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14. ABSTRACT

The Work Plan identifies the activities to be performed by URS for their project to sample earth fill beneath floor slabs at Load Lines 2, 3, and 4 at the Ravenna Army Ammunition Plant (RVAAP). The plan includes an approach for the sampling as well as addenda to the Facility-Wide Field Sampling Plan, the Quality Assurance Project Plan, and a site-specific Health and Safety Plan..

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CLARIFICATION STATEMENT

Although the footer identified the document as “Draft”, it should be considered “Final”.

Final of the Work Plan

for the Sampling of Soils Below Floor Slabs at LLs-2,3,4 and Excavation and Transportation of Contaminated Soils to Load Line 4 (Buildings G-1, G-1A, and G-3)

Ravenna Army Ammunition Plant
8451 St. Route 5
Ravenna, OH 44266-9297

Contract No. W912QR-04-D-0025
Delivery Order No. 0006

Prepared for:
U.S. Army Corps of Engineers
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May 29, 2008

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Technical Project Manager URS Group, Inc.	1	--

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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
CLIN	Contract Line Item
COR	Contracting Officer Representative
CPR	Cardio Pulmonary Resuscitation
CUL	Cleanup Level
DFFOs	Director’s Final Findings and Orders
DNT	Dinitrotoluene, also 2,4-Dinitrotoluene
DOT	Department of Transportation
DDESB	Department of Defense Explosives Safety Board
DMM	Discarded Military Munitions
ERIS	Environmental Restoration Information System
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	OSHA Hazardous Waste Operations and Emergency Response

IDW	Investigation-Derived Waste
IROD	Interim Record of Decision
IRP	Installation Restoration Program
ITR	Independent Technical Review
JOAAP	Joliet Army Ammunition Plant
JSA	Job Safety Analysis
MARC	Multiple Award Remediation Contract
MCE	Maximum Credible Event
MEC	Munitions and Explosives of Concern
MI	Multi-increment
MKM	MKM Engineers, Inc.
MSD	Minimum Separation Distance
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
PRG	Preliminary Remediation Goal
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 also Hexahydro-1,3,5-trinitro-1,3,5-triazine
REIMS	Ravenna Environmental Information Management System
RI	Remedial Investigation
ROS	Remediation Operating Services
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, also 2,4,6-Trinitrotoluene
SOW	Scope of Work
URS	URS Group, Inc.
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

1.1 PURPOSE AND SCOPE

URS Group, Inc. (URS) has been contracted by the United States Army Corps of Engineers (USACE) to sample soils below floor slabs at Load Lines 2, 3, and 4 and to excavate and transport contaminated soils to Load Line 4 (Buildings G-1, G-1A, and G-3) at the Ravenna Army Ammunition Plant (RVAAP) under their Multiple Award Remediation Contract (MARC), Delivery Order 0006. Floor slab removal may occur at Load Line 1 and Buildings F-15 and F-16 at a future date. In the event that a separate contract action is executed for completion of the same work at these additional locations, this Work Plan may be applicable to that work as well.

As part of the Scope of Work (SOW) for Task Order 0006, a Work Plan to address all SOW activities is required. This plan is a supplement to the 2001 Facility-Wide Sampling and Analysis Plan (FWSAP) for the RVAAP, Ravenna, Ohio (SAIC, 2001b). The FWSAP provides the base documentation (i.e., technical and investigative protocols) for conducting environmental investigations under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) at RVAAP.

1.2 SITE DESCRIPTION AND BACKGROUND

The RVAAP is located in northeastern Ohio within Portage and Trumbull Counties, approximately 1.6 km (1 mile) northwest of the city of Newton Falls and 4.8 km (3 miles) east-northeast of the city of Ravenna. The facility is a parcel of property approximately 17.7 kilometers (11 miles) long and 5.6 kilometers (3.5 miles) wide bounded by State Route 5, the Michael J. Kirwan Reservoir, and the CSX System Railroad on the south; Garret, McCormick, and Berry roads on the west; the Norfolk Southern Railroad on the north; and State Route 534 on the east (Figure 1-1). As of February 2006, a total of 20,403 acres of the former 21,683-acre RVAAP have been transferred to the United States Property and Fiscal Officer (USP&FO) for Ohio and subsequently licensed to the Ohio Army National Guard (OHARNG) for use as a training site. Currently, RVAAP consists of 1,280 acres in several distinct parcels scattered throughout the confines of the Ravenna Training and Logistics Site (RTLS). The RVAAP's remaining parcels of land are located completely within the RTLS. The RTLS did not exist when RVAAP was operational, and the entire 21,683-acre parcel was a government-owned, contractor-operated industrial facility. The RVAAP Installation Restoration Program (IRP) encompasses investigation and cleanup of past activities over the entire 21,683 acres of the former RVAAP and, therefore, references to the RVAAP in this document are considered to be inclusive of the historical extent of the RVAAP, which is inclusive of the combined acreages of the current RTLS and RVAAP, unless otherwise specifically stated.

Figure 1-2 shows the locations of the various portions of the facility. As the installation is remediated, acreage is transferred from the Base Realignment and Closure Division (BRACD) to the National Guard Bureau (NGB) for OHARNG training. The Ohio Environmental Protection Agency (Ohio EPA) is the lead regulatory agency for remediation being conducted by the Army.

The RVAAP was constructed in 1940 and 1941 for depot storage and ammunition assembly and loading. In 1950 the facility was placed on standby status until production activities were resumed in 1954 to 1957 and again in 1968 to 1972. Demilitarization activities continued until 1992. The only activities currently being carried out at RVAAP are environmental restoration, ordnance clearance, and demolition of discovered ordnance during those activities, as well as building decontamination and demolition.

The areas of concern for this work are Load Lines 2, 3, and 4 (Figures 1-3 through 1-5). Industrial operations at these locations consisted primarily of melting and loading trinitrotoluene (TNT, also 2,4,6-trinitrotoluene) and Composition B (TNT and Royal Demolition Explosive, also hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)) into large caliber shells. From approximately 1941 to 1971 building wash-down water and wastewater from load line operations collected in concrete sumps, were 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 both 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 Load Lines 1 through 4. The Remedial Investigations/Feasibility Studies (RIs/FSs), as well as remedial actions, are complete; and 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).

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. 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 for Load Lines 1 through 4 is for National Guard training. This area is slated to be developed as a vehicle maneuver area.

Under contract to the Army Environmental Command (AEC), Shaw E & I has 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, in order 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 has raised questions regarding preparation of a work plan detailing 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 may be needed for soil under the slabs, depending on the analytical results.

In late 2007, BRACD funded an option to its demolition contractor 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, this Work Plan has been prepared to address the issues raised by the Ohio EPA. The Work Plan accordingly describes the rationales used to support the Army’s proposed sampling protocol.

The work to be covered by URS’ Delivery Order 0006 is to evaluate potential contamination below the floor slabs and to excavate and transport contaminated earth fill materials above the chemical-specific cleanup levels for TNT and RDX. Once the evaluation has been completed, the earth fill materials exceeding the SOW chemical cleanup criteria for explosives will be transported to buildings G-1, G-1A, and G-3 at Load Line 4 for storage until final disposition decisions are made. If final MI sampling results indicate any exceedances of clean-up levels, additional soil excavation will be completed with approval from the USACE and Ohio EPA within the contract capacity limitations. If contract capacity limits are exceeded, a contract modification to address additional excavation volumes will be issued by USACE.

A soil cover system is currently being evaluated for application to the earth fill surfaces after building slab removal. The cover would provide adequate time to allow for coordination of the BRACD demolition contractor and URS to be in full compliance with the current regulatory site guidance from the Ohio EPA for exposure of building sub slab earth fill materials. The system will require stakeholder and regulatory approval prior to application. Additionally the “spray on” soil sealing system will require budget approval from the AEC. If approved, the system would allow the demolition contractor to perform the demolition process unimpeded. This would also allow for adherence to the Explosive Safety Submission (ESS) documents by maintaining the minimum separation distance (MSD) arcs of 1,250 feet for either contractor. Preparation water for the spray on cover, if used, will be obtained from a potable source (City of Ravenna or Newton Falls) and will be staged at the site in clean tanks for storage.

Floor slab removal by the BRACD contractor is scheduled to begin in early 2008 and will take approximately 9 to 10 weeks per load line. Work will be sequenced so that the areas thought to represent the least potential for residual contamination will be addressed first. This means that work will begin at Load Line 4, then Load Line 3, and finally at Load Line 2. Within each load line, work will similarly be staged beginning with the buildings thought to represent the least potential for residual contamination and ending with those buildings where residual contamination is more probable (i.e., melt pour buildings).

potential for residual contamination and ending with those buildings where residual contamination is more probable (i.e., melt pour buildings).

1.3 NATURE AND EXTENT OF SUB-SLAB CONTAMINATION

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 (Shaw, 2004a; b; c). Results of this sampling indicate that soil beneath the building sub-floors is generally uncontaminated. However, this conclusion is somewhat uncertain since it is based on a limited data set. Details of that sampling are described as follows:

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 field results for TNT and RDX were 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 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 detection of copper was 25.9 mg/kg, a result slightly above the background criteria of 17.7 mg/kg.

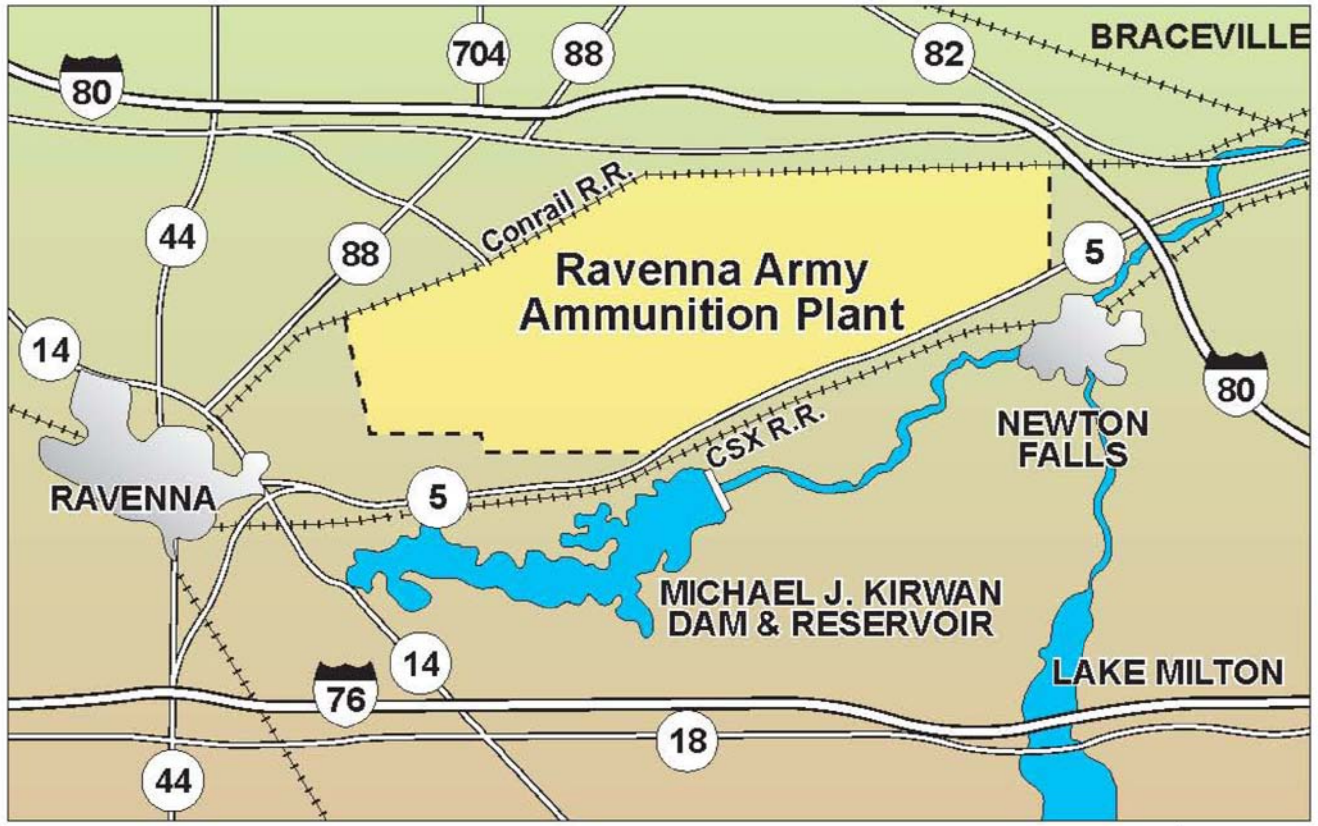
Load Line 3

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 detection of copper 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 detection of cadmium was 0.42 mg/kg. Low detectable concentrations of thallium were also observed in some samples (thallium was not detected in background).

Four stations were analyzed for explosives. Field analytical results were 8.9 mg/kg for RDX at station LL3-069 and 1.3 mg/kg for station LL3-123; thus, these samples were submitted for fixed-base laboratory analysis of explosives. The laboratory analysis for station LL3-069 did not detect any 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 sub-floor 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.



ORIENTATION OF RVAAP

0 3 6

SCALE IN MILE

GENERAL LOCATION

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PROJECT: RAVENNA ARMY AMMUNITION PLANT
SOIL / SAMPLING UNDER FLOOR SLABS
RAVENNA, OHIO

SUBJECT: GENERAL LOCATION AND ORIENTATION OF RVAAP

SCALE: AS SHOWN

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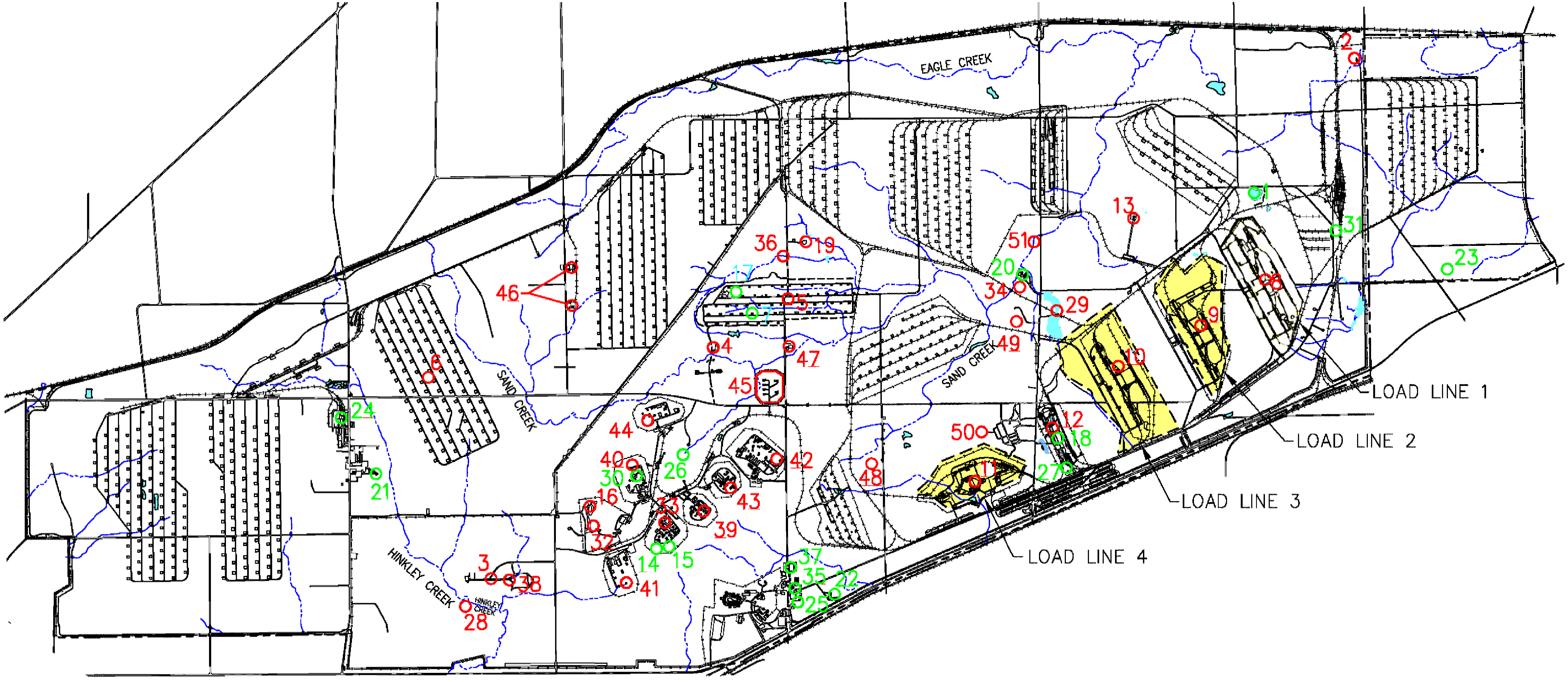
Legend

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



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MAP SOURCE:
RAVENNA ARMY AMMUNITION PLANT
RAVENNA, OHIO

PROJECT: RAVENNA ARMY AMMUNITION PLANT
SOIL / SAMPLING UNDER FLOOR SLABS
RAVENNA, OHIO

SUBJECT: RAVENNA ARMY AMMUNITION PLANT FACILITY MAP

SCALE: AS SHOWN

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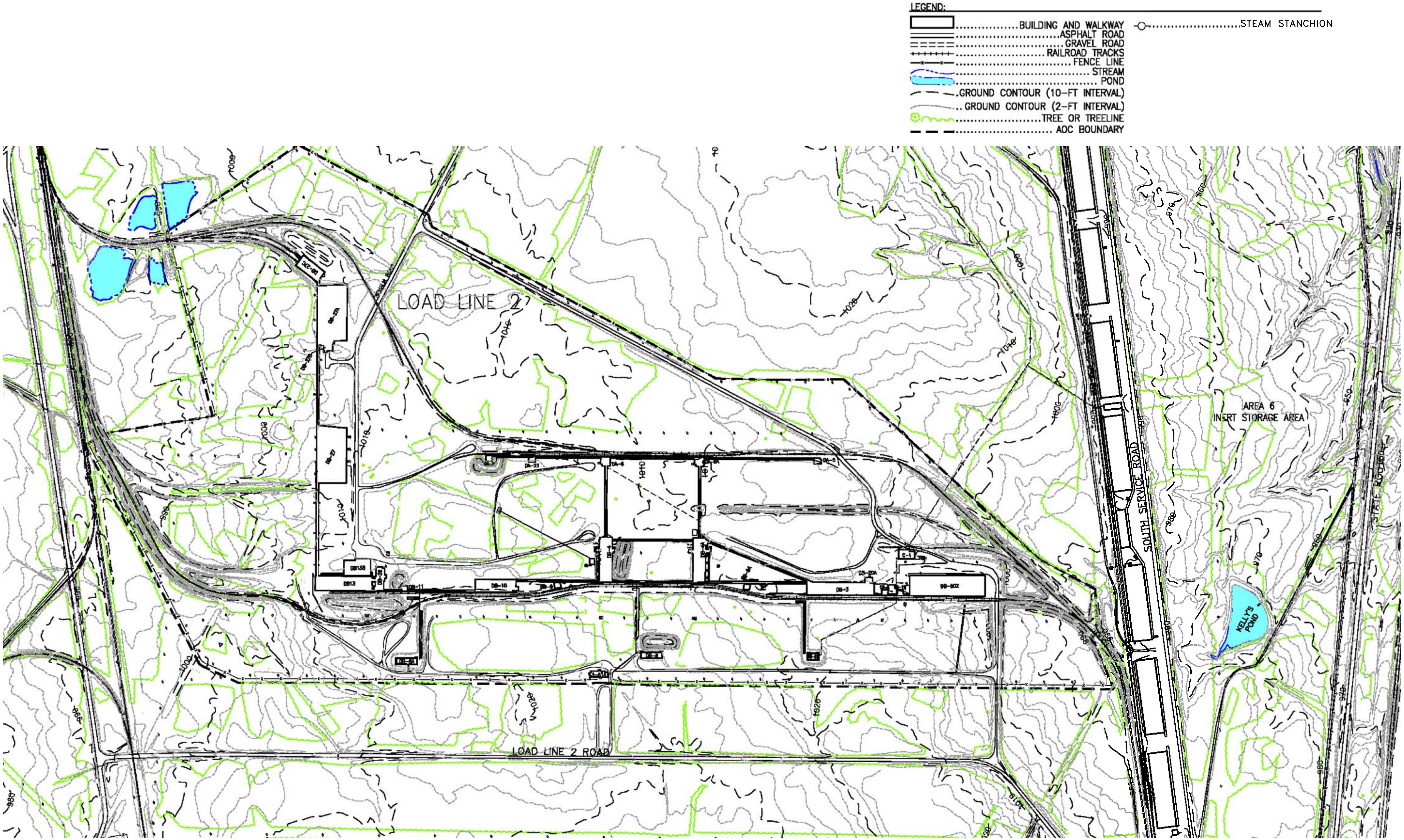

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RAVENNA, OHIO
RAVENNA ARSENAL, INC.
DRAWING No. 1500.2, DATED 6/17/69
"PLOT-PLAN LOAD LINE No.2"

PROJECT: RAVENNA ARMY AMMUNITION PLANT
SOIL / SAMPLING UNDER FLOOR SLABS
RAVENNA, OHIO

SUBJECT: PLOT PLAN - LOAD LINE No. 2

SCALE: AS SHOWN

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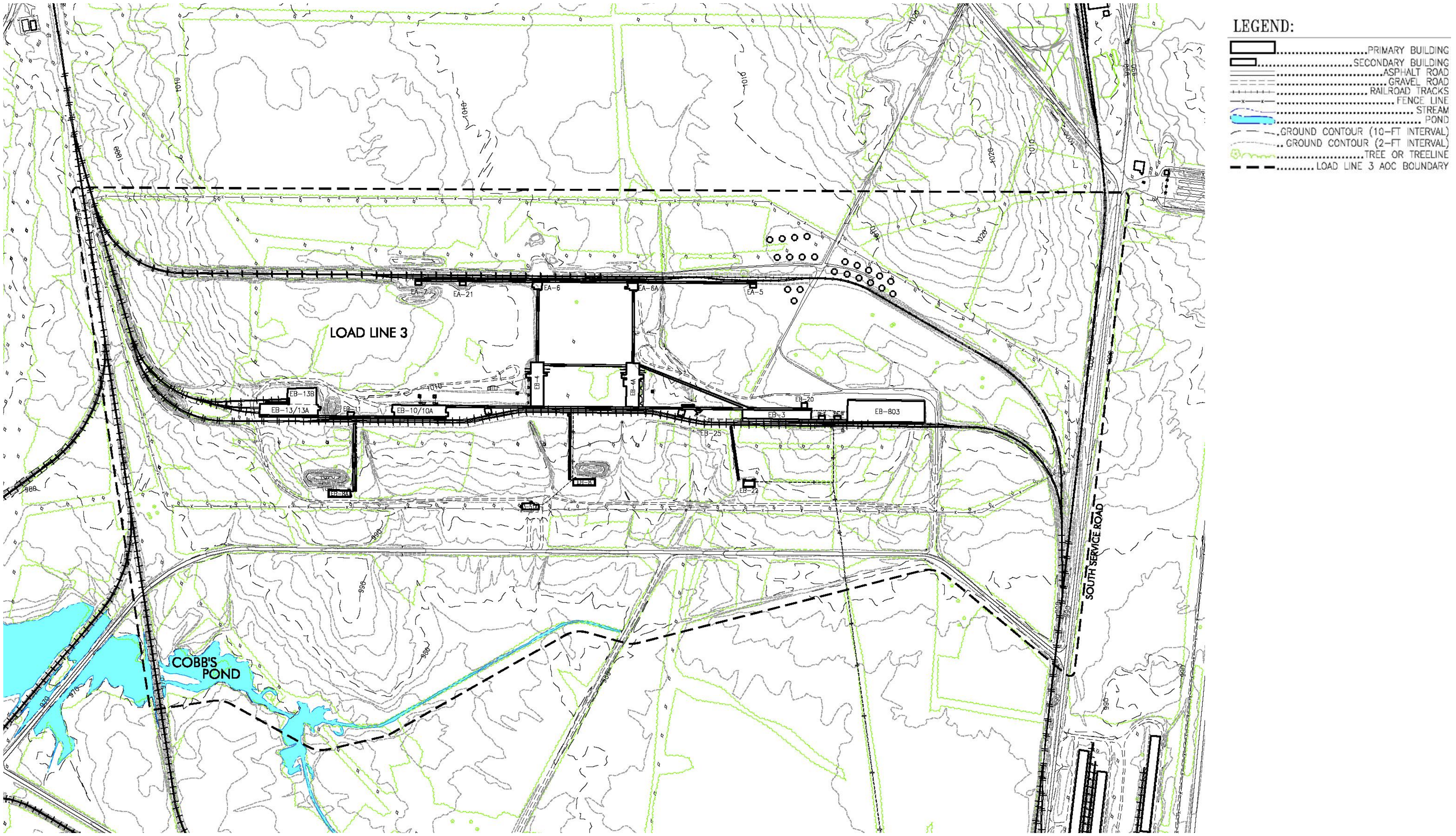

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RAVENNA ARSENAL, INC.
DRAWING No. 1500.3,
"PLOT-PLAN LOAD LINE No.3"

PROJECT: **RAVENNA ARMY AMMUNITION PLANT**
SOIL / SAMPLING UNDER FLOOR SLABS
RAVENNA, OHIO

SUBJECT: **PLOT PLAN - LOAD LINE No. 3**

SCALE: **AS SHOWN**

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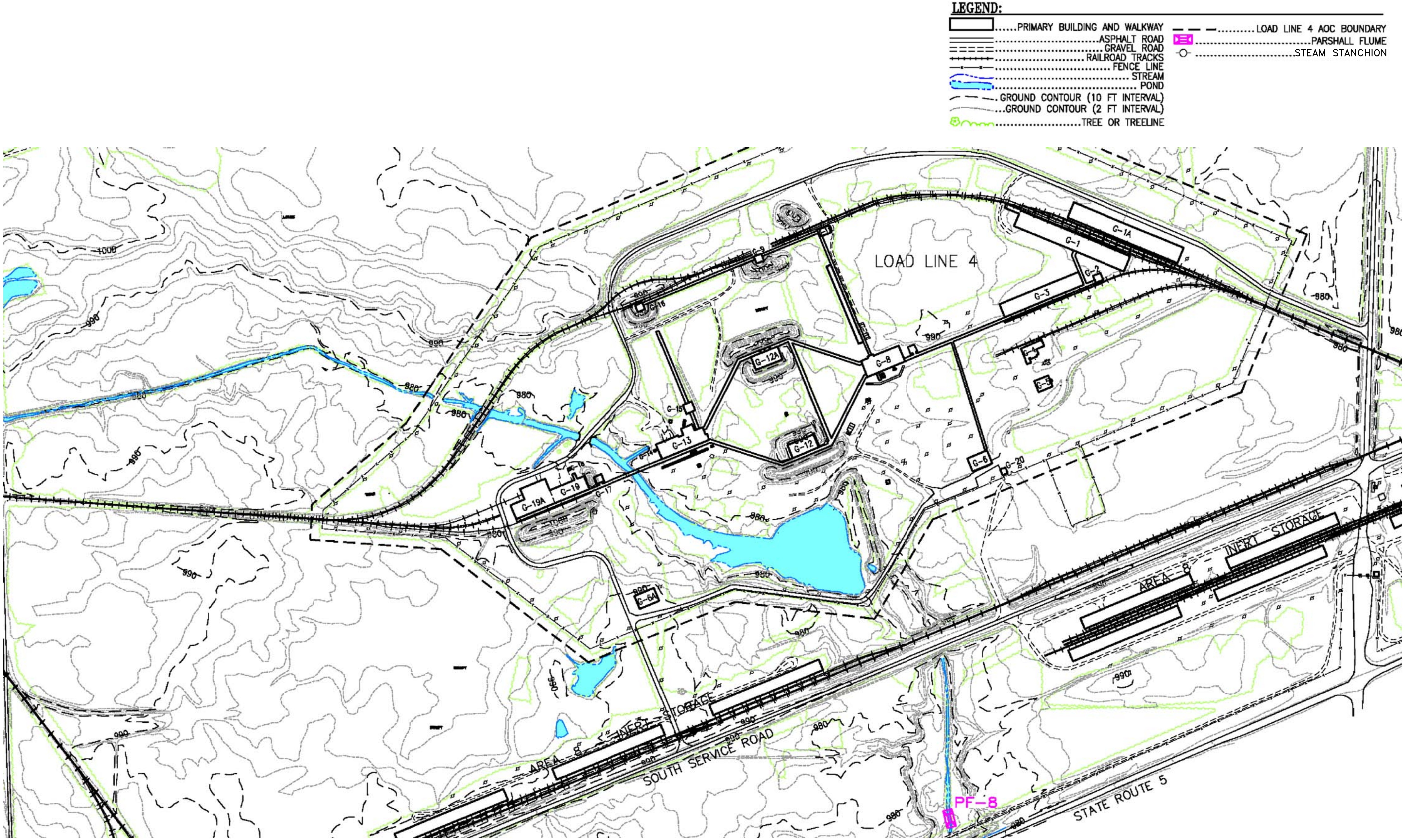

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RAVENNA ARMY AMMUNITION PLANT
RAVENNA, OHIO
RAVENNA ARSENAL, INC.
DRAWING No. 1500.4, DATED 10/30/70
"PLOT-PLAN LOAD LINE No.4"

PROJECT: RAVENNA ARMY AMMUNITION PLANT
SOIL / SAMPLING UNDER FLOOR SLABS
RAVENNA, OHIO

SUBJECT: PLOT PLAN - LOAD LINE No. 4

SCALE: AS SHOWN

JOB NO. 13812319
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The Contract SOW for Delivery Order 0006, dated December 11, 2007, is to complete both pre-slab removal sampling at selected buildings and post-slab removal sampling at 105 buildings within Load Lines 2, 3, and 4. Evaluation of the analytical data will be done to determine if any areas require excavation and transport of earth fill from the load lines to buildings at Load Line 4 (Buildings G-1, -1A and -3). The individual tasks listed in the SOW and activities included in the task are summarized in Table 2-1.

The SOW tasks can be grouped into five primary tasks:

- Preparation of Plans,
- Pre-Slab Removal Sampling and Evaluation,
- Characterization and Removal of Load Line 4 Piles,
- Post-Slab Removal Sampling and Evaluation, and
- Excavation and Transport of Material to Load Line 4 Buildings.

These five primary tasks are discussed in the following subsections. A generalized flow chart describing the SOW tasks is presented on Figure 2-1.

2.1 PREPARATION OF PLANS

In addition to this Work Plan, a Project Coordination Plan (PCP), and an amendment to the current ESS will be required in order to implement the work described in the SOW. The PCP describes the work items and schedules, focusing on the coordination of the URS work with the slab removal work being performed by MKM Engineers, Inc. (MKM), and on-going work being performed by other contractors at RVAAP. The ESS to be completed under this contract is an amendment to the existing ESS for these Load Lines (MKM, 2005). The amendment includes soil sampling, soil excavation, and transportation of explosives-contaminated soil to Load Line 4 buildings.

The Work Plan task will be completed in two segments: work to be done prior to the slab removal by MKM (in letter report format) and a full Work Plan containing all SOW elements. The letter report Work Plan has been completed and approved by Ohio EPA (URS, 2008b).

This Work Plan is the full Work Plan that 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 site-specific Health and Safety Plan (HASP) is included as Appendix C.

2.2 PRE-SLAB REMOVAL SAMPLING AND EVALUATION

Prior to slab removal two efforts will be undertaken:

- Field screening sampling at two currently exposed areas within Load Lines 2 and 3 for TNT and RDX, and

- Multi-increment (MI) sampling at five piles at Load Line 4.

Results from these analyses will be used to direct additional sampling once building slabs are removed and to characterize the five existing Load Line 4 piles so that their disposal can be implemented.

2.3 REMOVAL OF LOAD LINE 4 SOIL/DEBRIS PILES

The five piles of soil/debris at Load Line 4 buildings will be removed and disposed of in accordance with all applicable federal, state, and local rules, laws, and regulations, as well as any permit requirements for the receiving facility. Following removal and prior to placement of any other excavated soils, the integrity of the floors in these buildings will be evaluated and plastic placed as necessary.

2.4 POST-SLAB REMOVAL SAMPLING AND EVALUATION

As building slabs are removed, a sampling program will be implemented according to the SOW. The purpose of the soil sampling is to provide sufficient data at each load line building so that earth fill removal actions can be efficiently planned and accomplished. Earth fill is defined as the soil fill material contained within the elevated building foundations and immediately underneath the building slab. The sampling design for the 105 building locations is included in the SOW for each Load Line. The design is based on historical information such as past usage, RI reports, and past investigations at other ammunition plants, primarily Joliet Army Ammunition Plant. Field screening for TNT and RDX is planned for all building footprints followed by fixed laboratory analyses for SRCs. The field screening results will be used to determine if any earth fill requires removal; the fixed laboratory analyses will be used to determine if any further removal is warranted. The field investigations and evaluation of the data will be included in reports submitted to the USACE and stakeholders listed in the SOW.

2.5 EXCAVATION AND TRANSPORT OF MATERIAL TO LOAD LINE 4 BUILDINGS

All materials determined to require removal because of explosives contamination will be excavated and transported to Buildings G-1, G-1A, and G-3 within Load Line 4. If final MI sampling results indicate any exceedances of clean-up levels, additional soil excavation will be completed with approval from the USACE and Ohio EPA within the contract capacity limitations. If contract capacity limits are exceeded, a contract modification to address additional excavation volumes will be issued by USACE.

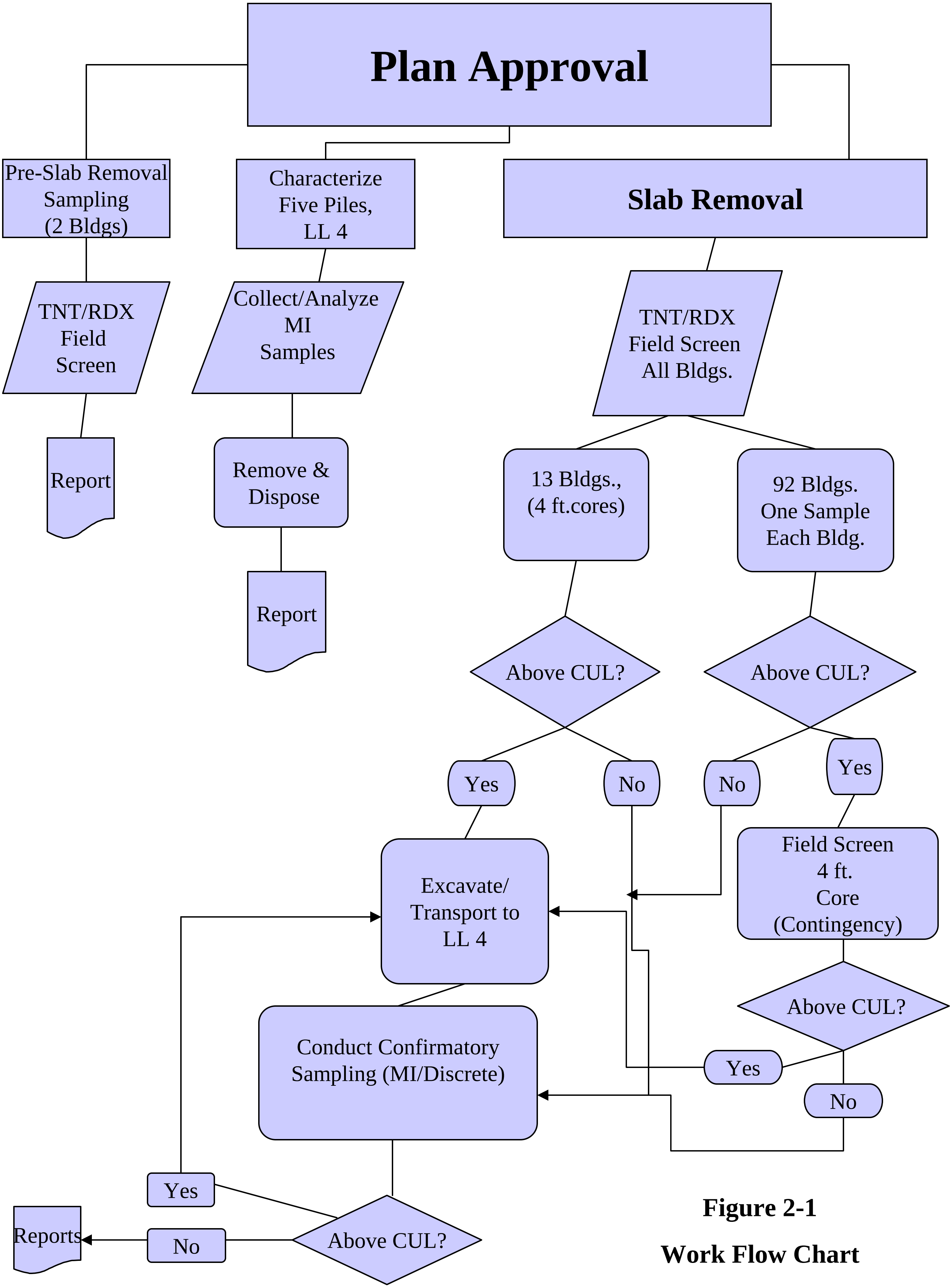


Figure 2-1

Work Flow Chart

Table 2-1
Summary of Tasks and Activities Included in the SOW
Ravenna Army Ammunition Plant
Ravenna, Ohio

Task No.	Description	Activities
1	Project Coordination Plan	Prepare concise PCP to ensure all stakeholders are informed of project status, existing or potential problems, and any project changes.
2A	Work Plan for Pre (Floor Slab) Removal Field Screen Testing	Prepare Work Plan to address field screening at three locations. Letter report Work Plan to include the sampling that will be done to characterize the existing piles within the buildings at Load Line 4. Letter report Work Plan to be included in full Work Plan for entire project.
2B	Explosives Safety Submission for Pre (Floor Slab) Removal Field Screen Testing	Prepare an amendment to the existing ESS (MKM, 2005) to include the field screening sampling that will occur before the slabs are removed.
2C	Completion of Sampling Specified on Table 1 (Selected Buildings)	Collect 10 samples at two building locations on Load Lines 2 and 3 and test for TNT and RDX using EnSys Soil Test System.
2D	Preliminary Evaluation of Pre (Floor Slab) Removal Contamination Beneath Selected Buildings at Load Lines 2,3,4	Provide a preliminary evaluation of the results of the field testing at the two buildings sampled in Task 2C.
2E	Characterize the Six Piles at Buildings G-1, 1A and 3 at Load Line 4	Collect one, 30-increment, multi-increment (MI) sample from each of the piles and analyze for a full suite of analytes.
2F	Remove Six Piles of Soil/Concrete Debris at Buildings G-1, G-1A, and G-3 at Load Line 4	Remove piles of soil/debris at Load Line 4. Dispose of as special waste (unless otherwise determined).
3A	Initial sampling and Analysis of 92 Buildings not Listed on Table 2	At most of the 105 buildings (92), collect a biased sample for field screening. If the TNT or RDX cleanup goals are exceeded, collect 4'cores as described in Task 4D.
3B	Short Report of the Sampling and Analysis of the 92 Buildings Not Listed on Table 2.	Prepare a short report of the field screening efforts at all 92 buildings sampled as part of task 3A.
4A	Work Plan for Initial After (Floor Slab) Removal Field Screening Testing	Prepare a section within the full Work Plan addressing the sampling that will occur after the slabs are removed. Include Field Sampling Plan and QAPP amendments and a site-specific HASP.
4B	Explosives Safety Submission for Initial After (Floor Slab) Removal Field Screen Testing	Prepare an amendment to the existing ESS (MKM, 2005) to include the field screening sampling that will occur after the slabs are removed. Include this information along with the amendment in Task 2B.
4C	Initial Sampling and Analysis of 13 Buildings Listed on Table 2	For those buildings representing a higher probability of residual contamination, collect multiple 4' cores and perform field screening (TNT/RDX) at five depths. Collect an additional 10 samples representative of a range of field screening concentrations and submit to the fixed laboratory for TNT/RDX analysis (to allow for correlation to future work).

Table 2-1
Summary of Tasks and Activities Included in the SOW
Ravenna Army Ammunition Plant
Ravenna, Ohio

Task No.	Description	Activities
4D	Initial Sampling and Analysis of Contingency Samples (from 3A)	If TNT or RDX cleanup levels are exceeded during the initial field screening tests at the 92 buildings, collect a deep core for further analysis to better define the area requiring excavation Send five samples per core to the screening laboratory for TNT/RDX analyses. If TNT or RDX cleanup levels are exceeded, proceed to excavation and transportation tasks.
4E	Short Report of the Sampling and Analysis of 13 Buildings Listed on Table 2	Prepare a short report of the field screening efforts at the 13 higher probability buildings, including the 4’ contingency cores, as well as a summary of areas requiring excavation.
5A	Work Plan for Final (MI) Sampling	Prepare a section within the full Work Plan addressing the MI sampling that will occur after the slabs are removed.
5B	Final Sampling and Analyses at Load Line 4	Conduct final MI sampling. Submit to the fixed laboratory for selected analyses. Compare results to Interim Record of Decision (IROD) cleanup levels.
5C	Evaluation of Final Sampling at Load Line 4	Prepare a report of the field sampling effort as well as the conclusions regarding the need for excavation.
5D	Final Sampling and Analyses at Load Line 3	Conduct final MI sampling. Submit to the fixed laboratory for selected analyses. Compare results to IROD cleanup levels.
5E	Evaluation of Final Sampling at Load Line 3	Prepare a report of the field sampling effort as well as the conclusions regarding the need for excavation.
5F	Final Sampling and Analyses at Load Line 2	Conduct final MI sampling. Submit to the fixed laboratory for selected analyses. Compare results to IROD cleanup levels.
5G	Evaluation of Final Sampling at Load Line 2	Prepare a report of the field sampling effort as well as the conclusions regarding the need for excavation.
6A	Explosives Safety Submission for Excavation and Transportation of Contaminated Soils to Load Line 4	Prepare an amendment to the existing ESS (MKM, 2005) to include the excavation of contaminated soil and transportation to the Load Line 4 Buildings. Include this information along with the amendment in Task 2B
6B	Mobilization and Demobilization for Excavation and Transportation of Contaminated soils	Mobilize all necessary equipment, supplies, and staff resources for excavation of earth fill materials. Demobilize when all removals and transportation activities at all three load lines are complete.
6C	Price to Excavate and Transport Contaminated Soils from Load Line 4 to Load Line 4 Buildings	Excavate earth fill determined to be impacted and transport material to Load Line 4 buildings.

Table 2-1
Summary of Tasks and Activities Included in the SOW
Ravenna Army Ammunition Plant
Ravenna, Ohio

Task No.	Description	Activities
6D	Price to Excavate and Transport Contaminated Soils from Load Line 3 to Load Line 4 Buildings	Excavate earth fill determined to be impacted and transport material to Load Line 4 buildings.
6E	Price to Excavate and Transport Contaminated Soils from Load Line 2 to Load Line 4 Buildings	Excavate earth fill determined to be impacted and transport material to Load Line 4 buildings.

This section describes the tasks that will be performed during the sampling and excavation at the three load lines. These tasks are grouped into the following items:

- Premobilization,
- Mobilization,
- Pre-slab removal sampling,
- Waste pile waste characterization,
- Covering of the removed slab areas,
- Post-slab removal field screening,
- Post-slab removal final sampling,
- Excavation,
- Transportation, and
- Decontamination.

3.1 PREMOBILIZATION

Prior to any and each field investigation, 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, PIKA, Inc. (PIKA) 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. Health and safety training documentation will be verified and copies delivered to PIKA

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

Designation of any truck routes cannot be established until decisions regarding whether any excavation of contaminated soil (and its location) are determined. Before any excavation or transportation occurs, however, 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 intrusive sampling, any subsurface utilities identified as part of the slab removal effort will be reviewed during a site walk over. Additional location activities may be necessary to locate any utilities in the vicinity of those areas where deeper sampling or excavation will occur.

3.1.4 Pre-Field Work Meetings

Pre-field work meetings will be held prior to commencing the sampling efforts. It is anticipated that these meetings will be held prior to the pre-slab removal work and prior to the post-slab removal sampling. In addition, if excavation is required, a pre-construction meeting will also be held. Attendees at these meetings will include URS, USACE, Ohio EPA, OHARNG, RVAAP, PIKA, MKM and any other contractors working in the proximity of the load lines. 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 URS Technical Project Manager in accordance with the meeting requirements in the URS Project Coordination Plan (PCP) (URS, 2008a).

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 sampling described in the following sections and shown on Figure 2-1. 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,
- 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),
- Install temporary field screening laboratory,
- Ensure that all necessary equipment is on site and ready for use,
- Inspect and transport construction equipment to the site,
- 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 the RTLS is required and will be obtained. Communications will include both cell phones and handheld radios.

Signs and barricades will be used to identify sampling 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 URS PCP (URS, 2008). A roster of all 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.

Other site security requirements are listed in the URS PCP.

3.2.3 Decontamination

A temporary decontamination area will be constructed to facilitate decontamination of the push probes and other associated equipment and personnel. The location and layout of the field decontamination area will be determined by the URS Technical 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.

3.2.4 Dust Management

During excavation activities control measures may be necessary to prevent airborne releases of dust. Application of a water spray to exposed soils will be the primary dust control measure. Only water from a potable water supply will be used and will be brought to the site using a water truck. Judicious use of the water will occur to ensure that no runoff or areas of standing water will be created.

Visual and real time monitoring for dust during excavation activities will be done in accordance with the HASP. A Mini-Ram® dust monitor will be strategically placed downwind from the excavation area to monitor dust levels. It may be necessary to reduce work or stop work in order to control dust levels.

3.3 PRE-SLAB REMOVAL SAMPLING

Before slabs are removed, sampling will be conducted at two load line areas where recent demolition activity has left holes or other damage that allows safe access to soil below the floor slab. The purpose of this initial sampling is to provide a preliminary evaluation of the likelihood of explosives contamination beneath floor slabs.

Field screening sampling will be conducted at the following specific locations:

- Load Line 2, Building DB-4, an area about 10 feet south and 15 feet west of the northeast corner of the building (area is about 10 feet in diameter) and

- Load Line 3, Building EB-10, an area about 40 feet south of the north end, midway east and west (area is about 20 feet in diameter).

Sampling will be conducted in accordance with the FWSAP (SAIC, 2001a) and the addendum in Appendix A. Before any sampling is conducted, the areas will be observed and cleared by UXO personnel. No sampling will occur if any raw explosive, crystallized explosive, or obvious red colored soils are present. Two discrete surface samples at the top of the earth fill will be collected from the first area; three from the second. Similarly, five discrete samples at the same locations will be collected at a 1-foot depth. 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 accordance with the procedures provided by the manufacturer (EnSys) with the kits. The EnSys procedures are included in Appendix B.

During the same field effort, the five piles located at Load Line 4 will be sampled. Sampling is being conducted for waste characterization purposes. The locations of these piles are:

- At Building G-1, a pile of soil and a pile of broken concrete at the northwest end of the building;
- At Building G-1, two piles of soil at the southeast end of the building; and
- At Building G-3, one pile of soil at the east end of the building.

One 30-increment MI sample will be collected at each of the five piles located at Buildings G-1 and G-3. Thirty random subsamples will be collected using a step probe. The subsamples will be placed in a plastic-lined bucket and combined to make a single sample. Every effort will be made to obtain the laboratory required volume for the sample preparation without excess. The entire single sample will be placed in a sealable plastic bag, secured, labeled, and delivered to the analytical laboratory. The analytical laboratory will dry, process, and analyze each sample for explosives, metals (TAL and hexavalent chromium), SVOCs, PCBs, pesticides, and herbicides. A discrete sample will also be collected from each stockpile for volatile organic compound (VOC) analyses. The discrete location will be selected based upon field observations and any elevated readings noted with a photo-ionization detector (PID) during a health and safety analysis of the breathing zone at each stockpile. Quality control samples will not be collected for this waste characterization. Analyses will be conducted in accordance with the Facility-Wide Quality Assurance Project Plan (QAPP) (SAIC, 2001b). Any revisions to the QAPP are included as an addendum within Appendix B of this Work Plan.

The field screening results will be transmitted to the USACE within 24 hours of the completion of the field effort. A preliminary draft report documenting the field screening effort will be submitted to USACE and BRACD within 30 days of the completion of the field investigation. Draft and final reports will be submitted to all stakeholders for review.

The analytical results from the pile sampling will be received from the laboratory and reviewed for usability. Results will be transmitted to the designated disposal facility for profiling and approval. The USACE, RVAAP, and Ohio EPA will be provided copies of all data for concurrent review. A preliminary draft report documenting the field effort and evaluation of the analytical data will be submitted to USACE and BRACD within 30 days of the receipt of the analytical data from the fixed laboratory. Draft and final reports will be submitted to all stakeholders for review.

3.4 WASTE PILE REMOVAL FROM BUILDINGS G-1 AND G-3

The disposal of the five piles at Load Line 4 will be arranged at an off-site facility, based upon the laboratory analytical data. The waste will be profiled and manifested through the disposal facility and the RVAAP Caretaker Contractor Facility Manager. All manifests will be signed by an RVAAP staff member, and a copy returned to the RVAAP Operating Contractor Site Manager. All applicable State, Federal, and local rules, laws, and regulations will be followed.

The materials will be loaded into trucks in a designated area adjacent to the stockpiles, to be determined. The designated areas will have adequate spill control measures to enable recovery of any spilled materials. The trucks will be inspected prior to loading for vehicle safety and an appropriate cover system to prevent loss of materials during transport.

The materials will be loaded onto the transport truck in a manner that distributes the load over the entire length of the truck bed. Special care will be given to the stockpiled materials that are comprised of rock and concrete. These materials could possibly damage the truck bed if not loaded properly. When the loading has been completed, the truck will be inspected for any loose stockpile materials that may have inadvertently been spilled on the exterior of the vehicle. Any identified materials will be removed and placed with the remaining stockpile materials. The truck cover will be deployed prior to departing the loading areas. Since the load out will not be conducted in an area with contaminated soils/materials, the truck itself will not require any decontamination.

All federal DOT regulations will be followed during transport to the disposal facility. The appropriate placards will be displayed and the required profile and manifest will accompany the truck to the disposal facility.

3.5 COVERING OF THE REMOVED SLAB AREAS

The project SOW requires that the post-slab removal field screen samples be collected within seven calendar days after the floor slabs/foundation walls have been removed. Upon receipt of analytical data for the field screen samples, the SOW further requires that excavation of explosives contaminated soils be initiated within seven calendar days of making determination that excavation is necessary, and be completed within 14 calendar days of such date. The SOW also includes an alternate provision for the application of cover to exposed soil areas within two calendar days of the date upon which a determination is made that explosives contaminated soils must be removed. The removal decision is based on noted exceedances of the established cleanup goals for TNT and RDX. These timeframes were agreed between the Ohio EPA and USACE, Louisville District, during a December 10, 2007, on-site meeting at the RVAAP. These timeframes imply agreement that a potential soil exposure period of 21 days would be acceptable.

Shortly after award of the contract, use of a temporary spray-on cover material was identified as a potential means to not only minimize the length of time that underslab soil remains exposed, but also to alleviate scheduling and coordination issues associated with explosive safety separation distance that must be maintained between the demolition and remediation contractors.

It is understood that use of the temporary spray-on cover material is contingent upon Ohio EPA approval for use of the product. In the event that use of the spray-on cover material, e.g., Posi-Shell, is approved, it is proposed that the cover be applied within seven calendar days after the floor slabs/foundation walls have been removed. The proposed application timeframe is consistent with the aforementioned acceptable soil exposure period.

Prior to application of the spray-on cover, the slab/foundation footprint will be visually inspected in order to identify impacted areas. After visual inspection (described later in this section) the collection of field screen samples will occur.

As an alternative to the spray-on cover, a plastic cover system may be used to either extend the sampling schedule or protect areas where contamination above cleanup levels is found. Visual inspection will be done as described below. The plastic cover will be an appropriate thickness to prevent tearing by materials left after slab removal. The plastic will be anchored sufficiently to prevent its removal by wind or other mechanical means. The plastic rolls will be stored with safeguards to prevent accidental rolling. If the plastic cover system is utilized, the field screen sampling may be suspended to allow the complete sampling effort to proceed.

In order to minimize the extent of areas requiring plastic cover, an alternate tiered approach to assess contamination has been identified. The tiered approach will entail collection of the field sample prior to placement of plastic as follows:

- Tier 1: If raw or crystallized explosive is observed within the building footprint, then the field screen sample will be collected from a location as close as safely possible before the plastic is placed. Plastic will be placed over the entire building footprint.

- Tier 2: If pink, green, or otherwise stained soil (or other indicators of contamination) is observed within the building footprint, then the field screen sample will be collected from that area. If multiple areas appear impacted based on visual observation, then the sample will be collected from the area that appears to be most impacted. If the field screen sample reveals no exceedance of the TNT/RDX cleanup goals, then no plastic will be applied. If there are cleanup goal exceedances, then the plastic will be applied to the areas showing signs of visible impact. Areas that require cover will be field-determined with approval from Ohio EPA and USACE.

- Tier 3: If no visible indicators of contamination are observed, then the field screen sample will be collected from a field-determined, biased location within the footprint or from the middle of the building footprint. If the field screen sample reveals no exceedance of the TNT/RDX cleanup goals, then no plastic will be applied. If there are cleanup goal exceedances, then the plastic will be applied to the areas believed to be impacted. Since visual indicators are not addressed within this Tier, areas that require cover will be field-determined with approval from Ohio EPA and USACE.

If plastic is used as a cover material, accumulations of rain water will be pumped off as needed to maintain the cover integrity. Provided that contaminated soil has not contacted the surface of the plastic cover, accumulations of rain water will be discharged to a nearby vegetated area at a controlled rate and in accordance with all other RVAAP-specified requirements. The requirements are as follows:

- The designated area will provide at least 200 feet of vegetated area prior to the intersection of a surface drainage way feature from the discharge point.
- The discharge point will be maintained with sufficient baffling to reduce the velocity to a low velocity sheet flow. This sheet flow velocity will be monitored during pumping to ensure that the discharge water has sufficient time and distance for soil infiltration prior to reaching the nearest surface water feature.
- The pump flow rate will be monitored in conjunction with the discharge point baffling and adjusted as required for compliance with the protection of surface water features.
- The discharge point location must be mutually agreed upon with the Ohio EPA and USACE prior to commencement of operations.

If plastic is used as a cover material, it may be reused as cover at a subsequent footprint location, provided that it has not been in contact with contaminated soil.

Prior to application of the spray-on cover, the slab/foundation footprint will be visually inspected in order to identify impacted areas. Identified areas will be handled as per the SOW (USACE, 2007b). The inspection criteria will include both soil staining and bulk explosive product. Any odors will also be noted in the inspection.

