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Final Site Safety & Health Plan Addendum for 2010 Phase I Remedial Investigation Services Compliance Restoration Sites CC RVAAP-78 Quarry Pond Surface Dump & CC RVAAP-80 Group 2 Propellant Can Tops

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14. ABSTRACT

The Site Safety & Health Plan Addendum describes activities to be performed by Prudent to conduct a Phase I RI of CC RVAAP-78 Quarry Pond Surface Dump & CC RVAAP-80 Group 2 Propellant Can Tops, comprising the comprehensive background historical review and research of available pertinent data and limited intrusive sampling.

15. SUBJECT TERMS

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Final Site Safety and Health Plan Addendum for 2010 Phase I Remedial Investigation Services Compliance Restoration Sites CC RVAAP-78 Quarry Pond Surface Dump & CC RVAAP-80 Group 2 Propellant Can Tops

Ravenna Army Ammunition Plant
Ravenna, Ohio

Contract No. W912QR-10-P-0052

Prepared for:

US Army Corps of Engineers

U.S. Army Corps of Engineers
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September 30, 2010

CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

Prudent Technologies, Incorporated (Prudent) has completed the Site Safety and Health Plan for 2010 Phase I Remedial Investigation (RI) Services Compliance Restoration Sites CC-RVAAP-78 and CC-RVAAP-80 at the Ravenna Army Ammunition Plant, Ravenna, Ohio. Notice is hereby given that an independent technical review has been conducted that is appropriate to the level of risk and complexity inherent in the project. During the independent technical review, compliance with established policy principles and procedures, utilizing justified and valid assumptions, was verified. This included review of data quality objectives; technical assumptions; methods, procedures, and materials to be used; the appropriateness of data used and level of data obtained; and reasonableness of the results, including whether the product meets the customer's needs consistent with law and existing United States Army Corps of Engineers policy.

John P. Jent

John P. Jent, P.E.
Project Manager

September 30, 2010
Date

Mark Snyder, P.E.
Independent Technical Review Team Leader

September 30, 2010
Date

Prakash Raja, CHMM
Program Manager

September 30, 2010
Date

DOCUMENT DISTRIBUTION

Name / Organization	Number of Printed Copies	Number of Electronic Copies
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OEPA	2	2
Enviro Spec 2 / OHARNG	2	2
REIMS	0	1
Program Manager / USAEC	0	1

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

Health and Safety Plan Addendum

2010 Phase I Remedial Investigation (RI) Services Compliance Restoration Sites
CC RVAAP-78 Quarry Pond Surface Dump &
CC RVAAP-80 Group 2 Propellant Can Tops

Ravenna Army Ammunition Plant, Ravenna, Ohio

Position	Name	Phone Number
Program Manager	Prakash Raja, CHMM	210-860-8623
Project Manager	John P. Jent, P.E.	502-439-8005
Deputy Project Manager	Tomas Hernandez, Jr., P.G.	210-385-2011
Site Health and Safety Manager	Aditya Moralwar	402-617-4654
Certified Industrial Hygienist	Tony Ogunsanya, CIH	210-485-6029

Plan Approval Signatures

for _____ September 30, 2010

Certified Industrial Hygienist Date

_____ September 30, 2010

Health and Safety Manager Date

_____ September 30, 2010

Project Manager Date

_____ September 30, 2010

Program Manager Date

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

Health and Safety Plan Addendum

2010 Phase I Remedial Investigation (RI) Services Compliance Restoration Sites
CC RVAAP-78 Quarry Pond Surface Dump &
CC RVAAP-80 Group 2 Propellant Can Tops

Ravenna Army Ammunition Plant, Ravenna, Ohio

Plan Acknowledgement Signatures

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

Printed Name	**Signature**	**Date**

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ACRONYMS AND ABBREVIATIONS

ACM	Asbestos-containing material
APA	Abbreviated Preliminary Asessment
APR	Air purifying respirators
AOC	Area of Concern
CERCLA	Comprehensive Environmental Response, Compensation & Liability Act
COPC	Chemicals of Potential Concern
CPR	Cardiopulmonary resuscitation
CR	Compliance Restoration
FID	Flame ionization detector
FP	Flash point
FWSAP	Facility-Wide Sampling and Analysis Plan
FWSHP	Facility-Wide Safety & Health Plan
GFCI	Ground-fault circuit interrupter
HAZWOPER	Hazardous Waste Operations and Emergency Response
IDLH	Immediately dangerous to life and health
IP	Ionization potential
IDW	Investigation-derived waste
LEL	Lower explosive limit
IRP	Installation Restoration Program
MC	Munitions constituents
MEC	Munitions and explosives of concern
MI	Multi-increment
MSDS	Material Safety Data Sheet
NIOSH	National Institute for Occupational Safety and Health
NRR	Noise reducing rating
OE	Ordnance and explosives
OHARNG	Ohio Army National Guard
OJT	On-the-job training
O&M	Operations and maintenance
PCBs	Polychlorinated biphenyls
PID	photoionization detector
PEL	Permissible explosive limit
PPE	Personal protective equipment
PVC	Polyvinyl chloride
RAC	Risk assessment code
RI	Remedial investigation
RRD	Range-related debris
RVAAP	Ravenna Army Ammunition Plant
SAP	Sampling and Analysis Plan
SCBA	Self contained breathing apparatus
STEL	Short-term exposure limit
SSHO	Site Safety & Health Officer
SSHP	Site Safety & Health Plan
SVOCs	Semi-volatile organic compounds

TLV	Threshold limit value
TWA	Time weighted average
VP	Vapor pressure
USACE	U.S. Army Corps of Engineers
USACHPPM	U.S. Army Center for Health Promotion and Preventive Medicine
UXO	Unexploded ordnance
VOCs	Volatile organic compounds

1.0 – INTRODUCTION

The Ravenna Army Ammunition Plant (RVAAP) Facility-Wide Safety and Health Plan (FWSHP) (USACE 2001) and this Site Safety and Health Plan (SSHP) Addendum collectively set forth the specific procedures required to protect Prudent Technologies, Inc. (Prudent) and Prudent subcontractor personnel involved in the field activities at CC RVAAP-78 and CC RVAAP-80 at the Ravenna Army Ammunition Plant (RVAAP). These plans are driven by requirements contained in U.S. Army Corps of Engineers (USACE) (1992) and USACE (1996). All field personnel are required to comply with the requirements of these programs and plans. In addition, subcontractors are responsible for providing their employees with a safe work place. These plans do not relieve subcontractors of this responsibility. If the requirements of these plans are not sufficient to protect the employees of a subcontractor, that subcontractor is required to supplement this information with work practices and procedures that will ensure the safety of its personnel.

The FWSHP addresses program issues, hazards, and hazard controls common to the entire installation. This SSHP Addendum to the FWSHP serves as the lower tier document addressing the hazards and controls specific to performing additional sampling and remedial activities at CC RVAAP-78 and CC RVAAP-80 at the Ravenna Army Ammunition Plant (RVAAP). Copies of the FWSHP and this SSHP Addendum will be present at the work site during all fieldwork.

Planned site activities consist of environmental sampling and support tasks. These tasks include soil sampling via trenching across the debris field, surface soil sampling immediately adjacent to the debris field, drum sampling, and drum removal.

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

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

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

2.0 – SITE DESCRIPTION AND CONTAMINATION CHARACTERIZATION

2.1 – Site Description

Environmental work at the RVAAP under the IRP began in earnest in 1995, with 32 environmental AOCs identified and prioritized according to U.S. Army Center for Health Promotion & Preventive Medicine (USACHPPM) relative risk protocols into high, medium, and low priority AOCs. Environmental restoration work has proceeded primarily by addressing the highest priority sites first, with sites of medium and low priority receiving attention later. In 2000, the number of environmental AOCs was increased from 32 to 51. Relative risk ranking was again performed to prioritize those additional environmental AOCs. Two areas identified for investigation for this project are Compliance Restoration (CR) Sites:

CC RVAAP-78	Quarry Pond Surface Dump
CC RVAAP-80	Group 2 Propellant Can Tops

The above sites are considered to potentially have munitions and explosives of concern (MEC). The following sections provide brief descriptions of each of these sites.

CC RVAAP-78, Quarry Pond Surface Dump – The Quarry Pond Surface Dump consists of an area of former dumping at the base of an approximately vertical rock cut slope. The surface dump is located north and northeast of the northern-most quarry pond within the Fuze and Booster Quarry. The potentially impacted area consists of approximately 8,750 square feet (250' long x 35' wide). The debris pile appears to have an average thickness of about five feet. Contents of the debris pile appear to consist of potential asbestos-containing materials (ACM), construction debris, scrap metal, and unidentified materials. One 55-gallon metal drum (contents unknown) is located at the ground surface within this area. A former burn pile location is also present along the northeastern portion of the surface dump. The burn pile location is characterized by ground charring.

The Quarry Pond Surface Dump appears to be a possible northern extension of the existing Fuze and Booster Quarry AOC (RVAAP-16), which operated from 1945 through 1993. Prior to 1976, the quarry was reportedly used for open burning and as a landfill. The debris from the burning/landfill was reportedly removed during pond construction during the late 1970's. In 1998, the Fuze and Booster Quarry site was expanded to include three other shallow settling ponds to the west and two debris piles to the northeast.

Limited soil sampling (surface and subsurface if possible) will be conducted and the results compared with cleanup goals, as prescribed in the Position Paper for the Application and Use of Facility-Wide Human Health Cleanup Goals (USACE 2009), to determine chemicals of potential concern (COPCs). As per the limited scope of a Phase I Remedial Investigation (Preliminary Assessment), no sampling of groundwater is provided within this project. However, brief summaries of existing related surface and groundwater data will be presented. MEC avoidance procedures will be needed during intrusive investigations.

CC RVAAP-80, Group 2 Propellant Can Tops – Propellant can tops were identified on the ground surface at the southern end of the former Group 2 Ammunition Storage Area. The propellant can tops at

the south end of Group 2 were initially observed by OHARNG trainees in the fall of 2008. The propellant can tops were encountered in the vegetative area located immediately south of the ammunition storage magazines in the vicinity of the railroad spur lines. This area consists of approximately 539,572 square feet (12.4 acres). While propellant can tops are likely not present in the northern end, as the historical research is conducted regarding the observed propellant cans in the southern end, any references to propellant can tops in the northern end will be documented and included in the Historical Records Review Report.

As a result, the Louisville District US Army Corps of Engineers (USACE) performed an initial geophysical delineation of the ground surface at the southern area. Results of the initial delineation revealed multiple magnetic anomalies in surface and near surface soils. The on-site unexploded ordnance (UXO) officer visually identified the surface anomalies as propellant can lids or tops.

Munitions debris from past activities is a potential environmental concern at both areas. A geophysical delineation by a UXO technician will be conducted under separate contract. No chemical constituents of concern are known to exist at the site. However, suspected munitions constituents (MC) and scrap metal are of concern at this AOC.

The work to be performed will consist of a Phase I Remedial Investigation (RI) of the AOCs and will include a comprehensive background historical review and research of available data pertaining to the two subject AOCs. The background historical review will follow the guidance and requirements of a CERCLA (Comprehensive Environmental Response, Compensation & Liability Act) Abbreviated Preliminary Assessment (APA) where possible.

The Phase I RI will also include an initial intrusive investigation of possible environmental impacts to the applicable media at CC RVAAP-78, the Quarry Pond Surface Dump. The initial intrusive investigation will be performed to confirm the presence or absence of contaminants.

2. 2 – Contaminant Characterization

Two categories of chemical hazards are associated with site activities:

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

Sampling at the nearby Fuze and Booster Quarry AOC and the presence of suspect asbestos-containing materials in the debris pile(s) indicate the possibility of encountering explosives and metals at the Quarry Pond Surface Dump. At the Group 2 Propellant Can Tops area, the past usage of the area as an ammunition storage area indicates the potential for encountering explosives and metals. Information on the potential contaminants and the reagents and chemicals that will be used for the project is contained in Table 2-1. It is important to note that the contaminants listed in Table 2-1 have been detected in a number of locations at RVAAP and may be present at former operations areas. Exposure to these potential contaminants and reagents/chemicals (such as corrosive sample preservatives, field laboratory reagents, or flammable fuels), is likely and will be controlled through compliance with this addendum.

2.2.1 – Site Constituents

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

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

Table 2-1 – Potential Contaminants in Soil at CC RVAAP-78 & CC RVAAP-80

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

2.2.2 – Materials Inventory

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

Table 2-2 – Chemicals Used to Conduct Site Work

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

2.2.3 – Hazard Communication Materials

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

3.0 – STAFF ORGANIZATION AND RESPONSIBILITIES

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

Table 3-1 – Staff Organization

Position	Name	Phone Number
Program Manager	Prakash Raja, CHMM	210-860-8623
Project Manager	John P. Jent, P.E.	502-439-8005
Deputy Project Manager	Tomas Hernandez, Jr., P.G.	210-385-2011
Health and Safety Manager	Aditya Moralwar	402-617-4654
Certified Industrial Hygienist	Tony Ogunsanya, CIH	210-485-6029

4.0 – TRAINING

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

Table 4-1 – Staff Training

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

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

5.0 – PERSONAL PROTECTIVE EQUIPMENT

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

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

Table 5-1 – Baseline Personnel Protective Equipment

Activity	PPE Required
Drum sampling and handling	LEVEL B PPE: pressure-demand, fill face SCBA or pressure-demand supplied air respirator with escape SCBA. Chemical-resistant clothing (overalls and long-sleeved jacket; hooded, one- or two-piece chemical splash suit; disposable chemical-resistant one-piece suit). Inner and outer chemical-resistant gloves. Chemical-resistant safety boots/shoes, hard hat, face shield, and two-way radio communications.
Civil Surveys and Visual Surveys	LEVEL D PPE: long pants, shirts with sleeves, safety glasses, heavy duty work gloves, safety boots, and hardhats if overhead hazards are present, plus nitrile or similar gloves for contact with potentially contaminated material. Insect repellant with Deet ™ on boots, pants, and elsewhere, as necessary to repel ticks and mosquitoes
Surface and subsurface soil sampling	Level D PPE plus nitrile or equivalent gloves to handle potentially contaminated material, plus hearing protection as necessary. Insect repellant with Deet ™ as needed
Investigative Derived Waste (IDW) handling	Level D PPE plus nitrile or equivalent gloves for handling of potentially contaminated material
Equipment Decontamination	Level D PPE plus nitrile or PVC gloves
Transite Sampling	Level C Modified: ½ mask particulate respirator to be worn by sampler, wear nitrile gloves, where safety glasses with side shields. Insect repellant with Deet ™ as needed.

