the preparation and receiving areas. Metals were the most pervasive SRCs in the packaging and shipping areas; explosives, PAHs, and PCBs were detected sporadically in these areas. Surface soil in the change houses aggregate was relatively uncontaminated. In the perimeter area, SRC concentrations were generally low, but there were sporadic high levels of inorganic chemicals detected at specific sampling stations. Explosives, propellants, and metals (lead and cadmium) were identified as SRCs along the railroad tracks within the perimeter area aggregate.

With respect to Load Line 3, the Phase II RI revealed that the Explosives Handling Areas aggregate contained the highest concentrations and most extensive SRCs within the load line (Shaw, 2004b). Explosives concentrations were found to be the highest near the major production and processing buildings. The highest detected concentration of TNT (390,000 mg/kg) was identified near Building EB-

10, and far exceeded any other detected concentration within the load line. Table 3-3 summarizes the Phase II RI findings for Load Line 3. The explosive handling areas contained the highest concentrations and the most extensive SRCs within the load line. In addition to explosives, metals were pervasive as well as PCBs and SVOCs (primarily PAHs). The highest concentrations clustered near the melt pour buildings and the drill and assembly building (EB-10). Metals and PCBs were also noted as pervasive SRCs in the preparation and receiving area as well as the packaging and shipping areas. Low concentrations of PAHs were detected in most other aggregates. Observed SRC concentrations detected within the change house and perimeter aggregates were generally low. Low concentrations of pesticides were detected throughout the load line.

With respect to Load Line 4, the Phase II RI revealed that detected explosive and propellant compounds in surface soil were relatively few in number, and concentrations were comparatively low relative to Load Lines 1 through 3 (Shaw, 2004c). Table 3-4 summarizes the Phase II RI findings for LL 4. Detections of explosives and propellants were also found to be limited in extent to the immediate proximity of the source areas. The highest concentrations and most extensive SRCs were contained within the Explosive Handling Areas aggregate. With respect to SVOCs, compounds detected were primarily PAHs, generally at low concentrations. Compared to findings for the other melt-pour load lines at the RVAAP, PCBs were not nearly as widespread at Load Line 4 (Shaw, 2004c). Pervasive inorganic SRCs were also detected in the preparation and receiving areas, the packaging and shipping areas, and the perimeter area aggregate, but not in the change house aggregate. Some pesticides were also sporadically detected.

The Phase II RI for Load Line 1 concluded that the Explosives Handling Areas aggregate contained the highest concentrations and most extensive site-related contaminants (SRCs) within the load line (SAIC, 2003). The highest overall concentrations of explosive and propellant compounds in the soil were identified in the vicinity of the melt-pour buildings, Buildings CB-4/4A. The explosive preparation buildings, Buildings CA-6/6A, were less contaminated relative to the melt-pour building areas. At the booster installation area (CB-10/13) the soil near the southeastern sides of the buildings was more heavily contaminated, suggesting that this is where the wash down effluent was directed (SAIC, 2003). Nitrocellulose was detected frequently across the entire load line production area. At the demilitarization processing area (Buildings CB-14, and CB-17), minimal explosives contamination was detected in soil as well as lesser metal contamination. However, lead was elevated at some sampling stations in both surface and subsurface soil.

Buildings related to storage and maintenance facilities and the water tower area were relatively uncontaminated. The highest metal concentrations were associated with slag on the railroad bed and paint in the area of the water tower. No explosives or propellants were detected in areas not associated with production (i.e., the perimeter) indicating minimal migration of contamination from the production area. A table summarizing this information for Load Line 1 is provided in (SAIC 2003).

1.4.2.2.B Load Lines 2, 3, and 4 Removal Data

<u>1.4.2.2.B.1 Post Slab Removal Field Screening</u>

Summary of Cleanup Level Exceedances

No exceedances of either the TNT or RDX cleanup levels were detected during the field screening investigation at either the low or medium potential buildings. Based on this post-slab removal sampling, explosive contamination beneath the floor slabs at these buildings was not detected above CUGs. However, there were a few low-level field detections of TNT. No remediation appears warranted.

There were no RDX exceedances at any high potential building at any load line. Exceedances for TNT were identified at three buildings in Load Line 3: Buildings EB-4, EA-6, and EA-6A. Seven exceedances ranged from 1,730 to 4,860 mg/kg. These areas were covered with plastic within two days of the completion of screening analyses. The exceedance at Building EB-4 occurred in one soil core sample at the shallowest depth. At Building EA-6A, three portions of one soil core sample exceeded the TNT cleanup level. An exceedance at Building EA-6 occurred in one soil core sample but only at the bottom depth location. Based on this post-slab removal sampling, there is evidence of explosive contamination above cleanup levels beneath the floor slabs at melt pour and TNT screening buildings within Load Line 3.

Cleanup Level Exceedances Outside Building Footprints

Additional samples were field screened primarily at Load Lines 2 and 3. At Load Line 2, additional samples were collected at Building DB-4 (sample ID LL2DB4-PIT), Building DB-10 (sample IDs LL2DB10-SCREEN 1 through 3), and Building DB-4A (Sample IDs Pink Water 1 through 4). At Load Line 3, contingency core samples were collected at Building EB-4A (sample IDs LL3EB4A-SB-100SN and LL3EB4A-SB-101SN) and confirmation EPA samples were collected near Building EB-4A (Sample IDs LL3EB4A URS-EPA 1 through 4).

TNT was detected in all the additional samples at these two load lines and seven of the additional sample concentrations were above the TNT cleanup level. Exceedances for the additional screening samples were detected at Load Line 2 in samples LL2DB10-SCREEN 1 through 3 and LL2DB4-PIT. These samples were collected near visibly contaminated areas outside building footprints. At Load Line 3 an additional TNT exceedance was observed near Building EB-4A.

Summary of Excavation Areas

The screening effort identified areas at three high potential buildings at Load Line 3 that exceeded the cleanup levels for TNT. These areas are noted for future remediation excavation work as indicated on Figures 4-1 and 4-2. These three areas are summarized below:

- Building EB-4, Northeast corner of footprint and north sump area (EB-4-WN). This area exceeded the TNT cleanup level down to approximately 3 feet bgs. Figure 4-1 indicates an area approximately 40 feet by 80 feet that will require excavation.
- Building EA-6. This area exceeded the TNT cleanup level in the deepest interval screened (4 feet). Figure 4-2 indicates an area approximately 40 feet by 40 feet that will require excavation.
- Building EA-6A. This area exceeded the TNT cleanup level in both the shallowest and deepest intervals screened from the coring collected in the northeast corner. Figure 4-2 indicates an area approximately 20 feet by 20 feet that will require excavation.

Additionally, based upon field observations, there is explosive contaminated soil not fully delineated by the screening effort. Two of these additional areas are near the Load Lines 2 and 3 melt pour buildings and associated sump areas. The melt pour sumps appear to have contributed to pink water emanating from the Load Lines 2 and 3 melt pour east foundations after slab removal. The elevator sump excavation at DB-4 was visually impacted at 3.5 feet bgs down gradient of the north sump. This area may be impacted to the east building foundation.

Analytical results of screening samples or fixed laboratory samples collected outside the building footprints indicate three areas where remediation is warranted. They are:

- At Load Line 2, the North Elevator sump area (near Building DB-4) and the north sump area (near Building DB-4-WN). The highest levels of TNT in the screening effort were observed in the pit area excavated around the north elevator sump. The pit currently contains standing water that was pink in color shortly after the slab removal effort. This pit will require excavation of the visually impacted zone at approximately 3 feet bgs. Based on limited information regarding the extent of contamination, this removal area is approximately 60 feet by 60 feet.
- At Load Line 2, the area near DB-10 and DB-10-VP-2. A large piece of TNT was removed from this area during the screening investigation. The area seems to be surficially impacted, but no samples were collected at depth. Therefore, the depth to which excavation may be required is unknown. Based on the limited information regarding the extent of contamination, this removal area is approximately 20 feet by 60 feet.
- At Load Line 3 outside the northeast corner of Building EB-4A and the sump area (EB-4A-WN). This area was identified by soil staining that occurred after the field-screening sample was collected. Additional samples indicated the TNT cleanup level exceedance. The sump area appears to be the source of contamination. Excavation of the sump is warranted. Based on the limited information regarding the extent of contamination, this removal area is approximately 40 feet by 60 feet.

Based upon observations and findings during this investigation, it is also apparent that these areas of potential impact are not delineated only by the building footprints. The impacted areas will require additional characterization to support area excavation. This will be done by collecting field screening confirmation samples once visually impacted soil is removed. If cleanup levels are not exceeded, then the final MI soil samples can then be collected.

In addition to excavation extent issues, the soil will need to be tested to determine whether it is Resource Conservation and Recovery Act (RCRA) hazardous, based on the concentrations of dinitrotoluene (DNT) found in the limited fixed laboratory samples collected during this sampling effort. Table 3-8 indicates that the 2,4-DNT concentration detected in sample LL3EB4A-EPA1SS was more than 20 times the toxicity characteristic leaching procedure (TCLP) limit of 0.13 mg/L.

1.4.2.2.B.2 Confirmatory Sampling

Load Lines 2, 3, 4 (URS 2009b)

The confirmatory sampling conducted at most of the buildings at Load Lines 2, 3, and 4 indicated that no further areas require remediation.

A cleanup goal was exceeded on LL3 at EB-25 only. At this location, product was discovered when the sampling crew arrived to collect the MI increments. It is recommended that this building footprint (which was covered with plastic after the MI sampling was completed) be included in the soil excavations planned for Load Line 3.

No additional areas for remediation were identified for Load Line 2. Therefore, the areas identified during the screening effort are the only areas warranting excavation.

No building footprints at Load Line 4 were identified for remediation either during the screening effort or by the sampling documented in this report.

The MI process provides a means to analytically evaluate soils over a wide area with a single sample and analysis. The analytical results are very reproducible as demonstrated by the QA sampling. However, the inherent issue with MI sampling is that it only addresses only the 0 to1-foot bgs interval. Based upon field screening data results there may be areas of impact below the 1-foot bgs depth that may be due to the natural distribution/migration or disturbances from demolition activities. Therefore there is a recognized data gap at depths below 1-foot bgs.

1.4.2.2.C Load Line 1 Removal Data

1.4.2.2.C.1 Post Slab Removal Field Screening

Load Line 1 (URS 2010)

Summary of Cleanup Goal Exceedances

No exceedances of either the TNT (CUGadj) or RDX (CUGIROD) cleanup goals were detected during the field screening investigation or the MI sampling at the low or medium potential buildings. The CUGadj was an adjustment value based on correlations between field screening measurements and fixed lab results. The CUGIRODs were the clean goals developed in the Interim ROD. Based on the post-slab removal field screening sampling, explosive contamination beneath the floor slabs at these buildings was not detected above CUGs. However, there were a few low-level field detections of TNT. No remediation is warranted based upon field screening laboratory analytical data.

There were no RDX exceedances in any field screening samples collected from the high potential building footprints. Exceedances for TNT were identified at two building footprints at Load Line 1: Buildings CB-4AWS and CB-4WN. At both buildings, the TNT CUGadj exceedances were detected in the deepest interval sampled within the affected core collected from the footprint. At Building CB-4WN the deepest interval sampled was 3.5 feet bgs; at Building CB-4AWS the deepest interval sampled was 2.3 feet bgs. The MI sampling conducted at high potential buildings confirmed that no additional areas require remediation.

SUMMARY OF EXCAVATION AREAS

The field screening effort identified two areas at two high potential buildings at Load Line 1 that exceeded the TNT CUGadj. These areas were noted for future remediation excavation work by URS. The two areas are summarized below:

- Building CB-4WN: This building was a wash out annex connected to the melt pour building CB-4. The TNT exceedance was detected in the core taken from the northeast corner of the annex. The highest level of TNT in two other cores in the vicinity of the exceedance was 11 mg/kg. Therefore, extent of contamination within the building footprint has been defined, but there may be contamination outside the building footprint in the easterly direction. The TNT exceedance occurred in the 3.5 foot bgs sampling interval, which was the deepest sample collected and analyzed. Based on this information, the removal area is estimated to be 20 feet by 20 feet by 5 feet deep.
- Building CB-4AWS: This building was a wash out annex connected to the melt pour building CB-4A. The TNT exceedance was detected in a 2.3-foot interval within the core taken from the northeast corner of the annex. The highest level of TNT in the other core collected from this footprint was 432 mg/kg. This result was also from the deepest interval sampled and analyzed in this core. While the extent of TNT contamination has been defined within the footprint, contamination may be outside the building footprint in the easterly direction. Based on this information, the removal area is estimated to be approximately 20 feet by 20 feet by 4 feet deep.

The impacted areas described above will require additional characterization to support area excavation. This will be done by collecting additional field screening samples during excavation. Final MI confirmatory samples will be collected from the sidewall and excavation floors after the field screening samples indicate that the TNT levels are below the CUGadj.

1.4.2.2.C.2 Confirmatory Sampling

Low Potential Buildings

Tables 1-2 through 1-5 show the chemicals detected at low potential buildings for Load Lines 1-4. Eleven primary MI samples were collected from the 0-1 foot bgs interval at eleven building footprints. Explosives were not detected in any samples from low potential buildings. Metals were detected in all samples collected from low potential buildings. Most of the TAL metals were detected in every sample. Hexavalent chromium, however, was not detected in any sample.

Medium Potential Buildings

Tables 1-2 through 1-5 show the chemicals detected at medium potential buildings for Load Lines 1-4. Thirteen primary MI samples were collected from the 0-1 foot bgs interval at 12 building footprints. One discrete VOC sample was collected from one building location.

Explosives were detected in five of the 15 MI samples at concentrations ranging from 0.264 mg/kg to 5.04 mg/kg. The highest concentration was for TNT (at Building CA-7), which was the explosive most frequently detected. No propellants were detected in any samples.

Metals were detected in all samples collected from medium potential buildings. Most of the TAL metals were detected in every sample. Hexavalent chromium was not detected in any samples.

Ten SVOCs were each detected in one or two of the three samples analyzed for SVOCs. Most of the detected SVOCs were polycyclic aromatic hydrocarbons (PAHs). The detected SVOC concentrations ranged from 97.4 µg/kg to 361 µg/kg. The highest detected concentration was for 2,4-dinitrotoluene at Building CB-2.

Aroclor 1254 was detected in the single sample analyzed for PCBs. The concentration of Aroclor 1254 was 251 µg/kg in the sample collected at Building CB-3.

No volatile organics or pesticides were detected in any samples.

High Potential Buildings

Tables 1-2 through 1-5 show the chemicals detected at high potential buildings at Load Lines 1-4. Twenty-three primary MI samples were collected from the 0-1 foot bgs interval from 21 high potential building footprints. Four discrete primary VOC samples were collected from two building footprints.

Explosives were detected in six of the 29 MI samples with concentrations ranging from 0.305 mg/kg to 158 mg/kg. The highest concentration was for TNT (at Building CB-4A), which was the explosive most frequently detected. The only propellant detected was nitrocellulose, in 11 samples. The nitrocellulose concentrations ranged from 2.65 mg/kg to 41.3 mg/kg.

Metals were detected in all samples collected from high potential buildings. Most of the TAL metals were detected in every sample. Hexavalent chromium was not detected in any sample.

Twelve SVOCs were detected in at least one of the six samples analyzed for SVOCs collected from high potential buildings. Most of the detected SVOCs were polycyclic aromatic hydrocarbons (PAHs). The detected SVOC concentrations ranged from 607 µg/kg to 4870 µg/kg. The highest concentration was for fluoranthene at Building CB-4A.

Aroclors 1254 and/or 1260 were detected in all ten samples analyzed for PCBs. Concentrations ranged from 54.5 µg/kg to 1,280 µg/kg. The highest concentration of PCBs was for Aroclor 1254 in an MI sample collected from Building CB-4A.

Two VOCs (methylene chloride and carbon disulfide) were detected in three of the five samples collected from high potential buildings, at concentrations ranging from 0.496 µg/kg to 9.34 µg/kg. The highest concentration detected was for methylene chloride at Building CB-10.

Pesticides were not detected in any samples.

The MI Process

The MI process provides a means to analytically evaluate soils over a wide area with a single sample and analysis. The analytical results are very reproducible as evidenced by the QC duplicate analyses from sampling conducted during this field investigation. The MI process, however, addresses only the 0 to 1-foot bgs interval. Based on field screening core results, there may be areas of impact below the 1-foot bgs depth due to the natural distribution or migration of the contamination. Therefore, a recognized data gap for contaminant information at depths below 1-foot bgs is acknowledged.

2.0 – PROJECT DESCRIPTION

2.1 PROJECT BACKGROUND AND SUMMARY

This project has multiple objectives. The first is to provide additional environmental characterization of subsurface materials below the former floor slabs of the buildings at Load Lines 1, 2, 3, and 4. This additional information will complement previous explosives field screening results that were determined in the recent past at these same locations. The results of this investigation will be presented in a report, which will also include previous explosive field screening measurements and the results of recent United States Army Corps of Engineers (USACE) sampling activities outside of former building footprints at the subject load lines to investigate if contamination was spread during building demolition activities. The second objective is to obtain site closure at Load Lines 1, 2, 3, 4, and 12. This will be done by reviewing previous investigation documents and analytical results and then assessing land use controls at each of the subject environmental areas of concern (AOC). The primary goal is to achieve an Unrestricted National Guard Trainee land use for surface soil, subsurface soil, dry sediment, wet sediment, and surface water media. Prudent will submit a report which summarizes its evaluation of previous environmental work in relation to recent land use control guidance. A proposed path forward will be presented to achieve the desired land use. Additional investigation and remediation may be required and will be conducted by Prudent. The results of this work will be presented in a closure document, which will be adequate to transfer the property to the NGB with the goal of Unrestricted National Guard Trainee Use.

2.2 PROJECT TASKS

The following tasks are prescribed in the contract to accomplish the overall project objectives.

Task 1	Project Management	
Task 2	Project Work Plan	
Task 3	Project Execution/Client Correspondence	
Task 4	A	Collect Subsurface *Multi-Increment (MI) Samples
	B	Analyze Subsurface MI Samples
	C	Sampling Report
Task 5	Land Use Control Assessment	
Task 6	**Characterization/Confirmatory Sampling (if needed)	
Task 7	Analyses of Characterization/Confirmatory Sampling (if needed)	
Task 8	Soil Remediation (if needed)	
Task 9	Closure Report	

*Multi-Increment© is a registered trademark of EnviroStat, Inc.

****To expedite the project, any required characterization sampling may begin prior to final approval of the Land Use Control Assessment Report.**

3.0 – PROJECT ACTIVITIES

The project activities will be completed in two segments: investigational work to be done, covered primarily by Appendices A, B, and C, and remediation activities covered generally in the following paragraphs and Appendix E.

This Work Plan includes all project activities. It contains amendments to the Facility-Wide Sampling and Analysis Plan (SAIC, 2001b). These amendments are included as Appendix A (the Field Sampling Plan Addendum) and Appendix B (the Facility - Wide Quality Assurance Project Plan (QAPP) Addendum). In addition, a MEC/Anomaly Avoidance Plan is provided as Appendix C and a Site Safety and Health Plan (SSHP) is included as Appendix D.

This section describes the tasks that will be performed during the investigation and remediation phases at the four load lines. More detailed discussion of the investigation work associated with this project is provided in Appendices A, B, and C. Project tasks are grouped into the following items:

- Pre-mobilization (Investigation and Remediation),
- Mobilization (Investigation and Remediation),
- Excavation (Remediation),
- Transportation (Remediation), and
- Decontamination (Investigation and Remediation).

3.1 PREMOBILIZATION

Prior to any field investigation or remediation, a series of pre-mobilization activities will be undertaken to ensure that all applicable requirements are met. These will include obtaining any necessary permits, notifications to the RVAAP Facility Manager, Ohio EPA, the operating contractor, Vista Technologies, Inc. (Vista) and other stakeholders. In addition, all necessary approvals (e.g., Work Plan) as well as subcontracts and purchase orders for transport, analytical, and other necessary services will be in place.

Prudent will make sure that all the permits are in place and the necessary authorities are notified prior to the start of any field activities. The following permits will be obtained:

Ohio EPA NPDES Construction General Permit No. OHC000003;

Notifications to the Ohio EPA; and

Wetland Permit Requirements.

3.1.1 Temporary Field Screening Laboratory

Arrangements will be finalized to utilize a portion of Building 1036 or 1038 for analyzing field-screening samples. The temporary field-screening laboratory will be equipped with materials to conduct the field screening operations on an as-needed basis to accommodate the sampling schedule. The work areas will be covered with plastic to avoid contamination of testing process surface areas. The acetone used for the soil test extraction will be stored in a storage cabinet (suitable for storing flammable materials) when not in use. The expended acetone/soil mix will be stored in approved 5-gallon containers with containment in the testing area. The extraction mix will be consolidated into an approved 55-gallon waste fluid drum on an as-needed basis. The drum and all containers will be appropriately labeled and staged for disposal. Disposal of wastes will occur in accordance with applicable Federal, State, and local rules, laws, and regulations.

3.1.2 Establishment of Truck Routes (Remediation)

Designation of any truck routes will be established after decisions regarding whether and where any excavations of contaminated soil are made. These decisions will be documented in the Land Use Control Assessment/Cost Analysis Report. Before any excavation or transportation occurs, transportation routes will be established for incoming and outgoing vehicles in order to minimize any impact to either RVAAP or the surrounding communities. All truck routes will utilize the gate at Post 1 for both entering and exiting RVAAP.

3.1.3 Utility Clearance

Prior to any intrusive sampling or remediation, any subsurface utilities identified as part of the pre-mobilization will be reviewed during a site walk over. Additional location activities may be necessary to locate any utilities near those areas where deeper sampling or excavation will occur.

Prior to starting any remediation activities, Prudent will notify the required authorities at least one week in advance to provide them enough time to mark all utilities in the area to be remediated.

Work around all marked utilities will be conducted with utmost precaution to ensure that no utility lines will be damaged. In case an unmarked utility line is exposed during remediation activities, Prudent will stop all work and notify the RVAAP Facility Manager. Work will resume only after Prudent gets a clearance from the RVAAP Facility Manager.

3.1.4 Pre-Field Work Meetings

Pre-field work meetings will be held prior to commencing investigational or remediation efforts. These meetings will communicate project expectations and requirements to ensure that all stakeholders understand their roles, responsibilities, and interactions with others. These meetings will be conducted by the Prudent Technical Project Manager and/or Remediation Engineer.

3.2 MOBILIZATION AND SITE PREPARATION

Sampling personnel will be mobilized multiple times during the implementation of this project. Each mobilization will be directed to the particular phase of a project task. All applicable requirements will be met prior to commencing work activities.

Mobilization and site preparation will include, but not be limited, to the following:

- Verify utility layout,
- Coordinate site security with Post 1,
- Set up controlled access to the job site,
- Review the job safety analysis (JSA) with field crews for those activities to be conducted,
- Establish any environmental monitoring operations in accordance with the Health and Safety Plan (HASP),
- Ensure that all necessary equipment is on site and ready for use,

- Inspect and transport construction equipment to the site, (for remediation)
- Set up an equipment staging area,
- Set up equipment fueling area,
- Construct access road & truck haul road improvements/repairs (if needed), and
- Set up decontamination facilities for vehicles exiting the excavation areas and a temporary area for decontaminating sampling equipment and personnel.

3.2.1 Temporary Facilities

Temporary facilities, including office space, sanitary facilities, hand wash stations, and the field testing laboratory will be placed at locations designated by the RVAAP Facilities Manager. If any of these temporary facilities use land previously transferred to NGB, approval from Camp Ravennais required and will be obtained. Communications will include both cell phones and handheld radios.

Signs and barricades will be used to identify sampling/remediation areas and provide traffic directions during excavation and transportation activities. Traffic control signs will used in accordance with a traffic control plan for access to each of the load lines during excavation and transportation activities. Any traffic control devices used will conform to Department of Transportation (DOT) applicable standards. Signs will be placed along truck routes for each load line for vehicles and equipment entering and exiting in order to maintain traffic flow.

Barricading may be used during excavation activities at the load lines. After decisions to excavate have been made, and before any excavation occurs, the areas will be inspected to determine whether barricading is necessary and the extent and type that will be needed.

3.2.2 Site Security

Site security for the protection of the general public, site workers and site equipment, and materials will be established in accordance with the Prudent SSHP Addendum. Personnel and any subcontractors who will be working at RVAAP will be submitted to the RVAAP Security Staff at least one week in advance. The roster will be updated/maintained on a weekly basis. All personnel approved for entry to the RVAAP will be required to provide government issued identification (i.e., driver's license, passport, etc.) in order to enter. Any personnel working within any of the load lines will also be required to provide documentation of their 40-hour Occupational Safety and Health Administration (OSHA) Hazardous Waste Operations and Emergency Response (HAZWOPER) Training and their current 8-hour OSHA HAZWOPER Refresher Training.

3.2.3 Decontamination

A temporary decontamination area will be constructed to facilitate decontamination of the push probe (by the push probe contractor) and other associated equipment and personnel. The location and layout of the field decontamination area will be determined by the Prudent Project Manager and the Site Safety and Health Officer. An additional decontamination area will be located in Building 1036/1038 (or another location determined by the RVAAP Facility Manager) and will be used to decontaminate soil sampling equipment. All sampling equipment will be decontaminated in accordance with the procedures outlined in Sections 4.4.2.8 and 4.3.8 of the FWSAP. Any exceptions to these procedures are detailed in the Field Sampling Plan (FSP) Addendum within Appendix A.

All remediation equipment and sampling instruments will be decontaminated prior to leaving the excavated area. To avoid cross contamination due to trucks coming in and out of the excavated area, the trucks will back backed in on a plastic sheet. This will avoid contamination of the tires. All the field equipment and sampling instruments will be decontaminated in accordance with the Prudent FSP.

3.2.4 Dust Management

During excavation and backfill activities, Prudent will ensure that necessary controls are in place to keep the dust down and in turn reduce cross contamination of contaminant via dust. Soil will be kept wet at all times to ensure no dust is generated during field operations. Potable water will be used and, if needed, will be hauled in from off-site. Precautions will be taken that there will be no pooling of water due to excessive water use which would create a run-off issue. If any water is generated inside the excavated area, it will be contained in the excavated area and later disposed off appropriately. Dust monitoring during field activities will be done in accordance with the approved Prudent Health & Safety Plan.

3.2.5 Clearing & Grubbing

Prior to start of excavation; clearing and grubbing of trees located on and around the excavation areas and haul truck routes will be completed as necessary. Trees four inches or less in diameter will be cut into smaller pieces and chipped. Trees having four inches or more diameters will be cut into manageable pieces and placed at the Load Lines away from the contaminated area. Remaining tree stumps and roots present in the contaminated area will be excavated along with the soil and hauled off.

3.3 EXCAVATION

Prudent field excavation crews will be comprised of two equipment operators, two laborers and two truck drivers. Prudent will utilize a mini-excavator, rubber tire skid loader and two tandem axle dump trucks to excavate, load and haul the contaminated soil to the pre-approved stockpile area. Contaminated soil from Load Lines 1 – 4 and 12 will be excavated only to a maximum depth of six feet. Any deeper excavation will be performed only with approval from the USACE. The extents and depths of excavation will be determined by the results of the Land Use Control Assessment/Cost Analysis coupled with additional characterization sampling.

3.4 CLOSURE SAMPLING

The types and number of closure samples will be determined after the Land Use Control Assessment/Cost Analysis Report and the additional characterization sampling have been completed. MI sampling of the bottoms and sides of any excavations will be taken to ensure sufficient contamination has been removed.

3.5 BACKFILL & REGRADING

Once an excavated area is cleared for backfilling, Prudent will backfill the area with approved soil. The backfill soil will be sampled prior to bringing it on-site and verified that levels of contaminants are below the required cleanup levels. The excavated area will be backfilled, compacted and graded to its original condition, unless the Army or OHARNG prefer a different final, readily constructed grade. The final grade will be constructed to ensure proper drainage on-site.

3.6 RESTORATION

The backfilled area will be restored as per requirements detailed in the scope of work. Erosion control systems will be placed to control any sediment erosion due to storm water flow, and the Ravenna-specific grass seed mix will be utilized.

3.7 SCHEDULE

The current schedule for the subject project is provided as Figure 3-1.

3.8 MEETINGS

The Prudent Project Manager or Remediation Engineer will attend the weekly contractor meetings at RVAAP during periods of active fieldwork. The Prudent Project Manager will attend Restoration Advisory Board Meetings as prescribed in the SOW for this project. Two Kick-Off meetings are anticipated at this time.

ID	Task Name	Duration	Start	Finish
1	**WBS 1 - Project Management**	**398 days?**	**Wed 3/31/10**	**Mon 5/2/11**
2	**WBS 2 - Work Plans**	**130 days**	**Wed 3/31/10**	**Sat 8/7/10**
3	Draft Work Plans	30 days	Wed 3/31/10	Thu 4/29/10
4	Army Review of Preliminary Draft Project Work Plan	15 days	Fri 4/30/10	Fri 5/14/10
5	Address Army Comments and Submit Draft Project Work Plan	10 days	Sat 5/15/10	Mon 5/24/10
6	Stakeholder Review of Draft Project Work Plan	45 days	Tue 5/25/10	Thu 7/8/10
7	Comment Resolution of Stakeholder Comments to Draft Project Work Plan	10 days	Fri 7/9/10	Sun 7/18/10
8	Prepare and Submit Final Work Plan	10 days	Mon 7/19/10	Wed 7/28/10
9	Stakeholder Review and Approval of Final Project Work Plan	10 days	Thu 7/29/10	Sat 8/7/10
10	**WBS 3 - Project Execution/Client Correspondence**	**393 days?**	**Mon 4/5/10**	**Mon 5/2/11**
11	Project Kick-Off Meeting	2 days?	Wed 4/28/10	Thu 4/29/10
12	Monthly Progress Reports	393 days?	Mon 4/5/10	Mon 5/2/11
13	Teleconferences	385 days?	Tue 4/13/10	Mon 5/2/11
14	**WBS 4 - MI Sampling**	**160 days**	**Fri 8/13/10**	**Wed 1/19/11**
15	Conduct Field Work	30 days	Fri 8/13/10	Sat 9/11/10
16	Analyze Results and Prepare/Submit Preliminary Draft Sampling Report	30 days	Sun 9/12/10	Mon 10/11/10
17	Army Review of Preliminary Draft Sampling Report	15 days	Tue 10/12/10	Tue 10/26/10
18	Address Army Comments and Submit Draft Sampling Report	10 days	Wed 10/27/10	Fri 11/5/10
19	Stakeholder Review of Draft Sampling Report	45 days	Sat 11/6/10	Mon 12/20/10
20	Comment Resolution of Stakeholder Comments to Draft Sampling Report	10 days	Tue 12/21/10	Thu 12/30/10
21	Prepare and Submit Final Sampling Report	10 days	Fri 12/31/10	Sun 1/9/11
22	Stakeholder Review and Approval of Final Sampling Report	10 days	Mon 1/10/11	Wed 1/19/11
23	**WBS 5 - Land Use Control Assessment Document**	**205 days?**	**Wed 3/31/10**	**Thu 10/21/10**
24	Complete Preliminary Draft Land Use Control (LUC) Assessment Document	105 days?	Wed 3/31/10	Tue 7/13/10
25	Army Review of Preliminary Draft LUC Assessment Document	15 days	Wed 7/14/10	Wed 7/28/10
26	Address Army Comments and Prepare Draft LUC Assessment Document	10 days	Thu 7/29/10	Sat 8/7/10
27	Stakeholder Review of Draft LUC Assessment Document	45 days	Sun 8/8/10	Tue 9/21/10
28	Comment Resolution of Stakeholder Comments to Draft LUC Assessment Document	10 days	Wed 9/22/10	Fri 10/1/10
29	Prepare and Submit Final LUC Assessment Document	10 days	Sat 10/2/10	Mon 10/11/10
30	Stakeholder Review and Approval of Final LUC Assessment Document	10 days	Tue 10/12/10	Thu 10/21/10
31	**WBS 6 - Characterization/Confirmatory Sampling**	**95 days**	**Mon 9/20/10**	**Thu 12/23/10**
32	Conduct Field Work and Characterization Sampling	60 days	Mon 9/20/10	Thu 11/18/10
33	**WBS 7 - Analyses of Characterization/Confirmatory Sampling**	**30 days**	**Tue 10/5/10**	**Wed 11/3/10**
34	Analyze and Prepare Results	30 days	Tue 10/5/10	Wed 11/3/10
35	**WBS 8 - Soil Remediation**	**60 days**	**Mon 10/25/10**	**Thu 12/23/10**
36	Conduct Field Work	60 days	Mon 10/25/10	Thu 12/23/10
37	**WBS 9 - Closeout Report**	**130 days**	**Thu 12/23/10**	**Sun 5/1/11**
38	Prepare/Submit Preliminary Draft Closeout Report	30 days	Thu 12/23/10	Fri 1/21/11
39	Army Review of Preliminary Draft Closeout Report	15 days	Sat 1/22/11	Sat 2/5/11
40	Address Army Comments and Prepare Draft Closeout Report	10 days	Sun 2/6/11	Tue 2/15/11
41	Stakeholder Review of Draft Closeout Report	45 days	Wed 2/16/11	Fri 4/1/11
42	Comment Resolution of Stakeholder Comments to Draft Closeout Report	10 days	Sat 4/2/11	Mon 4/11/11
43	Prepare and Submit Final Closeout Report	10 days	Tue 4/12/11	Thu 4/21/11
44	Stakeholder Review and Approval of Final Closeout Report	10 days	Fri 4/22/11	Sun 5/1/11

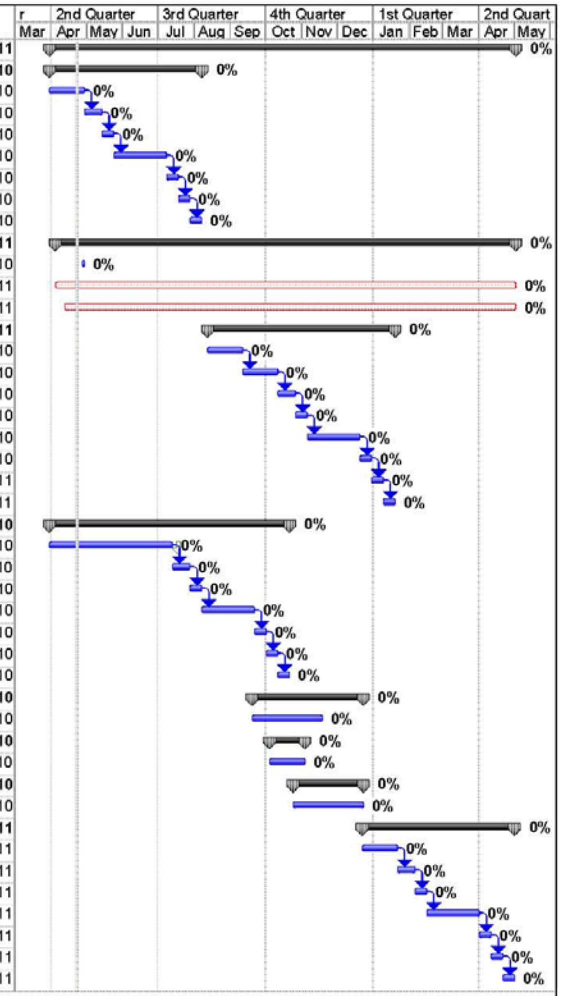


Figure 3-1 Project Schedule

Project: Sampling and Closure of Load Lines 1,2,3,4,12 and Other Areas of Concern
Date: Fri 4/23/10

Critical	Baseline	Project Summary
Critical Split	Baseline Split	External Tasks
Critical Progress	Baseline Milestone	External Milestone
Task	Milestone	Deadline
Split	Summary Progress	
Task Progress	Summary	

Page 1

4.0 – ENVIRONMENTAL PROTECTION PLAN

The environmental resources within the project boundaries and those affected outside the limits of permanent work under this contract will be protected during the entire period of this contract. Prudent will confine its activities to areas defined by this Work Plan.

4.1 STORM WATER POLLUTION PREVENTION

Prudent has prepared under separate cover an Addendum to the Facility-Wide Storm Water Pollution Prevention Plan (SWPPP) for Load Lines 1, 2, 3, 4, and 12. The soil movement control methods will be in place when Prudent commences remediation activities. These controls include runoff control, soil stabilization, and sediment control. Prudent will maintain the runoff and sediment controls and repair any disturbances that occur during removal and transport operations.

4.2 PROTECTION OF NATURAL RESOURCES

Prior to the beginning of any field operations, Prudent will identify, in consultation with the RVAAP Stakeholders, all land resources to be preserved within the work area. Prudent will not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, topsoil, and landforms without permission from RVAAP Stakeholders.

4.3 PROTECTION OF LANDSCAPE

Trees, shrubs, vines, grasses, landforms, and other landscape features to be preserved will be clearly identified. Except in work areas, trees or shrubs will not be removed, cut, defaced, injured, or destroyed without the permission from RVAAP Stakeholders. A poly liner will protect any areas accessed for the purpose of transporting or transferring wastewater or solid waste materials.

4.4 DISPOSAL OF WASTE

Disposal of waste, trash, and other materials off the project site will be in accordance with all applicable federal, state, and local rules, regulations, and laws and Section 7.0 of the FWSAP.

4.5 DISPOSAL OF HAZARDOUS WASTE

Resource Conservation and Recovery Act (RCRA) hazardous wastes that may be generated during performance of the SOW include explosive soil and waste acetone/mixtures from the onsite laboratory. Section 6.1 describes the management procedures for IDW, including wastes generated at the on-site laboratory.

Explosive soil is considered to fall into the Munitions and Explosives of Concern (MEC) category. MEC are defined as follows:

a. Unexploded ordnance (UXO), as defined in 10 United States Code (U.S.C.) 2710(e)(9);

b. Discarded military munitions (DMM), as defined in 10 U.S.C. 2710 (e)(2); or

c. Munitions constituents (e.g., TNT, RDX) present in high enough concentrations to pose an explosive hazard. (28 October 2003 Assistant Chief of Staff for Installation Management

(ACSIM) Memorandum) (USACE, 2004). "Pink water" is a listed RCRA hazardous waste, which may be encountered during this project.

With respect to condition (c) above, soil containing a concentration of secondary explosives, e.g., TNT or RDX, of 10% or greater by weight is considered an explosive hazard (USACE, 2007a). Explosive soil is therefore MEC, and it carries the RCRA D003 hazardous waste code for reactivity.

As described in the approved ESSs for Load Lines 1, 2, 3, 4 (MKM.2005) and (URS.2008) explosive soil, if identified, will be blended in place with non-explosive soil prior to transport to render the soil safe for handling. After the soil blending is completed, the soil will no longer carry the D003 hazardous waste code.

The project is being performed within the CERCLA framework; therefore, compliance with the substantive, not administrative, e.g., permitting, requirements of applicable or relevant and appropriate requirements is necessary. The Director's Final Findings and Orders (DFFOs), Section VI, 9, (a), also states that a hazardous waste facility and installation operation permit is not required for the in-place treatment (destruction) of MEC discovered at the RVAAP that cannot be safely transported to the RVAAP open detonation area, provided that the Army complies with other applicable hazardous waste requirements.

The soil blending will remove the D003 reactivity characteristic; however, the soil will still need to be characterized for underlying hazardous constituents, as needed, prior to land disposal to ensure compliance with the RCRA Land Disposal Restrictions. If, during the continued execution of the SOW, hazardous waste codes other than D003 are identified as potentially applicable, then the Army will re-evaluate the applicability of other hazardous waste requirements, as needed, including but not limited to personnel training, emergency equipment/procedures and contingency plan, accumulation in containment buildings, recordkeeping, manifesting, and annual reporting.

4.6 PROTECTION OF WATER RESOURCES

Prudent will keep field operations under surveillance, management, and control to avoid pollution of surface and ground waters. Prudent intends to protect streams and wetlands by not disturbing these areas; however, should remediation of surface waters be required management techniques will be implemented to control water pollution as a result of these remediation activities.

4.7 SPILL CONTROL

Special measures will be taken to prevent any chemicals, fuels, oils, greases, waste washings, herbicides, insecticides, rubbish or sewage, and other pollutants from entering RVAAP surface waters. Spill plans from URS and PIKA will be followed for Load Lines 1 through 4 and will be kept on-site. In addition Prudent will have spill supplies on hand and will respond to any on-site spills in accordance with the facility spill plans.

5.0 – PROJECT DOCUMENTATION & SAMPLE QA/QC

5.1 MONTHLY ACTIVITY REPORTS

Monthly activity reports will be submitted by the 5th of each month in accordance with the SOW.

5.2 SAMPLE HANDLING AND TRACKING

Samples will be prepared, packaged, and shipped in accordance with the FWSAP, Section 6.0. Exceptions to the FWSAP procedures will include:

- Subsurface MI VOC samples will be collected in controlled/capped bottles of methanol,
- No tape of any kind will be placed on any discrete VOC sample containers, and
- All VOC sample containers will be placed in either foam bubble wrap or paper towels to reduce the potential for breakage during shipping.

Sampling handling will be in accordance with the FWSAP Section 5.4. The laboratory's chain of custody will be used to document the integrity of all samples collected. A copy of each chain will be forwarded to the Prudent Senior Chemist in the San Antonio office for sample tracking purposes.

5.3 FIELD ACTIVITIES COORDINATION

During the performance of the SOW, field activities will be coordinated on a daily basis with any other onsite contractors. Additionally, weekly updates will be discussed at the RVAAP weekly contractors' meeting with the Facility, OHARNG, and other on-site contractors.

5.4 FIELD AND LABORATORY QA/QC

Triplicate subsurface MI samples will be taken to provide an overall evaluation of the total (field sampling + laboratory sample preparation + laboratory analysis) sampling and measurement process (see Hawaii Technical Guidance Manual for the Implementation of the Hawaii State Contingency Plan). One triplicate sample will be taken from each of the three main types of buildings; shell preparation, melt-pour, and drilling assembly. The results of the triplicate sample analyses will be used to measure the investigation error. The main criterion for this purpose will be the Relative Standard Deviation (RSD) calculated from the triplicate data as follows:

RSD (%) = 100% x (Standard Deviation)/Average

Acceptable RSDs for triplicate surface soil MI samples are generally within 35%. RSDs in the Bigl, Hewitt, and Ramsey study ranged from 3.9 - 112%. The one extremely high-percent RSD value (112) was obtained from a set of triplicates collected in a zone of backfill (which may be similar to conditions in the present project). Omitting the one high RSD value, the RSDs of the other triplicates ranged from 3.9 – 34 %.

Geotechnical logging of the push probe cores under stable, controlled conditions within the sampling building will promote more valid geotechnical logging. Prior to such logging of samples from any given AOC, geotechnical information (as unified soil classification system (USCS) classifications) from previous investigations will be reviewed to know what types of soils were encountered previously at that AOC. Logging data will be entered onto a boring log template (Figure 4-4 of the FSP, Appendix A) in the computer at the time the logging is done. Once that logging has been completed, the geologist or geotechnical engineer performing the logging will print out the boring log and sign his/her name to the log. Additional field and laboratory QC procedures are required for MI sampling. These procedures are described in the QAPP located in Appendix B of the Work Plan.

6.0 – DISPOSITION OF INVESTIGATION-DERIVED WASTE (IDW)

All IDW, including personal protective equipment, disposable sampling equipment, and decontamination fluids, will be segregated, handled, labeled, characterized, managed, and disposed in accordance with federal, state, and local rules, regulations, and laws, and Section 7.0 of the FWSAP. The waste will be temporarily stored on the east side of Bldg. 1036 pending disposal.

The IDW will be segregated by type of medium and will be containerized as follows:

- Personal protective equipment and disposable sampling equipment will be containerized in DOT-approved, 55-gallon steel drums and staged at the temporary waste accumulation area (Building 1036) pending sample analysis.
- Water used to decontaminate large and small equipment will be containerized in poly tank(s) or DOT-approved drums and staged at the temporary waste accumulation area pending sample and waste characterization analysis.
- Decontamination and extraction fluids including acid, methanol, and acetone will be containerized in poly tanks or DOT-approved drums and staged at the temporary waste accumulation area pending sample and waste characterization analysis.

IDW will be characterized as it is generated. The waste will be sampled for characterization after generation has filled a container with a particular waste stream. The characterization results, classification, and disposition of the IDW will be documented. Characterization, transportation, and disposal of the IDW will comply with federal, state and local rules laws and regulations, as well as the permit requirements for the receiving facility as applicable. In the event environmental sample data indicate that an IDW stream is potentially hazardous, a Toxicity Characteristic Leaching Procedure (TCLP) sample will be collected for additional characterization purposes. All shipments of IDW off site will be coordinated through the RVAAP Environmental Coordinator. 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. Labeling of all IDW containers will be in accordance with Section 7.2 of the FWSAP.

7.0 – ACTION LEVELS FOR EXCAVATION DECISIONS

Remediation measures, such as “dig and haul”, may be required for this project according to the outcome of the Land Use Control Assessment/Cost Analysis Report.

7.1 REMEDIAL ACTION OBJECTIVES

Remedial action objectives will be prepared in the Land Use Control Assessment Report (Task 5), which will be based on the Draft Guidance for the Evaluation of Land Use Controls at Ravenna Army Ammunition Plant, Ravenna, Ohio, February 2010 (USACE.2010b).

7.2 IDENTIFY DECISIONS

The key decisions associated with the sampling of this project will determine if an unrestricted national guard use scenario can be accommodated for Load Lines 1, 2, 3, 4, and 12; either with or without additional characterization and remediation; or if the land use will remain National Guard Trainee. There is also the possibility that any remaining contamination at the subject AOCs is sufficiently limited such that an unrestricted resident land use could be justified.

7.3 DEFINE THE STUDY BOUNDARIES

The investigation areas for subject load lines are defined as the former building footprints at Load Lines 1, 2, 3, and 4, and possible remediation boundaries will include Load Lines 1, 2, 3, 4, and 12. These areas were established and set forth in the project Scope of Work (SOW) by the U.S. Army Corps of Engineers (USACE.2010a). They encompass all known or suspected historical operations areas and adjacent support areas.

7.4 IDENTIFY DECISION RULES

Decision rules used to guide remediation decisions will be determined in the Land Use Control Assessment Report.

7.5 IDENTIFY INPUTS TO THE DECISIONS

Inputs to the decision process are the analytical results and the refined Load Line-specific conceptual model developed from field observations and environmental data.

7.6 SPECIFY LIMITS ON THE DECISION ERROR

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

7.7 CLOSURE SAMPLING DESIGN

The results of the MI sampling will be used to determine if additional excavation will be required at any of the building locations. Additional excavation based on the final MI sampling will occur if final MI sampling results indicate any exceedances of cleanup levels. Additional soil excavation will be completed with approval from the USACE and Ohio EPA within the contract capacity limitations.

8.0 – DELIVERABLES

The deliverables required by the SOW include plans and evaluations of the sampling conducted by multiple contractors. The following deliverables will be prepared to complete the SOW:

- Project Kick-Off Meeting Minutes,
- Project Management Plan,
- Investigation Sampling (Subsurface MI) Report,
- LUC Assessment/Cost Analysis Report (with detailed remediation information),
- ROD Addendum, and
- Final Closure Report.

Discussion of the distribution and approval requirements is provided in Paragraph 5 of the Project Management Plan.

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Appendix A – Field Sampling Plan Addendum

Final Field Sampling Plan Addendum for Sampling & Closure of Load Lines 1, 2, 3, 4, 12 (RVAAP 08, 09, 10, 11 and 12) and Other Areas of Concern

Ravenna Army Ammunition Plant
Ravenna, Ohio

Contract No. W912QR-10-P-0037

US Army Corps of Engineers

Prepared for:
U.S. Army Corps of Engineers
600 Martin Luther King, Jr. Place
Louisville, Kentucky 40202

PRUDENT TECHNOLOGIES, INC.
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July 30, 2010

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ACRONYMS AND ABBREVIATIONS

ADR	Automated Data Review
AOC	Area of Concern
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CSM	Conceptual Site Model
CO	Contracting Officer
COR	Contracting Officer Representative
CQAP	Contractor Quality Assurance Plan
DQO	Data Quality Objective
FSP	Field Sampling Plan
FWSAP	Facility-Wide Sampling and Analysis Plan
IDW	Investigation-Derived Waste
IS	Incremental Sampling
MI	Multi-Incremental
NGB	National Guard Bureau
OHARNG	Ohio Army National Guard
OSHA	Occupational Safety & Health Administration
OVA	Organic Vapor Analyzer
PCB	Polychlorinated Biphenyl
PPE	Personal Protective Equipment
Prudent	Prudent Technologies, Inc.
QAPP	Quality Assurance Project Plan
RVAAP	Ravenna Army Ammunition Plant
SAIC	Science Applications International Corporation
SOP	Standard Operating Procedure
SOW	Scope of Work
SVOC	Semivolatile Organic Compound
TAL	Target Analyte List
TCLP	Toxicity Characteristic Leaching Procedure
USACE	United States Army Corps of Engineers
UXO	Unexploded Ordnance
VOC	Volatile Organic Compound

1.0 –BACKGROUND

This Field Sampling Plan (FSP) addendum addresses supplemental project-specific information in relation to the revised Facility-Wide Sampling and Analysis Plan (FWSAP) for the Ravenna Army Ammunition Plant (RVAAP) (SAIC, 2001b). This FSP is an Appendix to the Work Plan (WP) that describes the project for the sampling of soils below former floor slabs at load lines 1, 2, 3, and 4, and potentially surface soil and dry sediment, wet sediment, and surface water sampling at LLs 1, 2, 3, 4, and 12 (Characterization Sampling). The following FSP sections present information either documenting adherence to the facility-wide FSP or stipulating project-specific addendum requirements.

1.1 PURPOSE AND SCOPE

About twelve years ago, the buildings at Load Lines 1-4 were demolished, but with massive elevated floor slabs and foundations left in place. About seven years ago, large-scale remediation began at Load Lines 1-4 with an assumed future land use of National Guard training and with the floor slabs assumed to be left in place. Remediation of areas outside of the building footprints was conducted to facilitate training of the Ohio Army National Guard under a set of exposure assumptions for that training. About the time that remediation was being completed, additional Army funding became available which allowed for the removal of the floor slabs and foundations; additionally, the set of assumptions associated with the National Guard training had to be modified to account for changes in mission and training. Within the past several years, the floor slabs and most of the foundations have been removed (by PIKA International, Inc., 2008-2009), and another contractor (URS Corporation, 2008-2010) tested, and where necessary, is remediating the soils beneath the former building slabs. Subsurface characterization was restricted to a depth of 4’ due to the sampling method utilized. Remediation of all areas (both within and outside building areas) and all media except groundwater is currently taking place at Load Line 12.

In this project, Prudent Technologies, Inc. (Prudent) is tasked with performing deeper characterization of the subsurface materials beneath the former building slabs via subsurface multi-increment sampling. Innovative means of performing this comprehensive sampling will be performed in an efficient and cost effective manner. Subsequent to that sampling, Prudent will compile all previous environmental sampling and evaluate that data against a more stringent set of cleanup goals that will reduce the land use restrictions for the OHARNG. Should additional remediation be required, it is planned that Prudent will complete this work. The results of this work will be presented in a closure document, which will be as adequate to transfer the property to the NGB with the goal of Unrestricted National Guard Trainee Use.

This FSP Addendum is a supplement to the 2001 FWSAP for RVAAP (SAIC, 2001b). The FWSAP provides the base documentation (i.e., technical and investigative protocols) for conducting a remedial investigation under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) at RVAAP.

1.2 SITE DESCRIPTION AND BACKGROUND

The site description and background information are contained in Section 1.2 of the Work Plan above. Additional information regarding the climatic conditions, geologic setting, hydrologic setting, and ecological setting are contained in Section 1.0 of the FWSAP.

1.3 SPECIFIC SAMPLING AND ANALYSIS PROBLEMS

Even though the buildings and slabs have been removed at the subject load lines, there is the potential for some/much construction debris causing difficulty in advancing push probe borings. Potentially, the push probe drilling may encounter artesian water conditions at which point the drilling would have to be abandoned at that location.

Moreover, the potential for this construction debris presents some safety concerns, primarily trips and falls, to which field personnel will have to remain ever vigilant. Finally, some habitat exists for wildlife that represents potential biological hazards (e.g., snakes, ground spiders, chiggers, ticks, etc) during the planned field activities. In accordance with the Facility-Wide Safety and Health Plan for Environmental Investigations (FWSHP) at RVAAP, (SAIC, 2001a), all sampling personnel will be advised specifically of biological hazards and pertinent preventive measures.

1.4 SCOPE AND OBJECTIVES

The scope of this investigation is to assess the extent of potential contamination in the exposed sub slab materials after the removal of the slabs at Load Lines 1, 2, 3, and 4. The primary objectives of the under the slab investigation are described in Section 2.1 of the Work Plan.

1.5 SAMPLING OPTIONS

The types and conditions of materials underlying the previous floor slabs of the buildings at Load Lines 1, 2, 3, and 4 are variable. At Load Line 1, sandstone bedrock appears to be shallow, approximately 6" – 12" below the present surface. It looks like bedrock was not far below the floor slabs, with bedrock blasted away near the walls. At Load Line 4 silty or clayey soils are present which should readily accommodate virtually any kind of subsurface sampling. At Load Lines 2 and 3 there are currently very large trenches, low spots, and otherwise variable topographic features, which make differentiating the extent of original sub slab materials and very recently placed new fill to restore the former building areas difficult. At all four load lines, a wide variety of material may be encountered beneath the former floor slabs, including concrete rubble, sandstone cobbles and boulders, recent fill, older (original construction fill), and original silts and clays. Moreover, portions of underground utility piping may remain. Should such underground piping be encountered, that geoprobe boring will be abandoned and another one attempted close to it so as to avoid the underground piping.

Prudent fully intends to perform as much of the planned subsurface sampling as possible with geoprobe drilling. However, if such drilling proves impractical at some of the planned areas, the following two options may be considered.

If a fairly large amount of cobbles, rubble, and boulders remain below the fill that Pika International is using to restore the sites, then backhoe test pits down to 4' or 5' followed by pushing, banging, or vibrating a 2-1/2" OD x 24" long California split barrel sampler with a liner would be an option to safely get the 5' – 7' stratum, and the shallower samples would be taken off the sides of the test pits.

Because of the uncertainty of the final conditions of the restored areas at Load Lines 1, 2, 3, and 4, it would be highly productive to bring to the site the geoprobe rig that the drilling sub contractor thinks has the best chance of penetrating large gravels and cobbles, a backhoe with a 2-1/2" OD x 24" long California split barrel sampler with liner, and the tracked roto-sonic rig to evaluate drilling performance soon after some or all of the restoration has been completed to allow evaluation of the best types of subsurface drilling at the four subject load lines.

2.0 – PROJECT ORGANIZATION & RESPONSIBILITIES

Section 2.0 of the FWSAP describes the project organization and responsibilities. This information is also contained in Section 4.0 of Prudent Project Management Plan (PMP).

2.1 Project Organization, Roles, and Responsibilities

Prudent is responsible for the execution of this project. The project team is shown in Figure 2-1. The project team organizational chart displays the management and technical roles for this project, as well as the personnel assigned to those roles. Prudent will utilize a two-tiered project management structure for execution of this project. The Program Manager will service all contractual elements and the Project Manager responsible for all technical work.

Program Manager - The Prudent Program Manager (Prakash Raja, CHMM) will be the principal point of contact for all matters relating to the USACE Contracting Officer (CO) or his/her representative (COR). The Program Manager will ensure that the necessary resources will be made available to the Project Manager for execution of the work. The Program Manager reports directly to the President of the firm on the competent execution and the satisfaction of customer and project stakeholders with Prudent's performance. Any changes in the Statement of Work (SOW), schedule, and/or costs which require action by Prudent with the CO or COR, will be handled exclusively by the Program Manager supported by the Project Manager and other key personnel as needed.

Project Manager - The Prudent Project Manager (John P. Jent, PE) will serve as the single point of contact and liaison for all technical work, executing the SOW in compliance with the required schedule. Day-to-day technical activities will be managed by the Project Manager with support from field and other key personnel.

Deputy Project Manager - The Prudent Deputy Project Manager (Tomas Hernandez, Jr., PG) will assist the Project Manager in ensuring project execution in accordance with the contract and regulatory requirements. The Deputy Project Manager will serve as the project scheduler and site supervisor during investigative field work.

Project Quality Assurance Officer - The Prudent Project Quality Assurance Officer (Mark Snyder, PE) will be the principal officer ensuring that the quality of all products adhere to the requirements of the Contractor Quality Assurance Plan (CQAP).

Remediation Engineer/Site Manager - The Prudent Remediation Engineer (Dennis Kirsch, P.E.) will be responsible for development of the remedial design and completion of that work per the design.

Project Chemist - The Prudent Project Chemist (Dr. Joe Fernando) will be responsible for preparing the project QAPP, coordination with the analytical lab, and data verification per the automated data review (ADR) software.

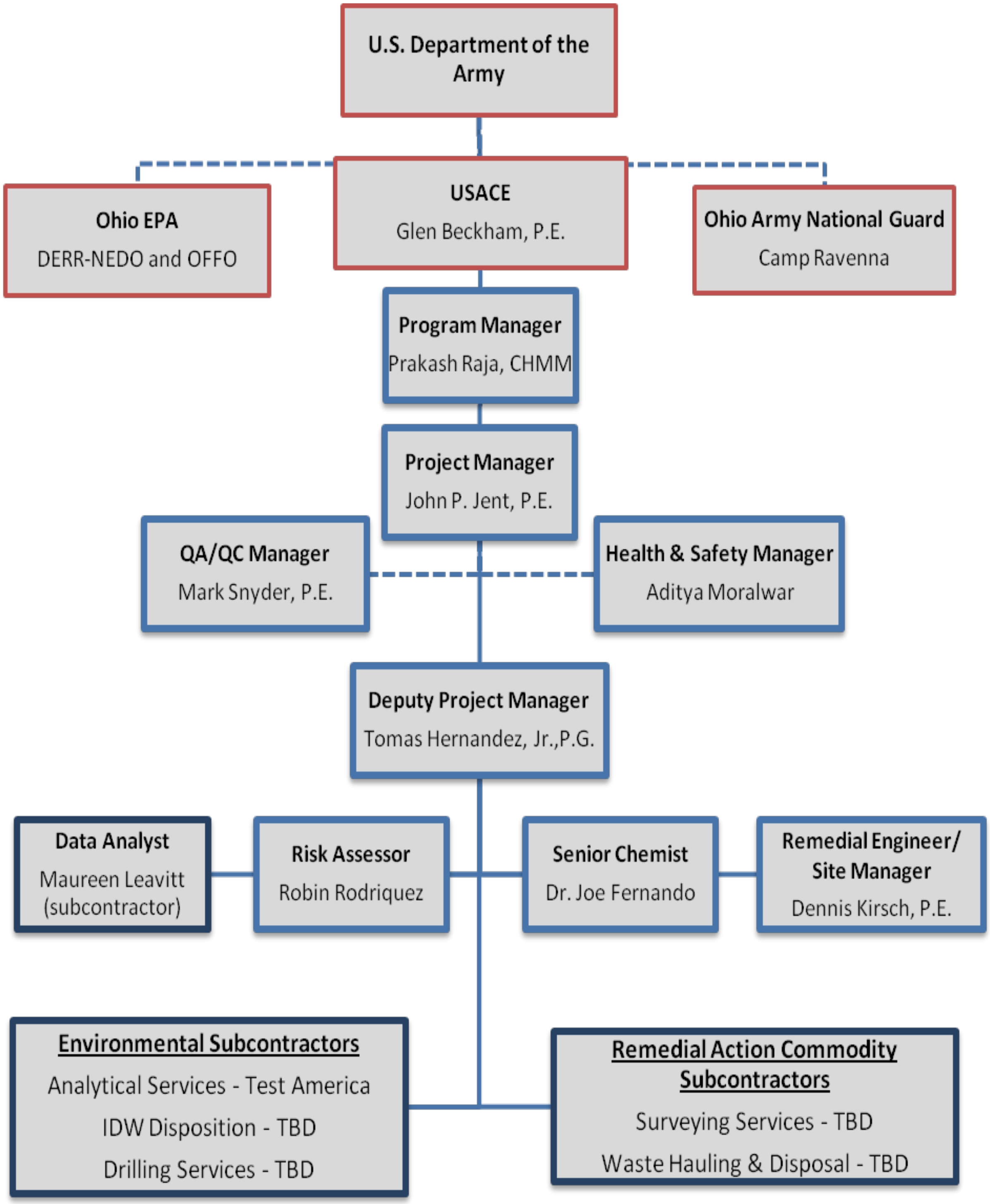
Project Data Analyst - The Project Data Analyst (Maureen Leavitt of Newfields) will perform the multiple evaluations of existing environmental data to the three sets of human health clean-up goals associated with this project to determine feasible remediation approaches and then to document how completed remedial actions have facilitated sufficient clean up to allow transfer of the subject AOCs from the Army to the National Guard Bureau for unrestricted national guard training.

Project Risk Assessor - The Prudent Project Risk Assessor (Dr. Robin Rodriquez) will assist the Project Data Analyst in preparing risk calculations associated with the project.

Project Attorney - Legal advice/review will be provided by Mr. Joseph Koncelik of Frantz Ward LLP.

Site Safety and Health Officer - The Prudent Project Site Safety and Health Officer (Aditya Moralwar) will prepare the project SSHP/Addendum for the necessary site work. The SSHO, or her representative, is responsible for implementation of the SSHP and conducts site inspections to ensure compliance with Federal, State, and Occupational Safety & Health Administration (OSHA) regulations and all aspect of the SSHP/Addendum including activity hazard analyses, air monitoring, use of personal protective equipment (PPE), decontamination, site control, standard operating procedures used to minimize hazards, safe use of engineering controls, the emergency response plan, and spill containment program. The SSHO ensures all personnel are properly trained for their assigned tasks. The SSHO has full authorization to stop work and to demand corrective action for non-compliance with the SSHP/Addendum.

Figure 2-1 Project Organizational Chart



2.2 Subcontractor Management

Prudent will implement this project using contractors for surveying, push probe drilling, chemical laboratory services, data evaluation, and waste removal services. Subcontracts will be carefully developed by the Project Manager to reflect detailed scope and realistic performance objectives and specifications. Performance of all subcontractors will be monitored by the Project Manager, the Investigation Site Supervisor, the Remediation Site Supervisor, and the SSHO who will record observations of progress. Deviations will be addressed in accordance with the protocols specified in the relevant Work Plan(s). Negative performance trends will instigate a negative performance evaluation and a correction action plan will be developed as required to bring schedule/cost performance back in line.

3.0 – PROJECT SCOPE & OBJECTIVES

3.1 SCOPE AND OBJECTIVES

This project has multiple objectives. The first is to provide additional environmental characterization of subsurface materials below the former floor slabs of the buildings at Load Lines 1, 2, 3, and 4. The results of this investigation will be presented in a report, which will also include previous results of recent United States Army Corps of Engineers (USACE) sampling activities outside of former building footprints at the subject load lines to investigate if contamination was spread during building demolition activities. The second objective is to obtain site closure at Load Lines 1, 2, 3, 4, and 12. This will be done by reviewing previous investigation documents and analytical results and then assessing land use controls at each of the subject environmental areas of concern (AOC). The primary goal is to achieve an Unrestricted National Guard Trainee land use for surface soil, subsurface soil, dry sediment, wet sediment, and surface water media. Prudent will submit a report, which summarizes its evaluation of previous environmental work in relation to recent land use control guidance. A proposed path forward will be presented to achieve the desired land use. Additional investigation and remediation may be required and will be conducted by Prudent. The results of this work will be presented in a closure document, which will be as adequate to transfer the property to the NGB with the goal of Unrestricted National Guard Trainee Use.

Specifically, the following tasks are prescribed in the contract to accomplish the overall project objectives.

Task 1	Project Management	
Task 2	Project Work Plan	
Task 3	Project Execution/Client Correspondence	
Task 4	A	Collect Subsurface *Multi-Increment (MI) Samples
	B	Analyze Subsurface MI Samples
	C	Sampling Report
Task 5	Land Use Control Assessment	
Task 6	**Characterization/Confirmatory Sampling (if needed)	
Task 7	Analyses of Characterization/Confirmatory Sampling (if needed)	
Task 8	Soil Remediation (if needed)	
Task 9	Closure Report	

*Multi-Increment© is a registered trademark of EnviroStat, Inc.

****To expedite the schedule, characterization sampling may begin prior to approval of the final LUC Assessment Report**

3.2 DATA QUALITY OBJECTIVES

The overall project data quality objective (DQO) is to provide representative, repeatable, high quality data to address the primary project objectives identified in Section 3.1 of the FWSAP.

3.2.1 Conceptual Site Model

The facility-wide conceptual site model (CSM) for all media except subsurface soil for RVAAP, presented in the FWSAP, is applicable to Load Lines 1, 2, 3, 4, and 12 based on current knowledge. The production activities at each of the lines are documented in the archives. Environmental contamination of subsurface materials is discussed below (Brockman and Szabo, and Christy Forsyth, and Weatherington-Rice, USACE, 1999).

3.2.1.1 Subsurface Soil Contamination Related to Vertical Contaminant Migration

3.2.1.1.1 Vertical Migration

Conventional Darcy flow down through surface (0 – 1') soils is very limited in intact cohesive (silt and clay) soils and is more pronounced in sandy or gravelly soils. Concentrated flow down through vertical cracks in the ground is the dominant means of contamination reaching into the subsurface. Such cracks are due to desiccation, stress rebound (removal of large glacial weight with subsequent expansion and stress relief cracks), animal paths and holes, and died or living vegetation.

Contamination can also occur as concentrated flow through pervious backfill in utility trenches and through underground structures, such as manholes, catch basins, and in man-made disposal pits.

3.2.1.1.2 Horizontal Migration at Depth (See Figure 3-1)

As contamination migrates downward through cracks in the surface and subsurface, once it encounters a natural pervious seam or utility trench it flows laterally in those seams. Subsurface cracks below a pervious subsurface seam may allow the contamination to flow further downward. Generally, with lesser vertical cracking at depth, the contamination may become trapped or limited in the subsurface seam until more inflow from above occurs and dilutes the contamination.

3.2.1.1.3 Implications for subsurface sampling:

Design larger sampling/exposure areas, especially with small buildings; possibly combine several small areas into one sampling area. Due to sand or other pervious subsurface seams, subsurface contamination may extend beyond the limits of the surface sample area. Software, such as Sesoil, used to predict vertical contaminant migration may be of limited value if it does not account for the effects of surface cracking.

3.2.2 Define the Problem

Comprehensive surface soil sampling has been accomplished within the footprints of recently demolished buildings at Load Lines 1, 2, 3, and 4 to characterize contamination within surface soils. Limited subsurface cores were taken to attempt to characterize contamination in subsurface soils. Based on that information, removal of areas of soil having levels of contaminants in excess of the clean up goals was performed. Additional, comprehensive push probe sampling is required to better characterize contamination, if any, within the non-remediated subsurface zones. The results of previous sampling were summarized in Section 1.4 of the Work Plan. The additional subsurface data gained from the subsurface MI sampling of non-remediated zones is needed to develop cost effective future planning for these AOCs.

3.2.3 Remedial Action Objectives

Remedial action objectives are being prepared (May 2010) by the Ravenna Stakeholders in a Draft Guidance document for the Evaluation of Land Use Controls.

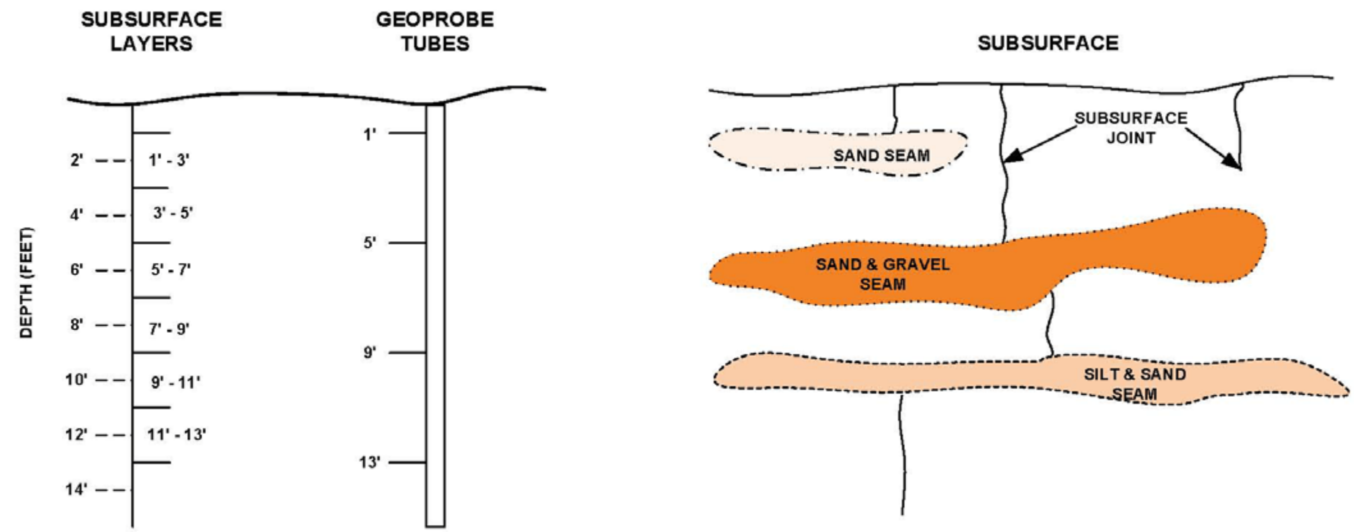


FIGURE 3-1
SUBSURFACE SCHEMATIC

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US Army Corps
of Engineers

3.2.4 Identify Decisions

The key decisions associated with the sampling of this project will determine if an unrestricted national guard use scenario can be accommodated for Load Lines 1, 2, 3, 4, and 12; either with or without additional characterization and remediation; or if the land use will remain National Guard Trainee. There is also the possibility that any remaining contamination at the subject AOCs is sufficiently limited such that an unrestricted resident land use could be justified.