- Photo documentation of the area with particular emphasis on any areas with visual signs of potential explosive impact.
- Observed areas of potential impact will be identified with grade stakes so that the area can be relocated after application of the spray cover.
- Field sketch of entire building footprint with potential impacted areas and photographic details.
- A Global Positioning System (GPS) survey will be conducted to further define the location of the potentially impacted area. The survey will be conducted using a sub-meter GPS unit for accuracy.

The spray-on soil stabilization cover application equipment will be washed out after each application. The wash out fluids will be temporarily stored in poly tanks staged at each Load Line. The tank contents will be analytically characterized after total accumulation and disposed at an off-site facility in accordance with all State, Federal, and local rules, laws, and regulations.

3.5.1 Additional MSD Information Pertinent to the Covering of the Removed Slab Areas

Adherence to the ESS documents by maintaining the MSD arcs of 1,250 feet for either contractor will be required during the performance of the demolition and characterization tasks. The MSD arcs are established through the development of the ESS by evaluating the Maximum Credible Event (MCE). The MCE is the estimated maximum explosive event that could credibly occur during operations. There are two recognized types of MCEs: intentional (explosives intentionally detonated for operations including residual explosives and initiating charges) and unintentional (accidental detonated explosives present at the site during operations). The MSD is a safety distance that is based upon operations at the site and is applicable to all nonessential personnel. The maintenance of the MSD arc is required as a stipulation of the authorization to work at the site by the United States Army Technical Center for Explosives Safety (USATCES) and the Department of Defense Explosives Safety Board (DDESB). The field operations staff for this contract will be required to maintain a 1,250-foot distance from the slab removal contractor during all intrusive operations. In the event that URS personnel are considered essential personnel, the 1,250 MSD may be reduced to the K40 distance (147 feet). The MSD is detailed in the ESS document. A significant amount of coordination with the demolition contractor will be required to allow safe operations of all contractors at the facility.

3.6 POST-SLAB REMOVAL SAMPLING

The purpose of the sampling below slabs after their removal is two-fold. The sampling regime needs to address whether there is residual contamination and whether the contamination requires removal. Both purposes can be addressed by a tiered approach that allows a rapid decision based on a field screening technique biased toward areas where explosives contamination is most likely and a more comprehensive second step that broadens the characterization both areally and with regard to a wider suite of potential SRCs.

Past Army experience at other ammunition plants indicates that there are certain process buildings within a load line that can be expected to have a greater potential for residual contamination than other buildings. Based on information from Joliet Army Ammunition Plant and the results of the load line RIs, the buildings at RVAAP were classified into three groups based on their likely potential for residual explosives contamination once floor slabs are removed. Thirteen buildings were identified as high potential, 43 buildings were identified as medium potential, and 49 buildings were identified as low potential.

3.6.1 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 3-1 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 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 3-2 through 3-4 summarize this information for each load line (Shaw, 2004 a,b,c).

Based on both the RVAAP RI data and the JOAAP project information, it was decided that buildings could be appropriately grouped into three categories based on 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 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 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 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 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.

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), with 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.

Tables 3-5 through 3-7 provide the classification of buildings at each load line. Although the rationale for the sampling plan is provided in this work plan, the sampling plan at this time remains unapproved by the Ohio EPA. Upon approval of the final work plan by the Ohio EPA, the USACE may need to issue a contract modification to address project requirements beyond those included in its current contract with URS.

A decision to excavate soils will be made on a building-by-building basis using the field screening results for TNT and RDX. Further excavation decisions will be made based on the final MI sample analyzed by a fixed laboratory.

In accordance with the SOW, final sampling will be completed at the buildings using a fixed laboratory for a wider suite of chemicals. Figure 2-1 portrays the flow of sampling work and the decisions based on the collected data. The following sections provide detail on each of the processes shown on that figure.

3.6.2 Work Sequencing

After a floor slab and any visible explosive waste are removed by MKM, and URS is cleared to enter the area, maintaining the MSD, field screening at each building will occur. The SOW requires that at each building the field screening be completed within 7 calendar days of the completion of the floor slab removal at that building. Close communication with the MKM Project Manager will be maintained so that mobilizations and sampling events can be minimized yet meet the SOW timeframe. Alternatively, the former slab areas may be covered to prevent surface water infiltration until the sampling can be completed (as discussed in Section 3.5).

3.6.3 Field Screening

The field screening protocol will vary depending on the potential for each building to be associated with residual explosives contamination once the floor slab is removed. Each scheme is described in the following subsections.

At the beginning of this work, ten samples subjected to the field screening will be sent to the fixed laboratory for TNT and RDX analyses. The ten samples selected for fixed laboratory analyses will range in TNT/RDX concentrations (as measured by the field screening) from nondetect up to the cleanup goals, if possible. These results will be used to provide a correlation of the field test results with the fixed lab results. Any modifications to subsequent field screening concentrations may be made based on a statistical correlation developed using an appropriate statistical test (e.g., Pearson’s, Kendall’s, etc.) to measure the strength of the correlation and its direction. Any modifications will be made based upon discussions and agreement with USACE and Ohio EPA.

3.6.3.1 Low and Medium Potential Building Sampling

At each low- and medium-potential building, one field screening sample will be collected from the most obvious area of explosive contamination (i.e., pink, green, or otherwise stained soil, or any other indicators of contamination), a field-determined biased location, or otherwise near the approximate middle of the building footprint. The sample will be collected from approximately

0 to 12" below the ground surface. The Field Team Leader will have the option of collecting additional contingency samples if field conditions warrant. The decision to collect additional field screening samples will require USACE and Ohio EPA approval.

Sampling will be conducted in accordance with the FWSAP (SAIC, 2001b). Before any sampling is conducted, the areas will be observed and cleared by 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 0 to 12" 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 determine 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.

If both the TNT and RDX levels measured in the sample are below the cleanup levels (1,646 and 838 mg/kg, respectively) final sampling will then be completed (Section 3.6.4). If either the TNT or RDX levels are above the cleanup goal, additional field screening will be done. As close as possible to the original screening location, a 4-foot core will be collected using the JMC Environmentalist's Subsoil Probe, in accordance with the FWSAP, including the addendum in Appendix A. The purpose of this additional sampling is to better define the area requiring excavation. Five discrete portions of the core will be selected for EnSys field analysis: the top, three portions within the core that best represent the range of materials found in the core, and the bottom. If the concentrations of TNT or RDX within this core are above the cleanup level, then excavation of the contamination will be done at this building.

3.6.3.2 High-Potential Explosive Building Sampling

For the 13 buildings considered high potential for residual explosive contamination, multiple 4-foot cores will be used to collect samples for field screening analysis. Table 3-8 shows the number of cores for each of these buildings and the approximate dimensions of the slabs; Figure 3-1 shows the approximate locations within each building footprint. The locations of these cores may be adjusted based on pre- and post-slab removal observations including cracks in the slabs, drains, doorways, staining etc. Field adjustments to the coring locations will be made upon approval of USACE and Ohio EPA.

Sampling will be conducted in accordance with the FWSAP and the addendum to it provided in Appendix B. Before any sampling is conducted, the areas will be observed and cleared by 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 determine TNT and RDX concentrations. Analysis will be in accordance with the procedures provided by the manufacturer (EnSys) with the kits. The EnSys procedures are included in Appendix B.

Five discrete portions of the core will be selected for EnSys field analysis: the top, three portions within the core that best represent the range of materials found in the core, and the bottom. If the concentrations within the cores from a given building of either TNT or RDX are above the cleanup level, then excavation of the contamination will be done at this building.

If contamination is identified at the 4-foot sampling endpoints that are currently in the SOW, additional 4-foot cores will be collected as allowable using remaining contingency core samples within the contract capacity. The additional cores will be collected so that depth of contamination can be further delineated and ultimately excavated.

3.6.3.3 Excavation Decisions

The field screening (i.e. EnSys test kits) will be used as indicators of overall contamination on a building by building basis. If the concentrations from the core samples are above either the TNT (1,646 mg/kg) or RDX (838 mg/kg) cleanup value excavation will be done. Results from the core samples will be mapped both laterally and vertically so that the area of impact can be delineated. These findings will be reviewed with both the USACE and Ohio EPA in order to determine excavation volumes. These volumes will be excavated and transported to a storage area at Load Line 4 (i.e., Buildings G-1, G-1A, or G-3). These activities are discussed in Sections 3.7 and 3.8.

If additional deeper borings are done, excavation volumes from those results will also be reviewed and approved by both the Ohio EPA and USACE prior to excavation. Excavation deeper than 4 feet will occur with approval from the USACE and Ohio EPA within the contract capacity limitations. If contract capacity limits are exceeded, a contract modification to address additional excavation volumes will be issued by USACE.

3.6.4 Final Sampling

As long as there are no exceedances of the TNT or RDX cleanup values measured by the field screening tests, the final sampling can be done after completion of the screening sampling. If there are field screening exceedances, the final sampling will occur on the excavated surface after removal is complete.

Thirty-increment, MI samples will be collected at the buildings. The MI sampling areas for some low potential buildings are combined with other buildings based on their proximity and similarity of former use. At several locations within each Load Line, a discrete sample will be collected for VOC analysis. Tables 3-9 through 3-11 detail the sampling scheme for each building including the analytical groups and samples designated for either quality assurance (QA) or quality control (QC) samples.

The thirty random subsamples will be collected using a step probe. The subsamples will be placed in a plastic-lined bucket and combined to make a single sample. Every effort will be made to obtain the laboratory required volume for the sample preparation without excess. The entire single sample will be placed in a sealable plastic bag, secured, labeled, and delivered to the analytical laboratory. The analytical laboratory will dry, process, and analyze each sample for explosives and metals (TAL and hexavalent chromium). Hexavalent chromium has been added to the list of metals since a cleanup goal for that metal has been determined. Appendix B (the addendum to the QAPP) provides information regarding the analysis for hexavalent chromium.

At selected buildings, analyses for propellants, SVOCs, and PCBs will also be done. These additional parameters are based on the actual operations at an individual building and whether those operations would be indicative of contamination other than explosives or metals. The review of the RI data set for each load line also provided information as to specific buildings where additional analyses are warranted based on soil contamination outside the building. The additional parameter groups for each building are also noted on Tables 3-9 through 3-11. In accordance with the *Facility-Wide QAPP*, 10% of the samples collected at each load line will be analyzed for these additional parameters and pesticides (i.e., the full analytical suite).

A discrete sample will also be collected from selected buildings for VOC analysis. The discrete location will be selected based upon field observations and any elevated readings noted with a PID during a health and safety analysis of the breathing zone at each building. Analyses will be conducted in accordance with the *Facility-Wide Quality Assurance Project Plan* (QAPP) (SAIC, 2001b). The collection of quality assurance and quality control samples will be in accordance with the QAPP. Revisions to the QAPP are included as an addendum within Appendix B of this Work Plan.

Although the rationale for the sampling plan is provided in this work plan, the sampling plan at this time remains unapproved by the Ohio EPA. Upon approval of the final work plan by the Ohio EPA, the USACE may need to issue a contract modification to address project requirements beyond those included in its current contract with URS. Additionally, Tables 3-9 through 3-11 may require revision to reflect the approved sampling plan, including changes to required QA/QC samples.

3.7 EXCAVATION

Prior to URS' mobilization to the site, all clearing and grubbing, utility location, road construction and/or maintenance, installation/maintenance of erosion and sediment control measures, and removal of concrete obstructions will be completed.

A visual survey of the excavation area will be conducted prior to the application of any soil stabilization cover system as detailed in Section 3.5. Any bulk explosives on the soil surface below the slabs will be managed by the demolition contractor. The product will be removed by first stabilizing and then moving it to the designated storage or demolition area. No work will be conducted at the building footprint until the explosive product has been removed.

URS will mobilize a crew consisting of a Site Supervisor, two equipment operators, a truck driver, and a laborer. The crew will utilize an excavator, rubber-tired loader, and off-road dump truck to perform excavation, on-site transportation, and stockpiling activities.

Excavation activities will be confined to the current locations of Load Lines 2, 3, and 4. As directed by the SOW, URS will excavate contaminated soil using an excavator to a maximum depth of 4 feet. Excavation deeper than 4 feet will occur with approval from the USACE and

Ohio EPA within the contract capacity limitations. If contract capacity limits are exceeded, a contract modification to address additional excavation volumes will be issued by USACE.

The excavated material will be loaded directly into an off-road dump truck for transport to a building that will house the stockpiles of contaminated soil. The excavated area(s) will be temporarily stabilized by applying an OHARNG approved seed mix once final sampling indicates no further excavation is necessary. The excavated areas will be backfilled to final grade with an approved clean fill.

Air monitoring will be performed as per Section 3.2.4. Visual and real time monitoring for dust during excavation activities will be done in accordance with the HASP utilizing the Mini Ram dust monitor.

3.8 TRANSPORTATION TO LOAD LINE 4

Earth fill materials excavated at the load lines that exceed the site clean-up goals will be transported to the SOW designated buildings at Load Line 4 (G-1, G-1A, and G-3) as required. The earth fill materials will be transported to Load Line 4 in off-road dump trucks or over the road dump trucks based upon site conditions.

Once at the building, the dump truck will dump the material outside the entrance of the building and return to the active excavation area. A loader will “shuttle” the dumped material into the building and construct stockpiles of the contaminated soil. Because the stockpiles are to be stored at Load Line 4 in a building under cover, the stockpiles will not be covered during storage. The staging area outside the buildings will be covered with plastic sheeting prior to stockpiling of contaminated soils.

The excavated earth fill materials will be temporarily staged at the entrance to the buildings on an area lined with two layers of 6 mil plastic. The plastic will be bermed to contain the materials within a defined area. The materials will be transported into the buildings using a front end loader. Plastic sheeting will be used to cover any materials not secured within the buildings at the end of each day. Materials will remain outside the buildings for a maximum of 24 hours.

3.9 DECONTAMINATION

Decontamination of field equipment associated with either the field screening or final sampling will be conducted in accordance with the FWSAP (SAIC, 2001b). Equipment will be decontaminated after completion of sampling activities at each multi-increment or field screening location.

Excavation and transportation equipment will be decontaminated in a designated area at each load line adjacent to the excavation area. The decontamination will consist of a dry scrape with collection of the scrapings and a steam cleaner washing of the portions of the equipment directly exposed to the contaminated soils. Decontamination fluids will be collected and disposed with the liquid Investigation-Derived Waste (IDW).

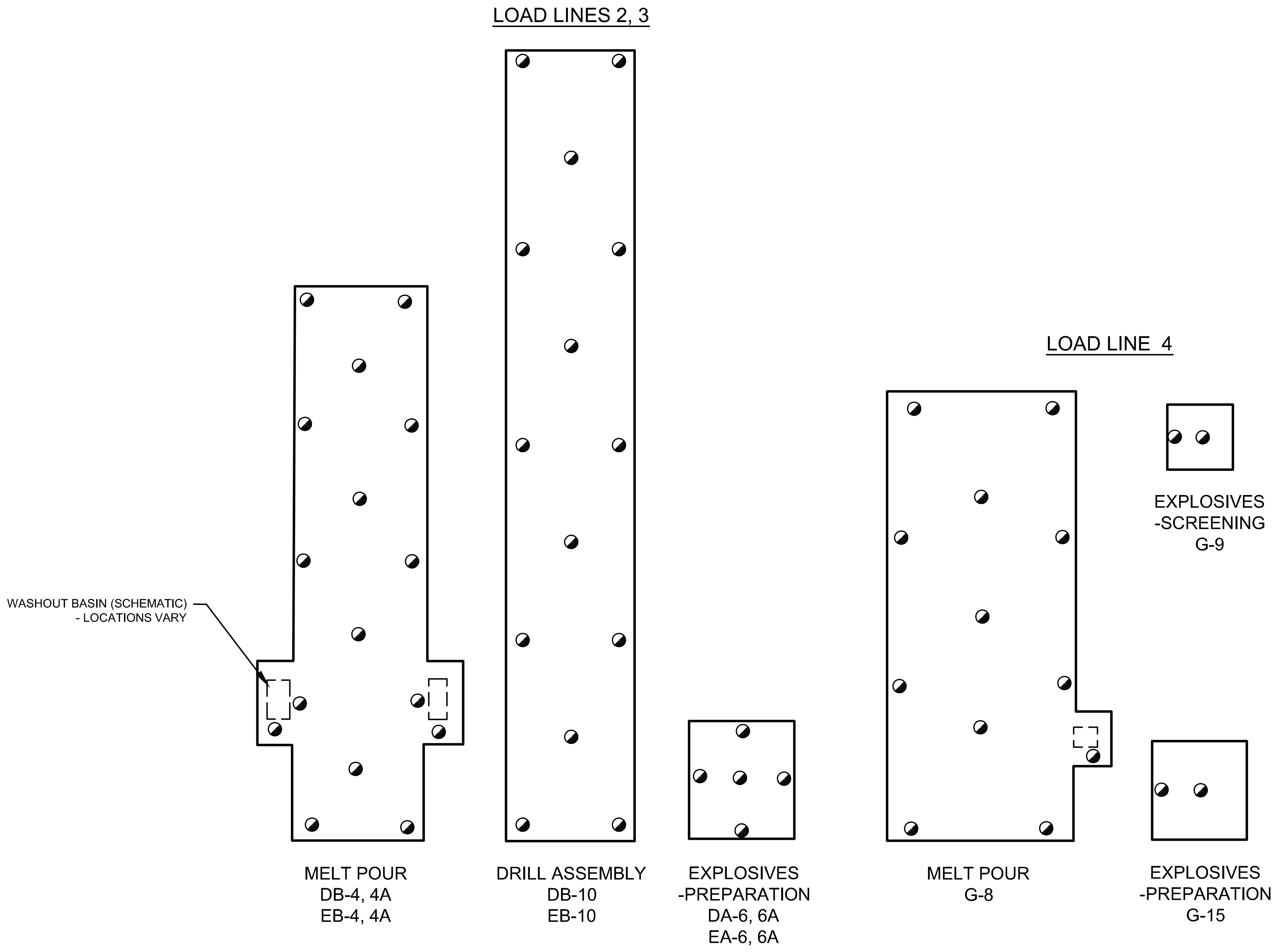
3.10 SCHEDULE

A facility-wide schedule of RVAAP activities will be obtained from USACE in order to coordinate with the appropriate parties once field activities are planned. Updates to this facility-wide schedule will be discussed biweekly and revised as necessary.

The URS field activities will be included in a Microsoft Project® schedule based on close coordination with the slab removal contractor. Figure 3-2 is the most recently updated schedule.

3.11 MEETINGS

As discussed in the PCP, the URS Technical Project Manager will attend the weekly contractor meetings at RVAAP during periods of active field work. The URS Project Manager will attend Restoration Advisory Board Meetings during the duration of this project. No other meetings are anticipated at this time.



URS

US Army Corps of Engineers®
Louisville District

0 20 40 80
SCALE IN FEET

LEGEND

● APPROXIMATE SAMPLING LOCATION
(4 FT . CORE)

PROJECT: RAVENNA ARMY AMMUNITION PLANT
SOIL / SAMPLING UNDER FLOOR SLABS
RAVENNA, OHIO

SUBJECT: PROPOSED CORE LOCATION MAP,
HIGH POTENTIAL BUILDINGS

SCALE: AS SHOWN

JOB NO.	13812319
DATE:	01/28/08
DRAWN BY:	YRC
DRAWING NO.	3-1

P:\R\Ravenna AAP\13812319\DWGs\Figures\Ravenna-Fig3-1.dwg User: Yng-Ru_Chen Jan 29, 2008 - 11:39am

ID	Task Name
1	**Project Schedule**
2	**Task 1: Project Coordination Plan**
3	Prepare Plan Internal Army Draft
4	Internal Draft Review (USACE)
5	Comment Resolution
6	Prepare Draft
7	Submit Draft (Stakeholder Review)
8	Comment Resolution
9	Prepare Final
10	Submit Final for (Stakeholder Review)
11	Final Approval
12	**Task 2**
13	**Task 2A: Letter Report Work Plan**
14	Prepare Internal Army Draft
15	Internal Army Review
16	Comment Resolution
17	Submit Draft

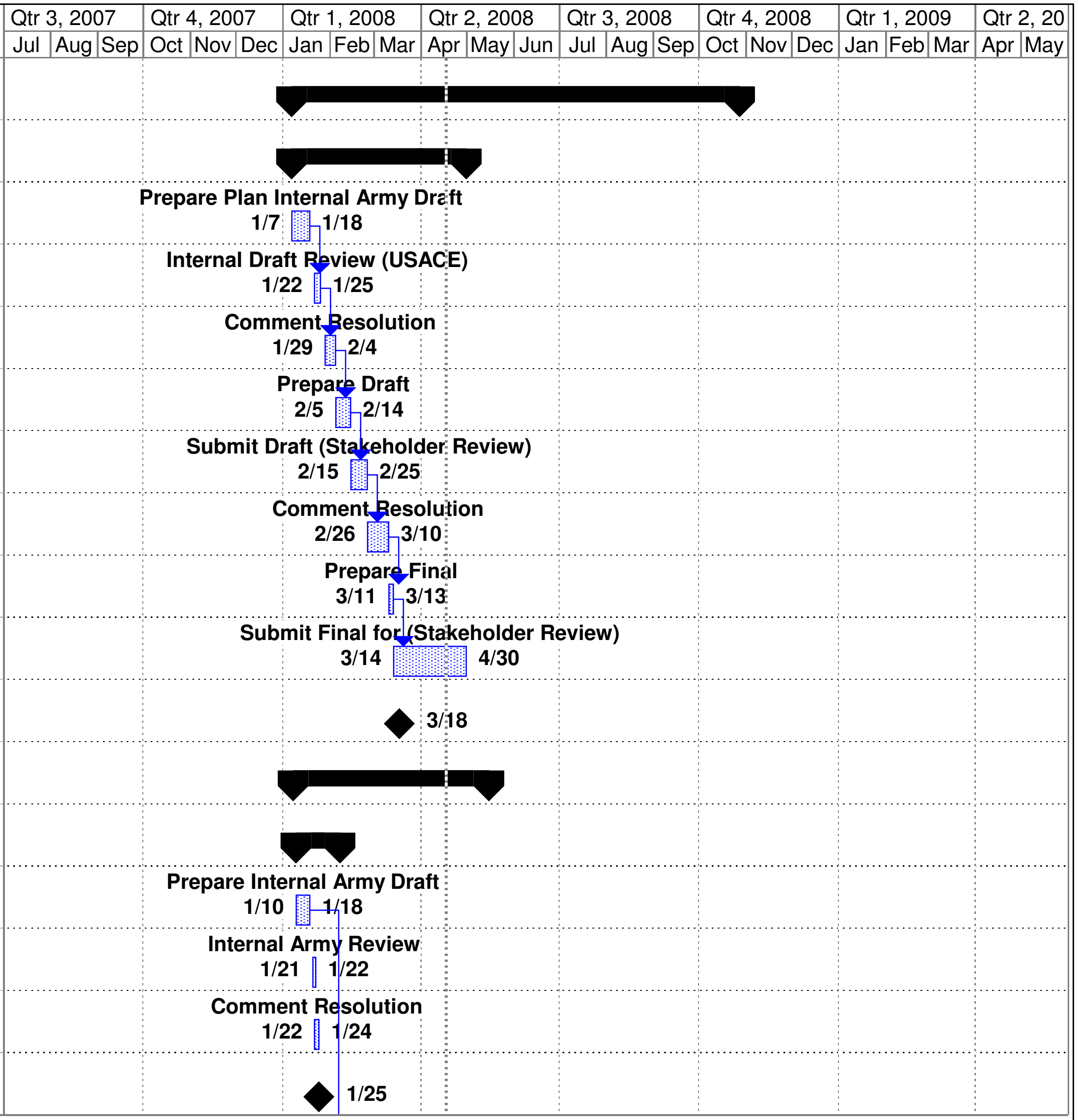


Figure 3-2
Project: RVAAP Sub Slab
Date: Thu 4/17/08

Task	▨	Milestone	◆	External Tasks	▭
Split	┈	Summary	▬	External Milestone	◆
Progress	▬	Project Summary	▬	Deadline	⇩

RVAAP Sub Slab 17 APR 08_Schedule

Schedule reflects durations and cycles as required by Findings and Orders. Actual durations may be expedited.

ID	Task Name
18	Review Draft (Stakeholders)
19	Comment Resolution
20	Prepare Final
21	Comment Resolution
22	Submit Final/Approval
23	**Task 2B/4B/6A: ESS**
24	Prepare Internal Army Draft
25	Internal Army Draft Review (USACE)
26	Comment Resolution
27	Submit Draft
28	Stakeholder Review
29	Comment Resolution
30	Prepare Final
31	Submit Final
32	Final Review (USATES; DDESB)
33	Approval USATES
34	Approval DDESB

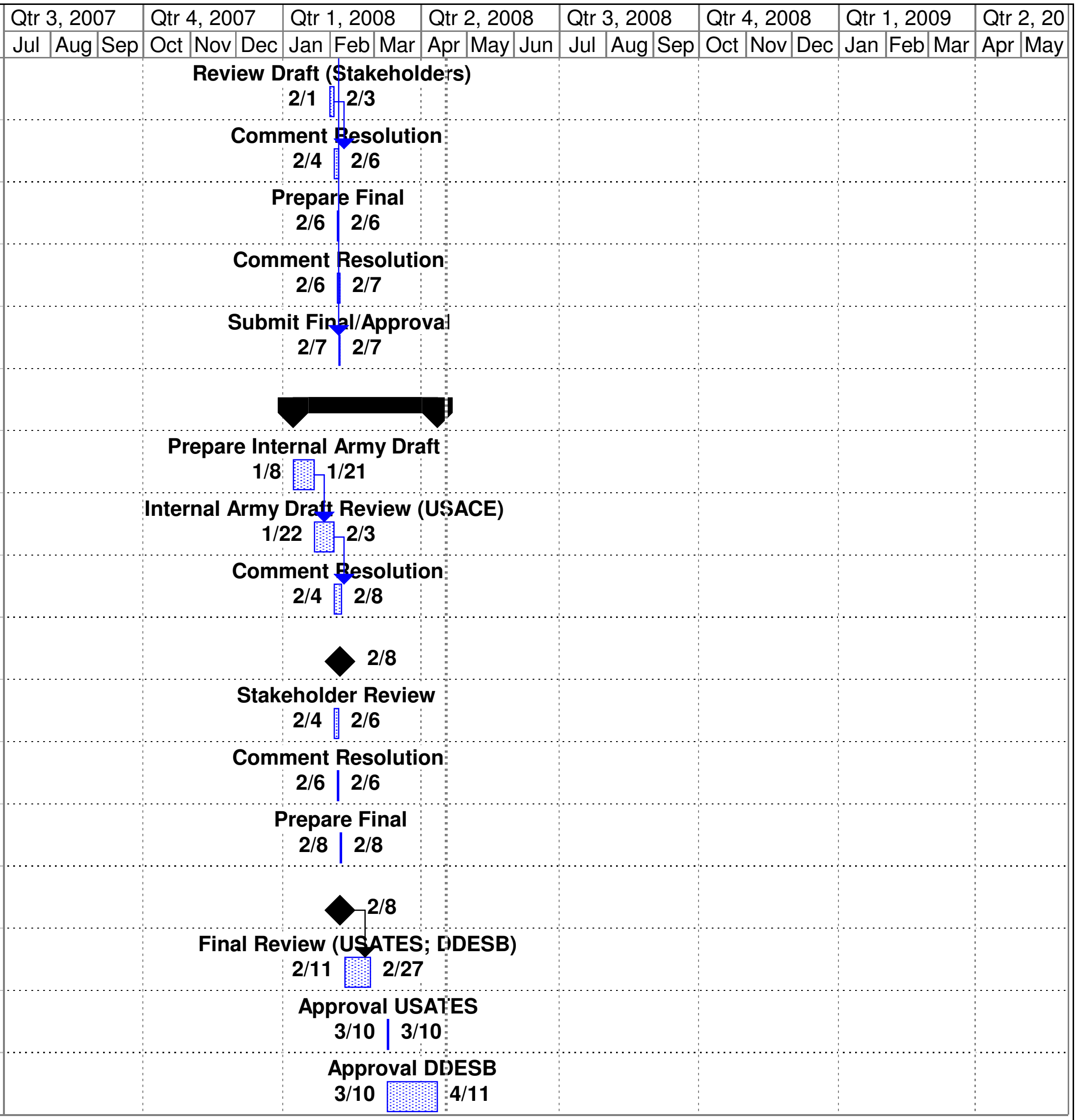


Figure 3-2
Project: RVAAP Sub Slab
Date: Thu 4/17/08

Task	▨	Milestone	◆	External Tasks	▬
Split	┆	Summary	▬	External Milestone	◆
Progress	▬	Project Summary	▬	Deadline	⇩

Schedule reflects durations and cycles as required by Findings and Orders. Actual durations may be expedited.

ID	Task Name
35	**Task 2C: Table 1 Soil Sampling**
36	Field Mobilization
37	Field Sample Collection
38	Sample Analysis
39	**Task 2D: Preliminary Evaluation of Pre-Removal Samples**
40	Evaluation
41	**Task 2E: Characterization of Soil Piles G-1, G-1A, G-3**
42	Field Mobilization
43	Field Sample Collection
44	Laboratory Analysis
45	Laboratory Result Evaluation
46	**Task 2F: Remove Soil Piles at G-1, G-1A, G-3**
47	Field Mobilization
48	Removal of Soil Piles
49	**Task 3**
50	**Task 3A: Initial Sampling and Analysis of 92 Buildings**
51	Field Mobilization

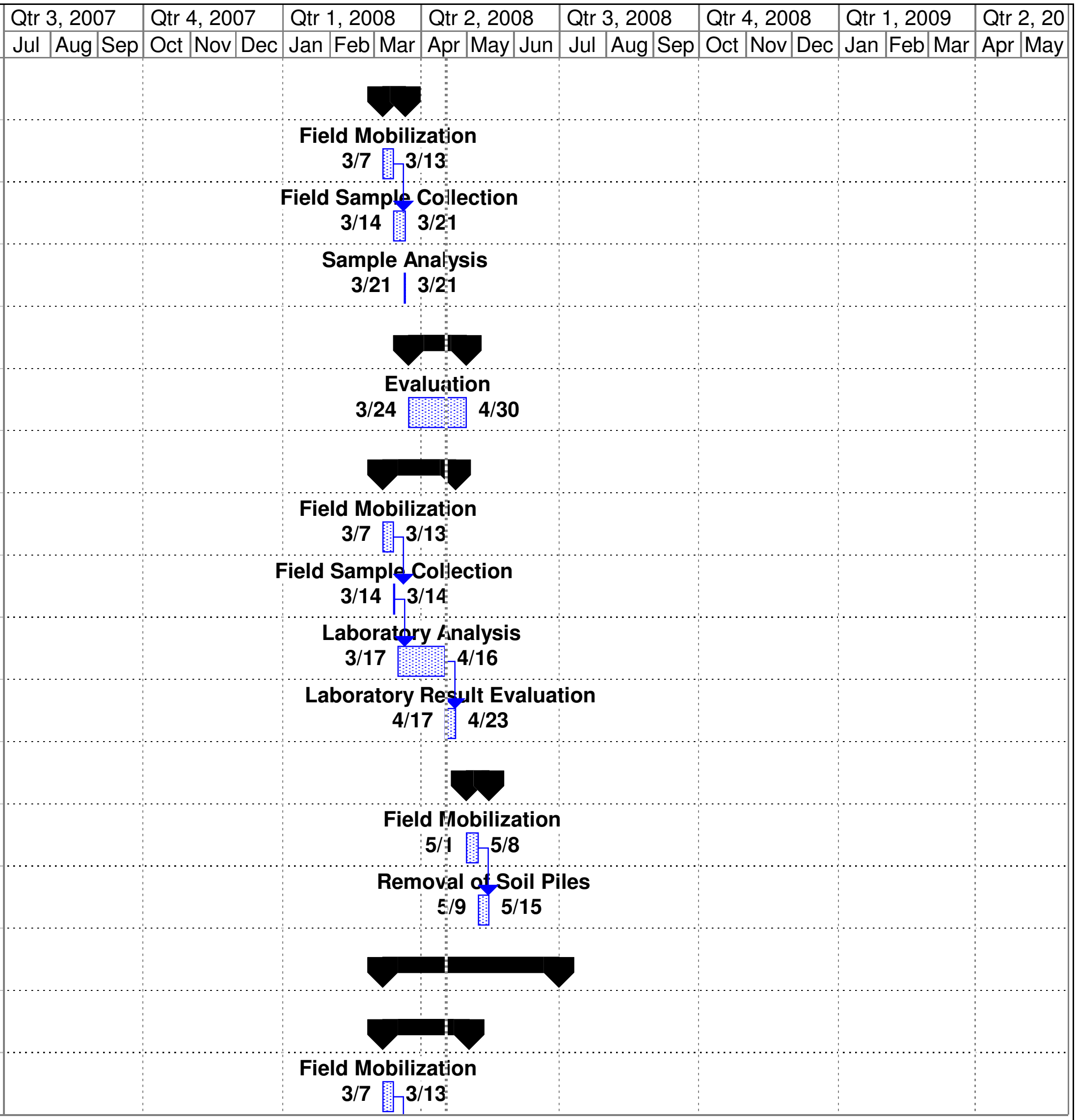


Figure 3-2
Project: RVAAP Sub Slab
Date: Thu 4/17/08

Task	▨	Milestone	◆	External Tasks	▬
Split	⋯	Summary	▬	External Milestone	◆
Progress	▬	Project Summary	▬	Deadline	⇩

Schedule reflects durations and cycles as required by Findings and Orders. Actual durations may be expedited.

ID	Task Name
52	Field Sampling
53	Field Screening
54	**Task 3B: Short Report for Sampling & Analysis from 92 Bldgs**
55	Report
56	**Task 4**
57	**Task 4A/5A: Full Work Plan**
58	Prepare Preliminary Draft
59	Stakeholder Review
60	Comment Response Table Submitted
61	Comment Resolution
62	Prepare Draft
63	Review Draft (all Stakeholders)
64	Submit Final
65	Review Final (Stakeholders)
66	Final Approval
67	**Task 4C: Initial Sampling - 13 Buildings**
68	Field Mobilization

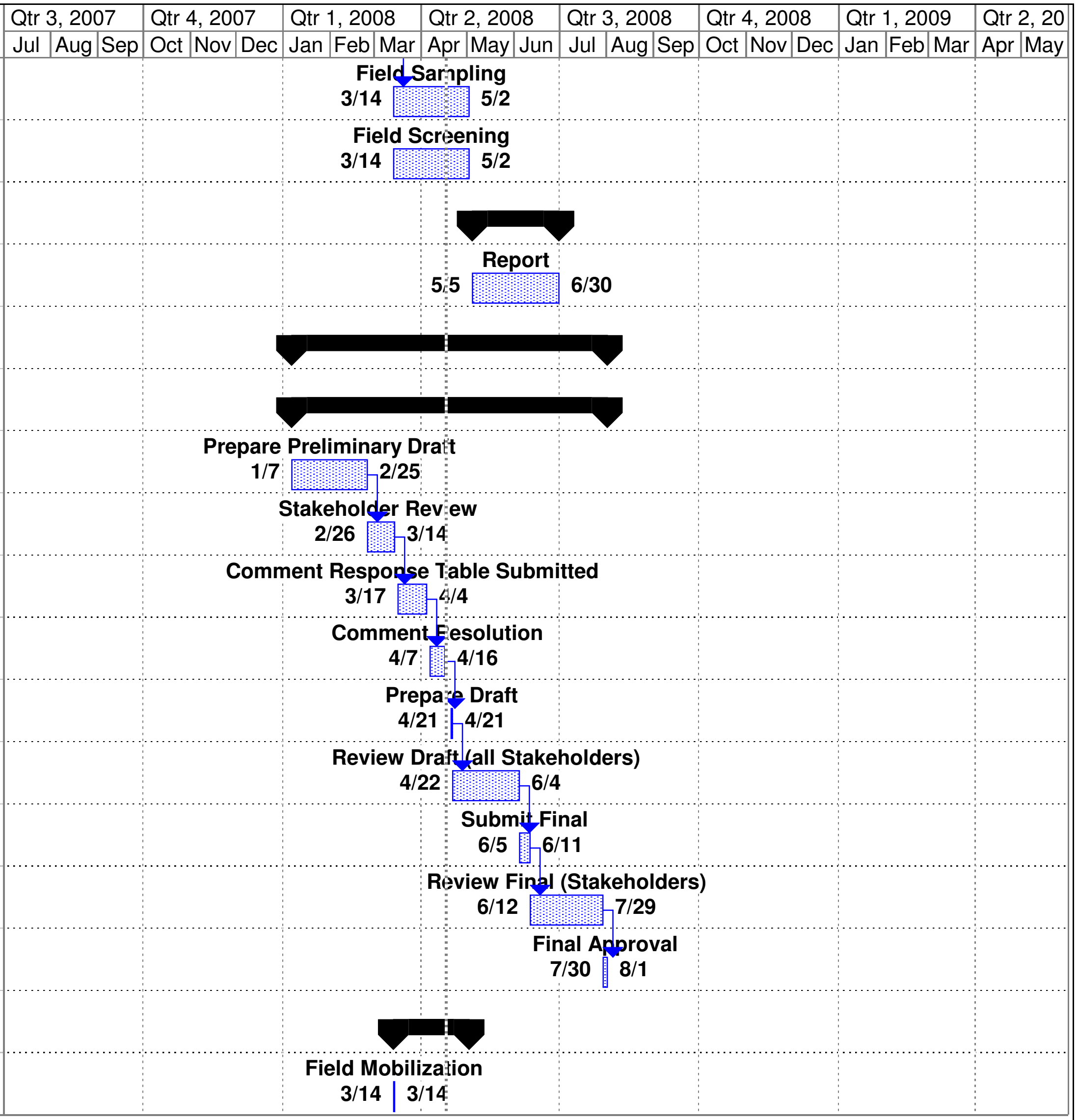


Figure 3-2
Project: RVAAP Sub Slab
Date: Thu 4/17/08

Task	▨	Milestone	◆	External Tasks	▨
Split	⋯	Summary	▬	External Milestone	◆
Progress	▬	Project Summary	▬	Deadline	⇩

Schedule reflects durations and cycles as required by Findings and Orders. Actual durations may be expedited.

ID	Task Name
69	Field Sampling
70	Laboratory Analysis
71	**Task 4D: Initial Sampling & Analysis-Contingency Samples**
72	Field Mobilization
73	Field Sampling
74	Laboratory Analysis
75	**Task 4E: Short Report of the Sampling & Analysis- 13 Bldgs.**
76	Report
77	**Task 5**
78	**Task 5B: Final Sampling and Analysis at LL#4**
79	Field Mobilization
80	Field Sampling
81	Laboratory Analysis
82	**Task 5C: Evaluation of Final Sampling at LL#4 from Task 5B**
83	Laboratory Analysis Evaluation
84	**Task 5D: Final Sampling & Analysis at LL#3**
85	Field Mobilization

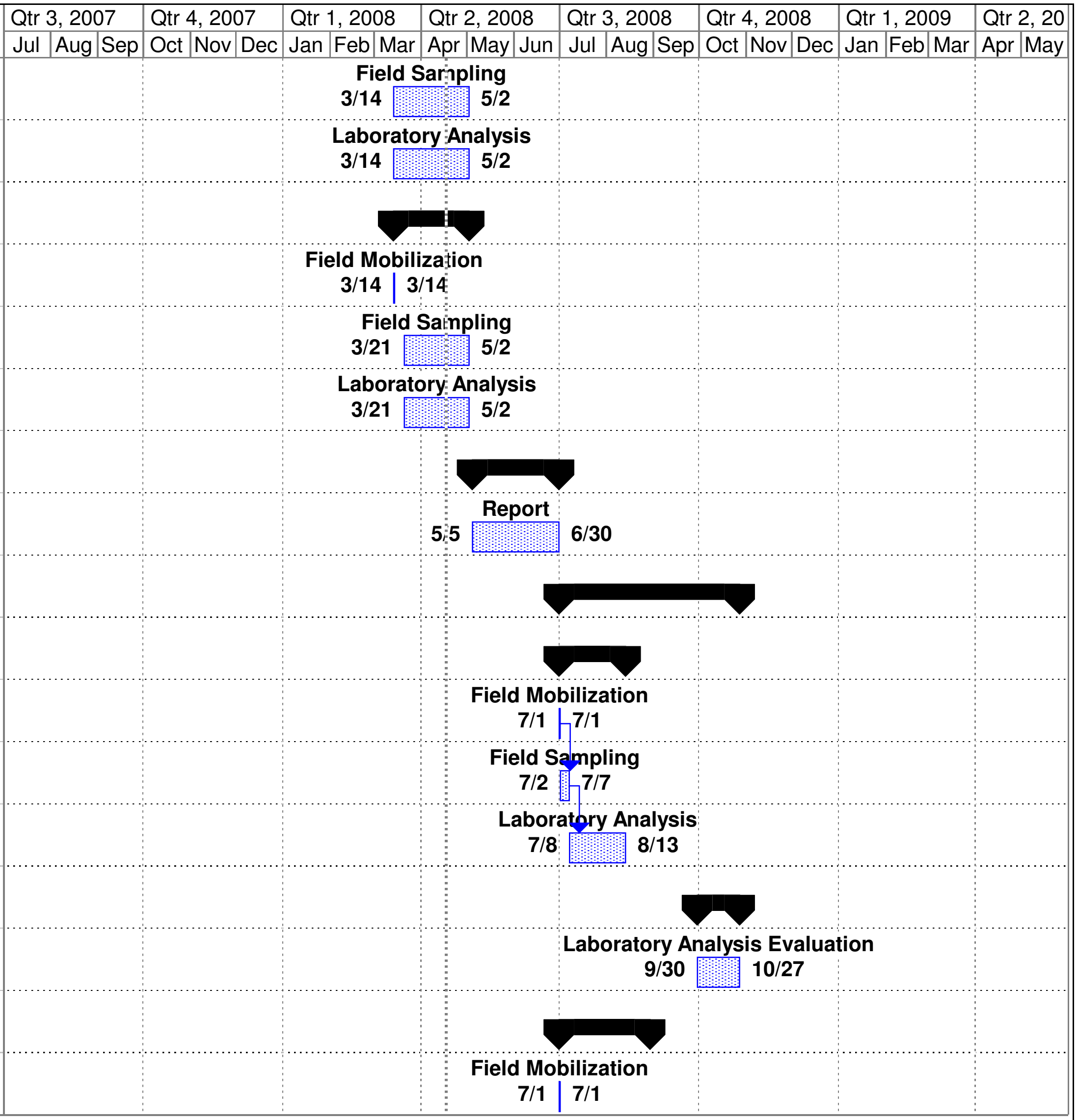


Figure 3-2
Project: RVAAP Sub Slab
Date: Thu 4/17/08

Task	▨	Milestone	◆	External Tasks	▨
Split	┆┆┆┆┆┆┆┆	Summary	▬	External Milestone	◆
Progress	▬	Project Summary	▬	Deadline	⇩

Schedule reflects durations and cycles as required by Findings and Orders. Actual durations may be expedited.

ID	Task Name
86	Field Sampling
87	Laboratory Analysis
88	**Task 5E: Evaluation of Final Sampling at LL#3**
89	Evaluation of Laboratory Analysis
90	**Task 5F: Final Sampling & Analysis at LL#2**
91	Field Mobilization
92	Field Sampling
93	Laboratory Analysis
94	**Task 5G: Evaluation of Final Sampling at LL#2**
95	Evaluation of Laboratory Analysis
96	**Task 6B: Mob/Demob for Excavation/Transport**
97	**Task 6C: Excavate/Transport Load Line 4**
98	**Task 6D: Excavate/Transport Load Line 3**
99	**Task 6E: Excavate/Transport Load Line 2**

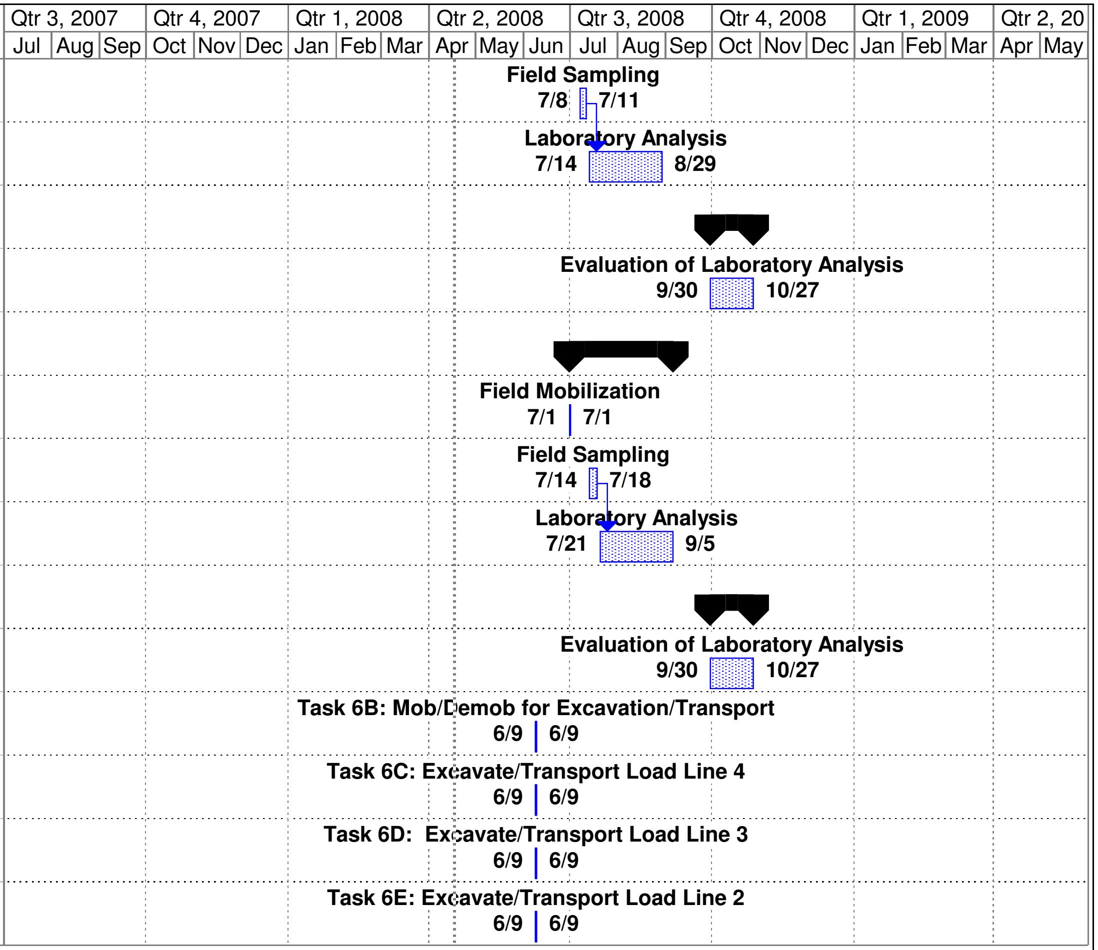


Figure 3-2
Project: RVAAP Sub Slab
Date: Thu 4/17/08

Task	▨	Milestone	◆	External Tasks	▭
Split	⋯	Summary	▬	External Milestone	◆
Progress	▬	Project Summary	▬	Deadline	⇩

Schedule reflects durations and cycles as required by Findings and Orders. Actual durations may be expedited.

Table 3-1
Summary of 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 Manufacturing			X
L10, 3A-47	Sump Building & Pump Hpuse			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 Building			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.

(2) This table discussed in Section 3.6.1.

Table 3-2
Summary of Load Line 2 Phase II RI Findings
Ravenna Army Ammunition Plant
Ravenna, Ohio

Exposure Unit	Explosives and Propellants	Inorganics	SVOCs	VOCs	PCBs	Pesticides
Explosives Handling Areas Aggregate (Includes Buildings DB-4/-4A DB-6/-6A, DB-10)	Surface soil: Highest concentrations near melt-pour buildings, Buildings DB-4/-4A, and explosive preparations buildings, Buildings DA-6/-6A. Explosives also found in soil near Building DB-10. Explosives contamination appeared to be highly localized around vacuum pumps, doorways, and drains. Subsurface soil: Explosive compounds occur in subsurface soil in areas with elevated surface concentrations, but at lower concentrations and less lateral extent. 2,4,6-TNT most commonly detected.	Surface soil: Aluminum, arsenic, barium, chromium, lead, and zinc most pervasive. Highest concentrations and frequencies clustered near former production buildings, similar to distribution observed for explosives. Subsurface soil: Lead and mercury most prevalent. Barium, beryllium, and chromium also detected. Highest concentrations clustered at Buildings DB-4 and DA-6.	Surface soil: SVOCs detected frequently, but almost all concentrations were less than 1 mg/kg and often were estimated values. Subsurface soil: Not detected.	Surface soil: Generally absent. Subsurface soil: Not detected.	Surface soil: PCB-1254 most commonly detected. PCB-1256 and PCB-1260 also detected, but at lower frequencies. Highest concentrations (5 to 6 mg/kg) were detected near Buildings DB-4 and DB-10.	Surface soil: Low concentrations consistently detected adjacent to former process buildings.

Exposure Unit	Explosives and Propellants	Inorganics	SVOCs	VOCs	PCBs	Pesticides
Preparation & Receiving Areas Aggregate (Includes Buildings DB-802, DB-3)	Surface soil: Low concentrations of explosive compounds and nitrocellulose detected, primarily near Buildings DB-3 and DB-802. Subsurface soil: Explosives not detected.	Surface soil: Inorganics occurring at the highest concentrations were antimony, chromium, copper, lead, mercury, and zinc. Hexavalent chromium detected in only 1 of 13 samples at an estimated concentration of 81.9J mg/kg. Subsurface soil: Antimony, cadmium, copper, lead and zinc identified as SRCs. Concentrations generally less than three times RVAAP background criteria. Clustered along railroad tracks west of Buildings DB-802 and DB-3.	Surface soil: PAHs primarily detected, at generally low concentrations. Highest concentrations were identified in immediate vicinity of Buildings DB-3 and DB-802. Subsurface soil: Low, estimated concentrations sporadically detected.	Surface soil: Sporadically detected at low, estimated concentrations. Subsurface soil: Low, estimated concentrations sporadically detected.	Surface soil: Low concentrations detected, primarily PCB-1254, in approximately 30% of samples. Highest concentration on eastern side of Building DB-3. PCBs localized around vacuum pumps and Buildings DB-3 and DB-19.	Surface soil: Low concentrations detected, in approximately 30% of samples. Highest concentration on eastern side of Building DB-3.

Exposure Unit	Explosives and Propellants	Inorganics	SVOCs	VOCs	PCBs	Pesticides
Packaging & Shipping Areas Aggregate (Includes BuildingsDB-13A/-13B/-13C, DB-26, DB-27A, -27B, and -27C).	Surface soil: Low concentrations detected, primarily along track DH and near Building DB-13B. Subsurface soil: Explosives not detected.	Surface soil: Inorganics occurring at highest concentrations were antimony, lead, and zinc. Maximum values for inorganics were clustered at Buildings DB-13, DB-13B, and DB-26, and the north side of Building DB-27A. Subsurface soil: Eleven inorganics identified. Most persistent are antimony, arsenic, barium, beryllium, chromium, copper, lead, mercury, and zinc. Distribution highly variable. Maximum detected concentrations for all but one limited to one sample station along railroad tracks west of Building DB-13.	Surface soil: PAHs primarily detected, in multiple samples. Only one station on the north side, Building DB-27A, had concentrations exceeding 1 mg/kg. Subsurface soil: Not detected.	Surface soil: Rarely detected. Subsurface soil: A few VOCs detected at low, estimated concentrations.	Surface soil: PCB-1254 and PCB-1260 commonly detected in surface soil, but concentrations greater than 1 mg/kg were limited to vicinity of Buildings DB-13 and DB-13B. Concentrations ranged from 3 to 9.5 mg/kg. Subsurface soil: Not detected.	Surface soil: Rarely detected. Subsurface soil: Not detected.

Exposure Unit	Explosives and Propellants	Inorganics	SVOCs	VOCs	PCBs	Pesticides
Change Houses Aggregate	Surface soil: Relatively uncontaminated. Explosives and propellants not detected.	Surface soil: Few inorganics identified. Lead and zinc exhibited highest concentrations, at three or four times RVAAP background values.	Surface soil: SVOCs not detected.	Surface soil: VOCs not detected.	Surface soil: PCBs not detected.	Surface soil: Pesticides not detected.

Exposure Unit	Explosives and Propellants	Inorganics	SVOCs	VOCs	PCBs	Pesticides
Perimeter Area Aggregate	Surface soil: Low concentrations of explosives and nitrocellulose detected in some samples, primarily along railroad tracks immediately east of Building DA-21, and at random grid sample station about 250 feet east of Building DB-3. Subsurface soil: Three explosive compounds detected at one sampling station located between the two sets of railroad tracks northeast of Building DA-21. No propellants detected.	Surface soil: Inorganics generally less than two times background criteria. Very high concentrations of antimony, chromium, copper, lead, and mercury detected in drainage swale south of Building DA-5. Elevated inorganics concentrations near Buildings DA-7 and DA-21 also. Subsurface soil: Lead and cadmium the only SRCs identified. Maximum lead concentrations occurred at the sample station located northeast of Building DA-21 where explosives were detected.	Surface soil: Rarely detected.	Surface soil: VOCs not detected.	Surface soil: PCB-1254 detected in four samples collected near Buildings DA-7 and DA-21, and in drainage swale south of Building DA-5. The maximum PCB concentration in the area was 5 mg/kg. Subsurface soil: PCB-1260 detected once at low estimated concentration.	Surface soil: Low concentrations sporadically detected.
Buildings and Structures	Soil beneath building sub-floors generally uncontaminated, based on limited number of soil	Soil beneath building sub-floors generally uncontaminated, based on limited	Soil beneath building sub-floors generally uncontaminated, based on limited	Soil beneath building sub-floors generally uncontaminated, based on limited	Soil beneath building sub-floors generally uncontaminated, based on limited	Soil beneath building sub-floors generally uncontaminated, based on limited

Exposure Unit	Explosives and Propellants	Inorganics	SVOCs	VOCs	PCBs	Pesticides
	samples collected from beneath building floor slabs. Several detectable concentrations of explosives and propellants in sediment from washout annexes inside Buildings DB-4 and DB-4A. Floor sweep samples collected from Buildings DB-3, DB-4 and DB-10 all contained explosive compounds. Highest concentration of 2,4,6-TNT was 160 mg/kg for sample collected from Building DB-3.	number of soil samples collected from beneath building floor slabs. Metal concentrations in all samples from sub-floor locations generally reflected an absence of inorganic contamination. High concentrations of metals in sediment from washout annexes inside Buildings DB-4 and DB-4A. Floor sweep samples collected from Buildings DB-3, DB-4 and DB-10 contained high concentrations of multiple metals. Cadmium and lead concentrations in floor sweep samples collected from Buildings DB-10 and DB-3 exceeded respective toxicity characteristic	number of soil samples collected from beneath building floor slabs. No SVOCs were detected in sub-floor samples. PAHs prevalent in basin sediment. Low, estimated concentrations of SVOCs in floor sweep samples collected from Buildings DB-3, DB-4 and DB-10.	number of soil samples collected from beneath building floor slabs. Trace levels (i.e., less than 1 ug/kg) of three VOCs were detected in the sub-floor sample station at Building DB-27B (sample station LL2-077), Boiler Plant. Low, estimated concentrations of VOCs (benzene and toluene) in floor sweep samples collected from Buildings DB-3, DB-4, and DB-10.	number of soil samples collected from beneath building floor slabs. High concentrations of PCB-1254 in sediment from washout annexes inside Buildings DB-4 and DB-4A. PCB-1254 detected in all floor sweep samples collected from Buildings DB-3, DB-4 and DB-10, at elevated concentrations ranging from 690 to 790 mg/kg.	number of soil samples collected from beneath building floor slabs. Low, estimated concentrations of pesticides detected in floor sweep samples collected from Buildings DB-3, DB-4 and DB-10.

