Final SHERP Addendum

Remediation of Soils at Load Lines 1, 2, 3, and 4

Addendum Number: 2007-02

Date Effective: Upon project mobilization (2007)

Addendum Summary

This safety addendum is applicable to the following soil removal and disposal activities:

- Mobilization and Site Preparation
- Pre-Excavation Foundation Slab Inspection
- Excavation
- Field Screen Sampling
- Confirmatory Sampling
- Material Handling and Transport
- Decontamination
- Site Restoration
- Groundwater Monitoring
- Post-Construction Maintenance and Inspection Activities

The specific requirements of this addendum and the general requirements of the SHERP are mandatory for all personnel performing the aforementioned activities.

Prepared/
Approved by: _____ Date: June 13, 2007

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List of Attachments

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Acronyms and Abbreviations

$\mu g/m^3$	micrograms per cubic meter
AHA	Activity Hazard Analysis
CFR	Code of Federal Regulations
CIH	Certified Industrial Hygienist
CSP	Certified Safety Professional
ESS	Explosives Safety Submission
HTRW	Hazardous, Toxic, and Radioactive Waste
JSA	Job Safety Analysis
MC	Munitions Constituents
MEC	Munitions and Explosives of Concern
mg/kg	milligrams per kilogram
mg/m^3	milligrams per cubic meter
MSDS	Material Safety Data Sheet
OB/OD	Open Burning/Open Detonation Area
Ohio EPA	Ohio Environmental Protection Agency
OSHA	Occupational Safety and Health Administration
PBC	Performance-Based Contract
PCB	Polychlorinated Biphenyl
PE	Professional Engineer
PEL	Permissible Exposure Limit
PPE	Personal Protective Equipment
PVC	Polyvinyl Chloride
RAWP	Remedial Action Work Plan
RDX	Royal Dutch Explosive - Cyclonite
RVAAP	Ravenna Army Ammunition Plant
SAIC	Science Applications International Corporation
Shaw	Shaw Environmental, Inc.
SHERP	Safety, Health, and Emergency Response Plan
SSHO	Site Safety and Health Officer
TLS	Ravenna Training and Logistics Site
TNT	2,4,6-Trinitrotoluene
USACE	U.S. Army Corps of Engineers
USAEC	U.S. Army Environmental Center
UXO	Unexploded Ordnance
XRF	X-Ray Fluorescence

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1.0 Safety, Health, and Emergency Response Plan Addendum

All work activities will be performed using safe work practices as detailed in the Ravenna Army Ammunition Plant (RVAAP) *Safety, Health, and Emergency Response Plan* (SHERP) (Shaw 2004a) and in accordance with the Occupational Safety and Health Administration (OSHA) Hazardous Waste Operations and Emergency Response standards (29 CFR 1926.65), the U.S. Army Corps of Engineers (USACE) *Safety and Occupational Health Requirements for Hazardous, Toxic and Radioactive Waste (HTRW) Activities, ER-385-1-92* (USACE 2003a) and the USACE *Safety and Health Requirements Manual, EM 385-1-1* (USACE 2003b). The SHERP presents the requirements applicable to general site field activities. Additionally, the following activity hazard analyses (AHA) have been generated and are applicable for the activities associated with soil remediation as discussed in detail in the *Remedial Action Work Plan* (RAWP; Shaw 2007):

- AHA 1.0, Vehicle Operations
- AHA 2.0, Field Mobilization / Site Preparation
- AHA 3.0, Location Surveys
- AHA 4.0, Clearing and Grubbing
- AHA 5.0, Engineering Controls Installation
- AHA 6.0, Relocate Debris
- AHA 7.0, Providing Structural Support to Buildings
- AHA 8.0, MEC Removal at Load Line 1
- AHA 9.0, Soil Excavation
- AHA 10.0, Confirmation Soil Sampling
- AHA 11.0, Field Screening of Samples with X-Ray Fluorescence (XRF)
- AHA 12.0, Stockpiling Excavated Soils
- AHA 13.0, Stockpile Soil Sampling
- AHA 14.0, Soil and Debris Load-out and Transportation for Off-site Disposal
- AHA 15.0, Well Sampling
- AHA 16.0, Well Development
- AHA 17.0, Fueling Operations
- AHA 18.0, Site Restoration
- AHA 19.0, Equipment Decontamination

The AHAs are provided in this addendum as Attachment 1. An excavation "Competent Person" shall be on-site at all times during excavation activity.

1.1 Chemical Hazards

Previous field investigations performed at RVAAP indicate the presence of organic chemicals, metals, and explosives in soil, groundwater, and surface water samples (SAIC 2003; Shaw 2004b, c, d). The majority of the chemical contaminants present are generally found in low concentrations; however, some are found in relatively high concentrations. The primary potential source of exposure to site contaminants would be from personnel contact with soils and dusts.

Results of these investigations indicated the maximum concentrations of the following notable contaminants of potential concern:

- 2,4,6-Trinitrotoluene (TNT) - 390,000 milligram per kg (mg/kg)*
- Nitrocellulose - 390 mg/kg
- RDX (Cyclonite) - 2,300 mg/kg
- Arsenic - 110 mg/kg
- Chromium - 4,000 mg/kg
- Chromium, hexavalent - 82 mg/kg
- Lead - 25,000 mg/kg
- Manganese - 8,810 mg/kg
- PCB-1254 - 1,100 mg/kg
- Zinc - 7,300 mg/kg
- Aluminum - 97,000 mg/kg
- Mercury - 9.7 mg/kg.

* This high concentration appears to be an anomaly. It is suspected that a small chunk of TNT was captured in the sample. An additional three samples were obtained in the immediate area with an average concentration of 1.48 mg/kg.

Dust exposure calculations were performed on these detected contaminants for each of the load lines. The calculation indicates that dust exposures to personnel should be maintained to below the following concentrations (8-hour time weighted average) at specific areas within each load line to maintain chemical exposures to below regulatory limits:

- Load Line 1 (Zone 1) – 6.285 milligram per cubic meter (mg/m^3)
- Load Line 1 (Zone 2) – 2.283 mg/m^3
- Load Line 1 (Zone 3) – 1.647 mg/m^3
- Load Line 1 (Zone 4) – 7.038 mg/m^3
- Load Line 1 (Zone 5) – 6.000 mg/m^3
- Load Line 1 (Zone 6) – 21.82 mg/m^3
- Load Line 2 (Zone 1) – 5.847 mg/m^3
- Load Line 2 (Zone 2) – 1.969 mg/m^3

- Load Line 2 (Zone 3) – 2.607 mg/m^3
- Load Line 2 (Zone 4) – 6.590 mg/m^3
- Load Line 2 (Zone 5) – 0.909 mg/m^3
- Load Line 2 (Zone 6) – 8.386 mg/m^3
- Load Line 3 (Zone 1) – 19.83 mg/m^3
- Load Line 3 (Zone 2) – 3.075 mg/m^3
- Load Line 3 (Zone 3) – 2.210 mg/m^3
- Load Line 3 (Zone 4) – 5.872 mg/m^3
- Load Line 3 (Zone 5) – 9.486 mg/m^3
- Load Line 3 (Zone 6) – 9.541 mg/m^3
- Load Line 4 (Zone 1) – 2.852 mg/m^3
- Load Line 4 (Zone 2) – 8.588 mg/m^3.

The dust calculation worksheets and site plans that indicate the zone locations at each load line are provided in this addendum in Attachment 2. Due to the low concentrations of chemical contaminants in most of the zones, nuisance dust (particulates, not otherwise regulated) will be considered the hazard. The OSHA Permissible Exposure Limit (PEL) for Particulates, Not Otherwise Regulated (total) is 15 mg/m^3.

Table 4-1, Maximum Detected Concentrations of Contaminants of Concern provided in the SHERP (Shaw 2004a) provides an expanded listing of the chemicals and their concentrations detected through previous investigations. Chapter 4.1, Chemical Hazards, in the SHERP (Shaw 2004a) provides employee exposure information on these specific chemicals. The Written Lead Compliance Plan is provided in this addendum as Attachment 3.

Numerous operational chemicals will be used to complete the scope of work covered under this Addendum. These operational chemicals include, but are not limited to fuels, lubricants, and detergents/cleaning solutions. Personnel shall review the Material Safety Data Sheets (MSDS) for these chemicals on a frequent basis and follow the recommended precautionary guidelines.

1.2 Munitions and Explosives of Concern

Subsequent observations to previous investigations have confirmed the presence of munitions and explosives of concern (MEC), specifically munitions constituents (MC) in the form of "propellant nodules" in the Load Line 1 Area.

Known Locations of Propellants at Load Line 1

Building	Propellant Location
CA-14	• Along east side of building on the surface • Proximate to slag pile on the surface
CB-13B	• Asphalt parking area along east side of the building

Shaw issued an Explosives Safety Submission (ESS) and associated work plan that detailed the planned activities for handling of the propellant material at the Load Line 1 Area. The USACE Military Munitions Center of Expertise approved the ESS, but the requirement for the submission was subsequently waived by the U.S. Army Technical Center for Explosives Safety.

Due to the presence of potential MC, particularly known propellants at identified locations at Load Line 1, a Shaw Unexploded Ordnance (UXO) Technician shall be present during intrusive activities at all load lines to perform pre-excavation surveys and to provide overall MEC support. The pre-excavation surveys will consists of an initial walkover of the areas to be disturbed to identify any potential unknown MC hazards. At Load Line 1, the UXO Technician will perform an initial walkover of the areas previously found to contain propellant nodules on the ground surface. The areas will be inspected for the presence of additional propellants so that visible propellants in the proposed areas of excavation can be identified prior to the commencement of any activities. Areas found to have propellant or other identified MC on the surface will be flagged for further inspection and removal prior to commencing activities. During all excavation activities, the UXO Team will be on-site to observe the soils for any MCs as they are removed. The UXO Team will be responsible for the removal, handling, and disposal of any MECs identified, including the propellants at Load Line 1.

When handling MC, the UXO Technicians shall, at a minimum:

- Ground body before picking up MC.
- Place recovered MC in non-sparking containers
- Keep MC away from heat, static electricity, and other ignition sources.

Recovered propellant material will be transported by the UXO Technician to the Ravenna Training and Logistics Site (TLS) open burning/open detonation (OB/OD) Area 2 for destruction by Shaw personnel. The Ohio Environmental Protection Agency (Ohio EPA) shall be notified in advance of planned destruction activities. The Ohio EPA MEC Notification Procedures are included in Attachment A of the *Project Coordination Plan for Structural Analysis and MEC Support for Load Lines 1-4* (Shaw 2006).

Additionally, the following safety criteria, as listed in *Follow-on Reactivity Study of Primary Explosives in Soil", SFIM-AEC-ET-CR-97015* (USACE 1997) shall be followed for all excavation at Load Line 1:

- Areas where soil will be excavated or sampled at Load Line 1 will be wetted with water prior to commencing the specific activity.
- Soil should contain a minimum moisture content of 10% by weight.

When working in areas where there is a potential for residual MC in the soil, the following procedure will be followed:

- Site personnel will be briefed during the morning tailgate safety meeting that there is a potential for the discovery of MC (explosive chunks or energetic material). They will be instructed to watch for "propellant nodules" and rocks or soils that do not match native materials or that in any other manner do not appear to be normal for the area.
- Raw explosive materials may become more sensitive after being weathered by time and the environment. Disturbing the explosive material could cause it to ignite or explode.
- At Load Line 1 where known propellants exist at certain locations, the UXO Technician will perform an initial survey of the excavation areas and will observe excavation activities. If any propellants are identified, the UXO Technician will immediately remove the nodules and work will continue.
- If any suspect MC is discovered at Load Line 1 besides propellant nodules or any MC is identified at Load Lines 2-4, the UXO technicians will immediately stop work and notify the Field Supervisor.
- Personnel shall not touch or disturb suspect materials until a determination has been made by the UXO Technician that the material does not present a hazard.
- The Field Supervisor will contact Tol-Test Inc. / Mid-American Security at 330-358-7406 (Pager: 261-626-0825).

Explosive soils are not considered a hazard unless the explosive concentration in the soil goes above 10%. Although, not anticipated to occur at any of the load lines, if encountered, chunks of explosives can present a significant hazard since the explosive material is concentrated. Propellant nodules at Load Line 1 are not expected to exceed 10% of soil concentrations; however, pieces may be weathered and may be difficult to distinguish from native soils. When broken, pieces of explosives or propellants may display a different color from that of the exterior of the piece.

1.3 Unexploded Ordnance

There is no reason to expect that UXO will be discovered during the activities required to complete the scope of work covered under this addendum; therefore, UXO is not addressed in this addendum. However, as a precaution, all field personnel shall have attended MEC Awareness Training in combination with the other required health and safety training prior to conducting any fieldwork.

1.4 General Hazard Control Measures

There are numerous physical hazards associated with the work. There are no unique or special physical hazards that are not addressed in the SHERP or the attached AHAs. Prior to beginning work, the following requirements and precautions apply:

- A site safety orientation training session shall be held for personnel completing this scope of work at RVAAP. The pertinent information contained in the SHERP, the information contained in this addendum, and the applicable AHAs shall be the content of the training.
- MEC Awareness Training shall be held. All personnel shall attend this training.
- Lead Awareness Training shall be held. The information contained in the Written Lead Compliance Plan (Attachment 3) shall be conveyed to personnel during this training. All personnel shall attend this training.
- Asbestos Awareness Training shall be held in relation to debris handling activities. All personnel shall attend this training.
- Personnel working within the established Exclusion Zones shall establish baseline blood-lead concentrations.
- Personnel shall not enter known areas containing propellants at Load Line 1 until authorized by the UXO Technician.
- Underground Utility/Overhead Hazard Awareness Training shall be held. All personnel shall attend this training.
- The Intrusive Activities Clearance Procedure (SHERP Section 4.2.11) shall be followed (Shaw 2004a).
- Underground utilities shall be located and marked prior to commencing intrusive activities.
- Heavy equipment shall be inspected prior to mobilization to the site. The initial inspection shall be documented on the USACE Inspection Form and submitted to the Site Safety and Health Officer (SSHO) upon receipt of the equipment.
- Personnel and equipment decontamination areas shall be set up prior to commencing work.

- Only trained personnel shall operate the XRF instrument.
- Any licenses necessary for the use of the XRF in Ohio shall be displayed in the work area.
- The XRF instrument operator shall be trained in the use of the instrument, trained in radiation safety, and shall carry a certificate stating so.
- A 2-A: 5-B:C fire extinguisher shall be readily available in all areas where methanol is being used.
- An emergency eyewash station (capable of delivering 0.4 gallons per minute for 15 minutes) shall be available in the immediate area when using corrosive materials or methanol is used in the decontamination process.

Throughout the duration of construction activities, the following requirements and precautions apply:

- Job Safety Analyses (JSAs) shall be completed each day by each distinct work crew.
- Personnel shall not enter any buildings unless authorized by the USACE, a structural engineer that has inspected the building, and the Field Supervisor.
- The structural hazards (falling overhead objects or piles of demolition debris around the buildings) in Load Lines 2, 3 and 4 may require some additional control measures. This includes the relocation of existing stockpiled demolition debris within the proposed work zones and the installation of support of structures and debris that could dislodge or collapse during excavation activities. The status of structural support activities and any specific hazards and necessary controls related to that work will be reviewed during the site-safety orientation training session and daily safety meetings (refer to the Structural Survey Report, Appendix D of the RAWP).
- Water shall be applied to sampling, excavation, and debris relocation areas in Load Line 1 to maintain soil moisture content greater than 10% by weight.
- Water shall be applied to debris prior to and during handling to control dust emissions to below 0.5 mg/m^3.
- Water shall be applied to all soils and debris prior to sampling, excavating, and handling to control dust emissions.
- Heavy equipment shall be inspected daily before use.
- Personnel shall be cautious of using equipment or parking vehicles in dry, tall grasses due to the possibility of starting a fire by contact with catalytic converters or hot exhaust gases.

1.5 Personal Protective Equipment

The following sections specify the required initial levels of personal protective equipment (PPE) during various activities within this scope of work. As monitoring data is obtained, levels of PPE will be reviewed by the Project Certified Industrial Hygienist (CIH) to determine if downgrades in PPE levels are possible.

1.5.1 Level D PPE

Level D PPE shall be worn by personnel, at a minimum, for all activities unless otherwise specified in Sections 1.5.1 and 1.5.2 below. Level D PPE shall consist of the following:

- Safety glasses with side shields
- Hearing protection (when operating equipment or using power tools)
- Nitrile or vinyl surgical gloves (during sampling and XRF).
- Vinyl or latex booties (ground personnel working in potentially contaminated areas)
- Safety-toed work boots
- Hard hat
- Leather gloves (as necessary).

1.5.2 Level D - Modified PPE

Level D - Modified PPE shall be worn by personnel working in the Exclusion Zone(s) of regulated areas except Load Line 1-Zone 3 and Load Line 2-Zones 2 and 5 (see Section 1.5.3 below) during the activities described below. See Attachment 2 for site plans depicting the zone locations:

- Dust generating activities
- Clearing and grubbing
- Excavation
- Soil handling
- Stockpiled soil sampling
- Load-out of soil and debris
- Field analytical of soils in all areas
- When handling soils from all areas
- During equipment decontamination

Level D – Modified PPE shall consist of the following:

- Hard hat
- Safety glasses with side shields
- Safety-toed work boots
- Tyvek coveralls
- Vinyl or latex boot covers

- Nitrile or vinyl surgical gloves
- Face Shield (pressure washing)
- PVC Rain Gear (pressure washing)
- Hearing protection (heavy equipment operators and pressure washing)

Equipment operators and truck drivers in closed cabs with windows closed may utilize Level D PPE during debris relocation activities. Truck drivers in closed cabs with windows closed may utilize Level D PPE during soil load-out activities, except as noted in Section 1.5.3 below.

1.5.3 Level C PPE

Level C PPE shall be worn initially by personnel working in the Exclusion Zone(s) during debris relocation and load-out at all locations, and at Load Line 1-Zone 3 and Load Line 2-Zones 2 and 5 (see Attachment 2) during clearing and grubbing, excavations, soils handling, and during load-out of contaminated materials from these areas. Activities – such as sampling, field analytical, and MEC support – generating minimal dust in these areas may be performed in Level D - Modified PPE (see Section 1.5.2). Truck drivers shall close windows on cabs, exit vehicles, and remain in a support area (upwind) during load-out activities of soils from Load Line 1-Zone 3 and Load Line 2-Zones 2 and 5. Level C PPE shall consist of the following:

- Hard hat
- Full-face Air Purifying Respirator equipped with combination P-100/organic vapor cartridges (new filter cartridges shall be installed on the respirator at the beginning of each day, or when personnel notice increased resistance in breathing due to filter-cartridge loading)
- Safety-toed work boots
- Tyvek coveralls
- Vinyl or latex boot covers
- Nitrile or vinyl surgical gloves
- Outer polyvinyl chloride (PVC) or neoprene gloves, as necessary
- Hearing protection (heavy equipment operators and personnel working in the vicinity of heavy equipment)
- All seams between gloves, boot covers, and Tyvek coveralls shall be taped.

1.6 Monitoring Requirements

There are air and noise monitoring requirements during the soil excavation of contaminated soils. All monitoring instruments shall be calibrated, and all monitoring shall be documented as specified in the RVAAP SHERP (Shaw 2004a). All air sampling will be performed using

National Institute for Occupational Safety and Health analytical methods and analyzed by an American Industrial Hygiene Association accredited laboratory.

1.6.1 Real-time Aerosol Monitoring

Real-time aerosol monitors (MIE pDR-1000 or equivalent) shall be used to monitor dust emissions during soils excavation, soil stockpiling, debris relocation, and load-out of contaminated soils and debris.

Monitoring stations will be established at the down-wind perimeter of each exclusion zone and within each work area where personnel may be exposed to dust.

1.6.2 Personal Air Sampling (Time-integrated)

To monitor employee exposures to lead, personal air sampling pumps (Gilian Gil-Air 5 or equivalent) will be used to collect air samples in the breathing zone of workers during certain work activities in Load Line 1-Zone 3 and Load Line 2-Zones 2 and 5 and the handling of soils from these areas. The results of this sampling will be compared against the OSHA PEL for lead of 50 micrograms per cubic meter ($\mu g/m^3$); and used to validate the selection of PPE or downgrade those levels of PPE, if possible. Personal air sampling for lead shall be performed on personnel working in the Exclusion Zones during contaminated soil excavation, and loading-out contaminated materials for movement on-site or transportation for disposal. The personnel selected for this air sampling shall represent employees with the highest potential for exposure. Three full-shift samples for lead (on each of the different types of operations in each of the distinct excavation, handling, and load-out areas) will be obtained early in the operations. The initial lead monitoring results for the aforementioned activities will be compared to the PEL for lead and additional exposure assessment will continue at the frequency required in accordance with 29CFR1926.62 for lead. Even if initial determination indicates worker exposure to be below the allowable PEL for lead, additional monitoring may be performed at the Shaw CIH's discretion.

To monitor employee exposures to contaminated dust (total dust), personal air sampling pumps (Gilian Gil-Air 5 or equivalent) will be used to collect air samples in the breathing zone of workers as new work activities that generate dust are initiated. Personal air sampling for total dust shall be performed on personnel working in the Exclusion Zones during contaminated soil excavation and loading out contaminated materials for movement on-site or transportation for disposal, at a minimum. The results of this sampling will be compared against the calculated dust exposure values (Section 1.1); and used to validate the selection of PPE or downgrade those levels of PPE, if possible. The personnel selected for this air sampling shall represent employees with the highest potential for exposure. Three full-shift samples for total dust (on each of the different types of operations) will be obtained at the beginning of each activity as an initial determination of dust exposure. Total dust concentration will be compared to the calculated dust

exposure values for each area as presented in Attachment 2 of this SHERP Addendum Additional monitoring of dust for a task will not be required if total dust concentrations for the three full shifts are below the calculated dust exposure value for an area; however, additional sampling may be required at the discretion of the Shaw CIH.

1.6.3 Noise Monitoring

Noise monitoring (dosimetry) shall be performed on personnel operating and/or working in the vicinity of heavy equipment and soil/debris handling operations. Noise attenuation ratings of the hearing protection used shall be compared against the noise dosimetry data to verify that exposures are maintained to below OSHA standards. Shaw personnel shall use an automated digital sound level meter to determine noise levels on a periodic basis throughout the duration of construction activities when sound levels are anticipated to exceed the OSHA permissible noise exposures presented in 29CFR1926.52. Monitoring frequency will be determined based on the activities being conducted and the potential for noise to be emitted in relation to workers in the immediate vicinity. The sound level meter shall be placed at an angle to the sound source and at least four feet above the ground. High noise areas will be posted as such.

1.6.4 Air Monitoring Action Levels

Calculations for air monitoring action levels were prepared using the highest detected concentrations of known site contaminants as identified during previous investigations at the four load lines (SAIC 2003; Shaw 2004b, c, d). These calculations were used to determine the dust action levels for the work to be performed during the proposed construction activities. The following action levels are established for the collected real-time air monitoring data:

<u>Work Areas Monitored</u>

- All site activities in areas that could potentially cause the release of dust will be monitored for dust particulates at the perimeter of the work areas.
- Aerosol monitors' instantaneous peak alarms shall be set at 1.0 mg/m^3. Aerosol monitors registering instantaneous peak dust concentrations at or above 1.0 mg/m^3 require that additional dust suppression measures be instituted. Aerosol monitors shall be checked on an hourly basis during dust generating activities, if the alarm is not heard.
- Aerosol monitors registering workday time-weighted average dust concentrations at or above the concentrations for each area listed in Section 1.1 or above 2.5 mg/m^3, whichever is lower, require that additional dust suppression measures be instituted on the following workday. The aerosol monitors shall be checked for this data at the conclusion of each workday. The Project CIH shall be immediately notified of any excursions.

Debris Relocation

- All debris relocation areas that could potentially cause the release of dust will be monitored for dust particulates at the perimeter of the work areas.
- Aerosol monitors' instantaneous peak alarms shall be set at 0.5 mg/m^3. Aerosol monitors registering instantaneous peak dust concentrations at or above 0.5 mg/m^3 require that additional dust suppression measures be instituted. Aerosol monitors shall be checked on an hourly basis during dust generating activities, if the alarm is not heard.

2.0 References

Science Applications International Corporation (SAIC) 2003. *Phase II Remedial Investigation Report for the Load Line 1 at the Ravenna Army Ammunition Plant, Ravenna, Ohio.* Final. June 2003.

Shaw Environmental, Inc. (Shaw), 2004a. *Safety, Health, and Emergency Response Plan, Ravenna Army Ammunition Plant*, Final, Revision 0. April.

Shaw 2004b. *Phase II Remedial Investigation Report for Load Line 2 at the Ravenna Army Ammunition Plant, Ravenna, Ohio*. Final. July.

Shaw 2004c. Phase II Remedial Investigation Report for Load Line 3 at the Ravenna Army Ammunition Plant, Ravenna, Ohio. Final. July.

Shaw 2004d. *Phase II Remedial Investigation Report for Load Line 4 at the Ravenna Army Ammunition Plant, Ravenna, Ohio.* Final. September.

Shaw 2006. *Project Coordination Plan for Structural Analysis and MEC Support at Load Lines 1-4, Ravenna Army Ammunition Plan, Ravenna, Ohio*. Final. October.

Shaw 2007. *Remedial Action Work Plan, Remediation of Soils at Load Lines 1 2, 3 and 4, Ravenna Army Ammunition Plant*, Final, Revision 0. April.

U.S. Army Corps of Engineers (USACE) 2003a. *Safety and Occupational Health Requirements for Hazardous, Toxic, and Radioactive Waste (HTRW) Activities*, ER 385-1-92, Washington, D.C., July 1.

USACE 2003b. *Safety and Health Requirements Manual*, EM 385-1-1, Washington, D.C., November 3.