3.2.5 Define the Study Boundaries

The investigation areas for subject load lines are defined as the former building footprints at Load Lines 1, 2, 3, and 4. These areas were established and set forth in the project SOW by the U.S. Army Corps of Engineers (USACE.2010a). They encompass all known or suspected historical operations areas and adjacent support areas.

3.2.6 Identify Decision Rules

Decision rules used to guide remediation decisions will be determined in the Land Use Control Assessment Report.

3.2.7 Identify Inputs to the Decisions

Inputs to the decision process are the analytical results and the refined Load Line-specific conceptual model developed from field observations and environmental data.

3.2.8 Specify Limits on the Decision Error

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

3.2.9 Sample Design

Typically, a minimum of thirty subsamples is used for multi-incremental sampling. This practice is utilized for surface soil MI sampling, except in very small areas where lesser numbers of subsamples have been used. For subsurface MI sampling a lesser number, eleven was used in the pioneering investigation by Bigl, Hewitt, and Ramsey. Moreover, the Hawaii Department of Health, in its highly regarded Technical Guidance Manual for the Implementation of the Hawaii State Contingency Plan recognized that while the use of 30 subsamples for subsurface MI sampling would be ideal, “reducing the number of increments collected in the MIS in the decision unit(s) may be the only option available.”

Much thought was given to the amount and locations of the 4’ deep cores in the previous URS work. Since the results of those investigations appeared to justify those selections, and because the Ravenna stakeholders agreed with both the rational of selecting the high potential buildings and the sampling designs for those buildings, the same sets of buildings and the same sampling plan for those buildings will be utilized. Additionally, the use of volatile organic compounds would have been the greatest at the shell receiving buildings. Further, the presence of floor slabs might have prevented rainfall from leaching out contamination within subsurface sand seams, and since the nature of such contaminants would not remain in the surface soil (which is what has been measured to date) very long, a decision to conduct subsurface MI sampling at the shell preparation buildings was made.

As per the data quality objective of determining contamination (if any) within zones of non-remediated subsurface materials, <u>no push probe subsurface borings will be located within remediated areas, unless approved by the stakeholders.</u> Additional push probe borings <u>may</u> be placed within the sampling/exposure area in zones of no remediation to account for the boring locations initially located in zones of remediated soils.

A generic plan for the subsurface sampling of the high potential buildings (from URS) with a shell receiving building added is provided as Figure 3-2.

Within the given constraints of the contract, a preliminary summary table of the planned subsurface MI sampling is provided as Table 3-1. Final detailed determination of the locations and depths of the subsurface MI sampling will be prepared upon stakeholder review of the draft FSP.

Figures 3-3, 3-4, 3-5, and 3-6 are the templates on which boring locations will be shown once the on-going remediation efforts are being completed at the subject AOCs.

Sampling ID tables for the planned subsurface push probe borings will be provided as Tables 3-2, 3-3, 3-4, and 3-5 once the detailed sampling plan is prepared after completion of the remediation at Load Lines 1, 2, 3, and 4. A discussion of the sampling identification protocols is given following Tables 3-2 – 3-5.

Any Characterization Investigation sampling will be determined after evaluation of the Land Use Control Assessment Report. The scope and details of that investigation are thus to be determined.

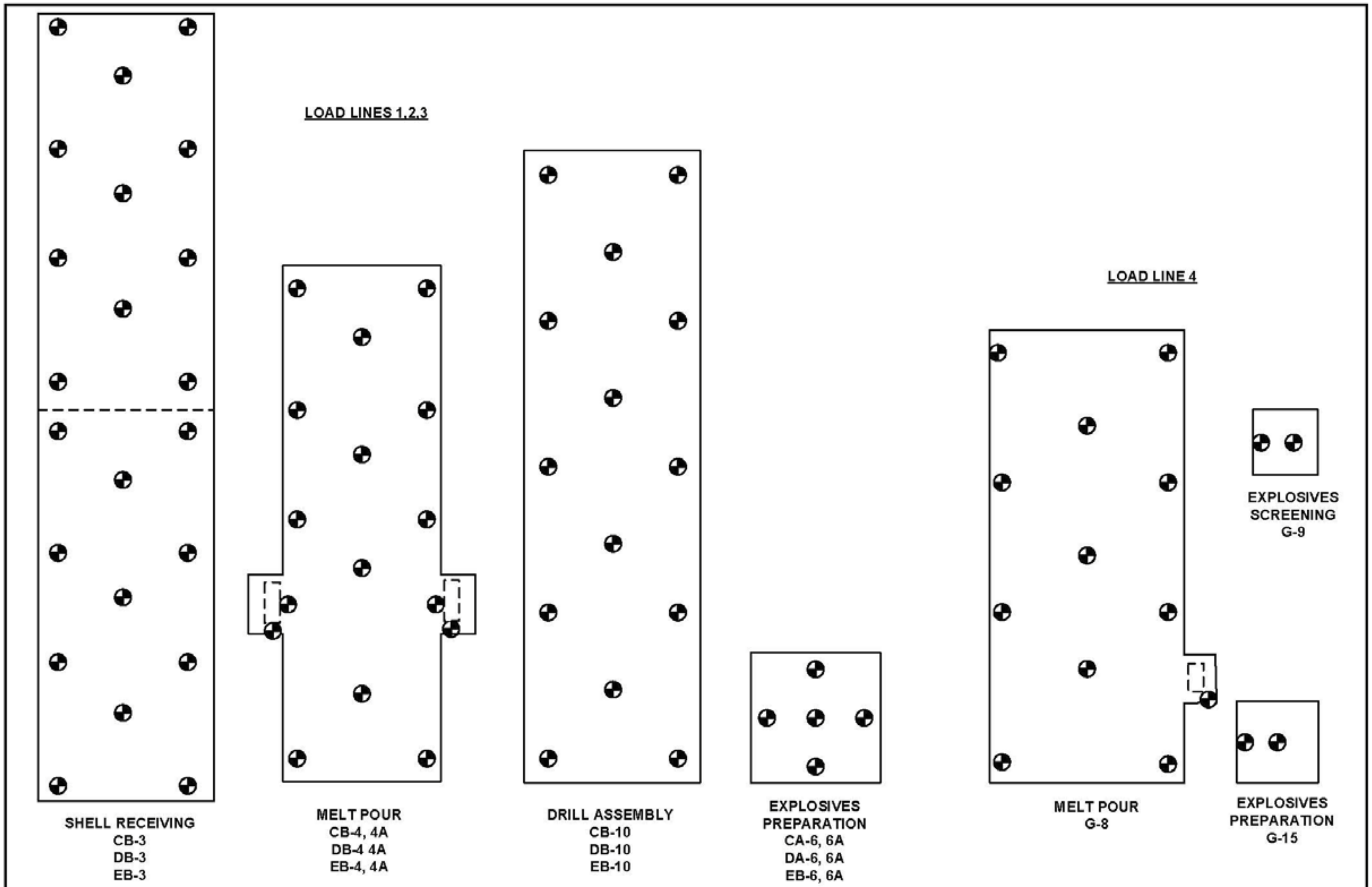


FIGURE 3-2
SCHEMATIC OF PROPOSED SUBSURFACE MI SAMPLING LOCATIONS

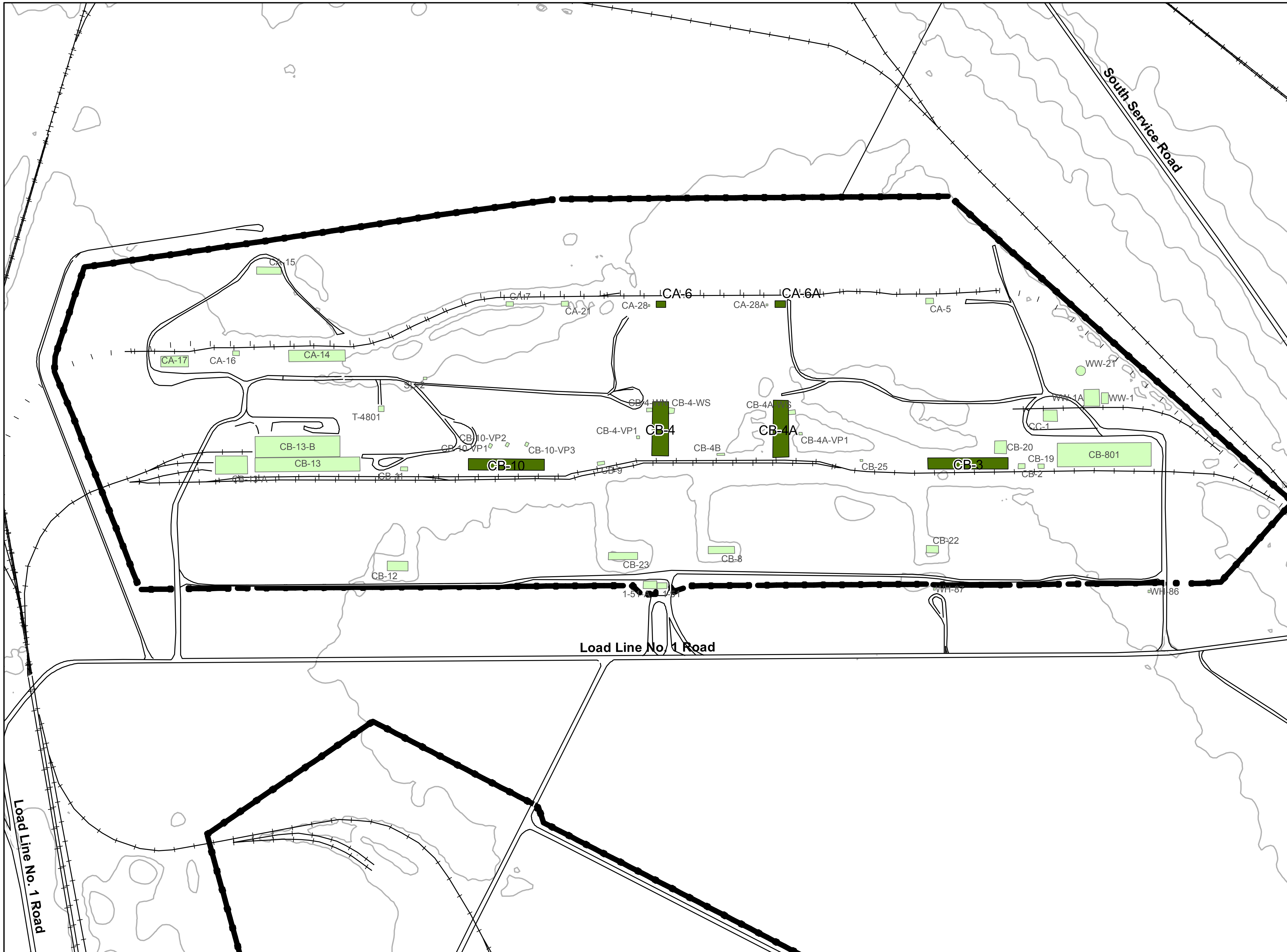
PRUDENT TECHNOLOGIES, INC. dba Prudent Environmental Services, Inc.

US Army Corps of Engineers

LEGEND

Approximate Sampling Location Geoprobe Boring

0 40
SCALE IN FEET



N

270 0 540 Feet

1 inch = 400 feet

Legend

- Roads
- Railroads
- Fence Line
- Elevation Contours (1-M)
- Potential Boring Locations
- LL1 Buildings

Figure 3-3
Load Line 1
Buildings &
Potential Sampling Areas
Ravenna, Ohio

PRUDENT TECHNOLOGIES, INC.
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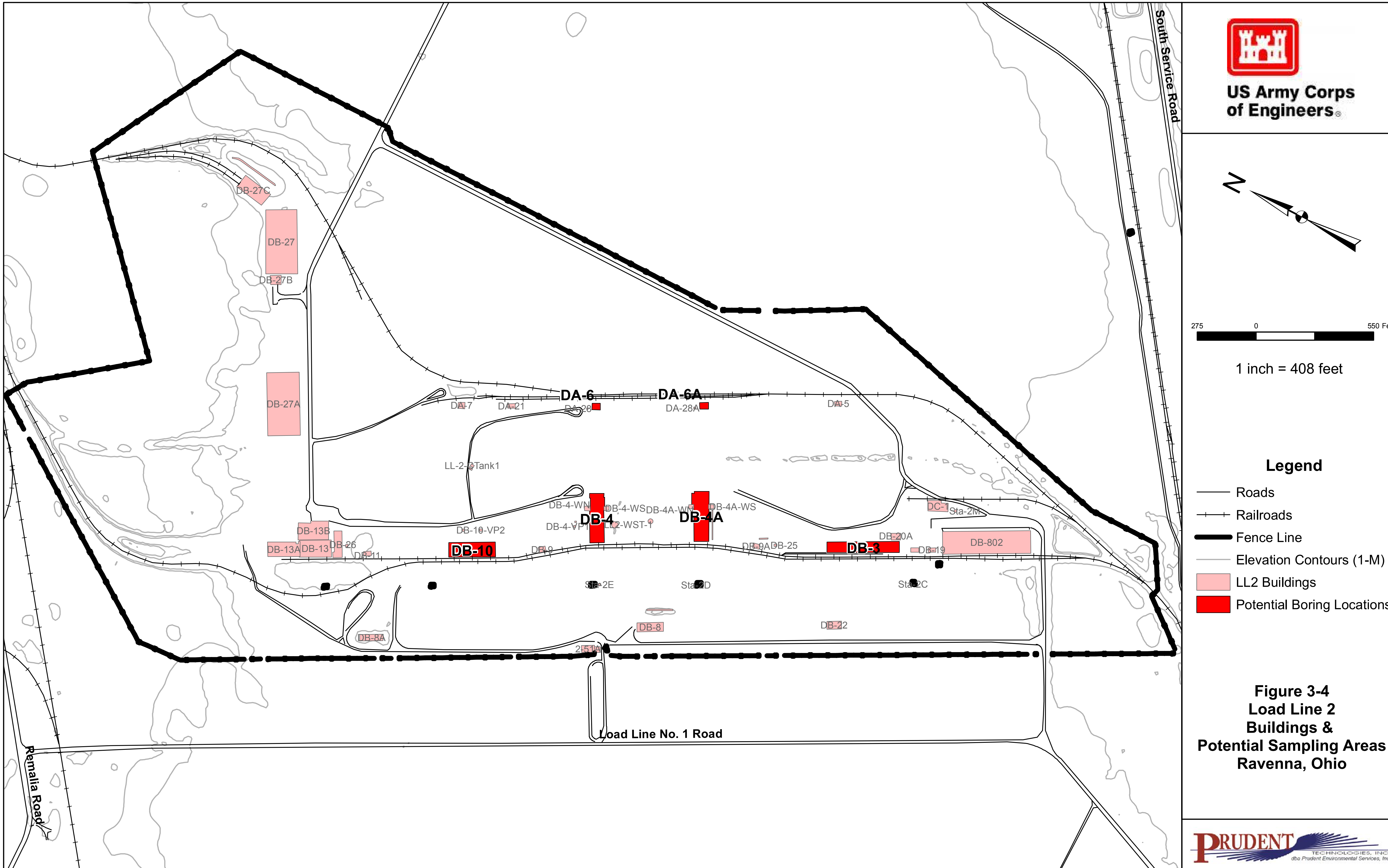
Note: Final boring locations will not be in areas where remediation has occurred.



Note: FInal boring locations will not be in areas where remediation has occurred

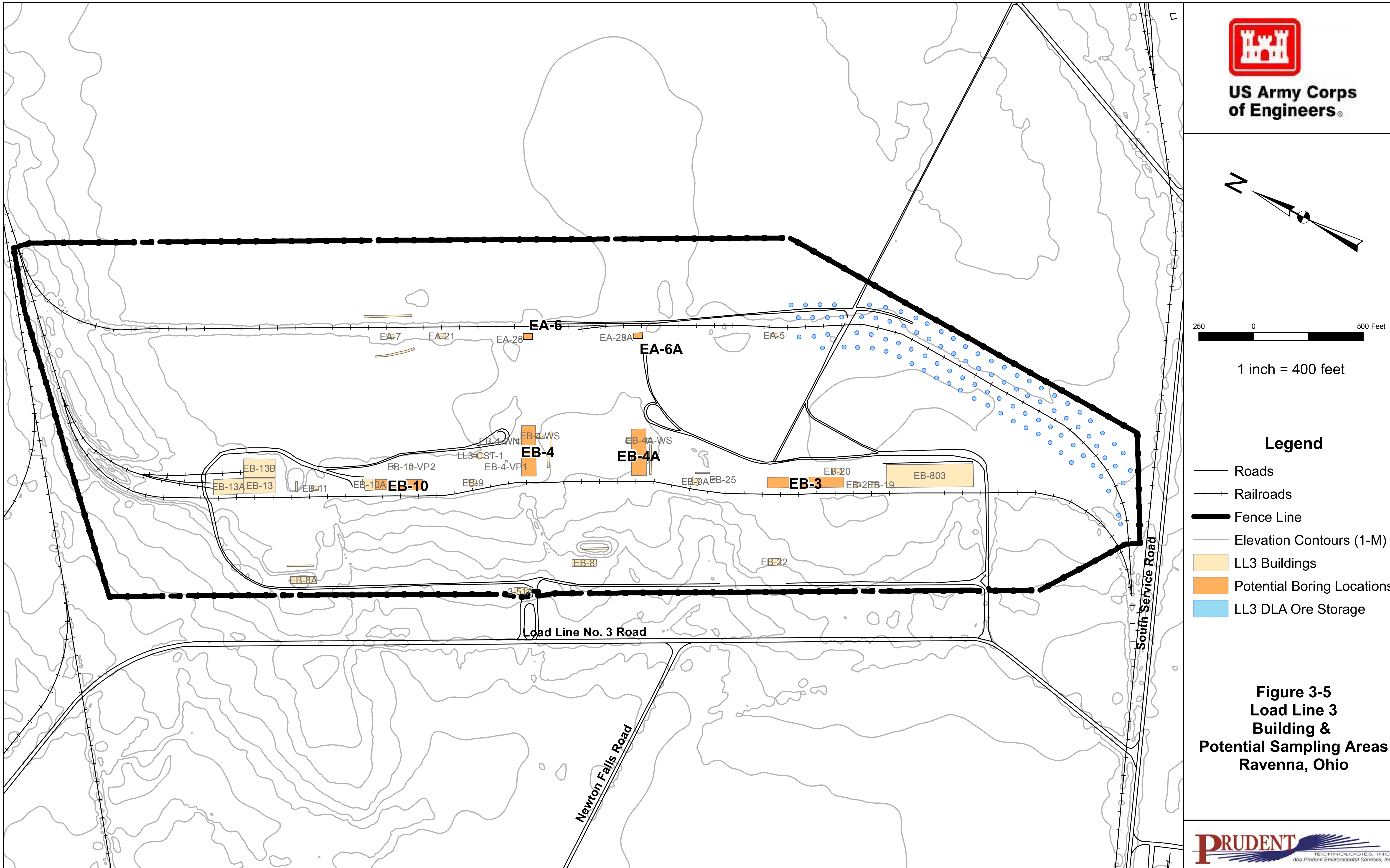


Figure 3-5
Load Line 3
Building &
Potential Sampling Areas
Ravenna, Ohio

Note: Final boring locations will not be in areas where remediation has occurred.

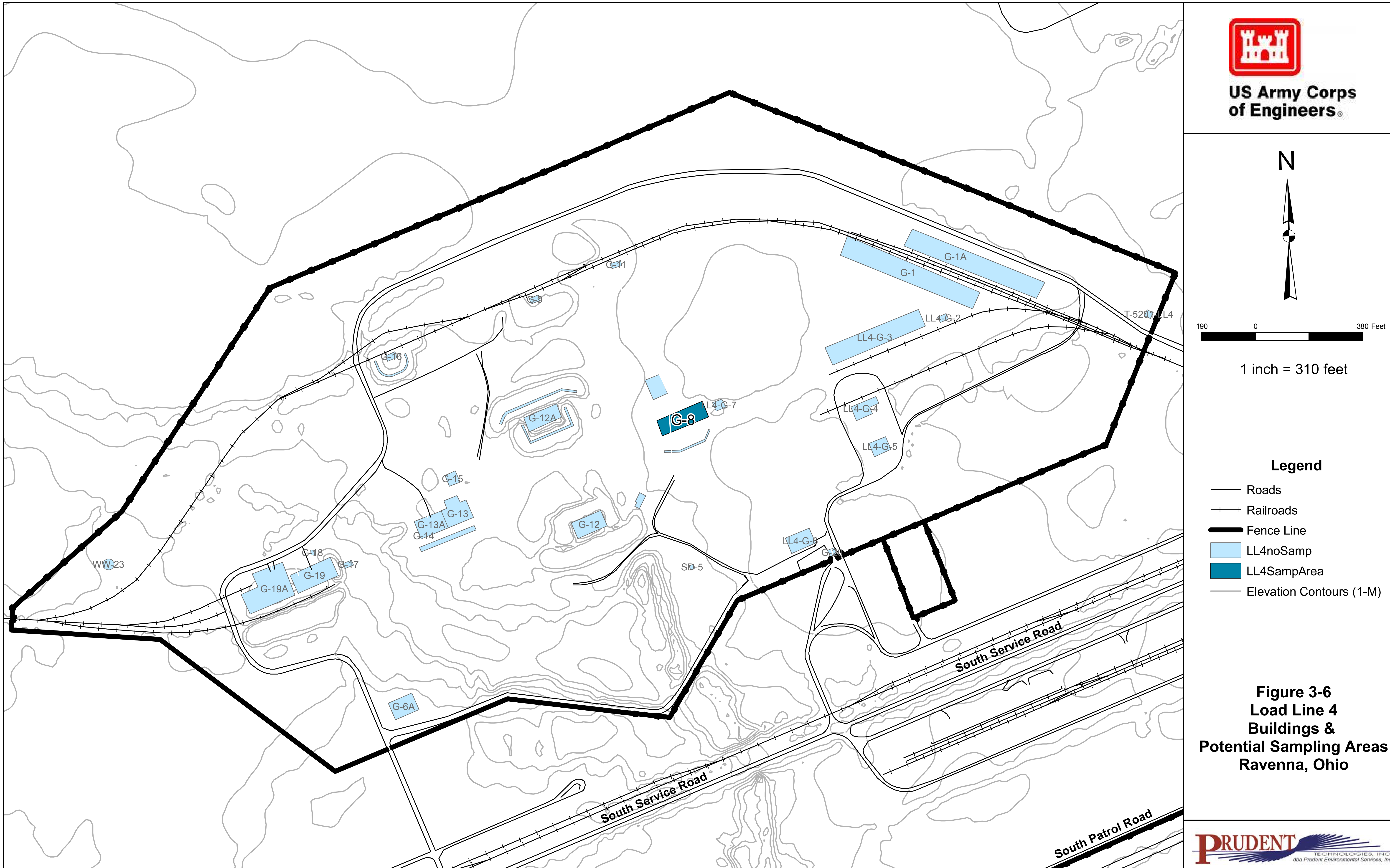


Figure 3-6
Load Line 4
Buildings &
Potential Sampling Areas
Ravenna, Ohio

Note: Final boring locations will not be in areas where remediation has occurred.

Table 3-1 Load Lines 1-4 Summary Sampling Table

	No.	Building Type	Length (ft)	Width ft)	Total No. Geoprobe Holes	Triplicate Geoprobe Holes	Estimated Geoprobe Depth (ft)	Number Primary Horizontal Samples	Number Triplicate Horizontal Samples	Total Geoprobe Footage (ft)	Number Vertical Samples	Analyses	
Load Line 1	CB-3	Shell Receiving Bldg-1	350	50	11		5	2		55	11	Met, Expl, VOC	1 Bldg per load line gets SVOCs/ Pesti/Herbi/ PCBs
		Shell Receiving Bldg-2			11		5	2		55	11	Met, Expl, VOC	
	CA-6	Explosives Preparation	40	40	5	10	5	2	4	75	15	Metals, Explos	
	CA-6A	Explosives Preparation	40	40	5		5	2		25	5	Metals, Explos	
	CB-4	Melt Pour	210	50	16		5	2		80	16	Metals, Explos	
	CB-4A	Melt Pour	210	50	16		5	2		80	16	Metals, Explos	
	CB-10	Drill & Assembly	300	50	14		5	2		70	14	Metals, Explos	
		Top/Rock Varies (0.0' - 6.1') per well logs			78			14		440	88		
Load Line 2	DB-3	Shell Receiving Bldg-1	350	50	11		7	3		77	11	Met, Expl, VOC	1 Bldg per load line gets SVOCs/ Propel Pesti/Herbi/ PCBs
		Shell Receiving Bldg-2			11	22	7	3	6	231	33	Met, Expl, VOC	
	DA-6	Explosives Preparation	40	40	5		7	3		35	5	Metals, Explos	
	DA-6A	Explosives Preparation	40	40	5		7	3		35	5	Metals, Explos	
	DB-4	Melt Pour	210	50	16		7	3		112	16	Metals, Explos	
	DB-4A	Melt Pour	210	50	16		7	3		112	16	Metals, Explos	
	DB-10	Drill & Assembly	300	50	14		7	3		98	14	Metals, Explos	
		Top/Rock Varies (0.7' - 18.6') per well logs			78			21		700	100		
Load Line 3	EB-3	Shell Receiving Bldg-1	350	50	11		7	3		77	11	Met, Expl, VOC	1 Bldg per load line gets SVOCs/ Propel Pesti/Herbi/ PCBs
		Shell Receiving Bldg-2			11		7	3		77	11	Met, Expl, VOC	
	EA-6	Explosives Preparation	40	40	5		7	3		35	5	Metals, Explos	
	EA-6A	Explosives Preparation	40	40	5		7	3		35	5	Metals, Explos	
	EB-4	Melt Pour	210	48	16		7	3		112	16	Metals, Explos	
	EB-4A	Melt Pour	210	48	16		7	3		112	16	Metals, Explos	
	EB-10	Drill & Assembly	300	48	14	28	7	3	6	294	42	Metals, Explos	
		Top/Rock Varies (1.5' - 15.5') per well logs			78			21		742	106		
Load Line 4	G-8	Melt Pour	171	71	12	24	7	3	6	252	36	Full Suite	
					246	84		59	22	2134	330		

Total Number of Horizontal Samples = 81

Total Number of Vertical Samples = 330

Total Number of Collected Samples = 411

Table 3-2: Subsurface MI Sampling Table for Load Lines 1, Ravenna, Ohio

Description			Bldg Size (Ft)		Sample ID		Number Geoprobe Borings	Depth (ft)		Number of Samples													
										Metals + Hg + Cr+6		Explosives		Propellants		VOCs		SVOCs		PCBs		Pesti/Herbi	
Facility/Area	Bldg	Building Utilization	LG	W	Hor	Vert		Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert
LL-1	CB-3	Shell Receiving Bldg-1	350	50	LL1SB-636V-0101-SO		11	1 – 3								1							
					LL1SB-636M-0101-SO			1 - 3		1		1											
					LL1SB-636V-0102-SO			3 – 5								1							
					LL1SB-636M-0102-SO			3 - 5		1		1											
						LLSB-636V-0001-SO			1 - 5								1						
						LLSB-636M-0001-SO			1 - 5		1		1										
						LLSB-636V-0002-SO			1 - 5								1						
						LLSB-636M-0002-SO			1 - 5		1		1										
						LLSB-636V-0003-SO			1 - 5								1						
						LLSB-636M-0003-SO			1 - 5		1		1										
						LLSB-636V-0004-SO			1 - 5								1						
						LLSB-636M-0004-SO			1 - 5		1		1										
						LLSB-636V-0005-SO			1 - 5								1						
						LLSB-636M-0005-SO			1 - 5		1		1										
						LLSB-636V-0006-SO			1 - 5								1						
						LLSB-636M-0006-SO			1 - 5		1		1										
						LLSB-636V-0007-SO			1 - 5								1						
						LLSB-636M-0007-SO			1 - 5		1		1										
						LLSB-636V-0008-SO			1 - 5								1						
						LLSB-636M-0008-SO			1 - 5		1		1										
						LLSB-636V-0009-SO			1 - 5								1						
						LLSB-636M-0009-SO			1 - 5		1		1										
						LLSB-636V-0010-SO			1 - 5								1						
						LLSB-636M-0010-SO			1 - 5		1		1										
						LLSB-636V-0011-SO			1 - 5								1						
						LLSB-636M-0011-SO			1 - 5		1		1										
	CB-3	Shell Receiving Bldg-2	350	50	LL1SB-634V-0101-SO		11	1 – 3								1							
					LL1SB-634M-0101-SO			1 - 3		1		1											
					LL1SB-634V-0102-SO			3 – 5								1							
					LL1SB-634M-0102-SO			3 - 5		1		1											
						LLSB-634V-0001-SO			1 - 5								1						
						LLSB-634M-0001-SO			1 - 5		1		1										
						LLSB-634V-0002-SO			1 - 5								1						
						LLSB-634M-0002-SO			1 - 5		1		1										
						LLSB-634V-0003-SO			1 - 5								1						
						LLSB-634M-0003-SO			1 - 5		1		1										
						LLSB-634V-0004-SO			1 - 5								1						
						LLSB-634M-0004-SO			1 - 5		1		1										
						LLSB-634V-0005-SO			1 - 5								1						
						LLSB-634M-0005-SO			1 - 5		1		1										
						LLSB-634V-0006-SO			1 - 5								1						
						LLSB-634M-0006-SO			1 - 5		1		1										
						LLSB-634V-0007-SO			1 - 5								1						

Description			Bldg Size (Ft)		Sample ID		Number Geoprobe Borings	Depth (ft)		Number of Samples													
										Metals + Hg + Cr+6		Explosives		Propellants		VOCs		SVOCs		PCBs		Pesti/Herbi	
Facility/Area	Bldg	Building Utilization	LG	W	Hor	Vert		Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert
LL-1	CB-3 (Continued)	Shell Receiving Bldg	350	50		LLSB-634M-0007-SO			1 - 5		1		1										
		(Continued)				LLSB-634V-0008-SO			1 - 5								1						
						LLSB-634M-0008-SO			1 - 5		1		1										
						LLSB-634V-0009-SO			1 - 5								1						
						LLSB-634M-0009-SO			1 - 5		1		1										
						LLSB-634V-0010-SO			1 - 5								1						
						LLSB-634M-0010-SO			1 - 5		1		1										
						LLSB-634V-0011-SO			1 - 5								1						
						LLSB-634M-0011-SO			1 - 5		1		1										
	CA-6	Explosives	40	40	LL1SB-635V-0101-SO		5	1 – 3								1							
		Preparation			LL1SB-635B-0101-SO			1 - 3								1							
					LL1SB-635M-0101-SO			1 - 3		1		1		1				1		1		1	
					LL1SB-635V-0102-SO			3 – 5								1							
					LL1SB-635B-0102-SO			3 – 5								1							
					LL1SB-635M-0102-SO			3 - 5		1		1		1				1		1		1	
						LLSB-635V-0001-SO			1 - 5								1						
						LLSB-635M-0001-SO			1 - 5		1		1		1				1		1		1
						LLSB-635V-0002-SO			1 - 5								1						
						LLSB-635M-0002-SO			1 - 5		1		1		1				1		1		1
						LLSB-635V-0003-SO			1 - 5								1						
						LLSB-635M-0003-SO			1 - 5		1		1		1				1		1		1
						LLSB-635V-0004-SO			1 - 5								1						
						LLSB-635M-0004-SO			1 - 5		1		1		1				1		1		1
						LLSB-635V-0005-SO			1 - 5								1						
						LLSB-635M-0005-SO			1 - 5		1		1		1				1		1		1
	CA-6	Explosives	40	40	LL1SB-637V-0101-SO		5	1 – 3								1							
		Preparation			LL1SB-637M-0101-SO			1 - 3		1		1		1				1		1		1	
					LL1SB-637V-0102-SO			3 – 5								1							
					LL1SB-637M-0102-SO			3 - 5		1		1		1				1		1		1	
						LLSB-637-0001-SO			1 - 5								1						
						LLSB-637M-0001-SO			1 - 5		1		1		1				1		1		1
						LLSB-637V-0002-SO			1 - 5								1						
						LLSB-637M-0002-SO			1 - 5		1		1		1				1		1		1
						LLSB-637V-0003-SO			1 - 5								1						
						LLSB-637M-0003-SO			1 - 5		1		1		1				1		1		1
						LLSB-637V-0004-SO			1 - 5								1						
						LLSB-637M-0004-SO			1 - 5		1		1		1				1		1		1
						LLSB-637V-0005-SO			1 - 5								1						
						LLSB-637M-0005-SO			1 - 5		1		1		1				1				1
	CA-6	Explosives	40	40	LL1SB-631V-0101-SO		5	1 – 3								1							
		Preparation			LL1SB-631M-0101-SO			1 - 3		1		1		1				1		1			1
					LL1SB-631V-0102-SO			3 – 5								1							
					LL1SB-631M-0102-SO			3 - 5		1		1		1				1		1			1
						LLSB-631V-0001-SO			1 - 5								1						
						LLSB-631M-0001-SO			1 - 5		1		1		1				1		1		1
						LLSB-631V-0002-SO			1 - 5								1						
						LLSB-631M-0002-SO			1 - 5		1		1		1				1		1		1

Description			Bldg Size (Ft)		Sample ID		Number Geoprobe Borings	Depth (ft)		Number of Samples													
										Metals + Hg + Cr+6		Explosives		Propellants		VOCs		SVOCs		PCBs		Pesti/Herbi	
Facility/Area	Bldg	Building Utilization	LG	W	Hor	Vert		Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert
LL-1						LLSB-631V-0003-SO			1 - 5								1						
						LLSB-631M-0003-SO			1 - 5		1		1		1				1		1		1
						LLSB-631V-0004-SO			1 - 5								1						
						LLSB-631M-0004-SO			1 - 5		1		1		1				1		1		1
						LLSB-631V-0005-SO			1 - 5								1						
						LLSB-631M-0005-SO			1 - 5		1		1		1				1		1		1
	CA-6A	Explosives	40	40	LL1SB-633M-0101-SO		5	1 – 3		1		1											
		Preparation			LL1SB-633M-0102-SO			3 -- 5		1		1											
						LLSB-633M-0001-SO			1 - 5		1		1										
						LLSB-633M-0002-SO			1 - 5		1		1										
						LLSB-633M-0003-SO			1 - 5		1		1										
						LLSB-633M-0004-SO			1 - 5		1		1										
						LLSB-633M-0005-SO			1 - 5		1		1										
	CB-4	Melt Pour	210	50	LL1SB-632M-0101-SO		16	1 – 3		1		1											
					LL1SB-632M-0102-SO			3 -- 5		1		1											
						LLSB-632M-0001-SO			1 - 5		1		1										
						LLSB-632M-0002-SO			1 - 5		1		1										
						LLSB-632M-0003-SO			1 - 5		1		1										
						LLSB-632M-0004-SO			1 - 5		1		1										
						LLSB-632M-0005-SO			1 - 5		1		1										
						LLSB-632M-0006-SO			1 - 5		1		1										
						LLSB-632M-0007-SO			1 - 5		1		1										
						LLSB-632M-0008-SO			1 - 5		1		1										
						LLSB-632M-0009-SO			1 - 5		1		1										
						LLSB-632M-0010-SO			1 - 5		1		1										
						LLSB-632M-0011-SO			1 - 5		1		1										
						LLSB-632M-0012-SO			1 - 5		1		1										
						LLSB-632M-0013-SO			1 - 5		1		1										
						LLSB-632M-0014-SO			1 - 5		1		1										
						LLSB-632M-0015-SO			1 - 5		1		1										
						LLSB-632M-0016-SO			1 - 5		1		1										
	CB-4A	Melt Pour	210	50	LL1SB-638M-0101-SO		16	1 – 3		1		1											
					LL1SB-638M-0102-SO			3 -- 5		1		1											
						LLSB-638M-0001-SO			1 - 5		1		1										
						LLSB-638M-0002-SO			1 - 5		1		1										
						LLSB-638M-0003-SO			1 - 5		1		1										
						LLSB-638M-0004-SO			1 - 5		1		1										
						LLSB-638M-0005-SO			1 - 5		1		1										
						LLSB-638M-0006-SO			1 - 5		1		1										
						LLSB-638M-0007-SO			1 - 5		1		1										
						LLSB-638M-0008-SO			1 - 5		1		1										
						LLSB-638M-0009-SO			1 - 5		1		1										
						LLSB-638M-0010-SO			1 - 5		1		1										
						LLSB-638M-0011-SO			1 - 5		1		1										
						LLSB-638M-0012-SO			1 - 5		1		1										

Description			Bldg Size (Ft)		Sample ID		Number Geoprobe Borings	Depth (ft)		Number of Samples													
										Metals + Hg + Cr+6		Explosives		Propellants		VOCs		SVOCs		PCBs		Pesti/Herbi	
Facility/Area	Bldg	Building Utilization	LG	W	Hor	Vert		Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert
LL-1	CB-4	Melt Pour	210	50		LLSB-638M-0013-SO			1 - 5		1		1										
	(Continued)	(Continued)				LLSB-638M-0014-SO			1 - 5		1		1										
						LLSB-638M-0015-SO			1 - 5		1		1										
						LLSB-638M-0016-SO			1 - 5		1		1										
	CB-10	Drill and	300	50	LL1SB-630M-0101-SO		14	1 – 3		1		1											
		Assembly			LL1SB-630M-0102-SO			3 - 5		1		1											
						LLSB-630M-0001-SO			1 - 5		1		1										
						LLSB-630M-0002-SO			1 - 5		1		1										
						LLSB-630M-0003-SO			1 - 5		1		1										
						LLSB-630M-0004-SO			1 - 5		1		1										
						LLSB-630M-0005-SO			1 - 5		1		1										
						LLSB-630M-0006-SO			1 - 5		1		1										
						LLSB-630M-0007-SO			1 - 5		1		1										
						LLSB-630M-0008-SO			1 - 5		1		1										
						LLSB-630M-0009-SO			1 - 5		1		1										
						LLSB-630M-0010-SO			1 - 5		1		1										
						LLSB-630M-0011-SO			1 - 5		1		1										
						LLSB-630M-0012-SO			1 - 5		1		1										
						LLSB-630M-0013-SO			1 - 5		1		1										
						LLSB-630M-0014-SO			1 - 5		1		1										
	Primary MI Sample							totals:		14	78	14	78	2	5	6	27	2	5	2	5	2	5
	Methanol Field Blank							totals								2							
	QC Triplicate to Primary Lab							totals:		2		2		2		2		2		2		2	
	QA Triplicate to QA Lab							totals:		2		2		2	5	2		2		2		2	5
								TOTAL		18	78	18	78	6	5	12	27	6	5	6	5	6	5

Only one set of vertical samples will be analyzed in a sample area, either those associated with the primary sample or those associated with the triplicate horizontal samples that have the most CUG exceedances.

Table 3-3: Subsurface MI Sampling Table for Load Lines 2, Ravenna, Ohio

Description			Bldg Size (Ft)		Sample ID		Number Geoprobe Borings	Depth (ft)		Number of Samples													
										Metals + Hg + Cr+6		Explosives		Propellants		VOCs		SVOCs		PCBs		Pesti/Herbi	
Facility/Area	Bldg	Building Utilization	LG	W	Hor	Vert		Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert
LL-2	DB-3	Shell Receiving Bldg-1	350	50	LL2SB-507V-0101-SO		11	1 – 3								1							
					LL2SB-507M-0101-SO			1 - 3		1		1											
					LL2SB-507V-0102-SO			3 – 5								1							
					LL2SB-507M-0102-SO			3 - 5		1		1											
					LL2SB-507V-0103-SO			5 - 7								1							
					LL2SB-507M-0103-SO			5 - 7		1		1											
						LL2SB-507V-0001-SO			1 - 7								1						
						LL2SB-507M-0001-SO			1 - 7		1		1										
						LL2SB-507V-0002-SO			1 - 7								1						
						LL2SB-507M-0002-SO			1 - 7		1		1										
						LL2SB-507V-0003-SO			1 - 7								1						
						LL2SB-507M-0003-SO			1 - 7		1		1										
						LL2SB-507V-0004-SO			1 - 7								1						
						LL2SB-507M-0004-SO			1 - 7		1		1										
						LL2SB-507V-0005-SO			1 – 7								1						
						LL2SB-507M-0005-SO			1 – 7		1		1										
						LL2SB-507V-0006-SO			1 – 7								1						
						LL2SB-507M-0006-SO			1 – 7		1		1										
						LL2SB-507V-0007-SO			1 – 7								1						
						LL2SB-507M-0007-SO			1 – 7		1		1										
						LL2SB-507V-0008-SO			1 – 7								1						
						LL2SB-507M-0008-SO			1 – 7		1		1										
						LL2SB-507V-0009-SO			1 – 7								1						
						LL2SB-507M-0009-SO			1 – 7		1		1										
						LL2SB-507V-0010-SO			1 – 7								1						
						LL2SB-507M-0010-SO			1 – 7		1		1										
						LL2SB-507V-0011-SO			1 – 7								1						
						LL2SB-507M-0011-SO			1 – 7		1		1										
	DB-3	Shell Receiving Bldg-2	350	50	LL2SB-505V-0101-SO		11	1 – 3								1							
					LL2SB-505B-0101-SO			1 - 3								1							
					LL2SB-505M-0101-SO			1 - 3		1		1		1				1		1		1	
					LL2SB-505V-0102-SO			3 – 5								1							
					LL2SB-505B-0102-SO			3 - 5								1							
					LL2SB-505M-0102-SO			3 - 5		1		1		1				1		1		1	
					LL2SB-505V-0103-SO			5 - 7								1							
					LL2SB-505V-0103-SO			5 - 7								1							
					LL2SB-505M-0103-SO			5 - 7		1		1		1				1		1		1	
						LL2SB-505V-0001-SO			1 - 7								1						
						LL2SB-505M-0001-SO			1 - 7		1		1		1				1		1		1
						LL2SB-505V-0002-SO			1 - 7								1						
						LL2SB-505M-0002-SO			1 - 7		1		1		1				1		1		1
						LL2SB-505V-0003-SO			1 - 7								1						
						LL2SB-505M-0003-SO			1 - 7		1		1		1				1		1		1
						LL2SB-505V-0004-SO			1 - 7								1						
						LL2SB-505M-0004-SO			1 - 7		1		1		1				1		1		1
						LL2SB-505V-0005-SO			1 – 7								1						

Description			Bldg Size (Ft)		Sample ID		Number Geoprobe Borings	Depth (ft)		Number of Samples													
										Metals + Hg + Cr+6		Explosives		Propellants		VOCs		SVOCs		PCBs		Pesti/Herbi	
Facility/Area	Bldg	Building Utilization	LG	W	Hor	Vert		Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert
LL-2	DB-3	Shell Receiving Bldg-2	350	50		LL2SB-505M-0005-SO			1 – 7		1		1		1				1		1		1
	(Continued)	(Continued)				LL2SB-505V-0006-SO			1 – 7								1						
						LL2SB-505M-0006-SO			1 – 7		1		1		1				1		1		1
						LL2SB-505V-0007-SO			1 – 7								1						
						LL2SB-505M-0007-SO			1 – 7		1		1		1				1		1		1
						LL2SB-505V-0008-SO			1 – 7								1						
						LL2SB-505M-0008-SO			1 – 7		1		1		1				1		1		1
						LL2SB-505V-0009-SO			1 – 7								1						
						LL2SB-505M-0009-SO			1 – 7		1		1		1				1		1		1
						LL2SB-505V-0010-SO			1 – 7								1						
						LL2SB-505M-0010-SO			1 – 7		1		1		1				1		1		1
						LL2SB-505V-0011-SO			1 – 7								1						
						LL2SB-505M-0011-SO			1 – 7		1		1		1				1		1		1
	DB-3	Shell Receiving Bldg-2	350	50	LL2SB-501V-0101-SO		11	1 – 3								1							
					LL2SB-501M-0101-SO			1 - 3		1		1		1				1		1		1	
					LL2SB-501V-0102-SO			3 – 5								1							
					LL2SB-501M-0102-SO			3 - 5		1		1		1				1		1		1	
					LL2SB-501V-0103-SO			5 - 7								1							
					LL2SB-501M-0103-SO			5 - 7		1		1		1				1		1		1	
						LL2SB-501V-0001-SO			1 - 7								1						
						LL2SB-501M-0001-SO			1 - 7		1		1		1				1		1		
						LL2SB-501V-0002-SO			1 - 7								1						
						LL2SB-501M-0002-SO			1 - 7		1		1		1				1		1		1
						LL2SB-501V-0003-SO			1 - 7								1						
						LL2SB-501M-0003-SO			1 - 7		1		1		1				1		1		1
						LL2SB-501V-0004-SO			1 - 7								1						
						LL2SB-501M-0004-SO			1 - 7		1		1		1				1		1		1
						LL2SB-501V-0005-SO			1 – 7								1						
						LL2SB-501M-0005-SO			1 – 7		1		1		1				1		1		1
						LL2SB-501V-0006-SO			1 – 7								1						
						LL2SB-501M-0006-SO			1 – 7		1		1		1				1		1		1
						LL2SB-501V-0007-SO			1 – 7								1						
						LL2SB-501M-0007-SO			1 – 7		1		1		1				1		1		1
						LL2SB-501V-0008-SO			1 – 7								1						
						LL2SB-501M-0008-SO			1 – 7		1		1		1				1		1		1
						LL2SB-501V-0009-SO			1 – 7								1						
						LL2SB-501M-0009-SO			1 – 7		1		1		1				1		1		1
						LL2SB-501V-0010-SO			1 – 7								1						
						LL2SB-501M-0010-SO			1 – 7		1		1		1				1		1		1
						LL2SB-501V-0011-SO			1 – 7								1						
						LL2SB-501M-0011-SO			1 – 7		1		1		1				1		1		1
	DB-3	Shell Receiving Bldg-2	350	50	LL2SB-504V-0101-SO		11	1 – 3								1							
					LL2SB-504M-0101-SO			1 - 3		1		1		1				1		1		1	
					LL2SB-504V-0102-SO			3 – 5								1							
					LL2SB-504M-0102-SO			3 - 5		1		1		1				1		1		1	

Description			Bldg Size (Ft)		Sample ID		Number Geoprobe Borings	Depth (ft)		Number of Samples													
										Metals + Hg + Cr+6		Explosives		Propellants		VOCs		SVOCs		PCBs		Pesti/Herbi	
Facility/Area	Bldg	Building Utilization	LG	W	Hor	Vert		Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert
LL-2	DB-3	Shell Receiving Bldg-2	350	50	LL2SB-504V-0103-SO			5 - 7								1							
	(Continued)	(Continued			LL2SB-504M-0103-SO			5 - 7		1		1		1				1		1		1	
						LL2SB-504V-0001-SO			1 - 7								1						
						LL2SB-504M-0001-SO			1 - 7		1		1		1				1		1		
						LL2SB-504V-0002-SO			1 - 7								1						
						LL2SB-504M-0002-SO			1 - 7		1		1		1				1		1		1
						LL2SB-504V-0003-SO			1 - 7								1						
						LL2SB-504M-0003-SO			1 - 7		1		1		1				1		1		1
						LL2SB-504V-0004-SO			1 - 7								1						
						LL2SB-504M-0004-SO			1 - 7		1		1		1				1		1		1
						LL2SB-504V-0005-SO			1 – 7								1						
						LL2SB-504M-0005-SO			1 – 7		1		1		1				1		1		1
						LL2SB-504V-0006-SO			1 – 7								1						
						LL2SB-504M-0006-SO			1 – 7		1		1		1				1		1		1
						LL2SB-504V-0007-SO			1 – 7								1						
						LL2SB-504M-0007-SO			1 – 7		1		1		1				1		1		1
						LL2SB-504V-0008-SO			1 – 7								1						
						LL2SB-504M-0008-SO			1 – 7		1		1		1				1		1		1
						LL2SB-504V-0009-SO			1 – 7								1						
						LL2SB-504M-0009-SO			1 – 7		1		1		1				1		1		1
						LL2SB-504V-0010-SO			1 – 7								1						
						LL2SB-504M-0010-SO			1 – 7		1		1		1				1		1		1
						LL2SB-504V-0011-SO			1 – 7								1						
						LL2SB-504M-0011-SO			1 – 7		1		1		1				1		1		1
	DA-6	Explosives Preparation	40	40	LL2SB-508M-0101-SO		5	1 – 3		1		1											
					LL2SB-508M-0102-SO			3 - 5		1		1											
					LL2SB-508M-0103-SO			5 - 7		1													
						LL2SB-508M-0001-SO			1 – 7		1		1										
						LL2SB-508M-0002-SO			1 – 7		1		1										
						LL2SB-508M-0003-SO			1 – 7		1		1										
						LL2SB-508M-0004-SO			1 – 7		1		1										
						LL2SB-508M-0005-SO			1 – 7		1		1										
	DA-6A	Explosives Preparation	40	40	LL2SB-506M-0101-SO		5	1 – 3		1		1											
					LL2SB-506M-0102-SO			3 - 5		1		1											
					LL2SB-506M-0103-SO			5 - 7		1													
						LL2SB-506M-0001-SO			1 – 7		1		1										
						LL2SB-506M-0002-SO			1 – 7		1		1										
						LL2SB-506M-0003-SO			1 – 7		1		1										
						LL2SB-506M-0004-SO			1 – 7		1		1										
						LL2SB-506M-0005-SO			1 – 7		1		1										
	DB-4	Melt Pour	210	50	LL2SB-502M-0101-SO		16	1 – 3		1		1											
					LL2SB-502M-0102-SO			3 - 5		1		1											
					LL2SB-502M-0103-SO			5 - 7		1		1											
						LL2SB-502M-0001-SO			1 – 7		1		1										
						LL2SB-502M-0002-SO			1 – 7		1		1										

Description			Bldg Size (Ft)		Sample ID		Number Geoprobe Borings	Depth (ft)		Number of Samples													
										Metals + Hg + Cr+6		Explosives		Propellants		VOCs		SVOCs		PCBs		Pesti/Herbi	
Facility/Area	Bldg	Building Utilization	LG	W	Hor	Vert		Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert
LL-2	DB-4	Melt Pour	210	50		LL2SB-502M-0003-SO			1 – 7		1		1										
	(Continued)	(Continued)				LL2SB-502M-0004-SO			1 – 7		1		1										
						LL2SB-502M-0005-SO			1 – 7		1		1										
						LL2SB-502M-0006-SO			1 – 7		1		1										
						LL2SB-502M-0007-SO			1 – 7		1		1										
						LL2SB-502M-0008-SO			1 – 7		1		1										
						LL2SB-502M-0009-SO			1 - 7		1		1										
						LL2SB-502M-0010-SO			1 - 7		1		1										
						LL2SB-502M-0011-SO			1 - 7		1		1										
						LL2SB-502M-0012-SO			1 - 7		1		1										
						LL2SB-502M-0013-SO			1 - 7		1		1										
						LL2SB-502M-0014-SO			1 - 7		1		1										
						LL2SB-502M-0015-SO			1 - 7		1		1										
						LL2SB-502M-0016-SO			1 - 7		1		1										
	DB-4A	Melt Pour	210	50	LL2SB-509M-0101-SO		16	1 – 3		1		1											
					LL2SB-509M-0102-SO			3 - 5		1		1											
					LL2SB-509M-0103-SO			5 - 7		1		1											
						LL2SB-509M-0001-SO			1 – 7		1		1										
						LL2SB-509M-0002-SO			1 – 7		1		1										
						LL2SB-509M-0003-SO			1 – 7		1		1										
						LL2SB-509M-0004-SO			1 – 7		1												
						LL2SB-509M-0005-SO			1 – 7		1		1										
						LL2SB-509M-0006-SO			1 – 7		1		1										
						LL2SB-509M-0007-SO			1 – 7		1		1										
						LL2SB-509M-0008-SO			1 – 7		1		1										
						LL2SB-509M-0009-SO			1 - 7		1		1										
						LL2SB-509M-0010-SO			1 - 7		1		1										
						LL2SB-509M-0011-SO			1 - 7		1		1										
						LL2SB-509M-0012-SO			1 - 7		1		1										
						LL2SB-509M-0013-SO			1 - 7		1		1										
						LL2SB-509M-0014-SO			1 - 7		1		1										
						LL2SB-509M-0015-SO			1 - 7		1		1										
						LL2SB-509M-0016-SO			1 - 7		1		1										
	DB-10	Drill and	300	50	LL1SB-503M-0101-SO		14	1 – 3		1		1											
		Assembly			LL1SB-503M-0102-SO			3 – 5		1		1											
					LL1SB-503M-0103-SO			5 – 7		1		1											
						LL2SB5030M-0001-SO			1 - 5		1		1										
						LL2SB-503M-0002-SO			1 – 7		1		1										
						LL2SB-503M-0003-SO			1 – 7		1		1										
						LL2SB-503M-0004-SO			1 – 7		1												
						LL2SB-503M-0005-SO			1 – 7		1		1										
						LL2SB-503M-0006-SO			1 – 7		1		1										
						LL2SB-503M-0007-SO			1 – 7		1		1										
						LL2SB-503M-0008-SO			1 – 7		1		1										
						LL2SB-503M-0009-SO			1 - 7		1		1										

Description			Bldg Size (Ft)		Sample ID		Number Geoprobe Borings	Depth (ft)		Number of Samples													
										Metals + Hg + Cr+6		Explosives		Propellants		VOCs		SVOCs		PCBs		Pesti/Herbi	
Facility/Area	Bldg	Building Utilization	LG	W	Hor	Vert		Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert
						LL2SB-503M-0010-SO			1 - 7		1		1										
						LL2SB-503M-0011-SO			1 - 7		1		1										
						LL2SB-503M-0012-SO			1 - 7		1		1										
						LL2SB-503M-0013-SO			1 - 7		1		1										
						LL2SB-503M-0014-SO			1 - 7		1		1										
	Primary MI Sample							totals:		21	78	21	78	3	11	6	22	3	11	3	11	3	11
	Methanol Field Blank							totals								3							
	QC Triplicate to Primary Lab							totals:		3		3		3		3		3		3		3	
	QA Triplicate to QA Lab							totals:		3		3		3		3		3		3		3	
								TOTAL		27	78	27	78	9	11	15	22	9	11	9	11	9	11

Only one set of vertical samples will be analyzed in a sample area, either those associated with the primary sample or those associated with the triplicate horizontal samples that have the most CUG exceedances

Table 3-4: Subsurface MI Sampling Table for Load Lines 3, Ravenna, Ohio

Description			Bldg Size (Ft)		Sample ID		Number Geoprobe Borings	Depth (ft)		Number of Samples													
										Metals + Hg + Cr+6		Explosives		Propellants		VOCs		SVOCs		PCBs		Pesti/Herbi	
Facility/Area	Bldg	Building Utilization	LG	W	Hor	Vert		Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert
LL3	EB-3	Shell Receiving Bldg-1	350	50	LL3SB-406V-0101-SO		11	1 – 3								1							
					LL3SB-406M-0101-SO			1 - 3		1		1											
					LL3SB-406V-0102-SO			3 – 5								1							
					LL3SB-406M-0102-SO			3 - 5		1		1											
					LL3SB-406V-0103-SO			5 - 7								1							
					LL3SB-406M-0103-SO			5 - 7		1		1											
						LL3SB-406V-0001-SO			1 - 7								1						
						LL3SB-406M-0001-SO			1 - 7		1		1										
						LL3SB-406V-0002-SO			1 - 7								1						
						LL3SB-406M-0002-SO			1 - 7		1		1										
						LL3SB-406V-0003-SO			1 - 7								1						
						LL3SB-406M-0003-SO			1 - 7		1		1										
						LL3SB-406V-0004-SO			1 - 7								1						
						LL3SB-406M-0004-SO			1 - 7		1		1										
						LL3SB-406V-0005-SO			1 – 7								1						
						LL3SB-406M-0005-SO			1 – 7		1		1										
						LL3SB-406V-0006-SO			1 – 7								1						
						LL3SB-406M-0006-SO			1 – 7		1		1										
						LL3SB-406V-0007-SO			1 – 7								1						
						LL3SB-406M-0007-SO			1 – 7		1		1										
						LL3SB-406V-0008-SO			1 – 7								1						
						LL3SB-406M-0008-SO			1 – 7		1		1										
						LL3SB-406V-0009-SO			1 – 7								1						
						LL3SB-406M-0009-SO			1 – 7		1		1										
						LL3SB-406V-0010-SO			1 – 7								1						
						LL3SB-406M-0010-SO			1 – 7		1		1										
						LL3SB-406V-0011-SO			1 – 7								1						
						LL3SB-406M-0011-SO			1 – 7		1		1										
	EB-3	Shell Receiving Bldg-2	350	50	LL3SB-401V-0101-SO		11	1 – 3								1							
					LL3SB-401M-0101-SO			1 - 3		1		1											
					LL3SB-401V-0102-SO			3 – 5								1							
					LL3SB-401M-0102-SO			3 - 5		1		1											
					LL3SB-401V-0103-SO			5 - 7								1							
					LL3SB-401M-0103-SO			5 - 7		1		1											
						LL3SB-401V-0001-SO			1 - 7								1						
						LL3SB-401M-0001-SO			1 - 7		1		1										
						LL3SB401M-0002-SO			1 - 7								1						
						LL3SB-401M-0002-SO			1 - 7		1		1										
						LL3SB-401V-0003-SO			1 - 7								1						
						LL3SB-401M-0003-SO			1 - 7		1		1										
						LL3SB-401V-0004-SO			1 - 7								1						
						LL3SB-401M-0004-SO			1 - 7		1		1										
						LL3SB-401V-0005-SO			1 – 7								1						

Description			Bldg Size (Ft)		Sample ID		Number Geoprobe Borings	Depth (ft)		Number of Samples													
										Metals + Hg + Cr+6		Explosives		Propellants		VOCs		SVOCs		PCBs		Pesti/Herbi	
Facility/Area	Bldg	Building Utilization	LG	W	Hor	Vert		Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert
LL-3	EB-3	Shell Receiving Bldg-2	350	50		LL3SB-401M-0005-SO			1 – 7		1		1										
	(Continured)	(Continued)				LL3SB-401V-0006-SO			1 – 7								1						
						LL3SB-401M-0006-SO			1 - 7		1		1										
						LL3SB-401V-0007-SO			1 – 7								1						
						LL3SB-401M-0007-SO			1 – 7		1		1										
						LL3SB-401V-0008-SO			1 – 7								1						
						LL3SB-401M-0008-SO			1 – 7		1		1										
						LL3SB-401V-0009-SO			1 – 7								1						
						LL3SB-401M-0009-SO			1 – 7		1		1										
						LL3SB-401V-0010-SO			1 – 7								1						
						LL3SB-401M-0010-SO			1 – 7		1		1										
						LL3SB-401V-0011-SO			1 – 7								1						
						LL3SB-401M-0011-SO			1 – 7		1		1										
	EA-6	Explosives Preparation	40	40	LL3SB-403M-0101-SO		5	1 – 3		1		1											
					LL3SB-403M-0102-SO			3 -- 5		1		1											
					LL3SB-403M-0103-SO			5 - 7		1		1											
						LL3SB-403M-0001-SO			1 – 7		1		1										
						LL3SB-403M-0002-SO			1 – 7		1		1										
						LL3SB-403M-0003-SO			1 – 7		1		1										
						LL3SB-403M-0004-SO			1 – 7		1		1										
						LL3SB-403M-0005-SO			1 – 7		1		1										
	EA-6A	Explosives Preparation	40	40	LL3SB-405M-0101-SO		5	1 – 3		1		1											
					LL3SB-405M-0102-SO			3 -- 5		1		1											
					LL3SB-405M-0103-SO			5 - 7		1		1											
						LL3SB-405M-0001-SO			1 – 7		1		1										
						LL3SB-405M-0002-SO			1 – 7		1		1										
						LL3SB-405M-0003-SO			1 – 7		1		1										
						LL3SB-405M-0004-SO			1 – 7		1		1										
						LL3SB-405M-0005-SO			1 – 7		1		1										
	EB-4	Melt Pour	210	50	LL3SB-407M-0101-SO		16	1 – 3		1		1											
					LL3SB-407M-0102-SO			3 -- 5		1		1											
					LL3SB-407M-0103-SO			5 - 7		1		1											
						LL3SB-407M-0001-SO			1 – 7		1		1										
						LL3SB-407M-0002-SO			1 – 7		1		1										
						LL3SB-407M-0003-SO			1 – 7		1		1										
						LL3SB-407M-0004-SO			1 – 7		1		1										
						LL3SB-407M-0005-SO			1 – 7		1		1										
						LL3SB-407M-0006-SO			1 – 7		1		1										
						LL3SB-407M-0007-SO			1 – 7		1		1										
						LL3SB-407M-0008-SO			1 – 7		1		1										
						LL3SB-407M-0009-SO			1 - 7		1		1										
						LL3SB-407M-0010-SO			1 - 7		1		1										
						LL3SB-407M-0011-SO			1 - 7		1		1										
						LL3SB-407M-0012-SO			1 - 7		1		1										
						LL3SB-407M-0013-SO			1 - 7		1		1										

Description			Bldg Size (Ft)		Sample ID		Number Geoprobe Borings	Depth (ft)		Number of Samples													
										Metals + Hg + Cr+6		Explosives		Propellants		VOCs		SVOCs		PCBs		Pesti/Herbi	
Facility/Area	Bldg	Building Utilization	LG	W	Hor	Vert		Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert
LL-3	EB-4	Melt Pour	210	50		LL3SB-407M-0014-SO			1 - 7		1		1										
	(Continued)	(Continued)				LL3SB-407M-0015-SO			1 - 7		1		1										
						LL3SB-407M-0016-SO			1 - 7		1		1										
	EB-4A	Melt Pour	210	50	LL3SB-402M-0101-SO		16	1 – 3		1		1											
					LL3SB-402M-0102-SO			3 – 5		1		1											
					LL3SB-402M-0103-SO			5 – 7		1		1											
						LL3SB-402M-0001-SO			1 – 7		1		1										
						LL3SB-402M-0002-SO			1 - 7		1		1										
						LL3SB-407M-0003-SO			1 – 7		1		1										
						LL3SB-407M-0004-SO			1 – 7		1												
						LL3SB-407M-0005-SO			1 – 7		1		1										
						LL3SB-407M-0006-SO			1 – 7		1		1										
						LL3SB-407M-0007-SO			1 – 7		1		1										
						LL3SB-407M-0008-SO			1 – 7		1		1										
						LL3SB-407M-0009-SO			1 - 7		1		1										
						LL3SB-407M-0010-SO			1 - 7		1		1										
						LL3SB-407M-0011-SO			1 - 7		1		1										
						LL3SB-407M-0012-SO			1 - 7		1		1										
						LL3SB-407M-0013-SO			1 - 7		1		1										
						LL3SB-407M-0014-SO			1 - 7		1		1										
						LL3SB-407M-0015-SO			1 - 7		1		1										
						LL3SB-407M-0016-SO			1 - 7		1		1										
	EB-10	Drill & Assembly	300	48	LL3SB-409V-0101-SO		14	1 – 3								1							
					LL3SB-409B-0101-SO			1 – 3								1							
					LL3SB-409M-0101-SO			1 – 3		1		1		1				1		1		1	
					LL3SB-409V-0102-SO			3 – 5								1							
					LL3SB-409B-0102-SO			3 – 5								1							
					LL3SB-409M-0102-SO			3 – 5		1		1		1				1		1		1	
					LL3SB-409V-0103-SO			5 – 7								1							
					LL3SB-409B-0103-SO			5 – 7								1							
					LL3SB-409M-0103-SO			5 – 7		1		1		1				1		1		1	
						LL3SB-409V-0001-SO			1 - 7								1						
						LL3SB-409M-0001-SO			1 - 7		1		1		1				1		1		1
						LL3SB-409V-0002-SO			1 - 7								1						
						LL3SB-409M-0002-SO			1 - 7		1		1		1				1		1		1
						LL3SB-409V-0003-SO			1 - 7								1						
						LL3SB-409M-0003-SO			1 - 7		1		1		1				1		1		1
						LL3SB-409V-0004-SO			1 - 7								1						
						LL3SB-409M-0004-SO			1 - 7		1		1		1				1		1		1
						LL3SB-409V-0005-SO			1 – 7								1						
						LL3SB-409M-0005-SO			1 – 7		1		1		1				1		1		1
						LL3SB-409V-0006-SO			1 – 7								1						
						LL3SB-409M-0006-SO			1 – 7		1		1		1				1		1		1
						LL3SB-409V-0007-SO			1 – 7								1						
						LL3SB-409M-0007-SO			1 – 7		1		1		1				1		1		1
						LL3SB-409V-0008-SO			1 – 7								1						
						LL3SB-409M-0008-SO			1 – 7		1		1		1				1		1		1
						LL3SB-409V-0009-SO			1 – 7								1						

Description			Bldg Size (Ft)		Sample ID		Number Geoprobe Borings	Number Geoprobe Borings		Number of Samples													
										Metals + Hg + Cr+6		Explosives		Propellants		VOCs		SVOCs		PCBs		Pesti/Herbi	
Facility/Area	Bldg	Building Utilization	LG	W	Hor	Vert		Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert
LL-3	EB-10	Drill & Assembly	300	48		LL3SB-409M-0009-SO			1 – 7		1		1		1				1		1		1
	(Continued)	(Continued)				LL3SB-409V-0010-SO			1 – 7								1						
						LL3SB-409M-0010-SO			1 – 7		1		1		1				1		1		1
						LL3SB-409V-0011-SO			1 – 7								1						
						LL3SB-409M-0011-SO			1 – 7		1		1		1				1		1		1
						LL3SB-409V-0012-SO			1 – 7								1						
						LL3SB-409M-0012-SO			1 – 7		1		1		1				1		1		1
						LL3SB-409V-0013-SO			1 – 7								1						
						LL3SB-409M-0013-SO			1 – 7		1		1		1				1		1		1
						LL3SB-409V-0014-SO			1 – 7								1						
						LL3SB-409M-0014-SO			1 – 7		1		1		1				1		1		1
	EB-10	Drill & Assembly	300	48	LL3SB-404V-0101-SO		14	1 – 3								1							
					LL3SB-404M-0101-SO			1 - 3		1		1		1				1		1		1	
					LL3SB-404V-0102-SO			3 – 5	3 – 5							1							
					LL3SB-404M-0102-SO			3 - 5	3 - 5	1		1		1				1		1		1	
					LL3SB-404V-0103-SO			5 - 7	5 - 7							1							
					LL3SB-404M-0103-SO			5 - 7	5 - 7	1		1		1				1		1		1	
						LL3SB-404V-0001-SO			1 - 7								1						
						LL3SB-404M-0001-SO			1 - 7		1		1		1				1		1		1
						LL3SB-404V-0002-SO			1 - 7								1						
						LL3SB-404M-0002-SO			1 - 7		1		1		1				1		1		1
						LL3SB-404V-0003-SO			1 - 7								1						
						LL3SB-404M-0003-SO			1 - 7		1		1		1				1		1		1
						LL3SB-404V-0004-SO			1 - 7								1						
						LL3SB-404M-0004-SO			1 - 7		1		1		1				1		1		1
						LL3SB-404V-0005-SO			1 – 7								1						
						LL3SB-404M-0005-SO			1 – 7		1		1		1				1		1		1
						LL3SB-404V-0006-SO			1 – 7								1						
						LL3SB-404M-0006-SO			1 – 7		1		1		1				1		1		1
						LL3SB-404V-0007-SO			1 – 7								1						
						LL3SB-404M-0007-SO			1 – 7		1		1		1				1		1		1
						LL3SB-404V-0008-SO			1 – 7								1						
						LL3SB-404M-0008-SO			1 – 7		1		1		1				1		1		1
						LL3SB-404V-0009-SO			1 – 7								1						
						LL3SB-404M-0009-SO			1 – 7		1		1		1				1		1		1
						LL3SB-404V-0010-SO			1 – 7								1						
						LL3SB-404M-0010-SO			1 – 7		1		1		1				1		1		1
						LL3SB-404V-0011-SO			1 – 7								1						
						LL3SB-404M-0011-SO			1 – 7		1		1		1				1		1		1
						LL3SB-404V-0012-SO			1 – 7								1						
						LL3SB-404M-0012-SO			1 – 7		1		1		1				1		1		1
						LL3SB-404V-0013-SO			1 – 7								1						
						LL3SB-404M-0013-SO			1 – 7		1		1		1				1		1		1
						LL3SB-404V-0014-SO			1 – 7								1						
						LL3SB-404M-0014-SO			1 – 7		1		1		1				1		1		1

Description			Bldg Size (Ft)		Sample ID		Number Geoprobe Borings	Number Geoprobe Borings		Number of Samples													
										Metals + Hg + Cr+6		Explosives		Propellants		VOCs		SVOCs		PCBs		Pesti/Herbi	
Facility/Area	Bldg	Building Utilization	LG	W	Hor	Vert		Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert
LL-3	EB-10	Drill & Assembly	300	48	LL3SB-408V-0101-SO		14	1 – 3								1							
					LL3SB-408M-0101-SO			1 - 3		1		1		1				1		1		1	
					LL3SB-408V-0102-SO			3 – 5	3 – 5							1							
					LL3SB-408M-0102-SO			3 - 5	3 - 5	1		1		1				1		1		1	
					LL3SB-408V-0103-SO			5 - 7	5 - 7							1							
					LL3SB-408M-0103-SO			5 - 7	5 - 7	1		1		1				1		1		1	
						LL3SB-408V-0001-SO			1 - 7								1						
						LL3SB-408M-0001-SO			1 - 7		1		1		1				1		1		
						LL3SB-408V-0002-SO			1 - 7								1						
						LL3SB-408M-0002-SO			1 - 7		1		1		1				1		1		
						LL3SB-408V-0003-SO			1 - 7								1						
						LL3SB-408M-0003-SO			1 - 7		1		1		1				1		1		
						LL3SB-408V-0004-SO			1 - 7								1						
						LL3SB-408M-0004-SO			1 - 7		1		1		1				1		1		
						LL3SB-408V-0005-SO			1 – 7								1						
						LL3SB-408M-0005-SO			1 – 7		1		1		1				1		1		
						LL3SB-408V-0006-SO			1 – 7								1						
						LL3SB-408M-0006-SO			1 - 7		1		1		1				1		1		
LL-3	EB-10	Drill & Assembly	300	48		LL3SB-408V-0007-SO			1 – 7								1						
	(Continued)	(Continued)				LL3SB-408M-0007-SO			1 – 7		1		1		1				1		1		1
						LL3SB-408V-0008-SO			1 – 7								1						
						LL3SB-408M-0008-SO			1 – 7		1		1		1				1		1		1
						LL3SB-408V-0009-SO			1 – 7								1						
						LL3SB-408M-0009-SO			1 – 7		1		1		1				1		1		1
						LL3SB-408V-0010-SO			1 – 7								1						
						LL3SB-408M-0010-SO			1 – 7		1		1		1				1		1		1
						LL3SB-408V-0011-SO			1 – 7								1						
						LL3SB-408M-0011-SO			1 – 7		1		1		1				1		1		1
						LL3SB-408V-0012-SO			1 – 7								1						
						LL3SB-408M-0012-SO			1 – 7		1		1		1				1		1		1
						LL3SB-408V-0013-SO			1 – 7								1						
						LL3SB-408M-0013-SO			1 – 7		1		1		1				1		1		1
						LL3SB-408V-0014-SO			1 – 7								1						
						LL3SB-408M-0014-SO			1 – 7		1		1		1				1		1		1
	Primary MI Sample							totals:		21	78	21	78	3	14	9	36	3	14	3	14	3	14
	Methanol Field Blank							totals								3							
	QC Triplicate to Primary Lab							totals:		3		3		3		3		3		3		3	
	QA Triplicate to QA Lab							totals:		3		3		3		3		3		3		3	
								TOTAL		27	78	27	78	9	14	18	36	9	14	9	14	9	14

Only one set of vertical samples will be analyzed in a sample area, either those associated with the primary sample or those associated with the triplicate horizontal samples that have the most CUG exceedances.