6.0 – MEDICAL SURVEILLANCE

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

Table 6-1 – Medical Surveillance Requirements

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

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

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

7.0 – EXPOSURE MONITORING / AIR SAMPLING PROGRAM

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

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

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

However, during drum sampling and handling, exposure to VOCs are more of a concern if drums containing liquid wastes are encountered.

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

Table 7-1 – Monitoring Requirements and Action Limits

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

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

8.0 – HEAT / COLD STRESS MONITORING

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

9.0 – STANDARD OPERATION SAFETY PROCEDURES

Standard operation safety procedures are described in the FWSHP.

10.0 – SITE CONTROL MEASURES

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

11.0 – PERSONNEL HYGIENE AND DECONTAMINATION

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

12.0 – EMERGENCY PROCEDURES AND EQUIPMENT

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

12.1 Emergency Phone Numbers

Listed below are emergency groups and their telephone numbers. Cellular telephones and two-way radios will be present in the field and available for use. RVAAP Post 1 will be contacted first for any emergency service.

Table 12-1 – Emergency Phone Numbers

Emergency Group	Phone Number
RVAAP Post 1	330-358-2017
Police (Mid-American Security)	330-338-7406
Emergency Medical Service	330-872-5050
Hospital	330-297-0811/2449
Fire Department (City of Ravenna)	330-297-5738
Hazardous Materials Response	330-358-7406/7409
USACE Project Manager (Glen Beckham)	502-315-6799
USACE Technical Manager (Tom Chanda)	502-315-6868
USACE Safety Officer (Matt Burg)	502-315-7061

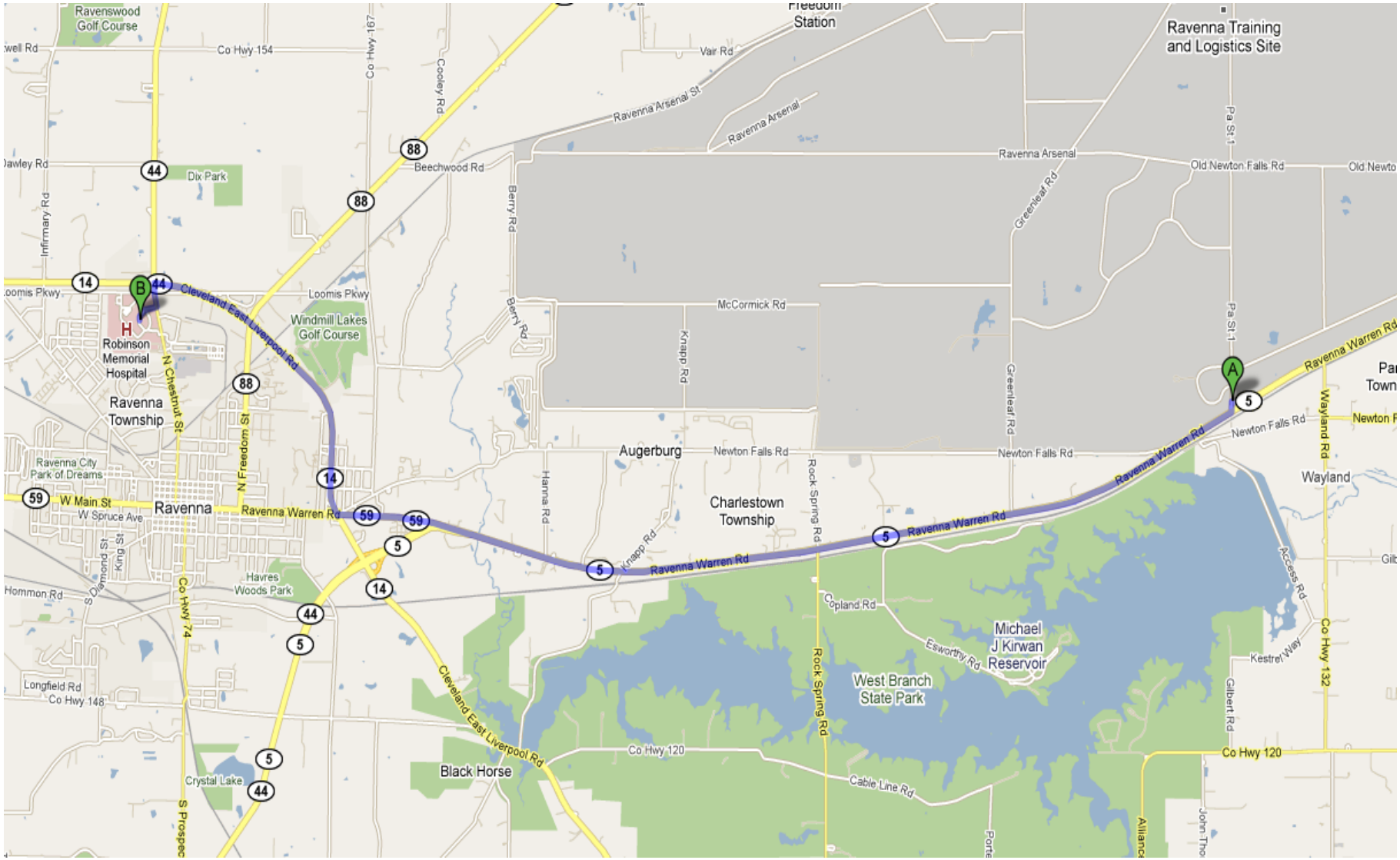
12.2 Procedures and Equipment

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

In the event of medical emergency, Robinson Memorial Hospital is located approximately 10 miles from the site at 6847 North Chestnut Street in Ravenna, Ohio (Figure 12-1). It can be reached by taking PA Street 1 (Paris-Windham Road) towards Highway 5 West/Ravenna Warren Road approximately 7.2 miles west, turn right at Cleveland East Liverpool Road/Highway 14 North/Highway 44 North approximately 2.4 miles, turn left at North Chestnut Street/Ravenna Painesville Road.

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

Figure 12-1 – Route Map to Pre-Notified Medical Facility



13.0 – LOGS, REPORTS, AND RECORD KEEPING

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

14.0 – REFERENCES

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

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

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

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US EPA 2007, *Waste Sampling*, Region 4 Science and Ecosystem Support Division. November 2007.

Appendix A – Hazard/Risk Analysis

HAZARD/RISK ANALYSIS

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

Table 1-1 – General Checklist for Hazards

Yes	No	Hazard
	X	Confined space entry
X		Heavy equipment (drum removal)
X		Fire and explosion (fuels)
X		Electrical shock (utilities and tools)
X		Exposure to chemicals (contaminants and chemical tools)
X		Temperature extremes
X		Biological hazards (poison ivy and Lyme disease)
	X	Radiation or radioactive contamination
X		Noise (drum removal equipment)
X		Drowning
X		OE (potential to encounter unexploded ordnance)

OE = ordnance and explosives.

Specific tasks are as follows:

- clearing of brush and vegetation,
- surface and subsurface soil sampling using step probes or soil augers,
- transite sampling,
- drum sampling,
- drum removal,
- civil surveying,
- sampling equipment decontamination, and
- investigation-derived waste handling and disposition.

1.1 Task-Specific Hazard Analysis

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

1.2 Potential Exposures

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

Table 1-2 – Hazards Analysis

Safety and Health Hazards		Controls	Monitoring Requirements
Overall Risk Assessment Code (RAC): Low Risk	**RAC**	**Civil Surveys and Visual Surveys in Potentially Contaminated Areas**	
General safety hazards (moving equipment, slips, falls)	M	Level D PPE: long pants, shirts with sleeves, safety glasses, safety boots, and hard hats if overhead hazards are present (see Section 5.0 of the FWSHP). Site-specific training, buddy system, proper housekeeping	Daily safety inspections
Exposure to chemicals	L	Nitrile or similar gloves for contact with potentially contaminated material. Gloves will be disposed after single use. Wash face and hands and any other exposed areas prior to taking anything by mouth. Hazardous waste site operations training and medical clearance site training must include hazards and controls for exposure to site contaminants and chemicals used on-site. MSDSs on-site. All chemical containers labeled to indicate contents and hazard	None
Biological hazards (bees, ticks, Lyme disease, histoplasmosis, wasps, snakes, West Nile Virus)	M	PPE (boots and work clothes). Insect repellant with Deet ™ on boots, pants, and elsewhere, as necessary, to repel ticks and mosquitoes. Pant legs tucked into boots or otherwise closed to minimize tick entry. Inspect for ticks during the day and at the end of each workday (see Section 9.0 of FWSHP). Avoidance of accumulations of bird or bat droppings (see Section 9.0 of FWSHP)	Visual survey
Temperature extremes	L	Administrative controls (see Section 8.0 of FWSHP). Cooled (shaded) or warmed break area depending on the season. Routine breaks in established break area (see Section 8.0 of FWSHP). Chilled drinks if temperature exceeds 70°F	Temperature measurements at least twice daily. Pulse rates at the start of each break if wearing impermeable clothing
Drowning	L	On-Site personnel will be alerted to the adjacent FBQ ponds and cautioned to stay at least 10-feet away from the ponds during sampling, drum removal, and transit to and from the site.	None

Table 1-2 – Hazards Analysis (continued)

Safety and Health Hazards		Controls	Monitoring Requirements
Overall Risk Assessment Code (RAC): Low Risk	**RAC**	**Soil Sampling and Sample Preservation**	
General safety hazards (moving equipment, lifting, slips, falls)	M	Level D PPE: long pants, shirts with sleeves, safety glasses, safety boots, hard hats if overhead hazards are present (see Section 5.0 of FWSHP). Buddy system. Site-specific training. Proper housekeeping. Lifts of >50 lbs will be performed by two or more personnel or with mechanical assistance; extensive heavy lifting will require additional lifting training. Exclusion zone if there is a potential for unauthorized entry	Daily site safety inspections
Noise	L	None, unless SSHO determines that equipment noise potentially exceeds 85 dBA. If equipment noise exceeds 85 dBA, wear appropriate hearing protective device to reduce actual exposure below 85dBA.	Daily safety inspection
Fire (fuels)	L	Fuel stored in safety cans with flame arresters. Fire extinguisher in all fuel use areas. No ignition sources in fuel storage areas. Bonding (metal to metal contact) during pouring. Gasoline-powered equipment must be shut down and allowed to cool for 5 min. prior to fueling	Daily site safety inspections
Exposure to chemicals	M	Level D PPE, including nitrile or PVC gloves, to handle potentially contaminated material. Minimal contact, wash face and hands prior to taking anything by mouth. Hazardous waste site operations training and medical clearance. Fifteen-min. eyewash within 100 ft when pouring corrosive sample preservatives; eyewash bottle within 10 ft when adding water to pre-preserved sample containers. Site training must include hazards and controls of exposure to contaminants and chemicals used on-site. MSDSs for chemical tools kept on-site. All chemical containers labeled with contents and hazard	Daily site safety inspections. PID monitoring if prior monitoring during soil boring indicated a potential for exposure
Electrical shock	L	GFCI for all electrical hand tools	Daily safety inspection
Temperature extremes	L	Administrative controls (see Section 8.0 of FWSHP). Cooled (shaded) or warmed break area depending on the season. Routine breaks in established break area (see Section 8.0 of FWSHP). Chilled drinks if temperature exceeds 70°F	Temperature measurements at least twice daily. Pulse rates at the start of each break if wearing impermeable clothing
Biological hazards (bees, ticks, Lyme disease, histoplasmosis, wasps, snakes, West Nile Virus)	M	PPE (boots and work clothes). Insect repellant Deet ™ on boots, pants, and elsewhere, as necessary, to repel ticks and mosquitoes. Pant legs tucked into boots or otherwise closed to minimize tick entry. Inspect for ticks during the day and at the end of each workday (see Section 9.0 of FWSHP). Avoidance of accumulations of bird or bat droppings (see Section 9.0 of FWSHP)	Visual survey

Table 1-2 – Hazards Analysis (continued)

Safety and Health Hazards		Controls	Monitoring Requirements
Overall Risk Assessment Code (RAC): <u>High Risk</u>	**RAC**	**Surface and Subsurface Soil Sampling**	
General safety hazards (rotating machinery, suspended loads, moving equipment, slips, falls)	H	Level D PPE: long pants, shirts with sleeves, safety glasses, safety boots, work gloves for material handling plus hard hat (see Section 5.0 of FWSHP). Buddy system. Site-specific training. Proper housekeeping. No employees under lifted loads. At least two functional kill switches. Functional backup alarm, equipment manual on-site. Only experienced operators. Exclusion zone at least equal to mast height if there is any potential for unauthorized entry	Daily site safety inspections.
Noise	L	None, unless SSHO determines that equipment potentially exceeds 85 dBA	Daily safety inspections
Fire (vehicle fuels or subsurface contaminants)	M	Fuels stored in safety cans with flame arrestors. Bonding (metal to metal) and grounding during fuel transfers. Fuel storage areas marked with no smoking or open flames signs. Fire extinguishers in all fuel use areas	Combustible gas indicator if buried organic material or other source of flammable gas is suspected
Exposure to chemicals	M	Level D PPE plus nitrile or equivalent gloves for contact with contaminated material. Wash face and hands prior to taking anything by mouth. Stay upwind of any dust-generating activities. Hazardous waste site operations training and medical clearance. Site training must include hazards and controls for site contaminants and all chemicals used on-site. MSDSs for chemical tools on-site. Chemical containers labeled to indicate contents and hazard	PID or other sampling, as appropriate
Temperature extremes	M	Administrative controls (see Section 8.0 of FWSHP). Cooled (shaded) or warmed break area depending on the season. Routine breaks in established break area (see Section 8.0 of FWSHP). Chilled drinks if temperature exceeds 70°F	Temperature measurements at least twice per day. Pulse rates at the start of each break if wearing impermeable clothing
Biological hazards (bees, ticks, Lyme disease, histoplasmosis, wasps, snakes, West Nile Virus)	H	PPE (boots and work clothes). Insect repellant Deet ™ on boots, pants, and elsewhere, as necessary, to repel ticks and mosquitoes. Pant legs tucked into boots or otherwise closed to minimize potential for tick entry. Snake chaps if working in overgrown areas. Inspect for ticks during the day and at the end of each workday (see Section 9.0 of FWSHP). Avoidance of accumulations of bird or bat droppings (see Section 9.0 of FWSHP)	Visual survey

Table 1-2 – Hazards Analysis (continued)