U.S. Army Environmental Center (USAEC), 1997. *Follow-on Reactivity Study of Primary Explosives in Soil", SFIM-AEC-ET-CR-97015,* Aberdeen Proving Grounds, Maryland, May.

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Attachment 1
Activity Hazard Analyses

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Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 1.0 – Vehicle Operations			Risk Assessment Code (RAC):	M
Date Prepared (mm-dd-yyyy):	04-26-2007				
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

Recommended Protective Clothing & Equipment:	E= Extremely High Risk H = High Risk M = Moderate Risk L = Low Risk	Probability				
		Frequent	Likely	Occasional	Seldom	Unlikely
Level D PPE Equipment: Vehicles	Severity Catastrophic					
	Severity Critical					
	Severity Marginal				X	
	Severity Negligible					

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE HAZARDS	EM 385-1-1 (PARA REF)
Project vehicle use.	Operation of motor vehicles and trucks-General.	All company owned, leased, or rented vehicle operations shall comply with the requirements of Shaw Procedure HS800, *Motor Vehicle Operation: General Requirements*. All company owned, leased, or rented commercial vehicle operations shall comply with the requirements of Shaw Procedure HS810, *Commercial Motor Vehicle Operation And Maintenance*. Subcontractors operating motor vehicles shall comply with all federal, state, and local traffic regulations. Subcontractors shall only use vehicles that are in good condition and safe to operate. All personnel shall drive defensively and wear seat belts while vehicles are in motion. The route to the site shall be planned prior to departure.	18.A.01 18.A.02.a,b,c,d,e,f 18.A.03 18.B.01 18.B.02
	Operation of motor vehicles and trucks-Accidents	In the event of an accident: Stop; call for medical assistance; notify police; complete Vehicle Accident Report and submit to your supervisor.	01.D.01
Project vehicle use (continued).	Operation of motor vehicles and trucks-Accidents (continued)	If a Shaw employee is injured, the Health Resource forms, Return to Work, Medical Release, and Treatment	

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 1.0 – Vehicle Operations				
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE HAZARDS	EM 385-1-1 (PARA REF)
		of Injury/Illness must completed at the health clinic or Emergency Room.	
	Operation of motor vehicles and trucks-Backing	Back into parking spaces upon arrival, whenever possible.	
		When preparing to move or back vehicles at the project site, walk around the vehicle before backing to identify any new conditions or obstructions.	18.B.14 08.B.04
		Use a spotter when backing whenever possible, and sound horn prior to backing.	
		Determine and agree upon hand signals (between spotter and driver) before attempting to back vehicle.	08.B.06
		Check the rear-view and side mirrors prior to backing (Note: All vehicles, other than automobiles, must have small convex mirrors attached to the side mirrors.)	
		Back slowly in areas of obstructed vision.	
		Anticipate others who may be backing out into your pathway and adjust accordingly.	18.B.01
	Operation of motor vehicles and trucks - Unfamiliar with the vehicle	Familiarize yourself with the vehicle before moving.	
		Review the dashboard controls, steering radius, overhead and side clearances. Locate windshield wipers and lights.	
Project vehicle use (continued).	Operation of motor vehicles and trucks-Speed	Properly adjust mirrors and seat.	
		Obey all posted speed limits.	18.B.04

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 1.0 – Vehicle Operations				
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE HAZARDS	EM 385-1-1 (PARA REF)
Project vehicle use (continued).		Radar detectors are prohibited in all company owned, leased, or rented vehicles.	18.B.04
	Operation of motor vehicles and trucks-Spacing/Distance	Reduce travel speed during hazardous conditions (i.e. rain, fog, snow). Identify if your vehicle has Anti-Lock Brakes (ABS). Follow the 3-second rule. Increase the 3-second rule as necessary during hazardous travel conditions. Always leave yourself an "out" during travel – this applies to stoplights as well.	
		When stopping, make sure that you leave enough distance between you and the car in front of you (you should be able to see the rear tires of the vehicle in front, when stopped).	18.B.03
		When at a red light, and it turns green, use the "delayed start" technique, by counting to three before you take your foot off the brake. DO NOT TAILGATE!	
	Operation of motor vehicles and trucks-skids	Allow extra spacing and braking time for trucks and vehicles towing trailers. Trailers shall be equipped with brakes	
	Operation of motor vehicles and trucks-skids (continued)	If the vehicle has begun to skid out of control, turn the steering wheel in the direction of the skid and re-adjust the wheel, as necessary.	
		Slow travel speeds during hazardous travel conditions.	18.B.04

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 1.0 – Vehicle Operations				
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE HAZARDS	EM 385-1-1 (PARA REF)
Project vehicle use (continued).	Operation of motor vehicles and trucks-Blind Spots	Use 4-wheel drive, if available, when driving vehicles off road, on steep inclines, muddy conditions, etc.	
		Do not take vehicles “off road” if they cannot be operated safely.	
		Become familiar with any blind spots associated with your vehicle.	
		Adjust mirrors properly.	
		Make sure you use your directional signals.	
	Operation of motor vehicles and trucks-Cellular phones	Always look over your shoulder to assure the lane is clear when changing lanes.	
		Exercise caution when approaching other driver’s blind spots.	18.B.01
		Do not use handheld cellular phones while driving	
	Operation of motor vehicles and trucks-Equipment Failure	Pull over to the side of the road when making a call.	
		Perform daily inspections of your vehicle.	18.A.02.e
	Operation of motor vehicles and trucks-Spacing/Distance	Any vehicle with mechanical problems that may endanger the safety of the driver, passengers, or the public shall not be used.	18.A.03
		Ensure safety equipment is in the vehicle. Safety equipment should include a spare tire, jack, first-aid kit, fire extinguisher, and flashlight. Flares and/or reflective triangles shall be available in larger trucks.	18.A.04

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 1.0 – Vehicle Operations				
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE HAZARDS	EM 385-1-1 (PARA REF)
	Operation of motor vehicles and trucks- Influenced by drug and alcohol	Verify that the proper documentation is in the vehicle - documentation includes an operations manual for the vehicle, insurance card, vehicle registration, and Shaw Accident forms.	
		NEVER DRIVE UNDER THE INFLUENCE OF DRUGS OR ALCOHOL. Disciplinary action, including termination, will be taken against anyone who is convicted of or who pleads no-contest to the charges of driving under the influence in accordance with Shaw Health and Safety Procedure HS800	01.C.02
	Operation of motor vehicles and Trucks-Driver Attitude/Fatigue.	Project-assigned hourly employees are not permitted to operate company owned, leased, or rented vehicles after 10:00 p.m. without written authorization from their supervisor.	
		Do not operate any vehicle when abnormally tired, temporarily disabled, or under the influence of drugs or alcohol.	
		Keep an even temper when driving. Do not let the actions of others affect your attitude.	
Project vehicle use (continued).	Operation of motor vehicles and trucks-Driver Attitude/Fatigue (continued).	Avoid “highway-hypnosis” and “falling asleep at the wheel.” Take plenty of breaks when driving long distances. Rotate driving responsibility with your partner.	
	Operation of motor vehicles and trucks-Vehicle Loading	No employee is authorized to operate a company vehicle (including rentals) after having been on-duty for a period of 12-hours.	01.C.04.b
		No employee may drive for more than 10-hours in a	

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 1.0 – Vehicle Operations				
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE HAZARDS	EM 385-1-1 (PARA REF)
		single on-duty period.	
		DO NOT OVERLOAD the vehicle.	18.B.16.c
		Secure all equipment within the body of the vehicle.	18.B.16.b
		Do not block side view mirrors with load.	18.A.01
		Do not transport DOT manifested hazardous materials without a commercial driver's license (CDL).	
		Dispatch all equipment and personnel with proper forms and identification.	

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 2.0 – Field Mobilization / Site Preparation			Risk Assessment Code (RAC):	M
Date Prepared (mm-dd-yyyy):	04-26-2007				
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

Recommended Protective Clothing & Equipment:
Level D: hard hat, safety glasses, steel-toed boots, work gloves Equipment: GFCIs, extension cords, temporary lights, hand tools, fire extinguishers, emergency eyewash, personal fall protection equipment,

E= Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

		Probability				
		Frequent	Likely	Occasional	Seldom	Unlikely
Severity	Catastrophic					
Severity	Critical					
Severity	Marginal				X	
Severity	Negligible					

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE HAZARDS	EM 385-1-1 (PARA REF)
Travel at project site.	See AHA Number 1.0, Vehicle Operation.		18.A
Arrival of new personnel at site.	Untrained personnel.	All personnel working on hazardous, toxic, and radioactive waste (HTRW) shall submit HAZWOPER training certificates (40-hour, 8-hour (if applicable), and supervisor (if applicable) to a Site Safety and Health Officer (SSHO). All personnel shall attend a site safety orientation. Other training certifications shall also be made available on-site.	01.B.03 01.E.01 28.A.03.a, b, c 06.B.05
	Medical qualifications.	All personnel working on HTRW shall submit current physician's certificate stating that employee is participating in an appropriate medical surveillance program meeting 29 Code of Federal Regulation (CFR) 1910.120.	01.C.01
	Allergies.	All personnel should complete the Known Allergies Questionnaire (voluntary only).	01.C.01

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 2.0 – Field Mobilization / Site Preparation				
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE HAZARDS	EM 385-1-1 (PARA REF)
Arrival of new personnel at site. (continued)	Unfamiliarity with: site, general (chemical, physical, environmental) site hazards, project safety rules and hazard control procedures, chain of command, and emergency procedures.	All personnel shall attend the site orientation training. The site orientation shall include a review of the phone locations, evacuation routes, and any special requests from the manager of the facility. After personnel are trained in the contents of the Safety, Health, and Emergency Response Plan (SHERP), SHERP Addenda, and they shall sign the SHERP Acknowledgment Form. Personnel who may participate in intrusive activities shall attend UXO and MEC Awareness training. All pertinent AHAs shall be reviewed with personnel (as applicable).	01.B.03 01.E.01 28.A.03.a,b,c
Unload equipment/prepare site		Post all hazard warning signs, emergency maps, and emergency phone numbers.	03.A.01.b
	Failure to properly plan daily activities.	A Job Safety Analysis (JSA), as required by Shaw HS 045 shall be prepared by the crew prior to commencing daily activities. The JSA may be used as a component of the morning Tailgate Safety Meeting. The JSA shall be revised at any time throughout the workday when new tasks are initiated, unforeseen circumstances arise, or if working conditions change.	01.A.09
	Heavy lifting, strains, and sprains.	No individual employee is permitted to lift any object that weighs over 60 pounds. Proper lifting techniques shall be used. Multiple employees or the use of mechanical lifting devices are required for lifting objects over the 60-pound limit.	14.A.01

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 2.0 – Field Mobilization / Site Preparation				
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE HAZARDS	EM 385-1-1 (PARA REF)
Unload equipment/prepare site (continued)	Use of mechanical equipment.	Only qualified personnel shall be permitted to operate equipment. Mechanical equipment shall be inspected daily. Deficiencies in equipment shall be noted on the inspection form. Equipment found to be unsafe shall not be used. All equipment shall be operated at safe speeds and in a safe manner. Equipment operators shall wear safety belts and hearing protection. Ground personnel shall not position themselves between equipment and stationary objects. Personnel are only permitted to approach equipment after a signal from the operator.	13.A
	Use of hydraulic equipment with rigging.	Follow EM 385-1-1 requirements if using hydraulic excavators, wheel loaders, track loaders and backhoe / loaders transport or hoist loads with rigging.	16.N
Rigging Competent Person:	Use of rigging.	Rigging shall be inspected before each use. Deficiencies shall be noted on the inspection form. Rigging found to be unsafe shall not be used, tagged, and taken out of service.	15
	Overhead.	Vehicle drivers must be aware of overhead hazards and maintain safe clearances - use spotters when necessary.	08.B.04 11.E
	Slips, trips, falls.	Work areas clear shall be kept organized during site set-up. Housekeeping shall be maintained. Personnel shall not jump from equipment or elevated surfaces.	14.C.01 -10

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 2.0 – Field Mobilization / Site Preparation				
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE HAZARDS	EM 385-1-1 (PARA REF)
Prepare site.	Hand injuries.	Items to be handled shall be inspected for sharp edges prior to being handled. Personnel shall wear leather gloves when handling sharp materials. Personnel shall be aware of and avoid pinch point hazards.	05.A.10
	Electrical.	Ground-fault circuit interrupters (GFCIs) shall be used on all power tools and extension cords.	11.C.05
		Extension cords, power tools, and lighting equipment shall be inspected before each use, protected from damage, and kept out of wet areas. Keep extension cords off of roads.	11.A.03
	Fire.	Fire extinguishers shall be placed in work areas. The SSHO and Site Supervisor shall establish smoking areas in compliance with the facility policy.	09.E.01 09.A.06
		Engines shall be shut off before refueling. A 40-B:C fire extinguisher shall be available at refueling areas. Smoking shall not be permitted near fueling areas. Use caution with vehicle exhaust systems in grassy areas.	09.E.02
	Chemical hazards.	The Exclusion Zone and Contamination Reduction Zone shall be set-up and appropriately marked with signage.	Definitions p. 522 28.C.03.b
		The Emergency Eyewash station shall be inspected, cleaned, filled, and then placed in service. Notify all personnel of the emergency eyewash station location.	06.B.02.b 06.B.01.b
Setting up field support trailers.	Personnel or property struck by moving equipment.	Clearance of overhead utilities shall be verified before backing. Spotters shall be used to back trailers. Trailer tires shall be chocked.	08.B.04 11.E

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 2.0 – Field Mobilization / Site Preparation				
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE HAZARDS	EM 385-1-1 (PARA REF)
Setting up field support trailers. (continued)	Emergency egress.	Trailers shall be positioned in a fashion to allow for safe and efficient egress during an emergency evacuation.	01.E
	Electrocution.	Only qualified electricians shall make electrical connections. All electrical work shall comply with National Electric Code standards. All circuit breakers shall be labeled. Personnel shall be instructed in main disconnect location.	11.A.01.a, b, c
	Slips, trips, falls.	Landings, stairs, and handrails shall be constructed for each doorway leading to the outside of a trailer which meet the requirements specified in 29 CFR 1910 Subpart D. Housekeeping shall be maintained.	14.C.01-10
	Fire.	Each trailer shall be immediately equipped with at least one 2-A: 10-B:C fire extinguisher.	09.E.01
	High wind.	All trailers shall be appropriately anchored.	04.A.02.c 04.A.03
	Sanitation.	Washing, toilet, and trash disposal facilities (dumpster) shall be installed prior to occupying trailers.	02.A.01
	Exposure to traffic.	Personnel shall park completely off roads. Personnel shall not perform work on active roads. Personnel shall wear high visibility work vests.	05.A.11

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 3.0 – Location Surveys			Risk Assessment Code (RAC):	M
Date Prepared (mm-dd-yyyy):	04-26-2007				
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

Recommended Protective Clothing & Equipment:
Level D: hard hat, safety glasses, steel-toed boots, work gloves Equipment: First aid kit, survey equipment

E= Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

		Probability				
		Frequent	Likely	Occasional	Seldom	Unlikely
Severity	Catastrophic					
Severity	Critical					
Severity	Marginal				X	
Severity	Negligible					

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE HAZARDS	EM 385-1-1 (PARA REF)
Arrival of new personnel at site.	Unfamiliarity with: site, general site hazards, project safety rules, chain of command, and emergency procedures.	All personnel shall attend the site orientation training.	01.B.03 01.E.01 28.A.03.a, b, c
Unload equipment/surveying.	Heavy lifting, strains, and sprains.	No individual employee is permitted to lift any object that weighs over 60 pounds. Proper lifting techniques shall be used. Multiple employees or the use of mechanical lifting devices are required for lifting objects over the 60-pound limit.	14.A.01
	Struck-by/Against.	Wear reflective warning vests when exposed to vehicular traffic. Personnel working on or near roads and only remain on road long enough to complete work. Personnel walking along roadway shall stay off roadway as far as possible and walk on the side facing traffic.	05.A.11
	Munitions and Explosives of Concern (MEC) / Unexploded Ordnance (UXO).	Personnel shall attend MEC Awareness and UXO Awareness training. UXO Technician shall be present during any intrusive soil activities at all load lines.	01.B.07

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 3.0 – Location Surveys				
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE HAZARDS	EM 385-1-1 (PARA REF)
Surveying (continued)	Intrusive activities.	Follow procedure for permit in Section 4.2.11, *Intrusive Activities*, Safety, Health, and Emergency Response Plan (SHERP) prior to driving stakes.	25.A.01
	Slips, trips, falls.	Keep work areas clear and maintain housekeeping. Personnel shall not jump from elevated surfaces. Personnel shall use caution when walking on rocky, slippery, or uneven terrain	14.C.01-10
	Hand injuries.	Items to be handled shall be inspected for sharp edges prior to being handled. Personnel shall wear leather gloves when handling sharp materials. Personnel shall be aware of and avoid pinch point hazards.	05.A.10
	Heat, cold, and severe weather.	Follow procedures outlined in the SHERP.	06.J
	Hazardous atmospheres.	Personnel shall immediately notify the SSHO if odors are detected.	
	Fire.	Smoking shall not be permitted in regulated areas. Vehicles shall not be parked in tall dry grass.	09.A.06

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 4.0 – Clearing and Grubbing			Competent Person:	
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

Recommended Protective Clothing & Equipment:
Level D - Modified: hard hats, safety glasses, Tyvek coveralls, protective gloves, leather gloves, steel-toed boots, Helmet systems for chain saw use, protective chaps Equipment Chain saws, bar oil, extra chains, fire extinguishers, track hoe, hearing protection, plastic or wood wedges

E= Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

		Probability				
		Frequent	Likely	Occasional	Seldom	Unlikely
Severity	Catastrophic					
Severity	Critical				X	
Severity	Marginal					
Severity	Negligible					

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS	EM 385-1-1 (PARA REF)
Clear out trees and brush.	Failure to properly plan daily activities.	A Job Safety Analysis (JSA), as required by Shaw HS 045 shall be prepared by the crew prior to commencing daily activities. The JSA may be used as a component of the morning Tailgate Safety Meeting. The JSA shall be revised at any time throughout the workday when new tasks are initiated, unforeseen circumstances arise, or if working conditions change. Read and understand all safety precautions presented in equipment operator manuals.	01.A.09
	Site contamination.	Follow procedures in SHERP and SHERP Addendum.	28.A.02
	Dust.	Dust shall be monitored and controlled. PPE use is required.	28.F.02
	Hand injuries.	Items to be handled shall be inspected for sharp edges and thorns prior to being handled. Personnel shall wear leather gloves when handling sharp materials. Personnel shall be aware of and avoid pinch point hazards.	05.A.10
	Noise.	Equipment operators and ground personnel working near heavy equipment shall wear hearing protection to reduce exposures to below the OSHA limits.	05.C

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 4.0 – Clearing and Grubbing			Competent Person:	
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS	EM 385-1-1 (PARA REF)
Clear out trees and brush (continued).	Use of heavy equipment.	Only qualified personnel shall be permitted to operate equipment. Heavy equipment shall be inspected daily after the initial USACE inspection (and documented.) Do not use unsafe equipment. All equipment shall have backing alarms. All equipment shall be operated at safe speeds and in a safe manner. Equipment operators shall wear safety belts. Personnel are only permitted to approach equipment after a signal from the operator. Ground personnel, working near heavy equipment, shall wear high visibility conspicuity vests. Ground personnel shall not enter the swing radius of the track hoe.	16.A.04 16.A.01 16.A.02 16.A.03 16.A.04 16.A.07
		Ground personnel shall not position themselves between equipment and stationary objects. Personnel shall verify all mechanical guards are in place and functioning properly. Moving equipment shall be equipped with a back-up alarm. All equipment shall be shut down with energies dissipated prior to performing maintenance activities - lock out/tag out procedures may apply. Only qualified mechanics shall work on or repair heavy equipment.	16.A.04 16.A.04 16.B.03 16.B.01 16.A.09 16.A.08 16.A.03
	Crushed by trees.	Heavy equipment shall be equipped with Falling Object Protective Structure (FOPS). Ground personnel shall stay clear at least twice the distance of the height of the tree being pushed over.	16.B.11
	Fire.	Engines shall be shut off before refueling. A 2:A-20-B:C fire extinguisher shall be available when refueling. Smoking shall not be permitted near fueling areas. Gasoline shall be stored in safety cans with flash arrestors and spring-loaded vents.	16.A.14 09.E.01 09.A.06 09.B.08

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 4.0 – Clearing and Grubbing			Competent Person:	
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS	EM 385-1-1 (PARA REF)
Clear out trees and brush (continued).	Fire (continued).	Fire extinguishers shall be placed in work areas. Smoking shall only be allowed in designated areas.	09.E.01 09.A.06
	Heavy lifting, strains, and sprains.	No individual employee is permitted to lift any object that weighs over 60 pounds. Proper lifting techniques shall be used. Multiple employees or the use of mechanical lifting devices are required for lifting objects over the 60-pound limit.	14.A.01
	Heat stress.	Personnel shall drink plenty of cool water. Personnel shall pace themselves while performing strenuous work and take adequate breaks in a cool area.	06.J.03 02.A.04 02.A.06
	Slips, trips, and falls.	Travel paths for materials removal shall be evaluated and cleared. Work areas clear shall be kept organized during work activities. Housekeeping shall be maintained. Personnel shall not jump from equipment or elevated surfaces.	14.C.01 14.C.02
	Injury from chain saws, wood/falling trees, chips, cuts, and noise.	Chain saw operators shall wear a specially designed helmet system (consisting of head, face, and hearing protection). Use gloves and chaps at all times when using saw. Operators shall wear chain saw protective boots with steel toes. Secure loose fitting clothing with duct tape. Keep other personnel at least two tree lengths away from tree being felled. Operators shall have escape routes planned that are at 45º from the projected direction of the falling tree. Keep escape routes clear of all tools, materials, and wood/brush. Always cut away from the body. Shut off chain saws when walking between work areas. Have spotter assist when falling large or tall trees. Only cut trees, logs, or branches from ground height. Shut off engines before freeing pinched chains. Chain	13.F.03 13.A.13 31.C.02

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 4.0 – Clearing and Grubbing			Competent Person:	
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS	EM 385-1-1 (PARA REF)
Clear out trees and brush (continued).		saw operators shall always hold the saw with both hands during cutting operations.	13.F.05
	Improperly maintained chain saws.	Inspect chain saw before each use. Do not use saws in which any safety feature is not functioning. Frequently check and adjust tension on chain. Do not use saws with or dull cutters. Do not increase force used as cutters become dull. The idle speed shall be properly adjusted to prevent the chain from moving when the engine is idling. Keep bar groove clean. Do not allow oil holes to become plugged. Use only new chains or professionally sharpened chains. Use specially formulated or diluted (25% diesel) bar and chain oil when using chain saw in cold weather. Replace sprockets, which show signs of wear.	13.A.02
	Fatigue.	Operators shall be given ample rest breaks.	
	Kick back of chain saw.	Remain alert to kickback hazards and keep a firm, proper grip on chain saw at all times. All chain saws shall be equipped with automatic chain brake and other anti-kickback devices. Use wedges to prevent binding of the chain. Do not cut with the tip (nose) of the bar. Do not use dull chains. Do not overreach with chain saw. Personnel shall not operate chain saws above shoulder height. Personnel shall be familiar with cutting techniques.	13.F.02 13.F.06
	Tree climbing.	Personnel are prohibited from climbing trees.	

