FINAL
REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORK PLAN

VOLUME IV

PROJECT OPERATIONS PLAN

HEALTH & SAFETY PLAN

OLIN CHEMICAL SUPERFUND SITE
51 EAMES STREET
WILMINGTON, MASSACHUSETTS

Submitted to:

United States Environmental Protection Agency

Region I – New England
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August 14, 2009

SDMS DocID 458072

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LIST OF ACRONYMS AND ABBREVIATIONS

°F	degrees Fahrenheit
AIHA	American Industrial Hygiene Association
AOC	Administrative Order on Consent
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CIH	Certified Industrial Hygienist
CPR	Cardiopulmonary Resuscitation
CRZ	Contamination Reduction Zone
CSP	Certified Safety Professional
DAPL	Dense Aqueous Phase Liquid
dBA	decibel
DES&H	Division Environmental Safety & Health
EEE	Eastern Equine Encephalitis
EZ	Exclusion Zone
FOL	Field Operations Leader
FSP	Field Sampling Plan
GFCI	Ground Fault Circuit Interrupter
GSS	General Site Supervisor
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
IDW	Investigation Derived Waste
IRSWP	Interim Response Steps Work Plan
JHA	Job Hazard Analyses
kV	kilovolt
LEL	Lower Explosive Limit
LHSR	Local Health and Safety Representative
LNAPL	Light Non-Aqueous Phase Liquid
MACTEC	MACTEC Engineering and Consulting, Inc.
MassDEP	Massachusetts Department of Environmental Protection
MBTA	Massachusetts Bay Transportation Authority
MCP	Massachusetts Contingency Plan
$\mu g/m^3$	micrograms per cubic meter
mg/m^3	milligrams per cubic meter
MSDS	Material Safety Data Sheet

NDMA	N-Nitrosodimethylamine
NIOSH	National Institute for Occupational Safety and Health
NPL	National Priorities List
off-PWD	off-Property West Ditch
OSHA	Occupational Safety and Health Administration
OU	Operable Unit
PFDs	Personal Flotation Devices
PID	Photoionization Detector
PM	Project Manager
PPE	Personal Protective Equipment
ppm	parts per million
Property	Olin Property
QAPP	Quality Assurance Project Plan
RI/FS	Remedial Investigation/Feasibility Study
ROW	Right-of-Way
SCBA	Self-Contained Breathing Apparatus
SHSO	Site Health and Safety Officer
SHSS	Site Health and Safety Supervisor
Site	Olin Chemical Superfund Site
SMP	Site Management Plan
SOW	Statement of Work
SZ	Support Zone
TBD	To Be Determined
TLV	Threshold Limit Value
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound

HEALTH AND SAFETY PLAN UPDATES

RECORD OF CHANGES

REVISION	DATE	DESCRIPTION
Initial Issue	09/2003	Initial Issuance
1	04/07/2006	HASP Addendum 1 for groundwater, surface water, and sediment sampling in the Maple Meadowbrook Wetlands.
2	08/20/2008	HASP Update to incorporate procedures and mitigation measures to cover Remedial Investigation (RI) activities for the CERCLA RI/FS program.
3	07/22/2009	HASP Update to incorporate EPA comments.

1.0 GENERAL

1.1 SCOPE AND PURPOSE

MACTEC Engineering and Consulting, Inc. (MACTEC) has prepared this Health and Safety Plan (HASP) in accordance with Section 2.II.F.3 of the Final Statement of Work (SOW) Remedial Investigation and Feasibility Study (RI/FS) for the Olin Chemical Superfund Site (Site) prepared by the United States Environmental Protection Agency (USEPA) Region 1 in June 2007. This HASP conforms to applicable Occupational Safety and Health Administration (OSHA) regulations and guidance documents for a RI/FS. The Site is located at 51 Eames Street in Wilmington, Massachusetts, and is comprised of the Olin Property (Property), an approximately 50-acre parcel, and adjoining off-Property areas impacted by manufacturing and waste disposal activities at the Property. The northern part of the Property was formerly the location of a chemical manufacturing facility.

In September 2005, the USEPA identified the Site as a Proposed Site for the National Priorities List (NPL) using N-nitrosodimethylamine (NDMA) as the primary substance to evaluate and score the Site (USEPA, 2005), and included chloride, sodium, sulfate, and ammonia as the other principal contaminants. On April 19, 2006, the Site was listed on the NPL pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The primary exposure pathway evaluated by USEPA was groundwater. Environmental contamination has migrated to surface water at on-Property locations by groundwater pathways.

Prior to the NPL listing, numerous investigations and response activities have been carried out by Olin Corporation and supervised by Massachusetts Department of Environmental Protection (MassDEP) under the Massachusetts Contingency Plan (MCP). The Site has been a Priority site under the MCP since 1993, and a Tier I site since 1994. As a result of these numerous investigations, USEPA recognized that a significant amount of Site data and other information has been collected. Respondents, Olin Corporation, American Biltrite Inc., and Stepan Company have voluntarily entered into an Administrative Order on Consent (AOC), effective July 3, 2007, with the USEPA to conduct the RI/FS for the Site to close the data gaps identified during the development of the Draft Focused Remedial Investigation (Draft FRI) Report.

Due to the complex nature of the cross-media impacts at the Site, the USEPA subdivided the Site into three Operable Units (OUs) described as follows.

- Operable Unit 1: OU1 is defined as on-Property (approximately 50 acres) soil, surface water, and sediment including the former facility area, the established conservation area, the on-Property ditch system, the Calcium Sulfate Landfill, and the Slurry Wall/Containment Area.
- Operable Unit 2: OU2 is defined as off-Property surface water and sediment areas, including at a minimum, the off-Property East Ditch, and the off-Property West Ditch (off-PWD). This OU also includes surface water and sediment in portions of Maple Meadow Brook and Sawmill Brook.
- Operable Unit 3: OU3 is defined as all on- and off-Property groundwater areas including Maple Meadow Brook Aquifer, groundwater beneath the Olin Property, and groundwater located south and east of the Property.

A more detailed description of the Site and its OUs is provided in the SOW.

An Interim Response Steps Work Plan (IRSWP) was prepared consistent with the SOW to identify the scope of continuing activities previously approved by MassDEP under the MCP. The IRSWP addresses activities associated with the Slurry Wall/Containment Area, Plant B, and the off-PWD.

To support the IRSWP and RI activities, MACTEC will conduct the following activities:

- Slurry Wall/Cap area groundwater and surface water monitoring and quarterly inspections
- Plant B groundwater monitoring
- Assist Olin in conducting a groundwater pumping rate reduction test at Plant B; including possible contingency actions associated with light non-aqueous phase liquid (LNAPL) if necessary
- Assist Olin in the construction and performance of a Dense Aqueous Phase Liquid (DAPL) Extraction Pilot Test
- Surface Soil Sampling
- Subsurface Soil Sampling
- Surface Water Sampling
- Sediment Sampling
- Overburden and Bedrock Groundwater Well Installations
- Groundwater Sampling
- Stream Gauging

RI Activities Performed by Others at the Site

- Site Survey
- Induction Logging

The purpose, location, field methodologies, and laboratory testing currently planned for these activities is described in the Field Sampling Plan (FSP).

During the RI activities, MACTEC personnel will be assisted on specific tasks, by Geomega, another environmental consulting firm hired by Olin. MACTEC will subcontract the drilling company who will perform soil borings and groundwater monitoring well installations. Olin will subcontract the surveyor who will survey elevation and location of monitoring wells. MACTEC will provide personnel to coordinate and oversee activities of these subcontractors and for the expressed purpose of geologically logging borings, collecting soil samples for chemical analysis, and installing groundwater monitoring wells, in addition to other RI activities. The purpose, location, field methodologies, and laboratory testing currently planned for these activities are provided in the FSP and Quality Assurance Project Plan (QAPP). This HASP describes the potential hazards associated with the installation of borings and monitoring wells that will be performed by subcontractor personnel and overseen by MACTEC personnel, the appropriate safe procedures and protective measures and equipment that will be implemented in response to those hazards, and the decontamination procedures that must be followed to minimize the off-Site transport of contaminants.

This HASP describes the potential hazards associated with each of the above listed activities that MACTEC will perform, and those activities that will be performed by MACTEC subcontractors, and other Olin contractors. In general, these parties are referred to as Subcontractors or a referred to by company name in this document. Additionally, the HASP discusses appropriate safe procedures and protective measures and equipment that will be implemented in response to those hazards and the decontamination procedures that must be followed to minimize the off-Site transport of contaminants. While all personnel working on the Olin Site must read and understand the HASP, MACTEC is only responsible for the safety of its personnel, and subcontractors to MACTEC, other contractors employed by Olin, Olin staff, regulatory agencies and their subcontractors must comply with their individual corporate or regulatory agency Health and Safety Program requirements.

1.2 PROJECT PERSONNEL

To meet its health and safety objectives, MACTEC has developed a line of reporting and has tasked those individuals with health and safety responsibilities. This information is presented below.

1.2.1 MACTEC Project Manager

The project manager (PM) is responsible for overall project management responsibilities including:

- Ensuring that a Site-specific HASP is written and approved for the Site prior to any work being conducting at the Site.
- Ensuring that necessary resources, including:
  - appropriate personal protective equipment (PPE) are available; and
  - adequate time and budget are allotted for each task performed at the Site.
- Coordinating staff assignments to ensure that personnel assigned to the project meet medical and training requirements.
- Acquainting field personnel with the potential hazards and procedures to minimize the negative impact of those hazards.
- Ensuring that the means and materials necessary to resolve any health and safety issues that are identified or that develop on the project are available.
- Investigating and reporting to the MACTEC Local Health and Safety Representative (LHSR) each work-related illness or injury, near-miss, accident, and damage to physical property that occurs at the Site.
- Ensuring that the HASP is updated/modified, in consultation with the Site Health and Safety Supervisor (SHSS), as necessary to reflect current exposure and hazard conditions, to include new Site work tasks or when Site environmental conditions change.

1.2.2 MACTEC Site Health and Safety Officer

The Site Health and Safety Officer (SHSO) is responsible for:

- Assisting with the development or review of the Site-specific HASP as needed.
- Conducting periodic audits, as necessary, of the Site to ensure that procedures are being followed as stated in the HASP.

1.2.3 MACTEC Site Health and Safety Supervisor

The SHSS is responsible for:

- Implementing the policies and procedures outlined in this Site-specific HASP and the MACTEC Health and Safety Program.
- Ensuring that MACTEC and Subcontractor personnel have read and signed the master copy of this document.
- Conducting accident investigations, as necessary in accordance with the MACTEC Incident Reporting procedure as outlined in the MACTEC Health and Safety Program.
- Being familiar with local emergency services.
- Implementing Site control measures as described in this HASP to ensure public safety.
- Conducting a tailgate health and safety meeting before work startup and daily thereafter. Additional meetings may be required for specific job tasks or Site activities.
- Monitoring on-Site hazards and the physical condition of Site personnel.

- Monitoring work area conditions to confirm that noise levels and/or fugitive emissions (dust, VOC vapors) are not migrating outside of the work area in off-Property areas.
- Reviewing analytical and air monitoring data, as appropriate, with respect to potential exposures to Site workers and the public.
- Performing daily inspections of work site activities.
- Maintaining health and safety files, which will include tailgate meeting notes, inspection notes, or other health and safety documentation, as applicable.
- Immediately shutting down operations that pose a potential threat to Site personnel or the public.
- Conducting periodic audits to confirm that the HASP is being followed.
- Updating the HASP, in consultation with the PM and Division Environmental Safety & Health (DES&H) Manager.
- Escorting all USEPA, MassDEP, OSHA, or other governmental agency personnel visiting the Site in response to health and safety issues.

1.2.4 MACTEC General Site Supervisor

The MACTEC General Site Supervisor (GSS) is responsible for performing the responsibilities as vested by the PM, to carry out day-to-day Site operations, including interfacing with the SHSS and Subcontractor Site Supervisor. This individual is also referred to as the Field Operations Leader (FOL).

1.2.5 Subcontractor Site Supervisor

The Subcontractor Site Supervisor is responsible for:

- Performing the responsibilities as vested by the Subcontractor, to carry out day-to-day Site operations, including interfacing with the MACTEC GSS and SHSS.
- Ensuring that all Subcontractor personnel have the proper training, medical monitoring, PPE, etc. prior to beginning work on the Site.

1.2.6 MACTEC and Subcontractor Personnel (Field Team Members)

All MACTEC and Subcontractor personnel are responsible for:

- Following and obeying the safety procedures outlined in the HASP.
- Immediately reporting any injury, accident, near-miss, and damage to proper to the GSS.

All Subcontractor personnel are responsible for:

- Following and obeying the safety procedures outlined in their task-specific HASP and their own Company/Corporate Health and Safety Program. The Subcontractor's task-specific HASPs provide health and safety information unique to each work task that the Subcontractor will perform on Site.

1.2.7 Visitors

All Site visitors are responsible for:

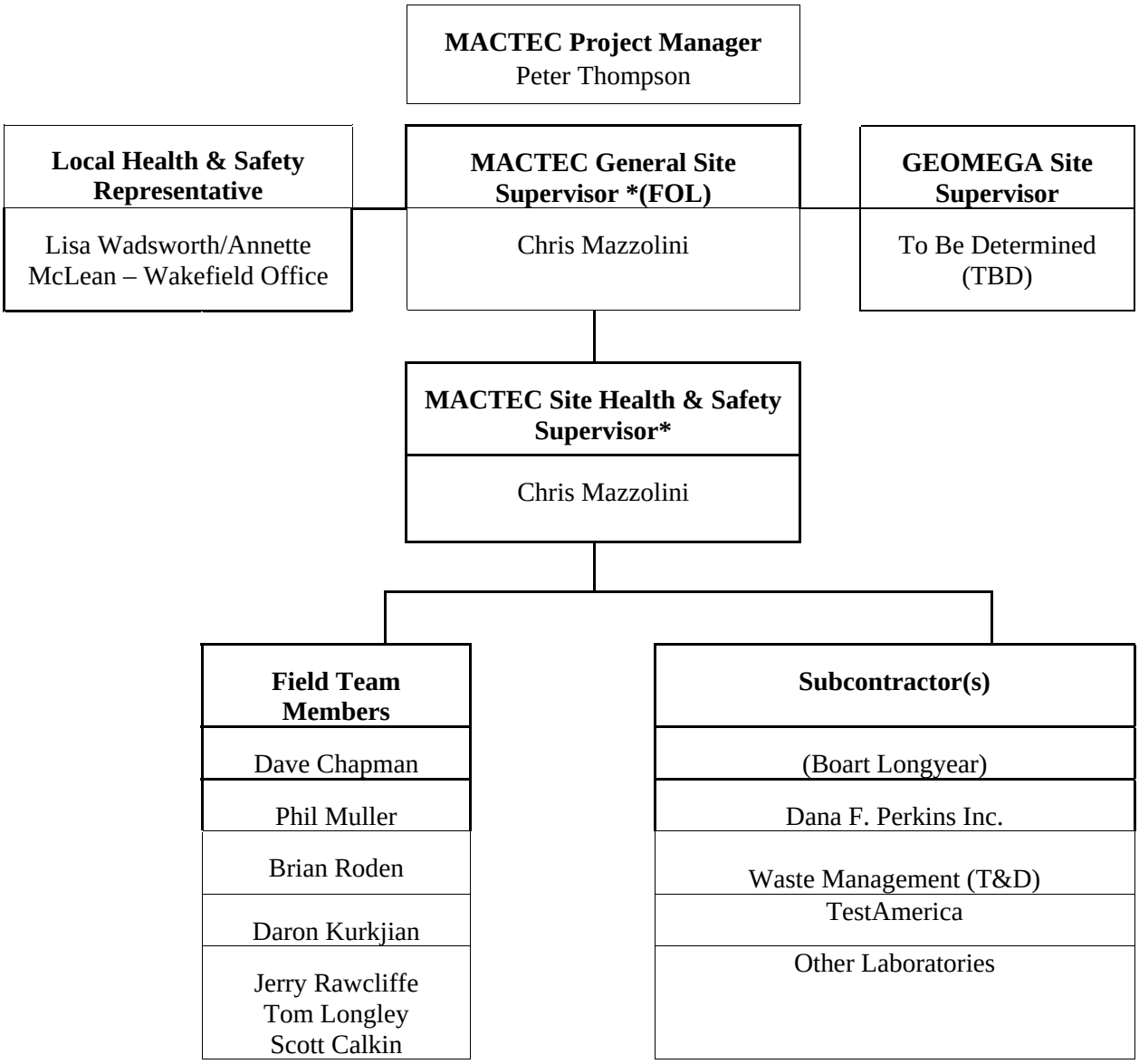
- Following the direction of the GSS and SHSS.
- Not entering any area or work zone without authorization by the SHSS.

1.2.8 Personnel Assigned to the Site (See attached personnel org chart)

The following is a list of other personnel who will be involved in this project and their responsibilities:

Name	Position Title/Responsibilities
Peter Thompson	PM of the project
Cindy Sundquist, CIH, CSP	MACTEC DES&H Manager, Certified Industrial Hygienist (CIH), Certified Safety Professional (CSP) for the project
Lisa Wadsworth/Annette McLean	LHSR for the Wakefield Office (Shared duties)
Chris Mazzolini	GSS/SHSS and Site Scientist/Engineer. The GSS is also referred to as the FOL. The GSS/SHSS is also the Safety Representative as defined in the Massachusetts Bay Transportation Authority (MBTA) Railroad Operations Directorate requirements.
See Organization Chart	MACTEC Field Team Members

HASP ORGANIZATION CHART



*No single MACTEC Field Team Member is assigned to this field project at all times; therefore, any MACTEC Field Team Member listed above who is qualified to be a GSS and SHSS in accordance with the MACTEC Hazardous Waste Operations and Emergency Response Program (ESH-2.9.A HAZWOPER) can be designated at the GSS and SHSS. When a MACTEC employee is working alone on Site that employee is the GSS and SHSS. If two or more employees are working on the Site at the same time, the employee who has been with MACTEC for the longest period is the GSS and SHSS unless otherwise stated in this HASP.

1.3 TRAINING

Training is defined under the MACTEC Health and Safety Program, and all personnel entering potentially contaminated areas of this Site (e.g., the exclusion zone [EZ] - the area defined by the temporary fence) must meet the requirements of 29 CFR 1910.120 (HAZWOPER Standard) as well as all other applicable OSHA standards. Personnel without the required training will not be permitted in any area with potential for exposure to toxic substances or harmful physical agents (e.g., electrical hazards, high noise areas, etc.). In addition, all personnel will be trained as appropriate:

- All MACTEC employees will complete MACTEC's Hazard Communication Program and Subcontractor employees will complete their respective Hazard Communication Program prior to working on Site.
- The GSS shall have appropriate training to be qualified to supervise workers assigned to him/her, including supervisor training defined under OSHA regulation 29 CFR 1910.120 (e)(4).
- The SHSS shall have supervisor training as defined under OSHA regulation 29 CFR 1910.120 (e)(4).
- At least one Field Team Member must be trained and certified in first aid and cardiopulmonary resuscitation (CPR). Medical help is more than four (4) minutes away from the Site, therefore, OSHA expects that at least one person who is trained in first aid be available at the work site at all times during work activities.
- Site personnel who are required to respond to medical emergencies (e.g., administering first aid to injured personnel) as a part of their job, must receive an appropriate level of bloodborne pathogen training in accordance with their respective company program.
- Equipment operators shall have appropriate training and licenses for the vehicles and equipment they operate.
- All Site workers who enter an area within 50 feet from the center line (also referred to as the Railroad Right-of-Way [ROW]) of an active railroad are required to be trained in accordance with MBTA Railroad Operations Directorate requirements.
- All Site workers must read this HASP and sign the HASP acknowledgement statement prior to performing work at the Site.
- Prior to commencement of Site activities, the GSS/SHSS shall conduct a pre-entry briefing, which shall cover all sections of this HASP.

NOTE: Workers not in attendance at the initial meeting must be given the pre-entry briefing by the GSS/SHSS prior to entering and working on Site.

- Site-specific safety meetings (also referred to as "tailgate meetings") must be held, at least, on a daily basis at the start of the Site work, and at other times as appropriate (e.g., changes in Site conditions, revision of the HASP, personnel changes, etc.). A Daily Safety Meeting Checklist (Appendix A) included as part of this HASP may be used to document this training. A brief description of topics covered shall be listed in the field logbook.

1.4 MEDICAL SURVEILLANCE

All MACTEC and Subcontractor personnel entering potentially contaminated areas of this Site will be medically qualified for Site assignment through a medical surveillance program outlined in the MACTEC Health and Safety Program and Subcontractor's Health and Safety Program, respectively. Personnel who have not received medical clearance **will not be permitted** in any area with potential for exposure to toxic substances or harmful physical agents (i.e., EZ).

- All Site personnel shall know the nearest location of a working land-line telephone for access to emergency services. In addition, as a backup, the GSS and the SHSS shall have access to cellular telephones for summing emergency services.
- For any bloodborne pathogen exposure incidents (e.g., where workers, while rendering first aid or CPR, are exposed to blood or other body fluids) the exposed individuals shall receive a medical evaluation and Hepatitis B vaccination in accordance with their company's Bloodborne Pathogen Program. The GSS, SHSS, SHSO, and LHSR shall be notified **immediately** of any exposure incidents. If the employee declines vaccination, the employee must sign a Declination Statement in accordance with the employee's company Bloodborne Pathogens Program.
- The OSHA 300 Logs for the Site workers covered by this HASP are located at:
  - MACTEC's OSHA 300 Log (including workers from the Wakefield, Massachusetts office) is maintained at 511 Congress Street, 2nd Floor, Portland, ME 04101.
  - The other Subcontractor's OSHA 300 Logs are maintained are at their respective corporate offices.

1.5 HAZARD COMMUNICATION

MACTEC and Subcontractor chemical use and chemical storage is anticipated to be minimal during the IRSWP and RI activities. The following table lists chemicals MACTEC and the Subcontractor anticipate bringing to the Site. Copies of material safety data sheets (MSDSs) for each of those chemicals are included in Appendix B. The Subcontractor is responsible for providing to MACTEC and maintaining copies of MSDSs for each of the chemicals they bring to the Site. New chemicals brought to the Site during activities at the Site will be added to the following Site Chemical Inventory form, and the MSDS for each of those new chemicals will be added to the MSDS section of this HASP. The Site Chemical Inventory and the MSDSs will be reviewed by all workers prior to starting work at the Site.

TABLE 1-1: SITE CHEMICAL INVENTORY

Chemical Name (Match to MSDS)	Estimated Quantity on Site at Any Given Time	Location on Site
Alconox	500 grams for equipment decontamination	MACTEC field vehicle
Bentonite	2000 pound pallet for well construction	Subcontractor field vehicle/rig
Hydrochloric Acid	50 milliliters contained in sample bottles for sample preservation	MACTEC sample bottles
Liquinox	0.5 liters for equipment decontamination	MACTEC field vehicle
Methanol	1 liter for equipment decontamination	MACTEC field vehicle
Nitric Acid	500 milliliters contained in sample bottles for sample preservation	MACTEC sample bottles
Portland cement	2000 pound pallett for well construction	Subcontractor vehicle/rig

A current MSDS must be present on Site for each chemical listed above. The containers must be labeled in accordance with the MACTEC and Subcontractor Hazard Communication Programs accordingly.

The MSDSs for bentonite and portland cement included in this HASP are generic and are provided for reference only. The Contractors/Subcontractors are responsible for providing the actual MSDS for the products they bring to the Site. Contractors/Subcontractors must maintain their own chemical inventory and provide copies of MSDSs for materials they bring to the Site.

2.0 SITE CHARACTERIZATION AND ANALYSIS

2.1 SITE NAME, LOCATION, AND SIZE

The Site is a former industrial Site located at 51 Eames Street, in Wilmington, Massachusetts. The Site includes the approximate 50 acre Property and adjacent off-Property areas that have been impacted by manufacturing and waste disposal activities at the Property.

2.2 SITE HISTORY

The Site was operated by as a chemical manufacturing facility from circa 1950's, and operations ceased in 1986. The facility was used to manufacture chemical blowing agents, stabilizers, antioxidants, and other specialty chemicals for the rubber and plastics industry. A vicinity map is presented in Appendix C. A detailed Site history of manufacturing operations is presented in Appendix A of the FSP.

2.3 SCOPE OF WORK (WORK PLAN)

The scope of work (as described in detail in the USEPA June 2007 SOW) includes the following anticipated tasks and equipment:

TASK	DESCRIPTION
Task 1: Observing the installation of soil borings; and the collection of soil cores to assess soil type. *Rotosonic Drilling Method* (OU1)	MACTEC personnel will observe Subcontractor personnel installing soil borings using a rotosonic drilling methods and collecting soil samples in polyethylene tubes. MACTEC personnel obtain soil samples directly from the tubes. Initial Level of Protection: Modified D.
Task 2: Observing installation of borings on the outside of existing buildings/structures to collect surface and subsurface soil samples. Drilling will advance through existing concrete foundations to reach the underlying soil. *Rotosonic Drilling Method* (OU1)	MACTEC personnel will observe the Subcontractor personnel installing soil borings using rotosonic drilling methods and collecting soil core samples in polyethylene tubes. MACTEC personnel obtain soil samples directly from the polyethylene tubes. Initial Level of Protection: Modified D.
Task 3: Collection of soil samples from flood plain area. *Hand Auger Method* (OU1/OU2)	MACTEC personnel will collect soil samples within the flood plain in OU1 and OU2 using stainless steel hand augers. The sample will be obtained directly from the hand auger. Initial Level of Protection: Modified D.

TASK	DESCRIPTION
Task 4: Collecting surface and subsurface soil samples from within existing structures. Coring will advance through existing concrete floors to reach the underlying soil prior to drilling in soil. *Direct Push Method* (OU1)	MACTEC personnel will observe the Subcontractor coring through the concrete floor of existing structures to access the soil beneath the building. The Subcontractor will then install borings to collect samples of the soil under buildings on the Property. The Subcontractor will use wet methods to core the concrete, then direct push drilling methods to install the borings and steel tubes to collect samples of surface and subsurface soil. MACTEC personnel will obtain soil samples directly from the sampling tubes. Initial Level of Protection: Modified D.
Task 5: Installation of monitoring wells and multilevel piezometers. (OU 3 and DAPL Extraction Pilot Test)	MACTEC personnel will observe the Subcontractor installing monitoring well, and multi-level piezometers using rotosonic drilling methods. Initial Level of Protection: Modified D.
Task 6: Measuring ground water levels in new and existing monitoring wells and multi-level and drive-point piezometers. (OU 3 and IRSWP)	MACTEC personnel will measure the synoptic water level within the new and existing monitoring wells and multi-level and drive-point piezometers using a water level meter. Initial Level of Protection: Modified D.
Task 7: Collecting groundwater samples from new and existing monitoring wells and multi-level and drive-point piezometers. (OU3 and IRSWP)	MACTEC personnel will collect groundwater samples from new and existing wells and piezometers using low-flow groundwater sampling methods. Initial Level of Protection: Modified D.
Task 8: Observing/Handling soil-filled and drilling fluid drums.	MACTEC personnel will observe Subcontractor personnel using mechanical lifting means to handle and move the soil-filled and drilling fluid drums. Initial Level of Protection: Modified D.
Task 9: Collecting surface water samples in Site wide areas excluding the Maple Meadow Brook Wetland Area. See note below this table.	MACTEC personnel will collect surface water samples from existing locations by direct dip method. Initial Level of Protection: Modified D.
Task 10: Collecting sediment samples in Site wide areas excluding the Maple Meadow Brook Wetland Area. See note below this table.	MACTEC personnel will collect sediment samples using hand held trowel or direct push core methods.
Task 11: Response actions associated with reduction in treatment system pumping flow rate. (Plant B and East Ditch)	MACTEC personnel will enter the East Ditch to inspect for the presence of LNAPL. If present, personnel will place absorbent materials in the ditch to prevent migration of LNAPL. Initial Level of Protection: Modified D.

NOTE: Because of the unique hazards associated with work in the Site wetlands and the various sampling locations within those wetlands, the operations and the potential hazard mitigation measures associated with all groundwater, surface water, and sediment sampling, and field operations conducted within the delineated wetland boundaries of the Maple Meadow Brook Aquifer (as defined in 310 CMR 10.000, 4.0000 and 310 CMR 40.0000) are covered in the MACTEC HASP Addendum, March 2006. **This Addendum, is included in Appendix D of this HASP.**

3.0 TASK ANALYSIS

3.1 SITE RISKS

The chemical and safety hazards listed below are those known or suspected to be present on-Site and which MACTEC and Subcontractor personnel could potentially be exposed. The chemical and safety hazards are summarized below and are discussed in detail later on in this section. Additional guidance on the mitigation and control of site and task hazards is provided in Job Hazard Analyses (JHAs) for MACTEC (Appendix E-1) and Subcontractor (Appendix E-2) personnel.

Task	Hazards
TASKS 1, 2, 4, 5, & 10	• Chemical • Heavy equipment and/or drilling & boring • Physical • Noise • Slips, trips, falls • Cold Stress • Water/drowning • Materials handling • Electrical hazards • Underground utilities • Lockout/tagout • Hand Tools • Biological
TASKS 3, 6, 7, 9 & 11	• Chemical • Physical • Slips, trips, falls • Cold Stress • Water/drowning • Materials handling • Electrical hazards • Lockout/tagout • Hand Tools • Biological • Railroad (Trains)
TASK 8	• Chemical • Physical • Slips, trips, falls • Cold Stress • Materials handling • Biological

3.2 CHEMICAL HAZARDS

The contaminants that may be present in environmental samples collected at the Site and that have potential adverse health effects are listed in Table 3-1.

TABLE 3-1: IDENTIFIED SITE CONTAMINANTS

Contaminant Name (Synonyms)	Appearance & Physical Form (Pure substance)	OSHA PEL/ NIOSH REL/ACGIH TLV	STEL	IDLH	Routes of Entry	Potential Health Effects (Acute & Chronic)	PID Ionization Potential
Acetone (Dimethyl ketone, ketone propane, 2-propanone)	Colorless liquid with fragrant mint-like odor	1000 ppm (PEL)	1000 ppm	2500 ppm	Inhalation Ingestion Contact	Irritation eyes, nose, throat; headache, dizziness, CNS depression; dermatitis	9.69
Alpha-BHC (alpha-Hexachlorocyclohexane or alpha-Benzenehexachloride)	Crystalline powder, with characteristic odor. This substance is a component of the insecticide hexachlorocyclohexane (mixed isomers). Insufficient data are available on the effect of this substance on human	NE	NE	NE	Inhalation Ingestion Contact	Cough, Sore throat. Diarrhea. Dizziness. Headache. Nausea. Vomiting. Tremors. May be absorbed. The substance may cause effects on the central nervous system.	UNK
Aluminum	Silvery-white, malleable, ductile, odorless metal	15 mg/m^3 (total) (PEL) 5 mg/m^3 (respirable) (PEL)	NE	NE	Inhalation Contact	Irritation eyes, skin, respiratory system.	NA
Arsenic - inorganic	Metal: silver-gray or tin-white, brittle, odorless solid	0.01 mg/m^3 (PEL)	NE	5 mg/m^3	Inhalation Ingestion Contact	Ulceration of nasal septum, dermatitis, GI disturbances, peripheral neuropathy, respiratory irritation, hyperpigmentation of skin, [carc].	NA
Arsenic - organic	Appearance varies depending on the specific organic arsenic compound	0.5 mg/m^3 (PEL)	NE	NE	Inhalation Ingestion Contact	In animals: irritation skin, possible dermatitis; respiratory distress; diarrhea; kidney damage; muscle tremor, convulsions; possible gastrointestinal tract, reproductive effects; possible liver damage.	varies
Asbestos	White or greenish (chrysotile), blue (crocidolite), or gray-green (amosite) fibrous, odorless solids.	0.1 fiber/cm^3 (PEL) 1 fiber/cm^3 (excursion)		ND Ca	Inhalation Ingestion Contact	Asbestosis (chronic exposure): affects the respiratory system, eyes and causes dyspnea (breathing difficulty), interstitial fibrosis, restricted pulmonary function, finger clubbing, irritation to the eyes; cancer.	NA
Barium - soluble compounds	Barium- Silver- slightly lustrous metal	0.5 mg/m^3 (PEL)	NE	50 mg/m^3	Inhalation Ingestion Contact	Irritation eyes, skin, upper respiratory system; skin burns; gastroenteritis; muscle spasm; slow pulse, extrasystoles; hypokalemia.	NA
Benzene (Benzol)	Colorless to light yellow liquid with aromatic odor	0.5 ppm (TLV)	2.5 ppm	500 ppm	Inhalation Absorption Ingestion Contact	Irritation eyes, skin, nose, respiratory system; dizziness; headache, nausea, staggered gait; anorexia, lassitude (weakness, exhaustion); dermatitis; bone marrow depression; [carc].	9.24
Benzoic acid	White powder.	NE	NE	NE	Inhalation Absorption Ingestion Contact	Cough, sore throat. (NIOSH information system). Abdominal pain, nausea. (NIOSH information system) Redness, burning sensation, pain. (NIOSH information system).	UNK
Benzyl alcohol	Water-white liquid, faint, aromatic odor.	NE	NE	NE	Inhalation Ingestion Contact	Cough. Dizziness. Headache. Abdominal pain. Diarrhea. Drowsiness. Nausea. Vomiting. Redness. (NIOSH)	UNK

TABLE 3-1: IDENTIFIED SITE CONTAMINANTS

Contaminant Name (Synonyms)	Appearance & Physical Form (Pure substance)	OSHA PEL/ NIOSH REL/ACGIH TLV	STEL	IDLH	Routes of Entry	Potential Health Effects (Acute & Chronic)	PID Ionization Potential
Beryllium	Metal: A hard, brittle, gray-white solid.	0.002 mg/m^3 (PEL)	0.005 mg/m^3 Ceiling 0.025 mg/m^3 (30 min)	4 mg/m^3	Inhalation Contact	Berylliosis (chronic exposure): anorexia, weight loss, lassitude (weakness, exhaustion), chest pain, cough, clubbing of fingers, cyanosis, pulmonary insufficiency; irritation eyes; dermatitis; [carc]	NA
Beta-BHC (beta-hexachlorocyclohexane)	Crystalline powder.	NE	NE	NE	Inhalation Ingestion Contact	Cough. Sore throat. Diarrhea. Dizziness. Headache. Nausea. Vomiting. Tremors. May be absorbed. The substance may cause effects on the central nervous system.	UNK
Bis(2-ethyl hexyl)phthalate (Di-sec octyl phthalate)	Colorless, oily liquid with a slight odor.	5 mg/m^3 (PEL)	NE	5000 mg/m^3	Inhalation Ingestion Contact	Irritation eyes, mucous membrane; in animals: liver damage; teratogenic effects; [carc]	UNK
Bromodichloromethane (dichlorobromomethane)	Colorless liquid.	NE	NE	NE			UNK
Bromoform (Tribromomethane)	Colorless to yellow liquid with chloroform-like odor	0.5 ppm (PEL)	NE	850 ppm	Inhalation Absorption Ingestion Contact	Irritation eyes, skin, respiratory system; CNS depression; liver, kidney damage	10.48
2-Butanone (methyl ethyl ketone, MEK, methyl acetone)	Colorless liquid with a moderately sharp, fragrant, mint- or acetone-like odor	200 ppm (PEL)	NE	3000 ppm	Inhalation Ingestion Contact	Irritation eyes, skin, nose; headache; dizziness; vomiting, dermatitis	9.54
Cadmium	Metal: silver-white, blue-tinged lustrous, odorless solid	0.005 mg/m^3 (PEL)	NE	9 mg/m^3	Inhalation Ingestion	Pulmonary edema, dyspnea (breathing difficulty), cough, chest tightness, substernal (occurring beneath the sternum) pain; headache; chills, muscle aches; nausea, vomiting, diarrhea; anosmia (loss of the sense of smell), emphysema, proteinuria, mild anemia; [carc]	NA
Carbon Disulfide	Colorless to faint-yellow liquid with a sweet ether-like odor. [Note: Reagent grades are foul smelling.]	20 ppm (PEL)	30 ppm Ceiling 100 ppm (30 min)	500 ppm	Inhalation Absorption Ingestion Contact	Dizziness, headache, poor sleep, lassitude (weakness, exhaustion), anxiety, anorexia, weight loss; psychosis; polyneuropathy; Parkinson-like syndrome; ocular changes; coronary heart disease; gastritis; kidney, liver injury; eye, skin burns; dermatitis; reproductive effects	10.08
Carbon Tetrachloride (Tetrachloromethane, Freon® 10, Halon® 114)	Colorless liquid with characteristic ether-like odor	10 ppm (PEL)	25 ppm Ceiling	200 ppm	Inhalation Absorption Ingestion Contact	Irritation eyes, skin; CNS depression; nausea, vomiting; liver, kidney injury; drowsiness, dizziness, incoordination; [carc]	11.47
Chlorobenzene (Benzyl chloride, MCB, phenyl chloride)	Colorless liquid with an almond-like odor	10 ppm (TLV)	NE	1000 ppm	Inhalation Ingestion Contact	Irritation eyes, skin, nose; drowsiness, incoordination, CNS depression; in animals: liver, lung, kidney injury	
Chloromethane (Methyl chloride)	Colorless gas with a faint, sweet odor which is not noticeable at dangerous concentrations. [Note: Shipped as a liquefied compressed gas.]	100 ppm (PEL)	200 ppm Ceiling	2000 ppm	Inhalation Contact (liq)	Dizziness, nausea, vomiting; visual disturbance, stagger, slurred speech, convulsions, coma; liver, kidney damage; liquid: frostbite; reproductive, teratogenic effects; [carc]	

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4-Chloro-3-methylphenol (4-Chloro-m-Cresol or p-Chloro-m-cresol)	White or slightly pink, hygroscopic crystals or crystalline powder.	NE	NE	NE	Inhalation Absorption Ingestion Contact	Cough. Sore throat. Redness. Pain. Headache. Dizziness. Shortness of breath. Abdominal pain. Vomiting. Diarrhea. Redness. Pain. Severe deep burns.	UNK
2-Chlorophenol (o – Chlorophenol)	Colorless liquid, with characteristic odor.	NE	NE	NE	Inhalation Absorption Ingestion Contact	Cough. Shortness of breath. Sore throat. Symptoms may be delayed. May be absorbed. Redness. Pain. Abdominal pain. Drowsiness. Weakness. Convulsions. Redness. Pain. Blurred vision. The substance strongly irritates the eyes, the skin and the respiratory tract. Inhalation of the aerosol may cause lung edema. The substance may cause effects on the CNS.	UNK
4-Chlorophenyl-phenyleither		NE	NE	NE		Strong eye and skin irritant. Systemic irritants by inhalation, ingestion, and skin contact.	UNK
Chromium Metal	Blue-white to Steel-gray, lustrous brittle, hard, odorless solid.	0.5 mg/m^3 (REL)	NE	250 mg/m^3	Inhalation Ingestion Contact	Irritation eyes, skin; lung fibrosis (histologic)	NA
Chromium, Hexavalent and Trivalent [Cr(VI) and Cr(III)]	Hexavalent chromium compounds rarely occur in nature and are typically associated with industrial sources. Chromium(VI) and chromium(III) are used for chrome plating, dyes and pigments, leather tanning, and wood preserving.	100 $\mu g/m^3$, measured as chromium (VI) and reported as chromic anhydride (CrO3). 5 $\mu g/m^3$ (new PEL for Chromium VI effective 11/27/06) 2.5 $\mu g/m^3$ (new action level for Chromium VI effective 11/27/06)			Inhalation Ingestion	Prolonged inhalation of hexavalent chromium by chromate production workers and people engaged in the manufacture of chromate pigments has been established as a cause of occupational lung cancer. (National Toxicology Program (NTP), NTP Factsheets - Year 2002)	NA
Cobalt - elemental and inorganic compounds	Odorless, silver-gray to black solid.	0.02 mg/m^3 (TLV)	NE	20 mg/m^3	Inhalation Ingestion Contact	Cough, dyspnea (breathing difficulty), wheezing, decreased pulmonary function; weight loss; dermatitis; diffuse nodular fibrosis; respiratory hypersensitivity, asthma	NA
Copper Dust	Reddish, lustrous, malleable, odorless solid	1 mg/m^3 (PEL)	NE	100 mg/m^3	Inhalation Ingestion Contact	Irritation eyes, respiratory system; cough, dyspnea (breathing difficulty), wheezing	NA

TABLE 3-1: IDENTIFIED SITE CONTAMINANTS

Contaminant Name (Synonyms)	Appearance & Physical Form (Pure substance)	OSHA PEL/ NIOSH REL/ACGIH TLV	STEL	IDLH	Routes of Entry	Potential Health Effects (Acute & Chronic)	PID Ionization Potential
Cresol (o-,m-,p- isomers)	o- white crystals with sweet tarry odor; p- crystalline solid with sweet tarry odor; m- colorless to yellowish liquid with sweet tarry odor	5 ppm (PEL)	NE	250 ppm	Inhalation Absorption Ingestion Contact	Irritation eyes, skin, mucous membrane; CNS effects: confusion, depression, respiratory failure; dyspnea (breathing difficulty), irregular rapid respiration, weak pulse; eye, skin burns; dermatitis; lung, liver, kidney, pancreatic damage	8.93-8.98
Cyanides	Varies with compound	5 mg/m^3 (PEL)	NE	25 mg/m^3	Inhalation Absorption Ingestion Contact	Poison; irritation eyes, skin, upper respiratory system; asphyxia; weak, headache, confusion; nausea, vomiting; increased rate respiration, slow, gasping respiration, thyroid, blood changes	NA
4,4'-DDD (1,1-Bis(4-chlorophenyl)-2,2-dichloroethane)	Crystalline solid DDT (dichlorodiphenyltrichloroethane) is a pesticide once widely used to control insects in agriculture and insects that carry diseases such as malaria. DDT is a white, crystalline solid with no odor or taste. Its use in the U.S. was banned in 1972 because of damage to wildlife, but is still used in some countries. DDD (dichlorodiphenyldichloroethane) is a chemical similar to DDT that contaminates commercial DDT preparations. DDD was also used to kill pests, but its use has also been banned. One form of DDD has been used medically to treat cancer of the adrenal gland.	NE	NE	NE		DDT affects the nervous system. People who accidentally swallowed large amounts of DDT became excitable and had tremors and seizures. These effects went away after the exposure stopped. No effects were seen in people who took small daily doses of DDT by capsule for 18 months. (ATSDR)	UNK
delta-BHC (delta-hexachlorocyclohexane)	See alpha-BHC.	NE	NE	NE	Inhalation Ingestion Contact		
Dibromochloromethane (chlorodibromomethane)	Colorless to pale yellow, heavy liquid.					Symptoms similar to chloroform and bromoform.	UNK
Di-n-butyl phthalate (Dibutylphthalate)	Colorless to faint-yellow, oily liquid with slight, aromatic odor	5 mg/m^3 (PEL)	NE	4000 mg/m^3	Inhalation Ingestion Contact	Irritation eyes, upper respiratory system, stomach	
1,3-Dichlorobenzene (m-Dichlorobenzene) See 1,4-Diclorobenzene)			NE	NE	Inhalation Ingestion Contact	Cough. Drowsiness. Nausea. Sore throat. Vomiting. Redness. Pain.	