Safety and Health Hazards		Controls	Monitoring Requirements
Electric shock	L	Identification and clearance of overhead and underground utilities. GFCI required for electric hand tools. Note – one live overhead electrical line is present at Load Line 2	Visual of all work areas
Overall Risk Assessment Code (RAC): <u>High Risk</u>	**RAC**	**Drum Sampling and Removal**	
General safety hazards (manual lifting, slips, falls)	H	Level D PPE: long pants, shirts with sleeves, safety boots, safety glasses, and work gloves for manual work (see Section 5.0 of FWSHP). Buddy system. Site-specific training. Proper housekeeping	Daily site safety inspections
Contact with unexploded ordnance	L	On-site training in ordnance recognition for all field personnel. Clearance of sites by OE personnel for intrusive work. Continuous escort by OE personnel when in areas with potential to encounter OE. Withdrawal of all non-OE personnel if ordnance or suspected ordnance is discovered. Sampling of stations having known or suspected (i.e., red soil or raw product) explosives >10% (100,000 mg/kg) to be performed by OE technicians following applicable OE safety requirements	Visual and instrument surveys by OE technicians
Exposure to chemicals	H	Level B PPE and respiratory protection plus nitrile or equivalent gloves for contact with contaminated material. Use of non-sparking tools. Wash face and hands prior to taking anything by mouth. Stay upwind of any dust-generating activities. Hazardous waste site operations training and medical clearance. Site training must include hazards and controls for site contaminants and all chemicals used on-site. Drum sampling operations will be monitored using a PID/FID and combustible gas detector. In the event that the lower explosive limit (LEL) reaches or exceeds 10%, drum sampling operations will be suspended. Respiratory protection for most drum–related activities will require the use of an SCBA. Where air monitoring data can support it, a reduction in respiratory protection to air purifying respirators (APRs) fitted with organic vapor cartridges may be appropriate.	Drum inspection to determine over pressuring or signs of bulging. PID or other sampling, as appropriate. Drum over packing as needed.
Temperature extremes	L	Administrative controls (see Section 8.0 of FWSHP). Cooled (shaded) or warmed break area depending on the season. Routine breaks in established break area (see Section 8.0 of FWSHP). Chilled drinks if temperature exceeds 70°F	Temperature measurements at least twice daily. Pulse rates at the start of each break if wearing impermeable clothing

Table 1-2 – Hazards Analysis (continued)

Biological hazards (bees, ticks, Lyme disease, histoplasmosis, wasps, snakes, West Nile Virus)	H	PPE (boots and work clothes). Insect repellant Deet ™ on boots, pants, and elsewhere, as necessary, to repel ticks and mosquitoes. Pant legs tucked into boots or otherwise closed to minimize tick entry. Snake chaps if working in overgrown areas. Inspect for ticks during the day and at the end of each workday (see Section 9.0 of FWSHP). Avoidance of accumulations of bird or bat droppings (see Section 9.0 of FWSHP)	Visual survey

Table 1-2 – Hazards Analysis (continued)

Safety and Health Hazards		Controls	Monitoring Requirements
Overall Risk Assessment Code (RAC): Low Risk	**RAC**	**Investigation-Derived Waste Handling**	
General hazards (lifting equipment, manual lifting, slips)	L	Level D PPE: long pants, shirts with sleeves, safety glasses, safety boots, heavy-duty gloves for materials handling, and hard hat if overhead hazards are present (see Section 5.0 of FWSHP). Buddy system. Site-specific training. Proper housekeeping. Unnecessary personnel will stay well clear of operating equipment. Functional back-up alarm on fork trucks, Bobcats, trucks, etc. Ravenna O&M contractor personnel will provide any required fork truck services in the IDW staging area (Building 1036) in accordance with their procedures. IDW movement from field sites to Building 1036 will be conducted by the drilling subcontractor using a backhoe equipped with forks and drum dollys. No personnel allowed under lifted loads. Lifts of greater than 50 lbs will be made with two or more personnel or with lifting equipment. Hazardous waste safety training. Compliance with EM 385-1-1 Sections 14 and 16	Daily safety inspections of operations. Daily inspection of equipment to verify brakes and operating systems are in proper working condition
Contact with unexploded ordnance	L	On-site training in ordnance recognition for all field personnel. Clearance of sites by OE personnel for intrusive work. Continuous escort by OE personnel if working in areas with potential for OE. Withdrawal of all non-OE personnel if ordnance or suspected ordnance is discovered	Visual and instrument surveys by OE technicians
Exposure to chemicals	L	Level D PPE plus nitrile or equivalent gloves for contact with contaminated material. Wash face and hands prior to taking anything by mouth. Hazardous waste site operation training and medical clearance. Site training must include hazards and controls for exposure to site contaminants and chemicals used on-site	Daily safety inspections
Fire (vehicle fuels and flammable contaminants)	M	Fuels stored in safety cans with flame arrestors. Bonding (metal to metal) and grounding during fuel transfers. Fuel storage areas marked with no smoking or open flames signs. Gasoline-powered equipment will be shut down and allowed to cool for 5 min. before fueling. Fire extinguishers in all fuel use areas	Daily safety inspection

Table 1-2 – Hazards Analysis (continued)

Noise	L	Hearing protection within 7.6 m (25 ft) of any noisy drum moving equipment unless equipment-specific monitoring indicates exposures less than 85 dBA	Daily safety inspections
Biological hazards (bees, ticks, Lyme disease, histoplasmosis, wasps, snakes, West Nile Virus)	L	PPE (boots, work clothes). Insect repellant Deet ™ on pants, boots, and elsewhere, as necessary to repel ticks and mosquitoes. Pant legs tucked into boots or otherwise closed to minimize tick entry. Snake chaps if working in overgrown areas. Inspect for ticks during the day and at the end of each workday (see Section 9.0 of FWSHP). Avoidance of accumulations of bird or bat droppings (see Section 9.0 of FWSHP)	Visual survey
Electric shock	L	Identification and clearance of overhead utilities. GFCI for all electrical hand tools	Visual survey of all work areas
Temperature extremes	L	Administrative controls (see Section 8.0 of FWSHP). Cooled (shaded) or warmed break area depending on the season. Routine breaks in established break area (see Section 8.0 of FWSHP). Chilled drinks if temperature exceeds 70°F	Temperature measurements at least twice daily. Pulse rates at the start of each break if wearing impermeable clothing

Table 1-2 – Hazards Analysis (continued)

Overall Risk Assessment Code (RAC): Low Risk		**Equipment Decontamination (Hot Water Washing, Soap and Water Washing, HCl, and Methanol Rinse)**	
General equipment decontamination hazards (hot water, slips, falls, equipment handling)	M	Level D PPE plus nitrile or PVC gloves (see Section 5.0 of FWSHP). Face shield and Saranax or rain suit when operating steam washer. Site-specific training. Proper housekeeping	Daily safety inspection
Noise (spray washer)	L	Hearing protection when washer is operating unless equipment-specific monitoring indicates that exposure is less than 85 dBA	None
Fire (decontamination solvents and gasoline)	L	Flammable material stored in original containers or in safety cans with flame arrestors. Fire extinguisher kept near decontamination area	Daily safety inspections
Exposure to chemicals	M	Level D PPE plus nitrile or equivalent gloves for contact with contaminated material. Wash face and hands prior to taking anything by mouth. Minimal contact. Hazardous waste site operations training and medical clearance. Site training must include hazards and controls for exposure to site contaminants and chemicals used on-site. MSDSs on-site. All chemical containers labeled to indicate contents and hazard	None
Temperature extremes	L	Administrative controls (see Section 8.0 of FWSHP). Cooled (shaded) or warmed break area depending on the season. Routine breaks in established break area (see Section 8.0 of FWSHP). Chilled drinks if temperature exceeds 70°F	Temperature measurements at least twice a day. Pulse rates at the start of each break if wearing impermeable clothing

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

Table 1-3 – Potential Exposures

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

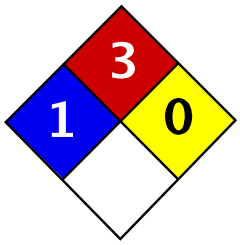
Table 1-3 – Potential Exposures (continued)

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

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

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

Appendix B – Material Safety Data Sheets (MSDS)



Health	2
Fire	3
Reactivity	0
Personal Protection	H

Material Safety Data Sheet
Acetone MSDS

Section 1: Chemical Product and Company Identification

Product Name: Acetone

Catalog Codes: SLA3502, SLA1645, SLA3151, SLA3808

CAS#: 67-64-1

RTECS: AL3150000

TSCA: TSCA 8(b) inventory: Acetone

CI#: Not applicable.

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

Chemical Name: Acetone

Chemical Formula: C3-H6-O

Contact Information:

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

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

Order Online: ScienceLab.com

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

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

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

Section 2: Composition and Information on Ingredients

Composition:

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

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

Section 3: Hazards Identification

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

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

Section 4: First Aid Measures

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

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

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

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

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

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

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

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

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

Flammable Limits: LOWER: 2.6% UPPER: 12.8%

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

Fire Hazards in Presence of Various Substances: Highly flammable in presence of open flames and sparks, of heat.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available.
Slightly explosive in presence of open flames and sparks, of oxidizing materials, of acids.

Fire Fighting Media and Instructions:
Flammable liquid, soluble or dispersed in water.
SMALL FIRE: Use DRY chemical powder.
LARGE FIRE: Use alcohol foam, water spray or fog.

Special Remarks on Fire Hazards: Vapor may travel considerable distance to source of ignition and flash back.

Special Remarks on Explosion Hazards:
Forms explosive mixtures with hydrogen peroxide, acetic acid, nitric acid, nitric acid + sulfuric acid, chromic anydride, chromyl chloride, nitrosyl chloride, hexachloromelamine, nitrosyl perchlorate, nitryl perchlorate, permonosulfuric acid, thiodiglycol + hydrogen peroxide, potassium ter-butoxide, sulfur dichloride, 1-methyl-1,3-butadiene, bromoform, carbon, air, chloroform, thitriazylperchlorate.

Section 6: Accidental Release Measures

Small Spill:
Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container.

Large Spill:
Flammable liquid.
Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up.. Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, reducing agents, acids, alkalis.

Storage:
Store in a segregated and approved area (flammables area) . Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Keep away from direct sunlight and heat and avoid all possible sources of ignition (spark or flame).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 500 STEL: 750 (ppm) from ACGIH (TLV) [United States]
TWA: 750 STEL: 1000 (ppm) from OSHA (PEL) [United States]
TWA: 500 STEL: 1000 [Austalia]
TWA: 1185 STEL: 2375 (mg/m3) [Australia]
TWA: 750 STEL: 1500 (ppm) [United Kingdom (UK)]
TWA: 1810 STEL: 3620 (mg/m3) [United Kingdom (UK)]
TWA: 1800 STEL: 2400 from OSHA (PEL) [United States]Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Fruity. Mint-like. Fragrant. Ethereal

Taste: Pungent, Sweetish

Molecular Weight: 58.08 g/mole

Color: Colorless. Clear

pH (1% soln/water): Not available.

Boiling Point: 56.2°C (133.2°F)

Melting Point: -95.35 (-139.6°F)

Critical Temperature: 235°C (455°F)

Specific Gravity: 0.79 (Water = 1)

Vapor Pressure: 24 kPa (@ 20°C)

Vapor Density: 2 (Air = 1)

Volatility: Not available.

Odor Threshold: 62 ppm

Water/Oil Dist. Coeff.: The product is more soluble in water; log(oil/water) = -0.2

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water.

Solubility: Easily soluble in cold water, hot water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Excess heat, ignition sources, exposure to moisture, air, or water, incompatible materials.

Incompatibility with various substances: Reactive with oxidizing agents, reducing agents, acids, alkalis.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation.

Toxicity to Animals:
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE.
Acute oral toxicity (LD50): 3000 mg/kg [Mouse].
Acute toxicity of the vapor (LC50): 44000 mg/m3 4 hours [Mouse].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH.

DEVELOPMENTAL TOXICITY: Classified Reproductive system/toxin/female, Reproductive system/toxin/male [SUSPECTED].
Causes damage to the following organs: central nervous system (CNS).
May cause damage to the following organs: kidneys, the reproductive system, liver, skin.

Other Toxic Effects on Humans:
Hazardous in case of skin contact (irritant), of ingestion, of inhalation.
Slightly hazardous in case of skin contact (permeator).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans:
May affect genetic material (mutagenicity) based on studies with yeast (S. cerevisiae), bacteria, and hamster fibroblast cells. May cause reproductive effects (fertility) based upon animal studies.
May contain trace amounts of benzene and formaldehyde which may cancer and birth defects. Human: passes the placental barrier.

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects:
Skin: May cause skin irritation. May be harmful if absorbed through the skin.
Eyes: Causes eye irritation, characterized by a burning sensation, redness, tearing, inflammation, and possible corneal injury.
Inhalation: Inhalation at high concentrations affects the sense organs, brain and causes respiratory tract irritation. It also may affect the Central Nervous System (behavior) characterized by dizzness, drowsiness, confusion, headache, muscle weakeness, and possibly motor incoordination, speech abnormalities, narcotic effects and coma. Inhalation may also affect the gastrointestinal tract (nausea, vomiting).
Ingestion: May cause irritation of the digestive (gastrointestinal) tract (nausea, vomiting). It may also affect the Central Nevous System (behavior), characterized by depression, fatigue, excitement, stupor, coma, headache, altered sleep time, ataxia, tremors as well at the blood, liver, and urinary system (kidney, bladder, ureter) and endocrine system. May also have musculoskeletal effects.
Chronic Potential Health Effects:
Skin: May cause dermatitis.
Eyes: Eye irritation.

Section 12: Ecological Information

Ecotoxicity:
Ecotoxicity in water (LC50): 5540 mg/l 96 hours [Trout]. 8300 mg/l 96 hours [Bluegill]. 7500 mg/l 96 hours [Fatthead Minnow]. 0.1 ppm any hours [Water flea].

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The product itself and its products of degradation are not toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 3: Flammable liquid.

Identification: : Acetone UNNA: 1090 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause reproductive harm (male) which would require a warning under the statute: Benzene
California prop. 65: This product contains the following ingredients for which the State of California has found to cause birth defects which would require a warning under the statute: Benzene
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Benzene, Formaldehyde
Connecticut hazardous material survey.: Acetone
Illinois toxic substances disclosure to employee act: Acetone
Illinois chemical safety act: Acetone
New York release reporting list: Acetone
Rhode Island RTK hazardous substances: Acetone
Pennsylvania RTK: Acetone
Florida: Acetone
Minnesota: Acetone
Massachusetts RTK: Acetone
Massachusetts spill list: Acetone
New Jersey: Acetone
New Jersey spill list: Acetone
Louisiana spill reporting: Acetone
California List of Hazardous Substances (8 CCR 339): Acetone
TSCA 8(b) inventory: Acetone
TSCA 4(a) final test rules: Acetone
TSCA 8(a) IUR: Acetone

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).
EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F).
CLASS D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC):
R11- Highly flammable.
R36- Irritating to eyes.
S9- Keep container in a well-ventilated place.
S16- Keep away from sources of ignition - No smoking.
S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 1

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves.
Lab coat.
Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.
Splash goggles.