Exposure Unit	Explosives and Propellants	Inorganics	SVOCs	VOCs	PCBs	Pesticides
		leaching procedure (TCLP) limits.				

Table 3-3
Summary of Load Line 3 Phase II RI Findings
Ravenna Army Ammunition Plant
Ravenna, Ohio

Exposure Unit	Explosives and Propellants	Inorganics	SVOCs	VOCs	PCBs	Pesticides
Explosives Handling Areas Aggregate (Includes Buildings EB-4, EB-4A, EA-6, EA-6A, EB-10)	Surface soil: Explosives were widespread throughout this aggregate. The highest explosive concentrations were near the major production and processing buildings. The highest concentration of 2,4,6-TNT was 390,000 mg/kg near Building EB-10. This concentration far exceeded any other detected concentration within the load line. Subsurface soil: 2,4,6-TNT was identified in nearly all subsurface soil samples. The peak concentration of 2,4,6-TNT was reported at 270	Surface soil: Aluminum, arsenic, barium, cadmium, chromium, cobalt, copper, lead, manganese, nickel, and zinc were most pervasive inorganics (detected the most frequently at concentrations above their respective established background concentrations). Subsurface soil: Cadmium and lead were the most pervasive inorganics. Other inorganics were found to be widely dispersed among all subsurface soil samples. The peak concentration	Surface soil: SVOCs were detected frequently. The highest concentrations were clustered near Buildings EA-6, EB-4, and EB-10. Subsurface soil: SVOCs were not characterized in the subsurface soil, based on established data quality objectives.	Surface soil: VOCs were generally limited to toluene and acetone, at low detected concentrations. Subsurface soil: VOCs were not characterized in the subsurface soil, based on established data quality objectives.	Surface soil: PCBs were detected in several samples. The highest concentrations, up to 1,100 mg/kg, were clustered near Building EB-4. Subsurface soil: PCBs were reported near Buildings EA-6 and EB-4. Subsurface concentrations identified near Building EB-4 exceeded their respective surface soil concentrations.	Surface soil: Low concentrations of pesticides were detected throughout the aggregate. The maximum detected concentration was 3.2 mg/kg for endrin. Subsurface soil: Pesticides were not characterized in the subsurface soil, based on established data quality objectives.

Exposure Unit	Explosives and Propellants	Inorganics	SVOCs	VOCs	PCBs	Pesticides
	mg/kg, near Building EA-6. Other elevated concentrations were reported in the same area, and adjacent to Building EB-4. Several concentrations in subsurface soil samples were notably higher than their respective concentrations in surface soil samples.	accumulation areas were in the immediate vicinity of Buildings EB-4 and EA-6.				

Exposure Unit	Explosives and Propellants	Inorganics	SVOCs	VOCs	PCBs	Pesticides
Preparation and Receiving Areas Aggregate (Includes Buildings EB-3 and EB-803)	Surface soil: Explosives and propellants were detected immediately adjacent to Building EB-803. All concentrations of explosives were less than 1 mg/kg. Nitrocellulose was present at a concentration of 29.9 mg/kg in the single sample that was analyzed (at EB-803). Note: this building is not being demolished. Subsurface soil: Concentrations of explosive compounds greater than 1 mg/kg were not detected during field analyses of subsurface soil.	Surface soil: Arsenic, barium, chromium, cobalt, copper, lead, manganese, nickel, vanadium, and zinc were identified as pervasive. The distribution of inorganics was widely variable. The highest overall concentrations of inorganics were clustered on the west side of Building EB-803. Subsurface soil: Arsenic, cadmium, lead, and zinc were identified. Peak concentrations exceeding background were reported immediate to Building EB-3. All detected concentrations were relatively low for those constituents with background values. Detected concentrations were less than two times background.	Surface soil: Low concentrations of PAHs were detected. The maximum detected concentration was 0.96 mg/kg for benzo(b)fluoranthene. Most detections were clustered near Building EB-3 and EB-803. Subsurface soil: SVOCs were not characterized in subsurface soil, based on established data quality objectives.	Surface soil: Four VOCs were detected in low concentrations near Building EB-3. Subsurface soil: VOCs were not characterized in subsurface soil, based on established data quality objectives.	Surface soil: PCBs were widely detected at low concentrations. Peak PCB concentrations were identified along the west side of Building EB-803. Subsurface soil: PCBs were not characterized in subsurface soil, based on established data quality objectives.	Surface soil: Low concentrations of pesticides were detected. Subsurface soil: Pesticides were not characterized in subsurface soil, based on established data quality objectives.

Exposure Unit	Explosives and Propellants	Inorganics	SVOCs	VOCs	PCBs	Pesticides
Packaging and Shipping Areas Aggregate (Includes Buildings EB-13B, EB-13, and EB-11)	Surface soil: Concentrations of explosives were generally low. A single peak concentration of 820 mg/kg for 2,4,6-TNT near Building EB-11 was identified. Nitroguanidine was detected at low concentrations.	Surface soil: Barium, cadmium, chromium, copper, lead, manganese, mercury, nickel, thallium, and zinc were identified to be pervasive. Peak inorganic concentrations were identified west of Building EB-11.	Surface soil: Detected SVOCs were primarily PAHs, as a single occurrence. All detected concentrations were less than 1 mg/kg.	Surface soil: VOCs were not detected.	Surface soil: PCB-1254 was consistently detected. The highest concentration, 91 mg/kg, was identified near Building EB-11.	Surface soil: Pesticides were not detected.
Change Houses Aggregate (Includes Buildings EB-8, EB-8A, and EB-22A)	Surface soil: No explosive compounds were detected at concentrations greater than 1 mg/kg.	Surface soil: Inorganics were widely detected. The majority of inorganics were detected at concentrations up to two times background values, where established. Peak inorganic concentrations were identified near Building EB-8A.	Surface soil: SVOCs were not analyzed within this aggregate, based on established data quality objectives.	Surface soil: VOCs were not analyzed within this aggregate, based on established data quality objectives.	Surface soil: PCB-1254 was identified in four of six samples. Reported concentrations (up to 6.3 mg/kg) were confined to Buildings EB-8 and EB-8A.	Surface soil: Pesticides were not analyzed within this aggregate, based on established data quality objectives.

Exposure Unit	Explosives and Propellants	Inorganics	SVOCs	VOCs	PCBs	Pesticides
Perimeter Area Aggregate	Surface soil: Low concentrations of explosive and propellant compounds were identified, associated with Buildings EA-21 and EA-5. Subsurface soil: 2,4,6-dinitrotoluene (DNT) was reported at 500 mg/kg near Building EA-5, along the railroad track. The corresponding surface soil sample exhibited a concentration of 0.83 mg/kg. Other explosives were reported as single occurrences with low concentrations near Building EA-6.	Surface soil: Inorganics were widely distributed. Peak concentrations of several metals were detected in the area of Building EA-21. Subsurface soil: Arsenic, barium, beryllium, cadmium, chromium, copper, lead, and zinc were identified at concentrations above background near Building EA-21. Arsenic and beryllium concentrations exceeded their respective surface soil sample concentrations. Inorganics were not reported above background in the area of Building EA-5.	Surface soil: PAHs were identified, associated with Building EA-21. Subsurface soil: SVOCs were not characterized within subsurface soil, based on established data quality objectives.	Surface soil: Toluene and acetone were identified at a single location near Building EA-21. Concentrations for these compounds were less than 1 mg/kg. Subsurface soil: VOCs were not characterized within subsurface soil, based on established data quality objectives.	Surface soil: PCB-1254 was reported at a concentration of 110 mg/kg near Building EA-21. Subsurface soil: PCBs were not characterized within subsurface soil, based on established data quality objectives.	Surface soil: Low concentrations of several pesticides were identified near Building EA-21. Subsurface soil: Pesticides were not characterized within subsurface soil, based on established data quality objectives.

Table 3-4
Summary of Load Line 4 Phase II RI Findings
Ravenna Army Ammunition Plant
Ravenna, Ohio

Exposure Unit	Explosives and Propellants	Inorganics	SVOCs	VOCs	PCBs	Pesticides
Preparation & Receiving Areas Aggregate (Includes Buildings G-1/1A, G-2, G-3, and G-4)	Surface soil: Explosives were not detected in samples that were submitted for laboratory analyses. Nitrocellulose was present at low concentrations at one location north of Building G-1A.	Surface soil: Arsenic, barium, chromium, cobalt, copper, cyanide, lead, manganese, nickel, vanadium, and zinc were identified as pervasive inorganic SRCs, with widely variable distributions. The highest overall concentrations of inorganics appear to be clustered on the south side of Building G-4. Subsurface soil: Inorganic SRCs were identified to be the primary SRC in subsurface soil at LL 4. Barium, beryllium, cadmium, lead, and zinc were detected at concentrations	Surface soil: Low concentrations of PAHs were detected. Most observed detections were clustered near Building G-4.	Surface soil: VOCs are generally absent.	Surface soil: PCBs appear to be clustered near Building G-4, at concentrations up to 48 mg/kg.	Surface soil: No pesticides were detected.

Exposure Unit	Explosives and Propellants	Inorganics	SVOCs	VOCs	PCBs	Pesticides
		exceeding RVAAP background criteria. The highest concentrations of metals above background occurred in the vicinity of Building G-1A.				
Packaging & Shipping Areas Aggregate (Includes buildings G-19 and G-19A)	Surface soil: Explosives were not detected in this aggregate. Nitrocellulose was detected in one sample south of Building G-19.	Surface soil: Barium, cadmium, chromium, copper, lead, manganese, mercury, nickel, thallium, and zinc were identified as pervasive inorganic SRCs.	Surface soil: SVOCs, primarily PAHs, were detected in only two samples. The highest concentration (160 ug/kg) occurred near Building G-19.	Surface soil: Except for detected trace concentrations of toluene, VOCs were not detected.	Surface soil: Low concentrations of PCBs, up to 1.3 mg/kg, were observed in the vicinity of Building G-19.	Surface soil: Trace levels of pesticides were observed in the vicinity of Building G-19.
Change Houses Aggregate (Includes Building G-5 and G-6/6A)	Surface soil: No explosive compounds greater than 1 mg/kg were detected during field analyses.	Surface soil: Few inorganic SRCs were detected at concentrations exceeding the RVAAP background values, except for lead and manganese.	Surface soil: Low, estimated concentrations of 16 PAHs were detected on the east side of Building G-6.	Surface soil: Three VOCs were detected at low, estimated concentrations on the east side of Building G-6.	Surface soil: PCB-1260 was detected once at an estimated concentration of 0.059 mg/kg in a sample collected on the east side of Building G-6.	Surface soil: Pesticides were not detected in this aggregate.
Buildings and Structures	Nine samples of soil beneath building floor slabs were collected and analyzed for field	Soil beneath building sub-floors exhibited low concentrations of several inorganics.	Low, estimated concentrations of various PAHs were detected in all three floor sweep samples.	Trace levels of acetone, benzene, and/or toluene were detected in	PCBs were not detected in sub-floor soil samples.	Sediment collected from the Building G-8 washout basin contained elevated

Exposure Unit	Explosives and Propellants	Inorganics	SVOCs	VOCs	PCBs	Pesticides
	explosives, TAL metals, and PCBs. All field results for TNT and RDX were nondetect; thus, no sub-floor samples were submitted for fixed-based laboratory analyses of explosives. Sediment collected from the Building G-8 washout basin contained elevated levels of explosives and propellants. Floor sweep samples were collected from areas inside of Buildings G-19, G-8, and G-3. Low concentrations of explosives (TNT, HMX, and RDX) were detected only in floor sweep samples collected from Buildings G-8 and G-19.	TAL metals concentrations in sub-floor samples were less than RVAAP background values, except for copper, magnesium and zinc. Sediment collected from the Building G-8 washout basin contained elevated levels of metals. Sediment collected from Building G-16 sedimentation basin contained elevated concentrations of several SRCs, including chromium, copper, and lead. Copper, cadmium, chromium, lead and zinc were present at high concentrations in all floor sweep samples. Building G-8 floor sweep sample had highest concentrations of		every floor sweep sample.	Sediment collected from the Building G-8 washout basin contained elevated levels of PCBs. Low conentrations of PCBs (PCB-1254 and PCB-1260) were detected in all three floor sweep samples, but at lower concentrations than observed at the other load lines.	levels of pesticides. Low concentrations of pesticides were detected in all three floor sweep samples, but at lower concentrations than observed at the other load lines.

Exposure Unit	Explosives and Propellants	Inorganics	SVOCs	VOCs	PCBs	Pesticides
		metals. Cadmium, chromium and lead were detected in toxicity characteristic leaching procedure (TCLP) extracts, but no constituent exceeded its respective criteria for characteristically hazardous waste.				

Table 3-5
Classification of Buildings at Load Line 2
Ravenna Army Ammunition Plant
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**
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-4AVP1 Vacuum Pump House
DA-6 Explosive Preparation	DB-3 Shell Receiving (VOCs, SVOCs, PCBs)	DB-4VP1 Vacuum Pump House
DA-6A Explosive Preparation	DB-4WM Washout Annex (PCBs)	DB-8 Change House
DB-10 Drill & Assembly (Propellants, VOCs, SVOCs, PCBs)	DB-4WS Washout Annex (PCBs, SVOCs))	DB-8A Change House
	DB-4AWM Washout Annex (PCBs, SVOCs, VOCS, Propellants)	DB-10VP1 Vacuum Pump House
	DB-4AWS Washout Annex (PCBs, SVOCs)	DB-10VP2 Vacuum Pump House
	DA-5 Ammonium Nitrate Service	DB-13 Packing & Shipping
	DA-7 TNT Service	DB-13A Barricade Shipping
	DB-9 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-28A 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 3-6
Classification of Buildings at Load Line 3
Ravenna Army Ammunition Plant
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**
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-4AVP1 Vacuum Pump House
EA-6 Explosive Preparation (PCBs,SVOCs)	EB-4WN 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 & Assembly (VOCs,PCBs)	EB-4AWN Washout Annex for Bldg. EB-4A	EB-10VP1 Vacuum Pump House
	EB-4AWS Washout Annex for Bldg. EB-4A (SVOCs)	EB-10VP2 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
	EB-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 3-7
Classification of Buildings at Load Line 4
Ravenna Army Ammunition Plant
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**
G-8 Melt Pour (SVOCs)	G-2 Paint Storage (VOCs)	G-5 Line Office
G-9 TNT Service	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-8VP1 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-13VP2 Vacuum Pump House
	G-18 Paint Storage (VOCs, SVOC, PCB, Propellants)	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 requirements 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.

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Table 3-8
High Potential Load Line Buildings Designated for 4-Foot Core Sampling
Ravenna Army Ammunition Plant
Ravenna, Ohio

Load Line	Bldg. Number	Building Type	Slab Length, ft.	Slab Width, ft.	Number of Core Locations (1)
Load Line 2	DB-4	Melt Pour	210	50	16
	DB-4A	Melt Pour	210	50	16
	DA-6	Explosives Preparation	40	40	5
	DA-6A	Explosives Preparation	40	40	5
	DB-10	Drill Assembly	300	50	14
Load Line 3	EB-4	Melt Pour	210	50	16
	EB-4A	Melt Pour	210	50	16
	EA-6	Explosives Preparation	40	40	5
	EA-6a	Explosives Preparation	40	40	5
	EB-10	Drill Assembly	300	50	14
Load Line 4	G-8	Melt Pour	170	70	12
	G-9	Explosives Screening	25	25	2
	G-15	Explosives Preparation	36	36	2

(1) Approximate coring locations are shown on Figure 3-1.

Core depth will be 4 feet. Five field screening samples will be collected from each core: at the top, three distributed to best represent the materials in the core, at the bottom.

Table 3-9
Confirmatory Sampling for Load Line 2 (RVAAP-09)
Ravenna Army Ammunition Plant
Ravenna, Ohio

Description			Sq. Ft.				Number of Samples						
Facility/Area	Building	Building Utilization	Slab Area	MI Area	Sample ID	Depth (ft)	Explosives	Propellants	Metals	SVOCs	VOCs	PCBs	Pesticides
Multi-increment Surface Soil Locations	2-51	Clock Alley	1980	2120	LL2ss-???M-SO	0 to 1	1		1				
	2-51A	Line Office	140										
	DC-1	Power House #2	90	45	LL2ss-???M-SO	0 to 1	1		1	1			
	DB-2	Service Building	1200	1200	LL2ss-???M-SO	0 to 1	1		1				
	DB-3	Shell Receiving Building	24700	8233	LL2ss-???M-SO	0 to 1	1		1	1		1	1
	DB-3	"	"	"	LL2ss-???M-QA	0 to 1	1		1	1		1	1
Field MI Duplicate	DB-3	"	"	"	LL2ss-???M-SO	0 to 1	1		1	1		1	1
Blind Duplicate	DB-3	"	"	"	LL2ss-???M-SO	0 to 1	1		1	1		1	1
	DB-3	"	"	"	LL2ss-???M-SO	0 to 1	1		1	1		1	
	DB-3	"	"	"	LL2ss-???M-SO	0 to 1	1	1	1	1		1	1
	DB-4	Melt Pour Loading and SPCC Building	16200	8100	LL2ss-???M-SO	0 to 1	1		1				
	DB-4	"	"	"	LL2ss-???M-SO	0 to 1	1		1				
	DB-4-VP1	Vacuum Pump House	100	476	LL2ss-???M-SO	0 to 1	1		1				
	DB-4A-VP1	Vacuum Pump House	100										
	DB-10-VP1	Vacuum Pump House	138										
	DB-10-VP2	Vacuum Pump House	138										
	DB-4-WM	Washout Annex	300	300	LL2ss-???M-SO	0 to 1	1		1			1	
	DB-4-WS	Washout Annex	300	300	LL2ss-???M-SO	0 to 1	1		1	1		1	
	DB-4-WS	"	"	"	LL2ss-???M-QA	0 to 1	1		1	1		1	
Field MI Duplicate	DB-4-WS	"	"	"	LL2ss-???M-SO	0 to 1	1		1	1		1	
Blind Duplicate	DB-4-WS	"	"	"	LL2ss-???M-SO	0 to 1	1		1	1		1	
	DB-4A	Melt Pour Loading and SPCC Building	16200	8100	LL2ss-???M-SO	0 to 1	1	1	1	1		1	1
	DB-4A	Melt Pour Loading and SPCC Building	16200	8228	LL2ss-???M-SO	0 to 1	1		1	1		1	
	DB-30	Elevator Machine House	128										
	DB-4A-WM	Washout Annex	300	300	LL2ss-???M-SO	0 to 1	1	1	1	1		1	1
	DB-4A-WM	"	"	"	LL2ss-???M-MS	0 to 1	1	1	1	1		1	1
	DB-4A-WM	"	"	"	LL2ss-???M-MSD	0 to 1	1	1	1	1		1	1
	DB-4A-WS	Washout Annex	300	300	LL2ss-???M-SO	0 to 1	1		1	1		1	
	DA-5	Service Building	1200	1200	LL2ss-???M-SO	0 to 1	1		1				
	DA-6	Explosive Preparation Building	2500	2564	LL2ss-???M-SO	0 to 1	1		1				
	DA-28	Elevator Machine House	64										
	DA-6A	Explosive Preparation Building	2500	2564	LL2ss-???M-SO	0 to 1	1		1				
	DA-28A	Elevator Machine House	64										
	DA-6A / DA-28A	Explosive Preparation Building / Elevator Machine House	2564	2564	LL2ss-???M-MS	0 to 1	1		1				
	DA-6A / DA-28A	"	2564	2564	LL2ss-???M-MSD	0 to 1	1		1				
	DA-7	Service Building	950	950	LL2ss-???M-SO	0 to 1	1		1				
	DB-8	Change House	6770	16988	LL2ss-???M-SO	0 to 1	1		1				
	DB-8A	Change House	6770										
	DB-22	Change House	3448										
	DB-9	Service Building	950	950	LL2ss-???M-SO	0 to 1	1		1				
	DB-9A	Service Building	950	950	LL2ss-???M-SO	0 to 1	1		1				
	DB-10	Drilling and Assembly Building	15100	7550	LL2ss-???M-SO	0 to 1	1	1	1				
	DB-10	"	"	"	LL2ss-???M-QA	0 to 1	1	1	1				
Field MI Duplicate	DB-10	"	"	"	LL2ss-???M-SO	0 to 1	1	1	1				
Blind Duplicate	DB-10	"	"	"	LL2ss-???M-SO	0 to 1	1	1	1				
	DB-10	Drilling and Assembly Building	"	"	LL2ss-???M-SO	0 to 1	1	1	1	1		1	1
	DB-11	Service Building	950	950	LL2ss-???M-SO	0 to 1	1		1				
	DB-13	Packing and Shipping	10998	10998	LL2ss-???M-SO	0 to 1	1		1				
	DB-13A	Barricade Shipping	13795	13795	LL2ss-???M-SO	0 to 1	1		1				
	DB-13B	Shipping Warehouse Annex	12211	12211	LL2ss-???M-SO	0 to 1	1		1				
	DB-19	Service Building	1200	1200	LL2ss-???M-SO	0 to 1	1		1				
	DB-20	Service Building	1300	1300	LL2ss-???M-SO	0 to 1	1		1				
	DA-21	Service Building	950	950	LL2ss-???M-SO	0 to 1	1		1				
	DA-21	"	"	"	LL2ss-???M-QA	0 to 1	1		1				
Field MI Duplicate	DA-21	"	"	"	LL2ss-???M-SO	0 to 1	1		1				
Blind Duplicate	DA-21	"	"	"	LL2ss-???M-SO	0 to 1	1		1				
	DB-25	Washout Building	120	120	LL2ss-???M-SO	0 to 1	1		1				
	DB-26	Radiographic Building	9500	9628	LL2ss-???M-SO	0 to 1	1		1				
	DB-29	Elevator Machine House	128										
	DB-27	Cyclic Heat Bldg. #2	19350	19550	LL2ss-???M-SO	0 to 1	1		1				
	DB-27B	Boiler Plant	200										
	DB-27A	Cyclic Heat Bldg. #1	19350	19350	LL2ss-???M-SO	0 to 1	1		1	1			
	DB-27C	Shipping Building	10625	10625	LL2ss-???M-SO	0 to 1	1		1				
	DB-802	Inert Storage	41213	20607	LL2ss-???M-SO	0 to 1	1		1	1			
	DB-802	"	"	"	LL2ss-???M-SO	0 to 1	1		1	1			
Discrete Surface Soil Locations	DB-3	Shell Receiving Building	24700	NA	LL2ss-???D-SO	0 to 1					1		
	DB-3	"	"	"	LL2ss-???D-QA	0 to 1					1		
Blind Duplicate	DB-3	"	"	"	LL2ss-???D-SO	0 to 1					1		
	DB-4A	Melt Pour Loading and SPCC Building	16200	NA	LL2ss-???D-SO	0 to 1					1		
	DB-4A-WM	Washout Annex	300	NA	LL2ss-???D-SO	0 to 1					1		
	DB-4A-WM	"	"	"	LL2ss-???D-MS	0 to 1					1		
	DB-4A-WM	"	"	"	LL2ss-???D-MSD	0 to 1					1		
	DB-10	Drilling and Assembly Building	15100	NA	LL2ss-???D-SO	0 to 1					1		
		Primary MI Sample					38	5	38	13		10	5
	▨	Quality Assurance					4	1	4	2	1	2	1
	▨	Field MI Duplicate					4	1	4	2		2	1
	▨	Blind Duplicate					4	1	4	2	1	2	1
	▨	MS/MSD Pair					4	2	4	2	2	2	2
	▨	Discrete Primary									4		

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Analyses	50	9	50	19	3	16	9

Table 3-10
Confirmatory Sampling for Load Line 3 (RVAAP-10)
Ravenna Army Ammunition Plant
Ravenna, Ohio

Description			Sq. Ft.				Number of Samples						
Facility/Area	Building	Building Utilization	Slab Area	MI Area	Sample ID	Depth (ft)	Explosives	Propellants	Metals	SVOCs	VOCs	PCBs	Pesticides
Multi-increment Surface Soil Locations	3-51	Clock Alley	1980	5234	LL3ss-???M-SO	0 to 1	1		1				
	3-51A	Line Office	2040										
	EB-20	Line Office	1214										
	EB-2	Service Building	500	500	LL3ss-???M-SO	0 to 1	1		1				
	EB-3	Shell Receiving Building	16700	8350	LL3ss-???M-SO	0 to 1	1		1	1			
	EB-3	"	"	"	LL3ss-???M-SO	0 to 1	1	1	1	1		1	1
	EB-3	"	"	"	LL3ss-???M-MS	0 to 1	1	1	1	1		1	1
	EB-3	"	"	"	LL3ss-???M-MSD	0 to 1	1	1	1	1		1	1
	EB-4	Melt Pour Loading Building	12000	6000	LL3ss-???M-SO	0 to 1	1		1			1	
	EB-4	"	"	"	LL3ss-???M-SO	0 to 1	1		1			1	
	EB-4-VP1	Vacuum Pump House	100	476	LL3ss-???M-SO	0 to 1	1		1				
	EB-4A-VP1	Vacuum Pump House	100										
	EB-10-VP1	Vacuum Pump House	138										
	EB-10-VP2	Vacuum Pump House	138										
	EB-4-WN	Washout Annex	1000	1000	LL3ss-???M-SO	0 to 1	1		1				
	EB-4-WN	"	"	"	LL3ss-???M-MS	0 to 1	1		1				
	EB-4-WN	"	"	"	LL3ss-???M-MSD	0 to 1	1		1				
	EB-4-WS	Washout Annex	360	360	LL3ss-???M-SO	0 to 1	1		1				
	EB-4-A	Melt Pour Loading Building	12000	6000	LL3ss-???M-SO	0 to 1	1		1			1	
	EB-4-A	"	"	"	LL3ss-???M-SO	0 to 1	1	1	1	1		1	1
	EB-4-A	"	"	"	LL3ss-???M-QA	0 to 1	1	1	1	1		1	1
Field MI Duplicate	EB-4-A	"	"	"	LL3ss-???M-SO	0 to 1	1	1	1	1		1	1
Blind Duplicate	EB-4-A	"	"	"	LL3ss-???M-SO	0 to 1	1	1	1	1		1	1
	EB-4A-WN	Washout Annex	1000	1000	LL3ss-???M-SO	0 to 1	1		1				
	EB-4A-WS	Washout Annex	1000	1000	LL3ss-???M-SO	0 to 1	1		1	1			
	EB-4A-WS	"	"	"	LL3ss-???M-QA	0 to 1	1		1	1			
Field MI Duplicate	EB-4A-WS	"	"	"	LL3ss-???M-SO	0 to 1	1		1	1			
Blind Duplicate	EB-4A-WS	"	"	"	LL3ss-???M-SO	0 to 1	1		1	1			
	EA-5	Service Building	360	360	LL3ss-???M-SO	0 to 1	1		1				
	EA-6	Explosives Preparation Building	1775	1843	LL3ss-???M-SO	0 to 1	1		1	1		1	
	EA-28	Elevator Machine House	68										
	EA-6A	Explosives Preparation Building	1775	1843	LL3ss-???M-SO	0 to 1	1		1				
	EA-28A	Elevator Machine House	68										
	EA-7	Service Building	500	500	LL3ss-???M-SO	0 to 1	1		1				
	EB-8	Change House	6770	16988	LL3ss-???M-SO	0 to 1	1		1				
	EB-8A	Change House	6770										
	EB-22	Change House	3448										
	EB-9	Service Building	1200	1200	LL3ss-???M-SO	0 to 1	1		1				
	EB-9A	Service Building	900	900	LL3ss-???M-SO	0 to 1	1		1				
	EB-10/10A	Drilling and Assembly Building	12400	6200	LL3ss-???M-SO	0 to 1	1	1	1	1		1	1
	EB-10/10A	Drilling and Assembly Building	12400	6200	LL3ss-???M-SO	0 to 1	1		1			1	
	EB-11	Service Building	500	500	LL3ss-???M-SO	0 to 1	1		1			1	
	EB-11	"	"	"	LL3ss-???M-QA	0 to 1	1		1			1	
Field MI Duplicate	EB-11	"	"	"	LL3ss-???M-SO	0 to 1	1		1			1	
Blind Duplicate	EB-11	"	"	"	LL3ss-???M-SO	0 to 1	1		1			1	
	EB-13	Packing and Shipping	11068	11212	LL3ss-???M-SO	0 to 1	1		1				
	EB-26	Elevator Machine House	144										
	EB-13A	Barricade Shipping	9849	9849	LL3ss-???M-SO	0 to 1	1		1				
	EB-13B	Shipping Warehouse Annex	11906	11906	LL3ss-???M-SO	0 to 1	1		1				
	EB-19	Service Building	500	500	LL3ss-???M-SO	0 to 1	1		1				
	EA-21	Service Building	500	500	LL3ss-???M-SO	0 to 1	1	1	1			1	
	EB-25	Washout Building	120	120	LL3ss-???M-SO	0 to 1	1		1				
Discrete Surface Soil Locations	EB-3	Shell Receiving Building	16700	NA	LL3ss-???D-SO	0 to 1					1		
	EB-3	"	"	"	LL3ss-???D-QA	0 to 1					1		
Blind Duplicate	EB-3	"	"	"	LL3ss-???D-SO	0 to 1					1		
	EB-4-A	Melt Pour Loading Building	12000	NA	LL3ss-???D-SO	0 to 1					1		
	EB-10/10A	Drilling and Assembly Building	12400	NA	LL3ss-???D-SO	0 to 1					1		
	EB-10/10A	"	"	"	LL3ss-???D-MS	0 to 1					1		
	EB-10/10A	"	"	"	LL3ss-???D-MSD	0 to 1					1		
		Primary MI Sample					29	4	29	6		10	3
	🟧	Quality Assurance					3	1	3	2	1	2	1
	🟨	Field MI Duplicate					3	1	3	2		2	1
	🟧	Blind Duplicate					3	1	3	2	1	2	1
	🟨	MS/MSD Pair					4	2	4	2	2	2	2
	🟦	Primary Discrete									3		

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	Explosives	Propellants	Metals	SVOCs	VOCs	PCBs	Pesticides
Analyses	39	8	39	12	3	16	7

Table 3-11
Confirmatory Sampling for Load Line 4 (RVAAP-11)
Ravenna Army Ammunition Plant
Ravenna, Ohio

Description			Sq. Ft.				Number of Samples						
Facility/Area	Building	Building Utilization	Slab Area	MI Area	Sample ID	Depth (ft)	Explosives	Propellants	Metals	SVOCs	VOCs	PCBs	Pesticides
Multi-increment Surface Soil Locations	G-2	Paint Storage	710	710	LL4ss-???M-SO	0 to 1	1	1	1	1		1	1
	G-4	Power House No. 7	100	55	LL4ss-???M-SO	0 to 1	1	1	1	1		1	1
	G-4	"	"	"	LL4ss-???M-MS	0 to 1	1	1	1	1		1	1
	G-4	"	"	"	LL4ss-???M-MSD	0 to 1	1	1	1	1		1	1
	G-5	Line Office	3294	3954	LL4ss-???M-SO	0 to 1	1		1				
	G-20	TIme Clock Alley	660										
	G-6	Change House	8018	16036	LL4ss-???M-SO	0 to 1	1		1				
	G-6A	Change House	8018										
	G-7	Booster Service	976	2272	LL4ss-???M-SO	0 to 1	1		1				
	G-14	Booster Service	1296										
	G-8	Melt Pour Loading Building	11700	5850	LL4ss-???M-SO	0 to 1	1		1	1			
	G-8	"	"	"	LL4ss-???M-SO	0 to 1	1		1	1			
	G-8-VP1	Vacuum Pump House	162	462	LL4ss-???M-SO	0 to 1	1		1				
	G-12-VP1	Vacuum Pump House	100										
	G-13-VP1	Vacuum Pump House	100										
	G-13-VP2	Vacuum Pump House	100										
	G-9	Explosive Screening Building	180	170	LL4ss-???M-SO	0 to 1	1		1				1
	G-9	"	"	"	LL4ss-???M-QA	0 to 1	1		1				1
Field MI Duplicate	G-9	"	"	"	LL4ss-???M-SO	0 to 1	1		1				1
Blind Duplicate	G-9	"	"	"	LL4ss-???M-SO	0 to 1	1		1				1
	G-10	Nitrate Screening	10064	10064	LL4ss-???M-SO	0 to 1	1		1				
	G-11	Magazine	180	170	LL4ss-???M-SO	0 to 1	1		1				
	G-12	Explosives Cooling Building	9775	9775	LL4ss-???M-SO	0 to 1	1		1	1		1	
	G-12	"	"	"	LL4ss-???M-QA	0 to 1	1		1	1		1	
Field MI Duplicate	G-12	"	"	"	LL4ss-???M-SO	0 to 1	1		1	1		1	
Blind Duplicate	G-12	"	"	"	LL4ss-???M-SO	0 to 1	1		1	1		1	
	G-12A	Explosives Cooling Building	9775	9772	LL4ss-???M-SO	0 to 1	1		1				
	G-13	Funnel & Face Off Building	18200	9100	LL4ss-???M-SO	0 to 1	1		1				
	G-13A	X-Ray	"	"	LL4ss-???M-SO	0 to 1	1		1				
	G-15	Explosives Preparation Building	1400	1400	LL4ss-???M-SO	0 to 1	1	1	1				
	G-15	"	"	"	LL4ss-???M-QA	0 to 1	1	1	1				
Field MI Duplicate	G-15	"	"	"	LL4ss-???M-SO	0 to 1	1	1	1				
Blind Duplicate	G-15	"	"	"	LL4ss-???M-SO	0 to 1	1	1	1				
	G-16	TNT Receiving	710	710	LL4ss-???M-SO	0 to 1	1		1				
	G-16	"	"	"	LL4ss-???M-MS	0 to 1	1		1				
	G-16	"	"	"	LL4ss-???M-MSD	0 to 1	1		1				
	G-17	Supplemental Charges Magazine	710	710	LL4ss-???M-SO	0 to 1	1		1				
	G-18	Paint Storage	60	60	LL4ss-???M-SO	0 to 1	1	1	1	1		1	1
	G-19	Packing and Assembly Building	10700	5350	LL4ss-???M-SO	0 to 1	1	1	1				
	G-19	"	"	"	LL4ss-???M-SO	0 to 1	1	1	1				
	G-19A	Shipping	10105	10105	LL4ss-???M-SO	0 to 1	1		1				
Discrete Surface Soil Locations	G-2	Paint Storage	710	NA	LL4ss-???D-SO	0 to 1					1		
	G-2	"	"	"	LL4ss-???D-QA	0 to 1					1		
Blind Duplicate	G-2	"	"	"	LL4ss-???D-SO	0 to 1					1		
	G-4	Power House No. 7	100	NA	LL4ss-???D-SO	0 to 1					1		
	G-4	"	"	"	LL4ss-???D-MS	0 to 1					1		
	G-4	"	"	"	LL4ss-???D-MSD	0 to 1					1		
	G-18	Paint Storage	60	NA	LL4ss-???D-SO	0 to 1					1		

Primary MI Sample	22	6	22	6		4	4
Quality Assurance	3	1	3	1	1	1	1
Field MI Duplicate	3	1	3	1		1	1
Blind Duplicate	3	1	3	1	1	1	1
MS/MSD Pair	4	2	4	2	2	2	2
Primary Discrete					3		

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Analyses	32	10	32	10	3	8	8

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. URS will confine its activities to areas defined by this Work Plan.

4.1 STORM WATER POLLUTION PREVENTION

URS will perform the SOW under the existing Storm Water Pollution Prevention Plan (SWPPP) for Load Lines 2, 3, and 4. The soil movement control methods will be in place when URS commences operations. These controls include runoff control, soil stabilization, and sediment control. URS 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, URS will identify all land resources to be preserved within the work area. URS will not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, topsoil, and landforms without permission from RVAAP and the OHARNG.

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 of RVAAP or OHARNG. 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 on-site 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).

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 ESS, explosive soil, if identified, will be blended at the slab locations prior to transport to the temporary storage buildings at Load Line 4, in order 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 can not 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

URS will keep field operations under surveillance, management, and control to avoid pollution of surface and ground waters. Management techniques will be implemented to control water pollution by the removal activities that are included in this contract.

4.7 SPILLAGE

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 for Load Lines 1 through 4 will be followed.

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:

- No tape of any kind will be placed on the 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 URS Chemist in the Cleveland 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 the demolition contractor. Additionally, weekly updates will be discussed at the RVAAP weekly contractors' meeting with the Facility, OHARNG, and MKM.

5.4 FIELD AND LABORATORY QA/QC

A suite of specific field and laboratory QC samples will be collected and analyzed. The level or frequency of QC samples will be in accordance with the QAPP, Section 3.2. Field blanks and duplicates will be collected at a frequency of one for every 10 investigative samples. One matrix spike/matrix spike duplicate will be collected for every 20 investigative samples. Additional detail regarding field and laboratory QC is included in the addendum to the QAPP, Appendix B.

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.

This section describes the action levels that will be used in this project to make excavation decisions.

7.1 FIELD SCREENING COMPARISONS

The purpose of the TNT/RDX field screening is to make decisions regarding whether material needs to be excavated. These decisions will be made based on a comparison of the field test kit results to the following cleanup levels as provided in the SOW:

- TNT: 1,646 mg/kg
- RDX: 838 mg/kg.

These levels were determined as acceptable in the IROD for Load Lines 2, 3, and 4. If either of these levels is exceeded, excavation decisions will be implemented as described in Section 3.6.3.3.

7.2 MULTI-INCREMENT SAMPLE RESULT COMPARISONS

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. If contract capacity limits are exceeded, a contract modification to address additional excavation volumes will be issued by USACE.

The cleanup levels provided in the SOW for those chemicals considered to be SRCs are summarized on Table 7-1. The results of the final MI samples at any of the three load lines may indicate chemicals other than those listed on Table 7-1 were detected. Should this occur, a comparison of the detected concentrations will be done in a step-wise process as follows:

- The detected concentration will be compared to Region 9 Preliminary Remediation Goals (PRGs) assuming a residential exposure scenario (USEPA, 2004). The PRGs based on a cancer endpoint will be adjusted to account for a 1E-05 target risk level (i.e., the value will be multiplied by 10).
- Any detected concentration that exceeds its respective PRG defined above will be further evaluated using screening criteria developed for RVAAP. These include comparisons to RVAAP background concentrations and essential nutrient levels.
- If the detected concentration is still above these criteria a cleanup level will be derived using the same assumptions and methodologies for the cleanup values listed in Table 7-1.

Table 7-1
Cleanup Levels for Soils at Load Lines 2, 3, and 4
Ravenna Army Ammunition Plant
Ravenna, Ohio

Site-Related Contaminant	Cleanup Level, mg/kg
Inorganics	
Aluminum	34,942
Antimony	2,458
Arsenic	31
Barium	3,483
Cadmium	109
Hexavalent Chromium	16
Lead	1,995
Manganese (surface)	1,800
Manganese (subsurface)	3,030
Explosives	
TNT	1,646
RDX	838
Organics	
Benz(a)anthracene	105
Benzo(a)pyrene	10
Benzo(b)fluoranthene	105
Dibenz(a,h)anthracene	10
Aroclor-1254	35

Notes:
mg/kg – milligrams per kilogram
Surface soil refers to the 0 to 1 foot interval below grade surface.
Subsurface soil is greater than 1 foot below grade surface.

The deliverables required by the SOW include plans and evaluations of the sampling conducted both before and after the slabs are removed. The PCP and the amendment to the ESS have already been prepared. The Letter Report Work Plan has been prepared and approved.

The following deliverables will be prepared to complete the SOW.

8.1 PRELIMINARY EVALUATION OF PRE-SLAB REMOVAL FIELD SCREENING

Prior to slab removal, two areas at Load Line 2 and two areas at Load Line 3 will be field screened for TNT/RDX. The results of that field work will be documented in a report submitted to the USACE within 30 days after the completion of the field investigation. Draft and final reports will be submitted to the stakeholders after USACE review of the preliminary draft.

8.2 DEBRIS PILE CHARACTERIZATION

A preliminary draft report documenting the debris pile sampling and the evaluation of the analytical data will be submitted within 30 days of the receipt of the data from the fixed laboratory. Draft and final reports will be submitted to the stakeholders after USACE review of the preliminary draft.

8.3 POST-SLAB REMOVAL FIELD SCREENING

Documentation of the field screening investigations will be documented in one report. The report will be organized so that the TNT/RDX results and conclusions for the high potential buildings, the medium potential buildings, and the low potential buildings can be viewed separately. This report (preliminary draft) will be submitted 30 days after all field screening is complete. Draft and final reports will be submitted to the stakeholders after USACE review of the preliminary draft.

8.4 FINAL SAMPLING REPORTS

A final sampling report will be prepared for each load line. These reports will document the field investigation (MI sampling) and present the analytical results. The data will be compared to cleanup levels as described earlier. Conclusions regarding the necessity for further removal will be presented. The preliminary draft report for each load line will be submitted 30 days after the receipt of the analytical data from the fixed laboratory. Draft and final reports will be submitted to the stakeholders after USACE review of the preliminary draft.

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APPENDIX A
Field Sampling Plan Addendum

Addendum to the Field Sampling Plan

for the Sampling of Soils Below Floor Slabs at LLs-2,3,4 and Excavation and Transportation of Contaminated Soils to Load Line 4 (Buildings G-1, G-1A, and G-3)

Ravenna Army Ammunition Plant
8451 St. Route 5
Ravenna, OH 44266-9297

Contract No. W912QR-04-D-0025
Delivery Order No. 0006

Prepared for:
U.S. Army Corps of Engineers
600 Martin Luther King, Jr. Place
P.O. Box 59
Louisville, Kentucky 40201-0059

Prepared by:
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1375 Euclid Avenue
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April 16, 2008

List of Appendices

Acronyms and Abbreviations

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CSM	Conceptual Site Model
ESS	Explosives Safety Submission
DQO	Data Quality Objective
FSP	Field Sampling Plan
FWSAP	Facility-Wide Sampling and Analysis Plan
IDW	Investigation-Derived Waste
MKM	MKM Engineers, Inc.
OVA	Organic Vapor Analyzer
PCB	Polychlorinated Biphenyl
PCP	Project Coordination Plan
PID	Photo Ionization Detector
PPE	Personal Protective Equipment
QAPP	Quality Assurance Project Plan
RDX	Hexahydro-1,3,5-trinitro-1,3,5-triazine
RVAAP	Ravenna Army Ammunition Plant
SOP	Standard Operating Procedure
SOW	Scope of Work
SVOC	Semivolatile Organic Compound
TAL	Target Analyte List
TCLP	Toxicity Characteristic Leaching Procedure
TNT	2,4,6-Trinitrotoluene
URS	URS Group, Inc.
USACE	United States Army Corps of Engineers
UXO	Unexploded Ordnance
VOC	Volatile Organic Compound

This Field Sampling Plan (FSP) addendum addresses supplemental project-specific information in relation to the revised Facility-Wide Sampling and Analysis Plan for the Ravenna Army Ammunition Plant (RVAAP) (SAIC, 2001b). This FSP is an Appendix to the Work Plan that describes the project for the sampling of soils below floor slabs at load lines 2, 3, and 4 and the excavation and transportation of contaminated soils to Load Line 4 (Buildings G-1, G-1A, and G-3). 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

The purpose and scope of this project is contained in Section 1.1 of the Work Plan for the sampling of soils below slabs at LLs-2, 3, 4 and subsequent excavation and transportation of contaminated earth fill soils to Load Line 4. The work to be covered by URS' Delivery Order 0006 is to evaluate potential contamination below these floor slabs and to excavate and transport any contaminated earth fill materials above the chemical-specific clean-up goals for 2,4,6-trinitrotoluene (TNT) and hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX). Once the evaluation has been completed, the earth fill materials exceeding the chemical clean-up criteria for explosives will be transported to buildings G-1, G-1A, and G-3 at Load Line 4 for storage until final disposition decisions are made. The term "earth fill" refers to the soil materials used to backfill the elevated foundations located immediately under the building slabs.

Confirmatory multi-increment (MI) sampling will be done and 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. If contract capacity limits are exceeded, a contract modification to address additional excavation volumes will be issued by USACE.

This FSP is a supplement to the 2001 Facility-Wide Sampling and Analysis Plan (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 for the Sampling of Soils Below Slabs at LLs-2, 3, 4 and Excavation and Transportation of Contaminated Soils to Load Line 4. Additional information regarding the climatic conditions, geologic setting, hydrologic setting, and ecological setting are contained in Section 1.0 of the Facility Wide Sampling and Analysis Plan (FWSAP).

1.3 SPECIFIC SAMPLING AND ANALYSIS PROBLEMS

Even though the buildings have been removed and the slabs will be removed prior to sampling from each of the load lines, 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 at RVAAP, (SAIC, 2001a), all sampling personnel will be advised specifically of biological hazards and pertinent preventive measures.

The coordination with the demolition contractor will present additional logistical issues to comply with the Explosive Safety Submission (ESS) and regulatory schedules.

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 2, 3, and 4. The primary objectives of the under the slab investigation are described in Section 1.1 of the Work Plan.

Section 2.0 of the FWSAP describes the project organization and responsibilities. This information is also contained in detail in Section 4.0 of the URS Project Coordination Plan (PCP) (URS, 2008) for this project.

The scope and objectives of this investigation are to assess the extent of potential contamination in the exposed sub slab materials after the removal of the slabs at Load Lines 2, 3, and 4 and removal of materials exceeding established clean-up goals.

3.1 SCOPE AND OBJECTIVES

The scope of this investigation is to assess the extent of potential contamination in the exposed sub slab earth fill materials after removal of the slabs at Load Lines 2, 3, and 4. Materials exceeding the site clean-up goals (established within the interim record of decision for these areas) will be removed and staged at Load Line 4. Section 3.1 of the FWSAP provides the basis for the scope and objectives. The primary objectives of the under-slab investigation are described in detail in Section 1.1 of the Work Plan.

3.2 DATA QUALITY OBJECTIVES

The overall project data quality objective (DQO) is to provide representative, sufficient 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 RVAAP, presented in the FWSAP, is applicable to each of the three load lines for this investigation, based on current knowledge. The CSM for these lines, although based on the compilation of previously collected data, may be limited due to the nature of the operations conducted at each of these lines.

Uncertainties within the CSM for Load Lines 2, 3, and 4 are for the most part minimal. The production activities at each of the lines are documented in the archives.

3.2.2 Define the Problem

Limited surface earth fill soil data have been collected under the slabs or in the proximity of the foundations of buildings at Load Lines 2, 3, and 4 during previous investigations. The results were summarized in Section 1.2 of the Work Plan. Collection of sufficient data to make removal decisions is required for these load lines.

3.2.3 Remedial Action Objectives

Section 3.2.3 of the FWSAP describes the process for identifying remedial action objectives for RVAAP under the CERCLA process.

3.2.4 Identify Decisions

The key decisions for all investigations at RVAAP have been identified in Section 3.2.4 in Table 3-1 of the FWSAP.

3.2.5 Define the Study Boundaries

The investigation areas for Load Lines are defined as the former building footprints at Load Lines 2, 3, and 4. These areas were established and set forth in the project Scope of Work (SOW) by the U.S. Army Corps of Engineers (USACE) during the previous scoping process. 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 are provided in Section 3.2.6 of the FWSAP. Since only limited soil data exist to define the nature and extent of contamination within the to-be-exposed sub slab earth fill materials, the potential for exposure to contaminants, if any, has not been ascertained. The purpose of the investigation is to determine the presence, type, concentration, and extent of contamination in surface earth fill soil. These data will be used to identify areas where removal and additional characterization may be needed.

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

The rationale for sampling of sub slab earth fill materials and the sampling design for the investigation of exposed earth fill soils after slab/foundation removal at Load Lines 2, 3, and 4 are described in detail in the Work Plan and the associated USACE SOW.

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

The earth fill soil samples to be taken to 4.0 feet below ground surface will be collected as per Section 4.4 and Section 4.4.2.1.5 of the FWSAP with the exception of the direct push method. The earth fill materials will be collected with manually driven direct push equipment as per the SOW. Clements Associates Inc. is the manufacturer of the JMC unit.

4.5 SURFACE SOIL

Multi-increment (MI) surface soils as well as surface soil samples for field screening will be collected from the buildings designated in the Work Plan.

4.5.1 Rationales

Surface earth fill soil sampling will employ both discrete field screening and multi-increment field sampling to provide characterization of the exposed soils after the removal of the slabs in the sub slab earth fill materials at Load Lines 2, 3, and 4. Field screening samples will be collected discretely from 0.0 to 0.3 m (0 to 1 ft.) and analyzed with field test kits for TNT and RDX.

Multi-increment surface earth fill soil field samples from 0.0 to 0.3 m (0 to 1 ft) 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 earth fill soil MI field samples are 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 sufficient number of aliquots are 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 samples will be collected in sample areas where the subsequent analysis is for VOCs.

4.5.3 Sample Collection for Field and Laboratory Analysis

The locations where discrete samples are collected for VOC analyses will be based on knowledge of the past production procedures. For safety purposes, field screening of surface soil earth fill discrete samples for organic vapors will be performed using a photo ionization detector (PID) per Section 4.3.2.3 of the FWSAP; samples for headspace analyses will not be collected. Organic vapor screening will not be conducted at multi-increment surface sampling points. For discrete sample locations, organic vapor screening will be performed at the time of sampling. Surface sample aliquots for the fixed laboratory will be collected as discussed in Section 4.5.2 of the FWSAP.

4.5.4 MI Quality Control Procedures

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 earth fill soil samples will be collected in accordance with the methodology presented in Appendix A. The following procedures will be used:

- The samples will be taken within the boundaries of the former building footprint.
- Within the sampling boundaries, 30 sampling points will be located in a stratified random pattern described in Appendix A.
- 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

Field determinations of explosives will be conducted during the investigation 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. The following chemical analyses will be conducted for MI surface soil samples:

- Multi-increment samples will be analyzed for explosives, propellants, TAL metals, hexavalent chromium, SVOCs, pesticides, and PCBs. The specific samples to be analyzed for each analytical group are defined in Tables 3-9 through 3-11 in the Work Plan.

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

- 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).

4.5.7 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 the in the facility-wide QAPP.

4.5.9 Site Survey

Not applicable.

4.6 SURFACE WATER

Not applicable.

4.7 ORDNANCE EXPLOSIVE ANOMALY AVOIDANCE

The ordnance explosive Contractor (MKM Engineers, Inc.) will have previously assessed the areas during the removal of the slabs at each of the three Load Lines. No UXO was detected at LL 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.

5.1 FIELD BOOK

All field logbook information will be entered either into a dedicated field log book or into a Panasonic Toughbook™ portable computer (or equivalent) that follows the structures identified in Section 5.1 of the FWSAP.

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 label, logbook, field record, 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.

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.

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 -DERIVED WASTE COLLECTION AND 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., 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. A centralized field staging area at Building 1036 will be established for the staging of all drums of IDW. The 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 not 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 on the basis of 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.

SAIC. 2001a. Facility-Wide Safety and Health Plan for Environmental Investigations at the Ravenna Army Ammunition Plant. Ravenna, Ohio. Prepared for the US Army Corps of Engineers, Louisville District. March 2001.

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URS. 2008. URS Group, Inc. Project Coordination Plan for the Sampling of Soils Below Floor Slabs at LLs-2,3,4 and Excavation and Transportation of Contaminated Soils to Load Line 4 (Buildings G-1, G-1A, and G-3). Internal Army Draft. February 2008.

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Appendix A

DRAFT GUIDANCE FOR MULTI-INCREMENT 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 is 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.

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. But 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 stratified-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. **Alternatively, the sub-sample locations may be located by a "drunken-sailor" approach wherein a sample locator merely wanders over the entire sample area throwing out sampling location stakes randomly as he/she walks over the entire sample area.**

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, rock
  bottoms, 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 of the field collected sample to again 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, either 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 5. 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.

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11 Industrial Waste Dumps, Sampling and Analysis, Rasemann, Encyclopedia of Analytical Chemistry, 2000, tu-freiberg.de/wwwiqs/industri9al%20waste%20dumps

APPENDIX B
Quality Assurance Project Plan Addendum

Quality Assurance Project Plan Addendum

for the Sampling of Soils Below Floor Slabs at LLs-2,3,4 and Excavation and Transportation of Contaminated Soils to Load Line 4 (Buildings G-1, G-1A, and G-3)

Ravenna Army Ammunition Plant
8451 St. Route 5
Ravenna, OH 44266-9297

Contract No. W912QR-04-D-0025
Delivery Order No. 0006

Prepared for:
U.S. Army Corps of Engineers
600 Martin Luther King, Jr. Place
P.O. Box 59
Louisville, Kentucky 40201-0059

Prepared by:
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1375 Euclid Avenue
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Cleveland, Ohio 44115-1808

April 16, 2008

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Acronyms and Abbreviations

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	2,4,6-Trinitrotoluene
URS	URS Group, Inc.
USACE	United States Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency

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 addendum is an Appendix to the Work Plan that describes the project for the sampling of soils below floor slabs at Load Lines 2, 3, and 4 and the excavation and transportation of contaminated soils to Load Line 4 (Buildings G-1, G-1A, and G-3). Each QAPP section is presented documenting adherence to the Facility-Wide QAPP or stipulating project-specific addendum requirements.

Primary analytical direction for these projects will be obtained from the identified U.S. Environmental Protection Agency (USEPA) SW-846 Methods, the U.S. Army Corps of Engineers (USACE) *Shell for Analytical Chemistry Requirements* (USACE Shell) (USACE, 2001a), and the USACE Louisville District *Louisville Chemistry Guideline* (LCG) (USACE, 2002).