NE

TABLE 3-1: IDENTIFIED SITE CONTAMINANTS

Contaminant Name (Synonyms)	Appearance & Physical Form (Pure substance)	OSHA PEL/ NIOSH REL/ACGIH TLV	STEL	IDLH	Routes of Entry	Potential Health Effects (Acute & Chronic)	PID Ionization Potential
1,4-Dichlorobenzene (p-Dichlorobenzene)	Colorless or white crystalline solid with a mothball-like odor. [insecticide]	75 ppm	NE	150 ppm	Inhalation Absorption Ingestion Contact	Eye irritation, swelling periorbital (situated around the eye); profuse rhinitis; headache, anorexia, nausea, vomiting; weight loss, jaundice, cirrhosis; in animals: liver, kidney injury; [carc]	8.98
1,1-Dichloroethane	Colorless, oily liquid with a chloroform-like odor	100 ppm (PEL)	NE	3000 ppm	Inhalation Ingestion Contact	Irritation skin; CNS depression; liver, kidney, lung damage	11.06
1,2-Dichloroethane (Ethylene dichloride)	Colorless liquid with a pleasant, chloroform-like odor. (Note: Decomposes slowly, becomes acidic & darkens in color).	50 ppm (PEL)	100 ppm Ceiling	50 ppm	Inhalation Absorption Ingestion Contact	Irritation eyes, corneal opacity; CNS depression; nausea, vomiting; dermatitis; liver, kidney, CVS damage; [carc]	11.05
1,2-Dichloroethene (1,2-Dichloroethylene)	Colorless liquid (usually a mixture of the cis & trans isomers) with a slightly acrid, chloroform-like odor	200 ppm (PEL)	NE	1000 ppm	Inhalation Ingestion Contact	Irritation eyes, respiratory system; CNS depression	9.65
2,4-Dichlorophenol	Colorless crystals, with characteristic odor.	NE	NE	NE	Inhalation Absorption Ingestion Contact	Burning sensation. Sore throat. Cough. Shortness of breath. May be absorbed. Redness. Pain. Blisters. Burning sensation. Abdominal pain. Tremor. Weakness. Convulsions. Labored breathing. Shock or collapse. Redness. Pain. Severe deep burns.	UNK
4,6-Dinitro-2-methylphenol	Liquid	NE	NE	NE	Inhalation Absorption Ingestion Contact	No data available.	UNK
Ethyl Benzene	Colorless liquid with an aromatic odor	100 ppm (PEL)	125 ppm	800 ppm	Inhalation Ingestion Contact	Irritation eyes, skin, mucous membrane; headache; dermatitis; narcosis, coma	8.76
Formaldehyde	Nearly colorless gas with a pungent, suffocating odor	0.75 ppm (PEL)	2 ppm	20 ppm	Inhalation Contact	Irritation eyes, nose, throat, respiratory system; lacrimation (discharge of tears); cough; wheezing; [carc]	10.88
Fuel Oil #2 (Diesel Fuel)	Brown liquid	NE	NE	NE	Inhalation Ingestion Contact	Mildly toxic by ingestion; fumes-eye irritation.	
gamma-BHC (Lindane, gamma-1,2,3,4,5,6-Hexachlorocyclohexane or gamma-HCH)	White to yellow, crystalline powder with a slight musty odor (pesticide).	0.5 mg/m^3 (PEL)	NE	50 mg/m^3	Inhalation Absorption Ingestion Contact	Irritation eyes, skin, nose, throat; headache; nausea; clonic convulsions; respiratory difficulty; cyanosis; aplastic anemia; muscle spasm; in animals: liver, kidney damage	UNK
Heptachlor and heptachlor epoxide	White to light tan crystals with a camphor-like odor (insecticide)	0.05 mg/m^3 (TLV)	NE	35 mg/m^3	Inhalation Absorption Ingestion Contact	In Animals: tremor, convulsions; liver damage; [carc]	UNK

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2-Hexanone	Colorless liquid with an acetone-like odor.	100 ppm (PEL)	NE	1600 ppm	Inhalation Absorption Ingestion Contact	Irritation eyes, nose; peripheral neuropathy: lassitude (weakness, exhaustion), paresthesia; dermatitis; headache, drowsiness	9.34
Iron oxide dust (as Fe)	Reddish-brown solid.	10 mg/m^3 (PEL)	NE	2500 mg/m^3 (as Fe)	Inhalation	Benign pneumoconiosis with x-ray shadows indistinguishable from fibrotic pneumoconiosis (siderosis)	NA
Isophorone	Colorless to white liquid with a peppermint-like odor	25 ppm (PEL)	NE	200 ppm	Inhalation Ingestion Contact	Irritation eyes, nose, throat; headache, nausea, dizziness, lassitude (weakness, exhaustion), malaise (vague feeling of discomfort), narcosis; dermatitis; in animals: kidney, liver damage	9.07
Lead - inorganic	Heavy, ductile, soft, gray solid	0.05 mg/m^3 (PEL)	NE	100 mg/m^3	Inhalation Ingestion Contact	Lassitude (weakness, exhaustion), insomnia; facial pallor; anorexia, weight loss, malnutrition; constipation, abdominal pain, colic; anemia; gingival lead line; tremor; paralysis wrist, ankles; encephalopathy; kidney disease; irritation eyes; hypertension	NA
Manganese - elemental and inorganic compounds	A lustrous, brittle, silvery solid	0.2 mg/m^3 (TLV)	5 mg/m^3 Ceiling	500 mg/m^3	Inhalation Ingestion	Manganism; asthenia, insomnia, mental confusion; metal fume fever dry throat, cough, chest tightness, dyspnea (breathing difficulty), rales, flu-like fever; low-back pain; vomiting; malaise (vague feeling of discomfort); lassitude (weakness, exhaustion); kidney damage	NA
Mercury	Metal: silver-white heavy, odorless liquid	0.025 mg/m^3 (TLV)	0.1 mg/m^3 Ceiling	10 mg/m^3	Inhalation Absorption Ingestion Contact	Irritation eyes, skin; cough, chest pain, dyspnea (breathing difficulty), bronchitis, pneumonitis; tremor, insomnia, irritability, indecision, headache, lassitude (weakness, exhaustion); stomatitis, salivation; GI disturbance, anorexia, weight loss; proteinuria	NA
Methylene Chloride (Dichloromethane)	Colorless liquid with a chloroform-like odor. [Note: A gas above 104°F.]	25 ppm (PEL)	125 ppm	2300 ppm	Inhalation Absorption Ingestion Contact	Irritation eyes, skin; lassitude (weakness, exhaustion), drowsiness, dizziness; numbness, tingle limbs; nausea; [carc]	11.32
Methyl Isobutyl Ketone (MIBK, 4-Methyl-2-Pentanone, Hexone)	Colorless liquid with a pleasant odor	100 ppm (PEL)	NE	500 ppm	Inhalation Ingestion Contact	Irritation eyes, skin, mucous membrane; headache, narcosis, coma; dermatitis; in animals: liver, kidney damage	9.30
Naphtha (Coal Tar)	Reddish-brown, mobile liquid with an aromatic odor	100 ppm (PEL)	NE	1000 ppm	Inhalation Ingestion Contact	Irritation eyes, skin, nose; dizziness, drowsiness; dermatitis; in animals: liver, kidney damage	
Naphthalene	Colorless to brown solid with an odor of mothballs	10 ppm (PEL)	NE	250 ppm	Inhalation Absorption Ingestion Contact	Irritation eyes; headache, confusion, excitement, malaise (vague feeling of discomfort); nausea, vomiting, abdominal pain; irritation bladder; profuse sweating; jaundice; hematuria (blood in the urine), renal shutdown; dermatitis, optical neuritis, corneal damage	8.12
Nickel	Metal: lustrous, silvery, odorless solid	1 mg/m^3 (PEL)	NE	10 mg/m^3	Inhalation Ingestion Contact	Sensitization dermatitis, allergic asthma, pneumonitis; [carc]	NA
4-Nitrophenol	Colorless to light yellow solid with no odor.	NE	NE	NE	Inhalation Ingestion Contact	Acute inhalation or ingestion of 4-nitrophenol in humans causes headaches, drowsiness, nausea, and cyanosis. Contact with the eyes causes irritation (USEPA).	UNK

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Contaminant Name (Synonyms)	Appearance & Physical Form (Pure substance)	OSHA PEL/ NIOSH REL/ACGIH TLV	STEL	IDLH	Routes of Entry	Potential Health Effects (Acute & Chronic)	PID Ionization Potential
N-nitrosodimethylamine (DMNA or NDMA)	Yellow, oily liquid with a faint, characteristic odor. NDMA may also form under natural conditions in air, water, and soil as a result of chemical, photochemical, and biological processes and has been detected in drinking-water and in automobile exhaust (World Health Organization)	No PEL established. Exposure controlled through the required use of engineering controls, work practices, and PPE, including respirators.	ND		Inhalation Absorption Ingestion Contact	Nausea, vomiting, diarrhea, abdominal cramps; headache; fever; enlarged liver, jaundice; decreased liver, kidney, pulmonary function; [carc]	8.69
N-nitrosodiphenylamine	Orange-brown or yellow solid. Produced since 1945, *n*-Nitrosodiphenylamine is used to make rubber products such as tires or to make other chemicals. In the early 1980s, most U.S. rubber manufacturers replaced it with more efficient chemicals. Today, only one manufacturer in the United States produces *n*-nitrosodiphenylamine.	NE	NE	NE	Inhalation Ingestion Contact	No information available.	UNK
Phenol	Colorless to light-pink crystalline solid with a sweet acrid odor	5 ppm (PEL)	NE	250 ppm	Inhalation Absorption Ingestion Contact	Irritation eyes, nose, throat; anorexia, weight loss; lassitude (weakness, exhaustion), muscle ache, pain; dark urine; cyanosis; liver, kidney damage; skin burns; dermatitis; ochronosis; tremor, convulsions, twitching	8.50
Phosphorous	White to yellow, soft, waxy solid with acrid fumes in air	0.1 mg/m^3 (PEL)	NE	5 mg/m^3	Inhalation Ingestion Contact	Irritation eyes, respiratory tract; eye, skin burns; abdominal pain, nausea, jaundice; anemia; cachexia; dental pain, salivation, jaw pain, swelling	UNK
Silicon (Elemental silicon does not occur free in nature, but is found in silicon dioxide [silica] and in various silicates)	Black to gray, lustrous, needle-like crystals. [Note: The amorphous form is a dark-brown powder.]	15 mg/m^3 (total) (PEL) 5 mg/m^3 (resp) (PEL)	NE	NE	Inhalation Ingestion Contact	Irritation eyes, skin, upper respiratory system; cough	NA
Silver	Metal: white, lustrous solid	0.01 mg/m^3 (PEL)	NE	10 mg/m^3	Inhalation Ingestion Contact	Blue-gray eyes, nasal septum, throat, skin; irritation, ulceration skin; GI disturbance	NA
Thallium - soluble compounds	Appearance and odor vary depending on the specific soluble thallium compound	0.1 mg/m^3 (PEL)	NE	15 mg/m^3	Inhalation Absorption Ingestion Contact	Nausea, diarrhea, abdominal pain, vomiting; ptosis, strabismus; peri neuritis, tremor; retrosternal (occurring behind the sternum) tightness, chest pain, pulmonary edema; convulsions, chorea, psychosis; liver, kidney damage; alopecia; paresthesia legs	varies

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Contaminant Name (Synonyms)	Appearance & Physical Form (Pure substance)	OSHA PEL/ NIOSH REL/ACGIH TLV	STEL	IDLH	Routes of Entry	Potential Health Effects (Acute & Chronic)	PID Ionization Potential
Toluene (Toluol, methyl benzene, phenyl methane)	Colorless liquid with a sweet, pungent, benzene-like odor	20 ppm (TLV)	300 ppm Ceiling	500 ppm	Inhalation Absorption Ingestion Contact	Irritation eyes, nose; lassitude (weakness, exhaustion), confusion, euphoria, dizziness, headache; dilated pupils, lacrimation (discharge of tears); anxiety, muscle fatigue, insomnia; paresthesia; dermatitis; liver, kidney damage	8.82
1,2,4-Trichlorobenzene	Colorless liquid or crystalline solid (below 63°F) with an aromatic odor.	NE		NE	Inhalation Absorption Ingestion Contact	Irritation eyes, skin, mucous membrane; in animals: liver, kidney damage; possible teratogenic effects	UNK
1,1,1-Trichloroethane (Methyl Chloroform)	Colorless liquid with a mild, chloroform-like odor	350 ppm (PEL)	NE	700 ppm	Inhalation Ingestion Contact	Irritation eyes, skin; headache, lassitude (weakness, exhaustion), CNS depression, poor equilibrium; dermatitis; cardiac arrhythmias; liver damage	11.00
Trichloroethene (Trichloroethylene, TCE)	Colorless liquid (unless dyed blue) with a chloroform-like odor	100 ppm (PEL)	200 ppm Ceiling	1000 ppm	Inhalation Absorption Ingestion Contact	Irritation eyes, skin; headache, visual disturbance, lassitude (weakness, exhaustion), dizziness, tremor, drowsiness, nausea, vomiting; dermatitis; cardiac arrhythmias, paresthesia; liver injury; [carc]	9.45
Trichloromethane (Chloroform)	Colorless liquid with a pleasant odor	50 ppm (PEL)	NE	500 ppm	Inhalation Absorption Ingestion Contact	Irritation eyes, skin; dizziness, mental dullness, nausea, confusion; headache, lassitude (weakness, exhaustion); anesthesia; enlarged liver; [carc]	11.42
2,4,6-Trichlorophenol	Yellow to pinkish orange flakes or colorless crystals or yellow solid; strong phenolic odor. Used primarily in various pesticide formulations and as a wood preservative.					This compound is "reasonably anticipated to be a human carcinogen" (Tenth Report on Carcinogens).	UNK
2,4,4-Trimethyl-1-pentene and 2,4,4-trimethyl-2-pentene	A clear liquid				Inhalation Contact	Confusion. Cough. Dizziness. Drowsiness. Dullness. Headache. Sore throat. Red skin. (International Occupational Health and Safety Information Center) An irritant. Irritating and narcotic in high concentrations.	UNK

Note:
°F = degrees Fahrenheit
$\mu g/m^3$ = micrograms per cubic meter
[carc] = Potential occupational Carcinogen
ACGIH = American Conference of Governmental Industrial Hygienists
CNS = Central Nervous System
CVS = Cardiovascular System
GI = Gastrointestinal
IDLH = Immediately Dangerous to Life or Health
mg/m^3 = milligrams per cubic meter
NA = Not Applicable
ND = Not Determined
NE - Not Established
NIOSH = National Institute for Occupational Safety and Health
OSHA = Occupational Safety and Health Administration
PEL = Permissible Exposure Limit (OSHA)
PID = Photoionization detector
ppm = parts per million
REL = Recommended Exposure Limit (NIOSH)
STEL = Short Term Exposure Limit (STEL)
TLV = Threshold Limit Value (ACGIH)
UNK = Unknown

Abbreviations in table taken from the NIOSH Pocket Guide to Chemical Hazards

3.2.1 Other Contaminants Related to Activities Conducted at the Site

During drilling indoors, the potential for accumulation of carbon monoxide and other hazardous components of diesel or gasoline exhaust from the drill rig exists. Therefore the following procedures will be implemented by the GSS and the Subcontractor:

- All exhaust gases from drill rig operations will be piped to the outdoors to an area well away from any points that have the potential to re-entrain the exhaust gases into the building.
- Oxygen, lower explosive limit (LEL), and carbon monoxide monitoring will be conducted by the Subcontractor and by MACTEC during all indoor drilling operations to ensure acceptable oxygen levels and to prevent the accumulation of hazardous gases in the work area from the drill rig.

3.3 SAFETY HAZARDS

MACTEC personnel may also encounter the following safety hazards while working at the Site:

- Heavy equipment
- Drilling/boring
- Physical
- Noise
- Slips, trips, falls
- Heat Stress
- Cold Stress
- Materials handling
- Electrical hazards
- Underground utilities
- Lockout/tagout (control of hazardous energy)
- Hand tools
- Biological
- Railroad (Trains)

As indicated, additional guidance describing the hazard mitigation and controls for the Site hazards and tasks is provided in Appendices E-1 (MACTEC) and E-2 (Contractor).

3.3.1 Heavy Equipment

The subcontractor is responsible for containerizing drill water, soil, and concrete cuttings from the bore hole. MACTEC will verify that the Subcontractor uses appropriate mechanical means to move the filled drums.

For the Site activities described in this HASP, MACTEC employees will not be required to operate heavy equipment. However, Subcontractor personnel will be operating various types of drill rigs (see Drilling/boring hazards in Section 3.3.2). When working on or around heavy equipment, a potential exists for physical injury resulting from contact with the equipment. All workers must be made aware of the presence of these hazards and take steps to avoid them. While working on or around heavy equipment, the following safety precautions will be followed:

- A *warning device or signal person* must be provided to protect employees from moving heavy equipment. Hand signals will be communicated to all Site personnel during the initial Site safety briefing and during the daily tailgate meetings. *For signal person:* Where hand signals are used, only one person shall be the designated signal person, and shall be located to see the load and be clearly visible to the operator. The SHSS shall ascertain from the Subcontractor which method(s) of warning they will use on Site and communicate that method to all Site workers.
- Workers who operate heavy equipment must be well trained, and licensed if appropriate, in the use of their particular equipment.
- Personnel are not permitted underneath loads handled by lifting or digging equipment. Personnel shall also stay clear of any vehicle being loaded or unloaded, and stand clear of loads being lifted.
- The Subcontractor shall shut down equipment prior to refueling.
- Neither loose fitting clothing nor long hair that is not adequately secured to prevent entanglement in moving parts are allowed when working in the vicinity of heavy equipment.

3.3.2 Drilling/Boring Hazards

Subcontractor personnel will be operating two types of drill rigs including rotosonic, and direct push to install borings and collect soil cores/samples. MACTEC personnel will not operate or assist with the operation of any drill rig equipment.

Drill rigs may cause hazards such as noise exposure, falling objects and uncontrolled movement of casings/rods from rigging/hoisting problems, lifting of heavy objects, contact with sharp surfaces (e.g., metal burrs), flying debris (dust, chips, water, soil, etc.), hazardous energies (hydraulic, electric, etc.), and slip/trip/fall hazards.

The following precautions will be followed during operation of the drill rig:

- Noise exposures are covered under Section 3.3.4.

- The Subcontractor Site Supervisor will conduct a "drill-site safety briefing" prior to all Site work for all Site personnel expected to work on or near the drill rig. The briefing will include identification of the danger zones around the drill rig, and the safe distance from the rig that all workers will observe, especially during rod hoisting and rod makeup/breakout, core retrieval, etc.
- All drilling personnel will have appropriate training on the safe operation of the drill rig they are operating.
- When approaching heavy equipment including drill rigs, approach should be made from a direction ensuring direct eye contact is made with operator.
- Personnel must not walk under suspended loads.
- Subcontractor Site Supervisor shall ensure that proper maintenance is performed on all drill equipment prior to and during work activities, and as necssary.
- An inspection of the drill rig and associated equipment (including safe guards, casing/rod handling system, etc.) shall be conducted by the Subcontractor drill rig operator prior to each day's work activities to ensure that all equipment is in good working order.
- All unnecessary vehicles shall be parked away from the drill rig a distance equal to the height of the drill rig mast.
- Seat belts shall be worn by operators and passengers when driving the drill rig across the Site and over the road.
- Appropriate PPE shall be worn in accordance with this HASP.
- Subcontractor personnel will follow appropriate lockout/tagout procedures when maintenance or servicing is performed on a drill rig. Refer to Subcontractor lockout/tagout program and equipment-specific procedure for additional details.
- The Subcontractor Site Supervisor shall ensure that:
  - A safety harness with a safety line (meeting the requirement of 29 CFR 1926.502) are provided to personnel that are required to climb or work on the drill rig derrick/mast. The Subcontractor Site Supervisor shall ensure that all workers who are required to use fall protection will be provided training including correct procedures for assembling, disassembling, maintaining, and inspecting the safety harness/line system prior to using this equipment.
  - The safety harness and associated equipment are inspected and verified to be in proper operating condition prior to each use.
  - Each drill rig is equipped with an appropriate fire extinguisher, a first aid kit, and other appropriate safety equipment as required.

3.3.3 Physical Hazards

All MACTEC and Subcontractor personnel shall:

- Keep ground clutter in the work area to a minimum to minimize the potential for tripping.
- Use caution when the ground surface is icy (use sand).
- Use proper lifting and reaching techniques.

3.3.4 Noise

Work conducted around heavy equipment may result in exposure to high noise levels. Drill rigs and direct push rigs produce high noise levels while drilling. Hearing protection with the appropriate attenuation factor will be worn by all workers in the area when noise levels meet or exceed 85 decibels measured on the A-weighted scale (dB(A)). The GSS shall strictly enforce the use of appropriate hearing protection for all personnel in the work area.

3.3.5 Slips, Trips, and Falls

Site personnel may be exposed to slip, trip, and fall hazards due to uneven terrain, presence of debris and stockpiled materials, drilling equipment, slippery or icy surfaces, etc. Workers will take proper care when walking on uneven surfaces. Proper footwear, which will include over-the-ankle leather or equivalent safety boots which have adequate traction, will be worn by all personnel when working on Site. Site personnel will adhere to the following additional safety measures while working at the Site:

- Workers will ensure that the Site is maintained in a neat orderly manner to minimize tripping hazards.
- Workers must be aware of the location of contractor materials and will avoid walking on, climbing, or crossing over these materials.
- Workers must be aware of holes, pits, or other depressions in the ground surface in the work area. Large depressions that can cause falls will be identified and marked using appropriate caution tape.
- Workers operating the drill rig will make sure that the driller's platform is free of obstructions, slip hazards, and is maintained in accordance with manufacturer's recommendations or company maintenance policy.
- The GSS will ensure that appropriate containers are provided and used for the collection and separation of waste materials. Waste materials shall be removed at regular intervals.

3.3.6 Heat Stress

Due to the increase in ambient air temperatures and the effects of protective outer wear decreasing body ventilation, there is increased potential for injury, specifically heat casualties during the summer months. Site personnel will be instructed in accordance with the Site safety procedures and first-aid treatment practices in the identification of a heat-related emergency, the first-aid treatment procedures for the victim, and the prevention of heat stress casualties. All personnel will follow the safe practices outlines in the SFJHA Field Work – General for heat-related emergencies contained in Appendix E.

3.3.7 Cold Stress

Cold stress is a potential at the Site due to the cold weather anticipated during Site operations. Fatal exposures almost always resulted from accidental exposures, immersion in low temperature water, or

failure to escape from low air temperatures. The following procedures will be followed to protect workers from cold-related injuries.

- In cold extremes, if feet or other body parts become wet they must be dried as soon as possible.
- After going through the decontamination procedures, employees should proceed directly to a protected area.
- At temperatures of 32˚F or below, the effects of wind speed become pronounced. A tarp or other barrier should be used to reduce the effects of wind speed if possible, provided the addition of such a structure does not cause other potential hazards in the work area. A protected area will be provided for workers for rest breaks if needed.
- Protective clothing shall be used, especially on the head, neck, and hands, to the extent possible to reduce chances of hypothermia and frostbite.
- Avoid skin contact with metal objects. Tools and equipment with nonmetallic handles should be used when possible.
- The GSS will discuss the signs and symptoms of cold weather injuries with workers and document the training. Refer to the MACTEC standard operating procedure for more information on prevention of cold related injuries.

NOTE: The GSS or SHSS is current in first aid. This training includes prevention of cold related injuries.

3.3.8 Water/Drowning

All personnel accessing areas that have the potential to cause a drowning hazard (i.e., working near or within water that is 2 or more feet deep, or where conditions such as the current, water temperature, wave action, presence of water falls, etc., increases hazards associated with water that is shallower in depth, must wear personal flotation devices (PFDs).

3.3.9 Materials Handling and Investigation Derived Wastes

Site personnel will be potentially exposed to materials handling related injuries due to the handling of heavy items (including drill rig materials, drums, etc.). The following safety precautions will be followed while handing materials at the Site:

- Workers shall not attempt to manually move full drums containing drill water/soil. Mechanical means will be used to move all filled drums. Depending on weight, surface conditions and other factors, it may be appropriate to move partially filled drums manually, over short distances, if such activity does not pose risk of injury.
- Workers will stand clear of the heavy equipment while the operator is handling a load (e.g., drum).
- Workers are prohibited from riding, being lifted, or being carried by the heavy equipment (including drum hoist equipment, fork lifts, etc.).
- The GSS will ensure that all Investigation Derived Waste (IDW) is secure and appropriately labeled and managed in accordance with the SMP. For off-Site areas, all IDW will be transported to the stagging area at the end of each work day.

- Olin will be responsible for the characterizing and the hiring of a licensed disposal company to remove all drums of collected IDW, including drill water and soil cuttings, from the Site. This IDW will be appropriately labeled, chemically characterized, and managed in accordance with the SMP.

3.3.10 Electrical Hazards

MACTEC does not anticipate exposure to overhead power lines during Site activities; however, potential electrical exposures exists due exposure to any electrical sources brought to the Site (e.g., generator). The following safety precautions will be followed:

- For voltages 50 kilovolts (kV) or less, maintain at least 10 feet of clearance from overhead power lines. For voltages exceeding 50 kV, the clearance shall be increased by 4 inches for every 10 kV over 50 kV. **Rule of thumb:** 10 feet if the lines are known to be 50 kV or less. Maintain a clearance of 35 feet for everything else. Contact the electric utility concerning blanketing of overhead power lines if these distances cannot be obtained.
- Electrical equipment, including pumps, sampling equipment, and power tools will be inspected prior to use to ensure that they are in good repair and have no frayed or loose connections.
- All electrical equipment used on-Site will be properly grounded or bonded.
- Ground Fault Circuit Interrupters (GFCI) will be used for personnel protection on all 120-volt, single phase, 15- and 20-ampere receptacle outlets on construction sites. Receptacles on a two-wire, single-phase portable or vehicle-mounted generator rated not more than 5 kW, where the circuit conductors of the generator are insulated from the generator frame and all other grounded surfaces, need not be protected with GFCIs.
- If electrical equipment must be connected by splicing wires, use properly insulated connectors and wrap with electrical tape. Splicing will only be done by qualified personnel.
- Do not perform work on electrical hook-ups and/or equipment when they are located in standing water or any wet location. When water is present, either drain/dry the area or move the equipment to a dry location.
- Only properly trained personnel should make electrical connections. If necessary, a master or licensed electrician should be subcontracted.

3.3.11 Underground Utility Hazards

Underground utilities may be present in the work area. MACTEC will contact Dig Safe and local utility companies to locate and mark all underground utilities in the work area prior to any intrusive Site work.

NOTE: In the Commonwealth of Massachusetts, notification is required at least 72 hours prior to any intrusive work.

In addition, the PM will ascertain from Olin the locations of on-Site utilities and obtain available Site utility drawings for all areas where intrusive work (e.g. drilling) will be conducted. The Subcontractor should hand dig or use other appropriate techniques, if questions remain on the locations of utilities.

The GSS will document all utility locates on a Site plan or other map of the Site for future reference. The GSS will ensure that the designated utility markings are maintained throughout the entire Site work covered under this HASP.

3.3.12 Lockout/Tagout

MACTEC does not anticipate any activity requiring the use of lockout/tagout for the tasks described in this HASP. However, the Subcontractor may have equipment (such as the drill rig) that may require maintenance or repair. The GSS shall ascertain (from the Subcontractor) the procedures for lockout/tagout, and communicate those procedures to all Site personnel. MACTEC personnel need to be aware of the Subcontractor procedures and follow all precautions.

MACTEC personnel shall not operate, render an opinion about, or attempt to maintain or repair any of the Subcontractor's equipment.

3.3.13 Hand Tools

All hand tools, including electric and pneumatic power tools, will be inspected (by the user) for condition prior to use. All hand tools will be used as they are designed to be used. No worker will modify the original design/purpose of the hand tool.

3.3.14 Biological Hazards

Poisonous Plants

Poison ivy, which typically grows as a shrub or vine and has leaves that grow in sets of three leaflets, may be present in some areas of the Site. The leaves stay green in the summer and red in the fall. In the late summer and fall, white berries may grow from the stems. Another poisonous plant, Poison Sumac, may be present in areas of the Site. This plant can grow up to 15 feet tall. The characteristic leaf of this plant has clusters of seven to 13 smooth-edged leaflets, which are orange in spring, green in summer and red, and orange or yellow in fall. The plant may also have clumps of pale yellow or cream-colored berries present.

All Site workers must receive training on identifying the specific poisonous plants that could be present at the Site. If work will be done in an area with poisonous plants present, workers should apply IvyX® (or similar product) to hands, forearms and other potentially exposed parts of the body, prior to starting work in the morning and again right after lunch. Since gloves will be worn during field activities, contact will be minimized. Wear long sleeved shirts and long pants that will provide a physical barrier between the skin and any urushiol oil encountered. Removing gloves must be done without touching the exterior

surface, when taking notes and prior to lunch or restroom breaks. Gloves that become worn must be replaced immediately. Do not scratch or rub the face or other exposed skin while wearing gloves. Workers should also apply Tecnu® (or similar product) to the hands and forearms immediately after removing their gloves, prior to lunch and again at the end of the day. Tecnu® will help cleanse the urushiol oil from the skin before it can be absorbed. Sensitive individuals can also apply prior to showering in the evening. Assume boots are contaminated with urushiol oil and handle them with gloved hands. Do not handle any field equipment that may have come in contact with poison ivy/oak/sumac without gloves. Decontaminate all equipment at the end of each workday with a solution of water and dish soap, and scrub all surfaces of the screens and shovels with a brush. Rinse with cool water using a portable garden sprayer. Wash clothing potentially contaminated with urushiol oil prior to wearing again and handle all contaminated clothing with gloves as the oil can remain on environmental surfaces for up to 5 years.

Insects

Ticks, mosquitoes, bees, wasps, etc., may be present at the Site. Ticks may carry Lyme Disease. Mosquitoes may carry viral diseases including Eastern Equine Encephalitis (EEE) and West Nile Virus. Bees and wasps may also be present at the Site and have the potential to cause an allergic reaction in some individuals.

Wear light colored clothing that fits tightly at the wrists, ankles, and waist, with each outer garment overlapping the one above it. Tuck shirts into pants. For areas where ticks are prevelant, a supply of Gaiters will be made available for Site personnel. Gaiters should be worn over the lower leg and extend over the boot to prevent ticks from getting into the pant legs an onto the body. Workers should spray clothing with insect repellant as a barrier; however, this may not be authorized by the PM if sampling for volatile organic compounds (VOCs) is being conducted. Search the body on a regular basis, especially hair and clothing; ticks generally do not attach for the first couple of hours.

If a tick becomes attached, pull it by grasping it as close as possible to the point of attachment and pull straight out with gentle pressure. Wash skin with soap and water then cleanse with rubbing alcohol. Place the tick in an empty container for later identification, if the victim should have a reaction. Record dates of exposure and removal. Do not try to remove the tick by burning it or covering it with chemical agents. If you can not remove the tick, or the head detaches, seek prompt medical help. Watch for warning signs of illness: a large red spot on the bite area; fever, chills, headache, joint and muscle ache, significant fatigue, and facial paralysis are reactions that may appear within two weeks of the attack. Workers must report all tick bites to their Supervisor and LHSR.

Be alert to bee/wasp hives in brush or in hollow logs. Watch for insects traveling in and out of one location. If you or anyone you are working with is known to have allergic reactions to bee stings, tell the rest of the crew and your Supervisor. Make sure you carry emergency medication with you at all times. Bright colors and metal objects may attract bees. If a worker is stung, apply a cold compress. If a stinger is left behind, scrape it off the skin. Do not use a tweezers as this squeezes the venom sack, worsening the injury. If a victim develops hives, asthmatic breathing, tissue swelling, or a drop in blood pressure, seek medical help immediately.

3.3.15 Railroads (Trains)

An active railroad line, the MBTA exists on the east side of the Site which has the potential to carry fast moving trains that can cause serious injuries or death. All Site workers who must enter an area within 50 feet from the center line (also referred to as the Railroad ROW) of an active railroad are required to be trained in accordance with MBTA Railroad Operations Directorate requirements, and implement safety procedures prior to entering a railroad ROW. A license agreement must be established to access the MBTA ROW.

This HASP will be updated by addition of an addendum to reflect any procedures that are required to be implemented prior to work in the vicinity of a Railroad ROW.

3.4 PROTECTIVE MEASURES

The following additional protective measures will be followed while working at the Site.

3.5 ENGINEERING CONTROLS

MACTEC anticipates using water spray methods during intrusive activities to reduce the potential for airborne dust. However, whenever the Subcontractor is drilling into and through concrete, wet methods of drilling must be implemented to prevent airborne dust. In the event that soil conditions have the potential to cause airborne dust, the GSS will notify the MACTEC PM and DES&H and determine if dust monitoring is necessary. This HASP will be updated/amended and changes/additions communicated to all Site personnel by the GSS.

WARNING: **This HASP does not cover activities related to the demolition, alteration, or moving of foundations, structures, or structure supports at the Site. These types of intrusive activities have the potential to impact lead-painted or asbestos-containing surfaces or substrates which can cause these hazardous substances to be released into the air.**

The floor tiles and the underlying mastic (glue) present in the office/lab contain asbestos. Asbestos is a generic name given to a fibrous variety of six naturally occurring minerals that have been used for many years in thousands of commercial products. The term "asbestos" is not a mineralogical definition but a commercial name given to a group of minerals that possess high tensile strength, flexibility, resistance to chemical and thermal degradation, and electrical resistance (NIOSH). These minerals have been used in many products, including insulation and fireproofing materials, automotive brakes and textile products, cement and wallboard materials, and mastic (glue) and flooring materials. Additional information about asbestos and asbestos containing materials (ACM) is included in Attachment A.

In Massachusetts, The Division of Occupational Safety (DOS) Asbestos Program is responsible for the regulation of occupational asbestos exposure, and requires that companies and individuals be licensed and certified to conduct asbestos abatement. Therefore, for this project, the tiles and mastic located in office/lab areas where coring/drilling will take place will be removed by a Massachusetts licensed asbestos contactor that holds appropriate certification and whose employees have received appropriate training. These requirements are described in the following regulations:

- 453 CMR 6.0 (Massachusetts Department of Labor and Workforce Development, Division of Occupational Safety)

Additional training and hazard mitigation requirements that may apply are included in the following regulations:

- 29 CFR 1926.1101 (Asbestos – Construction)
- 310 CMR 7.00 (Massachusetts Department of Environmental Protection)

3.5.1 Levels of Protection

Work will be conducted in **Modified Level D**.

Modified Level D protection should be used when the potential for contact with contaminated water/soil, atmospheric contaminants, liquid splashes, or other direct contact is likely and will not adversely affect or be absorbed through any exposed skin. Modified Level D has the same dermal contact protection as Level C; however, respiratory protection is not required. MACTEC does not anticipate having to upgrade from Modified Level D protection based on historic Site data; however, MACTEC has included Level C and Level B provisions in the event that upgrade is necessary. ***Upgrade to Level B can only be done with prior approval from the DES&H Manager***.

LEVEL B: ***MACTEC DIRECTOR OF SAFETY MUST BE NOTIFIED PRIOR TO USE OF LEVEL B.***

- Positive pressure, full face-piece self-contained breathing apparatus (SCBA), or positive pressure supplied air respirator with escape SCBA.
- Hooded, full-body chemical-resistant clothing such as saranex.
- Outer, sturdy nitrile gloves.
- Inner, chemical-resistant nitrile or vinyl gloves.
- Safety toe work boots (over-the-ankle) or cold–weather, insulated safety toe work boots as necessary depending on the ambient temperature.
- Chemical resistant boots covers if the potential for contact with contaminated soil or water exists.
- Hard hat whenever heavy equipment is used on Site and when overhead hazards exist.
- Hearing protection whenever heavy equipment is used on Site and when noise levels are at or above 85 dBA.
- Coast Guard-approved personal floatation device when working on or near water as described in Section 3.3.7 of this HASP.
- Work clothing appropriate for weather conditions.

Level C PPE for the Site includes:

- Full-face, NIOSH-approved air purifying respirator equipped with organic vapor/acid gas/etc. and P100 cartriges (usuallly these are magenta and yellow in color). **SEE CARTRIDGE CHANGE SCHEDULE BELOW.**
- Polycoated Tyvek or similar coverall.
- Outer, sturdy nitrile gloves.
- Inner, chemical-resistant nitrile or vinyl gloves to be worn under the outer glove.
- Safety toe work boots (over-the-ankle) or cold–weather, insulated safety toe work boots as necessary depending on the ambient temperature.
- Chemical resistant rubber boot covers if the potential for contact with contaminated soil or water exists.
- Hard hat whenever heavy equipment is used on Site and when overhead hazards exist.
- Hearing protection whenever heavy equipment is used on Site and when noise levels are at or above 85 dBA.
- Coast Guard-approved personal floatation device when working on or near water as described in Section 3.3.7 of this HASP.
- Work clothing appropriate for weather conditions.

Modified Level D PPE for the Site includes:

- Polycoated Tyvek or similar coverall for the protection of contaminants.
- Chemical-resistant nitrile or vinyl gloves. If a work activity requires the use of outer, sturdy nitrile gloves, then chemical resistant glove are to to be worn under the outer glove.

- Safety toe work boots (over-the-ankle) or cold–weather, insulated safety toe work boots as necessary depending on the ambient temperature.
- Chemical resistant rubber boots covers if required due to the potential for contact with contaminated soil or water exists.
- Safety glasses with side shields.
- Hard hat whenever heavy equipment is used on Site and when overhead hazards exist.
- Hearing protection whenever heavy equipment is used on Site and when noise levels are at or above 85 dBA.
- High-visibility vest whenever heavy equipment is used on Site, and work activity is in proximity to heavy equipment.
- Coast Guard-approved personal floatation device when working on or near water as described in Section 3.3.7 of this HASP.
- Work clothing appropriate for weather conditions.

Cartridge Change Schedule:

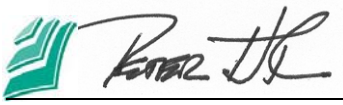
MACTEC and Subcontractor personnel will change their cartridges at the following frequency:

- If signs or symptoms of breakthrough occur; and
- Every 4 hours if humidity levels are greater than 85%.

In addition, MACTEC and Subcontractor personnel shall install new cartridges at the start of each shift and at least every 8-hours of work.

Certification of PPE Hazard Assessment

I certify that the hazard assessment regarding PPE for MACTEC and Subcontractor work at the Olin Chemical Superfund Site, Wilmington, Massachusetts was completed on or about November 1, 2007 and updated on August 21, 2008 by Cindy Sundquist and Annette McLean in accordance with 29 CFR 1910.132 and the MACTEC PPE and Respiratory Protection Programs. The results of the hazard assessment are incorporated in the PPE requirements noted above.



Signature of Project Manager

3.5.2 Monitoring

Monitoring of the work environment will be undertaken to ensure that the PPE and engineering controls utilized at the Site are sufficient to ensure worker safety. At a minimum, this monitoring will include evaluations for hazardous concentrations of airborne VOCs. When drilling indoors, the level of carbon monoxide and oxygen will be monitored continuously.

3.5.3 Air Sampling Equipment

To the extent feasible, the presence of airborne contaminants will be evaluated through the use of direct reading instrumentation. Information gathered will be used to ensure the adequacy of the levels of protection being used at the Site, and may be used as the basis for continuing or stopping work.

Air monitoring equipment to be used on Site includes:

- Photoionization detector (PID) equipped with a 11.7 or 11.8 eV Lamp.
- Benzene colorimetric detector tubes (e.g., Drager), able to detect benzene at 0.5 parts per million (ppm), and a appropriate bellows pump or similar device.
- Oxygen, LEL, and carbon monoxide meter to detect these gases during indoor drilling.

3.5.4 Site Monitoring Plan

3.5.4.1 Volatile Organic Compounds

Continuous total VOC air monitoring using direct reading instruments such as a PID will be conducted in the worker breathing zone during all Site investigation work. If total VOC readings are sustained at 1.4 ppm, benzene colorimetric detector tubes (e.g., Drager) will be used to determine the presence of benzene. If the benzene concentration reaches or exceeds 0.5 ppm, the level of protection will be upgraded to Level C. If benzene concentrations reach or exceed 5 ppm, the level of protection will be upgraded to Level B.

IMPORTANT: PRIOR NOTICE TO THE MACTEC SAFETY DIRECTOR IS REQUIRED BEFORE ANY USE OF LEVEL B.

If benzene is not present, Site activities may continue unless the total VOC concentration reaches or exceeds 1.4 ppm, at which time the level of protection will be upgraded to Level C. If total VOC concentrations reach or exceed 34 ppm, the level of protection will be upgraded to Level B. If the total VOC concentration reaches or exceeds 1.4 ppm in the work area (EZ), perimeter VOC monitoring using the PID will be conducted. If the ambient air concentration of VOCs exceeds 1.4 ppm at the perimeter of an EZ, the EZ perimeter will be increased if possible and if the increased distance will not impact public safety and then monitoring will be continued. This HASP is not intended to serve as a plan for emergency response for VOC conditions within the community or adjacent properties. If task-specific conditions indicate a potential for such vapors to travel off Site, the work will be stopped and the conditions and procedures re-evaluated. If an event occurs that may result in the potential for off-Site migration of contaminant vapors, that work activity will be stopped and an air monitoring plan will be developed as stated in Section 4.4 of the Site Management Plan (SMP).

The site is well vegetated, and although dust is not anticipated to be problem during work activities performed in the winter months, dust conditions are possible during other times of the year. If the creation of airborne dust becomes evident, the GSS and SHSS will consult with the SHSO and PM, to determine if airborne dust monitoring will be implemented. The HASP will be revised to reflect the addition of dust monitoring at that time and an action limit based on the available Site analytical data will be used to calculate a dust action level.

3.5.4.2 Exhaust Gases (carbon monoxide) – Drilling Indoors

When drilling indoors, adequate ventilation shall be implemented in order to maintain acceptable oxygen levels and prevent the accumulation of carbon monoxide and other hazardous components of diesel or gasoline exhaust from the drill rig. Oxygen, LEL, and carbon monoxide monitoring shall be performed by the Subcontractor and MACTEC during all activities that have the potential to generate exhaust (e.g., operation of a drill rig) within a building structure.

Table 3-2 summarizes the action levels for the levels of protection.

TABLE 3-2: SITE ACTION LEVELS AND LEVELS OF PROTECTION

TASK (Describe)	Anticipated LOP		Upgrade LOP		Upgrade LOP	
	LOP	**Sustained Airborne Levels**	**LOP**	**Sustained Airborne Levels**	**LOP**	**Sustained Airborne Levels**
All Tasks	Modified D	Total VOCs: 0 to 1.4 ppm Benzene: 0 to 0.5 ppm Carbon monoxide: 0 to 50 ppm	C	Total VOCs: 1.4 to 34 ppm Benzene: 0.5 to 5 ppm Carbon monoxide: 0 to 50 ppm	B	Total VOCs: >34 ppm Benzene: >5 ppm Carbon monoxide: >50 ppm

THE DEFINITION OF SUSTAINED IS THE CONCENTRATION REMAINS THE SAME FOR MORE THAN ONE MINUTE.

IF TOTAL VOC CONCENTRATIONS IN THE REACH OR EXCEED 1.4 PPM, IN THE BREATHING ZONE, IMPLEMENT BENZENE COLORMITRIC TUBE (e.g., Drager tube) MONITORING TO DETERMINE IF BENZENE IS PRESENT. IF BENZENE CONCENTRATIONS REACH OR EXCEED 0.5 PPM IN THE BREATHING ZONE, UPGRADE TO LEVEL C. IF BENZENE CONCENTRATIONS REACH OR EXCEED 5 PPM IN THE BREATHING ZONE, UPGRADE TO LEVEL B.

IF TOTAL VOC CONCENTRATIONS REACH OR EXCEED 1.4 PPM IN THE BREATHING ZONE, UPGRADE TO LEVEL C. IF TOTAL VOC CONCENTRATIONS REACH OR EXCEED 34 PPM, UPGRADE TO LEVEL B.

3.5.4.3 Direct Reading Instrumentation

Total VOC monitoring will be performed during all Site investigation activities as follows:

- Upon initial Site entry, total VOC monitoring using a PID shall be performed to characterize background levels within the EZ. Weather conditions, including the prevailing wind direction, will be observed and recorded for each day of Site activities. A dedicated Site Health and Saftey logbook will be used to record Site Health and Safety information on a daily basis.
- If the total VOC action level is reached in the breathing zone (total VOC levels at or above 1.4 ppm), benzene colorimetric tubes (e.g., Drager) will be used to determine if benzene is present. See Section 3.4.5.1.
- All routine breathing zone monitoring results collected in the EZ during installation of soil boring and monitoring wells and during groundwater sampling in Modified Level D will be recorded in the field logbook under control of those personnel assigned to completeing that specific activity. In the event an upgrade occurs from Level D to Level C or Level B the personal monitoring form (see Appendix F) will be used to record results of total VOC monitoring. Personal monitoring forms will be copied to the health and safety file of all MACTEC and Subcontractor personnel whose exposure conditions is represented by the monitoring conducted. The original form will be filed in the MACTEC project HASP file. The GSS shall ensure that copies of all monitoring forms are provided to Subcontractor.

3.5.4.4 Personal Samples for Laboratory Analyses

If necessary, personal samples for VOCs will be collected in accordance with standard industrial hygiene practices and OSHA/NIOSH. The DES&H will determine if personal samples are necessary based on Site conditions.

- Personal samples for VOC constituents will be collected on the field worker with the greatest potential for exposure in the work area for each day Site activities are performed.
- Samples will be collected over an entire shift (shifts are assumed to be 8-hours maximum).
- Samples will be sent via overnight courier to an American Industrial Hygiene Association (AIHA) accredited laboratory, and rush turnaround analyses will be requested.
- The DES&H will evaluate the sample results to determine if controls and PPE are appropriate for the exposure potential.
- Samples results will be communicated to all Site workers. Copies of analytical results and a description of the tasks performed during sample collection will be placed in each Site worker's file whose exposure is represented by the particular sample. The original analysis records will be filed in the MACTEC project HASP file.
- Based on results of the first round of sampling, personal samples may be collected on a periodic basis, and analytical turnaround time may be extended provided that significant changes have not occurred with respect to equipment, work tasks or processes, engineering controls, personnel, and environmental conditions.
- Personal and area sampling may be suspended during periods of heavy precipitation.

- All sample results shall be retained for a period of at least 30 years plus employment.

3.5.4.5 Equipment and Pump Calibration

All air monitoring instruments shall be calibrated according to manufacturer's instructions and standard industrial hygiene practices. Direct reading instruments shall be calibrated prior to each day's use, and at any time the operator of the instrument suspects instrument drift or malfunction. Calibrations shall be recorded in the equipment calibration logbook, or in a field logbook if instrument is recalibrated in the field.

In the event that personal sampling is required, person sampling pumps and appropriate sampling media will be used to collect breathing zone samples. The flow rate of air sampling pumps shall be set to a flow rate specified by the applicable NIOSH sampling methods. The pump flow rate shall be checked after each sampling event and recorded. The pre-sampling and post-sampling flow rates shall be used to obtain an average flowrate for the sampling period. The SHSO will provide guidance on the correct sampling media, pump flow rates, and collection times.

3.5.5 Sanitation

An adequate supply of potable drinking water for Site workers will be maintained at the Site in a location remote from field operations. At a minimum, the restrictions of 29 CFR 1910.120(n)(1) regarding the containers, marking, and drinking cups will be enforced.

A minimum of one portable toilet will be provided at the Site, if existing toilet facilities are not available.

4.0 MATERIAL SAFETY DATA SHEETS

MACTEC and the Subcontractor anticipate using some chemicals during the Site activities covered in this HASP. The MSDSs for chemicals that will be used at the Site are presented in Appendix B.

5.0 SITE CONTROL

5.1 ZONATION

The Site-specific zonation that will be used for this project will depend on the size of the work area, the task to be performed, the presence of contamination, etc. Since the Property has been extensively investigated, the need for a formal EZ and support zone (SZ) are not expected. Therefore, temporary work EZs will be established at investigation locations, as appropriate for the investigation activity. These temporary work EZs will be established around the immediate area work area in which heavy equipment are being used. Stakes and flags will be set up around drill rigs, overhead zones, etc., as necessary during work activities to designate the temporary EZ. All personnel shall take lunch and other breaks outside of the EZ after proper personnel decontamination procedures have been followed.

Planned RI/FS activities that have the potential to generate noise and airborne vapors and dust within the temporary work EZs include rotosonic drilling and concrete coring. However, these activities are not expected to generate nuisance noise levels or fugitive emissions that migrate outside of the temporary EZ.

Noise levels will be controlled to meet the applicable OSHA standards for workers as well as for the off-site community by the implementation of engineering controls. All drilling equipment will be properly inspected and maintained by the driller so that no unnecessary noise is generated. Noise-reducing barriers/equipment installed on drill rigs will remain in place at all times. Drilling activities will be conducted during daylight hours only. When the equipment is not being used, it will be shut off and not left running.

Air monitoring will be conducted within the EZ and at the perimeter of the EZ as described in Section 3.5.4 of this HASP to ensure that fugitive emissions do not impact areas outside of the EZ.

In the event that conditions within an EZ indicate that contamination may spread outside of that EZ, work will be stopped by the GSS and adjustments will be made to clearly define the EZ and SZ, with a contamination reduction zone (CRZ) established as a transition between the two zones. The CRZ must limit, as much as possible, the probability of the SZ becoming contaminated. A personnel decontamination line will be setup in the CRZ for personnel to remove contaminated PPE and to wash when exiting the EZ.

The GSS will determine and delineate the zones as described as follows:

- The EZ is the area of the Site where field activities will be performed. The GSS will ensure that all temporary and formal EZ are delineated with stakes, flags, barrier tape, or other effective means. Personnel that do not meeting the training and medical surveillance requirements will not be allowed entry into any EZ.
- In the event a CRZ and a SZ are needed, they will be delineated using barrier tape or other effective means, and be communicated to all Site workers. The SZ is considered to be a "clean" area. When possible, the CRZ shall be established upwind of the EZ. Wind direction will be determined by visual observation or field instrumentation.

5.2 COMMUNICATIONS

MACTEC will use voice communication for all communication between MACTEC and Subcontractor personnel. MACTEC will also have a cellular telephone available for off-Site calls. The GSS will determine the location of the nearest land line telephone and record the location on the emergency information sheet included in this HASP.

The following air horn signals (e.g., using an air horn) may be employed if the SSHO determines that voice communication will be insufficient in the event of an emergency:

HELP	three short blasts	(. . .)
EVACUATION	three long blasts	(_ _ _)
ALL CLEAR	alternating long and short blasts	(_ . _ .)

5.3 WORK PRACTICES

MACTEC and Subcontractor workers will be expected to adhere to the established safe work practices defined in this HASP and in the MACTEC and Subcontractor Health and Safety Programs respectively, and in the Subcontractor's Corporate or Company Health and Safety Program. The need to exercise caution in the performance of specific work tasks is made more acute due to: (1) weather conditions; (2) restricted mobility and reduced peripheral vision caused by the protective gear itself; and (3) the need to maintain integrity of the protective gear. Work at the Site will be conducted according to established protocol and guidelines for the safety and health of all involved. Among the most important of these principles for working at a hazardous waste site are the following:

- In any unknown situation, always assume the worst conditions and plan responses accordingly.
- All Site personnel must practice the buddy system of at least 2 people who maintain visual or verbal contact. Contact should be either constant or at some frequent interval during field work (frequency should depend on the nature of hazards present). The buddy may be an MACTEC or Subcontractor employee or other Site worker as appropriate.

- Establish and maintain communications. In addition to air horn signals, it is advisable to develop a set of hand signals that everyone on Site is familiar with, because conditions may greatly impair verbal communications.
- Because no PPE is 100 percent effective, all personnel must minimize contact with contaminated materials (soil, water). Plan work areas, decontamination areas, and procedures accordingly. Do not place equipment on the ground. Do not sit on contaminated/potentially contaminated materials. Do not sit or kneel on the ground in the EZ or CRZ. Avoid standing in or walking through puddles or stained soil.
- Disposable items will be used, when possible, to minimize risks during decontamination and possible cross-contamination when operating equipment and handling the materials.
- Eating, drinking, chewing gum or tobacco, smoking, and applying lip balm or make-up is prohibited in any area designated as contaminated. Oral ingestion of contaminants is a likely means of introducing toxic substances into the body.
- Personnel must wash hands and face prior to smoking, eating, drinking, applying lip balm or make-up. Field personnel must shower as soon as possible after leaving the Site.
- Smoking and other sources of ignition are prohibited in the vicinity of heavy equipment and flammable or contaminated material, including flammable vapors.
- Maintain monitoring systems. Conditions can change quickly.
- Conflicting situations that may arise concerning safety requirements and working conditions must be addressed and resolved rapidly by the SHSS.
- Personnel must be observant of not only their own immediate surroundings but also that of others. Everyone will be working under constraints; therefore, a team effort is needed to notice and warn of impending dangerous situations. Extra precautions are necessary when working near heavy equipment while using personnel protective gear because vision, hearing, and communication can be restricted.
- Horseplay is prohibited in all work areas.
- Personnel must be aware that chemical contaminants may mimic or enhance symptoms of other illnesses or intoxication.
- Working while under the influence of intoxicants, narcotics, or controlled substances is prohibited.
- Good housekeeping procedures shall be followed to reduce slips, trips, and falls.
- Operations shall be restricted to daylight hours unless adequate lighting is provided.
- Avoid activities that unnecessarily generate noise and disturbance not otherwise controlled by this HASP.

6.0 DECONTAMINATION/WASTE DISPOSAL

All personnel and equipment leaving contaminated areas of the Site will be subject to decontamination, which will take place in the CRZ.

6.1 PERSONNEL DECONTAMINATION

Any time a worker leaves the EZ, that worker must perform personal decontamination procedures as described below. In the event of an emergency, decontamination procedures may be waived as described in the contingeny plan in this HASP.

Decontamination Procedures (applicable for established CRZ):

Modified Level D

Station 1: Outer glove wash/rinse (tap water)
Station 2: Outer boot wash if used (tap water)
Station 3: Outer boot removal if used
Station 4: Coverall removal
Station 5: Nitrile glove removal (tap water)
Station 6: Hand wash/rinse (potable water)

All disposable items will be bagged, labeled, and prepared for appropriate disposal.

Level C

Station 1: Outer boot and glove wash (tap water with Alconox®)
Station 2: Outer boot and glove rinse (tap water)
Station 3: Outer boot and glove removal
Station 4: Coverall removal
Station 5: Respirator removal and wipe down
Station 6: Inner glove removal and hand wash/rinse

All disposable items will be bagged for appropriate disposal.

Level B

Station 1: Outer glove wash (tap water with Alconox®)
Station 2: Outer boot and glove rinse (tap water)
Station 3: Tape Removal
Station 4: Outer boot and glove removal
Station 5: Suit wash (tap water with Alconox®)
Station 6: Suit rinse (tap water)
Station 7: Suit and hard hat removal
Station 8: SCBA Backpack Removal
Station 9: Inner glove wash (tap water with Alconox®)

Station 10: Inner glove rinse (tap water)
Station 11: Face-piece removal
Station 12: Inner glove removal
Station 13: Field hand/face wash or shower

All disposable items will be bagged for appropriate disposal.

