WORK PLAN FOR PROCESS EQUIPMENT DISASSEMBLY, DECONTAMINATION AND DISPOSAL AT LOAD LINES 2 AND 3

RAVENNA ARMY AMMUNITION PLANT
RAVENNA, OHIO 44266

Prepared for

OPERATIONS SUPPORT COMMAND
AMSIO-ACE-D
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AUGUST 2002

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LETTER OF TRANSMITTAL

TO: Mark Patterson

RVAAP

8451 State Route 5

Ravenna, OH 44266

DATE	JOB NO
1 AUG 02	02032
ATTENTION: SAME	
RE: TRANSMITTAL OF WORK PLANS - PROCESS EQUIPMENT/PIPING DISASSEMBLY, DECON & DISPOSAL AT LL-2 & 3	
AUGUST 2002	

We are sending you ☒ Attached ☐ Under separate cover via_____ the following items:

☐ Shop Drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications
☐ Copy of Letter ☐ Change Order ☒ Plans

COPIES	DATE	NO.	DESCRIPTION
1	1 AUG 02	1	WORK PLAN FOR THE PROCESS EQUIPMENT/PIPING DISASSEMBLY, DECON & DISPOSAL AT LL-2 & 3, AUGUST 2002
1	1 AUG 02	1	ESS FOR THE PROCESS EQUIPMENT/PIPING DISASSEMBLY, DECON & DISPOSAL AT LL-2 & 3, AUGUST 2002
1	1 AUG 02	1	SITE SAFETY AND HEALTH PLAN FOR THE PROCESS EQUIPMENT/PIPING DISASSEMBLY , DECON & DISPOSAL AT LL-2 & 3, AUGUST 2002

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Signed: _____ Brian Stockwell

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LIST OF ABBREVIATIONS AND ACRONYMS

A&E	Architect and Engineer
ACGIH	American Conference of Governmental Industrial Hygienists
AEDA	Ammunition, Explosives and Dangerous Articles
ANSI	American National Standard Institute
AOC	Area of Concern
ARARs	Applicable or Relevant and Appropriate Requirements
ASTM	American Society for Testing and Materials
ATM	Atmospheres
BGS	Below-Ground Surface
BRA	Baseline Risk Assessment
BTEX	Benzene, Toluene, Ethylbenzene, and Xylene
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CESO	Corps of Engineers Safety Officer
COC	Chemicals of Concern
CF	Cubic Feet
CFR	Code of Federal Regulations
CIH	Certified Industrial Hygienist
CME	Central Mine Equipment
COR	Contracting Officer's Representative
CRREL	Cold Regions Research and Engineering Laboratory
CSHM	Corporate Safety and Health Manager
CRZ	Contamination Reduction Zone
CWM	Chemical Warfare Material
CWZ	Construction Work Zone
cu. yd.	Cubic Yard
DA	Decontamination Area

D&D	Decontamination and Decommissioning
DNT	Di-nitrotoluene
DOD	Department of Defense
DOT	United States Department of Transportation
DPW	Decon Pressure Wash Area
DQO	Data Quality Objective
DRMO	Defense Reutilization and Marketing Office
EM	Engineer Manual
EOD	Explosive Ordnance Disposal
EPA	United States Environmental Protection Agency
EZ	Exclusion Zone
GOCO	Government Owned Contractor Operator
HAZWOPER	Hazardous Waste Operating and Emergency Response
HDPE	High Density Polyethylene
HMX	Octahydro-1,3,5,7-Tetranitro-1,3,5,7-Tetrazocine
HTRW	Hazardous and Toxic Waste
IBD	Inhabited Building Distance
IOC P	IOC Pamphlet
IRP	Installation Restoration Program
LL	Load Line
mg/kg	Milligrams per Kilogram (parts per million)
mg/L	Milligrams per Liter (equivalent to ppm in liquids with specific gravity of 1.0)
MKM	MKM Engineers, Inc.
MPM	Most Potable Munition
MSD	Minimum Separation Distance
NEW	Net Explosive Weight
NIOSH	National Institute for Occupational Safety and Health

OE	Ordnance and Explosives
OSC	Operations Support Command
OSHA	Occupational Safety and Health Act
P.E.	Professional Engineer
PCBs	Polychlorinated Biphenyls
PM	Project Manager
PM	Program Manager
PPE	Personal Protective Equipment
ppm	Parts per Million
PVC	Polyvinyl Chloride
QA	Quality Assurance
QC	Quality Control
QCS	Quality Control Specialist
QD	Quanitity-Distance
RCRA	Resource Conservation and Recovery Act
RDX	Royal Demolition Explosive (Hexahydro-1,2,5-Trinitro-1,3,5-Triazine)
RI	Remedial Investigation
RVAAP	Ravenna Army Ammunition Plant
SOP	Standard Operating Procedure
SHE	Safety, Health and Environmental
SSHO	Site Safety and Health Officer
SSHP	Site Safety and Health Plan
SUXOS	Senior UXO Supervisor
SVOC	Semi-Volatile Organic Compound
SZ	Support Zone
T&D	Transportation and Disposal
TNB	1,3,5-Trinitrobenzene

TNT	2,4,6-Trinitrotoluene
TSCA	Toxic Substances Control Act
TSDF	Treatment, Storage, or Disposal Facility
ug/kg	Micrograms per Kiloliter (equivalent to parts per billion)
ug/L	Micrograms per Liter
USACE	United States Army Corp of Engineers
USATCES	United States Army Technical Center for Explosive Safety
USEPA	United States Environmental Protection Agency
UXO	Unexploded Ordnance
VOC	Volatile Organic Compound

1.0 INTRODUCTION

The objective of this Work Plan (WP) is to provide direction and guidance to all field personnel, resident employees, visitors, observers, and contractors during specific field activities at Load Lines 2 & 3 at the Ravenna Army Ammunition Plant. It has been developed in conjunction with the Explosive Safety Submission (ESS) and Site Safety and Health Plan (SSHP) prepared for this project.

The primary objective of this project is disassembly, decontamination and disposal of exposed, above ground explosive process equipment and piping, including any other exposed, above ground piping (i.e. steam, conduit, fire suppression) that exists in buildings classified as Explosive Buildings (EB) at Load Line 2 & Load Line 3 (LL-2 & 3). Additionally, all the steel from areas within the two load lines that does not present a structural safety hazard will be removed for recycling during this project. Specific disassembly/decon efforts will include the following major tasks:

- Mobilization and Site Set-Up
- Abatement Activities (Asbestos)
- Explosive Desensitizing and Disassembly of Exposed, Above Ground Process Equipment and Piping in EBs (In-place)
- Explosive Desensitizing and Disassembly of all other Exposed, Above Ground Piping (i.e., steam, conduit, fire suppression) in EBs (In-place)
- Pressure Washing and/or Thermal Decontamination in Flashing Furnace (as necessary)
- Inspection and Certification
- Remove all steel that will not present a structural safety hazard, such as walkways etc.
- Site Restoration

The following guidance documents have been reviewed during preparation of this work plan:

- IOCP 385-1, Classification and Remediation of Explosive Contamination
- MKM Corporate OE/UXO Occupational Safety and Health Standard Operating Procedures (SOPs)
- DOD 6055.9-STD, Ammunition and Explosives Safety Standard
- DOD 4145.26M, Contractors' Safety Manual for Ammunitions and Explosives
- ETL 1110-1-170, Community Relations Plan for HTRW and OE Removal Actions
- EM 385-1-95a, Basic Safety Concepts and Considerations for Unexploded Ordnance Operations, 29 June 2001
- AR 385-10, The Army Safety Program

- AR 385-64, U.S. Army Explosives Safety Program
- TM5-855-1, Fundamentals of Protective Design for Conventional Weapons
- 'USACE HTRW CX Guidance, Safety and Health Scope of Work Language', 1994
- MKM Corporate Safety and Health Program
- Dust Control at Hazardous Waste Sites Handbook, OSWER Directive 9380.0-14.

2.0 BACKGROUND

A brief description of the facility, site history and location, and physical description are presented in the following subsections.

2.1 FACILITY LOCATION AND PHYSICAL DESCRIPTION

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

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

2.2 LOAD LINE 2 DESCRIPTION

LL-2 was used to melt and load Trinitrtoluene (TNT) and Composition B into larger caliber shells and bombs (Figure 3A in Appendix A). The line operated during World War II, from 1951 to 1957, and again from1969 to 1971. In addition, munitions demilitarization activities (debanding and TNT washout) were conducted during the late 1940s, and cartridge reclamation work was performed from 1951 to 1957. Pink water generated from the munitions assembly operations was collected in concrete sumps located throughout the load line, which connected settling tanks. After settling, the water was pumped by low-pressure steam ejectors into two tanks, approximately 26,200 liters

(6,900 gallons) in volume for cooling. When the water cooled to 800F, it was pumped through an overhead pipe to a sawdust filtration unit. The sawdust filtration unit consisted of a set of three parallel 3 x 9.1 x 0.9 meter (10 x 30 x 3 feet) concrete settling tanks and a set of three 1.5 x 4.6 x 0.9 meter (5 x 15 x 3 feet) filter blocks in the bottom of the filtration tanks. The contaminated sawdust used in the filter tanks and the settled sludge were periodically removed and destroyed at Winklepeck Burning Grounds (WBG). The effluent from the sawdust filtration units was discharged to Kelly's Pond, a triangular, unlined earthen settling impoundment, which is approximately 0.8 hectares (2 acres) in size and from 1.8 to 2.4 meters (6 to 8 feet) deep. The discharge from the impoundment was channeled to a surface stream that immediately exits the installation south of the load line and ultimately empties into West Branch of the Mahoning River (SAP Addendum No.1 for the Phase II RI of Load Lines 2, 3, & 4 at the RVAAP. Prepared by SAIC for the USACE, Louisville District. July 2001).

During its operational history, Load Line 2 produced about 10 million munitions and salvaged about 1.8 million kilograms (4-million pounds) of TNT during demilitarization work. When the facility was at full capacity, Load Line 2 generated approximately 3,192,000 liters (842688 gallons) of pink water per month (Jacobs Engineering 1989). In addition, chromic acid waste was discharged from building 802 into a ditch that ultimately discharges to Kelly's Pond (USACE 1998).

2.3 LOAD LINE 3 DESCRIPTION

Load Line 3 had a similar operational history as Load Line 2 (Figure 3B in Appendix A). Demilitarization activities were also conducted between 1951 and 1957. Pink water generated from assembly of munitions was also collected in concrete sumps located throughout the Load Line 3 area and pumped into settling tanks via steam ejectors. Sawdust used in filtration tanks and the settled sludge were periodically removed and destroyed at WBG. Effluents were discharged to unlined drainage ditches that ultimately emptied into Upper Cobbs Pond and then into Lower Cobbs Pond for settling. During its operational history, Load Line 3 produced about 6.5 million munitions and processed about 228,000 munitions during demilitarization work. Approximately 9,173 kilograms (20,226 pounds) of explosives scrap and sludge and 304,800 liters (80,467 gallons) of pink water were generated per month when the facility was at full capacity.

Beginning in the early 1950s, the Defense Logistics Agency (DLA) conducted a strategic materials storage mission at Load Line 3. One-hundred above-grade storage tanks (Tank Nos. 1401-1500) having a capacity of 500 barrels (21,000 gallons) were constructed to store strategic materials. Tanks Nos. 1401-1476 were used to store silica carbide. The remainder were used to store various other strategic solid materials. By the late 1970s, all but 20 tanks been removed; those remaining were used to store antimony, asbestos, and

magnesium silicate (talc). All DLA storage tanks are now empty; the remaining materials were removed approximately 1.5 years ago (SAP Addendum No.1 for the Phase II RI of Load Lines 2, 3, & 4 at the RVAAP. Prepared by SAIC for the USACE, Louisville District. July 2001). Table 1 provides a brief operations chronology for LL-2 & 3:

TABLE 1
LL-2 & 3 OPERATIONS CHRONOLOGY

Location	Munitions	Quantities
	World War II Era Production	
Load Line 2	155-mm projectile 8-inch projectile 240-mm projectile 4.5-inch projectile bomb, 100 lb. 6-inch projectile	5,100,830 665,499 109,518 65,865 48,415 32,879 Total = 6,023,006
Load Line 3	8-inch projectile Bomb, 100 lb. Bomb, 500 lb. Bomb, 2,000 lb. 155-mm projectile 240-mm projectile Bomb, 1,000 lb.	582,586 293,670 131,862 91,536 73,701 73,100 13,309 Total = 1,259,764
	Late 1940s Demilitarization Activities	
Load Line 2	Debanding and TNT washout/recovery	1,800,000 kg of TNT salvaged
Load Line 2	Cartridge case reclamation	NA
Load Line 3	M74, 3-mm shot M1, 105-mm projectile M80, 3-mm shot	219,773 8,015 360 Total = 228,148
	1951 to 1957 Production	
Load Lines 2 and 3	M107, high explosive, 155-mm projectile M101, high explosive, 155-mm projectile	5,619, 243 256,585 Total = 5,875,828
Load Line 2	M106, 8-inch projectile M73, 120-mm projectile M101, 155-mm projectile	946,922 876, 947 63,502 Total = 1,887,371
	1969 to 1971 Production	
Load Line 2	175-mm projectile (TNT change)	Total = 372,803
Load Line 3	155-mm projectile (Composition B charge)	Total = 2,275,695

NA = Not available TNT = Trinitrotoluene

Source: SAP Addendum No.1 for the Phase II RI of Load Lines 2,3, & 4 at the RVAAP. Prepared by SAIC for the USACE, Louisville District. July 2001.

2.4 PREVIOUS INVESTIGATIONS SUMMARY

In July and August of 1996 Science Applications International Corporation (SAIC) conducted a Phase I RI to collect and analyze data needed to meet the established Data Quality Objectives (DQOs) for 11 high-priority AOCs identified during the facility-wide Preliminary Assessment for RVAAP (USACE 1996a). Load Lines 2 and 3 were identified as two of 11 AOCs. The following paragraphs provide a summary of the results from the Phase I investigations at LL-2 & 3 relative to potential site related contaminants.

Load Line 2

Environmental data from the Phase I shows that in soil, elevated concentrations of TNT and other explosives, inorganics and organics (PAHs and PCBs) occur in the central portion of LL-2, particularly around the doorways, drains, and vacuum pumps of the melt/pour buildings and other buildings. The maximum concentration of TNT was 12,000 ppm. Several inorganics including chromium, lead and manganese were also found to exist in soil above background. In sediment, explosives, inorganics, and PAHs/PCBs were observed in the drainage ditches leading to Kelly's Pond (SE of the load line) and in pond sediments. Low concentrations of DNT were found in groundwater at the perimeter of the LL-2 Area of Concern (AOC), and inorganics were also detected. It does not appear that the majority of the other chemicals found in soil and sediment migrated to the groundwater.

Load Line 3

In soil, elevated concentrations of TNT and other explosives, inorganics, and organic PAH and PCB compounds occur particularly around the doorways, drains and vacuum pumps of the melt/pour buildings and other buildings. The maximum explosive concentration in soil was reported at 390,000 ppm. Metals (soil) that were detected above background and USGS reference values include chromium, copper and lead. In sediment explosives were found to be present at moderate concentrations, especially in ditches around the melt/pour buildings. The maximum TNT concentration reported in sediment is 4.6 ppm. The highest concentrations of metals in sediment occur near building EB-4 and the drainage channel leading to Upper and Lower Cobbs Pond. Groundwater was not evaluated at this AOC.

Refer to the LL-2 & 3 Site Safety and Health Plan for details regarding exposure limits and potential health affects associated with potential chemicals of concern for this project.

3.0 PROJECT PERSONNEL

MKM has developed an Organizational Chart designed to safely, thoroughly, and efficiently conduct all tasks outlined in this Work Plan. The Organizational Chart for the Disassembly/Decontamination and Disposal of Equipment in specified buildings at LL-2 & 3 is shown in Figure 4 in Appendix A. This figure outlines the management structure that will be used to implement the process equipment disassembly, decontamination and disposal operations at Load Line 2 and Load Line 3. If changes in the MKM personnel or changes to the scope of work require a change to this organizational chart, MKM will immediately notify OSC and provide an amended organizational chart. The following subsections describe in brief the functional responsibilities of the key project personnel.

3.1 PROJECT MANAGER

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

3.2 CORPORATE SAFETY AND HEALTH MANAGER

The MKM Corporate Safety and Health Manager (CSHM) has the direct responsibility for developing and implementing the Site Safety and Health Plan for the project. This individual will ensure that health and safety procedures designed to protect personnel are maintained throughout all field activities conducted at RVAAP. This will be accomplished by providing occupational safety and health technical support to the SSHO and other project personnel. The CSHM will also assist with conducting task and hazard specific training and conduct periodic safety and health audits. Additional information related to the roles and responsibilities of the CSHM are included in Section 2 of the SSHP.

3.3 SENIOR UXO SUPERVISOR

The Senior UXO Supervisor (SUXOS) will act as the lead technical consultant for all on-site OE-related safety and operational matters. The SUXOS is responsible for implementation of all project-level UXO tasks and site-level implementation of the

Explosive Safety Submission (ESS). This individual will be responsible for assuring that adequate safety measures and house keeping are taken during all phases of site operation, to ensure disassembly/decon activities are carried out in a safe, clean, efficient and economical manner.

3.4 SITE SAFETY AND HEALTH OFFICER (SSHO)

The SSHO is responsible for on-site implementation of the Site Safety and Health Plan. This individual will conduct the safety portion of daily safety meeting and conduct and document site training related to site-specific hazards. The SSHO will also be responsible for conducting visitor orientation, daily safety inspections and weekly safety audits. The SSHO will specify the proper levels of PPE in accordance with the requirements of the SSHP and will be responsible for investigating any site-related injuries, illnesses, accidents, incidents and near misses. The SSHO will also communicate and coordinate closely with the CSHM regarding safety and health issues. Additional information related to the duties and responsibilities of the SSHO are outlined in Section 2.0 of the SSHP.

3.5 QUALITY CONTROL MANAGER

The Quality Control Manager (QA/QC Manager) is responsible for ensuring the completeness of disassembly/decon operations and ensuring the accuracy of site documentation. This individual will conduct quality surveillances of disassembly/decontamination procedures and be responsible for project-level documentation, including daily and weekly field reports and scrap material inspection forms. In addition the QA/QC Manager will be responsible for both project-level environmental management and waste management activities.

4.0 SCRAP INSPECTION QUALITY CONTROL (QC)

Visual inspection and/or field screening (EXPRAY or equivalent) will be used as the primary QC methods for 5X certification of metal scrap (process equipment/piping and non-process piping such as steam, conduit, fire suppression). The following subsections outline the procedures for scrap inspection activities at LL-2 and LL-3.

Once process equipment and piping and non-process piping has been disassembled, an initial two-part inspection will be performed by one of the UXOT2s and the Team Leader of the team that removed the item to determine the status of the components. Upon inspection the components will be segregated (i.e., contains explosive residue, does not contain explosive residue) and staged at the Interim Accumulation Area. A third inspection will be performed by the SUXOS at the Interim Accumulation Area to confirm the condition of the components classified as free of explosive residue. If necessary, items with potential explosive hazards will be moved to the Demolition Area and 200 grain det cord will be inserted inside the equipment/piping and initiated remotely to expose all surfaces for inspection and/or removal of any residual explosive hazards. Further decontamination and additional inspections of this material will be performed as needed (see Section 8.5). Once classified as clean, the equipment and piping will be transported to the Direct Disposal Area for consolidating prior to loading by the disposal facility. Only personnel who are qualified UXO personnel per CEHNC Contract Data Item Description (DID) OT-025 will perform these inspections until it is classified as clean.