Table 3-5: Subsurface MI Sampling Table for Load Lines 4, Ravenna, Ohio

Description			Bldg Size (Ft)		Sample ID		Number Geoprobe Borings	Depth (ft)		Number of Samples													
										Metals + Hg + Cr+6		Explosives		Propellants		VOCs		SVOCs		PCBs		Pesti/Herbi	
Facility/Area	Bldg	Building Utilization	LG	W	Hor	Vert		Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert
LL-4	G-8	Melt Pour	171	71	LL4SB-402V-0101-SO		12	1 – 3								1							
					LL4SB-402B-0101-SO			1 – 3								1							
					LL4SB-402M-0101-SO			1 – 3		1		1		1				1		1		1	
					LL4SB-402V-0102-SO			3 – 5	3 – 5							1							
					LL4SB-402B-0102-SO			3 – 5								1							
					LL4SB-402M-0102-SO			3 – 5	3 - 5	1		1		1				1		1		1	
					LL4SB-402V-0103-SO			5 – 7	5 - 7							1							
					LL4SB-402B-0103-SO			5 - 7								1							
					LL4SB-402M-0103-SO			5 - 7	5 - 7	1		1		1				1		1		1	
						LL4SB-402V-0001-SO			1 - 7								1						
						LL4SB-402M-0001-SO			1 - 7		1		1		1				1		1		1
						LL4SB-402V-0002-SO			1 - 7								1						
						LL4SB-402M-0002-SO			1 - 7		1		1		1				1		1		1
						LL4SB-402V-0003-SO			1 - 7								1						
						LL4SB-402M-0003-SO			1 - 7		1		1		1				1		1		1
						LL4SB-402V-0004-SO			1 - 7								1						
						LL4SB-402M-0004-SO			1 - 7		1		1		1				1		1		1
						LL4SB-402V-0005-SO			1 – 7								1						
						LL4SB-402M-0005-SO			1 – 7		1		1		1				1		1		1
						LL4SB-402V-0006-SO			1 – 7								1						
						LL4SB-402M-0006-SO			1 – 7		1		1		1				1		1		1
						LL4SB-402V-0007-SO			1 – 7								1						
						LL4SB-402M-0007-SO			1 – 7		1		1		1				1		1		1
						LL4SB-402V-0008-SO			1 – 7								1						
						LL4SB-402M-0008-SO			1 – 7		1		1		1				1		1		1
						LL4SB-402V-0009-SO			1 – 7								1						
						LL4SB-402M-0009-SO			1 – 7		1		1		1				1		1		1
						LL4SB-402V-0010-SO			1 – 7								1						
						LL4SB-402M-0010-SO			1 - 7		1		1		1				1		1		1
						LL4SB-402V-0011-SO			1 - 7								1						
						LL4SB-402M-0011-SO			1 - 7		1		1		1				1		1		1
						LL4SB-402V-0012-SO			1 - 7								1						
						LL4SB-402M-0012-SO			1 - 7		1		1		1				1		1		1
	G-8	Melt Pour	171	71	LL4SB-401V-0101-SO		12	1 – 3								1							
					LL4SB-401M-0101-SO			1 - 3		1		1		1				1		1		1	
					LL4SB-401V-0102-SO			3 – 5	3 – 5							1							
					LL4SB-401M-0102-SO			3 - 5	3 - 5	1		1		1				1		1		1	
					LL4SB-401V-0103-SO			5 - 7	5 - 7							1							
					LL4SB-401M-0103-SO			5 - 7	5 - 7	1		1		1				1		1		1	
						LL4SB-401V-0001-SO			1 - 7								1						
						LL4SB-401M-0001-SO			1 - 7		1		1		1				1		1		
						LL4SB-401V-0002-SO			1 - 7								1						
						LL4SB-401M-0002-SO			1 - 7		1		1		1				1		1		
						LL4SB-401V-0003-SO			1 - 7								1						

Description			Bldg Size (Ft)		Sample ID		Number Geoprobe Borings	Depth (ft)		Number of Samples													
										Metals + Hg + Cr+6		Explosives		Propellants		VOCs		SVOCs		PCBs		Pesti/Herbi	
Facility/Area	Bldg	Building Utilization	LG	W	Hor	Vert		Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert
						LL4SB-401M-0003-SO			1 - 7		1		1		1				1		1		
						LL4SB-401V-0004-SO			1 - 7								1						
						LL4SB-401M-0004-SO			1 - 7		1		1		1				1		1		
						LL4SB-401V-0005-SO			1 – 7								1						
LL-4	G-8	Melt Pour	171	71		LL4SB-401M-0005-SO			1 - 7		1		1		1				1		1		
	(Continued)	(Continued)				LL4SB-401V-0006SO			1 - 7								1						
						LL4SB-401M-0006SO			1 - 7		1		1		1				1		1		
						LL4SB-401V-0007-SO			1 - 7								1						
						LL4SB-401M-0007-SO			1 - 7		1		1		1				1		1		
						LL4SB-401V-0008-SO			1 - 7								1						
						LL4SB-401M-0008-SO			1 - 7		1		1		1				1		1		
						LL4SB-401V-0009SO			1 – 7								1						
						LL4SB-401M-0009-SO			1 - 7		1		1		1				1		1		
						LL4SB-401V-0010-SO			1 - 7								1						
						LL4SB-401M-0010-SO			1 - 7		1		1		1				1		1		
						LL4SB-401V-0011-SO			1 - 7								1						
						LL4SB-401M-0011-SO			1 - 7		1		1		1				1		1		
						LL4SB-401V-0012-SO			1 - 7								1						
						LL4SB-401M-0012-SO			1 - 7		1		1		1				1		1		
	G-8	Melt Pour	171	71	LL4SB-403V-0101-SO		12	1 – 3								1							
					LL4SB-403M-0101-SO			1 - 3		1		1		1				1		1		1	
					LL4SB-403V-0102-SO			3 – 5	3 – 5							1							
					LL4SB-403M-0102-SO			3 - 5	3 - 5	1		1		1				1		1		1	
					LL4SB-403V-0103-SO			5 - 7	5 - 7							1							
					LL4SB-403M-0103-SO			5 - 7	5 - 7	1		1		1				1		1		1	
						LL4SB-403V-0001-SO			1 - 7								1						
						LL4SB-403M-0001-SO			1 - 7		1		1		1				1		1		1
						LL4SB-403V-0002-SO			1 - 7								1						
						LL4SB-403M-0002-SO			1 - 7		1		1		1				1		1		1
						LL4SB-403V-0003-SO			1 - 7								1						
						LL4SB-403M-0003-SO			1 - 7		1		1		1				1		1		1
						LL4SB-403V-0004-SO			1 - 7								1						
						LL4SB-403M-0004-SO			1 - 7		1		1		1				1		1		1
						LL4SB-403V-0005-SO			1 – 7								1						
						LL4SB-403M-0005-SO			1 – 7		1		1		1				1		1		1
						LL4SB-403V-0006-SO			1 – 7								1						
						LL4SB-403M-0006-SO			1 – 7		1		1		1				1		1		1
						LL4SB-403V-0007-SO			1 – 7								1						
						LL4SB-403M-0007-SO			1 – 7		1		1		1				1		1		1
						LL4SB-403V-0008-SO			1 – 7								1						
						LL4SB-403M-0008-SO			1 – 7		1		1		1				1		1		1
						LL4SB-403V-0009-SO			1 – 7								1						
						LL4SB-403M-0009-SO			1 – 7		1		1		1				1		1		1
						LL4SB-403V-0010-SO			1 – 7								1						
						LL4SB-403M-0010-SO			1 - 7		1		1		1				1		1		1

Description			Bldg Size (Ft)		Sample ID		Number Geoprobe Borings	Depth (ft)		Number of Samples													
										Metals + Hg + Cr+6		Explosives		Propellants		VOCs		SVOCs		PCBs		Pesti/Herbi	
Facility/Area	Bldg	Building Utilization	LG	W	Hor	Vert		Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert	Hor	Vert
						LL4SB-403V-0011-SO			1 - 7								1						
						LL4SB-403M-0011-SO			1 - 7		1		1		1				1		1		1
						LL4SB-403V-0012-SO			1 - 7								1						
						LL4SB-403M-0012-SO			1 - 7		1		1		1				1		1		1
Primary MI Sample								totals:		3	12	3	12	3	12	3	12	3	12	3	12	3	12
Methanol Field Blank								totals								3							
QC Triplicate to Primary Lab								totals:		3		3		3		3		3		3		3	
QA Triplicate to QA Lab								totals:		3		3		3		3		3		3		3	
								TOTAL		9	12	9	12	9	12	12	12	9	12	9	12	9	12

Only one set of vertical samples will be analyzed in a sample area, either those associated with the primary sample or those associated with the triplicate horizontal samples that have the most CUG exceedances.

ID Naming for Subsurface MI Samples at LLs 1, 2, 3, 4

Horizontal MI Samples (at example MI location 123)

LL1SB-123V-0101-SO MI Sample from 1' – 3' VOCs- Methanol
LL1SB-123V-0102-SO MI Sample from 3' – 5' VOCs- Methanol
LL1SB-123V-0103-SO MI Sample from 5' – 7' VOCs- Methanol

LL1SB-123B-0101-SO 1' – 3' VOCs- Methanol Field Blank
LL1SB-123B-0102-SO 3' – 5' VOCs- Methanol Field Blank
LL1SB-123B-0103-SO 5' – 7' VOCs- Methanol Field Blank

LL1SB-123M-0101-SO MI Sample from 1' – 3' Non-VOCs
LL1SB-123M-0102-SO MI Sample from 3' – 5' Non-VOCs
LL1SB-123M-0103-SO MI Sample from 5' – 7' Non-VOCs

Vertical MI Samples (at example MI location 123)

LL1SB-123M-0001-SO	MI Sample at 1st sub-location within MI location 123	Non-VOCs
LL1SB-123M-0002-SO	MI Sample at 2nd sub-location within MI location 123	Non-VOCs
LL1SB-123M-0003-SO	MI Sample at 3rd sub-location within MI location 123	Non-VOCs
LL1SB-123M-000L-SO	MI Sample at last sub-location within MI location 123	Non-VOCs
LL1SB-123V-0001-SO	MI Sample at 1st sub-location within MI location 123	VOCs- Methanol
LL1SB-123V-0002-SO	MI Sample at 2nd sub-location within MI location 123	VOCs- Methanol
LL1SB-123V-0003-SO	MI Sample at 3rd sub-location within MI location 123	VOCs- Methanol
LL1SB-123V-000L-SO	MI Sample at last sub-location within MI location 123	VOCs- Methanol

Geoprobe Tubes at MI location 123 (Internal use with one copy placed on the geoprobe tube and the other affixed to the bottom of the boring log)

LL1SB-123M-0001A-SO	Upper geoprobe sample at location 123M-0001
LL1SB-123M-0001B-SO	Lower geoprobe sample at location 123M-0001
LL1SB-123M-0002A-SO	Upper geoprobe sample at location 123M-0002
LL1SB-123M-0002B-SO	Lower geoprobe sample at location 123M-0002
LL1SB-123M-000LA-SO	Upper geoprobe sample at last sub-location within 123
LL1SB-123M-000LB-SO	Lower geoprobe sample at last sub-location within 123

4.0 – FIELD ACTIVITIES

All field activities will be conducted in accordance with the FWSAP except as noted in the following subsections.

4.1 GEOPHYSICS

Not applicable.

4.2 SOIL GAS SURVEY

Not applicable.

4.3 GROUNDWATER

Not applicable.

4.4 SUBSURFACE SOIL

4.4.1 Rationales

Multi-increment subsurface samples from 0' to 7', where not prevented by refusal, will be collected from locations specified within each sampling area during the investigation to assess contaminant occurrence and distribution in subsurface soil. All samples will be analyzed for explosives, target analyte list (TAL) metals, mercury, and hexavalent chromium. Additionally, at 10% of the total number of multi-increment field samples will be analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), polychlorinated biphenyl compounds (PCBs), pesticides/herbicides, and propellants (i.e., full suite analyses). VOC testing will be conducted on samples from the shell preparation buildings.

Vertical samples are only to be analyzed if there is an exceedance of at least one of the CUG on any horizontal sample associated with that set of vertical samples, and only for that type of analysis, as explosives. Only one set of vertical samples will be analyzed in a sample area, either those associated with the primary sample or those associated with the triplicate horizontal samples that have the most CUG exceedances.

The goal of the subsurface MI sampling is to determine average levels of contamination within 2' horizontal layers within a given exposure/sample area. The subsurface layers will be, 1' – 3', 3' – 5', 5'–7'. A vertical MI sample will also be taken from 1' – 7' at each push probe boring.

Only if the analytical results of at least one of the horizontal MI samples within a sample area exceeds one of the established cleanup goals will the vertical samples be analyzed; and only for the type of contaminant (explosive, metal, etc) for which the horizontal sample had an exceedance of the cleanup goal.

Additionally, the subsurface MI sampling will aim at providing good estimates of the types, locations, and extents of subsurface contamination areas to guide cost effective remediation.

4.4.2 Soil Sampling Requirements – Multi Increment Soil Sampling

Subsurface push probe samples will be taken with sampling equipment providing push probe samples with a diameter of 1.5 inches. Push probe equipment will be pushed from 0' to 7', but only the samples from depths of 1' to 7' will be selected for geotechnical logging and analytical testing. Detailed geotechnical logging will be conducted on all samples to help delineate the location and extent of subsurface contamination should it be encountered.

The completed MI samples will be forwarded to a fixed base laboratory where laboratory sample preparation, consisting of air-drying, sieving, and grinding will be done to provide a small representative sample suitable for chemical analysis. The standard operating procedure (SOP) for laboratory drying and particle size reduction of the sample is provided in Method 8330B.

4.4.3 Sample Collection for Field and Laboratory Analysis

Within three weeks prior to the initiation of field sampling, the corners of the sampling areas will be located and marked on the ground to the nearest one-tenth foot, as prescribed in the RVAAP FWSAP. At each sampling area, the field team will lay out the designated push probe locations, in a systematic, random manner. The push probe contractor will then take borings at or as near as possible the locations staked out. If refusal is encountered at a planned push probe location and three nearby locations, that location will be temporarily abandoned. A portion, or all, of the remaining planned sub-locations will then be drilled. Based on the drilling behavior at the other planned sub-locations within the sampling area, a decision will be made if there is a widespread condition that would preclude drilling to the desired depth, as shallow bedrock, or if the planned locations where refusal was encountered at depths less than planned were anomalies based on localized obstructions. If there is a widespread condition that precludes drilling to the desired depths, then no additional drilling attempts will be made. If the locations where refusal at depths less than planned appear to be based on isolated or random obstructions, then up to two additional attempts will be made at planned locations where the borings failed to reach the planned depths. For horizontal MI samples where less than the planned number of sub-sample locations were collected because of refusal at less than the planned depth, a notation, discussion, and/or figure will be included regarding the reduced sub-sample number whenever reference is made to that horizontal MI sample in follow up reports or other texts. Upon completion of the push probe borings within the sample area, the field team will determine and note offsets from two of the surveyed sample area corners to each of the push probe locations. This process will be used to delineate the locations of the individual push probe borings.

All samples are to be analyzed for TAL metals, mercury, hexavalent chromium, and explosives with lesser numbers of samples analyzed for PCBs, propellants, pesticide/herbicides, SVOC's and VOCs. Because of volatility issues related to VOC analyzes, one set of procedures, as described below, will be followed for those samples pre-determined to have VOC analyzes performed, and another set of procedures followed for those samples on which VOC testing is not to be performed.

4.4.3.1 Processing of Non-VOC Samples (To Be Done at the Sampling Building)

Because there will be a large number of push probe sample tubes associated with a given sample area, the push probe sample tubes shall be capped, collected, and labeled as soon as they are withdrawn from the boring and placed in a custom made collection/ice box, Figures 4-1 and 4-2. The set of two push probe sample tubes associated with a given boring will be kept together with a large rubber band.

The push probe collection/ice box will be large enough to contain many push probe samples that will have been placed on ice immediately upon removal from the ground. It will be lockable to maintain custody of the samples. This collection/ice box will be heavily insulated to maintain low temperatures, placed at a 30-degree angle above horizontal so the push probe tube samples can be kept inclined, carried on a wooden frame that can be carried on a trailer behind a truck, and have rollers on the bottom of the wooden frame so the entire collection/ice box can be rolled from the trailer straight into the sample building, and vice versa when the box is empty. There will be at least two collection/ice boxes so that the push probe tube samples will always be maintained on ice.

Actual opening and processing of the soil within the push probe tubes will be done at the sampling building under controlled conditions minimize sampling error, to expedite sample processing, to minimize cross contamination, and to minimize safety concerns related to opening the tubes with retractable razorblade knives.

Horizontal Layer Samples - A small portion along an entire 2' thick layer (1 – 3', 3 – 5', etc) push probe sample shall be taken with an a sharpened length of ½"x ½" aluminum channel and combined with the corresponding same layer samples from all the other push probe borings within that sampling area. This sample will be processed at the lab and utilized for TAL metals, explosives, PCBs, pesticides/ herbicides, propellants, mercury and SVOCs as designated in the sampling tables.

Vertical Samples - A small portion along the entire 2' thick layer (1' – 3', 3' – 5', and 5' – 7') push probe sample shall be taken with a sharpened length of ½"x ½" aluminum channel and combined with the other samples from that push probe boring. Thus, one vertical MI sample will be collected for each push probe boring. <u>Because of required expedited time constraints, all vertical samples will be prepped for laboratory analysis. However, these samples will only be analyzed if the analytical results from at least one horizontal layer MI samples within that sampling area show contamination levels above cleanup goals.</u> The results of these vertical MI samples should assist in delineating the extent of the subsurface area above required cleanup levels.

A soil core cutting platform illustrated in Figure 4-3 shows the platform composed of a 6' long, aluminum half pipe with an inside diameter closely matching that of the outside diameter of the push probe sample tubes will be used to neatly, efficiently, quickly, and safely cut open the push probe tube samples. The aluminum half pipe will be secured to a table and will have a round stop at one end to securely hold a push probe sample tube when cutting is occurring. A decontaminated aluminum half tube will be used for each push probe sample tube.

4.4.3.2 Processing of Samples That Will Have VOC Analyses Performed (To Be done in the Field)

For those sample areas where VOC testing will occur, the methanol method of sample collection and analysis will be performed as described by Bigl, Hewitt, and Ramsey. To collect VOC samples in the field, a soil core-cutting platform will be secured to a 1" x 6" board that will be clamped to the tailgate of a pickup truck to provide a stable and safe platform. There will be one bottle for each of the three horizontal layers, and one bottle down the entire depth of each individual push probe boring. Terra Cores will be used to collect plugs of soil from the tubes and placed in the jars of methanol. At least 50 Terra Core plugs will be collected for horizontal samples, and as many as six 2' sampling intervals for vertical samples will be collected. Because of volatility issues, the contents of each of these bottles will be analyzed within 48 hours. After the removal of any samples for VOC analyses, as described, the push probe tube sample will be logged geotechnically to detect any obvious explosive or UXO type material, types and extents of natural and fill materials present, any obvious or visual contamination, estimated water condition, estimated strength, estimated determination of natural or fill material, and type and extent of any vertical cracking. These logging procedures should help determine how contamination proceeded and the extent of contamination. Terra core samplers will be used to collect horizontal and vertical samples for VOC analyses and the remaining push probe tube sample will be sampled for additional analyses (explosives, metals, etc). This whole process will be done in the field to minimize losses of VOCs. A portable soil core-cutting platform will still be used to safely process the samples in the field.

4.4.4 MI Quality Control Procedures

Triplicate subsurface MI samples (see QAPP section 4.5) will be taken to provide an overall evaluation of the total (field sampling + laboratory sample preparation + laboratory analysis) sampling and measurement process (see Hawaii Technical Guidance Manual for the Implementation of the Hawaii State Contingency Plan). One triplicate sample will be taken from each of the three main types of buildings; shell preparation, melt-pour, and drilling assembly. The results of the triplicate sample analyses will be used to measure the investigation error. The main criterion for this purpose will be the Relative Standard Deviation (RSD) calculated from the triplicate data as follows:

RSD(%) = 100% x (Standard Deviation)/Average

Acceptable RSDs for triplicate surface soil MI samples are generally within 35%. RSDs in the Bigl, Hewitt, and Ramsey study ranged from 3.9 - 112%. The one extremely high-percent RSD value (112) was obtained from a set of triplicates collected in a zone of backfill (which may be similar to conditions in the present project). Omitting the one high RSD value, the RSDs of the other triplicates ranged from 3.9 – 34 %.

Geotechnical logging of the push probe cores under stable, controlled conditions within the sampling building will promote more valid geotechnical logging. Prior to such logging of samples from any given AOC, geotechnical information (as unified soil classification system (USCS) classifications) from previous investigations will be reviewed to know what types of soils were encountered previously at that AOC. Logging data will be entered onto a boring log template (Figure 4-4) in the computer at the time the logging is done. Once that logging has been completed, the geologist or geotechnical engineer performing the logging print out the boring log and sign his/her name to the log. Additional field and laboratory QC procedures are required for MI sampling. These procedures are described in the Quality Assurance Project Plan Addendum (QAPP) located in Appendix B of the Work Plan.

4.4.5 Multi-Increment Sampling Methods for Subsurface Soil

Multi-increment subsurface samples will be collected as described in Section 4.4.2 above.

4.4.6 Field Measurement Procedures and Criteria During Remediation Activities

Field determinations of explosives, if required, will be conducted during the remediation activities using the Ensys field test kits. Sampling will be conducted in accordance with the FWSAP. Before any sampling is conducted, the areas will be inspected and cleared by unexploded ordnance (UXO) personnel. No sampling will occur if any raw explosive, crystallized explosive, or obvious red colored soils are present. The field samples will be collected from the desired depth using a step probe. These samples will be placed in a new, sealable plastic bag and transported to the temporary laboratory where EnSys soil test kits will be used to evaluate TNT and RDX concentrations. Analysis will be in strict accordance with the procedures provided by the manufacturer (EnSys) with the kits. The EnSys procedures are included in Appendix B of the Work Plan.

For the selections of discrete sample locations for VOC analysis, organic vapor screening will follow Section 4.5.2.3 of the FWSAP, with the following exception. Headspace gases will not be collected and screened in the field for organic vapors. All organic vapor analyzer (OVA) readings will be noted in the field sample logs.

Procedures for discrete sampling surface soil for chemical analyses are presented in Section 4.5.2.1 of the FWSAP.

Multi-increment samples will not be analyzed for VOCs during remediation activities. The following chemical analyses will be conducted for MI surface soil samples:

- Multi-increment samples will be analyzed for explosives, propellants, TAL metals, mercury, hexavalent chromium, SVOCs, pesticides, and PCBs.

The following chemical analyses will be conducted for discrete surface soil samples during remediation activities:

- Discrete samples will be analyzed for VOCs only.
- Discrete samples will be field screened for TNT and RDX.

Requirements for sample containers and preservation techniques for surface samples are presented in Section 4.4.2.6 of the FWSAP and in the QAPP Addendum (Appendix B of the Work Plan).

4.4.7 Decontamination Procedures

The decontamination procedures for soil sampling activities are presented in Section 4.4.2.8 of the FWSAP. Separate, decontaminated aluminum half pipes will be used in the sampling soil core cutting platform to cut all push probe samples in half along their lengths. A retractable knife with decontaminated blades will be used to cut the push probe liners. After a given liner is cut in half the tip of the retractable knife will be broken off allowing a fresh decontaminated portion of the blade to cut the next sample liner. A final decontamination inspection of any equipment leaving RVAAP at the end of field activities will be conducted to ensure proper decontamination.

4.4.8 Sample Container/Preservation Technique

Sample container and preservation technique requirements will follow those prescribed in the Table 5-3 of the QAPP Addendum (Appendix B).

4.4.9 Site Survey

A surveyor initially lay out the subject building corners at the subject load lines.

4.5 SURFACE SOIL (Only to be used if Characterization Sampling is required)

Multi-increment (MI) surface soils as well as surface soil samples for field screening will be collected at areas to be determined in the Land Use Control Report.

4.5.1 Rationales

Multi-increment surface earth fill soil field samples from 0’ to 1’ will be collected from a minimum of 30 discrete sample locations within each sampling area during the investigation to assess contaminant occurrence and distribution in surface soil within the exposed soil. All samples will be analyzed for explosives, target analyte list (TAL) metals, and hexavalent chromium. Additionally, 10% of the total number of multi-increment field samples will be analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), polychlorinated biphenyl compounds (PCBs), pesticides, and propellants (i.e., full suite analyses).

4.5.2 Soil Sampling Requirements – Multi Increment Soil Sampling

Surface soil MI samples will be aggregated samples collected from multiple stratified random locations within each of the designated sample areas. The sample aliquots are collected using a small-diameter (7/8" inside diameter) step probe; thus, the corresponding volume for each aliquot is small. As per the surface soil criterion at RVAAP, the individual aliquots will be obtained by pushing the step probe sampler from 0 – 12" in depth. A minimum of 30 aliquots will be collected to provide a representative, repeatable approximation of the average concentration of a particular constituent within a designated area. The entire volume of all aliquots is aggregated into a single field sample. That entire sample is then forwarded to a fixed base laboratory where laboratory sample preparation, consisting of air-drying, sieving, and grinding will be done to provide a small representative sample suitable for chemical analysis. The standard operating procedure (SOP) for laboratory drying and particle size reduction of the sample is provided in Method 8330B. Discrete (Terra core) samples will be collected in sample areas where the subsequent analysis is for VOCs.

4.5.3 Sample Collection for Field and Laboratory Analysis

See Table 5-3 of the QAPP Addendum (Appendix B)

4.5.4 MI Quality Control Procedures

Triplicate surface MI samples will be taken to provide an overall evaluation of the total (field sampling + laboratory sample preparation + laboratory analysis) sampling and measurement process. Both field and laboratory QC procedures are required for MI sampling. These procedures are described in the Quality Assurance Project Plan Addendum (QAPP) located in Appendix B of the Work Plan.

4.5.5 Multi-Increment Sampling Methods for Soil

Multi-increment surface soil samples will be collected in accordance with the methodology presented in Appendix A of this document. The following procedures will be used:

- Characterization sampling may include sampling areas within the AOCs.
- Within the sampling boundaries, 30 sampling points will be located in a systematic random pattern.
- Surface vegetation, roots, or soil stabilization covering will be scraped aside or removed if required.
- Using a stainless steel soil step probe or paint-free mattock, an aliquot of earth fill soil will be collected at each of the 30 sampling points.
- The 30 aliquots will be placed into a plastic-lined bucket. The 30 aliquots will be combined to make one MI sample.
- The plastic liner will be closed, labeled and delivered to Building 1036 or 1038 for storage in a refrigerator and subsequently shipped to the fixed laboratory where the sample will be processed.

4.5.6 Field Measurements Procedures and Criteria

The locations for field screening will be determined based on the remediation design, if required.

4.5.7 Decontamination Procedures

The decontamination procedures for soil sampling activities are presented in Section 4.4.2.8 of the FWSAP. A final decontamination inspection of any equipment leaving RVAAP at the end of field activities will be conducted to ensure proper decontamination.

4.5.8 Sample Container/Preservation Technique

Sample container and preservation technique requirements will follow those prescribed in Table 5-3 of the QAPP Addendum (Appendix B).

4.5.9 Site Survey

Not applicable.

4.6 SURFACE WATER (Only to be used if Characterization Sampling is required)

The scope and details of any surface water sampling will be delineated in the Land Use Control Report. Any such sampling will be conducted in accordance with the FW SAP.

4.7 ORDNANCE EXPLOSIVE ANOMALY AVOIDANCE

Initially a surface sweep of the entire sample area will be performed with equipment that can detect to a depth of at least 8' to detect metallic anomalies that might indicate buried ordnance. No UXO was detected at LL 1, 2, 3, or 4 during building demolition. However due to the possibility of encountering bulk explosives, a UXO technician will be required for the sampling of surface soils described in the preceding sections.

A detailed UXO Anomaly Avoidance Plan is attached as Appendix D

STORAGE CABINET
24"D x 46"W x 72"H

FIGURE 4-1
STEEL/ALUMINUM STORAGE CABINET

PRUDENT TECHNOLOGIES, INC.

US Army Corps of Engineers

Notes: Figure not to scale.
The storage cabinet will be insulated with rigid foam insulation and plywood on all inside sides and doors.

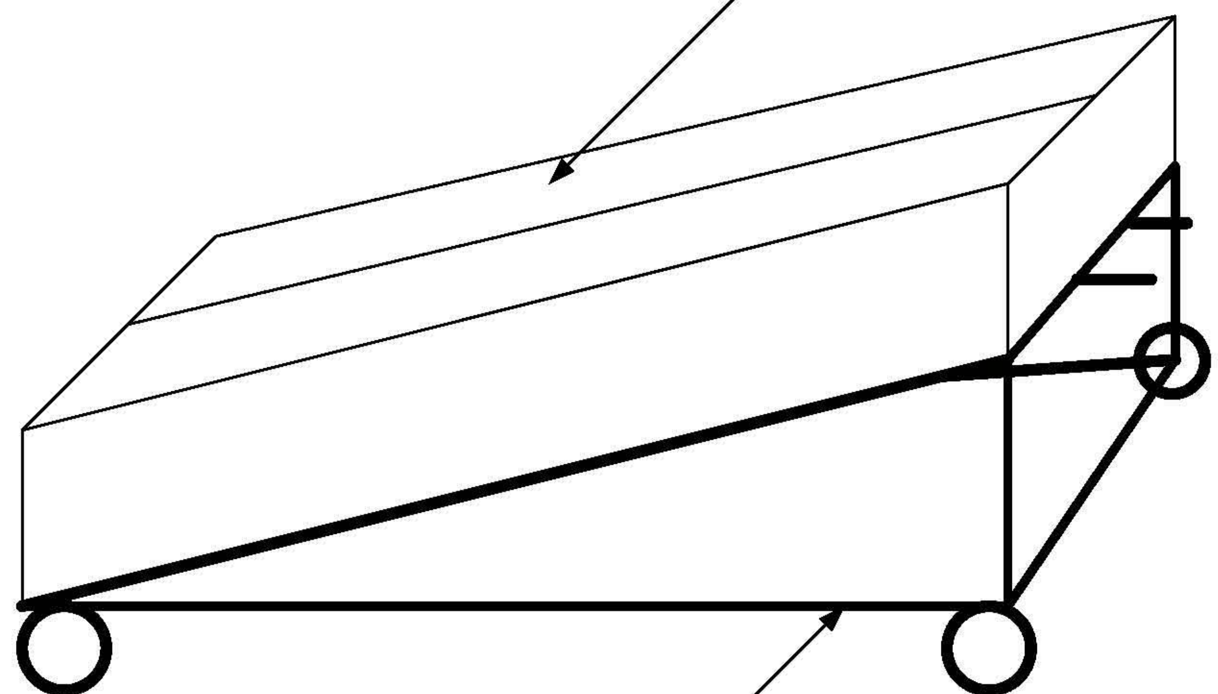
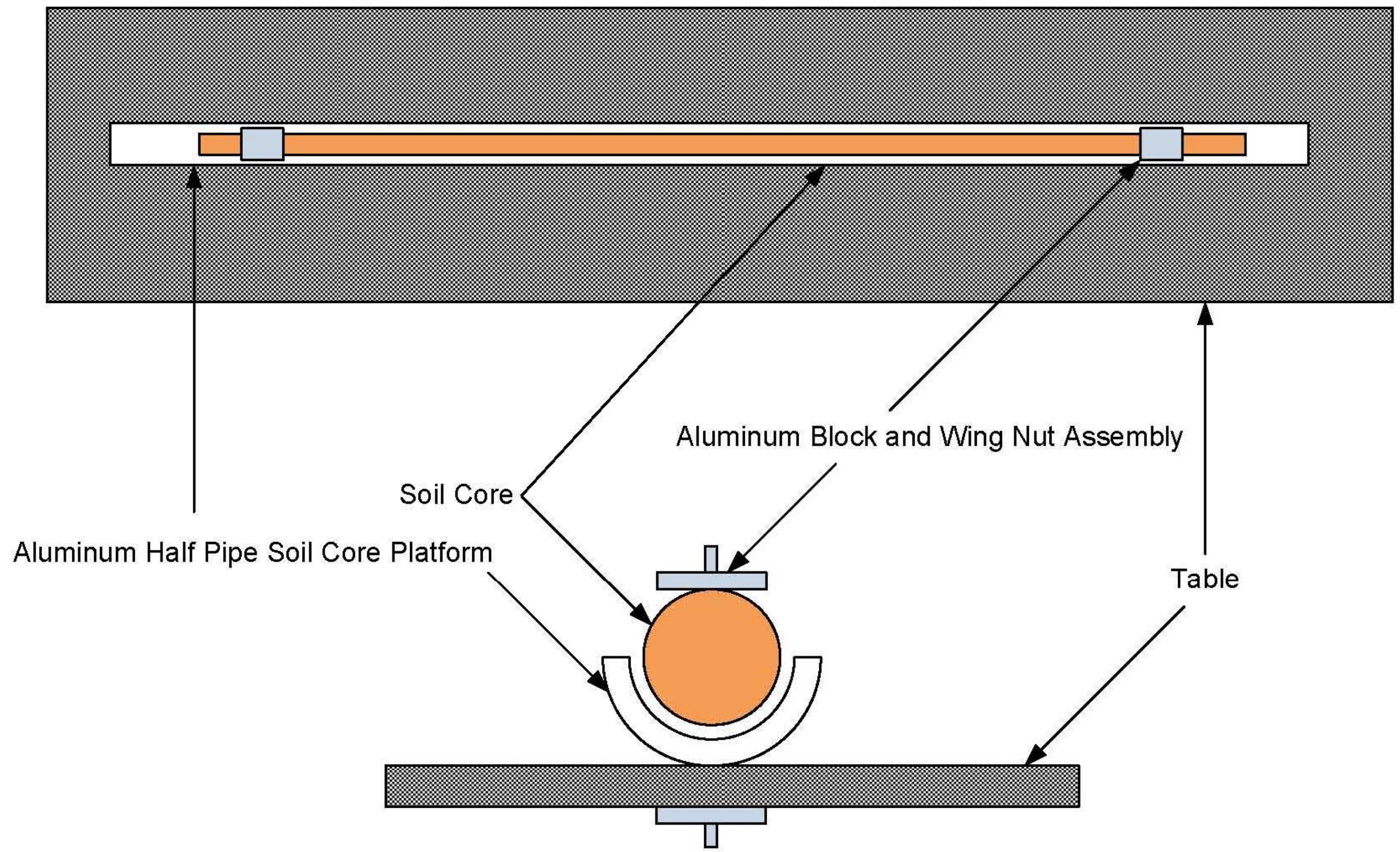


FIGURE 4-2
CUSTOMIZED COLLECTION/COOLER SCHEMATIC

PRUDENT TECHNOLOGIES, INC.
dba Prudent Environmental Services, Inc.

US Army Corps of Engineers

Note: Figure not to scale



Aluminum Half Pipe Soil Core Platform Assembly

FIGURE 4-3
PUSH PROBE SOIL CORE CUTTING PLATFORM

PRUDENT TECHNOLOGIES, INC. dba Prudent Environmental Services, Inc.

US Army Corps of Engineers®

Note: Figure not to scale

PRUDENT TECHNOLOGIES, INC. dba Prudent Environmental Services, Inc.

BORING LOG:

Sheet:___ of ___

Date:________

Site Name: ______________________

Site Address: ______________________

Project No: ______________

Logged By: ______________

Reviewed By: ______________

Drilled By: ______________

Driller: ______________

Drilling Method: ______________

Total Depth: ______________

Sampling Method: ______________

Groundwater Depth: ______________

Groundwater Measurement: ______________

TOC Elevation: ______________

Groundwater Elevation: ______________

Depth (Feet)	Interval	% Recovery	Sample ID	PID/FID (ppm)	Blow Counts	USCS	Log	Soil Description	Depth (Feet)	Comments
5									5	
10									10	
15									15	
20									20	
25									25	

5.0 – SAMPLE CHAIN-OF-CUSTODY DOCUMENTATION

5.1 FIELD BOOK

All field data will be entered into a dedicated field logbook. A typed, formatted blank boring log will be prepared before sampling begins. During geotechnical logging of the push probe samples, data will be entered into a computer with the boring log template, printed out, and signed by the geologist or geotechnical engineer performing the logging.

5.2 PHOTOGRAPHS

Information regarding the documentation of photographs for the investigation is presented in Section 5.2 of the FWSAP. Representative photographs will be taken of the investigative activities and any significant observations made during the field effort.

5.3 SAMPLE NUMBERING SYSTEM

The sample numbering system that will be used to identify samples collected during the investigation is explained in Section 5.3 of the FWSAP. Samples have previously been collected at each of the load lines; therefore, sample numbering will continue the sequence established in the previous investigation. Samples collected in addition to the baseline set will be identified sequentially by following the numbering system. If a sample in the baseline set is not collected or is reassigned to another location, a specific reason and notation will be given in the project field book.

5.4 SAMPLE DOCUMENTATION

All sample labels, logbook, field records, and field form information will follow structures identified in Section 5.4 of the FWSAP.

5.5 DOCUMENTATION PROCEDURE

Documentation and tracking of samples and field information will follow the series of steps identified in Section 5.5 of the FWSAP.

5.6 CORRECTIONS TO DOCUMENTATION

Any corrections to documentation will follow guidance established in Section 5.6 of the FWSAP.

6.0 – SAMPLE PACKAGING & SHIPPING REQUIREMENTS

Packaging and shipping of primary samples will follow procedures specified in Section 6.0 of the FWSAP. Coolers containing QA samples that are shipped to the contract laboratory for independent analysis will also be prepared and shipped in accordance with the FWSAP. Information for the primary and QA laboratories is provided below.

TestAmerica North Canton

4101 Shuffle Street NW

North Canton, Ohio 44720

Phone: 330-497-9396

Fax: 330-497-0772

www.testamericainc.com

Contact: Mark Loeb

USACE has selected the following QA laboratory

CT Laboratories

1230 Lange Court

Baraboo, WI 53913

Phone: 608-356-2760

POC: Pat Letterer

7.0 – INVESTIGATION-DERIVED WASTE

This section describes the Investigation-Derived Waste (IDW) handling for this project. All IDW, including auger cuttings, personal protective equipment (PPE), disposable sampling equipment, and decontamination fluids, will be properly handled, labeled, characterized, and managed in accordance with Section 7.0 of the FWSAP, federal and state of Ohio large-quantity generator requirements, and RVAAP's Installation Hazardous Waste Management Plan.

Four types of IDW are anticipated; each type will be contained separately. The types and estimated quantities for each include:

- Soil from various including residual surface soil, resulting from sample collection using hand sampling equipment. Ten, 55-gallon drums of soil IDW are anticipated.
- Decontamination fluids, including those derived from decontamination of sampling equipment. Ten, 55-gallon drums of decontamination fluid are anticipated from sampling equipment decontamination.
- Expendables/solid wastes, including PPE and disposable sampling equipment. Two, 55- gallon drums of expendable IDW are anticipated.
- Field test kit extraction fluids. Approximately 10 gallons are anticipated.

7.1 INVESTIGATION-DERIVEDWASTE COLLECTION & CONTAINERIZATION

All solid nonindigenous (expendable sampling equipment and trash) IDW will be segregated as noncontaminated and potentially contaminated material. Potentially contaminated and noncontaminated, solid, nonindigenous IDW will be identified in the field on the basis of visual inspection (e.g., soiled versus not soiled), usage of the waste material (e.g., outer sampling gloves versus glove liners), and field screening of the material using available field instrumentation (e.g., Organic Vapor Analyzer, OVA). All noncontaminated, nonindigenous IDW will be contained in trash bags. Potentially contaminated, nonindigenous IDW will be contained in labeled DOT approved, open-top, 55-gallon drums equipped with plastic drum liners and sealed with bung-top lids.

All liquid nonindigenous IDW (e.g., decontamination rinse water) will be segregated by waste stream (e.g., soap and water/water rinses will be separated from methanol and hydrochloric acid rinses and acetone extraction fluids) and the waste stream contained in labeled DOT-approved, 55-gallon closed-top drums. All known or potentially hazardous liquid, nonindigenous IDW streams, such as methanol, hydrochloric acid rinses, and acetone will be contained separately in labeled DOT-approved, closed-top, 55-gallon drums.

7.2 CONTAINER WASTE LABELING

All IDW containers will be labeled prior to placing IDW in them. All IDW containers (drums and roll-off boxes) will be labeled in accordance with Section 7.2 of the FWSAP.

7.3 INVESTIGATION-DERIVED WASTE FIELD STAGING

A field staging area will be designated at each load line at the beginning of field activities and approved by the RVAAP Acting Facility Manager. The IDW drums or other specified containers will be located at the designated field staging area for each load line. Centralized field staging areas will be managed according to the requirements of Section 7.3 of the FWSAP.

Daily inventories of IDW will be taken and provided to the RVAAP Acting Facility Manager by the designated IDW coordinator. A final inventory will be conducted prior to demobilization from the site and all IDW staged at Building 1036. All liquid waste that has not been transported off the facility within 90 days following project completion will require secondary containment.

7.4 INVESTIGATION-DERIVED WASTE CHARACTERIZATION AND CLASSIFICATION FOR DISPOSAL

All indigenous IDW (soil) will be characterized for disposal based on analytical results from environmental samples collected from each sampling station. Nonindigenous IDW (decontamination fluids), except for PPE and expendable sampling equipment, will be characterized for disposal on the basis of composite samples collected from segregated waste stream storage containers. Composite waste samples will be submitted for laboratory analysis of full Toxicity Characteristic Leaching Procedure (TCLP) to characterize each waste stream for disposal. Procedures for composite waste sampling are presented in Sections 7.4.1 and 7.4.2 of the FWSAP. The PPE and expendable sampling equipment will be managed in accordance with Section 7.4 of the FWSAP.

7.5 INVESTIGATION-DERIVED WASTE DISPOSAL

Upon approval of IDW classification reports, all solid and liquid IDW will be removed from the site and disposed of by a licensed waste disposal contractor in accordance with Section 7.5 of the FWSAP and all applicable State and Federal rules, laws, and regulations. All shipments of IDW off site will be coordinated through the RVAAP Environmental Coordinator and Caretaker Site Manager.

8.0 – REFERENCES

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Appendix A – Draft Guidance for Multi-Incremental Surface Soil Sampling

Appendix A

DRAFT GUIDANCE FOR MULTI-INCREMENT SURFACE SOIL SAMPLING

1. Purposes & Basic Requirements of Taking Multi-Increment Samples

a. The purpose of collecting, preparing, and analyzing a multi-incremental sample is to provide a repeatable and accurate measure of the average concentrations of constituents of interest within a sample area. Specific data quality objectives (DQOs) will be required for each project that will determine the types and numbers of samples required.

b. Sufficient amount of sample material must be collected from the sample area to account for compositional heterogeneity and additionally, a sufficient number of sub samples utilizing a stratified random methodology must be taken to account for distributional heterogeneity.

c. Typical uses of accurate, average values are as,

- exposure point concentrations in sample areas,
- delineation of nature and extent of contamination, characterization sampling of a potential waste material, and
- closure sampling of a remediated area to provide legally defensible, scientifically based evidence that satisfactory remediation has been accomplished.

d. The likelihood of determining small-scale hot spots of contamination by conventional discrete sampling is extremely low, and unrepeatable. Multi-increment sampling provides a much greater probability of determining representative and repeatable contamination within a reasonably sized area, see Reference 8.

2. Determination of Multi-Increment Sample Areas

The determination of appropriate sample areas depends on many factors including, the ultimate use of the average value, the constituent's toxicity and mobility, physical/chemical characteristics of a given site, and the reasonably anticipated future land use. For instance, in the ecological realm, if a fish population study is to be conducted over a specified reach of a creek or river, then the appropriate multi-increment sample area is the entire same specified reach of that creek or river. If a vegetation analysis is to be made at a burning pad at a burning ground, then the appropriate sample area is the pad area.

In the human health realm, if the future land use is known, then the appropriate sample area is the smallest exposure area associated with that land use. For instance, if a given site were to be industrial, then the appropriate sample area would be the smallest exposure area associated with industrial usage. If an unrestricted land use, residential, is used, then the smallest exposure area is ¼ acre, and thus sample areas would be no larger than ¼ acre.

In many instances, the physical/chemical/operational characteristics at the site will direct appropriate sample areas.

The determination of multi-increment sample areas would generally be done on a site-by-site basis for any given investigation in coordination with risk assessment guidelines and risk assessor recommendations. Similar site-by-site selection is required when discrete biased sampling is performed, so there is nothing new or additional in determining appropriate multi-increment sample areas.

Appendix A

3. Determination of Sub-Sample Locations within a Multi-Increment Sample Area

Obviously, the best and surest measure of determining the average value within a sample area would be to collect portions over the entire sample area. However, because that is cost prohibitive in most cases, sampling of only portions within the sample area must be done. As in many other disciplines where heterogeneity is a major concern, sub-sample locations should be selected on a systematic-random basis. The stratification assures coverage over the entire sample area and the randomness provides repeatability and accuracy. Varying degrees of sophistication may be utilized to achieve stratified random sampling locations, as subdividing a sample area into say 30 sub-sample areas and then using a random number generator to select a location within the 30 sub-sample areas. This method requires minor surveying, but the major disadvantage is that sometimes the random locations are not accessible, as for instance if a large tree is present at the specified location.

Generally about 30 sub-samples should be taken within a given sample area. If replicates yield a variability that is too great, then the number of sub-samples would have to be increased, possibly as high as 100 and potentially more sample mass would be required.

4. Collection of a Multi-Increment Sample

Because of the use of multi-increment sampling in other disciplines, tools already exist to collect sub samples of environmental media, as soil and sediment. Reference to the Forest Suppliers, Inc Catalog 54, pages 223 – 229 and the AMS 2003 Soil and Groundwater 2003 Catalog, pages 20 – 39 shows many types of tools are already available that can be used to easily collect the necessary sub-samples. Generally, the samplers should be stainless steel if metals analyses are to be made and a small volume should be collected to facilitate subsequent sample processing. For sediment sampling recently performed, something as simple as a plastic scope was utilized. Recent examples of sampling tools utilized have included:

- RVAAP Facility-Wide Surface Water Sediment Study- Eckman dredges for sediment in the large ponds with soft mud, silt or sand bottoms (not appropriate for gravel, rockbottoms, or detritus),
- Plastic scoops for silt, sand, clay creek sediment along the rock bottom creeks, A 7/8”-diameter step probe for small pond sediment sampling

If feasible, disposable tools may be utilized, otherwise decontamination can be made of tools between sample areas, but obviously not during collection of the sub-samples within a sample area. Selection of sampling tools and equipment will also be dependent upon the DQOs and will be identified in the Project Specific Sampling Plan Addendum.

As in all field sampling, sufficient prefield work should be done to select an array of possible tools. Then selection and use of the tools should be customized to the actual field conditions. For instance, one type of surface soil sampler may be more effective with sandy soils than with clayey soils.

The sub-samples collected from a sample area should be all placed in a container, as a large baggie or bowl, large enough to transport them back to the sample processing location.

Because of volatilization issues, multi-increment sampling cannot be utilized for collection of samples for VOC analysis unless collected samples are stored in a solution of methanol.

Additionally, if SVOCs are of concern, further consideration of the use of plastic sampling materials should be done prior to sampling.

5. Processing of a Multi-Increment Sample

The overall goal of the field collection is to collect sufficient material over the sample area to account for both compositional and distributional heterogeneity. In all probability, much more sample material will be collected in the field than will be tested in the laboratory. If facilities are available in the field, field sample processing can be done prior to shipment of a sample to the laboratory. If no facilities are available in the field, the total collected field sample can be forwarded to the laboratory where sample processing can be performed. Sample processing must be done on the field-collected sample to provide a representative, but smaller sample of appropriate quantity for laboratory analyses.

The type of material collected will determine the type of processing required. For the thoroughly saturated clayey sediments (muck) collected from the ponds in the RVAAP Surface Water/ Sediment Study, the entire saturated sample was laid out and 30 small spoon samples taken randomly across the mix to fill each of the analytical sample jars.

For less saturated materials, the total sample of a sample area should initially be air dried overnight. Subsequently, the entire air-dried multi-increment sample should be sieved according to the needs of the DQOs, but for soil, the most typical size is a #10 sieve. Any materials larger than #10 discarded should be discarded. The remaining air-dried, sieved material should then be ground to better homogenize the sample. As before, the ground material should be laid out and 30 small spoon samples were taken randomly across the mix to fill each of the analytical sample jars.

The sample processing provides a much more representative, uniform, repeatable set of jar samples that analytical labs can analyze.

6. Quality Control/Assurance

A Field

To measure repeatability of field collection techniques, two separate field samples can be collected using the same field collection techniques from any given sample areas to measure their repeatability. **Collection of duplicative samples should be done as a minimum for each type of environmental media and on a pre-selected basis of 1 in 10 where there are more than 15 samples of a given media.** The results of these duplicative samples can then be used to measure repeatability. If such samples are indeed very repeatable, their accuracy can be inferred. If the variability of the replicates is too great, the number of increments or the mass must be increased (and in some cases both).

B Laboratory

The current practice of preparing duplicates or splits from a single discrete sample is extremely flawed because of no sample processing prior to sending the jar samples to the laboratory. The measures specified for sample processing in five above will provide samples to the laboratories that are much more similar than the current practice. With more uniform samples received from the field, the comparison of analytical results from different labs and QC samples from the same laboratory will be much more valid. Significantly improved agreement between original, QC, and QA samples has been observed at both the RVAAP Facility-Wide Surface Water/Sediment Project and the Joliet Army Reserve Project.

Appendix A

References

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Appendix B – Quality Assurance Project Plan Addendum

Final Quality Assurance Project Plan Addendum for Sampling & Closure of Load Lines 1, 2, 3, 4, 12 (RVAAP- 08, 09, 10, 11 and 12) and Other Areas of Concern

Ravenna Army Ammunition Plant
Ravenna, Ohio

Contract No. W912QR-10-P-0037

Prepared for:

U.S. Army Corps of Engineers
600 Martin Luther King, Jr. Place
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4242 Medical Drive, Suite 7250
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July 30, 2010

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Acronyms and Abbreviations

CUGs	Clean up goals
DU	Decision Unit
FSP	Field Sampling Plan
LCG	Louisville Chemistry Guideline
LCS	Laboratory Control Sample
MDL	Method Detection Limit
MI	Multi-increment
MS/MSD	Matrix Spike/Matrix Spike Duplicate
Ohio EPA	Ohio Environmental Protection Agency
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
QC/MRL	QC/Method Reporting Level Standard
RDX	Hexahydro-1,3,5-trinitro-1,3,5-triazine
RL	Reporting Limit
RVAAP	Ravenna Army Ammunition Plant
SOP	Standard Operating Procedure
TNT	Trinitrotoluene
USACE	United States Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency

1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPP) Addendum addresses supplemental project-specific information in relation to the Facility-Wide QAPP for the Ravenna Army Ammunition Plant (RVAAP) (SAIC, 2001). This QAPP Addendum along with the Field Sampling Plan (FSP) Addendum constitutes the Sampling and Analysis Plan (SAP). The FSP describes the project for the sampling of soils below former floor slabs at Load Lines 1, 2, 3, and 4, and the possible excavation and transportation of contaminated soils. Table 2-1 of this QAPP Addendum lists the Multi-Increment (MI) subsurface samples and the analytical methods required for this investigation. A summary of the sampling scheme is in Table 3-1 of the FSP Addendum. Details of the subsurface MI sampling for each load line are listed in Tables 3-2 to 3-5 of the FSP Addendum.

During remediation, confirmatory analyses will be required. The number of samples and the analytical methods required for these characterization and confirmatory samples are listed in Table 2-2 of this QAPP Addendum.

Each QAPP section is presented documenting adherence to the Facility-Wide QAPP or stipulating project-specific addendum requirements.

Primary analytical and quality directions for this project will be obtained from the identified U.S. Environmental Protection Agency (USEPA) SW-846 Methods, the DoD Quality Systems Manual for Environmental Laboratories, Version 4.1 and the USACE Louisville District QSM supplement.

2.0 PROJECT DESCRIPTION

The site history, project objectives and scope, sampling design, parameters to be tested and the project schedule are described in the Work Plan and Field Sampling Plan Addendum.

A total of 411 subsurface MI samples are expected to be collected, including horizontal and vertical samples. Up to 327 of these samples will be analyzed for TAL metals, mercury, hexavalent chromium and explosives. In addition, up to 143 of the above samples will be analyzed for VOCs, and up to 75 of these samples will be analyzed for SVOCs, propellants, pesticides, PCBs and herbicides. Triplicate field QA samples will be collected and their locations are specified in Tables 3-2 to 3-5 of FSP Addendum. One of the triplicate samples will be sent to the primary laboratory, the second to the QA laboratory chosen by USACE and the third sent as a blind sample to the primary laboratory. Table 2-1 of the QAPP Addendum lists the total and QA samples along with all the analytical procedures required for this effort.

Additional characterization may be required to delineate remediation areas. If remediation is warranted, confirmatory samples of up to 120 surface soil/sediment samples and 20 surface water samples may be collected and analyzed for parameters listed in Table 2-2. This Table also includes QA samples needed for this portion of the investigation. The number of triplicate samples will depend on the actual number of confirmatory samples that cannot be determined until the extent of remediation is clear.

Field Screening analysis for TNT and RDX will be performed during remediation activities using EnSys test kits for TNT and RDX following the test kit instructions. The test kit instructions and SOP are contained in Appendix A of this QAPP Addendum. The number of samples for field screening will be determined during remediation activities.

Table 2-1 – Primary Multi-Incremental Samples

			Field Samples						
		Total Number. of Field Samples	Horizontal Samples				*Vertical Samples	MS/MSD	Rinsate samples
Parameters	Methods Preparation/Analysis		Primary	Methanol Field Blank	TriplicateQC Primary Lab	TriplicateQA Lab			
Metals (TAL)	3050/ 6020	327	59		11	11	246	17	4
Explosives + nitroglycerine & PETN	8330(prep &analysis)	327	59		11	11	246	17	4
Chromium, Hexavalent	3060A/ 7196A	327	59		11	11	246	17	4
Mercury	7471A (prep &analysis)	327	59		11	11	246	17	4
Volatile Organics	5035/8260B	154	24	11	11	11	97	8	4
Semivolatile Organics, Low level	3540C/8270C	75	11		11	11	42	4	4
Nitroquanidine	8330 Mod.(prep & analysis)	75	11		11	11	42	4	4
Nitrocellulose	353.2(prep &analysis)	75	11		11	11	42	4	4
Herbicides	8151A(prep & analysis)	75	11		11	11	42	4	4
Pesticides	3520C/8081A	75	11		11	11	42	4	4
PCBs	3520C/ 8082	75	11		11	11	42	4	4

*Vertical Samples are only to be analyzed if there is an exceedance of at least one of the CUGs on any horizontal sample associated with that set of vertical samples, and only for that type of analysis, as explosives, etc.

Only one set of vertical samples will be analyzed in a sample area, either those associated with the primary sample or those associated with triplicate the horizontal samples that have the most CUG exceedances.

Table 2-2 – Characterization/Confirmatory Samples

Parameters Soil/Sediment	Methods Preparation/Analytical	No. of Field Samples in SOW	Primary	Methanol Field Blank	TriplicateQC Primary Lab	Triplicate QA Lab	MS/MSD	Rinsate samples
Metals (TAL)	3050/ 6020	50	TBD		TBD	TBD	3	3
Explosives + nitroglycerine & PETN	8330(prep &analysis)	120	TBD		TBD	TBD	6	3
Chromium, Hexavalent	3060A/ 7196A	50	TBD		TBD	TBD	3	3
Mercury	7471A (prep &analysis)	50	TBD		TBD	TBD	3	3
Volatile Organics	5035/ 8260B	25	TBD	TBD	TBD	TBD	2	
Semivolatile Organics, Low level	3540C/ 8270C	25	TBD		TBD	TBD	2	3
Nitroquanidine	8330 Mod. (prep &analysis)	50	TBD		TBD	TBD	3	3
Nitrocellulose	353.2(prep & analysis)	50	TBD		TBD	TBD	3	3
Herbicides	8151A(prep & analysis)	25	TBD		TBD	TBD	2	3
Pesticides	3540C/ 8081A	25	TBD		TBD	TBD	2	3
PCBs	3540C/ 8082	25	TBD		TBD	TBD	2	3
Parameters Surface Water								
TAL metals	3005/6020	20	TBD		TBD	TBD	1	
Mercury	7470A(prep & Analysis)	20	TBD		TBD	TBD	1	
Hexavalent Chromium	3060A/7196	20	TBD		TBD	TBD	1	
Explosives	8330 (prep & analysis)	20	TBD		TBD	TBD	1	
SVOCs, Low Level	3520C/8270C	20	TBD		TBD	TBD	1	
VOCs	5030/8260B	20	TBD		TBD	TBD	1	
Pesticides	3520C/ 8081A	20	TBD		TBD	TBD	1	
PCBs	3520C/8082	20	TBD		TBD	TBD	1	
Herbicides	(prep & analysis) 8151A	20	TBD		TBD	TBD	1	

3.0 – PROJECT ORGANIZATION & RESPONSIBILITIES

The functional project organization and responsibilities are described in Section 2 of the Facility-Wide Field Sampling Plan (FSP) (SAIC, 2001) and in the Project Work Plan.

Analytical support for this work has been assigned to TestAmerica, North Canton, Ohio. TestAmerica will perform all required analyses at that location except for the explosives and propellant analyses, which will be performed in the TestAmerica West Sacramento facility. TestAmerica's organizational structure, roles, and responsibilities are identified in Section 4.0 of their Quality Assurance Manual (QA Manual), which is available for review upon request. The address and telephone number for TestAmerica laboratories are as follows:

TestAmerica North Canton

4101 Shuffle Street NW

North Canton, Ohio 44720

Phone: 330-497-9396

Fax: 330-497-0772

WWW.testamericainc.com

Contact: Mark Loeb

TestAmerica West Sacramento

880 Riverside Parkway

West Sacramento, CA 95605

Phone: 916-373-5600

Fax: 916-372-1059

Contact: Karen Dahl

USACE has selected the following QA laboratory

CT Laboratories

1230 Lange Court

Baraboo, WI 53913

Phone: 608-356-2760

POC: Pat Letterer

Data Validation will be performed by:

MECx, LP

12269 East Vessar Drive

Aurora, Colorado 80014

Phone: 720 535-5502

Fax: 720 535-7555

POC : Elizabeth Wessing

Mobile: 303-881-6816

Email: Elizabeth.wessing@mecx.net

4.0 – QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA

4.1 DATA QUALITY OBJECTIVES

Analytical data quality objectives for soils/sediments and surface water for this investigation are summarized in Table 3-1 and Table 3-2 respectively in the Facility-Wide QAPP. However, the laboratory will use accuracy and precision limits prescribed in the DoD Quality Systems Manual for Environmental Laboratories, version 4.1 (QSM). The laboratory is required to comply with all methods as written; recommendations are considered requirements.

4.2 LEVEL OF QUALITY CONTROL EFFORT

The QC efforts will follow Section 3.2 of the Facility-Wide QAPP. Field QC analyses will include field triplicates and equipment rinsate blanks. Trip blanks will be included when aqueous samples for volatile organic analyses are shipped to the laboratory. Laboratory QC will include method blanks, laboratory control samples (LCSs), laboratory duplicates, and matrix spike/matrix spike duplicate (MS/MSD) samples. One MS/MSD sample will be designated in the field and collected for at least every 20 investigative samples per sample matrix. Tables 2-1 and 2-2 of this QAPP Addendum list the needed number of rinsate blanks, and MS/MSDs. Additional laboratory QC will be explained in subsequent sections of this QAPP Addendum.

4.3 ACCURACY, PRECISION, AND SENSITIVITY OF ANALYSIS

Project accuracy and precision goals are identified in Section 3.3 and Table 3-1 for soil/sediment and Table 3-2 for surface water/groundwater of the Facility-Wide QAPP. However, the laboratory will adhere to Section 9.3 of this QAPP Addendum

4.4 COMPLETENESS, REPRESENTATIVENESS, AND COMPARABILITY

The completeness goals are identified in Table 3-1 and 3-2 of the Facility-Wide QAPP and will be imposed for this investigation. The horizontal and vertical MI sampling design allows Prudent Technologies, Inc. to evaluate the representativeness of the samples in relation to the field conditions. Comparability will be determined by evaluating two of the field triplicate sample results from the primary laboratory and also by comparing those results to one of the triplicate results obtained by the USACE QA laboratory. In the laboratory, internal comparability is established by analyzing laboratory duplicates and MS/MSD. The laboratory establishes external comparability by traceability studies with second source standards and by performance evaluation results.

4.5 TRIPLICATE SAMPLING

Collection of Triplicate Multi Increment Samples

To statistically evaluate sampling precision for each sample/decision area (DU), additional, completely separate replicate MI samples (collected from a set of systematic random or stratified random locations within the DU that are different from those used for the initial MI samples) are collected from selected DUs (see Hawaii Dept of Health, Technical Guidance Manual for the Implementation of the Hawaii State Contingency Plan). The replicates are made up of a minimum of 30 (for surface soils) different systematic or stratified random increments from within the same DU. The replicate samples are prepared and analyzed in the same manner as carried out for the initial sample. Triplicate samples (i.e., initial MI sample plus two replicates) are preferred and more useful than just duplicates for statistical evaluation.

If only one DU is being investigated, a triplicate sample is recommended for evaluation. For sites with a number of DUs, “batch” type replicates can be used – for example a triplicate sample in one DU to provide data for evaluating precision for up to 10 similar DUs. Each site will be unique in terms of numbers of DUs and how similar these DUs are, so decisions on numbers of replicates are unique to each site and should be addressed clearly in the SAP.

A different random starting location is determined for each replicate collected in the selected DUs. Replicate sample increments are generally collected along the same approximate directional lines established through the DU for the initial MI samples, though at different systematic random locations than initially used. This is accomplished by pacing off the replicate increments from a different random starting location on the first line/row of the DU, and continuing to sample at this random interval throughout the DU. The replicate increments should not be collected from the same points or co-located with those used for the initial MI samples. Replicate samples are sent to the laboratory as “blind” samples, meaning the laboratory does not know they represent replicate samples of the initial MI samples.

Statistical Evaluation of Replicate Multi Increment Samples

When field sampling is “representative,” repeat measurements within the same DU would be expected to estimate the average contaminant concentration similarly. Data from replicate sampling are used to determine:

1. The amount of variation from the mean that will be considered when comparing average contaminant concentrations in the DU to applicable clean-up goals (CUGs) and
2. Whether the estimate of average contaminant concentration(s) is adequately representative for the DU(s) under investigation.

There are a number of options available for determining what measure of data variation from the mean will be used when evaluating the MI sample replicate measurements and comparing MI sample data to the CUGs. The measure of data variation from the mean that is chosen is a function of the data quality objective (DQO) for the site investigation. Two common approaches are: 1) use of the standard deviation of the replicate values, or 2) use of the 95% Upper Confidence Level (UCL) of the replicate (triplicate) values.

Evaluation of Replicates and Data Representativeness

The field replicate data collected for DUs are also used to demonstrate that the investigation error for each contaminant is within a reasonable range that supports a conclusion that average contaminant concentrations (e.g., mean plus standard deviation or 95% UCL of the mean) are below or above the relevant CUG. In other words, this evaluation addresses the question of whether the data are good enough to make a decision that the average contaminant concentration is below or above the CUG.

Typically, the Relative Standard Deviation (RSD) of the field replicates (triplicates) is used for this evaluation. The RSD is expressed as a percentage and is calculated using the following formula:

$$\text{RSD\%} = \frac{100\% \times \text{Standard Deviation}}{\text{Average}}$$

The lower the RSD% of the replicate data the better. Generally, an RSD% of approximately 35% or less indicates the amount of estimated total error is within a reasonable range for decision making. However, this evaluation will also depend on the DQO established for the site investigation, as well as how close the contaminant concentrations are to the relevant CUGs. For example, if the RSD% of replicates for a contaminant concentration in a DU was determined to be 40% to 50%, but the contaminant concentration was a factor or 3 or 4 below the relevant CUG, then a decision that the contaminant is below levels of concern would still be valid. In general, the closer the contaminant level is to the CUG, the more impact this statistical measure will have on site decisions.

The MI sampling approach provides averages that approximate a statistically "normal distribution" if the RSD% of replicates is reasonably low (this is assumed, for example, when determining the 95% UCL of replicate data). The higher the RSD%, the less confidence there is that the averages approximate a normal distribution, and that the average contaminant concentrations are adequately representative of the DU(s). As the RSD exceeds 50%, and if the average DU concentrations are near the relevant CUGs, there is increasing uncertainty that the data are adequately representative. In this case additional MI sampling may be necessary, utilizing a larger number of sample increments and/or larger sample increment masses to obtain a more representative measure of the (very heterogeneous) contaminant concentrations in the DU. Careful evaluation of the sample processing and analysis procedures would also be indicated. In some cases, grinding samples may serve to reduce the RSD% and provide more representative sampling data.

As the RSD% approaches 100% there is little confidence that the sampling data are useful for decision making.

5.0 – SAMPLING PROCEDURES

Sampling procedures are discussed in Field Activities, Section 4.0 of the Field Sampling Plan Addendum. The MI sampling protocol to be used as part of this investigation is also included in the FSP Addendum. Table 5-1 lists soil and sediment container, preservation and holding time requirements for this investigation. Table 5-2 lists container, preservative and holding time requirements for surface waters.

Table 5-3 – Container Requirements for Soil and Sediment Samples

Analyte Group	Container	Minimum Sample size	Preservative	Holding Time
VOCs	500 ml glass jar	250g	Methanol, Cool, 4°C	14 d
SVOCs	MI Sample: 1X 1 liter. wide mouthed glass jar (about 1 Kg of soil material)	60g	Cool, 4°C	14 d (extraction) 40 d (analysis)
Pesticides		60g	Cool 4°C	14 d (extraction) 40 d (analysis
PCBs		60g	Cool 4°C	14 d (extraction) 40 d (analysis
Herbicides		50g	Cool 4°C	14 d(extraction) 40 d (analysis)
Explosives		60g	Cool 4°C	14 d (extraction) 40 d (analysis
Propellants		60g	Cool 4°C	14 d (extraction) 40 d (analysis
Metals and Mercury		50g	Cool 4°C	180 d, Mercury 28 d
Hexavalent Chromium		20g	Cool 4°C	30 d (digestion) 96 hrs (analysis)

Table 5-4 – Container Requirements for Surface Water Samples

Analyte Group	Container	Minimum Sample size	Preservative	Holding Time
VOCs	2 X VOA vials	2 X 40 ml	HCl, pH<2 Cool 4^0 C	14 d
SVOCs	Amber glass with Teflon lined lid	2X1000 ml	Cool 4^0 C	7 d extraction 40 d analysis
Explosives	Amber glass with Teflon lined lid	2X1000 ml	Cool 4^0 C	7 d extraction 40 d analysis
Pesticides	Amber glass with Teflon lined lid	2X1000 ml	Cool 4^0 C	7 d extraction 40 d analysis
PCBs	Amber glass with Teflon lined lid	2X1000 ml	Cool 4^0 C	7 d extraction 40 d analysis
Herbicides	Amber glass with Teflon lined lid	2X1000 ml	Cool 4^0 C	7 d extraction 40 d analysis
Propellants	Amber glass with Teflon lined lid	2X1000 ml	Cool 4^0 C	7.d extraction 40 d analysis
Metals and Mercury	Plastic	1000 ml	HNO_3 ,pH<2 Cool 4	180 d for metals 28 days for mercury
Hexavalent Chromium	Plastic	250 ml	Cool 4	24 hrs

6.0 – SAMPLE CUSTODY

6.1 FIELD CHAIN-OF-CUSTODY PROCEDURES

Sample handling, packaging, and shipment procedures will follow those identified in Section 5.1 of the Facility-Wide QAPP and Section 5.0 of the FSP. Prudent's Chain of Custody Form will follow the format of Figure 5.3 of the Facility-Wide QAPP.