Decontamination water and detergents from hand washing will be containerized for characterization and disposal as liquid IDW as described in the SMP.

6.2 EQUIPMENT DECONTAMINATION

Temporary decontamination areas will be set up at each outside soil boring and well installation location using plastic sheeting to retain solids removed from down hole equipment. Direct push sampling equipment will be manually decontaminated and will not require use of a temporary decontamination pad. Drilling equipment will be decontaminated prior to moving to the next boring location. Decontamination methods include removal of loose soil material from drill rods and bits by hand using brushes, water, and a high pressure sprayer. Water generated during decontamination procedures will be allowed to re-infiltrate into the ground at the location of the boring or in the immediately adjacent area. Sampling equipment will be decontaminated in accordance with requirements specified in the FSP and QAPP.

6.3 COLLECTION AND DISPOSAL OF DECON PRODUCTS

Subsurface soil material generated from decontamination procedures, will be collected and drummed for later disposal, appropriately labeled, chemically characterized, and managed in accordance with the SMP. Olin will be responsible for the characterizing and the hiring of a licensed disposal company to remove all drums of collected decontamination water from the Site. As indicated previously decontamination waters will be allowed to re-infiltrate into the ground at the location of the boring where decontamination of equipment occurred.

7.0 EMERGENCY/CONTINGENCY PLAN

This section identifies emergency/contingency planning that has been undertaken for operations at this Site. Most sections of the HASP provide information that would be used under emergency conditions.

7.1 PERSONNEL ROLES, LINES OF AUTHORITY, AND COMMUNICATION

The GSS, in consultation with the SHSS, is the primary authority for directing operations at the Site under emergency conditions. All communications both on- and off-Site will be directed through the GSS.

The extent of notification to specific target groups (i.e., regulatory agencies, the public) is discussed in the SMP.

7.2 Evacuation

In the event of an emergency situation, the GSS will stop work and notify **ALL** Site personnel to implement evacuation procedures. All Site personnel in the work area where the emergency is occuring, will evacuate and assemble near a previously identified emergency evacuation assembly area. The GSS will immediately assess the severity of the situation and will contact emergency support services as necessary.

The GSS will not allow unauthorized personnel to enter an area that has been evacuated because of an emergency situation.

7.3 EMERGENCY MEDICAL TREATMENT/FIRST AID

Any personnel injured on Site will be rendered first aid as appropriate and transported to competent medical facilities for further examination and/or treatment. The preferred method of transport would be through professional emergency transportation means (e.g., ambulance); however, when this is not readily available or would result in excessive delay; other transport will be authorized. Under no circumstances will injured persons transport themselves to a medical facility for emergency treatment. As soon as possible, notify the MACTEC PM and the injured person's supervisor.

7.4 EMERGENCY COMMUNICATION PROCEDURES

Prior to the start of Site work, the GSS shall hold a pre-work site briefing and inform **ALL** Site personnel, including subcontractor personnel, of the Site emergency communication procedures (e.g., how an emergency situation is communicated to all Site personnel). Prior to the start of work at each new area on

Site, the GSS shall identify an emergency evacuation assembly area upwind of the work site, for that work site and inform all personnel of that location.

7.4.1 Emergency Signals

In the unlikely event that an emergency situation occurs, all field activities at that site will cease. As discussed in Section 5, the following air horn signals (e.g., using an air horn) can be employed the SSHO determines that voice communication will be insufficient in the event of an emergency:

HELP	three short blasts	(. . .)
EVACUATION	three long blasts	(_ _ _)
ALL CLEAR	alternating long and short blasts	(_ . _ .)

The following hand/body emergency communication signals should be used when other forms of communication are difficult or impossible:

Signal	Meaning
Hand clutching throat	Out of air/can't breathe
Hands on top of head	Need assistance
Thumbs up	OK/I'm all right/I understand
Grip partner's wrist or both hands around partner's waist	Leave area immediately

Minor emergencies will be handled utilizing the on-Site first-aid kit. A portable emergency eyewash or 32 ounces of eyewash fluid will be available in the field vehicle. The GSS or SHSS is trained in first aid. All emergencies must be reported to the PM immediately.

7.5 FIRE OR EXPLOSION RESPONSE

In the event of a fire or explosion, the area will be immediately evacuated and the Fire Department will be summoned as soon as possible. If at all possible, workers in the EZ will exit through the CRZ and will, at a minimum, remove or scrub their outer boots and remove their outer layer of protective clothing prior to proceeding to the assembly location. Site personnel will gather at a designated location upwind of the fire/explosion (use predominant wind direction). The location shall be established during the daily safety meeting, and a head count will be taken at the location. Upon their arrival, notify the fire department of the location and nature of the fire/explosion.

If it can be done safely, Site personnel who have had the appropriate training may use available on-Site fire extinguisher to control or extinguish the fire if it is small and localized.

7.6 SPILL RESPONSE

MACTEC and the primary subcontractors do not anticipate using any chemicals any chemicals that would require an immediate response. In areas where investigations are planned, all tanks and storage vessels previoulsy used at the facility for maufacturing purposes have been removed. Therefore, the potential to encounter chemicals/materials during drilling activities that would require a reponse in the event of a spill is remote. However, drilling equipment and vehicles with self contained fuel tanks, and portable fuel tanks always present potential source for a liquid spill.

MACTEC and the subcontractor personnel shall attempt to contain spills only to the safe extend practical in the immediate work area through the use of those items listed below. If any release into surface water, or on-site utilities, etc. occurs, the GSS must notify the PM immediately (note that the Site does not have a sanitary sewer connection into which a spill could occur). The PM will provide response to the release if necessary. MACTEC will determine the strategy for notifying appropriate regulatory agencies.

The following materials will be available for spill containment on-Site with each work crew:

- Drums
- Absorbent materials (rolls, socks, sheets, adsorbent pillows, pads, etc.)
- Absorbent such as Spill-Dri™ or Speedi-dry
- Plastic sheeting
- Shovel, broom, and other tools as necessary for picking up the spill.

7.7 EMERGENCY DECONTAMINATION PROCEDURES

The level of decontamination in a medical emergency will be determined by the extent of the injury. For minor injuries, personnel must go through the proper decontamination sequence as stated in this HASP.

In life-threatening emergencies or when decontamination may aggravate the condition, decontamination procedures may be omitted. If decontamination cannot be performed, a field worker should accompany the injured worker to the medical facility, if possible, to provide information to medical response personnel regarding the contaminants and decontaminaiton procedures. In lieu of decontamination, actions such as removal of the outer layer of protective clothing or wrapping the victim in plastic (during treatment) can be taken if they will not delay or interfere with the treatment of the injury.

7.8 EMERGENCY RESPONSE FOR SEVERE WEATHER CONDITIONS

This section specifies what you should do in the event of a severe weather emergency, including electrical storms, high winds, and weather related icing.

7.8.1 Electrical Storms

- Seek shelter in the field vehicles.
- Do not stand near or under high objects, such as trees and drilling rigs.
- If possible, lower the drilling rig mast.

7.8.2 High Winds

- Seek shelter in the field vehicles.
- Park vehicles heading into the wind.
- If possible, secure loose objects, which may create projectile hazards.

7.8.3 Freezing Rain or Sleet, or Heavy Snow

- Cease working if icy conditions create a dangerous working environment.
- Use sand or other controls to improve footing.
- If conditions warrant, seek shelter in the field vehicles.

8.0 ADMINISTRATION

8.1 AUTHORIZED PERSONNEL

MACTEC Personnel authorized to participate in EZ activities at this Site have been reviewed and certified for Site operations by the MACTEC PM. The Subcontractor Site Supervisor is responsible for certifying all Subcontractor employees who are assigned to the Site. Certification involves the completion of appropriate training, a medical examination, and a review of this Site-specific HASP. All persons entering the Site must use the buddy system, and check in with the GSS before entering the EZ.

MACTEC FIELD TEAM MEMBERS:

Chris Mazzolini*+	General Site Supervisor(FOL) and Site Safety and Health Supervisor
Peter Thompson	Project Manager

Subontractor Field Team Members:

Boart Longyear	
TBD	
GEOMEGA	Chris Dacey
TBD	

* First-Aid-Trained
\+ CPR-Trained

8.2 HASP APPROVAL

Scheduled Start-up Date: TBD	Scheduled Start-up Time: ~0800
Project: Olin Chemical Superfund Site	Site: Wilmington, MA
Site Location: 51 Eames Street, Wilmington, MA	

We have reviewed the attached HASP for the above referenced Site. We recognize that when this form is completed, the attached HASP is approved for the field activities on the above referenced Site. Changes to this HASP shall be documented in writing and approved. Signatures also serve as certification of completion of the Hazard Assessments as required by 29 CFR 1910.132.

Annette McLean — 8-11-09
Name and Signature of HASP Author — Date

For Cindy Sundquist — 8-11-09
Name and Signature of HASP Reviewer *with permission* — Date

Peter Thompson — 8-11-09
Name and Signature of Project Manager — Date

Chris Mazzolini — 8-11-09
Name and Signature of General Site Supervisor (FOL) — Date

Chris Mazzolini — 8-11-09
Name and Signature of Site Health & Safety Supervisor — Date

8.3 HASP ACKNOWLEDGEMENT

Project: Olin Chemical Superfund Site Site: Wilmington, MA

Site Location: 51 Eames Street, Wilmington, MA

I acknowledge that I understand the requirements of this HASP, and agree to abide by the procedures and limitations specified herein. I also acknowledge that I have been given an opportunity to have my questions regarding the HASP and its requirements answered prior to performing field activities.

Employee Name	Employee Signature	Date

I acknowledge that I have verified that the employees listed above have fulfilled the health and safety training requirements for this Site. I have also verified that the above employees have fulfilled the medical surveillance requirements for this Site for the work they will perfom and do not have any medical restrictions that would prohibit them from working at this Site.

Project Manager's Signature: _____ Date: _____

8.4 EMERGENCY INFORMATION

LOCAL RESOURCES **Address & Phone Numbers**	
Police: **911** or on cell phone Wilmington Police Department **(978) 658-3331 or (978) 658-5071**	Fire: **911** or on cell phone **(978) 658-3346**
Ambulance: same as police	
Medical Facility Name: Winchester Hospital, 41 Highland Avenue, Winchester, MA 01890 **See attached route & map.**	
Route (also attach map showing route): See attached.	
Employee Who Drove Route:	Date:
Poison Control Center: 1-800-222-1222	Waste Clean-up Contacts: N/A
National Spill Response Center: (800) 424-8802	USCG: N/A

SITE RESOURCES	**Equipment**	**Location on Site**
First Aid	First aid kit and eyewash	Field vehicle
Fire Control	ABC fire extinguisher as appropriate	Contractor: Appropriate fire extinguisher equipment on the drill rig. MACTEC: Field vehicle.
Transportation	Personal or field vehicle	
Communication	Cell phone and nearest land line telephone at: _____	
Spill Control	See Section 7.6 • Absorbent materials (rolls, socks, sheets, adsorbent pillows, pads, etc.) • Absorbent such as Spill-Dri™ or Speedi-dry • Plastic sheeting • Shovel, broom, and other tools as necessary for picking up the spill.	Contractor

MACTEC AND OTHER RESOURCES	
Division EH&S Manager: Cindy Sunquist	Phone: (207) 775-5401 or cell phone: (207) 650-7593
Project Manager: Peter Thompson	Phone: (207) 775-5401 or (207) 828-3490
Wakefield LHSR: Lisa Wadsworth & Annette McLean	Phone: (781) 245-6606, (781) 213-5650 or (781) 213-5608
Other: Subcontractor (TBD)	Phone: ( )

8.5 MAP AND ROUTE TO EMERGENCY MEDICAL FACILITY

The primary source of medical assistance for the Site is:

Winchester Hospital
41 Highland Avenue, Winchester, MA 01890
(781) 729-9000

Driving distance: 6.2 mile(s) Driving time: 9 minute(s)			
1:	Depart 51 Eames St		
2:	Go South West on Eames St toward Jewel Dr	0.3 mile(s)	< 1 minute
3:	Turn left on STHY 38 (Main St)	4.5 mile(s)	5 minute(s)
4:	Turn left on Cross St	1.1 mile(s)	1 minute(s)
5:	Turn left on Washington St	< 0.1 mile(s)	< 1 minute
6:	Turn right on Fairmount St	0.1 mile(s)	< 1 minute
7:	Turn left on Maple Rd	< 0.1 mile(s)	< 1 minute
8:	Turn right on Valley Rd	< 0.1 mile(s)	< 1 minute
9:	Turn left on Highland Ave	< 0.1 mile(s)	< 1 minute

APPENDIX A

SAFETY MEETING CHECKLIST

DAILY SAFETY MEETING CHECKLIST (Page 1 of 2)

Project:	Olin Chemical Superfund Site	Site:	Wilmington, MA
Date:			

To be reviewed on the first day of Site activities and when new workers arrive on Site:

Site Health & Safety Supervisor:	
Alternate for Health & Safety:	
Location of on-Site HASP:	Field/personnel vehicle
Site training requirements:	See HASP
Specific medical surveillance requirements:	See HASP

During the project, one or more of the agenda items
could be selected for the required daily Site training.

Date: __ __ __ __ __

	Agenda:	**Check-off:**				
1.	Planned work for this day (discuss)	☐	☐	☐	☐	☐
2.	Physical hazards and controls (discuss/review)	☐	☐	☐	☐	☐
3.	Chemical hazards and controls (discuss/review)	☐	☐	☐	☐	☐
4.	Biological hazards and controls (discuss/review)	☐	☐	☐	☐	☐
5.	Personal protective equipment Modified D	☐	☐	☐	☐	☐
6.	Personal protective equipment required per the hazard assessment:	☐	☐	☐	☐	☐

	SPECIFY TYPE
Protective coveralls	Tyvek
Safety glasses/goggles	ANSI approved
Hard hat	ANSI approved
Foot protection	Safety boots & Chemical resistant overboots
Work gloves	Contractor: Heavy leather gloves over nitrile
Chemical gloves	Heavy nitrile outer and nitrile or vinyl inner
Hearing protection	Plugs or muffs
Other	

7.	Review inspection, decontamination, and maintenance procedures and the limitations of the above stated PPE.	☐	☐	☐	☐	☐
8.	Decontamination procedure (discuss/review)	☐	☐	☐	☐	☐
9.	Exclusion zone maintained	☐	☐	☐	☐	☐
10.	Site emergency response plan (discuss/review)	☐	☐	☐	☐	☐
11.	Signs and symptoms of overexposure to chemicals anticipated on-Site	☐	☐	☐	☐	☐
12.	General health and safety rules	☐	☐	☐	☐	☐
13.	Specific health and safety requirements relating to Site activities including: (discuss/review)					
	Drilling/boring	☐	☐	☐	☐	☐
	UST	☐	☐	☐	☐	☐
	Excavations	☐	☐	☐	☐	☐
	Heavy equipment	☐	☐	☐	☐	☐
	Slips, trips, and falls	☐	☐	☐	☐	☐
	Lockout/tagout	☐	☐	☐	☐	☐
	Working in temperature extremes	☐	☐	☐	☐	☐
14.	Other health & safety issues (discuss/note)	☐	☐	☐	☐	☐

DAILY SAFETY MEETING CHECKLIST (Page 2 of 2)

I have participated in the daily safety meeting discussing the topics indicated on the reverse and fully understand my responsibility for complying with all health and safety requirements. I have had the opportunity to have my questions on Site health and safety issues and procedures answered.

Employee Name (Print Name)	**Employee Signature**	**Date**

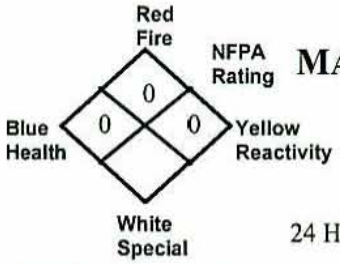
Name and Signature of person conducting training

Date

APPENDIX B

MATERIAL SAFETY DATA SHEETS

Alconox ®



MATERIAL SAFETY DATA SHEET

Alconox, Inc.
30 Glenn Street
White Plains, NY 10603

24 Hour Emergency Number – Chem-Tel (800) 255-3924

I. IDENTIFICATION

Product Name (as appears on label)	ALCONOX
CAS Registry Number:	Not Applicable
Effective Date:	January 1, 2001
Chemical Family:	Anionic Powdered Detergent
Manufacturer Catalog Numbers for sizes	1104, 1125, 1150, 1101, 1103 and 1112

II. HAZARDOUS INGREDIENTS/IDENTITY INFORMATION

There are no hazardous ingredients in ALCONOX as defined by the OSHA Standard and Hazardous Substance List 29 CFR 1910 Subpart Z.

III. PHYSICAL/CHEMICAL CHARACTERISTICS

Boiling Point (F):	Not Applicable
Vapor Pressure (mm Hg):	Not Applicable
Vapor Density (AIR=1):	Not Applicable
Specific Gravity (Water=1):	Not Applicable
Melting Point:	Not Applicable
Evaporation Rate (Butyl Acetate=1):	Not Applicable
Solubility in Water:	Appreciable-Soluble to 10% at ambient conditions
Appearance:	White powder interspersed with cream colored flakes.
pH:	9.5 (1%)

IV. FIRE AND EXPLOSION DATA

Flash Point (Method Used):	None
Flammable Limits:	LEL: No Data UEL: No Data
Extinguishing Media:	Water, dry chemical, CO_2, foam
Special Fire fighting Procedures:	Self-contained positive pressure breathing apparatus and protective clothing should be worn when fighting fires involving chemicals.
Unusual Fire and Explosion Hazards:	None

V. REACTIVITY DATA

Stability:	Stable
Hazardous Polymerization:	Will not occur
Incompatibility (Materials to Avoid):	None
Hazardous Decomposition or Byproducts:	May release CO_2 on burning

VI. HEALTH HAZARD DATA

Route(s) of Entry:	Inhalation? Yes Skin? No Ingestion? Yes
Health Hazards (Acute and Chronic):	Inhalation of powder may prove locally irritating to mucous membranes. Ingestion may cause discomfort and/or diarrhea. Eye contact may prove irritating.
Carcinogenicity:	NTP? No IARC Monographs? No OSHA Regulated? No
Signs and Symptoms of Exposure:	Exposure may irritate mucous membranes. May cause sneezing.
Medical Conditions Generally Aggravated by Exposure:	Not established. Unnecessary exposure to this product or any industrial chemical should be avoided. Respiratory conditions may be aggravated by powder.
Emergency and First Aid Procedures:	Eyes: Immediately flush eyes with water for at least 15 minutes. Call a physician. Skin: Flush with plenty of water. Ingestion: Drink large quantities of water or milk. Do not induce vomiting. If vomiting occurs administer fluids. See a physician for discomfort.

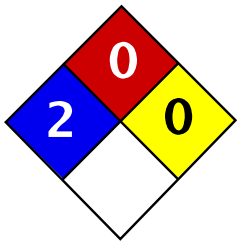
VII. PRECAUTIONS FOR SAFE HANDLING AND USE

Steps to be Taken if Material is Released or Spilled:	Material foams profusely. Recover as much as possible and flush remainder to sewer. Material is biodegradable.
Waste Disposal Method:	Small quantities may be disposed of in sewer. Large quantities should be disposed of in accordance with local ordinances for detergent products.
Precautions to be Taken in Storing and Handling:	Material should be stored in a dry area to prevent caking.
Other Precautions:	No special requirements other than the good industrial hygiene and safety practices employed with any industrial chemical.

VIII. CONTROL MEASURES

Respiratory Protection (Specify Type):	Dust mask - Recommended
Ventilation:	Local Exhaust-Normal Special-Not Required Mechanical-Not Required Other-Not Required
Protective Gloves:	Impervious gloves are useful but not required.
Eye Protection:	Goggles are recommended when handling solutions.
Other Protective Clothing or Equipment:	None
Work/Hygienic Practices:	No special practices required

THE INFORMATION HEREIN IS GIVEN IN GOOD FAITH BUT NO WARRANTY IS EXPRESSED OR IMPLIED.



Health	2
Fire	0
Reactivity	0
Personal Protection	E

Material Safety Data Sheet
Bentonite MSDS

Section 1: Chemical Product and Company Identification

Product Name: Bentonite

Catalog Codes: SLB1441, SLB2935, SLB4435

CAS#: 1302-78-9

RTECS: CT9450000

TSCA: TSCA 8(b) inventory: Bentonite

CI#: Not applicable.

Synonym: Montmorillonite;

Chemical Name: Not available.

Chemical Formula:
(Al,Fe1.67Mg.33)Si10(OH)2Na(+)Ca(++)/2.33

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
Bentonite	1302-78-9	100

Toxicological Data on Ingredients: Bentonite LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

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

Potential Chronic Health Effects:
Hazardous in case of inhalation.
CARCINOGENIC EFFECTS: Not available.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
The substance is toxic to lungs.
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. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. WARM water MUST be used. Get medical attention.

Skin Contact: Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops.

Serious Skin Contact: Not available.

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

Serious Inhalation: Not available.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: Not applicable.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available.
Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill:
Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:
Use a shovel to put the material into a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system. 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:
Do not breathe dust. Avoid contact with eyes. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If you feel unwell, seek medical attention and show the label when possible.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

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

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Dust 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: 10 from ACGIH (TLV) [United States]
Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid.

Odor: Odorless.

Taste: Not available.

Molecular Weight: Not available.

Color: Beige. (Light.)

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

Boiling Point: Not available.

Melting Point: Decomposes.

Critical Temperature: Not available.

Specific Gravity: 2.5 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility:
Very slightly soluble in cold water, hot water.
Insoluble in methanol, diethyl ether, n-octanol, acetone.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Not available.

Corrosivity: Not available.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Eye contact. Inhalation.

Toxicity to Animals:
LD50: Not available.
LC50: Not available.

Chronic Effects on Humans: Causes damage to the following organs: lungs.

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

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans: Not available.

Section 12: Ecological Information

Ecotoxicity: Not available.

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 products of degradation are as toxic as the original product.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information

Federal and State Regulations: TSCA 8(b) inventory: Bentonite

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada): CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC): R36- Irritating to eyes.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 0

Reactivity: 0

Personal Protection: E

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

Health: 2

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves.
Lab coat.
Dust 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: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:14 PM

Last Updated: 10/10/2005 08:14 PM

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MSDS Number: **H3886** * * * * * *Effective Date:* ***05/07/03*** * * * * * *Supercedes:* ***11/12/01***

MSDS **Material Safety Data Sheet**

From: **Mallinckrodt Baker, Inc.**
222 Red School Lane
Phillipsburg, NJ 08865

Mallinckrodt CHEMICALS J.T.Baker

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

HYDROCHLORIC ACID (10%-33%)

1. Product Identification

Synonyms: This MSDS applies to the concentrated standard used to make laboratory solutions and any solution that contains more than 10% but less than 33% Hydrochloric acid. For diluted product, see MSDS for Hydrochloric Acid (less than 10%). For saturated solution
CAS No.: 7647-01-0
Molecular Weight: 36.46
Chemical Formula: HCl in H2O
Product Codes:
J.T. Baker: 0323, 0327, 4654, 4657, 5618, 5619
Mallinckrodt: 2608, 2609, 2625, H151, H168; V035, V328

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Hydrogen Chloride	7647-01-0	10 - 33%	Yes
Water	7732-18-5	67 - 90%	No

3. Hazards Identification

Emergency Overview

POISON! DANGER! CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR INHALED.

SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Poison)
Flammability Rating: 0 - None
Reactivity Rating: 2 - Moderate
Contact Rating: 4 - Extreme (Corrosive)
Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES
Storage Color Code: White (Corrosive)

Potential Health Effects

Inhalation:
Corrosive! Inhalation of vapors can cause coughing, choking, inflammation of the nose, throat, and upper respiratory tract, and in severe cases, pulmonary edema, circulatory failure, and death.
Ingestion:
Corrosive! Swallowing hydrochloric acid can cause immediate pain and burns of the mouth, throat, esophagus and gastrointestinal tract. May cause nausea, vomiting, and diarrhea, and in severe cases, death.
Skin Contact:
Corrosive! Can cause redness, pain, and severe skin burns. Concentrated solutions cause deep ulcers and discolor skin.
Eye Contact:
Corrosive! Vapors are irritating and may cause damage to the eyes. Contact may cause severe burns and permanent eye damage.
Chronic Exposure:
Long-term exposure to concentrated vapors may cause erosion of teeth. Long term exposures seldom occur due to the corrosive properties of the acid.
Aggravation of Pre-existing Conditions:
Persons with pre-existing skin disorders or eye disease may be more susceptible to the effects of this substance.

---

4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.
Ingestion:

DO NOT INDUCE VOMITING! Give large quantities of water or milk if available. Never give anything by mouth to an unconscious person. Get medical attention immediately.

Skin Contact:

In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

Eye Contact:

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

---

5. Fire Fighting Measures

Fire:

Not considered to be a fire hazard. May react with metals or heat to release flammable hydrogen gas.

Explosion:

Not considered to be an explosion hazard.

Fire Extinguishing Media:

Water or water spray. Neutralize with soda ash or slaked lime.

Special Information:

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Structural firefighter's protective clothing is ineffective for fires involving hydrochloric acid. Stay away from ends of tanks. Cool tanks with water spray until well after fire is out.

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6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Neutralize with alkaline material (soda ash, lime), then absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

J. T. Baker NEUTRASORB® or TEAM® 'Low Na+' acid neutralizers are recommended for spills of this product.

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7. Handling and Storage

Store in a cool, dry, ventilated storage area with acid resistant floors and good drainage. Protect from physical damage. Keep out of direct sunlight and away from heat, water, and incompatible materials. Do not wash out container and use it for other purposes. When diluting, the acid should always be added slowly to water and in small amounts. Never use hot water and never add water to the acid. Water added to acid can cause uncontrolled boiling and splashing. When opening metal containers, use non-sparking tools because of the possibility of hydrogen gas being present. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

---

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
For Hydrochloric acid:
- OSHA Permissible Exposure Limit (PEL):
5 ppm (Ceiling)
- ACGIH Threshold Limit Value (TLV):
2 ppm (Ceiling), A4 Not classifiable as a human carcinogen

Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.
Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded and engineering controls are not feasible, a full facepiece respirator with an acid gas cartridge may be worn up to 50 times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. WARNING: Air purifying respirators do not protect workers in oxygen-deficient atmospheres.
Skin Protection:
Rubber or neoprene gloves and additional protection including impervious boots, apron, or coveralls, as needed in areas of unusual exposure to prevent skin contact.
Eye Protection:
Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

---

9. Physical and Chemical Properties

Appearance:
Clear, colorless liquid.
Odor:
Pungent odor.

Solubility:
Infinitely soluble.
Density:
1.05 @ 15C (59F)
pH:
For HCL solutions: 0.1 (1.0 N), 1.1 (0.1 N), 2.02 (0.01 N)
% Volatiles by volume @ 21C (70F):
100
Boiling Point:
101 - 103C (214 - 217F)
Melting Point:
No information found.
Vapor Density (Air=1):
No information found.
Vapor Pressure (mm Hg):
No information found.
Evaporation Rate (BuAc=1):
No information found.

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10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage.
Hazardous Decomposition Products:
When heated to decomposition, emits toxic hydrogen chloride fumes and will react with water or steam to produce heat and toxic and corrosive fumes. Thermal oxidative decomposition produces toxic chlorine fumes and explosive hydrogen gas.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
A strong mineral acid, concentrated hydrochloric acid is highly reactive with strong bases, metals, metal oxides, hydroxides, amines, carbonates and other alkaline materials. Incompatible with materials such as cyanides, sulfides, sulfites, and formaldehyde.
Conditions to Avoid:
Heat, direct sunlight.

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11. Toxicological Information

Hydrochloric acid: Inhalation rat LC50: 3124 ppm/1H; Oral rabbit LD50: 900 mg/kg. Investigated as a tumorigen, mutagen, reproductive effector.

--------\Cancer Lists\----------

Ingredient	---NTP Carcinogen--- Known	Anticipated	IARC Category

Hydrogen Chloride (7647-01-0)	No	No	3
Water (7732-18-5)	No	No	None

12. Ecological Information

Environmental Fate:
When released into the soil, this material is not expected to biodegrade. When released into the soil, this material may leach into groundwater.
Environmental Toxicity:
This material is expected to be toxic to aquatic life.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: HYDROCHLORIC ACID
Hazard Class: 8
UN/NA: UN1789
Packing Group: II
Information reported for product/size: 200L

International (Water, I.M.O.)

Proper Shipping Name: HYDROCHLORIC ACID
Hazard Class: 8
UN/NA: UN1789
Packing Group: II
Information reported for product/size: 200L

15. Regulatory Information

--------\Chemical Inventory Status - Part 1\---------------------------------
Ingredient TSCA EC Japan Australia

Ingredient	Korea	--Canada-- DSL	NDSL	Phil.
Hydrogen Chloride (7647-01-0)	Yes	Yes	No	Yes
Water (7732-18-5)	Yes	Yes	No	Yes

\Federal, State & International Regulations - Part 1\

Ingredient	-SARA 302- RQ	TPQ	------SARA 313------ List	Chemical Catg.
Hydrogen Chloride (7647-01-0)	5000	500*	Yes	No
Water (7732-18-5)	No	No	No	No

\Federal, State & International Regulations - Part 2\

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
Hydrogen Chloride (7647-01-0)	5000	No	No
Water (7732-18-5)	No	No	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: Yes
SARA 311/312: Acute: Yes Chronic: Yes Fire: No Pressure: No
Reactivity: No (Mixture / Liquid)

Australian Hazchem Code: 2R
Poison Schedule: None allocated.
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

---

16. Other Information

NFPA Ratings: Health: **3** Flammability: **0** Reactivity: **0**
Label Hazard Warning:
POISON! DANGER! CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR INHALED.
Label Precautions:
Do not get in eyes, on skin, or on clothing.
Avoid breathing vapor or mist.
Keep container closed.
Use with adequate ventilation.
Wash thoroughly after handling.
Label First Aid:
If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not

breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. In all cases call a physician.

Product Use:
Laboratory Reagent.

Revision Information:
MSDS Section(s) changed since last revision of document include: 8.

Disclaimer:
****

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****

Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

LIQUINOX MSDS

Section 1 : PRODUCT AND COMPANY IDENTIFICATION

Chemical family: Detergent.

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

Manufacturer emergency phone number: 800-255-3924.
813-248-0585 (outside of the United States).

Supplier: Same as manufacturer.

Product name: Liquinox

Section 2 : INGREDIENT INFORMATION

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

Section 3 : HAZARD IDENTIFICATION

Route of entry: Skin contact, eye contact, inhalation and ingestion.

Eye contact: May cause irritation.

Skin contact: Prolonged and repeated contact may cause irritation.

Inhalation: May cause headache and nausea.

Ingestion: May cause vomiting and diarrhea.
May cause gastric distress.

Effects of chronic exposure: See effects of acute exposure.

Section 4 : FIRST AID MEASURES

Skin contact: Remove contaminated clothing.
Wash thoroughly with soap and water.
Seek medical attention if irritation persists.

Eye contact: Check for and remove contact lenses.
Flush eyes with clear, running water for 15 minutes while holding eyelids open: if irritation persists, consult a physician.

Inhalation: Remove victim to fresh air.
If irritation persists, seek medical attention.

Ingestion: Do not induce vomiting, seek medical attention.
Dilute with two glasses of water.
Never give anything by mouth to an unconscious person.

Section 5 : FIRE FIGHTING MEASURES

Flammability: Not flammable.

Conditions of flammability: Surrounding fire.

Extinguishing media: Carbon dioxide, dry chemical, foam.
Water
Water fog.

Special procedures: Self-contained breathing apparatus required.
Firefighters should wear the usual protective gear.
Use water spray to cool fire exposed containers.

Auto-ignition temperature: Not available.

Flash point (°C), method: None

Lower flammability limit (% vol): Not applicable.

Upper flammability limit (% vol): Not applicable.

Sensitivity to static discharge: Not available.

Sensitivity to mechanical impact: Not available.

Hazardous combustion products: Oxides of carbon (COx).
Hydrocarbons.

Rate of burning: Not available.

Explosive power: Containers may rupture if exposed to heat or fire.

Section 6 : ACCIDENTAL RELEASE MEASURES

Leak/Spill: Contain the spill.
Prevent entry into drains, sewers, and other waterways.
Wear appropriate protective equipment.
Small amounts may be flushed to sewer with water.
Soak up with an absorbent material.
Place in appropriate container for disposal.
Notify the appropriate authorities as required.

Section 7 : HANDLING AND STORAGE

Handling procedures and equipment: Protect against physical damage.
Avoid breathing vapors/mists.
Wear personal protective equipment appropriate to task.
Wash thoroughly after handling.
Keep out of reach of children.
Avoid contact with skin, eyes and clothing.
Avoid extreme temperatures.
Launder contaminated clothing prior to reuse.

Storage requirements: Store away from incompatible materials.
Keep containers closed when not in use.

Section 8 : EXPOSURE CONTROLS / PERSONAL PROTECTION

Gloves / Type:

Wear appropriate gloves.

Respiratory / Type: None required under normal use.

Eye / Type:

Safety glasses recommended.

Footwear / Type: Safety shoes per local regulations.

Clothing / Type: As required to prevent skin contact.

Other / Type: Eye wash facility should be in close proximity.
Emergency shower should be in close proximity.

Ventilation requirements: Local exhaust at points of emission.

Exposure limit of material: Not available.

Section 9 : PHYSICAL AND CHEMICAL PROPERTIES

Physical state: Liquid.

Appearance & odor: Odourless.
Pale yellow.

Odor threshold (ppm): Not available.

Vapour pressure (mmHg): @ 20°C (68°F).
17

Vapour density (air=1): >1

By volume: Not available.

Evaporation rate (butyl acetate = 1): < 1.

Boiling point (°C): 100 (212F)

Freezing point (°C): Not available.

pH: 8.5

Specific gravity @ 20 °C: (water = 1).
1.083

Solubility in water (%): Complete.

Coefficient of water\oil dist.: Not available.

VOC: None

Chemical family: Detergent.

Section 10 : STABILITY AND REACTIVITY

Chemical stability: Product is stable under normal handling and storage conditions.

Conditions of instability: Extreme temperatures.

Hazardous polymerization: Will not occur.

Incompatible substances: Strong acids.
Strong oxidizing agents.

Hazardous decomposition products: See hazardous combustion products.

Section 11 : TOXICOLOGICAL INFORMATION

LD50 of product, species & route: > 5000 mg/kg rat oral.

LC50 of product, species & route: Not available.

Sensitization to product: Not available.

Carcinogenic effects: Not listed as a carcinogen.

Reproductive effects: Not available.

Teratogenicity: Not available.

Mutagenicity: Not available.

Synergistic materials: Not available.

Section 12 : ECOLOGICAL INFORMATION

Environmental toxicity: No data at this time.

Environmental fate: No data at this time.

Section 13 : DISPOSAL CONSIDERATIONS

Waste disposal: In accordance with local and federal regulations.

Section 14 : TRANSPORT INFORMATION

D.O.T. CLASSIFICATION: Not regulated.

Special shipping information: Not regulated.

Section 15 : REGULATORY INFORMATION

WHMIS classification: Not controlled.

DSL status: Not available.

SARA hazard catagories sections 311/312: Immediate (Acute) Health Hazard: No.
Delayed (Chronic) Health Hazard: No.
Fire Hazard: No.
Sudden Release of Pressure: No.
Reactive: No.

SARA Section 313: None

TSCA inventory: All components of this product are listed on the TSCA inventory.

Health Hazard: 1
Flammability: 0
Reactivity: 0

Health Hazard: 1
Flammability: 0
Physical hazard: 0
PPE: A

Section 16 : OTHER INFORMATION

Supplier MSDS date: 2006/07/14

Data prepared by: Global Safety Management
3340 Peachtree Road, #1800
Atlanta, GA 30326

Phone: 877-683-7460
Fax: (877) 683-7462

Web: www.globalsafetynet.com
Email: info@globalsafetynet.com.

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

MSDS Number: **M2015** * * * * * *Effective Date:* ***08/10/04*** * * * * * *Supercedes:* ***11/12/01***

MSDS ***Material Safety Data Sheet***

From: **Mallinckrodt Baker, Inc.**
222 Red School Lane
Phillipsburg, NJ 08865

Mallinckrodt CHEMICALS | J.T.Baker

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

METHYL ALCOHOL

1. Product Identification

Synonyms: Wood alcohol; **methanol**; carbinol
CAS No.: 67-56-1
Molecular Weight: 32.04
Chemical Formula: CH3OH
Product Codes:
J.T. Baker: 5217, 5370, 5794, 5811, 5842, 5869, 9049, 9063, 9065, 9066, 9067, 9069, 9070, 9071, 9073, 9075, 9076, 9077, 9091, 9093, 9096, 9097, 9098, 9263, 9822, 9830, V654
Mallinckrodt: 3004, 3006, 3016, 3017, 3018, 3024, 3041, 3701, 4295, 5160, 8814, H080, H488, H603, H985, V079, V571

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent Hazardous

Methyl Alcohol	67-56-1	100%	Yes

---

3. Hazards Identification

Emergency Overview

POISON! DANGER! VAPOR HARMFUL. MAY BE FATAL OR CAUSE BLINDNESS IF SWALLOWED. HARMFUL IF INHALED OR ABSORBED THROUGH SKIN. CANNOT BE MADE NONPOISONOUS. FLAMMABLE LIQUID AND VAPOR. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS CENTRAL NERVOUS SYSTEM AND LIVER.

SAF-T-DATA$^{(tm)}$ Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Poison)
Flammability Rating: 3 - Severe (Flammable)
Reactivity Rating: 1 - Slight
Contact Rating: 3 - Severe (Life)
Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES; CLASS B EXTINGUISHER
Storage Color Code: Red (Flammable)

Potential Health Effects

Inhalation:
A slight irritant to the mucous membranes. Toxic effects exerted upon nervous system, particularly the optic nerve. Once absorbed into the body, it is very slowly eliminated. Symptoms of overexposure may include headache, drowsiness, nausea, vomiting, blurred vision, blindness, coma, and death. A person may get better but then worse again up to 30 hours later.

Ingestion:
Toxic. Symptoms parallel inhalation. Can intoxicate and cause blindness. Usual fatal dose: 100-125 milliliters.

Skin Contact:
Methyl alcohol is a defatting agent and may cause skin to become dry and cracked. Skin absorption can occur; symptoms may parallel inhalation exposure.

Eye Contact:
Irritant. Continued exposure may cause eye lesions.

Chronic Exposure:
Marked impairment of vision has been reported. Repeated or prolonged exposure may

cause skin irritation.
Aggravation of Pre-existing Conditions:
Persons with pre-existing skin disorders or eye problems or impaired liver or kidney function may be more susceptible to the effects of the substance.

---

4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.
Ingestion:
Induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention immediately.
Skin Contact:
Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention. Wash clothing before reuse. Thoroughly clean shoes before reuse.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

---

5. Fire Fighting Measures

Fire:
Flash point: 12C (54F) CC
Autoignition temperature: 464C (867F)
Flammable limits in air % by volume:
lel: 6.0; uel: 36
Flammable Liquid and Vapor!
Explosion:
Above flash point, vapor-air mixtures are explosive within flammable limits noted above. Moderate explosion hazard and dangerous fire hazard when exposed to heat, sparks or flames. Sensitive to static discharge.
Fire Extinguishing Media:
Use alcohol foam, dry chemical or carbon dioxide. (Water may be ineffective.)
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Use water spray to blanket fire, cool fire exposed containers, and to flush non-ignited spills or vapors away from fire. Vapors can flow along surfaces to distant ignition source and flash back.

---

6. Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! If a leak or spill has not ignited, use water spray to disperse the vapors, to protect personnel attempting to stop leak, and to flush spills away from exposures. US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

J. T. Baker SOLUSORB® solvent adsorbent is recommended for spills of this product.

---

7. Handling and Storage

Protect against physical damage. Store in a cool, dry well-ventilated location, away from any area where the fire hazard may be acute. Outside or detached storage is preferred. Separate from incompatibles. Containers should be bonded and grounded for transfers to avoid static sparks. Storage and use areas should be No Smoking areas. Use non-sparking type tools and equipment, including explosion proof ventilation. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product. Do Not attempt to clean empty containers since residue is difficult to remove. Do not pressurize, cut, weld, braze, solder, drill, grind or expose such containers to heat, sparks, flame, static electricity or other sources of ignition: they may explode and cause injury or death.

---

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
For Methyl Alcohol:
- OSHA Permissible Exposure Limit (PEL):
200 ppm (TWA)
- ACGIH Threshold Limit Value (TLV):
200 ppm (TWA), 250 ppm (STEL) skin

Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document,

Industrial Ventilation, A Manual of Recommended Practices, most recent edition, for details. Use explosion-proof equipment.

Personal Respirators (NIOSH Approved):

If the exposure limit is exceeded and engineering controls are not feasible, wear a supplied air, full-facepiece respirator, airlined hood, or full-facepiece self-contained breathing apparatus. Breathing air quality must meet the requirements of the OSHA respiratory protection standard (29CFR1910.134). This substance has poor warning properties.

Skin Protection:

Rubber or neoprene gloves and additional protection including impervious boots, apron, or coveralls, as needed in areas of unusual exposure.

Eye Protection:

Use chemical safety goggles. Maintain eye wash fountain and quick-drench facilities in work area.

---

9. Physical and Chemical Properties

Appearance:

Clear, colorless liquid.

Odor:

Characteristic odor.

Solubility:

Miscible in water.

Specific Gravity:

0.8

pH:

No information found.

% Volatiles by volume @ 21C (70F):

100

Boiling Point:

64.5C (147F)

Melting Point:

-98C (-144F)

Vapor Density (Air=1):

1.1

Vapor Pressure (mm Hg):

97 @ 20C (68F)

Evaporation Rate (BuAc=1):

5.9

---

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage.
Hazardous Decomposition Products:
May form carbon dioxide, carbon monoxide, and formaldehyde when heated to decomposition.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Strong oxidizing agents such as nitrates, perchlorates or sulfuric acid. Will attack some forms of plastics, rubber, and coatings. May react with metallic aluminum and generate hydrogen gas.
Conditions to Avoid:
Heat, flames, ignition sources and incompatibles.

---

11. Toxicological Information

Methyl Alcohol (**Methanol**) Oral rat LD50: 5628 mg/kg; inhalation rat LC50: 64000 ppm/4H; skin rabbit LD50: 15800 mg/kg; Irritation data-standard Draize test: skin, rabbit: 20mg/24 hr. Moderate; eye, rabbit: 100 mg/24 hr. Moderate. Investigated as a mutagen, reproductive effector.

--------\Cancer Lists\----------

Ingredient	---NTP Carcinogen--- Known	Anticipated	IARC Category
Methyl Alcohol (67-56-1)	No	No	None

---

12. Ecological Information

Environmental Fate:
When released into the soil, this material is expected to readily biodegrade. When released into the soil, this material is expected to leach into groundwater. When released into the soil, this material is expected to quickly evaporate. When released into the water, this material is expected to have a half-life between 1 and 10 days. When released into water, this material is expected to readily biodegrade. When released into the air, this material is expected to exist in the aerosol phase with a short half-life. When released into the air, this material is expected to be readily degraded by reaction with photochemically produced hydroxyl radicals. When released into air, this material is expected to have a half-life between 10 and 30 days. When released into the air, this material is expected to be readily removed from the atmosphere by wet deposition.

Environmental Toxicity:
This material is expected to be slightly toxic to aquatic life.

---

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

---

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: METHANOL
Hazard Class: 3
UN/NA: UN1230
Packing Group: II
Information reported for product/size: 358LB

International (Water, I.M.O.)

Proper Shipping Name: METHANOL
Hazard Class: 3, 6.1
UN/NA: UN1230
Packing Group: II
Information reported for product/size: 358LB

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15. Regulatory Information

--------\Chemical Inventory Status - Part 1\------------------------
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Ingredient	TSCA	EC	Japan	Australia
Methyl Alcohol (67-56-1)	Yes	Yes	Yes	Yes

--------\Chemical Inventory Status - Part 2\------------------------
----

Ingredient	Korea	--Canada-- DSL	NDSL	Phil.
Methyl Alcohol (67-56-1)	Yes	Yes	No	Yes

Ingredient	-SARA 302- RQ	TPQ	List	------SARA 313------ Chemical Catg.
Methyl Alcohol (67-56-1)	No	No	Yes	No

Ingredient	CERCLA	-RCRA- 261.33	TSCA- 8(d)
Methyl Alcohol (67-56-1)	5000	U154	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
SARA 311/312: Acute: Yes Chronic: Yes Fire: Yes Pressure: No
Reactivity: No (Pure / Liquid)

Australian Hazchem Code: 2PE
Poison Schedule: S6
WHMIS:
This **MSDS** has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the **MSDS** contains all of the information required by the CPR.

---

16. Other Information

NFPA Ratings: Health: **1** Flammability: **3** Reactivity: **0**
Label Hazard Warning:
POISON! DANGER! VAPOR HARMFUL. MAY BE FATAL OR CAUSE BLINDNESS IF SWALLOWED. HARMFUL IF INHALED OR ABSORBED THROUGH SKIN. CANNOT BE MADE NONPOISONOUS. FLAMMABLE LIQUID AND VAPOR. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS CENTRAL NERVOUS SYSTEM AND LIVER.
Label Precautions:
Avoid breathing vapor.

Avoid contact with eyes, skin and clothing.
Wash thoroughly after handling.
Keep container closed.
Use only with adequate ventilation.
Keep away from heat, sparks and flame.

Label First Aid:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. If swallowed, induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. In all cases get medical attention immediately.

Product Use:

Laboratory Reagent.

Revision Information:

No Changes.

Disclaimer:

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****

Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

MSDS Number: **N3660** * * * * * *Effective Date:* ***05/06/05*** * * * * * *Supercedes:* ***07/02/02***

MSDS Material Safety Data Sheet

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

Mallinckrodt CHEMICALS J.T.Baker

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

NITRIC ACID, 50-70%

1. Product Identification

Synonyms: Aqua Fortis; Azotic Acid; Nitric Acid 50%; Nitric Acid 65%; nitric acid 69-70%
CAS No.: 7697-37-2
Molecular Weight: 63.01
Chemical Formula: HNO3
Product Codes:
J.T. Baker: 411D, 412D, 5371, 5796, 5801, 5826, 5856, 5876, 5896, 9597, 9598, 9600, 9601, 9602, 9603, 9604, 9606, 9607, 9608, 9610, 9616, 9617, 9670
Mallinckrodt: 1409, 2704, 2705, 2716, 6623, H862, H988, H993, H998, V077, V650

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Nitric Acid	7697-37-2	50 - 70%	Yes
Water	7732-18-5	30 - 50%	No

3. Hazards Identification

Emergency Overview

POISON! DANGER! STRONG OXIDIZER. CONTACT WITH OTHER MATERIAL MAY CAUSE FIRE. CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR INHALED. INHALATION MAY CAUSE

LUNG AND TOOTH DAMAGE.

SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 4 - Extreme (Poison)
Flammability Rating: 0 - None
Reactivity Rating: 3 - Severe (Oxidizer)
Contact Rating: 4 - Extreme (Corrosive)
Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES
Storage Color Code: White (Corrosive)

Potential Health Effects

Nitric acid is extremely hazardous; it is corrosive, reactive, an oxidizer, and a poison.

Inhalation:
Corrosive! Inhalation of vapors can cause breathing difficulties and lead to pneumonia and pulmonary edema, which may be fatal. Other symptoms may include coughing, choking, and irritation of the nose, throat, and respiratory tract.
Ingestion:
Corrosive! Swallowing nitric acid can cause immediate pain and burns of the mouth, throat, esophagus and gastrointestinal tract.
Skin Contact:
Corrosive! Can cause redness, pain, and severe skin burns. Concentrated solutions cause deep ulcers and stain skin a yellow or yellow-brown color.
Eye Contact:
Corrosive! Vapors are irritating and may cause damage to the eyes. Contact may cause severe burns and permanent eye damage.
Chronic Exposure:
Long-term exposure to concentrated vapors may cause erosion of teeth and lung damage. Long-term exposures seldom occur due to the corrosive properties of the acid.
Aggravation of Pre-existing Conditions:
Persons with pre-existing skin disorders, eye disease, or cardiopulmonary diseases may be more susceptible to the effects of this substance.

---

4. First Aid Measures

Immediate first aid treatment reduces the health effects of this substance.
Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.
Ingestion:
DO NOT INDUCE VOMITING! Give large quantities of water or milk if available. Never give anything by mouth to an unconscious person. Get medical attention immediately.
Skin Contact:
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids

occasionally. Get medical attention immediately.