The UXO QC Manager will be involved in the scrap process conducting quality surveillances of the procedures used by UXO teams and individuals for processing scrap throughout the field operations. He will perform visual inspections and random field screening on every container of scrap generated to ensure no items of a dangerous or explosive nature are identified as hazard free. All quality surveillance will be documented in daily/weekly reports.

A letter memo will be submitted to the recycling/salvage facility prior to the transport of any scrap. The letter will contain the following language to certify the scrap has been properly inspected and certified as free of explosive hazards:

"This certifies that the Explosive Process Equipment and Piping listed has been 100 percent properly inspected and to the best of our knowledge and belief, are inert and /or free of explosives or related material".

The letter will include the following information: the level of decontamination achieved (5X), the decontamination method(s) used, the decontamination completion date, suspected contaminant, source and the signatures of the SUXOS and the QC Manager.

5.0 PROJECT NOTIFICATIONS AND SURVEY

5.1 SUBMISSION OF NOTIFICATION

Public Notification:

The Ravenna Army Ammunition Plant has a Community Relations Plan. The Restoration Advisory Board (RAB) and public attended the July 27, 2002 RAB meeting where they were informed about the disassembly/decontamination activities to be performed at LL-2 and LL-3. During this meeting discussions ensued regarding project activities and schedule, and public comment was solicited. In addition, prior to initiating the field operations, a press release will be issued by the Army to further inform the public about the intended disassembly/decontamination operations at LL-2 and 3.

Emergency Response and General Notifications:

Prior to the initiation of site activities, MKM will contact all local emergency services to verify the availability of requisite services and to confirm the means used to summon the services. General notifications will be made to key project personnel at this time as well. This includes the following contacts:

- Air Space and Procedures Office, Cleveland Air Route Traffic Control Center (Notice to Airmen) Mark Agostinelli – (440)-774-0609
- RVAAP Security Dispatcher (Post 1) – (330)-358-2017
- Ravenna City Fire Department (330) 296-6422
- Hospital – Robinson Memorial Hospital (330) 297-0811
- Police –Portage County Sheriff Office (330) 296-5100/325-1023
- Police –Trumbull County Sheriff Office (330) 675-2540
- Ambulance - Ravenna City Fire Department (330) 297-5738
- William Ingold – OSC Project Manager (309) 782-1395/2213
- Jerry Bryan – OSC Safety Office (309)-782-2983
- John Cicero – RVAAP Commander Representative (330) 358-7311
- Mark Patterson, RVAAP, Environmental Coordinator (330) 358-7311
- Mark Davis, Akron Regional Air Quality Management District (330) 375-2480 (asbestos removal notification)

3/10/03 - add Local Media Notification TBA Local Radio, TV, newspapers

MKM will provide each contact with a detailed schedule describing when and where explosives will be detonated during explosive disassembly. If the schedule is modified,

MKM will provide each contact with the modified schedule before the modifications are implemented. RVAAP personnel will be responsible for notifying all other contractors working at other locations on the RVAAP.

5.2 ENGINEERING SURVEY

In order to ensure the safety of all site workers, an engineering survey will be performed on each of the targeted buildings at LL-2 & 3. The purpose of the engineering survey is to evaluate the structural integrity and current condition of each building/ structure prior to, during and following the disassembly/decontamination operations.

An independent firm demonstrating an expertise in structural engineering will conduct the engineering survey. The initial engineering survey will identify the layout of the buildings and structures, and the condition of the framing, floors, walls, and ceiling as well as non-structural steel items targeted for removal. The survey will identify the possibility of an unplanned collapse of any portion of the structures or any adjacent structure where employees or property may be exposed. The engineering survey will plan for potential hazards such as fires, collapses, cave-ins, and injuries.

It may be necessary in the course of this project to remove certain internal structural members which are explosively contaminated within the construction material layers. It may also be necessary to perform the alteration of outer walls in order to accomplish equipment removal during this project. As a result, continued inspections will be performed as necessary to ensure the structural integrity of targeted buildings is maintained throughout the project. Inspections shall detect hazards resulting from weakened or deteriorating floors, walls, or loosened material. If the internal structure of targeted buildings has been damaged, appropriate measures, including bracing and shoring of walls and floors, shall be taken to protect workers and any adjacent structures. Only those personnel essential to the installation of such items will be permitted inside the effected area until the control measures are in place.

6.0 MOBILIZATION

The initial mobilization will consist of the project management team to setup the project office, conduct a pre-project safety review and initial walkthrough, obtain information to submit permit application, and determine site-specific safety rules. MKM will conduct utility clearances, mobilize project equipment to the site, setup the decontamination area, setup the waste storage area, prep the thermal flashing furnace and arrange for proper storage of explosive and demolition materials.

6.1 SITE UTILITY CLEARANCE / CONFIRMATION OF ELECTRIC LOCKOUT / TAGOUT

MKM will ensure that all incoming electric, water, natural gas, compressed air, and steam lines have been locked and tagged out. All equipment within the buildings will be checked and tagged to ensure that no electrical or energetic source is or can be supplied. Utility clearance shall consider both overhead and underground utilities. MKM will consult available building plans and utility plans, which indicate the location of all service lines and the means for their control.

6.2 PROJECT EQUIPMENT

MKM will mobilize a full crew and all associated materials and equipment to perform disassembly/decontamination operations. MKM plans to mobilize the following equipment to assist in disassembly/decontamination operations:

- Long reach excavator w/ bucket and grappler
- Telescopic forklift
- Front end loaders
- Industrial forklift
- Crane and Wrecking Ball
- Scissor lift or boom lift
- 4x4 pickups
- See-Snake®
- Panoramic camera w/ monitor
- ATF-approved portable magazine
- Explosive demolition supplies, day box, blasting machines, galvanometers, sound meter, bull horn, firing wire, explosive placards
- Storage container
- Pallet jacks
- Portable communication radios

- Site vehicles and pickup trucks
- Office trailer w/ cellular phones
- Tool trailer
- Rolloff/dumpsters/55-gal drums
- 6 mil plastic liner
- Scaffolding
- Diesel fuel tank and relevant diking/containment supplies
- 5000 gallon baker tank (water storage)
- Pressure washers
- Pumps/Hoses
- First aid kit, fire blanket, eye wash kit, burn kit, fire blanket, and bloodborne pathogen kit for each team or work area, stretchers, 15-minute eyewash station, trauma kit and industrial first aid kit
- Fire extinguishers for each team and/or work area, office/storage area, and fuel storage area
- Decon showers
- Portable lighting
- Air compressor
- Generator and
- Misc. equipment and various tools required.

6.3 SET-UP OF DECONTAMINATION AREA

It is anticipated that one Decontamination Area (DA) will be set up at each of the two load lines. The Decontamination Areas (DA) for LL-2 and LL-3 will be set up on a leveled area near the building/structure where explosive disassembly is to occur. The DA will be built on a 40 mil HDPE liner with a bermed perimeter using railroad ties to contain all liquid and residue arising from the cleaning operations. The DA consists of three distinct areas: the Decon Pressure Wash Area, the Disassembly Area, and the Direct Disposal Operations Area:

Decon Pressure Wash Area – Area of the DA that is set up to facilitate pressure washing of equipment and piping as needed.

Inspection and Certification (ICA) Area – Area adjacent to DA (or at other strategic location) set up to facilitate inspection of disassembled equipment and piping. Inspection operations will be performed in accordance with the procedures outlined in Section 4.0. Inspections are performed to ensure there are no visible traces of explosive material on equipment and piping and to determine if further disassembly is needed to expose all surfaces.

Disassembly Area – Area of DA set up to facilitate disassembly of factory sealed units using perforators to expose all surfaces as needed. The interior components (electrical cables, contacts, etc.) are collected in the 55-gallon drums and staged in the area. Once all surfaces are exposed, the items are sent back to the DPW area for further Pressure washing to achieve level 5X condition.

Direct Disposal Operations Area – Area adjacent to DA (or at other strategic location) set up to facilitate staging, weighing and public viewing, of scrap for competitive bids. Only equipment that is certified 5X may be taken to the DDO area, where is will be stored in recycling containers.

Refer to Section 6.5 for details on equipment and piping decontamination procedures.

6.4 WASTE STAGING AREA

Based on previous experiences and MKM's preliminary survey of the buildings, several wastes are expected to be accumulated during disassembly/decontamination. Table 2 summarizes the wastes anticipated to be accumulated during the disassembly/ decontamination operations at LL-2 & 3.

During the mobilization task a waste storage area will be set up within the fenced area of the load lines to facilitate storage of non-hazardous waste streams. The location of the waste storage area will be pre-approved by RVAAP Environmental Coordinator. Alternate areas may also be considered based on safe distances from disassembly/ decontamination activities. Hazardous waste (if any) generated during this project will be staged at the RVAAP 90-day hazardous waste storage area established at LL-1. Waste storage areas will be built and operated according to EPA and State regulations. Each waste stream will have its unique assigned storage area to prevent commingling of potential asbestos contaminated wastes with hazardous, Class I Non-hazardous and construction debris wastes. Only uniquely numbered, leak-free, clean, labeled, and covered waste containers will be placed in the waste storage areas. No hazardous waste container will remain in the 90-day storage area for more than 90 days. The storage areas and containers will be inspected weekly. Inspection results will be recorded on the Weekly Waste Storage Inspection Record.

TABLE 2
Summary of Projected Wastes at LL-2 and LL-3
Ravenna Army Ammunition Plant

Waste Stream	MKM Disposal Outlet*	Sampling	Frequency
Organic Debris	Biopad	Not Applicable	Not Applicable
Asbestos - Transite	Offsite disposal	Asbestos by Polarized Light microscopy	Not Applicable
Mercury-Containing Debris	Offsite disposal	Not Applicable	Not Applicable
Suspect PCB –containing equipment	Temporary	PCB by Method 8082	1 composite/LL
Fluorescent Lights	Offsite Disposal	Not Applicable	Not Applicable
Decontamination Water	Biopad or Offsite Disposal	Explosives by Method 8330	1 composite/LL
Process Equipment and Piping	1. Det cord flashing + decon by power washing or furnace + downsize + visual inspection + recycle facility. Or 2. Det cord flashing + downsize + visual inspection + smelter.facility.	Not Applicable	Not Applicable

* MKM reserves the right choose the most economical disposal option that will comply with applicable Federal, State and Local regulations.

6.5 THERMAL DECONTAMINATION AREA

A mobile flashing furnace for the purpose of decontaminating explosively contaminated equipment is currently set up at LL-2 and has been in operation for other thermal decontamination activities at the RVAAP. As a result, the furnace compound has been inspected and meets or exceeds all operational requirements. The compound is secured by chain link fence and is equipped with appropriate safety equipment, including the necessary spill response kits. Refer to Section 6.5 for details on flashing furnace decontamination operations.

6.6 STORAGE OF EXPLOSIVE AND DEMOLOTION MATERIALS

All explosives will be stored on-site in a portable ATF approved Type 2, Class ABC explosive storage magazine. The storage site for the portable magazine will be inside the ~~WS-3~~ igloo at the RVAAP Wet Storage Area (Identified as Area #45 on Figure 2 – Appendix A).

The safety distances of the Explosive Storage (ES) Area are as follows:

- The portable explosive storage magazine is located at the RVAAP Wet Storage Area approximately 1.6 miles from the demolition sites.
- The site trailer will be on the NE end of LL-2, approximately 2 miles from the explosive storage magazine.
- The diesel fuel storage point is on the NE end of LL-2, approximately 2 miles from the explosive storage magazine.

See Figure 2 in Appendix A for the locations of LL-2 and LL-3 in relation to the RVAAP Wet Storage Area.

As explosives are purchased and received by MKM at RVAAP, they will be immediately stored in the Type 2 portable magazine at the RVAAP Wet Storage Area. The entire Wet Storage Area is secured by chain link fence and locked at all times. Additionally, a high security lock is fastened to the access door of the WS-3 igloo. MKM SUXOS and Demo Supervisor will maintain the keys for all of the above-mentioned locks. MKM will maintain an MKM Explosive Accountability Record which will provide a detailed itemization of all explosives in the magazine. The MKM Explosive Accountability Record will be completed/updated every time explosives are added to or removed from the magazine. The UXO Demolition Supervisor or the SUXOS will be responsible for accessing the magazine and properly completing the Record.

During explosive disassembly activities, MKM will remove only enough explosives expected to be used for one day. If any unused explosives are present at the end of the workday, MKM will transport the unused portion back to the magazine located in the WS-3 igloo.

MKM will document the quantities of piping/equipment cut in place during the explosive disassembly activities on an MKM Demolition Shot Record. The UXO Demolition Supervisor will record the location and type of pipe/equipment detonated in-place for inclusion in the Record (is this correct). He will be responsible for the proper storage, issue, and maintenance of all explosives and explosives' records.

6.6.1 Magazine Requirements

The following magazine requirements are applicable to the Type 2 storage magazine provided by MKM. Magazine construction is in accordance with BATF P 5400.7. Each door is to be equipped with one of the following locks (as listed in Section 55.208(a), ATF P5400.7):

- S&G 833C, Padlock, Key Operated, High Security, Shrouded Shackle
- S&G 831B, Padlock, Key Operated, High Security, Shrouded Shackle
- HI SHEAR LKI2OO, High Security Padlock.

Smoking, matches, open flames, spark-producing devices, and firearms shall not be permitted inside of or within 50 feet of magazines. The land surrounding the magazines shall be kept clear of all combustible materials for a distance of at least 25 feet. Combustible materials shall not be stored within 50 feet of magazines.

6.6.1.1 Placarding

Property upon which outdoor type magazines are located shall be posted with signs reading "EXPLOSIVES - KEEP OUT," legibly printed thereon in letters not less than three inches high on a reflective surface. Such signs shall be located so as to minimize the possibility of a bullet traveling in the direction of the magazine if anyone should shoot at the sign. A hazard identification for fire fighting personnel (indicated by a distinctive symbol in order to be recognized by the fire fighters approaching the fire scene) will be the only sign displayed. For the purpose of identifying the symbol from long range, the symbol shape shall be as follows: Octagon shape with an orange background, 10" high by 2" thick black number "1", and with each side of the octagon 10" in length. Class 1 (explosive) Division 1.1 placards as prescribed by the U.S. Department of Transportation in Title 49 CFR Parts 171 - 180 and 390 - 397 will not be placed on the outside of the magazines.

6.6.1.2 Inspections

The RVAAP Wet Storage Area igloo (WS-3) used to house the Type 2, Class ABC explosive storage magazine will be inspected at least once every 48 hours. Inspections will be conducted to ensure that the igloo is secured/locked and has not been entered by unauthorized personnel. MKM will be responsible for conducting security inspections during all scheduled workdays. The RVAAP security personnel will be responsible for conducting the security inspections during holidays, etc. All inspections will be documented on an MKM Magazine Inspection Record.

6.6.1.3 Material Storage

Packages of explosives stored within the magazine shall be laid flat with top up. Corresponding grades or brands shall be stored together in such a manner that brands/grade marks show, easily counted and checked, and in a stable manner. Tools used for opening packages of explosives shall be constructed of non-sparking materials.

6.6.1.4 Lightning Protection/Grounding

The Type 2, Class ABC explosive storage magazines is provided lightning protection by the existing lightning protection systems intended to protect the earth-covered igloos. The lightning systems for the earth-covered igloo extends approximately 3' above the igloo, and the grounding systems for the Type 2 explosive storage magazine is grounded to the earth-covered igloo. The approved grounding kit is inspected annually by a certified electrician.

6.6.2 Transportation of UXO/Demolition Materials On-Site

Either the UXO Demolition Supervisor or SUXOS will escort all movement of explosives and OE. All loads will be visually inspected by the SUXOS or Demolition Supervisor to ensure they are properly secured and safe to move. If in his opinion the material is improperly loaded, he shall initiate whatever corrective action he deems necessary before allowing the load to move.

When transporting explosives or OE, vehicles will not exceed the authorized speed limit. In many areas a prudent speed may be less than 25 mph, in which case the driver may not exceed a safe and reasonable speed.

Detonators and high explosives will remain separated at all times during transport. Suitable metal containers will be used for this purpose. The internal space of the container will be padded and the boxes will be separated by the largest distance possible

in the bed of the truck. The containers will remain closed at all times, except when actually using the materials.

Vehicles hauling OE will remain covered at all times, except when actually loading or unloading, and a flame resistant tarpaulin or a metal container with a flame resistant lid (such as a metal ammunition box) may be used for this purpose.

Vehicles transporting explosives and OE will be placarded with a Department of Transportation "Explosives Class 1.1" placard. Class 1.1 consists of explosives that have a mass detonating hazard.

6.6.3 Establishment of Quantity of Explosives and Fragmentation Distances

The following safe separation distance apply to the site magazines with a maximum of 150 pounds NEW (worst case scenario) of Class 1.1 explosives per magazine. Based on DoD 6055.9 STD Ammunition and Explosives Safety Standards, October 1992, the distance to inhabited buildings is 500 feet and the distance to the nearest public road is 300 feet. Refer to Tables A and B below.

Table A - Demolition Explosives

Description	Class/ Division	Quantity	Net Explosive Weight	Storage Compatibility Group
Blasting Caps	1.1	50 ea.	Less than 1.0 lb.	B
Jet Perforators (Shape Charge)	1.4	40 ea.	6.0 lbs.	D
Detonating Cord (80 gr. per foot)	1.1	1000 ft	7.0 lbs.	D
Detonating Cord (200 gr. per foot)	1.1	1000 ft	28.6	D
C-4 RDX	1.1	37 lb. bulk	37 lb.	D

Table B - Inhabited Building and Public Traffic Route Distances Class 1, Division 1

Net Explosive Weight (NEW)		Distance in Feet to Inhabited Building from Class II Magazine		Distance in Feet to Public Traffic Route from Class II Magazine	
Over	Not Over	Front	Rear/Side	Front/Side	Rear/Side
100lbs	150lbs	500	250	300	150

7.0 SITE PREPARATION TASKS

7.1 HAZARD ANALYSIS

Prior to any disassembly/decontamination activities, MKM Senior UXO Supervisor (SUXOS), Site Safety and Health Officer (SSHO) and Corporate Safety and Health Manager will perform a hazard analysis (evaluation) of the inside and perimeter of buildings to identify any unknown/unsuspected contaminants or hazards. Site work plans may be altered based on the results of the hazard analysis to ensure the safety and health of all workers and the surrounding environment.

7.2 LIMITED ASBESTOS ABATEMENT

The process-related asbestos, as well as any remaining transite roofing/siding material that that could be damaged during the disassembly/decontamination activities will be removed prior to initiating site operations. MKM does provide for the contingency removal of asbestos and lead when unexpectedly encountered (e.g. in lighting fixtures) during disassembly/decontamination activities.

7.3 ASBESTOS REMOVAL

The asbestos insulation on overhead process piping and the transite roofing/siding will be removed by an approved asbestos contractor prior to any explosive disassembly activities. The removal is mandatory to prevent uncontrolled damage of the ACM during shape charge disassembly operations. MKM will also remove and properly dispose of asbestos gaskets and linings encountered during disassembly of lighting fixtures, etc. during this step in the Decontamination Area. The asbestos removal operations will follow the specific procedures outlined in the Asbestos Contractor's Work Plan and Site Safety and Health Plan prepared for this project.

7.4 ASBESTOS DISPOSAL OPTIONS

Properly labeled friable and non-friable ACM will be disposed of to an EPA-approved landfill facility.

7.5 OTHER ASBESTOS CONTAINING MATERIAL

Other ACM which may be encountered during manual disassembly/ decontamination include friable and non-friable asbestos material within the interior of equipment, in machine and brake linings, hose casings, and belts. Asbestos insulation, asbestos gaskets

in lighting fixtures, asbestos mortar, galbestos roofing, may also be encountered. Removal of these items will be conducted as encountered and performed by an approved asbestos contractor.