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 4.0 – Clearing and Grubbing			Competent Person:	
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS	EM 385-1-1 (PARA REF)
Clear out trees and brush (continued).	Tree pruning, falling, and brush removal/chipping.	Machete use is prohibited. Personnel operating weed whackers shall wear hearing protection and eye/face protection. Steel blade use on weed whackers is prohibited. The procedures outlined in *Safety & Health Requirements Manual*, Sections 31.C, 31.D and 31.E shall be conveyed to all personnel involved in the operations. Remain clear of feed and discharge chutes on chippers.	
	Fire.	Engines shall be shut off before refueling. A 2:A-20-B:C fire extinguisher shall be available at refueling areas. Smoking shall not be permitted near fueling areas. Chain saws, weed whackers, and chippers shall be allowed to cool before refueling. Gas powered equipment shall not be started in fueling area (at least 10 feet away). Gasoline shall be stored in safety cans with flash arresters and spring-loaded vents.	13.F.04 13.F.04
	Poison ivy, oak, and sumac.	Brush and logs to be cut shall be inspected for the presence of irritating plants. Skin contact with these plants or the sawdust/chips shall be avoided by wearing Tyvek coveralls and gloves.	
	Munitions and Explosives of Concern (MEC) / Unexploded Ordnance (UXO).	Personnel shall attend MEC Awareness and UXO Awareness training. UXO Technician shall be present during any intrusive soil activities at all load lines. At Load Line 1 where there are known propellants, soil moisture shall be maintained above 10%. Eliminate ignition / impact sources.	01.B.07 25.A.01

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 5.0 – Engineering Controls Installation			Competent Person:	
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

Recommended Protective Clothing & Equipment:
Level D and D – Modified; puncture-proof footwear, Class 3 Reflective vests, Equipment: Decontamination station, water supply, fire extinguishers, excavator, hand tools, hearing protection, gloves

E= Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

		Probability				
		Frequent	Likely	Occasional	Seldom	Unlikely
Severity	Catastrophic					
Severity	Critical				X	
Severity	Marginal					
Severity	Negligible					

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS	EM 385-1-1 (PARA REF)
Silt Fence Installation, Diversion Ditch Construction, Straw-bale Placement.	Failure to properly plan daily activities.	A Job Safety Analysis (JSA), as required by Shaw HS 045 shall be prepared by the crew prior to commencing daily activities. The JSA may be used as a component of the morning Tailgate Safety Meeting. The JSA shall be revised at any time throughout the workday when new tasks are initiated, unforeseen circumstances arise, or if working conditions change.	01.A.09
	Chemical contamination.	Set up work zones and personnel washing facilities. PPE shall be worn as required. Perform air monitoring as specified in the SHERP. Personnel shall wash hands and face before eating, drinking, smoking, or chewing.	02.C.01 06.B.02 28.E.01 28.F.02
	Dust.	Personnel shall avoid working in dust. Dust from excavation and debris handling shall be controlled by water misting.	28.F.02
	Hand injuries.	Items to be handled shall be inspected for sharp edges prior to being handled. Personnel shall wear leather gloves when handling sharp materials. Personnel shall be aware of and avoid pinch point hazards.	05.A.10

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 5.0 – Engineering Controls Installation			Competent Person:	
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS	EM 385-1-1 (PARA REF)
Silt Fence Installation, Diversion Ditch Construction, Straw-bale Placement (continued).	Munitions and Explosives of Concern (MEC) / Unexploded Ordnance (UXO).	Personnel shall attend MEC Awareness and UXO Awareness training. UXO Technician shall be present during any intrusive soil activities at all load lines. At Load Line 1 where there are known propellants, soil moisture shall be maintained above 10%. Eliminate ignition / impact sources.	01.B.07 25.A.01
	Structural hazards.	The necessary structural support shall be completed prior to working in or near impacted areas.	
	Damage to underground utilities.	The Ohio Utilities Protection Service shall be contacted prior to any intrusive activities. The Intrusive Activities Procedure and Shaw HS 308, as specified in the SHERP, shall be followed.	23.A.02 25.A.01
	Overhead hazards/utilities.	Overhead hazards shall be evaluated prior to moving equipment on the project site. Overhead power lines shall be shut-off and locked-out. Areas with overhead hazards shall be barricaded with caution tape to prevent contact In areas where it is not feasible to use barricades, then spotters shall be provided: however, the minimum distances from electrical lines must be observed (See SHERP).	11.E.04
	Noise.	Equipment operators and ground personnel working near heavy equipment shall wear hearing protection to reduce exposures to below the OSHA limits.	05.C
	Use of heavy equipment.	Only qualified personnel shall be permitted to operate equipment. Heavy equipment shall be inspected daily after the initial USACE inspection (and documented.) Do not use unsafe equipment. All equipment shall have backing alarms. All equipment shall be operated at safe speeds and in a safe manner.	16.A.04 16.A.01 16.A.02 16.A.03 16.A.04 16.A.07

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 5.0 – Engineering Controls Installation			Competent Person:	
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS	EM 385-1-1 (PARA REF)
Silt Fence Installation, Diversion Ditch Construction, Straw-bale Placement (continued).	Use of heavy equipment (continued).	Equipment operators shall wear safety belts. Personnel are only permitted to approach equipment after a signal from the operator.	
		Ground personnel, working near heavy equipment, shall wear ANSI Class 3 high visibility conspicuity vests. Ground personnel shall not enter the swing radius of the backhoe.	16.A.04 16.A.04 16.B.03 16.B.01 16.A.09
		Ground personnel shall not position themselves between equipment and stationary objects. Personnel shall verify all mechanical guards are in place and functioning properly. Moving equipment shall be equipped with a back-up alarm. All equipment shall be shut down with energies dissipated prior to performing maintenance activities - lock out/tag out procedures may apply. Only qualified mechanics shall work on or repair heavy equipment.	16.A.08 16.A.03
	Excavations.	Excavations shall be inspected daily. Perimeter protection shall be provided when excavation is unattended. Protective systems (sloping) shall be provided as necessary if excavation is greater than four-foot deep and personnel must enter. Air monitoring shall be performed prior to entering excavations.	25.A.02 25.B.01 25.A.03
	Fire.	Engines shall be shut off before refueling. A 10-B:C fire extinguisher shall be available when refueling. Smoking shall not be permitted near fueling areas. Gasoline shall be stored in safety cans with flash arrestors and spring-loaded vents.	16.A.14 09.E.01 09.A.06 09.B.08

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 5.0 – Engineering Controls Installation			Competent Person:	
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS	EM 385-1-1 (PARA REF)
Silt Fence Installation, Diversion Ditch Construction, Straw-bale Placement (continued).	Fire (continued).	Fire extinguishers shall be placed in work areas. Smoking shall only be allowed in designated areas. Hot work permitting procedures shall be followed.	
	Heavy lifting, strains, and sprains.	No individual employee is permitted to lift any object that weighs over 60 pounds. Proper lifting techniques shall be used. Multiple employees or the use of mechanical lifting devices are required for lifting objects over the 60-pound limit.	09.E.01 09.A.06 09.A.03 14.A.01
	Heat, cold, severe weather.	Follow procedures outlined in the SHERP.	06.J
	Slips, trips, and falls.	Travel paths for materials removal shall be evaluated and cleared. Work areas shall be kept organized during work activities. Housekeeping shall be maintained. Personnel shall not jump from equipment or elevated surfaces.	14.C.01 14.C.02
	Punctures.	Personnel working near debris piles shall wear puncture-proof foot protection.	05.A.08
	Use of shovels and sledgehammers.	Hand tools shall be inspected daily and before each use. Damaged tools shall be removed from service. Personnel shall work in a manner and pace to reduce strains and overexertion. Wear leather gloves when using hand-tools. Only sledgehammers that are in good condition (without cracked handles or mushroomed heads) shall be used. The head shall be inspected prior to use to determine if it is securely attached to the handle. Personnel stabilizing the stake during driving shall stand clear of the sledgehammer path and keep head, hands, and arms out of the drive path. Wear leather gloves when using hand-tools.	13.A.02

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 6.0 – Relocate Debris			Competent Person:	
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

Recommended Protective Clothing & Equipment:
Level D and D – Modified; puncture-proof footwear, Class 3 Reflective vests Equipment: Decontamination station, water supply, fire extinguishers, excavator, shears, hearing protection

E= Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

		Probability				
		Frequent	Likely	Occasional	Seldom	Unlikely
Severity	Catastrophic					
Severity	Critical				X	
Severity	Marginal					
Severity	Negligible					

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS	EM 385-1-1 (PARA REF)
Relocate debris.	Failure to properly plan daily activities.	A Job Safety Analysis (JSA), as required by Shaw HS 045 shall be prepared by the crew prior to commencing daily activities. The JSA may be used as a component of the morning Tailgate Safety Meeting. The JSA shall be revised at any time throughout the workday when new tasks are initiated, unforeseen circumstances arise, or if working conditions change.	01.A.09
	Chemical contamination.	Set up work zones and personnel washing facilities. PPE shall be worn as required. Perform air monitoring as specified in the SHERP. Personnel shall wash hands and face before eating, drinking, smoking, or chewing.	02.C.01 06.B.02 28.E.01 28.F.02
	Dust.	Personnel shall avoid working in dust. Dust from excavation and debris handling shall be controlled by water misting.	28.F.02
	Hand injuries.	Items to be handled shall be inspected for sharp edges prior to being handled. Personnel shall wear leather gloves when handling sharp materials. Personnel shall be aware of and avoid pinch point hazards.	05.A.10

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 6.0 – Relocate Debris			Competent Person:	
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS	EM 385-1-1 (PARA REF)
Relocate debris (continued). UXO Technician:	Munitions and Explosives of Concern (MEC) / Unexploded Ordnance (UXO).	Personnel shall attend MEC Awareness and UXO Awareness training. UXO Technician shall be present during any intrusive soil activities at all load lines. At Load Line 1 where there are known propellants, soil moisture shall be maintained above 10%. Eliminate ignition / impact sources.	01.B.07 25.A.01
	Structural hazards.	The necessary structural support shall be completed prior to relocating debris in impacted areas. Personnel shall stay out of buildings.	
	Overhead hazards/utilities.	Overhead hazards shall be evaluated prior to moving equipment on the project site. Overhead power lines shall be shut-off and locked-out. Areas with overhead hazards shall be barricaded with caution tape to prevent contact In areas where it is not feasible to use barricades, then spotters shall be provided: however, the minimum distances from electrical lines must be observed (See SHERP).	11.E.04
	Noise.	Equipment operators and ground personnel working near heavy equipment shall wear hearing protection to reduce exposures to below the OSHA limits.	05.C
	Use of heavy equipment.	Only qualified personnel shall be permitted to operate equipment. Heavy equipment shall be inspected daily after the initial USACE inspection (and documented.) Do not use unsafe equipment. All equipment shall have backing alarms. All equipment shall be operated at safe speeds and in a safe manner. Equipment operators shall wear safety belts. Personnel are only permitted to approach equipment after a signal from the operator.	16.A.04 16.A.01 16.A.02 16.A.03 16.A.04 16.A.07

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 6.0 – Relocate Debris			Competent Person:	
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS	EM 385-1-1 (PARA REF)
Relocate debris (continued).	Use of heavy equipment (continued).	Ground personnel, working near heavy equipment, shall wear ANSI Class 3 high visibility conspicuity vests. Ground personnel shall not enter the swing radius of the backhoes/excavators.	05.A.11
		Ground personnel shall not position themselves between equipment and stationary objects. Personnel shall verify all mechanical guards are in place and functioning properly. Moving equipment shall be equipped with a back-up alarm. All equipment shall be shut down with energies dissipated prior to performing maintenance activities - lock out/tag out procedures may apply. Only qualified mechanics shall work on or repair heavy equipment.	16.A.04 16.A.04 16.B.03 16.B.01 16.A.09 16.A.08 16.A.03
	Fire.	Engines shall be shut off before refueling. A 10-B:C fire extinguisher shall be available when refueling. Smoking shall not be permitted near fueling areas. Gasoline shall be stored in safety cans with flash arrestors and spring-loaded vents.	16.A.14 09.E.01 09.A.06 09.B.08
		Fire extinguishers shall be placed in work areas. Smoking shall only be allowed in designated areas. Hot work permitting procedures shall be followed.	09.E.01 09.A.06 09.A.03
	Heavy lifting, strains, and sprains.	No individual employee is permitted to lift any object that weighs over 60 pounds. Proper lifting techniques shall be used. Multiple employees or the use of mechanical lifting devices are required for lifting objects over the 60-pound limit.	14.A.01
	Heat, cold, severe weather.	Follow procedures outlined in the SHERP.	06.J

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 6.0 – Relocate Debris			Competent Person:	
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS	EM 385-1-1 (PARA REF)
Relocate debris (continued).	Slips, trips, and falls.	Travel paths for materials removal shall be evaluated and cleared. Work areas shall be kept organized during work activities. Housekeeping shall be maintained. Personnel shall not jump from equipment or elevated surfaces.	14.C.01 14.C.02
	Punctures.	Personnel working near debris piles shall wear puncture-proof foot protection.	05.A.08
	Struck-by.	Long pieces of debris shall be sized into manageable lengths prior to loading. Personnel shall not be permitted in the swing radius of the equipment. Personnel shall maintain a safe distance from shearing operations and be aware that cut pieces of tank may fly a considerable distance. Cutting shall only be performed in areas clear of overhead hazards. Set up cutting area away from other operations when possible. Ground personnel shall wear ANSI Class 3 reflective vests when working near heavy equipment.	23.F.01 05.A.11
	Dump truck operations.	Overhead hazards shall be re-evaluated prior to allowing dump trucks onto the project site. Areas with overhead hazards shall be barricaded with caution tape to prevent dump bed from contacting. In areas where it is not feasible to use barricades, then spotters shall be provided: however, the minimum distances from electrical lines must be observed (See SHERP). Dump trucks shall not be allowed to contact contaminated materials unless proper decontamination will be performed.	16.B.11 16.B.08 16.B.02

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 6.0 – Relocate Debris			Competent Person:	
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS	EM 385-1-1 (PARA REF)
Relocate debris (continued).	Dump truck operations (continued).	Dump truck operators shall remain in truck with windows closed or exit trucks and stay in designated area while being loaded. Operators shall wear seat belts while trucks are in motion at the project site. Spotters shall assist trucks when backing is necessary.	

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 7.0 – Providing Structural Support to Buildings			Risk Assessment Code (RAC):	M
Date Prepared (mm-dd-yyyy):	04-26-2007				
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

Recommended Protective Clothing & Equipment:
Level D: hard hat, safety glasses, steel-toed boots, work gloves Equipment: Excavator

E= Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

		Probability				
		Frequent	Likely	Occasional	Seldom	Unlikely
Severity	Catastrophic					
Severity	Critical				X	
Severity	Marginal					
Severity	Negligible					

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE HAZARDS	EM 385-1-1 (PARA REF)
Arrival of new personnel at site.	Unfamiliarity with: site, general site hazards, project safety rules, chain of command, and emergency procedures.	All personnel shall attend the site orientation training.	01.B.03 01.E.01 28.A.03.a, b, c
Implement structural supports.	Failure to properly plan daily activities.	A Job Safety Analysis (JSA), as required by Shaw HS 045 shall be prepared by the crew prior to commencing daily activities. The JSA may be used as a component of the morning Tailgate Safety Meeting. The JSA shall be revised at any time throughout the workday when new tasks are initiated, unforeseen circumstances arise, or if working conditions change.	01.A.09
	Heavy lifting, strains, and sprains.	No individual employee is permitted to lift any object that weighs over 60 pounds. Proper lifting techniques shall be used. Multiple employees or the use of mechanical lifting devices are required for lifting objects over the 60-pound limit.	14.A.01
	Struck-by/Against.	Wear reflective warning vests when exposed to vehicular traffic. Personnel working on or near roads and only remain on road long enough to complete work.	05.A.11

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 7.0 – Providing Structural Support to Buildings				
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE HAZARDS	EM 385-1-1 (PARA REF)
Structural support (continued)	Munitions and Explosives of Concern (MEC) / Unexploded Ordnance (UXO).	Personnel shall attend MEC Awareness and UXO Awareness training. UXO Technician shall be present during any intrusive soil activities at all load lines.	01.B.07
	Slips, trips, falls.	Stairs and elevated walking surfaces shall not be used until evaluated by structural engineer. Personnel shall not jump from elevated surfaces. Personnel shall use caution when walking on rocky, slippery, or uneven terrain. Personnel shall not walk or climb on debris.	14.C.01-10 23.A.01
	Hand injuries.	Items to be handled shall be inspected for sharp edges prior to being handled. Personnel shall wear leather gloves when handling sharp materials. Personnel shall be aware of and avoid pinch point hazards.	05.A.10
	Heat, cold, and severe weather.	Follow procedures outlined in the SHERP.	06.J
	Hazardous atmospheres.	Personnel shall immediately notify the SSHO if odors are detected.	
	Fire.	Smoking shall not be permitted in regulated areas. Vehicles shall not be parked in tall dry grass.	09.A.06

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 8.0 – MEC Removal and Support			Competent Person:	
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	T. Mathison / J. Joice	Reviewed By:			

Recommended Protective Clothing & Equipment:
Level D PPE (nitrile surgical gloves, vinyl boot covers) Equipment: Decontamination station, water supply, fire extinguishers, first aid kit

E= Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

		Probability				
		Frequent	Likely	Occasional	Seldom	Unlikely
Severity	Catastrophic					
Severity	Critical				X	
Severity	Marginal					
Severity	Negligible					

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS	EM 385-1-1 (PARA REF)
MEC Removal and support.	Failure to properly plan daily activities.	A Job Safety Analysis (JSA), as required by Shaw HS 045 shall be prepared by the crew prior to commencing daily activities. The JSA may be used as a component of the morning Tailgate Safety Meeting. The JSA shall be revised at any time throughout the workday when new tasks are initiated, unforeseen circumstances arise, or if working conditions change.	01.A.09
	Chemical contamination.	Set up work zones and personnel washing facilities. PPE shall be worn as required. Personnel shall wash hands and face before eating, drinking, smoking, or chewing.	02.C.01 06.B.02
	Munitions and Explosives of Concern (MEC) / Unexploded Ordnance (UXO).	Personnel shall attend MEC Awareness and UXO Awareness training. UXO Technician shall be present during any intrusive soil activities at all load lines. At Load Line 1 where there are known propellants, soil moisture shall be maintained above 10%. Eliminate ignition / impact sources.	01.B.07 25.A.01
	Structural hazards.	The necessary structural support shall be completed prior to relocating debris in impacted areas. Personnel shall stay out of buildings.	

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 8.0 – MEC Removal at Load Line 1			Competent Person:	
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Line 1	Job:	100804		
Prepared By:	T. Mathison / J. Joice	Reviewed By:			

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS	EM 385-1-1 (PARA REF)
MEC Removal and support (continued).	Noise.	Equipment operators and ground personnel working near heavy equipment shall wear hearing protection to reduce exposures to below the OSHA limits.	05.C
	Heat, cold, severe weather.	Follow procedures outlined in the SHERP.	06.J
	Slips, trips, and falls.	Travel paths for personnel shall be evaluated and cleared. Watch for and avoid trip hazards. Work areas shall be kept organized during work activities. Housekeeping shall be maintained. Personnel shall not jump from equipment or elevated surfaces.	14.C.01 14.C.02
	Punctures.	Personnel working near debris piles shall wear puncture-proof foot protection.	05.A.08
	Accidental ignition of propellant.	Observe U.S. Army Engineering and Support Center, Huntsville, Safety Concepts and Basic Considerations for UXO Operations. UXO-trained personnel will escort non-UXO personnel at all times on site. Only UXO-qualified personnel will perform MEC operations. Explosives will be transported in accordance with 49 Code of Federal Regulations (CFR) Parts 100-199. Explosives will be transported in closed vehicles whenever possible. When using an open vehicle, explosives will be covered with a flame resistant tarpaulin. Motor vehicles will be shut off when loading/unloading explosives. Beds of vehicles will have a nonconductive bed liner, dunnage, or sand bags to protect the explosives from contact with the metal bed and fittings. Initiating explosives, such as blasting caps, will remain separated at all times. Each vehicle used for the transport of explosives will be outfitted with a fire extinguisher and first aid kit. Do not fuel trucks when loaded with explosives. Chock wheels	

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 8.0 – MEC Removal at Load Line 1			Competent Person:	
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Line 1	Job:	100804		
Prepared By:	T. Mathison / J. Joice	Reviewed By:			

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS	EM 385-1-1 (PARA REF)
MEC Removal and support (continued).	Accidental ignition of propellant (continued).	when unloading or loading MC materials. Vehicles transporting explosives off road will not exceed 15 MPH. Observe procedures in EOD/TM/TO 60A 1-1-31, Explosive Ordnance Disposal Operations. Use only UXO personnel qualified IAW TP 18, Minimum Qualifications for UXO Technicians and Personnel. Do not subject MEC to heat, shock, or friction. Establish exclusion zone (EZ); post warning signs, maintain site control. Stop all MEC operations when non-UXO trained personnel are within the EZ.	

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 9.0 – Soil Excavation			Competent Person:	
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

Recommended Protective Clothing & Equipment:
Level C, D, and D – Modified; puncture-proof footwear, Class 3 Reflective vests Equipment: Decontamination station, water supply, fire extinguishers, excavator, hearing protection

		Probability				
E= Extremely High Risk H = High Risk M = Moderate Risk L = Low Risk		Frequent	Likely	Occasional	Seldom	Unlikely
Severity	Catastrophic					
Severity	Critical				X	
Severity	Marginal					
Severity	Negligible					

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS	EM 385-1-1 (PARA REF)
Excavate soil.	Failure to properly plan daily activities.	A Job Safety Analysis (JSA), as required by Shaw HS 045 shall be prepared by the crew prior to commencing daily activities. The JSA may be used as a component of the morning Tailgate Safety Meeting. The JSA shall be revised at any time throughout the workday when new tasks are initiated, unforeseen circumstances arise, or if working conditions change.	01.A.09
	Chemical contamination.	Set up work zones and personnel washing facilities. PPE shall be worn as required. Perform air monitoring as specified in the SHERP Addendum. Personnel shall wash hands and face before eating, drinking, smoking, or chewing.	02.C.01 06.B.02 28.E.01 28.F.02
	Dust.	Personnel shall avoid working in dust. Dust from excavation and soil handling shall be monitored and controlled by water misting.	28.F.02
	Hand injuries.	Items to be handled shall be inspected for sharp edges prior to being handled. Personnel shall wear leather gloves when handling sharp materials. Personnel shall be aware of and avoid pinch point hazards.	05.A.10

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 9.0 – Soil Excavation			Competent Person:	
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS	EM 385-1-1 (PARA REF)
Excavate soil (continued). UXO Technician:	Munitions and Explosives of Concern (MEC) / Unexploded Ordnance (UXO).	Personnel shall attend MEC Awareness and UXO Awareness training. UXO Technician shall be present during any intrusive soil activities at all load lines. At Load Line 1 where there are known propellants, soil moisture shall be maintained above 10%. Eliminate ignition / impact sources.	01.B.07 25.A.01
	Structural hazards.	The structural analysis and necessary structural support shall be completed prior to excavating in impacted areas.	
	Damage to underground utilities.	The Ohio Utilities Protection Service shall be contacted prior to any intrusive activities. The Intrusive Activities Procedure and Shaw HS 308, as specified in the SHERP, shall be followed.	23.A.02 25.A.01
	Overhead hazards/utilities.	Overhead hazards shall be evaluated prior to moving equipment on the project site. Overhead power lines shall be shut-off and locked-out. Areas with overhead hazards shall be barricaded with caution tape to prevent contact In areas where it is not feasible to use barricades, then spotters shall be provided: however, the minimum distances from electrical lines must be observed (See SHERP).	11.E.04
	Noise.	Equipment operators and ground personnel working near heavy equipment shall wear hearing protection to reduce exposures to below the OSHA limits.	05.C

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 9.0 – Soil Excavation			Competent Person:	
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS	EM 385-1-1 (PARA REF)
Excavate soil (continued).	Use of heavy equipment.	Only qualified personnel shall be permitted to operate equipment. Heavy equipment shall be inspected daily after the initial USACE inspection (and documented.) Do not use unsafe equipment. All equipment shall have backing alarms. All equipment shall be operated at safe speeds and in a safe manner. Equipment operators shall wear safety belts. Personnel are only permitted to approach equipment after a signal from the operator.	16.A.04 16.A.01 16.A.02 16.A.03 16.A.04 16.A.07
		Ground personnel, working near heavy equipment, shall wear ANSI Class 3 high visibility conspicuity vests. Ground personnel shall not enter the swing radius of the backhoe.	05.A.11
		Ground personnel shall not position themselves between equipment and stationary objects. Personnel shall verify all mechanical guards are in place and functioning properly. Moving equipment shall be equipped with a back-up alarm. All equipment shall be shut down with energies dissipated prior to performing maintenance activities - lock out/tag out procedures may apply. Only qualified mechanics shall work on or repair heavy equipment.	16.A.04 16.A.04 16.B.03 16.B.01 16.A.09 16.A.08 16.A.03
Excavation Competent Person:	Excavations.	Excavations shall be inspected daily. Perimeter protection shall be provided when excavation is unattended. Protective systems (sloping) shall be provided as necessary if excavation is greater than four-foot deep and personnel must enter. Air monitoring shall be performed prior to entering excavations.	25.A.02 25.B.01 25.A.03

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 9.0 – Soil Excavation			Competent Person:	
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS	EM 385-1-1 (PARA REF)
Excavate soil (continued).	Fire.	Engines shall be shut off before refueling. A 10-B:C fire extinguisher shall be available when refueling. Smoking shall not be permitted near fueling areas. Gasoline shall be stored in safety cans with flash arrestors and spring-loaded vents.	16.A.14 09.E.01 09.A.06 09.B.08
		Fire extinguishers shall be placed in work areas. Smoking shall only be allowed in designated areas. Hot work permitting procedures shall be followed.	09.E.01 09.A.06 09.A.03
	Heavy lifting, strains, and sprains.	No individual employee is permitted to lift any object that weighs over 60 pounds. Proper lifting techniques shall be used. Multiple employees or the use of mechanical lifting devices are required for lifting objects over the 60-pound limit.	14.A.01
	Heat, cold, severe weather.	Follow procedures outlined in the SHERP.	06.J
	Slips, trips, and falls.	Travel paths for materials removal shall be evaluated and cleared. Work areas shall be kept organized during work activities. Housekeeping shall be maintained. Personnel shall not jump from equipment or elevated surfaces.	14.C.01 14.C.02
	Struck-by.	Personnel shall not be permitted in the swing radius of the equipment. Personnel shall maintain a safe distance from operations. Ground personnel shall wear ANSI Class 3 reflective vests when working near heavy equipment.	23.F.01 05.A.11

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 9.0 – Soil Excavation			Competent Person:	
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS	EM 385-1-1 (PARA REF)
Excavate soil (continued).	Dump truck operations.	Overhead hazards shall be re-evaluated prior to allowing dump trucks onto the project site. Areas with overhead hazards shall be barricaded with caution tape to prevent dump bed from contacting. In areas where it is not feasible to use barricades, then spotters shall be provided: however, the minimum distances from electrical lines must be observed (See SHERP). Dump trucks shall not be allowed to contact contaminated materials unless proper decontamination will be performed. Dump truck operators shall remain in the truck cab with the windows up while on the project site, unless truck is not equipped with a falling objects protective structure (FOPS). Operators shall wear seat belts while trucks are in motion at the project site. Spotters shall assist trucks when backing is necessary.	16.B.11 16.B.08 16.B.02

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 10.0 – Confirmation Soil Sampling			Competent Person:	
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

Recommended Protective Clothing & Equipment:
Level D – Modified PPE: hard hats, safety glasses, Tyvek coveralls, protective gloves (nitrile), leather gloves, safety-toed boots, disposable boot covers Equipment: high visibility vests, fire extinguishers, non-sparking sampling tools, hearing protection

E= Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

		Probability				
		Frequent	Likely	Occasional	Seldom	Unlikely
Severity	Catastrophic					
Severity	Critical					
Severity	Marginal				X	
Severity	Negligible					