1.1 SITE HISTORY/BACKGROUND INFORMATION

Background information and the site history are contained in the Work Plan.

1.2 PAST DATA COLLECTION ACTIVITY/CURRENT STATUS

The past data collection activities and current status of the load lines are contained in the Work Plan.

1.3 PROJECT OBJECTIVES AND SCOPE

The project objectives and scope are contained in the Work Plan.

1.4 SAMPLE NETWORK DESIGN AND RATIONALE

The sampling design and rationale are contained in the Work Plan.

1.5 PARAMETERS TO BE TESTED AND FREQUENCY

Sampling and analysis requirements are summarized in Table 1-1 of this QAPP addendum, in conjunction with anticipated sample numbers, field and lab quality control (QC) sample frequencies, and the USACE Quality Assurance (QA) split sample frequencies. All QA split samples will be submitted to a USACE-specified laboratory for analysis (see Section 2.0).

1.6 PROJECT SCHEDULE

The project schedule is included in the Work Plan and the Project Coordination Plan (URS, 2008).

Table 1-1
Analytical and QC Requirements
Sub-Slab Soil Sampling
Ravenna Army Ammunition Plant

Sample Type	Multi-Increment Samples						Discrete Samples
Analysis	**Explosives**	**Propellants**	**Metals$^{(1)}$**	**SVOC**	**PCB**	**Pesticides**	**VOCs**
Method(s)	8330B	8330(mod), 353.2, & 314.1, or equiv.	6010B, 7471A, & 7196A	8270C	8082	8081A	8260B
Load Line 2							
Primary Sample	38	5	38	13	10	5	4
QA Sample	4	1	4	2	2	1	1
Field MI Duplicate	4	1	4	2	2	1	NA
Blind Duplicate	4	1	4	2	2	1	1
MS/MSD	4	2	4	2	2	2	2
Load Line 3							
Primary Sample	29	4	29	6	10	3	3
QA Sample	3	1	3	2	2	1	1
Field MI Duplicate	3	1	3	2	2	1	NA
Blind Duplicate	3	1	3	2	2	1	1
MS/MSD	4	2	4	2	2	2	2
Load Line 4							
Primary Sample	22	6	22	6	4	4	3
QA Sample	3	1	3	1	1	1	1
Field MI Duplicate	3	1	3	1	1	1	NA
Blind Duplicate	3	1	3	1	1	1	1
MS/MSD	4	2	4	2	2	2	2

NA = Not applicable

(1) Defined as TAL metals plus hexavalent chromium.

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

Analytical support for this work has been assigned to Microbac Laboratories, Inc. (Microbac) of Marietta, Ohio[1]. Microbac will perform all required analyses at that location. Microbac's organizational structure, roles, and responsibilities are identified in Section 4.0 of their Quality Assurance Plan (QA Plan), which is available for review upon request. The address and telephone number for Microbac are as follows:

Microbac Laboratories, Inc.
156 Starlite Drive
Marietta, OH 45750
(740) 373-4071
Contact: Debra Elliot

Field analytical support for colorimetric analysis of trinitrotoluene (TNT) and hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX) will be provided by the URS Group, Inc. (URS) field team.

The QA laboratory contracted through the Louisville USACE is:

CT Laboratories
1230 Lange Court
Baraboo, WI 53913
(608) 356-2760
Contact: Ceress Berwanger

Comprehensive data validation will be independently performed by the following Louisville USACE-approved company:

MECx, LLC
3203 Audley Street
Houston, TX 77098
(713) 412-9697
Contact: Douglas D. Carvel, President

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[1] This laboratory was formerly known as Kemron Environmental Services. Subsequent references in this addendum to Kemron should be considered as references to Microbac.

3.1 DATA QUALITY OBJECTIVES

Analytical data quality objectives for this investigation are summarized in Table 3-1 in the Facility-Wide QAPP. The laboratory is required to comply with all methods as written; recommendations are considered requirements. Concurrence with the current versions of the USACE Shell and LCG is expected.

3.2 LEVEL OF QUALITY CONTROL EFFORT

The QC efforts will follow Section 3.2 of the Facility-Wide QAPP. Field QC analyses will include field duplicates, equipment rinsate blanks, and trip blanks. Laboratory QC analyses will include method blanks, laboratory control samples (LCSs), laboratory duplicates, and matrix spike/matrix spike duplicate (MS/MSD) samples. The LCS measurements will include the routine mid-level analyte concentration standard plus a QC/Method Reporting Level (QC/MRL) low-level concentration standard in accordance with the LCG. Corrective action for individual analyte variances will be required as specified in the LCG. In addition, a QC sample of known concentration must be analyzed to verify instrument sensitivity at the method detection limit (MDL) on a quarterly basis for every instrument used to run USACE samples.

3.3 ACCURACY, PRECISION, AND SENSITIVITY OF ANALYSIS

Project accuracy and precision goals are identified in Section 3.3 and Table 3-1 of the Facility-wide QAPP. In addition, the LCG identifies analytical method quality objectives related to individual method QC protocol. Current laboratory-generated analytical method control limits will be submitted to the USACE Louisville District Chemistry group for review. Upon acceptance, these QC limits will be imposed during analytical runs. If these internal QC operational limits are not acceptable to the Louisville District, the laboratory will impose the USACE Louisville District Chemistry Guideline control limits.

The sensitivities required are identified in Tables 3-3 through 3-8 of the Facility-wide QAPP as project quantitation levels. Microbac’s reporting limits (RLs) and MDLs are included in Appendix A of this QAPP Addendum, with highlighting to indicate those analytes for which their RL exceeds the specified quantitation level. The MDL for each of these analytes is at or below the specified quantitation level; therefore, the quantitation levels will be achieved by reporting concentrations between the MDL and RL with J-flags. When samples require dilution, both the quantified dilution and an undiluted or lesser-diluted run must be reported to obtain analyte reporting levels as low as possible without destroying analytical detectors and instrumentation. Further discussion of dilutions can be found in Section 7.1.

3.4 COMPLETENESS, REPRESENTATIVENESS, AND COMPARABILITY

Completeness, representativeness, and comparability goals identified in Section 3.4 and Table 3-1 of the Facility-Wide QAPP will be imposed for this investigation.

Sampling procedures are discussed in Section 4.0 of the Facility-Wide FSP and the FSP Addendum within the Work Plan. The multi-increment (MI) sampling protocol to be used as part of this investigation is also included in the FSP Addendum to the Work Plan.

Table 4-1 summarizes sample container, preservation, and holding time requirements for this investigation.

Table 4-1
Sample Containers, Preservatives, and Holding Times
Sub-Slab Soil Sampling
Ravenna Army Ammunition Plant

Analyte Group	Container	Minimum Sample Size	Preservative	Holding Time
Volatile Organic Compounds(1)	(3) 40-mL vials with septum, plus (1) 2-oz plastic/glass jar for solids determination	5 g per vial	Sodium bisulfate (2 vials) Methanol (1 vial) Cool, 4°C	14 d
Semivolatile Organic Compounds	Multi-Increment Sample: (1) 1-gallon zippered plastic bag (double-bagged)	1 kg	Cool, 4°C	14 d (extraction) 40 d (analysis)
Explosives/Propellants				14 d (extraction) 40 d (analysis)
Pesticides				14 d (extraction) 40 d (analysis)
PCBs				14 d (extraction) 40 d (analysis)
TAL Metals				180 days (28 for mercury)
Hexavalent Chromium				30 d (extraction) 7 d (analysis)

(1) Discrete soil samples for volatiles will be collected using TerraCore® sampling kits.

5.1 FIELD CHAIN-OF-CUSTODY PROCEDURES

Sample handling, packaging, and shipment procedures will follow those identified in Section 5.1 of the Facility-Wide QAPP.

5.2 LABORATORY CHAIN-OF-CUSTODY PROCEDURES

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

5.3 FINAL EVIDENCE FILES CUSTODY PROCEDURES

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

6.1 FIELD INSTRUMENTS/EQUIPMENT

Field instruments and equipment calibrations will follow those identified in Section 6.1 of the Facility-Wide QAPP.

6.2 LABORATORY INSTRUMENTS

Calibration of laboratory equipment will follow procedures identified in Section 9.0 of the Kemron QA Plan and analysis-specific standard operating procedures.

7.1 LABORATORY ANALYSIS

Analytical methods, parameters and quantitation limits are those listed in Tables 3-3 through 3-8 of the Facility-Wide QAPP. Laboratory reporting limits are provided in Appendix A.

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 (for some chemicals, the laboratory RL is above the quantitation level specified in the Facility-wide QAPP; therefore, concentrations between the MDL and RL will be reported with J-flags). 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, whenever possible. If dilutions are necessary, analytical screening procedures will be used to determine optimum dilution ranges. Dilutions will be performed to quantify high target analyte concentrations within the upper half of the calibration range, thus reducing the degree of dilution as much as possible. In addition, an undiluted or five times less diluted run will be performed to obtain other target analyte reporting limits as low as possible without destroying analytical detectors and instrumentation. Whenever there are matrix interferences or high target or nontarget analyte concentrations that preclude analysis of an undiluted sample, the laboratory project manager will notify the URS project chemist, Ms. Peggy Schuler.

7.2 FIELD SCREENING ANALYTICAL PROTOCOLS

Procedures for field analyses are identified in Section 4.0 of the Facility-Wide FSP and the FSP Addendum. Field screening analysis for TNT and RDX will be performed using EnSys® Test Kits for TNT and RDX, following the general procedures outlined in the test kit instructions and the RVAAP SOP for Field Colorimetric Analysis of Explosives (USACE, 2001b). The EnSys® test kit instructions and the SOP are contained in Appendix B of this QAPP Addendum.

8.1 FIELD SAMPLE COLLECTION

Field QC sample types, numbers, and frequencies are identified in Section 1.5 and are summarized in Table 1-1. In general, field duplicates will be collected at a frequency of 10 percent. The MS/MSD samples will be collected at a frequency of 5 percent. 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 volatile organic samples. The QA split samples will be collected on 10 percent of the total number of field samples collected and sent to the designated QA laboratory for analysis.

The soil samples for fixed laboratory analysis will be collected using a MI sampling method. For MI samples, two types of duplicate samples will be collected: MI duplicates, which are two samples that are comprised of soil from the same 30 sub-sample increments; and blind duplicates, which are two separate samples (each comprised of 30 different increments) collected from the same MI sampling area.

8.2 FIELD MEASUREMENT

The QC procedures associated with the field screening of 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.

8.3 LABORATORY ANALYSIS

Analytical QC procedures will follow those identified in the referenced USEPA methodologies. These will include method blanks, LCSs, MS/MSDs, laboratory duplicate analyses, calibration standards, internal standards, surrogate standards, and calibration verification standards.

Kemron will conform to their QA Plan and established SOPs to perform the various analytical methods required by the project. The QC frequencies will follow those identified in Section 8.3 of the Facility-Wide QAPP.

Analyses will also be consistent with direction provided by the USACE Shell and the LCG. The following are clarifications to this guidance relative to this project.

- Analytical method blanks will be considered clean as long as analyte concentrations are below reporting levels. Corrective actions will be performed for any analyte detected above the established method reporting level. Any analytes detected between the method detection limit and the method reporting level will be flagged appropriately.
- Laboratory Control Standards will contain all single-component target compounds; however, for organic methods only the SW-846 subset of system monitoring compounds will be used to monitor method performance and to initiate analytical method corrective actions.
- For methods that have multi-responders (e.g., Aroclors) within the same analytical process, the laboratory will not include all analytes within the spiking mixture. Representative analytes will be employed for the LCS and MS/MSD evaluation (e.g., Aroclors 1016 and 1260).

9.1 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 USACE Shell, and the LCG.

9.2 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 by URS according to the Facility-Wide QAPP.

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

9.3 DATA REPORTING

Analytical data reports will follow the direction provided in the Facility-Wide QAPP.

10.1 FIELD AUDITS

Internal audits of field activities (sampling and measurements) will be conducted by the URS 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.

10.2 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.

11.1 FIELD INSTRUMENTS AND EQUIPMENT

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

11.2 LABORATORY INSTRUMENTS

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

12.1 FIELD MEASUREMENTS DATA

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

12.2 LABORATORY DATA

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

13.1 SAMPLE COLLECTION/FIELD MEASUREMENTS

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

13.2 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.

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

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APPENDIX A
Kemron Laboratory Reporting Limits

Appendix A
Method Detection Limits and Reporting Limits
Kemron Environmental Services

Method 6010 Metals, Soil

Compound	Units	MDL	RL
Aluminum	mg/kg	10	20
Barium	mg/kg	0.1	0.5
Calcium	mg/kg	5	10
Chromium	mg/kg	0.12	1
Cobalt	mg/kg	0.12	1
Copper	mg/kg	0.5	1
Iron	mg/kg	1	2
Magnesium	mg/kg	12	25
Manganese	mg/kg	0.1	0.5
Potassium	mg/kg	25	50
Sodium	mg/kg	5	25
Vanadium	mg/kg	0.25	0.5
Zinc	mg/kg	0.5	1
Antimony	mg/kg	0.5	1
Arsenic	mg/kg	0.5	1
Beryllium	mg/kg	0.012	0.03
Cadmium	mg/kg	0.05	0.1
Selenium	mg/kg	0.5	1
Silver	mg/kg	0.25	0.5

Method 6020 Metals, Soil

Compound	Units	MDL	RL
Lead	mg/kg	0.1	0.2
Thallium	mg/kg	0.01	0.02
Nickel	mg/kg	0.2	0.8

Method 7471A, Soil

Compound	Units	MDL	RL
Mercury	mg/kg	0.01	0.1

Method 7196A, Soil

Compound	Units	MDL	RL
Hexavalent Chromium	mg/kg	0.05	0.1

NOTE: Shading indicates a Reporting Limit (RL) exceeding the Facility-wide QAPP quantitation level.

Appendix A
Method Detection Limits and Reporting Limits
Kemron Environmental Services

Method 8330 Explosives, Soil

Compound	Units	MDL	RL
Nitroglycerin	mg/kg	0.1	0.3
1,3,5-Trinitrobenzene	mg/kg	0.1	0.25
1,3-Dinitrobenzene	mg/kg	0.1	0.25
2,4,6-Trinitrotoluene	mg/kg	0.1	0.25
2,4-Dinitrotoluene	mg/kg	0.1	0.25
2,6-Dinitrotoluene	mg/kg	0.1	0.26
2-Amino-4,6-dinitrotoluene	mg/kg	0.1	0.26
2-Nitrotoluene	mg/kg	0.1	0.25
3-Nitrotoluene	mg/kg	0.1	0.25
4-Nitrotoluene	mg/kg	0.1	0.25
4-Amino-2,6-dinitrotoluene	mg/kg	0.1	0.26
HMX	mg/kg	0.1	2.2
Nitrobenzene	mg/kg	0.13	0.26
RDX	mg/kg	0.1	1
Tetryl	mg/kg	0.2	0.65
PETN	mg/kg	0.5	1.5

Method 8330 (modified) Propellant, Soil

Compound	Units	MDL	RL
Nitroguanidine	ug/kg	125	250

Method 314.1 Propellant, Soil

Compound	Units	MDL	RL
Nitrocellulose	mg/kg	2	2

NOTE: Shading indicates a Reporting Limit (RL) exceeding the Facility-wide QAPP quantitation level.

Appendix A
Method Detection Limits and Reporting Limits
Kemron Environmental Services

Method 8270B Semivolatiles, Soil

Compound	Units	MDL	RL
1,1'-Biphenyl	ug/kg	82.5	165
2,4,5-Trichlorophenol	ug/kg	82.5	165
2,4,6-Trichlorophenol	ug/kg	82.5	165
2,4-Dichlorophenol	ug/kg	82.5	165
2,4-Dimethylphenol	ug/kg	82.5	165
2,4-Dinitrophenol	ug/kg	412	825
2,4-Dinitrotoluene	ug/kg	82.5	165
2,6-Dinitrotoluene	ug/kg	82.5	165
2-Chloronaphthalene	ug/kg	82.5	165
2-Chlorophenol	ug/kg	82.5	165
2-Methylnaphthalene	ug/kg	82.5	165
2-Methylphenol	ug/kg	82.5	165
2-Nitroaniline	ug/kg	412	825
2-Nitrophenol	ug/kg	82.5	165
3,3'-Dichlorobenzidine	ug/kg	165	330
3-,4-Methylphenol	ug/kg	82.5	165
3-Nitroaniline	ug/kg	412	825
4,6-Dinitro-2-methylphenol	ug/kg	412	825
4-Bromophenyl phenyl ether	ug/kg	82.5	165
4-Chloro-3-methylphenol	ug/kg	82.5	165
4-Chloroaniline	ug/kg	82.5	165
4-Chlorophenyl phenyl ether	ug/kg	82.5	165
4-Nitroaniline	ug/kg	412	825
4-Nitrophenol	ug/kg	412	825
Acenaphthene	ug/kg	82.5	165
Acenaphthylene	ug/kg	82.5	165
Acetophenone	ug/kg	82.5	165
Anthracene	ug/kg	82.5	165
Atrazine	ug/kg	82.5	165
Benzaldehyde	ug/kg	82.5	165
Benzo(a)anthracene	ug/kg	82.5	165
Benzo(a)pyrene	ug/kg	82.5	165
Benzo(b)fluoranthene	ug/kg	82.5	165
Benzo(g,h,i)perylene	ug/kg	82.5	165
Benzo(k)fluoranthene	ug/kg	82.5	165
Benzoic acid	ug/kg	330	5000
Benzyl alcohol	ug/kg	82.5	165
Bis(2-Chloroethoxy)methane	ug/kg	82.5	165
Bis(2-Chloroethyl)ether	ug/kg	82.5	165
bis(2-Chloroisopropyl)ether	ug/kg	82.5	165
bis(2-Ethylhexyl)phthalate	ug/kg	82.5	165
Butyl benzyl phthalate	ug/kg	82.5	165
Caprolactam	ug/kg	82.5	165
Carbazole	ug/kg	82.5	165

NOTE: Shading indicates a Reporting Limit (RL) exceeding the Facility-wide QAPP quantitation level.

Appendix A
Method Detection Limits and Reporting Limits
Kemron Environmental Services

Method 8270B Semivolatiles, Soil, cont'd.

Compound	Units	MDL	RL
Chrysene	ug/kg	82.5	165
Dibenz(a,h)anthracene	ug/kg	82.5	165
Dibenzofuran	ug/kg	82.5	165
Diethyl phthalate	ug/kg	82.5	165
Dimethyl phthalate	ug/kg	82.5	165
Di-n-butyl phthalate	ug/kg	82.5	165
Di-n-octyl phthalate	ug/kg	82.5	165
Fluoranthene	ug/kg	82.5	165
Fluorene	ug/kg	82.5	165
Hexachlorobenzene	ug/kg	82.5	165
Hexachlorobutadiene	ug/kg	82.5	165
Hexachlorocyclopentadiene	ug/kg	82.5	165
Hexachloroethane	ug/kg	82.5	165
Indeno(1,2,3-cd)pyrene	ug/kg	82.5	165
Isophorone	ug/kg	82.5	165
Naphthalene	ug/kg	82.5	165
Nitrobenzene	ug/kg	82.5	165
N-Nitrosodiphenylamine	ug/kg	82.5	165
N-Nitrosodipropylamine	ug/kg	82.5	165
Pentachlorophenol	ug/kg	412	825
Phenanthrene	ug/kg	82.5	165
Phenol	ug/kg	82.5	165
Pyrene	ug/kg	82.5	165

NOTE: Shading indicates a Reporting Limit (RL) exceeding the Facility-wide QAPP quantitation level.

Appendix A
Method Detection Limits and Reporting Limits
Kemron Environmental Services

Method 8260B Volatiles, Soil

Compound	Units	MDL	RL
1,1,1-Trichloroethane	ug/kg	0.5	5
1,1,2,2-Tetrachloroethane	ug/kg	0.5	5
1,1,2-Trichloro-1,2,2-Trifluoroethane	ug/kg	0.5	5
1,1,2-Trichloroethane	ug/kg	0.5	5
1,1-Dichloroethane	ug/kg	1	5
1,1-Dichloroethene	ug/kg	0.5	5
1,2,4-Trichlorobenzene	ug/kg	0.5	5
1,2-Dibromo-3-chloropropane	ug/kg	2	5
1,2-Dibromoethane	ug/kg	0.5	5
1,2-Dichlorobenzene	ug/kg	0.5	5
1,2-Dichloroethane	ug/kg	0.5	5
1,2-Dichloroethene	ug/kg	0.5	2
1,2-Dichloropropane	ug/kg	0.5	5
1,3-Dichlorobenzene	ug/kg	0.5	5
1,4-Dichlorobenzene	ug/kg	0.5	5
2-Butanone	ug/kg	2.5	5
2-Hexanone	ug/kg	2.5	5
4-Methyl-2-pentanone	ug/kg	2.5	5
Acetone	ug/kg	5	10
Benzene	ug/kg	0.5	5
Bromodichloromethane	ug/kg	0.5	5
Bromoform	ug/kg	0.5	5
Bromomethane	ug/kg	1	5
Carbon disulfide	ug/kg	0.5	5
Carbon tetrachloride	ug/kg	0.5	5
Chlorobenzene	ug/kg	0.5	5
Chlorodibromomethane	ug/kg	0.5	5
Chloroethane	ug/kg	1	5
Chloroform	ug/kg	0.5	5
Chloromethane	ug/kg	2	5
cis-1,2-Dichloroethene	ug/kg	0.5	5
cis-1,3-Dichloropropene	ug/kg	0.5	5
Cyclohexane	ug/kg	0.5	10
Dichlorodifluoromethane	ug/kg	1	5
Ethylbenzene	ug/kg	0.5	5
Isopropylbenzene	ug/kg	0.5	5
Methyl acetate	ug/kg	0.5	5
Methyl cyclohexane	ug/kg	0.5	5
Methyl t-butyl ether (MTBE)	ug/kg	0.5	5
Methylene chloride	ug/kg	1	5
Styrene	ug/kg	0.5	5
Tetrachloroethene	ug/kg	0.5	5
Toluene	ug/kg	0.5	5
trans-1,2-Dichloroethene	ug/kg	0.5	5

NOTE: Shading indicates a Reporting Limit (RL) exceeding the Facility-wide QAPP quantitation level.

Appendix A
Method Detection Limits and Reporting Limits
Kemron Environmental Services

Method 8260B Volatiles, Soil, cont'd.

Compound	**Units**	**MDL**	**RL**
trans-1,3-Dichloropropene	ug/kg	0.5	5
trans-1,4-Dichloro-2-butene	ug/kg	0.5	5
Trichloroethene	ug/kg	0.5	5
Trichlorofluoromethane	ug/kg	1	5
Vinyl chloride	ug/kg	1	5
Xylenes	ug/kg	0.5	5

NOTE: Shading indicates a Reporting Limit (RL) exceeding the Facility-wide QAPP quantitation level.

Appendix A
Method Detection Limits and Reporting Limits
Kemron Environmental Services

Method 8082 PCBs, Soil

Compound	Units	MDL	RL
Aroclor-1016	ug/kg	8.25	16.5
Aroclor-1221	ug/kg	8.25	16.5
Aroclor-1232	ug/kg	8.25	16.5
Aroclor-1242	ug/kg	8.25	16.5
Aroclor-1248	ug/kg	8.25	16.5
Aroclor-1254	ug/kg	8.25	16.5
Aroclor-1260	ug/kg	8.25	16.5

NOTE: Shading indicates a Reporting Limit (RL) exceeding the Facility-wide QAPP quantitation level.

APPENDIX B

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

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.

<u>or</u>

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.”.

<u>or</u>

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 “$Abs_{background}$”.

<u>or</u>

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.

Cuvette **30 cc syringe** **Syringe filter**

READ SAMPLE

7a

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.

or

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.

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

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.

Minimum Detection Levels

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.**

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.

50mL Conical Tube

Extraction jar

RDX

Bulb pipette

Ampule cracker

ANALYZE THE CONTROL

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

Record the absorbance on the worksheet as “Abs$_{\text{control}}$”.

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 t 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 sunlig (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	PROCEDURE
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 “background”________ 2) Abs “control”___________ 3) Abs “Nitrate/Nitrite”_________

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

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

Cuvette

Cuvette stopper

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.

PHASE 1 TEST PREPARATION

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

READ BEFORE PROCEEDING

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

SPECTROPHOTOMETER PREPARATION

2b

2d

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

or

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.”.

or

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 “$\text{Abs}_{\text{background}}$”.

or

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

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

3c

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

4b

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

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

Syringe filter

30 cc syringe

Cuvette

PHASE 3 SAMPLE ANALYSIS

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

READ SAMPLE

6a

6a Place the “Sample” cuvette in the cell holder.

6b Press the “READ/ENTER” key and record the absorbance on the worksheet as “$\text{Abs}_{\text{initial}}$”.

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 “$\text{Abs}_{\text{sample}}$”.

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 "$\text{Abs}_{\text{initial}}$" value for each sample by 4. Enter these values on the worksheet.

7b Subtract this value from the "$\text{Abs}_{\text{sample}}$" 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.

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.

$$\text{TNT}_{(\text{ppm})} = \frac{\text{Abs}_{\text{sample}} - (\text{Abs}_{\text{initial}} x4)}{0.0323}$$

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.

Ampule cracker

TNT control

50mL Graduated Conical Tube

Extraction jar

Bulb pipette

Syringe filter

30 cc syringe

Cuvette stopper

Cuvette

Developer solution

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

$\text{Abs}_{\text{background}}$ ____________________

$\text{Abs}_{\text{control}}$ ____________________

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

STANDARD OPERATING PROCEDURE FOR COLORIMETRIC ANALYSIS OF EXPLOSIVES

PREPARED FOR

RAVENNA ARMY AMMUNITION PLANT
RAVENNA, OHIO

March 16, 2001

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STANDARD OPERATING PROCEDURE FOR FIELD COLORIMETRIC ANALYSIS OF EXPLOSIVES FOR RAVENNA ARMY AMMUNITION PLANT, RAVENNA, OHIO

1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to provide directions for in-the-field chemical determination of the presence of 2,4,6-trinitrotoluene (TNT) and Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX) in soil and sediment. This procedure will allow the quantification of these two compounds using a battery-operated spectrophotometer by experienced analytical personnel.

The resulting data are intended to provide information that meets DQOs for field screening for the purpose of expedient field operation decisions. The resulting data will neither meet DQOs necessary for risk assessment nor be stand-alone for feasibility studies.

2.0 METHOD SUMMARY

A 20 gram aliquot of undried sample is placed in an appropriate size container and extracted with 100 ml of acetone. Separate color developments and absorbance measurements are required for the determination of TNT and RDX by this procedure. TNT detection and quantification is based on the spectrophotometric measurement at 540 nm of the red color complex resulting from the addition of potassium hydroxide (KOH) and sodium sulfite (Na_2SO_3) to the filtered acetone extract. After filtration and color development, the background and developed color are measured at the appropriate wavelength on the spectrophotometer. After subtraction of the background color, the concentration of TNT is determined based on the absorbance measurement from the spectrophotometer. RDX detection and quantification are based on the spectrophotometric measurement at 507 nm of the red color complex resulting from the derivitization of the acetone extract with acetic acid and zinc and subsequent color development with commercially available HACH NitroVer 3 reagent.

The method concentration range for the compounds is typically 1 – 30 ppm for TNT and 2.5 – 35 ppm for RDX, wet weight. The actual range found will be dependent on the individual instrumentation and the cuvett diameter. The actual reportable concentration range needs to be determined on a project-by-project basis.

Strategic Diagnostics, Inc. has adapted this Jenkins method and developed prepackaged test kits to perform these colorimetric screening processes. The TNT EuSys® Soil Test System and the RDX EuSys® Soil Test System provide a comparable mode of completing these field screening analyses.

3.0 REFERENCES

3.1 Jenkins, T.F. (1990), “Development of a simplified Field Method for the Determination of TNT in Soil”, U.S. Cold Regions Research and Engineering Laboratory, Special Report 90-30.

3.2 RVAAP Site Wide SAP, July 2000.

3.3 RVAAP Site Wide QAPP, July 2000.
Science Applications International Corporation Quality Assurance Administrative Procedures (SAIC QAAPs).

3.4 Environmental Compliance Branch Standard Operating Procedures and Quality Assurance Manual, U.S. EPA, Region IV Environmental Services Division, February, 1991.
Science Applications International Corporation Field Technical Procedure (SAIC TFP) May 5, 1995.

3.5 Jenkins, T.F., and Walsh, M.E. (1993). "Determination of TNT/RDX in Soils Using Colorimetry", U.S. Cold Regions Research and Engineering Laboratory.

3.6 SDI EuSys® TNT Soil Test User's Guide, Part #30985, Rev. 7, 8/21/97.

3.7 SDI EnSys® RDX Soil Test System User's Guide, Part #30935, Rev. 5, 9/16/97.

4.0 RESPONSIBILITIES

4.1 CONTRACTOR PROGRAM MANAGER

The Program Manager is responsible for approving this procedure.

4.2 CONTRACTOR QUALITY ASSURANCE/QUALITY CONTROL (QA/QC) OFFICER

The QA/QC Officer is responsible for approving this procedure and verifying that this procedure is being implemented.

4.3 CONTRACTOR HEALTH AND SAFETY (H&S) OFFICER

The H&S Officer is responsible for ensuring that appropriate and contractual H&S policies and procedures are in effect and verifying enforcement of same by line management.

4.4 CONTRACTOR PROGRAM OR PROJECT MANAGER

The Program or Project Manager is responsible for

- designating a qualified person to train personnel who will be using this procedure
- ensuring that this and all appropriate procedures are followed
- the interpretation of these operating instructions
- verifying that the appropriate training records are submitted to the Central Records Facility

4.5 CONTRACTOR FIELD SAMPLING TEAM LEADER

The Field Sampling Team Leader is responsible for

- assigning field sampling team members
- coordinating and preparing for field sampling and field analytical activities by ensuring compliance with the SAP and field procedures (including operating instructions)
- ensuring that the field sampling team members and the field analysts are appropriately trained and the training is properly documented
- overall management of field activities.

4.6 CONTRACTOR FIELD SAMPLING TEAM MEMBERS

The field sampling team members are responsible for

- assisting the field sampling team leader in selecting locations and intervals for sampling as identified in the SAP
- collecting the required field samples, appropriately documenting sample collection activities, properly labeling samples, and delivering samples to the field analysts

4.7 CONTRACTOR FIELD ANALYSTS

The field analysts are responsible for

- implementation of and adherence to this field analytical procedure
- performing appropriate calibrations
- analyzing samples
- performing QC analysis
- maintaining analytical equipment
- documenting information according to the steps defined in this procedure.

5.0 GENERAL INFORMATION

5.1 Any deviation from this procedure's requirements will be justified to and authorized by the Contractor Project Manager or Program Manager.

5.2 Deviations from this procedure's requirements must be sufficiently documented to allow re-creation of the modified process.

5.3 Refer to and implement the site- or project-specific H&S Plan for relevant H&S requirements.

5.4 Refer to and implement the project-specific SAP for relevant sampling and analysis requirements.

5.5 It is RVAAP policy to maintain an effective program to control employee exposure to chemical, radiological, and physical stress that is consistent with U.S. Occupational Safety and Health Administration (OSHA) established standards and requirements.

5.6 Refer to and implement the site- or project-specific Waste Management Plan for relevant waste and waste disposal requirements.

5.7 Subcontractor personnel who implement this procedure must provide documented evidence of having been trained in the procedure to the Program Manager of Project Manager in accordance with subsection 4.5.

5.8 Data Quality Objectives (DQOs) for field analyses should be identified in project-specific documents (WP, SAP, QAPjP). As presented, this procedure provides appropriate guidance to produce quantitative screening data. QC includes multilevel calibration, method blank information, and control sample analysis. Duplicate analytical information is optional.

5.9 Sample analytical reports and QC information will be provided to the Sampling Team Leader daily. In addition, sample results may be requested as determined by the Sampling Team Leader.

5.10 Upon completion of a project, final data packages will be assembled including but not limited to: analytical results, QC data, calibration information, and a written summary of each day's activities.

5.11 For additional information regarding instrument calibration, adjustment, maintenance, or replacement components, consult the manufacturer's instruction and operational manuals.

5.12 Sampling equipment needed for the collection of soils and sediments will vary depending on project requirements and will be identified in the project-specific SAP.

5.13 The analyst must be capable of making judgment calls and technical decisions based upon a clear understanding of Beer Lambart's Law, dilutions; along with the ability to execute proper analytical measurement techniques.

6.0 INTERFERENCES

6.1 Several other nitroaromatic compounds have been investigated, which develop a visible color when processed through the procedure and measured at 540 nm: Tetryl (orange), TNB (red), DNB (purple), and 2,4,6-DNT (pink). These compounds, if present, may contribute to the sample absorbance and be calculated as TNT.

6.2 Similar color development was not observed for other nitroaromatics, e.g., RDX, HMX, nitrobenzene o-nitrotoluene, m-nitrotoluene, p-nitrotoluene, nitroglycerine, 4-amino-2,6-dinitrotoluene or 2-amino-4,6-dinitrotoluene, with the TNT method. These compounds, if present, would not contribute to the color intensity at 540 nm.

6.3 Humic organic matter in soil is extracted to some degree with the TNT method and yields a yellow color that becomes darker upon addition of the procedure's reagents. The contribution of this interference is estimated and accounted for with the background correction step outlined in this procedure.

6.4 Percentage of H_2O (ice and water) in soil samples can alter the color development time. In addition, results should be noted as wet weight.

6.5 The Griess Reaction that produces the red azo dye in the RDX determination will also produce similarly colored products if HMX, nitroglycerine, nitrocellulose, PETN, or nitroguanidine are present in the soil. This reaction keys on the presence of organo-nitrates and may give false positive results for RDX in samples from areas where destruction of explosives has occurred as a result of detonation or burning.

6.6 Humic substances that produce a background yellow color in the acetone extract are removed when the extract is acidified with acetic acid and filtered prior to RDX determination. Therefore, there is no requirement to obtain and subtract an initial absorbance from the final absorbance after color development.

7.0 SAFETY INFORMATION

7.1 Normal safety precautions associated with laboratory use of a flammable organic solvent should be employed.

7.2 Acetone and acetone solutions spilled on skin should be rapidly rinsed off with water.

7.3 Organic solvents and solvent wastes must be stored separately from strong oxidizers (e.g., nitric acid) and never mixed with them.

7.4 Flammable materials must be stored in approved containers and locations.

7.5 Eye protection must be worn at all times and by all individuals entering the field laboratory area.

8.0 INSTRUMENTS AND SUPPLIES

8.1 INSTRUMENTATION

8.1.1 Spectrophotometer – Fixed wavelength, battery-operated (e.g., HACH DR 2000) or for standard 110 v electrical if available at the project. Need a measurement path width of 25 mm (1 inch) for maximum sensitivity.

8.1.2 Balance – Accurate to 0.1 gram or better. Electrical (e.g., 110 v plug in) or battery-operated preferred. Mechanical is acceptable, but calibration check needs to be performed more frequently.

8.2 CHEMICALS AND REAGENTS

8.2.1 TNT – Traceable to a known quality SARM, provided commercially as a certified grade neat material or standard of known concentration in a known solvent. (Typically from commercial standards preparation as 1,000 ppm in acetone or methanol. Prefer from 5,000 to 10,000 ppm if available.)

8.2.2 RDX – Traceable to a known quality SARM, provided commercially as a certified grade neat material or standard of known concentration in a known compatible solvent. (Typically available as 1,000 ppm in acetonitrile; prefer from 5,000 or 10,000 ppm in acetone or methanol.)

8.2.3 Acetone – Commercially available as reagent grade from chemical suppliers. Also available off-the-shelf from local hardware or paint stores.

Caution – Acetone is a volatile solvent and must be used only in a well-ventilated, temperature-controlled environment.

Caution – Acetone is often a site contaminant of concern. As such, both analyst and sampling personnel must be aware of its presence and potential impact for cross contamination of samples destined for volatile organic analyses.

8.2.4 Glacial Acetic Acid – Reagent grade from chemical supplier.

8.2.5 Potassium Hydroxide – Reagent grade pellets.

8.2.6 Sodium Sulfite – Granular, reagent grade.

8.2.7 Zinc – Metal powder, reagent grade. Note: Must be kept dry in a dessicator.

8.2.8 Clean Sand – Sand being used for well construction or commercially available play sand that has been acetone washed.

8.2.9 Water Deionized – Commercially available from chemical supplier or off-the-shelf from local drug or food stores.

8.2.10 HACH NitroVer 3 Powder Pillow.

8.3 SUPPLIES

Caution – Acetone is a strong solvent that readily dissolves a majority of plastics. If substitutions are made to the following items, be sure they are compatible with acetone (i.e., polypropylene, nylon, glass, or Teflon®) and do not attribute any color, turbidity, or organo-nitrate materials.

8.3.1 Bottles

- 250-ml polypropylene bottles with screw-top caps
- 30-ml polypropylene bottle and screw cap

8.3.2 Squeeze wash bottles with hazard label:

- 1 liter deionized water
- 1 liter acetone

8.3.3 Serological Pipettes

- 2 ml
- 10 ml

8.3.4 Pipette Bulbs – Safety pipette filters

8.3.5 Transfer Pipettes and Tips

- 10 ml repipet sampling pipettes
- 10 ml repipet sampling pipettes Tip pkg 100

8.3.6 Volumetric Flasks

- 50 ml polypropylene
- 100 ml polypropylene
- 25 ml glass

8.3.7 Graduated Cylinders

- 10 ml polypropylene
- 50 ml polypropylene
- 100 ml polypropylene

8.3.8 Syringes

- 0.250 ml Hamilton Gastight fixed needle
- 2.50 ml Hamilton Gastight fixed needle
- 60 ml; Luer-Lock disposable syringes

8.3.8 Syringe Filters

- 25 mm; 0.45 nm nylon filters in polypropylene housing; Luer-Lock fitting (Milex SR; Whatman GD/X or equivalent)

8.3.9 Spectrophotometer Cuvetts

- 3 matched pairs; 25 mm path length compatible with spectrophotometer

8.3.10 Tongue Depressors

- 1 box

8.3.11 Desiccant system

- 1 small desiccator cabinet
- 2 silica gel desiccant cans

8.3.12 Alumina A Cartridge

- Alumina A ion exchange cartridge, 6 ml capacity

8.3.13 1,000 ml polypropylene beaker

9.0 METHOD CALIBRATION

9.1 STANDARDS PREPARATION

Four types of standards are prepared for each of the two analytical parameters. Actual concentrations and transfer volumes will be dependent on the stock solution concentration being used. The four standards to be prepared are the: working stock, calibration, Laboratory Control Sample (LCS) spiking, and Continuous Calibration Verification (CCV).

9.1.1 Working Stock Standards

9.1.1.1 SARM Source

Dry to a consistent weight overnight in a desiccator. Weigh ~0.5 g on a 4-place balance, transfer and dilute to volume in a 100 ml volumetric flask with acetone. This gives ~5,000 ppm stock solution. Store in either a sealed serum vial or a tightly capped 20 ml polypropylene or glass bottle with minimal headspace that has been blackened to keep light out.

Working Stock Solution 40 ppm

Source Concentration (ppm)	Transfer Volume[1] (ml)	Final Volume (ml acetone)	Final Concentration (ppm)
10,000[2]	0.20	50	40
5,000[2,3]	0.40	50	40
1,000[2]	1.00	25	40

[1] Transfer using the 2.5 ml gastight syringe.
[2] Commercially prepared standard source.
[3] Prepared source from either a SARM or available solid material source of known purity.

9.1.2 Calibration Standards

TNT Calibration Standards

Working Stock (ppm)	Transfer[1] Volume (ml)	Final[2] Volume (ml acetone)	Water[3] Volume (ml)	Final Conc. (ppm)
40	0.5	100	3	0.2
40	1.0	100	3	0.4
40	2.0	100	3	0.8
40	5.0	50	1.5	4.0
40	10.0	50	1.5	8.0

[1] Transfer using to deliver serological pipettes.
[2] Bring up to final volume in volumetric flask with acetone.
[3] Add defined water to volumetric flask after bringing to volume and prior to mixing, essentially giving a final volume of 103 and 51.5 ml.

RDX Calibration Standards

Working Stock (ppm)	Transfer[1] Volume (ml)	Final[2] Volume (ml acetone)	Water[3] Volume (ml)	Final Conc. (ppm)
40	1.2	100	3	0.48
40	2.5	100	3	1.0
40	2.5	50	1.5	2.0
40	5	50	1.5	4.0
40	9	50	1.5	7.2

[1] Transfer using to deliver serological pipettes.

[2] Bring up to final volume in volumetric flask with acetone.

[3] Add defined water to volumetric flask after bringing to volume and prior to mixing, essentially giving a final volume of 103 and 51.5 ml.

9.1.3 Continuing Calibration Verification Standards

TNT 0.8 ppm

Working Stock (ppm)	Transfer[1] Volume (ml)	Final[2] Volume (ml acetone)	Water[3] Volume (ml)	Final Conc. (ppm)
40	2.0	100	3	0.8

[1] Transfer using serological pipettes.

[2] Bring up to final volume in volumetric flask with acetone.

[3] Add defined water to volumetric flask after bringing to volume and prior to mixing, essentially giving a final volume of 103 ml.

RDX 2.0 ppm

Working Stock (ppm)	Transfer[1] Volume (ml)	Final[2] Volume (ml acetone)	Water[3] Volume (ml)	Final Conc. (ppm)
40	5.0	100	3	2.0

[1] Transfer using serological pipettes.

[2] Bring up to final volume in volumetric flask with acetone.

[3] Add defined water to volumetric flask after bringing to volume and prior to mixing, essentially giving a final volume of 103 ml.

9.1.4 Laboratory Control Standards

The RDX and TNT LCS are prepared at the same time on the same aliquot of clean sand.

Sand Weight (g)	RDX Transfer Volume/Conc. (ml/ppm)	TNT Transfer Volume/Conc. (ml/ppm)	Water Volume (ml)	Acetone Volume (ml)	Final TNT/RDX Conc. PRM
20	5.0/40	2.0/40	3	93	0.8/2.0

Note: Typically the LCS is allowed to stand for 1 hour after standard spiking and prior to water and solvent addition to allow the solvent to evaporate and the compound to come into contact with the soil. However, this is not done in this procedure due to the large volume of spiking solutions being added.

9.2 CALIBRATION

9.2.1 TNT Calibration

1. Zero spectrophotometer reading with an acetone blank.
2. Place a 25 ml aliquot of each prepared standard in a 30-ml bottle.
3. Add 4-5 KOH pellets and 0.5 g (excess) of Na_2SO_3 to each standard.
4. Cap bottle, shake, and allow a minimum of 10 minutes for color development.
5. Filter through syringe filter into cuvett and read absorbance at 540 nm.

9.2.2 RDX

1. To a measured 20 ml aliquot of each prepared standard in a 30 ml bottle, add 2 ml of acetic acid (using 10 ml sampling pipetor set to 2ml), mix and transfer to a prepared 60 ml syringe, and filter unit containing ~0.3g of zinc powder.

2. Twelve seconds after pouring the standard solution into the syringe, insert the plunger and begin filtering the derivitized extract through the filter back into the original 30 ml container. Filtration must be continuous once initiated and at a rate that does not allow the extract to be in contact with the zinc for more than 25 seconds total.

3. Measure and transfer 5 ml of the filtered extract (using a 10 ml sampling pipetor set to 5ml) to a second 30 ml bottle containing 20 ml of DI water (measure and transfer using a 10 ml sampling pipetor).

4. Add content of one NitroVer 3 powder pillow.

5. Cap, shake, and allow a minimum of 15 minutes for color development.

6. Zero the spectrophotometer with DI water.

7. Measure absorbance of each standard at 507 nm.

9.3 CALCULATIONS AND ACCEPTANCE CRITERIA

9.3.1 Response Factor

$$RF = \frac{CONC_{STD}}{ASB_{STD}}$$

where

RF = Response factor for a given standard as mg/l compound per absorbance unit,
$CONC_{STD}$ = Concentration of measured standard as mg/l,
ASB_{STD} = Absorbance reading of spectrophotometer for measured standard.

9.3.2 Relative Standard Deviation (% RSD)

$$\%RSD = \frac{RF_{SO}}{RF_{AVG}} \times 100$$

where

%RSD = Relative standard deviation as a percentage,
RF_{SO} = The standard deviation of all the RFs used in the calibration curve (N is equal to 5 if all points are used or 4 if one point is eliminated),
RF_{AVG} = Average response factor for all the RFs used in the calibration curve.

9.3.3 Calibration Criteria

The calibration curve is acceptable if the %RSD is < 25%. Note the use of all 5 points is preferable; however, the elimination of one point and use of 4 points is acceptable.

9.4 CONTINUING CALIBRATION VERIFICATION (CCV)

9.4.1 A CCV needs to be analyzed under the following circumstances:

- Start and end of each day's work for each compound
- At the completion of a compound's analytical sequence prior to changing the spectrophotometer wavelength setting
- Prior to the start of the compound's analysis sequence after changing the spectrophotometer wavelength setting.

9.4.2 CCV Analysis

The CCV standard will be prepared as defined in Section 9.1.3 for the applicable compound. The CCV standard will be developed according to the steps defined in Section 9.2.1 for TNT and 9.2.2 for RDX.

9.4.3 CCV Calculations and Acceptance Criteria

Acceptance that the derivitization, color development, and spectrophotometric system are in control is based on the comparability of the found CCV concentration to the expected CCV concentration (i.e., percent recovery; %R).

$$\%R = \frac{CCV_{MES}}{CCV_{EXP}} \times 100$$

where

%R = Percent recovered,
CCV_{MES} = Measured concentration of CCV using the RF from the applicable calibration curve,
CCV_{RXP} = Concentration of the prepared standard used for the CCV.

A %R of 75-125% is acceptable, and the system has been demonstrated to be in control. Recoveries outside this range will require appropriate corrective action and evaluation of results for affected samples.

10.0 SAMPLE PREPARATION AND ANALYSIS

10.1 EXPENDABLE MATERIALS

The following expendable materials are needed for the analysis of a sample for both TNT and RDX.

- 1 – 250 ml polypropylene bottle with screw cap
- 3 – 60 ml syringes with fitted filters
- 3 – syringe filters
- 3 – 30 ml polypropylene bottles with screw cap

- KOH pellets
- Sodium sulfite
- Zinc powder
- 1 – HACH NitroVer 3 powder pillow

10.2 SAMPLE EXTRACTION

10.2.1 LCS and Method Blank

Weigh two 20 g aliquots of clean sand into two separate 250 ml bottles. Mark one bottle as the method blank and leave unspiked adding only 3 ml water and 100 ml acetone. Mark the second bottle as the LCS and prepare as defined in Section 9.1.4.

10.2.2 Sample Preparation

To an appropriately marked 250 ml bottle, weigh 20 g $\pm$ 0.5 g of soil/sediment sample and record to the nearest 0.1 g. Measure and add 100 ml of acetone to the soil cap and shake for a minimum of 3 minutes. Allow the bottle to set a reasonable amount of time and let the soil/sediment settle out.

For the TNT background color measurement and RDX analysis, pull 40 ml of acetone from above the sediment up through the filter into Syringe 1.

10.3 TNT ANALYSIS

10.3.1 Color Development

For TNT analysis, remove the syringe plunger from Syringe 2 and place from 4 to 5 KOH pellets and ~0.5 g of Na_2SO_3 into the syringe barrel and replace the plunger. Place the tip of the syringe filter into the acetone extract above the sediment and pull 25 ml of extract into the syringe. Shake and allow a minimum of 10 minutes for color development. (Note: color development rate can be temperature dependent; therefore, it may be necessary to allow more development time during cold weather.)

10.3.2 Background Measurement

Remove the filter from Syringe 1 (Section 10.2.2) and fill the 10 ml cuvett ¾ full. Measure the absorbance of the sample's background color at 540 nm on the spectrophotometer. Record the absorbance in the appropriate logbook form column.

10.3.3 TNT Color Measurement

After the color development time has elapsed, change the filter on the TNT color syringe (Syringe 2). Filter the colored extract into the 10 ml cuvett until it is ¾ full. Measure the absorbance of the sample at 540 nm on the spectrophotometer. Record the absorbance in the logbook.
Calculate the TNT concentration based on the formula in Section 11.1 and the applicable Average Response Factor from the applicable calibration curve.

10.4 RDX ANALYSIS

10.4.1 Ion Exchange

Remove the filter from Syringe 1 (Section 10.2.2) and use the extract to fill the reservoir above the solid phase in the Supeleo Alumina-A ion exchange tube. (Note: Flow of the extract through the ion column should not exceed 5 ml/min. For the defined tubes, the acetone extract typically has a flow rate of from 2 to 3 mls/min (an occasional check of the flow rate is recommended).

Discard the first 2 to 3 ml that passed through the column. Collect the next 20 ml of extract that passes through the column. Pour a measured 20 ml of the ion exchanged extract into a 30 ml bottle.

10.4.2 Derivitization

Add 2 ml of glacial acetic acid to the 20 mls of ion exchanged extract, using a preset and dedicated 10 ml sampling pipetor. (Note: In cold weather temperature <40°F arrangements need to be made to keep the acetic acid warm to keep it from crystallizing.) Transfer the entire contents of the 30 ml bottle to a prepared syringe containing ~0.3 g of dry zinc powder. Pour it into the barrel through the top with the plunger removed. After 12 seconds, replace the syringe plunger and begin to filter the derivitized extract back into the 30 ml bottle. The filtration needs to be consistent in starting at 12 seconds and not taking more than from 10 to 15 seconds to complete.

10.4.3 RDX Color Development and Measurement

Measure and transfer 5 ml of the derivitized extract, using a dedicated preset sampling pipetor, to a second 30 ml bottle with 20 ml of DI water. Add the contents of one NitroVer 3 powder pillow, cap, mix, and allow 15 minutes for color development. (Note: set the remaining derivatized sample aside for re-analysis or dilutions, if necessary.)

After the color has developed, measure the absorbance at 507 nm on the spectrophotometer. Calculate the RDX concentration based on the Average Response Factor for the applicable calibration curve using the calculations found in Section 11.2.

11.0 CALCULATIONS

11.1 TNT CONCENTRATION

$$TNT_{CONC} = \frac{(ABS_{SMP} - 2XABS_{BKG})\ X\ RF_{AVG}\ X\ DF\ X\ 100}{WGT_{SMP}}$$

Where

TNT_{CONC} = Concentration of TNT in sample as ppm wet weight

ASB_{SMP} = Absorbance reading for the color developed sample extract

ASB_{BKG} = Absorbance reading for the background or non-color developed sample extract

RF_{AVG} = Average response factor for applicable calibration curve

DF = Dilution factor (when applicable)

WGT_{SMP} = Weight of sample aliquot used for extraction and analysis.

11.2 RDX CONCENTRATION

$$RDX_{CONC} = \frac{ASB_{SMP} \text{ X } RF_{AVG} \text{ X DF X } 100}{WGT_{SMP}}$$

Where

RDX_{CONC} = Concentration of RDX in the sample as ppm wet weight
ASB_{SMP} = Absorbance reading for the color developed sample extract
RF_{AVG} = Average response factor for applicable calibration curve
DF = Dilution factor (when applicable)
WGT_{SMP} = Weight of sample aliquot used for extraction and analysis.

12.0 QUALITY CONTROL

12.1 METHOD BLANK (MB)

Prepared as defined in Section 10.2.1. A MB is analyzed daily with first batch of samples processed and at a frequency of 1 per 20 samples thereafter. The method blank is acceptable when the calculated concentration does not exceed 1.0 ppm for TNT or 2.0 ppm for RDX.

12.2 LABORATORY CONTROL SAMPLE (LCS)

Prepared as defined in Section 10.2.2. The LCS is analyzed daily, with first batch of samples processed at a frequency of 1 per 20 samples thereafter. Acceptable if %R is 60-140%.

12.3 DUPLICATE ANALYSIS (DUP)

One laboratory duplicate analysis is performed for every 20 field samples analyzed. Samples for duplicate analysis can be selected at a later time based on samples having a positive result. Acceptable if RPD values are <50% for samples with concentrations >10 ppm and <90% for sample concentrations <10 ppm. (Note: Method resolution needs to be taken into consideration before accepting or rejecting duplicate analysis.)

12.4 REPORTING LIMIT

The lower reporting limit is calculated based on the concentration of the lowest standard used in the applicable calibration curve adjusted for the extraction volume and sample weight.

12.5 QC SUMMARY

QC Parameter	Frequency	Acceptance Criteria
Calibration Curve	Start of project; major change to instrument or procedure; failure of CCV	% RSD < 25%
CCV	Start of day End of day Before and after changing spectrophotometer wavelength	%R 75 ± 125%
Method Blank	1 per day and as needed to achieve 1 per 20 ratio	< 1 ppm TNT < 2 ppm RDX
LCS	1 per day and as needed to achieve 1 per 20 ratio	%R 60-140%
Analytical Duplicate	1 per 20 samples; preferable on samples with positive hits	Concentrations > 10 ppm RPD < 50% Concentrations < 10 ppm RPD < 90%

13.0 ANALYTICAL WASTE

The major waste generated during the implementation of this procedure will be extract solutions and colored complex solutions. These solutions are caustic flammable solvent wastes and should be handled as such. These wastes must be properly containerized and labeled. Coordination must be established with the site waste manager, and disposal must be in accordance with the site Waste Management Plan.

Other general waste generated during the analysis should not represent a chemical or biological hazard, however, proper site handling and disposal procedures should be implemented.