6.2 LABORATORY COC PROCEDURES

Laboratory chain of custody will follow handling and custody procedures identified in Section 7.0 of the TestAmerica QA Plan.

6.3 FINAL EVIDENCE FILES CUSTODY PROCEDURES

Custody of evidence files will follow those criteria defined in Section 5.3 of the Facility-Wide QAPP.

7.0 – CALIBRATION PROCEDURES AND FREQUENCY

7.1 FIELD INSTRUMENTS/EQUIPMENT

Field instruments and equipment calibrations will follow those identified in Section 6.1 of the Facility-Wide QAPP. Calibration for TNT and RDX screening procedures are included in Appendix A of this QAPP Addendum.

7.2 LABORATORY INSTRUMENTS

Calibration of laboratory instruments will be conducted according to USEPA analytical procedures. Additional method specific calibration information is provided in various Tables in Appendix F of the QSM, 4.1.

8.0 ANALYTICAL PROCEDURES

8.1 LABORATORY ANALYSIS

Analytical methods, parameters and quantitation limits are listed in Tables 3-3 through 3-8 of the Facility-Wide QAPP. Laboratory reporting limits for hexavalent chromium are 0.02 mg/L for water samples and 0.8 mg/Kg for soil samples. Reporting limits for VOCs in Methanol and for low level SVOCs are to be determined. Reporting limits for herbicides are from TestAmerica laboratory and are listed in Table 8-1.

All preparation and analytical methods required for this investigation are listed in Tables 2-1 and 2-2 of this QAPP Addendum.

Table 8-5 – Herbicides – Method 8151A Reporting Limits

Analyte	Reporting Levels	
	Water (µg/L)	Soil/Sediment (µg/kg)
2,4-D	4	80
Dalapon	2	40
2, 4-DB	4	80
Dicamba	2	40
Dichlorprop	4	80
Dinoseb	0.6	12
MCPA	400	8000
MCPP	400	8000
2, 4, 5- TP (Silvex)	1	20
2, 4, 5-T	1	20

Laboratory-specific Standard Operating Procedures (SOPs) will be followed during the analysis of project samples and are available upon request.

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

The laboratory will implement all reasonable procedures to achieve project quantitation levels for all sample analyses. Where contaminant levels or sample matrix analytical interferences impact the laboratory's ability to obtain RLs consistent with these requirements, the laboratory will institute sample clean-up processes, adjust instrument operational parameters, or propose alternative analytical methods or procedures.

All horizontal and vertical samples will be air dried upon receipt and extracted within the holding times.

Vertical samples are only to be analyzed if there is an exceedance of at least one of the CUGs on any horizontal sample associated with that set of vertical samples, and only for that type of analysis, as explosives, etc.

Only one set of vertical samples will be analyzed in a sample area, either those associated with the primary sample or those associated with triplicate horizontal samples that have the most CUG exceedances.

Sample Drying and Disaggregation

The samples are dry mixed and spread in a disposable aluminum tray. If aluminum is a metal of interest for the project the trays are lined with butcher paper. Remove all rocks and vegetation and spread the remaining sample in a thin layer in the tray. Place the tray in a ventilated drying rack for up to five days at room temperature. Periodically expose moist sample to the air. Soil sample should be dried to less than 15% moisture.

Pulverize the dried sample to break up the soil clumps into small particles, but keeping the small pebbles, hard crystalline particles and fibers intact. Pass the sample through a sieve to remove small pebbles. Typically a #10 sieve is used for soils.

Collecting representative aliquots for analyses are described in section 11.3.2.4.2 and subsequent sections of the Standard Operating procedure, NC-IP-001, Rev. 7 of the TestAmerica, North Canton Laboratory.

9.0 – INTERNAL QUALITY CONTROL CHECKS

9.1 FIELD SAMPLE COLLECTION

Field QC sample types, numbers, and frequencies are identified in Section 2 of this QAPP addendum and are summarized in Tables 2-1 and 2-2. Triplicate field QA samples will be collected and their locations are specified in Table 3-1 of the FSP Addendum. One of the triplicate samples will be sent to the primary laboratory, the second to the QA laboratory chosen by USACE and the third sent as a blind sample to the primary laboratory. Table 2-1 of the QAPP Addendum lists the total and QA samples along with all the analytical procedures required for this effort.

Additional characterization may be required to delineate a remediation area. If remediation is warranted, 120 surface soil/sediment samples and 20 surface water samples will be collected and analyzed for parameters listed in Table 2-2. This Table also includes QA samples needed for this portion of the investigation.

Field equipment rinsates for soil samples will be collected at a frequency of one per week of soil sampling. Volatile organic trip blanks will accompany all shipments containing aqueous volatile organic samples.

9.2 FIELD MEASUREMENT

The QC procedures associated with the field screening of confirmation samples for TNT and RDX will include the analysis of an LCS with each sample batch and field duplicate analysis at a frequency of 5 percent.

9.3 LABORATORY ANALYSIS

The QC checks and frequencies are prescribed in Section 8.3 of the Facility-Wide QAPP. In addition, the Tables F-2, F-3, F-4, F-7 and F-8 in Appendix F of the QSM 4.1 detail DoD-specific QC requirements for the various methods needed for this investigation. The control limits for various methods are listed in Appendix G of the QSM 4.1. In the absence of prescribed QC information in the Facility-Wide QAPP or the QSM 4.1, the laboratory-specific limits will used.

10.0 – DATA REDUCTION, VALIDATION, AND REPORTING

10.1 DATA REDUCTION

Sample collection and field measurements will follow the established protocols defined in the Facility-Wide FSP, Facility-Wide QAPP, and the FSP Addendum. Laboratory data reduction will follow the laboratory's QA Plan guidance and conform to general direction provided by the Facility-Wide QAPP, the QSM 4.1, and the LCG.

10.2 DATA VERIFICATION/VALIDATION

Project data verification and validation will follow direction provided in the Facility-Wide QAPP, Section 9.2 and diagrammed in Figure 9-1.

All data will be reviewed and verified in the ADR format by Prudent according to the Facility-Wide QAPP and a data verification report will be issued

Validation of a minimum of 10 percent of the data will be performed in accordance with the Facility-Wide QAPP. An independent data validation subcontractor qualified by the USACE Louisville District, will perform this data validation.

10.3 DATA REPORTING

Analytical data reports will follow the direction provided in Section 9.3 of the Facility-Wide QAPP. The laboratory data package will be organized and reported on a per batch basis. The hard copy standard data deliverable requirements for Ravenna are in Table 9-1 of the Facility-Wide QAPP. TestAmerica laboratory will also provide an ADR electronic data deliverable consistent with the format specified in Table 9-2 of the Facility-Wide QAPP, using the control limits in QSM 4.1 and the hard copy report. Case narratives and calibration information for the electronic files will be provided in hard copies.

Prudent will review the electronic files using the ADR software consistent with QSM 4.1 control limits and the project reporting limits.

11.0 – PERFORMANCE AND SYSTEM AUDITS

11.1 FIELD AUDITS

Internal audits of field activities will be conducted by the Prudent QA Officer (or designee) and/or Field Team Leader, according to the Facility-Wide QAPP.

USACE or Ohio EPA audits may be conducted at the discretion of each respective agency.

11.2 LABORATORY AUDITS

Internal performance and system audits of laboratories will be conducted by the laboratory QA Officer as directed in the laboratory QA plan. On-site laboratory audits may be conducted in conjunction with or at the direction of USACE or Ohio EPA at the discretion of each respective agency.

TestAmerica North Canton Laboratory has been successfully audited by ANSI-ASQ National Accreditation Board/ACLASS and the laboratory certification is valid until March 3, 2012 and the West Sacramento laboratory has been successfully audited by A2LA and the certification is valid until January 31, 2012.

12.0 – PREVENTIVE MAINTENANCE PROCEDURES

12.1 FIELD INSTRUMENTS AND EQUIPMENT

Maintenance of all field sampling equipment will follow direction provided in Section 11.1 of the Facility-Wide QAPP.

12.2 LABORATORY INSTRUMENTS

Routine and preventive maintenance for all laboratory instruments and equipment will follow the direction of the TestAmerica laboratory QA Manual.

13.0 – SPECIFIC ROUTINE PROCEDURES TO ASSESS DATA PRECISION, ACCURACY, AND COMPLETENESS

13.1 FIELD MEASUREMENTS DATA

Field data will be assessed as outlined in Section 12.1 of the Facility-Wide QAPP.

13.2 LABORATORY DATA

Laboratory data will be assessed as outlined in Section 12.2 of the Facility-Wide QAPP.

13.3 PROJECT COMPLETENESS

Project completeness will be calculated by evaluating the planned versus the actual data. All data that are not flagged as rejected will be considered valid. The project completeness will be assessed relative to media, analyte and area of investigation. The project completeness goals are listed in Tables 3-1 and 3-2 of the Facility-Wide QAPP.

14.0 – CORRECTIVE ACTIONS

14.1 SAMPLE COLLECTION/FIELD MEASUREMENTS

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

14.2 LABORATORY ANALYSES

Laboratory corrective action protocols will follow directions provided in Section 13.2 of the Facility-Wide QAPP, the laboratory QA Plan, and the LCG.

15.0 – QA REPORTS TO MANAGEMENT

Procedures and reports will follow the protocol identified in Section 14.0 of the Facility-Wide QAPP and the laboratory QA Plan.

16.0 – REFERENCES

EDQW 2009 DoD Quality Systems Manual for Environmental Laboratories, Version 4.1 April 2009.

Hawaii Dept of Health, Technical Guidance Manual for the Implementation of the Hawaii State Contingency Plan. November 2008.

SAIC. 2001. Science Applications International Corporation. Facility-Wide Sampling and Analysis Plan for Environmental Investigations at the Ravenna Army Ammunition Plant, Ravenna, Ohio, Part I: Field Sampling Plan and Part II: Quality Assurance Project Plan . DACA62-00-D-0001, Delivery Order CY02. Final. March.

TestAmerica 2008 Quality Systems Manual, TestAmerica North Canton Laboratories, January 2008.

TestAmerica, SOP No. NC-IP-001, Rev. 7, 2009, subsampling.

USACE. 2002. U.S. Army Corps of Engineers. Louisville Chemistry Guideline. Environmental Engineering Branch, Louisville District. Version 5. June 2001.

Appendix A – EnSys Test Kit Instructions and Operating Procedures

STRATEGIC DIAGNOSTICS INC.

RDX EnSys® SOIL TEST SYSTEM

70850/70851

RAPID FIELD SCREEN

User's Guide

IMPORTANT NOTICE

The range of the test is between 1 and 30 ppm RDX/HMX. The relative standard deviation is10%. The least detectable concentration is 0.8 ppm (RDX).

This test system should be used only under the supervision of a technically qualified individual who is capable of understanding any potential health and environmental risks of this product as identified in the product literature. The components must only be used for the analysis of soil samples for the presence of RDX/HMX. After use, the kits must be disposed of in accordance with applicable federal and local regulations.

PHASE 1 TEST PREPARATION

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

ITEMSINCLUDEDIN TEST KIT WITH EXTRACTION SET-UPS

- ❑ 2 Cuvette stopper plugs
- ❑ 1 Ampule Cracker
- ❑ 40 Syringe Filters
- ❑ 20 Wooden Spatulas
- ❑ 20 10cc Syringe
- ❑ 20 50mL Reaction Vials w/ H2O
- ❑ 20 Extraction jars
- ❑ 1 Bulb Pipette
- ❑ 1 50mL Conical Tube
- ❑ 20 5cc Zinc syringes
- ❑ 20 13mL Tubes
- ❑ 20 Acetic Acid Bulb Pipets
- ❑ 1 RDX control ampule
- ❑ 20 30 cc Syringes
- ❑ 20 Weigh Boats
- ❑ 20 NitriVer Pillows

- Your kit will not contain wooden spatulas, extraction jars or weigh boats if it was purchased to use in conjunction with the TNT Soil Test.

ITEMS NOT INCLUDED IN TEST KIT

- ❑ 2 matched HACH cuvettes
- ❑ Paper towels
- ❑ Disposable gloves
- ❑ Acetone
- ❑ Calculator
- ❑ Scissors
- ❑ Waste container
- ❑ Hach DR/2000 or DR/2010
- ❑ Balance

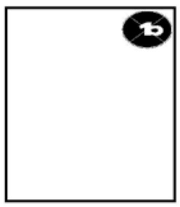
READ BEFORE PROCEEDING

- Recovery of the RDX from some soil samples is most consistent when the soil samples are air dried prior to extraction and testing.
- It is recommended that a control be run each day. See p.8 for instructions.
- **Nitrates and Nitrites cause false positive results with the RDX test. Therefore, it is necessary to evaluate the soil for these compounds prior to sample analysis. See p.9 for instructions.**
- SDI's EnSys® RDX Soil Test System is designed for use with either of Hach models **DR/2000** or the newer **DR/2010** spectrophotometers. Protocols for use of both instruments are provided in this User's Guide. Ensure the instrument protocol followed is appropriate for the instrument being used.
- The Hach **DR/2000** is designed to turn off after a few minutes of inactivity. Press the "READ/ENTER" key every few minutes to prevent **DR/2000** from turning off. If **DR/2000** turns off, use Reference cuvette to rezero. Newer **DR/2000** models and the **DR/2010** have an overide "constant on" feature that allows the machine to run indefinitely. Refer to the Instrument Operation: Spectrophotometer Setup section of the HACH **DR/2000** or **DR/2010** User's manuals.
- **If you are using the RDX soil test kit in conjunction with the TNT soil test kit, the sample extract generated with the TNT test may be used for the RDX test. (Skip steps 2a - 3e of the RDX test if this scenario applies.) An RDX kit without extraction set-ups can be provided specifically for this purpose.**

PHASE 1 TEST PREPARATION

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

CLEAN CUVETTES



1a Fill 2 Hach matched cuvettes with approximately 5 mL water.

1b Cap each with cuvette stopper plug and, holding plug in place, shake vigorously for 3 seconds

1c Empty into waste container.

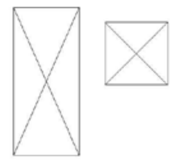
1d Fill cuvettes with approximately 5 mL acetone.

1e Cap each with cuvette stopper plug and, holding plug in place, shake vigorously for 3 seconds

1f Empty into waste container.

1g Repeat acetone wash(steps 1d - 1f).

1h Wipe outside of cuvette with paper towels. Take care to especially clean the side labeled "25 mL" and the side opposite.



Cuvette   Cuvette stopper

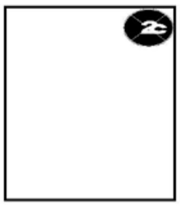
PHASE 2 SAMPLE EXTRACTION & PREPARATION

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

READ BEFORE PROCEEDING

- Sample should be mixed to ensure a homogeneous sample.

WEIGH SAMPLE



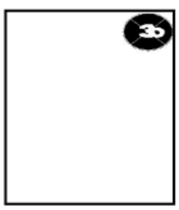
2a Place an unused weigh boat on pan balance.

2b Press ON/MEMORY button on pan balance. Balance will beep and display 0.0.

2c Weigh out 10+/-0.1 grams of soil.

2d If balance turns off prior to completing weighing, use empty weigh boat to retare, then continue.

EXTRACT RDX



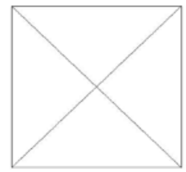
34a Measure 50mL acetone in the 50mL graduated conical tube.

3b Pour acetone into the extraction jar.

3c Using wooden spatula, transfer 10 grams of soil from weigh boat into extraction jar.

3d Recap extraction jar tightly and shake vigorously for three minutes.

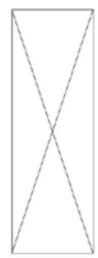
3e Allow to settle for five minutes.



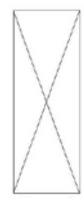
Weigh Boat

Pan balance

Wooden spatula



50mL Conical Tube



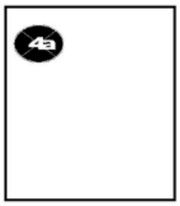
Extraction jar

PHASE 3 SAMPLE ANALYSIS

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

If nitrates/nitrites are present, follow instruction in bold type, if not, ignore.

ANALYZE SAMPLE



4a Using the 10cc syringe slowly draw up exactly 5.5mL of sample extract being careful to exclude air bubbles. **(8-10mL if nitrate/nitrite interferents are present)**

4b **(If nitrate/ nitrite interferents are present, attach Alumina-A cartridge to syringe filter discarding single drops of filtrate into a waste container until 5 mL of extract remain. Dropwise, add the remaining 5 mL of filtrate to the 13 mL tube.)** Attach the syringe filter securely to the syringe and dispense into 13mL tube. Cut open tip of Acetic Acid bulb pipet and expel contents into 13mL tube. Cap & shake. Repeat steps **4a - 4b** for remaining samples.

4c Cut open one end of a NitriVer pillow and pour it into a 50mL Reaction Vial containing water. Prepare a vial for each sample. (Do not let the NitriVer powder/water solution stand longer than 10 minutes before adding sample.)

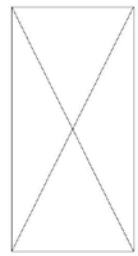
4d Remove plunger from 5cc zinc syringe and quickly pour the solution from the 13mL tube into the syringe barrel. Hold syringe over Reaction Vial as dripping will occur.

4e Replace the plunger & invert twice.

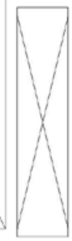
4f **Rapidly** filter the solution into the 50mL Reaction Vial. Cap and shake for 30 seconds. Repeat **4d - 4f** for remaining samples.

4g Allow this reaction to incubate for 15 minutes while color develops.

4h **Proceed to page 6 during incubation.**



13mL tube

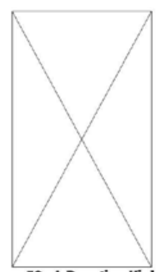


10 cc syringe

Syringe filter

NitriVer Pillow

Acetic Acid bulb pipette



50mL Reaction Vial

Zinc Syringe (in foil bag)

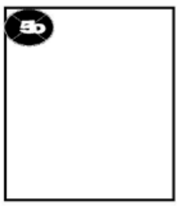
PHASE 4 INTERPRETATION

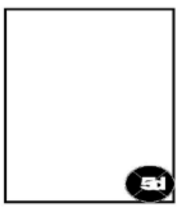
READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

READ BEFORE PROCEEDING

- Designate a “Reference” and “Sample”cuvette.

SPECTROPHOTOMETER PREPARATION





5a1 Turn on Hach **DR/2000**. The instrument will read “SELF-TEST” followed by “Method?”. Select Method “0” and press the “READ/ENTER” key.

or

5a2 Turn on the Hach **DR/2010**. The instrument will read “Self-Test V.xx”, then “Enter Program #”. Press the [Shift] key (do not hold) and then the [ABS/8] key. Note: Select Program # ”0” may also be used to select absorbance mode on the **DR/2010**.

5b Rotate the wavelength dial until the small display shows: 510 nm.

5c Fill both cuvettes with acetone to the 25 mL line.

5d Insert “Reference" cuvette into cell holder on Hach **DR/2000** or **DR/2010** with side marked “25 mL” on the right.

5e1 Close light shield of the **DR/2000** and press “CLEAR/ZERO” key to establish the reference. The display will read “WAIT” and then “0.000 Abs.”.

or

5e2 Close the light shield of the **DR/2010** and press the [ZERO] key. The display will read “Zeroing...” then “0.000 Abs.”.

5f Remove the “Reference” cuvette and place the “Sample” cuvette in the cell holder.

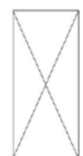
5g1 On the **DR/2000**, press the “READ/ENTER” key and record the absorbance on the worksheet as “$Abs_{background}$”.

or

5g2 On the **DR/2010**, press the [READ] key and record the absorbance on the worksheet as “$Abs_{background}$”.

5h If reading is greater than 0.002 in magnitude (+ or -), clean cuvettes and redo steps 2a - 2g.

5i Empty acetone from “Sample” cuvette into waste container



Cuvette

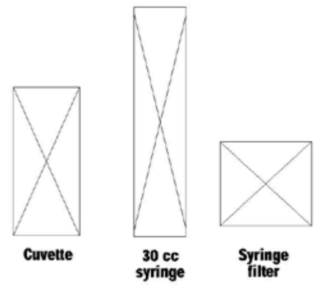
PHASE 4 INTERPRETATION

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

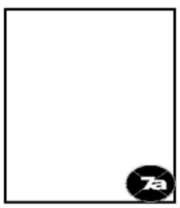
FILTER SAMPLE

6a Disassemble a 30cc syringe and attach a syringe filter.

6b After incubation, shake reacted sample vigorously and pour into barrel of 30cc syringe. Insert plunger. Press firmly and expel total contents into the HACH cuvette.



READ SAMPLE



7a Place the “Sample” cuvette in the cell holder.

7b1 On the **DR/2000**, press the “READ/ENTER” key and record the absorbance on the worksheet.

<u>or</u>

7b2 On the **DR/2010**, press the [READ] key and record the absorbance on the worksheet.

7c Clean cuvette between samples using procedure in steps 1a - 1h.

INTERTRETATION OF RESULTS

8a Subtract 0.014 value from the sample absorbance values

8b Divide this value by 0.0225 and record on the worksheet. This value is the RDX concentration of the sample in parts per million.

$$[RDX]\ (ppm) = \frac{Abs - 0.014}{0.0225}$$

Note: For sample concentrations greater than 30ppm the sample extract should be diluted with acetone and reanalyzed.

Remember to multiply the result by the dilution factor in order to determine the correct concentration.

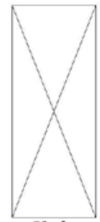
<u>**Minimum Detection Levels**</u>

RDX	0.8 ppm
HMX	2.4 ppm
PETN	1.0 ppm
Nitroglycerine	8.9 ppm
Nitroguanadine	10.1 ppm
Nitrocellulose	42.2 ppm

CONTROL (QA/QC) CHECK

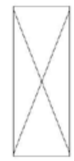
READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

- **The RDX control is optional but it is recommended that it be run daily.**



50mL Conical Tube

Extraction jar

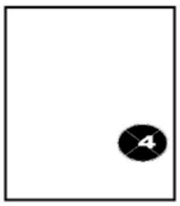


RDX

Ampule cracker

Bulb pipette

PREPARE CONTROL



1 Measure 50 mL acetone in a graduated 50mL conical tube.
2 Pour into extraction jar.
3 Open RDX control ampule by slipping ampule cracker over top, and then breaking tip at scored neck.
4 Transfer entire contents of RDX control ampule into extraction jar using empty bulb pipette.
5 Cap extraction jar and shake.

ANALYZE THE CONTROL

Repeat steps 4a - 7c on pages 5 - 7

Record the absorbance on the worksheet as "$Abs_{control}$".

Absorbance must be between 0.174 - 0.274 for the test to be in control.

If test is not in control, clean "Sample" cuvette, and then redo steps 4a- 7c using the remaining liquid in the extraction jar.

If test is in control clean "Sample" cuvette before proceeding with samples.

If kept tightly capped, the control can be used again for additional QC runs.

BACKGROUND - NITRATE/NITRITES TEST

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

- **Site representative samples must be run prior to analysis for RDX to ensure that Nitrate/Nitrite interferents (i.e., fertilizers, degraded explosives, etc.) are not present. Please call Technical Services at (800)544-8881.**
- These interferents cause a color reaction with the test identical to RDX and will lead to false positives.
- If Nitrates/Nitrites are present, Alumina–A cartridges must be utilized (refer to step 4b). These will quickly and easily remove the interferents from the soil extract during the extra filtration steps.

(Alumina-A cartridges suitable for this application are available from Alltech Associates, Inc. 2051 Waukegan Road, Deerfield, IL 60015, Part # 210094 (300 mg./ 25 pk.), Phone: (800)255-8324 & (847)948-8600, Fax: (847)948-1078.)

READ BEFORE PROCEEDING

- Sample should be mixed to ensure a homogeneous sample.

1) Repeat steps 2a - 4c on page 4 & 5.

2) **Omit steps** 4d - 4e*
   * Zinc syringe is not used when testing for Nitrates/Nitrites.
3) Proceed with steps 4f - 7c
   Record the absorbance on the worksheet as “Abs Nitrate/Nitrite”.

   If the absorbance is <0.05, the samples are free of Nitrates/Nitrites and the samples can be tested.

   If absorbance is > 0.05, then Alumina–A cartridges must be utilized to remove nitrate/nitrite interferents.

QUALITY CONTROL

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

System Description

Each SDI EnSys® RDX Soil Test System contains enough material to perform twenty complete tests.

The RDX Soil Test is divided into four phases. The instructions and notes should be reviewed before proceeding with the test.

Hotline Assistance

If you need assistance or are missing necessary Test System materials, call toll free: 1-800-544-8881.

Validation and Warranty Information

Product claims are based on validation studies carried out under controlled conditions. Data has been collected in accordance with valid statistical methods and the product has undergone quality control tests of each manufactured lot.

Strategic Diagnostics Inc. does not guarantee that the results with the RDX Soil Test System will always agree with instrument-based analytical laboratory methods. All analytical methods, both field and laboratory, need to be subject to the appropriate quality control procedures.

How It Works

Controls, Samples, and color-change reagents are added to cuvettes. The concentration of **RDX** in an unknown **Sample** is determined by evaluating how muc color is developed.

Quality Control

Standard precautions for maintaining quality control:

- Do not use reagents or components from one Test System with reagents or components from another Test System.
- Do not use the Test System after its expiration date.
- The sample must be analyzed within 60 minutes of tl color incubation step.
- Results may not be valid if DR/2000 or DR/2010 reading for **Control** is outside of the range of 0.174 - 0.274.

Storage and Handling Precautions

- Wear protective gloves and eye wear.
- Store kit at room temperature and out of direct sunliç (less than 80°F).
- If acetone comes into contact with eyes, wash thoroughly with cold water and seek immediate medical attention.
- Operate test at temperatures greater than 4° C/40° F and less than 39° C/100° F.
- After use, dispose of kit components in accordance with applicable federal and local regulations.

ON-SITE QUALITY CONTROL/QUALITY ASSURANCE RECOMMENDATIONS
SDI EnSys® TEST SYSTEM

Please read the following before proceeding with field testing.

SAMPLING

The result of your screening test is only as valid as the sample that was analyzed. Samples should be homogenized thoroughly to ensure that the 10 grams you remove for field testing is representative of the sample as a whole. All other applicable sample handling procedures should be followed as well.

PRIOR TO TESTING SAMPLES

Carefully follow the instructions in the User's Guide included with every test kit. This is the key element in obtaining accurate results. In addition, store your unused test kits at room temperature and do not use them past their expiration date (see label on each test kit).

INTERNAL TEST QC

One control is provided with each Kit to provide internal test system quality control. Test runs resulting in a number that falls outside of the specified range should be repeated to ensure valid conclusions.

QA/QC

The validity of field test results can be substantially enhanced by employing a modest, but effective QA/QC plan. SDI recommends that you structure your QA/QC plan with the elements detailed below. These have been developed based on the data quality principles established by the U.S. Environmental Protection Agency.

A. **Sample Documentation**
   1. Location, depth
   2. Time and date of collection and field analysis

B. **Field analysis documentation** - provide raw data, calibration, any calculations, and final results of field analysis for all samples screened (including QC samples)

C. **Method calibration** - this is an integral part of SDI tests; an RDX control analysis should be performed daily (see the instructions in the User's Guide)

D. **Method blank** - field analyze fresh acetone

E. **Site-specific matrix background field analysis** - collect and field analyze uncontaminated sample from site matrix to document matrix effect

F. **Duplicate sample field analysis** - field analyze duplicate sample to document method repeatability; at least one of every 20 samples should be analyzed in duplicate

G. **Confirmation of field analysis** - provide confirmation of the quantitation of the analyte via an EPA-approved method different from the field method on at least 10% of the samples; provide chain of custody and documentation such as gas chromatograms, mass spectra, etc.

H. **Performance evaluation sample field analysis (optional, but strongly recommended)** - field analyze performance evaluation sample daily to document method/operator performance

I. **Matrix spike field analysis (optional)** - field analyze matrix spike to document matrix effect on analyte measurement

J. **Nitrate/Nitrite test** - this is an integral part of the SDI EnSys® RDX Test; it should be performed at least once for each site.

FURTHER QUESTIONS?

SDI's Technical Support personnel are always prepared to discuss your quality needs to help you meet your data quality objectives. (800)-544-8881

RDX Soil Test - Abbreviated Procedure	
STEP	**P R O C E D U R E**
1	• Clean cuvettes • Zero the spectrophotometer at 510 nm
2	• Add 10 g soil and 50mL acetone to extraction jar • Shake 3 min., let settle
3	• Draw up 5.5 mL extract, filter into 13 mL tube **(If NO3/NO2 contaminants present: 8-10 mL of extract, filtered slowly through Alumina-A cartridge)** • Open bulb pipet, add Acetic Acid to 13 mL tube, mix • Add NitriVer to 50 mL Reaction Vial • Pour from 13 mL Tube into zinc syringe • Invert 2X and filter into 50 mL Reaction Vial • Shake 30 seconds • Incubate 15 minutes
4	• Read Abs at 510 • Calculate RDX concentration • [RDX]ppm = (Abs-0.014)/0.0225

RDX SOIL TEST KIT WORKSHEET

1) Abs $_{\text{“background”}}$________ 2) Abs $_{\text{“control”}}$__________ 3) Abs $_{\text{“Nitrate/Nitrite”}}$_________

SAMPLE #	ABSORBANCE	RDX CONC., PPM $\frac{RDX_{abs} - 0.014}{0.0225}$

STRATEGIC DIAGNOSTICS INC.

TNT EnSys® SOIL TEST SYSTEM

RAPID FIELD SCREEN

User's Guide

IMPORTANT NOTICE

The range of this test is between 1 and 30 ppm TNT/TNB/DNT. The relative standard deviation is 8% The least detectable concentration is 0.7 ppm (TNT).

This test system should be used only under the supervision of a technically qualified individual who is capable of understanding any potential health and environmental risks of this product as identified in the product literature. The components must only be used for the analysis of soil samples for the presence of TNT. After use, the kits must be disposed of in accordance with applicable federal and local regulations.

PHASE 1 TEST PREPARATION

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

ITEMS INCLUDED IN TEST KIT

- ❑ 2 Cuvette stopper plugs
- ❑ 1 Ampule cracker
- ❑ 20 Syringe filters
- ❑ 20 Wooden spatulas
- ❑ 20 Extraction jars
- ❑ 1 Bulb pipette
- ❑ 1 Developer solution
- ❑ 1 - 50mL graduated conical tube
- ❑ 1 TNT control ampule
- ❑ 20 - 30cc syringes
- ❑ 20 Weigh boats

ITEMS NOT INCLUDED IN TEST KIT

- ❑ 2 matched HACH cuvettes
- ❑ Paper towels
- ❑ Disposable gloves
- ❑ Acetone
- ❑ Hach DR/2000 or DR/2010
- ❑ Calculator
- ❑ Waste container
- ❑ Balance

READ BEFORE PROCEEDING

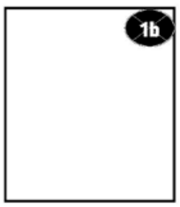
- For some matrices, air drying the soil samples may result in better TNT recovery or more reproducible data.
- A slightly modified protocol should be used if the primary analyte of concern is DNT. Please refer to the modification outlined on page 6.
- It is recommended that a control be run each day. See page 8 for instructions.
- SDI's EnSys® TNT Soil Test System is designed for use with either of Hach models **DR/2000** or the newer **DR/2010** spectrophotometers. Protocols for use of both instruments are provided in this User's Guide. Ensure the instrument protocol followed is appropriate for the instrument being used.
- The Hach DR/2000 is designed to turn off after a few minutes of inactivity. Press the "READ/ENTER" key every few minutes to prevent DR/2000 from turning off. If DR/2000 turns off, use Reference cuvette to rezero. Newer DR/2000 models and the DR/2010 have an overide "constant on" feature that allows the machine to run indefinitely. Refer to the Instrument Operation: Spectrophotometer Setup section of the HACH DR/2000 or DR/2010 User's manuals.

If you are using the TNT test in conjunction with the RDX test it is important to save your sample extracts. They will be used in the RDX test. Remember to cap the extracts tightly after use. An RDX kit without extraction set-ups can be purchased specifically for this purpose.

PHASE 1 TEST PREPARATION

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

CLEAN CUVETTES



1a Fill 2 Hach matched cuvettes with approximately 5 mL water.

1b Cap each with cuvette stopper plug and, holding plug in place, shake vigorously for 3 seconds.

1c Empty into waste container.

1d Fill cuvettes with approximately 5 mL acetone.

1e Cap each with cuvette stopper plug and, holding plug in place, shake vigorously for 3 seconds.

1f Empty into waste container.

1g Repeat acetone wash (steps 1d - 1f).

1h Wipe outside of cuvette with paper towels. Take care to especially clean the side labeled "25 mL" and the side opposite.

Cuvette

Cuvette stopper

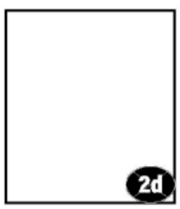
PHASE 1 TEST PREPARATION

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

READ BEFORE PROCEEDING

- Designate a “Reference” and “Sample”cuvette.

SPECTROPHOTOMETER PREPARATION



2a1 Turn on Hach **DR/2000**. The instrument will read “SELF-TEST” followed by “Method?”. Select Method “0” and press the “READ/ENTER” key.

<u>or</u>

2a2 Turn on the Hach **DR/2010**. The instrument will read “Self-Test V.xx”, then “Enter Program #”. Press the [Shift] key (do not hold) and then the [ABS/8] key. Note: Select Program # ”0” may also be used to select absorbance mode on the **DR/2010**.

2b Rotate the wavelength dial until the small display shows: 540 nm.

2c Fill both cuvettes with acetone to the 25 mL line.

2d Insert “Reference” cuvette into cell holder on Hach DR/2000 or DR/2010 with side marked “25 mL” on the right.

2e1 Close light shield of the **DR/2000** and press “CLEAR/ZERO” key to establish the reference. The display will read “WAIT” and then “0.000 Abs.”.

<u>or</u>

2e2 Close the light shield of the **DR/2010** and press the [ZERO] key. The display will read “Zeroing...” then “0.000 Abs.”.

2f Remove the “Reference” cuvette and place the “Sample” cuvette in the cell holder.

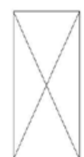
2g1 On the **DR/2000**, press the “READ/ENTER” key and record the absorbance on the worksheet as “$Abs_{background}$”.

<u>or</u>

2g2 On the **DR/2010**, press the [READ] key and record the absorbance on the worksheet as “$Abs_{background}$”.

2h If reading is greater than 0.002 in magnitude (+ or -), clean cuvettes and redo steps 2a - 2g.

2i Empty acetone from “Sample” cuvette into waste container.



Cuvette

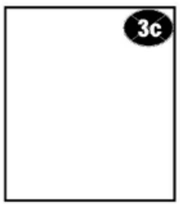
PHASE 2 SAMPLE EXTRACTION & PREPARATION

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

READ BEFORE PROCEEDING

- Sample should be mixed to ensure a homogeneous sample.

WEIGH SAMPLE



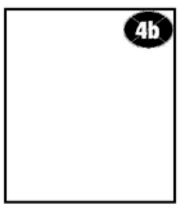
3a Place an unused weigh boat on pan balance.

3b Press ON/MEMORY button on pan balance. Balance will beep and display 0.0.

3c Weigh out 10+/- 0.1 grams of soil.

3d If balance turns off prior to completing weighing, use empty weigh boat to retare, then continue.

EXTRACT TNT



4a Measure 50 mL acetone in the 50mL graduated conical tube.

4b Pour acetone into an extraction jar.

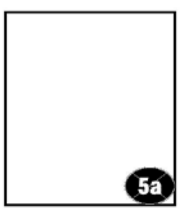
4c Using wooden spatula, transfer 10 grams of soil from weigh boat into extraction jar.

4d Recap extraction jar tightly and shake vigorously for three minutes.

4e Allow to settle for five minutes.

Repeat steps 3a - 4e for each sample to be tested.

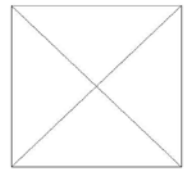
FILTER SAMPLE



5a Place tip of 30 cc syringe into liquid above the sediment layer in the extraction jar and draw up 25 mL of the sample.

5b Screw the syringe filter onto the end of the syringe.

5c Press the plunger firmly and dispense the sample into the "Sample" cuvette.

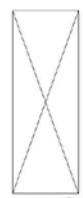


Weigh Boat

Pan balance

Wooden spatula

50mL Graduated Conical Tube



Extraction jar

30 cc syringe

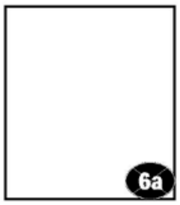
Syringe filter

Cuvette

PHASE 3 SAMPLE ANALYSIS

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

READ SAMPLE



6a Place the "Sample" cuvette in the cell holder.

6b Press the "READ/ENTER" key and record the absorbance on the worksheet as "$Abs_{initial}$".

6c Remove the "Sample" cuvette from the cell holder.

6d Add 1 drop of Developer Solution.

6e Cap the "Sample" cuvette and shake vigorously for 3 seconds.

Cuvette

DNT Analysis Note:

For analysis of samples containing DNT, and/or where DNT concentration is of concern, samples must be allowed to develop for 10 minutes before reading sample absorbance. This will not effect color development for other nitroaromatics.

6f Remove the cuvette stopper and place the "Sample" cuvette in the cell holder.

6g Press the "READ/ENTER" key and record the absorbance on the worksheet as "Abs_{sample}".

6h Clean cuvette between samples using procedure in steps 1a - 1h.

PHASE 4 INTERPRETATION

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

INTERPRETATION OF RESULTS

7a Multiply the "$Abs_{initial}$" value for each sample by 4. Enter these values on the worksheet.

7b Subtract this value from the "Abs_{sample}" values for each sample and record on the worksheet.

7c Divide the adjusted sample value by 0.0323 and record on the worksheet. This value is the TNT concentration of the sample in parts per million.

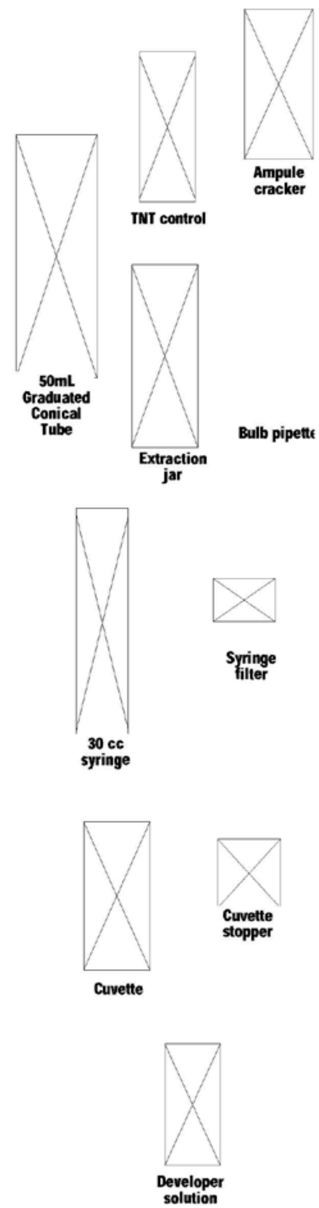
$$TNT_{(ppm)} = \frac{Abs_{sample} - (Abs_{initial} x 4)}{0.0323}$$

Note: For sample concentrations greater than 30ppm the sample extract should be diluted with acetone and reanalyzed. Remember to multiply the result by the dilution factor in order to determine the correct concentration.

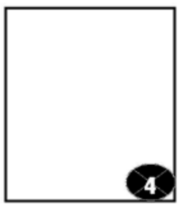
CONTROL (QA/QC) CHECK

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

- **The TNT control is optional, but it is recommended that it be run daily.**

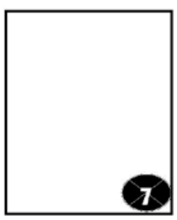


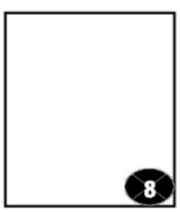
PREPARE CONTROL

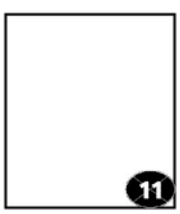


1 Measure 50 mL acetone in the 50mL graduated conical tube.
2 Pour into extraction jar.
3 Open TNT control ampule by slipping ampule cracker over top, and then breaking tip at scored neck.
4 Transfer entire contents of TNT control ampule into extraction jar using bulb pipette.
5 Cap extraction jar and shake vigorously for 3 seconds.

ANALYZE THE CONTROL







7 Place tip of 30 cc syringe in extraction jar and draw up 25 mL.
8 Attach syringe filter and dispense into "Sample" cuvette.
9 Add 1 drop of developer solution.
10 Cap the cuvette and shake vigorously for 3 seconds.
11 Remove the cuvette stopper and place in the cell holder.
12 Press "READ/ENTER" key and record the absorbance on the worksheet as "$Abs_{control}$".
Absorbance must be between 0.307 - 0.373 for the test to be in control.
If test is not in control, clean "Sample" cuvette, and then redo steps 7-12 using the remaining liquid from the extraction jar.
13 If test is in control clean "Sample" cuvette before proceeding with samples.

QUALITY CONTROL

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

System Description

Each SDI EnSys® TNT Soil Test System contains enough material to perform twenty complete tests.

The TNT Soil Test is divided into four phases. The instructions and notes should be reviewed before proceeding with the test.

Hotline Assistance

If you need assistance or are missing necessary Test System materials, call toll free: 1-800-544-8881.

Validation Information

Product claims are based on validation studies carried out under controlled conditions. Data has been collected in accordance with valid statistical methods and the product has undergone quality control tests of each manufactured lot.

Strategic Diagnostics Inc. does not guarantee that the results with the TNT Soil Test System will always agree with instrument-based analytical laboratory methods. All analytical methods, both field and laboratory, need to be subject to the appropriate quality control procedures.

How It Works

Controls, Samples, and color-change reagents are added to cuvettes. The concentration of TNT in an unknown **Sample** is determined by evaluating how much color is developed.

Quality Control

Standard precautions for maintaining quality control:

- Do not use reagents or components from one Test System with reagents or components from another Test System.
- Do not use the Test System after its expiration date.
- The sample must be analyzed immediately after adding the Developer Solution.
- Results may not be valid if DR/2000 reading for **Control** is outside of the range of 0.307 - 0.373.

Storage and Handling Precautions

- Wear protective gloves and eye wear.
- Store kit at room temperature and out of direct sunlight (less than 80°F).
- If acetone comes into contact with eyes, wash thoroughly with cold water and seek immediate medical attention.
- Operate test at temperatures greater than 4° C/40° F and less than 39° C/100° F.
- After use, dispose of kit components in accordance with applicable federal and local regulations.

ON-SITE QUALITY CONTROL/QUALITY ASSURANCE RECOMMENDATIONS
SDI EnSys® TEST SYSTEM

Please read the following before proceeding with field testing.

SAMPLING

The result of your screening test is only as valid as the sample that was analyzed. Samples should be homogenized thoroughly to ensure that the 10 grams you remove for field testing is representative of the sample as a whole. All other applicable sample handling procedures should be followed as well.

PRIOR TO TESTING SAMPLES

Carefully follow the instructions in the User's Guide included with every test kit. This is the key element in obtaining accurate results. In addition, store your unused test kits at room temperature and do not use them past their expiration date (see label on each test kit).

INTERNAL TEST QC

One control is provided with each Kit to provide internal test system quality control. Test runs resulting in a number that falls outside of the specified range should be repeated to ensure valid conclusions.

QA/QC

The validity of field test results can be substantially enhanced by employing a modest, but effective QA/QC plan. SDI recommends that you structure your QA/QC plan with the elements detailed below. These have been developed based on the data quality principles established by the U.S. Environmental Protection Agency.

A. **Sample Documentation**
   1. Location, depth
   2. Time and date of collection and field analysis

B. **Field analysis documentation -** provide raw data, calibration, any calculations, and final results of field analysis for all samples screened (including QC samples)

C. **Method calibration** - this is an integral part of SDI tests; a TNT control analysis should be performed daily (see the instructions in the User's Guide)

D. **Method blank** - field analyze fresh acetone

E. **Site-specific matrix background field analysis** - collect and field analyze uncontaminated sample from site matrix to document matrix effect

F. **Duplicate sample field analysis** - field analyze duplicate sample to document method repeatability; at least one of every 20 samples should be analyzed in duplicate

G. **Confirmation of field analysis** - provide confirmation of the quantitation of the analyte via an EPA-approved method different from the field method on at least 10% of the samples; provide chain of custody and documentation such as gas chromatograms, mass spectra, etc.

H. **Performance evaluation sample field analysis (optional, but strongly recommended)** - field analyze performance evaluation sample daily to document method/operator performance

I. **Matrix spike field analysis (optional)** - field analyze matrix spike to document matrix effect on analyte measurement

FURTHER QUESTIONS?

SDI's Technical Support personnel are always prepared to discuss your quality needs to help you meet your data quality objectives. Call 1-(800) 544-8881.

TNT SOIL TEST - ABBREVIATED PROCEDURE	
STEP	**PROCEDURE**
1	• Clean cuvettes • Zero the spectrophotometer at 540 nm
2	• Add 10 g soil and 50 ml acetone to extraction jar • Shake 3 minutes, let settle • Draw up 25 mL extract, filter into cuvette
3	• Read $Abs_{initial}$, record • Add 1 drop developer solution, shake • Read Abs_{sample}, record
4	• Multiply $Abs_{initial}$ by 4 • Subtract from Abs_{sample} • Divide by 0.0323 • $TNT_{(ppm)} = \frac{Abs_{sample} - (Abs_{initial} x 4)}{0.0323}$

TNT SOIL TEST KIT WORKSHEET

$Abs_{background}$ ____________________ $Abs_{control}$ ____________________

1	2	3	4	5	6
SAMPLE #	$Abs_{initial}$	Abs_{sample}	$Abs_{initial}$ x4	Abs_{final} (Column 3 - Column 4)	TNT CONC ppm (Column 5/0.0323)

Appendix A – Project Forms

PRUDENT TECHNOLOGIES, INC.
dba Prudent Environmental Services, Inc.

Daily Quality Control Report
Prepartory Phase

Report No.: ___________

Date: ___________________________

Project: ___________________________

Job No.: ___________________________

Project Manager: ___________________

Day	**S**	**M**	**T**	**W**	**Th**	**F**	**S**
Weather	Sunny	Part Sunny	Cloudy	Rain	Snow		
Temp °F							
Wind	Still	Moderate	High	Direction:			
Humidity	Dry	Moderate	Humid				

PERSONNEL ON-SITE				
QC Location & Description	Employer	Number	Job Title/Classification	Remarks

Was a job safety meeting held this date? Were there any lost time accidents this date? (if yes, attach meeting copy of completed OSHA/accident report)	0 yes 0 no 0 yes 0 no	Total work hours on job site this date	
Was trenching/scaffold/high volt electrical/high work done? (if yes, attach copy of statement or checklist showing inspection performed) Was hazardous material/waste released into the environment?(if yes, attach description of incident and corrective actions)	0 yes 0 no 0 yes 0 no	Cumulative total of work hours from previous report	
		Total work hours from start of project	
List quality control actions taken today/QC inspections conducted			

Equipment at the Site	Equipment Received at the Site

UXO Field Activities:

I certify that this report is complete and correct and that I or my authorized representative, have inspected the work performed this day and have determined that all materials, equipment and workmanship are in strict compliance with plans and specifications except as noted herein.

Name____ Date_______________

Quality Control Specialist

PREPARATORY PHASE

DEFINABLE FEATURE	Y-YES N-NO N/A	WORK LOCATION, PERSONNEL CONTACTED
VERIFY APPROVED AND CURRENT WORK PLAN ON-SITE		
VERIFY PROGRAM SCHEDULE IS CURRENT		
VERIFY SITE DOCUMENTS/DATA MAINTAINED IAW CONTRACT DOCUMENTS		
VERIFY SUBMITTAL REGISTER IS CURRENT AND ACCURATE		
VERIFY PLANS ARE PEER REVIEWED		
AUDIT MEDICAL RECORDS FOR COMPLETENESS AND CURRENCY		
VERIFY PERSONNEL TRAINING RECORDS ARE COMPLETE AND VERIFIED		
VERIFY COMMUNICATIONS SYSTEM IS SET-UP AND OPERATIONAL		
VERIFY VEHICLES ARE INSPECTED DAILY AND DOCUMENTED		
SITE LAY-OUT: VERIFY THAT MOBILIZATION OF EQUIPMENT AND PLACEMENT IAW PROJECT PLANS		
VERIFY GEOPHYSICAL EQUIPMENT IS IAW PROJECT PLANS		
VERIFY THAT EQUIP IS CALIBRATED		
VERIFY TEST GRID LOCATIONS ARE SELECTED IAW FIELD SAMPLING PLAN		
VERIFY TEST GRID LAYOUT IS IAW PROJECT PLANS		
VERIFY GRID LAY-OUT IAW FIELD SAMPLING PLAN		
VERIFY DAILY EQUIP FUNCTION CHECKS ARE PERFORMED AND RECORDED		
VERIFY GEOPHYSICAL DATA IS STORED, MARKED AND TRACKED		
DATA PROCESSING: VERIFY COMPLIANCE WITH QC PLAN		
DATA PROCESSING: VERIFY DOCUMENTATION OF DATA		
CONFIRM PROCESSING PROCEDURE AND SOFTWARE USED. VERIFY TRANSFER OF DATA TO DATA MANAGEMENT SYSTEM		
VERIFY DATA MANAGEMENT SYSTEM MEETS THE COR REQUIREMENTS		

PREPARATORY PHASE (cont)

DEFINABLE FEATURE	Y-YES N-NO N/A	WORK LOCATION, PERSONNEL CONTACTED
VERIFY DATA TRANSFER AND TRACKING PROCEDURES		
VERIFY COMPLIANCE WITH DATA QC PLAN		
VERIFY EXCLUSION ZONE ESTABLISHED IAW SSHP		
VERIFY NOTIFICATIONS ARE ACCOMPLISHED IAW SSHP		
VERIFY INTRUSIVE PROCEDURES COMPLIANCE		
VERIFY DAILY INSPECTION AND DOCUMENTATION OF EQUIPMENT INSPECTION BY OPERATOR		
VERIFY IDENTIFICATION OF ITEMS		
VERIFY DIG SHEET COMPLETION IAW WORK PLAN		
VERIFY MEC IDENTIFICATION PROCEDURES AND UXOSO VERIFICATION IAW WORK PLAN		
VERIFY MEC HANDLING/DISPOSITION IAW WORK PLAN		
VERIFY MEC ITEMS ARE PROPERLY DOCUMENTED, AND TRACKED		
VERIFY MEC HANDLING/DISPOSITION IS IAW SSHP AND WORK PLAN		
VERIFY/INSPECT EXPLOSIVE TRANSPORT VEHICLE FOR COMPLIANCE WITH SSHP		
VERIFY COMPLIANCE WITH COLLECTION POINT PROCEDURES IN WP		
MEC RELATED MATERIAL VERIFY MEC SEGREGATION AT COLLECTION POINT AND DURING TRANSFER		
NON-MEC -VERIFY SCRAP DISPOSAL IAW DIRECTIVES		

PREPARATORY PHASE (cont)

DEFINABLE FEATURE	Y-YES N-NO N/A	WORK LOCATION, PERSONNEL CONTACTED
MONITOR MEC IDENTIFICATION PROCEDURES AND UXOSO VERIFICATION IAW WORK PLAN		
MONITOR MEC HANDLING/DISPOSITION IS ACCORDING TO WORK PLAN		
VERIFY MEC ITEMS ARE PROPERLY DOCUMENTED, AND TRACKING COMPLETED		
CONFIRM MEC TRANSPORT VEHICLE INSPECTED FOR COMPLIANCE WITH SSHP		
MONITOR COMPLIANCE WITH COLLECTION POINT PROCEDURES IAW WORK PLAN		
CONFIRM MEC SEGRATION AT COLLECTION POINTS DURING TRANFER		
MONITOR MEC RELATED MATERIALS INSPECTION AND IDENTIFICATION IAW WP		
CONFIRM NON-MEC SCRAP DISPOSAL IAW DIRECTIVES		

PRUDENT TECHNOLOGIES, INC.
dba Prudent Environmental Services, Inc.

Daily Quality Control Report
Initial Phase

Report No.: ___________
Date: ___________________________
Project: _________________________
Job No.: _________________________
Project Manager: __________________

Day	S	M	T	W	Th	F	S
Weather	Sunny	Part Sunny		Cloudy	Rain	Snow	
Temp °F							
Wind	Still	Moderate	High	Direction:			
Humidity	Dry	Moderate	Humid				

PERSONNEL ON-SITE				
QC Location & Description	Employer	Number	Job Title/Classification	Remarks

Was a job safety meeting held this date? Were there any lost time accidents this date? (if yes, attach meeting copy of completed OSHA/accident report)	0 yes 0 no 0 yes 0 no	Total work hours on job site this date	
Was trenching/scaffold/high volt electrical/high work done? (if yes, attach copy of statement or checklist showing inspection performed)	0 yes 0 no	Cumulative total of work hours from previous report	
Was hazardous material/waste released into the environment?(if yes, attach description of incident and corrective actions)	0 yes 0 no	Total work hours from start of project	
List quality control actions taken today/QC inspections conducted			

Equipment at the Site	Equipment Received at the Site

UXO Field Activities:

I certify that this report is complete and correct and that I or my authorized representative, have inspected the work performed this day and have determined that all materials, equipment and workmanship are in strict compliance with plans and specifications except as noted herein.

Name____ Date__________________
Quality Control Specialist

INITIAL PHASE

DEFINABLE FEATURE	Y-YES N-NO N/A	WORK LOCATION, PERSONNEL CONTACTED
PRELIMINARY WORK WAS DONE CORRECTLY		
ASSURE PROGRAM SCHEDULE IS CURRENT		
ASSURE SITE DOCUMENTS/DATE IS MAINTAINED IAW CONTACT REQUIREMENTS		
ASSURE QC MEETINGS ARE HELD, REVIEW MINUTES		
REVIEW SUBMITTAL REGISTER TO ASSURE IT IS CURRENT AND ACCURATE		
CONFIRM PLANS ARE PEER REVIEWED		
CONFIRM MQAM REVIEWS AND CERTIFICATION OF PLANS		
AUDIT MEDICAL RECORDS FOR COMPLETENESS AND CURRENCY		
CONFIRM EMERGENCY TELEPHONE NUMBERS		
CONFIRM MEDICAL SUPPORT LOCATIONS ARE IDENTIFIED AND DIRECTIONS ARE AVAILABLE		
CONFIRM EVACUATION ROUTES ARE IDENTIFIED AND DOCUMENTED		
CONFIRM MEDICAL SUPPLIES ARE REPLENISHED AND IN PROPER LOCATIONS		
VERIFY LOCATION AND SERVICEABILITY OF FIRE EXTINGUISHERS		
CONFIRM THAT AHA'S ARE COMPLETE AND CURRENT		
VERIFY THAT MSDS ARE CURRENT AND AVAILABLE		
REVIEW TRAINING RECORDS FOR COMPLETENESS AND CURRENCY		
CONFIRM THAT PERSONNEL HAV RECEIVED SITE-SPECIFIC TRAINING		
CONFIRM DOCUMENTATION OF HAZARD COMMUNICATIONS		
CONFIRM COMPLETENESS AND CURRENCY OF REQUIRED TRAINING FOR UXO SPECIALISTS		
CONFIRM REQUIRED NOTIFICATIONS ARE COMPLETED		
VERIFY THAT COORDINATION MEETING WAS HELD AND MINUTES GENERATED		
CONFIRM COMMUNITIONS SYSTEM IS SET-UP AND OPERATIONAL		

INITIAL PHASE (cont)

DEFINABLE FEATURE	Y-YES N-NO N/A	WORK LOCATION, PERSONNEL CONTACTED
CONFIRM VEHICLES ARE INSPECTED DAILY AND HAVE REQUIRED MAPS		
CONFIRM THAT SITE LAYOUT IS IAW PROJECT PLANS		
VERIFY VISUAL SURFACE SWEEPS ARE CONDUCTED ACCORDING TO WORK PLAN		
CONFIRM THAT MEC IDENTIFICATION/HANDLING IS ACCORDING TO WORK PLAN		
VERIFY EQUIPMENT OBTAIN IS IN ACCORDANCE WITH PROJECT PLANS		
CONFIRM CALIBRATION OF EQUIPMENT		
VERIFY TEST GRID LOCATIONS ARE SELECTED IAW WORK PLAN		
CONFIRM TEST GRID LAYOUT IS IAW PROJECT PLANS		
CONFIRM GRID LAYOUT IS IAW WORKPLAN		
VERIFY DAILY EQUIPMENT FUNCTION CHECKS ARE PERFORMED AND RECORDED		
CONFIRM GEOPHYSICAL DATA GENERATED IS PROPERLY STORED, MARKED AND TRACKED		
VERIFY COMPLIANCE WITH DATA PROCESSING QC PLAN		
CONFIRM DATA PROCESSING DOCUMENTATION		
VERIFY SOFT WARE DATA PROCESSING TRANSFER TO DATA MANAGEMENT SYSTEM		
CONFIRM DATA MANAGEMENT SYSTEM MEETS CLIENT REQUIREMENTS		
CONFIRM DATA TRANSFER AND TRACKING PROCEDURES		
VERIFY DATA ARCHIVING IAW DATA MANAGEMENT PLAN PROCEDURES		
VERIFY COMPLIANCE WITH DATA QC PLAN		
CONFIRM EXCLUSION ZONE ESTABLISHED IAW SSHAP		
CONFIRM NOTIFICATIONS TO RESPONSE AGENCIES ARE ACCOMPLISHED IAW SSHP		
CONFIRM INTRUSIVE PROCEDURES COMPLIANCE		
CONFIRM INTRUSIVE PROCEDURES COMPLIANCE		
MONITOR DAILY INSPECTION AND DOCUMENTATION OF EQUIPMENT INSPECTIONS BY OPERATORS		
CONFIRM OPERATOR TRAINING		
CONFIRM ANOMALY IDENTIFICATION		
VERIFY DIG SHEET COMPLETION IS IAW WORK PLAN		

INITIAL PHASE (cont)

DEFINABLE FEATURE	Y-YES N-NO N/A	WORK LOCATION, PERSONNEL CONTACTED
MONITOR MEC IDENTIFICATION PROCEDURES AND UXOSO VERIFICATION IAW WORK PLAN		
MONITOR MEC HANDLING/DISPOSITION IS ACCORDING TO WORK PLAN		
VERIFY MEC ITEMS ARE PROPERLY DOCUMENTED, AND TRACKING COMPLETED		
CONFIRM MEC TRANSPORT VEHICLE INSPECTED FOR COMPLIANCE WITH SSHP		
MONITOR COMPLIANCE WITH COLLECTION POINT PROCEDURES IAW WORK PLAN		
CONFIRM MEC SEGRATION AT COLLECTION POINTS DURING TRANFER		
MONITOR MEC RELATED MATERIALS INSPECTION AND IDENTIFICATION IAW WP		
CONFIRM NON-MEC SCRAP DISPOSAL IAW DIRECTIVES		

PRUDENT TECHNOLOGIES, INC.
dba Prudent Environmental Services, Inc.

Daily Quality Control Report
Follow-On Phase

Report No.: ___________

Date: ___________________________

Project: _________________________

Job No.: _________________________

Project Manager: ___________________

Day	S	M	T	W	Th	F	S	
Weather	Sunny	Part Sunny	Cloudy	Rain	Snow			
Temp °F								
Wind	Still	Moderate	High	Direction:				
Humidity	Dry	Moderate	Humid					

PERSONNEL ON-SITE				
QC Location & Description	Employer	Number	Job Title/Classification	Remarks

Was a job safety meeting held this date? Were there any lost time accidents this date? (if yes, attach meeting copy of completed OSHA/accident report)	0 yes 0 no 0 yes 0 no	Total work hours on job site this date	
Was trenching/scaffold/high volt electrical/high work done? (if yes, attach copy of statement or checklist showing inspection performed) Was hazardous material/waste released into the environment?(if yes, attach description of incident and corrective actions)	0 yes 0 no 0 yes 0 no	Cumulative total of work hours from previous report	
		Total work hours from start of project	
List quality control actions taken today/QC inspections conducted			

Equipment at the Site	Equipment Received at the Site

UXO Field Activities:

I certify that this report is complete and correct and that I or my authorized representative, have inspected the work performed this day and have determined that all materials, equipment and workmanship are in strict compliance with plans and specifications except as noted herein.

Name____ Date_______________
Quality Control Specialist

FOLLOW-ON PHASE

DEFINABLE FEATURE	Y-YES N-NO N/A	WORK LOCATION, PERSONNEL CONTACTED
INITIAL WORK WAS DONE CORRECTLY		
ASSURE PROGRAM SCHEDULE IS CURRENT		
ASSURE SITE DOCUMENTS/DATE IS MAINTAINED IAW CONTACT REQUIREMENTS		
ASSURE QC MEETINGS ARE HELD, REVIEW MINUTES		
CONFIRM CHANGES ARE UPDATED INTO SITE PLANS		
REVIEW SUBMITTAL REGISTER TO ASSURE IT IS CURRENT AND ACCURATE		
CONFIRM PLANS ARE PEER REVIEWED		
CONFIRM MQAM REVIEWS AND CERTIFICATION OF PLANS		
AUDIT MEDICAL RECORDS FOR COMPLETENESS AND CURRENCY		
AUDIT SAFETY MEETING DOCUMENTATION		
AUDIT SITE VISITOR DOCUMENTATION		
REVIEW AND VERIFY PROPER MAINTENANCE		
VERIFY COMPLIANCE WITH SSHP (SPOT CHECK)		
CONFIRM EMERGENCY TELEPHONE NUMBERS		
CONFIRM MEDICAL SUPPORT LOCATIONS ARE IDENTIFIED AND DIRECTIONS ARE AVAILABLE		
CONFIRM EVACUATION ROUTES ARE IDENTIFIED AND DOCUMENTED		
CONFIRM MEDICAL SUPPLIES ARE REPLENISHED AND IN PROPER LOCATIONS		
VERIFY LOCATION AND SERVICEABILITY OF FIRE EXTINGUISHERS		
REVIEW TRAINING RECORDS FOR COMPLETENESS AND CURRENCY		
CONFIRM REQUIRED NOTIFICATIONS ARE COMPLETED		
CONFIRM COMMUNITIONS SYSTEM IS SET-UP AND OPERATIONAL		

FOLLOW-ON PHASE (cont)

DEFINABLE FEATURE	Y-YES N-NO N/A	WORK LOCATION, PERSONNEL CONTACTED
CONFIRM VEHICLES ARE INSPECTED DAILY AND HAVE REQUIRED MAPS AND FIRST AID KITS		
VERIFY VISUAL SURFACE SWEEPS ARE CONDUCTED ACCORDING TO WORK PLAN		
CONFIRM THAT MEC IDENTIFICATION/HANDLING IS ACCORDING TO WORK PLAN		
VERIFY EQUIPMENT OBTAIN IS IN ACCORDANCE WITH PROJECT PLANS		
CONFIRM CALIBRATION OF EQUIPMENT		
CONFIRM GRID LAYOUT IS IAW WORKPLAN		
VERIFY DAILY EQUIPMENT FUNCTION CHECKS ARE PERFORMED AND RECORDED		
CONFIRM GEOPHYSICAL DATA GENERATED IS PROPERLY STORED, MARKED AND TRACKED		
VERIFY COMPLIANCE WITH DATA PROCESSING QC PLAN		
VERIFY SOFT WARE DATA PROCESSING TRANSFER TO DATA MANAGEMENT SYSTEM		
CONFIRM DATA TRANSFER AND TRACKING PROCEDURES		
VERIFY DATA ARCHIVING IAW DATA MANAGEMENT PLAN PROCEDURES		
VERIFY COMPLIANCE WITH DATA QC PLAN		
CONFIRM EXCLUSION ZONE ESTABLISHED IAW SSHAP		
CONFIRM NOTIFICATIONS TO RESPONSE AGECIES ARE ACCOMPLISHED IAW SSHP		
CONFIRM INTRUSIVE PROCEDURES COMPLIANCE		
MONITOR DAILY INSPECTION AND DOCUMENTATION OF EQUIPMENT INSPECTIONS BY OPERATORS		
CONFIRM ANOMALY IDENTIFICATION		
VERIFY DIG SHEET COMPLETION IS IAW WORK PLAN		
MONITOR MEC IDENTIFICATION PROCEDURES AND UXOSO VERIFICATION IAW WORK PLAN		
CONFIRM EXCLUSION ZONE EVALUATION/MODIFICATION BASED ON MEC IDENTIFICATION		

FOLLOW-ON PHASE (cont)

DEFINABLE FEATURE	Y-YES N-NO N/A	WORK LOCATION, PERSONNEL CONTACTED
MONITOR MEC HANDLING/DISPOSITION IS ACCORDING TO WORK PLAN		
VERIFY MEC ITEMS ARE PROPERLY DOCUMENTED, AND TRACKING COMPLETED		
MONITOR COMPLIANCE WITH COLLECTION POINT PROCEDURES IAW WORK PLAN		
CONFIRM MEC SEGRATION AT COLLECTION POINTS DURING TRANFER		
MONITOR MEC RELATED MATERIALS INSPECTION AND IDENTIFICATION IAW WP		
CONFIRM NON-MEC SCRAP DISPOSAL IAW DIRECTIVES		

SAMPLE Soil Removal Summary Table
Pad TBD

PAD # (TBD) SOIL		
DATE	# OF TRUCK LOADS	VOLUME – DAILY (Cubic Yards)
WEEKLY TOTAL	0	0
WEEKLY TOTAL	0	0
WEEKLY TOTAL	0	0
WEEKLY TOTAL	0	0
WEEKLY TOTAL	0	0
WEEKLY TOTAL	0	0
GRAND TOTAL TO DATE		

Appendix C – MEC Anomaly Avoidance Plan

Final MEC Anomaly Avoidance for Sampling & Closure of Load Lines 1, 2, 3, 4, 12 (RVAAP- 08, 09, 10, 11, and 12) and Other Areas of Concern

Ravenna Army Ammunition Plant
Ravenna, Ohio

Contract No. W912QR-10-P-0037

Prepared for:

US Army Corps
of Engineers

U.S. Army Corps of Engineers
600 Martin Luther King, Jr. Place
Louisville, Kentucky 40202

Prepared by:

PRUDENT TECHNOLOGIES, INC.
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July 30, 2010

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ACRONYMS AND ABBREVIATIONS

bgs	below ground surface
CO	Contracting Officer
COR	Contracting Officer Representative
CPR	Cardiopulmonary Resuscitation
DDESB	Department of Defense Explosives Safety Board
DoD	Department of Defense
DPT	direct push technology
HTRW	hazardous, toxic, radioactive waste
MC	munitions constituents
MEC	munitions and explosives of concern
Prudent	Prudent Technologies, Inc.
QC	quality control
RVAAP	Ravenna Army Ammunition Plant
SHSO	Site Health and Safety Officer
SSHP	Site Safety and Health Plan
SOW	scope of work
UXOSO	Unexploded Ordnance Safety Officer
USACE	United States Army Corps of Engineers
UXO	unexploded ordnance
WP	work plan

1.0 – INTRODUCTION

This project specific Munitions and Explosives of Concern (MEC) Avoidance and Construction Support Plan discusses surface and subsurface MEC anomaly avoidance procedures and construction support techniques to be used while conducting hazardous, toxic, radioactive waste (HTRW)-related activities during investigative, design, and remedial actions to be completed at Ravenna Army Ammunition Plant (RVAAP), Ravenna, Ohio. The construction support and MEC anomaly avoidance procedures contained in this plan were developed in accordance with the United States Army Corps of Engineers (USACE) EP 75-1-2 “Munitions and Explosives of Concern (MEC) Support During HTRW and Construction Activities” (USACE, 2004a) and "DoD Ammunition and Explosive Safety Standards" DoD 6055.9-STD, Chapter 15, Change 2, August 21 2009. These procedures will be performed and adhered to by all Prudent Technologies, Inc. (Prudent) and subcontractor personnel during HTRW field activities conducted at RVAAP. Prudent and its subcontractors will work closely with the USACE staff assigned to RVAAP to ensure a safe working environment and to ensure the equipment, supplies, and other resources needed to provide MEC avoidance and MEC construction support are present on-site.