---

5. Fire Fighting Measures

Fire:
Not combustible, but substance is a strong oxidizer and its heat of reaction with reducing agents or combustibles may cause ignition. Can react with metals to release flammable hydrogen gas.
Explosion:
Reacts explosively with combustible organic or readily oxidizable materials such as: alcohols, turpentine, charcoal, organic refuse, metal powder, hydrogen sulfide, etc. Reacts with most metals to release hydrogen gas which can form explosive mixtures with air.
Fire Extinguishing Media:
Water spray may be used to keep fire exposed containers cool. Do not get water inside container.
Special Information:
Increases the flammability of combustible, organic and readily oxidizable materials. In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

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6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Neutralize with alkaline material (soda ash, lime), then absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

J. T. Baker NEUTRASORB® acid neutralizers are recommended for spills of this product.

---

7. Handling and Storage

Store in a cool, dry, ventilated storage area with acid resistant floors and good drainage. Protect from physical damage. Keep out of direct sunlight and away from heat, water, and incompatible materials. Do not wash out container and use it for other purposes. When diluting, the acid should always be added slowly to water and in small amounts. Never use hot water and never add water to the acid. Water added to acid can cause uncontrolled boiling and splashing. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

---

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
-OSHA Permissible Exposure Limit (PEL):
2 ppm (TWA), 4 ppm (STEL)

-ACGIH Threshold Limit Value (TLV):
2 ppm (TWA); 4 ppm (STEL)

Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.
Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded, wear a supplied air, full-facepiece respirator, airlined hood, or full-facepiece self-contained breathing apparatus. Nitric acid is an oxidizer and should not come in contact with cartridges and canisters that contain oxidizable materials, such as activated charcoal. Canister-type respirators using sorbents are ineffective.
Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.
Eye Protection:
Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

---

9. Physical and Chemical Properties

Appearance:
Colorless to yellowish liquid.
Odor:
Suffocating, acrid.
Solubility:
Infinitely soluble.
Specific Gravity:
1.41
pH:
1.0 (0.1M solution)
% Volatiles by volume @ 21C (70F):
100 (as water and acid)
Boiling Point:
122C (252F)
Melting Point:
-42C (-44F)
Vapor Density (Air=1):
2-3
Vapor Pressure (mm Hg):
48 @ 20C (68F)
Evaporation Rate (BuAc=1):
No information found.

---

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage. Containers may burst when heated.
Hazardous Decomposition Products:

When heated to decomposition, emits toxic nitrogen oxides fumes and hydrogen nitrate. Will react with water or steam to produce heat and toxic and corrosive fumes.

Hazardous Polymerization:
Will not occur.

Incompatibilities:
A dangerously powerful oxidizing agent, concentrated nitric acid is incompatible with most substances, especially strong bases, metallic powders, carbides, hydrogen sulfide, turpentine, and combustible organics.

Conditions to Avoid:
Light and heat.

---

11. Toxicological Information

Nitric acid: Inhalation rat LC50: 244 ppm (NO2)/30M; Investigated as a mutagen, reproductive effector. Oral (human) LDLo: 430 mg/kg.

--------\Cancer Lists\----------

Ingredient	---NTP Carcinogen--- Known	Anticipated	IARC Category
Nitric Acid (7697-37-2)	No	No	None
Water (7732-18-5)	No	No	None

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12. Ecological Information

Environmental Fate:
No information found.

Environmental Toxicity:
No information found.

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13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste facility. Although not a listed RCRA hazardous waste, this material may exhibit one or more characteristics of a hazardous waste and require appropriate analysis to determine specific disposal requirements. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

---

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: NITRIC ACID
Hazard Class: 8

UN/NA: UN2031
Packing Group: II
Information reported for product/size: 6.5GL

International (Water, I.M.O.)

Proper Shipping Name: NITRIC ACID (WITH NOT MORE THAN 70% NITRIC ACID)
Hazard Class: 8
UN/NA: UN2031
Packing Group: II
Information reported for product/size: 6.5GL

---

15. Regulatory Information

--------\Chemical Inventory Status - Part 1\---------------------------------

Ingredient	TSCA	EC	Japan	Australia
Nitric Acid (7697-37-2)	Yes	Yes	Yes	Yes
Water (7732-18-5)	Yes	Yes	Yes	Yes

--------\Chemical Inventory Status - Part 2\---------------------------------

Ingredient	Korea	--Canada-- DSL	NDSL	Phil.
Nitric Acid (7697-37-2)	Yes	Yes	No	Yes
Water (7732-18-5)	Yes	Yes	No	Yes

--------\Federal, State & International Regulations - Part 1\----------------

Ingredient	-SARA 302- RQ	TPQ	------SARA 313------ List	Chemical Catg.
Nitric Acid (7697-37-2)	1000	1000	Yes	No
Water (7732-18-5)	No	No	No	No

--------\Federal, State & International Regulations - Part 2\----------------

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
Nitric Acid (7697-37-2)	1000	No	No
Water (7732-18-5)	No	No	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
SARA 311/312: Acute: Yes Chronic: Yes Fire: Yes Pressure: No
Reactivity: No (Mixture / Liquid)

Australian Hazchem Code: 2PE
Poison Schedule: S6
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

---

16. Other Information

NFPA Ratings: Health: **3** Flammability: **0** Reactivity: **0** Other: **Oxidizer**

Label Hazard Warning:

POISON! DANGER! STRONG OXIDIZER. CONTACT WITH OTHER MATERIAL MAY CAUSE FIRE. CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR INHALED. INHALATION MAY CAUSE LUNG AND TOOTH DAMAGE.

Label Precautions:

Do not get in eyes, on skin, or on clothing.
Do not breathe vapor or mist.
Use only with adequate ventilation.
Wash thoroughly after handling.
Keep from contact with clothing and other combustible materials.
Do not store near combustible materials.
Store in a tightly closed container.
Remove and wash contaminated clothing promptly.

Label First Aid:

In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In all cases get medical attention immediately.

Product Use:

Laboratory Reagent.

Revision Information:

No Changes.

Disclaimer:

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Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

LEHIGH SOUTHWEST CEMENT COMPANY
MATERIAL SAFETY DATA SHEET
FOR
PORTLAND CEMENT

REVISED DATE: OCTOBER, 2002

1. PRODUCT/COMPANY IDENTIFICATION

Supplier:
Lehigh Southwest Cement Company
2300 Clayton Road, Suite 300
Concord, CA 94520
Phone (925) 609-6920
Fax (925) 609-6930
Contact Number:
(USE SALES OFFICE PHONE NUMBER)

Chemical Family: Calcium Compounds

Chemical Name and Synonyms:
Portland Cement (CAS # 65997-15-1), Hydraulic Cement Types I, I (WRA), II, III, V

Trade Name and Synonyms:
Lehigh Portland Cement Types I, II, III, V
Lehigh Plastic Cement

2. EMERGENCY AND FIRST AID

EMERGENCY INFORMATION: Portland cement is a light gray or white powder. When in contact with moisture in eyes or on skin, or when mixed with water, portland cement becomes highly caustic (pH > 12) and will damage or burn (as severely as third-degree) the eyes or skin. Inhalation may cause irritation to the moist mucous membranes of the nose, throat and upper respiratory system or may cause or may aggravate certain lung diseases or conditions. Use exposure controls or personal protection methods described in Section 10.

EYES: Immediately flush eye thoroughly with water. Continue flushing eye for at least 15 minutes, including under lids, to remove all particles. Call physician immediately.

SKIN: Wash skin with cool water and pH-neutral soap or a mild detergent. Seek medical treatment if irritation or inflammation develops or persists. Seek immediate medical treatment in the event of burns.

INHALATION: Remove person to fresh air. If breathing is difficult, administer oxygen. If not breathing, give artificial respiration. Seek medical help if coughing and other symptoms do not subside. Inhalation of large amounts of portland cement require immediate medical attention.

INGESTION: Do not induce vomiting. If conscious, have the victim drink plenty of water and call a physician immediately.

ACCIDENTIAL RELEASE MEASURES Clean up spilled material without causing it to become airborne or mixed with water to limit potential harm. Wear appropriate personal protective equipment. Dispose of waste material according to local, state or federal regulations.

3. COMPOSITION INFORMATION

DESCRIPTION:

This product consists of finely ground portland cement clinker mixed with a small amount of gypsum (calcium sulfate dihydrate). The portland cement clinker is made by heating to a high temperature a mixture of substances such as limestone, sand, clay and shale. Portland cement is essentially hydraulic calcium silicates contained in a crystalline mass, not separable into individual components. Major compounds are:

$3CaO•SiO_2$	Tricalcium Silicate	CAS #12168-85-3
$2CaO•SiO_2$	Dicalcium Silicate	CAS #10034-77-2
$3CaO•Al_2O_3$	Tricalcium Aluminate	CAS #12042-78-3
$4CaO•Al_2O_3•Fe_2O_3$	Tetracalcium aluminoferrite	CAS #12068-35-8
$CaSO_4•2H_2O$	Calcium Sulfate dihydrate (Gypsum)	CAS #7778-18-9 (CAS #13397-24-5)

4. HAZARDOUS INGREDIENTS

COMPONENT	OSHA PEL (8-Hour TWA)	ACGIH TLV-TWA (1995-1996)	NIOSH REL (8-Hour TWA)
Portland Cement (CAS #65997-15-1) 50 to 95% by weight	5 mg respirable dust/m^3 15 mg total dust/m^3	10 mg total dust/m^3	
Calcium sulfate (CAS #7778-18-9) [Gypsum (CAS #13397-24-5)] 0 to 10% by weight	5 mg respirable dust/m^3 15 mg total dust/m^3	10 mg total dust/m^3	
Iron oxide (CAS #1309-37-1) 0 to 15% by weight	10 mg/m^3	5 mg/m^3	
Calcium carbonate (CAS #1317-65-3) 0 to 5% by weight	5 mg respirable dust/m^3 15 mg total dust/m^3	10 mg total dust/m^3	
Magnesium oxide (CAS #1309-48-4) 0 to 5% by weight	15 mg total dust/m^3	10 mg total dust/m^3	
Calcium oxide (CAS #1305-78-8) 0 to 5%[1] by weight	5 mg/m^3	2 mg/m^3	
Crystalline silica (CAS #14808-60-7) 0 to 5% by weight	$\frac{\text{10 mg of respirable dust/m}^3}{\%\ SiO_2 + 2}$ $\frac{\text{30 mg of total dust/m}^3}{\%\ SiO_2 + 2}$ $\frac{\text{250 million particles/ft}^3}{\%\ SiO_2 + 5}$	0.05 mg respirable quartz/m^3	0.05 mg respirable quartz dust/m^3

TRACE INGREDIENTS:

Due to the use of substances mined from the earth's crust, trace amounts of naturally occurring, potentially harmful constituents may be detected during chemical analysis. Portland cement may contain up to 0.75% insoluble residue. A small amount of this residue includes free crystalline silica. Portland cement also may contain trace (<0.05%) amounts of chromium salts or compounds (including hexavalent chromium) or other metals (including nickel compounds) found to be hazardous or toxic in some chemical forms. These metals are present mostly as trace substitutions within the principal minerals. Other trace constituents may include potassium and sodium sulfate compounds.

[1] If Portland/Lime blended product "0 to 25%" values.

5. HAZARD IDENTIFICATION

POTENTIAL HEALTH EFFECTS:

NOTE: Potential health effects may vary depending upon the duration and degree of exposure. To reduce or eliminate health hazards associated with this product, use exposure controls or personal protection methods as described in Section 10.

EYE CONTACT:

(Acute/Chronic) Exposure to airborne dust may cause immediate or delayed irritation or inflammation of the cornea. Eye contact by larger amounts of dry powder or splashes of wet portland cement may cause effects ranging from moderate eye irritation to chemical burns and blindness.

SKIN CONTACT:

(Acute) Exposure to dry portland cement may cause drying of the skin with consequent mild irritation or more significant effects attributable to aggravation of other conditions. Discomfort or pain cannot be relied upon to alert a person to a hazardous skin exposure.

(Chronic) Dry portland cement coming in contact with wet skin or exposure to wet portland cement may cause more severe skin effects, including thickening, cracking or fissuring of the skin. Prolonged exposure can cause severe skin damage in the form of chemical (caustic) burns.

(Acute/Chronic) Some individuals may exhibit an allergic response upon exposure to portland cement. The response may appear in a variety of forms ranging from a mild rash to severe skin ulcers.

INHALATION:

(Acute) Exposure to portland cement may cause irritation to the moist mucous membranes of the nose, throat and upper respiratory system. Pre-existing upper respiratory and lung diseases may be aggravated by inhalation of portland cement.

(Chronic) Inhalation exposure to free crystalline silica may cause delayed lung injury including silicosis, a disabling and potentially fatal lung disease, and/or cause or aggravate other lung diseases or conditions.

INGESTION:

(Acute/Chronic) Internal discomfort or ill effects are possible if large quantities are swallowed.

CARCINOGENIC POTENTIAL:

Portland cement is not recognized as a carcinogen by NTP, OSHA, or IARC. However, it may contain trace amounts of heavy metals recognized as carcinogens by these organizations. In addition, IARC classifies crystalline silica, a trace constituent, as a known human carcinogen (Group I). NTP has characterized respirable silica as "reasonably anticipated to be a carcinogen." (See also Section 13.)

6. PHYSICAL/CHEMICAL DATA

APPEARANCE/ODOR:	Gray, white or colored powder, odorless	PHYSICAL STATE:	Solid (Powder)
BOILING POINT:	> 1000°C	MELTING POINT:	Not applicable
VAPOR PRESSURE:	Not applicable	VAPOR DENSITY:	Not applicable
pH (IN WATER) (ASTM D 1293-95)	12 to 13	SOLUBILITY IN WATER:	Slightly soluble (0.1% to 1.0%)
SPECIFIC GRAVITY (H_2O = 1.0):	3.15	EVAPORATION RATE:	Not applicable

7. FIRE AND EXPLOSION

FLASH POINT:	None	LOWER EXPLOSIVE LIMIT:	None
AUTO IGNITION TEMPERATURE:	Not combustible	UPPER EXPLOSIVE LIMIT:	None
FLAMMABLE LIMITS	Not applicable	SPECIAL FIRE FIGHTING PROCEDURES:	None
EXTINGUISHING MEDIA:	Not combustible	UNUSUAL FIRE AND EXPLOSION HAZARDS:	None
HAZARDOUS COMBUSTION PRODUCTS:	None		

8. STABILITY AND REACTIVITY DATA

STABILITY: Product is stable. Keep dry until used.

CONDITIONS TO AVOID: Unintentional contact with water. Contact with water will result in hydration and produces (caustic) calcium hydroxide.

INCOMPATIBILITY: Wet portland cement is alkaline. As such, it is incompatible with acids, ammonium salts and aluminum metal.

HAZARDOUS DECOMPOSITION: Will not occur.

HAZARDOUS POLYMERIZATION: Will not occur.

9. PRECAUTIONS FOR HANDLING, STORAGE AND DISPOSAL

HANDLING AND STORAGE Keep dry until used. Handle and store in a manner so that airborne dust does not exceed applicable exposure limits. Use adequate ventilation and dust collection. Use exposure control and personal protection methods as described in Section 10.

SPILL: Use dry clean-up methods that do not disperse dust into the air or entry into surface water. Material can be used if not contaminated. Place in an appropriate container for disposal or use. Avoid inhalation of dust and contact with skin and eyes. Use exposure control and personal protection methods as described in Section 10.

DISPOSAL: Comply with all applicable local, state and federal regulations for disposal of unusable or contaminated materials. Dispose of packaging/containers according to local, state and federal regulations.

10. EXPOSURE CONTROLS/PERSONAL PROTECTION

RESPIRATORY PROTECTION:	Use local exhaust or general dilution ventilation to control dust levels below applicable exposure limits. Minimize dispersal of dust into the air. If local or general ventilation is not adequate to control dust levels below applicable exposure limits or when dust causes irritation or discomfort, use MSHA/NIOSH approved respirators.
EYE PROTECTION:	Wear safety glasses with side shields or goggles to avoid contact with the eyes. In extremely dusty environments and unpredictable environments, wear tight-fitting unvented or indirectly vented goggles to avoid eye irritation or injury. Contact lenses should not be worn when handling cement or cement containing products.
SKIN PROTECTION:	Wear impervious abrasion- and alkali-resistant gloves, boots, long-sleeved shirt, long pants or other protective clothing to prevent skin contact. Promptly remove clothing dusty with dry portland cement or clothing dampened with moisture mixed with portland cement, and launder before re-use. If contact occurs, wash areas contacted by material with pH neutral soap and water.

11. TRANSPORTATION DATA

Portland cement is not hazardous under U.S. DOT regulations.

12. TOXICOLOGICAL AND ECOLOGICAL INFORMATION

For a description of available, more detailed toxicological and ecological information, contact Lehigh Cement Company.

13. OTHER REGULATORY INFORMATION

Status under US OSHA Hazard Communication Rule 29 CFR 1910.1200:	Portland cement is considered a hazardous chemical under this regulation and should be included in the employer's hazard communication program.
Status under CERCLA/Superfund, 40 CFR 117 and 302:	Not listed.
Hazard Category under SARA (Title III), Sections 311 and 312:	Portland cement qualifies as a hazardous substance with delayed health effects.
Status under SARA (Title III), Section 313:	Maybe subject to reporting requirements under Section 313. Contact sales office for further information.
Status under TSCA (as of May 1997):	Some substances in portland cement are on the TSCA inventory list.
Status under the Federal Hazardous Substances Act:	Portland cement is a hazardous substance subject to statutes promulgated under the subject act.

Status under California Proposition 65:	This product contains crystalline silica, a substance known to the State of California to cause cancer. This product also may contain trace amounts of heavy metals known to the State of California to cause cancer, birth defects or other reproductive harm.

14. OTHER INFORMATION

This MSDS provides information on various types of portland cement products. A particular product's composition may vary from sample to sample. The information provided herein is believed by Lehigh Cement Company to be accurate at the time of preparation or prepared from sources believed to be reliable. Health and safety precautions in this data sheet may not be adequate for all individuals or situations. Users have the responsibility to comply with all laws and procedures applicable to the safe handling and use of the product, to determine the suitability of the product for its intended use, and to understand possible hazards associated with mixing portland cement with other materials. This product neither contains nor is directly manufactured with any controlled ozone depleting substances, Class I and II. SELLER MAKES NO WARRANTY, EXPRESS OR IMPLIED, CONCERNING THE PRODUCT OR THE MERCHANTABILITY OR FITNESS THEREOF FOR ANY PURPOSE OR CONCERNING THE ACCURACY OF ANY INFORMATION PROVIDED BY LEHIGH CEMENT COMPANY.

ABBREVIATIONS

ACGIH	American Conference of Governmental Industrial Hygienists
ASTM	American Society for Testing and Materials
CAS	Chemical Abstract Service
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
ft^3	Cubic foot
IARC	International Agency for Research on Cancer
m^3	Cubic meter
mg	Milligram
MSHA	Mine Safety and Health Administration
NIOSH	National Institute for Occupational Safety and Health
NTP	National Toxicology Program
OSHA	Occupational Safety and Health Administration
PEL	Permissible Exposure Limit
REL	Recommended Exposure Limit
SARA	Superfund Amendments and Reauthorization Act
TLV	Threshold Limit Value
TSCA	Toxic Substance Control Act
TWA	Time Weighted Average

APPENDIX C

SITE/VICINITY MAP

Eames St
Former Office Building and Lab
Main Gate
Guard Shack
Butler Building
Office Trailer
Gate
Plant B Treatment Building
Storage Trailer #2
Storage Trailer #1
Boston and Maine Railroad
Concrete Slab
Concrete Slab
East Ditch
MBTA Rail Line
West Warehouse
East Warehouse
West Ditch Wetland
Plant B Outfall
On-Property West Ditch (Culvert)
Containment Area
Central Wetland
Central Pond
Delta Area
South Ditch
Gate
Off-Property West Ditch
Weir
South Ditch
Gate
Off-Property South Ditch
Ephemeral Drainage
Gate
Calcium Sulfate Landfill
Town of Wilmington
City of Woburn

Legend

- 51 Eames St. Property Boundary
- Fences
- Railroad
- Paved Road
- Unpaved Road
- Sidewalks
- Structures
- Surface Water
- Trails
- Wetland Boundary
- Wooded Areas
- Town Line

MACTEC
MACTEC Engineering and Consulting
107 Audubon Road Suite 301
Wakefield, MA 01880

N

0 100 200 400 Feet

Figure 1.0-2
Current Site Features
on the Former Facility
Draft Site Management Plan
Olin Chemical Superfund Site
Wilmington, Massachusetts

Prepared/Date: BJR 08/21/08 | Checked/Date: PHT 08/21/08

Document: P:\OLIN\Wilmington\GIS\MapDocuments\Focused RI\Olin_11X17_P.mxd PDF: P:\OLIN\Wilmington\2007 Remedial Investigation Work Plan\Site Management Plan & CRSP\Figure 1-0.2 Current On-Property Site Features.pdf 08/21/2008 2:06 PM BJRODEN

Butters Row
Butters Row Treatment Plant
Butters Row #2
Town Park
Butters Row #1
Chestnut St
Chestnut St #1A/2
Chestnut St #1
Sawmill Brook
Maple Meadow Brook
Spinazola Landfill
Main St
Eames St
Boston and Maine Railroad
MBTA Rail Line
East Ditch
Off-Property West Ditch
Containment Area
Cook Ave
South Ditch
Border Ave
Calcium Sulfate Landfill
Town of Wilmington
City of Woburn
Woburn Landfill
New Boston Street Drainway

Legend

- Town Wells
- Town Line
- 51 Eames St. Property Boundary
- Paved Road
- Unpaved Road
- Sidewalks
- Structures
- Surface Water
- Trails
- Wetland Boundary
- Wooded Areas
- Culvert

MACTEC Engineering and Consulting
107 Audubon Road Suite 301
Wakefield, MA 01880

N

0 340 680 1,360 Feet

Figure 1.0-3
Current Site Features Off-Property Areas

Draft Site Management Plan
Olin Chemical Superfund Site
Wilmington, Massachusetts

Prepared/Date: BJR 08/25/08 | Checked/Date: PHT 08/25/08

Document: P:\OLIN\Wilmington\GIS\MapDocuments\RI Work Plan\Olin_11X17_P_rotated.mxd PDF: P:\OLIN\Wilmington\2007 Remedial Investigation Work Plan\Site Management Plan & CRSP\Figure 1.0-3 Current Off-Property Site Features.pdf 08/25/2008 1:29 PM BJRODEN

APPENDIX D

HASP ADDENDUM: SAMPLING IN THE MAPLE MEADOWBROOK

APPENDIX D

Health & Safety Plan Addendum
Maple Meadowbrook Aquifer (MMBA) Area

OLIN CHEMICAL SUPERFUND SITE
WILMINGTON, MASSACHUSETTS

Health & Safety Plan Addendum
Maple Meadowbrook Aquifer (MMBA) Area

OLIN CHEMICAL SUPERFUND SITE
WILMINGTON, MASSACHUSETTS

Prepared for:

Olin Corporation
3855 North Ocoee Street
Suite 200
Cleveland, Tennessee 37312

Prepared by:

MACTEC Engineering and Consulting, Inc.
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Wakefield, MA 01880

Addendum Revised: August 2008, Revised April 2009, Revised August 2009

MACTEC Project No. 6107-09-0016/01

TABLE OF CONTENTS

Appendices

1.0 GENERAL

1.1 SCOPE AND PURPOSE

This Health and Safety Plan Addendum was initially developed to address operations and potential hazard mitigation measures associated with all groundwater, surface water, soil, and sediment sampling, and field operations located within the delineated wetland boundaries of the Maple Meadow Brook Aquifer (MMBA) as defined in 310 CMR 10.000, 4.0000 and 310 CMR 40.0000. The original addendum was established to adress health and safety during quarterly monitoring conducted under the MCP. A number of these wells and surface water locations will need to be accessed for sampling under the CERCLA RI/FS Program. These operations will be conducted on behalf of Olin Corporation (Olin) by MACTEC Engineering and Consulting Inc. (MACTEC). Prior to the issuance of the Olin Chemical Superfund Site (the Site) RI/FS HASP contained as Volume III of the RI/FS Project Operation Plan (POP), the standardized Health and Safety procedures, guidelines, and controls for Site wide operations were contained in the following three documents:

- MACTEC's site-specific *Health and Safety Plan for the Olin Site* document dated September 2003 (MACTEC, 2003);
- Olin Corporation's Wilmington Site Health & Safety Plan for General Activities issued September 1998, revision # 2, last revised 6/14/05(OLIN, 2005); and
- The Wilmington Site Health & Safety Plan/Emergency Action Plan/Plant B Area' issued June 1998, revision #1.1, last revised 1/30/06(Olin, 2006).

The current RI/FS HASP supersedes the 2003 MACTEC HASP. This HASP addendum is not intended to serve as a stand-alone document, but rather to address conditions specific to the Maple Meadow Brook Wetland, and must be used in conjunction with the current HASP to which this document is appended. This HASP addendum has been prepared in conformance with applicable Occupational Health and Administration (OSHA) regulations for the field investigation activities (e.g., sampling) that will occur at the Olin Site, i specific to work in the MMB Wetland area in Wilmington, Massachusetts. All Site workers entering the MMB wetland for groundwater sampling, surface water and sediment sampling, collection of groundwater water level measurements and stream gauging are required to read, understand and comply with procedures contained in this addendum.

This HASP addendum describes the potential hazards associated with collection of groundwater, surface water, and sediment, from inside the wetland boundaries. The addendum describes the appropriate safe procedures, and protective measures and equipment that will be implemented in response to those identified hazards, and the decontamination procedures that must be followed to minimize the off-site transport of contaminants.

1.2 PROJECT PERSONNEL

To meet its health and safety objectives, MACTEC has developed a line of reporting and has tasked those individuals with health and safety responsibilities. This information is presented below:

1) MACTEC Project Manager (PM)
2) MACTEC Health and Safety Manager (HSM)
3) MACTEC Site Health and Safety Supervisor (SHSS)
4) MACTEC General Site Supervisor/ Field Operations Leader
5) Visitors
6) Personnel Assigned to the Site (See attached personnel org chart)

The following is a list of other personnel who will be involved in the Site, and their responsibilities:

Name	**Position Title/Responsibilities**
Michael J. Murphy	Program Manager
Peter H. Thompson	Project Manager
Cindy Sundquist, CIH	MACTEC Health and Safety Manager and Certified Industrial Hygienist
Annette McLean, IH	Local Health and Safety Representative (LHSR) Wakefield office
Chris Mazzolini	Project Task Manager for Wakefield office
Chris Mazzolini	General Site Supervisor/Health and Safety Supervisor and Site Geologist

*No single Field Team Member is assigned to this field project at all times; therefore, any Field Team Member listed above who is qualified to be a GSS and SHSS (see the MACTEC Health and Safety Program for details of what classifies an individual as qualified) can be designated at the GSS and SHSS. If two or more employees are working on the site at the same time, the employee who has been with MACTEC for the longest period is the GSS and SHSS unless otherwise stated in this HASP.

1.3 TRAINING

Training for work at hazardous waste sites is defined under the MACTEC Health and Safety Program. All personnel who are assigned tasks / activities at the Site will be trained as described in the site-specific HASP (MACTEC, 2008). All personnel performing tasks as defined in this HASP addendum will also receive training in the following MACTEC programs, standard operating procedures (SOPs), and policies, and in other related guidelines:

- Float Plans (as described in the Boating Safety Program)
- Fall Protection Program
- Ladders Procedure
- Vehicle Safety Policy
- Cold Stress Program
- Working Over or Near Water Procedure
- Power and Hand Tools Procedure
- Handling and Storage of Hazardous Chemicals Program
- Job Hazard/Safety Analysis

- Insect Stings and Bites
- Environmental Sampling
- Vehicle Safety
- Safe Loads on Ice (US Army Corps of Engineers)
- OSHA's Heat Stress Module in the OSHA Technical Manual

Personnel without the required training **will not be permitted** in any area with potential for exposure to toxic substances or harmful physical agents (e.g., electrical hazards, high noise areas, etc.), or in areas where other safety hazards (physical, biological) may exist.

Daily safety training as described in the site-specific HASP will be documented on the Daily Safety Meeting Form (Appendix D-A).

1.4 MEDICAL SURVEILLANCE

All MACTEC and subcontractor personnel entering potentially contaminated areas of this site will be medically qualified for site assignment through a medical surveillance program outlined in the MACTEC Health and Safety Program and as described in the site-specific HASP (MACTEC, 2008). Personnel who have not received medical clearance **will not be permitted** in any area with potential for exposure to toxic substances or harmful physical agents (i.e., work or exclusion zone).

2.0 SITE CHARACTERIZATION AND ANALYSIS

2.1 SITE NAME, LOCATION, AND SIZE

The Olin Chemical Superfund Site (the Site) is located at 51 Eames Street in Wilmington, Massachusetts, and is comprised of the Olin Property (Property), an approximately 50-acre parcel, and adjoining off-Property areas impacted by manufacturing and waste disposal activities at the Property. Groundwater beneath a portion of the Maple Meadow Brook Wetland is included as part of the Site.

2.2 SITE HISTORY

The Olin facility began operations as a chemical manufacturing facility in the 1950's and ceased operations in 1986. A vicinity map is presented in Appendix D-B. Please refer to the site-specific HASP (MACTEC, 2008) to which this document is appended for more detailed information regarding the Site and Release History.

3.0 TASK HAZARD ANALYSIS AND MITIGATION MEASURES

3.1 SAMPLING RISK ANALYSIS

As discussed previously, this HASP addendum covers groundwater, surface water, and sediment sampling activities, and field operations conducted within the delineated wetland boundaries of the Maple Meadow Brook Aquifer, and is meant to supplment the site-specific HASP (MACTEC, 2008). The chemical and safety hazards listed below are those known or suspected to be present on-site and which MACTEC personnel and/or subcontractor personnel could potentially be exposed while performing the above mentioned tasks. The chemical and safety hazards are summarized below and are discussed in detail in subsequent sections. A summary is provided in Table 1-1.

- Accessing Private Property
  - Chemical Hazards
- Fall Hazards, Ladders, Climbing
- Bees, Ticks, Poisonous Plants, First Aid
- Extreme Weather, Hail, Wind, Thunderstorms
- Limited Daylight Periods
- Ice Thickness Determination
  - Heavy Equipment
  - Indeterminate Physical Hazards
- Lifting Hazards, Weight Requirements, Twisting
- Mud, Water, Fallen Trees, Brush
- Hunters and Well Security
  - Off-Site/ Off -Road Driving
  - Slips, Trips, and Falls
  - Cold Stress
- Snow, Sleet, Freezing Rain
  - Heat Stress
  - Materials Handling
  - Drowning
  - Communication
- Distance from Dry Land
  - Hand Tools
  - Medical Emergencies in Remote Locations

3.2 MAPLE MEADOW BROOK GROUNDWATER WELL SAMPLING

Maple Meadowbrook Wetland (MMBW) sampling activities are initiated from four (4) specific upland step-off points. These locations are accessed from either Town of Wilmington or Private landowner controlled properties. . Chemical, physical, and safety hazards are disparate depending on the step-off point and sampling location accessed. Conditions such as overhanging brush, water depth, mud depth, submerged roots, animals/insects, ice conditions, weather conditions, ambient light, site-related chemical constituent

concentrations, tree cover, topography, weight of equipment in tow, and the number of samples obtained are factors determining the unique character of each monitoring location as described below.

GW- 83 Cluster/MMB-SW-2:

The GW-83 Well Cluster is comprised of GW-83S, GW-83M and GW-83D. This location also includes the surface water sampling point MMB-SW-2. A four wheel drive utility vehicle is required to access this location from the rear of the private property located at 829 Main Street. Access is by way of a gravel fire road owned by the Town of Wilmington. The step-off point is located 10 feet from the former Middlesex canal bed (Figure 1). The distance from the wetland step-off point to surface water location MMB-SW-2 is 413 feet – the distance to monitoring well cluster GW-83, is 335 feet.

The substrate is primarily composed of flooded wetland soils made up of silty-saturated loam and organics with high porosity. Standing water is historically less than 0.5 feet, with mud present at depths in excess of 2.0 feet during most sampling events. Access to these locations involves crossing the Maple Meadow Brook, which historically (i.e., past 4 years) ranged in depth between 0.5 and 4.0 feet. Sampling equipment (i.e., pumps, etc.) and analytical bottles for 4 locations must be carried to these locations. Greater than 75 percent of the access path is tree covered, providing shade during the summer. Ice seldom forms in excess of 2 to 3 inches due to generally low water depths, which has the potential to create unsafe walking/working conditions during the colder months. The 3 monitoring wells contain iron standpipes 8 ¾ inches in diameter and are between 8 and 11 feet tall, and do not possess built in ladders. The iron standpipe well caps weight approximately 25 pounds and require removal via ladder to access the 2" PVC wells inside. These caps are preferential nesting locations for wasps and hornets, complicating removal of this equipment prior to sampling. This well cap will be replaced with an aluminum cap. GW-83D contains elevated concentrations of COC's and care should be taken when handling dedicated tubing and sampling apparatus.

GW- 84 Cluster/MMB-SW-3:

The GW-84 Well Cluster is comprised of GW-84S, GW-84M and GW-84D. A four wheel drive utility vehicle is required to access this location accessed from the rear of private property located at 829 Main Street. Access is by way of a gravel fire road owned by the Town of Wilmington. The step-off point for this well cluster is located 15 feet from monitoring well cluster GW-61. The distance from the step-off point into the wetland to surface water sampling location MMB-SW-3 is 356 feet – the distance to monitoring well cluster GW-84 is 294 feet (Figure 1).

The substrate at this location is comprised primarily of flooded wetland soils comprised of sandy-silt, degraded organics, and root material with a medium compactability. Standing water is historically less than 2.0 feet, with mud present at depths generally between 0.5 and 1.0 feet. Sampling equipment and analytical bottles for 4 locations must be carried to these locations. Greater than 95 percent of the access path is tree covered, providing excellent shade conditions during the summer. Ice generally forms in excess of 4-6 inches due to consistent standing water depths. Due to plentiful tree cover and other environmental factors, ice is generally encountered at this location during the 4th, 1st, and occasionally during the 2nd Quarter of the year. The three monitoring wells contain iron standpipes 8 ¾ inches in diameter and are between 8 and 10 feet tall, and do not contain built in ladders. The iron standpipe well caps weight approximately 25 pounds and require removal in order to access the 2" PVC wells. These caps are preferential nesting locations for wasps and hornets, complicating removal of this equipment prior to sampling. This well cap will be replaced with an aluminum cap. GW-84D contains elevated concentrations of site-related constituents and care should be taken when handling dedicated tubing and sampling apparatus.

GW- 85 Cluster:

The GW-85 Well Cluster is comprised of GW-85M and GW-85D. A four wheel drive utility vehicle is required to access this location accessed from the rear of private property located at 829 Main Street. Access is by way of a gravel fire road owned by the Town of Wilmington. The step-off point for GW-85 is located 15 feet from monitoring well cluster GW-61. The distance from the wetland step-off point to well cluster GW-85 is 698 feet (Figure 1).

The substrate is primarily flooded wetland soils comprised of silty-sand, degraded organics, and root material with a medium compactability. Standing water is historically between 0.5 and 3.0 feet, with mud depths in generally between 0.5 and 1.0 feet. Access to these locations involves crossing the Maple Meadow Brook, which can range in depth between 2.0 and 4.5 feet. Sampling equipment and analytical bottles for 2 locations must be carried to these locations. Less than 50 percent of the access path is sheltered by a tree canopy, providing inadequate cover from heat during the summer. Due to varying vegetation and water depths, ice depths are unpredictable but generally averaged 3.0 inches or greater during past winter seasons. These unpredictable conditions have the potential to create unsafe walking / working conditions during the colder months. The 3 monitoring wells contain iron standpipes 8 ¾ inches in diameter, are between 8 and 10 feet tall, and do not contain built in ladders. The iron standpipe well caps weight approximately 25 pounds and require removal to access the 2" PVC wells inside.

Multi-level Piezometer (MLP), MP-5:

The MLP-MP-5 is composed of a single 10 foot tall iron-standpipe protecting a 3" PVC riser, containing 5 vibrating wire transducers, and 12 ¼ inch sampling tubes, without dedicated tubing. A four wheel drive utility vehicle is required to access this location accessed from the rear of private property located at 829 Main Street. Access is by way of a gravel fire road owned by the Town of Wilmington. The step-off point for GW-85 sampling is located 15 feet from monitoring well cluster GW-61. The distance from the step-off point into the wetland to the distance to MLP-MP-5 is 601 feet (Figure 1).

The substrate is comprised primarily of flooded wetland soils comprised of silty-sand, degraded organics, and root material with a medium compactability and porosity. Standing water is historically between 0.5 and 3.0 feet, with mud depths in generally between 1.0 and 1.5 feet. Access to these locations involves crossing the Maple Meadow Brook, which can range in depth between 2.0 and 4.5 feet. Sampling equipment and analytical bottles for up to 12 locations may be required at this location. Less than 50 percent of the access path is sheltered by a tree canopy, providing inadequate cover from heat during the summer. Due to varying vegetation and water depths, ice depths are unpredictable or non-existent, and therefore have the potential to create unsafe walking/working conditions during the colder months. The MP-5 iron standpipe is 8 ¾ inches in diameter and 10.5 feet tall and it contains a built in peg-ladder. The iron standpipe well cap is made of aluminum, and weighs less than 4 ounces.

GW- 88 Cluster/MMB-SW-5:

The GW-8 Well Cluster is comprised of GW-88S, GW-88M, and GW-88D. A four wheel drive utility vehicle is required to access this location accessed from the Town of Wilmington's Chestnut Street Well 1A. The access is by way of a dirt access road, gated and locked, and controlled and owned by the Town of Wilmington. The step-off point for GW-88 is the town parking area. Approximately 200 feet of upland foot travel is required before encountering the wetland step-off point. The distance from the step-off point into the wetland to monitoring well cluster GW-88 is 627 feet while MMB-SW-5 is located 646 feet from the access point (Figure 1).

The substrate is comprised primarily of flooded wetland soils and root material with a medium compactability. Standing water historically ranges between 0.5 and 3.0 feet in depth, with mud present at depths generally between 0.25 and 1.0 feet. Access to these locations involves crossing Sawmill Brook, which has historically ranged in depth between 1.5 and 4.0 feet. Sampling equipment and analytical bottles for up to 4 locations may be required at this location. Less than 50 percent of the access path is sheltered by a

tree canopy, providing little cover from heat during the summer. Due to varying vegetation and water depths ice depths are unpredictable or non-existent, and therefore have the potential to create unsafe walking / working conditions during the colder months. The GW-88 iron standpipes are 8 ¾ inches in diameter and 10.5 feet tall. All 3 locations contain a built in peg-ladder. The iron standpipe well cap is made of aluminum, and weighs less than 4 ounces. During the summer growing season, this area is blanketed by *lythrum salicaria* (purple loosestrife) containing both individual hornets, wasps, and their nests. These insects are aggressive and territorial, therefore extreme care should be taken when traveling through this wetland vegetation.

GW- 86, MMB-SW-4:

These sampling locations are accessed from the Town of Wilmington's Butters Row Treatment Plan (BRTP). The wetland step-off location is accessed from a Town owned, packed dirt access road controlled by padlock. The step-off point for GW-86 well cluster is the BRTP parking area. The distance from the wetland step-off point to monitoring well cluster GW-86 is 187 feet, while MMB-SW-4 is located 298 feet from the same point (Figure 1).

The substrate at this location is comprised primarily of flooded wetland soils and root material with a low compactability. Standing water has historically been observed between 0.5 and 4.0 feet, with mud present at depths generally between 0.0 and 0.25 feet. Sampling equipment and analytical bottles for up to 4 locations may be required along this path. There are no trees along the access path, providing inadequate cover from heat during the summer. Due to varying vegetation and water depths, ice depths are unpredictable or non-existent, and therefore have the potential to create unsafe walking / working conditions during the colder months. The GW-86 iron standpipes are 8 ¾ inches in diameter, 10.0 feet tall, and do not contain built in ladders. Due to varying vegetation and water depths, ice depths are unpredictable but generally average 3.0 inches or greater during past 4 winter seasons. These unpredictable conditions have the potential to create unsafe walking / working conditions during the colder months. The iron standpipe well caps weight approximately 25 pounds and require on-ladder removal to access the 2" PVC wells. This well cap will be replaced with an aluminum cap.

GW- 87D, MMB-SW-10:

These sampling locations are accessed from the Town of Wilmington's BRTP. The wetland step-off location is accessed from a packed dirt access road controlled by lock, and owned by the Town of Wilmington. The step-off point for GW-87 well cluster is the BRTP parking area. The distance from the step-off point into the wetland to monitoring well cluster GW-87 is 386 feet while MMB-SW-10 is located 574 feet from the access point (Figure 1).

Standing water has historically been observed between 0.5 and 3.5 feet, with mud present at depths generally between 0.0 and 0.5 feet. Access to these locations involves crossing Sawmill Brook, which has historically ranged in depth between 1.5 and 7.0 feet. Sampling equipment and analytical bottles for up to 6 locations may be required along this path. There are no trees along the access path to provide reprieve from heat during the summer, and blowing snow in the winter. Due to varying vegetation, substrate and water depths, ice depths are unpredictable, and therefore have the potential to create unsafe walking / working conditions during the colder months. The GW-87 monitoring well is constructed of an iron standpipe 8 ¾ inches in diameter, is between 8 and 10 feet tall, and does not contain a built in ladder. The iron standpipe well cap weight approximately 25 pounds and require removal to access the 2" PVC wells inside.

3.3 MAPLE MEADOW BROOK SURFACE WATER SAMPLING

MMB-SW-8, 8A, 11:

These sampling locations are accessed from the Town of Wilmington's Chestnut Street Well 1A. Vehicular transport follows a Town owned, packed dirt access road controlled by lock. The step-off point for GW-88 is the town parking area. Approximately 200 feet of upland foot travel is required before encountering the wetland step-off point. The distance from the step-off point into the wetland to surface water monitoring locations MMB-SW-8, MMB-SW-8A and MMB-SW-11 are 5 feet, 358 feet and 770 feet respectively.

Standing water is historically between 0.5 and 3.0 feet, with mud depths in generally between 0.25 and 1.0 feet. Wetland access to these locations involves crossing Sawmill Brook, which has historically ranged in depth between 1.5 and 4.0 feet. Sampling equipment and analytical bottles for up to 4 locations may be required. Less than 50 percent of the access path is sheltered by a tree canopy, providing inadequate cover from heat during the summer. Due to varying vegetation and water depths, ice depths are unpredictable, or non-existent in average winter months. During the summer growing season, this area is blanketed by *lythrum salicaria* (purple loosestrife) containing both individual hornets, wasps, and their nests. These insects are aggressive and territorial, and extreme care should be taken when traveling through this wetland vegetation.

3.4 SITE AND TASK HAZARDS

MACTEC personnel may also encounter the following safety hazards while working at the Site:

- Underground utilities
- Hand tools

Please refer to the site-specific HASP (MACTEC, 2008) for details regarding physical, chemical and safety hazards associated with work in the Maple Meadow Brook Wetland. A specific wetland hazard matrix is included as Table 1-1.

3.4.1 Accessing Private Property

Maple Meadowbrook Wetland (MMBW) sampling activities are initiated from four (4) specific upland step-off points (Figure 1). These locations are accessed from either Town of Wilmington or private, landowner controlled properties as described previously. Access agreements have been obtained and are maintained by Olin.

Access for MMBW locations off Main Street are accessed courtesy of Mr. Robert Dillon, located at 829 Main Street. Access for other Main Street locations per the Town of Wilmington 2005 Assessors Map is provided courtesy of other land-owners. These landowners are listed on Table 2-1. Prior to accessing monitoring locations on private property each quarter, Olin and MACTEC representatives must verify that access agreements are in place to ensure continued unimpeded admittance to these properties. Prior to accessing any property, MACTEC personnel must notify Olin or at Olin's request contact the owner/resident of their sampling schedule.

3.4.2 Chemical Hazards

Please see the site-specific HASP (MACTEC, 2008) for a full listing of site-COCs, which includes constituents detected in groundwater samples collected at the Site. MACTEC assumes that constituents detected in the groundwater may also be present in the soil.

Section 4.0 of this HASP addendum lists the chemicals which MACTEC personnel may bring to the Site during wetland field work.

3.4.3 Safety Hazards

Fall Hazards, Ladders, Climbing

Sampling activities in the Maple Meadow Brook Wetland will require MACTEC personnel to access well heads and perform sampling activities at heights subject to OSHA fall protection requirements. The well heads (i.e., top of the casing) in which the dedicated tubing is located are located approximately 10 feet above the ground, which will require MACTEC personnel to work at heights of 6 feet or greater.

To mitigate the hazards, MACTEC has installed deer stands (otherwise known as hunting stands), equipped with an appropriate fixed ladder and standard guardrail, at each monitoring well location. Ladders will be required to access the working platform of the deer stands. Ladder access shall be done in accordance with MACTEC Ladders Procedure (Appendix D-C) as follows:

- Erect ladders following the 4 to 1 rule (i.e., base placed a distance from the vertical wall equal to ¼ the working length of the ladder, and position portable ladders so the side rails extend at least 3 feet above the landing.
- Situate/secure the ladder on solid wetland substrate.
- When accessing the ladder, follow the 3 point rule (have one hand and two feet; or one foot and two hands in contact with the ladder) at all times while on the ladder.
- The second employee must secure the ladder while the other person is climbing, descending, or working from that location.
- Secure side rails at the top to a rigid support and use a grab device when 3 foot extension is not possible.
- Ensure the weight on the ladder will not cause it to slip off its support and do not apply more weight on the ladder than it is designed to handle.
- Inspect the ladders for cracked or broken parts such as rungs, steps, side rails, feet and locking components before each use in accordance with the inspection checklist provided in Appendix D-C.
- Use only ladders that comply with OSHA design standards (OSHA, 2006).

All employees assigned to conduct groundwater sampling activities at the Site must be trained in accordance with the MACTEC ladders procedure prior to conducting any work within the Maple Meadow Brook Wetland.

Insects, Poisonous Plants

MACTEC personnel working in the MMBW will enter areas impacted by ticks, wasps, bees, non-poisonous snakes, snapping turtles, poison ivy, poison oak, and globeflower. Personnel should be vigilent to avoid areas containing these hazards whenever possible.

At a minimum, personnel must wear long sleeves, pants, avoid heavy scents (e.g., cologne, perfume, deodrant, etc.), use a insect repellant (preferrably one containing DEET [N,N-diethyl-3-methylbenzamide or N,N-diethyl-m-toluamide]), and bring a wasp or bee spray when working around areas where these insects may be located. Wear light-colored clothing with the pants tucked into boots. Carefully visually inspect clothing and exposed ares of the body for ticks. An insect head or upper body net that can tuck into waders will be provided to employees upon request for areas with heavy bees and wasps presence identified in subsections 3.2 and 3.3 above.

Upon returning home, employees should remove and wash their clothing. Employees assigned to conduct work under this HASP addendum must read and be familiar with the MACTEC Job Hazard Analysis (JHA) for Insect Stings and Bites, which is included as Appendix D-D, and be familiar with signs and symptoms of Lyme Disease.

3.4.4 Limited Daylight Periods

Due to potential hazards present in the MMBW, working during non-daylight times (i.e., twilight or night work) is not permitted. Personnel should be cognisant of sunrise and sunset hours during each sampling event, and plan to complete the last sampling point of the day prior to sunset. At no point must sampling, oversight, or entrance/egress from the MMBW be completed under limited daylight condtions. A flashlight will be included in the field kit in the event that an incident occurs that would require the field team to remain in the MMBW after sunset, for example if an injury occurs and the injured employee cannot walk out of MMBW by his/her own means.

3.4.5 Working on Ice

Work conducted on ice is inherantly dangerous and should never be underestimated. Breaking through the ice on streams with high velocities or depths in excess of three feet is life threatening. The procedures below are considered to be only marginally effective. No reliable method has been identified that will ensure a safe return if a person falls through the ice. Therefore considerable effort must be undertaken to establish the strength of the ice. When in doubt, work must be discontinued.

All operations on ice must be conducted in accordance with *Safe Loads on Ice sheets* by US Army Corps of Engineers Cold Regions Research and Engineering Laboratory (USACE-CRREL) which is included as Appendix D-E (USACE, 1996). Prior to any work on ice, the GSS and a buddy shall assess the ice conditions by checking information about the ice conditions from local officials or local residents (date of

ice formation, open water, sources of warmer water, previous history); checking weather forecasts; and visually checking the ice conditions and measuring the thickness as follows:

Visual Assessment

- Color. Blue ice is the strongest. Gray ice is generally poor.
- Snow cover. As described above, snow insulates ice, which may prevent strong ice formation and bridge open water.
- Cracks. Intersecting cracks are the most dangerous.
- Ice buildup on the banks could conceal thin ice and can be difficult to traverse.
- Ice near the banks or near rocks or fallen trees, etc., can be softer than the surrounding ice.
- Ice with overflow conditions (water over ice) can be unstable – do not walk on this ice. Overflow may refreeze causing one or more layers of ice with flowing water or slush between the layers. Overflow is dangerous and can make visual references (color) to ice stability impossible.

Ice thickness may be irregular, especially late in the season when a thick snow cover may act as an insulator, or when temperatures fluctuate over a long period of time. Water just above freezing can slowly melt the underside of ice, creating thin spots. Ice bridged above water may be weak, even though relatively thick. If temperatures have been or will be above freezing, snowmelt may increase the stage and this pressure on the ice sheet may cause the ice to breakup rapidly (sometimes within a matter of minutes). Ice buildup in the brook may constrict the flow causing faster deeper water in other areas of the brook. Breaking through the ice into deep and/or flowing water could easily sweep a person downstream under the ice.