Section 16: Other Information

References:
-Material safety data sheet issued by: la Commission de la SantÃ© et de la SÃ©curitÃ© du Travail du QuÃ©bec.
-The Sigma-Aldrich Library of Chemical Safety Data, Edition II.
-Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987.
LOLI, RTECS, HSDB databases.
Other MSDSs

Other Special Considerations: Not available.

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Last Updated: 11/06/2008 12:00 PM

LIQUI−NOX

Section 1: PRODUCT INFORMATION

Chemical family: Detergent.

Manufacturer: Alconox, Inc.
30 Glenn St. Suite 309
White Plains, NY 10603.

Manufacturer emergency phone number: 800−255−3924.
813−248−0573 (outside of the United States).

Supplier: Same as manufacturer.

TDG classification: Not regulated.

WHMIS classification: Not controlled.

DSL status: Not available.

Supplier MSDS date: 2008/01/07

Section 2: HAZARDOUS INGREDIENTS

C.A.S.	CONCENTRATION %	Ingredient Name	T.L.V.	LD/50	LC/50
25155−30−0	10−30	SODIUM DODECYLBENZENESULFONATE	NOT AVAILABLE	438 MG/KG RAT ORAL 1330 MG/KG MOUSE ORAL	NOT AVAILABLE

Section 3: PHYSICAL DATA

Physical state: Liquid.

Appearance & odor: Odourless.
Pale yellow.

Odor threshold (ppm): Not available.

Vapour pressure (mmHg): @ 68F (20C).
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Vapour density (air=1): >1

Volatiles (%)

By volume: Not available.

Evaporation rate (butyl acetate = 1):	< 1.
Boiling point (°C):	100 (212F)
Freezing point (°C):	Not available.
pH:	8.5
Specific gravity @ 20 °C:	(water = 1). 1.083
Solubility in water (%):	Complete.
Coefficient of water\oil dist.:	Not available.
VOC:	None

Section 4: FIRE & EXPLOSION DATA

Flammability:	Not flammable.
Conditions of flammability:	Surrounding fire.
Extinguishing media:	Carbon dioxide, dry chemical, foam. Water Water fog.
Special procedures:	Self−contained breathing apparatus required. Firefighters should wear the usual protective gear. Use water spray to cool fire exposed containers.
Auto−ignition temperature:	Not available.
Flash point (°C), method:	None
Lower flammability limit (% vol):	Not applicable.
Upper flammability limit (% vol):	Not applicable.

Explosion Data

Sensitivity to static discharge:	Not available.
Sensitivity to mechanical impact:	Not available.
Hazardous combustion products:	Oxides of carbon (COx). Hydrocarbons.
Explosive power:	Containers may rupture if exposed to heat or fire.

Section 5: REACTIVITY DATA

Chemical stability:	Product is stable under normal handling and storage conditions.
Conditions of instability:	Extreme temperatures.
Hazardous polymerization:	Will not occur.
Incompatible substances:	Strong acids. Strong oxidizing agents.
Hazardous decomposition products:	See hazardous combustion products.

Section 6: TOXICOLOGICAL PROPERTIES

Route of entry:	Skin contact, eye contact, inhalation and ingestion.
Effects of acute exposure	
Eye contact:	May cause irritation.
Skin contact:	Prolonged and repeated contact may cause irritation.
Inhalation:	May cause headache and nausea.
Ingestion:	May cause vomiting and diarrhea. May cause gastric distress.
Effects of chronic exposure:	See effects of acute exposure.
LD50 of product, species & route:	> 5000 mg/kg − rat oral.
LC50 of product, species & route:	Not available.
Exposure limit of material:	Not available.
Sensitization to product:	Not available.
Carcinogenic effects:	Not listed as a carcinogen.
Reproductive effects:	Not available.
Teratogenicity:	Not available.
Mutagenicity:	Not available.
Synergistic materials:	Not available.
Medical conditions aggravated by exposure:	Not available.

Section 7: PREVENTATIVE MEASURES

Precautionary Measures

Gloves/Type:	 Wear appropriate gloves.
Respiratory/Type:	None required under normal use.
Eye/Type:	 Safety glasses recommended.
Footwear/Type:	Safety shoes per local regulations.
Clothing/Type:	As required to prevent skin contact.
Other/Type:	Eye wash facility should be in close proximity. Emergency shower should be in close proximity.
Ventilation requirements:	Local exhaust at points of emission.
Leak/Spill:	Contain the spill. Soak up with an absorbent material. Prevent entry into drains, sewers, and other waterways. Wear appropriate protective equipment. Small amounts may be flushed to sewer with water. Place in appropriate container for disposal. Notify the appropriate authorities as required.

Waste disposal:	In accordance with local and federal regulations.
Handling procedures and equipment:	Protect against physical damage. Avoid breathing vapors/mists. Wear personal protective equipment appropriate to task. Wash thoroughly after handling. Keep out of reach of children. Avoid contact with skin, eyes and clothing. Avoid extreme temperatures. Launder contaminated clothing prior to reuse.
Storage requirements:	Store away from incompatible materials. Keep containers closed when not in use.
TDG classification:	Not regulated. 
Special shipping information:	Not regulated.

Section 8: FIRST AID MEASURES

Skin contact:	Remove contaminated clothing. Wash thoroughly with soap and water. Seek medical attention if irritation persists.
Eye contact:	Check for and remove contact lenses. Flush eyes with clear, running water for 15 minutes while holding eyelids open: if irritation persists, consult a physician.
Inhalation:	Remove victim to fresh air. If irritation persists, seek medical attention.
Ingestion:	Do not induce vomiting, seek medical attention. Dilute with two glasses of water. Never give anything by mouth to an unconscious person.

Section 9: ADDITIONAL INFORMATION

General note:	This material safety data sheet was prepared from information obtained from various sources, including product suppliers and the Canadian Center for Occupational Health and Safety.

AMERADA HESS CORPORATION

MATERIAL SAFETY DATA SHEET

Gasoline, All Grades **MSDS No. 9950**

EMERGENCY OVERVIEW
DANGER!
EXTREMELY FLAMMABLE - EYE AND MUCOUS MEMBRANE IRRITANT - EFFECTS CENTRAL NERVOUS SYSTEM - HARMFUL OR FATAL IF SWALLOWED - ASPIRATION HAZARD

NFPA 704 (Section 16)

High fire hazard. Keep away from heat, spark, open flame, and other ignition sources.

If ingested, do NOT induce vomiting, as this may cause chemical pneumonia (fluid in the lungs). Contact may cause eye, skin and mucous membrane irritation. Harmful if absorbed through the skin. Avoid prolonged breathing of vapors or mists. Inhalation may cause irritation, anesthetic effects (dizziness, nausea, headache, intoxication), and respiratory system effects.

Long-term exposure may cause effects to specific organs, such as to the liver, kidneys, blood, nervous system, and skin. Contains benzene, which can cause blood disease, including anemia and leukemia.

1. CHEMICAL PRODUCT and COMPANY INFORMATION (rev. Jan-04)

Amerada Hess Corporation
1 Hess Plaza
Woodbridge, NJ 07095-0961

EMERGENCY TELEPHONE NUMBER (24 hrs): **CHEMTREC (800)424-9300**
COMPANY CONTACT (business hours): Corporate Safety (732)750-6000
MSDS Internet Website www.hess.com/about/environ.html

SYNONYMS: Hess Conventional (Oxygenated and Non-oxygenated) Gasoline; Reformulated Gasoline (RFG); Reformulated Gasoline Blendstock for Oxygenate Blending (RBOB); Unleaded Motor or Automotive Gasoline

See Section 16 for abbreviations and acronyms.

2. COMPOSITION and INFORMATION ON INGREDIENTS * (rev. Jan-04)

INGREDIENT NAME (CAS No.)	CONCENTRATION PERCENT BY WEIGHT
Gasoline (86290-81-5)	100
Benzene (71-43-2)	0.1 - 4.9 (0.1 - 1.3 reformulated gasoline)
n-Butane (106-97-8)	< 10
Ethyl Alcohol (Ethanol) (64-17-5)	0 - 10
Ethyl benzene (100-41-4)	< 3
n-Hexane (110-54-3)	0.5 to 4
Methyl-tertiary butyl ether (MTBE) (1634-04-4)	0 to 15.0
Tertiary-amyl methyl ether (TAME) (994-05-8)	0 to 17.2
Toluene (108-88-3)	1 - 25
1,2,4- Trimethylbenzene (95-63-6)	< 6
Xylene, mixed isomers (1330-20-7)	1 - 15

A complex blend of petroleum-derived normal and branched-chain alkane, cycloalkane, alkene, and aromatic hydrocarbons. May contain antioxidant and multifunctional additives. Non-oxygenated Conventional Gasoline and RBOB do not have oxygenates (Ethanol or MTBE and/or TAME). Oxygenated Conventional and Reformulated Gasoline will have oxygenates for octane enhancement or as legally required.

3. HAZARDS IDENTIFICATION (rev. Dec-97)

EYES
Moderate irritant. Contact with liquid or vapor may cause irritation.

SKIN
Practically non-toxic if absorbed following acute (single) exposure. May cause skin irritation with prolonged or repeated contact. Liquid may be absorbed through the skin in toxic amounts if large areas of skin are exposed repeatedly.

INGESTION
The major health threat of ingestion occurs from the danger of aspiration (breathing) of liquid drops into the lungs, particularly from vomiting. Aspiration may result in chemical pneumonia (fluid in the lungs), severe lung damage, respiratory failure and even death.

Ingestion may cause gastrointestinal disturbances, including irritation, nausea, vomiting and diarrhea, and central nervous system (brain) effects similar to alcohol intoxication. In severe cases, tremors, convulsions, loss of consciousness, coma, respiratory arrest, and death may occur.

INHALATION
Excessive exposure may cause irritations to the nose, throat, lungs and respiratory tract. Central nervous system (brain) effects may include headache, dizziness, loss of balance and coordination, unconsciousness, coma, respiratory failure, and death.

WARNING: the burning of any hydrocarbon as a fuel in an area without adequate ventilation may result in hazardous levels of combustion products, including carbon monoxide, and inadequate oxygen levels, which may cause unconsciousness, suffocation, and death.

CHRONIC EFFECTS and CARCINOGENICITY
Contains benzene, a regulated human carcinogen. Benzene has the potential to cause anemia and other blood diseases, including leukemia, after repeated and prolonged exposure. Exposure to light hydrocarbons in the same boiling range as this product has been associated in animal studies with systemic toxicity. See also Section 11 - Toxicological Information.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE
Irritation from skin exposure may aggravate existing open wounds, skin disorders, and dermatitis (rash). Chronic respiratory disease, liver or kidney dysfunction, or pre-existing central nervous system disorders may be aggravated by exposure.

4. FIRST AID MEASURES (rev. Dec-97)

EYES
In case of contact with eyes, immediately flush with clean, low-pressure water for at least 15 min. Hold eyelids open to ensure adequate flushing. Seek medical attention.

SKIN
Remove contaminated clothing. Wash contaminated areas thoroughly with soap and water or waterless hand cleanser. Obtain medical attention if irritation or redness develops.

INGESTION
DO NOT INDUCE VOMITING. Do not give liquids. Obtain immediate medical attention. If spontaneous vomiting occurs, lean victim forward to reduce the risk of aspiration. Small amounts of material which enter the mouth should be rinsed out until the taste is dissipated.

INHALATION
Remove person to fresh air. If person is not breathing, ensure an open airway and provide artificial respiration. If necessary, provide additional oxygen once breathing is restored if trained to do so. Seek medical attention immediately.

5. FIRE FIGHTING MEASURES (rev. Dec-97)

FLAMMABLE PROPERTIES:

FLASH POINT:	-45 °F (-43°C)
AUTOIGNITION TEMPERATURE:	highly variable; > 530 °F (>280 °C)
OSHA/NFPA FLAMMABILITY CLASS:	1A (flammable liquid)
LOWER EXPLOSIVE LIMIT (%):	1.4%
UPPER EXPLOSIVE LIMIT (%):	7.6%

FIRE AND EXPLOSION HAZARDS

Vapors may be ignited rapidly when exposed to heat, spark, open flame or other source of ignition. Flowing product may be ignited by self-generated static electricity. When mixed with air and exposed to an ignition source, flammable vapors can burn in the open or explode in confined spaces. Being heavier than air, vapors may travel long distances to an ignition source and flash back. Runoff to sewer may cause fire or explosion hazard.

EXTINGUISHING MEDIA

SMALL FIRES: Any extinguisher suitable for Class B fires, dry chemical, CO2, water spray, fire fighting foam, or Halon.

LARGE FIRES: Water spray, fog or fire fighting foam. Water may be ineffective for fighting the fire, but may be used to cool fire-exposed containers.

During certain times of the year and/or in certain geographical locations, gasoline may contain MTBE and/or TAME. Firefighting foam suitable for polar solvents is recommended for fuel with greater than 10% oxygenate concentration - refer to NFPA 11 "Low Expansion Foam - 1994 Edition."

FIRE FIGHTING INSTRUCTIONS

Small fires in the incipient (beginning) stage may typically be extinguished using handheld portable fire extinguishers and other fire fighting equipment.

Firefighting activities that may result in potential exposure to high heat, smoke or toxic by-products of combustion should require NIOSH/MSHA- approved pressure-demand self-contained breathing apparatus with full facepiece and full protective clothing.

Isolate area around container involved in fire. Cool tanks, shells, and containers exposed to fire and excessive heat with water. For massive fires the use of unmanned hose holders or monitor nozzles may be advantageous to further minimize personnel exposure. Major fires may require withdrawal, allowing the tank to burn. Large storage tank fires typically require specially trained personnel and equipment to extinguish the fire, often including the need for properly applied fire fighting foam.

See Section 16 for the NFPA 704 Hazard Rating.

6. ACCIDENTAL RELEASE MEASURES (rev. Dec-97)

ACTIVATE FACILITY SPILL CONTINGENCY or EMERGENCY PLAN.

Evacuate nonessential personnel and remove or secure all ignition sources. Consider wind direction; stay upwind and uphill, if possible. Evaluate the direction of product travel, diking, sewers, etc. to confirm spill areas. Spills may infiltrate subsurface soil and groundwater; professional assistance may be necessary to determine the extent of subsurface impact.

Carefully contain and stop the source of the spill, if safe to do so. Protect bodies of water by diking, absorbents, or absorbent boom, if possible. Do not flush down sewer or drainage systems, unless system is designed and permitted to handle such material. The use of fire fighting foam may be useful in certain situations to reduce vapors. The proper use of water spray may effectively disperse product

vapors or the liquid itself, preventing contact with ignition sources or areas/equipment that require protection.