Anomaly avoidance procedures will be provided during HTRW-related field investigation activities. These activities include, but are not limited to, surface and subsurface soil sampling, and boring. The purpose of avoidance during field activities is to identify any potential surface or near-surface MEC and subsurface anomalies during field activities. For anomaly avoidance on site with potential MEC, Prudent will provide an unexploded ordnance (UXO) escort consisting of a qualified UXO Technician during the entire field work period.

If a magnetic anomaly is detected indicating the possible presence of MEC, the specific location will be marked and avoided. Intrusive anomaly investigation and/or MEC removal is not an authorized activity on this scope of work (SOW). Prudent will immediately notify the Contracting Officer (CO) or the designated CO Representative (COR) if suspected HTRW, MEC or munitions constituents (MC) of unknown origin are encountered. If an MEC removal action is authorized later, the policies and procedures for an MEC removal action will be contained in a separate MEC Removal Work Plan (WP).

2.0 – UXO TEAM QUALIFICATIONS & RESPONSIBILITIES

2.0 UXO TEAM

2.1.1 UXO Team Qualification

MEC avoidance support activity will be completed by a minimum of a UXO Technician III and at least one other individual. The UXO Technician III will escort the field team and will be on-site during all field activity. The Prudent UXO Technician III working at this site has completed a training program, prior to beginning work on site, which complies with OSHA Regulations 29 CFR 1910.120e(9).

2.1.2 Responsibilities

The UXO Technician III has the following responsibilities for MEC avoidance support procedures during the field investigation:

- Provide the ordnance expertise to identify MEC-related hazards and will also act as the UXO Safety Officer (UXOSO) for the project during field activities.
- Conduct a surface access survey
- Establish and delineate surface MEC -free ingress/egress lanes and work areas.
- Conduct MEC safety briefings for all site personnel and visitors.
- Mark and report any potential surface MEC encountered to the appropriate authority for proper response and disposition.
- Work closely with the USACE personnel on all MEC-related matters.

2.1.3 Authority

The designated site UXOSO has final on-site authority on all munitions and MEC matters concerning safety. The UXOSO will report to and communicate directly with the Prudent Project Manager.

3.0 – ON-SITE TRAINING

As part of the MEC avoidance process, Prudent will perform project-specific training for all field personnel. The purpose of this training is to ensure that all field personnel fully understand the operational procedures and methods to be used, responsibilities, safety and environmental concerns during sampling, investigation and excavation activities. Any field personnel arriving at the site after this initial training session will have to complete the training before starting work. The UXOSO will conduct the training, which will include the following topics:

- Specific ordnance materials (e.g., MEC, munitions constituents (MC), explosive soil) potentially found on-site and elements discussed in MEC Safety in the next section.
- Emergency procedures and contact information for RVAAP.

4.0 – MEC SAFETY

If potential or actual MEC is encountered during any phase of work, the Prudent Project Manager, Prudent Site Health and Safety Officer (SHSO), Prudent UXO Safety Officer (UXOSO), and the USACE Site Safety Representative will immediately be notified (USACE, 2004b). In general, the following MEC safety protocols will be followed:

- The cardinal principle to be observed involving ordnance, explosives, ammunition, severe fire hazards, or toxic materials is to limit the exposure to a minimum number of personnel, for the minimum amount of time, to a minimum amount of hazardous material consistent with a safe and efficient operation.
- The age or condition of a MEC item does not decrease its effectiveness. MEC that has been exposed to the elements for an extended period becomes more sensitive to shock, movement, and friction because the stabilizing agent in the explosives may be degraded.
- Consider MEC that has been exposed to fire to be extremely hazardous. Chemical and physical changes to the contents may have occurred that render it more sensitive than it was in its original state.
- DO NOT touch or move any ordnance items regardless of the markings or apparent condition.
- DO NOT visit an MEC site if an electrical storm is occurring or approaching. If a storm approaches during a site visit or during site operations, leave the site immediately and seek shelter.
- DO NOT use radio or cellular phones near suspect MEC items.
- DO NOT drive vehicles into a suspected MEC area; use clearly marked lanes.
- DO NOT carry matches, cigarettes, lighters or other flame-producing devices onto the RVAAP.
- Always assume MEC items contain a live charge until determined otherwise.
- DO NOT touch, move, or jar any MEC item, regardless of its apparent condition.
- DO NOT be misled by markings on the MEC item stating, “practice bomb,” “dummy,” or “inert.” Even practice bombs have explosive charges that are used to mark and/or spot the point of impact; or the item could be marked incorrectly.

5.0 – PROJECT EQUIPMENT

5.1 PROJECT EQUIPMENT

Project equipment for MEC avoidance will be inspected to ensure completeness and operational readiness. Any equipment found damaged or defective will be repaired or returned for replacement. All instruments and equipment that require routine maintenance and/or calibration will be inspected initially upon arrival and then periodically as required in the Facility-Wide Work Plan or manufacturer's equipment manual. Equipment required for daily usage shall be calibrated twice daily (start and finish). If an equipment check indicates that any piece of equipment is not operating correctly and field repair cannot immediately be accomplished, the equipment will be removed from service until it can be repaired. Alternately, the equipment may be replaced with an equivalent model. Key safety equipment will have an operational backup on site.

5.1.1 Geophysical Sweep Equipment

The use of geophysical sweep equipment will depend on the local area of the sweep and the intended work to be conducted in that area. If the area is to be investigated only on foot, it may suffice to conduct only a metal detector-aided visual search of the area. Along access routes for vehicular traffic, or at deep sampling sites, a geophysical sweep for subsurface anomalies to a depth of 4 feet or more is required.

For the purpose of MEC anomaly avoidance, the following geophysical equipment will be utilized:

- For a geophysical deep sweep of an area to be sampled, the Subsurface Instruments magnetometer Model BHG (or equivalent) will be utilized. This equipment will be used during the performance of test soil borings from within the borehole, beginning at ground surface and after each successive penetration of at most two feet until the borehole depth has exceeded four (4) feet...
- To detect shallow depth (up to 4 feet) metallic anomalies over larger areas, a Schonstedt Model GA-72-Cd magnetometer (or equivalent) will be used.

5.1.2 Geophysical Survey Equipment

(The use of Geophysical Survey Equipment is not applicable to this project)

6.0 – MEC AVOIDANCE ACTIVITIES

This section discusses MEC avoidance and clearance activities on this project.

6.1 SITE ACCESS AND MEC CLEARANCE SURVEYING

In areas with potential MEC, the UXO Technician III (escort) will conduct a magnetometer-assisted surface clearance access survey and/or a subsurface survey for anomalies before any activities (e.g., site visits or field investigations) commence, including foot and vehicular traffic. Geophysical magnetometer instrumentation capable of detecting the smallest anticipated MEC (75mm C/R shells for Load Lines 1, 2, and 3 and mines, AT T27, for Load Line 4) will be used to locate anomalies just below the surface that may be encountered through erosion from rain or continual vehicular traffic. The subsurface surveys (to a depth of 4 feet or more below ground surface (bgs)) need be conducted only when the use of motor vehicles is anticipated and at specific investigation sites. Anomalies found will be marked with red flags. No MEC items will be handled at any time during this project.

Prudent personnel will be escorted by a UXO technician at all times in areas potentially impacted with MEC until the team has completed the access surveys and the cleared areas are marked. Escorted Prudent personnel will follow behind the UXO technician. If anomalies are detected, the UXO tech escort will halt escorted personnel in place, flag the anomaly with a red survey flag, select a course around the item, and instruct escorted personnel to follow. No personnel will be allowed outside of the surveyed and cleared areas. No MEC items will be handled at any time during this project.

The UXO tech escort will conduct an access survey of the footpath and/or vehicular lanes approaching and leaving the site areas with known or suspected MEC. The access route shall be at least twice as wide as the widest vehicle that will use the route. The route shall be clearly marked with green flags or stakes for future entry.

The UXO tech escort will also complete an access survey of an area around the proposed investigation site that is large enough to support all planned operations. The size of the surveyed area will be site-specific and will take into account maneuverability of required equipment (e.g., drill rigs (push probe), excavation equipment, etc.), parking of support vehicles, and establishment of decontamination stations. At a minimum, the surveyed area will have a dimension in all directions equal to twice the length of the longest vehicle, or piece of equipment, to be brought on-site and clearly delineated with green flagging or stakes.

6.2 CLEARING AND GRUBBING

This section is not applicable to this project.

6.3 LAND SURVEYING

This section is not applicable to this project.

6.4 GEOPHYSICAL SURVEYING

This section is not applicable to this project.

6.5 SAMPLING AND DRILLING

6.5.1 Surface Soil Sampling

The following paragraphs describe anomaly avoidance procedures for surface soil sampling (between 0 and 12 inches bgs) in areas with potential MEC. Soil sampling at depths greater than 12 inches bgs will follow the procedures in **Section 6.5.2** of this plan.

The UXO tech will visually survey the surface of each proposed surface soil-sampling site for any indication of MEC or MEC-related contamination. In addition, the UXO tech will conduct a survey of the proposed sampling locations using hand-held magnetometer.

If anomalies or evidence of explosive contamination are detected at a proposed sampling location or too many anomalies are detected in a general area of interest, the Prudent Project Manager will select an alternate location for collection of surface soil samples. Any anomalies detected will be prominently marked with red survey flags or non-metallic pin flags for avoidance during HTRW sampling activities.

6.5.2 Subsurface Soil Sampling and Monitoring Well Installation

The following paragraphs describe anomaly avoidance procedures for subsurface soil sampling in an area with potential MEC. Subsurface soil sampling is to be performed using direct push technology (DPT).

The UXO tech will conduct surface clearance and access survey of the routes to and from the proposed investigation site as well as an area around the investigation site, as described in **Section 6.1**.

The UXO tech will complete a hand-held, magnetometer-assisted, subsurface survey of the proposed drilling location(s). If an anomaly is detected, sampling personnel will select a new borehole location. Any anomalies detected will be prominently marked with red survey flags or non-metallic pin flags for avoidance.

Underground Utilities

This section is not applicable to this project.

Pilot Hole and Incremental Geophysical Survey for Conventional MEC Clearance

This Section is not applicable to this project.

Test Pits for Non-Conventional MEC Clearance

This section is not applicable to this project.

6.5.3 Soil Sampling with Direct Push Technology (DPT)

The following paragraphs describe anomaly avoidance procedures for soil sampling and use of DPT in areas with potential MEC. Soil sampling with DPT typically involves manual or mechanical penetration at the desired location, followed by withdrawal and collection of a soil sample.

The UXO tech will conduct surface clearance and access clearance survey of the routes to and from the proposed investigation site as well as an area around the investigation site, as described in **Section 6.1**.

Soil sampling and DPT installations will follow the same anomaly-avoidance procedures as described previously for subsurface soil sampling (i.e., incremental down hole geophysical survey for metallic anomalies). However, the actual sampling and geophysical screening will occur through the

DPT borehole. For a geophysical deep sweep of an area to be investigated and sampled, the Subsurface Instruments magnetometer Model BHG (or equivalent) will be utilized. This equipment will be used during the performance of test soil borings from within the borehole after each penetration at depths of 0 feet, 2 feet, and 4 feet. The use of the magnetometer equipment (see paragraph 5.1.1) at a depth of 4 feet will detect any potential UXO down to the 7 feet, the total depth of the borings to be performed. If at any depth, the downhole magnetometer senses any potential MEC, drilling will cease immediately at that location and another nearby boring will be attempted.

Following collection of the soil samples, the sampling location will be backfilled in accordance with project-specific procedures.

7.0 – REFERENCES

Department of the Army (DA). 1978. Decontamination of Facilities and Equipment. Technical Bulletin 700-4. October.

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Department of Defense Explosives Safety Board (DDESB). 2004. Minimum Qualifications for Unexploded Ordnance (UXO) Technicians and Personnel. DDESB Technical Paper 18. December.

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DoD. 2009. DoD Ammunition and Explosives Safety Standards. Directive 6055.9-STD. Change 2, August 21.

DoD. 2008. Material Potentially Presenting an Explosive Hazard (MPPEH). DoD I 4140.62. November 28.

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United States Army Corps of Engineers (USACE). 1998. Use of Sandbags for Mitigation of Fragmentation and Blast Effects Due to Intentional Detonation of Munitions. Report HNC-ED-CS-S-98-7. August.

USACE. 2000. Ordnance and Explosives Response. USACE Engineering Pamphlet EP 1110-1-18. April.

USACE. 2004a. Munitions and Explosives of Concern (MEC) Support during HTRW and Construction Activities. USACE Engineering Pamphlet EP 75-1-2. August.

USACE. 2007. Safety and Health Requirements for Munitions and Explosives of Concern (MEC) Operations, USACE Engineer Regulation ER 385-1-95. March 30.

Appendix D – Site Safety and Health Plan Addendum

Final Site Safety and Health Plan Addendum for Sampling & Closure of Load Lines 1, 2, 3, 4, 12 (RVAAP – 08, 09, 10, 11 and 12) and Other Areas of Concern

Ravenna Army Ammunition Plant
Ravenna, Ohio

Contract No. W912QR-10-P-0037

Prepared for:

U.S. Army Corps of Engineers
600 Martin Luther King, Jr. Place
Louisville, Kentucky 40202

Prepared by:

Prudent Technologies, Inc.
4242 Medical Drive, Suite 7250
San Antonio, Texas 78229

July 30, 2010

Health and Safety Plan Addendum

Sampling & Closure of Load Lines 1, 2, 3, 4, 12 (RVAAP – 08, 09, 10, 11 and 12) and Other Areas of Concern

Ravenna Army Ammunition Plant, Ravenna, Ohio

Position	Name	Phone Number
Program Manager	Prakash Raja, CHMM	210-860-8623
Project Manager	John P. Jent, P.E.	502-439-8005
Deputy Project Manager	Tomas Hernandez, Jr., P.G.	210-385-2011
Site Health and Safety Manager	Aditya Moralwar	402-617-4654

Plan Approval Signatures

______________________________ ________________________

Health and Safety Manager Date

______________________________ ________________________

Project Manager Date

______________________________ ________________________

Program Manager Date

This Health and Safety Plan is valid for the duration of this specific project. A copy of this plan is to be maintained along with the Facility-Wide Health and Safety Plan at all times.

Health and Safety Plan Addendum

Sampling & Closure of Load Lines 1, 2, 3, 4, 12 (RVAAP – 08, 09, 10, 11 and 12) and Other Areas of Concern

Ravenna Army Ammunition Plant, Ravenna, Ohio

Plan Acknowledgement Signatures

I, by my signature, acknowledge that I have read and understand the contents of this Health and Safety Plan Addendum.

Printed Name	Signature	Date

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ACRONYMS AND ABBREVIATIONS

AOC	Area of Concern
FWSAP	Facility-Wide Sampling and Analysis Plan
FWSHP	Facility-Wide Safety & Health Plan
FSP	Field Sampling Plan
IDW	Investigation-derived waste
IRP	Installation Restoration Program
MI	multi-increment
MSDS	Material Safety Data Sheet
OHARNG	Ohio Army National Guard
PID	photoionization detector
PPE	personal protective equipment
RVAAP	Ravenna Army Ammunition Plant
SSHO	Site Safety & Health Officer
SSHP	Site Safety & Health Plan
USACE	U.S. Army Corps of Engineers

1.0 – INTRODUCTION

The Ravenna Army Ammunition Plant (RVAAP) Facility-Wide Safety and Health Plan (FWSHP) (USACE 2001) and this Site Safety and Health Plan (SSHP) Addendum collectively set forth the specific procedures required to protect Prudent Technologies, Inc. (Prudent) and Prudent subcontractor personnel involved in the field activities at Load Lines 1, 2, 3, 4 and 12 and other areas of concern (AOCs) at the Ravenna Army Ammunition Plant (RVAAP). These plans are driven by requirements contained in U.S. Army Corps of Engineers (USACE) (1992) and USACE (1996). All field personnel are required to comply with the requirements of these programs and plans. In addition, subcontractors are responsible for providing their employees with a safe work place. These plans do not relieve subcontractors of this responsibility. If the requirements of these plans are not sufficient to protect the employees of a subcontractor, that subcontractor is required to supplement this information with work practices and procedures that will ensure the safety of its personnel.

The FWSHP addresses program issues, hazards, and hazard controls common to the entire installation. This SSHP Addendum to the FWSHP serves as the lower tier document addressing the hazards and controls specific to performing additional sampling and remedial activities at Load Lines 1, 2, 3, 4 and 12 and other AOCs at the Ravenna Army Ammunition Plant (RVAAP). The additional sampling and remedial activities consist of additional subsurface soil sampling below floor slabs at the AOCs. Copies of the FWSHP and this SSHP Addendum will be present at the work site during all fieldwork.

Planned site activities consist of environmental sampling and support tasks. These tasks include soil sampling, surface water and sediment sampling, using push probe technology, and trenching.

Potential hazards posed by the planned tasks include: injury from ordnance and explosives; striking, rotation, and noise hazards from excavating and drilling equipment; lifting, noise, and strain hazards associated with operating soil sampling equipment; fuel or decontamination solvent fires; chemical exposure; temperature extremes; stinging/biting insects; poisonous plants; and snakes.

The potential for chemical overexposure during the performance of the planned tasks is low based upon the vapor pressure of the potential contaminants and the unlikely potential for creating airborne particulates. However, there is the potential for adverse health effects resulting from dermal contact with contaminated soil. This potential hazard will be mitigated through the use of protective gloves during the handling of potentially contaminated materials. Physical hazards are associated with water-borne operations, excavation and drilling equipment, and hand-operated power tools. Task-specific hazard controls have been specified for these tasks.

This investigation will be performed in Level D personal protective equipment (PPE), plus chemical-resistant gloves when handling potentially contaminated materials. If one of several action levels is exceeded or the potential for increased risk becomes apparent during the investigation, protective procedures, including protective clothing, will be upgraded as necessary by the Site Safety & Health Officer (SSHO).

2.0 – SITE DESCRIPTION AND CONTAMINATION CHARACTERIZATION

2.1 – Site Description

When the RVAAP Installation Restoration Program (IRP) began in 1989, RVAAP was identified as a 21,419-acre installation. The property boundary was resurveyed by Ohio Army National Guard (OHARNG) over a 2-year period (2002 and 2003) and the total acreage of the property was found to be 21,683.289 acres. As of February 2006, a total of 20,403 acres of the former 21,683-acre RVAAP has been transferred to the National Guard Bureau (NGB) and subsequently licensed to OHARNG for use as a military training site.

The current RVAAP consists of 1,280 acres scattered throughout the OHARNG Camp Ravenna Joint Military Training Center (Camp Ravenna). Camp Ravenna is in northeastern Ohio within Portage and Trumbull Counties, approximately 3 miles (4.8 km) east-northeast of the City of Ravenna and approximately 1 mile (1.6 km) northwest of the City of Newton Falls. The RVAAP portions of the property are solely located within Portage County. RVAAP/Camp Ravenna is a parcel of property approximately 11 miles (17.7 km) long and 3.5 miles (5.6 km) wide bounded by State Route 5, the Michael J. Kirwan Reservoir, and the CSX System Railroad on the south; Garret, McCormick, and Berry roads on the west; the Norfolk Southern Railroad on the north; and State Route 534 on the east. Camp Ravenna is surrounded by several communities: Windham on the north; Garrettsville 6 miles (9.6 km) to the northwest; Newton Falls 1 mile (1.6 km) to the southeast; Charlestown to the southwest; and Wayland 3 miles (4.8 km) to the south. The property location is depicted in Figure 1-1.

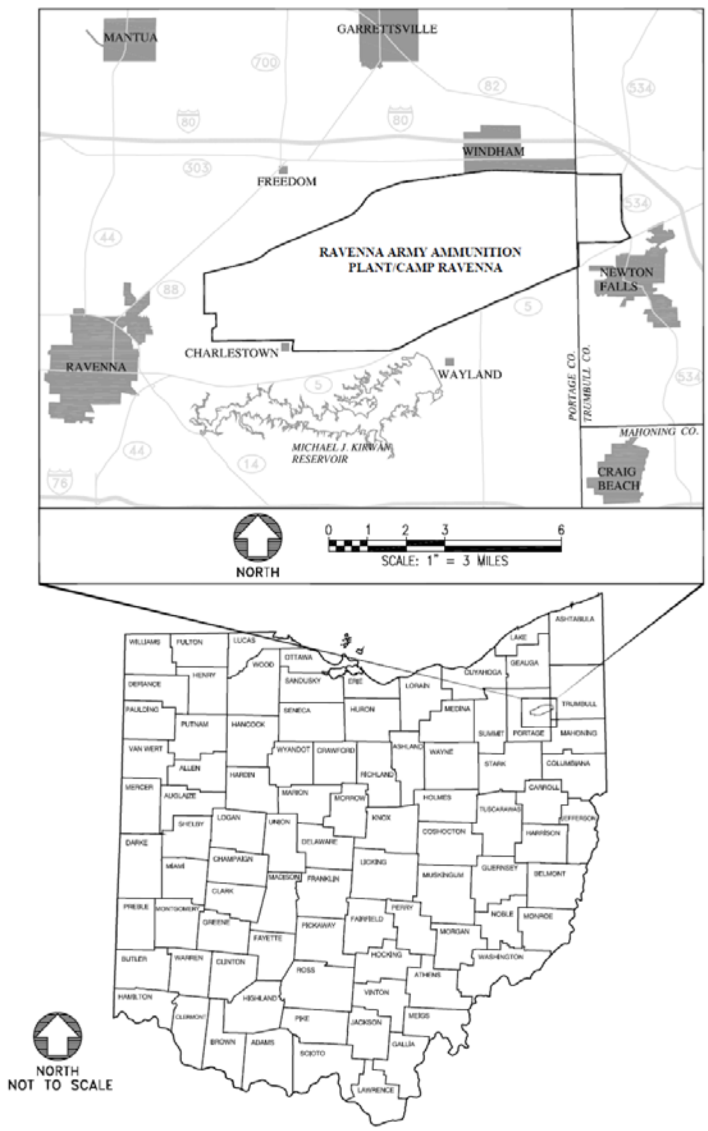
When RVAAP was operational, Camp Ravenna did not exist and the entire 21,683-acre parcel was a government-owned, contractor-operated industrial facility. The RVAAP IRP encompasses investigation and cleanup of past activities over the entire 21,683 acres of the former RVAAP. References to RVAAP in this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

Industrial operations at the former RVAAP consisted of 12 munitions-assembly facilities referred to as "load lines." Load Lines 1 through 4 were used to melt and load 2,4,6-trinitrotoluene (TNT) and Composition B into large-caliber shells and bombs. The operations on the load lines produced explosive dust, spills, and vapors that collected on the floors and walls of each building. Periodically, the floors and walls were cleaned with water and steam. Following cleaning, the wastewater, containing TNT and Composition B, was known as "pink water" for its characteristic color. Scupper systems were used to collect pink water, which was contained in concrete holding tanks, filtered, and pumped into unlined ditches for transport to earthen settling ponds. However, in some instances, pink water was swept from doorways, or scupper systems overflowed onto the ground surface. Load Lines 5 through 11 were used to manufacture fuzes, primers, and boosters. Potential contaminants in these load lines include lead compounds, mercury compounds, and explosives. From 1946 to 1949, Load Line 12 was used to produce ammonium nitrate for explosives and fertilizers prior to use as a weapons demilitarization facility.

In 1950, the facility was placed in standby status and operations were limited to renovation, demilitarization, and normal maintenance of equipment, along with storage of munitions. Production activities were resumed from July 1954 to October 1957 and again from May 1968 to August 1972. In addition to production missions, various demilitarization activities were conducted at facilities constructed at Load Lines 1, 2, 3, and 12. Demilitarization activities included disassembly of munitions and explosives melt-out and recovery operations using hot water and steam processes. Periodic demilitarization of various munitions continued through 1992.

In addition to production and demilitarization activities at the load lines, other facilities at RVAAP include AOCs that were used for the burning, demolition, and testing of munitions. These burning and demolition grounds consist of large parcels of open space or abandoned quarries. Potential contaminants at these AOCs include explosives, propellants, metals, and waste oils. Other types of AOCs present at RVAAP include landfills, an aircraft fuel tank testing facility, and various general industrial support and maintenance facilities.

Figure 1-1 - RVAAP Location and General Vicinity Maps



In this project, Prudent Technologies, Inc. (Prudent) is tasked with performing deeper characterization of the subsurface materials beneath the former building slabs via subsurface multi-increment (MI) sampling. Innovative means of performing this comprehensive sampling will be performed in an efficient and cost effective manner. Subsequent to that sampling, Prudent will compile all previous environmental sampling and evaluate that data against a more stringent set of cleanup goals that will reduce the land use restrictions for the OHARNG. Should additional remediation be required, Prudent will perform that work. Finally, Prudent will prepare a closure document and an associated Record of Decision (ROD) Addendum, to facilitate transfer of the property from the Army to the NGB with the goal of Unrestricted National Guard Trainee Use.

2. 2 – Contaminant Characterization

Two categories of chemical hazards are associated with site activities:

- Site constituents; and
- Chemicals used to conduct the site work.

Prior sampling results indicate that the primary contaminants of concern at Load Lines 1, 2, 3, 4, and 12 are explosives residues and metals. Information on the potential contaminants and the reagents and chemicals that will be used for the project is contained in Table 2-1. It is important to note that the contaminants listed in Table 2-1 have been detected in a number of locations at RVAAP and may be present at former operations area. Exposure to these potential contaminants and reagents/chemicals (such as corrosive sample preservatives, field laboratory reagents, or flammable fuels), is likely and will be controlled through compliance with this addendum.

2.2.1 – Site Constituents

Table 2-1 lists contaminants known to occur at the AOCs. Inclusion in this table indicates the potential to encounter a contaminant during field activities, but it does not necessarily indicate that the contaminant is present in sufficient quantity to pose a health risk to workers.

Hazard/Risk Analysis is provided in Appendix A. The purpose of the task hazard/risk analysis is to identify and assess potential hazards that may be encountered by personnel and to prescribe required controls.

Table 2-1 – Potential Contaminants of Concern in Soil at Load Lines 1, 2, 3, 4, and 12

Contaminants	
1,3,5-TNB	Alpha Chlordane
2,4,6-TNT	Gamma Chlordane
HMX	Aroclor-1254
RDX	Aroclor-1260
Antimony	Dieldrin
Arsenic	Endrin
Beryllium	Anthracene
Cadmium	Benzo(a)anthracene
Chromium	Benzo(b)pyrene
Lead	Benzo(b)fluoranthene
Manganese	Benzo(k)fluoranthene
Thallium	Chrysene
4,4'-DDT	Dibenzo(a,h)anthracene
Aldrin	Indeno(1,2,3-cd)pyrene
Heptachlor Epoxide	

2.2.2 – Materials Inventory

Table 2-2 lists chemical to be used at the site. Inclusion in this table does not necessarily indicate the chemical is present in sufficient quantity to pose a health risk to workers.

Table 2-2– Chemicals Used to Conduct Site Work

Materials Inventory
Acetone
Liquinox (decontamination)
Methanol (potentially used for equipment decontamination and sample preparation)
Isopropyl alcohol (potentially used for equipment decontamination)
Gasoline (equipment fuel)

2.2.3 – Hazard Communication Materials

Materials that are considered hazardous materials under the OSHA Hazard Communication Standard (29 CFR 1910.1200) may be used during this project. Material Safety Data Sheets (MSDSs) for the hazardous materials listed in table 2-2 are included in Attachment B. Copies of these MSDSs will be made available to any subcontractors (i.e, drillers, excavators) on this project.

3.0 – STAFF ORGANIZATION AND RESPONSIBILITIES

This section presents the personnel (and their associated telephone numbers) responsible for site safety and health and emergency response. Table 3-1 identifies the Prudent staff who will fill key roles.

Table 3-1 – Staff Organization

Position	Name	Phone Number
Program Manager	Prakash Raja, CHMM	210-860-8623
Project Manager	John P. Jent, P.E.	502-439-8005
Deputy Project Manager	Tomas Hernandez, Jr., P.G.	210-385-2011
Health and Safety Manager	Aditya Moralwar	402-617-4654

4.0 – TRAINING

Training requirements are summarized in Table 4-1. At least two persons trained in the American Red Cross cardiopulmonary resuscitation (CPR) for first responders will be present during sampling activities. At least two field personnel working within the area of concern will have general Red Cross first aid/CPR training.

Table 4-1 – Staff Training

Training	Worker	Supervisor	Site Visitor (exclusion zone)
HAZWOPER (40-hr, 3-day OJT)	√	√	√
HAZWOPER Annual Refresher (8 hr)	√	√	√
HAZWOPER Supervisors Training (8 hr)		√	
American Red Cross Standard First Aid (5.5 hr)	√	√	
General Hazard Communication Training	√	√	√
Respiratory Protection Training (required only if respirators are required)	√	√	√
Hearing Conservation Training (for workers in the hearing conservation program)	√	√	√
Pre-entry Briefing	√	√	√
Site-Specific Hazard Communication (contained in pre-entry briefing)	√	√	√
Safety Briefing (daily and whenever conditions or tasks change)	√	√	√
CPR for First Responders	√	√	

√ = required.
CPR = cardiopulmonary resuscitation.
HAZWOPER = Hazardous Waste Operations and Emergency Response.
OJT = on-the-job training.

5.0 – PERSONAL PROTECTIVE EQUIPMENT

General guidelines for selection and use of PPE are presented in the FWSHP. Specific PPE requirements for this work are presented in the hazard/risk analysis section (Appendix A).

This investigation will be performed in Level D PPE, plus chemical-resistant gloves when handling potentially contaminated materials. If one of several action levels is exceeded, or the potential for increased risk becomes apparent during the investigation, protective procedures, including protective clothing, will be upgraded, as necessary, by the SSHO. Specific tasks such as geoprobing, using push probe technology and soil chemical preparation, require additional PPE (e.g., hardhats, leather gloves, and face shield), as delineated in Table 5-1 below.

Table 5-1 – Baseline Personnel Protective Equipment

Activity	PPE Required
Civil Surveys and Visual Surveys	LEVEL D PPE: long pants, shirts with sleeves, safety glasses, heavy duty work gloves, safety boots, and hardhats if overhead hazards are present, plus nitrile or similar gloves for contact with potentially contaminated material. Insect repellant with Deet ™ on boots, pants, and elsewhere, as necessary to repel ticks and mosquitoes
Soil boring, soil sampling, and monitoring well installation using push probe technology	Level D PPE plus nitrile or equivalent gloves to handle potentially contaminated material, plus hearing protection as necessary. Insect repellant with Deet ™ as needed
Soil sampling using hand augers or scoops	Level D PPE plus nitrile or equivalent gloves to handle potentially contaminated material. Insect repellant Deet ™ as needed
Surface wet/dry sediment sampling using hand tools	Level D PPE plus Coast Guard-approved personal flotation vests if working near or over water deeper than 4 ft. Nitrile or equivalent gloves for contact with contaminated material. Insect repellant Deet ™ as needed
Investigative Derived Waste (IDW) handling	Level D PPE plus nitrile or equivalent gloves for handling of potentially contaminated material
Equipment Decontamination	Level D PPE plus nitrile or PVC gloves

6.0 – MEDICAL SURVEILLANCE

Medical surveillance requirements, as presented in Section 6.0 of the FWSHP, are summarized in Table 6-1.

Table 6-1 – Medical Surveillance Requirements

Baseline	Routine	Overexposure	Termination
Prior to work assessment	Every 12 months, unless greater frequency is deemed appropriate by attending physician. Not to exceed 2-year interval	Upon developing symptoms or where exposure limits have been exceeded or suspected to have been exceeded	Upon termination or re-assignment

All medical exams shall include (see Section 6.2 of the Facility-Wide Safety and Health Plan):

- medical/work history,
- physical exam by physician,
- audiometry,
- blood screening and blood count,
- chest x-ray, as specified by physician,
- electrocardiogram, as specified by physician,
- spirometry,
- urinalysis.

7.0 – EXPOSURE MONITORING / AIR SAMPLING PROGRAM

Assessment of airborne chemical concentrations will be performed, as appropriate, to ensure that exposures do not exceed acceptable levels. Action levels, with appropriate responses, have been established for this monitoring. In addition to the specified monitoring, the SSHO may perform or require additional monitoring, such as organic vapor monitoring, in the field laboratory or equipment decontamination area or personnel exposure monitoring for specific chemicals. The deployment of monitoring equipment will depend on the activities being conducted and the potential exposures. All personal exposure monitoring records will be maintained in accordance with 29 Code of Federal Regulations 1910.20. The minimum monitoring requirements and action levels are presented in Table 7-1.

Fieldwork is not expected to pose airborne exposure hazards for the following reasons:

- With the exception of sampling equipment decontamination, which will be performed in a well-ventilated building, work will be performed in open areas with natural ventilation.
- Prior site sampling indicated that contaminant concentrations are unlikely to pose an occupational health hazard.
- The most probable contaminants (metals, explosives, and propellants) are materials with relatively low vapor pressures.

Air monitoring of the breathing zone using a photoionization detector or equivalent is planned during soil sampling, drilling, and trenching activities. The SSHO will examine site conditions and will contact the Health and Safety Manager and initiate additional monitoring if there is any indication of potential airborne exposure.

Table 7-1 – Monitoring Requirements and Action Limits

Hazard or Measured Parameter	Area	Interval	Limit	Action	Tasks
Airborne organics	Breathing zone [0.36 m (14 in.)] in front of employee's shoulder	From 1 to 3 ft below ground surface and if site conditions, such as discolored soil or chemical smells, indicate that monitoring is necessary	<5 ppm >5 ppm	Level D Withdraw and evaluate • evaluate need for PPE upgrade • identify contaminants • notify project manager and H&S manager	Explosive screening using test kits, drilling, hand auguring, push probe, and other intrusive work
Noise	All	During operation of push probe and any area where there is some doubt about noise levels	85 dBA and any area perceived as noisy	Require the use of hearing protection	Hearing protection will be worn within the exclusion zone, around power augers, or other motorized equipment
Visible airborne dust	All	Continuously	Visible dust generation	Stop work; use dust suppression techniques such as wetting surface	All

H&S = Health and Safety.
PPE = personal protective equipment.
ppm = personal protective equipment.

8.0 – HEAT / COLD STRESS MONITORING

General requirements for heat/cold stress monitoring are contained in the FWSHP.

9.0 – STANDARD OPERATION SAFETY PROCEDURES

Standard operation safety procedures are described in the FWSHP.

10.0 – SITE CONTROL MEASURES

Site control measures are described in the FWSHP. No formal site control is expected to be necessary for this work, as the work areas are remote, fenced, and bystanders are not anticipated. The RVAAP installation is not open to the public, and only authorized personnel are allowed in the project site area. If the SSHO determines that a potential exists for unauthorized personnel to approach within 25 ft of a work zone or otherwise be at risk due to proximity, then exclusion zones will be established, as described in the FWSHP.

11.0 – PERSONNEL HYGIENE AND DECONTAMINATION

Personal hygiene and decontamination requirements are described in the FWSHP and in Section 2.0 of this addendum.

12.0 – EMERGENCY PROCEDURES AND EQUIPMENT

Emergency contacts, telephone numbers, directions to the nearest medical facility, and general procedures can be found in the FWSHP Section 12.0. Emergency phone numbers and the hospital route map are also included in this Section. The Prudent Project Manager will remain in charge of all Prudent and subcontractor personnel during emergency activities. The Prudent staging building (Building 1036) will serve as the assembly point if it becomes necessary to evacuate one or more sampling locations.

12.1 Emergency Phone Numbers

Listed below are emergency groups and their telephone numbers. Cellular telephones and two-way radios will be present in the field and available for use. Mid-American Security will be contacted first for any emergency service.

Table 12-1 – Emergency Phone Numbers

Emergency Group	Phone Number
Police (Mid-American Security)	330-338-7406
Emergency Medical Service	330-872-5050
Hospital	330-297-0811/2449
Fire Department (City of Ravenna)	330-297-5738
Hazardous Materials Response	330-358-7406/7409

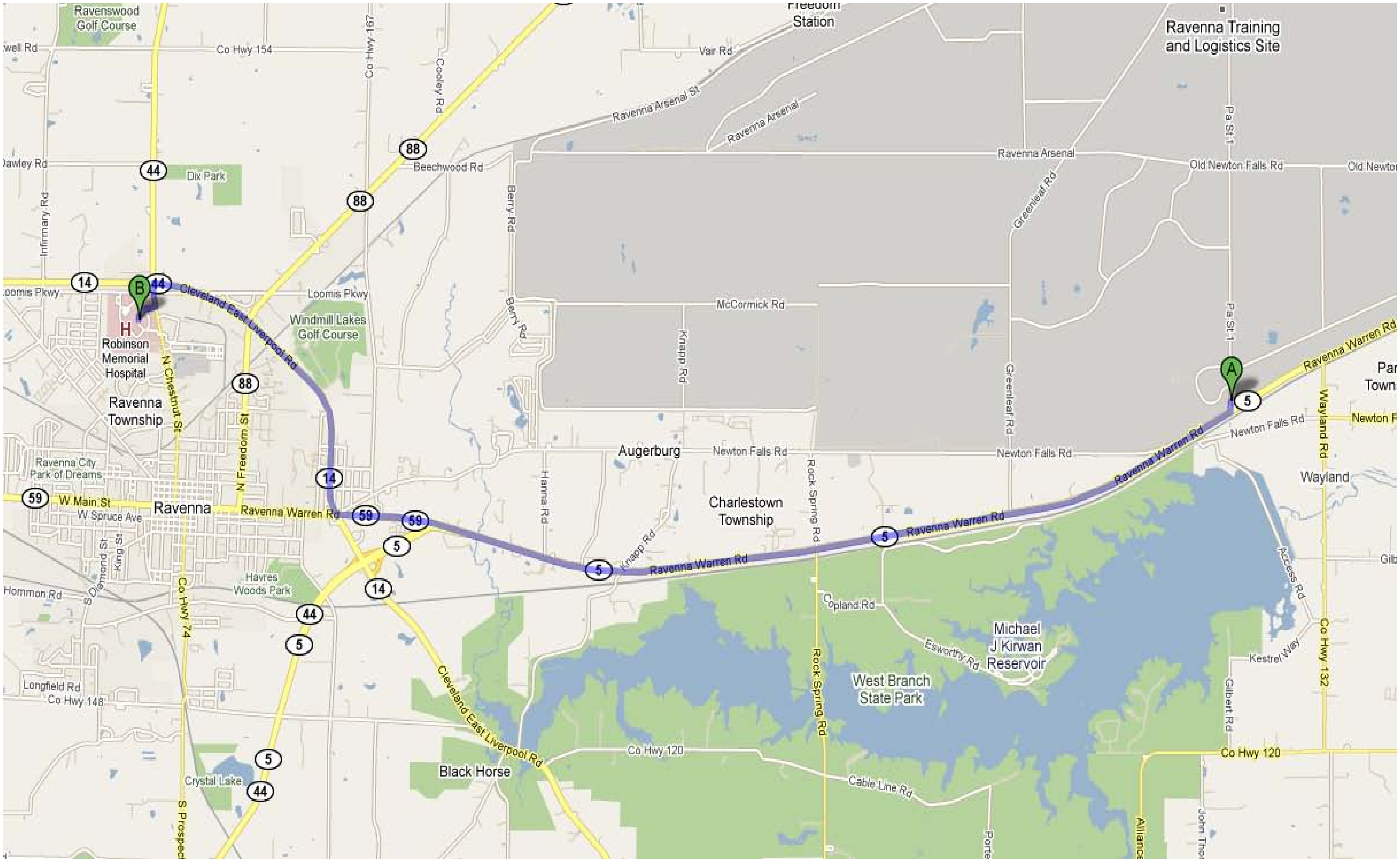
12.2 Procedures and Equipment

At least one person (i.e., project manager or site supervisor) must have a working two-way radio on the RVAAP frequency. The radio must be tested each morning before the start of work, by radioing Security with a communication check. Each team must have direct radio or telephone communication with the Project Manager or Site Supervisor. For the purposes of this requirement, a team is any individual(s) not having a line of sight or within normal voice range of another individual(s) having means of communication with the Project Manager or Site Supervisor.

In the event of medical emergency, Robinson Memorial Hospital is located approximately 10 miles from the site at 6847 North Chestnut Street in Ravenna, Ohio (Figure 2-1). It can be reached by taking PA Street 1 towards Highway 5 West/Ravenna Warren Road approximately 7.2 miles west, turn right at Cleveland East Liverpool Road/Highway 14 North/Highway 44 North approximately 2.4 miles, turn left at North Chestnut Street/Ravenna Painesville Road.

In the event of an accident or incident, the SSHO will first notify RVAAP's security personnel, who will, in turn, contact the proper authorities. The field supervisor should then notify the U.S. Army Project Manager immediately according to the requirements of EM 385-1-1. The required Accident Report (ENG Form 3394) must be completed and submitted to the U.S. Army Project Manager within two days, in accordance with the FWSHP.

Figure 2-1 – Route Map to Pre-Notified Medical Facility



13.0 – LOGS, REPORTS, AND RECORD KEEPING

Prudent will adhere to the documenting activities related to daily logs, reporting, and record keeping requirements as described in the FWSHP.

14.0 – REFERENCES

ACGIH (American Conference of Governmental Industrial Hygienists) 2003. *Threshold Limit Values*.

NIOSH (National Institute for Occupational Safety and Health). *NIOSH Pocket Guide to Chemical Hazards, the Condensed Chemical Dictionary,* online edition.

USACE (U.S. Army Corps of Engineers). *Safety and Occupational Health Requirements for Radioactive Waste (HTRW) and Ordnance and Explosive Waste (OEW) Activities*, ER-385-1-92.

USACE (U.S. Army Corps of Engineers). *Safety and Health Manual*, EM-385-1-1.

USACE (U.S. Army Corps of Engineers) 2001. *Facility-Wide Safety and Health Plan for Environmental Investigations at the Ravenna Army Ammunition Plant, Ravenna, Ohio,* DACA62-00-D-0001, D.O. CY02, March.

Appendix A – Hazard/Risk Analysis

HAZARD/RISK ANALYSIS

The purpose of the task hazard/risk analysis is to identify and assess potential hazards that may be encountered by personnel and to prescribe required controls. Table 1-1, a general checklist of hazards that may be posed by this project, indicates whether a particular major type of hazard is present. If additional tasks or significant hazards are identified during the work, this document will be modified by addendum or field change order to include the additional information.

Table 1-1 General Checklist for Hazards

Yes	No	Hazard
	X	Confined space entry
X		Excavation entry (excavations will not be entered)
X		Heavy equipment (push probe and backhoe)
X		Fire and explosion (fuels)
X		Electrical shock (utilities and tools)
X		Exposure to chemicals (contaminants and chemical tools)
X		Temperature extremes
X		Biological hazards (poison ivy and Lyme disease)
	X	Radiation or radioactive contamination
X		Noise (excavation equipment and push probe)
	X	Drowning
X		OE (potential to encounter unexploded ordnance)

OE = ordnance and explosives.

Specific tasks are as follows:

- soil sampling with hand augers or scoops,
- civil surveying,
- investigation-derived waste handling and disposition,
- subsurface soil sampling using push probe technology,
- sampling equipment decontamination.

1.1 Task-Specific Hazard Analysis

Table 1-2 presents task-specific hazards, relevant hazard controls, and required monitoring, if appropriate, for all of the planned tasks.

1.2 Potential Exposures

Prior sampling results indicate that the primary contaminants of concern at the project site are explosive residues and metals. Information on the potential contaminants, as well as the reagents and chemicals that will be used for the project is contained in Table 1-3. Material Safety Data Sheet records for reagents and chemicals to be used on the project are contained in Building 1036 at RVAAP. It is important to note that the contaminants listed in Table 1-3 have been detected in a number of locations at RVAAP and might be expected to occur at any former operations area. Exposure to chemical tools, such as corrosive sample preservatives, field laboratory reagents, or flammable fuels, is a possibility and will be controlled through standard safe handling practices.

Table 1-2 - Hazards Analysis

Safety and Health Hazards		Controls	Monitoring Requirements
Overall Risk Assessment Code (RAC): Low Risk	**RAC**	**Civil Surveys and Visual Surveys in Potentially Contaminated Areas**	
General safety hazards (moving equipment, slips, falls)	M	Level D PPE: long pants, shirts with sleeves, safety glasses, safety boots, and hard hats if overhead hazards are present (see Section 5.0 of the FWSHP). Site-specific training, buddy system, proper housekeeping	Daily safety inspections
Exposure to chemicals	L	Nitrile or similar gloves for contact with potentially contaminated material. Gloves will be disposed after single use. Wash face and hands and any other exposed areas prior to taking anything by mouth. Hazardous waste site operations training and medical clearance site training must include hazards and controls for exposure to site contaminants and chemicals used on-site. MSDSs on-site. All chemical containers labeled to indicate contents and hazard	None
Gunfire (deer hunting with shotguns loaded with slugs is allowed in some areas on Friday and Saturday during season, October and November)	L	Fieldwork will not be conducted during hunt days. Office work, sample management, and analytical work may be conducted in the Prudent staging building (Building 1036) if approved by the RVAAP environmental coordinator	None
Biological hazards (bees, ticks, Lyme disease, histoplasmosis, wasps, snakes, West Nile Virus)	M	PPE (boots and work clothes). Insect repellant with Deet ™ on boots, pants, and elsewhere, as necessary, to repel ticks and mosquitoes. Pant legs tucked into boots or otherwise closed to minimize tick entry. Inspect for ticks during the day and at the end of each workday (see Section 9.0 of FWSHP). Avoidance of accumulations of bird or bat droppings (see Section 9.0 of FWSHP)	Visual survey
Temperature extremes	L	Administrative controls (see Section 8.0 of FWSHP). Cooled (shaded) or warmed break area depending on the season. Routine breaks in established break area (see Section 8.0 of FWSHP). Chilled drinks if temperature exceeds 70°F	Temperature measurements at least twice daily. Pulse rates at the start of each break if wearing impermeable clothing

Table 1-2 - Hazards Analysis (continued)

Safety and Health Hazards		Controls	Monitoring Requirements
Overall Risk Assessment Code (RAC): <u>Low Risk</u>	**RAC**	**Soil Sampling and Sample Preservation**	
General safety hazards (moving equipment, lifting, slips, falls)	M	Level D PPE: long pants, shirts with sleeves, safety glasses, safety boots, hard hats if overhead hazards are present (see Section 5.0 of FWSHP). Buddy system. Site-specific training. Proper housekeeping. Lifts of >50 lbs will be performed by two or more personnel or with mechanical assistance, extensive heavy lifting will require additional lifting training. Exclusion zone if there is a potential for unauthorized entry	Daily site safety inspections
Noise	L	None, unless SSHO determines that equipment potentially exceeds 85 dBA	Daily safety inspection
Fire (fuels)	L	Fuel stored in safety cans with flame arresters. Fire extinguisher in all fuel use areas. No ignition sources in fuel storage areas. Bonding (metal to metal contact) during pouring. Gasoline-powered equipment must be shut down and allowed to cool for 5 min. prior to fueling	Daily site safety inspections
Exposure to chemicals	M	Level D PPE, including nitrile or PVC gloves, to handle potentially contaminated material. Minimal contact, wash face and hands prior to taking anything by mouth. Hazardous waste site operations training and medical clearance. Fifteen-min. eyewash within 100 ft when pouring corrosive sample preservatives; eyewash bottle within 10 ft when adding water to pre-preserved sample containers. Site training must include hazards and controls of exposure to contaminants and chemicals used on-site. MSDSs for chemical tools kept on-site. All chemical containers labeled with contents and hazard	Daily site safety inspections. PID monitoring if prior monitoring during soil boring indicated a potential for exposure
Gunfire (deer hunting with shotguns loaded with slugs allowed on Friday and Saturday during season, October and November)	L	Fieldwork will not be conducted on hunt days. Office work, sample management, and analytical work may be conducted in the Prudent staging building (Building 1036) if approved by the RVAAP environmental coordinator	None
Electrical shock	L	GFCI for all electrical hand tools	Daily safety inspection
Temperature extremes	L	Administrative controls (see Section 8.0 of FWSHP). Cooled (shaded) or warmed break area depending on the season. Routine breaks in established break area (see Section 8.0 of FWSHP). Chilled drinks if temperature exceeds 70°F	Temperature measurements at least twice daily. Pulse rates at the start of each break if wearing impermeable clothing
Biological hazards (bees, ticks, Lyme disease, histoplasmosis, wasps, snakes, West Nile Virus)	M	PPE (boots and work clothes). Insect repellant Deet ™ on boots, pants, and elsewhere, as necessary, to repel ticks and mosquitoes. Pant legs tucked into boots or otherwise closed to minimize tick entry. Inspect for ticks during the day and at the end of each workday (see Section 9.0 of FWSHP). Avoidance of accumulations of bird or bat droppings (see Section 9.0 of FWSHP)	Visual survey

Table 1-2 - Hazards Analysis (continued)

Safety and Health Hazards		Controls	Monitoring Requirements
Overall Risk Assessment Code (RAC): <u>High Risk</u>	**RAC**	**Soil Probing, Soil Sampling, and Using Push Probe/Other Drilling Technology**	
General safety hazards (rotating machinery, suspended loads, moving equipment, slips, falls)	H	Level D PPE: long pants, shirts with sleeves, safety glasses, safety boots, work gloves for material handling plus hard hat (see Section 5.0 of FWSHP). Buddy system. Site-specific training. Proper housekeeping. No employees under lifted loads. At least two functional kill switches. Functional backup alarm, drill rig manual on-site. Only experienced operators. Exclusion zone at least equal to mast height if there is any potential for unauthorized entry	Daily site safety inspections. Weekly drill rig inspections
Noise	H	Hearing protection >NRR 25 within 7.6 m (25 ft) of rig unless rig-specific monitoring indicates noise exposure of less than 85 dBA	Daily safety inspections
Fire (vehicle fuels or subsurface contaminants)	M	Fuels stored in safety cans with flame arrestors. Bonding (metal to metal) and grounding during fuel transfers. Fuel storage areas marked with no smoking or open flames signs. Fire extinguishers in all fuel use areas	Combustible gas indicator if buried organic material or other source of flammable gas is suspected
Exposure to chemicals	M	Level D PPE plus nitrile or equivalent gloves for contact with contaminated material. Wash face and hands prior to taking anything by mouth. Stay upwind of any dust-generating activities. Hazardous waste site operations training and medical clearance. Site training must include hazards and controls for site contaminants and all chemicals used on-site. MSDSs for chemical tools on-site. Chemical containers labeled to indicate contents and hazard	PID or other sampling, as appropriate
Gunfire (deer hunting with shotguns loaded with slugs allowed on Friday and Saturday during season, October and November)	L	Fieldwork will not be conducted on hunt days. Office work, sample management, and analytical work may be conducted in the Prudent staging building (Building 1036) if approved by the RVAAP environmental coordinator	None
Temperature extremes	M	Administrative controls (see Section 8.0 of FWSHP). Cooled (shaded) or warmed break area depending on the season. Routine breaks in established break area (see Section 8.0 of FWSHP). Chilled drinks if temperature exceeds 70°F	Temperature measurements at least twice per day. Pulse rates at the start of each break if wearing impermeable clothing
Biological hazards (bees, ticks, Lyme disease, histoplasmosis, wasps, snakes, West Nile Virus)	H	PPE (boots and work clothes). Insect repellant Deet ™ on boots, pants, and elsewhere, as necessary, to repel ticks and mosquitoes. Pant legs tucked into boots or otherwise closed to minimize potential for tick entry. Snake chaps if working in overgrown areas. Inspect for ticks during the day and at the end of each workday (see Section 9.0 of FWSHP). Avoidance of accumulations of bird or bat droppings (see Section 9.0 of FWSHP)	Visual survey

Table 1-2 - Hazards Analysis (continued)

Safety and Health Hazards		Controls	Monitoring Requirements
Electric shock	L	Identification and clearance of overhead and underground utilities. GFCI required for electric hand tools. Note – one live overhead electrical line is present at Load Line 2	Visual of all work areas
Overall Risk Assessment Code (RAC): Moderate Risk	**RAC**	**Soil Sampling Using Hand Augers or Scoops**	
General safety hazards (manual lifting, slips, falls)	H	Level D PPE: long pants, shirts with sleeves, safety boots, safety glasses, and work gloves for manual work (see Section 5.0 of FWSHP). Buddy system. Site-specific training. Proper housekeeping	Daily site safety inspections
Contact with unexploded ordnance	L	On-site training in ordnance recognition for all field personnel. Clearance of sites by OE personnel for intrusive work. Continuous escort by OE personnel when in areas with potential to encounter OE. Withdrawal of all non-OE personnel if ordnance or suspected ordnance is discovered. Sampling of stations having known or suspected (i.e., red soil or raw product) explosives >10% (100,000 mg/kg) to be performed by OE technicians following applicable OE safety requirements	Visual and instrument surveys by OE technicians
Exposure to chemicals	M	Level D PPE plus nitrile or equivalent gloves for contact with contaminated material. Wash face and hands prior to taking anything by mouth. Stay upwind of any dust-generating activities. Hazardous waste site operations training and medical clearance. Site training must include hazards and controls for site contaminants and all chemicals used on-site. MSDSs for chemical tools on-site. Chemical containers labeled to indicate contents and hazard	PID or other sampling, as appropriate
Gunfire (deer hunting with shotguns loaded with slugs allowed on Friday and Saturday during season, October and November)	L	Fieldwork will not be conducted on hunt days. Office work, sample management, and analytical work may be conducted in the Prudent staging building (Building 1036) if approved by the RVAAP environmental coordinator	None
Temperature extremes	L	Administrative controls (see Section 8.0 of FWSHP). Cooled (shaded) or warmed break area depending on the season. Routine breaks in established break area (see Section 8.0 of FWSHP). Chilled drinks if temperature exceeds 70°F	Temperature measurements at least twice daily. Pulse rates at the start of each break if wearing impermeable clothing
Biological hazards (bees, ticks, Lyme disease, histoplasmosis, wasps, snakes, West Nile Virus)	H	PPE (boots and work clothes). Insect repellant Deet ™ on boots, pants, and elsewhere, as necessary, to repel ticks and mosquitoes. Pant legs tucked into boots or otherwise closed to minimize tick entry. Snake chaps if working in overgrown areas. Inspect for ticks during the day and at the end of each workday (see Section 9.0 of FWSHP). Avoidance of accumulations of bird or bat droppings (see Section 9.0 of FWSHP)	Visual survey

Table 1-2 - Hazards Analysis (continued)

Safety and Health Hazards		Controls	Monitoring Requirements
Overall Risk Assessment Code (RAC): <u>Low Risk</u>	**RAC**	**Investigation-Derived Waste Handling**	
General hazards (lifting equipment, manual lifting, slips)	L	Level D PPE: long pants, shirts with sleeves, safety glasses, safety boots, heavy-duty gloves for materials handling, and hard hat if overhead hazards are present (see Section 5.0 of FWSHP). Buddy system. Site-specific training. Proper housekeeping. Unnecessary personnel will stay well clear of operating equipment. Functional back-up alarm on fork trucks, Bobcats, trucks, etc. Ravenna O&M contractor personnel will provide any required fork truck services in the IDW staging area (Building 1036) in accordance with their procedures. IDW movement from field sites to Building 1036 will be conducted by the drilling subcontractor using a backhoe equipped with forks and drum dollys. No personnel allowed under lifted loads. Lifts of greater than 50 lbs will be made with two or more personnel or with lifting equipment. Hazardous waste safety training. Compliance with EM 385-1-1 Sections 14 and 16	Daily safety inspections of operations. Daily inspection of equipment to verify brakes and operating systems are in proper working condition
Contact with unexploded ordnance	L	On-site training in ordnance recognition for all field personnel. Clearance of sites by OE personnel for intrusive work. Continuous escort by OE personnel if working in areas with potential for OE. Withdrawal of all non-OE personnel if ordnance or suspected ordnance is discovered	Visual and instrument surveys by OE technicians
Exposure to chemicals	L	Level D PPE plus nitrile or equivalent gloves for contact with contaminated material. Wash face and hands prior to taking anything by mouth. Hazardous waste site operation training and medical clearance. Site training must include hazards and controls for exposure to site contaminants and chemicals used on-site	Daily safety inspections
Gunfire (deer hunting with shotguns loaded with slugs allowed on Friday and Saturday during season, October and November)	L	Fieldwork will not be conducted on hunt days. Office work, sample management, and analytical work may be conducted in the Prudent staging building (Building 1036) if approved by the RVAAP environmental coordinator	None
Fire (vehicle fuels and flammable contaminants)	M	Fuels stored in safety cans with flame arrestors. Bonding (metal to metal) and grounding during fuel transfers. Fuel storage areas marked with no smoking or open flames signs. Gasoline-powered equipment will be shut down and allowed to cool for 5 min. before fueling. Fire extinguishers in all fuel use areas	Daily safety inspection
Noise	L	Hearing protection within 7.6 m (25 ft) of any noisy drum moving equipment unless equipment-specific monitoring indicates exposures less than 85 dBA	Daily safety inspections

Table 1-2 - Hazards Analysis (continued)

Safety and Health Hazards		Controls	Monitoring Requirements
Biological hazards (bees, ticks, Lyme disease, histoplasmosis, wasps, snakes, West Nile Virus)	L	PPE (boots, work clothes). Insect repellant Deet ™ on pants, boots, and elsewhere, as necessary to repel ticks and mosquitoes. Pant legs tucked into boots or otherwise closed to minimize tick entry. Snake chaps if working in overgrown areas. Inspect for ticks during the day and at the end of each workday (see Section 9.0 of FWSHP). Avoidance of accumulations of bird or bat droppings (see Section 9.0 of FWSHP)	Visual survey
Electric shock	L	Identification and clearance of overhead utilities. GFCI for all electrical hand tools	Visual survey of all work areas
Temperature extremes	L	Administrative controls (see Section 8.0 of FWSHP). Cooled (shaded) or warmed break area depending on the season. Routine breaks in established break area (see Section 8.0 of FWSHP). Chilled drinks if temperature exceeds 70°F	Temperature measurements at least twice daily. Pulse rates at the start of each break if wearing impermeable clothing
Overall Risk Assessment Code (RAC): <u>Low Risk</u>		**Equipment Decontamination (Hot Water Washing, Soap and Water Washing, HCl, and Methanol Rinse)**	
General equipment decontamination hazards (hot water, slips, falls, equipment handling)	M	Level D PPE plus nitrile or PVC gloves (see Section 5.0 of FWSHP). Face shield and Saranax or rain suit when operating steam washer. Site-specific training. Proper housekeeping	Daily safety inspection
Noise (spray washer)	L	Hearing protection when washer is operating unless equipment-specific monitoring indicates that exposure is less than 85 dBA	None
Fire (decontamination solvents and gasoline)	L	Flammable material stored in original containers or in safety cans with flame arrestors. Fire extinguisher kept near decontamination area	Daily safety inspections
Exposure to chemicals	M	Level D PPE plus nitrile or equivalent gloves for contact with contaminated material. Wash face and hands prior to taking anything by mouth. Minimal contact. Hazardous waste site operations training and medical clearance. Site training must include hazards and controls for exposure to site contaminants and chemicals used on-site. MSDSs on-site. All chemical containers labeled to indicate contents and hazard	None
Temperature extremes	L	Administrative controls (see Section 8.0 of FWSHP). Cooled (shaded) or warmed break area depending on the season. Routine breaks in established break area (see Section 8.0 of FWSHP). Chilled drinks if temperature exceeds 70°F	Temperature measurements at least twice a day. Pulse rates at the start of each break if wearing impermeable clothing

FWSHP = Facility-Wide Safety and Health Plan
PID = photoionization detector
GFCI = ground-fault circuit interrupter
PPE = personal protective equipment
HAZWOPER = Hazardous Waste Operations and Emergency Response
PVC = polyvinyl chloride
RVAAP = Ravenna Army Ammunition Plant
MSDS = Material Safety Data Sheet
NRR= Noise Reduction Rating
SSHO= Site Safety and Health Officer
O&M = operations and maintenance
OE = ordinance and explosives

Table 1-3 – Potential Exposures

Chemical[a]	TLV/PEL/STEL/IDLH[b]	Health Effects/ Potential Hazards[c]	Chemical and Physical Properties[c]	Exposure Route(s)[c]
Chromium	TLV/TWA: 0.5 mg/m^3, A4 IDLH: 25 mg/m3	Eye irritation, sensitization	Solid; properties vary depending upon specific compound	Inhalation Ingestion Contact
DNT (dinitrotoluene)	TLV/TWA: 0.2 mg/m^3, A2 IDLH: Ca [50 mg/m3]	Suspected human carcinogen, anorexia, cyanosis, reproductive effects	Orange-yellow solid, VP: 1 mm; FP: 404°F	Inhalation Absorption Ingestion Contact
Gasoline (used for fuel)	TLV/TWA: 300 ppm IDLH: Ca	Potential carcinogen per NIOSH, dizziness, eye irritation, dermatitis	Liquid with aromatic odor; FP: -45°F; VP: 38-300 mm	Inhalation Ingestion Absorption Contact
Acetone (potentially used for equipment decontamination)	TLV/TWA: 250 ppm IDLH: 2500 ppm	Irritation of eyes, nose, throat; headache, dizziness, CNS depression; dermatitis	Colorless liquid with a fragrant, mint-like odor. VP: 180 mmHg	Inhalation Ingestion
Hydrochloric acid (potentially used to preserve water samples or for equipment decontamination)	TLV: 5 ppm ceiling IDLH: 50 ppm	Irritation of eyes, skin, respiratory system	Liquid; VP: fuming; IP: 12.74 eV; FP: none	Inhalation Ingestion Contact
Isopropyl alcohol (potentially used for equipment decontamination)	TLV/TWA: 400 ppm STEL: 500 ppm IDLH: 2000 ppm	Irritation of eyes, skin, respiratory system; drowsiness, headache	Colorless liquid with alcohol odor; VP: 33 mm; IP: 10.10 eV; FP: 53°F	Inhalation Ingestion Contact
Lead	TLV/TWA: 0.05 mg/m^3, A3 PEL/TWA: 0.05 mg/m^3 IDLH: 100 mg/m3	Weakness, anorexia, abdominal pain, anemia	Solid metal; VP: 0 mm; FP: NA; IP: NA	Inhalation Ingestion Contact
Liquinox (used for decontamination)	TLV/TWA: None	Inhalation may cause local irritation to mucus membranes	Yellow odorless liquid (biodegradable cleaner); FP: NA	Inhalation Ingestion
Methanol (potentially used for equipment decontamination and sample preparation)	TLV/TWA: 200 ppm Skin notation IDLH: 6000 ppm	Irritation of eyes, skin, respiratory system; headache; optic nerve damage	Liquid; VP: 96 mm; IP: 10.84 eV; FP: 52°F	Inhalation Absorption Ingestion Contact
HMX (octogen)	TLV/TWA: None established; toxicity assumed to be similar to RDX, as compounds are very similar	Explosive, assumed irritation of eyes and skin, dizziness, weakness	Assumed similar to RDX- FP: explodes; VP: 0.0004 mm at 230°F	Assumed: Inhalation Absorption Ingestion Contact

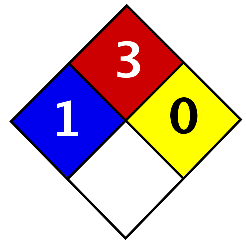
Table 1-3 – Potential Exposures (continued)

Chemical[a]	TLV/PEL/STEL/IDLH[b]	Health Effects/ Potential Hazards[c]	Chemical and Physical Properties[c]	Exposure Route(s)[c]
RDX (cyclonite)	TLV/TWA: 0.5 mg/m^3, A4 Skin notation IDLH: none established	Explosive, irritation of eyes and skin, dizziness, weakness	White powder; FP: explodes; VP: 0.0004 mm at 230°F	Inhalation Absorption Ingestion Contact
TNT (2,4,6-trinitrotoluene)	TLV/TWA: 0.5 mg/m^3 Skin notation IDLH: 500 mg/m^3	Cluster headache, irritation of skin and mucus membranes, liver damage, kidney damage	Pale solid; FP: explodes; VP: 0.0002 mm	Inhalation Absorption Ingestion Contact
HMX (octogen)	TLV/TWA: None established; toxicity assumed to be similar to RDX, as compounds are very similar	Explosive, assumed irritation of eyes and skin, dizziness, weakness	Assumed similar to RDX- FP: explodes; VP: 0.0004 mm at 230°F	Assumed: Inhalation Absorption Ingestion Contact
RDX (cyclonite)	TLV/TWA: 0.5 mg/m^3, A4 Skin notation IDLH: none established	Explosive, irritation of eyes and skin, dizziness, weakness	White powder; FP: explodes; VP: 0.0004 mm at 230°F	Inhalation Absorption Ingestion Contact
TNT (2,4,6-trinitrotoluene)	TLV/TWA: 0.5 mg/m^3 Skin notation IDLH: 500 mg/m^3	Cluster headache, irritation of skin and mucus membranes, liver damage, kidney damage	Pale solid; FP: explodes; VP: 0.0002 mm	Inhalation Absorption Ingestion Contact

[a] The potential chemicals were obtained from the Ravenna Army Ammunition Plant Phase I Remedial Investigation Report (USACE 1998).
[b] From 1999 Threshold Limit Values, NIOSH Pocket Guide to Chemical Hazards (1997).
[c] From 1997 NIOSH Pocket Guide to Chemical Hazards, the Condensed Chemical Dictionary, 10th ed.

A2 = Suspected human carcinogen
A3 = Confirmed animal carcinogen with unknown relevance to humans.
A4 = Not classifiable as a human carcinogen
FP = Flash point
IDLH = Immediately dangerous to life and health
IP = Ionization potential
NA = Not available
NIOSH = National Institute for Occupational Safety and Health
OE = Ordnance and explosives
PEL = Permissible exposure limit
PPE = Personal protective equipment
STEL = Short-term exposure limit
TLV = Threshold limit value
TWA = Time-weighted average
VP = Vapor pressure

Appendix B – Material Safety Data Sheets (MSDS)



Health	2
Fire	3
Reactivity	0
Personal Protection	H

Material Safety Data Sheet
Acetone MSDS

Section 1: Chemical Product and Company Identification

Product Name: Acetone

Catalog Codes: SLA3502, SLA1645, SLA3151, SLA3808

CAS#: 67-64-1

RTECS: AL3150000

TSCA: TSCA 8(b) inventory: Acetone

CI#: Not applicable.

Synonym: 2-propanone; Dimethyl Ketone; Dimethylformaldehyde; Pyroacetic Acid

Chemical Name: Acetone

Chemical Formula: C3-H6-O

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Acetone	67-64-1	100

Toxicological Data on Ingredients: Acetone: ORAL (LD50): Acute: 5800 mg/kg [Rat]. 3000 mg/kg [Mouse]. 5340 mg/kg [Rabbit]. VAPOR (LC50): Acute: 50100 mg/m 8 hours [Rat]. 44000 mg/m 4 hours [Mouse].

Section 3: Hazards Identification

Potential Acute Health Effects:
Hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation. Slightly hazardous in case of skin contact (permeator).

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Classified Reproductive system/toxin/female, Reproductive system/toxin/male [SUSPECTED].
The substance is toxic to central nervous system (CNS).
The substance may be toxic to kidneys, the reproductive system, liver, skin.
Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Get medical attention.

Skin Contact:
In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Cold water may be used.Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if symptoms appear.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 465°C (869°F)

Flash Points: CLOSED CUP: -20°C (-4°F). OPEN CUP: -9°C (15.8°F) (Cleveland).

Flammable Limits: LOWER: 2.6% UPPER: 12.8%

Products of Combustion: These products are carbon oxides (CO, CO2).

Fire Hazards in Presence of Various Substances: Highly flammable in presence of open flames and sparks, of heat.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available.
Slightly explosive in presence of open flames and sparks, of oxidizing materials, of acids.

Fire Fighting Media and Instructions:
Flammable liquid, soluble or dispersed in water.
SMALL FIRE: Use DRY chemical powder.
LARGE FIRE: Use alcohol foam, water spray or fog.

Special Remarks on Fire Hazards: Vapor may travel considerable distance to source of ignition and flash back.

Special Remarks on Explosion Hazards:
Forms explosive mixtures with hydrogen peroxide, acetic acid, nitric acid, nitric acid + sulfuric acid, chromic anydride, chromyl chloride, nitrosyl chloride, hexachloromelamine, nitrosyl perchlorate, nitryl perchlorate, permonosulfuric acid, thiodiglycol + hydrogen peroxide, potassium ter-butoxide, sulfur dichloride, 1-methyl-1,3-butadiene, bromoform, carbon, air, chloroform, thitriazylperchlorate.

Section 6: Accidental Release Measures

Small Spill:
Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container.

Large Spill:
Flammable liquid.
Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up.. Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, reducing agents, acids, alkalis.

Storage:
Store in a segregated and approved area (flammables area) . Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Keep away from direct sunlight and heat and avoid all possible sources of ignition (spark or flame).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 500 STEL: 750 (ppm) from ACGIH (TLV) [United States]
TWA: 750 STEL: 1000 (ppm) from OSHA (PEL) [United States]
TWA: 500 STEL: 1000 [Austalia]
TWA: 1185 STEL: 2375 (mg/m3) [Australia]
TWA: 750 STEL: 1500 (ppm) [United Kingdom (UK)]
TWA: 1810 STEL: 3620 (mg/m3) [United Kingdom (UK)]
TWA: 1800 STEL: 2400 from OSHA (PEL) [United States]Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Fruity. Mint-like. Fragrant. Ethereal

Taste: Pungent, Sweetish

Molecular Weight: 58.08 g/mole

Color: Colorless. Clear

pH (1% soln/water): Not available.

Boiling Point: 56.2°C (133.2°F)

Melting Point: -95.35 (-139.6°F)

Critical Temperature: 235°C (455°F)

Specific Gravity: 0.79 (Water = 1)

Vapor Pressure: 24 kPa (@ 20°C)

Vapor Density: 2 (Air = 1)

Volatility: Not available.