Thickness Measurement

- If you arrive at a site with significant overflow conditions, do not walk onto the ice.
- Use a crowbar, drill, or auger at distinct intervals to assess the ice thickness in the MMBW.
- Don't step into a hole you are chopping in the ice, the thinner ice may fail.
- If you create significant overflow by augering holes in the ice, leave if conditions become unstable. Look for an alternative location. If the overflow has refrozen causing layered ice conditions, carefully evaluate the ice thickness to ensure it will hold your weight. If there is any doubt find another location or discontinue any work on the river until conditions have improved.
- If a patch of ice looks unsafe, personnel should not attempt to determine its thickness.
- If at any time radial fissures, open water, or creaking or cracking sounds are encountered, personnel should leave the area immediately, and report their findings to the Project Manager.
- Test the ice continually as you walk using solid blows of the crowbar, drill, or auger. If, after repeated blows, the ice remains sound then proceed. If the tool penetrates to the water, go back to the bank immediately. When working on the ice stay in close proximity to the area that has been tested/measured.
- Measure the snow cover thickness on the ice cover; significant variations in thickness may mean highly variable ice thicknesses.

Measure the thickness of ice using the following formula maintained by the US Army Corps of Engineers Cold Regions Research and Engineering Laboratory (USACE-CRREL):

$$h = 4\,(P)^{1/2}$$

Where: h – is the ice thickness in inches

P – is the load, or gross weight in US tons

A uniform safety factor of 50% should be applied when determining if ambient ice thickness is sufficient for supporting personnel and equipment.

If personnel can not ensure reasonable confidence in continuous ice thickeness, work must be suspended and the Project Manager notified.

WARNING: Breaking through the ice on streams with high velocities or depths in excess of three feet is life threatening. The procedures below are considered to be only marginally effective. No reliable method has been identified that will ensure a safe return if a person falls through the ice. Therefore considerable effort must be undertaken to establish the strength of the ice. When in doubt, work must be discontinued.

All employees assigned to conduct work during the colder months of the year shall wear clothing that will help protect against hypothermia. Each employee will wear a Coast Guard-approved personal floatation device (PFD) rated for his/her weight. Due to the amount of gear, equipment, etc. that personnel will need to transport to each location, a Coast Guard-approved inflatable PFD may be used in lieu of the standard type PDF. A rescue plan, which is included as part of the contingency plan in this HASP Addendum, must be attached to the float plan (Appendix D-F) and must be submitted to the Project Manager and SSHS prior to each day's work at the Site. This float plan is intended to notify the Project Manager of the location of project personnel at all times.

3.4.6 Heavy Equipment

Regular sampling operations in the MMBW are not expected to require heavy equipment. Should future operations necessitate heavy equipment; a HASP addendum will be developed to cover those activities.

3.4.7 Physical Hazards

Lifting Hazards, Weight Requirements

For the tasks covered under this HASP addendum, a light-weight kayak will be used by personnel to transport equipment and sample bottles to each location. However, the method of getting the kayak to each location and handling the equipment and bottles requires that personnel lift, carry, and pass objects weighing less than 75 pounds. Objects weighing more than 50 pounds should be "team lifted," or mechanically lifted whenever possible. Recommended Safe Job Procedures are detailed in the site-specific HASP (MACTEC, 2008) and described in the *Environmental Sampling Job Safety Analysis Worksheet* included as Appendix D-G.

Mud, Water, Fallen Trees and Brush

Whenever possible, lift feet upwards using nearby stabile vegetation as support mechanisms when trapped in mud. All scrapes to skin, due to fallen trees or brush should be cleaned with soap and water, and treated with an anti-biotic cream to prevent infection, or possible scarring. In accordance with MACTEC's policies, all injuries must be reported to the LHSR in accordance with MACTEC incident reporting procedures.

Hunters and Well Security

MACTEC personnel working in the MMBW must remain vigilant and visible during hunting season (September through December), and must wear a highly visible orange, yellow, strong yellow green or a fluorescent version of these colors vest of article of clothing (i.e., jacket, vest, etc.) during MMBW sampling events occurring between September and December. A float plan (Appendix D-F) must be submitted to notify the Project Manager and SSHS of the location of project personnel at all times.

3.4.8 Off-site, Off-road Driving

Personnel working in the MMBW will be required to drive a four-wheel drive vehicle over un-even terrain. When driving on sloping ground, attempt to drive straight up or down a slope to reduce the possibility of rolling the vehicle. Personnel will be required to maintain a current driver's license, and be cleared to drive company vehicles per conditions outlined in MACTEC's drivers program. In addition, all personnel must follow requirements outlined in MACTEC's *Vehicle Safety Policy* (Appendix D-H) and *Vehicle Travel -Job Hazard Analysis* included as Appendix D-H. If the vehicle becomes stuck, a winch or similar mechanical device will be used to extract the vehicle.

3.4.9 Slips, Trips, and Falls

Regular sampling operations in the MMBW are not expected to require additional engineering controls, outside those prescribed in the site-specific HASP (MACTEC, 2008).

3.4.10 Cold Stress

MACTEC employees are responsible for following the requirements outlined in MACTEC's Cold Stress Health and Safety Program (Appendix D-I). Personnel should remain vigilant for cold related conditions such as frostnip, frostbite, chilblains, immersion foot -due to prolonged cold exposure by walking in frozen swampy conditions, and hypothermia. Personnel are reminded to notify the SSHS and the Project Manager if any of these conditions are identified. Employees who have a medical conditions such as cardiovascular disease, diabetes, or hypertension, or are taking medication that act on the cardio-respiratory system that interfere with normal body temperatures or tolerance to the cold, shall not be assigned to field work where temperature are below 32° F. The Project Manager must suspend work if weather forecasts indicate extremely cold weather or extremely cold wind chills during the sampling event.

Prior to the start of the sampling round, the GSS or SHSS shall check the weather forecast and ensure that employees assigned to the sampling event have adequate cold-weather gear. Employees should dress in layers, and must also bring extra clothing stored in the field vehicle in the event that person's clothing becomes wet during the sampling activities.

Field team members must regularly observe co-workers in order to detect any signs of hypothermia and other cold-related injuries/illnesses. Avoid dehydration by drinking plenty of water. Avoid caffeine.

<u>Snow, Sleet, Freezing Rain</u>

If personnel working in the MMBW encounter ice, snow, sleet, or freezing rain which readily impacts their safety or the precision, accuracy, reproducibility, comparability or completeness of data collected personnel must exit the wetland immediately and notify the Project Manager. If icy conditions create or have the potential to create and worsen an uncertain working environment, personnel must exit the wetland immediately and seek shelter in the field vehicles until conditions improved and become safe. Personnel must notify the Project Manager that work has been suspended.

3.4.11 Heat Stress

Personnel are responsible for following requirements outlined in MACTEC's Heat Stress Health and Safety Program guidelines described in the site-specific HASP (MACTEC, 2008), and in Chapter 4 - Section III of the OSHA Technical Manual contained in Appendix D-J (OSHA, 2006). Personnel completing strenuous tasks in high temperature conditions should be vigilant for signs of heat exhausting, heat stroke, heat fatigue, and heat exhausting. A work load assessment completed for personnel in a MMBW sampling program yielded physical activity classified as "Heavy-Work" per ACGIH standards. This designation requires constant hydration, frequent breaks in shaded locations, and suggested exertion restrictions (ACGIH, 1992 et seq).

MMBW Heat Stress Job Hazard Analysis
Work-Load Assessment
MACTEC Personnel
****Table III (OSHA, 2006 after ACGIH, 1992)**

ACGIH Work Task	Average Metabolic Rate (kcal/min)	Assumed Time (min) Daily	Total Kcal
Whole Body Work- Very Heavy	15	120	1800
Whole Body Work- Heavy	7	120	840
Whole Body Work - Moderate	5	120	600
Work Both Arms - Moderate	2.5	120	300
Sitting	0.3	60	18
Standing	0.6	30	18
Walking	3	30	90
AVERAGE TASK EXERTION RATE, MMBW SAMPLING DAY:		**367kcal/hr**	

Notes:
1) Work-Load Classified per ACGIH as "HEAVY-WORK: 350-500 kcal/hr"
2) Based on standard 10 hr work day (600 minutes) - at 6.11 kcal/min Average
3) Average Metabolic Rate for Standard 154 lb Worker Exposing 19.4 sq, ft Body Surface
4) Average hourly Metabolic rate computed: ((M1*t1) + (M2*t2) + (Mn*tn)) / (t1 + t2 + tn)

An umbrella (i.e., golf size) will be used to provide shade in the work area as needed.

3.4.12 Materials Handling and Investigation Derived Wastes

During sampling or maintenance operations in the MMBW, MACTEC personnel may encounter chemicals or hazardous materials in containerized and un-containerized forms. Personnel handling and dealing with these substances should be trained, or licensed by federal, state or corporate entities, as appropriate. Under no circumstance shall untrained staff generate, collect, transport, or otherwise manage hazardous materials. All handling and storage activities should be conducted pursuant to MACTEC's *Handling and Storage of Hazardous Chemicals Procedure* (Appendix D-K). Additionally, chemicals

meeting Federal and State criteria for Remediation Waste, Characteristic or Mixed Hazardous Materials, Waste, or Debris should be handled pursuant to the federal and state requirements.

Due to the extreme difficulty of carrying heavy loads through the marsh substrate, IDW consisting of purged ground-water will not be returned to the 51 Eames Street Site. The purged groundwater will be collected in collapsible plastic containers and pursuant to the Massachusetts Contingency Plan (MCP) (310 CMR 40.0045), emptied back down the monitoring well subsequent to sample collection. When field observations (green color) or indicator parameters (specific conductance greater then 20,300 umhos/cm) determine Dense Aqueous Phase Liquid (DAPL) is present in purged groundwater, this liquid will be containerized, and brought back to the 51 Eames Street property for proper, storage, characterization and disposal as described in the Olin Chemical Superfund Site- Site Management Plan..

3.4.13 Drowning/Working Over/Near Water

MACTEC personnel working inside the limits of the MMBA shall conduct operations in compliance with MACTEC Procedure ESH-2.9-23- *Working Over or Near Water* included as Appendix D-L which requires appropriate PPE, engineering controls, life saving equipment, and other procedures. Based on the actual activities which are performed during the groundwater and surface water activities at the MMWB, some of the provisions of the MACTEC procedure do not apply. For example, a life saving skiff would not be required for these activities.

Inflatable PDFs will be worn by all field personnel accessing areas that have the potential to cause a drowning hazard, which is defined in the MACTEC procedure as “when the depth [of water] is 2 or more feet, or when other conditions increase hazards associated with shallower depths such as current, water temperature, wave action, water falls, etc.”

3.4.14 Hand Tools

MACTEC personnel working inside the limits of the MMBW shall conduct operations in compliance with MACTEC Procedure ESH-2.9.21 - *Power and Hand Tools* included as Appendix D-M. Appropriate PPE, engineering controls, and safety procedures will be used/implemented in accordance with that procedure.

3.5 PROTECTIVE MEASURES

The following additional protective equipment will be worn while conducting activities covered by this HASP Addendum.

3.5.1 Levels of Protection

Work covered under this HASP Addendum will be conducted in **Modified Level D**.

Modified Level D protection should be used when the potential for contact with contaminated water/soil/sediment, atmospheric contaminants, liquid splashes, or other direct contact is likely and will not adversely affect or be absorbed through any exposed skin. Modified Level D has the same dermal contact protection as Level C; however, respiratory protection is not required.

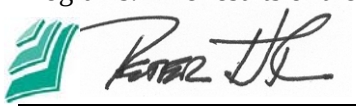
Modified Level D PPE for the Site includes:

Polycoated Tyvek or similar coverall for the protection of contaminants when sampling wells with DAPL.

- Chemical resistant nitrile or vinyl gloves during all sampling activities
- If outer, sturdy nitrile gloves are worn, inner, chemical-resistant gloves are to be worn under the outer glove during the sampling activitity.
- Waders, cold water 12 mil insulated with stocking feet for all sampling activities that require entry into/standing in water.
- Chola cold weather Wader Boots to wear with the waders (specified above).
- For all sampling tasks outside of the Maple Meadow Brook Wetlands that do not require entry or standing in water, Safety toe work boots (over-the-ankle) or cold–weather, insulated safety toe work boots as necessary depending on the ambient temperature.
- Chemical resistant boots covers rubber if the potential for contact with DAPL exists.
- Safety glasses with side shields.
- Hard hat whenever heavy equipment is used on site and when overhead hazards exist.
- Hearing protection whenever heavy equipment is used on site and when noise levels are at or above 85 dB(A).
- Inflatable, Coast Guard-approved personal flotation device when working in or near the water in which the depth of water creates a potential drowning hazard (i.e., 2 feet or deeper).
- Insect net for over the upper body for areas where insects (i.e., bees, hornets, etc.) are prevalent.
- Mudders Mud and Snow Shoes for muddy areas at the Site.
- Work clothing appropriate for weather conditions.
    - Glove liners for warmth.
    - Warm, underwear/clothing (shirt, pants, socks) to be worn under standard work clothing, hat, etc.
- Sunscreen appropriate for the duration of sampling activities conducted where exposure to ultraviolet radiation (i.e., sunlight) exists.

Certification of PPE Hazard Assessment

I certify that the hazard assessment regarding personal protective equipment for MACTEC work as described by this HASP Addendum, at Olin Corporation, 51 Eames Street, Wilmington, Massachusetts was completed on or about March 22, 2006 by Cindy Sundquist and Annette McLean in accordance with 29 CFR 1910.132 and the MACTEC Personal Protective Equipment and Respiratory Protection Programs. The results of the hazard assessment are incorporated in the PPE requirements noted above.



Signature of Project Manager

3.5.2 Monitoring

Monitoring of the work environment will be undertaken to ensure that the personal protective equipment and engineering controls utilized at the site are sufficient to ensure worker safety. At a minimum, this monitoring will include evaluations for hazardous concentrations of airborne volatile organic compounds (VOCs).

3.5.3 Air Sampling Equipment

To the extent feasible, the presence of airborne contaminants will be evaluated through the use of direct reading instrumentation. Information gathered will be used to ensure the adequacy of the levels of protection being used at the site, and may be used as the basis for continuing or stopping work.

Air monitoring equipment to be used on site includes a photoionization detector (PID) equipped with a 11.7 or 11.8 eV Lamp.

3.5.4 Site Monitoring Plan

Prior to sampling a well, total VOC air monitoring using direct reading instruments will be conducted to determine the VOCs. If total VOC readings are sustained at 0.5 ppm, work will cease and the CIH contacted for input in characterizing the exposure situation.

Table 3-2 summarizes the action levels for the levels of protection.

Table 3-2 SITE ACTION LEVES AND LEVELS OF PROTECTION

TASK (Describe)	Anticipated LOP		Upgrade LOP			
	LOP	**Sustained Airborne Levels**	**LOP**	**Sustained Airborne Levels**		
Task: Groundwater sampling MACTEC does not anticipate that surface water and sediment sampling to create airborne exposure hazards.	Modified D	Total VOCs: 0 to 0.5 ppm	Stop work and charcterize	Total VOCs: >0.5 ppm		
THE DEFINITION OF SUSTAINED IS THE CONCENTRATION REMAINS THE SAME FOR MORE THAN ONE MINUTE. IF TOTAL VOC CONCENTRATIONS REACH OR EXCEED 1 PPM IN THE BREATHING ZONE, WORK MUST CEASE AND THE AIR CHARACTERIZED TO DETERMINE WHAT IS CAUSING THE SUSTAINED VAPOR READING. CHARACTERIZATION WILL REQUIRE INPUT FROM THE CERTIFIED INDUSTRIAL HYGIENIST, AND POSSIBLY PERSONAL SAMPLING.						

4.0 MATERIAL SAFETY DATA SHEETS

MACTEC chemical use and chemical storage is anticipated to be minimal during the activities covered by this HASP Addendum. The following table lists those chemicals MACTEC anticipates bringing to the Site. Copies of material safety data sheets (MSDSs) for each of those chemicals are included in D-N. MSDSs for all chemicals brought to the site during activities at the Site will be added to the MSDS section of the Health and Safety Plan and will be reviewed by all affected employees prior to the start of work at the Site.

SITE CHEMICAL INVENTORY

Chemical Name (Match to MSDS)	Estimated Quantity on Site at Any Given Time	Location on Site
Alconox	<1 pound for decontamination of field equipment	Appropriate container in field vehicle
Hydrochloric acid	<40 milliliters (mL) for sample preservation	Sample bottles
Methanol	<500 mL for decontamiation of field equipment	Appropriate container in field vehicle
Nitric Acid	<40 milliliters (mL) for sample preservation	Sample bottles
Sodium bisulfide	<40 milliliters (mL) for sample preservation	Sample bottles
Sodium hydroxide	<40 milliliters (mL) for sample preservation	Sample bottles

A current MSDS must be present on Site for each chemical listed above. All chemical containers must be labeled in accordance with the MACTEC Hazard Communication Program. Subcontractors must maintain their own chemical inventory and provide copies of MSDSs for materials they bring to the Site.

5.0 SITE CONTROL

5.1 ZONATION

Prior to any work at the Site, a method shall be established at each sampling area to control the migration or spread of contaminants as result of field activities. Although typically this method would consist of the creation and delineation of three distinct work zones (i.e., Exclusion Zone, Contamination Reduction Zone, and Support Zone), based on historical results of previous site data and the limited access to the sampling areas MACTEC does not anticipate requiring actual delineation of three work zones.

To reduce the potential for exposure and to prevent migration of contamination outside the work area, personnel will follow the decontamination procedures described in Section 6.0 of this Addendum when exiting the work area.

5.2 COMMUNICATIONS

MACTEC will use voice communication for all communication between MACTEC Associates. MACTEC will also have a celluar telephone available for off-site calls. The GSS will determine the location of the nearest land line telephone and record the location on the emergency information sheet included in this HASP.

The following air horn signals (e.g., using an air horn) may be employed if the SSHS determines that voice communication will be insufficient in the event of an emergency:

HELP	three short blasts	(. . .)
EVACUATION	three long blasts	(_ _ _)
ALL CLEAR	alternating long and short blasts	(_._._)

5.3 WORK PRACTICES

MACTEC workers will be expected to adhere to the established safe work practices defined in the site-specific HASP (MACTEC, 2008). The need to exercise caution in the performance of specific work tasks is made more acute due to: (1) weather conditions; (2) restricted mobility and reduced peripheral vision caused by the protective gear itself; and (3) the need to maintain integrity of the protective gear. Work at the site will be conducted according to established protocol and guidelines for the safety and

health of all involved. Among the most important of these principles for working at a hazardous waste site are the following:

In any unknown situation, always assume the worst conditions and plan responses accordingly.

- All Site personnel must practice the buddy system of at least 2 people who maintain visual contact. All operations inside the MMBA will require three (3) employees. Contact should be either constant or at some frequent interval during field work (frequency should depend on the nature of hazards present). The buddy may be a MACTEC employee or other Site worker as appropriate.

- Establish and maintain communications. In addition to air horn signals, it is advisable to develop a set of hand signals during the 1st sampling event that everyone on Site is familiar with, because conditions may greatly impair verbal communications. These signals shall be re-iterated during the daily safety briefing at the Site.

- Because no personal protective equipment is 100 percent effective, all personnel must minimize contact with contaminated materials (soil, water). Plan work areas, decontamination areas, and procedures accordingly. Do not place equipment on the ground. Do not sit on contaminated/potentially contaminated materials.

- Disposable items will be used, when possible, to minimize risks during decontamination and possible cross-contamination when operating equipment and handling the materials.

- Eating, drinking, chewing gum or tobacco, smoking, and applying lip balm or make-up is prohibited in any area designated as contaminated. Oral ingestion of contaminants is a likely means of introducing toxic substances into the body.

- Personnel must wash hands and face prior to smoking, eating, drinking, applying lip balm or make-up. Field personnel must shower as soon as possible after leaving the site.

- Conflicting situations that may arise concerning safety requirements and working conditions must be addressed and resolved rapidly by the SHSS.

- Personnel must be observant of not only their own immediate surroundings but also that of others. Everyone will be working under constraints; therefore, a team effort is needed to notice and warn of impending dangerous situations. Extra precautions are necessary when working near heavy equipment while using personnel protective gear because vision, hearing, and communication can be restricted.

- Horseplay is prohibited in all work areas.

- Personnel must be aware that chemical contaminants may mimic or enhance symptoms of other illnesses or intoxication. Avoid excess use of alcohol during non-work hours or working while ill during field investigation assignments.

- Working while under the influence of intoxicants, narcotics, or controlled substances is prohibited.

- Good housekeeping procedures shall be followed to reduce slips, trips, and falls.

- Operations shall be restricted to daylight hours unless adequate lighting is provided.
- Avoid activities that un-necessarily generate noise and disturbance not otherwise controlled by this HASP.

6.0 DECONTAMINATION/DISPOSAL

All personnel and equipment leaving contaminated areas of the Site will be subject to decontamination, which will take place in the contamination reduction zone at the work area or on an established location at the Eames Street Facility.

6.1 PERSONNEL DECONTAMINATION

Any time a worker leaves the work area, that worker must perform personal decontamination procedures as described below. In the event of an emergency, decontamination procedures may be waived as described in the contingency plan in this HASP Addendum.

6.2 EQUIPMENT DECONTAMINATION

Dedicated sampling equipment and disposable sampling items will be utilized whenever possible to limit decontamination expenditures. All sampling equipment and other equipment that has come in contact with Dense Aqueous Phase Liquid (DAPL) impacted water/soil will be decontaminated using water, and the wash water captured and drummed. Gross amounts of soil/sediment adhered to equipment will be wiped off or removed using appropriate means that will not cause dust from dried soil.

7.0 EMERGENCY/CONTINGENCY PLAN

This section identifies emergency/contingency planning that has been undertaken for operations at this site. Most sections of this HASP Addendum provide information that would be used under emergency conditions.

7.1 PERSONNEL ROLES, LINES OF AUTHORITY, AND COMMUNICATION

The GSS, in consultation with the SHSS, is the primary authority for directing operations at the Site under emergency conditions. All communications both on- and off-site will be directed through the GSS.

7.2 EVACUATION

If immediate evacuation from the Maple Meadow Brook is necessary, personnel will cease all activities, and safely wade toward the closest upland area. All evacuations will be conducted with the site-specific HASP (MACTEC, 2008).

7.3 EMERGENCY MEDICAL TREATMENT/FIRST AID

Any personnel injured on-site will be rendered first aid as appropriate and transported to competent medical facilities for further examination and/or treatment. The preferred method of transport would be through professional emergency transportation means (e.g., ambulance); however, when this is not readily available or would result in excessive delay; other transport will be authorized. Under no circumstances will injured persons transport themselves to a medical facility for emergency treatment. As soon as possible, the GSS or SHSS will notify the MACTEC Project Manager and the injured person's supervisor.

7.4 EMERGENCY COMMUNICATION PROCEDURES

Prior to the start of site work, the GSS shall hold a pre-work site briefing and inform **ALL** Site personnel, including subcontractor personnel, of the Site emergency communication procedures (e.g., how an emergency situation is communicated to all site personnel). Prior to the start of work at each new area on site, the GSS shall identify an emergency evacuation assembly area upwind of the worksite, for that work site and inform all personnel of that location.

7.5 EMERGENCY DECONTAMINATION PROCEDURES

The level of decontamination in a medical emergency will be determined by the extent of the injury. For minor injuries, personnel must go through the proper decontamination sequence as stated in this HASP Addendum.

7.6 EMERGENCY RESPONSE FOR SEVERE WEATHER CONDITIONS

This section specifies what you should do in the event of a severe weather emergency, including electrical storms, high winds, and weather related icing.

7.6.1 Electrical Storms

- Seek shelter in the field vehicles.
- Do not stand near or under high objects, such as trees and drilling rigs.
- If possible, lower the drilling rig mast.

7.6.2 High Winds

- If conditions warrant, exit the wetland to seek shelter in the field vehicles.
- Avoid high, unprotected elevated positions.
- Park vehicles heading into the wind, and away from possible blowing objects or falling trees.
- If possible, secure loose objects, which may create projectile hazards.

7.6.3 Freezing Rain or Sleet, or Heavy Snow

- Cease working and exit wetland if icy conditions create a dangerous working environment.
- If conditions warrant, seek shelter in the field vehicles.

7.7 DISTANCE FROM DRY LAND

Maple Meadow Brook operations covered in this HASP Addendum require work in areas which are up to 1,000 feet from dry land. Due to these isolated locations, access to medical facilities, emergency supplies, and engineering controls may be delayed for 1 hour or more. Planning and preparation for un-expected events is necessary to mitigate potential hazards. A cellular phone, signal flares, and "float plan" detailing specific locations and the operations/activities the field teams are executing each day are required. These plans will be made available to the MACTEC Project Manager, Wakefield Local Health and Safety Representative (LHSR), and Olin Site Manager prior to each sampling day. In the event of an emergency, the SHSS will speak directly with the Project Manager who will be responsible for notifying the appropriate public safety personnel, as well as facilitating the extraction of the affected field personnel, if required.

7.8 MEDICAL EMERGENCIES IN REMOTE LOCATIONS

As described in subsection 7.7, the sampling areas are remote locations within the MMBW. All MACTEC personnel conducting activities covered by this HASP Addendum must be current/certified in CPR and First Aid prior to being assigned to work covered under this HASP Addendum. In the event of an emergency, the SHSS will speak directly with the Project Manager who will be responsible for notifying the appropriate emergency services, as well as facilitating the extraction of the impacted field personnel, if required.

Un-impacted field personnel will be expected to assess and care for injured person to the extent of their comfort and training, and to the best of their ability. Since work covered under this HASP Addendum requires at least three MACTEC employees at all times to be at the work area, one employee will assist the victim while the other employee exist the wetland to meet and direct emergency services and public safety personnel to the injured employee, as required. If a medical emergency occurs, the MACTEC Regional HSO shall be notified by the MACTEC Project Manager.

8.0 ADMINISTRATION

8.1 AUTHORIZED PERSONNEL

MACTEC Personnel authorized to participate in exclusion zone (work area) activities at this Site have been reviewed and certified for site operations by the MACTEC Project Manager. Certification involves the completion of appropriate training, a medical examination, and review and acceptance of the site-specific HASP (MACTEC, 2008) and this HASP Addendum. All persons entering the Site must use the buddy system, and check in with the GSS before entering the exclusion zone (work area).

MACTEC FIELD TEAM MEMBERS:	Position/Title
Chris Mazzolini*+	General Site Supervisor and Site Safety and Health Supervisor
Peter Thompson	Project Manager

Other Potential MACTEC Field Personnel:

David Chapman*+

Phil Muller*+

Jerry Rawcliffe *+

Daron Kurkjian*+

Tom Hanlon*+

* First-Aid-Trained

\+ CPR-Trained

8.2 HASP ADDENDUM APPROVAL

Scheduled Start-up Date: TBD	Scheduled Start-up Time: ~0800
Project: Olin Chemical Superfund Site RI/FS	Site: Wilmington, MA
Site Location: 51 Eames Street, Wilmington, MA	

We have reviewed the site-specific HASP and the HASP Addendum for the above referenced site. We recognize that when this form is completed, the attached HASP Addendum is approved for the field activities on the above referenced site. Changes to this HASP Addendum shall be documented in writing and approved in accordance with MACTEC policies. Signatures also serve as certification of completion of the Hazard Assessments as required by 29 CFR 1910.132.

Annette McLean — 8-11-09
Name and Signature of HASP Addendum Author — Date

For Cindy Sundquist — 8-11-09
Name and Signature of HASP Addendum Reviewer *with permission*
Date

Peter H. Thompson — 8-11-09
Name and Signature of Project Manager — Date

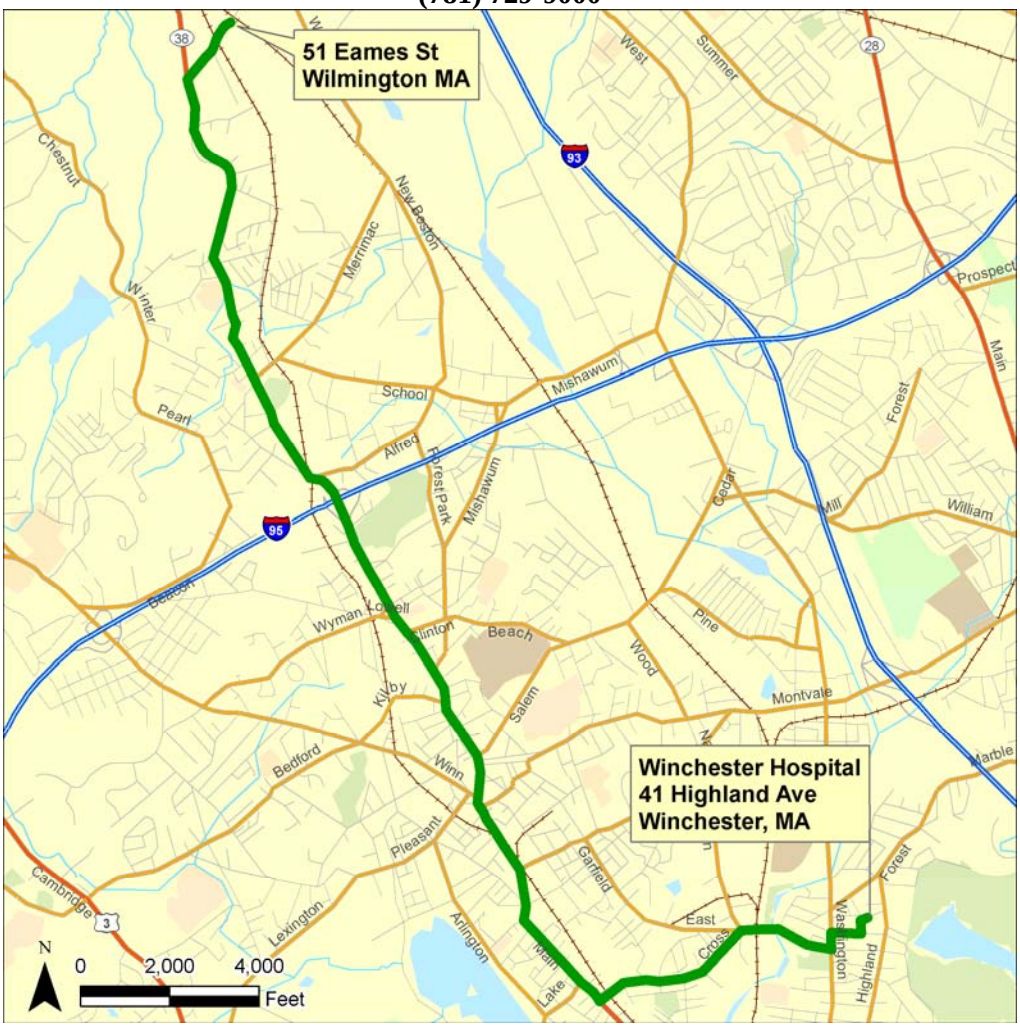
Chris Mazzolini — 8-11-09
Name and Signature of General Site Supervisor — Date

Chris Mazzolini — 8-11-09
Name and Signature of Site Health & Safety Supervisor — Date

8.3 MAP AND ROUTE TO EMERGENCY MEDICAL FACILITY

The primary source of medical assistance for the site is:

Winchester Hospital
41 Highland Avenue, Winchester, MA 01890
(781) 729-9000



Driving distance: 6.2 mile(s) Driving time: 9 minute(s)			
1:	Depart 51 Eames St		
2:	Go South West on Eames St toward Jewel Dr	0.3 mile(s)	< 1 minute
3:	Turn left on STHY 38 (Main St)	4.5 mile(s)	5 minute(s)
4:	Turn left on Cross St	1.1 mile(s)	1 minute(s)
5:	Turn left on Washington St	< 0.1 mile(s)	< 1 minute
6:	Turn right on Fairmount St	0.1 mile(s)	< 1 minute
7:	Turn left on Maple Rd	< 0.1 mile(s)	< 1 minute
8:	Turn right on Valley Rd	< 0.1 mile(s)	< 1 minute
9:	Turn left on Highland Ave	< 0.1 mile(s)	< 1 minute

9.0 Works Cited

Health and Safety Plan for the Olin Site (also referred to as the site-specific HASP), MACTEC Engineering and Consulting Inc., September, 2003. (MACTEC, 2008)

Wilmington Site Health & Safety Plan for General Activities, Olin Corporation. Issued September 1998, Revision # 2, last revised 6/14/05. (Olin, 2005)

The Wilmington Site Health & Safety Plan/Emergency Action Plan/Plant B Area', Olin Corporation. Issued June 1998, revision #1.1, last revised 1/30/06. (Olin, 2006)

Health and Safety Program No. 9.1, Boating Safety, MACTEC Engineering and Consulting Inc. Issued March 9, 2004. (MACTEC, 2004)

Health and Safety Procedure ESH-2.9.3 Rev. 0 – Ladders, MACTEC Engineering and Consulting Inc. Issued January 17, 2006. (MACTEC, 2006)

Health and Safety Job Hazard Analysis – Insect Stings and Bites, MACTEC Engineering and Consulting Inc. September, 2000. (MACTEC, 2000)

Health and Safety Job Hazard Analysis – Environmental Sampling, MACTEC Engineering and Consulting Inc. September, 2000. (MACTEC, 2000A)

Health and Safety Procedure ESH-2.5 Rev. 0 – Vehicle Safety, MACTEC Engineering and Consulting Inc. Issued October 10, 2004. (MACTEC, 2004A)

Health and Safety Program No. 6.3 – Cold Stress Program, MACTEC Engineering and Consulting Inc. Issued October 20, 2003. (MACTEC, 2003B)

Health and Safety Program No. 5.5.1- Handling and Storage of Hazardous Chemcials, MACTEC Engineering and Consulting Inc. Issued June 18, 2004. (MACTEC, 2004B)

Health and Safety Procedure ESH-2.9.23 Rev. 0 – Working Over or Near Water, MACTEC Engineering and Consulting Inc. Issued February 28, 2006. (MACTEC, 2006A)

Health and Safety Procedure ESH-2.9.21 Rev. 0 – Power and Hand Tools, MACTEC Engineering and Consulting Inc. Issued November 29, 2005. (MACTEC, 2005)

Heat Stress – Section 3: Chapter 4, Occupational Safety and Health Administration- OSHA On-line. www.OSHA.gov/dts/osta, March, 2006. (OSHA, 2006)

Massachusetts Maps, Wilmington – MA, YAHOO INC, - GDT Inc, 2002.

Safe Loads on Ice Sheets, US Army Corps of Engineers Cold Regions Research and Engineering Laboratory. Hanover, New Hampshire. January, 1996. (USACE, 1996)

APPENDIX D-A

DAILY SAFETY MEETING/TRAINING FORM

MACTEC ENGINEERING AND CONSULTING, INC.

DAILY SAFETY MEETING CHECKLIST

Project:	Olin	Site:	Olin -Wilmington
Date:		Location:	Wilmington, MA

To be reviewed on the first day of site activities and when new workers arrive on site:

Site Health & Safety Officer: _____

Alternate for Health & Safety: _____

Location of on-site HASP: _____

Site training requirements: See HASP

Specific medical surveillance requirements: See HASP

During the project, one or more of the agenda items could be selected for the required daily site training.

Date: __ __ __ __ __

	Agenda:	**Check-off:**
1.	Planned work for this day (discuss)	☐ ☐ ☐ ☐ ☐
2.	Physical hazards and controls (discuss/review)	☐ ☐ ☐ ☐ ☐
3.	Chemical hazards and controls (discuss/review)	☐ ☐ ☐ ☐ ☐
4.	Biological hazards and controls (discuss/review)	☐ ☐ ☐ ☐ ☐
5.	Personal protective equipment Modified D	☐ ☐ ☐ ☐ ☐
6.	Personal protective equipment required per the hazard assessment:	☐ ☐ ☐ ☐ ☐

	SPECIFY TYPE
Protective coveralls	
Safety glasses/goggles	ANSI approved
Hard hat	ANSI approved
Foot protection	Safety boots & overboots
Work gloves	
Chemical gloves	
Hearing protection	
Other	

7.	Review inspection, decontamination, and maintenance procedures and the limitations of the above stated PPE.	☐ ☐ ☐ ☐ ☐
8.	Decontamination procedure (discuss/review)	☐ ☐ ☐ ☐ ☐
9.	Exclusion zone maintained	☐ ☐ ☐ ☐ ☐
10.	Site emergency response plan (discuss/review)	☐ ☐ ☐ ☐ ☐
11.	Signs and symptoms of overexposure to chemicals anticipated on site	☐ ☐ ☐ ☐ ☐
12.	General health and safety rules	☐ ☐ ☐ ☐ ☐
13.	Specific health and safety requirements relating to site activities including: (discuss/review)	
	Drilling/boring	☐ ☐ ☐ ☐ ☐
	UST	☐ ☐ ☐ ☐ ☐
	Excavations	☐ ☐ ☐ ☐ ☐
	Heavy equipment	☐ ☐ ☐ ☐ ☐
	Slips, trips, and falls	☐ ☐ ☐ ☐ ☐
	Lockout/tagout	☐ ☐ ☐ ☐ ☐
	Working in temperature extremes	☐ ☐ ☐ ☐ ☐
14.	Other health & safety issues (discuss/note)	☐ ☐ ☐ ☐ ☐

I have participated in the daily safety meeting discussing the topics indicated on the reverse and fully understand my responsibility for complying with all health and safety requirements. I have had the opportunity to have my questions on site health and safety issues and procedures answered.

Employee Name	Employee Signature	Date

Name and Signature of person conducting training

Date

APPENDIX D-B

VICINITY MAP

LEGEND

- MMB-SW/GW-XX/MP-> MAPLE MEADOW BROOK SURFACE WATER / GROUNDWATER MONITORING LOCATIONS

SCALE IN FEET

0 200 400

PREPARED BY	JCN
CHECKED BY	KJC
DATE	3/7/06

51 EAMES STREET
WILMINGTON, MASSACHUSETTS

MACTEC

FIGURE 1

MMBA PRE-REMEDIAL INVESTIGATION SITE MAP
MONITORING LOCATIONS IN
MAPLE MEADOW BROOK AQUIFER

SCALE	AS SHOWN
CONTRACT	6300030008-62.04
DWG. NO.	
REV	0
PAGE NO.	1

CADD FILE: P:\W5-CHEM\OUN\Wilmington\FIGURES\Revised Well Locations (Ph II SOW 041003).dwg 05/03/2006 12:26pm armclean

APPENDIX D-C

LADDERS PROCEDURES

LADDERS

1. PURPOSE

The purpose of this Procedure is to provide minimum safety requirements for the general use of portable and fixed ladders.

2. SCOPE

This Procedure applies to all MACTEC operations where portable and fixed ladders are used.

3. REFERENCES

MACTEC Fall Protection Procedure

29 CFR 1910 Subpart D – *Walking-Working Surfaces* (applicable sections)

29 CFR 1926 Subpart X - *Ladders*

4. ACRONYMS AND DEFINITIONS

3 Point Rule – A safety rule regarding ladders. When climbing a ladder, have two (2) feet and one (1) hand or two (2) hands and one (1) foot on the ladder at all times, even when working.

4 to 1 Rule – A simple safety rule for setting up a ladder at the proper angle - place the base a distance from the vertical wall equal to one-fourth the working length of the ladder.

Double cleat ladder - A ladder similar in construction to a single-cleat ladder, but with a center rail to allow simultaneous two-way traffic for employees ascending or descending.

Fixed ladder - A ladder that is permanently attached to part of a building or structure.

Job-made ladder - A ladder fabricated by employees. One that is not commercially available.

Non-self-supporting ladder - A portable ladder that must be leaned against or attached to a building, structure, or other stable object for use. Straight ladders and extension ladders are the most common examples.

Portable ladder - A ladder that can be readily moved or carried.

Single-cleat ladder - A ladder consisting of a pair of side rails, connected together by cleats, rungs, or steps.

5. REQUIREMENTS

5.1 General Ladder Use

5.1.1 Work is not to be performed from a ladder unless the 3 Point Rule can be followed. Consideration should be given to use other temporary or permanent work platforms as they are typically safer than ladders. These other forms of work platforms eliminate many of the factors that lead to falls, and may be far more productive and efficient (e.g., scissor lifts or scaffolds). Safety related considerations include:

- Stability of the object or structure used as a support.
- Whether the user can safely reach the object to be worked on from a ladder.

- Whether the ladder can be securely fixed so as to prevent slipping outward or sideways.
- Whether the work can be performed while implementing the 3 Point Rule.
- Whether the ladder will sway or vibrate during use which might increase the risk of the user losing balance that could result in a fall.
- Whether tools that are required for the work can be safely managed while on the ladder and kept from falling and striking someone or something below.

5.1.2 A ladder must be provided for worker access if there is a break in elevation of 19 inches or more (unless a stairway is present).

5.1.3 Employees shall face the ladder when ascending or descending.

5.1.4 Heavy or bulky tools, equipment and welding cables, etc., shall be raised or lowered using a rope or a bucket.

5.1.5 Employees shall not overextend their reach while working from a ladder. A good guide is to keep your belt buckle within the side rails of the ladder.

5.1.6 All ladders shall be secured prior to use. Barricades stall be used if ladders are to be placed in doorways, passageways, or other locations where the ladder could be affected. Any door that could strike or impact the safe use of the ladder shall be closed and locked or blocked and signs indicating ladder use shall be posted on applicable doors and passageways.

5.1.7 Wood or fiberglass (never metal) ladders must be used (i.e., ladders made of a nonconductive material) when there is a possibility of contact with electrical wires or while working on or with electrical equipment.

5.1.8 Surrounding areas shall be checked for power lines, electrical wires, or other obstructions before raising a ladder. Ladders shall not be used within the falling radius of an electrical line.

5.1.9 Employees shall keep clear from the area below a ladder that is in use, except the person bracing a ladder.

5.1.10 Employees using ladders shall wear heavy-soled, slip resistant footwear to prevent fatigue and/or injury to feet caused by climbing or standing on rungs.

5.1.11 Before climbing any ladder, employees shall make certain that the soles of their footwear are free of mud, snow, ice, grease, oil, or any other substance that might cause them to lose their footing while on the ladder.

5.1.12 Ladders shall not be used during high winds, and work should be postponed until wind subsides. If the use of a ladder is unavoidable during high winds, a supplemental fall protection device shall be used (e.g., a personal fall arrest system). **See MACTEC's Fall Protection Procedure.**

5.1.13 Portable ladders must be capable of supporting at least 4 times the maximum intended load (3.3 times for type 1A metal or plastic ladders).

5.1.14 Ladder selection shall be based on intended combined load of the person plus the equipment and materials that is expected to be on the ladder at any one time.

5.1.15 Wooden ladders shall not be coated with any opaque covering, except for identification or warning labels that may be placed on one face of a side rail.

5.1.16 Whenever possible, 2 people shall carry a ladder greater than 10 feet in length. If unavoidable, the ladder shall be carried near the middle with the front end a little higher than the back end.

5.1.17 Non-self-supporting ladders shall always be secured before routine use.

5.1.18 Ladders shall be positioned to prevent slipping by securing the top and base. Do not climb an unsecured ladder unless someone is holding the ladder at the base.

5.1.19 Only one person may be on a ladder at any one time, unless the ladder is specifically designed for 2 or more persons such as a double cleat ladder.

5.1.20 A double-cleat ladder or two or more separate ladders shall be provided when ladders are the only mean of access or exit from a working area for 25 or more employees, or when a ladder is to serve simultaneous two-way traffic.

5.1.21 Ladders shall be erected following the 4 to 1 Rule and the ladder's base shall not be placed on boxes, drums, or other unstable material or surfaces.

5.1.22 Ladders shall never be spliced together in order to gain increased length.

5.1.23 Ladders should be stored in a dry area and away from damaging chemicals.

5.1.24 Ladders shall be stored either horizontally or vertically with support at each end, and support in the middle for all ladders over 15 feet in length (storage length) that are stored horizontally.

5.1.25 Material and/or equipment shall not be stored on ladders.

5.1.26 Rung locks, rope pulleys, spreader bar hinges, and other moving parts of ladders shall be inspected prior to use to ensure that they are in good repair and kept lubricated with oil or grease as required.

5.1.27 Lubricants and other slippery substances shall be kept off rails, rungs, and any other parts of a ladder where grip or traction is important to ensure safe use. Ladders shall be cleaned immediately if these parts come in contact with such materials.

5.1.28 If a ladder falls, it is to be re-inspected for damage prior to re positioning it.

5.2 Extension Ladders

5.2.1 Extension ladders shall not be used horizontally as a working platform.

5.2.2 Ladders shall extend 3 feet (36 inches) above the roof, platform, or resting point or be equipped and secured with a grasping rail for mounting and dismounting.

5.2.3 On two-section extension ladders, the minimum overlap for the two sections shall be as follows:

Size of ladder	Overlap
Up to 36 feet	3 feet
Over 36 to 48 feet	4 feet
Over 48 to 60 feet	5 feet

5.2.4 All extension ladders equipped with support rods shall be used in an upright position so that the rods are below the rungs for added support.

5.2.5 Extension ladder length must be adjusted while standing at the base of the ladder to be sure the locks are properly engaged.

5.2.6 Two-section extension ladders must be placed so that the narrow section rests on top of the wider section and toward the user.

5.2.7 Employees shall never work from an extension ladder when their head is higher than the top of the ladder.

5.2.8 The feet of an extension ladder should be in the approximate position of intended use before it is extended. An extension ladder shall not be moved unless the upper section(s) is completely lowered.

5.3 Step Ladders

5.3.1 Stepladders shall be fully opened with spreader bars locked before use.

5.3.2 The top cap, top step, pail holders, or the rungs on the back legs of a step ladder shall never be used as a step.

5.4 Fixed Ladders

5.4.1 If the top of a fixed ladder is 24 or more feet above the bottom of the ladder then the ladder shall be equipped with one or more of the following:

- A ladder safety device;
- A cage or well;
- Self-retracting lifeline and rest platform(s) at intervals of less than 150 feet; or
- A cage or well and multiple ladder sections. Each ladder section must be less than 50 feet in length, offset from adjacent sections, and with landing platforms at maximum intervals of 50 feet.

5.4.2 Employees shall not use any fixed ladder that does not meet these minimum requirements without appropriate modifications.

5.4.3 Fixed ladders must be capable of supporting at least 2 loads of 250 pounds and each step or rung shall be capable of supporting at least 250 pounds.

6. PROCEDURE

Step No.	Performer	Action
6.1	Local Operations Manager, Project Manager, Supervisor, or Field Team Leader	• Ensure that ladders are used in accordance with this Procedure as well as the ladder manufacturer's recommendations. • Ensure employees who use ladders as part of their work activities are trained to all applicable requirements of this procedure.
6.2	Employee	• Receive training on all applicable requirements of this Procedure prior to using a ladder. • Inspect ladders prior to each day's use. • Complete **Attachment A** • Report to the Supervisor all broken or damaged ladders (i.e., mechanical defects, fire or chemical damage), then tag them and remove from service.

7. RECORDS

All documents generated as a result of the implementation of this Procedure shall be kept in the project file.

8. ATTACHMENTS

Attachment A Ladder Inspection Form (typical)

Attachment A

Ladder Inspection Form (typical)

ID Of Ladder Being Inspected:

Name of Inspector: Date:

Employees shall inspect the ladder(s) prior to use. Ladders found to be damaged or defective shall be tagged "**Do Not Use**" (or similar language) and be removed from service.

All applicable items below must be checked off as OK. Any finding shall be noted at the bottom and the ladder tagged as defective/damaged and removed from service until repaired. If the ladder cannot be repaired, it shall be discarded.

	General (Place a mark next to each item if it was checked prior to use)
	Are rails free of damage such as bends or cracks?
	Are rungs free of damage such as bends, cracks, loose rail connections or missing rivets?
	Are ladder feet in good repair, not be broken or malfunctioning, and with slip-resistant pads intact?
	Are ladders free of dirt, mud, snow, ice, oil, or grease that would increase the hazard of losing grip or slipping on the ladder?
	On step ladders, are the spreader bars in good working order?
	Extension Ladders
	Are ropes in good condition, not frayed, cut, worn, or otherwise damaged?
	Are pulleys functioning smoothly?
	Are rung locks engaged correctly?