7.6 REMOVAL OF LOOSE EQUIPMENT, CONTAMINATED CANISTERS, CARTS, ETC.

Under the direction of MKM SUXO Supervisor and SSHO, loose equipment, trolleys, carts, canisters, conveyor rollers, lumber, and miscellaneous debris will be removed from the buildings as needed to facilitate the disassembly/decontamination activities. This equipment will be taken to the decontamination area for decontamination procedures.

8.0 DISASSEMBLY, DECONTAMINATION AND DISPOSAL OF EXPLOSIVE-CONTAMINATED EQUIPMENT

8.1 IDENTIFICATION OF EQUIPMENT TO BE DISASSEMBLED AND DECONTAMINATED

Table 3 summarizes the list of buildings containing the process equipment and piping, and non-process piping (i.e. steam, conduit, fire suppression) that will be disassembled and decontaminated during this project. At LL-2, a total of nineteen (19) buildings are included in the current scope of work: Melt Load Buildings (DB-4 & DB-4A 2nd & 3rd floors), Washout Buildings (DB4-WS, DB-4WN, DB-4AWS, DB-4AWN, & DB-25), Vacuum Pump Houses (DB-4VP1, DB-4AVP1, DB-10VP1, & DB-10VP2), High Explosive Prep. Buildings (DA-6 & DA-6A), TNT Service Building (DA-7), Drilling and Booster Building (DB-10), Packing and Shipping Building (DB-13), T., Barricade Shipping (DB-13A), Shipping Warehouse Annex (DB-13B) and X-Ray Building (DB-26).

At LL-3, a total of sixteen (16) buildings are included in the current scope of work: Cool, Probe, Repair, Melt Load (EB-4), Washout Annex Buildings (EB-4WN, EB-4WS, EB-4AWN & EB4AWS), Vacuum Pump Houses (EB-4VP1, EB-4AVP1, EB-10VP1 & EB-10VP2), Melt Load House (EB-4A), Explosive Prep. Buildings (EA-6 & EA-6A), Drilling and Boostering Building (EB-10), X-Ray Building (EB-10A), Washout Building (EB-25), and Assembly and Shipping Building (EB-13).

8.2 ESTABLISHING SITE CONTROL

8.2.1 Minimum Separation Distance (MSD)

The RVAAP is a secured facility with no inhabited buildings/vehicular traffic on public roads within 1,250 feet of LL-2 or LL- 3. As such, MKM will maintain a 1,250 Minimum Separation Distance (MSD) around LL-2 & 3 during all explosive disassembly operations. Additionally, an MSD of 680 feet will be established around the RVAAP Wet Storage Area where the Type 2, potable explosive storage magazine is sited. The MSD is designed to protect RVAAP personnel, other contractors working at the RVAAP, public personnel, as well as the MKM personnel working on the project. The MSD for both load lines, the wet storage area and the location of the field office trailer relative to facility boundaries are shown on Figure 5 in Appendix A.

TABLE 3
HAZARD CLASSIFICATION FOR BUILDINGS AT LL-2
RAVENNA ARMY AMMUNITION PLANT, RAVENNA, OHIO

BLDG. #	FLOOR	BAY	FUNCTION	EXPLOSIVE / LIMITS	REFERENCE	HAZARD CLASS
DC-1	1		Boiler House	n/a	Property Cards and Maps	PEB
DB-2	1		Paint and Oil Storage	n/a	Property Cards and Maps	NEB
DB-3	1		Shell Receiving & Painting	n/a	Property Cards and Maps	NEB
DB-4	3		Melt Load Bldg	TNT/Comp B	Property Cards and Maps	EB
DB-4A	3		Melt Load Bldg	TNT/Comp B	Property Cards and Maps	EB
DB-4WN	1		Washout Bldg	TNT/Comp B	Property Cards and Maps	EB
DB-4WS	1		Washout Bldg	TNT/Comp B	Property Cards and Maps	EB
DB-4VP1	1		Vacuum Pump House	TNT/Comp B	Property Cards and Maps	EB
DB-4AWN	1		Washout Bldg	TNT/Comp B	Property Cards and Maps	EB
DB-4AVP1	1		Vacuum Pump House	TNT/Comp B	Property Cards and Maps	EB
DB-4AWS	1		Washout Bldg	TNT/Comp B	Property Cards and Maps	EB
DB-5	1		Comp B Service	TNT/Comp B	Property Cards and Maps	EB
DA-6	1		High Explosive Prep Bldg	TNT/Comp B	Property Cards and Maps	EB
DA-6A	1		High Explosive Prep Bldg	TNT/Comp B	Property Cards and Maps	EB
DA-7	1		TNT Service Bldg	TNT/Comp B	Property Cards and Maps	EB
DB-8	2		Change House	n/a	Property Cards and Maps	PEB
DB-8A	2		Change House	n/a	Property Cards and Maps	PEB
DB-9	1		Booster Service Bldg	TNT/Comp B	Property Cards and Maps	EB
DB-9A	1		Booster Service Bldg	Tetryl, RDX, Black Powder	Property Cards and Maps	EB
DB-10	1		Drilling & Booster Bldg	Tetryl, RDX, Black Powder	Property Cards and Maps	EB
DB-10VP1	1		Vacuum Pump House	Tetryl, RDX, Black Powder	Property Cards and Maps	EB
DB-10VP2	1		Vacuum Pump House	Tetryl, RDX, Black Powder	Property Cards and Maps	EB
DB-11	1		Fuze Service Bldg	Tetryl, RDX, Black Powder	Property Cards and Maps	EB
DB-13	1		Packing and Shipping	TNT/Comp B	Property Cards and Maps	EB
DB-13A	1		T. Barricade Shipping	TNT/Comp B	Property Cards and Maps	EB
DB-13B	1		Shipping Warehouse Annex	TNT/Comp B	Property Cards and Maps	EB
DB-19	1		Elec Locomotive Service	n/a	Property Cards and Maps	NEB
DB-20	1		Line Office Bldg	n/a	Property Cards and Maps	NEB
DA-21	1		TNT Box Bldg	TNT/Comp B	Property Cards and Maps	EB
DB-22	2		Change House	n/a	Property Cards and Maps	PEB
DB-25	1		Washout Bldg	TNT/Comp B	Property Cards and Maps	EB

TABLE 3
HAZARD CLASSIFICATION FOR BUILDINGS AT LL-2
RAVENNA ARMY AMMUNITION PLANT, RAVENNA, OHIO

BLDG. #	FLOOR	BAY	FUNCTION	EXPLOSIVE / LIMITS	REFERENCE	HAZARD CLASS
DB-26	2		X-Ray Bldg	TNT/Comp B	Property Cards and Maps	EB
DB-27	1		Cyclic Heating Building	TNT/Comp B	On Maps	EB
DB-27A	1		Boiler Plant	TNT/Comp B	On Maps	EB
DB-27B	1		Boiler House	na	On Maps	NEB
DB-27C	1		Shipping Building	TNT/Comp B	On Maps	EB
DA-28	1		Elevator Machine House	n/a	Property Cards and Maps	NEB
DA-28A	1		Elevator Machine House	n/a	Property Cards and Maps	NEB
DB-29	1		Elevator Machine House	n/a	Property Cards and Maps	NEB
DB-30	1		Elevator Machine House	n/a	Property Cards and Maps	NEB
DB-802	1		** Inert Storage Warehouse	n/a	Property Cards and Maps	NEB
2-51	1		Gate House	n/a	Property Cards and Maps	NEB
2-51A	1		Office	n/a	Property Cards and Maps	NEB

*** Information taken from property cards and maps dated 1941, 1956, and 1979.**

Notes:

Explosive Building (EB)

Non-Explosive Building (NEB)

Potential Explosive Building (PEB)

** Structurally Unsound Bldg as determined by competent person

NOTE: Scope only includes removal of exposed above ground process equipment and piping, including any other exposed above ground piping (i.e. steam, conduit, fire suppression) that exists in EBs.

* Boiler house not included in current scope of work

TABLE 3 (continued)
HAZARD CLASSIFICATION FOR BUILDINGS AT LL-3
RAVENNA ARMY AMMUNITION PLANT, RAVENNA, OHIO

BLDG. #	FLOOR	BAY	FUNCTION	EXPLOSIVE / LIMITS	REFERENCE	HAZARD CLASS	
EB-2	1		Service	n/a	Property Cards and Maps	NEB	
EB-3	1		Inert Component Prep/ Segregation/Shell Receiving	n/a	Property Cards and Maps	NEB	
EB-4	3		Cool, Probe, Repair Melt Load	TNT/Ammonium Nitrate	Property Cards and Maps	EB	
EB-4WN	1		Washout North Annex	TNT/Ammonium Nitrate	Property Cards and Maps	EB	
EB-4WS	1		Washout South Annex	TNT/Ammonium Nitrate	Property Cards and Maps	EB	
EB-4VP1	1		Vacuum Pump	TNT/Ammonium Nitrate	Property Cards and Maps	EB	
EB-4A	3		Melt Load	TNT/Ammonium Nitrate	Property Cards and Maps	EB	
EB-4AWN	1		Washout North Annex	TNT/Ammonium Nitrate	Property Cards and Maps	EB	
EB-4AWS	1		Washout South Annex	TNT/Ammonium Nitrate	Property Cards and Maps	EB	
EB-4AVP1	1		Vacuum Pump	TNT/Ammonium Nitrate	Property Cards and Maps	EB	
EA-5	1		Temp Storage/Ammonium Nitrate Service	Ammonium Nitrate	Property Cards and Maps	EB	
EA-6	1		Explosive Prep	TNT/Ammonium Nitrate/Comp B/HMX	Property Cards and Maps	EB	
EA-6A	1		Explosive Prep	TNT/Ammonium Nitrate/Comp B/HMX	Property Cards and Maps	EB	
EA-7	1		Explosive Service	TNT/Ammonium Nitrate/Comp B/HMX	Property Cards and Maps	EB	
EB-8	2		Change house	n/a	Property Cards and Maps	PEB	
EB-8A	2		Change house	n/a	Property Cards and Maps	PEB	
EB-9	1		Booster Service	Tetryl/RDX	Property Cards and Maps	EB	
EB-9A	1		Booster Service	Tetryl/RDX	Property Cards and Maps	EB	
EB-10	1	1	Drilling and Boostering	Tetryl/RDX	Property Cards and Maps	EB	
EB-10A	1		X-ray	TNT/Ammonium Nitrate	Property Cards and Maps	EB	
EB-10VP1	1		Vacuum Pump	TNT/Ammonium Nitrate	Property Cards and Maps	EB	
EB10-VP2	1		Vacuum Pump	TNT/Ammonium Nitrate	Property Cards and Maps	EB	
EB-11	1		Fuze Service	RDX, Tetryl, Black Powder	Property Cards and Maps	EB	
EB-13	1		Assembly and Shipping	TNT/Ammonium Nitrate	Property Cards and Maps	EB	
EB-13A	1		Barricade and Shipping	TNT/Ammonium Nitrate	Property Cards and Maps	EB	
EB-13B	1		Shipping Warehouse	TNT/Ammonium Nitrate	Property Cards and Maps	EB	
EB-19	1		Electric Locomotive Service	n/a	Property Cards and Maps	NEB	
EB-20	1		Line Office	n/a	Property Cards and Maps	NEB	
EA-21	1		TNT Box Building	TNT	Property Cards and Maps	EB	
EB-22	2		Change House	n/a	Property Cards and Maps	PEB	
EB-25	1		Washout	TNT/Ammonium Nitrate/Comp B/HMX	Property Cards and Maps	EB	
EB-26	1		Elevator Machinery Bldg	n/a	Property Cards and Maps	NEB	

TABLE 3 (continued)
HAZARD CLASSIFICATION FOR BUILDINGS AT LL-3
RAVENNA ARMY AMMUNITION PLANT, RAVENNA, OHIO

BLDG. #	FLOOR	BAY	FUNCTION	EXPLOSIVE / LIMITS	REFERENCE	HAZARD CLASS	
EA-28	1		Elevator Machine House	n/a	Property Cards and Maps	NEB	
EA-28A	1		Elevator Machine House	n/a	Property Cards and Maps	NEB	
EB-803	1		Warehouse/Inert Storage	n/a	Property Cards and Maps	NEB	
3-51	1		Gatehouse	n/a	Property Cards and Maps	NEB	
3-51A	1		Office	n/a	Property Cards and Maps	NEB	
*** Information taken from property cards and maps dated 1941, 1956, and 1979.**							

Notes:

Explosive Building (EB)

Non-Explosive Building (NEB)

Potential Explosive Building (PEB)

** Structurally Unsound Bldg as determined by competent person

NOTE: Scope only includes removal of exposed above ground process equipment and piping, including any other exposed above ground piping (i.e. steam, conduit, fire suppression) that exists in EBs.

* Boiler house not included in current scope of work

No personnel will be allowed inside the 1,250-foot radius except the demo team during set up or conduct of demo operations. Once an explosive detonation episode has been scheduled, the MKM SUXOS will ensure that all site personnel and non-dedicated equipment are located outside the MSD. Roadblocks will be established on LL-2 Road and/or LL-3 Road during demo operations. Signs will be posted at strategic locations to actively warn RVAAP personnel of traffic restrictions. No persons or vehicles will be permitted past the roadblocks without direct permission from the MKM SUXOS.

After the roadblocks have been established, the MKM SUXOS (or his designee) will verify which persons are physically present within the roadblocks. Only personnel authorized by the SUXOS that have attended the Daily Site Safety Meeting, the Daily Task Order Meeting, and signed in on the Daily MKM Sign-In/Out Form will be permitted within the roadblocks. The MKM SUXOS, or his designee, will account for the presence/location of each person present at the load lines within the roadblocks before each explosive detonation episode. The physical location of each person may be confirmed by the MKM SUXOS either visually or by direct two-way communication. Work will resume upon notification that the person(s) have cleared the MSD.

8.2.2 Set-Up Of Work Zones

In addition to the 1,250 Minimum Separation Distance (MSD), three work zones will be established prior to initiating disassembly/decontamination at any building on the load lines. An Exclusion Zone (EZ) will be established around each building defining the area of real or potential contamination. Contaminant Reduction Zones (CRZs) will then be established at designated entrance points around the EZ. CRZs will be no smaller than 10 feet by 10 feet and will also be delineated with caution tape. CRZs may be larger in size depending on the activities that may take place within them. If more than one CRZ is established at any particular EZ, then one CRZ will be designated as the primary CRZ. The areas outside of the EZ/CRZs will serve as the Support Zones (SZs). A designated muster will be established within the SZ and will contain a first aid kit, an eyewash station, a fire extinguisher, and emergency communications. All wastes requiring temporary staging will be stored within the centrally located Waste Storage Area as previously described (see Section 6.4).

8.3 INSPECTION USING SEE-SNAKE®

Prior to initiating disassembly/decon operations of any process piping/equipment, MKM will inspect the interior using a See-Snake®. The purpose of the See-Snake® inspection is to assess the explosive hazard of disassembling the piping or equipment by determining the presence and relative amounts of residual explosives in the piping/equipment. The See-Snake® mechanism will be calibrated such that the location of residual explosives in

the piping can be measured and marked on the outside of the piping utilizing florescent paint. The presence of residual explosives in the piping or equipment will determine the placement of the shape charges that will be used to cut the pipe into manageable sections or initiate explosives inside process equipment.

8.4 EXPLOSIVE DISASSEMBLY USING SHAPE CHARGES

Based on the results of the See-Snake® inspection, disassembly of certain specified equipment and piping will be accomplished utilizing state of the art remotely-detonated explosives charges to sever the appropriate materials metal. Shape charges will be specifically designed to use minute amounts of explosives to cut/disassemble the metal piping and equipment. Each charge typically would contain approximately 22 grams of explosives. When required, water bags will be suspended around the charges to mitigate any potential fire hazard. All charges will be initiated utilizing Electric and Non-Electric Caps for maximum safety. A series of up to 5 charges would be connected utilizing 50/150 grain per foot detonating cord for each set up. Explosives will be stored on-site in a portable ATF approved Type 2, Class ABC explosive storage magazine as previously described.

After thorough inspection of the firing system, the team will depart the area beyond the 1,250 MSD for remote initiation of the individual shots. After all shots are initiated, the demolition site will be viewed by a UXO Technician. These observations will be reported to the UXO Demolition Supervisor. A two-member team comprised of the UXO Demolition Supervisor and a UXO Technician will then re-enter the area. The UXO Demolition Supervisor will proceed into the site, while the UXO Technician will remain at a safe distance and act as a safety observer. Once the UXO Demolition Supervisor has verified that all shot functioned as desired and no visible smoke is observed, he will give the all clear signal and then the UXO Technician can return to the area.

Once process equipment and piping and non-process piping has been disassembled, an inspection of the inner surfaces will be conducted to determine if any residual explosives exists. If necessary, 200 grain det cord will be inserted inside the equipment/piping and initiated remotely at the demo area (Figures 6A & 6B – Appendix A) to expose all surfaces for inspection and/or remove any residual explosive hazards. The SUXOS working with the UXO Demolition Supervisor will determine specific shot placement, number of charges on each set up, and protective measures if required. The UXO team will then inspect the materials as described in Section 4 to ensure that there are no visible traces of explosives and to determine if further disconnection/demolition and/or decontamination is required. Refer to Section 8.5 for details related to Decontamination operations.

8.4.1 Preparation Sequence

For explosive disassembly as described above, detonations will occur only after all personnel are in the safe area and road guards have been posted. The composition of the demolition team will be determined by the SUXOS. The team will only be composed of qualified UXO personnel under the direct supervision of a SUXOS. Additional demolition teams may be used at the discretion of the SUXOS if there are large quantities. The remaining UXO personnel may act as perimeter security or as directed by the SUXOS.

Notification of detonations will be made in accordance with the Standard Operating Procedures for Notification of UXO Detonations. During detonations, a designated project vehicle will remain in the area to provide emergency egress for the demolition team and will have the appropriate safety items onboard.

Only the Demolition Team, the UXO Demolition Supervisor, the SUXOS, and the SSHO will be permitted in the area where charges are being assembled and demolition operations are being conducted. However, all of the above authorized personnel should not be in the demolition operations area at the same time.

All demolition materials will be accounted for by the UXO Demolition Supervisor and reported to the SUXOS. Only the amount required to complete the day's operations will be drawn from the Type 2 storage magazine and transported to the site utilizing a day box.

The area where demolition operations are being conducted will remain secured until the "ALL CLEAR" is given by the UXO Demolition Supervisor or SUXOS. After each detonation, the detonation points will be inspected by the UXO Demolition Supervisor to ensure that a misfire, low order, or a kick out has not occurred. Detonating cord trunk and branch lines will be used to link multiple shots.

8.4.2 Misfire Procedures

In accordance with 29 CFR 1910-109 (e)(4) vi, EM 385-1-1 §29, and 60A1-1-31, if a misfire occurs, the following general procedures will be strictly adhered to.

The UXO Demolition Supervisor will notify the SUXOS and the MKM Project Manager (PM). All other personnel will be notified of the event via radio and instructed to hold their positions until the "ALL CLEAR" is given. A mandatory 30-minute waiting period will be observed. The circumstances surrounding the misfire will be included in the Daily Report.

8.4.3 Detonating Cord Misfires

Two new detonators will be attached to the remaining detonating cord, with care taken to fasten it properly, and the original charge will be detonated. Branch lines will be treated in the same manner as noted above.