Odor Threshold: 62 ppm

Water/Oil Dist. Coeff.: The product is more soluble in water; log(oil/water) = -0.2

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water.

Solubility: Easily soluble in cold water, hot water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Excess heat, ignition sources, exposure to moisture, air, or water, incompatible materials.

Incompatibility with various substances: Reactive with oxidizing agents, reducing agents, acids, alkalis.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation.

Toxicity to Animals:
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE.
Acute oral toxicity (LD50): 3000 mg/kg [Mouse].
Acute toxicity of the vapor (LC50): 44000 mg/m3 4 hours [Mouse].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH.

DEVELOPMENTAL TOXICITY: Classified Reproductive system/toxin/female, Reproductive system/toxin/male [SUSPECTED].
Causes damage to the following organs: central nervous system (CNS).
May cause damage to the following organs: kidneys, the reproductive system, liver, skin.

Other Toxic Effects on Humans:
Hazardous in case of skin contact (irritant), of ingestion, of inhalation.
Slightly hazardous in case of skin contact (permeator).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans:
May affect genetic material (mutagenicity) based on studies with yeast (S. cerevisiae), bacteria, and hamster fibroblast cells. May cause reproductive effects (fertility) based upon animal studies.
May contain trace amounts of benzene and formaldehyde which may cancer and birth defects. Human: passes the placental barrier.

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects:
Skin: May cause skin irritation. May be harmful if absorbed through the skin.
Eyes: Causes eye irritation, characterized by a burning sensation, redness, tearing, inflammation, and possible corneal injury.
Inhalation: Inhalation at high concentrations affects the sense organs, brain and causes respiratory tract irritation. It also may affect the Central Nervous System (behavior) characterized by dizzness, drowsiness, confusion, headache, muscle weakeness, and possibly motor incoordination, speech abnormalities, narcotic effects and coma. Inhalation may also affect the gastrointestinal tract (nausea, vomiting).
Ingestion: May cause irritation of the digestive (gastrointestinal) tract (nausea, vomiting). It may also affect the Central Nevous System (behavior), characterized by depression, fatigue, excitement, stupor, coma, headache, altered sleep time, ataxia, tremors as well at the blood, liver, and urinary system (kidney, bladder, ureter) and endocrine system. May also have musculoskeletal effects.
Chronic Potential Health Effects:
Skin: May cause dermatitis.
Eyes: Eye irritation.

Section 12: Ecological Information

Ecotoxicity:
Ecotoxicity in water (LC50): 5540 mg/l 96 hours [Trout]. 8300 mg/l 96 hours [Bluegill]. 7500 mg/l 96 hours [Fatthead Minnow]. 0.1 ppm any hours [Water flea].

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The product itself and its products of degradation are not toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 3: Flammable liquid.

Identification: : Acetone UNNA: 1090 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause reproductive harm (male) which would require a warning under the statute: Benzene
California prop. 65: This product contains the following ingredients for which the State of California has found to cause birth defects which would require a warning under the statute: Benzene
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Benzene, Formaldehyde
Connecticut hazardous material survey.: Acetone
Illinois toxic substances disclosure to employee act: Acetone
Illinois chemical safety act: Acetone
New York release reporting list: Acetone
Rhode Island RTK hazardous substances: Acetone
Pennsylvania RTK: Acetone
Florida: Acetone
Minnesota: Acetone
Massachusetts RTK: Acetone
Massachusetts spill list: Acetone
New Jersey: Acetone
New Jersey spill list: Acetone
Louisiana spill reporting: Acetone
California List of Hazardous Substances (8 CCR 339): Acetone
TSCA 8(b) inventory: Acetone
TSCA 4(a) final test rules: Acetone
TSCA 8(a) IUR: Acetone

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).
EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F).
CLASS D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC):
R11- Highly flammable.
R36- Irritating to eyes.
S9- Keep container in a well-ventilated place.
S16- Keep away from sources of ignition - No smoking.
S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 1

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves.
Lab coat.
Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.
Splash goggles.

Section 16: Other Information

References:
-Material safety data sheet issued by: la Commission de la SantÃ© et de la SÃ©curitÃ© du Travail du QuÃ©bec.
-The Sigma-Aldrich Library of Chemical Safety Data, Edition II.
-Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987.
LOLI, RTECS, HSDB databases.
Other MSDSs

Other Special Considerations: Not available.

Created: 10/10/2005 08:13 PM

Last Updated: 11/06/2008 12:00 PM

LIQUI−NOX

Section 1: PRODUCT INFORMATION

Chemical family:	Detergent.
Manufacturer:	Alconox, Inc. 30 Glenn St. Suite 309 White Plains, NY 10603.
Manufacturer emergency phone number:	800−255−3924. 813−248−0573 (outside of the United States).
Supplier:	Same as manufacturer.
TDG classification:	Not regulated.
WHMIS classification:	Not controlled.
DSL status:	Not available.
Supplier MSDS date:	2008/01/07

Section 2: HAZARDOUS INGREDIENTS

C.A.S.	CONCENTRATION %	Ingredient Name	T.L.V.	LD/50	LC/50
25155−30−0	10−30	SODIUM DODECYLBENZENESULFONATE	NOT AVAILABLE	438 MG/KG RAT ORAL 1330 MG/KG MOUSE ORAL	NOT AVAILABLE

Section 3: PHYSICAL DATA

Physical state:	Liquid.
Appearance & odor:	Odourless. Pale yellow.
Odor threshold (ppm):	Not available.
Vapour pressure (mmHg):	@ 68F (20C). 17
Vapour density (air=1):	>1
Volatiles (%)	
By volume:	Not available.

Evaporation rate (butyl acetate = 1):	< 1.
Boiling point (°C):	100 (212F)
Freezing point (°C):	Not available.
pH:	8.5
Specific gravity @ 20 °C:	(water = 1). 1.083
Solubility in water (%):	Complete.
Coefficient of water\oil dist.:	Not available.
VOC:	None

Section 4: FIRE & EXPLOSION DATA

Flammability:	Not flammable.
Conditions of flammability:	Surrounding fire.
Extinguishing media:	Carbon dioxide, dry chemical, foam. Water Water fog.
Special procedures:	Self−contained breathing apparatus required. Firefighters should wear the usual protective gear. Use water spray to cool fire exposed containers.
Auto−ignition temperature:	Not available.
Flash point (°C), method:	None
Lower flammability limit (% vol):	Not applicable.
Upper flammability limit (% vol):	Not applicable.
<u>Explosion Data</u>	
Sensitivity to static discharge:	Not available.
Sensitivity to mechanical impact:	Not available.
Hazardous combustion products:	Oxides of carbon (COx). Hydrocarbons.
Explosive power:	Containers may rupture if exposed to heat or fire.

Section 5: REACTIVITY DATA

Chemical stability:	Product is stable under normal handling and storage conditions.
Conditions of instability:	Extreme temperatures.
Hazardous polymerization:	Will not occur.
Incompatible substances:	Strong acids. Strong oxidizing agents.
Hazardous decomposition products:	See hazardous combustion products.

Section 6: TOXICOLOGICAL PROPERTIES

Route of entry:	Skin contact, eye contact, inhalation and ingestion.
<u>Effects of acute exposure</u>	
Eye contact:	May cause irritation.
Skin contact:	Prolonged and repeated contact may cause irritation.
Inhalation:	May cause headache and nausea.
Ingestion:	May cause vomiting and diarrhea. May cause gastric distress.
Effects of chronic exposure:	See effects of acute exposure.
LD50 of product, species & route:	> 5000 mg/kg − rat oral.
LC50 of product, species & route:	Not available.
Exposure limit of material:	Not available.
Sensitization to product:	Not available.
Carcinogenic effects:	Not listed as a carcinogen.
Reproductive effects:	Not available.
Teratogenicity:	Not available.
Mutagenicity:	Not available.
Synergistic materials:	Not available.
Medical conditions aggravated by exposure:	Not available.

Section 7: PREVENTATIVE MEASURES

<u>Precautionary Measures</u>	
Gloves/Type:	 Wear appropriate gloves.
Respiratory/Type:	None required under normal use.
Eye/Type:	 Safety glasses recommended.
Footwear/Type:	Safety shoes per local regulations.
Clothing/Type:	As required to prevent skin contact.
Other/Type:	Eye wash facility should be in close proximity. Emergency shower should be in close proximity.
Ventilation requirements:	Local exhaust at points of emission.
Leak/Spill:	Contain the spill. Soak up with an absorbent material. Prevent entry into drains, sewers, and other waterways. Wear appropriate protective equipment. Small amounts may be flushed to sewer with water. Place in appropriate container for disposal. Notify the appropriate authorities as required.

Waste disposal:	In accordance with local and federal regulations.
Handling procedures and equipment:	Protect against physical damage. Avoid breathing vapors/mists. Wear personal protective equipment appropriate to task. Wash thoroughly after handling. Keep out of reach of children. Avoid contact with skin, eyes and clothing. Avoid extreme temperatures. Launder contaminated clothing prior to reuse.
Storage requirements:	Store away from incompatible materials. Keep containers closed when not in use.
TDG classification:	Not regulated.
Special shipping information:	Not regulated.

Section 8: FIRST AID MEASURES

Skin contact:	Remove contaminated clothing. Wash thoroughly with soap and water. Seek medical attention if irritation persists.
Eye contact:	Check for and remove contact lenses. Flush eyes with clear, running water for 15 minutes while holding eyelids open: if irritation persists, consult a physician.
Inhalation:	Remove victim to fresh air. If irritation persists, seek medical attention.
Ingestion:	Do not induce vomiting, seek medical attention. Dilute with two glasses of water. Never give anything by mouth to an unconscious person.

Section 9: ADDITIONAL INFORMATION

General note:	This material safety data sheet was prepared from information obtained from various sources, including product suppliers and the Canadian Center for Occupational Health and Safety.

EMERGENCY OVERVIEW
DANGER!
EXTREMELY FLAMMABLE - EYE AND MUCOUS MEMBRANE IRRITANT - EFFECTS CENTRAL NERVOUS SYSTEM - HARMFUL OR FATAL IF SWALLOWED - ASPIRATION HAZARD

NFPA 704 (Section 16)

High fire hazard. Keep away from heat, spark, open flame, and other ignition sources.

If ingested, do NOT induce vomiting, as this may cause chemical pneumonia (fluid in the lungs). Contact may cause eye, skin and mucous membrane irritation. Harmful if absorbed through the skin. Avoid prolonged breathing of vapors or mists. Inhalation may cause irritation, anesthetic effects (dizziness, nausea, headache, intoxication), and respiratory system effects.

Long-term exposure may cause effects to specific organs, such as to the liver, kidneys, blood, nervous system, and skin. Contains benzene, which can cause blood disease, including anemia and leukemia.

1. CHEMICAL PRODUCT and COMPANY INFORMATION (rev. Jan-04)

Amerada Hess Corporation
1 Hess Plaza
Woodbridge, NJ 07095-0961

EMERGENCY TELEPHONE NUMBER (24 hrs):	**CHEMTREC (800)424-9300**
COMPANY CONTACT (business hours):	Corporate Safety (732)750-6000
MSDS Internet Website	www.hess.com/about/environ.html

SYNONYMS: Hess Conventional (Oxygenated and Non-oxygenated) Gasoline; Reformulated Gasoline (RFG); Reformulated Gasoline Blendstock for Oxygenate Blending (RBOB); Unleaded Motor or Automotive Gasoline

See Section 16 for abbreviations and acronyms.

2. COMPOSITION and INFORMATION ON INGREDIENTS * (rev. Jan-04)

INGREDIENT NAME (CAS No.)	CONCENTRATION PERCENT BY WEIGHT
Gasoline (86290-81-5)	100
Benzene (71-43-2)	0.1 - 4.9 (0.1 - 1.3 reformulated gasoline)
n-Butane (106-97-8)	< 10
Ethyl Alcohol (Ethanol) (64-17-5)	0 - 10
Ethyl benzene (100-41-4)	< 3
n-Hexane (110-54-3)	0.5 to 4
Methyl-tertiary butyl ether (MTBE) (1634-04-4)	0 to 15.0
Tertiary-amyl methyl ether (TAME) (994-05-8)	0 to 17.2
Toluene (108-88-3)	1 - 25
1,2,4- Trimethylbenzene (95-63-6)	< 6
Xylene, mixed isomers (1330-20-7)	1 - 15

A complex blend of petroleum-derived normal and branched-chain alkane, cycloalkane, alkene, and aromatic hydrocarbons. May contain antioxidant and multifunctional additives. Non-oxygenated Conventional Gasoline and RBOB do not have oxygenates (Ethanol or MTBE and/or TAME). Oxygenated Conventional and Reformulated Gasoline will have oxygenates for octane enhancement or as legally required.

3. HAZARDS IDENTIFICATION (rev. Dec-97)

EYES

Moderate irritant. Contact with liquid or vapor may cause irritation.

SKIN

Practically non-toxic if absorbed following acute (single) exposure. May cause skin irritation with prolonged or repeated contact. Liquid may be absorbed through the skin in toxic amounts if large areas of skin are exposed repeatedly.

INGESTION

The major health threat of ingestion occurs from the danger of aspiration (breathing) of liquid drops into the lungs, particularly from vomiting. Aspiration may result in chemical pneumonia (fluid in the lungs), severe lung damage, respiratory failure and even death.

Ingestion may cause gastrointestinal disturbances, including irritation, nausea, vomiting and diarrhea, and central nervous system (brain) effects similar to alcohol intoxication. In severe cases, tremors, convulsions, loss of consciousness, coma, respiratory arrest, and death may occur.

INHALATION

Excessive exposure may cause irritations to the nose, throat, lungs and respiratory tract. Central nervous system (brain) effects may include headache, dizziness, loss of balance and coordination, unconsciousness, coma, respiratory failure, and death.

WARNING: the burning of any hydrocarbon as a fuel in an area without adequate ventilation may result in hazardous levels of combustion products, including carbon monoxide, and inadequate oxygen levels, which may cause unconsciousness, suffocation, and death.

CHRONIC EFFECTS and CARCINOGENICITY

Contains benzene, a regulated human carcinogen. Benzene has the potential to cause anemia and other blood diseases, including leukemia, after repeated and prolonged exposure. Exposure to light hydrocarbons in the same boiling range as this product has been associated in animal studies with systemic toxicity. See also Section 11 - Toxicological Information.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE

Irritation from skin exposure may aggravate existing open wounds, skin disorders, and dermatitis (rash). Chronic respiratory disease, liver or kidney dysfunction, or pre-existing central nervous system disorders may be aggravated by exposure.

4. FIRST AID MEASURES (rev. Dec-97)

EYES

In case of contact with eyes, immediately flush with clean, low-pressure water for at least 15 min. Hold eyelids open to ensure adequate flushing. Seek medical attention.

SKIN

Remove contaminated clothing. Wash contaminated areas thoroughly with soap and water or waterless hand cleanser. Obtain medical attention if irritation or redness develops.

INGESTION

DO NOT INDUCE VOMITING. Do not give liquids. Obtain immediate medical attention. If spontaneous vomiting occurs, lean victim forward to reduce the risk of aspiration. Small amounts of material which enter the mouth should be rinsed out until the taste is dissipated.

INHALATION

Remove person to fresh air. If person is not breathing, ensure an open airway and provide artificial respiration. If necessary, provide additional oxygen once breathing is restored if trained to do so. Seek medical attention immediately.

5. FIRE FIGHTING MEASURES (rev. Dec-97)

FLAMMABLE PROPERTIES:

FLASH POINT:	-45 °F (-43°C)
AUTOIGNITION TEMPERATURE:	highly variable; > 530 °F (>280 °C)
OSHA/NFPA FLAMMABILITY CLASS:	1A (flammable liquid)
LOWER EXPLOSIVE LIMIT (%):	1.4%
UPPER EXPLOSIVE LIMIT (%):	7.6%

FIRE AND EXPLOSION HAZARDS

Vapors may be ignited rapidly when exposed to heat, spark, open flame or other source of ignition. Flowing product may be ignited by self-generated static electricity. When mixed with air and exposed to an ignition source, flammable vapors can burn in the open or explode in confined spaces. Being heavier than air, vapors may travel long distances to an ignition source and flash back. Runoff to sewer may cause fire or explosion hazard.

EXTINGUISHING MEDIA

SMALL FIRES: Any extinguisher suitable for Class B fires, dry chemical, CO2, water spray, fire fighting foam, or Halon.

LARGE FIRES: Water spray, fog or fire fighting foam. Water may be ineffective for fighting the fire, but may be used to cool fire-exposed containers.

During certain times of the year and/or in certain geographical locations, gasoline may contain MTBE and/or TAME. Firefighting foam suitable for polar solvents is recommended for fuel with greater than 10% oxygenate concentration - refer to NFPA 11 "Low Expansion Foam - 1994 Edition."

FIRE FIGHTING INSTRUCTIONS

Small fires in the incipient (beginning) stage may typically be extinguished using handheld portable fire extinguishers and other fire fighting equipment.

Firefighting activities that may result in potential exposure to high heat, smoke or toxic by-products of combustion should require NIOSH/MSHA- approved pressure-demand self-contained breathing apparatus with full facepiece and full protective clothing.

Isolate area around container involved in fire. Cool tanks, shells, and containers exposed to fire and excessive heat with water. For massive fires the use of unmanned hose holders or monitor nozzles may be advantageous to further minimize personnel exposure. Major fires may require withdrawal, allowing the tank to burn. Large storage tank fires typically require specially trained personnel and equipment to extinguish the fire, often including the need for properly applied fire fighting foam.

See Section 16 for the NFPA 704 Hazard Rating.

6. ACCIDENTAL RELEASE MEASURES (rev. Dec-97)

ACTIVATE FACILITY SPILL CONTINGENCY or EMERGENCY PLAN.

Evacuate nonessential personnel and remove or secure all ignition sources. Consider wind direction; stay upwind and uphill, if possible. Evaluate the direction of product travel, diking, sewers, etc. to confirm spill areas. Spills may infiltrate subsurface soil and groundwater; professional assistance may be necessary to determine the extent of subsurface impact.

Carefully contain and stop the source of the spill, if safe to do so. Protect bodies of water by diking, absorbents, or absorbent boom, if possible. Do not flush down sewer or drainage systems, unless system is designed and permitted to handle such material. The use of fire fighting foam may be useful in certain situations to reduce vapors. The proper use of water spray may effectively disperse product vapors or the liquid itself, preventing contact with ignition sources or areas/equipment that require protection.

Take up with sand or other oil absorbing materials. Carefully shovel, scoop or sweep up into a waste container for reclamation or disposal - caution, flammable vapors may accumulate in closed containers. Response and clean-up crews must be properly trained and must utilize proper protective equipment (see Section 8).

7. HANDLING and STORAGE (rev. Dec-97)

HANDLING PRECAUTIONS

******USE ONLY AS A MOTOR FUEL******

******DO NOT SIPHON BY MOUTH******

Handle as a flammable liquid. Keep away from heat, sparks, and open flame! Electrical equipment should be approved for classified area. Bond and ground containers during product transfer to reduce the possibility of static-initiated fire or explosion.

Special slow load procedures for "switch loading" must be followed to avoid the static ignition hazard that can exist when higher flash point material (such as fuel oil) is loaded into tanks previously containing low flash point products (such as this product) - see API Publication 2003, "Protection Against Ignitions Arising Out Of Static, Lightning and Stray Currents.

STORAGE PRECAUTIONS

Keep away from flame, sparks, excessive temperatures and open flame. Use approved vented containers. Keep containers closed and clearly labeled. Empty product containers or vessels may contain explosive vapors. Do not pressurize, cut, heat, weld or expose such containers to sources of ignition.

Store in a well-ventilated area. This storage area should comply with NFPA 30 "Flammable and Combustible Liquid Code". Avoid storage near incompatible materials. The cleaning of tanks previously containing this product should follow API Recommended Practice (RP) 2013 "Cleaning Mobile Tanks In Flammable and Combustible Liquid Service" and API RP 2015 "Cleaning Petroleum Storage Tanks".

WORK/HYGIENIC PRACTICES

Emergency eye wash capability should be available in the near proximity to operations presenting a potential splash exposure. Use good personal hygiene practices. Avoid repeated and/or prolonged skin exposure. Wash hands before eating, drinking, smoking, or using toilet facilities. Do not use as a cleaning solvent on the skin. Do not use solvents or harsh abrasive skin cleaners for washing this product from exposed skin areas. Waterless hand cleaners are effective. Promptly remove contaminated clothing and launder before reuse. Use care when laundering to prevent the formation of flammable vapors which could ignite via washer or dryer. Consider the need to discard contaminated leather shoes and gloves.

8. EXPOSURE CONTROLS and PERSONAL PROTECTION (rev. Jan-04)

EXPOSURE LIMITS

Component (CAS No.)	Exposure Limits			
	Source	TWA (ppm)	STEL (ppm)	Note
Gasoline (86290-81-5)	ACGIH	300	500	A3
Benzene (71-43-2)	OSHA	1	5	Carcinogen
	ACGIH	0.5	2.5	A1, skin
	USCG	1	5	
n-Butane (106-97-8)	ACGIH	800	--	2003 NOIC: 1000 ppm (TWA) Aliphatic Hydrocarbon Gases Alkane (C1-C4)
Ethyl Alcohol (ethanol) (64-17-5)	OSHA	1000	--	
	ACGIH	1000	--	A4
Ethyl benzene (100-41-4)	OSHA	100	--	
	ACGIH	100	125	A3

Component (CAS No.)	Source	TWA (ppm)	STEL (ppm)	Exposure Limits Note
Methyl tertiary-butyl ether [MTBE] (1634-04-4)	OSHA	500	–	
	ACGIH	50	–	skin
	ACGIH	50		A3
Tertiary-amyl methyl ether [TAME] (994-05-8)				None established
Toluene (108-88-3)	OSHA	200		Ceiling: 300 ppm; Peak: 500 ppm (10 min.)
	ACGIH	50	–	A4 (skin)
1,2,4-Trimethylbenzene (95-63-6)	ACGIH	25	–	
Xylene, mixed isomers (1330-20-7)	OSHA	100	–	
	ACGIH	100	150	A4

ENGINEERING CONTROLS

Use adequate ventilation to keep vapor concentrations of this product below occupational exposure and flammability limits, particularly in confined spaces.

EYE/FACE PROTECTION

Safety glasses or goggles are recommended where there is a possibility of splashing or spraying.

SKIN PROTECTION

Gloves constructed of nitrile or neoprene are recommended. Chemical protective clothing such as that made of of E.I. DuPont Tychem ®, products or equivalent is recommended based on degree of exposure.

Note: The resistance of specific material may vary from product to product as well as with degree of exposure. Consult manufacturer specifications for further information.

RESPIRATORY PROTECTION

A NIOSH-approved air-purifying respirator with organic vapor cartridges or canister may be permissible under certain circumstances where airborne concentrations are or may be expected to exceed exposure limits or for odor or irritation. Protection provided by air-purifying respirators is limited. Refer to OSHA 29 CFR 1910.134, NIOSH Respirator Decision Logic, and the manufacturer for additional guidance on respiratory protection selection and limitations.

Use a positive pressure, air-supplied respirator if there is a potential for uncontrolled release, exposure levels are not known, in oxygen-deficient atmospheres, or any other circumstance where an air-purifying respirator may not provide adequate protection.

9. PHYSICAL and CHEMICAL PROPERTIES (rev. Jan-04)

APPEARANCE

A translucent, straw-colored or light yellow liquid

ODOR

A strong, characteristic aromatic hydrocarbon odor. Oxygenated gasoline with MTBE and/or TAME may have a sweet, ether-like odor and is detectable at a lower concentration than non-oxygenated gasoline.

ODOR THRESHOLD

	Odor Detection	Odor Recognition
Non-oxygenated gasoline:	0.5 - 0.6 ppm	0.8 - 1.1 ppm
Gasoline with 15% MTBE:	0.2 - 0.3 ppm	0.4 - 0.7 ppm
Gasoline with 15% TAME:	0.1 ppm	0.2 ppm

BASIC PHYSICAL PROPERTIES

BOILING RANGE:	85 to 437 °F (39 to 200 °C)
VAPOR PRESSURE:	6.4 - 15 RVP @ 100 °F (38 °C) (275-475 mm Hg @ 68 °F (20 °C)
VAPOR DENSITY (air = 1):	AP 3 to 4
SPECIFIC GRAVITY (H_2O = 1):	0.70 – 0.78
EVAPORATION RATE:	10-11 (n-butyl acetate = 1)
PERCENT VOLATILES:	100 %

SOLUBILITY (H_2O): Non-oxygenated gasoline - negligible (< 0.1% @ 77 °F). Gasoline with 15% MTBE - slight (0.1 - 3% @ 77 °F); ethanol is readily soluble in water

10. STABILITY and REACTIVITY (rev. Dec-94)

STABILITY: Stable. Hazardous polymerization will not occur.

CONDITIONS TO AVOID

Avoid high temperatures, open flames, sparks, welding, smoking and other ignition sources

INCOMPATIBLE MATERIALS

Keep away from strong oxidizers.

HAZARDOUS DECOMPOSITION PRODUCTS

Carbon monoxide, carbon dioxide and non-combusted hydrocarbons (smoke). Contact with nitric and sulfuric acids will form nitrocresols that can decompose violently.

11. TOXICOLOGICAL PROPERTIES (rev. Dec-97)

ACUTE TOXICITY

Acute Dermal LD50 (rabbits): > 5 ml/kg

Acute Oral LD50 (rat): 18.75 ml/kg

Primary dermal irritation (rabbits): slightly irritating

Draize eye irritation (rabbits): non-irritating

Guinea pig sensitization: negative

CHRONIC EFFECTS AND CARCINOGENICITY

Carcinogenicity: OSHA: NO IARC: YES - 2B NTP: NO ACGIH: YES (A3)

IARC has determined that gasoline and gasoline exhaust are possibly carcinogenic in humans. Inhalation exposure to completely vaporized unleaded gasoline caused kidney cancers in male rats and liver tumors in female mice. The U.S. EPA has determined that the male kidney tumors are species-specific and are irrelevant for human health risk assessment. The significance of the tumors seen in female mice is not known. Exposure to light hydrocarbons in the same boiling range as this product has been associated in animal studies with effects to the central and peripheral nervous systems, liver, and kidneys. The significance of these animal models to predict similar human response to gasoline is uncertain.

This product contains benzene. Human health studies indicate that prolonged and/or repeated overexposure to benzene may cause damage to the blood-forming system (particularly bone marrow), and serious blood disorders such as aplastic anemia and leukemia. Benzene is listed as a human carcinogen by the NTP, IARC, OSHA and ACGIH.

This product may contain methyl tertiary butyl ether (MTBE): animal and human health effects studies indicate that MTBE may cause eye, skin, and respiratory tract irritation, central nervous system depression and neurotoxicity. MTBE is classified as an animal carcinogen (A3) by the ACGIH.

12. ECOLOGICAL INFORMATION (rev. Jan-04)

Keep out of sewers, drainage areas and waterways. Report spills and releases, as applicable, under Federal and State regulations. If released, oxygenates such as ethers and alcohols will be expected to exhibit fairly high mobility in soil, and therefore may leach into groundwater. The API (www.api.org) provides a number of useful references addressing petroleum and oxygenate contamination of groundwater.

13. DISPOSAL CONSIDERATIONS (rev. Dec-97)

Consult federal, state and local waste regulations to determine appropriate disposal options.

14. TRANSPORTATION INFORMATION (rev. Jan-04)

PLACARD:

DOT PROPER SHIPPING NAME:	Gasoline
DOT HAZARD CLASS and PACKING GROUP:	3, PG II
DOT IDENTIFICATION NUMBER:	UN 1203
DOT SHIPPING LABEL:	FLAMMABLE LIQUID

15. REGULATORY INFORMATION (rev. Jan-04)

U.S. FEDERAL, STATE, and LOCAL REGULATORY INFORMATION

This product and its constituents listed herein are on the EPA TSCA Inventory. Any spill or uncontrolled release of this product, including any substantial threat of release, may be subject to federal, state and/or local reporting requirements. This product and/or its constituents may also be subject to other federal, state, or local regulations; consult those regulations applicable to your facility/operation.

CLEAN WATER ACT (OIL SPILLS)

Any spill or release of this product to "navigable waters" (essentially any surface water, including certain wetlands) or adjoining shorelines sufficient to cause a visible sheen or deposit of a sludge or emulsion must be reported immediately to the National Response Center (1-800-424-8802) or, if not practical, the U.S. Coast Guard with follow-up to the National Response Center, as required by U.S. Federal Law. Also contact appropriate state and local regulatory agencies as required.

CERCLA SECTION 103 and SARA SECTION 304 (RELEASE TO THE ENVIRONMENT)

The CERCLA definition of hazardous substances contains a "petroleum exclusion" clause which exempts crude oil, refined, and unrefined petroleum products and any indigenous components of such. However, other federal reporting requirements (e.g., SARA Section 304 as well as the Clean Water Act if the spill occurs on navigable waters) may still apply.

SARA SECTION 311/312 - HAZARD CLASSES

ACUTE HEALTH	CHRONIC HEALTH	FIRE	SUDDEN RELEASE OF PRESSURE	REACTIVE
X	X	X	--	--

SARA SECTION 313 - SUPPLIER NOTIFICATION

This product contains the following toxic chemicals subject to the reporting requirements of section 313 of the Emergency Planning and Community Right-To-Know Act (EPCRA) of 1986 and of 40 CFR 372:

INGREDIENT NAME (CAS NUMBER)	CONCENTRATION WT. PERCENT
Benzene (71-43-2)	0.1 to 4.9 (0.1 to 1.3 for reformulated gasoline)
Ethyl benzene (100-41-4)	< 3
n-Hexane (110-54-3)	0.5 to 4
Methyl-tertiary butyl ether (MTBE) (1634-04-4)	0 to 15.0
Toluene (108-88-3)	1 to 15
1,2,4- Trimethylbenzene (95-63-6)	< 6
Xylene, mixed isomers (1330-20-7)	1 to 15

US EPA guidance documents (www.epa.gov/tri) for reporting Persistent Bioaccumulating Toxics (PBTs) indicate this product may contain the following deminimis levels of toxic chemicals subject to Section 313 reporting:

INGREDIENT NAME (CAS NUMBER)	CONCENTRATION - Parts per million (ppm) by weight
Polycyclic aromatic compounds (PACs)	17
Benzo (g,h,i) perylene (191-24-2)	2.55
Lead (7439-92-1)	0.079

CANADIAN REGULATORY INFORMATION (WHMIS)

Class B, Division 2 (Flammable Liquid)
Class D, Division 2A (Very toxic by other means) and Class D, Division 2B (Toxic by other means)

16. OTHER INFORMATION (rev. Jan-04)

NFPA® HAZARD RATING	HEALTH:	1	Slight
	FIRE:	3	Serious
	REACTIVITY:	0	Minimal
HMIS® HAZARD RATING	HEALTH:	1 *	Slight
	FIRE:	3	Serious
	REACTIVITY:	0	Minimal
	* CHRONIC		

SUPERSEDES MSDS DATED: 12/30/97

ABBREVIATIONS:

AP = Approximately	< = Less than	> = Greater than
N/A = Not Applicable	N/D = Not Determined	ppm = parts per million

ACRONYMS:

ACGIH	American Conference of Governmental Industrial Hygienists
AIHA	American Industrial Hygiene Association
ANSI	American National Standards Institute (212)642-4900
API	American Petroleum Institute (202)682-8000
CERCLA	Comprehensive Emergency Response, Compensation, and Liability Act
DOT	U.S. Department of Transportation [General Info: (800)467-4922]
EPA	U.S. Environmental Protection Agency
HMIS	Hazardous Materials Information System
IARC	International Agency For Research On Cancer
MSHA	Mine Safety and Health Administration
NFPA	National Fire Protection Association (617)770-3000
NIOSH	National Institute of Occupational Safety and Health
NOIC	Notice of Intended Change (proposed change to ACGIH TLV)
NTP	National Toxicology Program
OPA	Oil Pollution Act of 1990
OSHA	U.S. Occupational Safety & Health Administration
PEL	Permissible Exposure Limit (OSHA)
RCRA	Resource Conservation and Recovery Act
REL	Recommended Exposure Limit (NIOSH)
SARA	Superfund Amendments and Reauthorization Act of 1986 Title III
SCBA	Self-Contained Breathing Apparatus
SPCC	Spill Prevention, Control, and Countermeasures
STEL	Short-Term Exposure Limit (generally 15 minutes)
TLV	Threshold Limit Value (ACGIH)
TSCA	Toxic Substances Control Act
TWA	Time Weighted Average (8 hr.)
WEEL	Workplace Environmental Exposure Level (AIHA)
WHMIS	Workplace Hazardous Materials Information System (Canada)

DECON-AHOL WFI® 70%

Sterile Pharmaceutical Clean Room Formula

USP Isopropyl Alcohol with Water for Injection (WFI)

MATERIAL SAFETY DATA SHEET

COMPLIES WITH OSHA HAZARD COMMUNICATION STANDARD 29 CFR 1910.1200
(Complies with Commission Directive 91/155/EEC amended by 2001/58/EC)

Veltek Associates, Inc.
15 Lee Boulevard, Malvern, PA 19355-1234
Tel: 610-644-8335 Fax: 610-644-8336
www.sterile.com

* * * Section 1 - Chemical Product and Company Identification * * *

Chemical Name: USP Isopropyl Alcohol with USP Water for Injection
Product Use: Decontaminant.
Manufacturer Information
Veltek Associates, Inc.
15 Lee Blvd.
Malvern, PA 19355-1234

Phone: 610-644-8335

Emergency # 24 Hr CHEMTREC U.S. (800) 424-9300

* * * Section 2 - Hazards Identification * * *

Emergency Overview

Flammable liquid and vapor. Vapor may cause flash fire. This product may be irritating to the eyes, skin, gastrointestinal tract and respiratory system. May cause central nervous system depression.

Potential Health Effects: Eyes

This product may cause irritation to the eyes.

Potential Health Effects: Skin

This product may cause irritation to the skin.

Potential Health Effects: Ingestion

Ingestion of this product may result in central nervous system effects including headache, sleepiness, dizziness, slurred speech and blurred vision.

Potential Health Effects: Inhalation

May cause irritation to the nose and respiratory tract. Inhalation may cause central nervous system depression with symptoms such as weakness, dizziness, confusion and drowsiness.

Medical Conditions Aggravated by Exposure

Persons with pre-existing skin, eye and respiratory disorders may be aggravated by exposure to isopropyl alcohol component.

HMIS Ratings: Health: 1 **Fire:** 3 **Physical Hazard:** 0
Hazard Scale: 0 = Minimal 1 = Slight 2 = Moderate 3 = Serious 4 = Severe * = Chronic hazard

* * * Section 3 - Composition / Information on Ingredients * * *

CAS #	Component	Percent
67-63-0	Isopropyl alcohol	60-91
7732-18-5	USP Water for Injection	9-40

Component Information/Information on Non-Hazardous Components

This product is considered hazardous under 29 CFR 1910.1200 (Hazard Communication). This is a controlled product according to Canada's Controlled Product Regulation.

*Though the range is outside acceptable WHMIS limits, the range stated on this MSDS is the actual range within which this component varies between formulations of this product.

* * * Section 4 - First Aid Measures * * *

First Aid: Eyes

Immediately flush eyes with water for at least 15 minutes, while holding eyelids open. Seek medical attention at once.

First Aid: Skin

For skin contact flush with large amounts of water while removing contaminated clothing. Wash contaminated clothing before reuse. If irritation persists, get medical attention.

First Aid: Ingestion

Do not induce vomiting. If ingestion of a large amount does occur, seek medical attention.

First Aid: Inhalation

If inhaled, immediately remove the affected person to fresh air. Give artificial respiration if not breathing. Call a physician immediately.

First Aid: Notes to Physician

Do not induce vomiting. First, contact poison control center, treatment depends on volume of substance and time elapsed.

* * * Section 5 - Fire Fighting Measures * * *

General Fire Hazards

See Section 9 for Flammability Properties.

Severe fire hazard. Vapors are heavier than air and may travel along the ground to some distant source of ignition and flash back. Vapor/air mixtures are explosive.

Hazardous Combustion Products

Oxides of carbon.

Extinguishing Media

Dry chemical, alcohol-resistant foam, carbon dioxide, water fog.

Fire Fighting Equipment/Instructions

Firefighters should wear full protective clothing including self contained breathing apparatus. Clear area of unprotected personnel. Move container from area if it can be done without risk. Cool containers with water spray until well after fire is out to prevent vapor build up, which could result in container rupture.

NFPA Ratings: Health: 1 **Fire:** 3 **Reactivity:** 0
Hazard Scale: 0 = Minimal 1 = Slight 2 = Moderate 3 = Serious 4 = Severe

* * * Section 6 - Accidental Release Measures * * *

Containment Procedures

Stop the flow of material, if this is without risk. Reduce vapors with water spray. Eliminate all sources of ignition or flammables that may come into contact with a spill of this material. Equipment must be grounded to prevent sparking.

Clean-Up Procedures

Absorb spill with inert material. Shovel material into appropriate container for disposal.

Evacuation Procedures

Isolate area. Keep unnecessary personnel away.

Special Procedures

Regulations vary. Consult local authorities before disposal.

* * * Section 7 - Handling and Storage * * *

Handling Procedures

Avoid getting this material into contact with your skin and eyes. Use non-sparking tools when opening or closing large containers.

Storage Procedures

Keep the container tightly closed and in a cool, well-ventilated place. Eliminate all sources of ignition. Do not store, incinerate, or heat this material above 120 degrees Fahrenheit. Keep away from incompatible materials.

* * * Section 8 - Exposure Controls / Personal Protection * * *

A: Component Exposure Limits

Isopropyl alcohol (67-63-0)

ACGIH:	200 ppm TWA 400 ppm STEL
OSHA:	400 ppm TWA; 980 mg/m3 TWA 500 ppm STEL; 1225 mg/m3 STEL
NIOSH:	400 ppm TWA; 980 mg/m3 TWA 500 ppm STEL; 1225 mg/m3 STEL

Engineering Controls

Explosion proof exhaust ventilation should be used.

PERSONAL PROTECTIVE EQUIPMENT

Personal Protective Equipment: Eyes/Face

Wear chemical goggles; face shield (if splashing is possible).

Personal Protective Equipment: Skin

Use impervious gloves.

Personal Protective Equipment: Respiratory

Use a NIOSH approved HEPA filter, or supplied air respirators when exposures reach the OSHA established PELs.

Personal Protective Equipment: General

Eye wash fountain and emergency showers are recommended.

* * * Section 9 - Physical & Chemical Properties * * *

Appearance:	Clear, colorless liquid	**Odor:**	Mild alcohol
Physical State:	Liquid	**pH:**	7.0
Vapor Pressure:	28 torr @20°C	**Vapor Density:**	1.6 (air=1)
Boiling Point:	170°F (77°C)	**Melting Point:**	Not available
Solubility (H2O):	Complete	**Specific Gravity:**	0.8272-0.883 (H2O=1)
Freezing Point:	14°F (-10°C)	**Evaporation Rate:**	1.7 (Butyl Acetate=1)
VOC:	Not available	**Octanol/H2O Coeff.:**	Not available
Upper Flammability Limit (UFL):	12% (% volume in air)	**Lower Flammability Limit (LFL):**	2% (% volume in air)
Flash Point:	70°F (22°C)	**Auto Ignition:**	Not available

* * * Section 10 - Chemical Stability & Reactivity Information * * *

Chemical Stability

Stable under normal conditions.

Chemical Stability: Conditions to Avoid

Keep away from heat, ignition sources and incompatible materials.

Incompatibility

Acids, metals, oxidizing materials, combustible materials, halogens, peroxides, bases, metal salts.

Hazardous Decomposition

Oxides of carbon.

Possibility of Hazardous Reactions

Will not occur.

* * * Section 11 - Toxicological Information * * *

Acute Dose Effects

A: General Product Information

Excessive inhalation or ingestion of this material may cause central nervous system depression. Symptoms include headache, dizziness, nausea and incoordination. May cause irritation of the eyes, skin, gastrointestinal tract or respiratory system.

B: Component Analysis - LD50/LC50

Isopropyl alcohol (67-63-0)

Inhalation LC50 Rat: 16000 mg/kg/8H; Oral LD50 Rat: 5045 mg/kg; Oral LD50 Mouse: 3600 mg/kg; Dermal LD50 Rabbit: 12800 mg/kg

Carcinogenicity

A: General Product Information

No carcinogenicity data available for this product.

B: Component Carcinogenicity

Isopropyl alcohol (67-63-0)

ACGIH: A4 - Not Classifiable as a Human Carcinogen

IARC: Monograph 71, 1999; Supplement 7, 1987; Monograph 15, 1977 (Group 3 (not classifiable))

Target Organ Effects

Central Nervous System (CNS).

* * * Section 12 - Ecological Information * * *

Ecotoxicity

A: General Product Information

No information available for the product.

B: Component Analysis - Ecotoxicity - Aquatic Toxicity

Isopropyl alcohol (67-63-0)

Test & Species		Conditions
96 Hr LC50 fathead minnow (29 days old)	94900 mg/L	flow-through
96 Hr LC50 fathead minnow (31 days old)	61200 mg/L	flow-through
5 min EC50 Photobacterium phosphoreum	35390 mg/L	

* * * Section 13 - Disposal Considerations * * *

US EPA Waste Number & Descriptions

A: General Product Information

No additional information available.

B: Component Waste Numbers

No EPA Waste Numbers are applicable for this product's components.

Disposal Instructions

Dispose of waste material according to Local, State, Federal, and Provincial Environmental Regulations. If discarded, this product is considered a RCRA ignitable waste, D001.

See Section 7 for Handling Procedures. See Section 8 for Personal Protective Equipment recommendations.

* * * Section 14 - Transportation Information * * *

US DOT Information

Shipping Name: Isopropanol
UN/NA #: UN1219 **Hazard Class:** 3 **Packing Group:** II
Required Label(s): Flammable Liquid

TDG Information

Shipping Name: Isopropanol
UN/NA #: UN1219 **Hazard Class:** 3 **Packing Group:** II
Required Label(s): Flammable Liquid

IMDG Information

Shipping Name: Isopropanol
UN/NA #: UN1219 **Hazard Class:** 3 **Packing Group:** II
Required Label(s): Flammable Liquid

IATA/ICAO Information

Shipping Name: Isopropanol
UN/NA#: UN1219 **Hazard Class:** 3 **Packing Group:** II
Hazard Labels: Flammable Liquid

* * * Section 15 - Regulatory Information * * *

US Federal Regulations

A: General Product Information

All components are on the U.S. EPA TSCA Inventory List.

B: Component Analysis

This material contains one or more of the following chemicals required to be identified under SARA Section 302 (40 CFR 355 Appendix A), SARA Section 313 (40 CFR 372.65) and/or CERCLA (40 CFR 302.4).

Isopropyl alcohol (67-63-0)

SARA 313: 1.0 % de minimis concentration (only if manufactured by the strong acid process, no supplier notification)

State Regulations

A: General Product Information

Other state regulations may apply. Check individual state requirements.

B: Component Analysis - State

The following components appear on one or more of the following state hazardous substances lists:

Component	CAS	CA	MA	MN	NJ	PA	RI
Isopropyl alcohol	67-63-0	Yes	Yes	Yes	Yes	Yes	Yes

Canadian WHMIS Information

A: General Product Information

WHMIS Classification: B2- Flammable Liquid, D2B- Toxic Material

B: Component Analysis - WHMIS IDL

The following components are identified under the Canadian Hazardous Products Act Ingredient Disclosure List:

Component	CAS #	Minimum Concentration
Isopropyl alcohol	67-63-0	1 % (English Item 904, French Item 1050)

Additional Regulatory Information

A: General Product Information

No additional information available.

B: Component Analysis - Inventory

Component	CAS #	TSCA	CAN	EEC
Isopropyl alcohol	67-63-0	Yes	DSL	EINECS
USP Water for Injection	7732-18-5	Yes	DSL	EINECS

* * * Section 16 - Other Information * * *

Other Information

No additional information available.

MSDS History

New MSDS: 11 January 2005.

Key/Legend

ACGIH = American Conference of Governmental Industrial Hygienists; CERCLA = Comprehensive Environmental Response, Compensation and Liability Act; CFR = Code of Federal Regulations; CNS = Central Nervous System; DSL = Domestic Substances List; EINECS = European Inventory of Existing Commercial Chemical Substances; EPA = Environmental Protection Agency; HEPA = High Efficiency Particulate Air filters; IARC = International Agency for Research on Cancer; LC50 = Lethal Concentration 50%; LD50 = Lethal Dose 50%; NIOSH = National Institute for Occupational Safety and Health; NJTSR = New Jersey Trade Secret Registry; NTP = National Toxicology Program; OSHA = Occupational Safety and Health Administration; PEL = Permissible Exposure Limit; RCRA = Resource Conservation and Recovery Act; SARA = Superfund Amendments and Reauthorization Act; STEL = Short Term Exposure Limit; TDG = Transport Dangerous Goods TSCA = Toxic Substance Control Act; TWA = Time Weighted Average; WHMIS = Workplace Hazardous Materials Information System.

Contact: Arthur Vellutato, Sr., President
Contact Phone: 610-644-8335

This is the end of MSDS # VEL-104-NONAEROSOL

MATERIAL SAFETY DATA SHEET

This Material Safety Data Sheet complies with the Canadian Controlled Product Regulations and the United States Occupational Safety and Health Administration (OSHA) hazard communication standard.

1. Product and Supplier Identification

Product: **Methanol (CH_3OH)**

Synonyms: Methyl alcohol, methyl hydrate, wood spirit, methyl hydroxide

Product Use: Solvent, fuel, feedstock

Company Identification: **Methanex Corporation, 1800 Waterfront Centre, 200 Burrard Street, Vancouver, B.C. V6C 3M1**

Non-Emergency Tel. #: (604) 661-2600

Emergency Tel. #: (CHEMTREC) 1-800-424-9300 (Canada and US)

Note: CHEMTREC number to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

Importer: **Methanex Methanol Company**
Suite 1150 – 15301 Dallas Parkway
Addison, Texas 75001
Telephone: (972) 702-0909

2. Composition

Component	% (w/w)	Exposure Limits*	LD_{50}	LC_{50}
Methanol (CAS 67-56-1)	99-100	ACGIH TLV-TWA: 200 ppm, skin STEL: 250 ppm, skin notation OSHA PEL: 200 ppm TLV Basis, critical effects: neuropathy, vision, central nervous system	5628 mg/kg (oral/rat) 20 ml/kg (dermal/ rabbit)	64000 ppm (inhalation/rat)

* Exposure limits may vary from time to time and from one jurisdiction to another. Check with local regulatory agency for the exposure limits in your area.

3. Hazards Identification

Routes of Entry:

Skin Contact: Moderate Eye Contact: Moderate Ingestion: Major Inhalation: Major

Effects of Short-Term (Acute) Exposure:

Inhalation: Inhalation of high airborne concentrations can also irriate mucous membranes, cause headaches, sleepiness, nausea, confusion, loss of consciousness, digestive and visual disturbances and even death. NOTE: Odour threshhold of methanol is several times higher than the TLV-TWA. Depending upon severity of poisoning and the promptness of treatment, survivors may recover completely or may have permanent blindness, vision disturbances and/or nervous system effects. Concentrations in air exceeding 1000 ppm may cause irritation of the mucous membranes.

Skin Contact: Methanol is moderately irritating to the skin. Methanol can be absorbed through the skin and harmful effects have been reported by this route of entry. Effects are simialr to those described in “Inhalation”

Eye Contact: Methanol is a mild to moderate eye irritant. High vapour concentration or liquid contact with eyes causes irritation, tearing and burning.

Ingestion: Swallowing even small amounts of methanol could potentially cause blindness or death. Effects of sub lethal doses may be nausea, headache, abdominal pain, vomiting and visual disturbances ranging from blurred vision to light sensitivity.

Effects of Long-Term (Chronic) Exposure: Repeated exposure by inhalation or absorption may cause systemic poisoning, brain disorders, impaired vision and blindness. Inhalation may worsen conditions such as emphysema or bronchitis. Repeated skin contact may cause dermal irritation, dryness and cracking.

Medical Conditions Aggravated By Exposure: Emphysema or bronchitis.

4. First Aid Measures

Note: *Emergency assistance may also be available from the local poison control centre.*

Eye Contact: Remove contact lenses if worn. In case of contact, immediately flush eyes with plenty of clean running water for at least 15 minutes, lifting the upper and lower eyelids occasionally. Obtain medical attention.

Skin Contact: In case of contact, remove contaminated clothing. In a shower, wash affected areas with soap and water for at least 15 minutes. Seek medical attention if irritation occurs or persists. Wash clothing before reuse.

Inhalation: Remove to fresh air, restore or assist breathing if necessary. Obtain medical attention.

Ingestion: Swallowing methanol is potentially life threatening. Onset of symptoms may be delayed for 18 to 24 hours after digestion. If conscious and medical aid is not immediately available, do not induce vomiting. In actual or suspected cases of ingestion, transport to medical facility immediately.

NOTE TO PHYSICIAN: Acute exposure to methanol, either through ingestion or breathing high airborne concentrations can result in symptoms appearing between 40 minutes and 72 hours after exposure. Symptoms and signs are usually limited to CNS, eyes and gastrointestinal tract. Because of the initial CNS's effects of headache, vertigo, lethargy and confusion, there may be an impression of ethanol intoxication. Blurred vision, decreased acuity and photophobia are common complaints. Treatment with ipecac or lavage is indicated in any patient presenting within two hours of ingestion. A profound metabolic acidosis occurs in severe poisoning and serum bicarbonate levels are a more accurate measure of severity than serum methanol levels. Treatment protocols are available from most major hospitals and early collaboration with appropriate hospitals is recommended.

5. Fire Fighting Measures

Flash point:	11 ^{o}C (TCC)
Autoignition temperature:	385 ^{o}C (NFPA 1978), 470 ^{o}C (Kirk-Othmer 1981; Ullmann 1975)
Lower Explosive Limit:	6% (NFPA, 1978)
Upper Explosion Limit:	36% (NFPA, 1978), 36.5% (Ullmann, 1975)
Sensitivity to Impact:	Low
Sensitivity to Static Discharge:	Low
Hazardous Combustion Products:	Toxic gases and vapours; oxides of carbon and formaldehyde.

Extinguishing Media: Small fires: Dry chemical, CO_2, water spray
Large fires: Water spray, AFFF(R) (Aqueous Film Forming Foam (alcohol resistant)) type with either a 3% or 6% foam proportioning system.

Fire Fighting Instructions: Methanol burns with a clean clear flame that is almost invisible in daylight. Stay upwind! Isolate and restrict area access. Concentrations of greater that 25% methanol in water can be ignited. Use fine water spray or fog to control fire spread and cool adjacent structures or containers. Contain fire control water for later disposal. Fire fighters must wear full face, positive pressure, self-contained breathing apparatus or airline and appropriate protective clothing. Protective fire fighting structural clothing is not effective protection from methanol. Do not walk through spilled product.

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) HAZARD INDEX:

HEALTH: 1

FLAMMABILITY: 3

REACTIVITY: 0

6. Accidental Release Measures

Overview: Flammable liquid which can burn without a visible flame. Release can cause an immediate risk of fire and explosion. Eliminate all ignition sources, stop leak and use absorbent materials. If necessary, contain spill by diking. Fluorocarbon alcohol resistant foams may be applied to spill to diminish vapour and fire hazard. Maximize methanol recovery for recycling or re-use. Restrict access to area until completion of cleanup. Ensure cleanup is conducted by trained personnel only. Wear adequate personal protection and remove all sources of ignition. Notify all governmental agencies as required by law.

Personal Protection: Full face, positive pressure self-contained breathing apparatus or airline, and protective clothing must be worn. Protective fire fighting structural clothing is not effective protection from methanol.

Environmental Precautions: Biodegrades easily in water Methanol in fresh or salt water may have serious effects on aquatic life. A study on methanol's toxic efffects on sewage sludge bacteria reported little effect on digestion at 0.1% while 0.5% methanol retarded digestion. Methanol will be broken down to carbon dioxide and water.

Remedial Measures: Flammable liquid. Release can cause an immediate fire/explosion hazard. Eliminate all sources of ignition, stop leak and use absorbent materials. Collect liquid with explosion proof pumps. Do not walk through spill product as it may be on fire and not visible.

Large Spills: If necessary, contain spill by diking. Fluorocarbon alcohol resistant foams may be applied to spill to diminish vapour and fire hazard. Maximize methanol recovery for recycling or reuse. Collect liquid with explosion proof pumps.

Small Spills: Soak up spill with non-combustible absorbent material. Recover methanol and dilute with water to reduce fire hazard. Prevent spilled methanol from entering sewers, confined spaces, drains, or waterways. Restict access to unprotected personnel. Full. Put material in suitable, covered, labeled containers. Flush area with water.

7. Handling and Storage

Handling Procedures: No smoking or open flame in storage, use or handling areas. Use explosion proof electrical equipment. Ensure proper electrical grouding procedures are in place.

Storage: Store in totally enclosed equipment, designed to avoid ignition and human contact. Tanks must be grounded, vented, and should have vapour emission controls. Tanks must be diked. Avoid storage with incompatible materials. Anhydrous methanol is non-corrosive to most metals at ambient temperatures except for lead, nickel, monel, cast iron and high silicon iron. Coatings of copper (or copper alloys), zinc (including galvanized steel), or aluminum are unsuitable for storage. These materials may be attacked slowly by the methanol. Storage tanks of welded construction are normally satisfactory. They should be designed and built in conformance with good engineering practice for the material being stored. While plastics can be used for short term storage, they are generally not recommended for long-term storage due to deterioration effects and the subsequent risk of contamination.

Corrosion rates for several construction materials:

<0.508 mm/year	Cast iron, monel, lead, nickel
<0.051 mm/year	High silicon iron
Some attack	Polyethylene
Satisfactory	Neoprene, phenolic resins, polyesters, natural rubber, butyl rubber
Resistant	Polyvinyl chloride, unplasticized

8. Exposure Controls, Personal Protection

Engineering Controls: In confined areas, local and general ventilation should be provided to maintain airborne concentrations beloew permissable exposure limits. Ventilation systems must be designed according to approved engineering standards.

Respiratory Protection: NIOSH approved supplied air respirator when airborne concentrations exceed exposure limits.

Skin protection: Butyl and nitrile rubbers are recommended for gloves. Check with manufacturer. Wear chemical resistant pants and jackets, preferably of butyl or nitrile rubber. Check with manufacturer.

Eye and Face Protection: Face shield and chemical splash goggles when transferring is taking place.

Footwear: Chemical resistant, and as specified by the workplace.

Other: Eyewash and showers should be located near work areas. NOTE: PPE must not be considered a long-term solution to exposure control. PPE usage must be accompanied by employer programs to properly select, maintain, clean, fit and use. Consult a competent industrial hygiene resource to determine hazard potential and/or the PPE manufacturers to ensure aadequate protection.

9. Physical and Chemical Properties

Appearance: Liquid, clear, colourless
Odour: Mild characteristic alcohol odour
Odour Threshold: detection: 4.2 - 5960 ppm
(geometric mean) 160 ppm
recognition: 53 – 8940 ppm
(geometric mean) 690 ppm
pH: Not applicable
Vapour Pressure: 12.8 kPa @ 20°C
Solubility: Completely soluble
Vapour Density: 1.105 @ 15 °C
Freezing Point: -97.8 °C

Boiling Point: 64.7 °C @ 101.3 kPa
Critical Temperature: 239.4 °C
Relative Density: 0.791
Evaporation Rate: 4.1 (n-butyl acetate =1)

Partition Coefficient: Log P (oct) = -0.82
Solubility in other Liquids: Soluble in all proportions in other alcohols, esters, ketones, ethers and most other organic solvents

10. Stability and Reactivity

Chemical Stability: Yes

Incompatibility: Yes. Avoid contact with strong oxidizers, strong mineral or organic acids, and strong bases. Contact with these materials may cause a violent or explosive reaction. May be corrosive to lead, aluminum, magnesium, and platinum.

Conditions of Reactivity: Presence of incompatible materials and ignition sources.

Hazardous Decomposition Products: Formaldehyde, carbon dioxide, and carbon monoxide.

Hazardous Polymerization: Will not occur.

11. Toxicological Information

LD_{50}:	5628 mg/kg (oral/rat), 20 ml/kg (dermal/rabbit)
LC_{50}:	64000 ppm (rat)
Acute Exposure:	See Section 3
Chronic Exposure:	See Section 3.
Exposure Limits:	See Section 2.
Irritancy:	See Section 3.
Sensitization:	No
Carcinogenicity:	Not listed by IARC, NTP, ACGIH, or OSHA as a carcinogen.
Teratogenicity:	No
Reproductive toxicity:	Reported to cause birth defects in rats exposed to 20,000 ppm
Mutagenicity:	Insufficient data
Synergistic products:	None Known

12. Ecological Information

Environmental toxicity: Methanol in fresh or salt water may have serious effects on aquatic life. A study on methanol's toxic effects on sewage sludge bacteria reported little effect on digestion at 0.1% while 0.5% methanol retarded digestion. Methanol will be broken down into carbon dioxide and water.

Biodegradability: Biodegrades easily in water.

13. Disposal Considerations

Review federal, provincial or state, and local government requirements prior to disposal. Store material for disposal as indicated in Section #7, ***Handling and Storage***. Disposal by controlled incineration or by secure land fill may be acceptable.

14. Transport Information

Transport of Dangerous Goods (TDG and CLR):	Methanol, Class 3(6.1), UN1230, P.G. II Limited Quantity: ≤ 1 litres
United States Department of Transport (49CFR): (Domestic Only)	Methanol, Class 3, UN 1230, P.G. II, (RQ 5000 lbs/2270 kg) Limited Quantity: ≤ 1 litres
International Air Transport Association (IATA):	Methanol, Class 3(6.1), UN1230, P.G. II Packaging Instruction: 305, 1 litre maximum per package,
International Maritime Organization (IMO):	Methanol, Class 3(6.1), UN1230, P.G. II, Flash Point = 12 ^{o}C EmS No. F-E, S-D Stowage Category "B", Clear of living quarters

15. Regulatory Information

CANADIAN FEDERAL REGULATIONS:

CEPA, DOMESTIC SUBSTANCES LIST:	Listed
WHMIS CLASSIFICATION:	B2, D1A

UNITED STATES REGULATIONS:

29CFR 1910.1200 (OSHA):	Hazardous
40CFR 116-117 (EPA):	Hazardous
40CFR 355, Appendices A and B:	Subject to Emergency Planning and Notification
40CFR 372 (SARA Title III):	Listed
40CFR 302 (CERCLA):	Listed

16. Other Information

Preparation Date: October 13, 2005

Prepared by: Kel-Ex Agencies Ltd., P.O. Box 52201, Lynnmour RPO, North Vancouver, B.C., V7J 3V5

Disclaimer: The information above is believed to be accurate and represents the best information currently available to us. Users should make their own investigations to determine the suitability of the information for their particular purposes. This document is intended as a guide to the appropriate precautionary handling of the material by a properly trained person using this product.

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Revisions: None

Appendix E – Storm Water Pollution Prevention Plan

Final Storm Water Pollution Prevention Plan for Sampling & Closure of Load Lines 1, 2, 3, 4, 12 (RVAAP- 08, 09, 10, 11, and 12) and Other Areas of Concern

Ravenna Army Ammunition Plant
Ravenna, Ohio

Contract No. W912QR-10-P-0037

Prepared for:

US Army Corps of Engineers®

U.S. Army Corps of Engineers
600 Martin Luther King, Jr. Place
Louisville, Kentucky 40202

Prepared by:

PRUDENT TECHNOLOGIES, INC.
dba Prudent Environmental Services, Inc.

Prudent Technologies, Inc.
4242 Medical Drive, Suite 7250
San Antonio, Texas 78229

July 30, 2010

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ACRONYMS AND ABBREVIATIONS

A/E	Architectural/Engineering
AOC	Area of Concern
ARPA	Archeological Resources Protection Act
ASTM	American Society for Testing and Materials
bgs	below ground surface
BMP	Best management practice
BRAC	Base Realignment and Closure
Camp Ravenna	Camp Ravenna Joint Military Training Center
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CRM	Cultural Resource Manager
COCs	chemicals of concern
COPCs	chemicals of potential concern
CUG	Cleanup Goal
DFFO	Director's Final Findings and Orders
DO	Delivery Order
DoD	U.S. Department of Defense
DQO	Data Quality Objective
EPA	U.S. Environmental Protection Agency
EPC	Exposure Point Concentration
E&S	Erosion and Sediment
FS	Feasibility Study
FSA	field staging area
FSAP	Facility-Wide Sampling and Analysis Plan
FSP	Field Sampling Plan
ft	foot/feet
GPS	Global Positioning System
GPO	Geophysical Prove Out
HAZWOPER	Hazardous Waste Operations
HHRAM	Human Health Risk Assessor Manual
HQ	Hazard Quotient
IDW	Investigation-derived waste
IRP	Installation Restoration Program
km	kilometer
MABS	Mustard Agent Burial Site, RVAAP-28
MEC	munitions and explosives of concern
MI	multi-increment
mm	millimeter
mph	miles per hour
MS/MSD	Matrix spike / matrix spike duplicate
NAGPRA	Native American Graves Protection and Repatriation Act
ODA1	Open Demolition Area 1, RVAAP-03
OHARNG	Ohio Army National Guard
OHPO	Ohio Historic Preservation Office
OSHA	Occupational Safety and Health Administration
PCBs	polychlorinated biphenyls

PE	Professional Engineer
PID	photoionization detector
PIGS	steel shipping cylinders
PPE	personal protective equipment
QA	Quality Assurance
QA	Quality Assurance Project Plan
QC	Quality Control
REIMS	Ravenna Environmental Information Management System
RI	Remedial Investigation
ROD	Record of Decision
RS	Regional Screening Levels
RVAAP	Ravenna Army Ammunition Plant
SAP	Sampling and Analysis Plan
SDZ	Safety Danger Zone
SHERP	Safety, Health and Emergency Response Plan
SVOC	semivolatile organic compound
SWP3	Storm Water Pollution Prevention Plan
TAL	Target Analyte List
UCL	Upper Confidence Limit
USACE	U.S. Army Corps of Engineers
USCS	Unified Soil Classification System
UXO	unexploded ordnance
VOC	volatile organic compound

1.0 - INTRODUCTION

This Storm Water Pollution Prevention Plan (SWP3) has been prepared by Prudent Technologies, Inc. (Prudent) for the United States Army Corps of Engineers (USACE) to perform additional environmental investigations and obtain closure at Load Lines 1, 2, 3, 4, and 12 at the Ravenna Army Ammunition Plant (RVAAP), Ravenna, Ohio. This consists of additional subsurface soil sampling below previously removed floor slabs at Load Lines 1, 2, 3, and 4 and potentially surface soil, surface water, wet sediment, and dry sediment sampling during characterization and confirmation sampling at all five subject Load Lines, if required. Prudent will be working under contract W912QR-10-P-0037. This SWP3 specifies the storm water erosion and sediment (E&S) controls for the proposed sampling and remediation activities as required under the Ohio Environmental Protection Agency (EPA) General Permit OHC000003 dated April 21, 2008 (Appendix A) for Storm Water Discharges from construction activities.

This SWP3 provides best management practices to be implemented to achieve effective overall control over soil and sediment erosion and silt control of storm water runoff during field investigation and remediation activities.

This project-specific SWP3 includes the following:

- Identification of individuals responsible of managing the SWP3;
- Identification of the water bodies which will receive the runoff from the sampling activities;
- Identification of the water body which will receive storm water;
- Identification of drainage areas and potential storm water contaminants;
- Explanation of existing site conditions (i.e., wooded areas, open grassed areas, buildings, etc.), soil types, as well as the location of existing surface waters which are located on or next to the load lines (wetlands, streams, rivers, lakes, ponds, etc);
- Explanation of how controls will be implemented during sampling activities.

An addendum will be submitted once remediation areas are determined.

2.0 - SWP3 MANAGEMENT

The Prudent Project Manager (PM) will be responsible for implementing all activities associates within the SWP3. The PM responsibilities in relation to the SWP3 are as follows:

- Is responsible for overall implementation of the SWP3 for the project;
- Will ensure all field employees are trained in the requirements of the SWP3;
- Will perform regular inspection and monitoring of all activities identified in the SWP3;
- Will, with the help of his field staff, identify any pollution sources and control practices inadvertently not included in the SWP3 and will incorporate them into it;
- Will identify deficiencies in the SWP3 and correct them promptly;
- Will ensure that any future changes in the scope of work (SOW) affecting the SWP3 are incorporated into it.

3.0 - FACILITY DESCRIPTION

3.1 SITE DESCRIPTION AND BACKGROUND

When the Ravenna Army Ammunition Plant (RVAAP) Installation Restoration Program (IRP) began in 1989, RVAAP was identified as a 21,419-acre installation. The property boundary was resurveyed by the Ohio Army National Guard (OHARNG) over a 2-year period (2002 and 2003) and the total acreage of the property was found to be 21,683.289 acres. As of February 2006, a total of 20,403 acres of the former 21,683-acre RVAAP has been transferred to the National Guard Bureau (NGB) and subsequently licensed to OHARNG for use as a military training site.

The current RVAAP consists of 1,280 acres scattered throughout the OHARNG Camp Ravenna Joint Military Training Center (Camp Ravenna). Camp Ravenna is in northeastern Ohio within Portage and Trumbull Counties, approximately 3 miles (4.8 km) east-northeast of the City of Ravenna and approximately 1 mile (1.6 km) northwest of the City of Newton Falls. The RVAAP portions of the property are solely located within Portage County. RVAAP/Camp Ravenna is a parcel of property approximately 11 miles (17.7 km) long and 3.5 miles (5.6 km) wide bounded by State Route 5, the Michael J. Kirwan Reservoir, and the CSX System Railroad on the south; Garret, McCormick, and Berry roads on the west; the Norfolk Southern Railroad on the north; State Route 534 on the east. Camp Ravenna is surrounded by several communities: Windham on the north; Garrettsville 6 miles (9.6 km) to the northwest; Newton Falls 1 mile (1.6 km) to the southeast; Charlestown to the southwest; Wayland 3 miles (4.8 km) to the south. The property location is depicted in Figure 1-1.

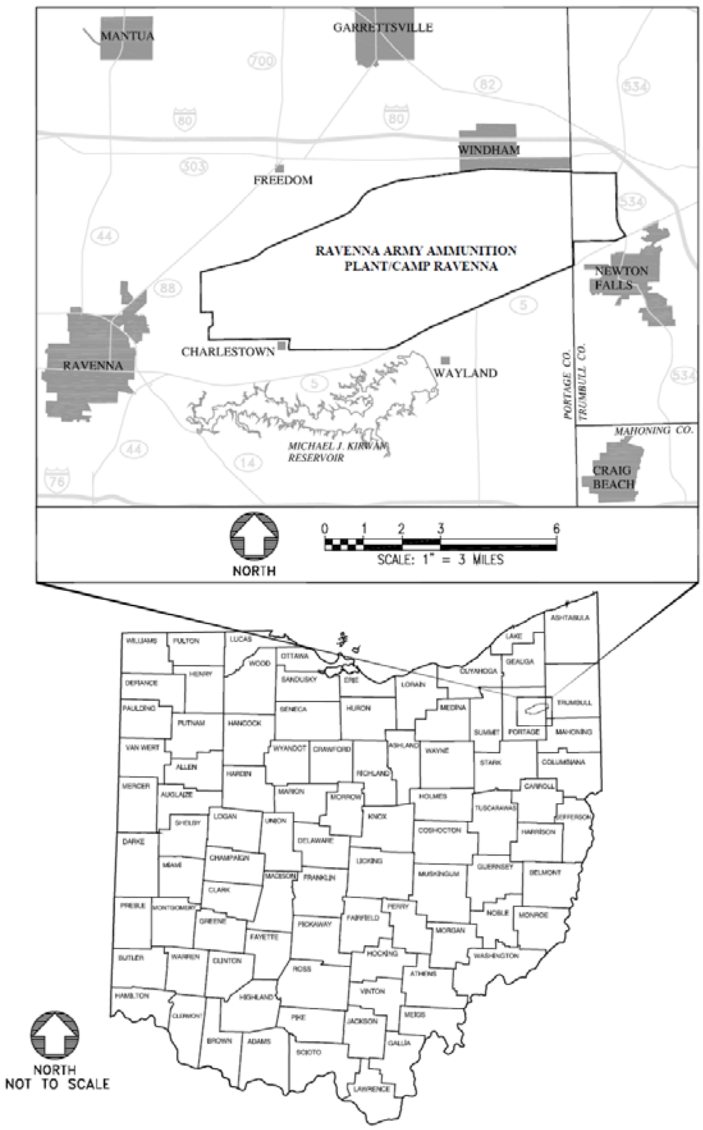
When RVAAP was operational, Camp Ravenna did not exist and the entire 21,683-acre parcel was a government-owned, contractor-operated industrial facility. The RVAAP IRP encompasses investigation and cleanup of past activities over the entire 21,683 acres of the former RVAAP. References to RVAAP in this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

Industrial operations at the former RVAAP consisted of 12 munitions-assembly facilities referred to as “load lines.” Load Lines 1 through 4 were used to melt and load 2,4,6-trinitrotoluene (TNT) and Composition B into large-caliber shells and bombs. The operations on the load lines produced explosive dust, spills, and vapors that collected on the floors and walls of each building. Periodically, the floors and walls were cleaned with water and steam. Following cleaning, the wastewater, containing TNT and Composition B, was known as “pink water” for its characteristic color. Scupper systems were used to collect pink water, which was contained in concrete holding tanks, filtered, and pumped into unlined ditches for transport to earthen settling ponds. However, in some instances, pink water was swept from doorways, or scupper systems overflowed onto the ground surface. Load Lines 5 through 11 were used to manufacture fuzes, primers, and boosters. Potential contaminants in these load lines include lead compounds, mercury compounds, and explosives. From 1946 to 1949, Load Line 12 was used to produce ammonium nitrate for explosives and fertilizers prior to use as a weapons demilitarization facility.