Findings:

APPENDIX D-D

INSECT STINGS AND BITES JOB HAZARD ANALYSIS

Job Hazard Analysis - Short Form HASP

Job Title: Insect Stings and Bites **Date of Analysis:** 4/20/06

Minimum Recommended PPE*: Long sleeved shirt and pants, light colored clothing

*See HASP for all required PPE

Key Work Steps	Hazards/Potential Hazards	Safe Practices
1. Traveling/working in areas with potential Tick Bites –Example outdoor wooded areas or fields.	1. Lyme Disease, Rocky Mountain Spotted Fever, etc.	1A) Spray clothing with insect repellant as a barrier. 1B) Wear light colored clothing that fits tightly at the wrists, ankles, and waist. 1C) Each outer garment should overlap the one above it. 1D) Cover trouser legs with high socks or boots. 1E) Tuck in shirt tails. 1F) Search the body on a regular basis, especially hair and clothing; ticks generally do not attach for the first couple of hours. 1G) If a tick becomes attached, pull it by grasping it as close as possible to the point of attachment and pull straight out with gentle pressure. Wash skin with soap and water then cleanse with rubbing alcohol. Place the tick in an empty container for later identification, if the victim should have a reaction. Record dates of exposure and removal. 1H) Do not try to remove the tick by burning with a match or covering it with chemical agents. 1I) If you can not remove the tick, or the head detaches, seek propmt medical help. 1J) Watch for warning signs of illness: a large red spot on the bite area; fever, chills, headache, joint and muscle ache, significant fatigue, and facial paralysis are reactions that may appear within two weeks of the attack. Symptoms specific to Lyme disease include: confusion, short-term memory loss, and disorientation.
2. Working/traveling in areas with potential bee and wasp stings-Example wooded areas and fields	2. Allergic reactions, painful stings	2A) Be alert to hives in brush or in hollow logs. Watch for insects travelling in and out of one location. 2B) If you or anyone you are working with is known to have allergic reactions to bee stings, tell the rest of the crew and your supervisor. Make sure you carry emergency medication with you at all times. 2C) Wear long sleeve shirts and trousers; tuck in shirt.. Bright colors and metal objects may attract bees. 2D) If you are stung, cold compresses may bring relief. 2E) If a stinger is left behind, scrape it off the skin. Do not use a tweezers as this squeezes the venom sack, worsening the injury. 2F) If the victim develops hives, asthmatic breathing, tissue swelling, or a drop in blood pressure, seek medical help immediately. Give victim antihistime, (Benadryl, chlo-amine tabs).
3. Traveling/working in areas of potential Mosquito Bites-Example- Woods, fields, near bodies of water and etc.	3. Skin irritation, encephalitis	3A) Wear long sleeves and trousers. 3B) Avoid heavy scents. 3C) Use insect repellants. If using DEET, do not apply directly to skin, apply to clothing only. 3D) Carry after-bite medication to reduce skin irritation.

Completed by: Annette McLean 10/06/08

APPENDIX D-E

SAFE LOAD ON ICE SHEETS (ACOE)

US Army Corps of Engineers

U.S. ARMY COLD REGIONS RESEARCH & ENGINEERING LABORATORY
Hanover, New Hampshire
SAFETY ON FLOATING ICE SHEETS

For many of us in northern climates, working or playing on the frozen surface of a river or lake is part of winter. Knowing how to do so safely can be a matter of life or death. This handout presents general, common-sense precautionary measures that should be followed when you plan to be on a floating freshwater ice cover. Since it cannot cover every ice condition you may encounter, your judgement is critical. Remember: *Only you are responsible for your own safety!*

PREPARATION

There are four things to focus on when planning an outing on the ice: your **physical condition**, your **clothing**, your **equipment**, and your **procedures**.

Physical condition

Anyone who goes out on the ice should be in reasonably good condition and be able to sustain periods of intense exertion if an emergency arises-either falling through the ice themselves or rescuing someone who does. Being able to swim, or at least being comfortable staying afloat, is important in an emergency and can reduce the chances for panic.

Clothing

Naturally you should choose clothing that provides protection from low air temperatures, wind, and precipitation while at the same time allowing you mobility. But in addition, when you select clothing, keep in mind the possibility of falling through the ice. Clothing that would severely restrict your ability to swim or to stay afloat is not a good choice. Hip boots or waders should never be worn, as they can fill with water and restrict movement while adding weight. A personal flotation device (PFD) should be worn. This can be a vest or jacket, either inflatable or aturally buoyant.

Equipment

Include items for testing and measuring the ice thickness, as well as items for rescue or self-rescue. In the first category are a heavy ice chisel, an ice drill or auger (manual or powered), a measuring tape or stick that can be hooked under the bottom edge of the ice in an auger hole, and possibly a perforated ladle for cleaning ice out of the auger holes. In addition to the PFD, bring a rope or rescue throw bag containing a rope that floats. Ice rescue picks sold for ice fishermen are an excellent idea. They thread through your jacket sleeves like children's mittens and are immediately available in an emergency for pulling yourself out of the water onto the ice.

Procedures

- *Never go out on an ice cover alone, and never go out on the ice if there is any question of its safety.*

- While you are planning the outing, obtain the record of air temperature for the past several days and continue observing air temperatures while the ice will be used to support loads.
- Always let someone know of your plans and when you will return.
- When you arrive at the water's edge, visually survey the ice. Look for open water areas, and look for signs of recent changes in water levels: ice sloping down from the bank because the water dropped, or wet areas on the ice because the water rose and flooded areas of the ice that couldn't float because it was frozen to the bottom or the banks. (If the ice is snow-covered, look for wet areas in the snow.)
- Listen for loud cracks or booms coming from the ice. In a river this can mean the ice is about to break up or move; on a lake larger than several acres such noises may be harmless responses to thermal expansion and contraction.
- Look for an easy point of access to the ice, free of cracks or piled, broken ice.
- If you are taking a vehicle or other equipment on the ice, go out on foot first. Vigorously probe ahead of yourself with the ice chisel. If the chisel ever goes through, carefully turn around and retrace your steps back to shore, and try again some other day.
- Near shore, listen for hollow sounds while probing. Ice sloping down from the bank may have air space underneath. This is *not* safe; ice must be floating on the water to support loads.
- After getting on the ice, others in the group should follow in the leader's steps, but stay at least 10 feet apart.
- Only after you have learned the characteristics of the ice cover should any vehicle be taken on the ice.

WHAT YOU NEED TO KNOW ABOUT THE ICE

Once on the ice it is time to begin more systematic observations of the ice sheet you want to use to support a load. There may be many variations in the structure, thickness, temperature, and strength of a floating freshwater ice sheet.

How thick is the ice?

This is determined by drilling holes with the drill or ice auger. The technique is to drill a hole and check the ice thickness every 150 feet or so along the intended path. This should be done more frequently if the ice thickness is quite variable. Note whether the ice in each hole is clear (sometimes called black ice) or white (due to air bubbles-sometimes called snow ice). Measure the thickness of both kinds.On rivers the ice thickness and quality can change a lot in a short distance; be particularly alert to variations in ice thickness due to bends, riffles or shallows, junctions with tributaries, etc. For both rivers and lakes, warm inflows from springs can create areas of thinner ice. The ice near shores can either be thinner (due to warm groundwater inflow or the insulating effect of drifted snow) or thicker (due to the candle-dipping effect of variable water levels).

Measure the snow cover thickness on the ice cover; significant variations in thickness may mean highly variable ice thicknesses.

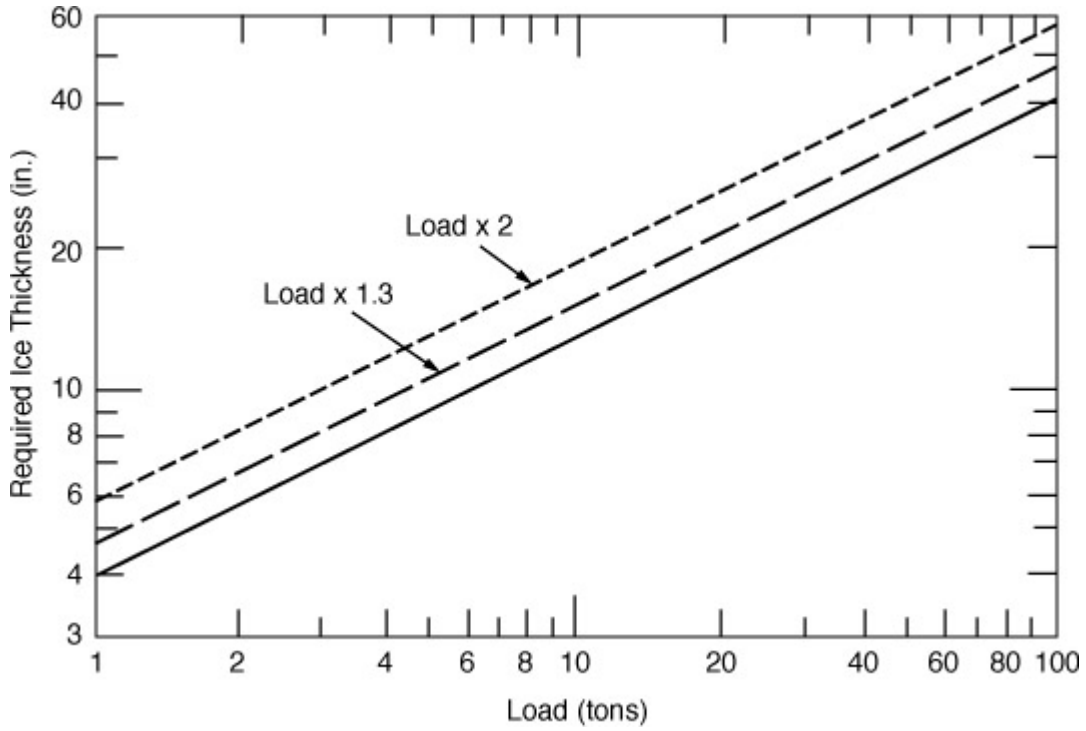
How thick does it need to be?

A simple formula to estimate the minimum ice thickness required to support a load is:

$$h = 4\sqrt{P}$$

where **h** is the ice thickness in inches and **P** is the load, or gross weight, in tons. You can also use the graph or table to determine the minimum thickness.

Remember that the load is the *total* load in tons (not a vehicle's load capacity).



Minimum ice thickness required to support a load

Ice Load (tons)	*Required ice thickness (inches)*	*Distance between loads (feet)*
0.1	2	17
1	4	34
2	6	48
3	7	58
4	8	67
5	9	75
10	13	106
20	18	149
30	22	183
40	26	211

The equation, graph, and table are valid when the load (such as a person on foot, or a wheeled or tracked vehicle) is distributed over a reasonable area of a continuous ice sheet. The larger the load, the greater the area it should cover for the calculation to remain valid. *Neither large loads that are concentrated in relatively smaller areas, nor loads that are at or near the edge of a large opening in the ice, are safely described by the equation, graph, or table.* In such cases, *seek more advice*.

The equation, graph and table assume clear, sound ice. If white, bubble-filled ice makes up part or all of the ice thickness, count it as only half as much clear ice.

Any recent large snowstorm creates a new load on the ice. If the new snow is heavy enough, the ice sheet will sag and its top surface will be submerged below the water level. Then water will flood the top of the ice sheet through cracks, saturating the lower layers of the snow. Until this slush is completely frozen, *stay off* the ice sheet. When the saturated snow becomes frozen, it is an added thickness of white ice.

Contrary to what you would expect, a rapid, large air temperature drop makes an ice sheet *brittle,* and the ice *may not be safe* to use for 24 hours or more.

If the air temperature has been *above* freezing for at least 6 of the past 24 hours, multiply the load by 1.3 before you use the equation (or use the lower dashed line on the graph), obtaining a larger minimum ice thickness to account for any possible weakening. If the air temperature stays above freezing for 24 hours or more, the ice starts losing strength, and the equation, figure, and table no longer represent safe conditions. *Stay off the ice!*

You are likely to encounter cracks in the ice. Cracks are either wet or dry. If they are dry, they do not penetrate the ice sheet and are not a concern. If they are wet, multiply the load by 2, as shown on the graph, before you use the equation to obtain the required minimum ice thickness. If you plan to leave a load on the ice for extended periods, usually more than two hours, multiply the load by 2 (as shown by the upper dashed line in the graph) before you use the equation to find the required minimum ice thickness.

SAFE OPERATIONS ON THE ICE COVER

- If using an enclosed vehicle, *always* drive with the windows or a door open for quick escape.
- If you drive across wet cracks, your path should be as close to perpendicular to them as possible, instead of parallel to them.
- A load deflects the ice slightly into a bowl shape. When you drive on floating ice, this moving bowl generates waves in the water. If the speed of the waves equals the vehicle speed, the ice-sheet deflection is *increased* and the ice is much more likely to break. The problem is more serious for thin ice and shallow water. In general you avoid this danger by driving below 15 mph.
- When there are two loads on the ice, the safe distance between them is about 100 times the ice thickness at the required minimum thickness. This is shown in the third column of the table. When the two loads are different, choose the spacing shown for the larger load. At ice thicknesses greater than the required minimum, this spacing can be reduced.

- A loaded ice sheet will creep, or deform, over a long period of time, *without any additional load.* If an ice sheet has to be loaded for a long period, drill a hole near the load. If the water begins to flood the ice through the hole, move the load *immediately.* Remember this if your vehicle ever becomes disabled: if left for a few days, it may break through the ice as a result of long-term creep.

IN CONCLUSION...

Be sure you understand this information. Don't hesitate to seek the advice of others whose experience you trust. Be safe out on the ice!

US Army Corps of Engineers
Cold Regions Research and Engineering Laboratory
72 Lyme Road, Hanover, New Hampshire 03755, USA
CRREL Public Affairs Office, 603-646-4386

US Army Corps of Engineers

Ice Thickness and Strength for Various Loading Conditions

Every winter it becomes very important to know when the ice is safe to use. Here are some guidelines for determining the safety of freshwater ice. The following table of safe loads is valid ONLY for ice that is clear and sound, with no flowing water underneath. it is not reliable for stationary loads. **When in doubt, stay off the ice !**

It is highly recommended that you familiarize yourself with the Safety on Floating Ice Sheets information by CRREL.

Loads on Ice

Required Minimum Ice Thickness in inches	Description of Safe Moving Load
1-3/4	One person on skies
2	One person on foot or skates
3	One snowmobile
3	A group of people walking single file
7	A single passenger automobile
8	A 2-1/2 ton truck
9	A 3-1/2 ton truck
10	A 7 to 8 ton truck

Ice Load Graphs

Graphs have been developed by researchers which include:

- CRREL Ice Load Chart
- Canadian Field Data Graph

What you need to know

Because there can be many variations in the structure, thickness, temperature and strength of an ice sheet, it is essential to carry out some fairly simple field observations of the ice sheet you want to use to support a load. Be cautious! Never go out on an unknown ice sheet alone, and always probe ahead of yourself with a heavy ice chisel. Consider wearing a personal flotation device and roping yourself to an assistant.

The main thing to determine is the ice thickness. This can be done by drilling holes with an ice auger. Note whether the ice is clear (sometimes called black ice) or white (due to air bubbles sometimes called snow ice). Measure the thickness of both kinds. Take note of the frequency of cracks and whether they are wet or dry. On rivers, be alert to variations in ice thickness that may occur as a result of bends, riffles or shallows, junctions with tributaries,

etc.

For both rivers and lakes, warm inflows from springs may create areas of thinner ice. Also, the ice thickness near shore may be thinner (due to warm groundwater inflow or the insulating effect of drifted snow) or thicker (due to the candle-dipping effect of variable water levels).

Observe any snow cover as well as variations in its thickness. Obtain the record of air temperature for the past several days, and continue observing air temperatures during the period the ice will be used to support loads.

Contrary to what many think, a rapid and large air temperature drop causes an ice sheet to become brittle, and the ice may not be safe to use for 24 hours.

If the air temperature stays above freezing for 24 hours or more, the ice begins to lose strength, and the table no longer represents safe conditions. This becomes the general condition in the spring. Even though the ice may have adequate thickness, the strength is quickly lost the longer the air temperature is above freezing. In all cases of air temperature changes, the effects are greatest on bare ice, and are subdued by increasing depths of snow cover. However, no quantitative guidance can be offered.

Other considerations

An ice sheet must be supported by water. Sometimes, near a riverbank, the water level will drop after the initial ice sheet is formed, leaving the ice sheet unsupported near the shore. This occurrence can be detected by hearing a hollow sound when probing with an ice chisel. Naturally this is not a safe location for loads on the ice.

Cracks in the ice are either wet or dry. If dry, they do not penetrate the ice sheet and are not a problem. If they are wet, multiply the vehicle class by 2 to obtain the required minimum ice thickness. Also, drive across the cracks as close to perpendicular as possible, instead of parallel to them.

On thicker ice with very heavy loads, radial cracks may be observed originating from the center of the load. This usually occurs at about one-half of the failure load. After the radial cracks develop, circumferential cracks will form and the ice sheet will fail. If radial cracks are seen, the load should be moved immediately. Because ice will creep, it is only a matter of time before the ice fails. The same process happens with thinner ice at breakthrough loading, but the process occurs so much faster that it cannot be relied upon for any warning.

Additional on-line information can be found in the CRREL Ice Engineering Information Exchange Bulletin. Number 13, January 1996.

APPENDIX D-F

SITE-SPECIFIC FLOAT PLAN AND RESCUE FROM ICE PROCEDURES

FLOAT PLAN

www.cgaux.org

INSTRUCTIONS: Complete this plan before you go boating and leave it with a reliable person who can be depended upon to notify the Coast Guard, or other rescue organization, should you not return or check-in as scheduled. If you have a ***change of plans*** after leaving, be sure to notify the person holding your Float Plan.

Do NOT file this plan with the Coast Guard.

www.uscgboating.org

VESSEL

IDENTIFICATION:

Name & Port _____

Document / Registration No. _____

Year / Make _____

Length _____(ft) Type _____

Hull & Trim Color _____

Unique Feature(s) _____

Propulsion: (Check all that apply)

☐ Paddle ☐ Gas ☐ Diesel ☐ Electric

☐ Inboard ☐ Outboard ☐ Inboard/Outboard

Fuel: Capacity _____(gal.) Cruising Range _____(max.)

COMMUNICATIONS: (Check all onboard & supply requested information)

☐ Radio Call Sign: _____

☐ DSC MMSI Number: _____

☐ Cockpit Radio-1: Type _____ Freq. Monitored _____

☐ Cockpit Radio-2: Type _____ Freq. Monitored _____

☐ Handheld Radio: Type _____ Freq. Monitored _____

☐ Cell Phone: _____

☐ _____

NAVIGATION: (Check all onboard)

☐ Maps ☐ Charts ☐ Compass ☐ Navigation Rules

☐ GPS ☐ Radar ☐ Loran C ☐ _____

SAFETY & SURVIVAL

PFDs: (Specify quantity)

____Type I

____Type II

____Type III

____Type IV

____Type V

VISUAL DISTRESS SIGNALS: (Specify quantity)

____Mirror (Day only)

____Red or Orange Distress Flag (Day only)

____Orange Smoke, Floating (Day & Night)

____Red Distress Flares (Day & Night)

____Electric distress light (Night only)

AUDIBLE DISTRESS SIGNALS:

☐ Horn / Whistle

☐ Bell

☐ _____

MEDICAL:

☐ First Aid

☐ _____

☐ _____

GROUND TACKLE: (Check all onboard & supply requested information)

☐ Working Anchor - line length _____ ft.

☐ Storm Anchor - line length _____ ft.

OTHER GEAR:

☐ Survival Suit(s) ☐ Flashlight / Searchlight

☐ Safety Harness ☐ Life Rafts: ____ (Qty) Lifeboats: ____ (Qty)

☐ Sea Anchor ☐ EPIRB _____

☐ Fire Extinguisher ☐ _____

PERSONS ON BOARD

OPERATOR: Age Sex Notes (Medical Condition, Can't Swim, etc.)

Name _____ ____ ____ _____

Address _____ Home Phone _____

City _____ State ____ Zip code _____ Drivers License _____

Vehicle (Year, Make & Model) _____ License No. _____

Where will trailer be parked? _____ License No. _____

PASSENGERS: Name & Home Phone Age Sex Notes (Medical Condition, Can't Swim, etc.)

1. _____ ____ ____ _____
2. _____ ____ ____ _____
3. _____ ____ ____ _____
4. _____ ____ ____ _____
5. _____ ____ ____ _____

ITINERARY

	DATE	TIME	LOCATION	MODE OF TRAVEL	REASON FOR STOP	CHECK-IN TIME
Depart						
Arrive						
Depart						
Arrive						
Depart						
Arrive						
Depart						
Arrive						
Depart						
Arrive						

Attach Supplemental Itinerary if additional space required.

Contact 1. _____ Phone Number _____

Contact 2. _____ Phone Number _____

If you have a genuine concern for the safety or welfare of any persons on board this vessel, who have not returned or checked-in within a reasonable amount of time, then follow the step-by-step instructions on the **Boating Emergency Guide** included with this plan, or on the World Wide Web at:

http://www.uscgaux.org/~floatplan/BoatingEmergencyGuide.htm

FPME(a) Rev(12.30.03)

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BOATING EMERGENCY GUIDE

You will need the following items before you begin: 1) The **Float Plan**, if one was given to you; 2) **Pen** or **Pencil**; 3) Clean sheet of **paper** or **writing tablet**; and 4) **Telephone Directory**.

Step 1

Is there a genuine concern for the safety or welfare of any persons on board the vessel, who have not returned or checked-in within a reasonable amount of time?

If YES, continue with **Step 2**. If NO, then **Stop**. No further action is required at this time.

Step 2

Were you given a prepared Float Plan by anyone onboard the vessel?

If YES, continue with **Step 3**. If NO, then go to **Step 5**.

Step 3

On the Float Plan, locate the two contact lines, below the "Itinerary" at the bottom of the Float Plan. Call the telephone number of Contact-1.

<table>
<tr><th>IF:</th><th>THEN:</th></tr>
<tr><td>A person answered the phone...</td><td>Take notes during your conversation.
1. Let the person know that you are responding to a late return or check-in by the individuals designated on the Float Plan.
2. Determine if the person you are talking to, or anyone else at that location, has recently had contact with anyone on the vessel, and when and where that contact occurred.
3. Are you still concerned about the safety or welfare of any persons on board the vessel?
<table><tr><th>IF:</th><th>THEN:</th></tr><tr><td>Yes</td><td>Continue with Step 4.</td></tr><tr><td>No</td><td>Stop. No further action is necessary at this time.</td></tr></table></td></tr>
<tr><td>Otherwise...</td><td>Continue with Step 4.</td></tr>
</table>

Step 4

Call the telephone number for Contact-2.

<table>
<tr><th>IF:</th><th>THEN:</th></tr>
<tr><td>A person answered the phone...</td><td>Take notes during your conversation.
1. Let the person know that you are responding to a late return or check-in by the individuals designated on the Float Plan.
2. Determine if the person you are talking to, or anyone else at that location, has recently had contact with anyone on the vessel, and when and where that contact occurred.
3. Are you still concerned about the safety or welfare of any persons on board?
<table><tr><th>IF:</th><th>THEN:</th></tr><tr><td>Yes</td><td>Continue with Step 6.</td></tr><tr><td>No</td><td>Stop. No further action is necessary at this time.</td></tr></table></td></tr>
<tr><td>Otherwise...</td><td>Continue with Step 6.</td></tr>
</table>

Step 5

Take a moment to jot down the facts you know about each item in the checklist below:

> Do not speculate! Speculation of a fact may mislead search and rescue personnel and add to the overall search and rescue time, adversely affecting the outcome.

- ❑ Period of time the vessel has been overdue.
- ❑ Purpose of the trip or voyage.
- ❑ Description of vessel (color, size, shape, etc.)
- ❑ Vessel's departure point and destination.
- ❑ Places the vessel planned to stop during transit.
- ❑ Navigation equipment on board (such as GPS, Compass, Maps, Charts, LORAN C, etc.)
- ❑ Survival equipment on board (life jackets, EPIRB, flares, etc.)
- ❑ Number of people on board the vessel, as well as personal habits e.g. dependability, reliability, etc.
- ❑ Was the vessel already moored, or did a vehicle tow it to the location?
- ❑ License plate number and description of the vehicle of the towing and/or crew transport vehicle.
- ❑ Communications equipment on board including radio frequencies monitored, cellular telephone numbers of people aboard.
- ❑ Additional points of contact in the area.
- ❑ Were there any pending commitments (work, appointments, etc.)?

Continue with **Step 6**.

Step 6

1. Contact your local Law Enforcement agency.
2. Let the dispatcher know that you are responding to a late return or check-in by the persons on board.
   a. The dispatcher will guide you from there. The dispatcher will provide you with the necessary contact or agency connection (if one was not given on the Float Plan) to get a Search And Rescue (SAR) mission started. This is usually handled this way because it puts you closest to the agency conducting the rescue mission, eliminating an unnecessary middleman.
   b. The dispatcher will let you know if they would like a follow-up call from you on the outcome.
3. The dispatcher will instruct you from there.

Continue with **Step 7**.

Step 7

Be patient... you've done everything you can possibly do for now. Stay off of the phone, so emergency personnel can contact you with additional information and/or questions concerning the Search And Rescue (SAR) effort.

End of Guide

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RESCUE FROM ICE PROCEDURES
(Attach to Float Plan)

- Have the proper rescue equipment such as a long rope or a throw bag (a self- contained rescue rope in a bag) also referred to as the "throw rope" easily accessible.
- All personnel must wear their PFD at all times.
- If a person falls in notify the Project Manager and Emergency Services immediately and use the rescue equipment.
- Call for assistance from the emergency services.
- Do not attempt to go out onto the ice yourself.
- Call to the fallen person and instruct him/her to keep still to maintain heat and energy.
- Use the rescue rope. Throw this or reach out to the fallen person with it.
- Then, making sure you are stable on the bank, by lying down or getting the other MACTEC employee to hold onto you securely, attempt to pull the fallen person to the shore.
- If you cannot find something with which to perform a reach or throw rescue, try to find something that will float to throw or push out to them. This will help to keep the fallen person afloat until assistance arrives.
- Through your rescue KEEP OFF THE ICE, continue to reassure the fallen person and keep them talking until help arrives.
- If the rescue is successful, the fallen person must be kept warm and must be treated for shock.
- The fallen person must be taken to hospital even if they appear to be unaffected by their ordeal.

APPENDIX D-G

ENVIRONMENTAL SAMPLING JOB HAZARD ANALYSIS

Job Hazard Analysis - Short Form

Job Title: Field Work – General (includes Environmental Sampling) **Date of Analysis:** 09/05/08

Minimum Recommended PPE*: hard hat, steel-toed boots, safety glasses

*See HASP for all required PPE

Key Work Steps	Hazards/Potential Hazards	Safe Practices
1. Mobilization/ See Mobilization/Demobilization and Site Preparation JHA Demobilization and Site Preparation	1A) See Mobilization/Demobilization and Site Preparation JHA	1A) See Mobilization/Demobilization and Site Preparation JHA
2. Communication	2A) Safety, crew unity	2A) Talk to each other. ▪ Let other crewmembers know when you see a hazard. ▪ Avoid working near known hazard trees. ▪ Always know the wherabouts of fellow crewmembers. ▪ Carry a radio and spare batteries or cell phone ▪ Review Emergency Evacuation Procedures (see below).
3. Walking and working in the field	3A) Falling down, twisted ankles and knees, poor footing	3A) Always watch your footing. ▪ Slow down and use extra caution around logs, rocks, and animal holes. ▪ Extremely steep slopes (>50%) can be hazardous under wet or dry conditions; consider an alternate route. ▪ Wear laced boots with a minimum 8" high upper and non-skid Vibram-type soles for ankle support and traction.
	3B) Falling objects	3B) Protect head agains falling objects. ▪ Wear your hardhat for protection from falling limbs and pinecones, and from tools and equipment carried by other crewmembers. ▪ Stay out of the woods during extremely high winds.
	3C) Damage to eyes	3C) Protect eyes: ▪ Watch where you walk, ecpecially around trees and brush with limbs sticking out. ▪ Exercise caution when clearing limbs from tree trunks. Advise wearing eye protection. ▪ Ultraviolet light from the sun can be damaging to the eyes; look for sunglasses that specify significant protection from UV-A and UV-B radiation. If safety glasses require, use one's with tinted lenses
	3D) Bee and wasp stings	3D) See JHA for Insect Stings and Bites
	3E) Ticks and infected mosquitos	3E) See JHA for Insect Stings and Bites
	3F) Lifting Injuries (e.g., Back Injuries)	3F) Lifting Injuries (e.g., Back Injuries) • Site personnel will be instructed on proper lifting techniques. • Perform warm-up excercises before starting work. • DO NOT EXCEED THE MACTEC LIFTING LIMIT OF 50 POUNDS. • Use two people to lift, lower, or carry equipment or materials heavier than 50 pounds. • Mechanical devices should be used to reduce manual handling of materials. • Drive the field vehicle as close to the point that the heavy equipment/material will be used as long as the area is safe to drive into and you do not create hazards to you, your co-worker, or the vehicle.

Job Hazard Analysis - Short Form

Job Title: Field Work – General (includes Environmental Sampling) **Date of Analysis:** 09/05/08

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	3G) Slips/Trips/Falls	3G) Slips/Trips/Falls • Maintain work areas safe and orderly; unloading areas should be on even terrain; mark or repair possible tripping hazards. • Site SHSO inspect the entire work area to identify and mark hazards.
	3H) Vehicular Traffic	3H) Vehicular Traffic ▪ Spotters will be used when backing up trucks and heavy equipment and when moving equipment. ▪ High visibility vests will be worn when workers are exposed to vehicular traffic at the site or on public roads.
	3I) Overhead Hazards	3I) Overhead Hazards ▪ Personnel will be required to wear hard hats that meet ANSI Standard Z89.1. ▪ All ground personnel will stay clear of suspended loads. ▪ All equipment will be provided with guards, canopies or grills to protect the operator from falling or flying objects. ▪ All overhead hazards will be identified prior to commencing work operations.
	3J) Dropped Objects	3J) Dropped Objects ▪ Steel toe boots meeting ANSI Standard Z41 will be worn.
	3K) Noise	3K) Noise ▪ Hearing protection will be worn with a noise reduction rating capable of maintaining personal exposure below 85 dBA (ear muffs or plugs); all equipment will be equipped with manufacturer's required mufflers. Hearing protection shall be worn by all personnel working in or near heavy equipment.
	3L) Eye Injuries	3L) Eye Injuries ▪ Safety glasses meeting ANSI Standard Z87 will be worn.
	3M) Heavy Equipment (overhead hazards, spills, struck by or against)	3M) Heavy Equipment ▪ Equipment will have seat belts. ▪ Operators will wear seat belts when operating equipment. ▪ Do not operate equipment on grades that exceed manufacturer's recommendations. ▪ Equipment will have guards, canopies or grills to protect from flying objects. ▪ Ground personnel will stay clear of all suspended loads. ▪ Ground personnel will wear high visibility vests ▪ Spill and absorbent materials will be readily available. ▪ Drip pans, polyethylene sheeting or other means will be used for secondary containment. ▪ Ground personnel will stay out of the swing radius of excavators. ▪ Eye contact with operators will be made before approaching equipment. ▪ Operator will acknowledge eye contact by removing his hands from the controls. ▪ Equipment will not be approached on blind sides. ▪ All equipment will be equipped with backup alarms and use spotters when significant physical movement of equipment occurs on-site, (i.e., other than in place excavation or truck loading).

Job Hazard Analysis - Short Form

Job Title: Field Work – General (includes Environmental Sampling) **Date of Analysis:** 09/05/08

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	3N) Struck by vehicle/equipment	3N) Struck by vehicle/equipment ▪ Be aware of heavy equipment operations. ▪ Keep out of the swing radius of heavy equipment. ▪ Ground personnel in the vicinity of heavy equipment operations will be within the view of the operator at all times and will wear high visibility vests. ▪ Ground personnel will be aware of the counterweight swing and maintain an adequate buffer zone. ▪ Ground personnel will not stand directly behind heavy equipment when it is in operation. ▪ Drivers will keep workers on foot in their vision at all times, if you lose sight of someone, Stop!
	3O) Struck/cut by tools	3O) Struck/cut by tools ▪ Cut resistant work gloves will be worn when dealing with sharp objects. ▪ All hand and power tools will be maintained in safe condition. ▪ Guards will be kept in place while using hand and power tools.
	3P) Caught in/on/between	3P) Caught in/on/between ▪ Workers will not position themselves between equipment and a stationary object. ▪ Workers will not wear long hair down (place in pony-tail and tuck into shirt) or jewelry if working with tools/machinery.
	3Q) Contact with Electricity/Lightning	3Q) Contact with Electricity/Lighting ▪ All electrical tools and equipment will be equipped with GFCI. ▪ Electrical extension cords will be of the “Hard” or “Extra Hard” service type. ▪ All extension cords shall have a three-blade grounding plug. ▪ Personnel shall not use extension cords with damaged outer covers, exposed inner wires, or splices. ▪ Electrical cords shall not be laid across roads where vehicular traffic may damage the cord without appropriate guarding. ▪ All electrical work will be conducted by a licensed electrician. ▪ All utilities will be marked prior to excavation activities. ▪ All equipment will stay a minimum of 10 feet from overhead energized electrical lines (50 kV). This distance will increase by 4 inches for each 10 kV above 50 kV. Rule of Thumb: Stay 10 feet away from all overhead powerlines known to be 50 kV or less and 35 feet from all others.) ▪ The SHSO shall halt outdoor site operations whenever lightning is visible, outdoor work will not resume until 30 minutes after the last sighting of lightning.
	3R) Equipment failure	3R) Equipment failure ▪ All equipment will be inspected before use. If any safety problems are noted, the equipment should be tagged and removed from service until repaired or replaced.
	3S) Hand & power tool usage.	3S) Hand & power tool usage ▪ Daily inspections will be performed. ▪ Remove broken or damaged tools from service. ▪ Use the tool for its intended purpose. ▪ Use in accordance with manufacturers instructions.

Job Hazard Analysis - Short Form

Job Title: Field Work – General (includes Environmental Sampling) **Date of Analysis:** 09/05/08

Key Work Steps	Hazards/Potential Hazards	Safe Practices
4. Environmental health considerations	4A) HEAT Stress	4A) Take precautions to prevent heat stress ▪ Remain constantly aware of the four basic factors that determine the degree of heat stress (air temperature, humidity, air movement, and heat radiation) relative to the surrounding work environmental heat load. ▪ Know the signs and symptoms of heat exhaustion, heat cramps, and heat stroke. Heat stroke is a true medical emergency requiring immediate emergency response action. NOTE: The severity of the effects of a given environmental heat stress is decreased by reducing the work load, increasing the frequency and/or duration of rest periods, and by introducing measures which will protect employees from hot environments. ▪ Maintain adequate water intake by drinking water periodically in small amounts throughout the day (flavoring water with citrus flavors or extracts enhances palatability). ▪ Allow approximately 2 weeks with progressive degrees of heat exposure and physical exertion for substantial acclimatization. ▪ Acclimatization is necessary regardless of an employee's physical condition (the better one's physical condition, the quicker the acclimatization). Tailor the work schedule to fit the climate, the physical condition of employees, and mission requirements. ▪ A reduction of work load markedly decreases total heat stress. ▪ Lessen work load and/or duration of physical exertion the first days of heat exposure to allow gradual acclimatization. ▪ Alternate work and rest periods. More severe conditions may require longer rest periods and electrolyte fluid replacement.
	4B) Wet Bulb Globe Temperature (WBGT) Index	4B) WBGT ▪ Curtail or suspend physical work when conditions are extremely severe (see attached Heat Stress Index). ▪ Compute a Wet Bulb Globe Temperature Index to determine the level of physical activity (take WBGT index measurements in a location that is similar or closely approximates the environment to which employees will be exposed). WBGT THRESHOLD VALUES FOR INSTITUTING PREVENTIVE MEASURES 80-90 degrees F — Fatigue possible with prolonged exposure and physical activity. 90-105 degrees F — Heat exhaustion and heat stroke possible with prolonged exposure and physical activity. 105-130 degrees F — Heat exhaustion and heat stroke are likely with prolonged heat exposure and physical activity.

Job Hazard Analysis - Short Form

Job Title: Field Work – General (includes Environmental Sampling) **Date of Analysis:** 09/05/08

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	4C) Cold Extremes	4C) Take precautions to prevent cold stress injuries ▪ Cover all exposed skin and be aware of frostbite. While cold air will not freeze the tissues of the lungs, slow down and use a mask or scarf to minimize the effect of cold air on air passages. ▪ Dress in layers with wicking garments (those that carry moisture away from the body – e.g., cotton) and a weatherproof slicker. A wool outer garment is recommended. ▪ Take layers off as you heat up; put them on as you cool down. ▪ Wear head protection that provides adequate insulation and protects the ears. ▪ Maintain your energy level. Avoid exhaustion and over-exertion which causes sweating, dampens clothing, and accelerates loss of body heat and increases the potential for hypothermia. ▪ Acclimate to the cold climate to minimize discomfort. ▪ Maintain adequate water/fluid intake to avoid dehydration.
	4D) Wind	4D) Effects of the wind ▪ Wind chill greatly affects heat loss (see attached Wind Chill Index). ▪ Avoid marking in old, defective timber, especially hardwoods, during periods of high winds due to snag hazards.
	4E) Thunderstorms	4E) Thunderstorms ▪ Monitor weather channels to determine if electrical storms are forcased. ▪ Plan ahead and identify safe locations to be in the event of a storm. (e.g., sturdy building, vehicle, etc.) ▪ Suspend all field work at the first sound of thurnder. You should be in a safe place when the time between the lightning and thunder is less than 30 seconds. ▪ Only return to work 30 minutes after the after the last strike or sound of thunder
5. Check and calibrate industrial hygiene and other field instruments and	5A) Exposure to Calibration Gases/Chemicals due to: • Use of damaged instruments.	5A) Verify proper operation of the instrument prior to calibration. Calibrate instruments in an area with adequate ventilation and follow the manufacturer's recommendations. ▪ Wear appropriate PPE to conduct calibrations as specified in the instrument manual.

Job Hazard Analysis - Short Form

Job Title: Field Work – General (includes Environmental Sampling) **Date of Analysis:** 09/05/08

Key Work Steps	Hazards/Potential Hazards	Safe Practices
equipment as required and as recommended by the manufacturer	5B) Exposure to Site contaminants due to: • Improper instrument calibration; • Misinterpretation of calibration results; • Improper instrument repair; • Improper use of instrument due to lack of training.	5B) Calibrate the instrument in accordance with the manufacturer's recommendations (see instrument manual) using the applicable calibration standard and calibration procedure. • Perform calibrations at a frequency recommended by the manufacturer. Be aware of the instrument's limitations (e.g., detection limit, maximum sensitivity) and the conditions (e.g., humidity) that may affect correct operation or accuracy of that equipment. Possible sources of error that may affect the correct calibration of the instrument. • Use only calibration materials recommended by the manufacturer for calibration. Do not use substitutions. • Confirm that the connections between the instrument and the calibration gas/material is leak-free. • Record all instrument calibrations in the field logbook. Include the instrument ID (type/manufacture/serial number/lamp eV, etc.), calibration gas used (chemical and concentration), and instrument result. • Do not attempt to repair instrument. Return to the vendor for replacement. Report any damaged or malfunctioning instrument to the vendor. • All personnel must be familiar with operation of the instrument and understand: - Theroy of its operation including any alarms and their setpoints - Materials the instrument can and cannot detect, - Instrument's limitations - The expected responses to calibration gases/materials - Interfering gases/chemicals and their affects on the instrument readings - When re-zeroing is appropriate

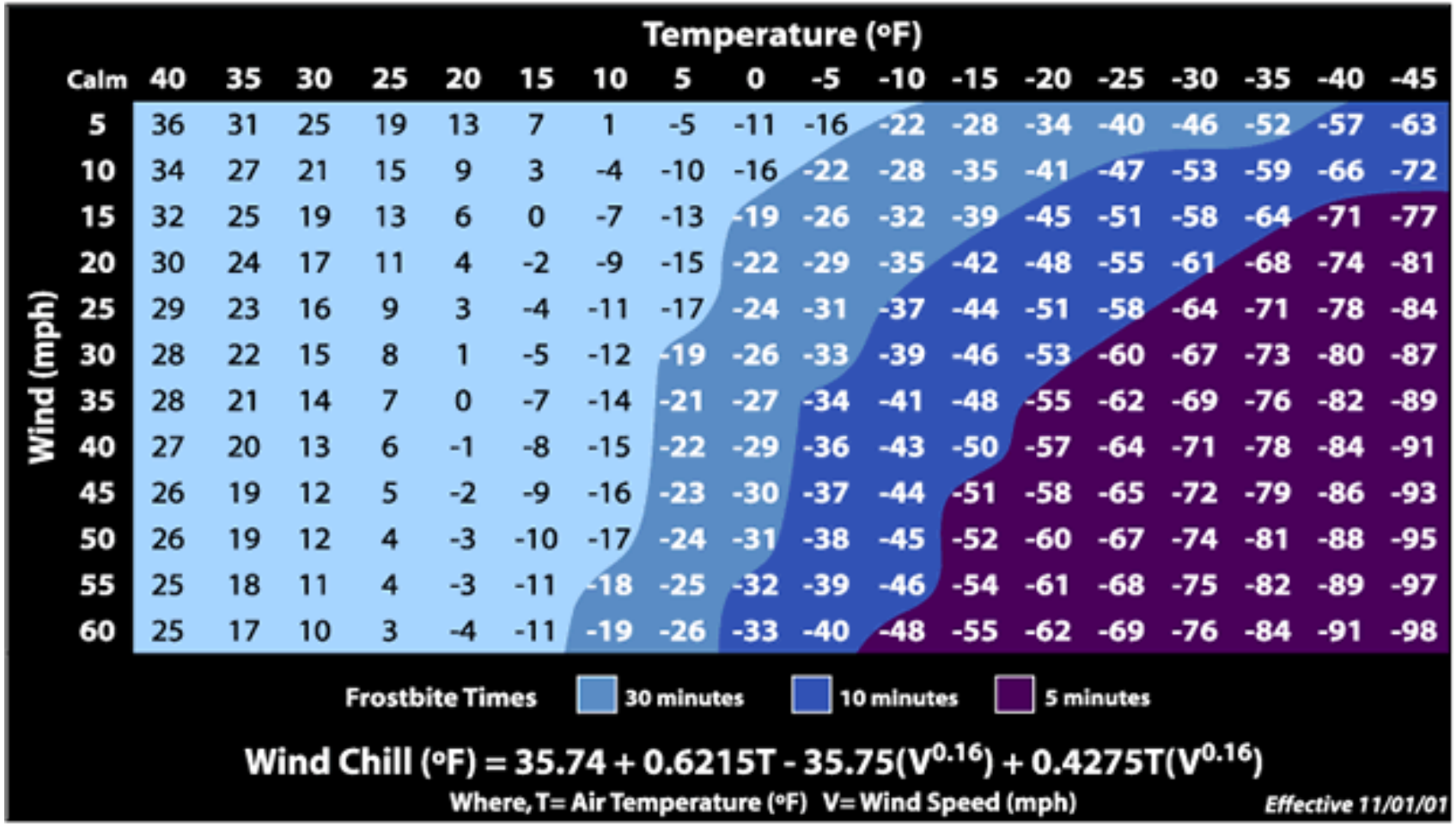
Heat Index Chart

Temperature \ % Relative Humidity	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90
110	108	112	117	123	130											
105	102	105	108	113	117	122	130									
100	97	98	102	104	107	110	115	120	126	132						
95	91	93	95	96	98	100	104	106	109	113	119	124	130			
90	86	87	88	90	91	92	95	97	98	100	103	106	110	114	117	121
85	81	82	83	84	85	86	87	88	89	90	92	94	96	97	100	102
80	76	77	78	78	79	79	80	81	82	83	84	85	86	87	88	89

Legend

80-89 degrees	Fatigue is possible with prolonged exposure and/or physical activity.
90-104 degrees	Sunstroke, heat cramps and heat exhaustion are possible with prolonged exposure and/or physical activity.
105-129 degrees	Sunstroke, heat cramps and heat exhaustion are likely. Heat stroke is possible with prolonged exposure and/or physical activity.
130+ degrees	Heatstroke/sunstroke is highly likely with continued exposure.

Wind Chill Chart



Completed by: Annette McLean Date: October 6, 2008

APPENDIX D-H

MOTOR VEHICLE POLICY AND MOTOR VEHICLE SAFETY JOB HAZARD ANALYSIS

Vehicle Safety

Purpose

The operation of any motorized vehicles during the performance of business related activity must be done in a safe and courteous manner.

Scope of Application

Applies to all operations of MACTEC.

Specific Requirements

All MACTEC business activities associated with motorized vehicles including, boats, drill rigs, trucks, heavy equipment, cars, whether company owned, leased or rented vehicles or personal vehicles used on company business must ensure:

- Compliance with all relevant local, state and federal regulations;
- Compliance with all appropriate elements of MACTEC's ES&H policies and procedures, and company standards and management systems;
- Due regard for the safety and health of employees, contractors and members of the public.

Job Hazard Analysis - Short Form

Job Title: Mobilization/Demobilization and Site Preparation **Date of Analysis:** 5/21/2008

Minimum Recommended PPE*: High visibility vest, hard hat, steel-toed boots, safety glasses, hearing protection
*See HASP for all required PPE

Key Work Steps	Hazards/Potential Hazards	Safe Practices
1. Prepare for Site Visit	1A) N/A	1A) Prior to leaving for site ▪ Obtain and review HASP prior to site visit, if possible ▪ Determine PPE needs – bring required PPE to the site, if not otherwise being provided at the site (e.g., steel toed boots) ▪ Determine training and medical monitoring needs and ensure all required Health and Safety training and medical monitoring has been received and is current ▪ If respiratory protection is required/potentially required, ensure that training and fit-testing has occurred within the past year. ▪ Familiarize yourself with route to the site
	1B) Vehicle defects	1B) Inspect company owned/leased vehicle for defects such as: ▪ Flat tires ▪ Windshield wipers worn or torn ▪ Oil puddles under vehicle ▪ Headlights, brake lights, turn signals not working
	1C) Insufficient emergency equipment, unsecured loads	1C) Insufficient emergency equipment, unsecured loads ▪ Ensure vehicle has first aid kit and that all medications are current (if first aid kits are not provided at the site) ▪ Ensure you have sufficient potable water for the duration of field work ▪ Ensure vehicle is equpped with warning flashers and/or flares and that the warning flashers work ▪ Cell phones are recommended to call for help in the event of an emergency ▪ Vehicles carrying tools must have a safety cage in place. All tools must be properly secured ▪ Vehicles must be equipped with chocks if the vehicle is to be left running, unattended. ▪ Ensure sufficient gasoline is in the tank
2. Operating vehicles – general	2A) Collisions, unsafe driving conditions	2A) Drive Defensively! ▪ Seat belts must be used at all times when operating any vehicle on company business. ▪ Drive at safe speed for road conditions ▪ Maintain adequate following distance ▪ Pull over and stop if you have to look at a map ▪ Try to park so that you don't have to back up to leave.
3. Driving to the jobsite	3A) Dusty, winding, narrow roads	3A) Dusty, winding, narrow roads ▪ Drive confidently and defensively at all times. ▪ Go slow around corners, occasionally clearing the windshield.
	3B) Rocky or one-lane roads	3B) Rocky or one-lane roads ▪ Stay clear of gullies and trenches, drive slowly over rocks. ▪ Yield right-of-way to oncoming vehicles---find a safe place to pull over.
	3C) Stormy weather, near confused tourists	3C) Stormy weather, near confused tourists ▪ Inquire about conditions before leaving the office. ▪ Be aware of oncoming storms. ▪ Drive to avoid accident situations created by the mistakes of others.

Job Hazard Analysis - Short Form

Job Title: Mobilization/Demobilization and Site Preparation **Date of Analysis:** 5/21/2008

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	3D) When angry or irritated	3D) When angry or irritated ▪ Attitude adjustment; change the subject or work out the problem before driving the vehicle. Let someone else drive.
	3E) Turning around on narrow roads	3E) Turning around on narrow roads ▪ Safely turn out with as much room as possible. ▪ Know what is ahead and behind the vehicle. ▪ Use a backer if available.
	3F) Sick or medicated	3F) Sick or medicated ▪ Let others on the crew know you do not feel well. ▪ Let someone else drive.
	3G) On wet or slimy roads	3G) On wet or slimy roads ▪ Drive slow and safe, wear seatbelts.
	3H) Animals on road	3H) Animals on road ▪ Drive slowly, watch for other animals nearby. ▪ Be alert for animals darting out of wooded areas
4. Gain permission to enter site	4A) Hostile landowner, livestock, pets	4A) Hostile landowner, livestock, pets ▪ Talk to land owner, be courteous and diplomatic ▪ Ensure all animals have been secured away from work area
5. Mobilization/ Demobilization of Equipment and Supplies	5A) Struck by Heavy Equipment/Vehicles	5A) Struck by heavy equipment ▪ Be aware of heavy equipment operations. ▪ Keep out of the swing radius of heavy equipment. ▪ Ground personnel in the vicinity of heavy equipment operations will be within the view of the operator at all times ▪ Employees shall wear a high visibility vest or T-shirt (reflective vest required if working at night). ▪ Ground personnel will be aware of the counterweight swing and maintain an adequate buffer zone. ▪ Ground personnel will not stand directly behind heavy equipment when it is in operation.
	5B) Struck by Equipment/Supplies	5B) Struck by Equipment/Supplies ▪ Workers will maintain proper space around their work area, if someone enters it, stop work. ▪ When entering another worker's work space, give a verbal warning so they know you are there.
	5C) Overexertion Unloading/Loading Supplies	5C) Overexertion Unloading/Loading Supplies ▪ Train workers on proper body mechanics, do not bend or twist at the waist while exerting force or lifting. ▪ Tightly secure all loads to the truck bed to avoid load shifting while in transit.
	5D) Caught in/on/between	5D) Caught in/on/between ▪ Do not place yourself between two vehicles or between a vehicle and a fixed object.