If the detonating cord leading to the charge detonates but fails to function the charge, the following actions will be taken:

- Investigation will not occur if charges are buried. Caps and detonating cord may have detonated, but possible burning explosives will not be visible. The contractor shall allow a minimum of 30 minutes wait on all charges that failed to detonate.

- The charge will be reset and another attempt will be made to detonate it. Scattered charges that do not contain detonators may be collected and detonated together.

- Notifications will take place as outlined in the Standard Operating Procedures for Notification of UXO Operations.

8.4.4 Removal Of Miscellaneous Items from Buildings

MKM will have a UXO Supervisor on-site at all times to oversee the dismantling and removal of all equipment, process and utility piping within the buildings. Removal of miscellaneous items such as factory sealed components (i.e., fluorescent tubes and PCB ballasts) may be necessary to prevent uncontrolled damage of such items during disassembly/decontamination operations. Removal of these type of components will only be performed to facilitate the disassembly/decontamination operations. If miscellaneous items that are removed they will be containerized in accordance with the applicable regulations for subsequent disposal.

8.4.5 Removal of Bulk Explosives

If bulk explosives are encountered during this project they will be removed under direction of the SUXOS and transported to the designated Demo Area for destruction. See Figure 6A and 6B in Appendix A for the location of the LL-2 and LL-3 Demo Areas, including applicable MSDs.

8.5 DECONTAMINATION OF EQUIPMENT AND PIPING

The process equipment and piping as well as the non-process related piping (i.e., steam and fire suppression) will be decontaminated, if required as determined through inspection procedures outlined in Section 4, using a combination of det cord flashing (as previously described in Section 8.4), pressure washing and/or thermal treatment, IAW IOCP 385-1,10.a.(2)(3). Explosive contamination designations of 1X, 3X, and 5X are described in IOC Document 385-1 presented in Appendix C. See Figure 7 in Appendix A for a flow chart showing the decontamination procedures for the disassembly/decon operations at LL-2 and LL-3.

Decontamination by Pressure Washing

Pressure washing is used to remove accumulations of explosives from equipment surfaces and inner walls of pipes to at least 3X, and ultimately 5X level. All water used is retained in a holding tank for reuse/off-site disposal. A frac tank is used to collect all liquid via pump/hose system and wash water will be recycled where possible. Figure 8 in Appendix A provides an illustration of the pressure washing set up. Only equipment certified 3X at the Interim Accumulation (staging) Area will be moved to the appropriate areas of the Decontamination Area for washing or re-washing. The Decon Pressure Wash (DPW) operations will be conducted by UXO technicians. The sequence for pressure washing operations (if needed) will be as follows:

- Disassembled items will be moved to the Interim Accumulation (staging) Area.
- If an item has not been det cord-flashed (i.e., non explosive process related item) or if pressure washing is deemed necessary, it will be taken to the Decon Pressure Wash (DPW) Area where it will be pressure washed to at least 3X levels.
- The component will then be inspected in the Inspection and Certification (ICA) Area by the UXO QC Manager and SUXOS to ensure that there are no visible traces of explosives. The result of this examination will determine if the material should reenter the processing flow for further washing, if further disconnection/demolition is needed to expose all surfaces or if the material is clean and can be staged for subsequent scrap recycling or salvaging.
- Only clean material certified as 5X by the UXO QC Manager and SUXOS will be taken to the Direct Disposal Operations (DDO) Area where the material is staged for final disposal to a scrap recycling or salvage facility. The SUXOS and UXO QC Manager Officer will provide certification documentation for every scrap container generated.

Decontamination by Flashing Furnace (Thermal Treatment)

The Mobile 5X- Furnace is a state of the art car-bottom flashing furnace that heats the contaminated materials (1X or 3X) to destroy any residual contamination to a 5X level. The contaminated materials are heated over 1,000 degrees Fahrenheit for at least 15 minutes, which will thermally decontaminate all materials. Explosives are oxidized to carbon dioxide and water during this thermal destruction process.

As required by the MKM SUXOS, unpainted metal components/fixtures that cannot be disassembled or cleaned/certified to 5X levels, will be taken to the 5X-flashing furnace for thermal treatment as follows:

- The SUXOS will inspect the material and load the furnace with suspect contaminated material for thermal treatment.
- Treatment cycles typically take approximately 1-3 hours per cycle depending upon the density of the load and the thickness of the material placed in the load.
- After the material has cooled sufficiently, the UXO QC Manager and SUXOS will visually inspect all thermally treated materials and verify that the decontaminated items have attained 5X level.
- After thermal treatment and certification, all decontaminated 5X materials will be loaded into appropriated containers for final disposal to a scrap recycling or salvage facility. The SUXOS and UXO QC Manager will provide certification documentation for every scrap container generated.
- All flashing furnace operations will be performed in accordance with the Flashing Furnace Standard Operating Procedure and Emergency Evacuation Plan, dated February 2001.

Visual inspection and QC testing will be performed in accordance with the procedures outlined in Section 4 to ensure cleanup to 5X status as per IOCP 385-1.

8.6 REMOVAL OF FLOOR DEBRIS

After completion of all explosives disassembly operations, the interior floors of the affected buildings will be cleared of organic debris (floor sweepings). MKM will containerize and stage the organic debris at the biopad area for future bioremediation (composting). Initial sweeping prior to explosive disassembly operations, removal of peeling lead-based paint and pressure wash down of buildings is not included under this scope of work. Vacuuming and sweeping will be conducted in Level C PPE as described in the SSHP. However, protection levels may be downgraded or modified, depending on both site conditions and air monitoring results, at the discretion of the MKM Corporate Safety and Health Manager (CSHM).

9.0 STEEL REMOVAL

All steel from areas within the two load lines that does not present a structural safety hazard, such as walkways (as identified during engineering survey) will be removed for recycling during the project. Removal will be accomplished through the use of track mounted excavators equipped with shear and/or grapple attachments, or the equivalent. During these steel removal operations, every container generated will be subject to the same type of visual inspections, random field screening and certification previously described in Section 4.

10.0 DISPOSAL OF ACCUMALATED WASTES

Besides asbestos containing materials, several other items may be encountered during disassembly/decontamination processes that will require special handling, storage, transportation, and disposal. These items include mercury–containing switches and guages, mercury-containing fluorescent lights, light ballasts and other electrical equipment potentially containing PCBs; all of which will only be removed as needed in order to promote safe execution (to human health and the environment) of the disassembly/decontamination operations. Environmental management of these items will be conducted in accordance with federal, state and local rules, laws and regulations. Table 2 (Section 2 of this document) provides a summary of the projected wastes at LL-2 and LL-3.

All wastes accumulated during the disassembly/decontamination of equipment at LL-2 & 3 will be transported and disposed in accordance with all Federal, State, DOT and local requirements.

11.0 SITE RESTORATION

Prior to demobilization, MKM will restore all affected areas of operations to their pre-mobilization condition. All waste materials generated will be disposed of in accordance with all Federal, state, and local rules, laws and regulations.

12.0 ENVIRONMENTAL PROTECTION PLAN

The environmental resources within the project boundaries and those affected outside the limits of permanent work under this contract shall be protected during the entire period of this contract. MKM Engineers, Inc. shall confine its activities to areas defined by this Work Plan. Environmental protection shall be as stated in the following subparagraphs.

MKM is directly responsible for the implementation of this plan. Inspections will be made to assure field personnel's compliance. Following are several specific areas of concern that fall under environmental protection:

12.1 SITE DESCRIPTION

The Ravenna Army Ammunition Plant (RVAAP) is located in northeastern Ohio in Portage and Trumbull Counties. RVAAP lies 23 miles east-northeast of Akron, Ohio and 30 miles west-northwest of Youngstown, Ohio. The installation includes 21,419 acres in a tract approximately 3.5 miles wide by 11 miles long. The RVAAP is a government-owned, contractor-operated (GOCO) military industrial installation.

The industrial operations at RVAAP consisted of 12 munitions assembly facilities referred to as "load lines". In addition, RVAAP also had several areas used for burning, demolition and testing of munitions and buildings/areas designated for clean up and decontamination activities for the production equipment. MKM has been retained by the OSC to disassemble, decontaminate and dispose of all process related equipment found in process buildings at Load Line 2 and Load Line 3. Additionally, any other piping (i.e. steam, conduit, fire suppression) that exists in buildings where explosive operations have taken place will also be removed from the load lines.

12.2 PRESERVATION & RECOVERY OF HISTORICAL, ARCHAEOLOGICAL, & CULTURAL RESOURCES

Known existing historical, archaeological, and cultural resources within MKM's work area will be so designated by OSC and precautions shall be taken by MKM to preserve all such resources as they existed at the time they were pointed out to MKM. MKM shall install protection for these resources and shall be responsible for their preservation during this contract. If during disassembly/decontamination activities MKM observes unusual items that might have historical, archaeological, or cultural value, such items shall be protected in place and reported immediately to OSC.

12.3 PROTECTION OF NATURAL RESOURCES

Prior to the beginning of any disassembly/decontamination, MKM shall identify all land resources to be preserved within the work area. MKM shall not remove, cut, deface, injure or destroy land resources including trees, shrubs, vines, grasses, topsoil, and land forms without special permission from OSC.

12.3.1 Work Area Limits

Prior to any disassembly/decontamination, MKM shall indicate areas where no work is to be performed under this contract. Any monuments and markers shall be protected before disassembly/decontamination operations commence. MKM shall convey to its personnel the purpose of marking and/or protection of all necessary objects.

12.3.2 Protection of Landscape

Trees, shrubs, vines, grasses, landforms and other landscape features to be preserved shall be clearly identified. Except in work areas, trees or shrubs will not be removed, cut, defaced, injured, or destroyed without the permission of OSC.

12.3.3 Temporary Embankments

Temporary embankments for project work areas shall be controlled to protect adjacent areas from despoilment.

12.3.4 Protection of Erodible Soils

Disassembly/decontamination will be planned and conducted as to minimize the exposure of unprotected soils.

12.3.5 Disposal of Solid Waste

Solid wastes shall be placed in appropriate containers, which shall be emptied regularly. All handling and disposal shall be conducted to prevent further contamination and/or contaminant migration. MKM shall dispose of all waste in compliance with Federal, State, and local requirements for solid waste disposal.

12.3.6 Disposal of Hazardous Waste

Hazardous waste shall be removed from the work area and disposed of in accordance with Federal, State, and local regulations.

12.4 PROTECTION OF WATER RESOURCES

MKM shall keep construction activities under surveillance, management, and control to avoid pollution of surface and ground waters. Special management techniques as set out below shall be implemented to control water pollution by the disassembly/ decontamination and decontamination activities, which are included in this contract.

12.4.1 Spillage

Special measure shall be taken to prevent chemicals, fuels, oils, greases, bituminous materials, sawdust, waste washings, herbicides, insecticides, rubbish or sewage, and other pollutants from entering public waters.

12.4.2 Waste Water

Wastewater shall not be allowed to enter streams, rivers, or lakes unless it meets United States Environmental Protection Agency (USEPA) Water Quality Criteria.

12.5 PROTECTION OF AIR RESOURCES

MKM shall keep disassembly/decontamination activities under surveillance, management, and control to minimize pollution of air resources. All activities, equipment processes, and work operated or performed by MKM shall be in strict accordance with all Federal emission and performance laws and standards. Ambient Air Quality Standards set by the EPA shall be maintained for those disassembly/ decontamination operations and activities specified in this contract. Special Management techniques as set out below shall be implemented to control air pollution by the construction activities, which are included in the contract.

12.5.1 Particulates

Dust particles, hazardous particulates, aerosols, and gaseous by-products from all disassembly/decontamination activities, processing, and preparation of materials shall be controlled at all times.

12.5.2 Particulate Control

MKM shall maintain all work areas within or outside the project boundaries free from particulate which would cause the air pollution standards to be exceeded or which would cause a hazard or a nuisance.

12.5.3 Hydrocarbons, Carbon Monoxide, and Oxides of Nitrogen and Sulfur

Vapor/gaseous emissions of hydrocarbons, carbon monoxide, oxides of nitrogen and sulfur oxides from equipment shall be controlled to Federal and State allowable limits at all times.

12.5.4 Odors

Odors from all activities, processing and preparation of materials shall be controlled at all times.

12.5.5 Monitoring of Air Quality

Monitoring of air quality for asbestos removal and final floor sweeping activities shall be the responsibility of MKM and its' subcontractor in accordance with 29 CFR 1910 as detailed in the LL-2 and LL-2 Equipment Disassembly, Decontamination and Disposal Site-Specific Safety and Plan.

12.6 PROTECTION FROM SOUND INTRUSIONS

MKM shall keep disassembly/decontamination activities under surveillance and control to minimize damage to the environment by noise.

12.7 POST CONSTRUCTION CLEANUP OR OBLITERATION

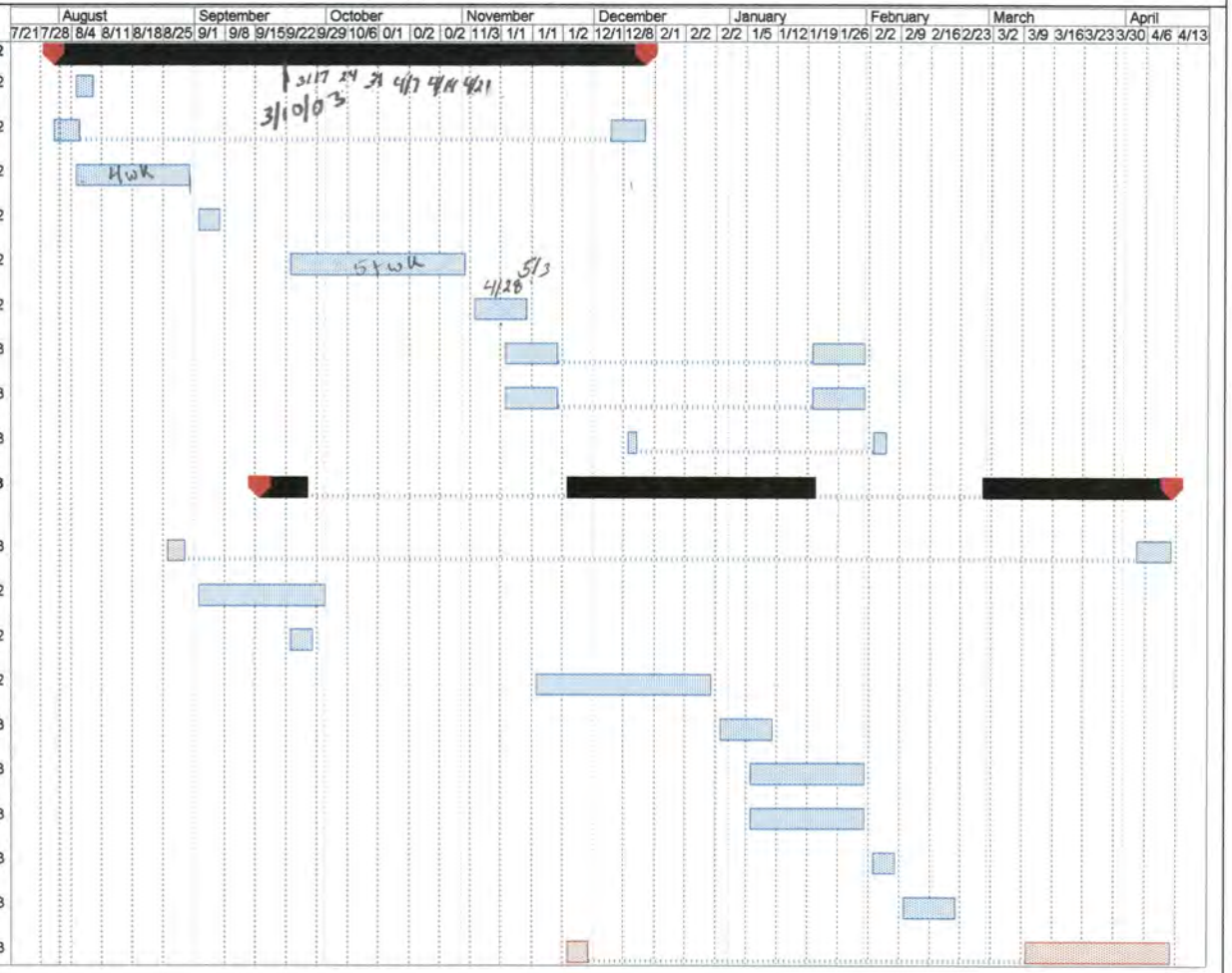
MKM shall obliterate all signs of temporary facilities such as work areas, structures, fencing, stakes, or any other signs of construction within the work, storage, and access areas. The areas shall be restored to near natural conditions.

13.0 PROJECT SCHEDULE

MKM has developed a proposed Project Schedule for the completion of all tasks presented in this Work Plan. The Project Schedule for Equipment disassembly/ decontamination at LL-2 & 3 is shown in Table 4. If changes in the MKM personnel or changes to the scope of work require a change to this project schedule, MKM will immediately notify OSC and provide an amended project schedule.