Take up with sand or other oil absorbing materials. Carefully shovel, scoop or sweep up into a waste container for reclamation or disposal - caution, flammable vapors may accumulate in closed containers. Response and clean-up crews must be properly trained and must utilize proper protective equipment (see Section 8).

7. HANDLING and STORAGE (rev. Dec-97)

HANDLING PRECAUTIONS

******USE ONLY AS A MOTOR FUEL******
******DO NOT SIPHON BY MOUTH******

Handle as a flammable liquid. Keep away from heat, sparks, and open flame! Electrical equipment should be approved for classified area. Bond and ground containers during product transfer to reduce the possibility of static-initiated fire or explosion.

Special slow load procedures for "switch loading" must be followed to avoid the static ignition hazard that can exist when higher flash point material (such as fuel oil) is loaded into tanks previously containing low flash point products (such as this product) - see API Publication 2003, "Protection Against Ignitions Arising Out Of Static, Lightning and Stray Currents.

STORAGE PRECAUTIONS

Keep away from flame, sparks, excessive temperatures and open flame. Use approved vented containers. Keep containers closed and clearly labeled. Empty product containers or vessels may contain explosive vapors. Do not pressurize, cut, heat, weld or expose such containers to sources of ignition.

Store in a well-ventilated area. This storage area should comply with NFPA 30 "Flammable and Combustible Liquid Code". Avoid storage near incompatible materials. The cleaning of tanks previously containing this product should follow API Recommended Practice (RP) 2013 "Cleaning Mobile Tanks In Flammable and Combustible Liquid Service" and API RP 2015 "Cleaning Petroleum Storage Tanks".

WORK/HYGIENIC PRACTICES

Emergency eye wash capability should be available in the near proximity to operations presenting a potential splash exposure. Use good personal hygiene practices. Avoid repeated and/or prolonged skin exposure. Wash hands before eating, drinking, smoking, or using toilet facilities. Do not use as a cleaning solvent on the skin. Do not use solvents or harsh abrasive skin cleaners for washing this product from exposed skin areas. Waterless hand cleaners are effective. Promptly remove contaminated clothing and launder before reuse. Use care when laundering to prevent the formation of flammable vapors which could ignite via washer or dryer. Consider the need to discard contaminated leather shoes and gloves.

8. EXPOSURE CONTROLS and PERSONAL PROTECTION (rev. Jan-04)

EXPOSURE LIMITS

Component (CAS No.)	Exposure Limits			
	Source	TWA (ppm)	STEL (ppm)	Note
Gasoline (86290-81-5)	ACGIH	300	500	A3
Benzene (71-43-2)	OSHA	1	5	Carcinogen
	ACGIH	0.5	2.5	A1, skin
	USCG	1	5	
n-Butane (106-97-8)	ACGIH	800	–	2003 NOIC: 1000 ppm (TWA) Aliphatic Hydrocarbon Gases Alkane (C1-C4)
Ethyl Alcohol (ethanol) (64-17-5)	OSHA	1000	–	
	ACGIH	1000	–	A4
Ethyl benzene (100-41-4)	OSHA	100	–	
	ACGIH	100	125	A3

Component (CAS No.)	Exposure Limits Source	TWA (ppm)	STEL (ppm)	Note
Methyl tert-butyl ether [MTBE] (1634-04-4)	OSHA	500	–	
	ACGIH	50	–	skin
	ACGIH	50		A3
Tertiary-amyl methyl ether [TAME] (994-05-8)				None established
Toluene (108-88-3)	OSHA	200		Ceiling: 300 ppm; Peak: 500 ppm (10 min.)
	ACGIH	50	–	A4 (skin)
1,2,4- Trimethylbenzene (95-63-6)	ACGIH	25	–	
Xylene, mixed isomers (1330-20-7)	OSHA	100	–	
	ACGIH	100	150	A4

ENGINEERING CONTROLS

Use adequate ventilation to keep vapor concentrations of this product below occupational exposure and flammability limits, particularly in confined spaces.

EYE/FACE PROTECTION

Safety glasses or goggles are recommended where there is a possibility of splashing or spraying.

SKIN PROTECTION

Gloves constructed of nitrile or neoprene are recommended. Chemical protective clothing such as that made of of E.I. DuPont Tychem ®, products or equivalent is recommended based on degree of exposure.

Note: The resistance of specific material may vary from product to product as well as with degree of exposure. Consult manufacturer specifications for further information.

RESPIRATORY PROTECTION

A NIOSH-approved air-purifying respirator with organic vapor cartridges or canister may be permissible under certain circumstances where airborne concentrations are or may be expected to exceed exposure limits or for odor or irritation. Protection provided by air-purifying respirators is limited. Refer to OSHA 29 CFR 1910.134, NIOSH Respirator Decision Logic, and the manufacturer for additional guidance on respiratory protection selection and limitations.

Use a positive pressure, air-supplied respirator if there is a potential for uncontrolled release, exposure levels are not known, in oxygen-deficient atmospheres, or any other circumstance where an air-purifying respirator may not provide adequate protection.

9. PHYSICAL and CHEMICAL PROPERTIES (rev. Jan-04)

APPEARANCE

A translucent, straw-colored or light yellow liquid

ODOR

A strong, characteristic aromatic hydrocarbon odor. Oxygenated gasoline with MTBE and/or TAME may have a sweet, ether-like odor and is detectable at a lower concentration than non-oxygenated gasoline.

ODOR THRESHOLD

	Odor Detection	Odor Recognition
Non-oxygenated gasoline:	0.5 - 0.6 ppm	0.8 - 1.1 ppm
Gasoline with 15% MTBE:	0.2 - 0.3 ppm	0.4 - 0.7 ppm
Gasoline with 15% TAME:	0.1 ppm	0.2 ppm

BASIC PHYSICAL PROPERTIES

BOILING RANGE:	85 to 437 °F (39 to 200 °C)
VAPOR PRESSURE:	6.4 - 15 RVP @ 100 °F (38 °C) (275-475 mm Hg @ 68 °F (20 °C)
VAPOR DENSITY (air = 1):	AP 3 to 4
SPECIFIC GRAVITY (H_2O = 1):	0.70 – 0.78
EVAPORATION RATE:	10-11 (n-butyl acetate = 1)
PERCENT VOLATILES:	100 %

SOLUBILITY (H_2O): Non-oxygenated gasoline - negligible (< 0.1% @ 77 °F). Gasoline with 15% MTBE - slight (0.1 - 3% @ 77 °F); ethanol is readily soluble in water

10. STABILITY and REACTIVITY (rev. Dec-94)

STABILITY: Stable. Hazardous polymerization will not occur.

CONDITIONS TO AVOID

Avoid high temperatures, open flames, sparks, welding, smoking and other ignition sources

INCOMPATIBLE MATERIALS

Keep away from strong oxidizers.

HAZARDOUS DECOMPOSITION PRODUCTS

Carbon monoxide, carbon dioxide and non-combusted hydrocarbons (smoke). Contact with nitric and sulfuric acids will form nitrocresols that can decompose violently.

11. TOXICOLOGICAL PROPERTIES (rev. Dec-97)

ACUTE TOXICITY

Acute Dermal LD50 (rabbits): > 5 ml/kg
Acute Oral LD50 (rat): 18.75 ml/kg
Primary dermal irritation (rabbits): slightly irritating
Draize eye irritation (rabbits): non-irritating
Guinea pig sensitization: negative

CHRONIC EFFECTS AND CARCINOGENICITY

Carcinogenicity: OSHA: NO IARC: YES - 2B NTP: NO ACGIH: YES (A3)

IARC has determined that gasoline and gasoline exhaust are possibly carcinogenic in humans. Inhalation exposure to completely vaporized unleaded gasoline caused kidney cancers in male rats and liver tumors in female mice. The U.S. EPA has determined that the male kidney tumors are species-specific and are irrelevant for human health risk assessment. The significance of the tumors seen in female mice is not known. Exposure to light hydrocarbons in the same boiling range as this product has been associated in animal studies with effects to the central and peripheral nervous systems, liver, and kidneys. The significance of these animal models to predict similar human response to gasoline is uncertain.

This product contains benzene. Human health studies indicate that prolonged and/or repeated overexposure to benzene may cause damage to the blood-forming system (particularly bone marrow), and serious blood disorders such as aplastic anemia and leukemia. Benzene is listed as a human carcinogen by the NTP, IARC, OSHA and ACGIH.

This product may contain methyl tertiary butyl ether (MTBE): animal and human health effects studies indicate that MTBE may cause eye, skin, and respiratory tract irritation, central nervous system depression and neurotoxicity. MTBE is classified as an animal carcinogen (A3) by the ACGIH.

12. ECOLOGICAL INFORMATION (rev. Jan-04)

Keep out of sewers, drainage areas and waterways. Report spills and releases, as applicable, under Federal and State regulations. If released, oxygenates such as ethers and alcohols will be expected to exhibit fairly high mobility in soil, and therefore may leach into groundwater. The API (www.api.org) provides a number of useful references addressing petroleum and oxygenate contamination of groundwater.

13. DISPOSAL CONSIDERATIONS (rev. Dec-97)

Consult federal, state and local waste regulations to determine appropriate disposal options.

14. TRANSPORTATION INFORMATION (rev. Jan-04)

DOT PROPER SHIPPING NAME:	Gasoline
DOT HAZARD CLASS and PACKING GROUP:	3, PG II
DOT IDENTIFICATION NUMBER:	UN 1203
DOT SHIPPING LABEL:	FLAMMABLE LIQUID

PLACARD:

15. REGULATORY INFORMATION (rev. Jan-04)

U.S. FEDERAL, STATE, and LOCAL REGULATORY INFORMATION

This product and its constituents listed herein are on the EPA TSCA Inventory. Any spill or uncontrolled release of this product, including any substantial threat of release, may be subject to federal, state and/or local reporting requirements. This product and/or its constituents may also be subject to other federal, state, or local regulations; consult those regulations applicable to your facility/operation.

CLEAN WATER ACT (OIL SPILLS)

Any spill or release of this product to "navigable waters" (essentially any surface water, including certain wetlands) or adjoining shorelines sufficient to cause a visible sheen or deposit of a sludge or emulsion must be reported immediately to the National Response Center (1-800-424-8802) or, if not practical, the U.S. Coast Guard with follow-up to the National Response Center, as required by U.S. Federal Law. Also contact appropriate state and local regulatory agencies as required.

CERCLA SECTION 103 and SARA SECTION 304 (RELEASE TO THE ENVIRONMENT)

The CERCLA definition of hazardous substances contains a "petroleum exclusion" clause which exempts crude oil, refined, and unrefined petroleum products and any indigenous components of such. However, other federal reporting requirements (e.g., SARA Section 304 as well as the Clean Water Act if the spill occurs on navigable waters) may still apply.

SARA SECTION 311/312 - HAZARD CLASSES

ACUTE HEALTH	CHRONIC HEALTH	FIRE	SUDDEN RELEASE OF PRESSURE	REACTIVE
X	X	X	--	--

SARA SECTION 313 - SUPPLIER NOTIFICATION

This product contains the following toxic chemicals subject to the reporting requirements of section 313 of the Emergency Planning and Community Right-To-Know Act (EPCRA) of 1986 and of 40 CFR 372:

INGREDIENT NAME (CAS NUMBER)	CONCENTRATION WT. PERCENT
Benzene (71-43-2)	0.1 to 4.9 (0.1 to 1.3 for reformulated gasoline)
Ethyl benzene (100-41-4)	< 3
n-Hexane (110-54-3)	0.5 to 4
Methyl-tertiary butyl ether (MTBE) (1634-04-4)	0 to 15.0
Toluene (108-88-3)	1 to 15
1,2,4- Trimethylbenzene (95-63-6)	< 6
Xylene, mixed isomers (1330-20-7)	1 to 15

US EPA guidance documents (www.epa.gov/tri) for reporting Persistent Bioaccumulating Toxics (PBTs) indicate this product may contain the following deminimis levels of toxic chemicals subject to Section 313 reporting:

INGREDIENT NAME (CAS NUMBER)	CONCENTRATION - Parts per million (ppm) by weight
Polycyclic aromatic compounds (PACs)	17
Benzo (g,h,i) perylene (191-24-2)	2.55
Lead (7439-92-1)	0.079

CANADIAN REGULATORY INFORMATION (WHMIS)

Class B, Division 2 (Flammable Liquid)
Class D, Division 2A (Very toxic by other means) and Class D, Division 2B (Toxic by other means)

16. OTHER INFORMATION (rev. Jan-04)

NFPA® HAZARD RATING	HEALTH:	1	Slight
	FIRE:	3	Serious
	REACTIVITY:	0	Minimal
HMIS® HAZARD RATING	HEALTH:	1 *	Slight
	FIRE:	3	Serious
	REACTIVITY:	0	Minimal
	* CHRONIC		

SUPERSEDES MSDS DATED: 12/30/97

ABBREVIATIONS:

AP = Approximately < = Less than > = Greater than
N/A = Not Applicable N/D = Not Determined ppm = parts per million

ACRONYMS:

ACGIH	American Conference of Governmental Industrial Hygienists
AIHA	American Industrial Hygiene Association
ANSI	American National Standards Institute (212)642-4900
API	American Petroleum Institute (202)682-8000
CERCLA	Comprehensive Emergency Response, Compensation, and Liability Act
DOT	U.S. Department of Transportation [General Info: (800)467-4922]
EPA	U.S. Environmental Protection Agency
HMIS	Hazardous Materials Information System
IARC	International Agency For Research On Cancer
MSHA	Mine Safety and Health Administration
NFPA	National Fire Protection Association (617)770-3000
NIOSH	National Institute of Occupational Safety and Health
NOIC	Notice of Intended Change (proposed change to ACGIH TLV)
NTP	National Toxicology Program
OPA	Oil Pollution Act of 1990
OSHA	U.S. Occupational Safety & Health Administration
PEL	Permissible Exposure Limit (OSHA)
RCRA	Resource Conservation and Recovery Act
REL	Recommended Exposure Limit (NIOSH)
SARA	Superfund Amendments and Reauthorization Act of 1986 Title III
SCBA	Self-Contained Breathing Apparatus
SPCC	Spill Prevention, Control, and Countermeasures
STEL	Short-Term Exposure Limit (generally 15 minutes)
TLV	Threshold Limit Value (ACGIH)
TSCA	Toxic Substances Control Act
TWA	Time Weighted Average (8 hr.)
WEEL	Workplace Environmental Exposure Level (AIHA)
WHMIS	Workplace Hazardous Materials Information System (Canada)

DISCLAIMER OF EXPRESSED AND IMPLIED WARRANTIES

Information presented herein has been compiled from sources considered to be dependable, and is accurate and reliable to the best of our knowledge and belief, but is not guaranteed to be so. Since conditions of use are beyond our control, we make no warranties, expressed or implied, except those that may be contained in our written contract of sale or acknowledgment.