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS	EM 385-1-1 (PARA REF)
Obtain soil samples.	Failure to properly plan daily activities.	A Job Safety Analysis (JSA), as required by Shaw HS 045 shall be prepared by the crew prior to commencing daily activities. The JSA may be used as a component of the morning Tailgate Safety Meeting. The JSA shall be revised at any time throughout the workday when new tasks are initiated, unforeseen circumstances arise, or if working conditions change.	01.A.09
	Hand injuries.	Items to be handled shall be inspected for sharp edges prior to being handled. Personnel shall wear leather gloves when handling sharp materials. Personnel shall be aware of and avoid pinch point hazards.	05.A.10
	Munitions and Explosives of Concern (MEC) / Unexploded Ordnance (UXO).	Personnel shall attend MEC Awareness and UXO Awareness training. UXO Technician shall be present during any intrusive soil activities at all load lines. At Load Line 1 where there are known propellants, soil moisture shall be maintained above 10%. Eliminate ignition / impact sources.	25.A.01
	Noise.	Equipment operators and ground personnel working near heavy equipment shall wear hearing protection to reduce exposures to below the OSHA limits.	05.C

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 10.0 – Confirmation Soil Sampling			Competent Person:	
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS	EM 385-1-1 (PARA REF)
Obtain soil samples (continued).	Chemical contamination.	Follow procedures in SHERP addendum.	
	Struck-by equipment.	Ground personnel, working near heavy equipment, shall wear ANSI Class 3 high visibility conspicuity vests. Ground personnel shall not enter the swing radius of excavators.	05.A.11
	Fire.	Fire extinguishers shall be available in work areas. Smoking shall only be allowed in designated areas.	09.E.01
	Heavy lifting, strains, and sprains.	No individual employee is permitted to lift any object that weighs over 60 pounds. Proper lifting techniques shall be used. Multiple employees or the use of mechanical lifting devices are required for lifting objects over the 60-pound limit. Do not over-load coolers.	14.A.01
	Heat, cold, severe weather.	Follow procedures outlined in the SHERP.	06.J
	Slips, trips, and falls.	Work areas shall be kept organized during work activities. Housekeeping shall be maintained. Personnel shall not jump from equipment or elevated surfaces. Do not climb on unstable piles or structures.	14.C.01 14.C.02
	Use of sampling tools.	All sampling tools shall be constructed of non-sparking materials. Hand tools shall be inspected daily and before each use. Tools, which are damaged, shall be removed from service. Personnel shall work in a manner and pace to reduce strains and overexertion.	13.A.02

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 11.0 – Field Screening of Samples XRF			Competent Person:	
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

Recommended Protective Clothing & Equipment:
Level D PPE (see SHERP Addendum 2006-01) Equipment: XRF device (Niton XL-700 or equivalent), personnel decontamination station

		Probability				
E= Extremely High Risk H = High Risk M = Moderate Risk L = Low Risk		Frequent	Likely	Occasional	Seldom	Unlikely
Severity	Catastrophic					
Severity	Critical					
Severity	Marginal			X		
Severity	Negligible					

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS	EM 385-1-1 (PARA REF)
Determination of target metals concentration in soil samples with X-ray fluorescence.	Munitions and Explosives of Concern (MEC) / Unexploded Ordnance (UXO).	Personnel shall attend MEC Awareness and UXO Awareness training. UXO Technician shall be present during any intrusive soil activities at all load lines. At Load Line 1 where there are known propellants, soil moisture shall be maintained above 10%. Eliminate ignition / impact sources.	25.A.01
	Exposure to lead or spreading lead contamination.	Personnel shall attend Lead Awareness training. Physical contact with soil shall be avoided. Personnel working shall wear disposable boot-covers and nitrile surgical gloves in addition to the other PPE specified in the SHERP Addendum 2007-1. Wash hands immediately after handling samples and before eating, drinking, smoking, or driving vehicles.	06.B.05

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 11.0 – Field Screening of Samples XRF			Competent Person:	
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS	EM 385-1-1 (PARA REF)
Determination of target metals concentration in soil samples with X-ray fluorescence. (continued)	Exposure to radiation.	Any licenses necessary for the use of the XRF in Ohio shall be displayed in the work area. The instrument operator shall be trained in the use of the instrument, trained in radiation safety, and shall carry a certificate stating so. The use of a TLD is not necessary. The operator shall keep aware of the instrument's radioactive source location and the direction of its beam of x-rays (this information should be marked on the front and top sides of the instrument. The shutter shall be kept closed except when performing an actual test. The XRF instrument shall never be pointed at oneself or at anyone else. The manufacturer states that the x-ray beam is easier to avoid when the instrument is held by the right hand. If the shutter is open, the plunger indicator will stick up through the instrument case. If the plunger sticks open – push it closed and then call NITON Service Department (401-294-1234). If the XRF instrument is damaged, destroyed, lost, or stolen – notify Barbara Reider at Shaw (617-589-5829) and Jim Blute at NITON Corp. (800-875-1578 or 617-275-1424). Additionally, the State of Ohio, Highway Patrol (330-297-1441) shall be notified. The Ravenna Fire Department (330-297-5738) shall also be notified if the instrument is damaged in a fire.	06.E.01 06.E.02

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 12.0 – Stockpiling Excavated Soils			Competent Person:	
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

Recommended Protective Clothing & Equipment:
Level C, D, and D – Modified; puncture-proof footwear, Class 3 Reflective vests Equipment: Decontamination station, water supply, fire extinguishers, excavator, hearing protection

E= Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

		Probability				
		Frequent	Likely	Occasional	Seldom	Unlikely
Severity	Catastrophic					
Severity	Critical				X	
Severity	Marginal					
Severity	Negligible					

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS	EM 385-1-1 (PARA REF)
Stockpiling excavated soil.	Failure to properly plan daily activities.	A Job Safety Analysis (JSA), as required by Shaw HS 045 shall be prepared by the crew prior to commencing daily activities. The JSA may be used as a component of the morning Tailgate Safety Meeting. The JSA shall be revised at any time throughout the workday when new tasks are initiated, unforeseen circumstances arise, or if working conditions change.	01.A.09
	Chemical contamination.	Set up work zones and personnel washing facilities. PPE shall be worn as required. Perform air monitoring as specified in the SHERP Addendum. Personnel shall wash hands and face before eating, drinking, smoking, or chewing.	02.C.01 06.B.02 28.E.01 28.F.02
	Dust.	Personnel shall avoid working in dust. Dust from soil handling shall be monitored and controlled by water misting.	28.F.02
	Hand injuries.	Items to be handled shall be inspected for sharp edges prior to being handled. Personnel shall wear leather gloves when handling sharp materials. Personnel shall be aware of and avoid pinch point hazards.	05.A.10

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 12.0 – Stockpiling Excavated Soils			Competent Person:	
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS	EM 385-1-1 (PARA REF)
Stockpiling excavated soil (continued).	Overhead hazards/utilities.	Overhead hazards shall be evaluated prior to moving equipment on the project site. Overhead power lines shall be shut-off and locked-out. Areas with overhead hazards shall be barricaded with caution tape to prevent contact In areas where it is not feasible to use barricades, then spotters shall be provided: however, the minimum distances from electrical lines must be observed (See SHERP).	11.E.04
	Noise.	Equipment operators and ground personnel working near heavy equipment shall wear hearing protection to reduce exposures to below the OSHA limits.	05.C
	Use of heavy equipment.	Only qualified personnel shall be permitted to operate equipment. Heavy equipment shall be inspected daily after the initial USACE inspection (and documented.) Do not use unsafe equipment. All equipment shall have backing alarms. All equipment shall be operated at safe speeds and in a safe manner. Equipment operators shall wear safety belts. Personnel are only permitted to approach equipment after a signal from the operator.	16.A.04 16.A.01 16.A.02 16.A.03 16.A.04 16.A.07
		Ground personnel, working near heavy equipment, shall wear ANSI Class 3 high visibility conspicuity vests. Ground personnel shall not enter the swing radius of the backhoe.	05.A.11

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 12.0 – Stockpiling Excavated Soils			Competent Person:	
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS	EM 385-1-1 (PARA REF)
Stockpiling excavated soil (continued).	Use of heavy equipment (continued0.	Ground personnel shall not position themselves between equipment and stationary objects. Personnel shall verify all mechanical guards are in place and functioning properly. Moving equipment shall be equipped with a back-up alarm. All equipment shall be shut down with energies dissipated prior to performing maintenance activities - lock out/tag out procedures may apply. Only qualified mechanics shall work on or repair heavy equipment.	16.A.04 16.A.04 16.B.03 16.B.01 16.A.09 16.A.08 16.A.03
	Fire.	Engines shall be shut off before refueling. A 10-B:C fire extinguisher shall be available when refueling. Smoking shall not be permitted near fueling areas. Gasoline shall be stored in safety cans with flash arrestors and spring-loaded vents.	16.A.14 09.E.01 09.A.06 09.B.08
		Fire extinguishers shall be placed in work areas. Smoking shall only be allowed in designated areas. Hot work permitting procedures shall be followed.	09.E.01 09.A.06 09.A.03
	Heavy lifting, strains, and sprains.	No individual employee is permitted to lift any object that weighs over 60 pounds. Proper lifting techniques shall be used. Multiple employees or the use of mechanical lifting devices are required for lifting objects over the 60-pound limit.	14.A.01
	Heat, cold, severe weather.	Follow procedures outlined in the SHERP.	06.J
	Slips, trips, and falls.	Travel paths for materials removal shall be evaluated and cleared. Work areas shall be kept organized during work activities. Housekeeping shall be maintained. Personnel shall not jump from equipment or elevated surfaces.	14.C.01 14.C.02

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 12.0 – Stockpiling Excavated Soils			Competent Person:	
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS	EM 385-1-1 (PARA REF)
Stockpiling excavated soil (continued).	Struck-by.	Personnel shall not be permitted in the swing radius of the equipment. Personnel shall maintain a safe distance from operations. Ground personnel shall wear ANSI Class 3 reflective vests when working near heavy equipment.	23.F.01 05.A.11
	Dump truck operations.	Overhead hazards shall be re-evaluated prior to allowing dump trucks onto the project site. Areas with overhead hazards shall be barricaded with caution tape to prevent dump bed from contacting. In areas where it is not feasible to use barricades, then spotters shall be provided: however, the minimum distances from electrical lines must be observed (See SHERP). Dump trucks shall not be allowed to contact contaminated materials unless proper decontamination will be performed. Dump truck operators shall remain in the truck cab with the windows up while on the project site, unless truck is not equipped with FOPS. Operators shall wear seat belts while trucks are in motion at the project site. Spotters shall assist trucks when backing is necessary.	16.B.11 16.B.08 16.B.02

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 13.0 – Stockpile Soil Sampling			Competent Person:	
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

Recommended Protective Clothing & Equipment:
Level D – Modified PPE: hard hats, safety glasses, Tyvek coveralls, protective gloves (nitrile), leather gloves, safety-toed boots, disposable boot covers Equipment: high visibility vests, fire extinguishers, non-sparking sampling tools, hearing protection

E= Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

		Probability				
		Frequent	Likely	Occasional	Seldom	Unlikely
Severity	Catastrophic					
Severity	Critical					
Severity	Marginal				X	
Severity	Negligible					

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS	EM 385-1-1 (PARA REF)
Obtain soil samples.	Failure to properly plan daily activities.	A Job Safety Analysis (JSA), as required by Shaw HS 045 shall be prepared by the crew prior to commencing daily activities. The JSA may be used as a component of the morning Tailgate Safety Meeting. The JSA shall be revised at any time throughout the workday when new tasks are initiated, unforeseen circumstances arise, or if working conditions change.	01.A.09
	Injury from avalanche.	Heavy equipment shall be used to eliminate large clods that might become unstable and roll-down pile. The slope of piles shall be no greater than 1:1 ratio.	
	Munitions and Explosives of Concern (MEC)	Personnel shall attend MEC Awareness and UXO Awareness training.	25.A.01
	Noise.	Equipment operators and ground personnel working near heavy equipment shall wear hearing protection to reduce exposures to below the OSHA limits.	05.C
	Chemical contamination.	Set up work zones and personnel washing facilities. PPE shall be worn and air monitoring performed as specified in the SHERP Addendum. Personnel shall wash hands and face before eating, drinking, smoking, or chewing.	02.C.01 06.B.02 28.E.01 28.F.02

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 13.0 – Stockpile Soil Sampling			Competent Person:	
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS	EM 385-1-1 (PARA REF)
Obtain soil samples (continued).	Struck-by equipment.	Ground personnel, working near heavy equipment, shall wear ANSI Class 3 high visibility conspicuity vests. Ground personnel shall not enter the swing radius of excavators.	05.A.11
	Fire.	Fire extinguishers shall be available in work areas. Smoking shall only be allowed in designated areas.	09.E.01
	Heavy lifting, strains, and sprains.	No individual employee is permitted to lift any object that weighs over 60 pounds. Proper lifting techniques shall be used. Multiple employees or the use of mechanical lifting devices are required for lifting objects over the 60-pound limit. Do not over-load coolers.	14.A.01
	Heat, cold, severe weather.	Follow procedures outlined in the SHERP.	06.J
	Slips, trips, and falls.	Personnel shall not climb on piles when too steep, unstable, or muddy.	
	Use of sampling tools.	All sampling tools shall be constructed of non-sparking materials. Hand tools shall be inspected daily and before each use. Tools, which are damaged, shall be removed from service. Personnel shall work in a manner and pace to reduce strains and overexertion.	13.A.02

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 14.0 – Soil and Debris Load-out and Transportation			Competent Person:	
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

Recommended Protective Clothing & Equipment:
Level C, D, and D – Modified; puncture-proof footwear, Class 3 Reflective vests Equipment: Decontamination station, water supply, fire extinguishers, excavator, shears, hearing protection

E= Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

		Probability				
		Frequent	Likely	Occasional	Seldom	Unlikely
Severity	Catastrophic					
Severity	Critical				X	
Severity	Marginal					
Severity	Negligible					

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS	EM 385-1-1 (PARA REF)
Load-out soil and debris.	Failure to properly plan daily activities.	A Job Safety Analysis (JSA), as required by Shaw HS 045 shall be prepared by the crew prior to commencing daily activities. The JSA may be used as a component of the morning Tailgate Safety Meeting. The JSA shall be revised at any time throughout the workday when new tasks are initiated, unforeseen circumstances arise, or if working conditions change.	01.A.09
	Chemical contamination.	Set up work zones and personnel washing facilities. PPE shall be worn as required. Perform air monitoring as specified in the SHERP. Personnel shall wash hands and face before eating, drinking, smoking, or chewing.	02.C.01 06.B.02 28.E.01 28.F.02
	Dust.	Personnel shall avoid working in dust. Dust from soil and debris handling shall be monitored and controlled by water misting.	28.F.02
	Hand injuries.	Items to be handled shall be inspected for sharp edges prior to being handled. Personnel shall wear leather gloves when handling sharp materials. Personnel shall be aware of and avoid pinch point hazards.	05.A.10
	Munitions and Explosives of Concern (MEC) / Unexploded Ordnance (UXO). (Load Line-1)	Personnel shall attend MEC Awareness and UXO Awareness training.	01.B.07 25.A.01

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 14.0 – Soil and Debris Load-out and Transportation			Competent Person:	
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS	EM 385-1-1 (PARA REF)
Load-out soil and debris (continued).	Overhead hazards/utilities.	Overhead hazards shall be evaluated prior to moving equipment on the project site. Overhead power lines shall be shut-off and locked-out. Areas with overhead hazards shall be barricaded with caution tape to prevent contact In areas where it is not feasible to use barricades, then spotters shall be provided: however, the minimum distances from electrical lines must be observed (See SHERP).	11.E.04
	Noise.	Equipment operators and ground personnel working near heavy equipment shall wear hearing protection to reduce exposures to below the OSHA limits.	05.C
	Use of heavy equipment.	Only qualified personnel shall be permitted to operate equipment. Heavy equipment shall be inspected daily after the initial USACE inspection (and documented.) Do not use unsafe equipment. All equipment shall have backing alarms. All equipment shall be operated at safe speeds and in a safe manner. Equipment operators shall wear safety belts. Personnel are only permitted to approach equipment after a signal from the operator.	16.A.04 16.A.01 16.A.02 16.A.03 16.A.04 16.A.07
		Ground personnel, working near heavy equipment, shall wear ANSI Class 3 high visibility conspicuity vests. Ground personnel shall not enter the swing radius of the backhoe.	05.A.11

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 14.0 – Soil and Debris Load-out and Transportation			Competent Person:	
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS	EM 385-1-1 (PARA REF)
Load-out soil and debris (continued).	Use of heavy equipment (continued).	Ground personnel shall not position themselves between equipment and stationary objects. Personnel shall verify all mechanical guards are in place and functioning properly. Moving equipment shall be equipped with a back-up alarm. All equipment shall be shut down with energies dissipated prior to performing maintenance activities - lock out/tag out procedures may apply. Only qualified mechanics shall work on or repair heavy equipment.	16.A.04 16.B.03 16.B.01 16.A.09 16.A.08 16.A.03
	Fire.	Engines shall be shut off before refueling. A 10-B:C fire extinguisher shall be available when refueling. Smoking shall not be permitted near fueling areas. Gasoline shall be stored in safety cans with flash arrestors and spring-loaded vents.	09.E.01 09.A.06 09.B.08
	Heavy lifting, strains, and sprains.	Fire extinguishers shall be placed in work areas. Smoking shall only be allowed in designated areas. Hot work permitting procedures shall be followed.	09.E.01 09.A.06 09.A.03
	Heat, cold, severe weather.	No individual employee is permitted to lift any object that weighs over 60 pounds. Proper lifting techniques shall be used. Multiple employees or the use of mechanical lifting devices are required for lifting objects over the 60-pound limit.	14.A.01
	Slips, trips, and falls.	Follow procedures outlined in the SHERP.	06.J
	Punctures.	Travel paths for materials removal shall be evaluated and cleared. Work areas shall be kept organized during work activities. Housekeeping shall be maintained. Personnel shall not jump from equipment or elevated surfaces.	14.C.01 14.C.02
	Struck-by.		05.A.08

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 14.0 – Soil and Debris Load-out and Transportation			Competent Person:	
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS	EM 385-1-1 (PARA REF)
Load-out soil and debris (continued).	Struck-by (continued).	Personnel working near debris piles shall wear puncture-proof foot protection.	
	Dump truck operations.	Long pieces of debris shall be sized into manageable lengths prior to loading. Personnel shall not be permitted in the swing radius of the equipment. Personnel shall maintain a safe distance from shearing operations and be aware that cut pieces of tank may fly a considerable distance. Cutting shall only be performed in areas clear of overhead hazards. Set up cutting area away from other operations when possible. Ground personnel shall wear ANSI Class 3 reflective vests when working near heavy equipment.	05.A.11
		Overhead hazards shall be re-evaluated prior to allowing dump trucks onto the project site. Areas with overhead hazards shall be barricaded with caution tape to prevent dump bed from contacting. In areas where it is not feasible to use barricades, then spotters shall be provided: however, the minimum distances from electrical lines must be observed (See SHERP).	16.B.11 16.B.08 16.B.02
		Dump trucks shall not be allowed to contact contaminated materials unless proper decontamination will be performed.	
		Dump truck operators shall remain in the truck cab with the windows up while on the project site, unless truck is not equipped with falling object protection support (FOPS).	
		Operators shall wear seat belts while trucks are in motion at the project site. Spotters shall assist trucks when backing is necessary.	

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 15.0 – Well Sampling			Competent Person:	
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

Recommended Protective Clothing & Equipment:
Level D – Modified PPE: hard hats, safety glasses, Tyvek coveralls, protective gloves (nitrile), leather gloves, safety-toed boots, disposable boot covers Equipment: high visibility vests, fire extinguishers, hearing protection

E= Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

		Probability				
		Frequent	Likely	Occasional	Seldom	Unlikely
Severity	Catastrophic					
Severity	Critical					
Severity	Marginal				X	
Severity	Negligible					

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS	EM 385-1-1 (PARA REF)
Obtain water samples.	Failure to properly plan daily activities.	A Job Safety Analysis (JSA), as required by Shaw HS 045 shall be prepared by the crew prior to commencing daily activities. The JSA may be used as a component of the morning Tailgate Safety Meeting. The JSA shall be revised at any time throughout the workday when new tasks are initiated, unforeseen circumstances arise, or if working conditions change.	01.A.09
	Hand injuries.	Items to be handled shall be inspected for sharp edges prior to being handled. Personnel shall wear leather gloves when handling sharp materials. Personnel shall be aware of and avoid pinch point hazards.	05.A.10
	Noise.	Equipment operators and ground personnel working near heavy equipment shall wear hearing protection to reduce exposures to below the OSHA limits.	05.C
	Chemical contamination.	Follow procedures in SHERP addendum.	
	Struck-by equipment.	Ground personnel, working near heavy equipment, shall wear ANSI Class 3 high visibility conspicuity vests. Ground personnel shall not enter the swing radius of excavators.	05.A.11

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 15.0 – Well Sampling			Competent Person:	
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS	EM 385-1-1 (PARA REF)
Obtain water samples (continued).	Fire.	Fire extinguishers shall be available in work areas. Smoking shall only be allowed in designated areas.	09.E.01
	Heavy lifting, strains, and sprains.	No individual employee is permitted to lift any object that weighs over 60 pounds. Proper lifting techniques shall be used. Multiple employees or the use of mechanical lifting devices are required for lifting objects over the 60-pound limit. Do not over-load coolers.	14.A.01
	Heat, cold, severe weather.	Follow procedures outlined in the SHERP.	06.J
	Slips, trips, and falls.	Work areas shall be kept organized during work activities. Housekeeping shall be maintained. Personnel shall not jump from equipment or elevated surfaces. Do not climb on unstable piles or structures.	14.C.01 14.C.02
	Use of acidic preservatives (if required).	Personal protective equipment use, including chemical splash goggles, shall be required. A portable eye wash station shall be readily available in the area where acids are being used. Use acids in areas with adequate ventilation. Properly label all containers.	05.B.01 03.A.04 01.B.06
	Generator use/electrical hazards.	Refer to the generator manufacturer's instructions for safe operation. Never use a generator in enclosed or partially enclosed spaces due to the quick build-up of high levels of carbon monoxide (CO). If you experience symptoms of CO exposure, get medical attention immediately. Keep the generator dry and do not use in rain or wet conditions. Dry your hands (if wet) before touching the generator. Use a heavy duty, outdoor-rated extension cord that is rated (in watts or amps) at least equal to the sum of the connected equipment and power-tool loads (S, ST, SO, STO, SJ, SJO, SJT, SJOT).	16.A 11.C.01 11.C.05 11.A.03.b 11.A.03.d

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 15.0 – Well Sampling			Competent Person:	
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS	EM 385-1-1 (PARA REF)
Obtain water samples (continued).	Generator use (continued).	Check that the entire cord is free of cuts or tears and that the plug has all three prongs, especially a grounding pin. Check operator's manual for generator grounding requirements, if any. Before refueling the generator, turn it off and let it cool down. Gasoline spilled on hot engine parts could ignite. A 20-B:C fire extinguisher shall be readily available in locations where a generator is being used. Use hearing protection when working near a generator. Use proper lifting procedures when moving portable generators.	09.E.01 05.C 14.A.01

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 16.0 – Well Development			Competent Person:	
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

Recommended Protective Clothing & Equipment:
Level D – Modified PPE: hard hats, safety glasses, Tyvek coveralls, protective gloves (nitrile), leather gloves, safety-toed boots, disposable boot covers Equipment: high visibility vests, fire extinguishers, hearing protection

E= Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

		Probability				
		Frequent	Likely	Occasional	Seldom	Unlikely
Severity	Catastrophic					
Severity	Critical					
Severity	Marginal				X	
Severity	Negligible					

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS	EM 385-1-1 (PARA REF)
Develop wells.	Failure to properly plan daily activities.	A Job Safety Analysis (JSA), as required by Shaw HS 045 shall be prepared by the crew prior to commencing daily activities. The JSA may be used as a component of the morning Tailgate Safety Meeting. The JSA shall be revised at any time throughout the workday when new tasks are initiated, unforeseen circumstances arise, or if working conditions change.	01.A.09
	Hand injuries.	Items to be handled shall be inspected for sharp edges prior to being handled. Personnel shall wear leather gloves when handling sharp materials. Personnel shall be aware of and avoid pinch point hazards.	05.A.10
	Noise.	Equipment operators and ground personnel working near heavy equipment shall wear hearing protection to reduce exposures to below the OSHA limits.	05.C
	Chemical contamination.	Follow procedures in SHERP addendum.	
	Struck-by equipment.	Ground personnel, working near heavy equipment, shall wear ANSI Class 3 high visibility conspicuity vests. Ground personnel shall not enter the swing radius of excavators.	05.A.11

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 16.0 – Well Development			Competent Person:	
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS	EM 385-1-1 (PARA REF)
Develop wells (continued).	Fire.	Fire extinguishers shall be available in work areas. Smoking shall only be allowed in designated areas.	09.E.01
	Heavy lifting, strains, and sprains.	No individual employee is permitted to lift any object that weighs over 60 pounds. Proper lifting techniques shall be used. Multiple employees or the use of mechanical lifting devices are required for lifting objects over the 60-pound limit.	14.A.01
	Heat, cold, severe weather.	Follow procedures outlined in the SHERP.	06.J
	Slips, trips, and falls.	Work areas shall be kept organized during work activities. Housekeeping shall be maintained. Personnel shall not jump from equipment or elevated surfaces. Do not climb on unstable piles or structures.	14.C.01 14.C.02
	Generator use/electrical hazards.	Refer to the generator manufacturer's instructions for safe operation. Never use a generator in enclosed or partially enclosed spaces due to the quick build-up of high levels of carbon monoxide (CO). If you experience symptoms of CO exposure, get medical attention immediately. Keep the generator dry and do not use in rain or wet conditions. Dry your hands (if wet) before touching the generator. Use a heavy duty, outdoor-rated extension cord that is rated (in watts or amps) at least equal to the sum of the connected equipment and power-tool loads (S, ST, SO, STO, SJ, SJO, SJT, SJOT). Check that the entire cord is free of cuts or tears and that the plug has all three prongs, especially a grounding pin. Check operator's manual for generator grounding requirements, if any.	05.B.01 03.A.04 01.B.06 16.A 11.C.01 11.C.05 11.A.03.b 11.A.03.d

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 16.0 – Well Development			Competent Person:	
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS	EM 385-1-1 (PARA REF)
Develop wells (continued).	Generator use (continued).	Before refueling the generator, turn it off and let it cool down. Gasoline spilled on hot engine parts could ignite. A 20-B:C fire extinguisher shall be readily available in locations where a generator is being used. Use hearing protection when working near a generator. Use proper lifting procedures when moving portable generators.	09.E.01 05.C 14.A.01

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 17.0 – Fueling Operations			Competent Person:	
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

Recommended Protective Clothing & Equipment:
Level D – Safety glasses and disposable nitrile gloves Equipment: Fire extinguisher (2-A:10-B), saddle tanks, bonding cable, eye wash bottle, five-gallon safety cans (equipped with self-venting cap and flash arrestor)

E= Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

		Probability				
		Frequent	Likely	Occasional	Seldom	Unlikely
Severity	Catastrophic					
Severity	Critical					
Severity	Marginal				X	
Severity	Negligible					

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS	EM 385-1-1 (PARA REF)
Fueling operations.	Exposures to fuels.	Personnel shall periodically review the MSDSs for the fuels that are being used at the project. The handling and use of fuels shall be performed in well-ventilated areas – preferably outside of buildings. Personnel shall avoid skin and eye contact with fuels. Safety glasses and disposable nitrile gloves shall be worn while handling fuels. A small eyewash bottle shall be readily available when fueling equipment. If personnel get fuel in their eyes, then the eyes shall be irrigated with the entire contents of the eye wash bottle and then the employee shall seek medical assistance. If personnel sustain skin contact with fuels, then the affected area shall be immediately washed with soap and water. If fuel contact with clothing is made, then clothing shall be removed and changed immediately.	06.B.01 09.B.07 05.B.01 05.A.10 09.B.05

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 17.0 – Fueling Operations			Competent Person:	
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS	EM 385-1-1 (PARA REF)
Fueling operations (continued).	Fire: extinguisher requirements.	A 2-A: 40-B fire extinguisher shall be readily available when fueling equipment at any location on site. Trucks with flammable/combustible fuels must be equipped with a 20-B:C fire extinguisher. Personnel who intend to extinguish small fires shall be trained in the use of fire extinguishers. Equipment and property are of secondary concern in a fire situation - personnel shall never try to extinguish a fire if there is any doubt that it can be extinguished safely.	09.E.03 09.B.03 09.B.21
	Fire: elimination of ignition sources – hot surfaces.	All vehicles and equipment shall be shut down prior to fueling. Small equipment, such as generators, mowers, pressure washers, etc. shall be allowed to cool prior to re-fueling. Heavy equipment with the fuel cap near the engine or near other hot surfaces shall also be allowed to cool prior to re-fueling.	09.B.02
	Fire: elimination of ignition sources – arcs/sparks/open flames.	Smoking shall not be allowed within 50 feet of fueling operations. Personnel shall visually survey the immediate area for open flames and other ignition sources prior to commencing fueling operations. Personnel are prohibited from using cell-phones or two-way radios during all fueling operations.	
	Fire: elimination of ignition sources – static electricity.	Personnel shall never fill portable fuel cans that are in the bed of a pickup truck or in the trunk of an automobile. Filling fuel containers on plastic pickup truck bed-liners can cause static electric discharges, which may ignite the fuel. The fuel can(s) shall be removed from the truck bed or automobile trunk and placed on the ground before adding fuel.	