14.0 EQUIPMENT AND SUPPLIES

14.1 NONEXPENDABLE

Item	Supplier	Catalog No.	Units	Order
DR2010 Spectrophotometer	HACH	DR2010	ea	1
10 ml DR2010 Matched Cuvetts	HACH	24954-02	pair	3
Top-loading Balance	Cole Palmer	E11300-06	ea	1
10 ml Polypropylene Serological pipettes	Fisher	13-662-12D	ea	2
Pipette Safety Bulb	Fisher	13-681-51	ea	3
10 ml Sampling Respirator	Fisher	13-689-26	ea	3
10 ml Polypropylene Graduated Cylinder	Fisher	08-572A	ea	8
50 ml Polypropylene Graduated Cylinder	Fisher	08-572C	ea	3
100 ml Polypropylene Graduated Cylinder	Fisher	08-572D	ea	3
Dessicator Cabinet	Fisher	08-647-20	ea	1
Deseccant Cans	Fisher	01-952-5	ea	2
50 ml Propylene Volumetric Flask	Fisher	10-198-50A	ea	5
100 ml Propylene Volumetric Flask	Fisher	10-198-50B	ea	5
25 ml Glass Volumetric Flask	Fisher	10-200A	ea	3
Acetone Washbottle	Fisher	03-409-23A	pkg/6	1
Water Washbottle	Fisher	03-409-23G	pkg/6	1
0.250 ml Hamilton Gastight Syringe	Fisher	13-684-102	ea	2
2.5 ml Hamilton Gastight Syringe	Fisher	13-684-110	ea	3

14.2 EXPENDABLE

Item	Supplier	Catalog No.	Units	Order
60 ml Disposable Syringe Luer-Lock	Fisher	14-823-2D	Case/120	3
25 mm; 0.45 Nylon; Polypropylene Housing Syringe Filters	Fisher	09-740-35Q	case/300	2
Acetone	local paint or hardware supplier		gal.	3
Zinc Powder Technical Grade	Fisher	25-500	500g	1
DI Water	Fisher	W2-4	Ll	2
Sodium Sulfide Technical; Granular	Fisher	5447-500	500 g	1
Potassium Hydroxide Technical; Pellets	Fisher	P250-500	500 g	1
Acetic Acid Glacial	Fisher	A385-500	500 ml	1
Polypropylene Bottles 250 ml	Fisher	03-083-52	case/72	1
Polypropylene Bottles 30 ml	Fisher	03-083-49	case/72	1
Alumina A SPME Column	Supeko	5-70834	30/pkg	4
25 ml NitroVer3 Powder Pillow	HACH	14034-99	100/pkg	2
Sampling Respirator Tips	Fisher	D7-101	100/pkg	2
RDX Standard 1,000 ppm in Acetonitrile	Accustandard		ea	4
TNT Standard 1,000 ppm in Methanol	Accustandard		ea	4
Tongue Depressors	Fisher	01-346	1,200/box	1
100 ml Tripour Polypropylene Beaker	Fisher	02-593-50F	pkg/100	1

APPENDIX C
Site-Specific Health & Safety Plan

HEALTH AND SAFETY PLAN

SAMPLING OF SOILS BELOW FLOOR SLABS AT LLs 2,3,4 AND EXCAVATION AND TRANSPORTATION OF CONTAMINATED SOILS TO LOAD LINE 4 (BUILDINGS G-1, G-1A AND G-3)

Ravenna Army Ammunition Plant, OH

February 2008

URS

URS Corporation – Ohio
1375 Euclid Avenue
Suite 600
Cleveland, OH 44115

Disclaimer:

This Health and Safety Plan, and each of its provisions, is applicable only to, and for use only by, URS Corporation, its affiliates, and its subcontractors. Any use of this Plan by other parties, including, without limitation, third party contractors on projects where URS is providing engineering, construction management, or similar services, without the express written permission of URS, will be at that party's sole risk, and URS Corporation shall have no responsibility therefore. The existence and use of this Plan by URS shall not be deemed an admission or evidence of any acceptance of any safety responsibility by URS for other parties unless such responsibility is expressly assumed in writing by URS in a specific project contract.

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HEALTH AND SAFETY PLAN
Ravenna Army Ammunition Plant, OH
8451 State Route 5, Ravenna, OH 44266

		PHONE
Project Number:	13812319	
Project Manager:	Jo Ann Bartsch	Office: 216-622-2229
Site Manager:	Stan Levenger	Cell: 330-687-1816
Site Safety Officer:	Stan Levenger	Cell: 330-687-1816
Plan Preparer:	Katy Alfaro	Office 216-622-2217
Preparation Date:	**01/21/2008**	
Expiration Date:	**01/21/2009**	

APPROVALS

Health, Safety, and Environment Representative:

2/6/2008
(DATE)

Revised 4/20/2008 5/20/2008

UXO Program Safety Manager:

Morris M. Reed
Morris M. Reed 28 May. 08
February 5, 2008
(DATE)

Regional Health, Safety, and Environment Manager:

2/6/08
CIH/CSP **(DATE)**
Revised 5/22/08

Project Manager:

2/7/08
(DATE)

04/21 revisions ok. 5/20/08

This Health and Safety Plan is valid only for this specific project as described in Section 3.0. It is not to be used for other projects or subsequent phases of this project without the written approval of the Regional Health, Safety, and Environment Manager. A copy of this plan is to be maintained at the site at all times.

HEALTH AND SAFETY PLAN
TABLE OF CONTENTS

Section **Page**

Attachments

GLOSSARY OF TERMS, ACRONYMS, AND ABBREVIATIONS

°C	degrees centigrade
°F	degrees Fahrenheit
ACGIH	American Conference of Governmental Industrial Hygienists
analyzer	field instrument described in Section 6.1
atm	atmosphere
C	ceiling
Carcinogen	a substance that can cause cancer
cc	cubic centimeter
CGI	combustible gas indicator
CNS	central nervous system
CSP	Certified Safety Professional
CRZ	contaminant reduction zone
DERA	Designated Emergency Response Authority
DOT	Department of Transportation
ESLI	End-of-Service-Life Indicator
eV	electron volts
EZ	Exclusion Zone
FID	flame ionization detector
FSHP	Facility Safety and Health Plan (RVAAP)
HEPA	high-efficiency particular arrestor
HNu	ionizing radiation detection device
HSM	Health and Safety Manager
HSP	Health and Safety Plan
IRP	Installation Restoration Program
kg	kilogram
LEL	lower explosive limit
Lpm	liters per minute
m	meter
MEC	Munitions and Explosives of Concern
mg	milligram
mg/M^3	milligrams per cubic meter
ml	milliliter
mm	millimeter
MSDS	Material Safety Data Sheet
ND	not detected
NIOSH	National Institute for Occupational Safety and Health

GLOSSARY OF TERMS, ACRONYMS, AND ABBREVIATIONS (CONTINUED)

O_2	oxygen
OBZ	operator's breathing zone
OEL	occupational exposure limit
OSHA	Occupational Safety and Health Administration
OVA	organic vapor analyzer
OVM	organic vapor monitor
PCB	polychlorinated biphenyl (Aroclor)
PEL	permissible exposure limit
PID	photoionization detector
PM	project manager
ppb	parts per billion
PPE	personal protective equipment
ppm	parts per million
RDX	hexahydro-1,3,5-trinitro-1,35-triazine
REL	recommended exposure limit
RSO	Radiation Safety Officer
RHSEM	Regional Health, Safety, and Environment Manager
RTLS	Ravenna Training and Logistics Site
RVAAP	Ravenna Army Ammunition Plant
SMS	Safety Management Standard
SSO	Site Safety Officer
SSR	Subcontractor's Safety Representative
STEL	short term exposure limit
TLV	threshold limit value
TNT	2,4,6-trinitrotoluene
TWA	time-weighted average
UEL	upper explosive limit
URS	URS Corporation and subsidiaries
USP&FO	United States Property and Fiscal Officer
VOC	volatile organic compound

1.0 PLAN-AT-A-GLANCE

HEALTH AND SAFETY PLAN SUMMARY SHEET

THIS SUMMARY SHEET IS PROVIDED AS A QUICK-REFERENCE/OVERVIEW ONLY. THE REMAINDER OF THIS SITE-SPECIFIC HEALTH AND SAFETY PLAN (HSP) IS INTEGRAL TO THE SAFE CONDUCT OF SITE OPERATIONS AND MUST BE APPLIED IN ITS ENTIRETY.

EMERGENCY INFORMATION

POST 1 WILL BE NOTIFIED FIRST IN THE EVENT OF A FIRE OR MEDICAL EMERGENCY

Police:	Post 1/Securitas	330-358-2017
	MKM Engineers	330-358-3005
Ambulance:	Ravenna Borowski Funeral Home	**330- 296-4541**
	North East Ambulance Services	330- 872-5050
Fire:	City of Ravenna Fire Department	330-297-5738
Hospital:	Robinson Memorial , Ravenna (See Attachment A for Map and directions)	330-297-0811
Occupational Clinic:	Medical Center One-Kent (See Attachment A for Map and directions)	330-678-4380
Incident Notification Call Chain		
URS Project Manager:	Jo Ann Bartsch	Office :216-622-2229 Cell: 440-376-2875
URS Site Safety Officer	Stan Levenger	Cell 330-687-1816 Office 614-726-3575
URS UXO Program Safety Manager	Mac Reed	Office 615.224.2148 Cell 615.618.5272
URS Health, Safety, and Environment Representative:	James Anderson	Cell: 440-241-6972 Office: 216- 622-2384
URS Regional Health, Safety, and Environment Manager:	Cece Weldon	Office: 248-204-4252 Cell: 248-752-3405
RVAAP U.S Army Facility Manager	Mark Patterson	330-358-7311

URS Occupational Nurse (Jeanette Schrimsher)	**1-866-326-7321 /512-656-0203**
National Response Center:	**(800) 424-8802**

HOSPITAL DIRECTIONS:

Robinson Memorial Hospital is located approximately 32 km (20 miles) from the site at 6847 N. Chestnut Street in Ravenna, Oh. It can be reached by taking Highway 5 E. approximately 11 km (7 miles), Highway 5 approximately 3.2 km (2 miles), Highway 59, then right onto highway 44 (Chestnut Street)

Additional information concerning emergency procedures is located in Section 12.0, and the hospital route map is located in Attachment A. A copy of the hospital route map must be readily available in each site vehicle that may be used to transport accident victims to the hospital.

OCCUPATIONAL CLINIC DIRECTIONS:

Start out going WEST on RAVENNA WARREN RD / OH-5 W toward NEWTON FALLS RD. Continue to follow OH-5 W (5.9). Stay STRAIGHT to go onto OH-59 W (6.1 miles). End at 1993 State Route 59, Kent, OH 44240-7609, US

CONSTITUENTS OF CONCERN

- TNT, TNB
- Heavy Metals
- RDX
- VOCs

- SVOCs

- PCBs (Aroclors)

Additional information regarding site history, constituents of concern, and scope of work activities is located in sections 2.0 and 5.0.

PROJECT HAZARD ANALYSIS

Task	Chemical Hzds.	Heat/Cold Stress	Noise	Slip/Trip/ Fall	Lifting Hzds.	Mechanical Hzds.	Electro-cution	Explosi-on	Excav-ation
1. Field Screening for Explosives	**Med**	**Med**	**n/a**	**Med**	**Low**	**n/a**	**n/a**	**Med**	**n/a**
2. Soil Sampling using step probes	**Med**	**Med**	**n/a**	**Med**	**Low**	**Low**	**n/a**	**Med**	**n/a**
3. Surface Debris Sampling	**Med**	**Med**	**n/a**	**Med**	**Low**	**Low**	**n/a**	**Med**	**n/a**
4. Excavation (removal of contaminated soils)	**Med**	**Med**	**High**	**Med**	**Low**	**Med**	**Low**	**Med**	**High**
5. Transportation of contaminated soils to Load Line4	**Med**	**Low**	**Med**	**Low**	**Low**	**Low**	**Low**	**Low**	**n/a**
6. Investigation – Derived Waste Handling	**Med**	**Med**	**Low**	**Med**	**High**	**n/a**	**n/a**	**Med**	**n/a**

High - Exposure likely more than 50% of the time	Med - Exposure likely 10 to 50% of the time
Low - Exposure likely less than 10% of the time	n/a – Exposure not anticipated

Additional information concerning project hazards and their control can be found in Section 5.0.

Task	<u>Minimum</u> Protective Clothing/Equipment Requirements
1. Field Screening for Explosives	Steel-toed boots, hard hat (as needed), safety glasses, long-sleeve shirts, work gloves, nitrile gloves when handling potentially contaminated materials, surgical nitriles for handling samples.
2. Soil Sampling using step probes	Steel-toed boots, hard hat, safety glasses, long-sleeve shirts, work gloves, nitrile gloves when handling potentially contaminated materials, surgical nitriles for handling samples, safety vest.
3. Surface Debris Sampling	Steel-toed boots, hard hat, safety glasses, long-sleeve shirts, work gloves, nitrile gloves when handling potentially contaminated materials, surgical nitriles for handling samples, safety vest
4. Excavation	Steel-toed boots, hard hat, safety glasses, hearing protection, long-sleeve shirts, work gloves, nitrile gloves when handling potentially contaminated materials, surgical nitriles for handling samples, safety vest. Mini Ram® monitoring equipment
.5. Transportation of Contaminated soils to Load Line4	Steel-toed boots, hard hat, safety glasses, hearing protection, long-sleeve shirts, work gloves, nitrile gloves when handling potentially contaminated materials, safety vest
6. Investigation – Derived Waste Handling	Steel-toed boots, hard hat, safety glasses, hearing protection, work gloves, nitrile gloves when handling potentially contaminated materials, surgical nitriles for handling samples, safety vest

The HSP Preparer has conducted a Hazard Assessment for this project based on information provided by the Project Manager, in accordance with 29 CFR 1910.132(d).

For more information on Personal Protective Equipment (PPE) and respiratory protection requirements, see the Action Levels table (Page 5) and Section 7.0.

ENGINEERING CONTROLS TO BE USED (AS APPLICABLE)

- Water spray for dust suppression (potable water will be used)
- Natural wind forces to reduce exposure to airborne contaminants
- Forced air ventilation (fans) to reduce potential airborne exposures
- Light-colored PPE to reduce solar load for heat stress control
- Dining canopy to provide shaded work/rest area for heat stress control

For more information, see Section 5.0.

INSTRUMENTATION TO BE USED

__ HNu Photoionization Detector (PID) w/ __ eV probe
__ Organic Vapor Monitor (OVM), PID w/ __ eV lamp
__ Photovac Microtip PID w/ __ eV lamp
X Multi RAE PID w/ 10.6 eV lamp
__ Combustible Gas/O_2 Indicator
__ Foxboro Organic Vapor Analyzer (OVA) Flame Ionization Detector (FID)
__ Miniram Real-time Dust Monitor
X Other ______ Mini-Ram **(dust monitoring Equipment)____________**

For more information, see Section 6.0

PERSONAL EXPOSURE SAMPLING

__ Will be conducted
X Will be conducted if PID readings require the use of respiratory protection as described in the Action Level Table (page 4) and in Section 6.1.1
__ Is not anticipated

For more information on monitoring, see Section 6.0.

HAZ-COM MATERIALS INVENTORY

- **Acetone**
- **Liquinox (decontamination)**
- **Isobutylene (calibration gas)**
- **Gasoline (equipment fuel)**
- **Methane (calibration gas)**
- **TNT Soil test Kit**
- **RDX 20 W/ extraction Jar Kit**

Table 1- ACTION LEVELS (for Photoionization Detector)

Analyzer Reading	Location	Duration	Action	Personal Protective Equipment
<1 ppm	Point of Operations/ Release Source point / OBZ	NA	Continue monitoring at 15 minute intervals.	Minimum Site Ensemble (Hardhat, Steel-toed Boots, Eye Protection, Safety Vest, Long-sleeved shirt, Gloves)
>1 ppm 1st Action Level	OBZ	> 1 minute	Use colorimetric tube or benzene specific monitor to check for benzene; if not present at or above 0.5 ppm continue monitoring and the action level is 25 ppm (see below).	Minimum Site Ensemble
Action Levels below assume benzene is present.				
1 ppm benzene	OBZ	> 1 minute	Monitor OBZ; don protective clothing; establish work zones; provide respiratory protection; establish decon area.	Minimum Site Ensemble, PLUS: Tyvek coveralls, Nitrile Outer Gloves, (if product or product saturated soils are encountered), Nitrile Inner Gloves, Chemical Resistant Steel-toed Boots (or chemical resistant covers over steel-toed boots) at discretion of SSO depending on the potential for exposure; half-face respirators with organic vapor cartridges
>5 ppm benzene (2nd Action Level)	OBZ	> 1 minute	Stop work; move upwind while vapors dissipate. If elevated levels remain, cover excavation and spoils, evacuate upwind and notify RHSEM or PM.	As specified by RHSEM
Action Levels below assume benzene is not detected.				
<25 ppm	Point of Operations/ Release Source point/ OBZ	NA	Continue monitoring at 15 minute intervals.	Minimum Site Ensemble
>25 ppm (3rd Action Level)	Point of Operations/ Release Source point	>1 minute	Monitor OBZ; don protective clothing; establish work zones	Minimum Site Ensemble, PLUS: Nitrile Outer Gloves, (if product or product saturated soils are encountered), and Nitrile Inner Gloves, Chemical Resistant Steel-toed Boots (or chemical resistant covers over steel-toed boots) at discretion of SSO depending on the potential for exposure.
>25 ppm	OBZ	>1 minute	Provide respiratory protection.	Add half-face respirators with organic vapor cartridges
>100 ppm (4th Action Level)	OBZ	>1 minute	Stop work; move upwind while vapors dissipate. If elevated levels remain, evacuate upwind and notify RHSEM or PM.	As specified by RHSEM

* Substitute poly-coated Tyvek® if there is potential for contact with liquids (groundwater, mud, etc).

OBZ = Operator's Breathing Zone

ppm = parts per million

ACTION LEVELS (LELs- Combustible Gases- MultiRae)

LEL Reading	Location	Action
<10% LEL	Point of Operations/General Work Area	Continue site operations and continue periodic monitoring
10-20% LEL	Point of Operations/General Work Area	Continue site operations and perform continuous monitoring
>20% LEL	Point of Operations/General Work Area	Shutdown operations, evaluate source, ventilate work area

LEL = Lower Explosive Limit

For additional information on Action Levels and their implementation, see Sections 6.0 and 7.0

ACTION LEVELS (Airborne hazards)

Hazard or Measured Parameter	Area	Interval	Limit	Action
Visible airborne dust	All	Continuously	Visible dust generation	Stop work, use dust suppression techniques

		>5 minutes	1mg/m3	Upgrade PPE Level C
Visible contamination	All	5 minutes/ Continuously	Visible contamination of skin or personal clothing	Upgrade PPE to preclude contact; Level C protection: disposal coveralls, boot covers, etc.

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1 HEALTH AND SAFETY EQUIPMENT LIST

Required	**Not Required**	**As needed**	
x			URS SMSs (relevant to project - see next page)
x			Occupational Safety and Health Administration (OSHA) “Safety on the Job” Posters
x			Hardhats
x			Safety glasses
		x	Ear plugs or muffs
	x		Cotton coveralls
x			Traffic safety vest
		x	Tyvek® coveralls
		x	Polycoated Tyvek® Q-23 coveralls
x			Steel-toed boots
		x	Chemical-resistant steel-toed boots or chemical-resistant boot covers
x			Work gloves
x			Nitrile outer gloves
x			Surgical nitrile inner gloves
x			Plastic sheeting (visqueen)
		x	55-gallon 17-H drums (for contaminated solids)
	x		55-gallon 17-E drums (for liquids)
	x		Drum liners
	x		Barricade tape and barricades
	x		Wash tubs and scrub brushes
x			Decontamination solution (i.e., TSP)
	x		Folding chairs
	x		5- or 10-gallon portable eyewash

	x		Respirator sanitizing equipment
x			First aid kit with eye wash
x			Drinking water
		x	Gatorade or similar drink
x			Type ABC fire extinguishers
		x	Half-face respirators approved by National Institute for Occupational Safety and Health (NIOSH)
		x	Full-face respirators (NIOSH-approved)
		x	Respirator cartridges **Organic Vapors -Particulates**
x			Multi Rae/lamp 10.6 eV and calibration kit
	x		Combustible gas indicator (CGI) and calibration kit
		x	Garden sprayer
x			Compressed gas horn
		x	Duct tape
x			Paper towels and hand soap
x			Basic Spill Kit
x			Plastic garbage bags
		x	Broom and/or shovel
		x	Liqui-Nox
x			Mini –Ram monitoring equipment

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URS SAFETY MANAGEMENT STANDARDS CHECKLIST

Copies of all the below listed SMSs are found in Attachment F. The SMSs in black are required for all sites, the Project Manager is required to indicate the additional SMSs that are specific to this site or task (red).

- ☑ **SMS 1 - Inspections by Regulatory Agencies**
- ☑ **SMS 2 - Worker Right to Know**
- ☑ **SMS 3 - Emergency Action Plans**
- ☑ **SMS 9 - Corrosive and Reactive Materials**
- ☑ **SMS 12 - Electrical Safety**
- ☑ ***SMS 13 - Excavation Safety***
- ☑ **SMS 14 - Fire Prevention**
- ☑ **SMS 15 - Flammable and Combustible Liquids and Gases**
- ☑ **SMS 16 - Hand Tools and Portable Equipment**
- ☑ **SMS 18 - Heat Stress**
- ☑ ***SMS 19 - Heavy Equipment Operations***
- ☐ ***SMS 20 - Hot Work***
- ☑ **SMS 21 - Housekeeping**
- ☑ **SMS 24 - Medical Screening and Surveillance**
- ☑ **SMS 25 - New Employee Health and Safety Orientation**
- ☑ ***SMS 26 - Noise and Hearing Conservation***
- ☑ **SMS 29 - Personal Protective Equipment**
- ☑ ***SMS 30 - Sanitation***
- ☑ **SMS 32 - Traffic Control**
- ☑ ***SMS 34 - Utility Clearances and Isolation***
- ☑ ***SMS 39 - Munitions Response/Munitions and Explosives of Concern***
- ☑ ***SMS 42 - Respiratory Protection***
- ☑ **SMS 43 - Personal Monitoring (Industrial Hygiene)**
- ☑ **SMS 46 - Subcontractor Health and Safety Requirements**
- ☑ **SMS 47 - Biological Hazards**
- ☑ **SMS 49 - Incident Reporting**

- ☑ **SMS 50 - Specific Chemical Hazards**
- ☑ **SMS 51 - Blood-borne Pathogens**
- ☑ **SMS 57 - Vehicle Safety Program**
- ☑ **SMS 59 - Cold Stress**
- ☑ **SMS 64 - Hand Safety**
- ☑ **SMS 65 - Injury Management**
- ☑ **SMS 66 - Incident Investigation**
- ☑ **SMS 69 - Manual Material Handling**
- ☑ **SMS 72 - Behavior Based Safety**
- ☑ **SMS 78 - Short Service Employee**
- ☑ **SMS 84 - Lone Worker Safety**

These SMSs are available on the URS Health, safety, and environment Web site. Access the Web site from the SoURSe or through the Internet (www.urshse).

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2.0 FACILITY BACKGROUND/WORK PLAN

2.1 SITE HISTORY

The RVAAP is located in northeastern Ohio within Portage and Trumbull Counties, approximately 1.6 km (1 mile) northwest of the city of Newton Falls and 4.8 km (3 miles) east-northeast of the city of Ravenna. The facility is a parcel of property approximately 17.7 kilometers (11 miles) long and 5.6 kilometers (3.5 miles) wide bounded by State Route 5, the Michael J. Kirwan Reservoir, and the CSX System Railroad on the south; Garret, McCormick, and Berry roads on the west; the Norfolk Southern Railroad on the north; and State Route 534 on the east. As of February 2006, a total of 20,403 acres of the former 21,683-acre RVAAP have been transferred to the United States Property and Fiscal Officer (USP&FO) for Ohio and subsequently licensed to the Ohio Army National Guard for use as a training site. Currently, RVAAP consists of 1,280 acres in several distinct parcels scattered throughout the confines of the Ravenna Training and Logistics Site (RTLS). The RVAAP's remaining parcels of land are located completely within the RTLS. The RTLS did not exist when RVAAP was operational, and the entire 21,683-acre parcel was a government-owned, contractor-operated industrial facility. The RVAAP Installation Restoration Program (IRP) encompasses investigation and cleanup of past activities over the entire 21,683 acres of the former RVAAP, and, therefore, references to the RVAAP in this document are considered to be inclusive of the historical extent of the RVAAP, which is inclusive of the combined acreages of the current RTLS and RVAAP, unless otherwise specifically stated.

The installation was active from 1941 to 1992. Activities included loading, assembling, storing, and packing military ammunition; demilitarization of munitions; production of ammonium nitrate fertilizer; disposal of "off-spec" munitions. Various munitions were handled on the installation including artillery rounds of 90mm or more and bombs up to 2,000 pounds.

2.2 PURPOSE AND SCOPE OF WORK

URS will perform field investigation at Load Lines 2, 3, and 4. Load lines 1 through 4 were used to melt and load 2,4,6-trinitrotoluene (TNT), Amatol and Composition B into large-caliber shells and bombs. Composition B is a mixture of hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX) and TNT. Amatol is a mixture of TNT and ammonium nitrate. The operations in these load lines produced explosive dust, spills and vapors collected on the walls and floors of each building.

The removal of the majority of buildings down to the floor slabs at load lines 2,3 and 4 has been completed by a contractor (MKM Engineers, Inc./PIKA). MKM/PIKA will be removing floor these floor slabs at 105 buildings. Their work is scheduled to begin in early February.

The extent of residual contamination in the earthfill below the floor slabs, and associated remediation, has not been determined to any degree of confidence.

URS' scope of work includes the assessment and remediation of soils below floor slabs at Load Lines 2, 3 and 4 and excavation and transportation of contaminated soils encountered below floor slabs to temporary covered storage areas, Buildings G-1, G-1A and G-3 at Load Line 4.

Work will begin at Load Line 4 since that load line us thought to have the least potential for significant residual contamination in earthfill below floor slabs. Work will then progress to Load Line 3, and then to Load Line 2. Excavations are anticipated to be no more than 4 feet.

3.0 APPLICABILITY

The purpose of this HSP, which was developed specifically for operations at the Ravenna Army Ammunition Plant site Ravenna, OH, is to assign responsibilities, establish personal protection standards and mandatory safety procedures, and provide for contingencies that may arise while operations are being conducted at the site. This HSP complies with, but does not replace, Federal Health and Safety Regulations, as set forth in 29 CFR 1910 and 1926, and applicable state regulations. This HSP is to be used by URS personnel as a supplement to these rules, regulations, and guidance. This HSP is to be augmented by the URS Health, Safety, and Environment Program and Management System; relevant standards from that program and system are required to be available on site during all activities. This HSP tiers under the Facility-Wide Safety and Health Plan prepared for environmental investigations at RVAAP (Prepared by SAIC, March, 2001).

The provisions of the HSP are mandatory for all onsite URS employees engaged in hazardous material management activities associated with this project, which may involve health and safety hazards.

Changing and/or unanticipated site conditions may require modification of this HSP to maintain a safe and healthful work environment. Any proposed changes to this plan will be reviewed with a URS health, safety, and environment professional prior to their implementation.

Excavation activities will be performed by URS Personnel from the Pittsburgh Office. They will follow procedures explained in this HSP. URS is providing a copy of this HSP to each site subcontractor to fulfill its obligation under 29 CFR 1910.120(b) to inform subcontractors of site hazards. In turn, each subcontractor will provide documentation to URS that describes their plan for addressing applicable health and safety requirements for activities that are unique to their scope of services (for example: drill rig operation, excavation safety, electrical safety, etc) (See SMS 46.).

4.0 RESPONSIBILITIES

URS will have site safety and health oversight and coordination responsibilities for URS personnel; each subcontractor will be held accountable for the safe and healthful performance of work by each of its employees, subcontractors, or support personnel who may enter the site.

URS will adhere strictly to the provisions of this HSP, along with applicable regulations issued by governmental entities **(See RVAAP Facility and Health Plan- Section 3)**

PROJECT MANAGER (URS) –Jo Ann Bartsch

The PM will direct URS onsite operations. The PM may delegate all or part of these duties to a properly qualified URS employee who is designated as the Site Manager. At the site, the PM, assisted by the Site Safety Officer (SSO), has primary responsibility for the following.

- Seeing that appropriate PPE and monitoring equipment are available and properly used by all onsite URS employees.
- Establishing that URS personnel are aware of the provisions of this HSP, are instructed in the work practices necessary to ensure safety, and are familiar with planned procedures for dealing with emergencies.
- Establishing that all URS onsite personnel have completed a minimum of 40 hours of health and safety training, have appropriate medical clearance, as required by 29 CFR 1910.120, and have been fit tested for the appropriate respirators.
- Seeing that URS personnel are aware of the potential hazards associated with site operations.
- Monitoring the safety performance of all URS personnel to see that required work practices are employed.
- Correcting any URS work practices or conditions that may result in injury or exposure to hazardous substances.
- Preparing any accident/incident reports for URS activities (see Section 12.6).
- Seeing to the completion of Safety Plan Compliance Agreements by URS personnel (See Attachment B).
- Halting URS site operations, if necessary, in the event of an emergency or to correct unsafe work practices.
- Seeing that utility clearances are obtained prior to the commencement of work (see Section 5.2.7).
- Seeing that the appropriate SMSs are appended to this HSP and are available on site (see "Plan-at-a-Glance").
- Reviewing and approving this project HSP.

SITE SAFETY OFFICER (URS) - Stan Levenger

The SSO's duties may be carried out by the PM or another qualified URS Site Manager. The SSO is responsible for the following.

10.0 Implementing the project HSP and reporting any deviations from the anticipated conditions described in that plan to the PM and, if necessary, the RHSEM.

11.0 Determining that monitoring equipment is used properly by URS personnel and calibrated in accordance with manufacturer's instructions or other standards and that results are properly recorded and filed.

12.0 Checking with a URS Health, Safety, and Environment Representative to assure URS personnel have current medical clearance and training.

13.0 Assuming any other duties as directed by the PM or RHSEM.

14.0 Coordinating with a URS health, safety, and environment professional to identify URS personnel on site for whom special PPE, exposure monitoring, or work restrictions may be required.

15.0 Conducting safety meetings for all site personnel in accordance with Section 13 of this HSP.

16.0 Conducting daily site inspections prior to the start of each shift. All inspections must be documented (preferably in a bound field logbook).

17.0 Providing ongoing review of protection level needs as project work is performed and informing the PM of the need to upgrade/downgrade protection levels, as appropriate.

18.0 Seeing that decontamination procedures described in Section 10.0 are followed by URS personnel.

19.0 Establishing monitoring of URS personnel and recording the results of exposure evaluations.

20.0 Halting URS site operations, if necessary, in the event of an emergency or to correct unsafe work practices.

21.0 Maintaining the visitor log.

REGIONAL HEALTH, SAFETY, AND ENVIRONMENT MANAGER (URS) – Cece Weldon

The RHSEM is responsible for:

- Determining the need for periodic audits of the operation to evaluate compliance with this plan; and
- Providing health and safety support as requested by the SSO and PM.

PROJECT PERSONNEL (URS)

Project personnel involved in onsite investigations and operations are responsible for:

- Taking all reasonable precautions to prevent injury to themselves and to their fellow employees;
- Performing only those tasks that they believe they can do safely and immediately reporting any accidents and/or unsafe conditions to the SSO or PM;
- Implementing the procedures set forth in the HSP and reporting any deviations from the procedures described in that HSP to the SSO or PM for action;
- Notifying the PM and SSO of any special medical problems (i.e., allergies) and seeing that all onsite URS personnel are aware of such problems; and
- Reviewing the project HSP and signing the Safety Plan Compliance Agreement.

Qualified URS UXO personnel will provide escort and MEC (munitions and explosives of concern) avoidance during field activities. See Attachment D for MEC avoidance and construction support procedures.

SUBCONTRACTOR’S SAFETY REPRESENTATIVE

Subcontractors are requested to designate an on-site employee (preferably a manager) who will serve as the Safety Representative (SSR) for their company. In this capacity, the SSR is responsible for providing health and safety oversight of their personnel participating on the project team. In addition, the SSR will perform routine work area inspections, conduct safety meetings, provide safety orientations for new employees and investigate incidents involving their employees. The SSR will attend periodic safety meetings with the URS SSO.

5.0 JOB HAZARD ANALYSIS

5.1 CHEMICAL HAZARDS

Two categories of chemical hazards are associated with site activities:

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

Site constituents are those that exist at the site and are the cause for conducting site activities. The chemicals that are brought on site to conduct the work may be hazardous and subject to regulation under OSHA's Hazard Communication Standard (29 CFR 1910.1200).

5.1.1 Site Constituents

From an occupational health standpoint, given that any potential exposure to site personnel will be only for a ***short period of time (intermittent for several days),*** the levels of contaminants that have been, or could be, encountered during site activities ***should not represent a significant concern*** if the provisions of this HSP are appropriately implemented. However, ***given that the site is still under investigation,*** the potential for exposure to elevated levels of these contaminants may exist. Exposure to elevated levels of these contaminants may pose hazards. Overviews of these hazards are presented here in terms of the following types of occupational exposure limits:

4.0 PEL Permissible Exposure Limit (OSHA Standard)

5.0 TLV Threshold Limit Value (American Conference of Governmental Industrial Hygienists [ACGIH] Guidance)

6.0 REL Recommended Exposure Limit (NIOSH Guidance)

7.0 STEL Short Term Exposure Limit

8.0 C Ceiling

OSHA PELs, ACGIH TLVs, and NIOSH RELs are time-weighted averages (TWAs), which are defined as concentrations for a normal 8-hour work day and 40-hour work week to which almost all workers can be exposed repeatedly without suffering adverse health effects.

STEL is defined as the concentration to which workers can be exposed for short time periods without irritation, tissue damage, or narcosis sufficient to be likely to cause impairment of self-rescue or to precipitate accidental injury. The STEL is a 15-minute TWA that will not be exceeded at any time during the workday. STELs are used by OSHA, ACGIH, and NIOSH for chemical exposure criteria.

A ceiling value (C) is a concentration that will not be exceeded at any time in any workday. Ceiling limits are used by OSHA, ACGIH, and NIOSH for chemical exposure criteria.

Summaries of the site constituents of concern follow.

1 Chemicals of Concern

Chemical	TLV/PEL/STEL/IDHL	Health Effects/Potential Hazards	Chemical and Physical Properties	Exposure Routes
Chromium	TLV/TWA: 0.5 mg/m3, A4 IDHL:25 mg/m3	Eye Irritation, sensitization	Solid: properties vary depending upon specific compound	Inhalation Ingestion Contact
DNT (Dinitrotoluene)	TLV/TWA: 1.25 mg/m3, A2 IDHL: (50 mg/m3)	Suspected human carcinogen, anorexia, cyanosis, reproductive effects	Orange-yellow solid, VPP: 1mm, FP: 404 F	Inhalation Absorption Ingestion Contact
Lead	TLV/TWA: 0.05 mg/m3, A3 PEL/TWA: 0.05 mg/m3 IDHL: 100 mg/m)	Weakness, anorexia, abdominal pain, anemia	Soil metal: VP: 0 mm	Inhalation Ingestion Contact
HMX (octogen)	TLV/TWA: N/A	Explosive: assumed irritation of eyes and skin, dizziness, weakness	Assumed similar to RDX FP: explodes, VP:0.0004 mm at 230F	Assumed: Inhalation Absorption Ingestion Contact
RDX (Cyclonite)	TLV/TWA: 0.5 mg/m3, A3 Skin Notation IDHL: none established	Explosive: irritation of eyes and skin, dizziness, weakness	White powder; FP: explodes, VP:0.0004 mm at 230F	Inhalation Absorption Ingestion Contact
TNT (2,4,6-Trinitrotoluene)	TLV/TWA: 0.5 mg/m3, A3 Skin Notation IDHL: 500 mg/m3	Cluster headache, irritation of skin and mucus membranes, liver damage, kidney damage	Pale solid: FP: explodes; VP: 0.0002 mm	Inhalation Absorption Ingestion Contact
Acetone (Use for EnSys test kit extraction)	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

	IDLH Notes: 10% of LEL			Contact
Aluminum	TLV/TWA mg/m3: 5 (resp) PEL/TWA mg/m3: 5 IDLH mg/m3: NA	Eye Irritation, skin, respiratory system	RESPIRABLE FRACTION, 10mg/m3 TOTAL DUST	Inhalation Contact
Antimony	TLV/TWA mg/m3: 0.5 PEL/TWA mg/m3: 0.5 IDLH mg/m3: 50	Irritation of eyes, skin, nose, throat, mouth; cough; dizz; head; nausea, vomit, diarrhe; stomach cramps; insomnia; anorexia, unable to smell properly	Noncombustible Solid in bulk form, but a moderate explosion hazard in the form of dust when exposed to flame	Inhalation Ingestion Contact
Arsenic	TLV/TWA mg/m3: NA PEL/TWA mg/m3: 0.01 IDLH mg/m3: 5 CARCINOGEN (Ca); as As;15 MINUTE CEILING	Ulceration of nasal septum, derm, GI disturbances, peripheral neuropathy, resp irritation, hyperpigmentation of skin, [carc]	Metal: Silver-gray or tin-white, brittle, odorless solid	Inhalation Absorption Ingestion Contact

Chemical	TLV/PEL/STEL/IDHL	Health Effects/Potential Hazards	Chemical and Physical Properties	Exposure Routes
Barium	TLV/TWA mg/m3: 0.5 PEL/TWA mg/m3: 0.5 IDLH mg/m3: NA	NA	NA	NA
Manganese	TLV/TWA mg/m3: 1 IDLH mg/m3: 500	Parkinson's; asthenia, insomnia, mental confusion; metal fume fever: dry throat, cough, chest tightness, dypsnea, rales, flu-like fever; low-back pain; vomit; malaise; fatigue; kidney damage	A lustrous, brittle, silvery solid. IP: NA	Inhalation Ingestion
Cadmium	TLV/TWA mg/m3: NA PEL/TWA mg/m3: 0.005 IDLH mg/m3: 9	Pulmonaary edema, dyspnea, cough, chest tight, substernal pain; head; chills, muscle aches; nausea, vomit, diarrhea; anosmia, emphysema, proteinuria, mild anemia; [carc]	Silver-white, blue-tinged lustrous, odorless solid CARCINOGEN (Ca); REDUCE EXPOSURE TO LOWEST FEASIBLE CONCENTRATION (LOQ 0.1 mg/m3)	Inhalation Ingestion
Aroclor-1254	TLV/TWA ppm: NA TLV/TWA mg/m3: 0.001 PEL/TWA mg/m3: 0.5 PEL/TWA mg/m3: 0.5	Irritataion of eyes, chloracne; liver damage; reproductive effects; [carc]	Colorless to pale-yellow, viscous liquid or solid (below 50F) with a mild, hydrocarbon odor.	Inhalation Absorption Ingestion Contact
Gasoline (used for fuel)	TLV/TWA: 300 ppm IDHL: Ca	Potential carcinogen per NIOSH, dizziness, eye irritation, dermatitis	Liquid with aromatic odor; FP: -45 F; VP:38-300 mm	Inhalation Absorption Ingestion Contact
Isopropyl alcohol (potentially used for equipment decontamination)	TLV/TWA: 400 ppm STEL: 500 ppm IDHL: 2000 ppm	Irritation may cause local irritation to mucus membranes	Colorless liquid with alcohol odor; VP:33 mm; IP:10.10 eV; FP:53 F	Inhalation Ingestion Contact
Liquinox (used for decontamination)	TLV/TWA: none	Inhalation may cause local irritation to mucus and membranes	Yellow odorless liquid FP: AN	Inhalation Absorption Ingestion Contact
Benzene	PEL/TWA: 1 ppm TLV/TWA: 0.5 ppm STE:5 ppm	Eye Irritant and Central Nervous System Depressant, Cancer	The vapor is heavier than air and may travel along the ground; distant ignition is possible. As a result of flow, agitation, etc. electrostatic charges can be generated.	Inhalation Absorption Contact

Skin contact with potentially contaminated materials will be minimized by the use of personal protective clothing (as described in Sections 1.0 and 7.0). Inhalation of vapors or particulates during site activities will be minimized by air monitoring and the use of engineering controls, and respiratory protection will be used if the action levels described in Section 1.0 are exceeded. Ingestion of contaminated materials will be minimized by the use of appropriate personal hygiene procedures during decontamination (i.e., thoroughly washing face and hands with soap and water after leaving the work area and prior to eating or drinking).

5.1.2 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. In accordance with the URS Hazard Communication Program, the Material Safety Data Sheets (MSDSs) for the hazardous materials listed in Section 1.0 are included in Attachment C The SSO will make copies of these MSDSs available to any subcontractors (i.e, drillers, excavators) on this project.

URS' written Hazard Communication Program is located in SMS 002, a copy of which is to be maintained on site.

5.2 PHYSICAL HAZARDS

Physical hazards at this work site include:

- Injury/accidents from ordnance and explosives;
- Heat stress and cold stress;
- Noise from the operation of site equipment;
- Slip-trip-fall types of accidents;
- Back injuries resulting from improper lifting;
- Being caught in or struck by moving equipment;
- ***Electrocution or explosion*** hazards associated with ***excavation activities,*** such as contact with overhead or underground power lines or pipelines;
- Excavation hazards; and
- Muscle strains from hand-auger work.

5.2.1 Heat Stress Recognition and Control

Heat stress monitoring will commence when personnel are wearing PPE, including Tyvek®-type coveralls, and the ambient temperature exceeds 70°F. If standard work garments (cotton coveralls) are worn, monitoring will commence at 85°F. ***Heat stress monitoring and control guidance can be found in Attachment F.*** Additional information regarding heat stress is provided in SMS 018, a copy of which is to be maintained on site.

5.2.2 Cold Stress Recognition and Control

Protection against cold stress will be initiated when temperatures drop below 45°F. Cold stress guidance is provided below **[and/or in Attachment F]**.

Exposure to cold working conditions can result in cold stress (hypothermia) and/or injury (frostbite) to hands, feet, and head. Hypothermia can result when the core body temperature drops below 36°C (96.8°F). Lower body temperature will be likely to result in dizziness, drowsiness, disorientation, slurred speech, or loss of consciousness, with possible fatal consequences. Pain in the extremities may be the first warning of danger from cold stress. Shivering develops when the body temperature falls to 35°C (95°F).

Hypothermia can be brought on by exposure to cold air, immersion in cold water, or a combination of both. The wind chill factor, which is the cooling power of moving air, is a critical factor in cold stress.

Workers must wear adequate insulating clothing if work is performed in temperatures below 4°C (40°F). At temperatures of 2°C (35.6°F or less), workers whose clothing becomes wet will be provided immediately with a change of clothing and, if necessary, treated for hypothermia. Treatment includes warming the victim (with skin-to-skin contact or by providing warm blankets or other coverings) and providing warm liquids for the victim to drink. Skin exposure will not be permitted at temperatures of -32°C (-25°F) or below.

If fine work is to be performed with bare hands for more than 10 to 20 minutes at temperatures below 16°C (60°F), provisions will be made for keeping the workers' hands warm. If equivalent chill temperatures fall below 40°F, and fine manual dexterity is not required, gloves will be worn. Metal handles of tools will be covered with insulating material at air temperatures below -1°C (30°F).

If work is to be performed continuously in the cold when the wind chill factor is at or below -7°C (19°F), heated warming shelters (tents, trailers, vehicle cabs) will be made available nearby.

5.2.3 Noise Hazards

Previous surveys indicate that heavy equipment, such as ***drilling or excavation*** equipment, may produce continuous and impact noise at or above the action level of 85 dBA. All URS personnel within 25 feet of operating equipment or near an operation that creates noise levels high enough to impair conversation will wear hearing protective devices (either muffs or plugs). URS personnel who are in the Medical Surveillance Program are automatically enrolled in the URS Hearing Conservation Program and have had baseline and, where appropriate, annual audiograms. Personnel will wash their hands with soap and water prior to inserting earplugs to avoid initiating ear infections. Additional information regarding the URS Hearing Conservation Program is located in SMS 026, a copy of which is to be maintained on site.

5.2.4 Slip/Trip/Fall Hazards

Workers should exercise caution when walking around the site to avoid fall and trip hazards. If there are holes or uneven terrain in the work area that could cause site personnel to fall or trip, they must be covered, flagged, or marked to warn workers. Workers should exercise caution around open excavations, such as test pits, and avoid getting closer than 2 feet to the edge of an unsloped excavation unless guardrails or fall protection is provided. If conditions become slippery, workers should take small steps with their feet pointed slightly outward to decrease the probability of slipping. Gravel or sand will be spread in muddy areas to reduce slipperiness. Workers should watch where they are walking and walk only in areas of good stability.

5.2.5 Lifting Hazards

The following guidelines will be followed whenever lifting equipment such as portable generators, coolers filled with samples, and any other objects that are of odd size or shape or that weigh over 40 pounds. Safe lifting procedures are described in SMS 069, a copy of which is to be available on site. The procedures include the following.

- Get help when lifting heavy loads. Lift portable generators using a two-person lift.
- When moving heavy objects, such as drums or containers, use a dolly or other means of assistance.
- Plan the lift. If lifting a heavy object, plan the route and where to place the object. In addition, plan communication signals to be used (i.e., "1,2,3, lift," etc.)
- Wear sturdy shoes that are in good condition and supply traction when performing lifts.
- Keep your back straight and head aligned during the lift, and use your legs to lift the load – do not twist or bend from the waist. Keep the load in front of you – do not lift or carry objects from the side.
- Keep the heavy part of the load close to your body to help maintain your balance.

5.2.6 Heavy Equipment

Operation of heavy equipment during site activities presents potential physical hazards to personnel. Issues associated with heavy equipment operations are addressed in SMS 019, a copy of which is to be maintained on site.

The following precautions must be observed whenever heavy equipment is in use:

- Wear PPE, such as steel-toed shoes, safety glasses or goggles, and hard hats, whenever such equipment is present.
- At all times, be aware of the location and operation of heavy equipment, and take precautions to avoid getting in the way of its operation. Never assume that the equipment operator sees you. Make eye contact and use hand signals to inform the operator of your intent, particularly if you intend to work near or approach the equipment.
- Traffic safety vests **ARE REQUIRED** for URS personnel working near mobile heavy equipment, such as backhoes and other excavators.
- Never walk directly in back of or to the side of heavy equipment without the operator's acknowledgment.
- When an equipment operator must operate in tight quarters, the equipment subcontractor will provide a person to assist in guiding the operator's movements.
- Keep all non-essential personnel out of the work area.
- Any heavy equipment that is used in the exclusion zone (EZ) will remain in that zone until its task is completed. The equipment subcontractor will completely decontaminate such equipment in the designated equipment decontamination area as required prior to moving the equipment outside of the EZ/Contamination Reduction Zone (CRZ).

5.2.7 Underground and Aboveground Utilities

The Site Manager or SSO is responsible for locating underground utilities before the commencement of any subsurface (> 0.3 meter [1 ft.]) activities. Resources include site plans, utility companies, and regional utility locating services. The proper utility company personnel will certify in writing to the Site Manager or SSO that underground utilities have been deactivated, and the certification will be retained in the project files.

Procedures for activities conducted proximate to utility locations are located in SMS 034, a copy of which is to be maintained on site.

Excavation, drilling, crane work, or similar operations adjacent to overhead lines will not be initiated until operations are coordinated with utility officials. Operations adjacent to overhead lines are prohibited unless one of the following conditions is satisfied.

Power has been shut off and positive means (e.g., lockout/tagout) have been taken to prevent lines from being energized. Wherever possible, the URS SSO will observe power shut off and place a lock and tag on the switch. In all cases, utility company personnel will certify in writing to the Site Manager or SSO that the overhead utilities have been deactivated, and the certification will be retained in the project files. The Site Manager or SSO must also attempt to verify power shut off by checking that power is no longer available to the affected building or equipment.

Equipment, or any part of the equipment, cannot come within the following minimum clearance from energized overhead lines:

Power Lines Nominal System (kv)	Minimum Required Clearance
0-50	**10 feet**
51- 200	**15 feet**
201-300	**20 feet**
301-500	**25 feet**
501-750	**35 feet**
751-1000	**45 feet**

5.2.8 Work Area Protection

Project operations may be undertaken in a roadway or parking lot, causing motor vehicles to pose a hazard. Guidance on properly coning and flagging the work area is provided in Attachment F. Consideration should be given to parking work vehicles within the coned area between the work area and oncoming traffic. Procedures for work zone traffic control are provided in SMS 032, a copy of which is to be maintained on site.

5.2.9 Trenching and Excavation

All URS personnel are prohibited from entering a trench or excavation until it has been inspected by a competent person in accordance with 29 CFR 1926.650-651. If personnel are required to enter a trench or excavation that is deeper than ***5*** feet, the contractor who created the excavation must provide the following prior to personnel entry:

- If hazardous atmospheres are suspected, any trench or excavation more than 4 feet deep must be monitored.
- Adequate shoring, sloping, or benching techniques must be employed.
- Adequate means of employee access and egress must be used.
- The contractor's trained, competent person must inspect the trench or excavation daily, before work commences and on an as-needed basis throughout the day.

A copy of the Fed-OSHA Excavation Standard can be obtained from OSHA's website. Compliance with all provisions of this regulation must be maintained when working in a trench or excavation. Additional information regarding URS procedures for excavation activities is located in SMS 013, a copy of which is to be maintained on site.

During excavation activities control measures may be necessary to prevent airborne releases of dust. Application of a water spray to exposed soils will be the primary dust control measure. Only water from a potable water supply will be used and will be brought to the site using a water truck. Judicious use of the water will occur; no runoff or areas of standing water will be created.

Visual and real time monitoring for dust during excavation activities will be done in accordance with the HASP. A Mini-Ram® dust monitor will be strategically placed downwind from the excavation area to monitor dust levels. It may be necessary to reduce work or stop work in order to control dust levels.

5.2.10 Hand Augering

Muscle strains can occur with hand augering. To minimize the occurrence of injury, the following will be observed.

- Keep augers sharp – a dull auger requires more work to advance through the soil.
- Before beginning work, stretch or warm up the body as you would prior to exercising.
- Try to avoid excessive twisting or wrenching motions when using the auger

Hand Safety –See SMS 16 Hand Tools and Portable Equipment.

5.2.11 Contact with MEC

The likelihood of encountering MEC during field operations is remote. However, URS will provide qualified UXO escort to perform MEC and anomaly avoidance during field activities. Site will be cleared by UXO personnel for field work. Drilling through the concrete floor slabs is considered too dangerous because of the potential for detonation of potential underlying explosive soil. Sampling activities will be allowable beneath areas of existing floor slab where recent demolition activity has left holes or other damage that allow safe access to the soils below the floor slabs. The surface of the earthfill immediately below the floor slab will be observed to determine if any raw explosives, crystallized explosives, or obvious red colored soil are present. If any of these materials are present, no attempt will made to sample. Non- UXO Personnel will evacuate the area if ordnance or suspected ordnance is discovered. **See Attachment D for additional details- MEC Avoidance Procedures and Construction Support Procedures.**

5.3 BIOLOGICAL HAZARDS

There is a risk of injury from biological hazards at the Site at or near natural grassy areas where exposure to toxic plants, noxious insects and poisonous snakes and other dangerous vertebrates is possible. Protective boots, clothing, repellents and other appropriate equipment are recommended (**See Attachment F for URS SMS 047**).

Ticks are another concern in these areas. The best way to prevent tick borne diseases (Lyme disease and Rocky Mountain spotted fever) is not to be bitten by a tick. Ticks do not jump, crawl, or fall onto a person. They are picked up when clothing or hair brushes a leaf or other object that a tick is on. Precautionary measures include tucking pant legs into socks or otherwise taping pant legs closed, wearing repellant with DEET, etc. In case of a tick bite, do not remove the tick with your bare hands. Tick bottles obtained from the Ohio Department of Health will be on site and are to be used in the event of a tick bite. See additional information “Biological Hazards” (**Attachment F -URS SMS 047**).

There is also a risk of histoplasmosis causing by inhaling the spores of a fungus called Histoplasma capsulatum. This fungus is endemic in the United States and seems to grow best in soils having high nitrogen content, especially those enriched with bat droppings or bird mature. Disturbances of contaminated materials cause small H. Capsulatum spores to become airborne or aerosolized. Workers who will disturb collections of bird or bat droppings must be trained in the potential hazard and control measures. See additional information in the FSHP Section 9.16.

Appropriate clothing should be worn if poison ivy, oak, and/or sumac are present. Exposed skin should be washed with a strong soap (e.g., Liqui-Nox) as soon as possible after suspected exposure. If mosquitoes are present, repellent should be used according to label directions to prevent possible transmission of encephalitis or other transmitted diseases. The use of repellents must be addressed to ensure sample integrity when there is a potential for sample medium exposure. See “Biological Hazards” (**Attachment F SMS 047**).

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6.0 EXPOSURE MONITORING PLAN

Heat stress, noise, and chemical exposures may be encountered at this site. Heat stress monitoring and prevention is addressed in Section 5.2.1. Noise levels will not be monitored; URS personnel will wear hearing protection as described in Section **[5.2.3]**.

6.1 CHEMICAL EXPOSURE MONITORING

The field instrumentation described in this HSP has been specifically selected for the contaminants that may be reasonably anticipated to be encountered during the course of this project. Selection factors include anticipated airborne concentrations, potential interference, ionization potentials, instrument sensitivity, and occupational exposure limits. The action levels specified in Section 1.0 were established with the expectation that specific instruments will be used. **DO NOT SUBSTITUTE INSTRUMENTS WITHOUT THE CONSENT OF THE HSP PREPARER OR THE REGIONAL HEALTH, SAFETY, AND ENVIRONMENT MANAGER.**

The monitoring equipment specified in Section 1.0 will be used on a regular basis to evaluate the potential for exposure to airborne contaminants, typically every five to ten minutes. Monitoring will be conducted in the immediate vicinity of the contaminant source point or work area (e.g., at the borehole and cuttings adjacent to the borehole). See Table 1 for Action Levels.

6.2 PERSONAL EXPOSURE MONITORING

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 SSO 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 CFR 1910.20. The minimum monitoring requirements and action levels are presented in Table 1.

Most of the fieldwork is not expected to pose airborne exposure hazards for the following reasons:

Work will be performed in open areas with natural ventilation. Field laboratory analyses will be performed in well-ventilated buildings.

Air monitoring for breathing zone using a Multirae is planned during soil sampling, and excavation. Site conditions will be examined by the SSO. If there is any indication of potential airborne hazards, the SSO will contact the Regional Health, Safety and Environment Manager and initiate additional monitoring.

Procedures for personal monitoring are located in SMS 043, a copy of which is to be maintained on site.

6.3 DATA LOGGING

All monitoring data, including background readings, will be logged in the field logbook. The results of daily instrument calibrations can be logged either on the form provided in Attachment E (RVAAP Reporting forms) or in the field logbook. All monitoring instruments will be calibrated in accordance with the manufacturers' instructions prior to the start of each shift. Calibration also will be performed when inconsistent or erratic readings are obtained. **IF AN INSTRUMENT CANNOT BE CALIBRATED TO SPECIFICATION OR BECOMES OTHERWISE INOPERABLE, ALL INVASIVE SITE WORK (I.E., DRILLING, EXCAVATING) WILL CEASE UNTIL THE INSTRUMENT IS APPROPRIATELY REPAIRED OR REPLACED,** and the PM or RHSEM will be contacted for further guidance. Key back-up equipment will be available for use on site during soil sampling and excavation.

6.4 DUST CONTROL

High winds and site operations can cause airborne dust hazards. If site operations generate sustained visible dust, a water mist (using potable water) will be applied to reduce dust generation. If the mist is not effective in reducing dust generation, personnel will upgrade to Level C (Full-face air respirator with combination organic vapor/high efficiency particulate arrestor (HEPA) cartridges -such as MSA's GMC-H cartridges, tyvex coveralls, nitrile inner gloves).