Vendor assumes no responsibility for injury to vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, vendor assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the material, even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in their use of the material.

DECON-AHOL WFI® 70%

Sterile Pharmaceutical Clean Room Formula

USP Isopropyl Alcohol with Water for Injection (WFI)

MATERIAL SAFETY DATA SHEET

COMPLIES WITH OSHA HAZARD COMMUNICATION STANDARD 29 CFR 1910.1200
(Complies with Commission Directive 91/155/EEC amended by 2001/58/EC)

Veltek Associates, Inc.
15 Lee Boulevard, Malvern, PA 19355-1234
Tel: 610-644-8335 Fax: 610-644-8336
www.sterile.com

* * * Section 1 - Chemical Product and Company Identification * * *

Chemical Name: USP Isopropyl Alcohol with USP Water for Injection
Product Use: Decontaminant.
Manufacturer Information

Veltek Associates, Inc.
15 Lee Blvd.
Malvern, PA 19355-1234

Phone: 610-644-8335

Emergency # 24 Hr CHEMTREC U.S. (800) 424-9300

* * * Section 2 - Hazards Identification * * *

Emergency Overview

Flammable liquid and vapor. Vapor may cause flash fire. This product may be irritating to the eyes, skin, gastrointestinal tract and respiratory system. May cause central nervous system depression.

Potential Health Effects: Eyes

This product may cause irritation to the eyes.

Potential Health Effects: Skin

This product may cause irritation to the skin.

Potential Health Effects: Ingestion

Ingestion of this product may result in central nervous system effects including headache, sleepiness, dizziness, slurred speech and blurred vision.

Potential Health Effects: Inhalation

May cause irritation to the nose and respiratory tract. Inhalation may cause central nervous system depression with symptoms such as weakness, dizziness, confusion and drowsiness.

Medical Conditions Aggravated by Exposure

Persons with pre-existing skin, eye and respiratory disorders may be aggravated by exposure to isopropyl alcohol component.

HMIS Ratings: Health: 1 **Fire:** 3 **Physical Hazard:** 0
Hazard Scale: 0 = Minimal 1 = Slight 2 = Moderate 3 = Serious 4 = Severe * = Chronic hazard

* * * Section 3 - Composition / Information on Ingredients * * *

CAS #	Component	Percent
67-63-0	Isopropyl alcohol	60-91
7732-18-5	USP Water for Injection	9-40

Component Information/Information on Non-Hazardous Components

This product is considered hazardous under 29 CFR 1910.1200 (Hazard Communication). This is a controlled product according to Canada's Controlled Product Regulation.

*Though the range is outside acceptable WHMIS limits, the range stated on this MSDS is the actual range within which this component varies between formulations of this product.

* * * Section 4 - First Aid Measures * * *

First Aid: Eyes

Immediately flush eyes with water for at least 15 minutes, while holding eyelids open. Seek medical attention at once.

First Aid: Skin

For skin contact flush with large amounts of water while removing contaminated clothing. Wash contaminated clothing before reuse. If irritation persists, get medical attention.

First Aid: Ingestion

Do not induce vomiting. If ingestion of a large amount does occur, seek medical attention.

First Aid: Inhalation

If inhaled, immediately remove the affected person to fresh air. Give artificial respiration if not breathing. Call a physician immediately.

First Aid: Notes to Physician

Do not induce vomiting. First, contact poison control center, treatment depends on volume of substance and time elapsed.

* * * Section 5 - Fire Fighting Measures * * *

General Fire Hazards

See Section 9 for Flammability Properties.

Severe fire hazard. Vapors are heavier than air and may travel along the ground to some distant source of ignition and flash back. Vapor/air mixtures are explosive.

Hazardous Combustion Products

Oxides of carbon.

Extinguishing Media

Dry chemical, alcohol-resistant foam, carbon dioxide, water fog.

Fire Fighting Equipment/Instructions

Firefighters should wear full protective clothing including self contained breathing apparatus. Clear area of unprotected personnel. Move container from area if it can be done without risk. Cool containers with water spray until well after fire is out to prevent vapor build up, which could result in container rupture.

NFPA Ratings: Health: 1 **Fire:** 3 **Reactivity:** 0

Hazard Scale: 0 = Minimal 1 = Slight 2 = Moderate 3 = Serious 4 = Severe

* * * Section 6 - Accidental Release Measures * * *

Containment Procedures

Stop the flow of material, if this is without risk. Reduce vapors with water spray. Eliminate all sources of ignition or flammables that may come into contact with a spill of this material. Equipment must be grounded to prevent sparking.

Clean-Up Procedures

Absorb spill with inert material. Shovel material into appropriate container for disposal.

Evacuation Procedures

Isolate area. Keep unnecessary personnel away.

Special Procedures

Regulations vary. Consult local authorities before disposal.

* * * Section 7 - Handling and Storage * * *

Handling Procedures

Avoid getting this material into contact with your skin and eyes. Use non-sparking tools when opening or closing large containers.

Storage Procedures

Keep the container tightly closed and in a cool, well-ventilated place. Eliminate all sources of ignition. Do not store, incinerate, or heat this material above 120 degrees Fahrenheit. Keep away from incompatible materials.

* * * Section 8 - Exposure Controls / Personal Protection * * *

A: Component Exposure Limits

Isopropyl alcohol (67-63-0)

ACGIH:	200 ppm TWA
	400 ppm STEL
OSHA:	400 ppm TWA; 980 mg/m3 TWA
	500 ppm STEL; 1225 mg/m3 STEL
NIOSH:	400 ppm TWA; 980 mg/m3 TWA
	500 ppm STEL; 1225 mg/m3 STEL

Engineering Controls

Explosion proof exhaust ventilation should be used.

PERSONAL PROTECTIVE EQUIPMENT

Personal Protective Equipment: Eyes/Face

Wear chemical goggles; face shield (if splashing is possible).

Personal Protective Equipment: Skin

Use impervious gloves.

Personal Protective Equipment: Respiratory

Use a NIOSH approved HEPA filter, or supplied air respirators when exposures reach the OSHA established PELs.

Personal Protective Equipment: General

Eye wash fountain and emergency showers are recommended.

* * * Section 9 - Physical & Chemical Properties * * *

Appearance:	Clear, colorless liquid	**Odor:**	Mild alcohol
Physical State:	Liquid	**pH:**	7.0
Vapor Pressure:	28 torr @20°C	**Vapor Density:**	1.6 (air=1)
Boiling Point:	170°F (77°C)	**Melting Point:**	Not available
Solubility (H2O):	Complete	**Specific Gravity:**	0.8272-0.883 (H2O=1)
Freezing Point:	14°F (-10°C)	**Evaporation Rate:**	1.7 (Butyl Acetate=1)
VOC:	Not available	**Octanol/H2O Coeff.:**	Not available
Upper Flammability Limit (UFL):	12% (% volume in air)	**Lower Flammability Limit (LFL):**	2% (% volume in air)
Flash Point:	70°F (22°C)	**Auto Ignition:**	Not available

* * * Section 10 - Chemical Stability & Reactivity Information * * *

Chemical Stability

Stable under normal conditions.

Chemical Stability: Conditions to Avoid

Keep away from heat, ignition sources and incompatible materials.

Incompatibility

Acids, metals, oxidizing materials, combustible materials, halogens, peroxides, bases, metal salts.

Hazardous Decomposition

Oxides of carbon.

Possibility of Hazardous Reactions

Will not occur.

* * * Section 11 - Toxicological Information * * *

Acute Dose Effects

A: General Product Information

Excessive inhalation or ingestion of this material may cause central nervous system depression. Symptoms include headache, dizziness, nausea and incoordination. May cause irritation of the eyes, skin, gastrointestinal tract or respiratory system.

B: Component Analysis - LD50/LC50

Isopropyl alcohol (67-63-0)

Inhalation LC50 Rat: 16000 mg/kg/8H; Oral LD50 Rat: 5045 mg/kg; Oral LD50 Mouse: 3600 mg/kg; Dermal LD50 Rabbit: 12800 mg/kg

Carcinogenicity

A: General Product Information

No carcinogenicity data available for this product.

B: Component Carcinogenicity

Isopropyl alcohol (67-63-0)

ACGIH: A4 - Not Classifiable as a Human Carcinogen

IARC: Monograph 71, 1999; Supplement 7, 1987; Monograph 15, 1977 (Group 3 (not classifiable))

Target Organ Effects

Central Nervous System (CNS).

*** Section 12 - Ecological Information ***

Ecotoxicity

A: General Product Information

No information available for the product.

B: Component Analysis - Ecotoxicity - Aquatic Toxicity

Isopropyl alcohol (67-63-0)

Test & Species		Conditions
96 Hr LC50 fathead minnow (29 days old)	94900 mg/L	flow-through
96 Hr LC50 fathead minnow (31 days old)	61200 mg/L	flow-through
5 min EC50 Photobacterium phosphoreum	35390 mg/L	

*** Section 13 - Disposal Considerations ***

US EPA Waste Number & Descriptions

A: General Product Information

No additional information available.

B: Component Waste Numbers

No EPA Waste Numbers are applicable for this product's components.

Disposal Instructions

Dispose of waste material according to Local, State, Federal, and Provincial Environmental Regulations. If discarded, this product is considered a RCRA ignitable waste, D001.

See Section 7 for Handling Procedures. See Section 8 for Personal Protective Equipment recommendations.

*** Section 14 - Transportation Information ***

US DOT Information

Shipping Name: Isopropanol
UN/NA #: UN1219 **Hazard Class:** 3 **Packing Group:** II
Required Label(s): Flammable Liquid

TDG Information

Shipping Name: Isopropanol
UN/NA #: UN1219 **Hazard Class:** 3 **Packing Group:** II
Required Label(s): Flammable Liquid

IMDG Information

Shipping Name: Isopropanol
UN/NA #: UN1219 **Hazard Class:** 3 **Packing Group:** II
Required Label(s): Flammable Liquid

IATA/ICAO Information

Shipping Name: Isopropanol
UN/NA#: UN1219 **Hazard Class:** 3 **Packing Group:** II
Hazard Labels: Flammable Liquid

*** Section 15 - Regulatory Information ***

US Federal Regulations

A: General Product Information

All components are on the U.S. EPA TSCA Inventory List.

B: Component Analysis

This material contains one or more of the following chemicals required to be identified under SARA Section 302 (40 CFR 355 Appendix A), SARA Section 313 (40 CFR 372.65) and/or CERCLA (40 CFR 302.4).

Isopropyl alcohol (67-63-0)

SARA 313: 1.0 % de minimis concentration (only if manufactured by the strong acid process, no supplier notification)

State Regulations

A: General Product Information

Other state regulations may apply. Check individual state requirements.

B: Component Analysis - State

The following components appear on one or more of the following state hazardous substances lists:

Component	CAS	CA	MA	MN	NJ	PA	RI
Isopropyl alcohol	67-63-0	Yes	Yes	Yes	Yes	Yes	Yes

Canadian WHMIS Information

A: General Product Information

WHMIS Classification: B2- Flammable Liquid, D2B- Toxic Material

B: Component Analysis - WHMIS IDL

The following components are identified under the Canadian Hazardous Products Act Ingredient Disclosure List:

Component	CAS #	Minimum Concentration
Isopropyl alcohol	67-63-0	1 % (English Item 904, French Item 1050)

Additional Regulatory Information

A: General Product Information

No additional information available.

B: Component Analysis - Inventory

Component	CAS #	TSCA	CAN	EEC
Isopropyl alcohol	67-63-0	Yes	DSL	EINECS
USP Water for Injection	7732-18-5	Yes	DSL	EINECS

* * * Section 16 - Other Information * * *

Other Information

No additional information available.

MSDS History

New MSDS: 11 January 2005.

Key/Legend

ACGIH = American Conference of Governmental Industrial Hygienists; CERCLA = Comprehensive Environmental Response, Compensation and Liability Act; CFR = Code of Federal Regulations; CNS = Central Nervous System; DSL = Domestic Substances List; EINECS = European Inventory of Existing Commercial Chemical Substances; EPA = Environmental Protection Agency; HEPA = High Efficiency Particulate Air filters; IARC = International Agency for Research on Cancer; LC50 = Lethal Concentration 50%; LD50 = Lethal Dose 50%; NIOSH = National Institute for Occupational Safety and Health; NJTSR = New Jersey Trade Secret Registry; NTP = National Toxicology Program; OSHA = Occupational Safety and Health Administration; PEL = Permissible Exposure Limit; RCRA = Resource Conservation and Recovery Act; SARA = Superfund Amendments and Reauthorization Act; STEL = Short Term Exposure Limit; TDG = Transport Dangerous Goods TSCA = Toxic Substance Control Act; TWA = Time Weighted Average; WHMIS = Workplace Hazardous Materials Information System.

Contact: Arthur Vellutato, Sr., President
Contact Phone: 610-644-8335

This is the end of MSDS # VEL-104-NONAEROSOL

MATERIAL SAFETY DATA SHEET

This Material Safety Data Sheet complies with the Canadian Controlled Product Regulations and the United States Occupational Safety and Health Administration (OSHA) hazard communication standard.

1. Product and Supplier Identification

Product: **Methanol (CH_3OH)**

Synonyms: Methyl alcohol, methyl hydrate, wood spirit, methyl hydroxide

Product Use: Solvent, fuel, feedstock

Company Identification: **Methanex Corporation, 1800 Waterfront Centre, 200 Burrard Street, Vancouver, B.C. V6C 3M1**

Non-Emergency Tel. #: (604) 661-2600

Emergency Tel. #: (CHEMTREC) 1-800-424-9300 (Canada and US)

Note: CHEMTREC number to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

Importer: **Methanex Methanol Company**
Suite 1150 – 15301 Dallas Parkway
Addison, Texas 75001
Telephone: (972) 702-0909

2. Composition

Component	% (w/w)	Exposure Limits*	LD_{50}	LC_{50}
Methanol (CAS 67-56-1)	99-100	ACGIH TLV-TWA: 200 ppm, skin STEL: 250 ppm, skin notation OSHA PEL: 200 ppm TLV Basis, critical effects: neuropathy, vision, central nervous system	5628 mg/kg (oral/rat) 20 ml/kg (dermal/ rabbit)	64000 ppm (inhalation/rat)

* Exposure limits may vary from time to time and from one jurisdiction to another. Check with local regulatory agency for the exposure limits in your area.