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 17.0 – Fueling Operations			Competent Person:	
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS	EM 385-1-1 (PARA REF)
Fueling operations (continued).	Fire: elimination of ignition sources – static electricity (continued).	Electrical continuity shall be maintained between the portable fuel can and the tank being filled. A bonding cable shall be used to maintain continuity between the metal fuel container and the equipment fuel tank. Allowing free-fall of fuel into the tank is prohibited. Personnel shall not re-enter vehicles while fueling is underway due to the static electric charge generated between clothing and vehicle seats. If you absolutely HAVE to get in your vehicle while the gas is pumping, make sure you get out, close the door TOUCHING THE METAL, before you pull the nozzle out. This way the static from your body will be discharged before you remove the nozzle.	09.B.20
	Storage and transportation: five-gallon cans in pick-up trucks.	Gasoline shall be stored and transported in properly marked/labeled five-gallon safety cans (equipped with self-venting cap and flash arrestor). Gasoline cans shall be secured to prevent movement during transportation. No more than six - five gallon containers of gasoline may be transported in vehicles (back of pick-up trucks or trailers) at the same time unless all the DOT Hazardous Material Regulations are complied with, such as proper packaging, completing shipping papers, placarding (as required), and the appropriate HM 126 Training (as well as having been provided emergency response information and training.) The total quantity of hazardous materials may never exceed 440 pounds total. Hazardous materials must be secured prior to transporting.	09.B.10 09.B.11

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 17.0 – Fueling Operations			Competent Person:	
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS	EM 385-1-1 (PARA REF)
Fueling operations (continued).	Communication of hazards.	Drivers must be notified that they are transporting hazardous materials. Drivers shall review MSDS for the fuels transported in their vehicle.	01.B.06
	Storage of fuels on-site.	Portable safety gasoline cans must be stored within a flammable materials storage area, have appropriate warning signs, be posted as “No Smoking’, and have a fire extinguisher available in the area.	09.B.02
	Spills.	All spills shall be immediately cleaned-up. Spill control equipment shall be readily available. All spills shall be reported to the SSHO.	09.B.18
	Storage and transportation: safety containers and saddle tanks in pick-up trucks.	Gasoline shall not be transported in portable saddle tanks – only diesel fuel shall be transported in saddle tanks. All portable saddle tanks mounted in pick-up trucks shall be manufactured to meet DOT specifications. Portable saddle tanks shall be securely mounted to the pick-up truck, as recommended by the manufacturer. Saddle tanks shall be properly marked (see 49 CFR 172.101) with the proper shipping name and labeled for “No Smoking.” No more than 110 gallons of diesel fuel may be transported in a saddle tank unless all the DOT Hazardous Material Regulations are complied with, such as proper packaging, completing shipping papers, placarding, and the appropriate HM 126 Training (as well as having been provided emergency response information and training.) Caps on saddle tanks shall be securely closed. Saddle tanks shall be inspected weekly to check for leaks.	09.B.08

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 17.0 – Fueling Operations			Competent Person:	
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS	EM 385-1-1 (PARA REF)
Fueling operations (continued).	Bulk storage of diesel fuel on-site.	Bulk storage tanks shall not be permitted on-site without express permission from the Shaw Project CIH.	

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 18.0 – Site Restoration			Competent Person:	
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

Recommended Protective Clothing & Equipment:
Level C, D, and D – Modified; puncture-proof footwear, Class 3 Reflective vests Equipment: Decontamination station, water supply, fire extinguishers, excavator, hearing protection

E= Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

		Probability				
		Frequent	Likely	Occasional	Seldom	Unlikely
Severity	Catastrophic					
Severity	Critical				X	
Severity	Marginal					
Severity	Negligible					

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS	EM 385-1-1 (PARA REF)
Site restoration.	Failure to properly plan daily activities.	A Job Safety Analysis (JSA), as required by Shaw HS 045 shall be prepared by the crew prior to commencing daily activities. The JSA may be used as a component of the morning Tailgate Safety Meeting. The JSA shall be revised at any time throughout the workday when new tasks are initiated, unforeseen circumstances arise, or if working conditions change.	01.A.09
	Hand injuries.	Items to be handled shall be inspected for sharp edges prior to being handled. Personnel shall wear leather gloves when handling sharp materials. Personnel shall be aware of and avoid pinch point hazards.	05.A.10
	Overhead hazards/utilities.	Overhead hazards shall be evaluated prior to moving equipment into the area. Areas with overhead hazards shall be barricaded with caution tape to prevent contact In areas where it is not feasible to use barricades, then spotters shall be provided: however, the minimum distances from electrical lines must be observed (See SHERP).	11.E.04

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 18.0 – Site Restoration			Competent Person:	
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS	EM 385-1-1 (PARA REF)
Site restoration (continued).	Noise.	Equipment operators and ground personnel working near heavy equipment shall wear hearing protection to reduce exposures to below the OSHA limits.	05.C
	Use of heavy equipment.	Only qualified personnel shall be permitted to operate equipment. Heavy equipment shall be inspected daily after the initial USACE inspection (and documented.) Do not use unsafe equipment. All equipment shall have backing alarms. All equipment shall be operated at safe speeds and in a safe manner. Equipment operators shall wear safety belts. Personnel are only permitted to approach equipment after a signal from the operator.	16.A.04 16.A.01 16.A.02 16.A.03 16.A.04 16.A.07
		Ground personnel, working near heavy equipment, shall wear ANSI Class 3 high visibility conspicuity vests. Ground personnel shall not enter the swing radius of the backhoe.	05.A.11
		Ground personnel shall not position themselves between equipment and stationary objects. Personnel shall verify all mechanical guards are in place and functioning properly. Moving equipment shall be equipped with a back-up alarm. All equipment shall be shut down with energies dissipated prior to performing maintenance activities - lock out/tag out procedures may apply. Only qualified mechanics shall work on or repair heavy equipment.	16.A.04 16.A.04 16.B.03 16.B.01 16.A.09 16.A.08 16.A.03

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 18.0 – Site Restoration			Competent Person:	
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS	EM 385-1-1 (PARA REF)
Site restoration (continued).	Fire.	Engines shall be shut off before refueling. A 10-B:C fire extinguisher shall be available when refueling. Smoking shall not be permitted near fueling areas. Gasoline shall be stored in safety cans with flash arrestors and spring-loaded vents.	16.A.14 09.E.01 09.A.06 09.B.08
		Fire extinguishers shall be placed in work areas. Smoking shall only be allowed in designated areas. Hot work permitting procedures shall be followed.	09.E.01 09.A.06 09.A.03
	Heavy lifting, strains, and sprains.	No individual employee is permitted to lift any object that weighs over 60 pounds. Proper lifting techniques shall be used. Multiple employees or the use of mechanical lifting devices are required for lifting objects over the 60-pound limit.	14.A.01
	Heat, cold, severe weather.	Follow procedures outlined in the SHERP.	06.J
	Slips, trips, and falls.	Travel paths for materials removal shall be evaluated and cleared. Work areas shall be kept organized during work activities. Housekeeping shall be maintained. Personnel shall not jump from equipment or elevated surfaces.	14.C.01 14.C.02
	Struck-by.	Personnel shall not be permitted in the swing radius of the equipment. Personnel shall maintain a safe distance from operations. Ground personnel shall wear ANSI Class 3 reflective vests when working near heavy equipment.	23.F.01 05.A.11

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 18.0 – Site Restoration			Competent Person:	
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS	EM 385-1-1 (PARA REF)
Site restoration (continued).	Dump truck operations.	Overhead hazards shall be re-evaluated prior to allowing dump trucks onto the project site. Areas with overhead hazards shall be barricaded with caution tape to prevent dump bed from contacting. In areas where it is not feasible to use barricades, then spotters shall be provided: however, the minimum distances from electrical lines must be observed (See SHERP). Operators shall wear seat belts while trucks are in motion at the project site. Spotters shall assist trucks when backing is necessary.	16.B.11 16.B.08 16.B.02
	Use of fertilizers.	The MSDS for fertilizers shall be read and understood. Personnel shall avoid contact with fertilizer.	01.B.06
	Electrocution.	Only qualified electricians shall perform electrical disconnection activities.	11.A
Rigging Competent Person:	Use of hydraulic equipment with rigging.	Follow EM 385-1-1 requirements if using hydraulic excavators, wheel loaders, track loaders and backhoe / loaders transport or hoist loads with rigging.	16.N
	Use of rigging.	Rigging shall be inspected before each use. Deficiencies shall be noted on the inspection form. Rigging found to be unsafe shall not be used, tagged, and taken out of service.	15

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 19.0 – Equipment Decontamination			Competent Person:	
Date Prepared (mm-dd-yyyy):	04-26-2007			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804		
Prepared By:	James Joice, CIH	Reviewed By:			

Recommended Protective Clothing & Equipment:
Level D - Modified: hard hats, Tyvek coveralls, protective gloves, vinyl rain-gear, steel-toed boots, protective over-boots Equipment: temporary lighting, GFCIs, extension cords, pressure washer, fire extinguishers, carbon monoxide monitor, chemical splash goggles, emergency eyewash station, spill control equipment

E= Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

		Probability				
		Frequent	Likely	Occasional	Seldom	Unlikely
Severity	Catastrophic					
Severity	Critical					
Severity	Marginal				X	
Severity	Negligible					

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE HAZARDS	EM 385-1-1 (PARA REF)
Clean Equipment.	Failure to properly plan daily activities.	A Job Safety Analysis (JSA), as required by Shaw HS 045 shall be prepared by the crew prior to commencing daily activities. The JSA may be used as a component of the morning Tailgate Safety Meeting. The JSA shall be revised at any time throughout the workday when new tasks are initiated, unforeseen circumstances arise, or if working conditions change.	01.A.09
	Exposure to contaminants.	Maintain work zones and decontamination areas. Level D - Modified PPE shall be worn as required in the HASP. Personnel shall perform proper decontamination procedures each time when exiting the Exclusion Zone.	28.I.02 05.A.01
	Poor lighting.	Additional lighting shall be put in place as necessary. Temporary lighting shall be protected with GFCIs.	07.A.01 11.C.05
	Slips, trips, falls.	Work areas shall be kept organized during work activities. Housekeeping shall be maintained. Personnel shall use caution when walking/working on wet surfaces.	14.C.01 14.C.02

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 13.0 – Equipment Decontamination			Competent Person:	
Date Prepared (mm-dd-yyyy):	09-06-2006			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804 / 122788		
Prepared By:	James Joice, CIH	Reviewed By:			

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE HAZARDS	EM 385-1-1 (PARA REF)
Clean Equipment (continued).	Electrical.	GFCIs shall be used on all power tools and extension cords. Extension cords, power tools, and lighting equipment shall be inspected before each use, protected from damage, and kept out of wet areas.	11.C.05 11.A.03.b 11.A.03.d
	Heavy lifting.	No individual employee is permitted to lift any object that weighs over 60 pounds. Proper lifting techniques shall be used. Multiple employees or the use of mechanical lifting devices are required for lifting objects over the 60-pound limit.	14.A.01
	Noise.	Personnel shall wear hearing protection when operating pressure washer.	05.C
	Fire.	Fire extinguishers shall be placed in work areas. Smoking shall only be allowed outside of the facility in designated areas.	09.E.01 09.A.06
	Heat Stress.	Personnel shall drink plenty of cool water. Personnel shall pace themselves while performing strenuous work and take adequate breaks in a cool area.	06.J.03 02.A.04 02.A.06
	Use of pressure or steam washer.	The pressure/steam washer shall be inspected before each use. The manufacturer's instruction manual shall be used to guide the inspection process. Personnel shall be trained in the use of the washing equipment. All personnel working in the equipment decontamination area shall be trained in the emergency shut-off procedures for the equipment being used.	16.A.01

Activity Hazard Analysis (AHA)

Definable Feature of Work	AHA 13.0 – Equipment Decontamination			Competent Person:	
Date Prepared (mm-dd-yyyy):	09-06-2006			Risk Assessment Code (RAC):	M
Project:	RVAAP Load Lines 1-4	Job:	100804 / 122788		
Prepared By:	James Joice, CIH	Reviewed By:			

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE HAZARDS	EM 385-1-1 (PARA REF)
Clean Equipment (continued).	Use of pressure or steam washer (continued).	The minimum amount of steam/pressure that will complete the job should be used. Pressure washers exceeding 3000 psi shall not be used without the approval of the CIH. The spray from such equipment shall only be directed at surfaces to be cleaned and never at body parts or other personnel. Personnel in the immediate area shall use face shields and metatarsal/shin guards. Personnel shall keep firm grip on wand and not point it at anything that is not being washed. Pressure washer operators must maintain good footing. The trigger on the wand shall never be wired/fixed open. Operators are to take adequate breaks to avoid fatigue.	16.A.01
		Hot surfaces shall be avoided. Units shall be shut off and allowed to cool prior to re-fueling (if gas-powered).	09.B.21.b
		Carbon monoxide shall be monitored if gas-powered pressure washers are used. Carbon monoxide concentrations shall not be allowed to exceed 25 ppm within any indoor areas.	13.A.12
	Spills of decontamination water.	All waste handling activity shall be performed on visqueen (polyethylene sheeting) lined work surfaces. Waste liquids shall be stored with secondary containment. Lids and bungs shall be secured when drums are in storage or are being moved. Spill cleanup equipment shall be readily available when handling wastes. Drums containing waste shall be inspected on a daily basis. Spills shall be immediately reported to the SSHO.	28.H.03 28.H.04

Attachment 2
Dust Exposure Calculations

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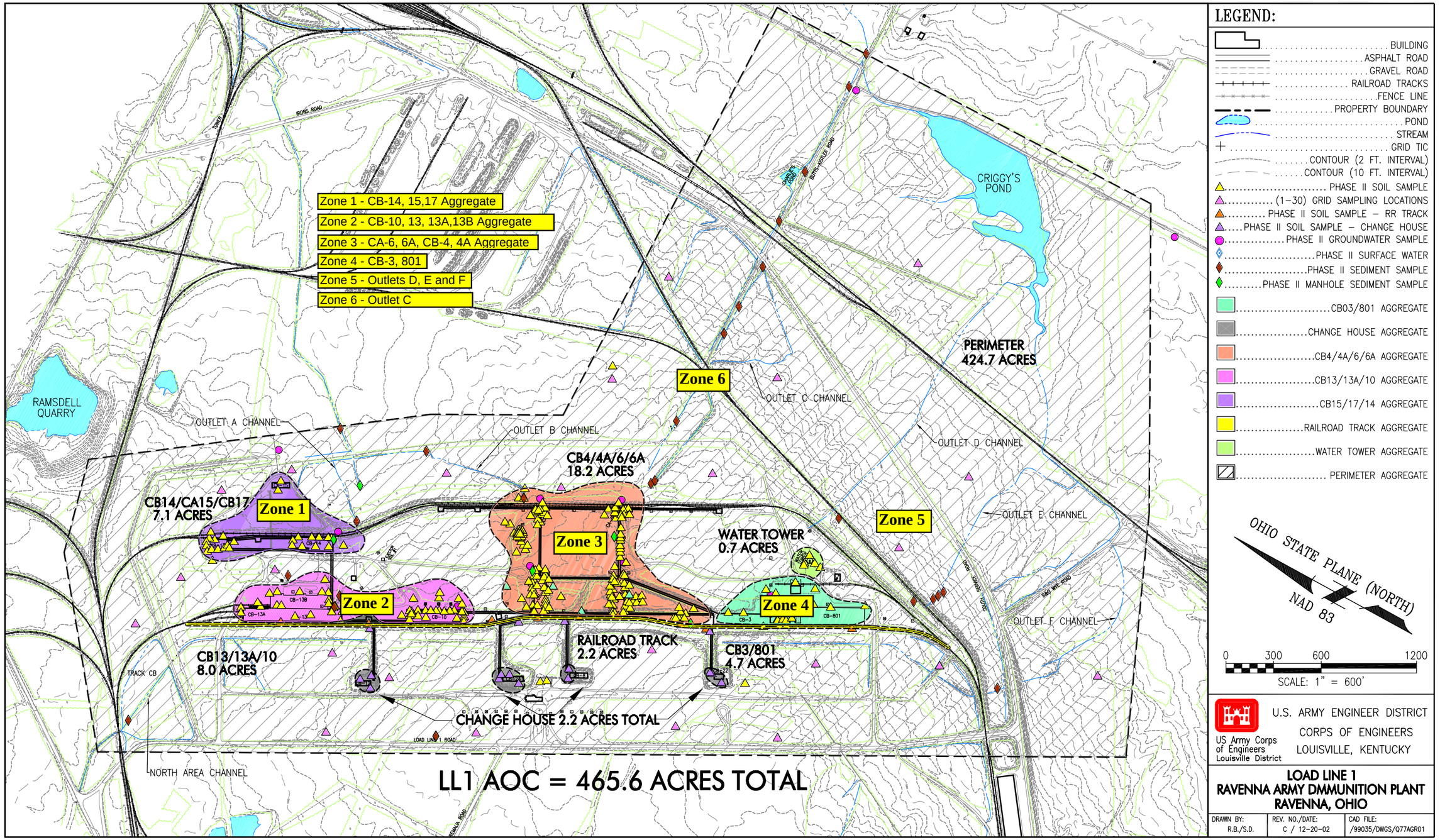


Figure 4-1. Soil Aggregates for Load Line 1 Phase II R1

Load Line 1
Zone 1 (Bldgs CB-14, 15, 17)

DUST EXPOSURE CALCULATION WORKSHEET				
Dust Level		Safety Factor for this site = 2		
Chemical	Exposure Limit (mg/m3)	Maximum Soil Concentration (mg/kg)	Exposure Limit Based on Single Compound (EL Mix, mg/m3)	Dust Quotient for Each Compound (level/limit)
Aluminum	5	97,300	25.69	1.95E+04
Antimony	0.5	0.64	3.91E+5	1.28E+00
Arsenic	0.01	112	44.64	1.12E+04
Barium	0.5	572	437.06	1.14E+03
Beryllium	0.002	3.3	303.03	1.65E+03
Cadmium	0.005	12	215.52	2.32E+03
Chlordane	0.5	0.13	1.92E+6	2.60E-01
Chromium	0.5	128	1,953.13	2.56E+02
Chrome (hex)	0.01	1.E-9	5.E+12	1.00E-07
Cobalt	0.02	72	138.31	3.62E+03
Copper	1	199	2,512.56	1.99E+02
Cyanides	5	2.4	1.04E+6	4.80E-01
Dioxins (tetra)	2.00E-07	1.E-9	1.E+8	5.00E-03
Dioxins (hex)	0.001	1.E-9	5.E+11	1.00E-06
Endosulfan	0.1	1.E-9	5.E+13	1.00E-08
Fluorides	2.5	1.E-9	1.25E+15	4.00E-10
Lead	0.05	602	41.53	1.20E+04
Manganese	0.2	4,700	21.28	2.35E+04
Mercury	0.025	0.37	3.38E+4	1.48E+01
Nickel	1	160	3,125.	1.60E+02
Oil Mist	5	1.E-9	2.5E+15	2.00E-10
PCBs	0.5	4.7	5.32E+4	9.40E+00
PNAs	0.2	9.6	1.04E+4	4.80E+01
Phthalates	5	1.E-9	2.5E+15	2.00E-10
RDX	0.5	34	7,352.94	6.80E+01
Selenium	0.2	1.1	9.09E+4	5.50E+00
Silica	0.05	1.E-9	2.5E+13	2.00E-08
Silver	0.01	0.21	2.38E+4	2.10E+01
Thallium	0.1	4.6	1.09E+4	4.60E+01
Tin	2	1.E-9	1.E+15	5.00E-10
Titanium	10	1.E-9	5.E+15	1.00E-10
Trinitrotoluene	0.1	4.5	1.11E+4	4.50E+01
Vanadium	0.05	179	139.66	3.58E+03
Zinc	5	881	2,837.68	1.76E+02
			Sum	7.96E+04
Dust Exposure Level at Mixture PEL =			6.285	

Load Line 1
Zone 2 (Bldgs CB-10, 13, 13A, 13B)

DUST EXPOSURE CALCULATION WORKSHEET				
DustLevel		Safety Factor for this site = 2		
Chemical	Exposure Limit (mg/m3)	Maximum Soil Concentration (mg/kg)	Exposure Limit Based on Single Compound (EL Mix, mg/m3)	Dust Quotient for Each Compound (level/limit)
Aluminum	5	25,800	96.9	5.16E+03
Antimony	0.5	98	2,551.02	1.96E+02
Arsenic	0.01	18	273.22	1.83E+03
Barium	0.5	410	609.76	8.20E+02
Beryllium	0.002	3.4	294.12	1.70E+03
Cadmium	0.005	48	51.87	9.64E+03
Chlordane	0.5	0.035	7.14E+6	7.00E-02
Chromium	0.5	312	801.28	6.24E+02
Chrome (hex)	0.01	25	200.	2.50E+03
Cobalt	0.02	32	312.5	1.60E+03
Copper	1	2,390	209.21	2.39E+03
Cyanides	5	1.	2.5E+6	2.00E-01
Dioxins (tetra)	2.00E-07	1.E-9	1.E+8	5.00E-03
Dioxins (hex)	0.001	1.E-9	5.E+11	1.00E-06
Endosulfan	0.1	1.E-9	5.E+13	1.00E-08
Fluorides	2.5	1.E-9	1.25E+15	4.00E-10
Lead	0.05	8,510	2.94	1.70E+05
Manganese	0.2	3,650	27.4	1.83E+04
Mercury	0.025	0.41	3.05E+4	1.64E+01
Nickel	1	62	8,012.82	6.24E+01
Oil Mist	5	1.E-9	2.5E+15	2.00E-10
PCBs	0.5	40	6,250.	8.00E+01
PNAs	0.2	5.6	1.79E+4	2.80E+01
Phthalates	5	1.E-9	2.5E+15	2.00E-10
RDX	0.5	27	9,259.26	5.40E+01
Selenium	0.2	3.6	2.78E+4	1.80E+01
Silica	0.05	1.E-9	2.5E+13	2.00E-08
Silver	0.01	0.52	9,615.38	5.20E+01
Thallium	0.1	0.78	6.41E+4	7.80E+00
Tin	2	1.E-9	1.E+15	5.00E-10
Titanium	10	1.E-9	5.E+15	1.00E-10
Trinitrotoluene	0.1	230	217.39	2.30E+03
Vanadium	0.05	31	806.45	6.20E+02
Zinc	5	4,160	600.96	8.32E+02
			Sum	2.19E+05
		Dust Exposure Level at Mixture PEL =	2.283	