6.5 EXPLOSIVE ATMOSPHERES

Given the presence of elevated concentrations of site constituents that have a low flash point, the potential exists for explosive atmospheres at the site. Therefore, a MultiRae meter will be used to monitor ambient conditions, and decisions will be based on the levels measured using a MultiRae meter (measurements are in % of the LEL), as determined by the action level Table 1**.**

For excavation operations, a Multirole with a remote sensing head will be used. The sensing head will be attached to the excavator arm near the bucket, and the cable will be run back along the arm to the Multirole in the excavator cab. This will permit the operator to be alerted to hazardous situations without requiring monitoring personnel to stand at the working face.

Fire suppression equipment (Two 2A10B:C fire extinguishers or fire hoses) is to be present at all times during site operations in areas where fire potential exists.

6.6 OXYGEN-DEFICIENT ATMOSPHERES

Oxygen-deficient atmospheres may be encountered in excavations. An excavation with an oxygen-deficient atmosphere is not to be entered, unless absolutely necessary, and then only after following appropriate confined-space entry procedures. These procedures are described in SMS 010, a copy of which is to be maintained at the site. The confined-space entry permit is provided by, and must be approved by, the RHSEM.

Prior to entering any space where an oxygen deficiency may exist, an oxygen meter will be used to test for adequate oxygen levels. Decisions will be based on oxygen concentrations as follows:

- 20.8% Continue Operations
- <20.8% Monitor continuously
- <19.5% Do not enter; ventilate and determine whether supplied air equipment is required
- >20.8% Do not enter, competent person will look for the cause of the oxygen-enriched atmosphere and correct it prior to entry

7.0 PERSONAL PROTECTIVE EQUIPMENT

The minimum Personal Protective Equipment (PPE) for site personnel includes:

- Hardhat;
- Safety glasses with side shields (or impact-resistant goggles);
- Steel-toed boots;
- Ear protection in the vicinity of noisy equipment;
- Work gloves and/or chemical-resistant gloves; and
- Traffic safety vest in the vicinity of heavy equipment.

As the various monitoring action levels are reached, additional PPE is required. Section 1.0 describes the incremental PPE requirements relative to specific action levels and the specific kinds of PPE to be used. Procedures for the use and selection of PPE are provided in SMS 029, a copy of which is to be maintained on site. Also, general guidelines for selection and use of PPE are presented in the RVAAP -FSHP-Section 5.

7.1 LIMITATIONS OF PROTECTIVE CLOTHING

The protective equipment ensembles selected for this project are anticipated to provide protection against the types and concentrations of hazardous materials that may be encountered during field operations. However, no protective garment, glove, or boot is resistant to all chemicals at any concentration; in fact, chemicals may continue to permeate or degrade a garment even after the source of the contamination is removed.

To obtain optimal usage from PPE, the following procedures are to be followed by all URS personnel.

- When using disposable coveralls, don a clean, new garment after each rest break or at the beginning of each shift.
- Inspect all clothing, gloves and boots both prior to and during use for:
    - Imperfect seams;
    - Non-uniform coatings;
    - Tears; and
    - Poorly functioning closures**.**
- Inspect reusable garments, boots, and gloves prior to and during use for:
    - Visible signs of chemical permeation, such as swelling, discoloration, stiffness, or brittleness; and
    - Cracks or any signs of puncture or abrasion.

Reusable garments exhibiting any of these characteristics will be discarded.

7.2 DURATION OF WORK TASKS

The SSO will establish the duration of work tasks in which personnel use PPE ensembles that include chemical protective clothing (including uncoated Tyvek®). Variables to be considered include ambient temperature and other weather conditions, the capacity of individual personnel to work in the required level of PPE in heat and cold, and the limitations of specific PPE ensembles. Recommended rest breaks are as follows:

- Fifteen minutes midway between shift startup and lunch;
- Lunch break (30 to 60 minutes); and
- Fifteen minutes midway between lunch and shift end.

Rest breaks are to be taken in the support zone or other clean area after personnel have completed the decontamination process, including washing the hands and face with soap and water. ***[Additional rest breaks will be scheduled according to heat stress monitoring protocols as described in SMS 18.]***

8.0 RESPIRATORY PROTECTION

8.1 RESPIRATOR SELECTION

Engineering controls and safe work practices (e.g., elimination of the source of contamination, ventilation equipment, working upwind, limiting exposure time, etc.) always must be the primary control for air contaminants. Respirators will be used if engineering or work practice controls are not feasible for controlling airborne exposures below acceptable concentrations and as an interim control measure while engineering or work practice controls are implemented.

Once the need for respirators has been established, the respirators will be selected on the basis of the hazards to which the worker is exposed. Only NIOSH-approved respirators will be issued. Selection criteria established in 29 CFR 1910.134 have been used by the Preparer of this HSP in determining respirator requirements for this project.

> *CAUTION: Full-face piece or half-face piece air-purifying respirators are not to be used where there is an oxygen deficiency. Only air-supplied respirators with an emergency escape cylinder or self-contained breathing apparatus will be worn when an oxygen deficiency exists.*

> *CAUTION: A respirator does not protect against excessive heat or against a hazardous substance that can attack the body through the skin.*

Airborne contaminants have been evaluated based on the suspected contaminants of concern. The concentration of the airborne chemical hazard will be evaluated using direct-reading instruments to determine what type of respirator will be used. Airborne readings will be compared to the action levels in the table in Section 1.0. See action level/respirator requirements in Section 6.1.

8.2 MEDICAL SCREENING

Project employees are enrolled in the URS Medical Surveillance Program and are medically evaluated in compliance with the requirements of 29 CFR 1910.134(a)(10). Employees not medically cleared to wear respirators will not be assigned to this project.

The medical status of each employee is reviewed annually and as may be deemed necessary by the examining physician if the physical status of the employee changes.

8.3 FIT TESTING

A person wearing a respirator must be clean-shaven in the area of the face-piece seal. Long hair, sideburns, and skullcaps that extend under the seal are not allowed. Glasses with temple pieces extending under the seal are not allowed for full-face respirators. Persons with facial conditions that prevent a proper seal are not allowed to wear a respirator until the condition is corrected. Facial conditions that may cause a seal problem include missing dentures, scars, severe acne, etc. Contact lenses may be worn with respiratory protection.

No individual will enter an area where the use of respiratory protective equipment is required unless the person has been fit tested within the last year. Fit testing will be performed in accordance with accepted fit test procedures defined in SMS 042, a copy of which is to be maintained at the site.

Records of fit testing will be maintained on site or by the employee's office and/or corporate medical surveillance program.

Respirator wearers will perform a user seal check each time they put on the respirator. For air-purifying respirators, the positive user seal check is performed by removing the exhalation valve cover, placing the palm over the respirator exhalation valve, and exhaling gently. The respirator mask should puff out without noticeable leakage. The negative user seal check is performed by placing the palms over both of the respirator cartridges, inhaling gently, and holding the breath for 10 seconds. The respirator mask should remain collapsed on the face without noticeable leakage.

8.4 RESPIRATOR USE INSTRUCTIONS

Only those employees who have been properly trained and qualified on the specific type of respirator to be worn may use respirators. No individual will enter an area where the use of respiratory protective equipment is required unless the person has been trained.

All employees whose job assignments require the use of respirators are trained in accordance with 29 CFR 1910.134 during an initial 40-hour and annual refresher training for hazardous waste operations.

Hands-on training in inspecting and donning a respirator, including user seal checks, also is provided at the time of fit testing. Retraining is performed annually on each type of respirator worn by the individual. In addition, site-specific respirator training is provided during site safety briefings conducted by the SSO. Training records are kept in the employee’s training file.

A particulate respirator cartridge will be changed out when the wearer has difficulty breathing through the cartridge. Chemical gas or vapor respirator cartridges will be *changed out at least daily.*

The fit of a chemical gas or vapor respirator will be rechecked, and the cartridges will be changed, if the wearer detects chemical odor or feels chemical irritation on the skin, both of which are indicators of leakage or cartridge breakthrough. Where available, an End-of-Service Life Indicator (ESLI) will be used on chemical respirator cartridges. Cartridges will be changed as soon as the ESLI indicates that the cartridge is saturated and no longer effective in absorbing airborne chemicals.

8.5 RESPIRATOR INSPECTION

The user will inspect respirators before and after each day's use. The inspection procedure for air-purifying respirators (full-face piece and half-face piece cartridge respirators) follows.

Examine the face piece for:

- Excessive dirt;
- Cracks, tears, holes, or distortion from improper storage;
- Inflexibility;
- Cracked or badly scratched lenses (full-face only);
- Incorrectly mounted eyeglass lenses or broken or missing mounting clips (full-face only); and

- Cracked or broken air-purifying element holder, badly worn threads, or missing gaskets.

Examine the head straps or head harness for:

- Breaks or cracks;
- Broken or malfunctioning buckles; and
- Excessively worn serration on the headstraps, which may permit slippage.

Examine the two inhalation valves and the exhalation valve for:

- Foreign material (e.g., hairs, particles, etc.);
- Improper insertion of the valve body in the face piece;
- Cracks, tears, or chips in the valve body, particularly in the sealing surface; and
- Missing or defective exhalation valve covers.

Examine the air-purifying cartridge for:

- Missing or worn cartridge-holder gasket;
- Incorrect cartridge/canister for the hazard;
- Incorrect cartridge installation, loose connections, or cross threading in the holder; and
- Cracks or dents in the outside case or threads of the filter or cartridge/canister.

8.6 CLEANING OF RESPIRATORS

Respirators assigned and worn by one individual must be dismantled and thoroughly cleaned and disinfected after each day's use. A disinfectant spray or wipe is approved as a disinfectant between uses during the day but not for cleaning and sanitizing after each day's use. Care must be taken to prevent damage from rough handling during the cleaning procedure. After cleaning, respirators must be reassembled. The procedures for cleaning respirators follow.

- Washing: Disassemble and wash with a mild liquid detergent in warm water (not to exceed 110°F). A stiff bristle (not wire) brush may be used.
- Rinsing: Rinse in clean water (110°F maximum) to remove all traces of detergent. This is important to prevent dermatitis.
- Disinfecting: Thoroughly rinse or immerse in a sanitizer provided by the manufacturer. Alternatively, a weak chlorine bleach solution (1 milliliter of liquid bleach per liter of water) may be used.
- Final Rinsing: Rinse thoroughly in clean water (110°F maximum) to remove all traces of disinfectant. This is important to prevent dermatitis.
- Drying: Drain and dry by hanging by the straps from racks (take care to prevent damage) or by towel drying with clean, soft cloths or paper towels.

8.7 MAINTENANCE OF RESPIRATORS

Routine respirator maintenance, such as replacing missing valves, gaskets, and nosecups, must only be performed by trained respirator users or a respirator manufacturer's representative. Only approved replacement parts must be used. The substitution of parts from a different brand or type of respirator is generally not possible, invalidates the technical approval of the respirator, and is not permitted. Any respirator suspected of being defective must be removed from service and replaced.

8.8 STORAGE OF RESPIRATORS

When not in use, respirators must be stored to protect them from dust, sunlight, heat, extreme cold, excessive moisture, damaging chemicals, and physical damage. Respirators must be stored in sealable (e.g., Ziplock® or twist-tie) reusable plastic bags between shifts.

The respirator storage environment must be clean, dry, and away from direct sunlight. Onsite cabinets or cases are suggested. Storing bagged respirators in vehicles is discouraged because of the potential for damage from other material or equipment.

8.9 ADDITIONAL INFORMATION

Additional information on the URS Respiratory Protection Program is located in SMS 042, a copy of which is to be available on site.

9.0 SITE CONTROL

Additional site control measures are described in the FSHP- Section 10. The RVAAP is not open to the public, and only authorized personnel are allowed in the load line areas. The SSH will be responsible for establishing the site control zones, as necessary, around controlled areas that present physical or chemical hazards.

9.1 GENERAL

Barricade tape and/or barricades will be used to delineate a work zone for safety purposes around the work area. The barriers will be set in a 25-foot radius (as practical) around the work area to provide sufficient maneuvering space for personnel and equipment. A short piece of barricade tape can be affixed to a secure upright (e.g., a drill rig mast or a vehicle antenna) to serve as a wind direction telltale. A 5-foot opening in the barricades at the support zone (upwind of the work area) will serve as the personnel and equipment entry and exit point. The personnel decontamination station will be established at this point if formal decontamination procedures are required (see Section 9.0). All entry and exit from the work area will be made at this opening to control potential sources of contamination and leave contaminated soil and debris in the work area.

At the end of the shift, all boring/sampling holes and excavations must be covered or otherwise secured. All cuttings and decontamination fluids are to be handled in accordance with relevant regulations and instructions from the PM.

The PM or SSO ***(with the assistance of the facility representative)*** will determine an upwind evacuation area prior to each shift, and all personnel will be notified of its location. A horn or other signaling device will be used to signal an evacuation in the event of an emergency. Three blasts of the horn will be the signal to immediately stop work and proceed to the evacuation area.

The SSO will verify that all site visitors sign the visitors' log. In addition, all URS personnel and site visitors entering the work area must present evidence of their participation in a medical surveillance program and completion of health and safety training programs that fulfill the requirements of this HSP.

The SSO will provide site hazard and emergency action information to all site visitors before they enter the site. This can be done by providing a copy of this HSP to the visitor.

9.2 WORK ZONES

Site control zones will be established in multiple locations over the site. The exact locations will vary depending on site conditions. As a general rule, an exclusion zone will be established around any task or area that poses a potential to spread contamination or injure personnel.

- EZ – A 25-foot circle (as practical) around the work area will be defined before work starts. The encircled area will constitute the EZ. This zone is where potentially hazardous contaminants and physical hazards to the workers will be contained. Appropriate personal protection, as described in Section 1.0, will be required in this area. Plastic sheeting (visqueen) and/or tarps may be used as necessary to control contaminated materials spilled to the ground during site operations. The size of the EZ may be altered to accommodate site conditions and to ensure contaminant containment.

- CRZ – A corridor leading from the EZ will be defined; it will lead from the work area to a break area. All decontamination activities will occur in the CRZ. A waste container will be placed at the end of the corridor so that contaminated disposable equipment can be placed inside and covered. Surface/soil contamination in this area will be controlled using plastic sheeting. No one will be permitted into the CRZ or EZ unless he/she is in full compliance with the requirements of this HSP.

- Support Zone – A Support Zone, the outermost part of the site, must be defined for each field activity. Support equipment is located in this uncontaminated or clean area. Normal work clothes are appropriate within this zone. The location of this zone depends on factors such as accessibility, wind direction (upwind of work area), and resources (i.e., roads, shelter, utilities).

• 10.0 DECONTAMINATION PROCEDURES

Personal Hygiene and decontamination requirements are described in the FSHP-Section 11. For additional details see instructions below:

- Remove all equipment, sample containers, and notes to the CRZ. Obtain decontamination solutions and decontaminate the tools (shovels, auger flights, etc.) by brushing them under a water rinse. A high-pressure steam cleaner also may be used for decontamination. All waste and spent decontamination solutions will be properly contained.
- Scrub boots with a stiff bristle brush and water. Washtubs and chairs will be provided.
- Remove outer gloves (and boot covers, if used).
- Remove Tyvek® coveralls; discard in provided container.
- Remove hardhat and eye protection.
- Remove respirator.
- Remove inner gloves.
- Wash hands and face.

The decontamination area will be covered with plastic sheeting that will be replaced when torn or heavily soiled and at the end of each shift.

Each worker will be responsible for cleaning, sanitizing, and storing his/her own respirator in accordance with the manufacturer's guidance (i.e., washing in warm water and detergent or sanitizing solution, air drying, and storing in a plastic storage bag; see Sections 8.6 - 8.8). Cartridges will be changed in accordance with the procedures described in Section 8.4.

All spent decontamination fluids (rinse waters, etc.) will be handled as directed by the PM and in accordance with relevant regulations.

10.1 SANITATION

Potable water will be made available at the site, either from a pressurized source or as commercially available bottled water. Drinking cups will be supplied; personnel will not drink directly from the source of water or share drinking cups. Sources of non-potable water will be labeled clearly.

Unless toilet facilities are available on site, or transportation is readily available (within five minutes) to transport personnel to nearby toilet facilities, portable toilet facilities, such as chemical toilets, will be provided on site.

Washing facilities will be provided on site and be located in the decontamination area or in the support area. Soap, clean water, wash basins, and single-use towels will be available for personnel use.

URS procedures for site sanitation are located in SMS 030, a copy of which is to be maintained on site.

10.2 DECONTAMINATION – MEDICAL EMERGENCIES

In the event of physical injury or other serious medical concerns, immediate first aid is to be administered in lieu of further decontamination efforts.

See the Emergency Decontamination chart for a decision tree for emergency decontamination.

10.3 DECONTAMINATION OF TOOLS

When all work activities have been completed, contaminated tools used by URS personnel will be appropriately decontaminated.

It is expected that all tools will be constructed of non-porous, non-absorbent materials. This will aid the decontamination process.

Decontamination of sampling equipment and tools will follow the procedures in the *Facility-Wide Sampling and Analysis Plan.*

• 11.0 SAFE WORK PRACTICES

11.1 GENERAL SITE RULES

- **Eating, drinking, chewing gum or tobacco, and smoking are prohibited in the contaminated or potentially contaminated area or where the possibility for the transfer of contamination exists.**
- **Alcohol consumption is prohibited during work hours. Use of prescription medications that impair judgment or affect motor skill and all illegal drugs are also prohibited. For additional information, please review the URS Substance Abuse Policy. Behavior that could endanger the health or safety of any individual of the field team will not be tolerated. Any individual violating these requirements will be subject to disciplinary action that may include termination.**

- **All personnel will enter designated work areas only through the CRZ. All personnel leaving an EZ/work zone must exit through the CRZ and pass through the decontamination station, as described in Section 10.0.**
- **Personnel will wash their hands and faces thoroughly with soap and water prior to eating, drinking, or smoking.**
- **Personnel will avoid contact with potentially contaminated substances. Do not walk through puddles, pools, mud, etc. Avoid, whenever possible, kneeling, leaning, or sitting on contaminated surfaces. Do not place monitoring equipment on potentially contaminated surfaces (i.e., the ground, etc.)**
- **All field crew members should remain alert to potentially dangerous situations in which they should not become involved (i.e., note the presence of strong, irritating, or nauseating odors, etc.).**
- **Only those vehicles and the equipment required to complete work tasks should be permitted within the EZ/work zone (drill rigs, excavators, and similar items). All non-essential vehicles should remain within the support zone.**
- **Containers, such as drums, will be moved only with the proper equipment and will be secured to prevent dropping or the loss of control during transport.**
- **Field survey instruments, such as PIDs, will be covered with plastic or similar coverings to minimize the potential for contamination.**
- **No matches or lighters are permitted on RVAAP.**
- **Contaminated protective equipment, such as respirators, hoses, boots, and disposable protective clothing, will not be removed from the work area/EZ or decontamination area until it has been cleaned or properly packaged and labeled.**
- **Spills should be prevented, to the extent possible. Should a spill occur, any liquid should be contained, if possible.**
- **Splashing of contaminated materials should be prevented.**
- **Field crew members should be familiar with the physical characteristics of the site operations including:**
  - Wind direction in relation to the contaminated area;
  - Accessibility to equipment and vehicles;
  - Areas of known or suspected contamination;

  - Site access; and
  - Nearest water sources.

- The number of personnel and equipment in the EZ should be minimized, but only to the extent consistent with workforce requirements for safe site operations.

- All wastes generated by URS activities at the site will be disposed of as directed by the PM.

- All personal protective equipment will be used as specified and required.

- The buddy system will be used at all times when sampling for hazardous material, when the first action level criteria have been exceeded, or when working in remote areas.

- Personnel are to immediately notify the SSO or Site Manager if any indications of potential explosions or unusual conditions are observed.

11.2 SAMPLING PRACTICES

For all sampling activities, the following standard safety procedures will be employed:

- All sampling equipment will be cleaned before proceeding to the site.
- At the sampling site, sampling equipment will be cleaned after each use.
- Work in “cleaner” areas will be conducted first, where practical.
- All unauthorized personnel will remain outside the EZ at all times.

11.3 SAMPLE SHIPMENT/HAZARDOUS MATERIALS SHIPMENT

If samples to be collected during the course of this project fall under criteria that define them as hazardous materials under Department of Transportation (DOT) regulations 49 CFR Parts 171-177 (see URS guidelines for determination), then they <u>must</u> be shipped in accordance with those regulations by an individual who is certified as having been “function-specific” trained, as required under the DOT regulations.

• 12.0 EMERGENCY RESPONSE PLAN

It is URS policy to evacuate personnel from areas of hazardous material emergencies and to summon outside assistance from agencies with personnel trained to respond to the specific emergency. This section outlines the procedures to be followed by URS personnel in the event of a site emergency. These procedures are to be reviewed during the onsite safety briefings conducted by the SSO.

In the event of a fire or medical emergency, the emergency numbers identified in Section 1.0 (page 1) can be called for assistance.

12.1 PLACES OF REFUGE

In the event of a site emergency requiring evacuation, all personnel will evacuate to a pre-designated area a safe distance from any health or safety hazard (typically, the URS field office, unless conditions dictate otherwise). The SSO ***(in cooperation with a facility representative)*** will designate a primary assembly area prior to the start of work each day. The assembly area may have to be re-designated by the SSO in the event that the area of influence of an emergency affects the primary assembly area. Once personnel are assembled, the SSO will do a head count. The SSO will evaluate the assembly area to determine whether it is outside of the influence of the situation; if it is not, the SSO will redirect the group to a new assembly area where a new head count will be taken.

During any site evacuation, all employees will be instructed to observe wind direction indicators. During evacuation, employees will be instructed to travel upwind or crosswind of the area of influence. The SSO will provide site personnel with specific evacuation instructions via the site emergency radio, if necessary, specifying the actual site conditions.

12.2 FIRE

Fire prevention procedures are described in SMS 14, a copy of which is to be maintained on site. To protect against fires, the following special precautions must be taken.

- Before any flame-producing devices (i.e., cutting torches or welding irons) are used in the EZ, the SSO must be contacted. In some cases, the client may require to be contacted as well, to determine whether a hot work permit is required. A detailed inspection of the work area will be conducted to determine whether potential fire sources exist; if they do, they must be removed to at least 35 feet away before work can commence.

- Two 2A10B:C fire extinguishers must be located at the work area when cutting or welding is being conducted, and a fire watch will be posted.

- Upon completion of the cutting/welding activities, the area will be inspected for hot metal, slag, etc. The fire watch will remain at its station for at least 15 minutes after the hot work is completed.

Type ABC fire extinguishers will be available on site to contain and extinguish small fires. Post 1 will be notified in the event of any fire on site. URS will provide an escort from Post 1 to the fire site.

12.3 COMMUNICATION

A communication network must be set up to alert site personnel of emergencies and to summon outside emergency assistance. Where voice communication is not feasible, an audible alarm (compressed gas horn or vehicle horn) will be set up to alert employees of emergencies. These devices will be used to signal to other project personnel in the event of accidents or emergencies. Short blast (less than ½ second) of the horn will be used to request assistance, while extended blasts (more than 2 seconds) will signal an evacuation.

Each field team shall have a hand-held, 2-way radio for communication purposes. Post 1 is the first point of contact for any emergency service. Securitas will coordinate the response.

Emergency phone numbers will be posted at the phone or radio used for outside communication. The SSO is responsible for establishing the communication network prior to the start of work and for explaining it to all site personnel during the site safety briefing.

In the event of an emergency, personnel will use the following hand signals where voice communications are not feasible:

Signal	Definition
Hands clutching throat	Out of air/can't breathe
Hands on top of head	Need assistance
Thumbs up	OK/I'm all right/I understand
Thumbs down	No/negative
Arms waving upright	Send back support
Grip partner's wrist	Exit area immediately

12.4 EMERGENCY RESPONSE PROCEDURES

The emergency response team will consist of employees who assume the following roles:

- Emergency care provider(s)
- Provide first aid/CPR as needed
- Communicator

  The role of the communicator is to maintain contact with appropriate emergency services and to provide as much information as possible, such as the number injured, the type and extent of injuries, and the exact location of the accident scene. The communicator will be located as close to the scene as possible to transmit to the emergency care providers any additional instructions that may be given by emergency services personnel in route.
- Site Supervisor

  The site supervisor (usually the SSO) will survey and assess existing and potential hazards, evacuate personnel as needed, and contain the hazard. Follow up responsibilities include replacing or repairing damaged equipment, documenting the incident, and notifying appropriate personnel/agencies described under Incident Reporting. Responsibilities also include reviewing and revising site safety and contingency plans as necessary.

In the event of an emergency, Notify site personnel of the situation, survey the scene to determine whether the situation is safe, to determine what happened, and to search for other victims. The Emergency Response Checklist can be used to help remember the things to do in an emergency.

12.5 MEDICAL EMERGENCY RESPONSE PLAN

At least one URS employee on site will hold a current certificate in American Red Cross Standard First Aid. This training provides six and one-half hours of instruction in adult CPR and basic first aid. If a medical emergency exists, personnel should:

- Notify Post 1 immediately and provide an escort from Post 1 to the accident site;
- Perform First Aid/CPR as necessary;
- Stabilize the injured; decontaminate if necessary, and extricate *only* if the environment the injured/ill person is in is dangerous or unsafe and ONLY if the rescuers are appropriately protected from potential hazards that might be encountered during the rescue.
- When emergency services personnel arrive, communicate all first aid activities that have occurred.
- Transfer responsibility for the care of the injured/ill to the emergency services personnel.

The following items and emergency response equipment will be located within easy access at all times:

- First aid kit and infection control kit (inspected weekly);
- Eyewash – A 15 minute eyewash (required if corrosives are present), or an appropriate amount of portable sterile eyewash bottles, will be available on site for flushing foreign particles or contaminants out of eyes. The SSO will demonstrate the proper operation of the unit(s) prior to the start of work;
- Compressed gas horns;
- Emergency telephone numbers list;
- Basic spill kits;
- Portable radios for emergency communications in remote areas; and
- Fire extinguisher 25 to 75 feet from outside flammables storage (or use) area.

Drugs, inhalants, or medications will not be included in the first aid kit.

Supplies should be reordered as they are used. A monthly inventory must be done on the first aid kit and infection control kit contents, and supplies that have been used must be reordered.

12.6 INCIDENT REPORT

ALL site injuries and illnesses must be reported to the SSO (Stan Levenger) and PM (Jo Ann Bartsch) immediately following first-aid treatment. The SSO will notify the RHSEM (Cece Weldon) . Work is to be stopped until the PM or SSO have determined the cause of the incident and have taken the appropriate action to prevent a recurrence. Any injury or illness, regardless of severity, is to be reported (see SMS 049).

SSO must first notify RVAAP's security personnel, who will, in turn, contact the proper authorities. The SSO or RHSEM should then notify the U.S. Army Project Manager immediately. The required Accident Report (ENG from 3394) must be completed and submitted to the US Army Project Manager within 2 days. (See RVAAP FSHP-Section 12 and Attachment E for additional details)

Incident Notification Call Chain

URS Site Safety Officer	Stan Levenger	Cell 330-687-1816 Office 614-726-3575
URS Project Manager:	Jo Ann Bartsch	Office :216-622-2229 Cell: 440-376-2875
URS Health, Safety, and Environment Representative:	James Anderson	Cell: 440-241-6972 Office: 216- 622-2384
URS Regional Health, Safety, and Environment Manager:	Cece Weldon	Office: 248-994-7466 Cell: 248-752-3405
URS UXO Program Safety Manager	Mac Reed	Office: 615-224-2148 Cell: 615-618-5272
RVAAP U.S Army Facility Manager	Mark Patterson	330-358-7311

12.7 OPERATION SHUTDOWN

In certain extremely hazardous situations, the SSO or SSR may request that site operations be temporarily suspended while the underlying hazard is corrected or controlled. During operations shutdowns, all personnel will be required to stand upwind to prevent exposure to fugitive emissions. The SSO, with concurrence from the RHSEM, will have ultimate authority for operations shutdown and restart.

The Army reserves the right to stop work for any violations of the HSP. The Ohio EPA also has stop-work authority under the June 2004 Directors Final Findings and Orders.

12.8 SPILL OR HAZARDOUS MATERIALS RELEASE

Potential spills include releases of fuels, lubricants, hydraulic fluids, and decontamination solvents. In the event of a spill or leak, the employee making the discovery will immediately notify the SSO. The SSO will determine whether the leak poses an environmental risk or will exceed the capacity of on-site personnel and equipment. In the unlikely event that there is a probability that the spill will extend beyond the immediate area, site personnel will evacuate to the pre-designated assembly area. The SSO will inform the local fire department (330-297-5738) and hazardous materials response team. If this is not the case, the on-site spill kit will be utilized to clean up the spill. Spill plans have been prepared for each Load Line and are available in the Field Office.

The Site Safety Officer will make the following emergency contacts:

Regional Health, Safety, and Environment Manager – Cece Weldon
Office: 248-204-4252

	Cell: 248-752-3405
Health, Safety, and Environment Representative –	James Anderson Cell: 440-241-6972 Office: 216- 622-2384
Project Manager –	Jo Ann Bartsch Office :216-622-2229 Cell: 440-376-2875
Ohio EPA Spill Number	1-800-282-9378
EPA Response Center (if reportable quantity is exceeded)	– (800) 424-8802.
RVAAP U.S Army Facility Manager	Mark Patterson 330-358-7311
RVAAP Security-Post 1	Securitas 330-358-2017

EMERGENCY RESPONSE CHECKLIST

In an Emergency	Yes	No
Confirm the reported incident	__________	__________
Evacuate and secure the area	__________	__________
Render first aid/emergency medical care	__________	__________
Notify promptly:		
Security, Post 1	__________	__________
Fire Department	__________	__________
Police Department	__________	__________
Nearest Hospital or Medical Care Facility	__________	__________
Project Manager		
Start Documentation	__________	__________
If spill or leak occurs:		
Don the proper PPE	__________	__________
Stop the source	__________	__________
Contain the spill	__________	__________
Clean up the spill	__________	__________
Upon evacuating, take attendance at the assembly area	__________	__________
Authority given:		
Leave the site	__________	__________
Restart the operations	__________	__________
Debrief and document the incident	__________	__________
Submit a copy of the document to the Health and Safety Manager	__________	__________

12.9 WEATHER EMERGENCIES

Weather forecasts 4 days ahead should be obtained during fieldwork planning. During field activities, the Project Manager will assess current weather conditions utilizing Radar websites (http://www.weather.gov/radar_tab.php). The following climatic factors should be considered in fieldwork planning:

- temperature range,
- rain,
- flood,
- wind,
- cyclone,
- electrical storm,
- dry, hot conditions and fire risk,
- snow , and
- UV exposure.

In the case of lightning, evacuate to the pre-designated area or field office and do not use the telephone until the storm has passed. If high winds occur, move away from the exterior windows. Report the situation to the Project Manager /Site Safety Officer.

The National Weather Service issues severe weather warning including thunderstorm, tornado and winter storm warnings when a high probability of severe weather exists. If a severe weather warning is issued, field work activities will be cancelled.

In the event of a reported flood, severe storm, or tornado and after the risk for personal safety has diminished, the Project Manager should visit and inspect the site. Any unsafe or abnormal conditions should be reported to the U.S Army Project Manager immediately.

13.0 TRAINING, MEDICAL SURVEILLANCE, SITE INSPECTIONS

13.1 TRAINING AND MEDICAL SURVEILLANCE

All URS site personnel will have met the requirements of 29 CFR 1910.120(e), including:

- Forty hours of initial off-site training or its recognized equivalent
- Eight hours of annual refresher training for all personnel (as required);
- Eight hours of supervisor training for personnel serving as SSOs; and
- Three days of work activity under the supervision of a trained and experienced supervisor.
- UXO personnel will have appropriate training in accordance with the Department of Defense Explosives Safety Board.

All URS site personnel are participating in medical surveillance programs that meet the requirements of 29 CFR 1910.120(f). Current copies of training certificates and statements of medical program participation for all URS personnel are maintained by the local URS office. The RVAAP operating contractor will be given copies of all required 40-hour HAZWOPER training, 8-hour refresher training, and First Aid/CPR training for any URS employees and subcontractor personnel on site.

In addition, all URS site personnel will review this HSP and sign a copy of the Safety Plan Compliance Agreement provided in Attachment B. The PM will maintain these agreements at the site and place them in the project file at the conclusion of the operation.

Prior to the start of operations at the site, the SSO will conduct a site safety briefing, which will include all personnel involved in site operations. At this meeting, the SSO will discuss:

- Contents of this HSP;
- Types of hazards at the site and means for minimizing exposure to them;
- The type of monitoring that will be performed;
- Action levels for upgrade and downgrade of PPE;
- PPE that will be used;
- Site-specific respiratory protection requirements;
- Decontamination protocol;
- Site control measures, including safe operating practices and communication;
- Location and use of emergency equipment; and
- Evacuation signals and procedures.

All site personnel, including subcontractor personnel, are to attend the briefings and sign the briefing form.

Subsequent site safety briefings will be conducted at least weekly, or whenever there is a change in task or significant change in task location. Briefings also will be conducted whenever new personnel report to the site.

13.2 SITE INSPECTIONS

The URS Site Manager or SSO is to conduct a daily site inspection prior to the start of each shift. It is the responsibility of the PM or Site Manager to resolve discrepancies immediately, contacting the RHSEM if necessary for assistance. Inspections are to be documented and maintained on site until the completion of the project, at which time they are placed in the project files.

14.0 RECORDKEEPING

The PM and SSO are responsible for site recordkeeping. Prior to the start of work, they will review this HSP; if no changes are needed, they will sign the approval form (PM) or acceptance form (SSO) and forward a copy to the RHSEM.

All URS personnel will review the HSP and sign the Safety Plan Compliance Agreement in Attachment B; copies of these forms will be maintained in the project file as noted in Section 12.

The SSO will conduct a Site Safety Briefing in accordance with Section 13 and have all attendees sign the form in Attachment B; copies will be maintained in the project file.

Any incident or exposure incident will be investigated and the Incident Report form (SMS 049) will be completed and forwarded to the Office Human Resources Representative and the RHSEM.

All instrument readings and calibrations, PPE use and changes, health and safety-related issues, and deviations from or problems with this HSP will be recorded in the field log.

Additionally, weekly reports will be submitted to the U.S Army Project Manager. See FSHP-Section 13 for details. (See Attachment E- Reporting Forms)

ATTACHMENT A

HOSPITAL AND OCCUPATIONAL CLINIC ROUTE MAP

Hospital Route and Map

Start: 8451 State Route 5
Ravenna, OH 44266-9244, US

End: Robinson Memorial Hospital: 330-297-0811
6847 N Chestnut St, Ravenna, OH 44266, US

Directions			**Distance**
		Total Est. Time: 13 minutes **Total Est. Distance:** 9.23 miles	
START	**1:**	Start out going WEST on RAVENNA WARREN RD / OH-5 W toward NEWTON FALLS RD. Continue to follow OH-5 W.	5.9 miles
WEST 59	**2:**	Stay STRAIGHT to go onto OH-59 W.	0.7 miles
→	**3:**	Turn RIGHT onto CLEVE E LIVERPOOL RD / OH-14 / OH-44.	2.3 miles
←	**4:**	Turn LEFT onto N CHESTNUT ST.	0.1 miles
END	**5:**	End at **Robinson Memorial Hospital:** 6847 N Chestnut St, Ravenna, OH 44266, US	
		Total Est. Time: 13 minutesTotal Est. Distance: 9.23 miles	

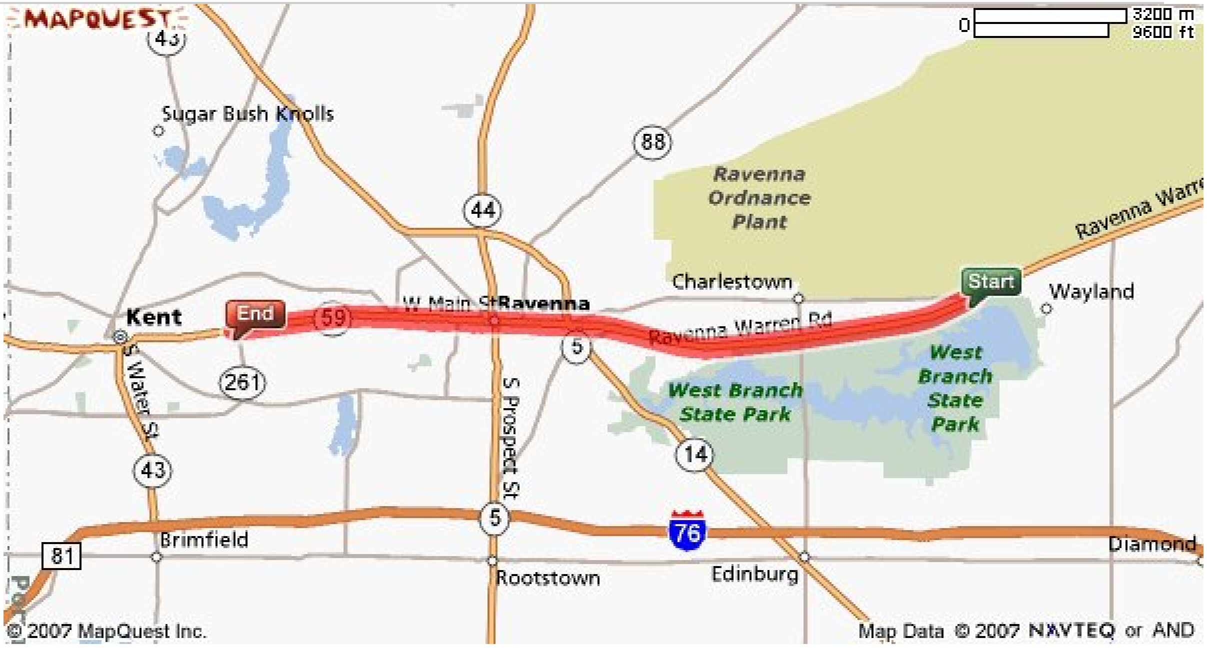
Occupational Clinic Route and Map

Start: 8451 State Route 5
Ravenna, OH 44266-9244, US

End:1993 State Route 59
Kent, OH 44240-7609, US

Directions			**Distance**
		Total Est. Time: 20 minutes **Total Est. Distance:** 12.06 miles	
START	**1:**	Start out going WEST on RAVENNA WARREN RD / OH-5 W toward NEWTON FALLS RD. Continue to follow OH-5 W.	5.9 miles
WEST 59	**2:**	Stay STRAIGHT to go onto OH-59 W.	6.1 miles
END	**3:**	End at **1993 State Route 59** Kent, OH 44240-7609, US	

Total Est. Time: 20 minutes**Total Est. Distance:** 12.06 miles



ATTACHMENT B

SAFETY PLAN COMPLIANCE AGREEMENT AND MEDICAL EMERGENCY CONTACT SHEET

ATTACHMENT B
SAFETY PLAN COMPLIANCE AGREEMENT AND MEDICAL EMERGENCY CONTACT SHEET

I, ___________________________________, have received a copy of the Health and Safety Plan for this Project. I have reviewed the plan, understand it, and agree to comply with all of its provisions. I understand that I could be prohibited from working on the project for violating any of the health and safety requirements specified in the plan.

SIGNED: ________________________________ __________________________

Signature Date

Firm: URS Corp.

OPTIONAL: This brief Medical Emergency Contact Sheet will be kept in the Support Zone during site operations. This data sheet will accompany injured personnel when medical assistance or transport to hospital facilities is necessary.

Emergency Contact: __________________________ Phone #:_________________________

Relationship: ____

Do you wear contact lenses? _____________

ATTACHMENT C

MATERIAL SAFETY DATA SHEETS

Strategic Diagnostics Inc.

Part #: 9998057.0
Revised November 1998

Material Safety Data Sheet

TNT Soil 20 Test Kit

MATERIAL IDENTIFICATION

Manufacturer/Distributor:	Strategic Diagnostics Inc. 111 Pencader Drive Newark, DE 19702
Phone Number:	1-(302) 456-6789
Trade Names and Synonyms:	TNT Soil 20 Test Kit (7002000)
NFPA Ratings	Health: 2 Flammability: 4 Reactivity: 1

OSHA HAZARD DETERMINATION

Hazardous Ingredients	**CAS Number**	**Weight Percent**
Acetone Acetone, Dimethyl Ketone	67-64-1	≤ 100
Tetrabutylammonium Hydroxide	2052-49-5	≤ 25

PHYSICAL DATA

Plastic kit containing small amounts of various liquids and powders.

HAZARDOUS REACTIVITY

Instability	Stable - Reactivity not expected with the product.

FIRE AND EXPLOSION DATA

Fire and Explosion Hazards	There is a fire and explosion hazard with this chemical. Acetone has a flash point of 1°F and 869°F for auto ignition.
Extinguishing Media	Use Carbon dioxide, dry chemical powder or appropriate foam.
Special Fire Fighting Instructions	This chemical kit is highly flammable. Vapor may travel considerable distance to source of ignition and flashback.

HEALTH HAZARD INFORMATION

Primary Route(s) of Exposure/Entry: Skin, Eyes and inhalation. Wash thoroughly after handling and take precautionary measures. If victim is experiencing difficulty in breathing, remove to fresh air and provide oxygen.

Signs and Symptoms of Exposure/Medical Conditions Aggravated by Exposure:
Skin exposure to acetone may cause irritation, redness, dryness or inflammation. Acetone may cause irritation to eyes that is characterized by a burning sensation, redness, tearing, inflammation and possible

corneal injury. Inhaling or ingesting acetone may cause irritation to the digestive tract, central nervous system depression, headache, dizziness, unconsciousness, coma, respiratory tract irritation, and kidney and liver damage. May cause motor incoordination and speech abnormalities.
Tetrabutylammonium Hydroxide is extremely destructive to the tissue of the mucous membranes and upper respiratory tract, eyes and skin. Inhalation may cause spasm, inflammation, and edema of the larynx and bronchi, chemical pneumonitis and pulmenary edema. Symptoms of overexposure may include burning sensations, coughing, wheezing, laryngitis, shortness of breath, headache, nausea and vomiting.

Carcinogenicity: None of the components in this material is listed by IARC, NTP, OSHA, or ACGIH as a carcinogen.

Applicable Exposure Limits

Acetone
TLV (ACGIH) 750 ppm; 1780 mg/m3
STEL: 1000 ppm; 2380 mg/m3
PEL (OSHA) TWA: 1000 ppm
TWA: 2400 mg/m3

Tetrabutylammonium Hydroxide
TLV (ACGIH) 200 ppm; 260 mg/m3
PEL (OSHA) TWA: 200 ppm; 260 mg/m3 8 H
STEL : 250 ppm; 310 mg / m3

FIRST AID

Inhalation	Get medical attention immediately. Remove affected person to fresh air.
Skin Contact	The compound is not likely to be hazardous by skin contact, but may cause irritation. Flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. If irritation persists, contact a physician.
Eye Contact	In case of contact, immediately flush eyes with plenty of water for at least 15 minutes occasionally lifting upper and lower lids. Call a physician.
Ingestion	The compound is toxic by ingestion. If victim is conscious and alert, give 2 –4 cupfuls of milk or water. Call a physician immediately.

PROTECTION INFORMATION

General Control Measures and Precautions: Ventilation – Chemical fume hood required.

Personal Protective Equipment: Respiratory Protection: NIOSH / MSHA –approved respirator face shield (8 inch minimum)

Protective Gloves: Are highly recommended.

Eye Protection: Safety glasses are required.

Other Protective Equipment: A lab coat or other long sleeved garment is required to limit skin exposure. Access to safety shower and eyewash is required.

SPILL, LEAK AND DISPOSAL INFORMATION

Spill, Leak, or Release Review FIRE AND EXPLOSION HAZARDS and SAFETY PRECAUTIONS before proceeding with clean up.

Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean up.

No special clean up practices are required. Absorb spill with inert material and collect in suitable waste container.

Waste Disposal Dispose of as solid waste in accordance with any applicable federal, state, and local requirements.

SHIPPING INFORMATION

DOT	Proper Shipping Name	Not DOT regulated.
IATA/IMO	Proper Shipping Name	Not restricted.

TITLE III HAZARD CLASSIFICATION

Acute	No
Chronic	No
Fire	No
Reactivity	No
Pressure	No

REGULATORY INFORMATION

OSHA HAZARD DETERMINATION: This material is not known to be hazardous as defined by OSHA's Hazard Communication Standard, 29 CFR 1910.1200

EPA DETERMINATIONS:
COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, & LIABILITY ACT (CERCLA/SUPERFUND), 40 CFR 302 - This material is not known to contain hazardous substances in sufficient quantity to make it subject to CERCLA regulations.

TOXIC SUBSTANCES CONTROL ACT (TSCA), 40 CFR 710
The material is a mixture as defined by TSCA. The chemical ingredients in this material are in the Section 8(b) Chemical Substance Inventory and/or are otherwise in compliance with TSCA. In the case of ingredients obtained from other manufacturers, Strategic Diagnostics, Inc. relies on the assurance of responsible third parties in providing this statement.

RESOURCE CONSERVATION AND RECOVERY ACT (RCRA), 40 CFR 261, SUBPARTS C AND D
The material, when discarded or disposed of, is not specifically listed as a hazardous waste in Federal regulations; however, it could be considered hazardous if it meets criteria for being toxic, corrosive, ignitable or reactive according to U.S. EPA definitions (40 CFR 261). This material could also become a hazardous waste if it is mixed with or comes in contact with a listed hazardous waste. If it is a hazardous waste, regulations 40 CFR 262-266 and 268 may apply.

HAZARDOUS MATERIALS TRANSPORTATION REGULATIONS, 49 CFR 171-178 - This material is not known to contain hazardous substances in sufficient quantity to make it subject to the Regulations.

FOREIGN REGULATIONS: CANADIAN HAZARDOUS PRODUCTS ACT (WHMIS)
The material is not a WHMIS Controlled Product.

STATE REGULATIONS:
CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT OF 1986 ("PROPOSITION 65")

The material is not known to contain any ingredient (s) subject to the Act.

PENNSYLVANIA WORKER AND COMMUNITY RIGHT TO KNOW ACT
This material is not known to contain any ingredient(s) subject to the Act. Non-hazardous ingredient(s) information is withheld as trade secret in accordance with Section 11 of the Pennsylvania Worker and Community Right to Know Act.

The above data are based on tests, experience, and other information which Strategic Diagnostics Inc. believes reliable and are supplied for informational purposes only. However, some ingredients may have been purchased or obtained from third-party manufacturers. In these instances, Strategic Diagnostics, Inc., in good faith, relies on information provided by those third parties. Since conditions of use are outside our control, STRATEGIC DIAGNOSTICS INC. DISCLAIMS ANY LIABLITITY FOR DAMAGE OR INJURY WHICH RESULTS FROM USE OF THE ABOVE DATA. NOTHING CONTAINED HEREIN SHALL CONSTITUTE A GUARANTEE, WARRANTY (INCLUDING WARRANTY OF MERCHANTABILITY) OR REPRESENTATION (INCLUDING FREEDOM FROM PATENT LIABILITY) BY STRATEGIC DIAGNOSTICS, INC. WITH RESPECT TO THE DATA, THE MATERIAL DESCRIBED, OR ITS USE FOR ANY SPECIFIC PURPOSE, EVEN IF THAT PURPOSE IS KNOWN TO STRATEGIC DIAGNOSTICS INC.

Responsibility for MSDS:
Strategic Diagnostics Inc.
111 Pencader Drive
Newark, DE 19702
(302) 456-6789

* End of MSDS *

SDI

Material Safety Data Sheet

RDX 20 w/ Extraction Jar Kit

MATERIAL IDENTIFICATION

Manufacturer/Distributor:	Strategic Diagnostics Inc. 111 Pencader Drive Newark, DE 19702
Phone Number:	1-(302) 456-6789
Trade Names and Synonyms:	RDX 20 w / Extraction Jar Kit (7085000)
NFPA Ratings	Health: 2 Flammability: 4 Reactivity: 1

OSHA HAZARD DETERMINATION

Hazardous Ingredients	CAS Number	Weight Percent
Acetone	67-64-1	≤ 100
Acetic Acid	64-19-1	≤ 77

PHYSICAL DATA

Plastic kit containing small amounts of various liquids and powders.

HAZARDOUS REACTIVITY

Instability	Stable - Reactivity not expected with the product.

FIRE AND EXPLOSION DATA

Fire and Explosion Hazards	There is a fire and explosion hazard with this kit. Acetone has a flash point of 1°F and an autoignition temperature of 869°F.
Extinguishing Media	Use carbon dioxide, dry chemical powder or appropriate foam. Water may be effective for cooling, but not for extinguishing.
Special Fire Fighting Instructions	Fire fighters must wear appropriate protective clothing and a self – contained breathing apparatus.

HEALTH HAZARD INFORMATION

Primary Route(s) of Exposure/Entry: Skin, Eyes and Mouth. Wash thoroughly after handling. If ingested or inhaled seek prompt medical attention.

Signs and Symptoms of Exposure/Medical Conditions Aggravated by Exposure:
Acetone and acetic acid may be harmful by ingestion, inhalation and / or skin absorption. Material may cause irritation to skin, eyes, mucous membranes and upper respiratory tract. Continual skin exposure to acetone may cause dermatitis.

Carcinogenicity: None of the components in this material is listed by IARC, NTP, OSHA, or ACGIH as a carcinogen.

Applicable Exposure Limits

Acetone

TLV (ACGIH)	2380 mg / m3 (1000 ppm) 1780 mg / m3 (750 ppm)
PEL (OSHA)	8H TWA 2400 mg / m3 (1000 ppm)

Acetic acid

TLV (ACGIH)	37 mg / m3 (15 ppm) 25 mg / m3 (10 ppm)
PEL (OSHA)	25 mg / m3 (10 ppm)

FIRST AID

Inhalation If inhaled, remove victim to fresh air. If not breathing give artificial respiration. Consult a physician if necessary.

Skin Contact The compound is not likely to be hazardous by skin contact, but may cause irritation. If irritation occurs, flush skin with large amounts of soapy water.

Eye Contact In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Call a physician.

Ingestion The compound is toxic by ingestion. If swallowed, wash mouth out with water provided that person is conscious. Call a physician.

PROTECTION INFORMATION

General Control Measures and Precautions: Ventilation - Mechanical ventilation required.

Personal Protective Equipment: Respiratory Protection: None required.

Protective Gloves: Are highly recommended.

Eye Protection: Safety glasses are required.

Other Protective Equipment: Access to a safety shower and eyewash is required. Lab coat or other long – sleeved garment is required.

SPILL, LEAK AND DISPOSAL INFORMATION

Spill, Leak, or Release Review FIRE AND EXPLOSION HAZARDS and SAFETY PRECAUTIONS before proceeding with clean up.

Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean up.

Clean up spill with an activated carbon absorbent, take up and place in closed container. Ventilate and wash spill site after material pick up is complete.

Waste Disposal Dispose of as solid waste in accordance with any applicable federal, state, and local requirements.

SHIPPING INFORMATION

DOT Proper Shipping Name Not DOT regulated.

IATA/IMO	Proper Shipping Name	Not restricted.

TITLE III HAZARD CLASSIFICATION

Acute	No
Chronic	No
Fire	No
Reactivity	No
Pressure	No

REGULATORY INFORMATION

OSHA HAZARD DETERMINATION: This material is not known to be hazardous as defined by OSHA's Hazard Communication Standard, 29 CFR 1910.1200

EPA DETERMINATIONS:
COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, & LIABILITY ACT (CERCLA/SUPERFUND), 40 CFR 302 - This material is not known to contain hazardous substances in sufficient quantity to make it subject to CERCLA regulations.

TOXIC SUBSTANCES CONTROL ACT (TSCA), 40 CFR 710
The material is a mixture as defined by TSCA. The chemical ingredients in this material are in the Section 8(b) Chemical Substance Inventory and/or are otherwise in compliance with TSCA. In the case of ingredients obtained from other manufacturers, Strategic Diagnostics, Inc. relies on the assurance of responsible third parties in providing this statement.

RESOURCE CONSERVATION AND RECOVERY ACT (RCRA), 40 CFR 261, SUBPARTS C AND D
The material, when discarded or disposed of, is not specifically listed as a hazardous waste in Federal regulations; however, it could be considered hazardous if it meets criteria for being toxic, corrosive, ignitable or reactive according to U.S. EPA definitions (40 CFR 261). This material could also become a hazardous waste if it is mixed with or comes in contact with a listed hazardous waste. If it is a hazardous waste, regulations 40 CFR 262-266 and 268 may apply.

HAZARDOUS MATERIALS TRANSPORTATION REGULATIONS, 49 CFR 171-178 - This material is not known to contain hazardous substances in sufficient quantity to make it subject to the Regulations.

FOREIGN REGULATIONS: CANADIAN HAZARDOUS PRODUCTS ACT (WHMIS)
The material is not a WHMIS Controlled Product.

STATE REGULATIONS:
CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT OF 1986 ("PROPOSITION 65")
The material is not known to contain any ingredients (s) subject to the Act.

PENNSYLVANIA WORKER AND COMMUNITY RIGHT TO KNOW ACT
This material is not known to contain any ingredient(s) subject to the Act. Non-hazardous ingredient(s) information is withheld as trade secret in accordance with Section 11 of the Pennsylvania Worker and Community Right to Know Act.

The above data are based on tests, experience, and other information which Strategic Diagnostics Inc. believes reliable and are supplied for informational purposes only. However, some ingredients may have been purchased or obtained from third-party manufacturers. In these instances, Strategic Diagnostics, Inc., in good faith, relies on information provided by those third parties. Since conditions of use are outside our control, STRATEGIC DIAGNOSTICS INC. DISCLAIMS ANY LIABLITITY FOR DAMAGE OR INJURY WHICH RESULTS FROM USE OF THE ABOVE DATA. NOTHING CONTAINED HEREIN SHALL CONSTITUTE A GUARANTEE, WARRANTY

(INCLUDING WARRANTY OF MERCHANTABILITY) OR REPRESENTATION (INCLUDING FREEDOM FROM PATENT LIABILITY) BY STRATEGIC DIAGNOSTICS, INC. WITH RESPECT TO THE DATA, THE MATERIAL DESCRIBED, OR ITS USE FOR ANY SPECIFIC PURPOSE, EVEN IF THAT PURPOSE IS KNOWN TO STRATEGIC DIAGNOSTICS INC.

Responsibility for MSDS:

Strategic Diagnostics Inc.
111 Pencader Drive
Newark, DE 19702
(302) 456-6789

* End of MSDS *

MATERIAL SAFETY DATA SHEET

BP UNLEADED GASOLINES

MSDS No. 12632000 ANSI/ENGLISH

1.0 CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: BP UNLEADED GASOLINES

MANUFACTURER/SUPPLIER:

BP Oil Company
200 East Randolph Drive
Chicago, Illinois 60601 U.S.A.