TABLE 4
PROJECT SCHEDULE
RAVENNA ARMY AMMUNITION PLANT, RAVENNA, OHIO

ID	Task Name	Duration	Start	Finish
1	**Load Line-2**	**97 days**	**Wed 7/31/02**	**Thu 12/12/02**
2	Mobilization	4 days	Mon 8/5/02	Thu 8/8/02
3	Engineering Survey	10 days	Wed 7/31/02	Thu 12/12/02
4	Asbestos Abatement	20 days	Mon 8/5/02	Fri 8/30/02
5	Hazard Review	5 days	Mon 9/2/02	Fri 9/6/02
6	Explosive Disassembly of Eqmt/Piping	30 days	Mon 9/23/02	Fri 11/1/02
7	Organic & Explosive Debris/Loose Eqmt Removal	10 days	Mon 11/4/02	Fri 11/15/02
8	Decontamination- Pressure Wash	20 days	Mon 11/11/02	Fri 1/31/03
9	Decontamination- Flashing Furnace	20 days	Mon 11/11/02	Fri 1/31/03
10	5X- Scrap Certification and Disposal	5 days	Mon 12/9/02	Wed 2/5/03
11	**Load Line-3**	**81 days**	**Mon 9/16/02**	**Fri 4/11/03**
12	Enginering Survey	10 days	Mon 8/26/02	Fri 4/11/03
13	Asbestos Abatement	21 days	Mon 9/2/02	Mon 9/30/02
14	Hazard Review	5 days	Mon 9/23/02	Fri 9/27/02
15	Explosive Disassembly of Eqmt/Piping	30 days	Mon 11/18/02	Fri 12/27/02
16	Organic & Explosive Debris/ Loose Eqmt. Removal	10 days	Mon 12/30/02	Fri 1/10/03
17	Decontamination- Pressure Wash	20 days	Mon 1/6/03	Fri 1/31/03
18	Decontamination- Flashing Furnace	20 days	Mon 1/6/03	Fri 1/31/03
19	5X- Scrap Certification and Disposal	5 days	Mon 2/3/03	Fri 2/7/03
20	Site Restoration	10 days	Mon 2/10/03	Fri 2/21/03
21	Final Report	30 days	Mon 11/25/02	Fri 4/11/03



Project: LOAD LINE 2 & 3
Date: Thu 8/1/02

Task | Progress | Summary | External Tasks | Deadline
Split | Milestone | Project Summary | External Milestone

APPENDIX A

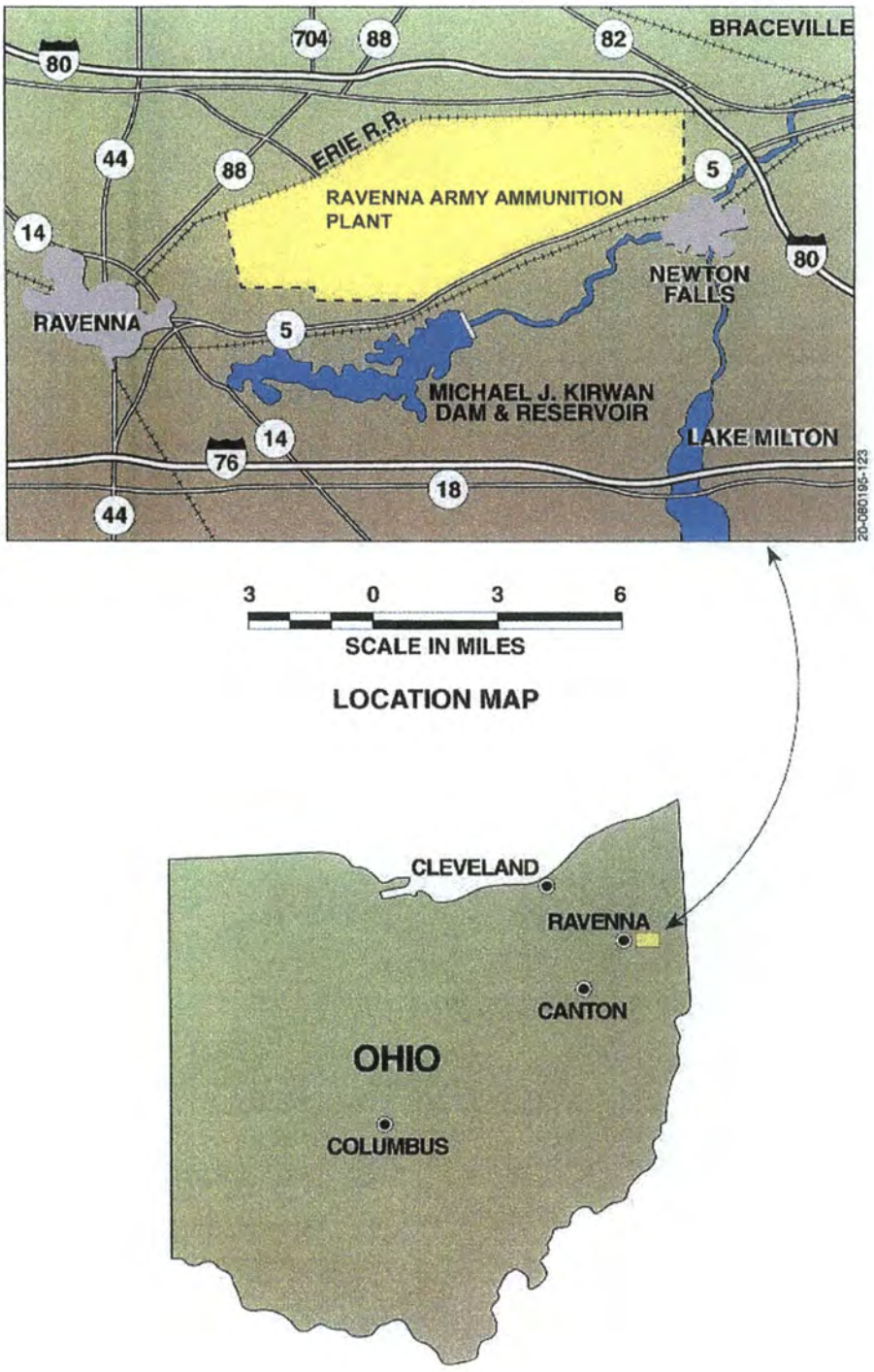
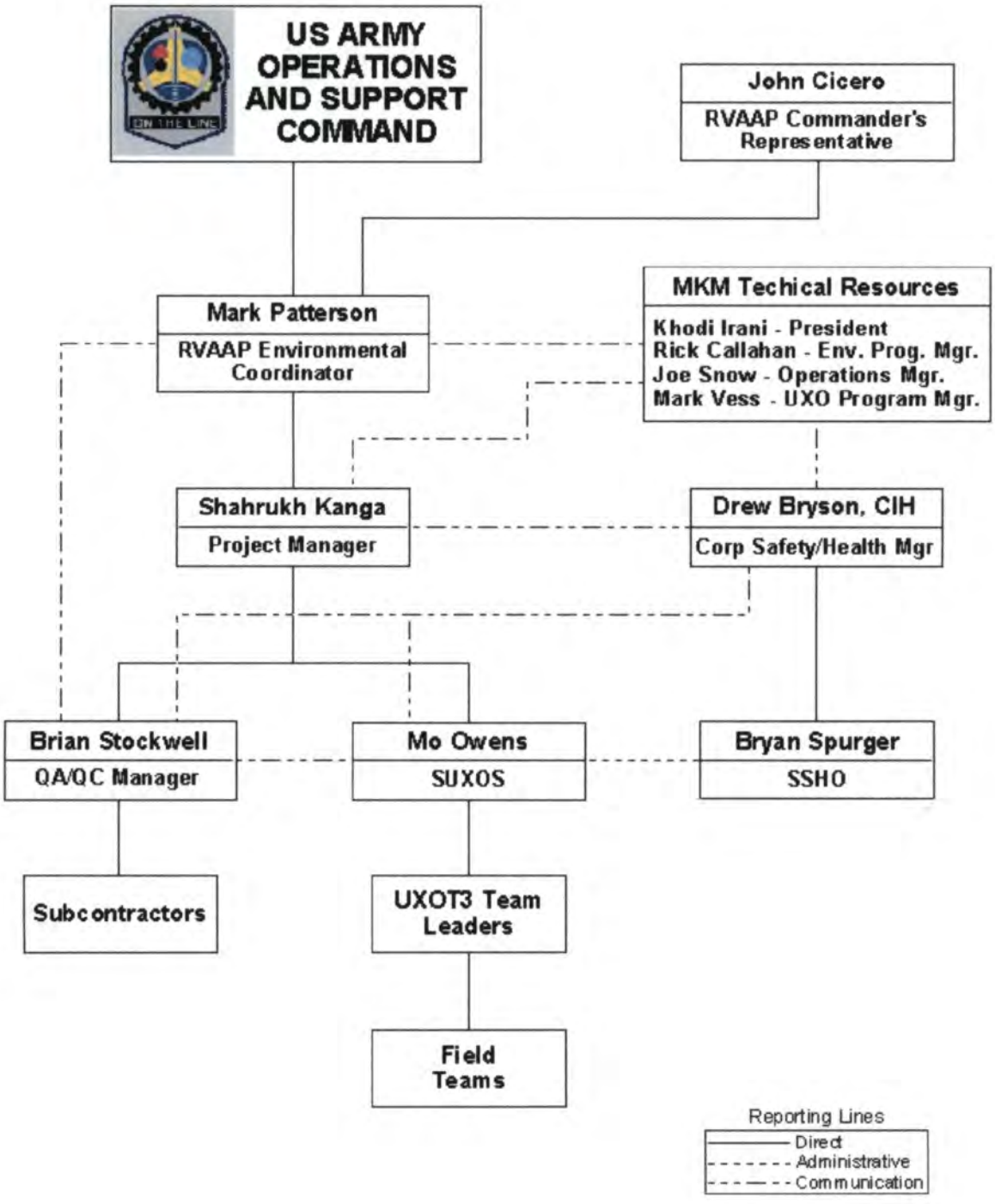
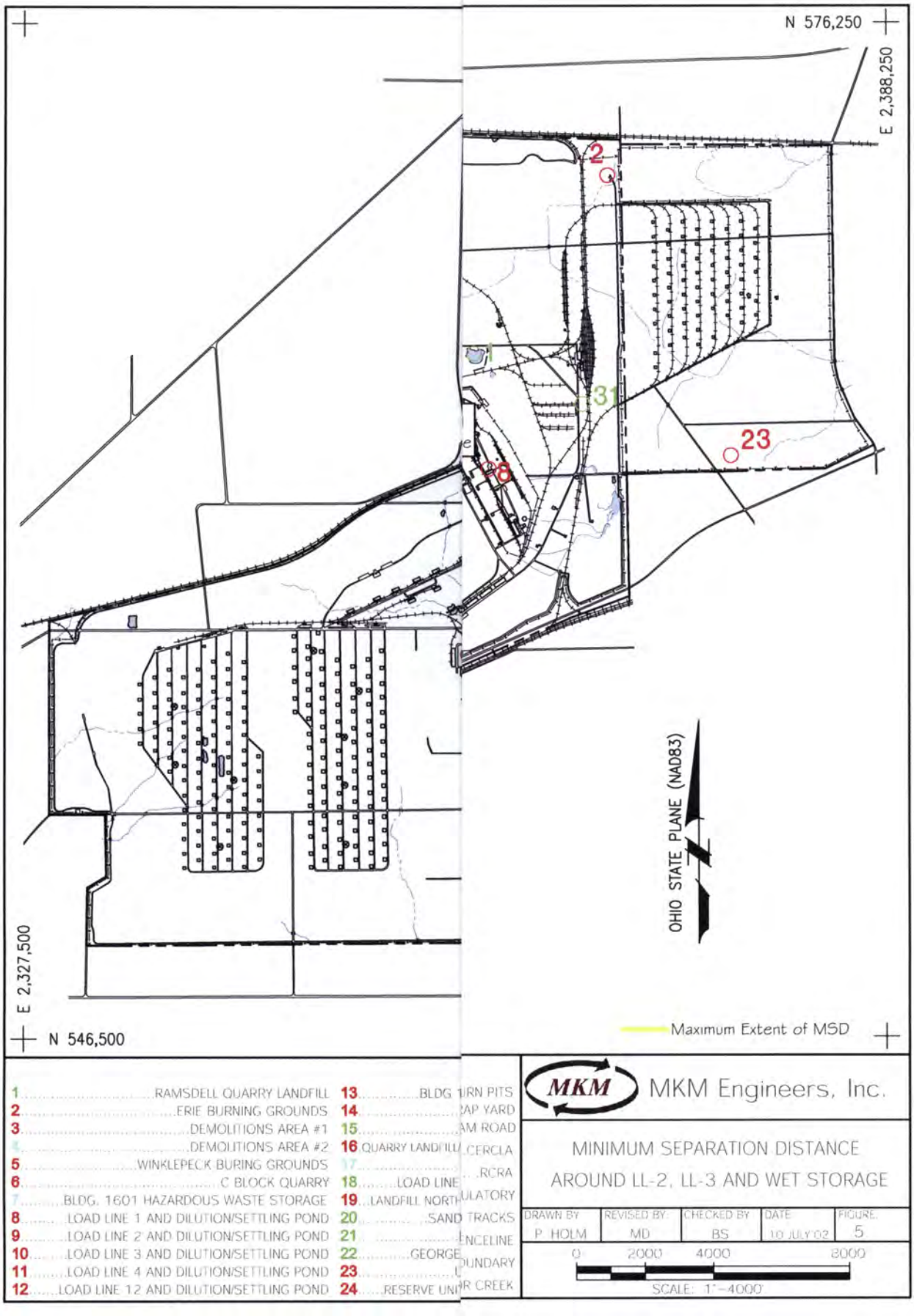


Figure 1. Ravenna Army Ammunition Plant Location Map

Figure 4 - Organizational Chart
Process Equipment Disassembly, Decontamination and Disposal
Load Lines 2 and 3
Ravenna Army Ammunition Plant, Ravenna, Ohio





1	RAMSDELL QUARRY LANDFILL	13	BLDG 1
2	ERIE BURNING GROUNDS	14	
3	DEMOLITIONS AREA #1	15	
4	DEMOLITIONS AREA #2	16	QUARRY LANDFILL
5	WINKLEPECK BURING GROUNDS	17	
6	C BLOCK QUARRY	18	LOAD LINE
7	BLDG. 1601 HAZARDOUS WASTE STORAGE	19	LANDFILL NORTH
8	LOAD LINE 1 AND DILUTION/SETTLING POND	20	SAND
9	LOAD LINE 2 AND DILUTION/SETTLING POND	21	
10	LOAD LINE 3 AND DILUTION/SETTLING POND	22	GEORGE
11	LOAD LINE 4 AND DILUTION/SETTLING POND	23	
12	LOAD LINE 12 AND DILUTION/SETTLING POND	24	RESERVE UNI

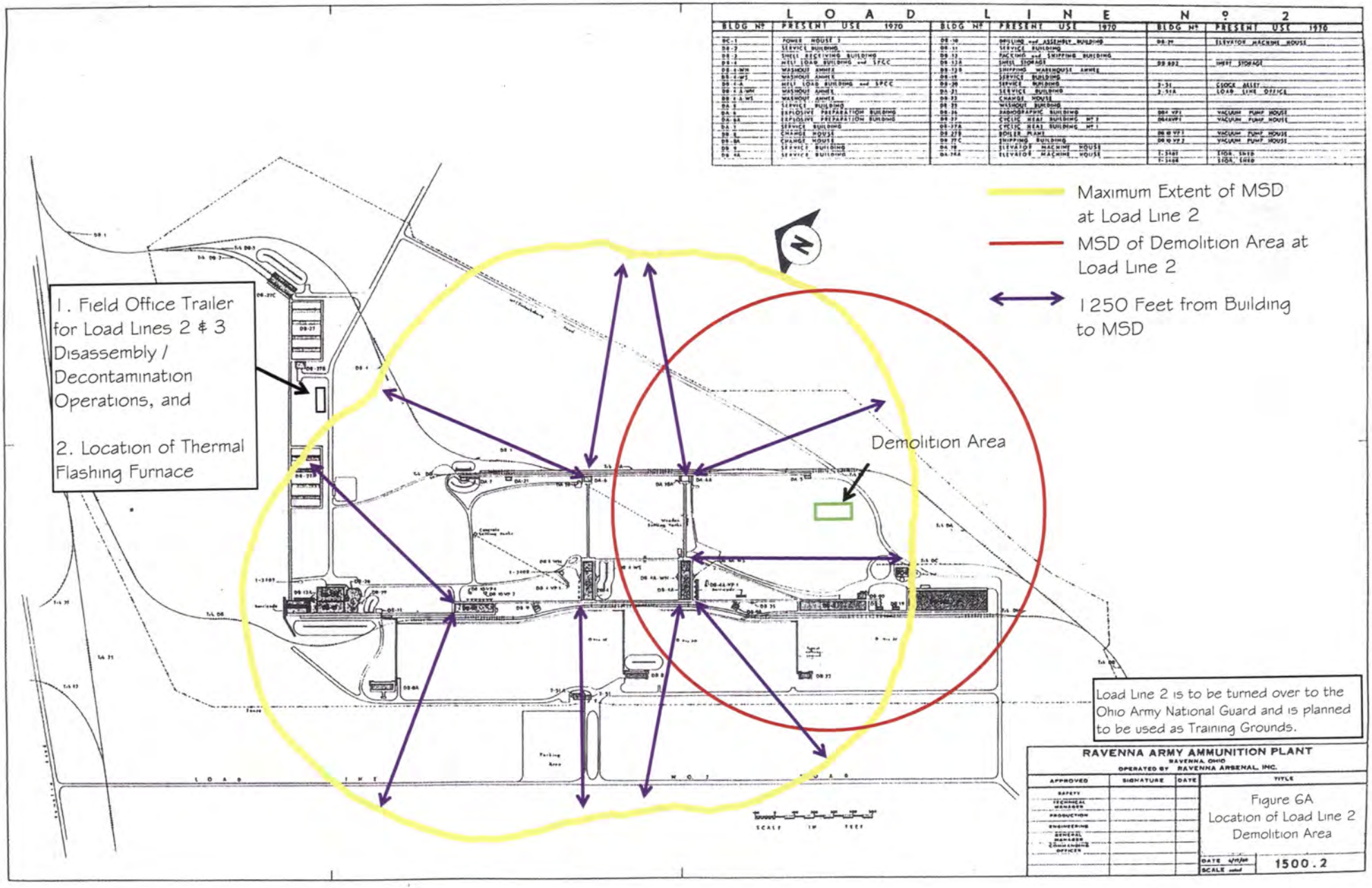
MKM Engineers, Inc.

MINIMUM SEPARATION DISTANCE AROUND LL-2, LL-3 AND WET STORAGE

DRAWN BY	REVISED BY:	CHECKED BY	DATE	FIGURE:
P. HOLM	MD	BS	10 JULY 03	5

0 2000 4000 8000

SCALE: 1"=4000'


LOAD LINE NO 2
BLDG Nº PRESENT USE 1970
Maximum Extent of MSD at Load Line 2
MSD of Demolition Area at Load Line 2
1250 Feet from Building to MSD
1. Field Office Trailer for Load Lines 2 & 3 Disassembly / Decontamination Operations, and
2. Location of Thermal Flashing Furnace
Demolition Area
N
Load Line 2 is to be turned over to the Ohio Army National Guard and is planned to be used as Training Grounds.
RAVENNA ARMY AMMUNITION PLANT
RAVENNA, OHIO
OPERATED BY RAVENNA ARSENAL, INC.
APPROVED
SIGNATURE
DATE
TITLE
SAFETY
TECHNICAL MANAGER
PRODUCTION
ENGINEERING
GENERAL MANAGER COMMANDING OFFICER
Figure 6A
Location of Load Line 2
Demolition Area
DATE
SCALE
1500.2