In 1950, the facility was placed in standby status and operations were limited to renovation, demilitarization, and normal maintenance of equipment, along with the storage of munitions. Production activities were resumed from July 1954 to October 1957 and again from May 1968 to August 1972. In addition to production missions, various demilitarization activities were conducted at facilities constructed at Load Lines 1, 2, 3, and 12. Demilitarization activities included disassembly of munitions and explosives melt-out, and recovery operations using hot water and steam processes. Periodic demilitarization of various munitions continued through 1992.

In addition to production and demilitarization activities at the load lines, other facilities at RVAAP include environmental areas of concern (AOCs) that were used for the burning, demolition, and testing of munitions. These burning and demolition grounds consist of large parcels of open space or abandoned quarries. Potential contaminants at these AOCs include explosives, propellants, metals, and waste oils. Other types of AOCs present at RVAAP include landfills, an aircraft fuel tank testing facility, and various general industrial support and maintenance facilities.

Figure 1-1 - RVAAP Location and General Vicinity Maps



3.2 AREAS OF CONCERN

The Areas of Concern (AOCs) identified for further investigation in this SOW are shown below. Additional AOCs may be added if required.

- RVAAP-08 Load Line 1
- RVAAP-09 Load Line 2
- RVAAP-10 Load Line 3
- RVAAP-11 Load Line 4
- RVAAP-12 Load Line 12

3.3 PROJECT OBJECTIVES

This project has two objectives. The first is to perform environmental investigation requirements of soil below floor slabs (which have previously been removed) at Load Lines 1, 2, 3, and 4, involving additional subsurface soil sampling below floor slabs at these AOCs. Analytical results of such soil samples in addition to the previous explosives field screening results that have been conducted in the past will aid in determining if additional activities are needed. The results of this investigation will be presented in a report, which will also include the results of USACE sampling activities outside of former building foot prints at the Load Lines to investigate if contamination was spread during building demolition activities.

The second objective is to obtain site closure at Load Lines 1, 2, 3, 4 and 12. This will be done by reviewing previous investigation documents and analytical results of soil samples taken and then assessing Land Use Controls (LUC) at each AOC. The goal is to achieve an Unrestricted National Guard Trainee land use for surface soil, subsurface soil, dry sediment, wet sediment, and surface water media. The Contractor shall submit a report, which summarizes their review of the data and their assessment of LUCs. A proposed path forward will be presented to achieve the desired land use status. Should additional remediation be required, it is planned that Prudent will complete this work. The results of this work will be presented in a closure document, which will be adequate to transfer the property to the NGB with the goal of Unrestricted National Guard Trainee Use.

3.4 SOILS AND GEOLOGY

The regional geology at RVAAP consists of horizontal to gently dipping bedrock strata of Mississippian and Pennsylvanian age overlain by varying thickness of unconsolidated glacial deposits. Bedrock at RVAAP is overlain by deposits of Wisconsin-aged Lavery Till in the western portion of the facility and the younger Hiram Till and associated outwash deposits in the eastern portion. Unconsolidated glacial deposits vary considerably in their character and thickness across the RVAAP, with deposits absent in some of the eastern portion of the facility to an estimated 150 feet in the south-central portion. Soils at RVAAP are generally derived from Wisconsin-aged silty clay glacial till. Much of the native soil at RVAAP was reworked or removed during construction activities in operational areas of the installation. In general, the soils at the load lines are poorly drained and consist of silty clay or clay loam formed over glacial till. Runoff is typically medium to rapid and the soil is seasonally wet.

3.5 ENVIRONMENTALLY SENSITIVE AREAS

The entire RVAAP facility is situated within the Ohio River Basin; the West Branch of the Mahoning River representing the major surface stream in the area. This stream flows adjacent to the western end of the facility, from north to south, before flowing into the Kirwan Reservoir located south of State Route 5. The West Branch flows out of the reservoir along the southern facility boundary before joining the Mahoning River east of the RVAAP.

The South Fork of Eagle Creek, Sand Creek and Hinkley Creek are the three major drainage ways at RVAAP. In addition, several wetland areas are present on RVAAP. The western and northern regions of RVAAP have low hills and many surface drainages in the shape of tree branches. The southern & eastern regions have mostly level surfaces.

Approximately 50 ponds are scattered throughout the installation. Many were built within natural drainage ways to function as settling ponds or basins for process effluent and runoff. Others may be the result of glacial or beaver activity. Ponds within the installation are not used as water supply sources.

3.6 SITE PLANS

Please refer to Figure 1-1, RVAAP Location and General Vicinity Map, in Prudent's Work Plan. The proposed remediation locations have not yet been determined. An addendum will be submitted once remediation areas are determined.

3.7 STORM WATER DRAINAGE

Most of the drainage on the RVAAP is through overland flow into natural and/or manmade drainage ways.

3.7.1 *Load Line 1*

Most surface water from precipitation collects in storm water catch basins and unlined ditches throughout the Load Line 1 production area. Most runoff is discharged through the following exit pathways: (1) Outlets A and B, which discharge ultimately to a Parshall flume on Sand Creek at State Route 534 northeast of LL 1; (2) Outlet C and Charlie's Pond east of LL 1; (3) Outlets D, E and F discharging through Criggy's Pond southeast of LL 1; (4) an unnamed drainage outlet in the northwest corner of the area of concern that flows into Sand Creek. Outlets A, B and C are considered interim surface water pathways and retain water based on seasonal precipitation conditions. Outlets D, E and F are consistently dry.

3.7.2 *Load Line 2*

The primary surface water conveyance at Load Line 2 drains to the south, ultimately discharging to Kelly's Pond. Surface water flows through a series of man-made ditches, which flow to the south end of the Load Line 2 production area. Surface water also flows north through a smaller network of ditches to a group of four ponds situated on the northeast corner of Load Line 2; however, the majority of surface water runoff is to the south.

3.7.3 *Load Line 3*

The primary surface water conveyance at Load Line 3 is man-made ditches that drain to the western portion of Load Line 3. These drainage ditches ultimately convey the surface water to Cobb's Pond located just north of Load Line 3.

3.7.4 *Load Line 4*

Surface water runoff at Load Line 4 primarily drains into the large settling pond at the central southern portion of the load line. Drainage from the pond flows southeast of Load Line 4, exiting the RVAAP at a Parshall flume. Surface water at the northeastern most portion of Load Line 4 drains towards the northeast into a heavily wooded area and ultimately drains into an unnamed pond situated to the west of Load Line 12.

3.7.5 *Load Line 12*

Surface water drainage on Load Line 12 generally flows from south to north across the area. The Main Ditch that bisects the central part of the AOC flows from the north into drainage ditches north of the AOC. The Main Ditch is heavily wooded. A stream traverses the area from west to east and intercepts the Main Ditch near the northern boundary of the AOC. Ultimately, the drainage flows into the Cobbs Pond complex (Upper/Lower Cobbs Pond) several hundred yards to the north of the Load Line. However, in recent years a beaver colony has constructed dams north, preventing surface water drainage from the AOC. Because of these dams, stagnant water often resides within the Main Ditch and Active Area Channel.

4.0 - IDENTIFICATION OF POTENTIAL STORM WATER CONTAMINANTS

The purpose of this section is to identify pollutants that could impact the quality of the storm water due to sampling and remediation activities involved with the RVAAP Load Lines 1, 2, 3, 4, and 12 . The pollutants to be addressed in this section include both those resulting from previous activities and from material and practices used during the sampling and closure activities on the current project. The aim of this plan is to address minimization or prevention of any flow or release of these contaminants into the water bodies present on RVAAP.

4.1 POTENTIAL CONTAMINANTS FROM PAST ACTIVITIES

The contaminants of concern are TAL (target analyte list) metals, mercury, hexavalent chromium, explosives, propellants, semivolatile organic compounds (SVOCs), volatile organic compounds (VOCs), pesticides, herbicides and polychlorinated biphenyls (PCBs) that may have been released during operations previously conducted within the subject buildings.

4.2 POTENTIAL POLLUTANTS FROM FIELD ACTIVITIES

Following are the various potential pollutants due to various field activities:

4.2.1 *Decontamination Water Release*

This could occur due to over flow or breakage of the contaminated water containment tank. Secondary containment will be provided to mitigate such incidents.

4.2.2 *Fuel Spill*

This could occur while re-fueling equipment onsite. This incident will be avoided by observing proper procedures while re-fueling.

4.2.3 *Antifreeze, Motor Oil or Hydraulic Oil Spill*

This could occur because of hose rupture or other leaks. Regular inspection of equipment will be performed to minimize this possibility.

4.2.4 *Dust*

Prudent will ensure that dust suppression measures will be implemented.

4.2.5 *Contaminated Soil Spill*

Contaminated soil spills could occur while loading trucks or while transporting soil from the excavation to staging area. Prudent will ensure that contamination spill while loading will be avoided by using plastic underneath the loading area. In addition, while transporting the soil the loading trucks will have proper traps to avoid spills.

4.3 SPILL REPORTING REQUIREMENTS

In the event of a petroleum product spill, Prudent employees will notify the required authorities at RVAAP. In addition, Prudent employees will also report to the required regulatory agencies.

5.0 - STORM WATER MANAGEMENT CONTROL

Contamination transport via storm water runoff can be minimized by controlling both run-on and runoff from the construction site and by promptly stabilizing the disturbed soil in the excavated area. The three methods that will be implemented to avoid contamination via storm water are run-on and runoff control, site stabilization and sediment control. The purpose of this is to minimize soil erosion at the job site and minimization of eroded silt transport to waters of the United States.

5.1 RUN-ON AND RUN-OFF CONTROL PRACTICES

Controls are necessary to minimize storm water from entering (run-on) or leaving (runoff) a contaminated disturbed area and to limit the occurrence of gully, channel and stream erosion. In order to mitigate runoff, at each work location, Prudent shall identify potential overland storm water drainage routes. Run-on and runoff controls used shall consist of diversion structures and channeling to enclosed drainage areas. Secondary controls may include conveyance to existing waterways and construction of stabilization outlets. Only water flow (run-on) from precipitation events and not run-off from construction activities will be diverted to existing waterways. The implementation of these methods will depend on the location of the work and the potential for the release of contaminants, and requires prior approval by the Ohio EPA, USACE and the RVAAP.

Diversion structures consisting of temporary earth dikes and/or drainage swales shall be formed up-gradient of construction areas where the volume of overland flow is such that it is necessary to divert flow around disturbed portions at the load line worksites. As a best management practice (BMP), earthwork and other construction operations shall be conducted in a manner to minimize muddy water, eroded materials and other undesirable constituents of project construction waters being discharged through storm water runoff.

5.2 SOIL STABILIZATION

Soil stabilization will be performed at disturbed areas and conveyance channels to control potential erosion of soils due to rain, sheet flow and rills. The purpose of soil stabilization is to protect surface areas and strengthen subsurface areas to minimize or prevent soil erosion. Soil stabilization methods will primarily consist of using vegetative soil cover (such as sod or hydro seed), non-vegetative cover (such as rip-rap, gravel or synthetic soil cover) and structural cover. The preferred method of soil stabilization is the placement of permanent vegetative cover upon work completion; however, non-vegetative and/or structural erosion control practices may be necessary when disturbed areas cannot be promptly stabilized with vegetation or during the period when work is in progress.

Vegetative soil cover will include the placement of temporary or permanent seed or the protection of existing vegetation removed from construction activities. Only non-invasive species will be used for temporary and permanent soil stabilization efforts and the type of seeding required for the various areas will be coordinated with the Ohio EPA, USACE, OHARNG and RVAAP. For non-vegetative cover, Prudent will place mulch in unprotected areas. Structural soil stabilization options will include land grading to provide erosion and runoff control

5.3 SEDIMENT CONTROL

Sediment (silt) control is necessary for the protection of areas down-gradient of construction areas and off-site locations from silt carried by storm water run-off. The purpose of sediment control is to retain sediments on site that are generated as a result of soil erosion and storm water runoff. The primary method of sediment control to be implemented by Prudent is using sediment barriers such as silt fences, hay bale dikes, and similar obstacles to be used individually or in conjunction with each other.

To the greatest extent practicable, all soil disturbing activities at each of the load lines shall be minimized and shall proceed in a manner to reduce erosion and sedimentation. All earthwork, grading, movement of equipment, and other operations likely to cause siltation and off-site tracking of sediments, shall be planned and performed in a sequence as to avoid pollution in adjacent waters. Clearing activities shall be performed in a way that minimizes erosion and sedimentation. Only the absolute minimum surface areas will be disturbed, leaving as much ground cover as possible intact.

To protect nearby waterways and environmentally sensitive areas, silt fencing or equivalent effectiveness porous or semi-porous barriers will be installed along the down gradient perimeter at all work areas. Silt fences may be constructed using filter fabric that shall be staked to provide a barrier to transport silts, fines and debris yet provide passage of runoff. Selection of the type and grade of fabric shall be made to allow adequate passage of water. Stakes will be used to construct silt fences, and will be of wood with squared butt ends and tapered driving points. Filter fabric shall be stapled or tied with jute twine to stakes. All filter fences shall be removed after their function has been fulfilled.

6.0 - MANAGEMENT AND INSPECTION PROCEDURES

6.1 EROSION AND SEDIMENT CONTROL MANAGEMENT

Prudent will manage onsite erosion and sediment control activities in an effort to reduce the need for maintenance of structural controls, regarding of severely eroded areas, and reconstruction of failed controls. In conjunction with the implementation of the erosion and sediment control methods, Prudent management activities will include the following:

- The construction area will be marked and enclosed with the help of tape and construction fences;
- A minimum number of sites will be active at the same time;
- Appropriate sediment confinement features (silt fences, hay bales, etc.), if needed, will be installed in appropriate areas and inspected and maintained regularly, and especially immediately after rainfall events;
- Offsite runoff from highly erodible soils and steep slopes will be diverted to a stable area;
- Entrances for vehicles to the construction area will be designed to reduce dust emissions and mud tracking outside the work area;
- Site stabilization efforts will be started as soon as construction activities are completed;
- Stabilized areas will be seeded if needed;
- Temporary sediment trapping devices will be removed only after permanent stabilization has been established on all contributory drainage areas;
- Ensure all employees and subcontractors are trained on the necessary SWP3 requirements;
- Designate responsibility of the erosion and sediment requirements to one individual to be named prior to onsite mobilization;
- Establish and maintain an erosion and sediment inspection schedule that states the completion of identified repairs and maintenance items.

6.2 INSPECTIONS

Daily inspections will be performed in active work areas to ensure proper performance of run-on and run-off controls. Inactive, non-vegetated, disturbed areas will be inspected on a regular basis to ensure that the berms, hay bales and sediment fences are functioning properly. Inspections will be made within 24-hours after any storm event greater than one-half inch of rain per a 24-hour period. Inspections will be conducted on a daily basis during extensive periods of rainfall. The following inspection and maintenance practices will be used to maintain erosion and sediment controls:

- Silt fences and/or hay bales will be inspected on a regular basis;
- Sediment build up against the silt fence will be removed on a regular basis;
- The sediment basin will be inspected for depth of sediment and built up sediment will be removed on a regular basis;
- Seeding will be inspected for bare spots, washouts, and healthy growth. Regular watering will be required for all seeded areas;

- Entrances to construction area will always be kept clean and free of contaminants and sediments. A Proper drainage system will be installed to avoid sediment accumulation;
- Any sediment prevention devices installed to protect existing storm drains will be inspected daily to ensure effectiveness;
- Paved streets along the load line and buildings haul route will be inspected daily and maintained as required to remove any mud, dirt, rock or other materials originating from the work areas;
- Sediment collected from all the above-mentioned areas will be hauled to the soil stockpile area and disposed of on a regular basis.

6.3 EMPLOYEE TRAINING

On-site field employees will be trained to know the goals of this SWP3 in addition to hands-on training in erosion controls, spill prevention and response, good housekeeping, proper material handling, disposal and control of waste, equipment fueling, proper storage, washing and inspection procedures as per their site orientation training. Prudent will assign only qualified and well-trained personnel to conduct inspections to ensure control practices are functional and to evaluate whether the SWP3 is adequate and properly implemented in accordance with the schedule or whether additional control measures are required. All employees will receive the site orientation training prior to or on their first day on the site.

7.0 - REFERENCES

- Science Applications International Corporation (SAIC) 2003. *Final Phase II Remedial Investigation Report for the Load Line 1 at the Ravenna Army Ammunition Plant, Ravenna, Ohio.* June 2003.
- Shaw Environmental, Inc. (Shaw) 2004a. *Final Phase II Remedial Investigation Report for Load Line 2 at the Ravenna Army Ammunition Plant, Ravenna, Ohio.* July 2004.
- Shaw 2004b. *Final Phase II Remedial Investigation Report for Load Line 3 at the Ravenna Army Ammunition Plant, Ravenna, Ohio*. July 2004.
- Shaw 2004c. *Final Phase II Remedial Investigation Report for Load Line 4 at the Ravenna Army Ammunition Plant, Ravenna, Ohio.* September 2004.
- Shaw 2006. Final Waste Management and Minimization Plan for the Remediation of Soils at Load Lines 1, 2, 3 and 4 at the Ravenna Army Ammunition Plant, Ravenna, Ohio. November 2006

8.0 - CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or person(s) who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment of knowing violations.

____

Prakash Raja, CHMM

Executive

Appendix A – Ohio EPA Permit No. OHC000003

Ohio EPA Permit No.: OHC000003

Effective Date: April 21, 2008
Expiration Date: April 20, 2013

OHIO ENVIRONMENTAL PROTECTION AGENCY

AUTHORIZATION FOR STORM WATER DISCHARGES ASSOCIATED WITH CONSTRUCTION ACTIVITY UNDER THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the federal Water Pollution Control Act, as amended (33 U.S.C. Section 1251 et. seq. hereafter referred to as "the Act") and the Ohio Water Pollution Control Act [Ohio Revised Code ("ORC") Chapter 6111], dischargers of storm water from sites where construction activity is being conducted, as defined in Part I.B of this permit, are authorized by the Ohio Environmental Protection Agency, hereafter referred to as "Ohio EPA," to discharge from the outfalls at the sites and to the receiving surface waters of the State identified in their Notice of Intent ("NOI") application form on file with Ohio EPA in accordance with the conditions specified in Parts I through VII of this permit.

It has been determined that a lowering of water quality of various waters of the State associated with granting coverage under this permit is necessary to accommodate important social and economic development in the state of Ohio. In accordance with OAC 3745-1-05, this decision was reached only after examining a series of technical alternatives, reviewing social and economic issues related to the degradation, and considering all public and intergovernmental comments received concerning the proposal.

This permit is conditioned upon payment of applicable fees, submittal of a complete NOI application form and written approval of coverage from the director of Ohio EPA in accordance with Ohio Administrative Code ("OAC") Rule 3745-38-06.

Laura H. Powell

Laura H. Powell
Assistant Director

I certify this to be a true and accurate copy of the official documents as filed in the records of the Ohio Environmental Protection Agency.

By: [signature] Date: 4-21-08

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PART I. COVERAGE UNDER THIS PERMIT

A. Permit Area.

This permit covers the entire State of Ohio.

B. Eligibility.

1. Construction activities covered. Except for storm water discharges identified under Part I.B.2, this permit may cover all new and existing discharges composed entirely of storm water discharges associated with construction activity that enter surface waters of the State or a storm drain leading to surface waters of the State.

   For the purposes of this permit, construction activities include any clearing, grading, excavating, grubbing and/or filling activities that disturb one or more acres of land. Discharges from trench dewatering are also covered by this permit as long as the dewatering activity is carried out in accordance with the practices outlined in Part III.G.2.g.iv of this permit. The threshold acreage includes the entire area disturbed in the larger common plan of development or sale.

   This permit also authorizes storm water discharges from support activities (e.g., concrete or asphalt batch plants, equipment staging yards, material storage areas, excavated material disposal areas, borrow areas) provided:

   a. The support activity is directly related to a construction site that is required to have NPDES permit coverage for discharges of storm water associated with construction activity;

   b. The support activity is not a commercial operation serving multiple unrelated construction projects and does not operate beyond the completion of the construction activity at the site it supports;

   c. Appropriate controls and measures are identified in a storm water pollution prevention plan (SWP3) covering the discharges from the support activity; and

   d. The support activity is on or contiguous with the property defined in the NOI (off-site borrow pits and soil disposal areas, which serve only one project, do not have to be contiguous with the construction site);

Part I.B

2. Limitations on coverage. The following storm water discharges associated with construction activity are not covered by this permit:

   a. Storm water discharges that originate from the site after construction activities have been completed, including any temporary support activity, and the site has achieved final stabilization. Industrial post-construction storm water discharges may need to be covered by an NPDES permit;

   b. Storm water discharges associated with construction activity that the director has shown to be or may reasonably expect to be contributing to a violation of a water quality standard; and

   c. Storm water discharges authorized by an individual NPDES permit or an alternative NPDES general permit;

3. Waivers. After March 10, 2003, sites whose larger common plan of development or sale have at least one, but less than five acres of land disturbance, which would otherwise require permit coverage for storm water discharges associated with construction activities, may request that the director waive their permit requirement. Entities wishing to request such a waiver must certify in writing that the construction activity meets one of the two waiver conditions:

   a. **Rainfall erosivity waiver.** For a construction site to qualify for the rainfall erosivity waiver, the cumulative rainfall erosivity over the project duration must be five or less and the site must be stabilized with at least a 70 percent vegetative cover or other permanent, non-erosive cover. The rainfall erosivity must be calculated according to the method in U.S. EPA Fact Sheet 3.1 Construction Rainfall Erosivity Waiver dated January 2001. If it is determined that a construction activity will take place during a time period where the rainfall erosivity factor is less than five, a written waiver certification must be submitted to Ohio EPA at least 21 days before construction activity is scheduled to begin. If the construction activity will extend beyond the dates specified in the waiver certification, the operator must either: (a) recalculate the waiver using the original start date with the new ending date (if the R factor is still less than five, a new waiver certification must be submitted) or (b) submit an NOI application form and fee for coverage under this general permit at least seven days prior to the end of the waiver period (see Attachment A); or

b. **TMDL (Total Maximum Daily Load) waiver.** Storm water controls are not needed based on a TMDL approved or established by U.S. EPA that addresses the pollutant(s) of concern or, for non-impaired waters that do not require TMDLs, an equivalent analysis that determines allocations for small construction sites for the pollutant(s) of concern or that determines that such allocations are not needed to protect water quality based on consideration of existing in-stream concentrations, expected growth in pollutant contributions from all sources, and a margin of safety. The pollutant(s) of concern include sediment or a parameter that addresses sediment (such as total suspended solids, turbidity or siltation) and any other pollutant that has been identified as a cause of impairment of any water body that will receive a discharge from the construction activity. The operator must certify to the director of Ohio EPA that the construction activity will take place, and storm water discharges will occur, within the drainage area addressed by the TMDL or equivalent analysis. A written waiver certification must be submitted to Ohio EPA at least 21 days before the construction activity is scheduled to begin.

4. <u>Prohibition on non-storm water discharges</u>. All discharges covered by this permit must be composed entirely of storm water with the exception of the following: discharges from fire fighting activities; fire hydrant flushings; potable water sources including waterline flushings; irrigation drainage; lawn watering; routine external building washdown which does not use detergents; pavement washwaters where spills or leaks of toxic or hazardous materials have not occurred (unless all spilled material has been removed) and where detergents are not used; air conditioning condensate; springs; uncontaminated ground water from trench or well point dewatering and foundation or footing drains where flows are not contaminated with process materials such as solvents. Dewatering activities must be done in compliance with Part III.G.2.g.iv of this permit. Discharges of material other than storm water or the authorized non-storm water discharges listed above must comply with an individual NPDES permit or an alternative NPDES general permit issued for the discharge.

   Except for flows from fire fighting activities, sources of non-storm water listed above that are combined with storm water discharges associated with construction activity must be identified in the SWP3. The SWP3 must identify and ensure the implementation of appropriate pollution prevention measures for the non-storm water component(s) of the discharge.

5. Spills and unintended releases (Releases in excess of Reportable Quantities). This permit does not relieve the permittee of the reporting requirements of 40 CFR Part 117 and 40 CFR Part 302. In the event of a spill or other unintended release, the discharge of hazardous substances in the storm water discharge(s) from a construction site must be minimized in accordance with the applicable storm water pollution prevention plan for the construction activity and in no case, during any 24-hour period, may the discharge(s) contain a hazardous substance equal to or in excess of reportable quantities.

   40 CFR Part 117 sets forth a determination of the reportable quantity for each substance designated as hazardous in 40 CFR Part 116. The regulation applies to quantities of designated substances equal to or greater than the reportable quantities, when discharged to surface waters of the State. 40 CFR Part 302 designates under section 102(a) of the Comprehensive Environmental Response, Compensation and Liability Act of 1980, those substances in the statutes referred to in section 101(14), identifies reportable quantities for these substances and sets forth the notification requirements for releases of these substances. This regulation also sets forth reportable quantities for hazardous substances designated under section 311(b)(2)(A) of the Clean Water Act (CWA).

C. Requiring an individual NPDES permit or an alternative NPDES general permit.

1. The director may require an alternative permit. The director may require any operator eligible for this permit to apply for and obtain either an individual NPDES permit or coverage under an alternative NPDES general permit in accordance with OAC Rule 3745-38-04. Any interested person may petition the director to take action under this paragraph.

   The director will send written notification that an alternative NPDES permit is required. This notice shall include a brief statement of the reasons for this decision, an application form and a statement setting a deadline for the operator to file the application. If an operator fails to submit an application in a timely manner as required by the director under this paragraph, then coverage, if in effect, under this permit is automatically terminated at the end of the day specified for application submittal.

2. Operators may request an individual NPDES permit. Any owner or operator eligible for this permit may request to be excluded from the coverage of this permit by applying for an individual permit. The owner or operator shall submit an individual application with reasons supporting the request to the director in accordance with the requirements of 40 CFR 122.26. If the reasons adequately support the request, the director shall grant it by issuing an individual NPDES permit.

3. When an individual NPDES permit is issued to an owner or operator otherwise subject to this permit or the owner or operator is approved for coverage under an alternative NPDES general permit, the applicability of this permit to the individual NPDES permittee is automatically terminated on the effective date of the individual permit or the date of approval for coverage under the alternative general permit, whichever the case may be.

D. Permit requirements when portions of a site are sold

If an operator obtains a permit for a development, and then the operator (permittee) sells off lots or parcels within that development, permit coverage must be continued on those lots until a Notice of Termination (NOT) in accordance with Part IV.B is submitted. For developments which require the use of centralized sediment and erosion controls (i.e., controls that address storm water runoff from one or more lots) for which the conveyance of permit coverage for a portion of the development will either prevent or impair the implementation of the controls and therefore jeopardize compliance with the terms and conditions of this permit, the permittee will be required to maintain responsibility for the implementation of those controls. For developments where this is not the case, it is the permittee's responsibility to temporarily stabilize all lots sold to individual lot owners unless an exception is approved in accordance with Part III.G.4. In cases where permit coverage for individual lot(s) will be conveyed, the permittee shall inform, in writing, the individual lot owner of the obligations under this permit and ensure that the Individual Lot NOI application is submitted to Ohio EPA.

E. Authorization

1. Obtaining authorization to discharge. Operators that discharge storm water associated with construction activity must submit an NOI application form in accordance with the requirements of Part II of this permit to obtain authorization to discharge under this general permit. As required under OAC Rule 3745-38-06(E), the director, in response to the NOI submission, shall notify the applicant in writing that he/she has been granted general permit coverage to discharge storm water associated with construction activity under the terms and conditions of this permit or that the applicant must apply for an individual NPDES permit or coverage under an alternate general NPDES permit as described in Part I.C.1.

Part I.E

2. No release from other requirements. No condition of this permit shall release the permittee from any responsibility or requirements under other environmental statutes or regulations. Other permit requirements commonly associated with construction activities include, but are not limited to, section 401 water quality certifications, isolated wetland permits, permits to install sanitary sewers or other devices that discharge or convey polluted water, permits to install drinking water lines, single lot sanitary system permits and disturbance of land which was used to operate a solid or hazardous waste facility (i.e., coverage under this NPDES general permit does not satisfy the requirements of OAC Rule 3745-27-13 or ORC Section 3734.02(H)). This permit does not relieve the permittee of other responsibilities associated with construction activities such as contacting the Ohio Department of Natural Resources, Division of Water, to ensure proper well installation and abandonment of wells.

Part II. NOTICE OF INTENT REQUIREMENTS

A. Deadlines for notification.

Initial coverage: Operators who intend to obtain initial coverage for a storm water discharge associated with construction activity under this general permit must submit a complete and accurate NOI application form and appropriate fee at least 21 days prior to the commencement of construction activity. If more than one operator, as defined in Part VII of this general permit, will be engaged at a site, each operator shall seek coverage under this general permit. Where one operator has already submitted an NOI prior to other operator(s) being identified, the additional operator shall request modification of coverage to become a co-permittee. In such instances, the co-permittees shall be covered under the same facility permit number. No additional permit fee is required.

Individual lot transfer of coverage: Operators must each submit an individual lot notice of intent (Individual Lot NOI) application form (no fee required) to Ohio EPA at least seven days prior to the date that they intend to accept responsibility for permit requirements for their portion of the original permitted development from the previous permittee. The original permittee may submit an Individual Lot NOT at the time the Individual Lot NOI is submitted. Transfer of permit coverage is not granted until an approval letter from the director of Ohio EPA is received by the applicant.

B. Failure to notify.

Operators who fail to notify the director of their intent to be covered and who discharge pollutants to surface waters of the State without an NPDES permit are in violation of ORC Chapter 6111. In such instances, Ohio EPA may bring an enforcement action for any discharges of storm water associated with construction activity.

Part II

C. Where to submit an NOI.

Operators seeking coverage under this permit must submit a signed NOI form, provided by Ohio EPA, to the address found in the associated instructions.

D. Additional notification.

The permittee shall make NOIs and SWP3s available upon request of the director of Ohio EPA, local agencies approving sediment and erosion control plans, grading plans or storm water management plans, local governmental officials, or operators of municipal separate storm sewer systems (MS4s) receiving drainage from the permitted site. Each operator that discharges to an NPDES permitted MS4 shall provide a copy of its Ohio EPA NOI submission to the MS4 in accordance with the MS4's requirements, if applicable.

E. Renotification.

Upon renewal of this general permit, the permittee is required to notify the director of his intent to be covered by the general permit renewal. Permittees covered under the previous NPDES general permits for storm water discharges associated with construction activity (NPDES permit numbers OHR100000 and OHC000002) shall have continuing coverage under this permit. The permittees covered under OHR100000 or OHC000002 shall submit a letter within 90 days of receipt of written notification by Ohio EPA expressing their intent that coverage be continued. There is no fee associated with these letters of intent for continued coverage. Permit coverage will be terminated after the 90-day period if the letter is not received by Ohio EPA. Ohio EPA will provide instructions on the contents of the letter and where it is to be sent within the notification letter.

PART III. STORM WATER POLLUTION PREVENTION PLAN (SWP3)

A. Storm Water Pollution Prevention Plans.

A SWP3 shall be developed for each site covered by this permit. For a multi-phase construction project, a separate NOI shall be submitted when a separate SWP3 will be prepared for subsequent phases. SWP3s shall be prepared in accordance with sound engineering and/or conservation practices by a professional experienced in the design and implementation of standard erosion and sediment controls and storm water management practices addressing all phases of construction. The SWP3 shall identify potential sources of pollution which may reasonably be expected to affect the quality of storm water discharges associated with construction activities. The SWP3 shall be a comprehensive, stand-alone document, which is not complete unless it contains the information required by Part III.G of this permit. In addition, the SWP3 shall describe and ensure the implementation of best management practices (BMPs) that reduce the pollutants in storm water discharges during construction and pollutants associated with post-construction activities to ensure compliance with ORC Section 6111.04, OAC Chapter 3745-1 and the terms and conditions of this permit.

B. Timing

A SWP3 shall be completed prior to the timely submittal of an NOI and updated in accordance with Part III.D. Upon request and good cause shown, the director may waive the requirement to have a SWP3 completed at the time of NOI submission. If a waiver has been granted, the SWP3 must be completed prior to the initiation of construction activities. The SWP3 must be implemented upon initiation of construction activities.

Permittees continuing coverage from the previous generations of this permit (OHR100000 and OHC000002) that have initiated construction activity prior to the receipt of the first written notification from Ohio EPA to submit a letter of intent to continue coverage, as required in Part II.E, are not required to update their SWP3 as a result of this renewal (OHC000003). Permittees continuing coverage from the previous generations of this permit (OHR100000 and OHC000002) that have not initiated construction activity prior to the receipt of the first written notification from Ohio EPA to submit a letter of intent to continue coverage, as required in Part II.E, are required to update their SWP3 as a result of this renewal (OHC000003).

C. SWP3 Signature and Review.

1. Plan Signature and Retention On Site. The SWP3 shall include the certification in Part V.H., be signed in accordance with Part V.G., and be retained on site during working hours.

Part III.C

2. Plan Availability

   a. On-site: The plan shall be made available immediately upon request of the director or his authorized representative during working hours. A copy of the NOI and letter granting permit coverage under this general permit also shall be made available at the site.

   b. By written request: The permittee must provide a copy of the SWP3 within 10 days upon written request by any of the following:

      i. The director or the director's authorized representative;

      ii. A local agency approving sediment and erosion plans, grading plans or storm water management plans; or

      iii. In the case of a storm water discharge associated with construction activity which discharges through a municipal separate storm sewer system with an NPDES permit, to the operator of the system.

   c. To the public: All NOIs, general permit approval for coverage letters, and SWP3s are considered reports that shall be available to the public in accordance with the Ohio Public Records law. The permittee shall make documents available to the public upon request or provide a copy at public expense, at cost, in a timely manner. However, the permittee may claim to Ohio EPA any portion of an SWP3 as confidential in accordance with Ohio law.

3. Plan Revision. The director or authorized representative, may notify the permittee at any time that the SWP3 does not meet one or more of the minimum requirements of this part. Within 10 days after such notification from the director (or as otherwise provided in the notification) or authorized representative, the permittee shall make the required changes to the SWP3 and, if requested, shall submit to Ohio EPA the revised SWP3 or a written certification that the requested changes have been made.

D. Amendments

The permittee shall amend the SWP3 whenever there is a change in design, construction, operation or maintenance, which has a significant effect on the potential for the discharge of pollutants to surface waters of the State or if the SWP3 proves to be ineffective in achieving the general objectives of controlling pollutants in storm water discharges associated with construction activity. Amendments to the SWP3 may be reviewed by Ohio EPA in the same manner as Part III.C.

Part III

E. Duty to inform contractors and subcontractors

The permittee shall inform all contractors and subcontractors not otherwise defined as "operators" in Part VII of this general permit, who will be involved in the implementation of the SWP3, of the terms and conditions of this general permit. The permittee shall maintain a written document containing the signatures of all contractors and subcontractors involved in the implementation of the SWP3 as proof acknowledging that they reviewed and understand the conditions and responsibilities of the SWP3. The written document shall be created and signatures of each individual contractor shall be obtained prior to their commencement of work on the construction site.

F. Total Maximum Daily Load (TMDL) allocations

If a TMDL is approved for any waterbody into which the permittee's site discharges and requires specific BMPs for construction sites, the director may require the permittee to revise his/her SWP3.

G. SWP3 Requirements

Operations that discharge storm water from construction activities are subject to the following requirements and the SWP3 shall include the following items:

1. Site description. Each SWP3 shall provide:

    a. A description of the nature and type of the construction activity (e.g., low density residential, shopping mall, highway, etc.);

    b. Total area of the site and the area of the site that is expected to be disturbed (i.e., grubbing, clearing, excavation, filling or grading, including off-site borrow areas);

    c. An estimate of the impervious area and percent imperviousness created by the construction activity;

    d. A calculation of the runoff coefficients for both the pre-construction and post construction site conditions;

    e. Existing data describing the soil and, if available, the quality of any discharge from the site;

    f. A description of prior land uses at the site;

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g. An implementation schedule which describes the sequence of major construction operations (i.e., grubbing, excavating, grading, utilities and infrastructure installation) and the implementation of erosion, sediment and storm water management practices or facilities to be employed during each operation of the sequence;

h. The name and/or location of the immediate receiving stream or surface water(s) and the first subsequent named receiving water(s) and the areal extent and description of wetlands or other special aquatic sites at or near the site which will be disturbed or which will receive discharges from disturbed areas of the project. For discharges to an MS4, the point of discharge to the MS4 and the location where the MS4 ultimately discharges to a stream or surface water of the State must be indicated;

i. For subdivided developments where the SWP3 does not call for a centralized sediment control capable of controlling multiple individual lots, a detail drawing of a typical individual lot showing standard individual lot erosion and sediment control practices.

   This does not remove the responsibility to designate specific erosion and sediment control practices in the SWP3 for critical areas such as steep slopes, stream banks, drainage ways and riparian zones.

j. Location and description of any storm water discharges associated with dedicated asphalt and dedicated concrete plants covered by this permit and the best management practices to address pollutants in these storm water discharges;

k. A copy of the permit requirements (attaching a copy of this permit is acceptable);

l. A cover page or title identifying the name and location of the site, the name and contact information of all construction site operators, the name and contact information for the person responsible for authorizing and amending the SWP3, preparation date, and the estimated dates that construction will start and be complete;

m. A log documenting grading and stabilization activities as well as amendments to the SWP3, which occur after construction activities commence; and

n. Site map showing:

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i. Limits of earth-disturbing activity of the site including associated off-site borrow or spoil areas that are not addressed by a separate NOI and associated SWP3;

ii. Soils types should be depicted for all areas of the site, including locations of unstable or highly erodible soils;

iii. Existing and proposed contours. A delineation of drainage watersheds expected during and after major grading activities as well as the size of each drainage watershed, in acres;

iv. Surface water locations including springs, wetlands, streams, lakes, water wells, etc., on or within 200 feet of the site, including the boundaries of wetlands or stream channels and first subsequent named receiving water(s) the permittee intends to fill or relocate for which the permittee is seeking approval from the Army Corps of Engineers and/or Ohio EPA;

v. Existing and planned locations of buildings, roads, parking facilities and utilities;

vi. The location of all erosion and sediment control practices, including the location of areas likely to require temporary stabilization during the course of site development;

vii. Sediment and storm water management basins noting their sediment settling volume and contributing drainage area;

viii. Permanent storm water management practices to be used to control pollutants in storm water after construction operations have been completed.

ix. Areas designated for the storage or disposal of solid, sanitary and toxic wastes, including dumpster areas, areas designated for cement truck washout, and vehicle fueling;

x. The location of designated construction entrances where the vehicles will access the construction site;

xi. The location of any in-stream activities including stream crossings;

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2. Controls. The SWP3 must contain a description of the controls appropriate for each construction operation covered by this permit and the operator(s) must implement such controls. The SWP3 must clearly describe for each major construction activity identified in Part III.G.1.g: (a) appropriate control measures and the general timing (or sequence) during the construction process that the measures will be implemented; and (b) which contractor is responsible for implementation (e.g., contractor A will clear land and install perimeter controls and contractor B will maintain perimeter controls until final stabilization). The SWP3 shall identify the subcontactors engaged in activities that could impact storm water runoff. The SWP3 shall contain signatures from all of the identified subcontractors indicating that they have been informed and understand their roles and responsibilities in complying with the SWP3. Ohio EPA recommends that the primary site operator review the SWP3 with the primary contractor prior to commencement of construction activities and keep a SWP3 training log to demonstrate that this review has occurred.

   Ohio EPA recommends that the erosion, sediment, and storm water management practices used to satisfy the conditions of this permit should meet the standards and specifications in the current edition of Ohio's Rainwater and Land Development (see definitions) manual or other standards acceptable to Ohio EPA. The controls shall include the following minimum components:

   a. **Non-Structural Preservation Methods.** The SWP3 must make use of practices which preserve the existing natural condition as much as feasible. Such practices may include: preserving riparian areas adjacent to surface waters of the State, preserving existing vegetation and vegetative buffer strips, phasing of construction operations in order to minimize the amount of disturbed land at any one time and designation of tree preservation areas or other protective clearing or grubbing practices. The recommended buffer that operators should leave undisturbed along a surface water of the State is 25 feet as measured from the ordinary high water mark of the surface water.

   b. **Erosion Control Practices.** The SWP3 must make use of erosion controls that are capable of providing cover over disturbed soils unless an exception is approved in accordance with Part III.G.4. A description of control practices designed to restabilize disturbed areas after grading or construction shall be included in the SWP3. The SWP3 must provide specifications for stabilization of all disturbed areas of the site and provide guidance as to which method of stabilization will be employed for any time of the year. Such practices may include: temporary seeding, permanent seeding, mulching, matting, sod stabilization, vegetative buffer strips, phasing of construction operations, use of construction entrances and the use of alternative ground cover.

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i. **Stabilization.** Disturbed areas must be stabilized as specified in the following tables below. Permanent and temporary stabilization are defined in Part VII.

Table 1: Permanent Stabilization

Area requiring permanent stabilization	Time frame to apply erosion controls
Any areas that will lie dormant for one year or more	Within seven days of the most recent disturbance
Any areas within 50 feet of a surface water of the State and at final grade	Within two days of reaching final grade
Any other areas at final grade	Within seven days of reaching final grade within that area

Table 2: Temporary Stabilization

Area requiring temporary stabilization	Time frame to apply erosion controls
Any disturbed areas within 50 feet of a surface water of the State and not at final grade	Within two days of the most recent disturbance if the area will remain idle for more than 21 days
For all construction activities, any disturbed areas that will be dormant for more than 21 days but less than one year, and not within 50 feet of a surface water of the State	Within seven days of the most recent disturbance within the area For residential subdivisions, disturbed areas must be stabilized at least seven days prior to transfer of permit coverage for the individual lot(s).
Disturbed areas that will be idle over winter	Prior to the onset of winter weather

Where vegetative stabilization techniques may cause structural instability or are otherwise unobtainable, alternative stabilization techniques must be employed.

ii. **Permanent stabilization of conveyance channels**. Operators shall undertake special measures to stabilize channels and outfalls and prevent erosive flows. Measures may include seeding, dormant seeding (as defined in the current edition of the <u>Rainwater and Land Development</u> manual), mulching, erosion control matting, sodding, riprap, natural channel design with bioengineering techniques or rock check dams.

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c. **Runoff Control Practices.** The SWP3 shall incorporate measures which control the flow of runoff from disturbed areas so as to prevent erosion from occurring. Such practices may include rock check dams, pipe slope drains, diversions to direct flow away from exposed soils and protective grading practices. These practices shall divert runoff away from disturbed areas and steep slopes where practicable. Velocity dissipation devices shall be placed at discharge locations and along the length of any outfall channel to provide non-erosive flow velocity from the structure to a water course so that the natural physical and biological characteristics and functions are maintained and protected.

d. **Sediment Control Practices.** The plan shall include a description of structural practices that shall store runoff allowing sediments to settle and/or divert flows away from exposed soils or otherwise limit runoff from exposed areas. Structural practices shall be used to control erosion and trap sediment from a site remaining disturbed for more than 14 days. Such practices may include, among others: sediment settling ponds, silt fences, earth diversion dikes or channels which direct runoff to a sediment settling pond and storm drain inlet protection. All sediment control practices must be capable of ponding runoff in order to be considered functional. Earth diversion dikes or channels alone are not considered a sediment control practice unless those are used in conjunction with a sediment settling pond.

The SWP3 must contain detail drawings for all structural practices.

i. <u>Timing</u>. Sediment control structures shall be functional throughout the course of earth disturbing activity. Sediment basins and perimeter sediment barriers shall be implemented prior to grading and within seven days from the start of grubbing. They shall continue to function until the up slope development area is restabilized. As construction progresses and the topography is altered, appropriate controls must be constructed or existing controls altered to address the changing drainage patterns.

ii. <u>Sediment settling ponds</u>. A sediment settling pond is required for any one of the following conditions:

- concentrated storm water runoff (e.g., storm sewer or ditch);
- runoff from drainage areas, which exceed the design capacity of silt fence or other sediment barriers;
- runoff from drainage areas that exceed the design capacity of inlet protection; or
- runoff from common drainage locations with 10 or more acres of disturbed land.

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The permittee may request approval from Ohio EPA to use alternative controls if the permittee can demonstrate the alternative controls are equivalent in effectiveness to a sediment settling pond.

The sediment settling pond volume consists of both a dewatering zone and a sediment storage zone. The volume of the dewatering zone shall be a minimum of 1800 cubic feet (ft^3) per acre of drainage (67 yd^3/acre) with a minimum 48-hour drain time for sediment basins serving a drainage area over 5 acres. The volume of the sediment storage zone shall be calculated by one of the following methods: Method 1: The volume of the sediment storage zone shall be 1000 ft^3 per disturbed acre within the watershed of the basin. OR Method 2: The volume of the sediment storage zone shall be the volume necessary to store the sediment as calculated with RUSLE or a similar generally accepted erosion prediction model. The accumulated sediment shall be removed from the sediment storage zone once it's full. When determining the total contributing drainage area, off-site areas and areas which remain undisturbed by construction activity must be included unless runoff from these areas is diverted away from the sediment settling pond and is not co-mingled with sediment-laden runoff. The depth of the dewatering zone must be less than or equal to five feet. The configuration between inlets and the outlet of the basin must provide at least two units of length for each one unit of width (> 2:1 length:width ratio), however, a length to width ratio of 4:1 is recommended. When designing sediment settling ponds, the permittee must consider public safety, especially as it relates to children, as a design factor for the sediment basin and alternative sediment controls must be used where site limitations would preclude a safe design. The use of a combination of sediment and erosion control measures in order to achieve maximum pollutant removal is encouraged.

iii. Silt Fence and Diversions. Sheet flow runoff from denuded areas shall be intercepted by silt fence or diversions to protect adjacent properties and water resources from sediment transported via sheet flow. Where intended to provide sediment control, silt fence shall be placed on a level contour downslope of the disturbed area. This permit does not preclude the use of other sediment barriers designed to control sheet flow runoff. The relationship between the maximum drainage area to silt fence for a particular slope range is shown in the table below.

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Maximum drainage area (in acres) to 100 linear feet of silt fence	**Range of slope for a particular drainage area (in percent)**
0.5	< 2%
0.25	≥ 2% but < 20%
0.125	≥ 20% but < 50%

Placing silt fence in a parallel series does not extend the size of the drainage area. Storm water diversion practices shall be used to keep runoff away from disturbed areas and steep slopes where practicable. Such devices, which include swales, dikes or berms, may receive storm water runoff from areas up to 10 acres.

iv. Inlet Protection. Other erosion and sediment control practices shall minimize sediment laden water entering active storm drain systems, unless the storm drain system drains to a sediment settling pond. All inlets receiving runoff from drainage areas of one or more acres will require a sediment settling pond.

v. Surface Waters of the State Protection. If construction activities disturb areas adjacent to surface waters of the State, structural practices shall be designed and implemented on site to protect all adjacent surface waters of the State from the impacts of sediment runoff. No structural sediment controls (e.g., the installation of silt fence or a sediment settling pond) shall be used in a surface water of the State. For all construction activities immediately adjacent to surface waters of the State, it is recommended that a setback of at least 25-feet, as measured from the ordinary high water mark of the surface water, be maintained in its natural state as a permanent buffer. Where impacts within this setback area are unavoidable due to the nature of the construction activity (e.g., stream crossings for roads or utilities), the project shall be designed such that the number of stream crossings and the width of the disturbance within the setback area are minimized.

vi. Modifying Controls. If periodic inspections or other information indicates a control has been used inappropriately or incorrectly, the permittee must replace or modify the control for site conditions.

e. **Post-Construction Storm Water Management Requirements.** So that the receiving stream's physical, chemical, and biological characteristics are protected and stream functions are maintained, post-construction storm water practices shall provide perpetual management of runoff quality and quantity. To meet the post-construction requirements of this permit, the SWP3 must contain a description of the post-construction BMPs that will be installed during construction for the site and the rationale for their selection. The rationale must address the anticipated impacts on the channel and floodplain morphology, hydrology, and water quality. Post-construction BMPs cannot be installed within a surface water of the State (e.g., wetland or stream) unless it's authorized by a CWA 401 water quality certification, CWA 404 permit, or Ohio EPA non-jurisdictional wetland/stream program approval. Note: localities may have more stringent post-construction requirements.

Detail drawings and maintenance plans must be provided for all post-construction BMPs. Maintenance plans shall be provided by the permittee to the post-construction operator of the site (including homeowner associations) upon completion of construction activities (prior to termination of permit coverage). For sites located within a community with a regulated municipal separate storm sewer system (MS4), the permittee, land owner, or other entity with legal control of the property may be required to develop and implement a maintenance plan to comply with the requirements of the MS4. Maintenance plans must ensure that pollutants collected within structural post-construction practices, be disposed of in accordance with local, state, and federal regulations. To ensure that storm water management systems function as they were designed and constructed, the post construction operation and maintenance plan must be a stand-alone document, which contains: (1) a designated entity for storm water inspection and maintenance responsibilities; (2) the routine and non-routine maintenance tasks to be undertaken; (3) a schedule for inspection and maintenance; (4) any necessary legally binding maintenance easements and agreements; and (5) a map showing all access and maintenance easements. Permittees are not responsible under this permit for operation and maintenance of post-construction practices once coverage under this permit is terminated.

Post-construction storm water BMPs that discharge pollutants from point sources once construction is completed, may in themselves, need authorization under a separate NPDES permit (one example is storm water discharges from regulated industrial sites).

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Construction activities that do not include the installation of any impervious surface (e.g., soccer fields), abandoned mine land reclamation activities regulated by the Ohio Department of Natural Resources, stream and wetland restoration activities, and wetland mitigation activities are not required to comply with the conditions of Part III.G.2.e of this permit. Linear construction projects, (e.g., pipeline or utility line installation), which do not result in the installation of additional impervious surface, are not required to comply with the conditions of Part III.G.2.e of this permit. However, linear construction projects must be designed to minimize the number of stream crossings and the width of disturbance and achieve final stabilization of the disturbed area as defined in Part VII.H.1.

<u>Large Construction Activities</u>. For all large construction activities (involving the disturbance of five or more acres of land or will disturb less than five acres, but is a part of a larger common plan of development or sale which will disturb five or more acres of land), the post construction BMP(s) chosen must be able to detain storm water runoff for protection of the stream channels, stream erosion control, and improved water quality. The BMP(s) chosen must be compatible with site and soil conditions. Structural (designed) post-construction storm water treatment practices shall be incorporated into the permanent drainage system for the site. The BMP(s) chosen must be sized to treat the water quality volume (WQv) and ensure compliance with Ohio's Water Quality Standards in OAC Chapter 3745-1. The WQv shall be equivalent to the volume of runoff from a 0.75-inch rainfall and shall be determined according to the following equation:

$$WQv = C * P * A / 12$$

where:
WQv = water quality volume in acre-feet
C = runoff coefficient appropriate for storms less than 1 inch
(Either use the following formula: $C = 0.858i^3 - 0.78i^2 + 0.774i + 0.04$, where i = fraction of post-construction impervious surface or use Table 1)
P = 0.75 inch precipitation depth
A = area draining into the BMP in acres

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Table 1
Runoff Coefficients Based on the Type of Land Use

Land Use	Runoff Coefficient
Industrial & Commercial	0.8
High Density Residential (>8 dwellings/acre)	0.5
Medium Density Residential (4 to 8 dwellings/acre)	0.4
Low Density Residential (<4 dwellings/acre)	0.3
Open Space and Recreational Areas	0.2

Where the land use will be mixed, the runoff coefficient should be calculated using a weighted average. For example, if 60% of the contributing drainage area to the storm water treatment structure is Low Density Residential, 30% is High Density Residential, and 10% is Open Space, the runoff coefficient is calculated as follows (0.6)(0.3) + (0.3)(0.5) + (0.1)(0.2) = 0.35.

An additional volume equal to 20 percent of the WQv shall be incorporated into the BMP for sediment storage. Ohio EPA recommends that BMPs be designed according to the methodology included in the Rainwater and Land Development manual or in another design manual acceptable for use by Ohio EPA.

The BMPs listed in Table 2 below shall be considered standard BMPs approved for general use. However communities with a regulated MS4 may limit the use of some of these BMPs. BMPs shall be designed such that the drain time is long enough to provide treatment, but short enough to provide storage for successive rainfall events and avoid the creation of nuisance conditions. The outlet structure for the post-construction BMP must not discharge more than the first half of the WQv or extended detention volume (EDv) in less than one-third of the drain time. The EDv is the volume of storm water runoff that must be detained by a structural post-construction BMP. The EDv is equal to 75 percent of the WQv for wet extended detention basins, but is equal to the WQv for all other BMPs listed in Table 2.

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Table 2
Structural Post-Construction BMPs & Associated Drain (Drawdown) Times

Best Management Practice	Drain Time of WQv
Infiltration Basin^	24 - 48 hours
Enhanced Water Quality Swale	24 hours
Dry Extended Detention Basin*	48 hours
Wet Extended Detention Basin**	24 hours
Constructed Wetland (above permanent pool)$^+$	24 hours
Sand & Other Media Filtration	40 hours
Bioretention Cell^	40 hours
Pocket Wetland$^\#$	24 hours
Vegetated Filter Strip	24 hours

* Dry basins must include forebay and micropool each sized at 10% of the WQv
** Provide both a permanent pool and an EDv above the permanent pool, each sized at 0.75 * WQv
$^+$ Extended detention shall be provided for the full WQv above the permanent water pool.
^ The WQv shall completely infiltrate within 48 hours so there is no standing or residual water in the BMP.
$^\#$ Pocket wetlands must have a wet pool equal to the WQv, with 25% of the WQv in a pool and 75% in marshes. The EDv above the permanent pool must be equal to the WQv.

The permittee may request approval from Ohio EPA to use alternative post-construction BMPs if the permittee can demonstrate that the alternative BMPs are equivalent in effectiveness to those listed in Table 2 above. Construction activities shall be exempt from this condition if it can be demonstrated that the WQv is provided within an existing structural post-construction BMP that is part of a larger common plan of development or if structural post-construction BMPs are addressed in a regional or local storm water management plan. A municipally operated regional storm water BMP can be used as a post-construction BMP provided that the BMP can detain the WQv from its entire drainage area and release it over a 24 hour period.

<u>Transportation Projects</u> The construction of new roads and roadway improvement projects by public entities (i.e., the state, counties, townships, cities, or villages) may implement post-construction BMPs in compliance with the current version (as of the effective date of this permit) of the Ohio Department of Transportation's "Location and Design Manual, Volume Two Drainage Design" that has been accepted by Ohio EPA as an alternative to the conditions of this permit.

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Offsite Mitigation of Post-Construction Ohio EPA may authorize the offsite mitigation of the post-construction requirements of Part III.G.2.e of this permit on a case by case basis provided the permittee clearly demonstrates the BMPs listed in Table 2 are not feasible and the following criteria is met: (1) a maintenance agreement or policy is established to ensure operations and treatment in perpetuity; (2) the offsite location discharges to the same HUC-14 watershed unit; and (3) the mitigation ratio of the WQv is 1.5 to 1 or the WQv at the point of retrofit, whichever is greater. Requests for offsite mitigation must be received prior to receipt of the NOI applications.

Redevelopment Projects Sites that have been previously developed where no post-construction BMPs were installed shall either ensure a 20 percent net reduction of the site impervious area, provide for treatment of at least 20 percent of the WQ_v, or a combination of the two. A one-for-one credit towards the 20 percent net reduction of impervious area can be obtained through the use of pervious pavement and/or green roofs. Where projects are a combination of new development and redevelopment, the total WQv that must be treated shall be calculated by a weighted average based on acreage, with the new development at 100 percent WQv and redevelopment at 20 percent WQv.

Non-Structural Post-Construction BMPs The size of the structural post-construction can be reduced by incorporating non-structural post-construction BMPs into the design. Practices such as preserving open space will reduce the runoff coefficient and, thus, the WQv. Ohio EPA encourages the implementation of riparian and wetland setbacks. Practices which reduce storm water runoff include permeable pavements, green roofs, rain barrels, conservation development, smart growth, low-impact development, and other site design techniques contained in the Ohio Lake Commission's Balanced Growth Program (see www.glc.org/landuse/ohroundtable/ohiobgi.html). In order to promote the implementation of such practices, the Director may consider the use of non-structural practices to demonstrate compliance with Part III.G.2.e of this permit for areas of the site not draining into a common drainage system of the site, i.e., sheet flow from perimeter areas such as the rear yards of residential lots, for low density development scenarios, or where the permittee can demonstrate that the intent of pollutant removal and stream protection, as required in Part III.G.2.e of this permit is being addressed through non-structural post-construction BMPs based upon review and approval by Ohio EPA.

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Use of Alternative Post-Construction BMPs This permit does not preclude the use of innovative or experimental post-construction storm water management technologies. However, the Director may require these practices to be tested using the protocol outlined in the Technology Acceptance Reciprocity Partnership's (TARP) Protocol for Stormwater Best Management Practice Demonstrations (see http://www.dep.state.pa.us/dep/deputate/pollprev/techservices/tarp).

The Director may require discharges from such structures to be monitored to ensure compliance with Part III.G.2.e of this permit. Permittees must request approval from Ohio EPA to use alternative post-construction BMPs if the permittee can demonstrate that the alternative BMPs are equivalent in effectiveness to those listed in Table 2 above. To demonstrate this equivalency, the permittee must show that the alternative BMP has a minimum total suspended solids (TSS) removal efficiency of 80 percent. Also, the WQv discharge rate from the practice must be reduced to prevent stream bed erosion and protect the physical and biological stream integrity unless there will be negligible hydrological impact to the receiving surface water of the State. The discharges will have a negligible impact if the permittee can demonstrate that one of the following four conditions exist:

i. The entire WQv is recharged to groundwater;

ii. The larger common plan of development or sale will create less than one acre of impervious surface;

iii. The project is a redevelopment project within an ultra-urban setting (i.e., a downtown area or on a site where 100 percent of the project area is already impervious surface and the storm water discharge is directed into an existing storm sewer system); or

iv. The storm water drainage system of the development discharges directly into a large river (fourth order or greater) or to a lake and where the development area is less than 5 percent of the watershed area upstream of the development site, unless a TMDL identified water quality problems in the receiving surface waters of the State.

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The Director shall only consider the use of alternative BMPs on projects where the permittee can demonstrate that the implementation of the BMPs listed in Table 2 is infeasible due to physical site constraints that prevent the ability to provide functional BMP design. Alternative practices may include, but are not limited to, underground detention structures, vegetated swales and vegetated filter strips designed using water quality flow, natural depressions, rain barrels, permeable pavements green roofs, rain gardens, catch basin inserts, and hydrodynamics separators. The Director may also consider non-structural post-construction approaches where no local requirement for such practices exist.

Small Construction Activities. For all small land disturbance activities (which disturb one or more, but less than five acres of land and is not a part of a larger common plan of development or sale which will disturb five or more acres of land), a description of measures that will be installed during the construction process to control pollutants in storm water discharges that will occur after construction operations have been completed must be included in the SWP3. Structural measures should be placed on upland soils to the degree attainable. Such practices may include, but are not limited to: storm water detention structures (including wet basins); storm water retention structures; flow attenuation by use of open vegetated swales and natural depressions; infiltration of runoff onsite; and sequential systems (which combine several practices). The SWP3 shall include an explanation of the technical basis used to select the practices to control pollution where flows exceed pre-development levels.

f. **Surface Water Protection.** If the project site contains any streams, rivers, lakes, wetlands or other surface waters, certain construction activities at the site may be regulated under the CWA and/or state non-jurisdictional stream and wetland requirements. Sections 404 and 401 of the Act regulate the discharge of dredged or fill material into surface waters and the impacts of such activities on water quality, respectively. Construction activities in surface waters which may be subject to CWA regulation and/or state requirements include, but are not limited to: sewer line crossings, grading, backfilling or culverting streams, filling wetlands, road and utility line construction, bridge installation and installation of flow control structures. If the project contains streams, rivers, lakes or wetlands or possible wetlands, the permittee must contact the appropriate U.S. Army Corps of Engineers District Office. (CAUTION: Any area of seasonally wet hydric soil is a potential wetland - please consult the Soil Survey and list of hydric soils for your County, available at your county's Soil and Water Conservation District. If you have any questions about Section 401 water quality certification, please contact the Ohio Environmental Protection Agency, Section 401 Coordinator.)

U.S. Army Corps of Engineers (Section 404 regulation):
Huntington, WV District (304) 399-5210 (Muskingum River, Hocking River, Scioto River, Little Miami River, and Great Miami River Basins)
Buffalo, NY District (716) 879-4191 (Lake Erie Basin)
Pittsburgh, PA District (412) 395-7154 (Mahoning River Basin)
Louisville, KY District (502) 315-6733 (Ohio River)

Ohio EPA 401/404 and non-jurisdictional stream/wetland coordinator can be contacted at (614) 644-2001 (all of Ohio)

Concentrated storm water runoff from BMPs to natural wetlands shall be converted to diffuse flow before the runoff enters the wetlands. The flow should be released such that no erosion occurs downslope. Level spreaders may need to be placed in series, particularly on steep sloped sites, to ensure non-erosive velocities. Other structural BMPs may be used between storm water features and natural wetlands, in order to protect the natural hydrology, hydroperiod, and wetland flora. If the applicant proposes to discharge to natural wetlands, a hydrologic analysis shall be performed. The applicant shall attempt to match the pre-development hydroperiods and hydrodynamics that support the wetland. The applicant shall assess whether their construction activity will adversely impact the hydrologic flora and fauna of the wetland. Practices such as vegetative buffers, infiltration basins, conservation of forest cover, and the preservation of intermittent streams, depressions, and drainage corridors may be used to maintain wetland hydrology.

g. **Other controls.** The SWP3 must also provide BMPs for pollutant sources other than sediment. Non-sediment pollutant sources, which may be present on a construction site, include paving operations, concrete washout, structure painting, structure cleaning, demolition debris disposal, drilling and blasting operations, material storage, slag, solid waste, hazardous waste, contaminated soils, sanitary and septic wastes, vehicle fueling and maintenance activities, and landscaping operations.

i. **Non-Sediment Pollutant Controls.** No solid or liquid waste, including building materials, shall be discharged in storm water runoff. The permittee must implement all necessary BMPs to prevent the discharge of non-sediment pollutants to the drainage system of the site or surface waters of the State. Under no circumstance shall concrete trucks wash out directly into a drainage channel, storm sewer or surface waters of the State. No exposure of storm water to waste materials is recommended.

ii. **Off-site traffic.** Off-site vehicle tracking of sediments and dust generation shall be minimized.

Part III.G.2.g

iii. **Compliance with other requirements.** The SWP3 shall be consistent with applicable State and/or local waste disposal, sanitary sewer or septic system regulations, including provisions prohibiting waste disposal by open burning and shall provide for the proper disposal of contaminated soils to the extent these are located within the permitted area.

iv. **Trench and ground water control**. There shall be no turbid discharges to surface waters of the State resulting from dewatering activities. If trench or ground water contains sediment, it must pass through a sediment settling pond or other equally effective sediment control device, prior to being discharged from the construction site. Alternatively, sediment may be removed by settling in place or by dewatering into a sump pit, filter bag or comparable practice. Ground water dewatering which does not contain sediment or other pollutants is not required to be treated prior to discharge. However, care must be taken when discharging ground water to ensure that it does not become pollutant-laden by traversing over disturbed soils or other pollutant sources.

v. **Contaminated Sediment.** Where construction activities are to occur on sites with contamination from previous activities, operators must be aware that concentrations of materials that meet other criteria (is not considered a Hazardous Waste, meeting VAP standards, etc.) may still result in storm water discharges in excess of Ohio Water Quality Standards. Such discharges are not authorized by this permit. Appropriate BMPs include, but are not limited to:

- The use of berms, trenches, and pits to collect contaminated runoff and prevent discharges;
- Pumping runoff into a sanitary sewer (with prior approval of the sanitary sewer operator) or into a container for transport to an appropriate treatment/disposal facility; and
- Covering areas of contamination with tarps or other methods that prevent storm water from coming into contact with the material.

Operators should consult with Ohio EPA Division of Surface Water prior to seeking permit coverage.

h. **Maintenance.** All temporary and permanent control practices shall be maintained and repaired as needed to ensure continued performance of their intended function. All sediment control practices must be maintained in a functional condition until all up slope areas they control are permanently stabilized. The SWP3 shall be designed to minimize maintenance requirements. The applicant shall provide a description of maintenance procedures needed to ensure the continued performance of control practices.

Part III.G.2

i. **Inspections.** At a minimum, procedures in an SWP3 shall provide that all controls on the site are inspected at least once every seven calendar days and within 24 hours after any storm event greater than one-half inch of rain per 24 hour period. The inspection frequency may be reduced to at least once every month if the entire site is temporarily stabilized or runoff is unlikely due to weather conditions (e.g., site is covered with snow, ice, or the ground is frozen). A waiver of inspection requirements is available until one month before thawing conditions are expected to result in a discharge if all of the following conditions are met: the project is located in an area where frozen conditions are anticipated to continue for extended periods of time (i.e., more than one month); land disturbance activities have been suspended; and the beginning and ending dates of the waiver period are documented in the SWP3. Once a definable area has been finally stabilized, you may mark this on your SWP3 and no further inspection requirements apply to that portion of the site. The permittee shall assign "qualified inspection personnel" to conduct these inspections to ensure that the control practices are functional and to evaluate whether the SWP3 is adequate and properly implemented in accordance with the schedule proposed in Part III.G.1.g of this permit or whether additional control measures are required.

Following each inspection, a checklist must be completed and signed by the qualified inspection personnel representative. At a minimum, the inspection report must include:

i. the inspection date;
ii. names, titles, and qualifications of personnel making the inspection;
iii. weather information for the period since the last inspection (or since commencement of construction activity if the first inspection) including a best estimate of the beginning of each storm event, duration of each storm event, approximate amount of rainfall for each storm event (in inches), and whether any discharges occurred;
iv. weather information and a description of any discharges occurring at the time of the inspection;
v. location(s) of discharges of sediment or other pollutants from the site;
vi. location(s) of BMPs that need to be maintained;
vii. location(s) of BMPs that failed to operate as designed or proved inadequate for a particular location;
viii. location(s) where additional BMPs are needed that did not exist at the time of inspection; and
ix. corrective action required including any changes to the SWP3 necessary and implementation dates.

Part III.G.2.i

Disturbed areas and areas used for storage of materials that are exposed to precipitation shall be inspected for evidence of or the potential for pollutants entering the drainage system. Erosion and sediment control measures identified in the SWP3 shall be observed to ensure that those are operating correctly. Discharge locations shall be inspected to ascertain whether erosion and sediment control measures are effective in preventing significant impacts to the receiving waters. Locations where vehicles enter or exit the site shall be inspected for evidence of off-site vehicle tracking.

The permittee shall maintain for three years following the submittal of a notice of termination form, a record summarizing the results of the inspection, names(s) and qualifications of personnel making the inspection, the date(s) of the inspection, major observations relating to the implementation of the SWP3 and a certification as to whether the facility is in compliance with the SWP3 and the permit and identify any incidents of non-compliance. The record and certification shall be signed in accordance with Part V.G. of this permit.

i. **When practices require repair or maintenance.** If the inspection reveals that a control practice is in need of repair or maintenance, with the exception of a sediment settling pond, it must be repaired or maintained within three days of the inspection. Sediment settling ponds must be repaired or maintained within 10 days of the inspection.

ii. **When practices fail to provide their intended function.** If the inspection reveals that a control practice fails to perform its intended function and that another, more appropriate control practice is required, the SWP3 must be amended and the new control practice must be installed within 10 days of the inspection.

iii. **When practices depicted on the SWP3 are not installed.** If the inspection reveals that a control practice has not been implemented in accordance with the schedule contained in Part III.G.1.g of this permit, the control practice must be implemented within 10 days from the date of the inspection. If the inspection reveals that the planned control practice is not needed, the record must contain a statement of explanation as to why the control practice is not needed.

Part III.G

3. **Approved State or local plans.** All dischargers regulated under this general permit must comply, except those exempted under state law, with the lawful requirements of municipalities, counties and other local agencies regarding discharges of storm water from construction activities. All erosion and sediment control plans and storm water management plans approved by local officials shall be retained with the SWP3 prepared in accordance with this permit. Applicable requirements for erosion and sediment control and storm water management approved by local officials are, upon submittal of a NOI form, incorporated by reference and enforceable under this permit even if they are not specifically included in an SWP3 required under this permit. When the project is located within the jurisdiction of a regulated municipal separate storm sewer system (MS4), the permittee must certify that the SWP3 complies with the requirements of the storm water management program of the MS4 operator.

4. **Exceptions.** If specific site conditions prohibit the implementation of any of the erosion and sediment control practices contained in this permit or site specific conditions are such that implementation of any erosion and sediment control practices contained in this permit will result in no environmental benefit, then the permittee shall provide justification for rejecting each practice based on site conditions. Exceptions from implementing the erosion and sediment control standards contained in this permit will be approved or denied on a case-by-case basis.

   The permittee may request approval from Ohio EPA to use alternative methods to satisfy conditions in this permit if the permittee can demonstrate that the alternative methods are sufficient to protect the overall integrity of receiving streams and the watershed. Alternative methods will be approved or denied on a case-by-case basis.

PART IV. NOTICE OF TERMINATION REQUIREMENTS

A. Failure to notify.

The terms and conditions of this permit shall remain in effect until a signed Notice of Termination (NOT) form is submitted. Failure to submit an NOT constitutes a violation of this permit and may affect the ability of the permittee to obtain general permit coverage in the future.