Job Hazard Analysis - Short Form

Job Title: Mobilization/Demobilization and Site Preparation **Date of Analysis:** 5/21/2008

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	5E) Slip/Trip/Fall	5E) 1E). Slip/Trip/Fall ▪ Mark all holes and low spots in area with banner tape. Instruct personnel to avoid these areas. ▪ Drivers will maintain 3 point contact when mounting/dismounting vehicles/equipment. ▪ Drivers will check surface before stepping, not jumping down.
	5F) Vehicle accident	5F) Vehicle accident ▪ Employees should follow MACTEC vehicle operation policy and be aware of all stationary and mobile vehicles.
6. Site Preparation	6A) Slip/Trip/Fall	6A) Slip/Trip/Fall ▪ Mark all holes and low spots in area with banner tape. Instruct personnel to avoid these areas ▪ Drivers will maintain 3 point contact when mounting/dismounting vehicles/equipment. ▪ Drivers will check surface before stepping, not jumping down.
7. Installation of soil erosion and sediment controls	7A) Overexertion	7A) Overexertion ▪ Workers will be trained in the proper method of placing erosion controls. ▪ Do not bend and twist at the waist while lifting or exerting force.
	7B) Struck by Equipment/Supplies	7C) Struck by Equipment/Supplies ▪ Workers will maintain proper space around their work area, if someone enters it, stop work. ▪ When entering another worker's work space, give a verbal warning so they know you are there.
8. Driving back from the jobsite	8A) See hazards listed under item #3	8A) See safe work practices under item #3

Completed by: Annette McLean Date: October 6, 2008

APPENDIX D-I

COLD STRESS PROGRAM

ATTACHMENT A
COLD RELATED ILLNESSES

ATTACHMENT A

COLD RELATED ILLNESSES

SUPERFICIAL FROSTBITE

Caused By: Exposure to cold temperatures. Severity depends on air temperature, length of exposure, and wind. Also called frost nip or incipient frostbite.

Signs: Skin is waxy or white (or may look discolored, e.g., red, yellow, or blue). Skin is firm to the touch, but tissue beneath is resilient.

Response:

- Cover the cheeks with warm hands
- Place uncovered frostbitten fingers under the opposing armpit next to the skin.
- Place bare frostbitten feet under the clothing and against the skin of a companion.
- Never Rub Frostbitten **Areas!**
- Only small frostbitten areas should be thawed without professional assistance. Once thawed the area MUST be protected from refreezing.

Prevention: It is far easier to prevent or stop frostbite in earlier stages than to thaw and take care of badly frozen flesh. To protect the body against frostbite, the following precautions should be taken:

- Wear enough clothing to protect against the cold and wind.
- Wear warm gloves and boots.
- Pull a scarf or jacket flap over the lower part of the face or pull a hood tightly around the face.
- Occasionally exercise the face, fingers, and toes to keep them warm and to detect any areas that may have become numb.
- Watch co-workers closely, especially the face, for signs of frostbite.

DEEP FROSTBITE

Caused By: Exposure to cold temperatures. Severity depends on air temperature, length of exposure, and wind.

Signs: Skin is waxy or white. Skin is firm to the touch, and tissue beneath is cold, pale, and solid.

Response:

- Seek professional medical help as soon as possible

- Don't thaw hands or feet unless medical aid is distant and there is no chance of refreezing. Parts are better thawed at a hospital.
- If medical attention is distant and there is no danger of re-freezing, soak affected part in warm water (100 – 105 ºF). Do not allow affected area to touch container. Keep in water until affected area looks red and feels warm.
- After soaking, bandage affected area with dry, sterile dressing. If fingers or toes are affected, place gauze between them.
- Never Rub Frostbitten **Areas!**

Prevention: See Superficial Frostbite

HYPOTHERMIA

Caused By: Exposure to cold temperatures. Severity depends on air or water temperature, length of exposure, and wind. Temperatures do not have to be below freezing in order to develop hypothermia.

Signs: Uncontrollable shivering, numbness, glassy stare, apathy, and loss of consciousness.

Response:
- Call for emergency medical care immediately:
- While waiting, remove any wet clothing and dry victim.
- Warm body gradually using blankets, etc., do not immerse in warm water.
- If conscious and alert, give warm liquids to drink.
- If necessary, perform CPR if certified.
- Warm the body with a vapor barrier to retain body heat

Prevention:
- Stay dry. If your clothing becomes wet from perspiration, rain, snow, or immersion in water, change it as soon as possible.
- If you start to shiver in a prolonged or violent way, seek shelter at once. Shivering may produce heat but it also uses up energy. Violent shivering may be an early sign of hypothermia.
- Avoid accidental immersion in water.
- Practice boat safety and learn cold water survival techniques. If you fall into water and you are not very close to shore, remain quiet. Keep your head out of water, climb into the boat, or hold or climb onto any other object that will support you and keep you up out of the water.

IMMERSION FOOT (TRENCH FOOT)

Caused By: Prolonged exposure to near-freezing temperatures when standing or walking on wet or swampy ground

Signs: Feet and toes are pale, cold, numb, and stiff, and walking is difficult. In later stages, the feet will swell and ache; in extreme cases, this may result in irreversible damage to the tissues of the foot or leg.

Response:

- Handle feet very gently.
- DO NOT rub or massage.
- If necessary, clean feet carefully with soap and warm water, then dry, elevate, and expose to warm but not hot air.

Prevention:

- Keep feet dry by wearing waterproof footgear
- Change socks frequently because perspiration, trapped inside waterproof boots or heavy footgear, can contribute to immersion foot symptoms.
- Avoid standing in wet areas.
- If feet get wet, dry them as soon as possible, warm them with your hands, then use foot powder, and change to dry socks.
- If you cannot change wet boots and socks, exercise your feet frequently by wiggling your toes and moving your ankles.
- Never wear tight boots.

APPENDIX D-J

OSHA TECHNICAL MANUAL – HEAT STRESS

SECTION III: CHAPTER 4

HEAT STRESS

Contents:

I. INTRODUCTION.

Operations involving high air temperatures, radiant heat sources, high humidity, direct physical contact with hot objects, or strenuous physical activities have a high potential for inducing heat stress in employees engaged in such operations. Such places include: iron and steel foundries, nonferrous foundries, brick-firing and ceramic plants, glass products facilities, rubber products factories, electrical utilities (particularly boiler rooms), bakeries, confectioneries, commercial kitchens, laundries, food canneries, chemical plants, mining sites, smelters, and steam tunnels.

Outdoor operations conducted in hot weather, such as construction, refining, asbestos removal, and hazardous waste site activities, especially those that require workers to wear semipermeable or impermeable protective clothing, are also likely to cause heat stress among exposed workers.

A. CAUSAL FACTORS.

1. Age, weight, degree of physical fitness, degree of acclimatization, metabolism, use of alcohol or drugs, and a variety of medical conditions such as hypertension all affect a person's sensitivity to heat. However, even the type of clothing worn must be considered. Prior heat injury predisposes an individual to additional injury.

2. It is difficult to predict just who will be affected and when, because individual susceptibility varies. In addition, environmental factors include more than the ambient air temperature. Radiant heat, air movement, conduction, and relative humidity all affect an individual's response to heat.

B. DEFINITIONS.

1. The American Conference of Governmental Industrial Hygienists (1992) states that workers should not be permitted to work when their deep body temperature exceeds 38°C (100.4°F).

2. **Heat** is a measure of energy in terms of quantity.

3. A **calorie** is the amount of heat required to raise 1 gram of water 1°C (based on a standard temperature of 16.5 to 17.5°C).

4. **Conduction** is the transfer of heat between materials that contact each other. Heat passes from the warmer material to the cooler material. For example, a worker's skin can transfer heat to a contacting surface if that surface is cooler, and vice versa.

5. **Convection** is the transfer of heat in a moving fluid. Air flowing past the body can cool the body if the air temperature is cool. On the other hand, air that exceeds 35°C (95°F) can increase the heat load on the body.

6. **Evaporative cooling** takes place when sweat evaporates from the skin. High humidity reduces the rate of evaporation and thus reduces the effectiveness of the body's primary cooling mechanism.

7. **Radiation** is the transfer of heat energy through space. A worker whose body temperature is greater than the temperature of the surrounding surfaces radiates heat to these surfaces. Hot surfaces and infrared light sources radiate heat that can increase the body's heat load.

8. **Globe temperature** is the temperature inside a blackened, hollow, thin copper globe.

9. **Metabolic heat** is a by-product of the body's activity.

10. **Natural wet bulb (NWB) temperature** is measured by exposing a wet sensor, such as a wet cotton wick fitted over the bulb of a thermometer, to the effects of evaporation and convection. The term natural refers to the movement of air around the sensor.

11. **Dry bulb (DB) temperature** is measured by a thermal sensor, such as an ordinary mercury-in-glass thermometer, that is shielded from direct radiant energy sources.

II. HEAT DISORDERS AND HEALTH EFFECTS.

A. **HEAT STROKE** occurs when the body's system of temperature regulation fails and body temperature rises to critical levels. This condition is caused by a combination of highly variable factors, and its occurrence is difficult to predict. Heat stroke is a medical emergency. The primary signs and symptoms of heat stroke are confusion; irrational behavior; loss of consciousness; convulsions; a lack of sweating (usually); hot, dry skin; and an abnormally high body temperature, e.g., a rectal temperature of 41°C (105.8°F). If body temperature is too high, it causes death. The elevated metabolic temperatures caused by a combination of work load and environmental heat load, both of which contribute to heat stroke, are also highly variable and difficult to predict.

If a worker shows signs of possible heat stroke, professional medical treatment should be obtained immediately. The worker should be placed in a shady area and the outer clothing should be removed. The worker's skin should be wetted and air movement around the worker should be increased to improve evaporative cooling until professional methods of cooling are initiated and the seriousness of the condition can be assessed. Fluids should be replaced as soon as possible. The medical outcome of an episode of heat stroke depends on the victim's physical fitness and the timing and effectiveness of first aid treatment.

Regardless of the worker's protests, no employee suspected of being ill from heat stroke should be sent home or left unattended unless a physician has specifically approved such an order.

B. **HEAT EXHAUSTION**. The signs and symptoms of heat exhaustion are headache, nausea, vertigo, weakness, thirst, and giddiness. Fortunately, this condition responds readily to prompt treatment. Heat exhaustion should not be dismissed lightly, however, for several reasons. One is that the fainting associated with heat exhaustion can be dangerous because the victim may be operating machinery or controlling an operation that should not be left unattended; moreover, the victim may be injured when he or she faints. Also, the signs and symptoms seen in heat exhaustion are similar to those of heat stroke, a medical emergency.

Workers suffering from heat exhaustion should be removed from the hot environment and given fluid replacement. They should also be encouraged to get adequate rest.

C. **HEAT CRAMPS** are usually caused by performing hard physical labor in a hot environment. These cramps have been attributed to an electrolyte imbalance caused by sweating. It is important to understand that cramps can be caused by both too much and too little salt. Cramps appear to be caused by the lack of water replenishment. Because sweat is a hypotonic solution (±0.3% NaCl), excess salt can build up in the body if the water lost through sweating is not replaced. Thirst cannot be relied on as a guide to the need for water; instead, water must be taken every 15 to 20 minutes in hot environments.

Under extreme conditions, such as working for 6 to 8 hours in heavy protective gear, a loss of sodium may occur. Recent studies have shown that drinking commercially available carbohydrate-electrolyte replacement liquids is effective in minimizing physiological disturbances during recovery.

D. **HEAT COLLAPSE** ("Fainting"). In heat collapse, the brain does not receive enough oxygen because blood pools in the extremities. As a result, the exposed individual may lose consciousness. This reaction is similar to that of heat exhaustion and does not affect the body's heat balance. However, the onset of heat collapse is rapid and unpredictable. To prevent heat collapse, the worker should gradually become acclimatized to the hot environment.

E. **HEAT RASHES** are the most common problem in hot work environments. Prickly heat is manifested as red papules and usually appears in areas where the clothing is restrictive. As sweating increases, these papules give rise to a prickling sensation. Prickly heat occurs in skin that is persistently wetted by unevaporated sweat, and heat rash papules may become infected if they are not treated. In most cases, heat rashes will disappear when the affected individual returns to a cool environment.

F. **HEAT FATIGUE**. A factor that predisposes an individual to heat fatigue is lack of acclimatization. The use of a program of acclimatization and training for work in hot environments is advisable. The signs and symptoms of heat fatigue include impaired performance of skilled sensorimotor, mental, or vigilance jobs. There is no treatment for heat fatigue except to remove the heat stress before a more serious heat-related condition develops.

III. INVESTIGATION GUIDELINES.

These guidelines for evaluating employee heat stress approximate those found in the 1992-1993 ACGIH publication, *Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices.*

A. EMPLOYER AND EMPLOYEE INTERVIEWS.

1. The inspector will review the OSHA 200 Log and, if possible, the OSHA 101 forms for indications of prior heat stress problems.

2. Following are some questions for employer interviews: What type of action, if any, has the employer taken to prevent heat stress problems? What are the potential sources of heat? What employee complaints have been made?

3. Following are some questions for employee interviews: What heat stress problems have been experienced? What type of action has the employee taken to minimize heat stress? What is the employer's involvement, i.e., does employee training include

information on heat stress? (Appendix III:4-1 lists factors to be evaluated when reviewing a heat stress situation, and Appendix III:4-2 contains a follow-up checklist.)

B. **WALKAROUND INSPECTION**. During the walkaround inspection, the investigator will: determine building and operation characteristics; determine whether engineering controls are functioning properly; verify information obtained from the employer and employee interviews; and perform temperature measurements and make other determinations to identify potential sources of heat stress. Investigators may wish to discuss any operations that have the potential to cause heat stress with engineers and other knowledgeable personnel. The walkaround inspection should cover all affected areas. Heat sources, such as furnaces, ovens, and boilers, and relative heat load per employee should be noted.

C. **WORK-LOAD ASSESSMENT**.

1. Under conditions of high temperature and heavy workload, the CSHO should determine the work-load category of each job (Table III:4-1 and Figure III:4-1). Work-load category is determined by averaging metabolic rates for the tasks and then ranking them:

    1. Light work: up to 200 kcal/hour
    2. Medium work: 200-350 kcal/hour
    3. Heavy work: 350-500 kcal/hour

2. *Cool Rest Area:* Where heat conditions in the rest area are different from those in the work area, the metabolic rate (M) should be calculated using a time-weighted average, as follows:

    Equation III:4-1. Average Metabolic Rate

$$Average\,M = \frac{(M_1)(t_1) + (M_2)(t_2) + \ldots + (M_n)(t_n)}{t_1 + t_2 + \ldots + t_n}$$

where: M = metabolic rate
t = time in minutes

In some cases, a videotape is helpful in evaluating work practices and metabolic load.

FIGURE III:4-1. ACTIVITY EXAMPLES

- Light hand work: writing, hand knitting
- Heavy hand work: typewriting
- Heavy work with one arm: hammering in nails (shoemaker, upholsterer)
- Light work with two arms: filing metal, planing wood, raking the garden
- Moderate work with the body: cleaning a floor, beating a carpet
- Heavy work with the body: railroad track laying, digging, barking trees

Sample Calculation: Assembly line work using a heavy hand tool

Walking along	2.0 kcal/min
Intermediate value between heavy work with two arms and light work with the body	3.0 kcal/min
Add for basal metabolism	1.0 kcal/min
Total:	6.0 kcal/min

Source: ACGIH 1992.

TABLE III:4-1. ASSESSMENT OF WORK

Body position and movement	***kcal/min****
Sitting	0.3
Standing	0.6
Walking	2.0-3.0
Walking uphill	add 0.8 for every meter (yard) rise

Type of work	***Average kcal/min***	***Range kcal/min***
Hand work		
Light	0.4	0.2-1.2
Heavy	0.9	
Work: One arm		
Light	1.0	0.7-2.5
Heavy	1.7	
Work: Both arms		
Light	1.5	1.0-3.5
Heavy	2.5	
Work: Whole body		
Light	3.5	2.5-15.0
Moderate	5.0	
Heavy	7.0	
Very heavy	9.0	

* For a "standard" worker of 70 kg body weight (154 lbs) and 1.8m^2 body surface (19.4 ft^2).

Source: ACGIH 1992.

IV. SAMPLING METHODS.

A. **BODY TEMPERATURE MEASUREMENTS**. Although instruments are available to estimate deep body temperature by measuring the temperature in the ear canal or on the skin, these instruments are not sufficiently reliable to use in compliance evaluations.

B. **ENVIRONMENTAL MEASUREMENTS**. Environmental heat measurements should be made at, or as close as possible to, the specific work area where the worker is exposed. When a worker is not continuously exposed in a single hot area but moves between two or more areas having different levels of environmental heat, or when the environmental heat varies substantially at a single hot area, environmental heat exposures should be measured for each area and for each level of environmental heat to which employees are exposed.

C. **WET BULB GLOBE TEMPERATURE INDEX**.

1. Wet Bulb Globe Temperature (WBGT) should be calculated using the appropriate

formula in Appendix III:4-2. The WBGT for continuous all-day or several hour exposures should be averaged over a 60-minute period. Intermittent exposures should be averaged over a 120-minute period. These averages should be calculated using the following formula:

Equation III:4-2. Average Web Bulb Globe Temperature (WBGT)

$$Average\ WBGT = \frac{(WBGT_1)(t_1)+(WBGT_2)(t_2)+\ldots+(WBGT_n)(t_n)}{t_1+t_2+\ldots+t_n}$$

For indoor and outdoor conditions with no solar load, WBGT is calculated as:

$$WBGT = 0.7NWB + 0.3GT$$

For outdoors with a solar load, WBGT is calculated as

$$WBGT = 0.7NWB + 0.2GT + 0.1DB$$

where: WBGT = Wet Bulb Globe Temperature Index
NWB = Nature Wet-Bulb Temperature
DB = Dry-Bulb Temperature
GT = Globe Temperature

2. The exposure limits in Table III:4-2 are valid for employees wearing light clothing. They must be adjusted for the insulation from clothing that impedes sweat evaporation and other body cooling mechanisms. Use Table III:4-3 to correct Table III:4-2 for various kinds of clothing.

3. Use of Table III:4-2 requires knowledge of the WBGT and approximate workload. Workload can be estimated using the data in Table III:4-1, and sample calculations are presented in Figure III:4-1.

D. **MEASUREMENT**. Portable heat stress meters or monitors are used to measure heat conditions. These instruments can calculate both the indoor and outdoor WBGT index according to established ACGIH Threshold Limit Value equations. With this information and information on the type of work being performed, heat stress meters can determine how long a person can safely work or remain in a particular hot environment. See Appendix III:4-2 for an alternate method of calculation.

TABLE III:4-2. PERMISSIBLE HEAT EXPOSURE THRESHOLD LIMIT VALUES

	---------- Work Load* ----------		
Work/rest regimen	**Light**	**Moderate**	**Heavy**
Continuous work	30.0°C (86° F)	26.7°C (80°F)	25.0°C (77° F)
75% Work, 25% rest, each hour	30.6°C (87° F)	28.0°C (82°F)	25.9°C (78° F)

50% Work, 50% rest, each hour	31.4°C (89° F)	29.4°C (85°F)	27.9°C (82° F)
25% Work, 75% rest, each hour	32.2°C (90° F)	31.1°C (88°F)	30.0°C (86° F)

*Values are in °C and °F, WBGT.

These TLV's are based on the assumption that nearly all acclimatized, fully clothed workers with adequate water and salt intake should be able to function effectively under the given working conditions without exceeding a deep body temperature of 38° C (100.4° F). They are also based on the assumption that the WBGT of the resting place is the same or very close to that of the workplace. Where the WBGT of the work area is different from that of the rest area, a time-weighted average should be used (consult the ACGIH *1992-1993 Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices* (1992).

These TLV's apply to physically fit and acclimatized individuals wearing light summer clothing. If heavier clothing that impedes sweat or has a higher insulation value is required, the permissible heat exposure TLV's in Table III:4-2 must be reduced by the corrections shown in Table III:4-3.

Source: ACGIH 1992.

E. **OTHER THERMAL STRESS INDICES**.

1. The Effective Temperature index (ET) combines the temperature, the humidity of the air, and air velocity. This index has been used extensively in the field of comfort ventilation and air-conditioning. ET remains a useful measurement technique in mines and other places where humidity is high and radiant heat is low.

2. The Heat-Stress Index (HSI) was developed by Belding and Hatch in 1965. Although the HSI considers all environmental factors and work rate, it is not completely satisfactory for determining an individual worker's heat stress and is also difficult to use.

TABLE III:4-3. WBGT CORRECTION FACTORS IN °C

Clothing type	Clo* value	WBGT correction
Summer lightweight working clothing	0.6	0
Cotton coveralls	1.0	-2
Winter work clothing	1.4	-4
Water barrier, permeable	1.2	-6

*Clo: Insulation value of clothing. One clo = 5.55 kcal/m^2/hr of heat exchange by radiation and convection for each degree °C difference in temperature between the skin and the adjusted dry bulb temperature.

Note: Deleted from the previous version are trade names and "fully encapsulating suit, gloves, boots and hood" including its clo value of 1.2 and WBGT correction of -10.

Source: ACGIH 1992.

V. **CONTROL.**

Ventilation, air cooling, fans, shielding, and insulation are the five major types of engineering controls used to reduce heat stress in hot work environments. Heat reduction can also be achieved by using power assists and tools that reduce the physical demands placed on a worker.

However, for this approach to be successful, the metabolic effort required for the worker to use or operate these devices must be less than the effort required without them. Another method is to reduce the effort necessary to operate power assists. The worker should be allowed to take frequent rest breaks in a cooler environment.

A. **ACCLIMATIZATION**.

1. The human body can adapt to heat exposure to some extent. This physiological adaptation is called acclimatization. After a period of acclimatization, the same activity will produce fewer cardiovascular demands. The worker will sweat more efficiently (causing better evaporative cooling), and thus will more easily be able to maintain normal body temperatures.

2. A properly designed and applied acclimatization program decreases the risk of heat-related illnesses. Such a program basically involves exposing employees to work in a hot environment for progressively longer periods. NIOSH (1986) says that, for workers who have had previous experience in jobs where heat levels are high enough to produce heat stress, the regimen should be 50% exposure on day one, 60% on day two, 80% on day three, and 100% on day four. For new workers who will be similarly exposed, the regimen should be 20% on day one, with a 20% increase in exposure each additional day.

B. **FLUID REPLACEMENT**. Cool (50°-60°F) water or any cool liquid (except alcoholic beverages) should be made available to workers to encourage them to drink small amounts frequently, e.g., one cup every 20 minutes. Ample supplies of liquids should be placed close to the work area. Although some commercial replacement drinks contain salt, this is not necessary for acclimatized individuals because most people add enough salt to their summer diets.

C. **ENGINEERING CONTROLS**.

1. **General ventilation** is used to dilute hot air with cooler air (generally cooler air that is brought in from the outside). This technique clearly works better in cooler climates than in hot ones. A permanently installed ventilation system usually handles large areas or entire buildings. Portable or local exhaust systems may be more effective or practical in smaller areas.

2. **Air treatment/air cooling** differs from ventilation because it reduces the temperature of the air by removing heat (and sometimes humidity) from the air.

3. **Air conditioning** is a method of air cooling, but it is expensive to install and operate. An alternative to air conditioning is the use of chillers to circulate cool water through heat exchangers over which air from the ventilation system is then passed; chillers are more efficient in cooler climates or in dry climates where evaporative cooling can be used.

4. **Local air cooling** can be effective in reducing air temperature in specific areas. Two methods have been used successfully in industrial settings. One type, cool rooms, can be used to enclose a specific workplace or to offer a recovery area near hot jobs. The second type is a portable blower with built-in air chiller. The main advantage of a blower, aside from portability, is minimal set-up time.

5. Another way to reduce heat stress is to increase the air flow or **convection** using fans, etc. in the work area (as long as the air temperature is less than the worker's skin temperature). Changes in air speed can help workers stay cooler by increasing both the convective heat exchange (the exchange between the skin surface and the surrounding air) and the rate of evaporation. Because this method does not actually cool the air, any increases in air speed must impact the worker directly to be

effective.

If the dry bulb temperature is higher than 35°C (95°F), the hot air passing over the skin can actually make the worker hotter. When the temperature is more than 35°C and the air is dry, evaporative cooling may be improved by air movement, although this improvement will be offset by the convective heat. When the temperature exceeds 35°C and the relative humidity is 100%, air movement will make the worker hotter. Increases in air speed have no effect on the body temperature of workers wearing vapor-barrier clothing.

6. **Heat conduction** methods include insulating the hot surface that generates the heat and changing the surface itself.

7. Simple engineering controls, such as shields, can be used to reduce radiant **heat,** i.e. heat coming from hot surfaces within the worker's line of sight. Surfaces that exceed 35°C (95°F) are sources of infrared radiation that can add to the worker's heat load. Flat black surfaces absorb heat more than smooth, polished ones. Having cooler surfaces surrounding the worker assists in cooling because the worker's body radiates heat toward them.

   With some sources of radiation, such as heating pipes, it is possible to use both insulation and surface modifications to achieve a substantial reduction in radiant heat. Instead of reducing radiation from the source, shielding can be used to interrupt the path between the source and the worker. Polished surfaces make the best barriers, although special glass or metal mesh surfaces can be used if visibility is a problem.

   Shields should be located so that they do not interfere with air flow, unless they are also being used to reduce convective heating. The reflective surface of the shield should be kept clean to maintain its effectiveness.

D. **ADMINISTRATIVE CONTROLS AND WORK PRACTICES**.

1. Training is the key to good work practices. Unless all employees understand the reasons for using new, or changing old, work practices, the chances of such a program succeeding are greatly reduced.

2. NIOSH (1986) states that a good heat stress training program should include at least the following components:

   - Knowledge of the hazards of heat stress;
   - Recognition of predisposing factors, danger signs, and symptoms;
   - Awareness of first-aid procedures for, and the potential health effects of, heat stroke;
   - Employee responsibilities in avoiding heat stress;
   - Dangers of using drugs, including therapeutic ones, and alcohol in hot work environments;
   - Use of protective clothing and equipment; and
   - Purpose and coverage of environmental and medical surveillance programs and the advantages of worker participation in such programs.

3. Hot jobs should be scheduled for the cooler part of the day, and routine maintenance and repair work in hot areas should be scheduled for the cooler seasons of the year.

E. **WORKER MONITORING PROGRAMS**.

1. Every worker who works in extraordinary conditions that increase the risk of heat stress should be personally monitored. These conditions include wearing semipermeable or impermeable clothing when the temperature exceeds 21°C (69.8° F), working at extreme metabolic loads (greater than 500 kcal/hour), etc.

2. Personal monitoring can be done by checking the heart rate, recovery heart rate, oral temperature, or extent of body water loss.

3. To check the heart rate, count the radial pulse for 30 seconds at the beginning of the

rest period. If the heart rate exceeds 110 beats per minute, shorten the next work period by one third and maintain the same rest period.

4. The recovery heart rate can be checked by comparing the pulse rate taken at 30 seconds (P_1) with the pulse rate taken at 2.5 minutes (P_3) after the rest break starts. The two pulse rates can be interpreted using Table III:4-4.

5. Oral temperature can be checked with a clinical thermometer after work but before the employee drinks water. If the oral temperature taken under the tongue exceeds 37.6°C, shorten the next work cycle by one third.

6. Body water loss can be measured by weighing the worker on a scale at the beginning and end of each work day. The worker's weight loss should not exceed 1.5% of total body weight in a work day. If a weight loss exceeding this amount is observed, fluid intake should increase.

F. **OTHER ADMINISTRATIVE CONTROLS**. The following administrative controls can be used to reduce heat stress:

- Reduce the physical demands of work, e.g., excessive lifting or digging with heavy objects;
- Provide recovery areas, e.g., air-conditioned enclosures and rooms;
- Use shifts, e.g., early morning, cool part of the day, or night work;
- Use intermittent rest periods with water breaks;
- Use relief workers;
- Use worker pacing; and
- Assign extra workers and limit worker occupancy, or the number of workers present, especially in confined or enclosed spaces.

TABLE III:4-4. HEART RATE RECOVERY CRITERIA

Heart rate recovery pattern	P_3	Difference between P_1 and P_3
Satisfactory recovery	<90	--
High recovery (Conditions may require further study)	90	10
No recovery (May indicate too much stress)	90	<10

VI. PERSONAL PROTECTIVE EQUIPMENT.

A. **REFLECTIVE CLOTHING**, which can vary from aprons and jackets to suits that completely enclose the worker from neck to feet, can stop the skin from absorbing radiant heat. However, since most reflective clothing does not allow air exchange through the garment, the reduction of radiant heat must more than offset the corresponding loss in evaporative cooling. For this reason, reflective clothing should be worn as loosely as possible. In situations where radiant heat is high, auxiliary cooling systems can be used under the reflective clothing.

B. **AUXILIARY BODY COOLING**.

1. Commercially available **ice vests**, though heavy, may accommodate as many as 72 ice packets, which are usually filled with water. Carbon dioxide (dry ice) can also be used as a coolant. The cooling offered by ice packets lasts only 2 to 4 hours at moderate to heavy heat loads, and frequent replacement is necessary. However, ice vests do not encumber the worker and thus permit maximum mobility. Cooling with ice is also relatively inexpensive.

2. **Wetted clothing** is another simple and inexpensive personal cooling technique. It is effective when reflective or other impermeable protective clothing is worn. The clothing may be wetted terry cloth coveralls or wetted two-piece, whole-body cotton suits. This approach to auxiliary cooling can be quite effective under conditions of high

temperature and low humidity, where evaporation from the wetted garment is not restricted.

3. **Water-cooled garments** range from a hood, which cools only the head, to vests and "long johns," which offer partial or complete body cooling. Use of this equipment requires a battery-driven circulating pump, liquid-ice coolant, and a container.

   Although this system has the advantage of allowing wearer mobility, the weight of the components limits the amount of ice that can be carried and thus reduces the effective use time. The heat transfer rate in liquid cooling systems may limit their use to low-activity jobs; even in such jobs, their service time is only about 20 minutes per pound of cooling ice. To keep outside heat from melting the ice, an outer insulating jacket should be an integral part of these systems.

4. **Circulating air** is the most highly effective, as well as the most complicated, personal cooling system. By directing compressed air around the body from a supplied air system, both evaporative and convective cooling are improved. The greatest advantage occurs when circulating air is used with impermeable garments or double cotton overalls.

   One type, used when respiratory protection is also necessary, forces exhaust air from a supplied-air hood ("bubble hood") around the neck and down inside an impermeable suit. The air then escapes through openings in the suit. Air can also be supplied directly to the suit without using a hood in three ways:

   - by a single inlet;
   - by a distribution tree; or
   - by a perforated vest.

   In addition, a vortex tube can be used to reduce the temperature of circulating air. The cooled air from this tube can be introduced either under the clothing or into a bubble hood. The use of a vortex tube separates the air stream into a hot and cold stream; these tubes also can be used to supply heat in cold climates. Circulating air, however, is noisy and requires a constant source of compressed air supplied through an attached air hose.

   One problem with this system is the limited mobility of workers whose suits are attached to an air hose. Another is that of getting air to the work area itself. These systems should therefore be used in work areas where workers are not required to move around much or to climb. Another concern with these systems is that they can lead to dehydration. The cool, dry air feels comfortable and the worker may not realize that it is important to drink liquids frequently.

C. **RESPIRATOR USAGE**. The weight of a self-contained breathing apparatus (SCBA) increases stress on a worker, and this stress contributes to overall heat stress. Chemical protective clothing such as totally encapsulating chemical protection suits will also add to the heat stress problem.

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APPENDIX III:4-1. HEAT STRESS: GENERAL WORKPLACE REVIEW.

NOTE: Listed below are sample questions that the Compliance Officer may wish to consider when investigating heat stress in the workplace.

WORKPLACE DESCRIPTION.

A. Type of business
B. Heat-producing equipment or processes used
C. Previous history (if any) of heat-related problems
D. At "hot" spots:

- Is the heat steady or intermittent?
- Number of employees exposed?
- For how many hours per day?
- Is potable water available?
- Are supervisors trained to detect/evaluate heat stress symptoms?

ARE EXPOSURES TYPICAL FOR A WORKPLACE IN THIS INDUSTRY?

A. Weather at Time of Review
B. Temperature
C. Humidity
D. Air velocity
E. Is Day Typical of Recent Weather Conditions?
(Get information from the Weather Bureau)
F. Heat-Reducing Engineering Controls
G. Ventilation in place?
H. Ventilation operating?
I. Air conditioning in place?
J. Air conditioning operating?
K. Fans in place?
L. Fans operating?
M. Shields or insulation between sources and employees?
N. Are reflective faces of shields clean?

WORK PRACTICES TO DETECT, EVALUATE, AND PREVENT OR REDUCE HEAT STRESS.

A. Training program?
B. Content?
C. Where given?
D. For whom?
E. Liquid replacement program?
F. Acclimatization program?
G. Work/rest schedule?
H. Scheduling of work (during cooler parts of shift, cleaning and maintenance during shut-downs, etc.)
I. Cool rest areas (including shelter at outdoor work sites)?
J. Heat monitoring program?
K. Personal Protective Equipment
L. Reflective clothing in use?
M. Ice and/or water-cooled garments in use?
N. Wetted undergarments (used with reflective or impermeable clothing) in use?
O. Circulating air systems in use?
P. First Aid Program
Q. Trained personnel?
R. Provision for rapid cool-down?
S. Procedures for getting medical attention?
T. Transportation to medical facilities readily available for heat stroke victims?
U. Medical Screening and Surveillance Program
V. Content?
W. Who manages program?
X. Additional Comments

(Use additional pages as needed.)

APPENDIX III: 4-2. HEAT STRESS-RELATED ILLNESS OR ACCIDENT FOLLOW-UP.

A. Describe events leading up to the episode.
B. Evaluation/comments by other workers at the scene.
C. Work at time of episode (heavy, medium, light)?
D. How long was affected employee working at site prior to episode?
E. Medical history of affected worker, if known.
F. Appropriate engineering controls in place?
G. Appropriate engineering controls in operation?
H. Appropriate work practices used by affected employee(s)?
I. Appropriate personal protective equipment available?
J. Appropriate personal protective equipment in use?
K. Medical screening for heat stress and continued surveillance for signs of heat stress given other employees?
L. Additional comments regarding specific episode(s): (Use additional pages as needed.)

APPENDIX III: 4-3. MEASUREMENT OF WET BULB GLOBE TEMPERATURE.

Measurement is often required of those environmental factors that most nearly correlate with deep body temperature and other physiological responses to heat. At the present time, the Wet Bulb Globe Temperature Index (WBGT) is the most used technique to measure these environmental factors. WBGT values are calculated by the following equations: **Equation III:4-4. Indoor or Outdoor Wet Bulb Gobe Temperature Indexes (WBGI)** Indoor or outdoors with no solar load

$$WBGT = 0.7NWB + 0.3GT$$

Outdoors with solar load

$$WBGT = 0.7NWB + 0.2GT + 0.1DB$$

where: WBGT = Wet Bulb Globe Temperature Index
NWB = Natural Wet-Bulb Temperature
DB = Dry-Bulb (air) Temperature
GT = Globe Thermometer Temperature

The determination of WBGT requires the use of a black globe thermometer, a natural (static) wet-bulb thermometer, and a dry-bulb thermometer. The measurement of environmental factors shall be performed as follows:

1. The range of the dry and the natural wet-bulb thermometers should be -5°C to +50°C, with an accuracy of ±0.5°C. The dry bulb thermometer must be shielded from the sun and the other radiant surfaces of the environment without restricting the airflow around the bulb. The wick of the natural wet bulb thermometer should be kept wet with distilled water for at least one-half hour before the temperature reading is made. It is not enough to immerse the other end of the wick into a reservoir of distilled water and wait until the whole wick becomes wet by capillarity. The wick must be wetted by direct application of water from a syringe one-half hour before each reading. The wick must cover the bulb of the thermometer and an equal length of additional wick must cover the stem above the bulb. The wick should always be clean, and new wicks should be washed before using.

2. A globe thermometer, consisting of a 15 cm (6-inch) in diameter hollow copper sphere painted on the outside with a matte black finish, or equivalent, must be used. The bulb or sensor of a thermometer (range -5°C to +100°C with an accuracy of ±0.5°C) must be fixed in the center of the sphere. The globe thermometer should be exposed at least 25 minutes before it is read.

3. A stand should be used to suspend the three thermometers so that they do not restrict free air flow around the bulbs and the wet-bulb and globe thermometer are not shaded.

4. It is permissible to use any other type of temperature sensor that gives a reading similar to that of a mercury thermometer under the same conditions.

5. The thermometers must be placed so that the readings are representative of the employee's work or rest areas, as appropriate.

Once the WBGT has been estimated, employers can estimate workers' metabolic heat load (see Tables III:4-1 and III:4-2) and use the ACGIH method to determine the appropriate work/rest regimen, clothing, and equipment to use to control the heat exposures of workers in their facilities.

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Occupational Safety & Health Administration
200 Constitution Avenue, NW
Washington, DC 20210

APPENDIX D-K

HANDLING AND STORAGE OF HAZARDOUS CHEMICALS

MACTEC, Inc.

HANDLING AND STORAGE OF HAZARDOUS CHEMICALS
Health and Safety Program No. 5.5.1

Revision #: 0	Issue Date: June 18, 2004	Effective Date: July 18, 2004

1.0 PURPOSE

The purpose of this Program is to provide the minimum safety requirements for the storage and handling of hazardous chemicals and to help comply with applicable health and safety standards. As much as practicable, the Company shall use the least hazardous chemical (e.g., least toxic, least corrosive) that will do a particular job effectively.

2.0 SCOPE

This Program applies to all Company operations which use or store hazardous chemicals. The handling and storage of hazardous wastes and radioactive chemicals are beyond the scope of this Program.

3.0 DEFINITIONS

Hazardous Chemical: Any chemical which poses a physical or health hazard.

Oxidizer: A chemical that has the capacity to initiate combustion or promote combustion in other chemicals.

Water Reactive: A chemical that reacts with water to release a gas that is either flammable or presents a health hazard.

4.0 RESPONSIBILITIES

4.1 EMPLOYEES

Employees are responsible for:

- Following the requirements outlined in Section 5.0 of this Program when storing or handling hazardous chemicals.
- Immediately reporting any improperly stored hazardous chemicals to their Supervisor.
- Immediately reporting any spilled chemical to their Supervisor.

4.2 SUPERVISORS

Supervisors of employees working with hazardous chemicals are responsible for ensuring that:

- Their employees are provided training as required by Section 6.0 of this Program.

- Their employees understand the proper storage location(s) for the chemicals they use.
- Appropriately addressing any employee reports of improperly stored hazardous chemicals.

4.3 LOCAL OPERATIONS MANAGERS

Local Operations Managers are responsible for ensuring that:

- Employees are provided training as required by Section 6.0 of this Program.
- Adequate facilities are made available for hazardous chemical storage.
- Appropriate engineering controls, administrative, and/or personal protective equipment are provided to employees handling hazardous chemicals.

4.4 LOCAL HEALTH AND SAFETY REPRESENTATIVES (LHSR)

The LHSR is responsible for:

- Conducting periodic inspections to verify that chemicals are being stored properly and in their correct location and documenting these inspections.
- Reporting the results of the inspections to the Local Operations Manager.

5.0 DESCRIPTION

5.1 HOUSEKEEPING

Clearance Distances - All aisles, emergency exits, fire extinguishers, etc. shall be kept clear, with a minimum of 3 feet either side of hazardous chemical storage, at all times. In addition, hazardous chemicals shall not be stored within 18 inches of automatic sprinkler heads.

Storage Areas - Storage areas shall be maintained in a neat and orderly fashion at all times. When chemicals are received, they shall be stored properly and in a timely fashion.

Spills - Spills shall be cleaned up immediately and wastes disposed of properly (see Section 5.6 for more information on spill procedures).

5.2 USE AND HANDLING

Least Hazardous Choice – For any particular application, the least hazardous chemical that can effectively do the job shall be chosen.

Use Controls - Employees handling hazardous chemicals shall use any available engineering controls and any personal protective equipment required by the Company for that task.

Training Required - Employees handling hazardous chemicals shall have successfully participated in Hazard Communication training, including training on the specific chemical.

Labeling - All hazardous chemical containers shall be labeled in accordance with the Hazard Communication Program.

Personal Hygiene - Employees handling hazardous chemicals shall wash their hands before leaving work and before using eating, drinking, applying cosmetics or lip balm, and before using the toilet.

Prohibited Activities - Eating, drinking, smoking, and applying cosemetics and lip balm are strictly prohibited in areas where hazardous chemicals are being used.

Transferring Chemicals – Employees shall hold chemical containers firmly and always transfer chemicals slowly and carefully to avoid spills and splashes.

Corrosives - Employees shall always pour corrosives into water, not the reverse.

Flammable Liquids - The Flammable and Combustible Liquids Program shall be followed when storing or handling flammable and combustible liquids.

Compressed Gases The Compressed Gas Safety Program shall be followed when handling and storing compressed gases.

5.3 STORING HAZARDOUS CHEMICALS

5.3.1 General Storage Requirements

- Hazardous chemicals shall not be stored in office areas or in exits, stairways, hallways, or any other means of egress.
- No hazardous chemicals, including batteries, shall be kept in any refrigerator used by employees to store food products.
- Chemicals shall be stored away from sources of heat and away from direct sunlight.
- Chemical storage areas shall be checked regularly for spills and leaks, and any necessary clean-up undertaken (see Section 5.6).
- All chemicals shall be stored in an appropriate manner and in a suitable area. Storage areas may include, but are not limited to: specialized storage cabinets (e.g., flammable cabinet or corrosives cabinet); in cabinet space underneath laboratory bench tops; in any other appropriate storage cabinet.
- All chemical shelving shall have either a ½ inch containment lip, other spill containment method (e.g., polyethylene trays), or have leakproof doors covering the shelves.
- Shelves shall be painted or covered with chemical resistant paint or other chemical resistant coating.
- Shelves shall be sturdy enough to support the chemicals being stored on them. Shelves shall not be overloaded.
- Liquid chemicals shall not be stored above shoulder level.

5.3.2 Additional Rules for Storing Corrosives

- Acids and bases shall be stored away from each other.
- Larger bottles of corrosives shall be stored on the lower shelves of the corrosives cabinets.

5.3.3 Additional Rules for Storing Oxidizers

- Oxidizers shall be stored in glass or other inert containers.
- Oxidizers shall be stored inside a noncombustible cabinet.
- Corks and rubber stoppers shall not be used to cover or seal containers of oxidizers.

5.3.4 Additional Rules for Storing Water Reactive Chemicals -

- Store in a cool, dry location.
- Protect from water fire sprinklers.

5.4 CHEMICAL COMPATABILITY

Incompatibles - Incompatible chemicals shall not be stored in close proximity to each other. The MSDS for a particular chemical shall be consulted for any special storage information as well as information on incompatibilities. A listing of some common chemicals and those they are not compatible with is presented at Attachment A.

Categories for Storage - Hazardous chemicals shall be separated into the following categories for storage:

- Solids
  - oxidizers
  - flammable solids (e.g., red phosphorous, magnesium, lithium)
  - water reactives
  - others

- Liquids
  - acids
  - caustics
  - oxidizers
  - flammable/combustible
  - perchloric acid

- Gases
  - toxic
  - oxidizers and inert
  - flammable

Chemicals that may fall into more than one of the above categories shall be stored in deference to the greater hazard. For example, organic acids should be stored in the flammable liquids cabinet, not with the other acids.

5.5 TRANSPORTING/SHIPPING HAZARDOUS CHEMICALS

Training Required - All shipment of hazardous chemicals (as well as other hazardous materials) shall be handled by employees who have successfully completed the training required by US Department of Transportation (DOT) regulation 49 CFR 172.700.

Shipping/Transporting - All shipping or transporting of hazardous chemicals shall meet the requirements of 49 CFR 171 through 180.

Transporting Small Quantities – Employees transporting small quantities (meeting exception requirements of 49 CFR 172) of hazardous chemicals in Company or their personal vehicles shall do so with great care, including:

- Ensure containers are tightly closed.
- Containers shall be secured while being transported.
- If possible, place containers in trunk or cargo bed.
- Do not leave chemicals unattended or stored in a vehicle, especially in extreme temperatures.
- Do not transport incompatible materials together.
- Have the applicable MSDSs available in the vehicle.

Carrying Chemicals - When carrying hazardous chemicals by hand, they shall be placed in a safety container, acid-carrying bucket, or other appropriate container to protect against breakage and spills.

5.6 SPILL MANAGEMENT

Field Projects - Project specific spill response procedures shall be included in the project site specific health and safety plan and communicated to all affected employees on site.

Minor Chemical Spill – For spills of approximately one gallon of chemical or less which do not present an immediate fire, safety, environmental, or health hazard, the following steps shall be taken:

- Alert people in the area of the spill to keep away.
- Notify your Supervisor or the Supervisor in charge of the area of the spill.
- An employee with the appropriate HAZWOPER training may be assigned by management to contain and clean up the spill using proper clean up techniques and materials and proper personal protective equipment. Consult MSDS for spill clean up procedures.
- The assigned employee shall place waste in appropriate container and label as required by hazardous waste regulations.
- Clean spill area with water.
- Arrange for proper disposal of waste material.

Major Chemical Spill – For spills of greater than one gallon; any spill involving a chemical which presents an immediate fire, safety, environmental, or health hazard; or a minor spill where there are no appropriately trained employees to clean up the spill, the Local Operation's Emergency Action Plan or Emergency Response Plan shall be activated.

6.0 TRAINING

Hazard Communication - All affected employees shall receive hazard communication training as required by the Hazard Communication Program.

Program Requirements - Employees shall be trained in the contents and requirements of this Program initially and upon hire, and as deemed necessary by the health and safety staff.

Regarding Storage - Employees responsible for storing chemicals shall be advised of the different storage areas for all chemical classes.

Documentation - All training shall be documented in accordance with the Personnel Health and Safety Records Management Program.

7.0 REGULATORY REFERENCES

- 29 CFR 1910.120 – Hazardous Waste Operations and Emergency Response
- 29 CFR 1910.1200 – Hazard Communication
- 49 CFR 171-180 – Hazardous Materials

APPENDIX D-L

WORKING OVER OR NEAR WATER

WORKING OVER OR NEAR WATER

1. PURPOSE

This procedure outlines the requirements for work performed over, near, or in water, including work performed by MACTEC and subcontractor employees, where a danger of drowning exists.

2. SCOPE

This procedure applies to all segments of MACTEC where work is performed over, near, or in water and applies to all such work when it is not governed by a more restrictive client policy or procedure. If a client policy or procedure is less restrictive, it will be used in addition to this policy. Subcontractors will use this policy in addition to any procedure they may have.

3. REFERENCES

Corporate ESH Policy, 2.10, *Compliance with Regulations*

MACTEC's Fall Protection Procedure

MACTEC's Boating Procedure

29 CFR 1926.106, Working Over and Near Water, and associated OSHA Interpretation Letters

29 CFR 1926 Subpart M, *Fall Protection*

29 CFR 1926 Subpart E - *Personal Protective and Life Saving Equipment*

4. ACRONYMS AND DEFINITIONS

Barge: A non-self-propelled vessel, generally with a flat bottom and shallow draft, used as a working platform.

Dock: A stationary platform to which vessels are tied when not underway on water.

Drowning Hazard: Is considered a potential when the depth is 2 or more feet, or when other conditions increase hazards associated with shallower depths such as current, water temperature, wave action, water intakes, rapids, water falls, etc.

Lifesaving skiff: A small, open boat, vessel, dedicated solely for water rescue and equipped with oars and a motor as well as equipment required by the U.S. Coast Guard, including safety lights, fire extinguishers, radios, and lifesaving devices.

Operator: A designated individual who must either man the skiff at all times or remain in the immediate area such that they can quickly reach the skiff and get underway.

Personal Flotation Device (PFD): A life jacket or buoyant work vest approved by the U.S. Coast Guard. MACTEC uses only PFDs rated for flotation in the water conditions at the job site and based on the wearer's weight.

Ring buoy: A life preserver in the form of a ring made of buoyant material, known informally as a life buoy. MACTEC uses only 30-inch diameter ring buoys approved by the U.S. Coast Guard, and each ring buoy has a line attached of at least 90 feet in length.

5. REQUIREMENTS

5.1 Training requirements shall be assessed and training shall be obtained and documented for workers performing work over or near water, including the use and inspection of PFDs, lifesaving and fall protection equipment.

5.2 Barges shall be equipped with at least one portable or permanent ladder of sufficient length to allow employees to reach safety in the event they fall into the water. Barges shall also be equipped with ring buoys with lines attached and located in readily visible and accessible places.

5.3 Ring buoys shall have at least 90 feet of line attached. When work is performed on a floating vessel 200 feet or more in length, at least three 30-inch ring buoys with lines attached shall be located in readily visible and accessible places. This will include one ring buoy located forward, one aft, and one at the access to the gangway. When work is performed on a vessel under 200 feet in length, at least one 30-inch ring buoy will be located at the gangway. Docks will be equipped with ring buoys at least every 200 feet.

5.4 Fall protection shall be provided for all employees working 6 feet or more above the water surface. If continuous fall protection, other than safety nets, is used to prevent employees from falling into the water, employees so protected will not be required to wear PFDs. When safety nets are used in place of other continuous fall protection measures, employees will be required to wear PFDs. All employees working on bridges and not constantly protected from falls into the water where the danger of drowning exists are required to PFDs.