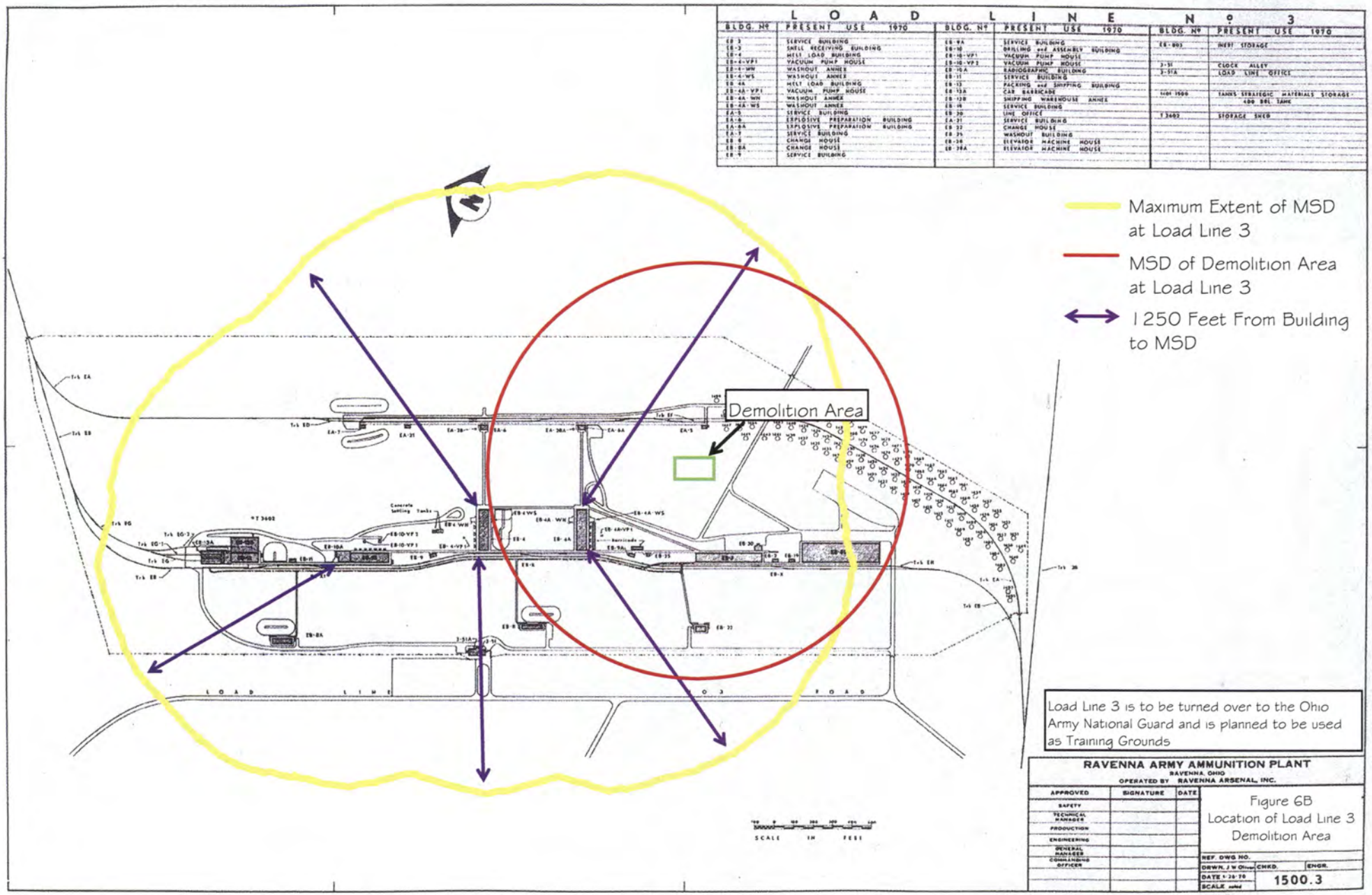
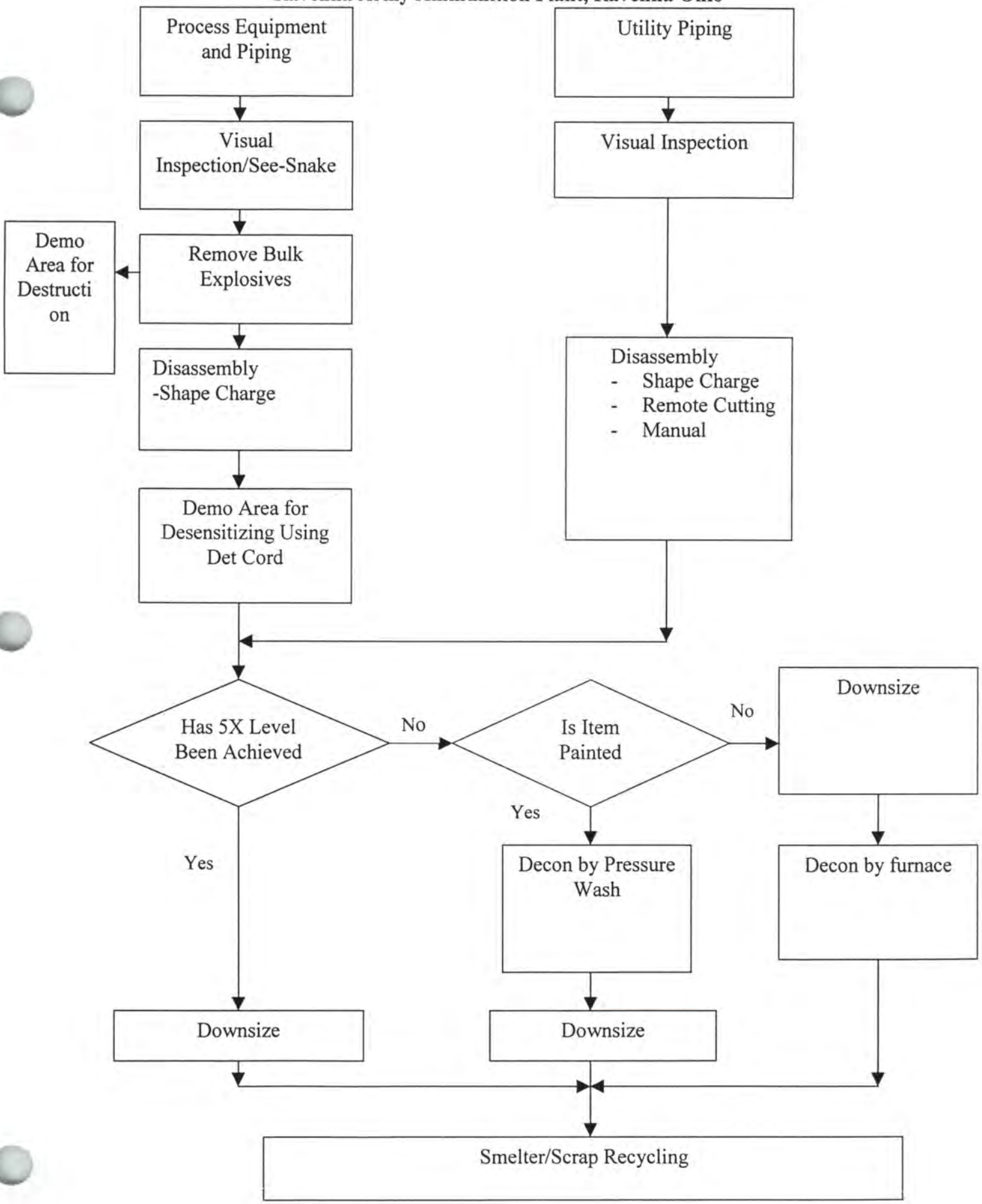

LOAD LINE Nº 3
BLDG. Nº PRESENT USE 1970
EB 3 SERVICE BUILDING
EB-3 SHELL RECEIVING BUILDING
EB-4 HEAT LOAD BUILDING
EB-4-VP1 VACUUM PUMP HOUSE
EB-4-WN WASHOUT ANNEX
EB-4-WS WASHOUT ANNEX
EB 4A MELT LOAD BUILDING
EB-4A-VP1 VACUUM PUMP HOUSE
EB-4A-WN WASHOUT ANNEX
EB-4A-WS WASHOUT ANNEX
EA-5 SERVICE BUILDING
EA-6 EXPLOSIVE PREPARATION BUILDING
EA-6A EXPLOSIVE PREPARATION BUILDING
EA-7 SERVICE BUILDING
EB 8 CHANGE HOUSE
EB-8A CHANGE HOUSE
EB-9 SERVICE BUILDING
EB-9A SERVICE BUILDING
EB-10 DRILLING and ASSEMBLY BUILDING
EB-10-VP1 VACUUM PUMP HOUSE
EB-10-VP2 VACUUM PUMP HOUSE
EB-10A RADIOGRAPHIC BUILDING
EB-11 SERVICE BUILDING
EB-12 PACKING and SHIPPING BUILDING
EB-13A CAR BARRICADE
EB-13B SHIPPING WAREHOUSE ANNEX
EB-14 SERVICE BUILDING
EB-20 LINE OFFICE
EA-21 SERVICE BUILDING
EB 22 CHANGE HOUSE
EB 25 WASHOUT BUILDING
EB-26 ELEVATOR MACHINE HOUSE
EB-26A ELEVATOR MACHINE HOUSE
EB-803 INERT STORAGE
2-51 GUARD ALLEY
3-51A LOAD LINE OFFICE
1500 TANKS STRATEGIC MATERIALS STORAGE - 400 BBL TANK
T 3402 STORAGE SHED
Maximum Extent of MSD at Load Line 3
MSD of Demolition Area at Load Line 3
1250 Feet From Building to MSD
Demolition Area
Concrete bottling Tanks
LOAD LINE 03 ROAD
SCALE IN FEET
Load Line 3 is to be turned over to the Ohio Army National Guard and is planned to be used as Training Grounds
RAVENNA ARMY AMMUNITION PLANT
RAVENNA, OHIO
OPERATED BY RAVENNA ARSENAL, INC.
APPROVED SIGNATURE DATE
SAFETY
TECHNICAL MANAGER
PRODUCTION
ENGINEERING
GENERAL MANAGER
COMMANDING OFFICER
Figure 6B
Location of Load Line 3
Demolition Area
REF. DWG NO.
DRWN. J W Oliver CHKD. ENGR.
DATE 1-28-70
SCALE noted
1500.3

FIGURE 7: Flow Chart Showing Decontamination Procedures and Sequence
Ravenna Army Ammunition Plant, Ravenna Ohio



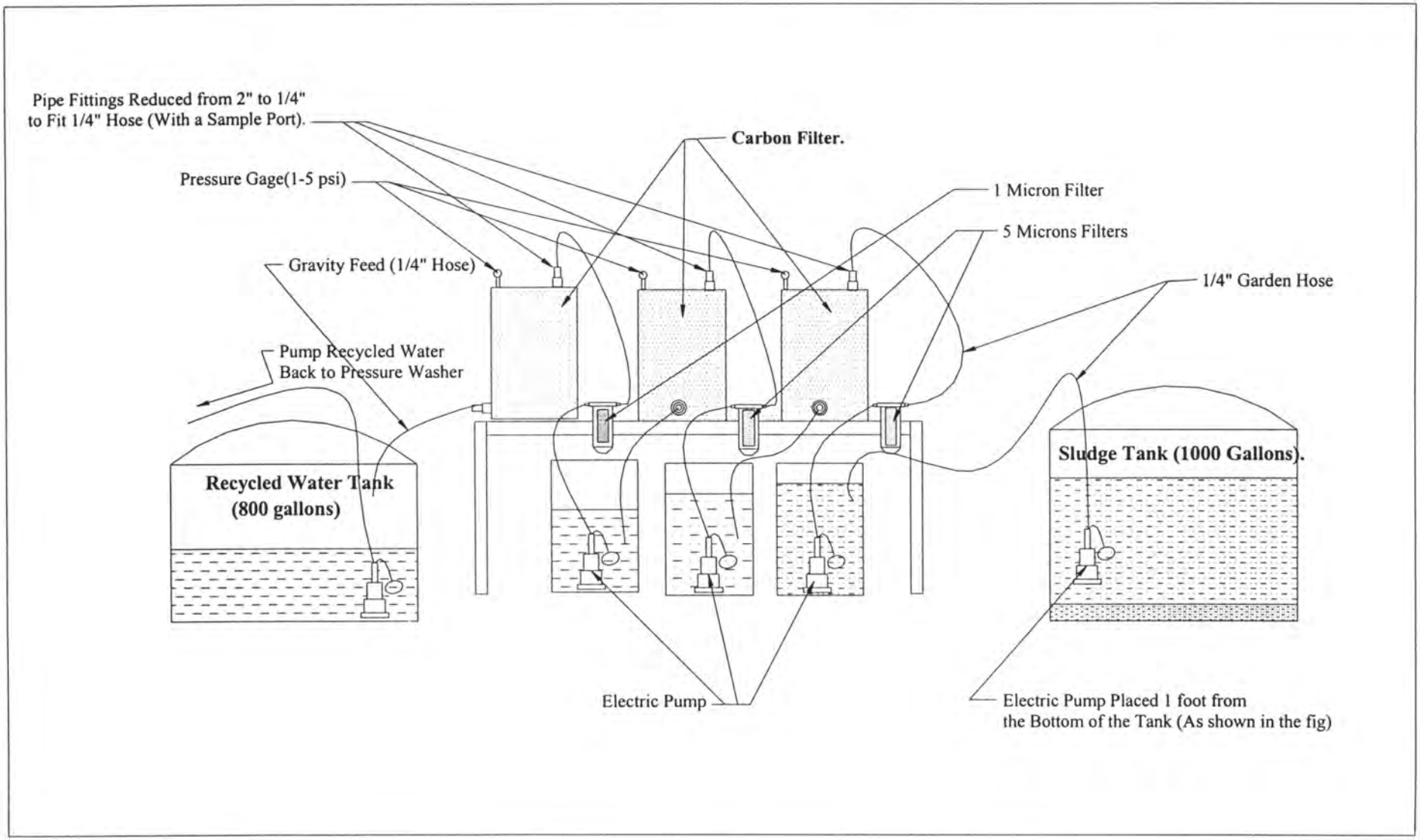


Figure 8 – Illustration of Pressure Washing Set Up

APPENDIX B

Industrial Operations Command (IOC) Document 385-1

Department of the Army
Headquarters, U.S. Army
Industrial Operations Command
Rock Island, IL 61299-6000

*IOCP 385-1

16 JUL 1997

Safety

CLASSIFICATION AND REMEDIATION OF EXPLOSIVE CONTAMINATION

Applicability. This pamphlet applies to all HQ, IOC, elements and their subordinate installations.

Decentralized printing. All IOC installations are authorized to locally reproduce this pamphlet.

Suggested improvements. The proponent of this pamphlet is the Deputy Chief of Staff for Industrial Risk Management. Users should send comments and suggested improvements to Commander, HQ, IOC, ATTN: AMSIO-DMS, Rock Island, IL 61299-6000.

Distribution. Distribution of this pamphlet is in accordance with requirements submitted by IOC organizations (stocked/issued by Rock Island Arsenal, ATTN: RSSC-PSP).

FOR THE COMMANDER:

Official:

JAMES P. FAIRALL, JR.
Colonel, GS
Chief of Staff

Contents

*This pamphlet supersedes AMCCOMR 385-5, 2 September 1987.

Contents

1. Purpose. To provide guidance to IOC installations and elements, enabling them to detect explosive contamination, determine the contamination status, recommend remedial decontamination methods, and mark contaminated items. This pamphlet is not a substitute for attention to detail or for knowledge and experience specific to the materials, processes, procedures, and contaminants involved.

2. References. The TM 700-4, Decontamination of Facilities and Equipment, October 1978 (or latest revision) contains additional information on explosive decontamination.

3. Definitions.

a. Articles. The term "articles" refers to items such as cartridge cases, projectile bodies, bullets, pipes, scrap, etc., which are not pieces of equipment or buildings.

b. 1X (X) level of contamination. This level applies to articles, equipment, and buildings subjected to only routine, after-use cleaning. Substantial contamination (explosive residue) continues to exist. Limit maintenance to minor adjustments.

c. 3X (XXX) level of contamination. This level applies where cleaning has removed surface contamination, but significant amounts (enough to present an explosive safety hazard) may remain in less obvious places. The article, equipment, or building is safe for its intended purpose. Do not subject 3X-contaminated articles, equipment, or buildings to welding, drilling, sawing,

or other processes that may generate enough heat to ignite residual contamination. Such articles, equipment, or buildings are safe for routine maintenance and careful disassembly, but not for sale to the general public. Qualified buyers (as set forth in paragraph 13c(2)) may buy them.

d. 5X (XXXXX) level of contamination. This level applies when no significant amounts (not enough to present an explosive safety hazard) of contaminants remain. The article, equipment, or building does not pose an explosive safety hazard and is safe for welding, drilling, sawing, etc., and sale to the general public.

e. 0 (zero) level of contamination. This level applies when the articles, equipment, or buildings were never contaminated. They pose no explosive safety hazard and are safe for welding, drilling, sawing, etc., and sale to the general public.

f. Qualified buyer. A qualified buyer is a company or individual possessing a Bureau of Alcohol, Tobacco, and Firearms (BATF) explosive manufacturer's license or meeting the requirements of paragraphs 13c(2)(a) through 13c(2)(d).

g. Explosive safety hazard. The hazard of personal injury and/or equipment damage created by residual explosives on articles, equipment, or buildings. The amount of explosives required to create an explosive safety hazard is dependent on the properties of the explosive, the concentration or distribution of the contaminant on the surface, and the amount of confinement in the potential incident.

4. Background.

a. From the start of the modern Government-owned explosive and ammunition production base until the early 1990's, each time production ceased, managers assumed they would need the facilities and equipment in the future and preserved them. The contamination status decisions on individual articles, pieces of equipment, buildings, and even whole production lines were

simple. Classifiers marked almost everything as "3X", even if uncontaminated. This was the simplest, most economical course when keeping everything for its original purpose.

b. In the 1990's, the basic assumption, "the Army will always keep it", changed to "get rid of it, we no longer need it." Because the end use changed, the IOC needed more specific guidance:

(1) on determining the correct contamination classification of an article, piece of equipment, or building,

(2) on establishing remediation measures to go from a 3X classification to a 5X classification,

(3) on changing obsolete/incorrect classifications from 3X to 5X without performing additional remediation,

(4) on changing obsolete/incorrect classifications from 3X to 0 without performing additional remediation.

5. Guidance structure. The guidance in this document centers on visual inspection. It asks questions about the article, piece of equipment, or building under consideration, and provides general rules and specific examples telling how to proceed with the answers. The objective is to provide a progression of inquiry and general rules which result in logical and defensible classifications and remediation measures.

6. Porous or not. The first question in evaluating contaminated articles, equipment, or buildings is, "Is the material porous to the contaminant(s)?"

a. The division of "porous" from "nonporous" affects the depth/detail of the visual examination. Porous generally refers to building materials, such as wood, gypsum board, etc., and paper products, like cardboard. Porous materials have a surface which is not smooth, not hard, nor resistant to contaminant absorption. Porous material lends itself to visual examination because it seldom has hidden surfaces. Nonporous refers to metal or other materials with hard, smooth, and resistant surfaces.

NOTE: Porous material covered with a nonporous finish may resist contamination and clean to acceptable levels for reuse or release.

b. Experience with porous materials created these rules:

(1) POROUS RULE 1: You must assume physical removal cannot decontaminate porous material contaminated by solids, unless a smooth nonporous coating covers the exposed surface.

(2) POROUS RULE 2: If evidence of a liquid or vapor contaminant is present, you must assume the contaminant penetrates the porous material surface, and physical cleaning will not decontaminate the material.

(3) POROUS RULE 3: For partially-contaminated porous material, you may carefully cut away or separate the contaminated part from the rest and appropriately label each part.

(4) POROUS RULE 4: You must assume porous material exposed to an explosive contaminant which leaves no visible trace or signature is contaminated. Testing may change this assumption.

c. Nonporous materials often have areas and discontinuities not readily accessible to visual examination where contaminants may be present. In some cases, careful disassembly of articles and pieces of equipment will reveal hidden surfaces and contaminants. In other cases, cracks may hide contamination. Cracks often occur in welds or joints, but can occur in other areas as well. Experience has shown the amount of explosive contaminant in cracks is insufficient to create a hazard where the outside surfaces are confirmed clean and the nonporous material is 1/8-inch thick or less. Experience with nonporous materials created these rules:

(1) CRACK RULE 1: In nonporous materials greater than 1/8-inch thick, the quantity of explosives contained in cracks may be sufficient to cause an explosive hazard. NOTE: Crack Rule 1 is only a guide. Use your judgment and deviate from the rule only toward the safer side.

(2) CRACK RULE 2: You must assume all nonporous materials over 1/8-inch thick have cracks, unless a detailed visual inspection proves otherwise.

7. Presumed contaminated or not. The second question in evaluating contaminated articles, equipment, or buildings is, "By virtue of environment, must you presume the material under consideration contaminated, or can you presume it not contaminated?"

a. The answer determines the extent of visual inspection required for proof of the contamination status. You must base the presumption of "contaminated" or "not contaminated" on use, the properties of the contaminants, and the environment. If a doubt exists, you must presume articles, equipment, and buildings contaminated.

b. If, by virtue of its environment, the article, piece of equipment, or building is "presumed contaminated", a very detailed visual examination is required to prove it is not contaminated, denying the assumption. If that material is "presumed not contaminated", for proof you must inspect only the likely places for contamination, confirming the assumption.

c. "Presumed contaminated" applies to everything in rooms or bays with uncontrolled or uncontained explosives, propellants, and pyrotechnics. Exposure need not be continuous to require a presumed contaminated evaluation. Mixer bays are examples of presumed contaminated locations. Even closed mixers allow many opportunities for explosive contamination of the area during loading and unloading. Explosive dusts and vapors potentially contaminate all areas they contact.