Load Line 1
Zone 3 (Bldgs CB-4, 4A, 6, 6A)

DUST EXPOSURE CALCULATION WORKSHEET				
DustLevel		Safety Factor for this site = 2		
Chemical	Exposure Limit (mg/m3)	Maximum Soil Concentration (mg/kg)	Exposure Limit Based on Single Compound (EL Mix, mg/m3)	Dust Quotient for Each Compound (level/limit)
Aluminum	5	47,600	52.52	9.52E+03
Antimony	0.5	3.	8.33E+4	6.00E+00
Arsenic	0.01	56	89.93	5.56E+03
Barium	0.5	1,970	126.9	3.94E+03
Beryllium	0.002	2.6	384.62	1.30E+03
Cadmium	0.005	27	91.58	5.46E+03
Chlordane	0.5	5.3	4.72E+4	1.06E+01
Chromium	0.5	400	625.	8.00E+02
Chrome (hex)	0.01	14	367.65	1.36E+03
Cobalt	0.02	49	202.84	2.47E+03
Copper	1	3,680	135.87	3.68E+03
Cyanides	5	3.8	6.58E+5	7.60E-01
Dioxins (tetra)	2.00E-07	1.E-9	1.E+8	5.00E-03
Dioxins (hex)	0.001	1.E-9	5.E+11	1.00E-06
Endosulfan	0.1	1.E-9	5.E+13	1.00E-08
Fluorides	2.5	1.E-9	1.25E+15	4.00E-10
Lead	0.05	7,130	3.51	1.43E+05
Manganese	0.2	3,500	28.57	1.75E+04
Mercury	0.025	9.7	1,288.66	3.88E+02
Nickel	1	101	4,950.5	1.01E+02
Oil Mist	5	1.E-9	2.5E+15	2.00E-10
PCBs	0.5	1,100	227.27	2.20E+03
PNAs	0.2	16	6,097.56	8.20E+01
Phthalates	5	1.E-9	2.5E+15	2.00E-10
RDX	0.5	2,300	108.7	4.60E+03
Selenium	0.2	5.3	1.89E+4	2.65E+01
Silica	0.05	1.E-9	2.5E+13	2.00E-08
Silver	0.01	0.88	5,681.82	8.80E+01
Thallium	0.1	4.6	1.09E+4	4.60E+01
Tin	2	1.E-9	1.E+15	5.00E-10
Titanium	10	2.5	2.E+6	2.50E-01
Trinitrotoluene	0.1	10,000	5.	1.00E+05
Vanadium	0.05	78	320.92	1.56E+03
Zinc	5	1,690	1,479.29	3.38E+02
			Sum	3.04E+05
Dust Exposure Level at Mixture PEL =			1.647	

Load Line 1
Zone 4 (Bldgs CB-3, 801)

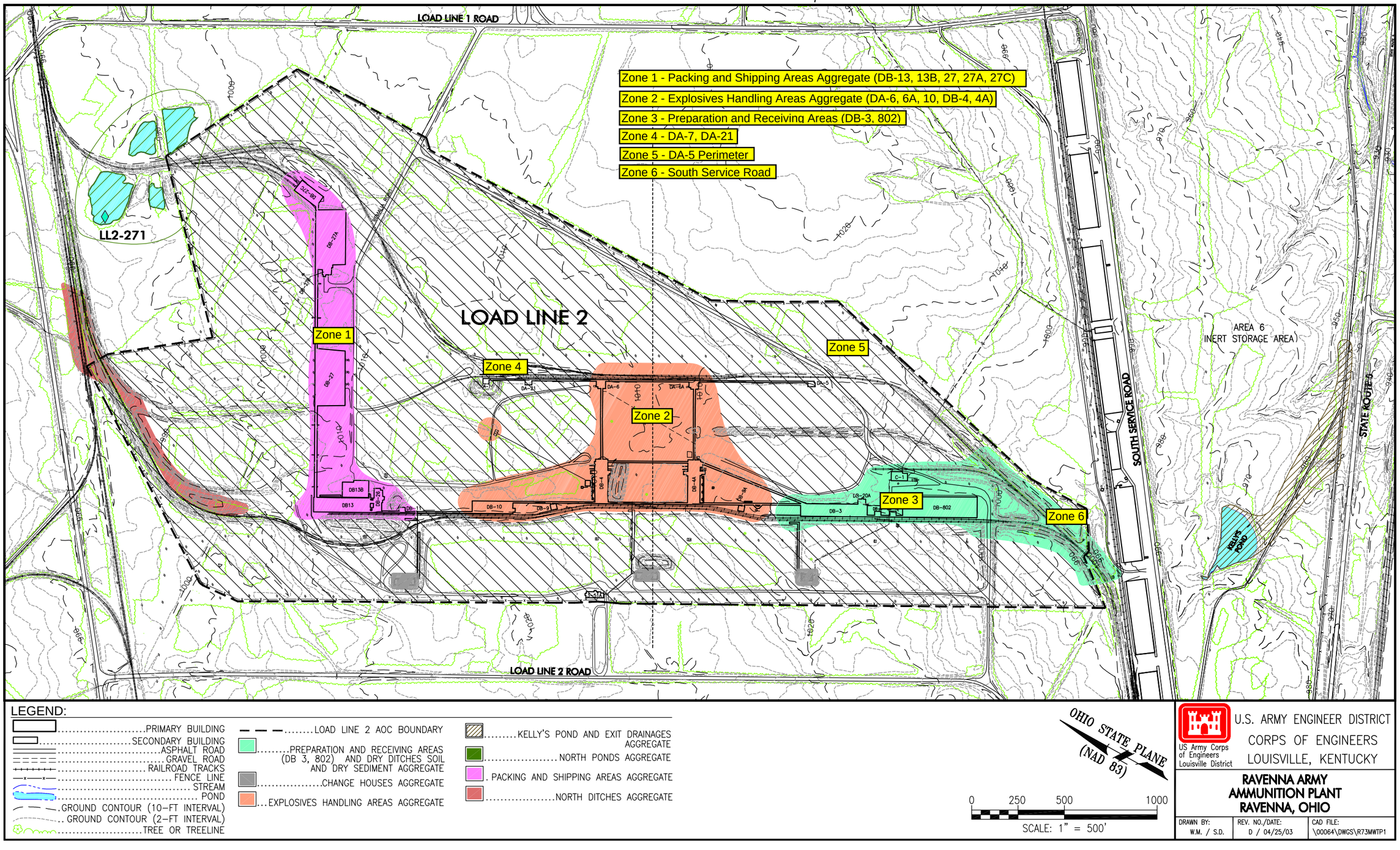
DUST EXPOSURE CALCULATION WORKSHEET				
DustLevel			Safety Factor for this site = 2	
Chemical	Exposure Limit (mg/m3)	Maximum Soil Concentration (mg/kg)	Exposure Limit Based on Single Compound (EL Mix, mg/m3)	Dust Quotient for Each Compound (level/limit)
Aluminum	5	23,200	107.76	4.64E+03
Antimony	0.5	648	385.8	1.30E+03
Arsenic	0.01	19	263.16	1.90E+03
Barium	0.5	347	720.46	6.94E+02
Beryllium	0.002	2.5	400.	1.25E+03
Cadmium	0.005	27	92.59	5.40E+03
Chlordane	0.5	0.052	4.81E+6	1.04E-01
Chromium	0.5	174	1,436.78	3.48E+02
Chrome (hex)	0.01	1.4	3,571.43	1.40E+02
Cobalt	0.02	11	917.43	5.45E+02
Copper	1	191	2,617.8	1.91E+02
Cyanides	5	1.	2.5E+6	2.00E-01
Dioxins (tetra)	2.00E-07	1.E-9	1.E+8	5.00E-03
Dioxins (hex)	0.001	1.E-9	5.E+11	1.00E-06
Endosulfan	0.1	1.E-9	5.E+13	1.00E-08
Fluorides	2.5	1.E-9	1.25E+15	4.00E-10
Lead	0.05	1,620	15.43	3.24E+04
Manganese	0.2	4,070	24.57	2.04E+04
Mercury	0.025	0.42	2.98E+4	1.68E+01
Nickel	1	61	8,264.46	6.05E+01
Oil Mist	5	1.E-9	2.5E+15	2.00E-10
PCBs	0.5	4.3	5.81E+4	8.60E+00
PNAs	0.2	208	480.77	1.04E+03
Phthalates	5	1.E-9	2.5E+15	2.00E-10
RDX	0.5	0.29	8.62E+5	5.80E-01
Selenium	0.2	1.8	5.56E+4	9.00E+00
Silica	0.05	1.E-9	2.5E+13	2.00E-08
Silver	0.01	0.46	1.09E+4	4.60E+01
Thallium	0.1	0.8	6.25E+4	8.00E+00
Tin	2	1.E-9	1.E+15	5.00E-10
Titanium	10	1.E-9	5.E+15	1.00E-10
Trinitrotoluene	0.1	1.2	4.17E+4	1.20E+01
Vanadium	0.05	27	912.41	5.48E+02
Zinc	5	674	3,709.2	1.35E+02
			Sum	7.10E+04
Dust Exposure Level at Mixture PEL =			7.038	

Load Line 1
Zone 5 (Outlets D, E, F)

DUST EXPOSURE CALCULATION WORKSHEET				
DustLevel		Safety Factor for this site = 2		
Chemical	Exposure Limit (mg/m3)	Maximum Soil Concentration (mg/kg)	Exposure Limit Based on Single Compound (EL Mix, mg/m3)	Dust Quotient for Each Compound (level/limit)
Aluminum	5	13,300	187.97	2.66E+03
Antimony	0.5	2,460	101.63	4.92E+03
Arsenic	0.01	21	238.1	2.10E+03
Barium	0.5	168	1,488.1	3.36E+02
Beryllium	0.002	1.1	909.09	5.50E+02
Cadmium	0.005	2.4	1,041.67	4.80E+02
Chlordane	0.5	1.E-9	2.5E+14	2.00E-09
Chromium	0.5	124	2,016.13	2.48E+02
Chrome (hex)	0.01	11	454.55	1.10E+03
Cobalt	0.02	17	588.24	8.50E+02
Copper	1	1,020	490.2	1.02E+03
Cyanides	5	1.E-9	2.5E+15	2.00E-10
Dioxins (tetra)	2.00E-07	1.E-9	1.E+8	5.00E-03
Dioxins (hex)	0.001	1.E-9	5.E+11	1.00E-06
Endosulfan	0.1	1.E-9	5.E+13	1.00E-08
Fluorides	2.5	1.E-9	1.25E+15	4.00E-10
Lead	0.05	2,510	9.96	5.02E+04
Manganese	0.2	3,380	29.59	1.69E+04
Mercury	0.025	0.4	3.13E+4	1.60E+01
Nickel	1	43	1.15E+4	4.34E+01
Oil Mist	5	1.E-9	2.5E+15	2.00E-10
PCBs	0.5	1.E-9	2.5E+14	2.00E-09
PNAs	0.2	200	500.	1.00E+03
Phthalates	5	1.E-9	2.5E+15	2.00E-10
RDX	0.5	1.E-9	2.5E+14	2.00E-09
Selenium	0.2	2.2	4.55E+4	1.10E+01
Silica	0.05	1.E-9	2.5E+13	2.00E-08
Silver	0.01	0.88	5,681.82	8.80E+01
Thallium	0.1	0.7	7.14E+4	7.00E+00
Tin	2	1.E-9	1.E+15	5.00E-10
Titanium	10	1.E-9	5.E+15	1.00E-10
Trinitrotoluene	0.1	1.E-9	5.E+13	1.00E-08
Vanadium	0.05	32	786.16	6.36E+02
Zinc	5	805	3,105.59	1.61E+02
			Sum	8.33E+04
Dust Exposure Level at Mixture PEL =			6.000	

Load Line 1
Zone 6 (Outlet C)

DUST EXPOSURE CALCULATION WORKSHEET				
DustLevel		Safety Factor for this site = 2		
Chemical	Exposure Limit (mg/m3)	Maximum Soil Concentration (mg/kg)	Exposure Limit Based on Single Compound (EL Mix, mg/m3)	Dust Quotient for Each Compound (level/limit)
Aluminum	5	13,600	183.82	2.72E+03
Antimony	0.5	1.2	2.08E+5	2.40E+00
Arsenic	0.01	51	99.01	5.05E+03
Barium	0.5	151	1,655.63	3.02E+02
Beryllium	0.002	0.9	1,111.11	4.50E+02
Cadmium	0.005	1.4	1,785.71	2.80E+02
Chlordane	0.5	1.E-9	2.5E+14	2.00E-09
Chromium	0.5	21	1.17E+4	4.26E+01
Chrome (hex)	0.01	1.E-9	5.E+12	1.00E-07
Cobalt	0.02	11	909.09	5.50E+02
Copper	1	20	2.46E+4	2.03E+01
Cyanides	5	1.E-9	2.5E+15	2.00E-10
Dioxins (tetra)	2.00E-07	1.E-9	1.E+8	5.00E-03
Dioxins (hex)	0.001	1.E-9	5.E+11	1.00E-06
Endosulfan	0.1	1.E-9	5.E+13	1.00E-08
Fluorides	2.5	1.E-9	1.25E+15	4.00E-10
Lead	0.05	56	448.83	1.11E+03
Manganese	0.2	2,350	42.55	1.18E+04
Mercury	0.025	0.1	1.25E+5	4.00E+00
Nickel	1	28	1.76E+4	2.84E+01
Oil Mist	5	1.E-9	2.5E+15	2.00E-10
PCBs	0.5	0.87	2.87E+5	1.74E+00
PNAs	0.2	1.	1.E+5	5.00E+00
Phthalates	5	1.E-9	2.5E+15	2.00E-10
RDX	0.5	1.E-9	2.5E+14	2.00E-09
Selenium	0.2	3.6	2.78E+4	1.80E+01
Silica	0.05	1.E-9	2.5E+13	2.00E-08
Silver	0.01	1.E-9	5.E+12	1.00E-07
Thallium	0.1	0.9	5.56E+4	9.00E+00
Tin	2	1.E-9	1.E+15	5.00E-10
Titanium	10	1.E-9	5.E+15	1.00E-10
Trinitrotoluene	0.1	0.54	9.26E+4	5.40E+00
Vanadium	0.05	26	961.54	5.20E+02
Zinc	5	215	1.16E+4	4.30E+01
			Sum	2.29E+04
Dust Exposure Level at Mixture PEL =			21.819	



LEGEND:

- PRIMARY BUILDING
- SECONDARY BUILDING
- ASPHALT ROAD
- GRAVEL ROAD
- RAILROAD TRACKS
- FENCE LINE
- STREAM
- POND
- GROUND CONTOUR (10-FT INTERVAL)
- GROUND CONTOUR (2-FT INTERVAL)
- TREE OR TREELINE
- LOAD LINE 2 AOC BOUNDARY
- PREPARATION AND RECEIVING AREAS (DB 3, 802) AND DRY DITCHES SOIL AND DRY SEDIMENT AGGREGATE
- CHANGE HOUSES AGGREGATE
- EXPLOSIVES HANDLING AREAS AGGREGATE
- KELLY'S POND AND EXIT DRAINAGES AGGREGATE
- NORTH PONDS AGGREGATE
- PACKING AND SHIPPING AREAS AGGREGATE
- NORTH DITCHES AGGREGATE

OHIO STATE PLANE (NAD 83)

0 250 500 1000

SCALE: 1" = 500'

US Army Corps of Engineers Louisville District

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
LOUISVILLE, KENTUCKY

RAVENNA ARMY AMMUNITION PLANT
RAVENNA, OHIO

DRAWN BY:	REV. NO./DATE:	CAD FILE:
W.M. / S.D.	D / 04/25/03	\00064\DWGS\R73MWTP1

Figure 4-1. Soil, Sediment, and Surface Water Aggregates for Load Line 2

Load Line 2
Zone 1 (Bldgs DB-13, 13B, 27, 27A, 27C)

DUST EXPOSURE CALCULATION WORKSHEET				
DustLevel		Safety Factor for this site = 2		
Chemical	Exposure Limit (mg/m3)	Maximum Soil Concentration (mg/kg)	Exposure Limit Based on Single Compound (EL Mix, mg/m3)	Dust Quotient for Each Compound (level/limit)
Aluminum	5	26,000	96.15	5.20E+03
Antimony	0.5	60	4,166.67	1.20E+02
Arsenic	0.01	74	67.57	7.40E+03
Barium	0.5	900	277.78	1.80E+03
Beryllium	0.002	4.2	238.1	2.10E+03
Cadmium	0.005	17	147.06	3.40E+03
Chlordane	0.5	1.E-9	2.5E+14	2.00E-09
Chromium	0.5	220	1,136.36	4.40E+02
Chrome (hex)	0.01	1.E-9	5.E+12	1.00E-07
Cobalt	0.02	15	666.67	7.50E+02
Copper	1	140	3,571.43	1.40E+02
Cyanides	5	1.E-9	2.5E+15	2.00E-10
Dioxins (tetra)	2.00E-07	1.E-9	1.E+8	5.00E-03
Dioxins (hex)	0.001	1.E-9	5.E+11	1.00E-06
Endosulfan	0.1	1.E-9	5.E+13	1.00E-08
Fluorides	2.5	1.E-9	1.25E+15	4.00E-10
Lead	0.05	1,200	20.83	2.40E+04
Manganese	0.2	7,500	13.33	3.75E+04
Mercury	0.025	0.18	6.94E+4	7.20E+00
Nickel	1	52	9,615.38	5.20E+01
Oil Mist	5	1.E-9	2.5E+15	2.00E-10
PCBs	0.5	9.5	2.63E+4	1.90E+01
PNAs	0.2	20	5,000.	1.00E+02
Phthalates	5	1.E-9	2.5E+15	2.00E-10
RDX	0.5	0.28	8.93E+5	5.60E-01
Selenium	0.2	1.2	8.33E+4	6.00E+00
Silica	0.05	1.E-9	2.5E+13	2.00E-08
Silver	0.01	18	277.78	1.80E+03
Thallium	0.1	0.99	5.05E+4	9.90E+00
Tin	2	1.E-9	1.E+15	5.00E-10
Titanium	10	1.E-9	5.E+15	1.00E-10
Trinitrotoluene	0.1	2.6	1.92E+4	2.60E+01
Vanadium	0.05	25	1,000.	5.00E+02
Zinc	5	700	3,571.43	1.40E+02
			Sum	8.55E+04
Dust Exposure Level at Mixture PEL =			5.847	

Load Line 2
Zone 2 (Bldgs DB-4, 4A, 6, 6A)

DUST EXPOSURE CALCULATION WORKSHEET				
DustLevel		Safety Factor for this site = 2		
Chemical	Exposure Limit (mg/m3)	Maximum Soil Concentration (mg/kg)	Exposure Limit Based on Single Compound (EL Mix, mg/m3)	Dust Quotient for Each Compound (level/limit)
Aluminum	5	35,200	71.02	7.04E+03
Antimony	0.5	180	1,388.89	3.60E+02
Arsenic	0.01	32	156.25	3.20E+03
Barium	0.5	300	833.33	6.00E+02
Beryllium	0.002	3.1	322.58	1.55E+03
Cadmium	0.005	23	108.7	4.60E+03
Chlordane	0.5	0.57	4.39E+5	1.14E+00
Chromium	0.5	140	1,785.71	2.80E+02
Chrome (hex)	0.01	1.E-9	5.E+12	1.00E-07
Cobalt	0.02	19	526.32	9.50E+02
Copper	1	82	6,097.56	8.20E+01
Cyanides	5	5.	5.E+5	1.00E+00
Dioxins (tetra)	2.00E-07	1.E-9	1.E+8	5.00E-03
Dioxins (hex)	0.001	1.E-9	5.E+11	1.00E-06
Endosulfan	0.1	1.E-9	5.E+13	1.00E-08
Fluorides	2.5	1.E-9	1.25E+15	4.00E-10
Lead	0.05	880	28.41	1.76E+04
Manganese	0.2	5,370	18.62	2.69E+04
Mercury	0.025	0.99	1.26E+4	3.96E+01
Nickel	1	42	1.19E+4	4.20E+01
Oil Mist	5	1.E-9	2.5E+15	2.00E-10
PCBs	0.5	6.	4.17E+4	1.20E+01
PNAs	0.2	41	2,439.02	2.05E+02
Phthalates	5	1.E-9	2.5E+15	2.00E-10
RDX	0.5	9,800	25.51	1.96E+04
Selenium	0.2	3.3	3.03E+4	1.65E+01
Silica	0.05	1.E-9	2.5E+13	2.00E-08
Silver	0.01	1.5	3,333.33	1.50E+02
Thallium	0.1	7.6	6,578.95	7.60E+01
Tin	2	1.E-9	1.E+15	5.00E-10
Titanium	10	1.E-9	5.E+15	1.00E-10
Trinitrotoluene	0.1	17,000	2.94	1.70E+05
Vanadium	0.05	25	1,000.	5.00E+02
Zinc	5	890	2,808.99	1.78E+02
			Sum	2.54E+05
Dust Exposure Level at Mixture PEL =			1.969	

Load Line 2
Zone 3 (Bldgs DB-3, 802)

DUST EXPOSURE CALCULATION WORKSHEET				
DustLevel			Safety Factor for this site = 2	
Chemical	Exposure Limit (mg/m3)	Maximum Soil Concentration (mg/kg)	Exposure Limit Based on Single Compound (EL Mix, mg/m3)	Dust Quotient for Each Compound (level/limit)
Aluminum	5	22,000	113.64	4.40E+03
Antimony	0.5	660	378.79	1.32E+03
Arsenic	0.01	39	128.21	3.90E+03
Barium	0.5	810	308.64	1.62E+03
Beryllium	0.002	2.6	384.62	1.30E+03
Cadmium	0.005	50	50.	1.00E+04
Chlordane	0.5	0.46	5.43E+5	9.20E-01
Chromium	0.5	1,900	131.58	3.80E+03
Chrome (hex)	0.01	82	60.98	8.20E+03
Cobalt	0.02	25	400.	1.25E+03
Copper	1	3,300	151.52	3.30E+03
Cyanides	5	0.4	6.25E+6	8.00E-02
Dioxins (tetra)	2.00E-07	1.E-9	1.E+8	5.00E-03
Dioxins (hex)	0.001	1.E-9	5.E+11	1.00E-06
Endosulfan	0.1	1.E-9	5.E+13	1.00E-08
Fluorides	2.5	1.E-9	1.25E+15	4.00E-10
Lead	0.05	6,900	3.62	1.38E+05
Manganese	0.2	2,300	43.48	1.15E+04
Mercury	0.025	2.4	5,208.33	9.60E+01
Nickel	1	140	3,571.43	1.40E+02
Oil Mist	5	1.E-9	2.5E+15	2.00E-10
PCBs	0.5	59	4,237.29	1.18E+02
PNAs	0.2	72	1,388.89	3.60E+02
Phthalates	5	1.E-9	2.5E+15	2.00E-10
RDX	0.5	1.E-9	2.5E+14	2.00E-09
Selenium	0.2	5.2	1.92E+4	2.60E+01
Silica	0.05	1.E-9	2.5E+13	2.00E-08
Silver	0.01	3.1	1,612.9	3.10E+02
Thallium	0.1	4.2	1.19E+4	4.20E+01
Tin	2	1.E-9	1.E+15	5.00E-10
Titanium	10	1.E-9	5.E+15	1.00E-10
Trinitrotoluene	0.1	1.2	4.17E+4	1.20E+01
Vanadium	0.05	30	833.33	6.00E+02
Zinc	5	7,300	342.47	1.46E+03
			Sum	1.92E+05
Dust Exposure Level at Mixture PEL =			2.607	

Load Line 2
Zone 4 (Bldgs DA-7, 21)

DUST EXPOSURE CALCULATION WORKSHEET				
DustLevel			Safety Factor for this site = 2	
Chemical	Exposure Limit (mg/m3)	Maximum Soil Concentration (mg/kg)	Exposure Limit Based on Single Compound (EL Mix, mg/m3)	Dust Quotient for Each Compound (level/limit)
Aluminum	5	21,000	119.05	4.20E+03
Antimony	0.5	1.E-9	2.5E+14	2.00E-09
Arsenic	0.01	8.6	581.4	8.60E+02
Barium	0.5	1,100	227.27	2.20E+03
Beryllium	0.002	2.9	344.83	1.45E+03
Cadmium	0.005	4.8	520.83	9.60E+02
Chlordane	0.5	0.008	3.01E+7	1.66E-02
Chromium	0.5	4,000	62.5	8.00E+03
Chrome (hex)	0.01	1.E-9	5.E+12	1.00E-07
Cobalt	0.02	120	83.33	6.00E+03
Copper	1	720	694.44	7.20E+02
Cyanides	5	1.E-9	2.5E+15	2.00E-10
Dioxins (tetra)	2.00E-07	1.E-9	1.E+8	5.00E-03
Dioxins (hex)	0.001	1.E-9	5.E+11	1.00E-06
Endosulfan	0.1	1.E-9	5.E+13	1.00E-08
Fluorides	2.5	1.E-9	1.25E+15	4.00E-10
Lead	0.05	37	675.68	7.40E+02
Manganese	0.2	2,760	36.23	1.38E+04
Mercury	0.025	2.8	4,464.29	1.12E+02
Nickel	1	35	1.43E+4	3.50E+01
Oil Mist	5	1.E-9	2.5E+15	2.00E-10
PCBs	0.5	1.4	1.79E+5	2.80E+00
PNAs	0.2	0.2	5.E+5	1.00E+00
Phthalates	5	1.E-9	2.5E+15	2.00E-10
RDX	0.5	3.6	6.94E+4	7.20E+00
Selenium	0.2	4.	2.5E+4	2.00E+01
Silica	0.05	1.E-9	2.5E+13	2.00E-08
Silver	0.01	1.E-9	5.E+12	1.00E-07
Thallium	0.1	0.93	5.38E+4	9.30E+00
Tin	2	1.E-9	1.E+15	5.00E-10
Titanium	10	1.E-9	5.E+15	1.00E-10
Trinitrotoluene	0.1	3,600	13.89	3.60E+04
Vanadium	0.05	29	862.07	5.80E+02
Zinc	5	900	2,777.78	1.80E+02
			Sum	7.59E+04
Dust Exposure Level at Mixture PEL =			6.590	