5.5 A lifesaving skiff shall be immediately available at any location where there is a drowning hazard. At least one skiff shall be available at each job site. Lifesaving skiffs shall not be used for any other purpose except for rescue and shall be in the water or capable of being launched by one person

5.6 PFDs and fall protection equipment shall be inspected before and after each use for defects and signs of wear that would alter their strength or buoyancy. Defective units will be destroyed or tagged out of service and not used.

5.7 Ladders shall be provided in the vicinity of all floating vessels on which work is being performed. Ladders shall be portable or fixed, and shall be of sufficient length to allow employees to reach safety in the event they fall into the water. Use of ladders will follow established MACTEC procedure requirements.

5.8 Employees conducting work activities within 6 feet of the edge of any open body of water such as rivers, bays, lakes or ocean shall wear PFDs. A safety line must also be attached to the employee if the body of water is fast moving such that if the employee falls into the water they could not easily extract themselves.

6. PROCEDURE

Major process steps involved with the implementation of this Procedure are as follows:

Step No.	Performer	Action
6.1	Project Manager, Field Leader or Supervisor	• Ensure all applicable employees are trained to the requirements of this Procedure. • Remain aware of changing work conditions that may result in employees working, even briefly, in areas not covered by continuous fall protection. • Has been trained to all applicable requirements of this Procedure. • Shall be present and specifically designated to respond to water emergencies and operate the skiff at all times when employees are working over or near water.
6.2	Operator	• Must remain in the immediate area of the skiff at all times. • May be assigned other duties only if those duties do not interfere with the operator's ability to be aware of and respond to water emergencies. • Must be aware of the number of work locations where there is a danger of falling into water and the distance to each of those locations
6.3	Employee	• Performs work over or near water only after being trained to the requirements of this Procedure.

7. RECORDS

Job hazard analyses, mitigation measures and training shall be documented and maintained in accordance with the project record index or office records management requirements.

8. ATTACHMENTS

None

APPENDIX D-M

POWER AND HAND TOOLS

POWER AND HAND TOOLS

1. PURPOSE

This Procedure is to provide minimum safety requirements for the use of hand and portable power tools.

2. SCOPE

This Procedure applies to all MACTEC operations where hand and/or portable power tools are used.

3. REFERENCES

29 CFR 1910 Subpart P; *Hand and Portable Power Tools and Other Hand-Held Equipment*

29 CFR1926 Subpart I; *Tools – Hand and Power*

4. ACRONYMS AND DEFINITIONS

Ground-fault circuit interrupter (GFCI) - A protective electrical device that is used to interrupt the flow of electrical power to a piece of equipment upon detection of current leakage.

Hand tools - All non-powered, portable tools such as screwdrivers, wrenches, hammers, etc.

Open blade knife - Any knife with an open, exposed, or non-retractable blade such as utility knives, Xacto® knives, razor knives and machetes.

Pneumatic tools - Tools powered by compressed air such as chippers, drills, hammers, sanders, etc.

Portable abrasive wheel tools - Tools that grind, cut, polish, or use wire buffing wheels.

Power tool – Tools which use electric, pneumatic, liquid fuel and hydraulic means for power

p.s.i. - Pounds per square inch.

5. REQUIREMENTS

5.1 Safety

5.1.1 Only authorized employees who have been trained or have had previous documented experience in the field shall be permitted use of hand and/or power tools.

5.1.2 Employees shall not use tools that are visibly damaged, or that produce smoke, smells, or sparks apart from their normal operation. Damaged tools shall be removed from service and tagged "Do Not Use" or similar language until fully repaired or discarded. The appropriate supervisor shall be notified immediately of a defective tool.

5.1.3 Tools shall be used only for the purpose for which they were intended. All tools shall be used as required by manufacturer's instructions and within their design limitations.

5.1.4 MACTEC's Personal Protective Equipment (PPE) Program shall be followed to determine the need for any PPE when using a specific tool (e.g., safety glasses, face shield, gloves, etc). Care shall be taken to ensure that PPE does not interfere with the safe operation of hand and portable power tools.

5.1.5 Employees shall not wear loose clothing, ties, jewelry or other personal attire that can be caught in moving or rotating parts while operating power tools. Long hair that extends below the shoulder level shall be restrained in a manner to prevent contact with moving and rotating parts.

5.1.6 Employees shall not be subject to prolonged periods of use with any power tool, and it is suggested that they take turns operating equipment or take short breaks.

5.1.7 Power tools shall be unplugged from the energy source during service and when not in use. When this method of hazard control is not feasible, the requirements of MACTEC's Lockout/Tagout Procedure shall apply, including any applicable equipment specific procedures, when performing maintenance or repair.

5.1.8 All company owned hand and portable power shall be equipped with a guard and safety switch as required. Guards must provide protection at the point of operation, running nip points, rotating parts, and flying chips and sparks and are never to be removed when the tool is in use. A constant-pressure switch or control that shuts off the power when pressure is released is required on power tools. Tools may also be equipped with a "lock-on" control, if it allows the operator to also shut off the tool in a single motion using the same finger or fingers.

5.1.9 Portable fans shall have a full guard or screen that has openings of ½ inch or less.

5.1.10 Tools shall not be used in awkward positions if at all possible. Employees shall ensure that they can easily reach the work and that they have good footing prior to using the tool.

5.1.11 When passing tools to others, employees shall pass them handle first or place them on the floor or other surface. Equipment shall not be passed to others or lowered, raised, or carried by the power cord or pneumatic hose.

5.1.12 When feasible, items that may move while being worked on with tools shall be secured with clamps, vise, or other means to prevent accidental slippage.

5.1.13 Personnel not involved with the work shall be kept at a safe distance away from work being done with tools. When working with tools, direct the tools away from aisle areas and away from co-located employees.

5.1.14 Care shall be taken to prevent cords and hoses associated with portable power tools from causing a tripping hazard.

5.1.15 Extreme caution shall be taken when working with tools that produce sparks. MACTEC's Hot Works Procedure shall be followed at all times to prevent ignition hazards.

5.2 Maintenance

5.2.1 Employees shall follow manufacturer's instructions for lubricating tools, changing accessories, and other basic maintenance needs. The following items shall be included in the inspection as applicable:

- Check power cords for signs of damage or wear.
- Check for cracking or other damage.
- Ensure bits and blades are sharp.
- Check all guards to ensure that they are both attached and functioning properly.
- For impact tools, check to ensure the head is not mushroomed.
- For pneumatic tools, check hose connections.
- For wooden handled tools, check handle for splinters, cracking, and tightness.

5.2.2 All tools shall be maintained in good working order, and shall be kept clean, sharp and lubricated to prevent wear and misalignment.

5.2.3 All hand and portable power tools shall be stored in a dry, secure location.

5.2.4 All worn or damaged tools be tagged out of service with a tag indication "Do Not Use" or similar and repaired immediately or discarded.

5.3 Electric Power Tools

5.3.1 Power cords and air hose must be kept away from heat, oil and sharp edges.

5.3.2 Employees shall have dry hands, and proper personal protective equipment (e.g., gloves, safety footwear, safety eyewear, etc), when working with electrical power tools.

5.3.3 Electric power tools and power cords shall not be used or stored in damp or wet locations unless they are approved for that use.

5.3.4 Electric power tools shall be either double-insulated, or have a three-wire cord with ground and be grounded. If a three-wire cord is used with an adapter to accommodate a two-hole receptacle, the adapter wire shall be attached to a known ground. Use of adapters without an assured ground is strictly forbidden.

5.3.5 Only three-wire extension cords designated for hard usage shall be used with electric tools. Cords shall have one of the following designations: S, SC, SCE, SJT, SE SEO, SEOO, SJ, SJE, SJEO, SJEOO, SJO, SJT, SJTO, SJTOO, SO, SOO, ST, STO, STOO, G, PPE, or W. Never use extension cords as permanent wiring.

5.3.6 GFCIs shall be used with electric power tools, including double-insulated tools, as required by MACTEC's Electrical Safety Procedure.

5.4 Pneumatic Power Tools

5.4.1 Eye protection is required. Head and face (face shield) protection, and safety shoes, as appropriate, shall be worn when working with pneumatic tools. Hearing protection is required when using or working within proximity to pneumatic tools such as jackhammers. Heavy rubber grips reduce fatigue and strains by providing a secure handhold on equipment such as jackhammers.

5.4.2 Pneumatic power tools shall be securely fastened to the hose by some mechanical means of securing the connection (e.g., chain, wire, or positive locking device) to prevent accidental disconnection.

5.4.3 Safety clips or retainers shall be securely installed and maintained on all pneumatic impact tools to prevent attachments from being accidentally expelled.

5.4.4 All pneumatically driven nailers, staplers and other similar equipment provided with automatic fastener feed, which operate at pressures greater than 100 p.s.i. at the tool, shall have a safety device on the muzzle to prevent accidental ejection.

5.4.5 The manufacturer's safe operating pressure for hoses, pipes, valves, filters, and other fittings shall not be exceeded.

5.4.6 Hoses exceeding ½ inch inside diameter shall have a safety excess flow valve at the supply source or branch line to reduce pressure in case of hose failure.

5.4.7 Airless spray guns that atomize paints and fluids at pressures of 1,000 p.s.i. or greater shall be equipped with automatic or visible manual safety devices that will prevent pulling the trigger until the safety device is manually released.

5.4.8 Screens shall be set up to protect nearby workers from being struck by flying fragments around chippers, riveting guns, staplers, or air drills. Ensure work area is arranged to minimize tripping hazards.

5.4.9 Employees shall not point air guns toward anyone, or "dead-end" them against themselves or anyone else.

5.4.10 Compressed air shall not be used for cleaning purposes except where reduced to less than 30 p.s.i. and then only with effective chip guarding and personal protective equipment.

5.5 Hydraulic Power Tools

5.5.1 Hydraulic fluid shall be fire-resistant. The exception is hydraulic fluids used for the insulated sections of hydraulic tools that are used on or around energized electrical lines. In this case, insulating type hydraulic fluid shall be used.

5.5.2 Hydraulic fluid shall retain its operating characteristics at the most extreme temperatures to which it will be exposed.

5.5.3 The manufacturer's recommended safe operating pressure for hoses, pipes, valves, filters, and other fittings shall not be exceeded.

5.5.4 All jacks shall have a stop indicator, and the stop limit shall not be exceeded. Also, the manufacturer's load limit shall be permanently marked on a prominent place on the jack, and that load limit shall not be exceeded.

5.5.5 When setting up a jack, the base and head of the jack shall rest on a firm, level surface, and the jack shall be correctly centered in order for the lift force to be applied evenly.

5.5.6 All jacks used continuously or intermittently at one site must be inspected at least once every 6 months.

5.6 Knives

5.6.1 Employees shall only use open blade knives if absolutely necessary. Sheath the knife when not in use. If at all possible, another alternative such as spring loaded knives or scissors shall be used in lieu of an open blade knife. Never walk with an open knife in your hand unless it is a machete of similar cutting knife.

5.6.2 Employees using an open blade knife shall position their hands and all other parts of their body so the blade will not make contact with the user if the knife were to slip or suddenly cut through any material being cut. Maintain proper posture and cut at waist level to reduce muscle strains. Hold the knife with a firm grip.

5.6.3 The need for personal protective equipment shall be evaluated as required by MACTEC's Procedure ES&H-2.9.1, *Risk Assessment and Job Hazard Analysis Procedure* for each work task involving an open blade knife. Any protective equipment indicated by that Procedure, shall be used for the duration of the work task.

5.6.4 All personnel shall be kept a safe distance from the area of use of an open blade knife.

5.6.5 Blades must be stored in a protective container that is clearly labeled as to contents.

5.6.6 Keep the knife in good condition, clean and the blade sharp, and keep cutting surfaces smooth and clean. When hand-sharpening a knife, the honing steel or stone must have a guard to protect the hand that is holding it.

5.6.7 In order to maximize grip, minimize exertion, and ease hand or wrist strain, look for the following when selecting a knife:

- An easy to clean, non-slip handle that provides a good grip;
- A hilt guard to prevent your hand from slipping from handle to blade;
- Grooves in the blade (the grooves break the vacuum and thus reduce the force needed for the cut);
- A strong, thin, and flexible hard steel alloy blade;
- A handle that is shaped to reduce excessive bending of the wrist;
- A handle that is the right size for the user's hand; and
- A knife suitable for right or left handed users.

5.7 Portable Abrasive Wheel Tools

5.7.1 When operating a portable abrasive wheel tool, always wear eye and face protection.

5.7.2 Abrasive wheel tools shall be equipped with guards that cover the spindle end, nut, and flange projections, maintain proper alignment with the wheel, and do not exceed the strength of the fastenings.

5.7.3 Before an abrasive wheel is mounted, it shall be inspected closely for damage and shall be ring- or sound-tested to ensure that it is free of cracks or defects. (NOTE: To perform this test, tap wheel gently with a light, non-metallic instrument. If the wheel is stable and undamaged, it will give a clear metallic tone or "ring").

5.7.4 The manufacturer's recommendations shall be followed for tightening the spindle nut.

5.7.5 The spindle speed of the tool shall not exceed the maximum operating speed marked on the abrasive wheel.

5.7.6 The operator shall allow the tool to come up to operating speed before grinding or cutting. Employees shall not stand directly in front of the wheel as it accelerates to full operating speed.

5.7.7 Hand held grinders or other abrasive wheel tools shall never be clamped into a vise for use. Always use a wheel with the proper RPM rating on all portable grinders.

5.8 Liquid Fuel Tools

5.8.1 Fuel shall be handled, transported and stored as required by MACTEC's Flammable and Combustible Liquids Procedure.

6. PROCEDURE

Step No.	Performer	Action
6.1	Supervisor/Local Health and Safety Representative (LHSR)	• Complete a job hazard analysis (JHA) before the start of any project related work is initiated. • Ensure employees have received training associated with applicable requirements of this procedure associated with the work and tools to be used in order to complete work tasks in a safe manner.
6.3	Employee	• Receive training on applicable requirements of this procedure prior to the use of hand or power tools. • Inspect hand and power tools before and after each day's use. Maintain the tools, equipment, and work area in an orderly and safe manner, which includes proper clean-up and storage of tools. • Report any broken or damaged tools to your supervisor or appropriate individual, and immediately tag the tool and remove it from service.

7. RECORDS

All document generated as a result of the implementation of this Procedure shall be kept on file at the local office or project.

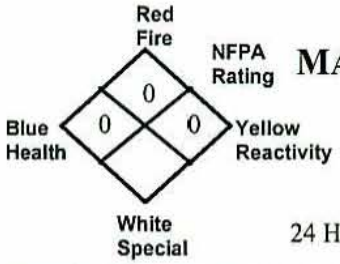
8. ATTACHMENTS

Not applicable

APPENDIX D-N

MATERIAL SAFETY DATA SHEETS

Alconox ®



MATERIAL SAFETY DATA SHEET

Alconox, Inc.
30 Glenn Street
White Plains, NY 10603

24 Hour Emergency Number – Chem-Tel (800) 255-3924

I. IDENTIFICATION

Product Name (as appears on label)	ALCONOX
CAS Registry Number:	Not Applicable
Effective Date:	January 1, 2001
Chemical Family:	Anionic Powdered Detergent
Manufacturer Catalog Numbers for sizes	1104, 1125, 1150, 1101, 1103 and 1112

II. HAZARDOUS INGREDIENTS/IDENTITY INFORMATION

There are no hazardous ingredients in ALCONOX as defined by the OSHA Standard and Hazardous Substance List 29 CFR 1910 Subpart Z.

III. PHYSICAL/CHEMICAL CHARACTERISTICS

Boiling Point (F):	Not Applicable
Vapor Pressure (mm Hg):	Not Applicable
Vapor Density (AIR=1):	Not Applicable
Specific Gravity (Water=1):	Not Applicable
Melting Point:	Not Applicable
Evaporation Rate (Butyl Acetate=1):	Not Applicable
Solubility in Water:	Appreciable-Soluble to 10% at ambient conditions
Appearance:	White powder interspersed with cream colored flakes.
pH:	9.5 (1%)

IV. FIRE AND EXPLOSION DATA

Flash Point (Method Used):	None
Flammable Limits:	LEL: No Data UEL: No Data
Extinguishing Media:	Water, dry chemical, CO_2, foam
Special Fire fighting Procedures:	Self-contained positive pressure breathing apparatus and protective clothing should be worn when fighting fires involving chemicals.
Unusual Fire and Explosion Hazards:	None

V. REACTIVITY DATA

Stability:	Stable
Hazardous Polymerization:	Will not occur
Incompatibility (Materials to Avoid):	None
Hazardous Decomposition or Byproducts:	May release CO_2 on burning

VI. HEALTH HAZARD DATA

Route(s) of Entry:	Inhalation? Yes Skin? No Ingestion? Yes
Health Hazards (Acute and Chronic):	Inhalation of powder may prove locally irritating to mucous membranes. Ingestion may cause discomfort and/or diarrhea. Eye contact may prove irritating.
Carcinogenicity:	NTP? No IARC Monographs? No OSHA Regulated? No
Signs and Symptoms of Exposure:	Exposure may irritate mucous membranes. May cause sneezing.
Medical Conditions Generally Aggravated by Exposure:	Not established. Unnecessary exposure to this product or any industrial chemical should be avoided. Respiratory conditions may be aggravated by powder.
Emergency and First Aid Procedures:	Eyes: Immediately flush eyes with water for at least 15 minutes. Call a physician. Skin: Flush with plenty of water. Ingestion: Drink large quantities of water or milk. Do not induce vomiting. If vomiting occurs administer fluids. See a physician for discomfort.

VII. PRECAUTIONS FOR SAFE HANDLING AND USE

Steps to be Taken if Material is Released or Spilled:	Material foams profusely. Recover as much as possible and flush remainder to sewer. Material is biodegradable.
Waste Disposal Method:	Small quantities may be disposed of in sewer. Large quantities should be disposed of in accordance with local ordinances for detergent products.
Precautions to be Taken in Storing and Handling:	Material should be stored in a dry area to prevent caking.
Other Precautions:	No special requirements other than the good industrial hygiene and safety practices employed with any industrial chemical.

VIII. CONTROL MEASURES

Respiratory Protection (Specify Type):	Dust mask - Recommended
Ventilation:	Local Exhaust-Normal Special-Not Required Mechanical-Not Required Other-Not Required
Protective Gloves:	Impervious gloves are useful but not required.
Eye Protection:	Goggles are recommended when handling solutions.
Other Protective Clothing or Equipment:	None
Work/Hygienic Practices:	No special practices required

THE INFORMATION HEREIN IS GIVEN IN GOOD FAITH BUT NO WARRANTY IS EXPRESSED OR IMPLIED.

MSDS Number: **H3886** * * * * * *Effective Date:* ***05/07/03*** * * * * * *Supercedes:* ***11/12/01***

MSDS **Material Safety Data Sheet**

From: **Mallinckrodt Baker, Inc.**
222 Red School Lane
Phillipsburg, NJ 08865

Mallinckrodt CHEMICALS J.T.Baker

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

HYDROCHLORIC ACID (10%-33%)

1. Product Identification

Synonyms: This MSDS applies to the concentrated standard used to make laboratory solutions and any solution that contains more than 10% but less than 33% Hydrochloric acid. For diluted product, see MSDS for Hydrochloric Acid (less than 10%). For saturated solution
CAS No.: 7647-01-0
Molecular Weight: 36.46
Chemical Formula: HCl in H2O
Product Codes:
J.T. Baker: 0323, 0327, 4654, 4657, 5618, 5619
Mallinckrodt: 2608, 2609, 2625, H151, H168; V035, V328

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Hydrogen Chloride	7647-01-0	10 - 33%	Yes
Water	7732-18-5	67 - 90%	No

3. Hazards Identification

Emergency Overview

POISON! DANGER! CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR INHALED.

SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Poison)
Flammability Rating: 0 - None
Reactivity Rating: 2 - Moderate
Contact Rating: 4 - Extreme (Corrosive)
Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES
Storage Color Code: White (Corrosive)

Potential Health Effects

Inhalation:
Corrosive! Inhalation of vapors can cause coughing, choking, inflammation of the nose, throat, and upper respiratory tract, and in severe cases, pulmonary edema, circulatory failure, and death.
Ingestion:
Corrosive! Swallowing hydrochloric acid can cause immediate pain and burns of the mouth, throat, esophagus and gastrointestinal tract. May cause nausea, vomiting, and diarrhea, and in severe cases, death.
Skin Contact:
Corrosive! Can cause redness, pain, and severe skin burns. Concentrated solutions cause deep ulcers and discolor skin.
Eye Contact:
Corrosive! Vapors are irritating and may cause damage to the eyes. Contact may cause severe burns and permanent eye damage.
Chronic Exposure:
Long-term exposure to concentrated vapors may cause erosion of teeth. Long term exposures seldom occur due to the corrosive properties of the acid.
Aggravation of Pre-existing Conditions:
Persons with pre-existing skin disorders or eye disease may be more susceptible to the effects of this substance.

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4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.
Ingestion:

DO NOT INDUCE VOMITING! Give large quantities of water or milk if available. Never give anything by mouth to an unconscious person. Get medical attention immediately.

Skin Contact:

In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

Eye Contact:

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

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5. Fire Fighting Measures

Fire:

Not considered to be a fire hazard. May react with metals or heat to release flammable hydrogen gas.

Explosion:

Not considered to be an explosion hazard.

Fire Extinguishing Media:

Water or water spray. Neutralize with soda ash or slaked lime.

Special Information:

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Structural firefighter's protective clothing is ineffective for fires involving hydrochloric acid. Stay away from ends of tanks. Cool tanks with water spray until well after fire is out.

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6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Neutralize with alkaline material (soda ash, lime), then absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

J. T. Baker NEUTRASORB® or TEAM® 'Low Na+' acid neutralizers are recommended for spills of this product.

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7. Handling and Storage

Store in a cool, dry, ventilated storage area with acid resistant floors and good drainage. Protect from physical damage. Keep out of direct sunlight and away from heat, water, and incompatible materials. Do not wash out container and use it for other purposes. When diluting, the acid should always be added slowly to water and in small amounts. Never use hot water and never add water to the acid. Water added to acid can cause uncontrolled boiling and splashing. When opening metal containers, use non-sparking tools because of the possibility of hydrogen gas being present. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

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8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
For Hydrochloric acid:
- OSHA Permissible Exposure Limit (PEL):
5 ppm (Ceiling)
- ACGIH Threshold Limit Value (TLV):
2 ppm (Ceiling), A4 Not classifiable as a human carcinogen

Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.
Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded and engineering controls are not feasible, a full facepiece respirator with an acid gas cartridge may be worn up to 50 times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. WARNING: Air purifying respirators do not protect workers in oxygen-deficient atmospheres.
Skin Protection:
Rubber or neoprene gloves and additional protection including impervious boots, apron, or coveralls, as needed in areas of unusual exposure to prevent skin contact.
Eye Protection:
Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

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9. Physical and Chemical Properties

Appearance:
Clear, colorless liquid.
Odor:
Pungent odor.

Solubility:
Infinitely soluble.
Density:
1.05 @ 15C (59F)
pH:
For HCL solutions: 0.1 (1.0 N), 1.1 (0.1 N), 2.02 (0.01 N)
% Volatiles by volume @ 21C (70F):
100
Boiling Point:
101 - 103C (214 - 217F)
Melting Point:
No information found.
Vapor Density (Air=1):
No information found.
Vapor Pressure (mm Hg):
No information found.
Evaporation Rate (BuAc=1):
No information found.

---

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage.
Hazardous Decomposition Products:
When heated to decomposition, emits toxic hydrogen chloride fumes and will react with water or steam to produce heat and toxic and corrosive fumes. Thermal oxidative decomposition produces toxic chlorine fumes and explosive hydrogen gas.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
A strong mineral acid, concentrated hydrochloric acid is highly reactive with strong bases, metals, metal oxides, hydroxides, amines, carbonates and other alkaline materials. Incompatible with materials such as cyanides, sulfides, sulfites, and formaldehyde.
Conditions to Avoid:
Heat, direct sunlight.

---

11. Toxicological Information

Hydrochloric acid: Inhalation rat LC50: 3124 ppm/1H; Oral rabbit LD50: 900 mg/kg. Investigated as a tumorigen, mutagen, reproductive effector.

--------\Cancer Lists\----------

Ingredient	---NTP Carcinogen--- Known	Anticipated	IARC Category

Hydrogen Chloride (7647-01-0)	No	No	3
Water (7732-18-5)	No	No	None

12. Ecological Information

Environmental Fate:
When released into the soil, this material is not expected to biodegrade. When released into the soil, this material may leach into groundwater.
Environmental Toxicity:
This material is expected to be toxic to aquatic life.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: HYDROCHLORIC ACID
Hazard Class: 8
UN/NA: UN1789
Packing Group: II
Information reported for product/size: 200L

International (Water, I.M.O.)

Proper Shipping Name: HYDROCHLORIC ACID
Hazard Class: 8
UN/NA: UN1789
Packing Group: II
Information reported for product/size: 200L

15. Regulatory Information

--------\Chemical Inventory Status - Part 1\---------------------------------
Ingredient TSCA EC Japan Australia

Ingredient	Korea	--Canada-- DSL	NDSL	Phil.
Hydrogen Chloride (7647-01-0)	Yes	Yes	No	Yes
Water (7732-18-5)	Yes	Yes	No	Yes

\Federal, State & International Regulations - Part 1\

Ingredient	-SARA 302- RQ	TPQ	------SARA 313------ List	Chemical Catg.
Hydrogen Chloride (7647-01-0)	5000	500*	Yes	No
Water (7732-18-5)	No	No	No	No

\Federal, State & International Regulations - Part 2\

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
Hydrogen Chloride (7647-01-0)	5000	No	No
Water (7732-18-5)	No	No	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: Yes
SARA 311/312: Acute: Yes Chronic: Yes Fire: No Pressure: No
Reactivity: No (Mixture / Liquid)

Australian Hazchem Code: 2R
Poison Schedule: None allocated.
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

---

16. Other Information

NFPA Ratings: Health: **3** Flammability: **0** Reactivity: **0**
Label Hazard Warning:
POISON! DANGER! CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR INHALED.
Label Precautions:
Do not get in eyes, on skin, or on clothing.
Avoid breathing vapor or mist.
Keep container closed.
Use with adequate ventilation.
Wash thoroughly after handling.
Label First Aid:
If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not

breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. In all cases call a physician.

Product Use:
Laboratory Reagent.

Revision Information:
MSDS Section(s) changed since last revision of document include: 8.

Disclaimer:
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Mallinckrodt Baker, Inc. provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person using this product. Individuals receiving the information must exercise their independent judgment in determining its appropriateness for a particular purpose. MALLINCKRODT BAKER, INC. MAKES 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, MALLINCKRODT BAKER, INC. WILL NOT BE RESPONSIBLE FOR DAMAGES RESULTING FROM USE OF OR RELIANCE UPON THIS INFORMATION.
****

Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

MSDS Number: **M2015** * * * * * *Effective Date:* ***08/10/04*** * * * * * *Supercedes:* ***11/12/01***

MSDS ***Material Safety Data Sheet***

From: **Mallinckrodt Baker, Inc.**
222 Red School Lane
Phillipsburg, NJ 08865

Mallinckrodt CHEMICALS | J.T.Baker

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

METHYL ALCOHOL

1. Product Identification

Synonyms: Wood alcohol; **methanol**; carbinol
CAS No.: 67-56-1
Molecular Weight: 32.04
Chemical Formula: CH3OH
Product Codes:
J.T. Baker: 5217, 5370, 5794, 5811, 5842, 5869, 9049, 9063, 9065, 9066, 9067, 9069, 9070, 9071, 9073, 9075, 9076, 9077, 9091, 9093, 9096, 9097, 9098, 9263, 9822, 9830, V654
Mallinckrodt: 3004, 3006, 3016, 3017, 3018, 3024, 3041, 3701, 4295, 5160, 8814, H080, H488, H603, H985, V079, V571

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent Hazardous

Methyl Alcohol	67-56-1	100%	Yes

---

3. Hazards Identification

Emergency Overview

POISON! DANGER! VAPOR HARMFUL. MAY BE FATAL OR CAUSE BLINDNESS IF SWALLOWED. HARMFUL IF INHALED OR ABSORBED THROUGH SKIN. CANNOT BE MADE NONPOISONOUS. FLAMMABLE LIQUID AND VAPOR. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS CENTRAL NERVOUS SYSTEM AND LIVER.

SAF-T-DATA$^{(tm)}$ Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Poison)
Flammability Rating: 3 - Severe (Flammable)
Reactivity Rating: 1 - Slight
Contact Rating: 3 - Severe (Life)
Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES; CLASS B EXTINGUISHER
Storage Color Code: Red (Flammable)

Potential Health Effects

Inhalation:
A slight irritant to the mucous membranes. Toxic effects exerted upon nervous system, particularly the optic nerve. Once absorbed into the body, it is very slowly eliminated. Symptoms of overexposure may include headache, drowsiness, nausea, vomiting, blurred vision, blindness, coma, and death. A person may get better but then worse again up to 30 hours later.

Ingestion:
Toxic. Symptoms parallel inhalation. Can intoxicate and cause blindness. Usual fatal dose: 100-125 milliliters.

Skin Contact:
Methyl alcohol is a defatting agent and may cause skin to become dry and cracked. Skin absorption can occur; symptoms may parallel inhalation exposure.

Eye Contact:
Irritant. Continued exposure may cause eye lesions.

Chronic Exposure:
Marked impairment of vision has been reported. Repeated or prolonged exposure may

cause skin irritation.
Aggravation of Pre-existing Conditions:
Persons with pre-existing skin disorders or eye problems or impaired liver or kidney function may be more susceptible to the effects of the substance.

---

4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.
Ingestion:
Induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention immediately.
Skin Contact:
Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention. Wash clothing before reuse. Thoroughly clean shoes before reuse.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

---

5. Fire Fighting Measures

Fire:
Flash point: 12C (54F) CC
Autoignition temperature: 464C (867F)
Flammable limits in air % by volume:
lel: 6.0; uel: 36
Flammable Liquid and Vapor!
Explosion:
Above flash point, vapor-air mixtures are explosive within flammable limits noted above. Moderate explosion hazard and dangerous fire hazard when exposed to heat, sparks or flames. Sensitive to static discharge.
Fire Extinguishing Media:
Use alcohol foam, dry chemical or carbon dioxide. (Water may be ineffective.)
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Use water spray to blanket fire, cool fire exposed containers, and to flush non-ignited spills or vapors away from fire. Vapors can flow along surfaces to distant ignition source and flash back.

---

6. Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! If a leak or spill has not ignited, use water spray to disperse the vapors, to protect personnel attempting to stop leak, and to flush spills away from exposures. US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

J. T. Baker SOLUSORB® solvent adsorbent is recommended for spills of this product.

---

7. Handling and Storage

Protect against physical damage. Store in a cool, dry well-ventilated location, away from any area where the fire hazard may be acute. Outside or detached storage is preferred. Separate from incompatibles. Containers should be bonded and grounded for transfers to avoid static sparks. Storage and use areas should be No Smoking areas. Use non-sparking type tools and equipment, including explosion proof ventilation. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product. Do Not attempt to clean empty containers since residue is difficult to remove. Do not pressurize, cut, weld, braze, solder, drill, grind or expose such containers to heat, sparks, flame, static electricity or other sources of ignition: they may explode and cause injury or death.

---

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
For Methyl Alcohol:
- OSHA Permissible Exposure Limit (PEL):
200 ppm (TWA)
- ACGIH Threshold Limit Value (TLV):
200 ppm (TWA), 250 ppm (STEL) skin

Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document,

Industrial Ventilation, A Manual of Recommended Practices, most recent edition, for details. Use explosion-proof equipment.

Personal Respirators (NIOSH Approved):

If the exposure limit is exceeded and engineering controls are not feasible, wear a supplied air, full-facepiece respirator, airlined hood, or full-facepiece self-contained breathing apparatus. Breathing air quality must meet the requirements of the OSHA respiratory protection standard (29CFR1910.134). This substance has poor warning properties.

Skin Protection:

Rubber or neoprene gloves and additional protection including impervious boots, apron, or coveralls, as needed in areas of unusual exposure.

Eye Protection:

Use chemical safety goggles. Maintain eye wash fountain and quick-drench facilities in work area.

---

9. Physical and Chemical Properties

Appearance:

Clear, colorless liquid.

Odor:

Characteristic odor.

Solubility:

Miscible in water.

Specific Gravity:

0.8

pH:

No information found.

% Volatiles by volume @ 21C (70F):

100

Boiling Point:

64.5C (147F)

Melting Point:

-98C (-144F)

Vapor Density (Air=1):

1.1

Vapor Pressure (mm Hg):

97 @ 20C (68F)

Evaporation Rate (BuAc=1):

5.9

---

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage.
Hazardous Decomposition Products:
May form carbon dioxide, carbon monoxide, and formaldehyde when heated to decomposition.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Strong oxidizing agents such as nitrates, perchlorates or sulfuric acid. Will attack some forms of plastics, rubber, and coatings. May react with metallic aluminum and generate hydrogen gas.
Conditions to Avoid:
Heat, flames, ignition sources and incompatibles.

---

11. Toxicological Information

Methyl Alcohol (**Methanol**) Oral rat LD50: 5628 mg/kg; inhalation rat LC50: 64000 ppm/4H; skin rabbit LD50: 15800 mg/kg; Irritation data-standard Draize test: skin, rabbit: 20mg/24 hr. Moderate; eye, rabbit: 100 mg/24 hr. Moderate. Investigated as a mutagen, reproductive effector.

--------\Cancer Lists\----------

Ingredient	---NTP Carcinogen--- Known	Anticipated	IARC Category
Methyl Alcohol (67-56-1)	No	No	None

---

12. Ecological Information

Environmental Fate:
When released into the soil, this material is expected to readily biodegrade. When released into the soil, this material is expected to leach into groundwater. When released into the soil, this material is expected to quickly evaporate. When released into the water, this material is expected to have a half-life between 1 and 10 days. When released into water, this material is expected to readily biodegrade. When released into the air, this material is expected to exist in the aerosol phase with a short half-life. When released into the air, this material is expected to be readily degraded by reaction with photochemically produced hydroxyl radicals. When released into air, this material is expected to have a half-life between 10 and 30 days. When released into the air, this material is expected to be readily removed from the atmosphere by wet deposition.

Environmental Toxicity:
This material is expected to be slightly toxic to aquatic life.

---

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

---

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: METHANOL
Hazard Class: 3
UN/NA: UN1230
Packing Group: II
Information reported for product/size: 358LB

International (Water, I.M.O.)

Proper Shipping Name: METHANOL
Hazard Class: 3, 6.1
UN/NA: UN1230
Packing Group: II
Information reported for product/size: 358LB

---

15. Regulatory Information

--------\Chemical Inventory Status - Part 1\------------------------
----

Ingredient	TSCA	EC	Japan	Australia
Methyl Alcohol (67-56-1)	Yes	Yes	Yes	Yes

--------\Chemical Inventory Status - Part 2\------------------------
----

Ingredient	Korea	--Canada-- DSL	NDSL	Phil.
Methyl Alcohol (67-56-1)	Yes	Yes	No	Yes

Ingredient	-SARA 302- RQ	TPQ	List	------SARA 313------ Chemical Catg.
Methyl Alcohol (67-56-1)	No	No	Yes	No

Ingredient	CERCLA	-RCRA- 261.33	TSCA- 8(d)
Methyl Alcohol (67-56-1)	5000	U154	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
SARA 311/312: Acute: Yes Chronic: Yes Fire: Yes Pressure: No
Reactivity: No (Pure / Liquid)

Australian Hazchem Code: 2PE
Poison Schedule: S6
WHMIS:
This **MSDS** has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the **MSDS** contains all of the information required by the CPR.

---

16. Other Information

NFPA Ratings: Health: **1** Flammability: **3** Reactivity: **0**
Label Hazard Warning:
POISON! DANGER! VAPOR HARMFUL. MAY BE FATAL OR CAUSE BLINDNESS IF SWALLOWED. HARMFUL IF INHALED OR ABSORBED THROUGH SKIN. CANNOT BE MADE NONPOISONOUS. FLAMMABLE LIQUID AND VAPOR. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS CENTRAL NERVOUS SYSTEM AND LIVER.
Label Precautions:
Avoid breathing vapor.

Avoid contact with eyes, skin and clothing.
Wash thoroughly after handling.
Keep container closed.
Use only with adequate ventilation.
Keep away from heat, sparks and flame.

Label First Aid:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. If swallowed, induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. In all cases get medical attention immediately.

Product Use:

Laboratory Reagent.

Revision Information:

No Changes.

Disclaimer:

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Mallinckrodt Baker, Inc. provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person using this product. Individuals receiving the information must exercise their independent judgment in determining its appropriateness for a particular purpose. MALLINCKRODT BAKER, INC. MAKES 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, MALLINCKRODT BAKER, INC. WILL NOT BE RESPONSIBLE FOR DAMAGES RESULTING FROM USE OF OR RELIANCE UPON THIS INFORMATION.

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Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

MSDS Number: **N3660** * * * * * *Effective Date:* ***05/06/05*** * * * * * *Supercedes:* ***07/02/02***

MSDS Material Safety Data Sheet

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

Mallinckrodt CHEMICALS J.T.Baker

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

NITRIC ACID, 50-70%

1. Product Identification

Synonyms: Aqua Fortis; Azotic Acid; Nitric Acid 50%; Nitric Acid 65%; nitric acid 69-70%
CAS No.: 7697-37-2
Molecular Weight: 63.01
Chemical Formula: HNO3
Product Codes:
J.T. Baker: 411D, 412D, 5371, 5796, 5801, 5826, 5856, 5876, 5896, 9597, 9598, 9600, 9601, 9602, 9603, 9604, 9606, 9607, 9608, 9610, 9616, 9617, 9670
Mallinckrodt: 1409, 2704, 2705, 2716, 6623, H862, H988, H993, H998, V077, V650

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Nitric Acid	7697-37-2	50 - 70%	Yes
Water	7732-18-5	30 - 50%	No

3. Hazards Identification

Emergency Overview

POISON! DANGER! STRONG OXIDIZER. CONTACT WITH OTHER MATERIAL MAY CAUSE FIRE. CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR INHALED. INHALATION MAY CAUSE

LUNG AND TOOTH DAMAGE.

SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 4 - Extreme (Poison)
Flammability Rating: 0 - None
Reactivity Rating: 3 - Severe (Oxidizer)
Contact Rating: 4 - Extreme (Corrosive)
Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES
Storage Color Code: White (Corrosive)

Potential Health Effects

Nitric acid is extremely hazardous; it is corrosive, reactive, an oxidizer, and a poison.

Inhalation:
Corrosive! Inhalation of vapors can cause breathing difficulties and lead to pneumonia and pulmonary edema, which may be fatal. Other symptoms may include coughing, choking, and irritation of the nose, throat, and respiratory tract.
Ingestion:
Corrosive! Swallowing nitric acid can cause immediate pain and burns of the mouth, throat, esophagus and gastrointestinal tract.
Skin Contact:
Corrosive! Can cause redness, pain, and severe skin burns. Concentrated solutions cause deep ulcers and stain skin a yellow or yellow-brown color.
Eye Contact:
Corrosive! Vapors are irritating and may cause damage to the eyes. Contact may cause severe burns and permanent eye damage.
Chronic Exposure:
Long-term exposure to concentrated vapors may cause erosion of teeth and lung damage. Long-term exposures seldom occur due to the corrosive properties of the acid.
Aggravation of Pre-existing Conditions:
Persons with pre-existing skin disorders, eye disease, or cardiopulmonary diseases may be more susceptible to the effects of this substance.

---

4. First Aid Measures

Immediate first aid treatment reduces the health effects of this substance.
Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.
Ingestion:
DO NOT INDUCE VOMITING! Give large quantities of water or milk if available. Never give anything by mouth to an unconscious person. Get medical attention immediately.
Skin Contact:
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids

occasionally. Get medical attention immediately.

---

5. Fire Fighting Measures

Fire:
Not combustible, but substance is a strong oxidizer and its heat of reaction with reducing agents or combustibles may cause ignition. Can react with metals to release flammable hydrogen gas.
Explosion:
Reacts explosively with combustible organic or readily oxidizable materials such as: alcohols, turpentine, charcoal, organic refuse, metal powder, hydrogen sulfide, etc. Reacts with most metals to release hydrogen gas which can form explosive mixtures with air.
Fire Extinguishing Media:
Water spray may be used to keep fire exposed containers cool. Do not get water inside container.
Special Information:
Increases the flammability of combustible, organic and readily oxidizable materials. In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

---

6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Neutralize with alkaline material (soda ash, lime), then absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

J. T. Baker NEUTRASORB® acid neutralizers are recommended for spills of this product.

---

7. Handling and Storage

Store in a cool, dry, ventilated storage area with acid resistant floors and good drainage. Protect from physical damage. Keep out of direct sunlight and away from heat, water, and incompatible materials. Do not wash out container and use it for other purposes. When diluting, the acid should always be added slowly to water and in small amounts. Never use hot water and never add water to the acid. Water added to acid can cause uncontrolled boiling and splashing. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

---

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
-OSHA Permissible Exposure Limit (PEL):
2 ppm (TWA), 4 ppm (STEL)

-ACGIH Threshold Limit Value (TLV):
2 ppm (TWA); 4 ppm (STEL)

Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.
Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded, wear a supplied air, full-facepiece respirator, airlined hood, or full-facepiece self-contained breathing apparatus. Nitric acid is an oxidizer and should not come in contact with cartridges and canisters that contain oxidizable materials, such as activated charcoal. Canister-type respirators using sorbents are ineffective.
Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.
Eye Protection:
Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

---

9. Physical and Chemical Properties

Appearance:
Colorless to yellowish liquid.
Odor:
Suffocating, acrid.
Solubility:
Infinitely soluble.
Specific Gravity:
1.41
pH:
1.0 (0.1M solution)
% Volatiles by volume @ 21C (70F):
100 (as water and acid)
Boiling Point:
122C (252F)
Melting Point:
-42C (-44F)
Vapor Density (Air=1):
2-3
Vapor Pressure (mm Hg):
48 @ 20C (68F)
Evaporation Rate (BuAc=1):
No information found.

---

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage. Containers may burst when heated.
Hazardous Decomposition Products:

When heated to decomposition, emits toxic nitrogen oxides fumes and hydrogen nitrate. Will react with water or steam to produce heat and toxic and corrosive fumes.

Hazardous Polymerization:
Will not occur.

Incompatibilities:
A dangerously powerful oxidizing agent, concentrated nitric acid is incompatible with most substances, especially strong bases, metallic powders, carbides, hydrogen sulfide, turpentine, and combustible organics.

Conditions to Avoid:
Light and heat.

---

11. Toxicological Information

Nitric acid: Inhalation rat LC50: 244 ppm (NO2)/30M; Investigated as a mutagen, reproductive effector. Oral (human) LDLo: 430 mg/kg.

--------\Cancer Lists\----------

Ingredient	---NTP Carcinogen--- Known	Anticipated	IARC Category
Nitric Acid (7697-37-2)	No	No	None
Water (7732-18-5)	No	No	None

---

12. Ecological Information

Environmental Fate:
No information found.

Environmental Toxicity:
No information found.

---

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste facility. Although not a listed RCRA hazardous waste, this material may exhibit one or more characteristics of a hazardous waste and require appropriate analysis to determine specific disposal requirements. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

---

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: NITRIC ACID
Hazard Class: 8

UN/NA: UN2031
Packing Group: II
Information reported for product/size: 6.5GL

International (Water, I.M.O.)

Proper Shipping Name: NITRIC ACID (WITH NOT MORE THAN 70% NITRIC ACID)
Hazard Class: 8
UN/NA: UN2031
Packing Group: II
Information reported for product/size: 6.5GL

---

15. Regulatory Information

--------\Chemical Inventory Status - Part 1\---------------------------------

Ingredient	TSCA	EC	Japan	Australia
Nitric Acid (7697-37-2)	Yes	Yes	Yes	Yes
Water (7732-18-5)	Yes	Yes	Yes	Yes

--------\Chemical Inventory Status - Part 2\---------------------------------

Ingredient	Korea	--Canada-- DSL	NDSL	Phil.
Nitric Acid (7697-37-2)	Yes	Yes	No	Yes
Water (7732-18-5)	Yes	Yes	No	Yes

--------\Federal, State & International Regulations - Part 1\----------------

Ingredient	-SARA 302- RQ	TPQ	------SARA 313------ List	Chemical Catg.
Nitric Acid (7697-37-2)	1000	1000	Yes	No
Water (7732-18-5)	No	No	No	No

--------\Federal, State & International Regulations - Part 2\----------------

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
Nitric Acid (7697-37-2)	1000	No	No
Water (7732-18-5)	No	No	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
SARA 311/312: Acute: Yes Chronic: Yes Fire: Yes Pressure: No
Reactivity: No (Mixture / Liquid)

Australian Hazchem Code: 2PE
Poison Schedule: S6
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

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16. Other Information

NFPA Ratings: Health: **3** Flammability: **0** Reactivity: **0** Other: **Oxidizer**

Label Hazard Warning:

POISON! DANGER! STRONG OXIDIZER. CONTACT WITH OTHER MATERIAL MAY CAUSE FIRE. CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR INHALED. INHALATION MAY CAUSE LUNG AND TOOTH DAMAGE.

Label Precautions:

Do not get in eyes, on skin, or on clothing.
Do not breathe vapor or mist.
Use only with adequate ventilation.
Wash thoroughly after handling.
Keep from contact with clothing and other combustible materials.
Do not store near combustible materials.
Store in a tightly closed container.
Remove and wash contaminated clothing promptly.

Label First Aid:

In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In all cases get medical attention immediately.

Product Use:

Laboratory Reagent.

Revision Information:

No Changes.

Disclaimer:

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****

Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

GENIUM PUBLISHING CORP -- SODIUM BISULFIDE COMMERCIAL -- 6810-00N051793

========== Product Identification ==========

Product ID:SODIUM BISULFIDE COMMERCIAL
MSDS Date:09/01/1991
FSC:6810
NIIN:00N051793
MSDS Number: BVQJM
=== Responsible Party ===
Company Name:GENIUM PUBLISHING CORP
Address:1145 CATALYN ST
City:SCHENECTADY
State:NY
ZIP:12303-1836
Country:US
Info Phone Num:518-377-8854
Emergency Phone Num:518-377-8854
CAGE:5Z768
=== Contractor Identification ===
Company Name:GENIUM PUBLISHING CORPORATION
Address:1145 CATALYN ST
Box:City:SCHENECTADY
State:NY
ZIP:12303-1836
Country:US
Phone:518-377-8854
CAGE:5Z768

========== Composition/Information on Ingredients ==========

Ingred Name:SODIUM SULFIDE; (SODIUM BISULFIDE) (WITH NOT < 25% WATER OF
CRYSTALLIZATION)
CAS:16721-80-5
RTECS #:WE1900000
Fraction by Wt: 74%
OSHA PEL:N/K
ACGIH TLV:N/K
EPA Rpt Qty:5000 LBS
DOT Rpt Qty:5000 LBS

Ingred Name:DITHIONOUS ACID, DISODIUM SALT; (SODIUM SULFIDE)
CAS:7775-14-6
RTECS #:JP2100000
Fraction by Wt: 1.5%
OSHA PEL:N/K
ACGIH TLV:N/K

Ingred Name:THIOSULFURIC ACID, DISODIUM SALT; (SODIUM THIOSULFATE)
CAS:7772-98-7
RTECS #:XN6476000
Fraction by Wt: 0.4%
OSHA PEL:N/K
ACGIH TLV:N/K

Ingred Name:SODIUM CARBONATE (2:1); (SODIUM CARBONATE)
CAS:497-19-8
RTECS #:VZ4050000
Fraction by Wt: 0.3%
OSHA PEL:N/K
ACGIH TLV:N/K

Ingred Name:EFTS OF OVEREXP:CORNEAL INJURY. NOTE:EXPOS TO LIGHT MAY
INCREASE PAINFUL EFTS. LIQ CNTCT W/SKIN CAUSES TISS IRRIT(ING 6)
RTECS #:9999999ZZ

Ingred Name:ING 5:& CORR & CONTINUED EXPOS MAY CAUSE DERM. INGEST
CAUSES PAIN & BURNING IN THROAT & ABDOMEN, NAUSEA & VOMIT (ING 7)
RTECS #:9999999ZZ

Ingred Name:ING 6:FOLLOWED BY DIARRHEA. IN SEVERE CASES,COLLAPSE,UNCON
& RESP PARALYSIS MAY BE EXPECTED. CHRONIC:NONE REPORTED.
RTECS #:9999999ZZ

Ingred Name:FIRST AID PROC:AIR & SUPPORT BRTHG AS NEEDED. INGEST:CALL
MD IMMED. NEVER GIVE ANYTHING BY MOUTH TO UNCONSCIOUS (ING 9)
RTECS #:9999999ZZ

Ingred Name:ING 8:OR CONVULSING PERSON. IF INGESTED HAVE CONSCIOUS &
ALERT PERSON DRINK LARGE AMNTS OF WATER/WARM SALTY (ING 10)
RTECS #:9999999ZZ

Ingred Name:ING 9:WATER (2 TBLSPN OF TABLE SALT TO PINT OF WATER) TO
INDUCE VOMIT; ENCOURAGE VOMIT UNTIL VOMITUS CLEAR. IF (ING 11)
RTECS #:9999999ZZ

Ingred Name:