3. Hazards Identification

Routes of Entry:

Skin Contact: Moderate Eye Contact: Moderate Ingestion: Major Inhalation: Major

Effects of Short-Term (Acute) Exposure:

Inhalation: Inhalation of high airborne concentrations can also irriate mucous membranes, cause headaches, sleepiness, nausea, confusion, loss of consciousness, digestive and visual disturbances and even death. NOTE: Odour threshhold of methanol is several times higher than the TLV-TWA. Depending upon severity of poisoning and the promptness of treatment, survivors may recover completely or may have permanent blindness, vision disturbances and/or nervous system effects. Concentrations in air exceeding 1000 ppm may cause irritation of the mucous membranes.

Skin Contact: Methanol is moderately irritating to the skin. Methanol can be absorbed through the skin and harmful effects have been reported by this route of entry. Effects are simialr to those described in “Inhalation”

Eye Contact: Methanol is a mild to moderate eye irritant. High vapour concentration or liquid contact with eyes causes irritation, tearing and burning.

Ingestion: Swallowing even small amounts of methanol could potentially cause blindness or death. Effects of sub lethal doses may be nausea, headache, abdominal pain, vomiting and visual disturbances ranging from blurred vision to light sensitivity.

Effects of Long-Term (Chronic) Exposure: Repeated exposure by inhalation or absorption may cause systemic poisoning, brain disorders, impaired vision and blindness. Inhalation may worsen conditions such as emphysema or bronchitis. Repeated skin contact may cause dermal irritation, dryness and cracking.

Medical Conditions Aggravated By Exposure: Emphysema or bronchitis.

4. First Aid Measures

Note: *Emergency assistance may also be available from the local poison control centre.*

Eye Contact: Remove contact lenses if worn. In case of contact, immediately flush eyes with plenty of clean running water for at least 15 minutes, lifting the upper and lower eyelids occasionally. Obtain medical attention.

Skin Contact: In case of contact, remove contaminated clothing. In a shower, wash affected areas with soap and water for at least 15 minutes. Seek medical attention if irritation occurs or persists. Wash clothing before reuse.

Inhalation: Remove to fresh air, restore or assist breathing if necessary. Obtain medical attention.

Ingestion: Swallowing methanol is potentially life threatening. Onset of symptoms may be delayed for 18 to 24 hours after digestion. If conscious and medical aid is not immediately

available, do not induce vomiting. In actual or suspected cases of ingestion, transport to medical facility immediately.

NOTE TO PHYSICIAN: Acute exposure to methanol, either through ingestion or breathing high airborne concentrations can result in symptoms appearing between 40 minutes and 72 hours after exposure. Symptoms and signs are usually limited to CNS, eyes and gastrointestinal tract. Because of the initial CNS's effects of headache, vertigo, lethargy and confusion, there may be an impression of ethanol intoxication. Blurred vision, decreased acuity and photophobia are common complaints. Treatment with ipecac or lavage is indicated in any patient presenting within two hours of ingestion. A profound metabolic acidosis occurs in severe poisoning and serum bicarbonate levels are a more accurate measure of severity than serum methanol levels. Treatment protocols are available from most major hospitals and early collaboration with appropriate hospitals is recommended.

5. Fire Fighting Measures

Flash point:	11^{o}C (TCC)
Autoignition temperature:	385 ^{o}C (NFPA 1978), 470 ^{o}C (Kirk-Othmer 1981; Ullmann 1975)
Lower Explosive Limit:	6% (NFPA, 1978)
Upper Explosion Limit:	36% (NFPA, 1978), 36.5% (Ullmann, 1975)
Sensitivity to Impact:	Low
Sensitivity to Static Discharge:	Low
Hazardous Combustion Products:	Toxic gases and vapours; oxides of carbon and formaldehyde.
Extinguishing Media:	Small fires: Dry chemical, CO_2, water spray Large fires: Water spray, AFFF(R) (Aqueous Film Forming Foam (alcohol resistant)) type with either a 3% or 6% foam proportioning system.

Fire Fighting Instructions: Methanol burns with a clean clear flame that is almost invisible in daylight. Stay upwind! Isolate and restrict area access. Concentrations of greater that 25% methanol in water can be ignited. Use fine water spray or fog to control fire spread and cool adjacent structures or containers. Contain fire control water for later disposal. Fire fighters must wear full face, positive pressure, self-contained breathing apparatus or airline and appropriate protective clothing. Protective fire fighting structural clothing is not effective protection from methanol. Do not walk through spilled product.

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) HAZARD INDEX:

HEALTH: 1

FLAMMABILITY: 3

REACTIVITY: 0

6. Accidental Release Measures

Overview: Flammable liquid which can burn without a visible flame. Release can cause an immediate risk of fire and explosion. Eliminate all ignition sources, stop leak and use absorbent materials. If necessary, contain spill by diking. Fluorocarbon alcohol resistant foams may be applied to spill to diminish vapour and fire hazard. Maximize methanol recovery for recycling or re-use. Restrict access to area until completion of cleanup. Ensure cleanup is conducted by

trained personnel only. Wear adequate personal protection and remove all sources of ignition. Notify all governmental agencies as required by law.

Personal Protection: Full face, positive pressure self-contained breathing apparatus or airline, and protective clothing must be worn. Protective fire fighting structural clothing is not effective protection from methanol.

Environmental Precautions: Biodegrades easily in water Methanol in fresh or salt water may have serious effects on aquatic life. A study on methanol's toxic efffects on sewage sludge bacteria reported little effect on digestion at 0.1% while 0.5% methanol retarded digestion. Methanol will be broken down to carbon dioxide and water.

Remedial Measures: Flammable liquid. Release can cause an immediate fire/explosion hazard. Eliminate all sources of ignition, stop leak and use absorbent materials. Collect liquid with explosion proof pumps. Do not walk through spill product as it may be on fire and not visible.

Large Spills: If necessary, contain spill by diking. Fluorocarbon alcohol resistant foams may be applied to spill to diminish vapour and fire hazard. Maximize methanol recovery for recycling or reuse. Collect liquid with explosion proof pumps.

Small Spills: Soak up spill with non-combustible absorbent material. Recover methanol and dilute with water to reduce fire hazard. Prevent spilled methanol from entering sewers, confined spaces, drains, or waterways. Restict access to unprotected personnel. Full. Put material in suitable, covered, labeled containers. Flush area with water.

7. Handling and Storage

Handling Procedures: No smoking or open flame in storage, use or handling areas. Use explosion proof electrical equipment. Ensure proper electrical grouding procedures are in place.

Storage: Store in totally enclosed equipment, designed to avoid ignition and human contact. Tanks must be grounded, vented, and should have vapour emission controls. Tanks must be diked. Avoid storage with incompatible materials. Anhydrous methanol is non-corrosive to most metals at ambient temperatures except for lead, nickel, monel, cast iron and high silicon iron. Coatings of copper (or copper alloys), zinc (including galvanized steel), or aluminum are unsuitable for storage. These materials may be attacked slowly by the methanol. Storage tanks of welded construction are normally satisfactory. They should be designed and built in conformance with good engineering practice for the material being stored. While plastics can be used for short term storage, they are generally not recommended for long-term storage due to deterioration effects and the subsequent risk of contamination.

Corrosion rates for several construction materials:

<0.508 mm/year	Cast iron, monel, lead, nickel
<0.051 mm/year	High silicon iron
Some attack	Polyethylene
Satisfactory	Neoprene, phenolic resins, polyesters, natural rubber, butyl rubber
Resistant	Polyvinyl chloride, unplasticized

8. Exposure Controls, Personal Protection

Engineering Controls: In confined areas, local and general ventilation should be provided to maintain airborne concentrations beloew permissable exposure limits. Ventilation systems must be designed according to approved engineering standards.

Respiratory Protection: NIOSH approved supplied air respirator when airborne concentrations exceed exposure limits.

Skin protection: Butyl and nitrile rubbers are recommended for gloves. Check with manufacturer. Wear chemical resistant pants and jackets, preferably of butyl or nitrile rubber. Check with manufacturer.

Eye and Face Protection: Face shield and chemical splash goggles when transferring is taking place.

Footwear: Chemical resistant, and as specified by the workplace.

Other: Eyewash and showers should be located near work areas. NOTE: PPE must not be considered a long-term solution to exposure control. PPE usage must be accompanied by employer programs to properly select, maintain, clean, fit and use. Consult a competent industrial hygiene resource to determine hazard potential and/or the PPE manufacturers to ensure aadequate protection.

9. Physical and Chemical Properties

Appearance: Liquid, clear, colourless
Odour: Mild characteristic alcohol odour
Odour Threshold: detection: 4.2 - 5960 ppm
(geometric mean) 160 ppm
recognition: 53 – 8940 ppm
(geometric mean) 690 ppm
pH: Not applicable
Vapour Pressure: 12.8 kPa @ 20^{o}C
Solubility: Completely soluble
Vapour Density: 1.105 @ 15 ^{o}C
Freezing Point: -97.8 ^{o}C

Boiling Point: 64.7 ^{o}C @ 101.3 kPa
Critical Temperature: 239.4 ^{o}C
Relative Density: 0.791
Evaporation Rate: 4.1 (n-butyl acetate =1)

Partition Coefficient: Log P (oct) = -0.82
Solubility in other Liquids: Soluble in all proportions in other alcohols, esters, ketones, ethers and most other organic solvents

10. Stability and Reactivity

Chemical Stability: Yes

Incompatibility: Yes. Avoid contact with strong oxidizers, strong mineral or organic acids, and strong bases. Contact with these materials may cause a violent or explosive reaction. May be corrosive to lead, aluminum, magnesium, and platinum.

Conditions of Reactivity: Presence of incompatible materials and ignition sources.

Hazardous Decomposition Products: Formaldehyde, carbon dioxide, and carbon monoxide.

Hazardous Polymerization: Will not occur.

11. Toxicological Information

LD_{50}:	5628 mg/kg (oral/rat), 20 ml/kg (dermal/rabbit)
LC_{50}:	64000 ppm (rat)
Acute Exposure:	See Section 3
Chronic Exposure:	See Section 3.
Exposure Limits:	See Section 2.
Irritancy:	See Section 3.
Sensitization:	No
Carcinogenicity:	Not listed by IARC, NTP, ACGIH, or OSHA as a carcinogen.
Teratogenicity:	No
Reproductive toxicity:	Reported to cause birth defects in rats exposed to 20,000 ppm
Mutagenicity:	Insufficient data
Synergistic products:	None Known

12. Ecological Information

Environmental toxicity: Methanol in fresh or salt water may have serious effects on aquatic life. A study on methanol's toxic effects on sewage sludge bacteria reported little effect on digestion at 0.1% while 0.5% methanol retarded digestion. Methanol will be broken down into carbon dioxide and water.

Biodegradability: Biodegrades easily in water.

13. Disposal Considerations

Review federal, provincial or state, and local government requirements prior to disposal. Store material for disposal as indicated in Section #7, ***Handling and Storage***. Disposal by controlled incineration or by secure land fill may be acceptable.

14. Transport Information

Transport of Dangerous Goods (TDG and CLR):	Methanol, Class 3(6.1), UN1230, P.G. II Limited Quantity: ≤ 1 litres
United States Department of Transport (49CFR): (Domestic Only)	Methanol, Class 3, UN 1230, P.G. II, (RQ 5000 lbs/2270 kg) Limited Quantity: ≤ 1 litres
International Air Transport Association (IATA):	Methanol, Class 3(6.1), UN1230, P.G. II Packaging Instruction: 305, 1 litre maximum per package,
International Maritime Organization (IMO):	Methanol, Class 3(6.1), UN1230, P.G. II, Flash Point = 12 ^{o}C EmS No. F-E, S-D Stowage Category "B", Clear of living quarters

15. Regulatory Information

CANADIAN FEDERAL REGULATIONS:

CEPA, DOMESTIC SUBSTANCES LIST: Listed

WHMIS CLASSIFICATION: B2, D1A

UNITED STATES REGULATIONS:

29CFR 1910.1200 (OSHA):	Hazardous
40CFR 116-117 (EPA):	Hazardous
40CFR 355, Appendices A and B:	Subject to Emergency Planning and Notification
40CFR 372 (SARA Title III):	Listed
40CFR 302 (CERCLA):	Listed

16. Other Information

Preparation Date: October 13, 2005

Prepared by: Kel-Ex Agencies Ltd., P.O. Box 52201, Lynnmour RPO, North Vancouver, B.C., V7J 3V5

Disclaimer: The information above is believed to be accurate and represents the best information currently available to us. Users should make their own investigations to determine the suitability of the information for their particular purposes. This document is intended as a guide to the appropriate precautionary handling of the material by a properly trained person using this product.

Methanex Corporation and its subsidiaries make no representations or warranties, either express or implied, including without limitation any warranties of merchantability, fitness for a particular purpose with respect to the information set forth herein or the product to which the information refers. Accordingly, Methanex Corp. will not be responsible for damages resulting from use of or reliance upon this information.