(1) PRESUMED CONTAMINATED RULE 1: You must label presumed contaminated articles, pieces of equipment, and buildings 1X or 3X unless proof establishes otherwise.

(2) PRESUMED CONTAMINATED RULE 2: To assign a 5X or 0 classification to presumed contaminated articles, pieces of equipment, and buildings, you must inspect and/or test every surface.

(3) PRESUMED CONTAMINATED RULE 3: Where a doubt exists, articles, pieces of equipment, and buildings are presumed contaminated.

d. A "presumed not contaminated" evaluation results from evidence the article, piece of equipment, or building had no exposure to uncontrolled or uncontained explosive contaminants or has been completely decontaminated by a verified and repeatable process. Articles from an equipment room or equipment properly labeled 5X are normally presumed not contaminated.

(1) PRESUMED NOT CONTAMINATED RULE 1: You may label presumed not contaminated articles, pieces of equipment, and buildings 0 or 5X only after inspection and/or testing reveals no contamination on the surfaces where it is likely to exist.

(2) PRESUMED NOT CONTAMINATED RULE 2: If you find contamination on a presumed not contaminated article, piece of equipment, or building, you must change the presumption and inspect/treat it as presumed contaminated.

e. In a presumed contaminated area, contaminants may pass to interiors, collecting in places not accessible to visual examination. In presumed not contaminated areas, few or no transmittable contaminants are present to accumulate in hard-to-see places. You cannot visually inspect all surfaces of articles or equipment containing holes, blind spaces, rivets, open seams, cracks, etc. Nor can you visually inspect buildings with hollow walls (stud-type walls with both sides covered). Paragraph 11 lists several other special cases where hazards may exist.

f. How accidents and abnormal operations affect the decision if an article, piece of equipment, or building is presumed contaminated depends on the accident frequency, how widespread the potential contamination is, the ease of detection, and the harmful effects of a wrong decision. All these factors depend on local knowledge and judgment. Local judgment will prevail. These examples may assist you in coming to a local decision.

(1) Nitroglycerine (NG) nitrator bay (Biazzi process). During normal operations, NG remains totally enclosed within the process equipment and sealed well enough to prevent migration; but during abnormal operations, the process may dump NG to a drowning tank, thereby exposing the atmosphere briefly. Although process upsets of this type are rare, the contaminant (NG) leaves no visible trace when absorbed in porous material. The effects of a wrong decision are potentially catastrophic, so it appears prudent to label this operation "presumed contaminated".

(2) Shipping building. During normal shipping operations, there are no exposed explosives, but a container could rupture and contaminate a small area. This is most likely when handling bulk material. Because the possibility of accidental contamination is small and the contaminant can be readily identified and cleaned, you would probably be safe in classifying the building as "presumed not contaminated".

8. Visual detection. The third question in evaluating contaminated articles, pieces of equipment, and buildings is, "Does the contaminant leave a visible trace or signature?"

a. In most instances, the answer is yes, but there is one notable exception, NG. NG is a milky, oily liquid at ambient temperatures above 54 degrees Fahrenheit. The milky color is visible in large batches but virtually disappears when a small amount spreads over a surface. This makes it hard to detect in cracks and crevices. NG absorbed into porous material leaves no visible trace. When you heat materials containing NG, some of the NG will vaporize and condense on cooler objects. This leads to the NG rule.

NG RULE: You must consider any porous material totally contaminated if it was in direct contact with NG-containing material or from an environment where NG-containing material was heated.

b. "What if a nonexplosive material looks similar to an explosive one?" If research shows both materials could be present, two options exist. The first is to assume any material noted during visual examination is the explosive material and

proceed on that assumption. The second option is to perform chemical tests on the found material to determine which of the two it is. One of the simplest chemical tests is the use of an indicator solution. These solutions change color in response to specific chemicals or compounds. You must take care to select an indicator solution that correctly identifies the explosive contaminant while minimizing false positive indications. For example, Webster's reagent detects substances with high nitrogen, from nitrated explosives to some fertilizer. Before using any indicator solution, consult a chemist or other knowledgeable person concerning what to use and how to use it.

9. Visual examination. The primary objective of visual examination is to assist in proper classification of articles, pieces of equipment, or buildings, following the guidance and rules.

a. Only knowledgeable individuals familiar with the explosive contaminants; the articles, equipment, or buildings involved; and decontamination methods qualify to conduct visual examinations. The light and equipment at the inspection site must be sufficient to assure a proper and detailed examination.

b. The visual inspection requirements for porous material are much the same for both the "presumed contaminated" and the "presumed not contaminated" categories when you are looking at individual pieces of material where normally all surfaces are readily visible.

10. Remediation.

a. Decontamination methods are specific to the explosive contaminant, its form, the level of decontamination required, and the article, piece of equipment, or building involved. A knowledgeable individual must tailor all specific decontamination plans and efforts. Generally, there are only three decontamination processes:

(1) Chemical/biological alteration. These processes chemically alter the contaminant to produce a nonexplosive, hopefully inert, substance.

(2) Physical removal of contaminants. Washing, scraping, and vacuuming are examples of the processes which remove the contaminant unchanged. Waterjet technologies have been effective in removing surface contamination.

(3) Heat. These processes heat the article or piece of equipment to a level above the decomposition temperature of the contaminant and hold it there long enough to assure the largest mass is at that temperature, consuming contaminants by oxidation. For many building materials this means total destruction by burning.

(a) Historically, decontamination using heat literally meant building a bonfire under the article or piece of equipment to heat it "cherry red". Some installations have decontamination ovens or flashing furnaces designed to permit temperature control as a more positive means of assuring decontamination.

(b) Now, some contaminated waste processors originally designed to burn contaminated rags and paper are decontaminating nonporous articles or equipment. Hot gas decontamination provides similar levels of decontamination without exposing articles or pieces of equipment to direct flames.

b. A decontamination plan (see paragraph 14 and appendix b) may specify any process that is repeatable and verifiable for the contaminant(s). You may classify articles, pieces of equipment, or buildings subjected to processes 10a(1) and 10a(2) 5X only when every surface is visible and/or capable of being inspected or sampled and is thereby positively exposed to the removal agent. Where holes, blind spaces, rivets, cracks, etc., exist, washing or chemical cleaning alone is not usually effective in removing the contaminant. A situation can result where the surface appears decontaminated to visual examination and/or surface testing, but hazardous explosive contaminants remain hidden.

11. Special Cases. These cases present grave hazards because, generally, visual examination cannot identify contamination on the listed articles or pieces of equipment. You can decontaminate them to 5X only by heat unless otherwise specified.

a. Pipe.

(1) Explosive-carrying pipe. No amount of flushing, steaming, or "roto-rooting" can positively remove all contamination, and visual inspection cannot identify pipe interior contamination. NOTE: Only the use of a boroscope or similar device to inspect the pipe interior relaxes this absolute restriction on pipe.

(2) Pipes not carrying explosives, but passing through or located in a "presumed contaminated" area. Generally, pipes filled with inert material pose no threat of interior contamination, because the inert material blocks entry of explosive contamination. However, empty pipes may pose a problem if entry points exist in "presumed contaminated" areas. The clearest examples are dry-pipe sprinkler or deluge systems. Experience has shown that explosive material may migrate into these systems. You must consider any dry pipe system that protects an explosive operation to have interior explosive contamination. This includes all piping, valves, etc., from the nozzle back to the water valve.

b. Thick metal objects in a "presumed contaminated" area. There is no precise definition of the term "thick", but anything over 1 inch should be suspect. Many times in the casting of thick metal objects, subsurface voids form. Cracking in the area weakened by the void is likely. Cracks leading to voids and those voids can harbor hazardous quantities of contaminants. Only special testing can prove voids/cracks do not exist in thick metal objects.

c. Welded overlapping plates in a "presumed contaminated" area. Regardless of thickness, items containing overlapping welds may harbor hazardous contaminants in the area between the welds. Only heat processes decontaminate overlapping welds.

d. You must be aware of potential material incompatibilities when evaluating contaminants and developing decontamination plans, as these can create new hazards which are difficult to identify. Smooth metal resists most contaminants, but may

experience a chemical change which creates a hazard, as in the case of copper contacted by moist lead azide, which creates copper azide at the contact zone.

12. Marking.

a. Articles. You may wish to group small articles in a bin or other container and tag the container. Tag large articles individually. Follow the general guidance for equipment in paragraph 12b below.

b. Equipment. After the effective date of this pamphlet, you must tag each piece of equipment programed for layaway, going into modified caretaker status, or for disposal with DD Form 2271, Decontamination Tag, or equivalent. (See appendix C.) You need not tag idle production equipment until it falls in one of the preceding classes. Where exposed to extremes or weather outside, tags may require protection or frequent replacement to remain readable. Painting large equipment and buildings with the correct contamination status in a contrasting color may provide a further means of easy identification. In addition to the information required on the DD Form 2271, you must include the rationale for the assigned classification in the "Specific Instructions/Additional Information" block. Two examples follow.

(1) In this example, a piece of equipment came from a "presumed not contaminated" environment and received a 5X classification. The Specific Instructions/Additional Information block reads, "Presumed not contaminated; took off cover and visually examined exposed surfaces and air inlet/outlet. No contamination, all rules and special cases considered."

(2) In this example, a piece of equipment came from a "presumed contaminated" environment and received a 3X classification. The block reads, "Presumed contaminated; outer surfaces cleaned by water wash. Additional contamination may be present in bearings."

c. Buildings. You may classify buildings as a single unit or different bays and areas individually. Within a single bay, it is possible to have different classifications for different

areas (walls, ceilings, floors, barricades, etc.). For example, a bay may have 5X walls (interior covering removed, contaminants may be detected by visual examination but none was found) and 5X ceilings (smooth sealed surface, contaminants may be detected by visual examination but none was found), but only a 3X floor (large cracks may hide contaminants, visual inspection not effective).

13. Acceptable levels of decontamination.

a. Ongoing production. The acceptable decontamination level at the end of a production shift is 1X, defined as routine cleaning. Substantial surface contamination may remain, but it must not endanger knowledgeable personnel or the start of the next shift.

b. Maintenance of articles, pieces of equipment, and buildings.

(1) The minimum acceptable decontamination level for minor equipment adjustment is 1X. You may do minor disassembly to facilitate further decontamination. Local judgement will prevail when defining the term "minor". The immediate area around the disassembly point should be as clean as possible. You may do intraplant movement to facilitate further decontamination, provided you have written concurrence of the installation safety office (or their designee).

(2) The minimum acceptable decontamination level for routine maintenance, careful equipment disassembly (greater degree of disassembly than requiring 1X), etc., is 3X. Intra-plant movement requires no separate safety office approval. Do not subject these materials to welding, drilling, sawing, etc., or other processes that may generate enough heat to ignite residual contamination.

(3) The minimum acceptable decontamination level for unrestricted sawing, welding, drilling, etc., is 5X. You may transfer 5X-contaminated articles, pieces of equipment, or buildings to the general public for maintenance.

c. Disposal of articles, pieces of equipment, and buildings.

(1) The general public may buy or receive items classified as 5X or 0. These items are also safe for welding, sawing, or other heat-generating processes.

(2) The general public cannot buy or receive items classified as 3X. Knowledgeable Government installations or qualified buyers may buy and receive them. A qualified buyer is a person or company possessing a BATF explosive manufacturer's license. You may sell 3X-contaminated items to organizations or individuals who are not Government entities and do not possess a BATF license (usually scrap dealers) if:

(a) They have the proper facilities and detailed knowledge to safely store, handle, and disassemble 3X items, and decontaminate them to 5X.

(b) They agree to decontaminate the items to a 5X condition IAW with this guidance.

(c) They agree to provide an end-use certificate. (See appendix D.)

(d) They successfully pass an IOC Safety Division preaward survey (or the equivalent by the responsible entity or agency) verifying satisfaction of paragraph 13c(2)(a) above.

(3) Upon obtaining all permits and approvals, you may dispose of 3X-classified items in qualified landfills.

14. Decontamination plans.

a. Establishing a decontamination plan. The IOC Safety Division highly recommends a decontamination plan to organize large or complex decontamination efforts, establish duties and responsibilities, and provide traceable records. The parties responsible for the decontamination effort; i.e., the plant manager, commander, BATF license holder, etc., should approve the plan. The plan should include the appropriate information and details for the decontamination effort under consideration.

Standing operating procedures (SOPs), as part of or referenced in the decontamination plan, should cover routine decontamination for maintenance, cleanup of operations and equipment, and unusual events. For a short sample plan see appendix B.

b. Elements of a decontamination plan. Depending on the scope and requirements of the decontamination effort, the decontamination plan may contain the following or other elements:

(1) Specifics as to exactly what articles, pieces of equipment, and buildings the decontamination effort covers. (In the provided example, the plan is for the decontamination and marking of two specific buildings and all remaining articles and equipment.)

(2) References to the decontamination SOPs, technical documents, and maintenance procedures. (For example, SOP ABC-12 will cover decontamination of Acme loading machines contaminated with RDX and RDX containing explosives.)

(3) Methods and specific equipment used for decontamination. (In most cases, this information is already in an SOP, which may be a reference.)

(4) Assignment of duties and responsibilities to specific people or specified positions. (For example, John Brown or the installation safety officer will be the only individuals authorized to sign a DD Form 2271.)

(5) Knowledge, training, or skill requirements for personnel involved in the decontamination effort. (This would ordinarily include specific background requirements, SOP training, specific equipment training, and other similar things. This might also include Hazard Communication (HAZCOM), Right-to-Know, and other OSHA requirements.)

(6) Procedures addressing emergency actions and unusual events during decontamination. (This may already exist in SOPS.)

(7) Records and recordkeeping. Before starting decontamination, historical records characterize the potential for contamination and identify contaminants. Historical records may include hazard analyses, operating SOPS, information posted in the facility, individual knowledge, record drawings, installation histories, production records, and all other past and present information sources. After decontamination, records assure correct article, equipment, and building marking, and establish an audit trail for the future. (Filing the plan itself and copies of decontamination tags, drawings, SOPS, other procedures, and other information referenced in the plan may establish adequate records.)

Appendix A

Examples

These examples demonstrate a variety of decontamination situations and how the HQ, IOC, Safety Division views them. They are not meant to direct actions in any case, as local conditions will dictate the actual classifications.

1. A motor sitting in the same bay as the mixer it powers. The mixer is processing single base propellant.

a. Porous or not? In this case, the answer is nonporous.

b. Presumed contaminated? In this case, the answer is yes. The motor sat in the room with the mixer. Loading and unloading exposed mix ingredients. Furthermore, the mixer lid was removable during some portions of the cycle.

c. Is the contaminant readily visible? In this case, the answer is yes. Nitrocellulose is a white powdery substance. Single base mix is light tan.

d. Can a visual examination alone produce a 5X or 0 classification? In this case, the answer is no. Since the motor was presumed contaminated, the contaminant could be in hidden locations. Airborne contaminants may be drawn into the interior of the motor by cooling air and deposited within the motor. In this case, the burden of proof requires the inspector to prove what level of contamination exists.

NOTE: Could you tear down/disassemble the motor to expose those hidden locations? It may be possible. Whether or not this is an option for your situation depends on your confidence in seeing every surface. The cost of disassembly may not justify this action. If you try this, the metal portions of the motor would be subject to Crack Rule 1 and the thick-metal-object warning in paragraph 11b.

e. Remediation options and marking.

(1) To render the motor 5X, heat is the preferred method.

(2) To render it 3X, remove any outside contamination, practical, remove the outer housing and remove visible, easy-to-reach contamination.

2. A motor sitting in a separate motor room with a shaft running through a wall to the mixer. The mixer is processing single base propellant.

a. Porous or not? Nonporous.

b. Presumed contaminated? No. This motor was sitting in a separate motor room with a shaft running through a wall to the contaminated area.

c. Is the contaminant readily visible? Yes. Nitrocellulose is a white powdery substance. Single base mix is light tan.

d. Can a visual examination alone produce a 5X or 0 classification? In this case, the answer is yes. Because this motor is presumed not contaminated, visual inspection confirms that assumption, but does not prove all harmful contamination has been removed, as in example 1. This is a different burden of proof. Inspect the air intakes and exhaust for contaminant. Remove the motor housing and take a general look inside.

e. Remediation options and marking.

(1) If you find no contaminant, the motor needs no remediation. Mark the motor 0, never contaminated.

(2) If you find contamination, the "presumed not contaminated" category changes to "presumed contaminated", giving you the options listed in example 1.

3. A 2-inch by 4-inch by 8-foot wooden wall stud from a single base propellant mixer bay.

a. Porous or not? In this case, the answer is porous.

b. Presumed contaminated? Yes, this stud came from the wall of an explosive processing bay.

NOTE: If a nonporous material or finish covers the stud and no cracks/openings exist which provide access for contamination, you may treat this stud like the stud in example 4, presumed not contaminated.

c. Is the contaminant readily visible? Yes. Nitrocellulose is a white powdery substance. Single base mix is light tan.

d. Can a visual examination alone produce a 5X or 0 classification? Yes, you can inspect all surfaces.

e. Remediation options and marking. Cut off any contaminated portion. Mark the uncontaminated portion 0, never contaminated. Mark the contaminated portion 3X.

4. A 2-inch by 4-inch by 8-foot wooden wall stud from an inert part of a TNT processing building.

a. Porous or not? In this case, the answer is porous.

b. Presumed contaminated? No. This wall stud came from an inert part of an explosive processing building.

NOTE: Before presuming the stud is not contaminated because it came from an inert portion of the building, you must make sure the operation on the other side of the wall was also inert.

c. Is the contaminant readily visible? Yes, TNT is readily recognizable as tan-to-red granules or masses.

d. Can a visual examination alone produce a 5X or 0 classification? Yes, you can inspect all surfaces.

e. Remediation options and marking.

(1) If not contaminated, mark the stud 0, never contaminated.

(2) If you find contamination, the "presumed not contaminated" category changes to "presumed contaminated", giving you the options listed in example 3.

5. A 2-inch by 4-inch by 8-foot wooden wall stud from an inert part of an NG processing building.

a. Porous or not? In this case, the answer is porous.

b. Presumed contaminated? No, this wall stud came from an inert part of an explosive processing building.

NOTE: Before presuming the stud is not contaminated because it came from an inert portion of the building, you must make sure the operation on the other side of the wall was also inert.

c. Is the contaminant readily visible? No, when NG *is* absorbed in wood, it leaves no visible trace. (For a further discussion of this consideration, see paragraph 8.)

d. Can a visual examination alone produce a 5X or 0 classification? No.

e. Remediation options and marking. If any doubt exists, consider the stud contaminated and mark it 3X. Since there is no visual way to differentiate between contaminated and not contaminated, be on the safe side and consider it contaminated.

NOTE: There are exceptions to the "cannot see it, it is contaminated" rule. For example, if the wall stud came from a line office in a separate building, you could conclude there is a zero probability of explosive contamination and it should be marked 0.

6. A 2-inch by 4-inch by 8-foot wooden wall stud from an evenspeed bay processing double-based, solventless propellant.

a. Porous or not? In this case, the answer is porous.

b. Presumed contaminated? Yes, the stud came from an explosive process.

c. Is the contaminant readily visible? No, even though the propellant is readily detected, this process heats a NG-bearing material. NG, once absorbed in wood, leaves no visual evidence. (Historical research is essential in determining if this type of "hidden" hazard exists.)

d. Can a visual examination alone produce a 5X or 0 classification? No.

e. Remediation options and marking. Consider the stud contaminated and mark it 3X. There is no practical way to remove the NG and leave the stud intact.