B. When to submit an NOT

1. Permittees wishing to terminate coverage under this permit must submit an NOT form in accordance with Part V.G. of this permit. Compliance with this permit is required until an NOT form is submitted. The permittee's authorization to discharge under this permit terminates at midnight of the day the NOT form is

submitted. Prior to submitting the NOT form, the permittee shall conduct a site inspection in accordance with Part III.G.2.i of this permit and have a maintenance agreement is in place to ensure all post-construction BMPs will be maintained in perpetuity.

2. All permittees must submit an NOT form within 45 days of completing all permitted land disturbance activities. Enforcement actions may be taken if a permittee submits an NOT form without meeting one or more of the following conditions:

   a. Final stabilization (see definition in Part VII) has been achieved on all portions of the site for which the permittee is responsible (including, if applicable, returning agricultural land to its pre-construction agricultural use);

   b. Another operator(s) has assumed control over all areas of the site that have not been finally stabilized;

   c. For residential construction only, temporary stabilization has been completed and the lot, which includes a home, has been transferred to the homeowner. (Note: individual lots without housing which are sold by the developer must undergo final stabilization prior to termination of permit coverage.); or

   d. An exception has been granted under Part III.G.4.

C. How to submit an NOT

Permittees must use Ohio EPA's approved NOT form. The form must be completed and mailed according to the instructions and signed in accordance with Part V.G of this permit.

PART V. STANDARD PERMIT CONDITIONS.

A. Duty to comply.

1. The permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of ORC Chapter 6111. and is grounds for enforcement action.

2. Ohio law imposes penalties and fines for persons who knowingly make false statements or knowingly swear or affirm the truth of a false statement previously made.

B. Continuation of an expired general permit.

An expired general permit continues in force and effect until a new general permit is issued.

Part V

C. Need to halt or reduce activity not a defense.

It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

D. Duty to mitigate.

The permittee shall take all reasonable steps to minimize or prevent any discharge in violation of this permit which has a reasonable likelihood of adversely affecting human health or the environment.

E. Duty to provide information.

The permittee shall furnish to the director, within 10 days of written request, any information which the director may request to determine compliance with this permit. The permittee shall also furnish to the director upon request copies of records required to be kept by this permit.

F. Other information.

When the permittee becomes aware that he or she failed to submit any relevant facts or submitted incorrect information in the NOI, SWP3, NOT or in any other report to the director, he or she shall promptly submit such facts or information.

G. Signatory requirements.

All NOIs, NOTs, SWP3s, reports, certifications or information either submitted to the director or that this permit requires to be maintained by the permittee, shall be signed.

1. These items shall be signed as follows:

    a. For a corporation: By a responsible corporate officer. For the purpose of this section, a responsible corporate officer means:

        i. A president, secretary, treasurer or vice-president of the corporation in charge of a principal business function or any other person who performs similar policy or decision-making functions for the corporation; or

Part V.G.1.a

ii. The manager of one or more manufacturing, production or operating facilities, provided, the manager is authorized to make management decisions which govern the operation of the regulated facility including having the explicit or implicit duty of making major capital investment recommendations and initiating and directing other comprehensive measures to assure long-term environmental compliance with environmental laws and regulations; the manager can ensure that the necessary systems are established or actions taken to gather complete and accurate information for permit application requirements; and where authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures;

b. For a partnership or sole proprietorship: By a general partner or the proprietor, respectively; or

c. For a municipality, State, Federal or other public agency: By either a principal executive officer or ranking elected official. For purposes of this section, a principal executive officer of a Federal agency includes (1) the chief executive officer of the agency or (2) a senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency (e.g., Regional Administrators of U.S. EPA).

2. All reports required by the permits and other information requested by the director shall be signed by a person described in Part V.G.1 of this permit or by a duly authorized representative of that person. A person is a duly authorized representative only if:

   a. The authorization is made in writing by a person described in Part V.G.1 of this permit and submitted to the director;

   b. The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity, such as the position of manager, operator of a well or well field, superintendent, position of equivalent responsibility or an individual or position having overall responsibility for environmental matters for the company. (A duly authorized representative may thus be either a named individual or any individual occupying a named position); and

   c. The written authorization is submitted to the director.

3. Changes to authorization. If an authorization under Part V.G.2 of this permit is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of Part V.G.2 of this permit must be submitted to the director prior to or together with any reports, information or applications to be signed by an authorized representative.

H. Certification.

Any person signing documents under this section shall make the following certification:

> *"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."*

I. Oil and hazardous substance liability.

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities or penalties to which the permittee is or may be subject under section 311 of the CWA or 40 CFR Part 112. 40 CFR Part 112 establishes procedures, methods and equipment and other requirements for equipment to prevent the discharge of oil from non-transportation-related onshore and offshore facilities into or upon the navigable surface waters of the State or adjoining shorelines.

J. Property rights.

The issuance of this permit does not convey any property rights of any sort, nor any exclusive privileges, nor does it authorize any injury to private property nor any invasion of personal rights, nor any infringement of Federal, State or local laws or regulations.

K. Severability.

The provisions of this permit are severable and if any provision of this permit or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances and the remainder of this permit shall not be affected thereby.

Part V

L. Transfers.

Ohio NPDES general permit coverage is transferable. Ohio EPA must be notified in writing sixty days prior to any proposed transfer of coverage under an Ohio NPDES general permit. The transferee must inform Ohio EPA it will assume the responsibilities of the original permittee transferor.

M. Environmental laws.

No condition of this permit shall release the permittee from any responsibility or requirements under other environmental statutes or regulations.

N. Proper operation and maintenance.

The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of this permit and with the requirements of SWP3s. Proper operation and maintenance requires the operation of backup or auxiliary facilities or similar systems, installed by a permittee only when necessary to achieve compliance with the conditions of the permit.

O. Inspection and entry.

The permittee shall allow the director or an authorized representative of Ohio EPA, upon the presentation of credentials and other documents as may be required by law, to:

1. Enter upon the permittee's premises where a regulated facility or activity is located or conducted or where records must be kept under the conditions of this permit;
2. Have access to and copy at reasonable times, any records that must be kept under the conditions of this permit; and
3. Inspect at reasonable times any facilities or equipment (including monitoring and control equipment).

PART VI. REOPENER CLAUSE

A. If there is evidence indicating potential or realized impacts on water quality due to any storm water discharge associated with construction activity covered by this permit, the permittee of such discharge may be required to obtain coverage under an individual permit or an alternative general permit in accordance with Part I.C of this permit or the permit may be modified to include different limitations and/or requirements.

B. Permit modification or revocation will be conducted according to ORC Chapter 6111.

PART VII. DEFINITIONS

A. "Act" means Clean Water Act (formerly referred to as the Federal Water Pollution Control Act or Federal Water Pollution Control Act Amendments of 1972) Pub. L. 92-500, as amended Pub. L. 95-217, Pub. L. 95-576, Pub. L. 96-483, Pub. L. 97-117 and Pub. L. 100-4, 33 U.S.C. 1251 et. seq.

B. "Best management practices (BMPs)" means schedules of activities, prohibitions of practices, maintenance procedures and other management practices (both structural and non-structural) to prevent or reduce the pollution of surface waters of the State. BMP's also include treatment requirements, operating procedures and practices to control plant and/or construction site runoff, spillage or leaks, sludge or waste disposal or drainage from raw material storage.

C. "Commencement of construction" means the initial disturbance of soils associated with clearing, grubbing, grading, placement of fill or excavating activities or other construction activities.

D. "Concentrated storm water runoff" means any storm water runoff which flows through a drainage pipe, ditch, diversion or other discrete conveyance channel.

E. "Director" means the director of the Ohio Environmental Protection Agency.

F. "Discharge" means the addition of any pollutant to the surface waters of the State from a point source.

G. "Disturbance" means any clearing, grading, excavating, filling, or other alteration of land surface where natural or man-made cover is destroyed in a manner that exposes the underlying soils.

H. "Final stabilization" means that either:

   1. All soil disturbing activities at the site are complete and a uniform perennial vegetative cover (e.g., evenly distributed, without large bare areas) with a density of at least 70 percent cover for the area has been established on all unpaved areas and areas not covered by permanent structures or equivalent stabilization measures (such as the use of landscape mulches, rip-rap, gabions or geotextiles) have been employed. In addition, all temporary erosion and sediment control practices are removed and disposed of and all trapped sediment is permanently stabilized to prevent further erosion; or

   2. For individual lots in residential construction by either:

      a. The homebuilder completing final stabilization as specified above or

b. The homebuilder establishing temporary stabilization including perimeter controls for an individual lot prior to occupation of the home by the homeowner and informing the homeowner of the need for and benefits of, final stabilization. (Homeowners typically have an incentive to put in the landscaping functionally equivalent to final stabilization as quick as possible to keep mud out of their homes and off sidewalks and driveways.); or

3. For construction projects on land used for agricultural purposes (e.g., pipelines across crop or range land), final stabilization may be accomplished by returning the disturbed land to its pre-construction agricultural use. Areas disturbed that were previously used for agricultural activities, such as buffer strips immediately adjacent to surface waters of the State and which are not being returned to their pre-construction agricultural use, must meet the final stabilization criteria in (1) or (2) above.

I. “Individual Lot NOI” means a Notice of Intent for an individual lot to be covered by this permit (see parts I and II of this permit).

J. “Larger common plan of development or sale”- means a contiguous area where multiple separate and distinct construction activities may be taking place at different times on different schedules under one plan.

K. “MS4" means municipal separate storm sewer system which means a conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels or storm drains) that are:

1. Owned or operated by the federal government, state, municipality, township, county, district(s) or other public body (created by or pursuant to state or federal law) including special district under state law such as a sewer district, flood control district or drainage districts or similar entity or a designated and approved management agency under section 208 of the act that discharges into surface waters of the State; and

2. Designed or used for collecting or conveying solely storm water,

3. Which is not a combined sewer and

4. Which is not a part of a publicly owned treatment works.

L. “National Pollutant Discharge Elimination System (NPDES)” means the national program for issuing, modifying, revoking and reissuing, terminating, monitoring and enforcing permits and enforcing pretreatment requirements, under sections 307, 402, 318 and 405 of the CWA. The term includes an "approved program."

Part VII

M. "NOI" means notice of intent to be covered by this permit.

N. "NOT" means notice of termination.

O. "Operator" means any party associated with a construction project that meets either of the following two criteria:

1. The party has operational control over construction plans and specifications, including the ability to make modifications to those plans and specifications; or

2. The party has day-to-day operational control of those activities at a project which are necessary to ensure compliance with an SWP3 for the site or other permit conditions (e.g., they are authorized to direct workers at a site to carry out activities required by the SWP3 or comply with other permit conditions).

As set forth in Part II.A, there can be more than one operator at a site and under these circumstances, the operators shall be co-permittees.

P. "Owner or operator" means the owner or operator of any "facility or activity" subject to regulation under the NPDES program.

Q. "Permanent stabilization" means the establishment of permanent vegetation, decorative landscape mulching, matting, sod, rip rap and landscaping techniques to provide permanent erosion control on areas where construction operations are complete or where no further disturbance is expected for at least one year.

R. "Percent imperviousness" means the impervious area created divided by the total area of the project site.

S. "Point source" means any discernible, confined and discrete conveyance, including but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, landfill leachate collection system, vessel or the floating craft from which pollutants are or may be discharged. This term does not include return flows from irrigated agriculture or agricultural storm water runoff.

T. "Qualified inspection personnel" means a person knowledgeable in the principles and practice of erosion and sediment controls, who possesses the skills to assess all conditions at the construction site that could impact storm water quality and to assess the effectiveness of any sediment and erosion control measures selected to control the quality of storm water discharges from the construction activity.

Part VII

U. "Rainwater and Land Development" is a manual describing construction and post-construction best management practices and associated specifications. A copy of the manual may be obtained by contacting the Ohio Department of Natural Resources, Division of Soil & Water Conservation.

V. "Riparian area" means the transition area between flowing water and terrestrial (land) ecosystems composed of trees, shrubs and surrounding vegetation which serve to stabilize erodible soil, improve both surface and ground water quality, increase stream shading and enhance wildlife habitat.

W. "Runoff coefficient" means the fraction of total rainfall that will appear at the conveyance as runoff.

X. "Sediment settling pond" means a sediment trap, sediment basin or permanent basin that has been temporarily modified for sediment control, as described in the latest edition of the Rainwater and Land Development manual.

Y. "State isolated wetland permit requirements" means the requirements set forth in Sections 6111.02 through 6111.029 of the ORC.

Z. "Storm water" means storm water runoff, snow melt and surface runoff and drainage.

AA. "Surface waters of the State" or "water bodies" means all streams, lakes, reservoirs, ponds, marshes, wetlands or other waterways which are situated wholly or partially within the boundaries of the state, except those private waters which do not combine or effect a junction with natural surface or underground waters. Waters defined as sewerage systems, treatment works or disposal systems in Section 6111.01 of the ORC are not included.

BB. "SWP3" means storm water pollution prevention plan.

CC. "Temporary stabilization" means the establishment of temporary vegetation, mulching, geotextiles, sod, preservation of existing vegetation and other techniques capable of quickly establishing cover over disturbed areas to provide erosion control between construction operations.

DD. "Water Quality Volume (WQ_v)" means the volume of storm water runoff which must be captured and treated prior to discharge from the developed site after construction is complete. WQ_v is based on the expected runoff generated by the mean storm precipitation volume from post-construction site conditions at which rapidly diminishing returns in the number of runoff events captured begins to occur.

Appendix B – Inspection & Maintenance Forms

Ravenna Army Ammunition Plant
Storm Water Pollution Prevention Plan
Inspection & Maintenance Report Form

To be completed every 7 days and within 24 hours of a rainfall event of 0.5 inches or more.

Inspector: ______________________________

Date: ______________

Days since last rainfall: __________

Amount of last rainfall: _______ inches

Stabilization Measures

Drainage Area	Date Since Last Disturbance	Date of Next Disturbance	Stabilized (Yes/No)	Stabilized with	Condition
Load Line 1					
Areas to be determined					
Load Line 2					
Areas to be determined					
Load Line 3					
Areas to be determined					
Load Line 4					
Areas to be determined					

Stabilization required:

____

____

____

To be performed by: _______________________ On or before: _______________________

Ravenna Army Ammunition Plant
Storm Water Pollution Prevention Plan
Inspection & Maintenance Report Form

Inspector: ______________________________

Date: ______________

Stabilized Construction Entrances

Construction entrance location	Is mulch tracked onto road?	Is the Gravel Clean of is it filled with sediment?	Does all traffic use the stabilized entrance to leave the site?	Is the culvert beneath the entrance working?
Load Line 1				
Load Line 2				
Load Line 3				
Load Line 4				

Maintenance required for stabilized construction entrance:

____

____

____

To be performed by: ______________________ On or before: ______________________

Ravenna Army Ammunition Plant
Storm Water Pollution Prevention Plan
Inspection & Maintenance Report Form

Inspector: ______________________________

Date: ______________

Silt Fence and Straw Bales

Drainage Area Perimeter	Has silt fence reached 1/3 of fence height?	Is fence properly secured?	Is there evidence of washout or topping over?	Comment
Load Line 1				
Areas not yet determined				
Load Line 2				
Areas not yet determined				
Load Line 3				
Areas not yet determined				
Load Line 4				
Areas not yet determined				

Maintenance required for stabilized construction entrance:

____

____

____

To be performed by: ________________________ On ______or________________before:

Appendix C – Facility-Wide Storm Water Pollution Prevention Plan

TABLE OF CONTENTS

APPENDICES

LIST OF ACRONYMS

AOCs	Areas of Concern
BMPs	Best Management Practices
BRAC	Base Realignment Commission
CERCLA	Comprehensive Environmental Response, Compensation and Recovery Act
DEMO	Demolition
DLA	Defense Logistics Agency
DOT	Department of Transportation
EPA	Environmental Protection Agency
FY	Fiscal Year
HAZMAT	Hazardous Material
ISCP	Installation Spill Contingency Plan
MSDS	Material Safety Data Sheets
NPDES	National Pollutant Discharge Elimination System
OD	Open Demolition Area II
OHARNG	Ohio Army National Guard
RCRA	Resource Conservation and Recovery Act
RVAAP	Ravenna Army Ammunition Plant
SOP	Standard Operating Procedures
SWPPP	Storm Water Pollution Prevention Plan

DOCUMENT DISTRIBUTION

NAME/ORGANIZATION	NUMBER OF COPIES
Mark Patterson, Facility Manager/RVAAP	1

SECTION I

INSTALLATION OVERVIEW

General Information

The Ravenna Army Ammunition Plant (RVAAP) property is located within the Ohio Army National Guard's (OHARNG) Camp Ravenna and consists of approximately 1200 acres. This 1200 acres is made up of Areas OF Concern (AOCs) controlled by the Base Realignment Commission (BRAC). The approximately 1200 acres consist of mainly former ammunition production areas and some administration buildings near the main entrance of the facility. This Storm Water Pollution Prevention Plan (SWPPP) covers only the BRAC owned portions of the Facility. Camp Ravenna maintains its own SWPPP. The Point of Contact is Tim Morgan, phone number 614-336-6568. Appendix A shows the locations of the BRAC owned property within Camp Ravenna.

Installation History

In August 1940, a tract of land covering 25,000 acres was purchased by the United States Government in the northeastern part of Ohio in Portage and Trumbull Counties. Construction of the plant started in September 1940. The facility was completed and commenced operations in January 1942 with the primary missions of depot storage and ammunition loading.

During the next 50 years the installation was operated for the government by a number of different companies. Level of production varied with the nation's military activities during that time.

Current Operations

In September 1998, R&R International, Inc. took over operation of the facility as a Modified Caretaker Contractor for the government. Toltest Inc. assumed operations at RVAAP for R&R International in December 2000. Toltest, Inc. was the Modified Caretaker Contractor from January 2001 until May 2005. MKM Engineers, Inc. (MKM) took over as Modified Caretaker Contractor in May 2005. PIKA International, Inc took over as the Modified Caretaker Contractor from December 2007 until May 2009. In May 2009, Vista Sciences Corporation took over as the operating contractor. There is no longer any production activity at the installation; the only mission is one of remediation of the contaminated former production areas and National Guard training events.

SECTION II

POLLUTION PREVENTION TEAM

The Storm Water Pollution Prevention Team has the responsibility of implementing the provisions of this Pollution Prevention Plan. This includes providing for the implementation of Best Management Practices (BMPs) such as training, preventive maintenance, inspections and record keeping. The team will review new facility activities to determine their potential impact on storm water, and will identify BMPs necessary to minimize any impact. The team will assess the effectiveness of this plan and revise it as needed.

The members of the RVAAP Storm Water Pollution Prevention Team are as follows:

Vista Sciences Corporation, Project Manager

Facility Manager, RVAAP

Environmental Support Coordinator, RVAAP

The composition of the team is subject to revision as necessary to achieve compliance with all aspects of the Storm Water Pollution Prevention Plan (SWPPP).

SECTION III

MATERIALS INVENTORY

An inventory of hazardous materials currently used at RVAAP is presented in Table 1 and an inventory of pesticides kept on hand in Building 1037 is presented in Table 2. RVAAP also maintains an inventory of explosive materials stored within the installation's explosive storage buildings. With the exception of the listed tanks storing petroleum products, none of the hazardous materials maintained on site are exposed to precipitation.

TABLE 1

HAZARDOUS MATERIALS INVENTORY

MATERIAL	AMOUNT	LOCATION	REPORT. QUANT.	DOT RESPONSE GUIDE NO	MSDS AVAILABLE
Acetylene	200 lbs. **	Bldg. 1034	NA	17	Y
Anti-Freeze	100 gal. **	Bldg. 1034	1000 gal.	26	Y
Diesel Fuel	300 gal.	Bldg. 1034 (East Side)	25 gal.	27	Y
Gasoline	700 gal.	Bldg. 1034 (East Side)	25 gal.	27	Y
Kerosene	150 gal. **	Bldg. 1034 (East Side)	25 gal.	17	Y
Gasoline	1000 gal.	Bldg. 1047 (North Side)	25 gal.	27	Y
Motor and Gear Oil	200 gal. **	Bldg. 1034 (Inside Bldg.)	25 gal.	27	Y
Oxygen	200 lbs. **	Bldg. 1034	25 gal.	14	Y
Paints, Asst.	75 gal. **	Bldg. 1034	NA	26	Y
140 Solvent (Pet Naphtha)	55 gal. **	Bldg. 1034	25 gal.	27	Y
Propane	500 gal.	Bldg. 1034 (North Side)	NA	22	Y
	1000 gal.	Bldg. 1037 (South Side)	NA	22	Y
	1000 gal.	Bldg. 1047 (North Side)	NA	22	Y
	1000 gal.	Bldg. 1038 (West Side)	NA	22	Y
	1000 gal.	Bldg. 1038 (North End)	NA	22	Y
	1000gal.	Bldg. 1036 (East Side)	NA	22	Y
Rock Salt	25 Tons**	Bldg. 1034 (North Side)	NA	NA	Y

* Taken from 1987 Edition, DOT Response Guidebook
** Amount Varies; Estimated Maximum On-Site Quantity

TABLE 2

INVENTORY OF PESTICIDES ON HAND IN BUILDING 1037

Pesticide Name	EPA Reg. No.	Active Ingredient	Size & Type Container	Quantity on Hand	Exp. Date
WASP-FREEZE	499-362	d-trans-Allethrin 0.129% carboxylate 0.120% inert ingredients 99.751%	Net wt. 17.5 oz. Aerosol cans	3 cans	None
Bugout Foaming Wasp & Hornet Spray	7056-180	Resmethrin, .25%; inert ingredients, 99.75%	Net wt. 19.5 oz. Aerosol cans	1 can	None
Bugout Insect Repellent	7056-20	N, N-diethyl-m-toluamide, 14.25%; other isomers, .75%; inert ingredients, 85%	Net wt. 6 oz. Aerosol cans	2 cans	None
Repel Permanone Clothing & Gear Insect Repellent	305-55	Permethrin, .5%; inert ingredients, 99.5%	Net wt. 6 oz aerosol cans	1 can	None

SECTION IV

DESCRIPTION OF POTENTIAL POLLUTANT SOURCES

The identification and description of areas of potential pollutant releases to the environment via storm water at RVAAP is provided below. A facility map, showing the location of major drainage streams in relation to the described areas of potential pollutant sources, is included in Appendix A. Detail Maps of the facility are presented in Appendix B.

Loading and Unloading Operations

Explosive loading and unloading operations occur at storage points located in C-Block and DEMO (Demolition) Area II. All stored munitions materials are contained within earth-covered explosive storage igloos. The Defense Logistics Agency (DLA) also maintains storage of varied types of ore at the RVAAP Ore Yard.

There is little potential for storm water pollution from loading/unloading activities. Stored materials are protected from precipitation and runoff. An uncontrolled spill from the loading dock area could result in a release to storm water if it occurred during a rain event and was not promptly controlled. However, materials stored are in a solid form and the probability of an uncontrolled spill is remote.

BMPs in place: Materials are loaded and unloaded by trained employees. Standard Operating Procedures (SOPs) for loading/unloading of materials have been developed and are followed for all loading/unloading operations. All personnel performing loading/unloading are trained in spill prevention/control procedures.

Storm Water Pollution Risk Assessment: Very low risk to storm water given current loading/unloading procedures.

Outdoor Storage Activities

The DLA maintains outdoor storage of varied types of ore and metal strategic materials in piles on the ground or on concrete pads. The DLA owned material is currently being out-loaded from RVAAP.

BMPs in Place: DLA materials are inspected by the government on an annual basis.

Storm Water Pollution Risk Assessment: Moderate risk to storm water from runoff. A small stream drains the area to the south of the strategic ore stockpile area.

Maintenance Facility

A vehicle maintenance/storage facility is maintained by a subcontractor for the Modified Caretaker contractor in Building 1034. Vehicle maintenance activities (oil changes, etc.) are performed within the building.

There is little potential for storm water pollution resulting from activities within this area. Used oils are containerized and recycled. There is no discharge of oil or other fluids and the area is protected from precipitation and runoff.

Storm water Pollution Risk Assessment: There is a low risk to waters of the state from storm water discharges from these tank areas. The small quantities of fuel stored in the fuel tanks on RVAAP property are not likely to reach waterways before being contained unless an uncontrolled spill occurred during a major precipitation event; DLA materials are in a solid form and are not likely to migrate far in the event of a spill.

Areas of Concern

There are 51 identified Areas of Concern (AOCs) at RVAAP that present a potential contamination threat due to storm water. Contaminants of concern include metals, explosives and unknown contaminants. The location of each AOC is shown on the map included as Appendix A.

BMPs Recommended: Remedial Investigation and clean up actions are currently in progress at all RVAAP Areas of Concern.

All demolition and clean up contractors are required to submit a Spill Prevention Plan, Storm Water Pollution Prevention Plan, and secure a Storm Water Permit, if required, prior to performing any work on AOCs. Copies of all Permits, Notice of Intents and Notice of Terminations shall be submitted to RVAAP through Vista Sciences Corporation at Bldg. 1037 before any work is performed.

Storm Water Pollution Risk Assessment: These units present a moderate risk to storm water from contaminant releases that may come in contact with precipitation.

SECTION V

SPILLS AND LEAKS

It is the policy at RVAAP to maintain the capability to respond to, contain, and clean up spills of hazardous materials to the environment. The RVAAP Installation Spill Contingency Plan (ISCP) provides guidance as to the response procedures to be implemented in the event of a spill or release of hazardous materials to the environment. This plan, in conjunction with this Storm Water Pollution Prevention Plan, provides a mechanism to mitigate the impact of any spill to the environment, including the contamination of storm water runoff.

No reportable spills of oil or other hazardous substances have occurred at Ravenna Army Ammunition Plant for at least three years prior to the implementation of this plan.

On November 3, 1997, a reportable quantity spill of PCB-contaminated oil occurred at the West Substation Building at RVAAP. Diamond Environmental conducted spill site remediation activities in accordance with Ohio EPA requirements, including excavation of contaminated soils and sampling/analysis. Work at the site is now complete.

A reportable quantity spill of approximately 20 gallons of K047 pinkwater took place in September 1991 at Load Line 12. The pinkwater was spilled onto the ground outside of Building 900. The affected earth was immediately dug up and drummed for disposal.

The criteria used for determination of reportable or significant spills are that contained in Section 311 of the Clean Water Act, Section 102 of Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), or state equivalent criteria.

SECTION VI

SAMPLING DATA

Visual inspections of key outfalls within identified major drainage areas, along with institutional knowledge regarding historical production and past disposal activities at RVAAP, have resulted in the decision to collect storm water samples on an annual basis from three of the outfalls. Historically, samples have been collected from Outfalls 903, 905 and 908. Analytical results from the sampling of those outfalls are maintained in the Vista Sciences Corporation Project Manager's office at Bldg. 1037. The Storm Water Pollution Prevention Team determined that the annual sampling strategy under this plan should change from sampling at Outfalls 903, 905 and 908 to sampling at Outfalls 903, 907 and 908. This change will allow for inclusion of the drainage from the Chromium Ore piles in the annual sampling event.

A copy of RVAAP's current Ohio EPA General Permit for Storm Water Associated with Industrial Activity, Permit No. OHR000004 is provided in Appendix C.

SECTION VII

AUTHORIZED NON-STORM WATER DISCHARGES

All non storm water discharges from RVAAP have been discontinued.

SECTION VIII

NON-STORM WATER DISCHARGE TESTING

All outfalls located on the attached Facility Map (Appendix A) have been evaluated for the presence of non-storm water discharges. The outfalls were evaluated using visual inspections, and by reviewing plant drawings for wastewater conveyances.

SECTION IX

SUMMARY OF POLLUTANT SOURCES

Table 3 provides a summary of activities conducted at RVAAP that present a potential pollutant to the environment via storm water.

TABLE 3

SUMMARY OF POTENTIAL POLLUTANT SOURCES TO STORM WATER AT RVAAP

ACTIVITY	POLLUTANT SOURCE	POLLUTANTS OF CONCERN	BMPS IN PLACE OR RECOMMENDED
Loading/Unloading Operations	Spills of Material during loading/unloading activity.	Explosives, Metals	SOPs for loading/unloading Employee training in ISCP
Outdoor Storage Activities DLA Strategic Materials	Contact with Precipitation/Runoff	Metals, Dissolved Solids	Annual Inspections by Government Personnel
Maintenance Facility	Leaks/Spills from Vehicle maintenance into floor drains.	Oils, Greases, Antifreeze	Employee Training in ISCP and HAZMAT handling.
Open Demolition Area II	Contact with Precipitation/Runoff Erosion	Explosives, Dissolved Solids	Erosion Control measures as approved by the RVAAP Facility Mgr.
Hazardous Waste Storage Area	Spills/leaks from stored material	Explosives, Metals, Solvents	Properly contained, marked. Stored on pallets or in secondary containment, spill cleanup materials in place.
Above Ground Tank Storage:	Spills/leaks from tank and fueling activity.	Gasoline, Fuel Oil and Propane	All sub-contractors are required to submit Storm Water Mgt. Plan prior to starting work at RVAAP. Inspected monthly for leaks, condition. All personnel trained in ISCP.
RVAAP Areas of Concern	Contact with Precipitation/Runoff	Explosives, Metals Unknown Contaminants	Adherence to approved Work Plans, Health & Safety Plans and Storm Water Mgt. Plans.

SECTION X

BEST MANAGEMENT PRACTICES IDENTIFICATION

This section describes the Best Management Practices in place or recommended to be put in place at RVAAP to manage potential sources of storm water pollution. A schedule for the implementation of recommended BMPs is provided in Section XI of this plan. Table 3 also provides a summary listing of BMPs in place or recommended for each potential source of storm water pollution at RVAAP. A more detailed description of the nature of each identified BMP is provided below:

Good Housekeeping

Good Housekeeping consists of programs, practices, policies and procedures that provide for maintenance of areas that may contribute pollutants to storm water discharges. These procedures are required in facility SOPs and include such elements as:

Maintain clean floors and ground surfaces
Regular pickup of waste materials
Inspections for leaks or discharges
Ensure employees are trained in spill procedures
Provide adequate aisle space for inspection
Use pallets to prevent contact with moisture
Stack material properly to avoid spills or damage
Maintain inventory of materials stored
Have Material Safety Data Sheets (MSDS) sheets on hand for all hazardous materials
Properly label all containers
Provide spill control equipment at storage/handling sites

Preventive Maintenance

Preventive Maintenance consists of a program to maintain existing equipment in such a manner as to prevent accidental releases of pollutants to the environment. The preventive maintenance program includes:

Conducting inspections of equipment or structures (such as tanks, piping, siltation fencing, etc.) that could result in spills or leaks if not in proper operating condition,

Maintaining a record of inspection results, including a record of corrective actions performed as a result of the inspection (See Appendix D for inspection form).

Visual Inspections

A program of visual inspections ensures that all BMPs are in place and are effective in reducing the potential for storm water pollution releases from the units inspected. The personnel conducting these inspections at RVAAP are trained for conducting proper and effective inspections. In addition to ensuring that BMPs are implemented, visual inspections also can identify conditions that may lead to contamination of storm water. A record of all visual inspections is maintained, including a record of any corrective actions performed as a result of the inspection.

Spill Prevention and Response

RVAAP has developed separate comprehensive ISCP plans that identifies and provides a description of potential spill sources on the installation, and measures to be taken to respond to spills should they occur. All field personnel at RVAAP are trained, on at least an annual basis, in the implementation of the ISCP procedures.

Sedimentation and Erosion Control

Procedures used in sedimentation and erosion control include the following:

Mulching, matting and netting
Temporary/permanent seeding and plantings
Subsurface drains
Straw bale barriers
Placement of siltation fencing

Management of Runoff

Other BMPs designed to address specific pollution sources or activities at a site can be implemented in order to minimize or eliminate runoff of potentially contaminated storm water. Some of the practices used to manage run-on/runoff include:

Diversion of run-on of storm water through the use of curbing, etc.,

Elimination of exposure of material to storm water by covering, placing in containment pans, placing inside of buildings, etc.,

Providing diking or secondary containment for tank systems.

SECTION XI

BMP IMPLEMENTATION PLAN

A schedule of the planned implementation of recommended BMPs is presented in Table 4.

TABLE 4

RECOMMENDED BMPs AND IMPLEMENTATION SCHEDULE

ACTIVITY	RECOMMENDED BMP	FY FOR IMPLEMENTATION
Any Area Requiring Land Disturbance	Practice Erosion Control Methods	FY 2006 Thru FY 2010
Areas of Concern	Follow all Work Plans and Health and Safety Plans	FY 2006 Thru FY 2010

SECTION XII

EMPLOYEE TRAINING

Employee training is an important part of the storm water management program at RVAAP. All personnel involved in field operations of any kind at RVAAP are trained in spill prevention and response procedures, applicable installation SOPs, hazardous material right-to-know training, and hazardous waste training. Personnel performing inspections of various plant activities are trained in proper inspection methods. Training is repeated on an annual basis. All employees training is documented in the employee training file.

SECTION XIII

RECORD KEEPING

A written record of incidents such as spills, or discharges of a reportable nature, is currently maintained by the Vista Sciences Corporation Project Manager. Other records maintained by Vista Sciences Corporation personnel include written records of all inspection activities, records of storm water sampling and analysis results, and written documentation of employee training.

SECTION XIV

COMPREHENSIVE SITE COMPLIANCE EVALUATION

The Pollution Prevention Team, or other designated personnel, shall conduct an installation compliance evaluation on at least an annual basis. Those personnel conducting the inspection are required to:

Inspect storm water drainage areas for evidence of pollution entering the drainage system.

Evaluate the effectiveness of BMPs to reduce potential for pollutant discharge.

Inspect any equipment necessary to implement this plan, such as spill response equipment.

Revise the plan as necessary within two weeks of the inspection.

Implement any necessary changes within 12 weeks of the inspection.

Prepare a report summarizing inspection results and follow-up actions, the date of the inspection, personnel conducting the inspection, incidents of noncompliance or certify that the facility is in compliance with this plan. Sign the report in accordance with Section XVI and keep it with the plan.

SECTION XV

SALT STORAGE

Salt for deicing purposes is stored in a covered storage building located on the north side of Bldg. 1034. Care is taken to prevent precipitation from contacting the stored salt.

SECTION XVI

CERTIFICATION

I certify, under penalty of law, that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

____________________________ ____________________________

Mark Patterson, Date
Government Facility Manager

Storm water Pollution Risk Assessment: There is a low risk to waters of the state from storm water discharges from these tank areas. The small quantities of fuel stored in the fuel tanks on RVAAP property are not likely to reach waterways before being contained unless an uncontrolled spill occurred during a major precipitation event; DLA materials are in a solid form and are not likely to migrate far in the event of a spill.

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APPENDIX B

DETAIL MAPS

APPENDIX C

RVAAP STORM WATER GENERAL PERMIT
OHR000004

APPENDIX D

MONTHLY PREVENTIVE MAINTENANCE INSPECTION FORM

Appendix F – Contractor Quality Assurance Plan

Final Contractor Quality Assurance Plan for Sampling & Closure of Load Lines 1, 2, 3, 4, 12 (RVAAP- 08, 09, 10, 11, and 12) and Other Areas of Concern

Ravenna Army Ammunition Plant
Ravenna, Ohio

Contract No. W912QR-10-P-0037

Prepared for:

US Army Corps
of Engineers®

U.S. Army Corps of Engineers
600 Martin Luther King, Jr. Place
Louisville, Kentucky 40202

Prepared by:

PRUDENT
TECHNOLOGIES, INC.
dba Prudent Environmental Services, Inc.

Prudent Technologies, Inc.
4242 Medical Drive, Suite 7250
San Antonio, Texas 78229

July 30, 2010

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ACRONYMS AND ABBREVIATIONS

CHSM	Corporate Health and Safety Manager
CO	Contracting Officer
COC	Contaminant of Concern
COR	Contracting Officer's Representative
CQAP	Contractor Quality Assurance Plan
FFP	Firm Fixed Price
ITR	Independent Technical Review
PM	Project Manager
PMP	Project Management Plan
QA	Quality Assurance
QA/QC	Quality Assurance/Quality Control
QAM	Quality Assurance Manager
QAP	Quality Assurance Plan
QC	Quality Control
RVAAP	Ravenna Army Ammunition Plant
SSHP	Site Safety and Health Plan
USACE	United States Army Corps of Engineers
WP	Work Plan

1.0 – INTRODUCTION

Prudent Technologies, Inc. (Prudent) has developed this Contractor Quality Assurance Plan (CQAP) to comply with the US Army Corps of Engineers (USACE) Guide Specification 01451A dated January 2003. The CQAP covers the design and construction activities both on-site and off-site, including work by subcontractors and suppliers. Prudent will modify this CQAP with addenda to incorporate details of individual or groups of similar task orders.

The CQAP provides guidance for remediation activities, design, construction activities, and data quality for the activities described in the *Work Plan for Sampling & Closure of Load Lines 1, 2, 3, 4, 12 (RVAAP 08, 09, 10, 11, and 12) and Other Areas of Concerns at Ravenna Army Ammunition Plant, Ravenna, Ohio.* The activity will be conducted under a Firm-Fixed Price (FFP) Contract No. W912QR-10-P-0037, Sampling & Closure of Load Lines 1, 2, 3, 4, 12 (RVAAP 08, 09, 10,11 and 12) and Other Areas of Concern at Ravenna Army Ammunition Plant, Ravenna, Ohio.

2.0 – QUALITY CONTROL ORGANIZATION

The following section describes the structure of the quality management team for Prudent's operations at Load Lines 1, 2, 3, 4, and 12. Personnel were selected based on previous experience and their familiarity with the Prudent Quality Assurance/Quality Control (QA/QC) system. The project team will provide the specific technical and management capabilities and qualifications to perform the contract work.

The Prudent Quality Assurance organization hierarchy of positions responsible for establishing Prudent's Quality Assurance Plan (QAP) is shown in Figure 1-1. It includes the President, Corporate Quality Assurance Manager (QAM), Program and Project Managers (PMs), and Corporate Health and Safety Manager (CHSM).

Project staff members will be qualified to perform their assigned tasks in accordance with terms outlined in the work plan (WP). Verification of personnel qualifications will be documented by the QAM and will review expiration dates to ensure the PM is aware or training requirements.

2.1 PRESIDENT

The President is ultimately responsible for the effective implementation of the CQAP for all field operations. The President issues the Corporate Policy Statement and directs management and workers to follow the requirements of the CQAP.

The President has chosen to delegate QA authority as defined in the following paragraphs. Each designee is held accountable for delegated authorities.

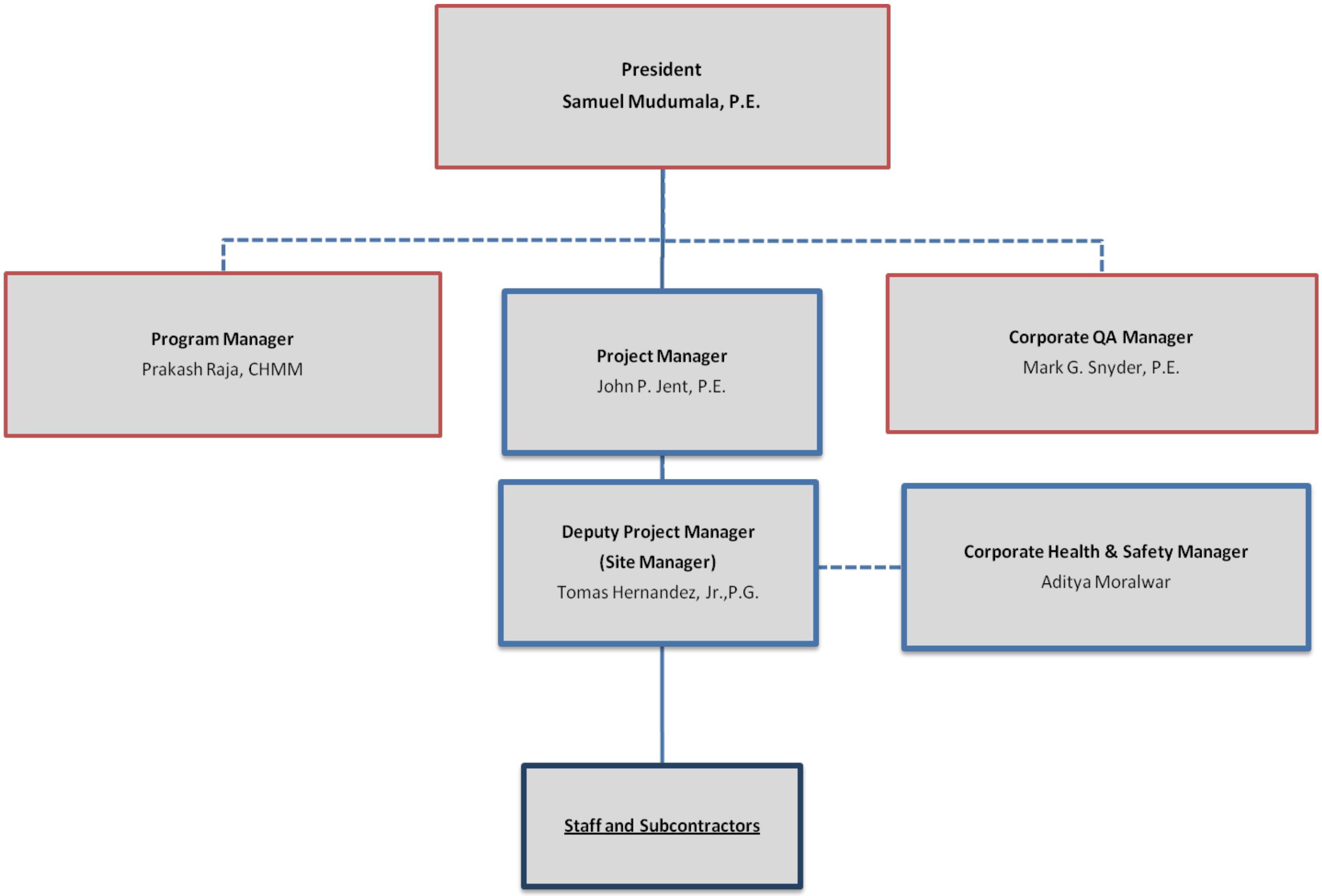
2.2 PROGRAM MANAGER

The Program Manager has overall authority and responsibility for quality achievement of assigned projects and project support programs. He will foster a culture of excellence for quality and safety and assign responsible personnel to the Program and PM Positions in support of the QA management direction of the President and QA Manager.

2.3 CORPORATE QA MANAGER

The QA Manager reports to the President and has the authority and overall responsibility for independently verifying that quality is achieved. The QA Manager is responsible for development, maintenance and implementation of the quality program. This responsibility includes overseeing activities under the guidance of this CQAP, performing periodic reviews of the processes being implemented, evaluating any recommendations made by the project team of the course of the program regarding use of these process, and implementing continuous improvement evaluations of the program.

Figure 1-1 Quality Assurance Organization



The QA Manager will:

- Foster a culture of excellence for quality;
- Manage the QA Organization and maintain the CQAP;
- Approve QA requirement documents, project and program implementing procedures, and subcontractor CQAP;
- Assess the effective implementation of the CQAP;
- Ensure that all personnel are properly trained and adequately experienced for the duties;
- Establish guidelines to assist in the development of program, project, site and task specific Quality Control (QC) policies and procedures;
- Ensure corrective actions are documented and acknowledged by the PM and field personnel, as well as communicated to the client, when adverse situations or defective work result from a project activity;

- Conduct periodic field audits of the programs, projects and sites and submitting a report of findings to the President;
- Monitor results of the site audits;
- Conduct project audits;
- Conduct training;
- Ensure project deliverables are defined prior to initiation of field operations and are submitted as required by the WP and project schedule;
- Report regularly to the President of Prudent on the adequacy, status and effectiveness of the QC program.

2.4 PROJECT MANAGER

The PM is responsible for ensuring the availability of the resources needed to implement the project CQAP and will ensure the QC processes are incorporated in the project plans, procedures, and training for the specific project. The primary responsibility of the PM is the overall direction of the project and accountability for work activities undertaken as part of the WP. The PM is responsible for the quality and timeliness of all project activities, including those performed by subcontractors and suppliers.

The PM's global quality related responsibilities include:

- Understanding the Contract and project objectives for the specific project;
- Overall Project Quality Management;
- Maintaining contact with the client;
- Scheduling of activities and preparing documents and reports associated with the project;
- Ensuring that submittals are completed and submitted as required;
- Ensuring project staff are knowledgeable of client requirements and Prudent's QC processes;
- Review and approval of sampling, testing, and field investigation methods and CQAP, including designs, schedules and labor allocations;
- Preparation of progress reports with the assistance of key support personnel;
- Organization of project staff and assigning tasks;
- Coordinating with the QAM to ensure project quality and safety issues are addressed;
- Developing Project Plans and associated documentation;
- Technical review of all project deliverables;
- Approving project documents;
- Communicating project related information from the client;
- Liaison between the project staff and subcontractors;
- Liaison between project staff and other internal groups;
- Investigation of nonconformance and implementation of corrective actions;

- Evaluation of the effects that nonconformance has on the project and the appropriateness of reporting these issues with the client;
- Providing appropriate documentation of nonconformance when reporting to the client;
- Serving as final reviewer prior to release of project information;
- Approving and signing outgoing correspondence.

The PM may delegate portions of the responsibilities to Site Managers who are assigned to be on site for the duration of the project.

2.5 SITE MANAGER

The Site Manager is responsible for assuring the resources of the project team are available to execute the field phases of the project. The Site Manager is responsible for on-site client coordination relating the details of the project and activities of the project team. He/she will assist the PM in maintaining sufficient resource allocations to meet the project schedule and budget and provides daily reports to the PM on progress of the project.

The responsibilities of the Site Manager as they relate to the quality of the project include:

- Regularly reviewing the project WPs;
- Monitoring work progress and adherence to project requirements for task completion;
- Providing logistical support for field operations;
- Interfacing with the subcontractors;
- Conducting onsite status meetings on a weekly basis;
- Assisting in preparing required submittals;
- Providing integration of subcontractor services to provide optimum support;
- Liaison with project staff and subcontractors as well as the onsite client representative;
- Notification of the PM if conflicts arise with the proposed schedule;
- Assessing the effective implementation of the project CQAP;
- Coordinating with the client to ensure that QC objectives appropriate to the project are set and all personnel are aware of these objectives;
- Maintaining a QC log to document details for field activities during QC monitoring activities to serve as a memory aid in preparation of the daily QC Report;
- Coordinating with the Prudent's QAM to ensure that QC procedures are being followed and are appropriate for achieving data validity sufficient to meet QC objectives;
- Conducting periodic QC surveillances of all site activities using the 3 phase inspection process and recording the findings in the Preparatory, Initial, and Follow-on Phase Daily Quality QC Report;
- Conducting random sampling of Ammunition, Explosives, and Dangerous Articles (AEDA) and Range Residue cleared from the site;

- Reporting noncompliance with QC criteria to Prudent's QAM and PMs and documenting these non-conformances on the Prudent Nonconformance Report;
- Initiating a Rework Items List on nonconformance areas that must be re-accomplished to meet quality specifications;
- Conducting QC Meetings. Record meeting outcome in the Follow-on Phase Daily Quality Control Report;
- Coordinating with the responsible parties to initiate the proper corrective actions to be taken in the event of a QC deviation and documenting these actions on the Corrective Action Request;
- Ensuring that Lessons Learned are documented and forwarded to the Prudent QA Manager for analysis;
- Having the authority to stop work when significant conditions adversely impacts the quality of work and such action is warranted;
- Identifying quality problems and ensure that unsatisfactory conditions are controlled until proper disposition has occurred.

2.6 CORPORATE HEALTH AND SAFETY MANAGER (CHSM)

Prudent's CHSM will be responsible for:

- Implementing the Corporate Health and Safety Program;
- Reviewing and monitoring compliance with site safety and health plans (SSHPs);
- Implementing corrective measures for health and safety deficiencies;
- Enduring required training and medical monitoring of personnel.

The CHSM has the authority to implement corrective measures related to health and safety issues and to stop work, if required, to ensure a safe working environment.

3.0 – CONTROL SYSTEM

Prudent will use the Control System to ensure that the Team is ready to begin each new feature of work. The complexity of each task or group of tasks will determine the definable features of work and, therefore, the number of meetings and inspections. The control system will cover work on-site and off-site, and the work performed by Prudent subcontractors and suppliers. The QA Manager and staff will be responsible for:

- Developing the definable features of work,
- Notifying appropriate people for meetings,
- Documenting the meetings and distributing the minutes, and
- Monitoring the work.

3.1 PREPARATORY PHASE

Before the start of a new phase (definable feature) of work, the USACE Contracting Officer's Representative (COR) and PM will be notified at least 48 hours in advance of a Preparatory Meeting. This meeting will be conducted by the QA Manager and attended by the Site Manager, relevant Site Superintendent, other applicable QC Personnel, and other key participants in the new phase of work. The minutes of the meeting will be prepared by the QA Manager, distributed to the participants, and documented on the Preparatory Phase Daily Quality Control Report. The applicable workers will be instructed as to the performance required to meet the requirements of the contract for this phase of work. Specific topics for review at this meeting include:

- Review of each paragraph of applicable specifications and contract drawings;
- Ensure that all submittals and permits have been approved;
- Review inspection and/or testing criteria;
- Examination of the work area to assure that preliminary work has been completed satisfactorily;
- Examination of required materials and equipment are on hand, properly stored, and ready for use;
- Review the activity hazard analysis to assure safety requirements are met;
- Ensure that site personnel have been trained in required classes for safety and security;
- Discussion of procedures for the execution of work;
- Establishment of levels of performance and review minimum acceptable performance standards.

3.2 INITIAL PHASE

The Initial Phase inspection for each definable feature of work will occur after a representative portion of that feature of work has been completed. The purpose of the Initial Phase is to verify that the workmanship standards are being implemented and corrected and the work is performed to the mutually agreed upon level of quality. The USACE COR will be notified 48 hours in advance of the Initial Phase. Minutes of this Phase will be taken by a QC representative, distributed to participants, and documented on the Initial Phase Daily Quality Control Report. The Initial Phase inspection will:

- Review minutes of the Preparatory Meeting,
- Verify contract compliance,
- Verify plans for control inspection and testing,
- Verify level of workmanship versus standards,
- Resolve differences, and
- Review safety versus activity hazard analysis.

The Initial Phase will be repeated for each new crew to work on site, at the start of each new work feature, any time acceptable specified quality standards are not being met, or when modifications will impact existing Prudent procedures.

3.3 FOLLOW-ON PHASE

Follow-on Phase inspections will occur daily throughout the task to assure continuing compliance with both contract specifications and the requirements of the WP. The inspections and observations will be documented on the Follow-on Phase Daily Quality Control Report. Any deficiencies will be corrected and a follow-up check conducted to ensure that a deficiency does not continue. If deficient work is identified, Prudent will implement corrective action immediately and will provide the USACE COR with a written description of the corrective action within five days.

3.4 ADDITIONAL PREPARATORY AND INITIAL PHASES

Prudent will conduct additional Preparatory and Initial Phase meetings and inspections during the same definable feature of work at the direction of USACE if the quality of work is unacceptable, if there are changes in the QC staff or task supervisors, if a definable feature of work is restarted after a substantial period of inactivity, or if other problems develop.

4.0 – TRACKING DEFICIENCIES

Nonconforming items and activities are those that do not meet the design drawings, construction specifications, procurement document criteria, approved work procedures, or the CQAP.

Nonconformance may be detected and identified by any site worker including:

- CQAP personnel during construction operations by field inspections and/or verification testing;
- Laboratory personnel during the preparation for and performance of laboratory testing and/or during calibration of equipment;
- USACE personnel during the performance of audits or surveillances;
- Construction team during construction operations by field inspections.

Each nonconformance affecting quality will be documented by the personnel identifying or originating the nonconformance. For this purpose, the results of calibration and laboratory analysis QC tests, audit reports, inspection reports, or an internal memorandum or letter can be used as appropriate. This documentation will be compiled by the QA Manager and documented in a Nonconformance Report and Corrective Action Request form and submitted to the USACE COR.

This report will, when necessary, include:

- Description of nonconformance;
- Identification of individual(s) identifying or originating the nonconformance;
- Method(s) for completing corrective action and corrective action taken;
- Schedule for completing corrective action and corrective action taken;
- Responsible individuals for correcting the nonconformance and verifying satisfactory resolution.

It is the responsibility of every one working on the site to inform the QC personnel of a nonconformance. The QC personnel will discuss the issue and if necessary stop work to resolve the issue. In addition, the USACE COR will be notified by the QA Manager, as soon as practical, of nonconformance that could impact the results of the work. A corrective action will be determined and implemented. QC personnel will verify completion and effectiveness of corrective actions for nonconformance. Any recurring nonconformance should be evaluated by the USACE COR, PM, and QA Manager to determine its cause and the appropriate changes instituted to prevent future recurrence. When such an evaluation is performed, the results will be documented.

5.0 – SAMPLING AND TESTING

The purpose of sampling and testing is to obtain an objective, typically quantitative, measure of conformance with the WP. Prudent will outline the type and frequency of sampling and testing to be conducted for each specific task in the WP. The testing and analytical laboratories will be discussed with the USACE COR for approval. The sampling and testing include:

- Soil sampling and testing for environmental contaminants;
- UXO/MEC surveys and test equipment calibration;
- Waste sampling for waste characterization and disposal requirements.

The QA Manager and support personnel will verify that the sampling and testing personnel are trained in the relevant procedures. They will witness the sampling and testing to verify that the proper equipment is available, that the equipment has been calibrated against certified standards, that the procedures are followed, and that the activities are documented. Any nonconformance will be discussed and resolved immediately or corrective actions will be instituted. Prudent will use Test America in North Canton, Ohio for the analysis for environmental contaminants.

The sampling and testing events will be identified and reported in the Follow-on Phase Daily Quality Control Report. Analytical and test result forms will be filed. The USACE COR personnel will be advised of the analytical and test results on a regular basis. Prudent understands that the USACE COR may conduct QA checks of testing techniques and results.

5.1 EQUIPMENT CALIBRATION AND TESTS

Measurement equipment used on site, e.g., sampling pumps, magnetometers, real-time monitors, etc., will be checked for operational reliability and calibration in accordance with the manufacturer's specifications.

5.2 DOCUMENTATION OF TESTING

Results will be documented by the individual performing the test. Calibration and maintenance records associated with the measuring and testing equipment will be generated by the individual performing the activity. Documentation for required calibrations, testing and maintenance of measuring and testing equipment will be stored in the field office until the project is completed. When the project is completed, all files will be transferred to the project office in San Antonio, Texas. All project files will be made available to the COR upon request.

5.3 MAINTENANCE PROGRAM

All tools, instruments and equipment deployed to the project will be properly maintained and calibrated (as necessary) in accordance with the instrument manufacture specifications or standard industry practices. This applies to equipment used in the field for UXO safety support and related activities affecting quality, including geophysical instruments, communications equipment, vehicles/machinery, environmental monitoring equipment and personal protective equipment.

Equipment will be protected from dust and contamination and visually checked for damage prior to use. Preventative maintenance on the metal detectors will be performed on a regular basis. Critical spare parts will be kept on site to minimize downtime.

6.0 – SUBMITTALS

Prudent and the USACE COR will determine the submittals required for each specific task and include them in the Project Management Plan (PMP). The list of submittals provided in the PMP may be modified during the preparation of the task WP. This will allow the USACE COR time to review and approve the submittals before work begins.

The QA Manager and PM will delegate staff to assist with the collection and scheduling of submittals for each task. Each submittal will be listed in chronological order on Form 4025 or its equivalent and delivered to the USACE COR. Prudent will ensure that the submittals are in compliance with the contract.

The submittals will be reviewed and approved by the USACE COR. Any modifications will be made by Prudent. The submittal schedule will be maintained by the QC Manager or delegate. Any adjustments of dates will be justified to the USACE COR. Submittals to be furnished by subcontractors or suppliers will be managed by Prudent.

7.0 – REPORTING AND DOCUMENTATION

Prudent will comply with its reporting and documentation procedures requiring multiple peer and technical reviews and a final technical edit before submitting a report to a customer. The PM and Independent Technical Review (ITR) team will work together to ensure instructions and procedural items are given to the reviewers and that the reviews are documented. The QA Manager will audit the report review and documentation process. The independent reviews will be performed by persons equally qualified as those performing the original work but who were not performing the work. These independent reviewers may be Prudent or non-Prudent personnel.

Compliance with the requirements of the design and construction specifications for each task of the project will be documented. Documentation will consist of records prepared by QC personnel, the testing and analytical laboratories, the design and construction personnel, and any subcontractors. The various reports are discussed below.

7.1 FOLLOW-ON PHASE DAILY QUALITY CONTROL REPORT

Whenever there is any construction activity, a Follow-on Phase Daily Quality Control Report will be prepared. Other records required will depend on the specific work being performed that day.

The Follow-on Phase Daily Quality Control Report will be prepared by the QC personnel and reviewed by the QA Manager and the Site Manager. The Follow-on Phase Daily Quality Control Report form is found in Appendix A. It will contain the following:

- The contractor/subcontractor name and area of responsibility;
- Date and report number;
- Summary of the weather conditions;
- Summary of locations where work is occurring;
- List of personnel on the project and names of visitors to the site;
- Summary of any meetings held and attendees;
- Submittals reviewed and action taken;
- Description of any off-site surveillances;
- Description of all materials received and acceptability;
- Reference to test or control inspection performed and results;
- Description of equipment with hours worked and down time;
- Certificates for calibration and recalibration of test equipment;
- Results of safety evaluations and results;
- Description of nonconformance and corrective actions taken;
- Signature of person completing the report and QA Manager's review.

The original and one copy of the Follow-on Phase Daily Quality Control Report will be provided to the USACE COR and/or designated site representatives and PM. Non-work days will be covered in the next workday so that each calendar day of the task will be accounted for throughout the contract period. Copies of the test results will be attached.

7.2 WEEKLY REPORTS

Weekly progress reports will be prepared by the Prudent Site Manager and submitted through the Prudent PM to the USACE COR. The weekly progress report will summarize the progress, plans for the next week, and problems.

7.3 NONCONFORMANCE REPORT AND CORRECTIVE ACTION REQUEST

Whenever any material or workmanship does not meet the specified requirements or has an obvious defect, the appropriate personnel will be notified and a Nonconformance Report and Corrective Action Request will be completed by the QA Manager.

7.4 PHOTOGRAPHIC RECORD

Any photographs used to document the progress and acceptability of the work activity will be referenced in the Follow-on Phase Daily Quality Control Report and attached to the final report. Each photo will be identified individually as well as in a photograph log that contains the following information:

- Date, time, location, and direction of the photograph,
- The name of the photographer, and
- A brief description of the activity photographed.

7.5 FINAL REPORT

When a specific design and/or construction task for the project has been completed and the final inspection list shows that all items have been resolved, Prudent will prepare a final report to submit to the USACE Contracting Officer (CO)/COR. The final report (Construction Completion Report) contents will vary; however, it will document the following items:

- Historical background and scope of work;
- Description of the preparatory activities and plans;
- Detail of the task activities;
- Sampling and testing performed and reference to the results files;
- Waste management and disposal activities;
- Site restoration activities;
- Project/task administration and financial results;
- Attachments:
  - Weekly Progress Reports,
  - Nonconformance Reports and Corrective Action Requests,
  - Field Test Results,

- Laboratory Analytical Results including Chain of Custody Forms,
- Design Assumptions and Calculations,
- Photographic Log, and
- Design Changes.

7.6 DOCUMENT CONTROL

The master file includes all historical documents related to the site and task as well as all site-related documents prepared under this contract until the completion. The master file will contain the following information: project file index, proposal documents, project initiation documents, contract documents, project accounting and finance documents, schedules, correspondence, meeting notes, project permits, laboratory documentation, deliverables, field photos, waste management documentation, environmental safety and health documentation, subcontracts, client-furnished drawings/data/equipment documents, company reviews and comments, client approval/reviews and comments, quality documents, manuals, maps, project training records, and superseded/void documents. Documents in the master file will contain the following information, if applicable: document number, title, date, revisions, and supplements to the document.

Documents will be retained in a safe location and protected from environmental damage. The original documents will be delivered as a hard copy and/or electronic file to the USACE COR after the final report is approved. The master file will be maintained by Prudent until approval of the final report is obtained from the regulatory agencies. After all reports are finalized, the master file will be moved to Prudent's San Antonio, Texas office and maintained for a minimum of ten years.

7.7 DEFINABLE FEATURES OF WORK

Each task or group of similar tasks will be divided into separate and distinct subtask as defined in the WP. The definable features of Remedial Design are to be determined. The following defined features anticipated for this project included:

- Subsurface MI sampling beneath former floor slabs of selected building at Load Lines 1, 2, 3, and 4;
- Characterization sampling as needed at Load Lines 1, 2, 3, 4, and 12;
- Excavate Contaminant of Concern (COCs) where COCs exceed cleanup;
- Collect confirmatory soil samples from resultant excavations;
- Dispose of excavated soils;
- Site restoration.

7.8 COORDINATION MEETING

The Coordination Meeting will be scheduled by the USACE COR after the Kick-off Meeting and before the start of any work. The entire QC staff will attend the meeting (Prudent and subcontractors). The Prudent and Corps staff will review this CQAP and reach a mutual understanding of the roles for QC. Details of the control process will be discussed to include forms, testing, reports, definable features of work, and final inspections. Changes to the CQAP will be discussed and the changes must be approved before work begins. The meeting minutes will be recorded and distributed to the participants.

7.9 COMPLETION INSPECTION

At the completion of each task the QA Manager will conduct an inspection and create a punch list of items which need to be completed or modified to comply with the requirements. The list of deficiencies becomes a part of the quality documentation. The QA Manager will re-inspect the list of items to verify correction of the deficiencies and document the completion.

7.10 NOTIFICATION OF NONCOMPLIANCE

Prudent will take immediate corrective action after notification by the USACE CO/COR of a noncompliance issue. Prudent will gather the required personnel to meet with the USACE CO and delegates to discuss the noncompliance issue and agree upon the corrective action. Prudent understands that if a corrective action takes more than a day, the work could be stopped until the action has been approved.

7.11 DEFICIENCY TRACKING SYSTEM

Prudent will track the deficiencies on a log which identifies the project/task, item number, date, initiated by, description, responsible party, corrective action date, re-inspection results, and corrective action approval date. The log will be maintained at the work site and be available to the Corps for review and submitted to the USACE COR monthly.

Comment Resolution Table

Installation: Ravenna Army Ammunition Plant, Ravenna, Ohio
Document: Prudent Draft Work Plan for Sampling and Closure of LL1-4 and 12
Reviewer(s): Katie Tait, Envmtl. Specialist, OHARNG
Date: July 8, 2010

Cmt. No.	Page or Sheet	Comment	Recommendation	Response
	Pg 1-20, line 26	"These areas are noted for future remediation excavation work." Indicate who will be doing the excavation, URS or Prudent.		Will change to, "*These areas were noted for future remediation excavation work by URS*."
	Section 3.1 Premobilizatio n	Notification to USFWS and SHPO are not required for doing investigation activities. The OHARNG requires Army contractors to do these notifications when they are conducting remedial activities (excavation) on OHARNG property. LL1-4 and 12 are on Army property. Therefore, you will need to check with Mark Patterson to see if these are warranted or required. Typically, these are not required by the Army.		We have conferred with Mark Patterson and he related that such permits are not required for investigation activities on CERCLA sites. However, he said that any requirements/provisions associated with those permits must be met. So we will delete lines 26 and 27, and add after line 30, "*Prior to any remediation all requirements/provisions of the permits normally required by the U.S. Fish and Wildlife Service and the State of Ohio Historic Preservation.Office will be met*."
	General	Will there be a separate Work Plan for remediation activities? Seems odd to discuss remediation activities in this report when we don't yet know the details of the remediation effort. Please clarify.		A general work plan for remediation activities is provided as per the scope of work. A final detailed work plan for remediation activities will be drafted once we know the level of remediation effort if any is required for the project, see the last sentence of Paragraph 3.3.
	Pg 3-3, Line 13	Change RTLS to Camp Ravenna.		Changed.
	Section 4.6 Protection of Water Resources	Please also indicate that you will protect streams and wetlands by not disturbing them.		Prudent intends to protect streams and wetlands by not disturbing these areas; however, should remediation of surface waters be required management techniques will be

Comment Resolution Table

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				implemented to control water pollution as a result of these remediation activities.
	Section 4.7, Spillage	Change name of section to Spill Control. Also please indicate that you will have spill supplies on hand and will respond to any spills in accordance with the facility spill plans.		Title changed. Spill plans from URS and PIKA will be followed for Load Lines 1 through 4 and will be kept on-site. In addition Prudent will have spill supplies on hand and will respond to any on-site spills in accordance with the facility spill plans.

DRAFT WORK PLAN (WP) FOR SAMPLING & CLOSURE OFLOAD LINES 1, 2, 3, 4, 12 (RVAAP- 08, 09, 10, 11, AND 12) AND OTHER AREAS OF CONCERN AT THE RAVENNA ARMY AMMUNITION PLANT, RAVENNA, OHIO COMMENT RESPONSE TABLE JULY 16, 2010

Comment Number	Page No./Line No.	New Page or Sheet	Comment	Recommendation	Response
			Ohio EPA (Andrew Kocher& Eileen Mohr)		
O-1	Appendix A /Page 1-2/ Lines 17-26		This section discusses the types of material that may be encountered. Maybe also include piping material (e.g., sewer and water lines).	Include text noting that underground piping may be encountered although will be avoided.	Beginning at line 24, change to*,"At all four load lines a wide variety of materials may be encountered beneath the former floor slabs, including concrete rubble, sandstone cobbles and boulders, recent fill, older (original construction fill), and original silts and clays. Moreover portions of underground utility piping may remain. If underground piping is encountered, that geoprobe boring location will be moved slightly to avoid the underground piping."*
O-2	Appendix A /Page 1-2/ Lines 34-38		This section discusses the use of a roto-sonic drill rig. Although this rig may be useful in penetrating the fill material, it was noted bt previous observations that the roto-sonic "cores" were basically pulverized and recovery was poor.	It is likely that the collection of discrete samples (e.g., 3-5ft) will be compromised using a roto-sonic drill rig. No change to the text is needed; however, it may be unnecessary to mobilize the roto-sonic rig for this sampling event.	Based on the pulverization and heat associated with drilling, which would preclude analyzing for VOCs and SVOCs, it is proposed to remove the entire paragraph.
O-3	Appendix A /Page 4-2/ Lines 16-17		This sentence discusses the procedure if refusal of the push probe occurs. Ohio EPA thinks that other alternatives should be evaluated to maximize the number of deeper samples.	One approach might be to move after three attempts and then, based upon what happened at the next few sub-locations, potentially re-visit the ones where they were getting shallow refusal. For example: if the driller were able to get samples at depth in other "sub-locations" ... then they	Propose changing the sentence to, "*If refusal is encountered at a planned push probe location and three nearby locations, that location will be temporarily abandoned. A portion or all of the remaining planned sub-locations will then be drilled. Based on the drilling behavior at the other planned sub-locations within the*

Comment Number	Page No./Line No.	New Page or Sheet	Comment	Recommendation	Response
				would go back to the areas where they had shallow refusal and try more times to get samples at depth.	*sampling area, a decision will be made if there is a widespread condition that would preclude drilling to the desired depth, as shallow bedrock, or if the planned locations where refusal was encountered at depths less than planned were anomalies based on localized obstructions. If there is a widespread condition that precludes drilling to the desired depths, then no additional drilling attempts will be made. If the locations where refusal at depths less than planned appear to be based on isolated or random obstructions, then up to two additional attempts will be made at planned locations where the borings failed to reach the planned depths".*
O-4	Appendix A /Page 4-2/ Lines 16-17		Again, this sentence discusses the procedure if refusal of the push probe occurs. The building footprint (i.e., sampling area) will likely have numerous borings with different refusal depths. The text doesn't clearly explain that this will likely be the case and how this will be logged, collected, and reported. For example: The Plan is the collect 16 borings at the melt pour building. After all the attempts at varies locations,	Please add some text describing how Prudent will deal with various numbers of increments with depth. Also, explain that if a cleanup standard is exceeded at depth, then only the vertical samples that actually went down to that depth will be analyzed. In my example, the lab would only have to analyze nine samples, if the standard was exceeded in the horizontal sample at 5-7 feet. Discussion may be needed.	Propose adding additional discussion at the end of the above (O-3) discussion as follows. "*For horizontal MI samples where proposed depths were not achieved, a notation regarding the reduced sub-sample number will be made in follow- up reports or other texts."* *"If clean up goals are exceeded, Prudent believes all vertical samples within that decision unit should be analyzed to gain a better understanding of the source and*

Comment Number	Page No./Line No.	New Page or Sheet	Comment	Recommendation	Response
			we end up with sixteen 1-3ft increments, thirteen 3-5ft increments, and nine 5-7ft increments.		*extent of subsurface contamination."*
O-5	Appendix A /Page 4-3/ Lines 9-11		This sentence discusses the collection of vertical MI samples. The text mentions the vertical MI sample will be collected and that it will not be processed or analyzed unless the horizontal sample results are above cleanup standards. However, there is no mention of where these samples will be stored and how they will be stored, while maintaining proper chain-of-custody and holding times.	Please add some text to clarify the storage of the vertical samples.	Propose changing the subject sentence as follows, "*Because of required expedited time constraints, all vertical samples will be prepped for laboratory analysis. However, these samples will only be analyzed if the analytical results from at least one of the horizontal layer MI samples within that sampling area shows contamination levels above cleanup goals."*