EMERGENCY HEALTH INFORMATION:
1 (800) 447-8735

EMERGENCY SPILL INFORMATION:
1 (800) 424-9300 CHEMTREC (USA)

OTHER PRODUCT SAFETY INFORMATION:
(630) 836-5441

2.0 COMPOSITION/INFORMATION ON INGREDIENTS

Component	CAS#	Range % by Wt.
Gasoline	8006-61-9	99.9-100
Benzene	71-43-2	0-3
Butane	106-97-8	4-6
Cyclohexane	110-82-7	0-1
Ethylbenzene	100-41-4	0-2
Heptane	142-82-5	6-8
Hexane	110-54-3	8-10
Pentane	109-66-0	9-11
Toluene	108-88-3	10-12
Trimethylbenzene	95-63-6	0-3
Xylene	1330-20-7	8-10

(See Section 8.0, "Exposure Controls/Personal Protection", for exposure guidelines)

3.0 HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW: Danger! Extremely flammable. Inhalation of vapor/aerosol concentrations above the recommended exposure limits causes headaches, drowsiness, and nausea, and may lead to unconsciousness or death. Harmful if swallowed and/or aspirated into the lungs. Prolonged or repeated contact may cause irritation and/or dermatitis. Use as motor fuel only. Long-term exposure to vapors has caused cancer in laboratory animals.

POTENTIAL HEALTH EFFECTS:

EYE CONTACT: High concentrations of vapor/mist may cause eye discomfort.

SKIN CONTACT: Prolonged or repeated contact can defat the skin and lead to irritation and/or dermatitis.

INHALATION: Inhalation of vapor/aerosol concentrations above the recommended exposure limits causes headaches, drowsiness, and nausea, and may lead to unconsciousness or death. See "Toxicological Information" section (Section 11.0).

INGESTION: Harmful or fatal if liquid is aspirated into lungs. Ingestion causes gastrointestinal irritation and diarrhea. See "Toxicological Information" section (Section 11.0).

HMIS CODE: (Health:1) (Flammability:3) (Reactivity:0) CHRONIC HEALTH HAZARD.

NFPA CODE: (Health:1) (Flammability:3) (Instability:0)

4.0 FIRST AID MEASURES

EYE: Flush eyes with plenty of water. Get medical attention if irritation persists.

SKIN: Wash exposed skin with soap and water. Remove contaminated clothing, including shoes, and thoroughly clean and dry before reuse. Get medical attention if irritation develops.

INHALATION: If adverse effects occur, remove to uncontaminated area. Give artificial respiration if not breathing. Get medical attention.

INGESTION: If swallowed, do NOT induce vomiting. Get immediate medical attention.

5.0 FIRE FIGHTING MEASURES

FLASHPOINT: -45°F

UEL: 7.6%

LEL: 1.3%

AUTOIGNITION TEMPERATURE: 495.0°F

FLAMMABILITY CLASSIFICATION: Extremely Flammable Liquid.

EXTINGUISHING MEDIA: Agents approved for Class B hazards (e.g., dry chemical, carbon dioxide, foam, steam) or water fog. Water may be ineffective but should be used to cool-fire exposed containers, structures and to protect personnel.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Extremely flammable vapor/air mixtures form. Extinguishment of fire before source of vapor is shut off can create an explosive mixture in air. Product gives off vapors that are heavier than air which can travel considerable distances to a source of ignition and flashback. Runoff to sewer may cause a fire or explosion hazard.

FIRE-FIGHTING EQUIPMENT: Firefighters should wear full bunker gear, including a positive pressure self-contained breathing apparatus.

PRECAUTIONS: Keep away from sources of ignition (e.g., heat and open flames). Keep container closed. Use with adequate ventilation.

HAZARDOUS COMBUSTION PRODUCTS: Combustion of this product in an area without adequate ventilation may result in hazardous levels of combustion products (e.g., carbon monoxide, carbon dioxide) and inadequate oxygen levels.

6.0 ACCIDENTAL RELEASE MEASURES

Remove or shut off all sources of ignition. Wear respirator and spray with water to disperse vapors. Increase ventilation if possible. Prevent spreading by diking, ditching, or absorbing on inert materials. Keep out of sewers and waterways.

7.0 HANDLING AND STORAGE

HANDLING: Use with adequate ventilation. Keep away from ignition sources (e.g., heat, sparks, or open flames). Ground and bond containers when transferring materials. Wash thoroughly after handling.

STORAGE: Store in flammable liquids storage area. Keep container closed. Store away from heat, ignition sources, and open flame in accordance with applicable regulations.

SPECIAL PRECAUTIONS: Keep out of sewers and waterways. Avoid strong oxidizers. Report spills to appropriate authorities. USE AS MOTOR FUEL ONLY.

8.0 EXPOSURE CONTROLS / PERSONAL PROTECTION

EYE: None required; however, use of eye protection is good industrial practice.

SKIN: Avoid prolonged or repeated skin contact. Wear protective clothing and gloves if prolonged or repeated contact is likely.

INHALATION: Use with adequate ventilation. Avoid breathing vapor and/or mist. If ventilation is inadequate, use NIOSH certified respirator that will protect against organic vapor and dust/mist.

ENGINEERING CONTROLS: Control airborne concentrations below the exposure guidelines.

EXPOSURE GUIDELINES:

Component	CAS#	Exposure Limits
Gasoline	8006-61-9	OSHA PEL: 300 ppm (1989); Not established. (1971) OSHA STEL: 500 ppm (1989); Not established. (1971) ACGIH TLV-TWA: 300 ppm ACGIH TLV-STEL: 500 ppm
Benzene	71-43-2	OSHA PEL: 1 ppm OSHA STEL: 5 ppm ACGIH TLV-TWA: 0.5 ppm (skin) ACGIH TLV-STEL: 2.5 ppm (skin) Mexico TWA: 10 ppm Mexico STEL: 25 ppm
Butane	106-97-8	OSHA PEL: 800 ppm (1989); Not established. (1971) ACGIH TLV-TWA: 800 ppm Mexico TWA: 800 ppm
Cyclohexane	110-82-7	OSHA PEL: 300 ppm (1989)(1971) ACGIH TLV-TWA: 300 ppm Mexico TWA: 300 ppm Mexico STEL: 375 ppm
Ethylbenzene	100-41-4	OSHA PEL: 100 ppm (1989)(1971) OSHA STEL: 125 ppm(1989); Not established. (1971) ACGIH TLV-TWA: 100 ppm ACGIH TLV-STEL: 125 ppm Mexico TWA: 100 ppm Mexico STEL: 125 ppm

Heptane	142-82-5	OSHA PEL: 400 ppm (1989); 500 ppm (1971) OSHA STEL: 500 ppm (1989); Not established. (1971) ACGIH TLV-TWA: 400 ppm ACGIH TLV-STEL: 500 ppm Mexico TWA: 400 ppm (skin) Mexico STEL: 500 ppm (skin)
Hexane	110-54-3	OSHA PEL: 50 ppm (1989); 500 ppm (1971) ACGIH TLV-TWA: 50 ppm (skin) Mexico TWA: 100 ppm
Pentane	109-66-0	OSHA PEL: 600 ppm (1989); 1000 ppm (1971) OSHA STEL: 750 ppm (1989); Not established. (1971) ACGIH TLV-TWA: 600 ppm Mexico TWA: 600 ppm Mexico STEL: 760 ppm
Toluene	108-88-3	OSHA PEL: 100 ppm (1989); 200 ppm (1971) OSHA STEL: 150 ppm (1989); Not established. (1971) OSHA Ceiling: 300 ppm (1971) ACGIH TLV-TWA: 50 ppm (skin) Mexico TWA: 100 ppm Mexico STEL: 150 ppm
Trimethylbenzene	95-63-6	OSHA PEL: 25 ppm (1989); Not established. (1971) ACGIH TLV-TWA: 25 ppm Mexico TWA: 25 ppm Mexico STEL: 35 ppm
Xylene	1330-20-7	OSHA PEL: 100 ppm (1989)(1971) OSHA STEL: 150 ppm (1989); Not established. (1971) ACGIH TLV-TWA: 100 ppm ACGIH TLV-STEL: 150 ppm Mexico TWA: 100 ppm (skin) Mexico STEL: 150 ppm (skin)

9.0 CHEMICAL AND PHYSICAL PROPERTIES

APPEARANCE AND ODOR: Clear. Liquid. Hydrocarbon odor.

pH: Not determined.

VAPOR PRESSURE: 7-15 lb RVP (ASTM D323)

VAPOR DENSITY: 3.0-4.0

BOILING POINT: 80.0-430.0°F (range)

MELTING POINT: Not determined.

SOLUBILITY IN WATER: Negligible, below 0.1%.

SPECIFIC GRAVITY (WATER=1): 0.75

10.0 STABILITY AND REACTIVITY

STABILITY: Burning can be started easily.

CONDITIONS TO AVOID: Keep away from ignition sources (e.g. heat, sparks, and open flames).

MATERIALS TO AVOID: Avoid chlorine, fluorine, and other strong oxidizers.

HAZARDOUS DECOMPOSITION: None identified.

HAZARDOUS POLYMERIZATION: Will not occur.

11.0 TOXICOLOGICAL INFORMATION

ACUTE TOXICITY DATA:

EYE IRRITATION: This product had a primary eye irritation score (PEIS) of 0/110.0 (rabbit)

SKIN IRRITATION: This product had a primary skin irritation score (PDIS) of 1.1/8.0 (rabbit)

DERMAL LD50: greater than 5 ml/kg (rabbit).

ORAL LD50: 18.8 ml/kg (rat).

INHALATION LC50: 20.7 mg/l (rat)

OTHER TOXICITY DATA: Excess exposure to vapors may produce headaches, dizziness, nausea, drowsiness, irritation of eyes, nose and throat and central nervous system depression. Aspiration of this material into the lungs can cause chemical pneumonia and can be fatal. Aspiration into the lungs can occur while vomiting after ingestion of this product. Inhalation of unleaded gasoline vapors did not produce birth defects in laboratory animals. Ingestion of this material can cause gastrointestinal irritation and diarrhea.

In a long-term inhalation study of whole unleaded gasoline vapors, exposure-related kidney damage and kidney tumors were observed in male rats. Similar kidney effects were not seen in female rats or in mice. At the highest exposure level (2056 ppm), female mice had an increased incidence of liver tumors. Results from subsequent scientific studies have shown that a broad variety of chemicals cause these kidney effects only in the male rat. Further studies have discovered the means by which the physiology of the male rat uniquely predispose it to these effects. Consequently, the Risk Assessment Forum of the Environmental Protection Agency has recognized that these responses are not predictive of a human health hazard. The liver tumors that were increased in the high-dose female mice are likewise of questionable significance because of their high spontaneous occurrence even without chemical exposure and because the rate of their occurrence is accelerated by a broad spectrum of chemicals not commonly considered to be carcinogens (e.g., phenobarbital). Thus, the significance of the mouse liver tumor response in terms of human health is questionable.

Gasoline is a complex mixture of hydrocarbons and contains benzene (typically no more than 2 volume%), toluene, and xylene. Chronic exposure to high levels of benzene has been shown to cause cancer (leukemia) in humans and other adverse blood effects (anemia). Benzene is considered a human carcinogen by IARC, NTP and OSHA. Over exposure to xylene and toluene can cause irritation to the upper respiratory tract, headache and narcosis. Some liver damage and lung inflammation were seen in chronic studies on xylene in guinea pigs but not in rats.

Solvent "sniffing" (abuse) or intentional overexposure to vapors can produce serious central nervous system effects, including unconsciousness, and possibly death.

12.0 ECOLOGICAL INFORMATION

Ecological testing has not been conducted on this material by BP Amoco.

13.0 DISPOSAL INFORMATION

Residues and spilled material are hazardous waste due to ignitability. Disposal must be in accordance with applicable federal, state, or local regulations. Enclosed-controlled incineration is recommended unless directed otherwise by applicable ordinances.

The container for this product can present explosion or fire hazards, even when emptied! To avoid risk of injury, do not cut, puncture, or weld on or near this container. Since the emptied containers retain product residue, follow label warnings even after container is emptied.

14.0 TRANSPORTATION INFORMATION

U.S. DEPT OF TRANSPORTATION

Shipping Name	Gasoline
Hazard Class	3
Identification Number	UN1203
Packing Group	II

INTERNATIONAL INFORMATION:

Sea (IMO/IMDG)

Shipping Name Gasoline
Class 3.1
Packing Group II
UN Number UN1203

Air (ICAO/IATA)

Shipping Name Gasoline , UN1203
Class 3
Packing Group II

European Road/Rail (ADR/RID)

Shipping Name Not determined.

Canadian Transportation of Dangerous Goods

Shipping Name Gasoline
Hazard Class 3
UN Number UN1203
Packing Group II

15.0 REGULATORY INFORMATION

CERCLA SECTIONS 102a/103 HAZARDOUS SUBSTANCES (40 CFR Part 302.4): This product is exempt from the CERCLA reporting requirements under 40 CFR Part 302.4. However, if spilled into waters of the United States, it may be reportable under 33 CFR Part 153 if it produces a sheen.

SARA TITLE III SECTION 302 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR Part 355): This product is not regulated under Section 302 of SARA and 40 CFR Part 355.

SARA TITLE III SECTIONS 311/312 HAZARDOUS CATEGORIZATION (40 CFR Part 370): This product is defined as hazardous by OSHA under 29 CFR Part 1910.1200(d). Hazardous categories for this product are: Acute = yes; Chronic = yes; Fire = yes; Pressure = no; Reactive = no.

SARA TITLE III SECTION 313 (40 CFR Part 372): This product contains the following substance(s), which is on the Toxic Chemicals List in 40 CFR Part 372:

Component/CAS Number	Weight Percent
Benzene 71-43-2	3
Trimethylbenzene 95-63-6	3
Cyclohexane 110-82-7	1
Ethylbenzene 100-41-4	2
Xylene 1330-20-7	10
Hexane 110-54-3	10
Toluene 108-88-3	12

U.S. INVENTORY (TSCA): Listed on inventory.

OSHA HAZARD COMMUNICATION STANDARD: Flammable liquid. Irritant. Contains components listed by ACGIH. Contains components listed by OSHA. Contains a carcinogenic component.

WHMIS Controlled Product Classification: B2, D2A, D2B.

EC INVENTORY (EINECS/ELINCS): Not determined.

JAPAN INVENTORY (MITI): Not determined.

AUSTRALIA INVENTORY (AICS): Not determined.

KOREA INVENTORY (ECL): Not determined.

CANADA INVENTORY (DSL): Not determined.

PHILIPPINE INVENTORY (PICCS): Not determined.

16.0 OTHER INFORMATION

This material contains an ingredient/ingredients present on the following State Right-To-Know lists:

-Florida- -Massachusetts- -New Jersey- -Pennsylvania- -California- -Minnesota-

This product contains an ingredient/ingredients known to the state of California to cause cancer and/or reproductive toxicity.

Prepared by:

Environment, Health and Safety Department

Issued: July 16, 1999

This Material Safety Data Sheet conforms to the requirements of ANSI Z400.1.

U.S. Department of Labor
Occupational Safety & Health Administration
www.osha.gov

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OSHA/EPA Occupational Chemical Database

Chemical Identification

Chemical Name: ISOPROPANOL

CAS #: 67-63-0 **UN No:** 1219 **Formula:** C3H8O

Synonyms: Dimethyl carbinol; IPA; Isopropanol; 2-Propanol; sec-Propyl alcohol; Rubbing alcohol; isoprop

Physical Properties

Physical Description: Colorless liquid with the odor of rubbing alcohol.			
BP: 181°F	**MW:** 60.1	**LEL:** 2.0%	**NFPA Fire Rating:** 3
FRZ/MLT: FRZ: -127°F	**VP:** 33 mmHg	**UEL:** (200°F): 12.7%	**NFPA Health Rating:** 1
FP: 53°F	**VD:** NA		**NFPA Reactivity Rating:** 0
Sp. GR: 0.79	**IP:** 10.10 eV		**NFPA Sp. Inst.:** NA

Exposure Limits

OSHA	**NIOSH**	**Related Information**
PEL-TWA ppm: 400	**REL-TWA ppm:** 400	**AIHA Emergency Response Pl Guidelines - ERPG-1/ERPG-2/** NA
PEL-TWA mg/m3: 980	**REL-TWA mg/m3:** 980	
PEL-STEL ppm: NA	**REL-STEL ppm:** 500	
PEL-STEL mg/m3: NA	**REL-STEL mg/m3:** 1225	
PEL-C ppm: NA	**REL-C ppm:** NA	
PEL-C mg/m3: NA	**REL-C mg/m3:** NA	**Carcinogen Classifications:** IA
Skin Notation: No	**Skin Notation:** No	
Notes: NA	**Notes:** NA	
	IDLH ppm: 2000	
	IDLH mg/m3: NA	
	IDLH Notes: 10% of LEL	

NIOSH Pocket Guide to Chemical Hazards (Current through June 2006)

Isopropyl alcohol	CAS: 67-63-0
Formula: (CH3)2CHOH	RTECS: NT8050(
Synonyms & Trade Names: Dimethyl carbinol, IPA, Isopropanol, 2-Propanol, sec-Propyl alcohol, Rubbing alcohol	DOT ID & Guide:
Exposure Limits	
NIOSH REL: TWA 400 ppm (980 mg/m3) ST 500 ppm	OSHA PEL : TWA 400 ppm (980 mg/m3)

(1225 mg/m3)	
IDLH: 2000 ppm [10%LEL]	Conversion: 1 ppm = 2.46 mg/m3

Physical Description

Colorless liquid with the odor of rubbing alcohol.

MW: 60.1	BP: 181F	FRZ: -127F	Sol: Miscible
VP: 33 mmHg	IP: 10.10 eV	RGasD: NA	Sp.Gr: 0.79
Fl.P: 53F	UEL(200F): 12.7%	LEL: 2.0%	MEC: NA

Class IB Flammable Liquid (See flammable and combustible liquid classes)

Incompatibilities & Reactivities

Strong oxidizers, acetaldehyde, chlorine, ethylene oxide, acids, isocyanates

Measurement Methods

NIOSH 1400; OSHA 109

Personal Protection & Sanitation	First Aid
Skin: Prevent skin contact Eyes: Prevent eye contact Wash skin: When contam Remove: When wet (flamm) Change: N.R.	Eye: Irr immed Skin: Water flush Breath: Resp support Swallow: Medical attention immed (See procedures)

NIOSH Respirator Recommendations

NIOSH/OSHA 2000 ppm: SA:CF/CCRFOV/GMFOV/PAPROV/SCBAF/SAF : SCBAF:PD,PP/SAF:PD,PP:ASCBA GMFOV/SCBAE
(See symbols and codes)

Exposure Routes

Inh Ing Con

Symptoms

Irrit eyes, nose, throat; drow, dizz, head; dry cracking skin; in animals: narco
(See abbreviations)

Target Organs

Eyes, skin, resp sys
(See abbreviations)

DOT Emergency Response Guidebook (ERG 2004)

Guide Number: 129

129 Flammable Liquids (Polar/Water-Miscible/Noxious)
POTENTIAL HAZARDS
FIRE OR EXPLOSION

- HIGHLY FLAMMABLE: Will be easily ignited by heat, sparks or flames.
- Vapors may form explosive mixtures with air.
- Vapors may travel to source of ignition and flash back.
- Most vapors are heavier than air. They will spread along ground and collect in low or confined areas (sewers, basements, tanks).
- Vapor explosion hazard indoors, outdoors or in sewers.
- Those substances designated with a P may polymerize explosively when heated or involved in a fire.
- Runoff to sewer may create fire or explosion hazard.
- Containers may explode when heated.
- Many liquids are lighter than water.

HEALTH

* May cause toxic effects if inhaled or absorbed through skin.
* Inhalation or contact with material may irritate or burn skin and eyes.
* Fire will produce irritating, corrosive and/or toxic gases.
* Vapors may cause dizziness or suffocation.
* Runoff from fire control or dilution water may cause pollution.

PUBLIC SAFETY

* CALL Emergency Response Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, refer to appropriate telephone number listed on the inside back cover.
* Isolate spill or leak area immediately for at least 50 to 100 meters (160 to 330 feet) in all directions.
* Keep unauthorized personnel away.
* Stay upwind.
* Keep out of low areas.
* Ventilate closed spaces before entering.

PROTECTIVE CLOTHING

* Wear positive pressure self-contained breathing apparatus (SCBA).
* Structural firefighters' protective clothing will only provide limited protection.

EVACUATION

Large Spill

* Consider initial downwind evacuation for at least 300 meters (1000 feet).

Fire

* If tank, rail car or tank truck is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions.

EMERGENCY RESPONSE

FIRE

CAUTION: All these products have a very low flash point: Use of water spray when fighting fire may be inefficient.

Small Fires

* Dry chemical, CO2, water spray or alcohol-resistant foam.
* Do not use dry chemical extinguishers to control fires involving nitromethane or nitroethane.

Large Fires

* Water spray, fog or alcohol-resistant foam.
* Do not use straight streams.
* Move containers from fire area if you can do it without risk.

Fire involving Tanks or Car/Trailer Loads

* Fight fire from maximum distance or use unmanned hose holders or monitor nozzles.
* Cool containers with flooding quantities of water until well after fire is out.
* Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
* ALWAYS stay away from tanks engulfed in fire.
* For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn.

SPILL OR LEAK

* ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area).
* All equipment used when handling the product must be grounded.
* Do not touch or walk through spilled material.
* Stop leak if you can do it without risk.
* Prevent entry into waterways, sewers, basements or confined areas.
* A vapor suppressing foam may be used to reduce vapors.
* Absorb or cover with dry earth, sand or other non-combustible material

and transfer to containers.

* Use clean non-sparking tools to collect absorbed material.

Large Spills

* Dike far ahead of liquid spill for later disposal.
* Water spray may reduce vapor; but may not prevent ignition in closed spaces.

FIRST AID

* Move victim to fresh air.
* Call 911 or emergency medical service.
* Apply artificial respiration if victim is not breathing.
* Administer oxygen if breathing is difficult.
* Remove and isolate contaminated clothing and shoes.
* In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes.
* Wash skin with soap and water.
* Keep victim warm and quiet.
* Effects of exposure (inhalation, ingestion or skin contact) to substance may be delayed.
* Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

Additional Emergency Response Information (CAMEO Data)

Non-fire Spill Response: Keep sparks, flames, and other sources of ignition away. Keep material out of
and sewers. Build dikes to contain flow as necessary. Attempt to stop leak if without undue personnel haz
spray to disperse vapors and dilute standing pools of liquid. (AAR, 1999)

Firefighting: Do not extinguish fire unless flow can be stopped. Use water in flooding quantities as fog. S
of water may be ineffective. Cool all affected containers with flooding quantities of water. Apply water fror
distance as possible. Use "alcohol" foam, dry chemical or carbon dioxide. (AAR, 1999)

Reactivity: STABILITY: This chemical is sensitive to heat. Solutions of this chemical in water, DMSO, 95%
acetone should be stable for 24 hours under normal lab conditions.REACTIVITY: This chemical reacts with
to form dangerously unstable peroxides. Contact with 2-butanone increases the reaction rate for peroxide
violent, explosive reaction occurs when it is heated with (aluminum isopropoxide + crotonaldehyde). It fo
mixtures with trinitromethane and hydrogen peroxide. This chemical reacts with barium perchlorate to for
explosive compound. It ignites on contact with dioxygenyl tetrafluoroborate, chromium trioxide and potas
butoxide. Vigorous reactions occur with (hydrogen + palladium), nitroform, oleum, COCl2, aluminum triis
and oxidizers. It also reacts explosively with phosgene in the presence of iron salts. It is incompatible wit
anhydrides, halogens and aluminum. (NTP, 1992)

First Aid: EYES: First check the victim for contact lenses and remove if present. Flush victim's eyes with
normal saline solution for 20 to 30 minutes while simultaneously calling a hospital or poison control cente
any ointments, oils, or medication in the victim's eyes without specific instructions from a physician. IMME
transport the victim after flushing eyes to a hospital even if no symptoms (such as redness or irritation) d
IMMEDIATELY flood affected skin with water while removing and isolating all contaminated clothing. Gentl
affected skin areas thoroughly with soap and water. If symptoms such as redness or irritation develop, IM
call a physician and be prepared to transport the victim to a hospital for treatment. INHALATION: IMMEDI
the contaminated area; take deep breaths of fresh air. If symptoms (such as wheezing, coughing, shortne
Breathing, or burning in the mouth, throat, or chest) develop, call a physician and be prepared to transpo
a hospital. Provide proper respiratory protection to rescuers entering an unknown atmosphere. Whenever
Contained Breathing Apparatus (SCBA) should be used; if not available, use a level of protection greater t
to that advised under Protective Clothing. INGESTION: DO NOT INDUCE VOMITING. Volatile chemicals ha
of being aspirated into the victim's lungs during vomiting which increases the medical problems. If the vic
conscious and not convulsing, give 1 or 2 glasses of water to dilute the chemical and IMMEDIATELY call a
poison control center. IMMEDIATELY transport the victim to a hospital. If the victim is convulsing or uncon
give anything by mouth, ensure that the victim's airway is open and lay the victim on his/her side with th
lower than the body. DO NOT INDUCE VOMITING. IMMEDIATELY transport the victim to a hospital. (NTP,

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LIQUINOX MSDS

Section 1 : PRODUCT AND COMPANY IDENTIFICATION

Chemical family: Detergent.

Manufacturer: Alconox, Inc.
30 Glenn St.
Suite 309
White Plains, NY 10603.

Manufacturer emergency phone number: 800-255-3924.
813-248-0585 (outside of the United States).

Supplier: Same as manufacturer.

Product name: Liquinox

Section 2 : INGREDIENT INFORMATION

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 : HAZARD IDENTIFICATION

Route of entry: Skin contact, eye contact, inhalation and ingestion.

Effects of acute exposure

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.

Section 4 : 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 5 : FIRE FIGHTING MEASURES

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.
Rate of burning:	Not available.
Explosive power:	Containers may rupture if exposed to heat or fire.

Section 6 : ACCIDENTAL RELEASE MEASURES

Leak/Spill:	Contain the spill. Prevent entry into drains, sewers, and other waterways. Wear appropriate protective equipment. Small amounts may be flushed to sewer with water. Soak up with an absorbent material. Place in appropriate container for disposal. Notify the appropriate authorities as required.

Section 7 : HANDLING AND STORAGE

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.

Section 8 : EXPOSURE CONTROLS / PERSONAL PROTECTION

Precautionary Measures

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.

Exposure limit of material: Not available.

Section 9 : PHYSICAL AND CHEMICAL PROPERTIES

Physical state: Liquid.

Appearance & odor: Odourless.
Pale yellow.

Odor threshold (ppm): Not available.

Vapour pressure (mmHg): @ 20°C (68°F).
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

Chemical family: Detergent.

Section 10 : STABILITY AND REACTIVITY

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 11 : TOXICOLOGICAL INFORMATION

LD50 of product, species & route: > 5000 mg/kg rat oral.

LC50 of product, species & route: 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.

Section 12 : ECOLOGICAL INFORMATION

Environmental toxicity: No data at this time.

Environmental fate: No data at this time.

Section 13 : DISPOSAL CONSIDERATIONS

Waste disposal: In accordance with local and federal regulations.

Section 14 : TRANSPORT INFORMATION

D.O.T. CLASSIFICATION: Not regulated.

Special shipping information: Not regulated.

Section 15 : REGULATORY INFORMATION

Canadian Regulatory Information

WHMIS classification: Not controlled.

DSL status: Not available.

USA Regulatory Information

SARA hazard catagories sections 311/312: Immediate (Acute) Health Hazard: No.
Delayed (Chronic) Health Hazard: No.
Fire Hazard: No.
Sudden Release of Pressure: No.
Reactive: No.

SARA Section 313: None

TSCA inventory: All components of this product are listed on the TSCA inventory.

NFPA

Health Hazard: 1

Flammability: 0

Reactivity: 0

HMIS

Health Hazard: 1

Flammability: 0

Physical hazard: 0

PPE: A

Section 16 : OTHER INFORMATION

Supplier MSDS date: 2006/07/14

Data prepared by: Global Safety Management
3340 Peachtree Road, #1800
Atlanta, GA 30326

Phone: 877-683-7460
Fax: (877) 683-7462

Web: www.globalsafetynet.com
Email: info@globalsafetynet.com.

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.

OSHA/EPA Occupational Chemical Database

Chemical Identification

Chemical Name: BENZENE
CAS #: 71-43-2 **UN No:** 1114 **Formula:** C6H6
Synonyms: Benzol; Phenyl hydride

Physical Properties

Physical Description: Colorless to light-yellow liquid with an aromatic odor. [Note: A solid below 42°F.]

BP: 176°F	**MW:** 78.1	**LEL:** 1.2%	**NFPA Fire Rating:** 3
FRZ/MLT: FRZ: 42°F	**VP:** 75 mmHg	**UEL:** 7.8%	**NFPA Health Rating:** 2
FP: 12°F	**VD:** NA		**NFPA Reactivity Rating:** 0
Sp. GR: 0.88	**IP:** 9.24 eV		**NFPA Sp. Inst.:** NA

Exposure Limits

OSHA	**NIOSH**	**Related Information**
PEL-TWA ppm: 1	**REL-TWA ppm:** 0.1	**AIHA Emergency Response Pl Guidelines - ERPG-1/ERPG-2/** 50 ppm/150 ppm/1000 ppm
PEL-TWA mg/m3: NA	**REL-TWA mg/m3:** NA	
PEL-STEL ppm: 5	**REL-STEL ppm:** 1	
PEL-STEL mg/m3: NA	**REL-STEL mg/m3:** NA	
PEL-C ppm: NA	**REL-C ppm:** NA	
PEL-C mg/m3: NA	**REL-C mg/m3:** NA	**Carcinogen Classifications:** IA Ca, NTP-K, OSHA-Ca, TLV-A1
Skin Notation: No	**Skin Notation:** No	
Notes: SEE 29 CFR 1910.1028, FOR INDUSTRIES EXEMPT FROM THIS STANDARD THE PELs ARE LOCATED IN 29 CFR 1910.1000 TABLE Z-2 (8-HR TWA=10 ppm, C=25ppm, PEAK=50ppm FOR A 10 MINUTE INTERVAL DURING AN 8-HOUR SHIFT)	**Notes:** CARCINOGEN (Ca)	
	IDLH ppm: 500	
	IDLH mg/m3: NA	
	IDLH Notes: Ca	

NIOSH Pocket Guide to Chemical Hazards (Current through June 2006)

Benzene	CAS: 71-43-2
Formula: C6H6	RTECS: CY14000

Synonyms & Trade Names: Benzol, Phenyl hydride	DOT ID & Guide:

Exposure Limits

NIOSH REL: Ca TWA 0.1 ppm ST 1 ppm See Appendix A	OSHA PEL: [1910.1028] TWA 1 ppm ST 5 ppm F
IDLH: Ca [500 ppm]	Conversion: 1 ppm = 3.19 mg/m3

Physical Description

Colorless to light-yellow liquid with an aromatic odor. [Note: A solid below 42F.]

MW: 78.1	BP: 176F	FRZ: 42F	Sol: 0.07%
VP: 75 mmHg	IP: 9.24 eV	RGasD: NA	Sp.Gr: 0.88
Fl.P: 12F	UEL: 7.8%	LEL: 1.2%	MEC: NA

Class IB Flammable Liquid (See flammable and combustible liquid classes)

Incompatibilities & Reactivities

Strong oxidizers, many fluorides & perchlorates, nitric acid

Measurement Methods

NIOSH 1500, 1501, 3700, 3800; OSHA 12, 1005

Personal Protection & Sanitation	First Aid
Skin: Prevent skin contact Eyes: Prevent eye contact Wash skin: When contam Remove: When wet (flamm) Change: N.R. Provide: Eyewash, Quick drench	Eye: Irr immed Skin: Soap wash immed Breath: Resp support Swallow: Medical attention immed (See procedures)

NIOSH Respirator Recommendations

NIOSH : SCBAF:PD,PP/SAF:PD,PP:ASCBA Escape: GMFOV/SCBAE
(See symbols and codes)

Exposure Routes

Inh Abs Ing Con

Symptoms

Irrit eyes, skin, nose, resp sys; gidd; head, nau, staggered gait; ftg, anor, lass; derm; bone marrow depr
(See abbreviations)

Target Organs

Eyes, skin, resp sys, blood, CNS, bone marrow
(See abbreviations)

DOT Emergency Response Guidebook (ERG 2004)

Guide Number: 130

130 Flammable Liquids (Non-Polar/Water-Immiscible/Noxious)
POTENTIAL HAZARDS
FIRE OR EXPLOSION

- HIGHLY FLAMMABLE: Will be easily ignited by heat, sparks or flames.
- Vapors may form explosive mixtures with air.
- Vapors may travel to source of ignition and flash back.
- Most vapors are heavier than air. They will spread along ground and collect in low or confined areas (sewers, basements, tanks).
- Vapor explosion hazard indoors, outdoors or in sewers.
- Those substances designated with a P may polymerize explosively when heated or involved in a fire.

* Runoff to sewer may create fire or explosion hazard.
* Containers may explode when heated.
* Many liquids are lighter than water.

HEALTH

* May cause toxic effects if inhaled or absorbed through skin.
* Inhalation or contact with material may irritate or burn skin and eyes.
* Fire will produce irritating, corrosive and/or toxic gases.
* Vapors may cause dizziness or suffocation.
* Runoff from fire control or dilution water may cause pollution.

PUBLIC SAFETY

* CALL Emergency Response Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, refer to appropriate telephone number listed on the inside back cover.
* Isolate spill or leak area immediately for at least 50 to 100 meters (160 to 330 feet) in all directions.
* Keep unauthorized personnel away.
* Stay upwind.
* Keep out of low areas.
* Ventilate closed spaces before entering.

PROTECTIVE CLOTHING

* Wear positive pressure self-contained breathing apparatus (SCBA).
* Structural firefighters' protective clothing will only provide limited protection.

EVACUATION

Large Spill
* Consider initial downwind evacuation for at least 300 meters (1000 feet).
Fire
* If tank, rail car or tank truck is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions.

EMERGENCY RESPONSE

FIRE

CAUTION: All these products have a very low flash point: Use of water spray when fighting fire may be inefficient.
Small Fires
* Dry chemical, CO2, water spray or regular foam.
Large Fires
* Water spray, fog or regular foam.
* Do not use straight streams.
* Move containers from fire area if you can do it without risk.
Fire involving Tanks or Car/Trailer Loads
* Fight fire from maximum distance or use unmanned hose holders or monitor nozzles.
* Cool containers with flooding quantities of water until well after fire is out.
* Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
* ALWAYS stay away from tanks engulfed in fire.
* For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn.

SPILL OR LEAK

* ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area).
* All equipment used when handling the product must be grounded.
* Do not touch or walk through spilled material.
* Stop leak if you can do it without risk.
* Prevent entry into waterways, sewers, basements or confined areas.
* A vapor suppressing foam may be used to reduce vapors.

* Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers.
* Use clean non-sparking tools to collect absorbed material.

Large Spills

* Dike far ahead of liquid spill for later disposal.
* Water spray may reduce vapor; but may not prevent ignition in closed spaces.

FIRST AID

* Move victim to fresh air.
* Call 911 or emergency medical service.
* Apply artificial respiration if victim is not breathing.
* Administer oxygen if breathing is difficult.
* Remove and isolate contaminated clothing and shoes.
* In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes.
* Wash skin with soap and water.
* Keep victim warm and quiet.
* Effects of exposure (inhalation, ingestion or skin contact) to substance may be delayed.
* Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

Additional Emergency Response Information (CAMEO Data)

Non-fire Spill Response: Keep sparks, flames, and other sources of ignition away. Keep material out of and sewers. Build dikes to contain flow as necessary. Attempt to stop leak if without undue personnel haz spray to knock-down vapors. (AAR, 1999)

Firefighting: Do not extinguish fire unless flow can be stopped. Use water in flooding quantities as fog. S of water may spread fire. Cool all affected containers with flooding quantities of water. Apply water from a distance as possible. Use foam, dry chemical, or carbon dioxide. (AAR, 1999)

Reactivity: CHEMICAL PROFILE: Allyl chloride or other alkyl halides will react vigorously with benzene or at minus 70C. in the presence of ethyl aluminum dichloride or ethyl aluminum sesquichloride. Explosions reported (NFPA 491M 1991). Benzene ignites in contact with the powdered chromic anhydride (Mellor 11: (REACTIVITY, 1999)

First Aid: EYES: First check the victim for contact lenses and remove if present. Flush victim's eyes with normal saline solution for 20 to 30 minutes while simultaneously calling a hospital or poison control cente any ointments, oils, or medication in the victim's eyes without specific instructions from a physician. IMME transport the victim after flushing eyes to a hospital even if no symptoms (such as redness or irritation) d IMMEDIATELY flood affected skin with water while removing and isolating all contaminated clothing. Gentl affected skin areas thoroughly with soap and water. IMMEDIATELY call a hospital or poison control center symptoms (such as redness or irritation) develop. IMMEDIATELY transport the victim to a hospital for trea washing the affected areas. INHALATION: IMMEDIATELY leave the contaminated area; take deep breaths IMMEDIATELY call a physician and be prepared to transport the victim to a hospital even if no symptoms (wheezing, coughing, shortness of breath, or burning in the mouth, throat, or chest) develop. Provide prop protection to rescuers entering an unknown atmosphere. Whenever possible, Self-Contained Breathing Ap (SCBA) should be used; if not available, use a level of protection greater than or equal to that advised un Clothing. INGESTION: DO NOT INDUCE VOMITING. Volatile chemicals have a high risk of being aspirated victim's lungs during vomiting which increases the medical problems. If the victim is conscious and not co 1 or 2 glasses of water to dilute the chemical and IMMEDIATELY call a hospital or poison control center. I transport the victim to a hospital. If the victim is convulsing or unconscious, do not give anything by mout the victim's airway is open and lay the victim on his/her side with the head lower than the body. DO NOT VOMITING. IMMEDIATELY transport the victim to a hospital. OTHER: Since this chemical is a known or sus carcinogen you should contact a physician for advice regarding the possible long term health effects and recommendation for medical monitoring. Recommendations from the physician will depend upon the speci its chemical, physical and toxicity properties, the exposure level, length of exposure, and the route of exp 1992)

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ATTACHMENT D

MEC Avoidance and Construction Support Procedures

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Acronyms and Abbreviations

ACM	asbestos-containing material
AEDA	Ammunition, Explosives, and other Dangerous Articles
bgs	below ground surface
DDESB	Department of Defense Explosives Safety Board
DoD	Department of Defense
DPT	direct push technology
ECS	explosives-contaminated soil
EODB	Explosive Ordnance Disposal Bulletin
ESS	Explosive Safety Submission
EZ	exclusion zone
FSP	Field Sampling Plan
GPS	geographic position system
HD	Hazard Division
HTRW	hazardous, toxic, radioactive waste
IDW	investigation-derived waste
MC	munitions constituents
MEC	munitions and explosives of concern
MGFD	munition with the greatest fragmentation distance
MSD	minimum separation distance
NEW	net explosive weight
PPE	personal protective equipment
QC	quality control
RVAAP	Ravenna Army Ammunition Plant
SHSO	Site Health and Safety Officer
SSHP	Site Safety and Health Plan
SOP	standard operating procedure
SOW	scope of work
SUXOS	Senior Unexploded Ordnance Supervisor

UXOQC	Unexploded Ordnance Quality Control officer
UXOSO	Unexploded Ordnance Safety Officer
URS	URS Group, Inc.
USACE	United States Army Corps of Engineers
UXO	unexploded ordnance
WP	work plan

1.1 INTRODUCTION

This Facility-Wide 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 MEC avoidance and construction support 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). These procedures will be performed and adhered to by all URS Group, Inc. (URS) and subcontractor personnel during HTRW field activities conducted at RVAAP. URS 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 utilized during HTRW-related field investigation activities at RVAAP that have the potential for encountering MEC. These activities include, but are not limited to, surface and subsurface soil sampling, and boring. The purpose of avoidance during field activities is to avoid any potential surface MEC and subsurface anomalies during sampling, investigative, or excavation activities. For anomaly avoidance on site with potential MEC, URS will provide an unexploded ordinance (UXO) escort consisting of a qualified UXO Technician III.

For MEC support during construction activities, URS will provide the appropriate personnel based on the project-specific conditions. When a determination is made by the project management team (USACE and URS) that the probability of encountering MEC is low (e.g., current or previous land use leads to an initial determination that MEC may be present), a two-person UXO team consisting of a minimum of two qualified UXO personnel (one UXO Technician III and one UXO Technician II) will provide on-site UXO standby support in case the construction contractor encounters a suspected MEC item.

No intrusive work will be allowed if a determination is made that the probability of encountering MEC is moderate to high (current or previous land use leads to a determination that MEC was employed or disposed of in the parcel of concern). Intrusive anomaly investigation and/or MEC removal is not authorized under the current scope of work (SOW) at RVAAP. If a MEC removal action is authorized at a later date, the policies and procedures for a MEC removal action will be contained in a separate MEC Removal Work Plan (WP).

2.1 UXO TEAM

2.1.1 UXO team Qualifications

MEC avoidance and construction support activities will be completed by URS personnel (and/or subcontract personnel) with UXO Technician training and appropriate documentation, in accordance with Department of Defense Explosives Safety Board (DDESB) Technical Paper 18 (DDESB 2004). The UXO escort must be on-site during all investigative/design HTRW activities in specific areas of RVAAP that have a potential for encountering MEC. For MEC support during construction activities, a two-person UXO team consisting of a minimum of two qualified UXO personnel (one UXO Technician III and one UXO Technician II) will provide on-site UXO standby support in case the construction contractor encounters a suspected MEC item. The team may include additional UXO-qualified personnel, depending on project-specific and task-specific conditions and requirements.

2.1.2 Responsibilities

The UXO team members have the following responsibilities for MEC avoidance and construction support procedures during HTRW field investigations in areas with potential or suspected MEC:

- Provide the ordnance expertise to identify and avoid all possible MEC-related hazards and act as the UXO Safety Officer (UXOSO) for the project during HTRW field activities.
- Conduct a surface access survey and a subsurface survey for anomalies (if applicable).
- Establish and delineate surface MEC or subsurface anomaly-free ingress/egress lanes and work areas.
- Conduct MEC safety briefings for all site personnel and visitors.
- Reporting of all surface and subsurface potential 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. The UXOSO will report to and communicate directly with the URS Project Manager.

3.1 ON-SITE TRAINING

As part of the MEC avoidance and construction support process, URS will perform project-specific training for all on-site personnel assigned to MEC avoidance and construction support activities. The purpose of this training is to ensure that all on-site personnel fully understand the operational procedures and methods to be used at RVAAP, including individual duties and responsibilities and all safety and environmental concerns during sampling, investigation and excavation activities. Any 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:

- Field equipment operation, including safety precautions and safety equipment, field inspection of equipment, and maintenance procedures that will be used
- Procedures, guidelines, and requirements in relevant sections of the WP and the SSHP, as they relate to the task being performed
- Site- and task-specific hazards, including physical, biological, and chemical hazards
- Public relations, including encounters with press and public
- Environmental concerns and sensitivities, including endangered/threatened species and historic, archaeological, and cultural resources on-site
- Specific ordnance materials (e.g., MEC, munitions constituents [MC], explosive soil) potentially found on-site
- Emergency procedures and contact information for RVAAP

4.1 MEC SAFETY

If MEC is encountered during any phase of work on RVAAP, the URS Project Manager, URS Health and Safety Representative, URS UXO Safety/Quality Control (QC) Manager, URS UXO Program Safety Manager, 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 the effectiveness. MEC that has been exposed to the elements for an extended period of time 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 as 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 a 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 in the vicinity of 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.

5.1 PROJECT EQUIPMENT

Project equipment for MEC avoidance and construction support will come from URS sources, subcontractors, and local vendors offering equipment for lease or purchase. All equipment, regardless of source, 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 WP or manufacturer's equipment manual. Equipment required for daily usage shall be calibrated twice daily (start and finish). This system of checks ensures that the equipment on-site is functioning properly. 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 a like model or an approved substitute. Replacement equipment will meet the same specifications for accuracy and precision as the equipment removed from service. 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 detector-aided visual search of the area. If vehicular traffic is expected, the site will require a geophysical sweep for shallow subsurface anomalies (to a depth of 4 feet). For the purpose of MEC and anomaly avoidance, the following geophysical equipment will be utilized.

- For a geophysical sweep of an area, either the Schonstedt GA-52Cx or the GA-72Cd will be utilized. These units can be expected to detect subsurface ferrous anomalies to a depth of 4 feet.
- Additionally, a White's Spectrum XLT all-metals detector may be utilized. This unit can be expected to detect subsurface ferrous and non-ferrous anomalies to a depth of 18 to 24 inches.
- For downhole surveillance, either the Schonstedt MG 220/230 or the MK26 Forrester will be utilized. The use of the MK26 will depend on the diameter of the borehole. If direct push technology (DPT) is used, then the Schonstedt MG 220/230 will be used. The MK 26 will not fit inside the typical direct push borehole (e.g., 1 to 1.5 inches outer diameter).

5.1.2 Geophysical Survey Equipment

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

This section discusses MEC avoidance and clearance activities to be used at RVAAP.

6.1 SITE ACCESS AND MEC CLEARANCE SURVEYING

In areas with potential MEC, the UXO 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 instrumentation capable of detecting the smallest known or anticipated MEC 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 below ground surface [bgs]) need only be conducted when the use of motor vehicles is anticipated. The subsurface MEC clearance will be completed to the full excavation depth should site conditions require excavation depths greater than 4 feet bgs. If only foot traffic is required, then a surface clearance and access survey (to a depth of 2 feet bgs) will suffice.

HTRW personnel must be escorted by UXO-qualified personnel at all times in areas potentially impacted with MEC until the team has completed the access surveys and the cleared areas are marked. Escorted HTRW personnel will follow behind the UXO escort. If anomalies are detected, the UXO escort will halt escorted personnel in place, select a course around the item, and instruct escorted personnel to follow. No personnel will be allowed outside of the surveyed and cleared areas.

The UXO team will conduct an access survey of the footpath and/or vehicular lanes approaching and leaving HTRW 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 flagging or stakes for future entry.

UXO personnel must 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 project-specific and will take into account, for example, maneuverability of required equipment (e.g., drill rigs, excavation equipment, etc.), parking of support vehicles, and establishment of decontamination stations. At a minimum, the surveyed area should 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 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 team will visually survey the surface of each proposed surface soil sampling site for any indication of MEC or MEC-related contamination. In addition, the team will conduct a survey of the proposed sample locations using hand-held magnetometers.

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 HTRW personnel will select an alternate location for collection of surface soil samples. Any anomalies detected will be prominently marked with survey flagging 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 defined as the collection of samples below a nominal depth of approximately 12 inches with a split-spoon, Shelby tube, direct push sampler, or bucket auger (i.e., hand auger) soil sampler using drilling techniques. Drilling techniques will also be used to drill larger diameter soil borings (e.g., 4- to 8-inch outer diameter) for HTRW investigations.

The team will conduct a 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 team will complete a hand-held, magnetometer-assisted, subsurface survey of the proposed drill-hole location(s) to a depth of 4 feet. If an anomaly is detected, sampling personnel will select a new borehole location. Any anomalies detected will be prominently marked with survey flagging or non-metallic pin flags for avoidance. If the subsurface sampling depth is greater than the geophysical instrumentation (e.g. hand-held magnetometer) detection capabilities, the team must incrementally complete the downhole geophysical survey to undisturbed soil depth as outlined below.

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

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 team will conduct a 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 downhole geophysical survey for metallic anomalies). However, the actual sampling and geophysical screening will occur through the DPT borehole. Following collection of the soil samples, the sampling location will be backfilled in accordance with project-specific procedures.

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

Department of Defense (DoD). 1995. Defense Demilitarization Manual. DoD 4160.21-M-1. February.

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

DDESB. 1998. Guidance of Clearance Plans. Memorandum. February.

DoD. 1997. Defense Materiel Disposition Manual. DoD 4160.21-M August

DoD. 2004. DoD Ammunition and Explosives Safety Standards. Directive 6055.9-STD. October.

DoD. 2004a. Management and Disposition of Material Potentially Presenting an Explosive Hazard (MPPEH). DoD 4140.62. December.

Explosive Ordnance Disposal Bulletin (EODB). 2002. General Information on EOD Disposal Procedures. TM 60A-1-1-31. January

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. 2004b. Basic Safety Concepts and Considerations for Munitions and Explosives of Concern (MEC) Response Action Operations. USACE Engineering Pamphlet EP 385-1-95a. August.

ATTACHMENT E

RVAAP Reporting Forms

OSHA Form 200

U.S. Department of Labor

For Calendar Year 20___ Page ___ of ___

Company Name

Establishment Name

Establishment Address

Form Approved
O.M.B. No. 1220-0029

Extent of and Outcome of INJURY						Type, Extent of, and Outcome of ILLNESS												
Fatalities	Nonfatal Injuries					Type of Illness							Fatalities	Nonfatal Illness				
Injury Related	Injuries With Lost Workdays				Injuries Without Lost Workdays	CHECK Only One Column for Each Illness (*See other side of form for terminations or permanent transfers.*)							Illness Related	Illnesses With Lost Workdays				Illnesses Without Lost Workdays
Enter DATE of death. Mo./day/yr.	Enter a CHECK if injury involves days away from work, or days of restricted work activity, or both.	Enter a CHECK if injury involves days away from work.	Enter number of DAYS *away from work.*	Enter number of DAYS of *restricted work activity.*	Enter a CHECK if no entry was made in columns 1 or 2 but the injury is re-cordable as defined above.	Occupational skin diseases or disorders	Dust diseases of the lungs	Respiratory conditions due to toxic agents	Poisoning (systemic ef-fects of toxic materials)	Disorders due to physical agents	Disorders associated with repeated trauma	All other occupa-tional illnesses	Enter DATE of death. Mo./day/yr.	Enter a CHECK if illness involves days away from work, or days of restricted work activity, or both.	Enter a CHECK if illness involved days away from work.	Enter num-ber of DAYS *away from work.*	Enter number of DAYS of *re-stricted work activity.*	Enter a CHECK if no entry was made in columns 8 or 9.
(1)	(2)	(3)	(4)	(5)	(6)	(7)							(8)	(9)	(10)	(11)	(12)	(13)
						(a)	(b)	(c)	(d)	(e)	(f)	(g)						

Certification of Annual Summary Totals By ______________________ Title ______________________ Date ______________

OSHA No. 200 POST ONLY THIS PORTION OF THE LAST PAGE NO LATER THAN FEBRUARY 1.