Load Line 2
Zone 5 (Bldg DA-5 Perimeter)

DUST EXPOSURE CALCULATION WORKSHEET				
DustLevel			Safety Factor for this site = 2	
Chemical	Exposure Limit (mg/m3)	Maximum Soil Concentration (mg/kg)	Exposure Limit Based on Single Compound (EL Mix, mg/m3)	Dust Quotient for Each Compound (level/limit)
Aluminum	5	21,000	119.05	4.20E+03
Antimony	0.5	8,100	30.86	1.62E+04
Arsenic	0.01	37	135.14	3.70E+03
Barium	0.5	1,100	227.27	2.20E+03
Beryllium	0.002	2.9	344.83	1.45E+03
Cadmium	0.005	4.8	520.83	9.60E+02
Chlordane	0.5	0.008	3.01E+7	1.66E-02
Chromium	0.5	4,000	62.5	8.00E+03
Chrome (hex)	0.01	1.E-9	5.E+12	1.00E-07
Cobalt	0.02	120	83.33	6.00E+03
Copper	1	720	694.44	7.20E+02
Cyanides	5	1.E-9	2.5E+15	2.00E-10
Dioxins (tetra)	2.00E-07	1.E-9	1.E+8	5.00E-03
Dioxins (hex)	0.001	1.E-9	5.E+11	1.00E-06
Endosulfan	0.1	1.E-9	5.E+13	1.00E-08
Fluorides	2.5	1.E-9	1.25E+15	4.00E-10
Lead	0.05	24,800	1.01	4.96E+05
Manganese	0.2	1,920	52.08	9.60E+03
Mercury	0.025	2.8	4,464.29	1.12E+02
Nickel	1	35	1.43E+4	3.50E+01
Oil Mist	5	1.E-9	2.5E+15	2.00E-10
PCBs	0.5	5.7	4.39E+4	1.14E+01
PNAs	0.2	0.2	5.E+5	1.00E+00
Phthalates	5	1.E-9	2.5E+15	2.00E-10
RDX	0.5	1.E-9	2.5E+14	2.00E-09
Selenium	0.2	4.	2.5E+4	2.00E+01
Silica	0.05	1.E-9	2.5E+13	2.00E-08
Silver	0.01	1.E-9	5.E+12	1.00E-07
Thallium	0.1	0.93	5.38E+4	9.30E+00
Tin	2	1.E-9	1.E+15	5.00E-10
Titanium	10	1.E-9	5.E+15	1.00E-10
Trinitrotoluene	0.1	1.E-9	5.E+13	1.00E-08
Vanadium	0.05	29	862.07	5.80E+02
Zinc	5	900	2,777.78	1.80E+02
			Sum	5.50E+05
Dust Exposure Level at Mixture PEL =			0.909	

Load Line 2
Zone 6 (South Service Road)

DUST EXPOSURE CALCULATION WORKSHEET				
DustLevel		Safety Factor for this site = 2		
Chemical	Exposure Limit (mg/m3)	Maximum Soil Concentration (mg/kg)	Exposure Limit Based on Single Compound (EL Mix, mg/m3)	Dust Quotient for Each Compound (level/limit)
Aluminum	5	21,000	119.05	4.20E+03
Antimony	0.5	21	1.17E+4	4.26E+01
Arsenic	0.01	29	172.41	2.90E+03
Barium	0.5	1,100	227.27	2.20E+03
Beryllium	0.002	2.9	344.83	1.45E+03
Cadmium	0.005	4.8	520.83	9.60E+02
Chlordane	0.5	0.008	3.01E+7	1.66E-02
Chromium	0.5	4,000	62.5	8.00E+03
Chrome (hex)	0.01	1.E-9	5.E+12	1.00E-07
Cobalt	0.02	120	83.33	6.00E+03
Copper	1	720	694.44	7.20E+02
Cyanides	5	1.E-9	2.5E+15	2.00E-10
Dioxins (tetra)	2.00E-07	1.E-9	1.E+8	5.00E-03
Dioxins (hex)	0.001	1.E-9	5.E+11	1.00E-06
Endosulfan	0.1	1.E-9	5.E+13	1.00E-08
Fluorides	2.5	1.E-9	1.25E+15	4.00E-10
Lead	0.05	150	166.67	3.00E+03
Manganese	0.2	5,840	17.12	2.92E+04
Mercury	0.025	2.8	4,464.29	1.12E+02
Nickel	1	35	1.43E+4	3.50E+01
Oil Mist	5	1.E-9	2.5E+15	2.00E-10
PCBs	0.5	1.E-9	2.5E+14	2.00E-09
PNAs	0.2	0.2	5.E+5	1.00E+00
Phthalates	5	1.E-9	2.5E+15	2.00E-10
RDX	0.5	6.8	3.68E+4	1.36E+01
Selenium	0.2	4.	2.5E+4	2.00E+01
Silica	0.05	1.E-9	2.5E+13	2.00E-08
Silver	0.01	1.E-9	5.E+12	1.00E-07
Thallium	0.1	0.93	5.38E+4	9.30E+00
Tin	2	1.E-9	1.E+15	5.00E-10
Titanium	10	1.E-9	5.E+15	1.00E-10
Trinitrotoluene	0.1	1.E-9	5.E+13	1.00E-08
Vanadium	0.05	29	862.07	5.80E+02
Zinc	5	900	2,777.78	1.80E+02
			Sum	5.96E+04
Dust Exposure Level at Mixture PEL =			8.386	

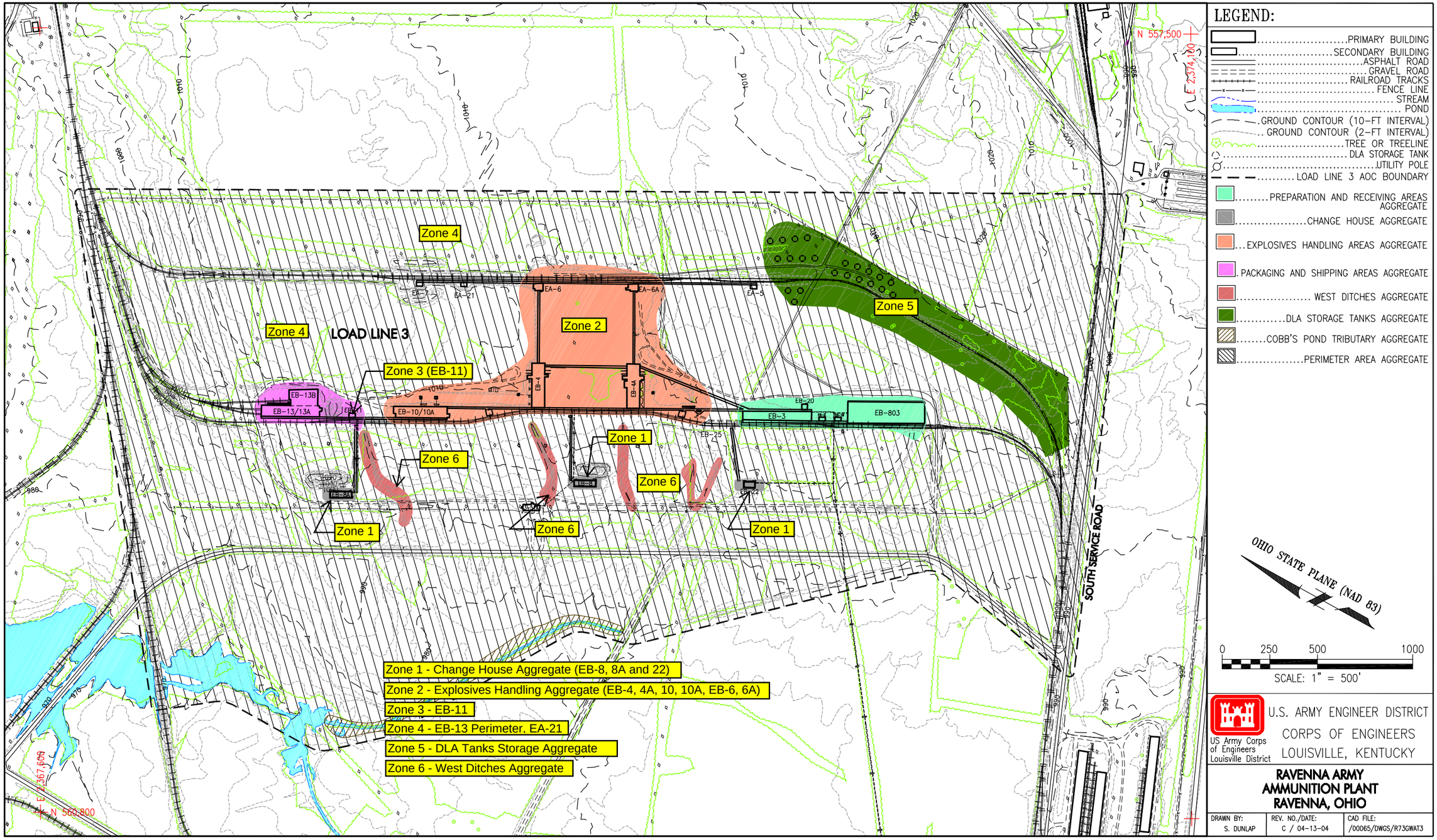


Figure 4-1. Spatial Aggregates for the Load Line 3 Phase II RI

Load Line 3
Zone 1 (Bldgs EB-8, 8A, 22)

DUST EXPOSURE CALCULATION WORKSHEET				
DustLevel		Safety Factor for this site = 2		
Chemical	Exposure Limit (mg/m3)	Maximum Soil Concentration (mg/kg)	Exposure Limit Based on Single Compound (EL Mix, mg/m3)	Dust Quotient for Each Compound (level/limit)
Aluminum	5	19,000	131.58	3.80E+03
Antimony	0.5	1.E-9	2.5E+14	2.00E-09
Arsenic	0.01	15	333.33	1.50E+03
Barium	0.5	210	1,190.48	4.20E+02
Beryllium	0.002	2.9	344.83	1.45E+03
Cadmium	0.005	1.	2,500.	2.00E+02
Chlordane	0.5	1.E-9	2.5E+14	2.00E-09
Chromium	0.5	19	1.32E+4	3.80E+01
Chrome (hex)	0.01	1.E-9	5.E+12	1.00E-07
Cobalt	0.02	11	909.09	5.50E+02
Copper	1	22	2.27E+4	2.20E+01
Cyanides	5	1.E-9	2.5E+15	2.00E-10
Dioxins (tetra)	2.00E-07	1.E-9	1.E+8	5.00E-03
Dioxins (hex)	0.001	1.E-9	5.E+11	1.00E-06
Endosulfan	0.1	1.E-9	5.E+13	1.00E-08
Fluorides	2.5	1.E-9	1.25E+15	4.00E-10
Lead	0.05	180	138.89	3.60E+03
Manganese	0.2	2,440	40.98	1.22E+04
Mercury	0.025	0.074	1.69E+5	2.96E+00
Nickel	1	23	2.17E+4	2.30E+01
Oil Mist	5	1.E-9	2.5E+15	2.00E-10
PCBs	0.5	6.3	3.97E+4	1.26E+01
PNAs	0.2	1.E-9	1.E+14	5.00E-09
Phthalates	5	1.E-9	2.5E+15	2.00E-10
RDX	0.5	1.E-9	2.5E+14	2.00E-09
Selenium	0.2	0.74	1.35E+5	3.70E+00
Silica	0.05	1.E-9	2.5E+13	2.00E-08
Silver	0.01	8.7	574.71	8.70E+02
Thallium	0.1	0.34	1.47E+5	3.40E+00
Tin	2	1.E-9	1.E+15	5.00E-10
Titanium	10	1.E-9	5.E+15	1.00E-10
Trinitrotoluene	0.1	1.E-9	5.E+13	1.00E-08
Vanadium	0.05	25	1,000.	5.00E+02
Zinc	5	95	2.63E+4	1.90E+01
			Sum	2.52E+04
Dust Exposure Level at Mixture PEL =			19.830	

Load Line 3
Zone 2 (Bldgs EA-6, 6A, EB-4, 4A, 10, 10A)

DUST EXPOSURE CALCULATION WORKSHEET				
DustLevel		Safety Factor for this site = 2		
Chemical	Exposure Limit (mg/m3)	Maximum Soil Concentration (mg/kg)	Exposure Limit Based on Single Compound (EL Mix, mg/m3)	Dust Quotient for Each Compound (level/limit)
Aluminum	5	35,200	71.02	7.04E+03
Antimony	0.5	177	1,412.43	3.54E+02
Arsenic	0.01	34	147.06	3.40E+03
Barium	0.5	1,300	192.31	2.60E+03
Beryllium	0.002	4.6	217.39	2.30E+03
Cadmium	0.005	29	86.21	5.80E+03
Chlordane	0.5	0.14	1.79E+6	2.80E-01
Chromium	0.5	320	781.25	6.40E+02
Chrome (hex)	0.01	1.1	4,545.45	1.10E+02
Cobalt	0.02	29	344.83	1.45E+03
Copper	1	300	1,666.67	3.00E+02
Cyanides	5	1.E-9	2.5E+15	2.00E-10
Dioxins (tetra)	2.00E-07	1.E-9	1.E+8	5.00E-03
Dioxins (hex)	0.001	1.E-9	5.E+11	1.00E-06
Endosulfan	0.1	1.E-9	5.E+13	1.00E-08
Fluorides	2.5	1.E-9	1.25E+15	4.00E-10
Lead	0.05	2,600	9.62	5.20E+04
Manganese	0.2	4,800	20.83	2.40E+04
Mercury	0.025	0.67	1.87E+4	2.68E+01
Nickel	1	77	6,493.51	7.70E+01
Oil Mist	5	1.E-9	2.5E+15	2.00E-10
PCBs	0.5	1,100	227.27	2.20E+03
PNAs	0.2	415	240.96	2.08E+03
Phthalates	5	1.4	1.79E+6	2.80E-01
RDX	0.5	34	7,352.94	6.80E+01
Selenium	0.2	4.1	2.44E+4	2.05E+01
Silica	0.05	1.E-9	2.5E+13	2.00E-08
Silver	0.01	4.5	1,111.11	4.50E+02
Thallium	0.1	3.5	1.43E+4	3.50E+01
Tin	2	1.E-9	1.E+15	5.00E-10
Titanium	10	1.E-9	5.E+15	1.00E-10
Trinitrotoluene	0.1	5,660	8.83	5.66E+04
Vanadium	0.05	26	961.54	5.20E+02
Zinc	5	2,800	892.86	5.60E+02
			Sum	1.63E+05
Dust Exposure Level at Mixture PEL =			3.075	

Load Line 3
Zone 3 (Bldg EB-11)

DUST EXPOSURE CALCULATION WORKSHEET				
DustLevel		Safety Factor for this site = 2		
Chemical	Exposure Limit (mg/m3)	Maximum Soil Concentration (mg/kg)	Exposure Limit Based on Single Compound (EL Mix, mg/m3)	Dust Quotient for Each Compound (level/limit)
Aluminum	5	24,000	104.17	4.80E+03
Antimony	0.5	166	1,506.02	3.32E+02
Arsenic	0.01	23	217.39	2.30E+03
Barium	0.5	820	304.88	1.64E+03
Beryllium	0.002	3.4	294.12	1.70E+03
Cadmium	0.005	37	67.57	7.40E+03
Chlordane	0.5	1.E-9	2.5E+14	2.00E-09
Chromium	0.5	140	1,785.71	2.80E+02
Chrome (hex)	0.01	1.E-9	5.E+12	1.00E-07
Cobalt	0.02	7.6	1,315.79	3.80E+02
Copper	1	120	4,166.67	1.20E+02
Cyanides	5	1.E-9	2.5E+15	2.00E-10
Dioxins (tetra)	2.00E-07	1.E-9	1.E+8	5.00E-03
Dioxins (hex)	0.001	1.E-9	5.E+11	1.00E-06
Endosulfan	0.1	1.E-9	5.E+13	1.00E-08
Fluorides	2.5	1.E-9	1.25E+15	4.00E-10
Lead	0.05	8,950	2.79	1.79E+05
Manganese	0.2	3,300	30.3	1.65E+04
Mercury	0.025	0.59	2.12E+4	2.36E+01
Nickel	1	20	2.5E+4	2.00E+01
Oil Mist	5	1.E-9	2.5E+15	2.00E-10
PCBs	0.5	91	2,747.25	1.82E+02
PNAs	0.2	2.7	3.7E+4	1.35E+01
Phthalates	5	1.E-9	2.5E+15	2.00E-10
RDX	0.5	1.E-9	2.5E+14	2.00E-09
Selenium	0.2	0.77	1.3E+5	3.85E+00
Silica	0.05	1.E-9	2.5E+13	2.00E-08
Silver	0.01	28	178.57	2.80E+03
Thallium	0.1	0.3	1.67E+5	3.00E+00
Tin	2	1.E-9	1.E+15	5.00E-10
Titanium	10	1.E-9	5.E+15	1.00E-10
Trinitrotoluene	0.1	820	60.98	8.20E+03
Vanadium	0.05	14	1,785.71	2.80E+02
Zinc	5	1,500	1,666.67	3.00E+02
			Sum	2.26E+05
Dust Exposure Level at Mixture PEL =			2.210	

Load Line 3
Zone 4 (Bldg EB-13 Perimeter, EA-21)

DUST EXPOSURE CALCULATION WORKSHEET				
DustLevel			Safety Factor for this site = 2	
Chemical	Exposure Limit (mg/m3)	Maximum Soil Concentration (mg/kg)	Exposure Limit Based on Single Compound (EL Mix, mg/m3)	Dust Quotient for Each Compound (level/limit)
Aluminum	5	17,000	147.06	3.40E+03
Antimony	0.5	5.4	4.63E+4	1.08E+01
Arsenic	0.01	24	208.33	2.40E+03
Barium	0.5	770	324.68	1.54E+03
Beryllium	0.002	1.2	833.33	6.00E+02
Cadmium	0.005	77	32.47	1.54E+04
Chlordane	0.5	0.71	3.52E+5	1.42E+00
Chromium	0.5	110	2,272.73	2.20E+02
Chrome (hex)	0.01	1.E-9	5.E+12	1.00E-07
Cobalt	0.02	15	666.67	7.50E+02
Copper	1	55	9,090.91	5.50E+01
Cyanides	5	2.4	1.04E+6	4.80E-01
Dioxins (tetra)	2.00E-07	1.E-9	1.E+8	5.00E-03
Dioxins (hex)	0.001	1.E-9	5.E+11	1.00E-06
Endosulfan	0.1	1.E-9	5.E+13	1.00E-08
Fluorides	2.5	1.E-9	1.25E+15	4.00E-10
Lead	0.05	2,500	10.	5.00E+04
Manganese	0.2	1,900	52.63	9.50E+03
Mercury	0.025	0.1	1.25E+5	4.00E+00
Nickel	1	24	2.08E+4	2.40E+01
Oil Mist	5	1.E-9	2.5E+15	2.00E-10
PCBs	0.5	110	2,272.73	2.20E+02
PNAs	0.2	7.4	1.35E+4	3.70E+01
Phthalates	5	0.42	5.95E+6	8.40E-02
RDX	0.5	22	1.14E+4	4.40E+01
Selenium	0.2	1.9	5.26E+4	9.50E+00
Silica	0.05	1.E-9	2.5E+13	2.00E-08
Silver	0.01	0.4	1.25E+4	4.00E+01
Thallium	0.1	0.42	1.19E+5	4.20E+00
Tin	2	1.E-9	1.E+15	5.00E-10
Titanium	10	1.E-9	5.E+15	1.00E-10
Trinitrotoluene	0.1	2.4	2.08E+4	2.40E+01
Vanadium	0.05	29	862.07	5.80E+02
Zinc	5	1,400	1,785.71	2.80E+02
			Sum	8.51E+04
Dust Exposure Level at Mixture PEL =			5.872	

Load Line 3
Zone 5 (DLA Tanks)

DUST EXPOSURE CALCULATION WORKSHEET				
DustLevel		Safety Factor for this site = 2		
Chemical	Exposure Limit (mg/m3)	Maximum Soil Concentration (mg/kg)	Exposure Limit Based on Single Compound (EL Mix, mg/m3)	Dust Quotient for Each Compound (level/limit)
Aluminum	5	16,000	156.25	3.20E+03
Antimony	0.5	830	301.2	1.66E+03
Arsenic	0.01	16	312.5	1.60E+03
Barium	0.5	190	1,315.79	3.80E+02
Beryllium	0.002	1.7	588.24	8.50E+02
Cadmium	0.005	3.2	781.25	6.40E+02
Chlordane	0.5	1.E-9	2.5E+14	2.00E-09
Chromium	0.5	120	2,083.33	2.40E+02
Chrome (hex)	0.01	1.E-9	5.E+12	1.00E-07
Cobalt	0.02	12	833.33	6.00E+02
Copper	1	31	1.61E+4	3.10E+01
Cyanides	5	1.E-9	2.5E+15	2.00E-10
Dioxins (tetra)	2.00E-07	1.E-9	1.E+8	5.00E-03
Dioxins (hex)	0.001	1.E-9	5.E+11	1.00E-06
Endosulfan	0.1	1.E-9	5.E+13	1.00E-08
Fluorides	2.5	1.E-9	1.25E+15	4.00E-10
Lead	0.05	1,500	16.67	3.00E+04
Manganese	0.2	2,500	40.	1.25E+04
Mercury	0.025	0.1	1.25E+5	4.00E+00
Nickel	1	25	2.E+4	2.50E+01
Oil Mist	5	1.E-9	2.5E+15	2.00E-10
PCBs	0.5	1.E-9	2.5E+14	2.00E-09
PNAs	0.2	0.6	1.67E+5	3.00E+00
Phthalates	5	1.E-9	2.5E+15	2.00E-10
RDX	0.5	1.E-9	2.5E+14	2.00E-09
Selenium	0.2	1.6	6.25E+4	8.00E+00
Silica	0.05	1.E-9	2.5E+13	2.00E-08
Silver	0.01	1.E-9	5.E+12	1.00E-07
Thallium	0.1	2.7	1.85E+4	2.70E+01
Tin	2	1.E-9	1.E+15	5.00E-10
Titanium	10	1.E-9	5.E+15	1.00E-10
Trinitrotoluene	0.1	1.E-9	5.E+13	1.00E-08
Vanadium	0.05	29	862.07	5.80E+02
Zinc	5	2,300	1,086.96	4.60E+02
			Sum	5.28E+04
Dust Exposure Level at Mixture PEL =			9.468	

Load Line 3
Zone 6 (Bldgs EB-8A and 22 west ditches)

DUST EXPOSURE CALCULATION WORKSHEET				
DustLevel		Safety Factor for this site = 2		
Chemical	Exposure Limit (mg/m3)	Maximum Soil Concentration (mg/kg)	Exposure Limit Based on Single Compound (EL Mix, mg/m3)	Dust Quotient for Each Compound (level/limit)
Aluminum	5	14,000	178.57	2.80E+03
Antimony	0.5	180	1,388.89	3.60E+02
Arsenic	0.01	22	227.27	2.20E+03
Barium	0.5	190	1,315.79	3.80E+02
Beryllium	0.002	1.4	714.29	7.00E+02
Cadmium	0.005	1.9	1,315.79	3.80E+02
Chlordane	0.5	1.E-9	2.5E+14	2.00E-09
Chromium	0.5	110	2,272.73	2.20E+02
Chrome (hex)	0.01	1.E-9	5.E+12	1.00E-07
Cobalt	0.02	31	322.58	1.55E+03
Copper	1	1,100	454.55	1.10E+03
Cyanides	5	1.E-9	2.5E+15	2.00E-10
Dioxins (tetra)	2.00E-07	1.E-9	1.E+8	5.00E-03
Dioxins (hex)	0.001	1.E-9	5.E+11	1.00E-06
Endosulfan	0.1	1.E-9	5.E+13	1.00E-08
Fluorides	2.5	1.E-9	1.25E+15	4.00E-10
Lead	0.05	870	28.74	1.74E+04
Manganese	0.2	4,600	21.74	2.30E+04
Mercury	0.025	0.23	5.43E+4	9.20E+00
Nickel	1	31	1.61E+4	3.10E+01
Oil Mist	5	1.E-9	2.5E+15	2.00E-10
PCBs	0.5	36	6,944.44	7.20E+01
PNAs	0.2	52	1,923.08	2.60E+02
Phthalates	5	1.E-9	2.5E+15	2.00E-10
RDX	0.5	1.E-9	2.5E+14	2.00E-09
Selenium	0.2	3.6	2.78E+4	1.80E+01
Silica	0.05	1.E-9	2.5E+13	2.00E-08
Silver	0.01	1.5	3,333.33	1.50E+02
Thallium	0.1	0.44	1.14E+5	4.40E+00
Tin	2	1.E-9	1.E+15	5.00E-10
Titanium	10	1.E-9	5.E+15	1.00E-10
Trinitrotoluene	0.1	110	454.55	1.10E+03
Vanadium	0.05	28	892.86	5.60E+02
Zinc	5	560	4,464.29	1.12E+02
			Sum	5.24E+04
Dust Exposure Level at Mixture PEL =			9.541	