7. A 155mm projectile body with Composition B (Comp B) fill, cleaned using a steam/water sumping process to reach at least a 3X condition.

a. Porous or not? In this case, the answer is nonporous.

b. Presumed contaminated? Yes, the projectile has obviously been contaminated with Comp B.

c. Is the contaminant readily visible? Yes, Comp B is easily recognizable as slightly waxy brownish granules or masses.

d. Can a visual examination alone produce a 5X or 0 classification? No. The closed nature of the projectile makes visual examination difficult. The threads and joints are areas where contamination can exist undetected. Additionally, parts of the projectile may be over 1-inch thick. (See paragraph 6c for the crack rules, paragraph 10b for the specific classification rationale, and paragraph 11b for the thick metal rule.)

e. Remediation options and marking.

(1) If the projectile body is for transfer or sale to a knowledgeable Government organization or qualified user, mark the projectile 3X and dispose of it without further remediation.

(2) If the projectile body is for transfer or sale to the general public, the projectile must undergo remediation to a 5X level of contamination. (For details in methods of remediation, see paragraph 10.)

8. A 105mm projectile body cut in half lengthwise and with the TNT fill cleaned out.

a. Porous or not? In this case, the answer is nonporous.

b. Presumed contaminated? Yes, the projectile has obviously been contaminated with TNT.

c. Is the contaminant readily visible? Yes, because the projectile is cut lengthwise, exposing all surfaces for visual inspection. TNT is easily recognizable as slightly tan-to-red granules or masses.

d. Can a visual examination alone produce a 5X or 0 classification? Yes, unless a part of the projectile body is over 1-inch thick. The thick metal rule will then apply.

e. Remediation options and marking.

(1) If all body parts are under 1-inch thick, mark the projectile 5X and transfer or sell without restrictions.

(2) If there are metal masses over 1-inch thick, mark the projectile 3X unless further remediation is done. (If the decontamination process is repeatable and verifiable for this projectile, and no contamination is found, the projectile can be classified 5X anyway.)

9. A 90mm cartridge case which has the propellant removed and the primer fired.

a. Porous or not? In this case, the answer is nonporous.

b. Presumed contaminated? Yes, the cartridge case has obviously been contaminated with propellant grains. The current visual inspection is to verify decontamination/demilitarization.

c. Is the contaminant readily visible? Yes, propellant is easily recognizable as regularly shaped grains, and it is obvious if the primer has fired.

d. Can a visual examination alone produce a 5X or 0 classification? Yes. The visual examination can verify the primer has fired and no propellant remains in the case.

e. Remediation options and marking. If the cartridge case contains no propellant and the primer has fired, mark it 5X and transfer or sell it without restrictions. Mark propellant contaminated cases 3X and handle, transfer, or sell them appropriately. Treat those cases with unfired primers as 1X, pending further remediation.

Appendix B

Sample Decontamination Plan

The following sample decontamination plan is a simple illustration of the elements outlined in paragraph 14.

1. This document is the Decontamination Plan for the decontamination and marking of detonator loading machines, associated equipment, and the bays in buildings 15 and 16 containing the machines. Current and past plant records indicate lead azide, primer mix (containing lead azide, lead styphnate, and tetracene), and RDX explosives contaminate these bays and machines.

2. Decontamination methods. Decontamination will take place in two steps:

a. Production personnel will clean all machines, associated equipment, and bays according to the regular cleaning requirements in SOP AA, Operation of Detonator Loading Machines, operations Q through S. The line supervisor will verify this cleaning.

b. After verification, the supervisor will turn over the bays and contents to the Decontamination Team responsible for any further cleaning and all marking according to SOP BB, Decontamination and Marking of Buildings and Equipment, operation A on lead azide, operation D on primer mix, and operation E on RDX. All personnel will use the tools and methods specified in SOP AA and SOP BB, and handle and dispose of all hazardous waste according to the requirements in SOP CC, Hazardous Waste Handling and Disposal.

3. Personnel. Only trained and qualified personnel will enter the decontamination areas.

a. Only production personnel fully trained in the proper operations of SOP AA, and familiar and accomplished at completing these tasks, will do the regular cleaning.

b. The Decontamination Team will consist of a member from the safety office who is familiar with detonator loading machines, knowledgeable of the contaminants and decontamination methods, trained in SOP BB, and who will act as team leader; one or more millwrights who regularly worked on detonator loading machines and specifically trained in decontamination methods and SOP BB; and one or more explosive operators specifically trained in decontamination methods and SOP BB. The Training Department will train all members of the Decontamination Team in the HAZCOM/Right-to-Know Program, the requirements of SOP CC, and SOP DD, Accidents, Incidents, and Emergency Operations.

C. The Maintenance, Engineering, Transportation, and Demolition Ground groups will support the Decontamination Team as required to complete the Decontamination Plan and prepare the loading machines for final disposal. The Training Department will train all personnel entering the decontamination areas in the applicable sections of SOP BB, SOP CC, and SOP DD.

4. Marking. After decontamination, the Decontamination Team will clearly mark the final contamination level on all equipment and bays/buildings.

a. Only the Decontamination Team leader (or his written designee) is authorized to determine contamination levels as defined by SOP BB and IOCP 385-1.

b. Personnel will mark large pieces of equipment and bays/buildings with large letters of clearly visible contrasting paint and attach a completed DD Form 2271. (See SOP BB, operation K for the appropriate marking directions and instruction on filling out the DD Form 2271.) Small pieces of equipment, piping, or groups of tooling need not be individually marked if they have the same level of contamination and the same destination. Group them in a properly marked container and attach the completed DD Form 2271.

c. Maintain file copies of the DD Form 2271s, any materials dealing with the decontamination effort, and the decontamination plan and appendices in a permanent file for future reference.

5. References and attachments.

a. Reference, IOCP 385-1, Classification and Remediation of Explosive Contamination.

b. Attachment 1, SOP AA, Operation of Detonator Loading Machines, operations Q through S.

c. Attachment 2, SOP BB, Decontamination and Marking of Buildings and Equipment, operation A on lead azide, operation D on primer mix, operation E on RDX, and operation K on marking.

d. Attachment 3, SOP CC, Hazardous Waste Handling and Disposal.

e. Attachment 4, SOP DD, Accidents, Incidents, and Emergency Operations.

Mr. Joe Bigshot
Plant Manager
3X Corporation, Inc.
Anywhere, USA

Appendix C

Decontamination Tags

A decontamination tag must contain the following information to be acceptable for marking articles, equipment, or buildings under paragraph 12. Attach one copy to the item and keep one copy in a permanent file.

1. The name of the installation, activity, or company.

2. A unique serial number.

3. The previous tag serial number (for a changed/replaced tag).

4. The level of contamination; i.e., 1X, 3X, 5X, or 0.

5. The completion date for the decontamination.

6. A short description of the article, equipment, or building.

7. The use of the article, equipment, or building and any serial number, model number, or similar identifier.

8. Contaminant(s) name(s).

9. Area or building where tagging was done.

10. Reason for decontamination; i.e., repair in place, move to _____ for _____, disposal, or other (explain).

11. The decontamination method used and the process controls.

12. The identifier for the SOP or decontamination plan used (number and/or title).

13. A brief rationale for the assigned classification.

14. Signature and date by both the person in charge of the decontamination and the inspector or safety representative.

Appendix D

End Use Certificate

An end use certificate, similar to the following, establishes that the qualified user (see paragraph 12) will properly handle and dispose of contaminated articles, equipment, and buildings. The qualified user will sign the end use certificate and impose a similar requirement on the transfer to another user of articles, equipment, or buildings not decontaminated to 5X.

It is hereby certified that (individual/company name) will comply with all applicable federal, state, and local ordinances and regulations with respect to the care, handling, storage, shipment, resale, export and other use of the material, hereby purchased, and that he/she as a user of, or dealer in, said materials, is capable of complying with all applicable federal, state, and local laws. This certification is made in accordance with and subject to the penalties of Title 18, Section 1001, of the United States Code, Crimes and Criminal Procedures.

(Signature), (Date)

ATTACHMENT "F"

DRAWING #1500.101

1 PAGE

EXPRAY Use and Application

EXPRAY is a field test kit for the identification and detection of trace levels of explosives and explosive residues. The kits have been extensively used in forensic investigations since 1991 and they have only recently been applied to environmental work. During its use for forensic applications, the kits have proven to be fast (less than one minute per test), sensitive (nanogram level), reliable, easy to transport (under two pounds), easy to operate (no special training required, and no power requirements), and inexpensive (less than $3 per test). These characteristics make the test kits a valuable tool for environmental work.

EXPRAY can be used to supply valuable qualitative information during both OE and environmental investigation, and site remediation. Listed below are a sampling of applications:

- Use to determine if process equipment or a surface has been in contact with explosives
- Certify scrap for disposal
- Screening of unknowns in preparation for disposal
- Soil sample screening
- Delineate edge of a contaminated area
- Prescreen locations to identify appropriate sites for collection of samples for quantitative analysis
- Prescreen extracts for immunoassay analysis to determine if an explosive is present and if so identify which test (TNT or RDX) should be performed

Through a series of sequential reactions, EXPRAY distinguishes between 1) polynitroaromatics, 2) nitrate esters and nitramines, and 3) inorganic nitrate compounds. Based on a patented procedure, this aerosol kit identifies these classes of compounds accurately, quickly, and distinctively. Refer to Tables 1 and 2 for a partial list of explosive compounds and mixtures detected.

The collector papers are laminated on one side and covered with a thin layer of glue on the other side to ensure good collection of specimen and prevent contamination from the sampler's hands.

EXPRAY can be used as an investigative aid to distinguish between an explosive and a non-explosive material. Through two or three very simple consecutive tests the kit will provide visual evidence of traces of the explosives. The traces can be found on any surface suspected to have been in contact with explosives.

What does each can test for?

EXPRAY-1 – Group A (Nitroaromatics) - Letter 'E' on the front. This type of explosives includes TNT, Tetryl, TNB, DNT, picric acid and its salts.

EXPRAY-2 – Group B (Nitrate esters and nitramines) - Letter 'X' on the front. This type of explosives includes Dynamite, nitroglycerine, RDX, PETN, Semtex, nitrocellulose, smokeless powder, and Tetryl. NOTE: Most plastic types of explosives belong to this group.

EXPRAY-3 – Group I (Inorganic nitrates) - Letter 'I' on the front. The nitrates based explosives which includes ANFO (ammonium nitrate-fuel oil), commercial and improvised explosives based on inorganic nitrates, black powder, flash powder, gun powder, potassium nitrate, and ammonium nitrate.

How do I use the EXPRAY?

Most explosives are not water-soluble and traces can be found months and years after the explosives have been removed. Directions are also printed on each can and inside cover of the EXPRAY kit carrying case.

1. Wipe suspected surface with special collector test paper. (A small amount of soil or extract can be placed on the collection paper.)

2. Spray test paper briefly with EXPRAY-1. If a dark brown-violet color (similar to the color of the label) appears this indicates the presence of TNT. An orange color indicates the presence of Tetryl or other GROUP A explosives.

3. If after spraying with the EXPRAY-1 there is no color reaction, then spray the same test paper with EXPRAY-2.

4. The almost immediate appearance of a pink color change (similar to the color of the 'X' letter on the label) indicates the presence of GROUP B explosives. Most plastic types of explosives belong to this group, including Semtex. [Tetryl belongs to both Groups, so it will change from orange (color change caused by EXPRAY-1) to pink after being sprayed with EXPRAY-2.]

5. If there is still no reaction after using the EXPRAY cans 1 and 2, but presence of explosives is still suspected, spray the same paper with EXPRAY-3. A pink reaction indicates the presence of nitrates, which could be part of an improvised explosive.

How sensitive is the kit?

Laboratory tests found the kit can detect particles as small as 20 nanograms. Such small particles can be found on ordnance related scrap, on working surfaces such as equipment or buildings (walls, floors, ventilation systems), and on the outer side of packaging in which

explosives were sent. Even after an explosion, unexploded particles can be found in the area, which can give an immediate clue about the nature of the explosive.

For detection of nitrate esters, nitramines or inorganic nitrates, can EXPRAY-2 or EXPRAY-3 be used alone?

Definitely not! The EXPRAY cans must always be used sequentially. The spraying order must not be altered and all three sprays should be used when testing, in order to perform a complete test. If EXPRAY-2 is sprayed after a positive result was obtained with EXPRAY-1, a change to pink color is an indication of a double base or a triple base explosive (such as Composition B and triple base gunpowder). Even when Group B explosives only are tested, one should start with EXPRAY-1 and only then spray with EXPRAY-2. If nitrate based explosives are suspected, one should still start with EXPRAY-1, then move to EXPRAY-2 and only then apply EXPRAY-3.

How long after handling the explosive can traces be found?

Most explosives are not water soluble, and traces are often present on the hands even after washing with water and soap. Explosive traces can be found on undisturbed objects even months and years after the actual explosive has been removed.

Is the result of the testing with EXPRAY accepted as evidence in court?

Definitely not! In order to gain evidence for court, a laboratory examination is needed.

If so, why use the kit?

Without a field kit, a technician performing an evaluation cannot know which object/sample should be sent for laboratory examination or must rely solely on physical appearance to determine the nature of the material present. With EXPRAY you can more effectively utilize a limited number of samples allotted to a project or for an additional level of confidence to the technical judgement. By using the kit, the technician can screen several objects/samples and send to the laboratory only those that give a positive result with EXPRAY, thus saving time and money in the laboratory.

How can I be sure that the kit is working properly?

The kit is equipped with verification papers that allow the technician to verify that the kit is working. To test the reagents, simply spray one of the EXPRAY cans on unused verification papers. If the letters EX come up, then the reagents are still good.

Do I have to use the collection papers?

No, the collection papers are provided as a convenient way to collect samples. Any clean white paper can be used. Although not recommended the spray can be used on any surface that contrasts with the developed color.

CHEMISTRY PRINCIPLES OF THE EXPRAY KIT

Nitroaromatics such as TNT, TNB, picric acid and its derivatives form highly colored compounds (Meisenheimer Complexes) upon reaction with alkali. Common alkali formulations for explosives analysis contain 5 to 10 percent tetrabutylammonium hydroxide in ethanol or water.

Nitrate esters such as nitroglycerine (NG), EGNG, PETN, and nitrocellulose (NC) under similar conditions will undergo alkaline hydrolysis producing nitrate ions (NO_2), which can be readily detected with the Griess reaction. This includes the action of nitrate ions on an aromatic amine, usually sulfanilic acid, in an acidic medium. The diasonium ion that is then formed is complexed with an aromatic nucleophile to produce a colored azo dye.

Nitramines such as RDX, HMX, and tetryl also undergo alkaline cleavage to form nitrate ions, which produce the same colored azo compound by the Griess reaction. Dimethyl sulfoxide (DMSO) is used as a solvent for the alkaline reagent. This solvent accelerates the color formation with plastic explosives. A combination of sulfanilamide and N–(1-naphthyl) ethylenediamine gives a fast and intensified color reaction.

As for the inorganic nitrates, a fine zinc dust is used to reduce them to nitrite ions that then react with the Griess reagent.

NOTES

Stability and Storage:

All three reagents have been tested after accelerated aging experiment (50°C, 8 weeks). However, it is recommended that when not in use, that the cans should be stored a cool, dry place. The cans should always be stored in an upright position, and the carrying case of the EXPRAY kit should be stored in standing position. The cans are guaranteed for one year after purchase. However, the reagents should remain effective almost indefinitely.

False positives:

Any fertilizer containing nitrates will react to EXPRAY-3 (after 'E' and 'X'). If nitrite compounds (such as sodium nitrite) are tested, a color reaction will be obtained even after applying EXPRAY-1 and EXPRAY-2. No other false positives are known, but one should note that only the colors listed should be observed.

If a different color appears in any stage, it should be disregarded. Furthermore, an unreacted test paper left in the open air will gradually change it's color to light pink. Note that there are some varnishes and lacquers made of nitrocellulose (which is a group B explosive), and if the kit is applied directly to a surface treated with such coatings, a positive (pink) reaction will appear. The varnishes do not disperse residues, so that touching a varnished surface will not cause positive reaction on the touching hand or surface.

Health and Safety:

In general, all spray products should be treated carefully. Do not: puncture the can, throw into fire, or expose to extreme heat.

The spray can should be held in upright position, and exposure to direct sunlight (especially in a parked car in the summer) should be avoided. Usually it is recommended to use the sprays in a ventilated area and to avoid inhalation of the spray. Do not smoke while spraying, as the propellant is flammable.

TABLE 1
DETECTED COMPOUNDS

Product:	EXPRAY – 1	EXPRAY - 2	EXPRAY - 3
Detects:	Polynitro-Aromatics	Nitrate-esters Nitramines	Inorganic Nitrate Compounds
Group:	Group A	Group B	Improvised

#	Substance	Color	Substance	Color	Substance	Color
1	Ammonium Picrate	Yellow	BTN	Pink	Ammonium Nitrate	Pink
2	DDNP	Orange-Brown	DEGN	Pink	Barium Nitrate	Pink
3	DNT	Blue-Green	EDDN	Pink	Black Powder	Pink
4	Lead Styphnate	Yellow	EGDN	Pink	Potassium Nitrate	Pink
5	Nitroxylene	Brown	Haleite	Pink	Silver Nitrate	Pink
6	Picric Acid	Yellow	HMX	Pink	Sodium Nitrate	Pink
7	Tetryl	Orange	NC	Pink	Strontium Nitrate	Pink
8	TNB	Dark Brown	NG	Pink		
9	TNT	Dark Brown	Nitroguanidine	Pink		
10	Tri Nitro Napthalene	Violet	PETN	Pink		
11			RDX	Pink		
12			Semtex	Pink		
12			Smokeless Powder	Pink		
13			Tetryl	Pink		

TABLE 2
CROSS REFERENCE TABLE FOR TRADE NAMES OF EXPLOSIVES

#	Name of Explosive	Composition	Detected by EXPRAY Can
1	Amatol	Ammonium Nitrate + TNT	1, 3
2	Ammonal	Ammonium Nitrate + TNT + Aluminum Powder	1, 3
3	Ammongelite		1, 2
4	Ammonium Perchlorate		Not Detected
5	ANFO	Ammonium Nitrate + Fuel Oil	3
6	C3	TNT + DNT + RDX + NC + Tetryl	1, 2
7	C4	RDX	2
8	Composition B	RDX + TNT	1, 2
9	Cordite	NC + NG	2
10	Cyclonite	RDX	2
11	Demolux	RDX + EGDN	2
12	Dynamite	Nitroglycerin	2
13	Gelanite	NC + NG	2
14	Gun Cotton	NC	2
15	HBX, H6	RDX + TNT	1, 2
16	Lead Azide		Not Detected
17	Mercury Fulminate		Not Detected
18	Octogen	HMX	2
19	Octol	HMX + TNT	1, 2
20	Pentolite	TNT + PETN	1, 2
21	Pentrite	PETN	2
22	Picratol	TNT + Picric Acid	1
23	Semtex H	RDX + PETN	2
24	Tetrytol	Tetryl + TNT	1, 2
25	Torpex	TNT + RDX + Aluminum Powder	1, 2
26	Tritonal	TNT + Aluminum Powder	1
27	Water Gel	Ammonium Nitrate + Magnesium	3

Price List

Explosive Detection & Identification Sprays

M1553	EXPRAY Kit	Size / Quantity	Kit Price
Includes:	EXPRAY #1	100 ml	
	EXPRAY #2	100 ml	
Used as per instructions, kit yields 110 tests minimum.	EXPRAY #3	60 ml	
	Collection Papers (M0530)	50 each	
	Collection Papers (M0530)	50 each	
	Verification Papers	10 each	
	Large Carrying Case (MR1)	Tan	
			$245.00

Price is effective 1 January, 1998. Inquire concerning quantity discounts. Prices subject to change without notice. Additional shipping charges apply.