Bureau of Labor Statistics
Log and Summary of Occupational
Injuries and Illnesses

NOTE: This form is required by Public Law 91-596 and must be kept in the establishment for *5 years*. Failure to maintain and post can result in the issuance of citations and assessments of penalties. (*See posting requirements on the other side of form.*)

RECORDABLE CASES: You are required to record information about every occupational **death**, every nonfatal occupational **illness**, and those nonfatal occupational **injuries** which involve one or more of the following: loss of consciousness, restriction of work or motion, transfer to another job, or medical treatment (other than first aid). (*See definitions on the other side of form.*)

Case or File Number	**Date of Injury or Onset of Illness**	**Employee's Name**	**Occupation**	**Department**	**Description of Injury or Illness**
Enter a nonduplicating number which will facilitate comparisons with supplementary records.	Enter Mo./day.	Enter first name or initial, middle initial, last name.	Enter regular job title, not activity employee was performing when injured or at onset of illness. In the absence of a formal title, enter a brief description of the employee's duties.	Enter department in which the employee is regularly employed or a description of normal workplace to which employee is assigned, even thought temporarily working in another department at the time of the injury or illness	Enter a brief description of the injury or illness and indicate the part or parts of body affected. Typical entries for this column might be: Amputation of 1st joint right forefinger; Strain of lower back; Contact dermatitis on both hands; Electrocution—body.
(A)	(B)	(C)	(D)	(E)	(F)
					PREVIOUS PAGE TOTALS
					TOTALS (Instructions on other side of form)

DAILY SAFETY INSPECTION

PROJECT:____ Page 2 of 2

			Portable electrical equipment double insulated or plugged to a GFCI
			Electrical wiring covered by insulation or enclosure
			Three wire, UL approved, extension cords used
			Housekeeping adequate (walkways clear of loose, sharp or dangerous objects and trip hazards, work areas clear of objects that might fall on employees)
			Walking/working surfaces safe (not slippery, no unguarded holes, no trip hazards)
			Excavations deeper than 5 feet shored or sloped (if personnel will enter) and in compliance with SSHP
			Moving (rotating) machinery guarded to prevent employee contact
			Fall protection provided for work at elevations greater than 4 feet
			All containers of hazardous material labeled to indicate contents and hazards
			MSDSs for hazardous materials on site
			If work is conducted in areas open to hunting (and during season) high visibility vests and other alerting systems such as lights, noise devices (radios) in use
			15-minute eyewash (accessible and full) within 100 feet of areas where corrosive sample preservatives are poured
			Potable and non-potable water labeled
			Chainsaws have anti kick-back protection, personnel wearing cut resistant gloves, protective chaps
			Visitor access controlled
			Site hazards and controls consistent with SSHP
			Site hazard controls appropriate and sufficient

Actions taken to correct or control any "N" responses

Name Signature Date

DAILY SAFETY INSPECTION

PROJECT:______________________________ Page 1 of 2

N	Y	NA	Item
			Daily safety briefing conducted
			Emergency numbers and route to hospital posted
			SSHP onsite, available to employees, and complete
			Required exposure monitoring conducted and documented
			Monitoring instruments (PID, OVA, CGI) calibrated daily against known standard and documented
			First aid kit available and inspected weekly
			Personnel wearing PPE required by SSHP for field work (at least safety shoes or boots, safety glasses with side shields, and nitrile or similar gloves to handle potentially contaminated material)
			Personnel using buddy system (maintain visual or verbal contact and able to render aid)
			If temperature >70□F: heat stress training conducted, cool fluids available, pulse rates of personnel wearing Tyvek are being monitored, work/rest cycle in SSHP being followed
			If temperature <40□F: cold stress training conducted, controls in SSHP implemented
			Personnel using appropriate biological hazard controls (See SSHP)
			Drill rig operating manual on site
			Drill rigs inspected weekly and documented
			Personnel near drill rig or other overhead hazards wearing hardhats
			Each of two drill rig kill switches tested daily
			Employees excluded from under lifted loads
			Unnecessary personnel excluded from hazardous areas, specifically near drill rigs
			Radius of exclusion zone around drill rig at least equal to mast height
			Personnel wearing hearing protection when within 25 feet of drill rigs, generators, or other noisy equipment
			Containers of flammable liquids closed and labeled properly
			Fully charged fire extinguisher available 25 to 50 feet from flammables storage area and inspected monthly
			Personnel exiting potentially contaminated areas washing hands and face before eating
			Personnel using steam washer wearing faceshield, hearing protection, heavy duty waterproof gloves, Saranax or rainsuit

DAILY HEALTH AND SAFETY SUMMARY

PROJECT NAME: **PROJECT NO:**

NAME: DATE: M Tu W Th F Sa Su TIME:

TASKS PERFORMED:

OFF-NORMAL EVENTS:

TAILGATE SAFETY MEETING LOG

PROJECT NAME: **PROJECT NO:**

DATE: M Tu W Th F Sa Su TIME:

WEATHER:

WORKING CONDITIONS:

PPE:

ITEMS DISCUSSED:

THE FOLLOWING INDIVIDUALS ATTENDED THE DAILY TAILGATE SAFETY MEETING (SIGNATURES)

SITE SAFETY AND HEALTH OFFICER

VISITORS LOG

PROJECT NAME: **PROJECT NO:**

DATE	NAME	COMPANY	BADGE #	TIME IN	TIME OUT	H&S BRIEFING	PURPOSE

EQUIPMENT CALIBRATION

PROJECT NAME: **PROJECT NO:**

IDENTIFIER	DESCRIPTION	BACKGROUND READING	PRE	ADJUSTMENT (IF NEEDED)	POST	NAME	DATE

HEALTH AND SAFETY MONITORING LOG

PROJECT NAME: PROJECT NO:

DATE	INSTRUMENT/NO.	RESULTS	TIME	REMARKS	NAME

CALIBRATION STANDARD

PROJECT NAME: **PROJECT NO:**

INCLUSIVE DATES FOR CALIBRATION MATERIAL USAGE		INSTRUMENT DESCRIPTION	CALIBRATION MATERIAL	LOT #	NAME
Start	Finish				

(For Safety Staff only)	REPORT NO	EROC CODE	**UNITED STATES ARMY CORPS OF ENGINEERS** **ACCIDENT INVESTIGATION REPORT** *(For Use of this Form See Attached Instructions and USACE Suppl to AR 385-40)*	**REQUIREMENT CONTROL SYMBOL: CEEC-S-8(R2)**

1 **ACCIDENT CLASSIFICATION**

PERSONNEL CLASSIFICATION	INJURY/ILLNESS/FATAL	PROPERTY DAMAGE	MOTOR VEHICLE INVOLVED	DIVING
GOVERNMENT ☐ CIVILIAN ☐ MILITARY	☐	☐ FIRE INVOLVED ☐ OTHER	☐	☐
☐ CONTRACTOR	☐	☐ FIRE INVOLVED ☐ OTHER	☐	☐
☐ PUBLIC	☐ FATAL ☐ OTHER		☐	

2 **PERSONAL DATA**

a. NAME *(Last,First,MI)*

b. AGE

c. SEX ☐ MALE ☐ FEMALE

d. SOCIAL SECURITY NUMBER ___ ___ ___ / ___ ___ / ___ ___ ___ ___

e. GRADE

f. JOB SERIES/TITLE

g. DUTY STATUS AT TIME OF ACCIDENT ☐ ON DUTY ☐ TDY ☐ OFF DUTY

i. EMPLOYMENT STATUS AT TIME OF ACCIDENT
☐ ARMY ACTIVE ☐ ARMY RESERVE ☐ VOLUNTEER
☐ PERMANENT ☐ FOREIGN NATIONAL ☐ SEASONAL
☐ TEMPORARY ☐ STUDENT
☐ OTHER *(Specify)* ______________________

3 **GENERAL INFORMATION**

a. DATE OF ACCIDENT *(month/day/year)*

b. TIME OF ACCIDENT *(Military time)*

c. EXACT LOCATIONS OF ACCIDENT

d. CONTRACTOR'S NAME
(1) PRIME
(2) SUBCONTRACTOR

e. CONTRACT NUMBER ______________________
☐ CIVIL WORKS ☐ MILITARY
☐ OTHER *(Specify)*

f. TYPE OF CONTRACT
☐ CONSTRUCTION ☐ SERVICE
☐ A/E ☐ DREDGE
☐ OTHER *(Specify)* ______________

g. HAZARDOUS/TOXIC WASTE ACTIVITY
☐ SUPERFUND ☐ DERP
☐ IRP ☐ OTHER *(Specify)*
____

4 **CONSTRUCTION ACTIVITIES ONLY** *(Fill in line and corresponding code number in box from list - see instructions)*

a. CONSTRUCTION ACTIVITY ______________________ (CODE) #

b. TYPE OF CONSTRUCTION EQUIPMENT ______________________ (CODE) #

5 **INJURY/ILLNESS INFORMATION** *(Include name on line and corresponding code number in box for items e, f, & g - see instructions)*

a. SEVERITY OF ILLNESS/INJURY ______________________ (CODE) #

b. ESTIMATED DAYS LOST

c. ESTIMATED DAYS HOSPITALIZED

d. ESTIMATED DAYS RESTRICTED DUTY

e. BODY PART AFFECTED
PRIMARY ______________________ (CODE) #
SECONDARY ______________________ (CODE) #

f. NATURE OF ILLNESS/INJURY ______________________ (CODE) #

g. TYPE AND SOURCE OF INJURY/ILLNESS
TYPE ______________________ (CODE) #
SOURCE ______________________ (CODE) #

6 **PUBLIC FATALITY** *(Fill in line and corresponding code number in box - see instructions)*

a. ACTIVITY AT TIME OF ACCIDENT ______________________ (CODE) #

b. PERSONAL FLOTATION DEVICE USED? ☐ YES ☐ NO ☐ N/A

7 **MOTOR VEHICLE ACCIDENT**

a. TYPE OF VEHICLE
☐☐ PICKUP/VAN ☐☐ AUTOMOBILE
☐☐ TRUCK ☐☐ OTHER *(Specify)*
____

b. TYPE OF COLLISION
☐ SIDE SWIPE ☐ HEAD ON ☐ REAR END
☐ BROADSIDE ☐ ROLL OVER ☐ BACKING
☐ OTHER *(Specify)* ______________

c. SEAT BELTS	USED	NOT USED	NOT AVAILABLE
(1) FRONT SEAT			
(2) REAR SEAT			

8 **PROPERTY/MATERIAL INVOLVED**

a. NAME OF ITEM	b. OWNERSHIP	c. $ AMOUNT OF DAMAGE
(1)		
(2)		
(3)		

9 **VESSEL/FLOATING PLANT ACCIDENT** *(Fill in line and corresponding code number in box from list. See instructions)*

a. TYPE OF VESSEL/FLOATING PLANT ______________________ (CODE) #

b. TYPE OF COLLISION/MISHAP ______________________ (CODE) #

10 **ACCIDENT DESCRIPTION** *(Use additional paper, if necessary)*

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11 **CAUSAL FACTOR(S)** *(Read Instruction Before Completing)*

a. *(Explain YES answers in item 13)*	YES	NO
DESIGN Was design of facility workplace or equipment a factor?	☐	☐
INSPECTION MAINTENANCE Were inspection and maintenance procedures a factor?	☐	☐
PERSON'S PHYSICAL CONDITION In your opinion, was the physical condition of the person a factor?	☐	☐
OPERATING PROCEDURES Were operating procedures a factor?	☐	☐
JOB PRACTICES Were any job safety/health practices not followed when the accident occurred?	☐	☐
HUMAN FACTORS Did any human factors such as size or strength of person, etc. contribute to accident?	☐	☐
ENVIRONMENTAL FACTORS Did heat, cold, dust, sun, glare, etc. contribute to the accident?	☐	☐

a. *(CONTINUED)*	YES	NO
CHEMICAL AND PHYSICAL AGENT FACTORS Did exposure to chemical agents, such as dust, fumes, mists, vapors, or physical agents such as noise, radiation, etc. contribute to accident?	☐	☐
OFFICE FACTORS Did office setting such as lifting office furniture, carrying, stooping, etc. contribute to the accident?	☐	☐
SUPPORT FACTORS Were inappropriate tools/resources provided to properly perform the activity/task?	☐	☐
PERSONAL PROTECTIVE EQUIPMENT Did the improper selection, use, or maintenance of personal protective equipment contribute to the accident?	☐	☐
DRUGS/ALCOHOL In your opinion was drugs or alcohol a factor to the accident?	☐	☐

b. WAS A WRITTEN JOB/ACTIVITY HAZARD ANALYSIS COMPLETED FOR TASK BEING PERFORMED AT TIME OF ACCIDENT?

☐ YES *(If yes, attach a copy)* ☐ NO

12 **TRAINING**

a. WAS PERSON TRAINED TO PERFORM ACTIVITY/TASK? ☐ YES ☐ NO

b. TYPE OF TRAINING ☐ CLASSROOM ☐ ON JOB

c. DATE OF MOST RECENT FORMAL TRAINING / / *(Month)* *(Day)* *(Year)*

13 **FULLY EXPLAIN WHAT ALLOWED OR CAUSED THE ACCIDENT; INCLUDE DIRECT AND INDIRECT CAUSES** *(See instruction for definition of direct and indirect causes) (Use additional paper, if necessary)*

a. DIRECT CAUSE

b. INDIRECT CAUSE(S)

14 **ACTION(S) TAKEN ANTICIPATED OR RECOMMENDED TO ELIMINATE CAUSE(S)**

DESCRIBE FULLY

15 **DATES FOR ACTIONS IDENTIFIED IN BLOCK 14**

a. BEGINNING *(Month/Day/Year)* / /

b. ANTICIPATED COMPLETION *(Month/Day/Year)* / /

c. SIGNATURE AND TITLE OF SUPERVISOR COMPLETING REPORT

CORPS ____________________

SUBCONTRACTOR ____________________

d. DATE *(Mo/Da/Yr)*

___ / ___ / ___

___ / ___ / ___

e. ORGANIZATION IDENTIFIER *(Div. Br. Sect.)*

f. OFFICE SYMBOL

16 **MANAGEMENT REVIEW *(1st)***

a. ☐ CONCUR b. ☐ NON CONCUR c. COMMENTS

SIGNATURE

TITLE

DATE

17 **MANAGEMENT REVIEW *(2nd - Chief Operations, Construction, Engineering, etc.)***

a. ☐ CONCUR b. ☐ NON CONCUR c. COMMENTS

SIGNATURE

TITLE

DATE

18 **SAFETY AND OCCUPATIONAL HEALTH OFFICE REVIEW**

a. ☐ CONCUR b. ☐ NON CONCUR c. ADDITIONAL ACTIONS/COMMENTS

SIGNATURE

TITLE

DATE

19 **COMMAND APPROVAL**

COMMENTS

COMMANDER SIGNATURE

DATE

(Reverse of ENG Form 3394)

Page 2 of 2 pages

U S G P O 1989 626-113

GENERAL. Complete a separate report for each person who was *injured, caused, or contributed* to the accident (excluding uninjured personnel and witnesses). Use of this form for reporting USACE employee first-aid type injuries not submitted to the Office of Workers' Compensation Programs (OWCP) shall be at the discretion of the FOA Commander. Please type or print legibly. Appropriate items shall be marked with an "X" in box(es). If additional space is needed, provide the information on a separate sheet and attach to the completed form. Ensure that these instructions are forwarded with the completed report to the designated management reviewers indicated in sections 16 and 17.

INSTRUCTIONS FOR SECTION 1 — ACCIDENT CLASSIFICATION. *(Mark All Boxes That Are Applicable.)*

a. GOVERNMENT. Mark "CIVILIAN" box if accident involved government civilian employee; mark "MILITARY" box if accident involved U.S. military personnel.

  (1) INJURY/ILLNESS/FATALITY— Mark if accident resulted in any government civilian employee injury, illness, or fatality that requires the submission of OWCP Forms CA-1 (injury), CA-2 (illness), or CA-6 (fatality) to OWCP; mark if accident resulted in military personnel lost-time or fatal injury or illness.

  (2) PROPERTY DAMAGE—Mark the appropriate box if accident resulted in any damage of $1000 or more to government property (including motor vehicles).

  (3) VEHICLE INVOLVED—Mark if accident involved a motor vehicle, *regardless* of whether "INJURY/ILLNESS/FATALITY" or "PROPERTY DAMAGE" are marked.

  (4) DIVING ACTIVITY—Mark if the accident involved an in-house USACE diving activity.

b. CONTRACTOR.

  (1) INJURY/ILLNESS/FATALITY—Mark if accident resulted in any contractor lost-time injury/illness or fatality.

  (2) PROPERTY DAMAGE—Mark the appropriate box if accident resulted in any damage of $1000 or more to contractor property (including motor vehicles).

  (3) VEHICLE INVOLVED—Mark if accident involved a motor vehicle, *regardless* of whether "INJURY/ILLNESS/FATALITY" or "PROPERTY DAMAGE" are marked.

  (4) DIVING ACTIVITY—Mark if the accident involved a USACE Contractor diving activity.

c. PUBLIC.

  (1) INJURY/ILLNESS/FATALITY—Mark if accident resulted in public fatality or permanent total disability. (The "OTHER" box will be marked when requested by the FOA to report an unusual non-fatal public accident that could result in claims against the government or as otherwise directed by the FOA Commander).

  (2) VOID SPACE—Make no entry.

  (3) VEHICLE INVOLVED—Mark if accident resulted in a fatality to a member of the public and involved a motor vehicle, *regardless* of whether "INJURY/ILLNESS/FATALITY" is marked.

  (4) VOID SPACE—Make no entry.

INSTRUCTIONS FOR SECTION 2 — PERSONAL DATA

a. NAME—(MANDATORY FOR GOVERNMENT ACCIDENTS. OPTIONAL AT THE DISCRETION OF THE FOA COMMANDER FOR CONTRACTOR AND PUBLIC ACCIDENTS). Enter last name, first name, middle initial of person involved.

b. AGE—Enter age.

c. SEX—Mark appropriate box.

d. SOCIAL SECURITY NUMBER—(FOR GOVERNMENT PERSONNEL ONLY) Enter the social security number (or other personal identification number if no social security number issued).

e. GRADE—(FOR GOVERNMENT PERSONNEL ONLY) Enter pay grade. Example: 0-6; E-7; WG-8; WS-12; GS-11; etc.

f. JOB SERIES/TITLE—For *government civilian employees* enter the pay plan, full series number, and job title, e.g., GS-0810/Civil Engineer. For *military personnel* enter the primary military occupational specialty (PMOS), e.g., 15A40 or 11G50. For *contractor employees* enter the job title assigned to the injured person, e.g., carpenter, laborer, surveyor, etc.

g. DUTY STATUS—Mark the appropriate box.

  (1) ON DUTY—Person was at duty station during duty hours or person was away from duty station during duty hours but on official business at time of the accident.

  (2) TDY—Person was on official business, away from the duty station and with travel orders at time of accident. Line-of-duty investigation required.

  (3) OFF DUTY—Person was not on official business at time of accident.

h. EMPLOYMENT STATUS—(FOR GOVERNMENT PERSONNEL ONLY) Mark the most appropriate box. If "OTHER" is marked, specify the employment status of the person.

INSTRUCTIONS FOR SECTION 3 — GENERAL INFORMATION

a. DATE OF ACCIDENT—Enter the month, day, and year of accident.

b. TIME OF ACCIDENT—Enter the local time of accident in military time. Example: 1430 hrs (not 2:30 p.m.).

c. EXACT LOCATION OF ACCIDENT—Enter facts needed to locate the accident scene (installation/project name, building number, street, direction, and distance from closest landmark, etc.).

d. CONTRACTOR NAME

  (1) PRIME—Enter the exact name (title of firm) of the prime contractor.

  (2) SUBCONTRACTOR—Enter the name of any subcontractor involved in the accident.

e. CONTRACT NUMBER—Mark the appropriate box to identify if contract is civil works, military, or other: if "OTHER" is marked, specify contract appropriation on line provided. Enter complete contract number of prime contract, e.g., DACW 09-85-C-0100.

f. TYPE OF CONTRACT—Mark appropriate box. A/E means architect/engineer. If "OTHER" is marked, specify type of contract on line provided.

g. HAZARDOUS/TOXIC WASTE ACTIVITY (HTW)—Mark the box to identify the HTW activity being performed at the time of the accident. For Superfund, DERP, and Installation Restoration Program (IRP) HTW activities include accidents that occurred during inventory, predesign, design, and construction. For the purpose of accident reporting, DERP Formerly Used DoD Site (FUDS) activities and IRP activities will be treated separately. For Civil Works O&M HTW activities mark the "OTHER" box.

INSTRUCTIONS FOR SECTION 4 — CONSTRUCTION ACTIVITIES

a. CONSTRUCTION ACTIVITY—Select the *most appropriate* construction activity being performed at time of accident from the list below. Enter the activity name and place the corresponding code number identified in the box.

CONSTRUCTION ACTIVITY LIST

1. MOBILIZATION
2. SITE PREPARATION
3. EXCAVATION/TRENCHING
4. GRADING (EARTHWORK)
5. PIPING/UTILITIES
6. FOUNDATION
7. FORMING
8. CONCRETE PLACEMENT
9. STEEL ERECTION
10. ROOFING
11. FRAMING
12. MASONRY
13. CARPENTRY
14. ELECTRICAL
15. SCAFFOLDING/ACCESS
16. MECHANICAL
17. PAINTING
18. EQUIPMENT/MAINTENANCE
19. TUNNELING
20. WAREHOUSING/STORAGE
21. PAVING
22. FENCING
23. SIGNING
24. LANDSCAPING/IRRIGATION
25. INSULATION
26. DEMOLITION

b. TYPE OF CONSTRUCTION EQUIPMENT—Select the equipment involved in the accident from the list below. Enter the name and place the corresponding code number identified in the box. If equipment is not included below, use code 24, "OTHER," and write in specific type of equipment.

CONSTRUCTION EQUIPMENT

1. GRADER
2. DRAGLINE
3. CRANE (ON VESSEL/BARGE)
4. CRANE (TRACKED)
5. CRANE (RUBBER TIRE)
6. CRANE (VEHICLE MOUNTED)
7. CRANE (TOWER)
8. SHOVEL
9. SCRAPER
10. PUMP TRUCK (CONCRETE)
11. TRUCK (CONCRETE/TRANSIT MIXER)
12. DUMP TRUCK (HIGHWAY)
13. DUMP TRUCK (OFF HIGHWAY)
14. TRUCK (OTHER)
15. FORKLIFT
16. BACKHOE
17. FRONT-END LOADER
18. PILE DRIVER
19. TRACTOR (UTILITY)
20. MANLIFT
21. DOZER
22. DRILL RIG
23. COMPACTOR/VIBRATORY ROLLER
24. OTHER

INSTRUCTIONS FOR SECTION 5—INJURY/ILLNESS INFORMATION

a. SEVERITY OF INJURY/ILLNESS—Reference para 2-10 of USACE Suppl 1 to AR 385-40 and enter code and description from list below.

NOI	NO INJURY
FAT	FATALITY
PTL	PERMANENT TOTAL DISABILITY
PPR	PERMANENT PARTIAL DISABILITY
LWD	LOST WORKDAY CASE INVOLVING DAYS AWAY FROM WORK
NLW	RECORDABLE CASE WITHOUT LOST WORKDAYS
RFA	RECORDABLE FIRST AID CASE
NRI	NON-RECORDABLE INJURY

b. ESTIMATED DAYS LOST—Enter the estimated number of workdays the person will lose from work.

c. ESTIMATED DAYS HOSPITALIZED—Enter the estimated number of workdays the person will be hospitalized.

d. ESTIMATED DAYS RESTRICTED DUTY—Enter the estimated number of workdays the person, as a result of the accident, will not be able to perform all of their regular duties.

e. BODY PART AFFECTED—Select the most appropriate primary and when applicable, secondary body part affected from the list below. Enter body part name on line and place the corresponding code letters identifying that body part in the box.

GENERAL BODY AREA	CODE	BODY PART NAME
ARM/WRIST	AB	ARM AND WRIST
	AS	ARM OR WRIST
TRUNK, EXTERNAL MUSCULATURE	B1	SINGLE BREASTS
	B2	BOTH BREASTS
	B3	SINGLE TESTICLE
	B4	BOTH TESTICLES
	BA	ABDOMEN
	BC	CHEST
	BL	LOWER BACK
	BP	PENIS
	BS	SIDE
	BU	UPPER BACK
	BW	WAIST
	BZ	TRUNK OTHER
HEAD, INTERNAL	C1	SINGLE EAR INTERNAL
	C2	BOTH EARS INTERNAL
	C3	SINGLE EYE INTERNAL
	C4	BOTH EYES INTERNAL
	CB	BRAIN
	CC	CRANIAL BONES
	CD	TEETH
	CJ	JAW
	CL	THROAT, LARYNX
	CM	MOUTH
	CN	NOSE
	CR	THROAT, OTHER
	CT	TONGUE
	CZ	HEAD OTHER INTERNAL
ELBOW	EB	BOTH ELBOWS
	ES	SINGLE ELBOW
FINGER	F1	FIRST FINGER
	F2	BOTH FIRST FINGERS
	F3	SECOND FINGER
	F4	BOTH SECOND FINGERS
	F5	THIRD FINGER
	F6	BOTH THIRD FINGERS
	F7	FOURTH FINGER
	F8	BOTH FOURTH FINGERS
TOE	G1	GREAT TOE
	G2	BOTH GREAT TOES
	G3	TOE OTHER
	G4	TOES OTHER
HEAD, EXTERNAL	H1	EYE EXTERNAL
	H2	BOTH EYES EXTERNAL
	H3	EAR EXTERNAL
	H4	BOTH EARS EXTERNAL
	HC	CHIN
	HF	FACE
	HK	NECK/THROAT
	HM	MOUTH/LIPS
	HN	NOSE
	HS	SCALP
KNEE	KB	BOTH KNEES
	KS	KNEE
LEG, HIP, ANKLE, BUTTOCK	LB	BOTH LEGS/HIPS/ ANKLES/BUTTOCKS
	LS	SINGLE LEG/HIP ANKLE/BUTTOCK
HAND	MB	BOTH HANDS
	MS	SINGLE HAND
FOOT	PB	BOTH FEET
	PS	SINGLE FOOT
TRUNK, BONES	R1	SINGLE COLLAR BONE
	R2	BOTH COLLAR BONES
	R3	SHOULDER BLADE
	R4	BOTH SHOULDER BLADES
	RB	RIB
	RS	STERNUM (BREAST BONE)
	RV	VERTEBRAE (SPINE, DISC)
	RZ	TRUNK BONES OTHER
SHOULDER	SB	BOTH SHOULDERS
	SS	SINGLE SHOULDER
THUMB	TB	BOTH THUMBS
	TS	SINGLE THUMB
TRUNK, INTERNAL ORGANS	V1	LUNG, SINGLE
	V2	LUNGS, BOTH
	V3	KIDNEY, SINGLE
	V4	KIDNEYS, BOTH
	VH	HEART
	VL	LIVER
	VR	REPRODUCTIVE ORGANS
	VS	STOMACH
	VV	INTESTINES
	VZ	TRUNK, INTERNAL; OTHER

f. NATURE OF INJURY/ILLNESS—Select the most appropriate nature of injury/illness from the list below. This nature of injury/illness shall correspond to the primary body part selected in 5e, above. Enter the nature of injury/illness name on the line and place the corresponding CODE letters in the box provided.

CODE	SOURCE OF INJURY NAME
0200	ENVIRONMENTAL CONDITION
0210	TEMPERATURE EXTREME (INDOOR)
0220	WEATHER (ICE, RAIN, HEAT, ETC.)
0230	FIRE, FLAME, SMOKE (NOT TOBACCO)
0240	NOISE
0250	RADIATION
0260	LIGHT
0270	VENTILATION
0271	TOBACCO SMOKE
0280	STRESS (EMOTIONAL)
0290	CONFINED SPACE
0300	MACHINE OR TOOL
0310	HAND TOOL (POWERED: SAW, GRINDER, ETC.)
0320	HAND TOOL (NONPOWERED)
0330	MECHANICAL POWER TRANSMISSION APPARATUS
0340	GUARD, SHIELD (FIXED, MOVEABLE, INTERLOCK)
0350	VIDEO DISPLAY TERMINAL
0360	PUMP, COMPRESSOR, AIR PRESSURE TOOL
0370	HEATING EQUIPMENT
0380	WELDING EQUIPMENT
0400	VEHICLE
0411	AS DRIVER OF PRIVATELY OWNED/RENTAL VEHICLE
0412	AS PASSENGER OF PRIVATELY OWNED/RENTAL VEHICLE
0421	DRIVER OF GOVERNMENT VEHICLE
0422	PASSENGER OF GOVERNMENT VEHICLE
0430	COMMON CARRIER (AIRLINE, BUS, ETC.)
0440	AIRCRAFT (NOT COMMERCIAL)
0450	BOAT, SHIP, BARGE
0500	MATERIAL HANDLING EQUIPMENT
0510	EARTHMOVER (TRACTOR, BACKHOE, ETC.)
0520	CONVEYOR (FOR MATERIAL AND EQUIPMENT)
0530	ELEVATOR, ESCALATOR, PERSONNEL HOIST
0540	HOIST, SLING CHAIN, JACK
0550	CRANE
0551	FORKLIFT
0560	HANDTRUCK, DOLLY
0600	DUST, VAPOR, ETC.
0610	DUST (SILICA, COAL, ETC.)
0620	FIBERS
0621	ASBESTOS
0630	GASES
0631	CARBON MONOXIDE
0640	MIST, STEAM, VAPOR, FUME
0641	WELDING FUMES
0650	PARTICLES (UNIDENTIFIED)
0700	CHEMICAL, PLASTIC, ETC.
0711	DRY CHEMICAL-CORROSIVE
0712	DRY CHEMICAL-TOXIC
0713	DRY CHEMICAL-EXPLOSIVE
0714	DRY CHEMICAL-FLAMMABLE
0721	LIQUID CHEMICAL-CORROSIVE
0722	LIQUID CHEMICAL-TOXIC
0723	LIQUID CHEMICAL-EXPLOSIVE
0724	LIQUID CHEMICAL-FLAMMABLE
0730	PLASTIC
0740	WATER
0750	MEDICINE
0800	INANIMATE OBJECT
0810	BOX, BARREL, ETC.
0820	PAPER
0830	METAL ITEM, MINERAL
0831	NEEDLE
0840	GLASS
0850	SCRAP, TRASH
0860	WOOD
0870	FOOD
0880	CLOTHING, APPAREL, SHOES
0900	ANIMATE OBJECT
0911	DOG
0912	OTHER ANIMAL
0920	PLANT
0930	INSECT
0940	HUMAN (VIOLENCE
0950	HUMAN (COMMUNICABLE DISEASE)
0960	BACTERIA, VIRUS (NOT HUMAN CONTACT)

CODE	SOURCE OF INJURY NAME
1000	PERSONAL PROTECTIVE EQUIPMENT
1010	PROTECTIVE CLOTHING, SHOES, GLASSES, GOGGLES
1020	RESPIRATOR, MASK
1021	DIVING EQUIPMENT
1030	SAFETY BELT, HARNESS
1040	PARACHUTE

INSTRUCTIONS FOR SECTION 6—PUBLIC FATALITY

a. ACTIVITY AT TIME OF ACCIDENT—Select the activity being performed at the time of the accident from the list below. Enter the activity name on the line and the corresponding number in the box if the activity performed is not identified on the list. Select from the most appropriate primary activity area (water related, non-water related or other activity), the code number for "Other," and write in the activity being performed at the time of the accident.

WATER RELATED RECREATION

1. Sailing
2. Boating - powered
3. Boating - unpowered
4. Water skiing
5. Fishing from boat
6. Fishing from bank dock or pier
7. Fishing while wading
8. Swimming/supervised area
9. Swimming/designated area
10. Swimming/other area
11. Underwater activities (skin diving scuba, etc.)
12. Wading
13. Attempted rescue
14. Hunting from boat
15. Other

NON-WATER RELATED RECREATION

16. Hiking and walking
17. Climbing (general)
18. Camping/picnicking authorized area
19. Camping/picnicking unauthorized area
20. Guided tours
21. Hunting
22. Playground equipment
23. Sports/summer (baseball, football, etc.
24. Sports/winter (skiing, sledding, snowmobiling, etc.)
25. Cycling (bicycle, motorcycle, scooter)
26. Gliding
27. Parachuting
28. Other non-water related

OTHER ACTIVITIES

29. Unlawful acts (fights, riots, vandalism, etc.)
30. Food preparation/serving
31. Food consumption
32. Housekeeping
33. Sleeping
34. Pedestrian struck by vehicle
35. Pedestrian other acts
36. Suicide
37. "Other" activities

b. PERSONAL FLOTATION DEVICE USED—If fatality was water-related was the victim wearing a personal flotation device? Mark the appropriate box.

INSTRUCTIONS FOR SECTION 7—MOTOR VEHICLE ACCIDENT

a. TYPE OF VEHICLE—Mark appropriate box for each vehicle involved. If more than one vehicle of the same type is involved, mark both halves of the appropriate box. USACE vehicle(s) involved shall be marked in left half of appropriate box.

b. TYPE OF COLLISION—Mark appropriate box.

c. SEAT BELT—Mark appropriate box.

INSTRUCTIONS FOR SECTION 8—PROPERTY/MATERIAL INVOLVED

a. NAME OF ITEM—Describe all property involved in accident. Property/material involved means material which is damaged or whose use or misuse contributed to the accident. Include the name, type, model; also include the National Stock Number (NSN) whenever applicable.

b. OWNERSHIP—Enter ownership for each item listed. (Enter one of the following: *USACE; OTHER GOVERNMENT; CONTRACTOR; PRIVATE*)

c. $ AMOUNT OF DAMAGE—Enter the total estimated dollar amount of damage (parts and labor), if any.

- The injury or condition selected below must be caused by a specific incident or event which occurred during a single work day or shift.

GENERAL NATURE CATEGORY	CODE	NATURE OF INJURY NAME
*TRAUMATIC INJURY OR DISABILITY	TA	AMPUTATION
	TB	BACK STRAIN
	TC	CONTUSION, BRUISE, ABRASION
	TD	DISLOCATION
	TF	FRACTURE
	TH	HERNIA
	TK	CONCUSSION
	TL	LACERATION, CUT
	TP	PUNCTURE
	TS	STRAIN, MULTIPLE
	TU	BURN, SCALD, SUNBURN
	TI	TRAUMATIC SKIN DISEASES/ CONDITIONS INCLUDING DERMATITIS
	TR	TRAUMATIC RESPIRATORY DISEASE
	TQ	TRAUMATIC FOOD
POISONING		
	TW	TRAUMATIC TUBERCULOSIS
	TX	TRAUMATIC VIROLOGICAL/ INFECTIVE/PARASITIC
DISEASE		
	T1	TRAUMATIC CEREBRAL
VASCULAR		
		CONDITION/STROKE
	T2	TRAUMATIC HEARING LOSS
	T3	TRAUMATIC HEART
CONDITION		
	T4	TRAUMATIC MENTAL
DISORDER		
		STRESS, NERVOUS
CONDITION		
	T8	TRAUMATIC INJURY - OTHER (EXCEPT DISEASE, ILLNESS)

** A nontraumatic physiological harm or loss of capacity produced by systematic infection; continued or repeated stress or stain; exposure to toxins, poisons, fumes, etc., or other continued and repeated exposures to conditions of the work environment over a long period of time. For practical purposes, an occupational illness/disease or disability is any reported condition which does not meet the definition of traumatic injury or disability as described above.

GENERAL NATURE CATEGORY	CODE	NATURE OF INJURY NAME
**NON-TRAUMATIC ILLNESS/DISEASE OR DISABILITY		
RESPIRATORY DISEASE	RA	ASBESTOSIS
	RB	BRONCHITIS
	RE	EMPHYSEMA
	RP	PNEUMOCONIOSIS
	RS	SILICOSIS
	R9	RESPIRATORY DISEASE,
OTHER		
VIROLOGICAL, INFECTIVE & PARASITIC DISEASES	VB	BRUCELLOSIS
	VC	COCCIDIOMYCOSIS
	VF	FOOD POISONING
	VH	HEPATITIS
	VM	MALARIA
	VS	STAPHYLOCOCCUS
	VT	TUBERCULOSIS
	V9	VIROLOGICAL/INFECTIVE/ PARASITIC - OTHER
DISABILITY, OCCUPATIONAL	DA	ARTHRITIS, BURSITIS
	DB	BACK STRAIN, BACK SPRAIN
	DC	CEREBRAL VASCULAR CONDITION: STROKE
	DD	ENDEMIC DISEASE (OTHER THAN CODE TYPES R&S)
	DE	EFFECT OF ENVIRONMENTAL CONDITION
	DH	HEARING LOSS
	DK	HEART CONDITION
	DM	MENTAL DISORDER, EMOTIONAL STRESS, NERVOUS CONDITION
	DR	RADIATION
	DS	STRAIN, MULTIPLE
	DU	ULCER
	DV	OTHER VASCULAR CONDITIONS
	D9	DISABILITY, OTHER
SKIN DISEASE OR CONDITION	SB	BIOLOGICAL
	SC	CHEMICAL
	S9	DERMATITIS, UNCLASSIFIED

g. TYPE AND SOURCE OF INJURY/ILLNESS (CAUSE) - Type and source Codes are used to describe what caused the incident. The Type Code stands for an ACTION and the Source Code for an OBJECT or SUBSTANCE. Together, they form a brief description of how the incident occurred. Where there are two different sources, code the initiating source of the incident (see example 1, below). Examples

(1) An employee tripped on carpet and struck his head on a desk.
TYPE: 210 (fell on same level) SOURCE: 0110 (walking/working surface)

NOTE: This example would NOT be coded 120 (struck against) and 0140 (furniture).

(2) A Park Ranger contracted dermatitis from contact with poison ivy/ oak.
TYPE: 510 (contact) SOURCE: 0920 (plant)

(3) A lock and dam mechanic punctured his finger with a metal sliver while grinding a turbine blade
TYPE: 410 (punctured by) SOURCE: 0830 (metal

(4) An employee was driving a government vehicle when it was struck by another vehicle.
TYPE: 800 (traveling in) SOURCE: 0421 (government-owned vehicle, as driver)

NOTE: The Type Code 800, "Traveling In" is different from the other type codes in that its function is not to identify factors contributing to the injury or fatality, but rather to collect data on the type of vehicle the employee was operating or traveling in at the time of the incident.

Select the most appropriate TYPE and SOURCE identifier from the list below and enter the name on the line and the corresponding code in the appropriate box.

CODE	TYPE OF INJURY NAME
	STRUCK
0110	STRUCK BY
0111	STRUCK BY FALLING OBJECT
0120	STRUCK AGAINST
	FELL, SLIPPED, TRIPPED
0210	FELL ON SAME LEVEL
0220	FELL ON DIFFERENT LEVEL
0230	SLIPPED, TRIPPED (NO FALL)
	CAUGHT
0310	CAUGHT ON
0320	CAUGHT IN
0330	CAUGHT BETWEEN
	PUNCTURED, LACERATED
0410	PUNCTURED BY
0420	CUT TY
0430	STUNG BY
0440	BITTEN BY
	CONTACTED
0510	CONTACTED WITH (INJURED PERSON MOVING)
0520	CONTACTED BY (OBJECT WAS MOVING)
	EXERTED
0610	LIFTED, STRAINED BY (SINGLE ACTION)
0620	STRESSED BY (REPEATED ACTION)
	EXPOSED
0710	INHALED
0720	INGESTED
0730	ABSORBED
0740	EXPOSED TO
0800	TRAVELING IN

CODE	SOURCE OF INJURY NAME
0100	BUILDING OR WORKING AREA
0110	WALKING/WORKING SURFACE (FLOOR, STREET, SIDEWALKS, ETC.)
0120	STAIRS, STEPS
0130	LADDER
0140	FURNITURE, FURNISHINGS, OFFICE EQUIPMENT
0150	BOILER, PRESSURE VESSEL
0160	EQUIPMENT LAYOUT (ERGONOMIC)
0170	WINDOWS, DOORS
0180	ELECTRICITY

INSTRUCTIONS FOR SECTION 9—VESSEL/ FLOATING PLANT ACCIDENT

a. TYPE OF VESSEL/FLOATING PLANT — Select the most appropriate vessel/floating plant from list below. Enter name and place corresponding number in box. If item is not listed below, enter item number for "OTHER" and write in specific type of vessel/floating plant.

VESSEL/FLOATING PLANTS

1. ROW BOAT
2. SAIL BOAT
3. MOTOR BOAT
4. BARGE
5. DREDGE/HOPPER
6. DREDGE/SIDE CASTING
7. DREDGE/DIPPER
8. DREDGE/CLAMSHELL, BUCKET
9. DREDGE/PIPE LINE
10. DREDGE/DUST PAN
11. TUG BOAT
12. OTHER

b. COLLISION/MISHAP— Select from the list below the object(s) that contributed to the accident or were damaged in the accident.

COLLISION/MISHAP

1. COLLISION W/OTHER VESSEL
2. UPPER GUIDE WALL
3. UPPER LOCK GATES
4. LOCK WALL
5. LOWER LOCK GATES
6. LOWER GUIDE WALL
7. HAULAGE UNIT
8. BREAKING TOW
9. TOW BREAKING TOW
10. SWEPT DOWN ON DAM
11. BUOY/DOLPHIN/CELL
12. WHARF OR DOCK
13. OTHER

INSTRUCTIONS FOR SECTION 10—ACCIDENT DESCRIPTION

DESCRIBE ACCIDENT—Fully describe the accident. Give the sequence of events that describe what happened leading up to and including the accident. Fully identify personnel and equipment involved and their role(s) in the accident. Ensure that relationships between personnel and equipment are clearly specific. Continue on blank sheets if necessary and attach to this report.

INSTRUCTIONS FOR SECTION 11—CAUSAL FACTORS

a. Review thoroughly. Answer each question by marking the appropriate block. If any answer is yes, explain on item 13 below. Consider, as a minimum, the following:

(1) DESIGN— Did inadequacies associated with the building or work site play a role? Would an improved design or layout of the equipment or facilities reduce the likelihood of similar accidents? Were the tools or other equipment designed and intended for the task at hand?

(2) INSPECTION/MAINTENANCE — Did inadequately or improperly maintained equipment, tools, workplace, etc. create or worsen any hazards that contributed to the accident? Would better equipment, facility, work site, or work activity inspections have helped avoid the accident?

(3) PERSON'S PHYSICAL CONDITION — Do you feel that the accident would probably not have occurred if the employee was in "good" physical condition? If the person involved in the accident had been in better physical condition, would the accident have been less severe or avoided altogether? Was overexertion a factor?

(4) OPERATING PROCEDURES— Did a lack of or inadequacy within established operating procedures contribute to the accident? Did any aspect of the procedures introduce any hazard to, or increase the risk associated with the work process? Would establishment or improvement of operating procedures reduce the likelihood of similar accidents?

(5) JOB PRACTICES — Were any of the provisions of the Safety and Health Requirements Manual (EM 381-1) violated? Was the task being accomplished in a manner which was not in compliance with an established job hazard analysis or activity hazard analysis? Did any established job practice (including EM 385-1-1) fail to adequately address the task or work process? Would better job practices improve the safety of the task?

(6) HUMAN FACTORS — Was the person under undue stress (either internal or external to the job)? Did the task tend toward overloading the capabilities of the person, i.e., did the job require tracking and reacting to many external inputs such as displays, alarms, or signals? Did the arrangement of the workplace tend to interfere with efficient task performance? Did the task require reach, strength, endurance, agility, etc. at or beyond the capabilities of the employee? Was the work environment ill-adapted to the person? Did the person need more training, experience, or practice in doing the task? Was the person inadequately rested to perform safely?

(7) ENVIRONMENTAL FACTORS — Did any factors such as moisture, humidity, rain, snow, sleet, hail, ice, fog, cold, heat, sun, temperature changes, wind, tides, floods, currents, dust, mud, glare, pressure changes, lightning, etc. play a part in the accident?

(8) CHEMICAL AND PHYSICAL AGENT FACTORS — Did exposure to chemical agents (either single shift exposure or long-term exposure) such as dusts, fibers (asbestos, etc.), silica, gases (carbon monoxide, chlorine, etc.), mists, steam, vapors, fumes, smoke, other particulates, liquid or dry chemicals that are corrosive, toxic, explosive or flammable, by-products of combustion or physical agents such as noise, ionizing radiation, non-ionizing radiation (UV radiation created during welding, etc.) contribute to the accident/incident?

(9) OFFICE FACTORS — Did the fact that the accident occurred in an office setting or to an office worker have a bearing on its cause? For example, office workers tend to have less experience and training in performing tasks such as lifting office furniture. Did physical hazards within the office environment contribute to the hazard?

(10) SUPPORT FACTORS — Was the person using an improper tool for the job? Was inadequate time available or utilized to safely accomplish the task? Were less than adequate personnel resources (in terms of employee skills, number of workers, and adequate supervision) available to get the job done properly? Was funding available, utilized, and adequate to provide proper tools, equipment, personnel, site preparation, etc.?

(11) PERSONAL PROTECTIVE EQUIPMENT— Did the person fail to use appropriate personal protective equipment (gloves, eye protection, hard-toed shoes, respirator, etc.) for the task or environment? Did protective equipment provided or worn fail to provide adequate protection from the hazard(s)? Did lack of or inadequate maintenance of protective gear contribute to the accident?

(12) DRUGS/ALCOHOL— Is there any reason to believe the person's mental or physical capabilities, judgment, etc. were impaired or altered by the use of drugs or alcohol? Consider the effects of prescription medicine and over the counter medications as well as illicit drug use. Consider the effect of drug or alcohol inducted "hangovers."

b. WRITTEN JOB/ACTIVITY HAZARD ANALYSIS — Was a written Job/Activity Hazard Analysis completed for the task being performed at the time of the accident. Mark the appropriate box. *If one was performed, attach a copy of the analysis to the report.*

INSTRUCTIONS FOR SECTION 12 — TRAINING

a. WAS PERSON TRAINED TO PERFORM ACTIVITY/TASK? — For the purpose of this section, "trained" means the person has been provided the necessary information [either formal and/or on-the-job (OJT) training] to competently perform the activity/task in a safe and healthful manner.

b. TYPE OF TRAINING — Mark the appropriate box that best indicates the type of training (classroom or on-the-job) that the injured person received before the accident happened.

c. DATE OF MOST RECENT TRAINING — Enter the month, day, and year of the last *formal* training completed that covered the activity-task being performed at the time of the accident.

INSTRUCTIONS FOR SECTION 13—CAUSES

a. DIRECT CAUSES — The direct cause is that single factor which most directly lead to the accident. See examples below.

b. INDIRECT CAUSES — Indirect causes are those factors which contributed to but did not directly initiate the occurrence of the accident.

Examples for section 13:

a. Employee was dismantling scaffold and fell 12 feet from unguarded opening.
Direct cause: failure to provide fall protection at elevation.
Indirect causes: failure to enforce USACE safety requirements; improper training/motivation of employee (possibility that employee was not knowledgeable of USACE fall protection requirements or was lax in his attitude towards safety); failure to ensure provision of positive fall protection whenever elevated; failure to address fall protection during scaffold dismantling in phase hazard analysis.

b. Private citizen has stopped his vehicle at intersection for red light when vehicle was struck in rear by USACE vehicle (note USACE vehicle was in proper/safe working condition).
Direct cause: failure of USACE driver to maintain control of and stop USACE vehicle within safe distance.
Indirect cause: failure of employee to pay attention to driving (defensive driving).

INSTRUCTIONS FOR SECTION 14—ACTION TO ELIMINATE CAUSE(S)

DESCRIPTION — Fully describe all the actions taken, anticipated, and recommended to eliminate the cause(s) and prevent reoccurrence of similar accidents/illnesses. Continue on blank sheets of paper if necessary to fully explain and attach to the completed report form.

INSTRUCTIONS FOR SECTION 15—DATES FOR ACTION

a. BEGIN DATE — Enter the date when the corrective action(s) identified in Section 14 will begin.

b. COMPLETE DATE — Enter the date when the corrective action(s) identified in Section 14 will be completed.

c. TITLE AND SIGNATURE — Enter the title and signature of supervisor completing the accident report. For a GOVERNMENT employee accident/illness the immediate supervisor will complete and sign the report. For PUBLIC accidents the USACE Project Manager/Area Engineer responsible for the USACE property where the accident happened shall complete and sign the report. For CONTRACTOR accidents the Contractor's project manager shall complete and sign the report and provide to the USACE supervisor responsible for oversight of that contractor activity. This USACE supervisor shall also sign the report. Upon entering the information required in 15.d, 15.e, and 15.f below, the responsible USACE supervisor shall forward the report for management review as indicated in Section 16.

d. DATE SIGNED — Enter the month, day, and year that the report was signed by the responsible supervisor.

e. ORGANIZATION NAME — For GOVERNMENT employee accidents enter the USACE organization name (Division, Branch, Section, etc.) of the injured employee. For PUBLIC accidents enter the USACE organization name for the person identified in block 15.c. For CONTRACTOR accidents enter the USACE organization name for the USACE office responsible for providing contact administration oversight.

f. OFFICE SYMBOL — Enter the latest complete USACE Office Symbol for the USACE organization identified in block 15.e.

INSTRUCTIONS FOR SECTION 16—MANAGEMENT REVIEW (1st)

1st REVIEW — Each USACE FOA shall determine who will provide 1st management review. The responsible USACE supervisor in section 15.c shall forward the completed report to the USACE office designated as the 1st Reviewer by the FOA. Upon receipt, the Chief of the Office shall review the completed report, mark the appropriate box, provide substantive comments, sign, date, and forward to the FOA Staff Chief (2nd review) for review and comment.

INSTRUCTIONS FOR SECTION 17—MANAGEMENT REVIEW (2nd)

2nd REVIEW — The FOA Staff Chief (i.e., FOA Chief of Construction, Operations, Engineering, Planning, etc.) shall mark the appropriate box, review the completed report, provide substantive comments, sign, date, and return to the FOA Safety and Occupational Health Office.

INSTRUCTIONS FOR SECTION 18—SAFETY AND OCCUPATIONAL HEALTH REVIEW

3rd REVIEW — The FOA Safety and Occupational Health Office shall review the completed report, mark the appropriate box, ensure that any inadequacies, discrepancies, etc. are rectified by the responsible supervisor and management reviewers, provide substantive comments, sign, date, and forward to FOA Commander for review, comment, and signature.

INSTRUCTIONS FOR SECTION 19—COMMAND APPROVAL

4th REVIEW — The FOA Commander shall (to include the person designated Acting Commander in his absence) review the completed report, comment if required, sign, date, and forward the report to FOA Safety and Occupational Health Office. Signature authority should not be delegated.

ATTACHMENT F

URS Safety Management Standards (SMS)

COPIES OF ALL SMSs WILL BE KEPT IN THE FIELD OFFICE AT THE SITE (BUILDING 1036/1038) AND WITH THE SITE SAFETY OFFICER (Stan Levenger)

APPENDIX D
Comment Response Table

DRAFT WORK PLAN FOR
THE SAMPLING OF SOILS BELOW FLOOR SLABS AT LLS-2,3,4 AND EXCAVATION & TRANSPORTATION OF CONTAMINATED SOILS TO LOAD LINE 4 (BUILDINGS G-1, G-1A, AND G-3)
COMMENT RESPONSE TABLE
MAY 29, 2008

Comment Number	Page/ Line	New Page or Sheet	Comment	Recommendation	Response
Ohio EPA (Eileen Mohr)					
O-1			Please make sure the “Disclaimer Statement” is removed from the final version of the workplan.		In the Change Page Instructions for the Final Work Plan, the first item under the Main Text section will be to remove the Disclaimer Statement.
O-2 (Original #9)	1-3/6		Again, the issue of preparation of a workplan for slab removal etc. was not identified during the Interim Record of Decision (IROD) process. It was after the IROD was signed. Although the new language inserted in the paragraph subsequent to this one helps, the information in line 6 is incorrect.	Revise	Lines 6 through 10 of this paragraph are a summary of Ohio EPA’s comment #2 on the Draft Final ROD (April, 2006). In order to resolve the disagreement in timing, the introductory phrase of the first sentence has been removed. The sentence now reads: *The Ohio EPA has raised questions regarding…..* A change page will be provided.
O-3 (Original #4)	1-3/17		Change goals to levels.		The word goals has been changed to levels and a change page provided.

O-4	Figure 2-1		How are the "low-risk" buildings that are grouped together by various criteria depicted on this flowchart?		The low potential buildings all fall within the 92-building decision chain within the flow chart. The flow chart was intended to provide the general steps within the project. The flowchart does not provide the details of how many MI samples per building or which buildings are grouped together for MI sampling. No changes to the flow chart are necessary based on this comment.
O-5 (Original #19)			The text about using a gate other than Post 1 was removed. However, the text indicates that the "proposed truck routes will use the shortest egress from the load lines to State Route 5." There are closer gates to the load lines than the Post 1 gate; however, they are currently locked and secure.	Please revise the text to indicate that the trucks will go through the gate at Post 1.	The last sentence in Section 3.1.2 on Page 3-2 has been revised as follows: *All truck routes will utilize the gate at Post 1 for both entering and exiting RVAAP.* A change page will be provided for this revision.
O-6	3-5/6		Change six piles to five piles.		The number six has been changed to five and a change page provided.

O-7 (Original #34)	3-15/3		Add in pesticides.		This sentence is referring to additional analyses based on operations or RI information. Pesticides were added to the analytical regime to meet the full suite requirements, not because of operations or RI findings. Therefore, this sentence is correct as written. Please note that the last sentence of this paragraph acknowledges the addition of pesticides to meet the full analytical suite requirements.
O-8 (Original #36)	3-16/after 6		Add in text that MKM is responsible for bringing the area to final grade with an approved clean fill – if this is the case.		URS will be responsible for bringing the remediation (excavation) areas to final grade, based on a modification to their task order. Therefore, the following sentence has been added: *The excavated areas will be backfilled to final grade with an approved clean fill.* A change page will be provided.

O-9	Table 3-5		Why were propellants removed from DB-20? Justify.		Propellants were not included in the analyte list for DB-20 either in the original contract award or in the preliminary draft of the full work plan. The review comment may be referring to DB-19. Propellants were initially added at this location to fulfill the 10% full analytical suite requirement. When the analytical scheme was revised to include the low-potential buildings, different buildings were chosen to fulfill the full suite requirement. No changes to this table are necessary.
O-10	Table 3-6		Why were PCBs removed from EB-10A? Justify.		PCBs are still part of the analytical suite at EB-10A, as shown on Table 3-10. The PCB notation has been added to Table 3-6 to make the two tables consistent, and a change page provided.
O-11A	Tables 3-9,3-10, 3-11		When will sample numbers be assigned?		Sample numbers will be assigned at the start of the MI field effort. They will begin with the next number available based on previous field investigations. These numbers will be communicated to the stakeholders at the start of the MI field effort.

O-11B	Tables 3-9,3-10, 3-11		All sample depths are listed as 0-1 foot. This is currently fine, but be aware that if the MI samples at this depth exceed cleanup levels, that additional excavation and collection of another (subsequently deeper) "surface soil" sample will need to occur. Also depending upon the depth of excavation, we may need to look at sidewall (i.e. lateral extent) issues.		Agree. The URS task order is being modified to include potential additional sampling to address these issues. These issues will be discussed with Ohio EPA as they arise and will be handled via the technical change memorandum process. No changes to the work plan are necessary.
O-12	Appendix A, 4-1/27		Add in hexavalent chromium		This sentence has been revised as follows: *All samples will be analyzed for explosives, target analyte list (TAL) metals, and hexavalent chromium.* A change page will be provided.
O-13 (Original #67)	Appendix A, 4-3/19 (bullet)		Add in propellants as requested.		The bullet has been revised as follows: • *Multi-increment samples will be analyzed for explosives, propellants, TAL metals, hexavalent chromium, SVOCs, pesticides, and PCBs. The specific samples to be analyzed for each analytical group are defined in Tables 3-9 through 3-11 in the Work Plan.* A change page will be provided.

O-14	Appendix A, 4-3/19 (bullet)		Add in hexavalent chromium.		The response for comment O-13 includes the addition of hexavalent chromium.
O-15	Appendix B, pg. 3-1/26; Appendix A coversheet and all throughout the method detection limit sheets.		Change Kemron to Microbac.		Kemron’s name change to Microbac occurred during the review of the Work Plan. A footnote has been added to Page 2-1 of the QAPP addendum reflecting this change, as follows: *Analytical support for this work has been assigned to Microbac Laboratories, Inc. of Marietta, Ohio.* (1) (1) *This laboratory was formerly known as Kemron Environmental Services. Subsequent references in this addendum to Kemron should be considered as references to Microbac.* References to Kemron within the text will be changed to Microbac. Change pages for Pg. 2-1 and 3-1 will be provided.

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O-16	Appendix B		Add in the method detection limits and reporting limits for hexavalent chromium.		The first page of Appendix A in the QAPP Addendum has been revised to add: ***Method 7196A, Soil*** ***Compound*** *Hexavalent Chromium MDL 0.05 mg/kg and RL 0.1 mg/kg* A change page will be provided.
O-17	Appendix C		Changes were made to the health and safety plan (HASP); however, the sign-off sheet is the same one that appeared in the Internal Army Draft.	Provide an updated sign-off sheet.	An updated sign-off sheet will be provided as a change page.
O-18	Appendix C	22/31-32	Add in Appendix F(CD) to the final HASP.		A CD with the cited URS SMSs (Attachment F) will be provided to the Ohio EPA Project Manager.
O-19 (Original #77)	29/4		Add in text that key back-up equipment will be on site during sampling.		The following sentence has been added: *Key back-up equipment will be available for use on site during soil sampling and excavation.* A change page will be provided.
OHARNG RTLS-ENV (Katie Elgin)					
R-1	Drawing 1-2		Yellow highlighted areas indicate “AOC under IRP/JMC Use Areas”. This descriptor is misleading and needs changed because these are not the only AOCs under the IRP. Change to something like “AOCs included in project” of “AOCs where underslab sampling will occur as part of this project”, etc.		The legend has been revised to read: *Underslab sampling Project AOC*

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R-2	Drawing 1-4		Where did this AOC boundary come from for Load Line 3? Why is it not located along the fence line of the Load Line? This boundary on the map goes beyond the load line fence line and as far as I know this boundary is inaccurate. I believe the area marked within the area marked as the AOC boundary is the area investigated as part of the RI phases (not the AOC area). This needs verified.		A check of figures in past reports all show the boundary of Load Line 3 beyond the fence line. The figure in the work plan was obtained from the Load Line 3 RI report.
R-3	Drawing 1-3, 1-4, and 1-5		The item identified as the "electrical poles" on these drawings are actually steam stanchions. Please change.		The electric pole legend will be changed to steam stanchion on Figures 1-3 and 1-5. Replacement figures will be provided. The legend on Figure 1-4 does not contain electric poles therefore this figure has not been changed.