Revisions: None

Appendix C – ENG Form 3394 Accident Investigation Form

(For Safety Staff only)	REPORT NO.	EROC CODE	**UNITED STATES ARMY CORPS OF ENGINEERS ACCIDENT INVESTIGATION REPORT** *(For Use of this Form See Help Menu and USACE Suppl to AR 385-40)*	**REQUIREMENT CONTROL SYMBOL: CEEC-S-8(R2)**

1. **ACCIDENT CLASSIFICATION**

PERSONNEL CLASSIFICATION	INJURY/ILLNESS/FATAL	PROPERTY DAMAGE	MOTOR VEHICLE INVOLVED	DIVING
GOVERNMENT ☐ CIVILIAN ☐ MILITARY	☐	☐ FIRE INVOLVED ☐ OTHER	☐	☐
☐ CONTRACTOR	☐	☐ FIRE INVOLVED ☐ OTHER	☐	☐
☐ PUBLIC ☐ FATAL ☐ OTHER			☐	

2. **PERSONAL DATA**

a. Name *(Last, First, MI)*	b. AGE	c. SEX ☐ MALE ☐ FEMALE	d. SOCIAL SECURITY NUMBER	e. GRADE

f. JOB SERIES/TITLE	g. DUTY STATUS AT TIME OF ACCIDENT	h. EMPLOYMENT STATUS AT TIME OF ACCIDENT
	☐ ON DUTY ☐ TDY ☐ OFF DUTY	☐ ARMY ACTIVE ☐ ARMY RESERVE ☐ VOLUNTEER ☐ PERMANENT ☐ FOREIGN NATIONAL ☐ SEASONAL ☐ TEMPORARY ☐ STUDENT ☐ OTHER *(Specify)*

3. **GENERAL INFORMATION**

a. DATE OF ACCIDENT *(month/day/year)*	b. TIME OF ACCIDENT *(Military time)* hrs	c. EXACT LOCATION OF ACCIDENT	d. CONTRACTOR'S NAME (1) PRIME: (2) SUBCONTRACTOR:

e. CONTRACT NUMBER	f. TYPE OF CONTRACT	g. HAZARDOUS/TOXIC WASTE ACTIVITY
☐ CIVIL WORKS ☐ MILITARY ☐ OTHER *(Specify)*	☐ CONSTRUCTION ☐ SERVICE ☐ A/E ☐ DREDGE ☐ OTHER *(Specify)*	☐ SUPERFUND ☐ DERP ☐ IRP ☐ OTHER *(Specify)*

4. **CONSTRUCTION ACTIVITIES ONLY** *(Fill in line and corresponding code number in box from list - see help menu)*

a. CONSTRUCTION ACTIVITY	(CODE) #	b. TYPE OF CONSTRUCTION EQUIPMENT	(CODE) #

5. INJURY/ILLNESS INFORMATION *(Include name on line and corresponding code number in box for items e, f & g - see help menu)*

a. SEVERITY OF ILLNESS/INJURY	(CODE) #	b. ESTIMATED DAYS LOST	c. ESTIMATED DAYS HOSPITALIZED	d. ESTIMATED DAYS RESTRICTED DUTY

e. BODY PART AFFECTED	(CODE) #	g. TYPE AND SOURCE OF INJURY/ILLNESS	(CODE) #
PRIMARY		TYPE	
SECONDARY		SOURCE	
f. NATURE OF ILLNESS/INJURY			

6. PUBLIC FATALITY *(Fill in line and correspondence code number in box - see help menu)*

a. ACTIVITY AT TIME OF ACCIDENT	(CODE) #	b. PERSONAL FLOATATION DEVICE USED?
		☐ YES ☐ NO ☐ N/A

7. MOTOR VEHICLE ACCIDENT

a. TYPE OF VEHICLE	b. TYPE OF COLLISION	c. SEAT BELTS	USED	NOT USED	NOT AVAILABLE
☐☐ PICKUP/VAN ☐☐ AUTOMOBILE ☐☐ TRUCK ☐☐ OTHER *(Specify)*	☐ SIDE SWIPE ☐ HEAD ON ☐ REAR END ☐ BROADSIDE ☐ ROLL OVER ☐ BACKING ☐ OTHER *(Specify)*	(1) FRONT SEAT			
		(2) REAR SEAT			

8. PROPERTY/MATERIAL INVOLVED

a. NAME OF ITEM	b. OWNERSHIP	c. $ AMOUNT OF DAMAGE
(1)		
(2)		
(3)		

9. VESSEL/FLOATING PLANT ACCIDENT *(Fill in line and correspondence code number in box from list - see help menu)*

a. TYPE OF VESSEL/FLOATING PLANT	(CODE) #	b. TYPE OF COLLISION/MISHAP	(CODE) #

10. ACCIDENT DESCRIPTION *(Use additional paper, if necessary)*

11. **CAUSAL FACTOR(S)** *(Read Instruction Before Completing)*

a. (Explain YES answers in item 13)	YES	NO
DESIGN: Was design of facility, workplace or equipment a factor?	☐	☐
INSPECTION/MAINTENANCE: Were inspection & maintenance procedures a factor?	☐	☐
PERSON'S PHYSICAL CONDITION: In your opinion, was the physical condition of the person a factor?	☐	☐
OPERATING PROCEDURES: Were operating procedures a factor?	☐	☐
JOB PRACTICES: Were any job safety/health practices not followed when the accident occurred?	☐	☐
HUMAN FACTORS: Did any human factors such as, size or strength of person, etc., contribute to accident?	☐	☐
ENVIRONMENTAL FACTORS: Did heat, cold, dust, sun, glare, etc., contribute to the accident?	☐	☐

a. *(CONTINUED)*	YES	NO
CHEMICAL AND PHYSICAL AGENT FACTORS: Did exposure to chemical agents, such as dust, fumes, mists, vapors or physical agents, such as, noise, radiation, etc., contribute to accident?	☐	☐
OFFICE FACTORS: Did office setting such as, lifting office furniture, carrying, stooping, etc., contribute to the accident?	☐	☐
SUPPORT FACTORS: Were inappropriate tools/resources provided to properly perform the activity/task?	☐	☐
PERSONAL PROTECTIVE EQUIPMENT: Did the improper selection, use or maintenance of personal protective equipment contribute to the accident?	☐	☐
DRUGS/ALCOHOL: In your opinion, was drugs or alcohol a factor to the accident	☐	☐

b. WAS A WRITTEN JOB/ACTIVITY HAZARD ANALYSIS COMPLETED FOR TASK BEING PERFORMED AT TIME OF ACCIDENT?

☐ YES *(If yes, attach a copy.)* ☐ NO

12. **TRAINING**

a. WAS PERSON TRAINED TO PERFORM ACTIVITY/TASK?	b. TYPE OF TRAINING.	c. DATE OF MOST RECENT FORMAL TRAINING.
☐ YES ☐ NO	☐ CLASSROOM ☐ ON JOB	(Month) (Day) (Year)

13. **FULLY EXPLAIN WHAT ALLOWED OR CAUSED THE ACCIDENT; INCLUDE DIRECT AND INDIRECT CAUSES** *(See instruction for definition of direct and indirect causes.) (Use additional paper, if necessary)*

a. DIRECT CAUSE

b. INDIRECT CAUSE(S)

14. **ACTION(S) TAKEN, ANTICIPATED OR RECOMMENDED TO ELIMINATE CAUSE(S).**

DESCRIBE FULLY:

15. **DATES FOR ACTIONS IDENTIFIED IN BLOCK 14.**

a. BEGINNING (Month/Day/Year)	b. ANTICIPATED COMPLETION (Month/Day/Year)		
c. SIGNATURE AND TITLE OF SUPERVISOR COMPLETING REPORT CORPS _____ CONTRACTOR _____	d. DATE *(Mo/Da/Yr)*	e. ORGANIZATION IDENTIFIER *(Div, Br, Sect)*	f. OFFICE SYMBOL

16. **MANAGEMENT REVIEW** *(1st)*

a. ☐ CONCUR b. ☐ NON CONCUR c. COMMENTS

SIGNATURE	TITLE	DATE

17. **MANAGEMENT REVIEW** *(2nd - Chief Operations, Construction, Engineering, etc.)*

a. ☐ CONCUR b. ☐ NON CONCUR c. COMMENTS

SIGNATURE	TITLE	DATE

18. **SAFETY AND OCCUPATIONAL HEALTH OFFICE REVIEW**

a. ☐ CONCUR b. ☐ NON CONCUR c. ADDITIONAL ACTIONS/COMMENTS

SIGNATURE	TITLE	DATE

19. **COMMAND APPROVAL**

COMMENTS

COMMANDER SIGNATURE	DATE

*U.S. GOVERNMENT PRINTING OFFICE: 1993-0-791-757

10. ACCIDENT DESCRIPTION ***(Continuation)***

13a. DIRECT CAUSE ***(Continuation)***

13b. INDIRECT CAUSES *(Continuation)*

14. ACTION(S) TAKEN, ANTICIPATED, OR RECOMMENDED TO ELIMINATE CAUSE(S) *(Continuation)*

Appendix D – UXO/MEC Anomaly Avoidance Plan

Final UXO/MEC Anomaly Avoidance Plan for 2010 Phase I Remedial Investigation Services Compliance Restoration Sites CC RVAAP-78 Quarry Pond Surface Dump & CC RVAAP-80 Group 2 Propellant Can Tops

Ravenna Army Ammunition Plant
Ravenna, Ohio

Contract No. W912QR-10-P-0052

Prepared for:

US Army Corps of Engineers

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

Prepared by:

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

4242 Medical Drive, Suite 7250
San Antonio, Texas 78229

September 30, 2010

TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS

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

1.0 – INTRODUCTION

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

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

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

2.0 – UXO TEAM QUALIFICATIONS & RESPONSIBILITIES

2.0 UXO TEAM

2.1.1 UXO Team Qualification

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

2.1.2 Responsibilities

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

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

2.1.3 Authority

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

3.0 – ON-SITE TRAINING

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

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

4.0 – MEC SAFETY

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

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

5.0 – PROJECT EQUIPMENT

5.1 PROJECT EQUIPMENT

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

5.1.1 Geophysical Sweep Equipment

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

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

- For a geophysical sweep of an area to be sampled, a Schonstedt Model GA-72-Cd magnetometer (or equivalent) will be utilized. This equipment will be used prior the performance of soil sampling, beginning at ground surface and just before penetration.

5.1.2 Geophysical Survey Equipment

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

6.0 – MEC AVOIDANCE ACTIVITIES

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

6.1 SITE ACCESS AND MEC CLEARANCE SURVEYING

In areas with potential MEC, the UXO Technician III (escort) will conduct a magnetometer-assisted surface clearance access survey and/or a subsurface survey for anomalies before any activities (e.g., site visits or field investigations) commence, including foot and vehicular traffic. The subsurface surveys (to a depth of 4 feet or more below ground surface (bgs)) need be conducted only when the use of motor vehicles is anticipated and at specific investigation sites. Anomalies found will be marked with red flags. No MEC items will be handled at any time during this project.

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

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

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

6.2 CLEARING AND GRUBBING

This section is not applicable to this project.

6.3 LAND SURVEYING

This section is not applicable to this project.

6.4 GEOPHYSICAL SURVEYING

This section is not applicable to this project.

6.5 SAMPLING AND DRILLING

6.5.1 Surface Soil Sampling

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

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

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

6.5.2 Subsurface Soil Sampling

The following paragraphs describe anomaly avoidance procedures for subsurface soil sampling in an area with potential MEC. Subsurface soil sampling is to be performed using hand auguring and is not expected to extend to depths of three feet.

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

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

Underground Utilities

This section is not applicable to this project.

Pilot Hole and Incremental Geophysical Survey for Conventional MEC Clearance

This Section is not applicable to this project.

Test Pits for Non-Conventional MEC Clearance

This section is not applicable to this project.

6.5.3 Soil Sampling with Hand Auger

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

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

Soil sampling and hand auguring/DPT installations will follow the same anomaly-avoidance procedures as described previously for subsurface soil sampling.

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

7.0 – REFERENCES

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

Department of Defense (DoD). 1995. Defense Demilitarization Manual. DoD 4160.21-M-1. February.

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

DDESB. 1998. Guidance of Clearance Plans. Memorandum. February.

DoD. 1997. Defense Materiel Disposition Manual. DoD 4160.21-M August

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

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

Explosive Ordnance Disposal Bulletin (EODB). 2002. General Information on EOD Disposal Procedures. TM 60A-1-1-31. January

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

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

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

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

Appendix E – Comment Response Table

Draft Site Safety & Health Plan for 2010 Phase I Remedial Investigation Services Compliance Restoration Sites
CC-RVAAP-78 & CC-RVAAP 80 at the Ravenna Army Ammunition Plant, Ravenna Ohio
Comment Response Table
9/16/2010

Comment No. #	Pg. No. # Line No. #	Comment	Recommendation	Response
O-1	Page 7-1 Table 7-1	Under airborne organics, two action level limits are specified (<5ppm and >5ppm). The action includes both Level D and Level B PPE. The table is unclear which action goes with which limit.	Under the Action column heading, change the action to read "Level D (< 5 ppm)" and "Level B (> 5 ppm)."	Due to the presence of suspected ACM material in the debris piles, no trenching will be conducted and thus the reference to "Soil sampling during trenching activities" will be removed in the "Tasks" column. Under "Action" column", revise as per the recommendation for < 5ppm and leave the "Action" for > 5 ppm as is.
O-2	Page 12-1 Lines 9-10	The text states that Mid-American Security will be contacted first for any emergency service.	Change the sentence to "RVAAP Post 1 will be contacted first for any emergency service."	Will revise as per the recommendation.
O-3	Page A-2 Table 1-1	Drowning is not listed as a possible hazard in this general checklist.	Due to the close proximity of Fuze and Booster Quarry Ponds, please include Drowning as a possible hazard	Will revise as per the recommendation.
O-4	Page A-3 Table 1-2	Drowning is not included as a possible safety and health hazard for any of the proposed site activities.	Please add drowning hazard to any of the site activities where workers will be in close proximity to water (i.e FBQ ponds).	A row will be added for drowning. The RAC will be L. Controls will be, "On site personnel will be alerted to the adjacent FBQ ponds and cautioned to stay at least 10-feet away from the ponds during sampling, drum removal, and transit to and from the site.

				Monitoring requirements will be "None".

Comment Resolution Table

Installation: Ravenna Army Ammunition Plant, Ravenna, Ohio
Document: Draft Site Safety and Health Plan for 2010 Phase I RI at CC-RVAAP-78 and CC-RVAAP-80
Reviewer(s): Katie Tait, Envmtl. Specialist, OHARNG, (614)336-6136 or katie.elgin@us.army.mil
Date: August 19, 2010

Cmt. No.	Page or Sheet	Comment	Recommendation	Response
1	Pg 2-2. Line 4	"Additional propellant can lids were identified at the northern end of Group 2 by the OHARNG. The reported northern area consists of approximately 43,418 square feet (approximately 1 acre)." This northern area (1 acre) was supposed to be deleted from the scope of work. There is no northern area that had propellant cans. This was conveyed to USACE and discussed and it was agreed that this area should be excluded. I checked on this internally and no one from the OHARNG identified propellant cans on a 1 acre northern area in Group 2. This area does not need to be investigated. May require some discussion.	No propellant cans were identified in a northern area in Group 2 and therefore this area should not be included in the investigation area.	Pg 2-1, Line 39; Will change to --- at the southern end of the former Group 2 ---. Pg 2-2, Line 4; Will delete sentences "Additional --- OHARNG." and "The reported northern --- 1 acre)." Pg 2-2, Line 4; After --- (12.4 acres), will add, "While propellant can lids are likely not present in the northern end, as the historical research conducted regarding the observed propellant cans in the southern end is conducted, any references to propellant can lids in the northern end will be documented and included in the Historical Records Review Report."
2	Pg 2-2, Line 27	"Sampling at the nearby Fuze and Booster Quarry AOC and the presence of transite in the debris pile…" Who specifically identified the transite in the debris pile? Was it a certified asbestos hazard evaluation specialist? If not, please just indicate that suspect asbestos-containing materials (ACM) were identified in the debris pile."	Suggested text revision: "Sampling at the nearby Fuze and Booster Quarry AOC and the presence of suspect asbestos-containing materials in the debris pile…"	Will revise as suggested.