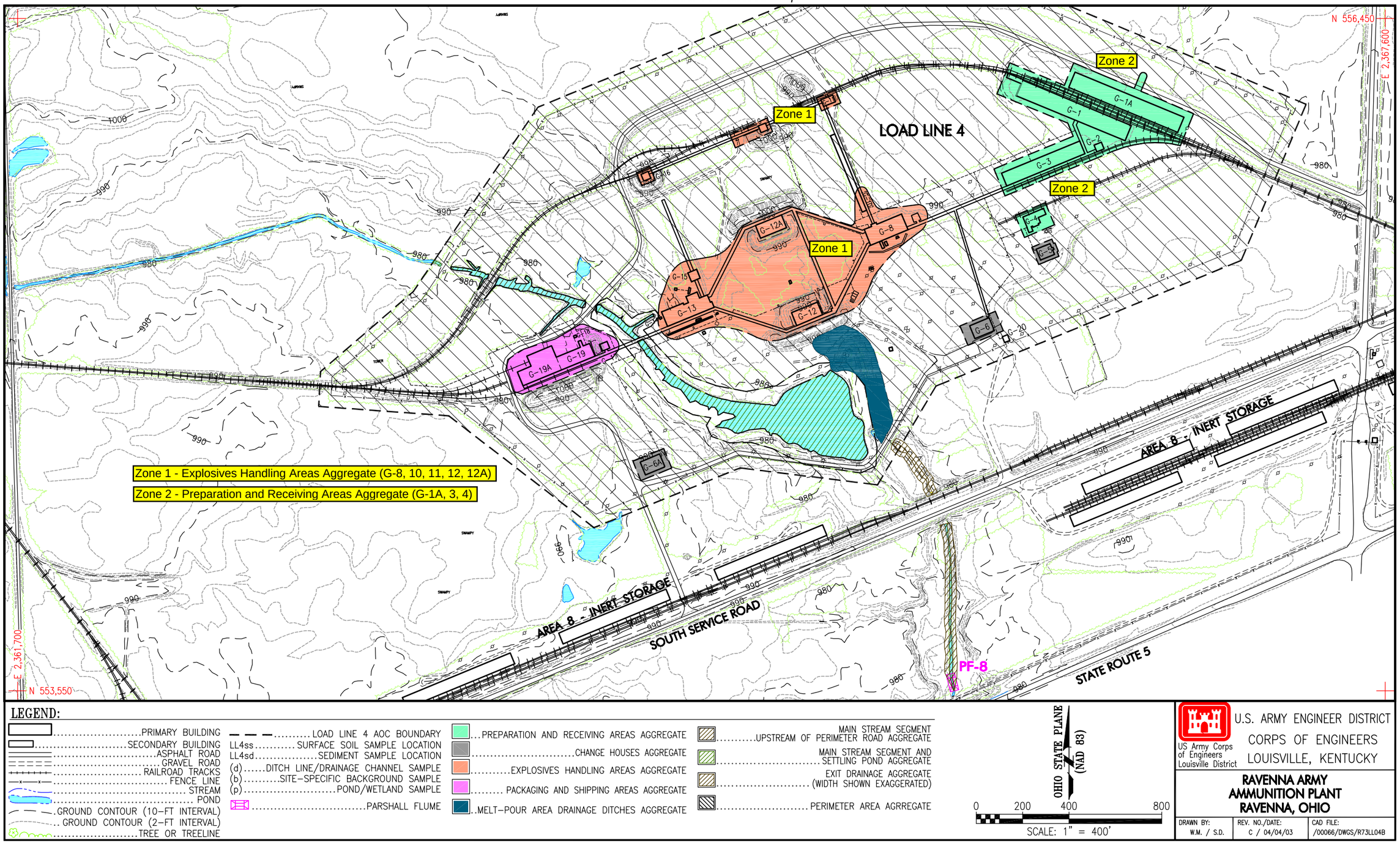


Figure 4-1. Soil, Sediment, and Surface Water Aggregates for Load Line 4

Load Line 4
Zone 1 (Bldgs G-8, 10, 11, 12, 12A)

DUST EXPOSURE CALCULATION WORKSHEET				
DustLevel		Safety Factor for this site = 2		
Chemical	Exposure Limit (mg/m3)	Maximum Soil Concentration (mg/kg)	Exposure Limit Based on Single Compound (EL Mix, mg/m3)	Dust Quotient for Each Compound (level/limit)
Aluminum	5	39,000	64.1	7.80E+03
Antimony	0.5	2.2	1.14E+5	4.40E+00
Arsenic	0.01	18	277.78	1.80E+03
Barium	0.5	750	333.33	1.50E+03
Beryllium	0.002	5.9	169.49	2.95E+03
Cadmium	0.005	13	192.31	2.60E+03
Chlordane	0.5	0.083	3.01E+6	1.66E-01
Chromium	0.5	68	3,676.47	1.36E+02
Chrome (hex)	0.01	1.9	2,631.58	1.90E+02
Cobalt	0.02	78	128.21	3.90E+03
Copper	1	110	4,545.45	1.10E+02
Cyanides	5	0.51	4.9E+6	1.02E-01
Dioxins (tetra)	2.00E-07	1.E-9	1.E+8	5.00E-03
Dioxins (hex)	0.001	1.E-9	5.E+11	1.00E-06
Endosulfan	0.1	1.E-9	5.E+13	1.00E-08
Fluorides	2.5	1.E-9	1.25E+15	4.00E-10
Lead	0.05	5,800	4.31	1.16E+05
Manganese	0.2	7,320	13.66	3.66E+04
Mercury	0.025	0.36	3.47E+4	1.44E+01
Nickel	1	32	1.56E+4	3.20E+01
Oil Mist	5	1.E-9	2.5E+15	2.00E-10
PCBs	0.5	28	8,928.57	5.60E+01
PNAs	0.2	51	1,960.78	2.55E+02
Phthalates	5	1.1	2.27E+6	2.20E-01
RDX	0.5	19	1.32E+4	3.80E+01
Selenium	0.2	3.2	3.13E+4	1.60E+01
Silica	0.05	1.E-9	2.5E+13	2.00E-08
Silver	0.01	1.E-9	5.E+12	1.00E-07
Thallium	0.1	13	3,846.15	1.30E+02
Tin	2	1.E-9	1.E+15	5.00E-10
Titanium	10	1.E-9	5.E+15	1.00E-10
Trinitrotoluene	0.1	2.2	2.27E+4	2.20E+01
Vanadium	0.05	20	1,250.	4.00E+02
Zinc	5	3,700	675.68	7.40E+02
			Sum	1.75E+05
Dust Exposure Level at Mixture PEL =			2.852	

Load Line 4
Zone 2 (Bldgs G-1A, 3, 4)

DUST EXPOSURE CALCULATION WORKSHEET				
DustLevel			Safety Factor for this site = 2	
Chemical	Exposure Limit (mg/m3)	Maximum Soil Concentration (mg/kg)	Exposure Limit Based on Single Compound (EL Mix, mg/m3)	Dust Quotient for Each Compound (level/limit)
Aluminum	5	36,700	68.12	7.34E+03
Antimony	0.5	1.E-9	2.5E+14	2.00E-09
Arsenic	0.01	27	185.19	2.70E+03
Barium	0.5	200	1,250.	4.00E+02
Beryllium	0.002	1.6	625.	8.00E+02
Cadmium	0.005	4.6	543.48	9.20E+02
Chlordane	0.5	1.E-9	2.5E+14	2.00E-09
Chromium	0.5	160	1,562.5	3.20E+02
Chrome (hex)	0.01	1.E-9	5.E+12	1.00E-07
Cobalt	0.02	14	714.29	7.00E+02
Copper	1	510	980.39	5.10E+02
Cyanides	5	0.11	2.27E+7	2.20E-02
Dioxins (tetra)	2.00E-07	1.E-9	1.E+8	5.00E-03
Dioxins (hex)	0.001	1.E-9	5.E+11	1.00E-06
Endosulfan	0.1	1.E-9	5.E+13	1.00E-08
Fluorides	2.5	1.E-9	1.25E+15	4.00E-10
Lead	0.05	990	25.25	1.98E+04
Manganese	0.2	4,660	21.46	2.33E+04
Mercury	0.025	7.4	1,689.19	2.96E+02
Nickel	1	48	1.04E+4	4.80E+01
Oil Mist	5	1.E-9	2.5E+15	2.00E-10
PCBs	0.5	48	5,208.33	9.60E+01
PNAs	0.2	0.2	5.E+5	1.00E+00
Phthalates	5	0.061	4.1E+7	1.22E-02
RDX	0.5	1.E-9	2.5E+14	2.00E-09
Selenium	0.2	1.2	8.33E+4	6.00E+00
Silica	0.05	1.E-9	2.5E+13	2.00E-08
Silver	0.01	1.E-9	5.E+12	1.00E-07
Thallium	0.1	1.2	4.17E+4	1.20E+01
Tin	2	1.E-9	1.E+15	5.00E-10
Titanium	10	1.E-9	5.E+15	1.00E-10
Trinitrotoluene	0.1	1.E-9	5.E+13	1.00E-08
Vanadium	0.05	41	609.76	8.20E+02
Zinc	5	750	3,333.33	1.50E+02
			Sum	5.82E+04
		Dust Exposure Level at Mixture PEL =	8.588	

Attachment 3
Written Lead Compliance Plan

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Written Lead Compliance Plan
Remediation of Soils at Load Lines 1, 2, 3, and 4
Ravenna Army Ammunition Plant
June 2007
Prepared by: James Joice, CIH, CSP

Introduction

The United States Army Corps. of Engineers (USACE) has contracted Shaw Environmental, Inc. (Shaw) to excavate lead-contaminated soil and relocate demolition debris at the Ravenna Army Ammunition Plant (RVAAP) located in Ravenna, Ohio. The debris is not known to contain lead; however, it is being handled as potentially lead-contaminated. The work activity is expected to take several weeks to complete.

Previous analytical data indicates that the soil contains lead at concentrations up to 25,000 mg/kg. It is possible that employees may be exposed above the Permissible Exposure Limit (PEL) of 50 $\mu g/m^3$ to metallic lead, if dust levels are not controlled. These exposures to lead would primarily occur during the excavation and load-out of contaminated soil. This Written Lead Compliance Plan, used in conjunction with the Site Safety, Health, and Emergency Response Plan (SHERP; Shaw 2004), will outline the procedures and controls necessary to prevent employee exposures.

Lead-Emitting Activities

The following construction activities may emit lead into the air:

- Land clearing and grubbing;
- Excavation and stockpiling of lead contaminated soil;
- Loading lead contaminated soil into trucks for disposal; and
- Relocation of demolition debris piles.

Equipment Used

The following lists the equipment that will be used to remediate lead-contaminated soil and debris from RVAAP:

- Tracked excavator
- Front end loader
- Hand tools consisting of shovels and rakes
- Dump-trucks
- Dust control equipment
- Air monitoring equipment
- Decontamination and personal hygiene facilities
- Lead warning signs.

Materials Involved

On-site materials that may contain lead particulates and will be disturbed as part of proposed construction activities include the following:

- Excavated remediation soils.
- Demolition debris.

In order to minimize lead dust exposure to on-site personnel, water will be applied as necessary to soils to be excavated to maintain average dust levels below the following concentrations:

- Load Line 1 (Zone 3) – 1.647 mg/m^3
- Load Line 2 (Zone 2) – 1.969 mg/m^3
- Load Line 2 (Zone 5) – 0.909 mg/m^3

Attachment 2 in the SHERP Addendum 2007-02 presents the calculated dust levels for each of the load lines and includes site plans for each load line that depict the delineated zones for which dust levels were calculated.

Controls in Place

The following controls are in place to reduce personnel exposures to lead:

- Work practices to minimize dust generating activity:
  - Excavation rates will be paced to minimize dust generation;
  - Excavated soils shall be placed on stockpile and in dump trucks (allowing "free-falling" of soils from excavator bucket shall be minimized); and
  - Stock-piled soil and dump trucks will be covered.

- Wetting of soil and debris with water to suppress dust – water will be applied as necessary to maintain average dust levels below those specified in the SHERP Addendum 2007-02.

- Personnel shall work upwind of dust generating activities.

- Use of Personal Protective Equipment (PPE) such as disposable coveralls, gloves, and boot-covers. Air purifying respirators (APRs) equipped with P-100 HEPA cartridges shall be worn by all personnel in the Exclusion Zone (specific zones in Load Lines 1 and 2) while contaminated soils are being excavated or handled and/or dust levels cannot be controlled. Additional PPE requirements are specified in Section 1.5 of the SHERP Addendum 2007-02.

- Use of personnel and equipment decontamination facilities with hand/face washing capabilities and supplies:

  - Disposable PPE shall be discarded each time upon exiting the Exclusion Zone;
  - Non-disposable PPE (hard-hats/APRs) shall be cleaned each time upon exiting the Exclusion Zone; and
  - Equipment used in the Exclusion Zone shall be decontaminated promptly upon being removed from the Exclusion Zone.

- Use of D-lead hand wipes – personnel working in the Exclusion Zone will wipe hands immediately after doffing PPE (during the personal decontamination process).

- Use of D-lead hand soap – personnel working in the Exclusion Zone will wash hands with this special soap immediately after using D-lead hand wipes (during the personal decontamination process).

- Air monitoring:

  - Personal air monitoring shall be performed on personnel working in the Exclusion Zone during excavation and handling of contaminated soils and loading contaminated soils into dump trucks (personal air monitoring requirements are specified in Section 1.6 of the SHERP Addendum 2007-02); and
  - Perimeter air monitoring shall be performed downwind of work areas (at the perimeter of Exclusion Zones) during excavation of contaminated soils and loading contaminated soils into dump trucks (perimeter air monitoring requirements are specified in Section 1.6 of the SHERP Addendum 2007-02).

- Medical surveillance:

  - All personnel working in the Exclusion Zone shall be currently participating in a medical surveillance program as specified in 29 CFR 1910.120;
  - All personnel working in the Exclusion Zone shall be medically qualified to wear respiratory protection as specified in 29 CFR 1910.134; and
  - All personnel working in the Exclusion Zone shall be monitored for blood-lead and zinc protoporphyrin (pre-work/post-work) as specified in 29 CFR 1926.62.

- Training:

  - All personnel working in the Exclusion Zone shall be HAZWOPER trained as specified in 29 CFR 1910.120; and
  - All personnel working in the Exclusion Zone shall have received Lead Awareness Training as specified in 29 CFR 1926.62

Crew Size and Responsibilities

The crew will consist of a Field Supervisor, a Site Safety Officer, and three to six equipment operators/laborers.

The Field Supervisor is responsible for:

- Implementing this Written Compliance Plan, the SHERP (Shaw 2004) and associated addenda;
- Verifying by inspection/documentation that work is performed in compliance with Federal/State regulation;
- Verifying that employees are trained and participating in a medical surveillance program by inspection of medical surveillance and training documentation;
- Verifying by inspection and documentation that all equipment is in satisfactory working order and is properly maintained;
- Facilitating Morning Safety Meetings;
- Monitoring employees for safety, health, and operational performance; and
- Other responsibilities are outlined in the SHERP (Shaw 2004) and associated addenda.

The Site Safety Officer is responsible for:

- Maintaining all project related safety records
- Performing the necessary air monitoring
- Assisting the Field Supervisor with safety responsibilities as necessary
- Other responsibilities are outlined in the SHERP (Shaw 2004) and associated addenda.

Laborers are responsible for:

- Attending Morning Safety Meetings
- Performing all work in compliance with rules and procedures
- Washing hands and face at the conclusion of work and before eating, drinking, and smoking.

Operating Procedures and Maintenance Practices

The following operating procedures are in effect:

- Only trained employees will be allowed to work in lead-contaminated areas – training consists of HAZWOPER (29 CFR 1910.120), Hazard Communication (29 CFR 1910.1200), and Lead Awareness (29 CFR 1926.62)
- Only employees participating in a medical surveillance program, complying with 29 CFR 1910.120 will be allowed to work in lead contaminated areas – physically fit for use of respirators and work with lead (29 CFR 1926.62). Biological monitoring (pre-work, intermittent (only if over PEL, show signs or symptoms), post-project blood lead and zinc protoporphyrin levels) shall be performed on all personnel performing lead abatement activities
- Decontamination and personal hygiene facilities shall be set-up prior to working in lead contaminated areas
- Appropriate warning signs shall be posted prior to working in lead-contaminated areas
- All equipment and tools shall be inspected prior to working in lead-contaminated areas
- Personal and perimeter air monitoring shall be performed during excavation and handling of lead-contaminated soil
- Smoking, chewing, drinking, or eating is prohibited in the Exclusion Zone
- All work will be performed in a manner to minimize dust generation. Dry sweeping shall be avoided
- Personnel shall utilize Level C PPE, as specified in the SHERP Addendum 2007-02 during excavation and handling of lead-contaminated soil and handling debris. Tyvek hoods shall be worn during dust generating activities
- Compressed air shall not be used to remove lead-contaminated dust from any surface
- All surfaces shall be maintained as free as practicable of accumulations of lead contaminated dust
- Personnel shall wash hands and face before each break
- Disposable PPE shall be used
- Personnel are prohibited from removing lead from protective clothing by blowing, shaking, or any other means that disperses lead contaminated dust into the air

The following maintenance practices are in effect:

- Personnel shall inspect PPE and respiratory protection (if used) before each use. Respirators (if used) shall be cleaned and disinfected at the conclusion of each day. All respirators shall be properly dried and stored in clean plastic bags after cleaning. Personnel are responsible for maintaining respirators according to the manufacturer's recommendations. Respirator cartridges (HEPA) shall be changed when breathing resistance increases, or at the end of the workday (whichever comes first)

- Tools and extension cords shall be maintained according to manufacturer recommendations.

Technology Considered in Meeting the PEL

The following technologies were considered for meeting PEL requirements, and will be used for this project:

- HEPA equipped Air Purifying Respirators
- Dust control with water.

Air Monitoring Data

Air monitoring data is not available. Air monitoring will be performed during excavation and handling of lead contaminated soil as discussed in Section 1.6 of the SHERP Addendum 2007-02.

Implementation Schedule

This Written Lead Compliance Plan is to be implemented before commencing project activities involving lead-contaminated soil and debris.

Other Contractors

Subcontractors may be used to complete the project. These subcontractors could perform the following activities:

- Munitions and explosives of concern excavation oversight support;
- Clearing and grubbing;
- Debris relocation;
- Structural building support;
- Excavation and handling of lead contaminated soil and debris;
- Trucking;
- Clearance sampling;
- Analytical laboratory; and
- Site restoration.

On-site contractors, other than the analytical laboratory, shall comply with all requirements of the SHERP (Shaw 2004) and Written Lead Compliance Plan. The SSHO shall notify the contractors of these requirements and verify compliance.

Attachment 4
Response to Comments

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COMMENT RESPONSE TABLE

Draft NOI and Storm Water Pollution Prevention Plan, Remediation of Soils at Load Lines 1, 2, 3 and 4
Ravenna Army Ammunition Plant, Ravenna, Ohio

Reviewer: Katie Elgin, OHARNG RTLS-EN **Date: June 4, 2007**

Cmt. #	Page # Line #	Comment	Recommendation	Response
1	Pg. 3-1, Section 3.1, paragraphs 1 and 2	This description is incorrect. The RVAAP is scattered parcels owned and operated by the Army which are located throughout the confines of the RTLS. Please change to: "When the RVAAP Installation Restoration Program (IRP) began in 1989, the RVAAP was identified as a 21,419-acre installation. The property boundary was resurveyed by the OHARNG over a two year period (2002 and 2003) and the actual total acreage of the property was found to be 21,683.289 acres. As of February 2006, a total of 20,403 acres of the former 21,683 acre RVAAP have been transferred to the National Guard Bureau and subsequently licensed to the OHARNG for use as a military training site. The current RVAAP consists of 1,280 acres scattered throughout the OHARNG Ravenna Training and Logistics Site (RTLS). The RTLS is in northeastern Ohio within Portage and Trumbull Counties, approximately 4.8 kilometers (3 miles) east northeast of the city of Ravenna and approximately 1.6 kilometers (1 mile) northwest of the city	Insert new description for Paragraphs 1 and 2 in Section 3.1.	This comment will be incorporated and this section will be revised to state the following: "The RVAAP Installation Restoration Program (IRP) began in 1989 and consisted of a 21,683-acre installation. As of February 2006, a total of 20,403 of the original 21,683 acres have been transferred to the National Guard Bureau (NGB) and subsequently licensed to the Ohio Army National Guard (OHARNG) for use as a military training site. The current RVAAP consists of 1,280 acres scattered throughout the OHARNG Ravenna Training and Logistics Site (RTLS). The RTLS is located in northeastern Ohio within east-central Portage County and southwestern Trumbull County, approximately three miles east northeast of the city of Ravenna and approximately one mile northwest of the city of

Cmt. #	Page # Line #	Comment	Recommendation	Response
		of Newton Falls. The RVAAP portions of the property are solely located within Portage County. The RTLS/RVAAP 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 (see Figures 1-1 and 1-2). The RTLS is surrounded by several communities: Windham on the north; Garrettsville 9.6 kilometers (6 miles) to the northwest; Newton Falls 1.6 kilometers (1 mile) to the southeast; Charlestown to the southwest; and Wayland 4.8 kilometers (3 miles) to the south. When the RVAAP was operational the RTLS did not exist and the entire 21,683-acre parcel was a government-owned, contractor-operated industrial facility. The RVAAP IRP encompasses investigation and cleanup of past activities over the entire 21,683 acres of the former RVAAP and therefore references to the RVAAP in		Newton Falls (**Figure 3-1**). The RVAAP portions of the RTLS are solely located within Portage County. The combined RTLS/RVAAP areas consist of a rectangular parcel of land approximately 11 miles long and 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 3-2**). The RTLS is surrounded by several communities: Windham on the north; Garrettsville six miles to the northwest; Newton Falls one mile to the southeast; Charlestown to the southwest; and Wayland three miles to the south. When the RVAAP was operational, the RTLS did not exist and the entire 21,683-acre parcel was a government-owned, contractor-operated (GOCO) industrial

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		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 third paragraph in this section is fine.		facility. Industrial operations at the RVAAP primarily consisted of 12 munitions assembly facilities referred to as "load lines". LLs 1-4 were used between 1941 and 1971 to melt and load trinitrotoluene (TNT) and Composition B, a mixture of TNT and cyclotrimethylenetrinitramine (RDX) into large-caliber shells. The RVAAP has been inactive since 1992. The RVAAP IRP encompasses investigation and cleanup of past activities over the entire 21,683 acres of the former RVAAP. 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.
2	Pg. 3-1, Section 3.2	"Shaw and their contractors will be on-site during daylight working hours		Shaw anticipates commencing construction activities within 45

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		between 7 AM to 5 PM and will work six (6) days a week from Monday through Saturday." I am assuming that work activities are projected for Fall 2007. All weekend work must be coordinated with the OHARNG to assure that there are no conflicts with training or scheduled Fall deer hunts. Saturday work must be approved by the OHARNG. Even though LL1-4 are owned by the Army, you must access RTLS portions of the property to get to those areas.		days of sign off on the ROD. Assuming work will start in mid-July, it will most likely extend into early Fall. Shaw will seek approval from the OHARNG when work during Saturdays are anticipated and will coordinate any potential conflicts with training or scheduled Fall deer hunts.
3	General	In our experience with working with the Portage County Soil and Water Conservation District, they have requested to see a copy of the NOI and SWP3 plan since these activities are within their jurisdiction. I would recommend sending a copy of this document to the Portage County Soil and Water Conservation District to let them know what is going on.	Recommend sending a copy of this document to the Portage County Soil and Water Conservation District.	Shaw intends on submitting a signed copy of the NOI and SWP3 plan to the Portage County Soil and Water Conservation District once it has gone through the proper review cycle process and prior to beginning construction activities.
4	Pg. 3-6, Section 3.7.4	Change "setting" to "settling". Using "property" makes it sound like you are describing the entire facility not just LL4. Change "property" to "site" or	Change "property" to "site" or "AOC".	• "setting" will be changed to "settling". • "property" will be changed to "LL 4" to avoid further

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		"AOC".		confusion.
5	Pg. 4-1, Section 4.1	"… that collected in soils dry sediments." Insert a / between soils and dry sediments.		A "/" will be inserted between "soils" and "dry sediments".
6	Pg. 4-3, Section 4.3 Spill Reporting	If a spill occurs outside the Load Line work areas on RTLS property or migrates from the Load Lines onto RTLS property, RTLS must be notified (either MAJ Meade or Tim Morgan). You must then follow the RTLS Spill Procedures and fill out a spill report.		In the event of a release at any location within the boundaries of the RVAAP, Shaw will notify RVAAP security at Post 1. Post 1 will make the necessary notifications to the applicable emergency response personnel and response centers. The following text will be added to this section regarding spill procedures that will be followed: "In the event of a petroleum spill, Shaw will provide notification to the RVAAP security at Post 1 at (330) 358-2017. The spill reporter should identify **"This is a spill alert"** with the following information: • Reporter's name; • Location of spill or leak; • Description and estimated quantity of material

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				released; • Description of situation; • Whether there are any injuries; • Whether the spill/leak is continuing or contained; • Who else is on the scene; • Where the reporter will be; and • How the reporter can be reached (radio/telephone). The reporter may be required to complete spill alert forms at the instruction of RVAAP security prior to leaving the site".
7	Pg. 5-6, Section 5.4, Item 1	Keep in mind that OHARNG roadways must be kept clear of debris and dirt as well.		Item 1 in Section 5.4 will be revised to include the following sentence: "All roadways must be kept clear of dirt and debris."
8	Appendix B, Figures	Are there areas outside of the Load Lines that will be remediated? There are areas denoted with purple outside the load lines. This purple marks "Areas of soil remediation". If not, change these		The figures in Appendix B are correct. There are several locations outside the defined boundaries of the load lines that will be remediated as part of

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		areas to another color.		Shaw's soil remediation activities. Although, technically outside of the load line boundaries, they are assumed to be associated with past activities at the load lines and will be remediated in conjunction with the load line soil removal activities.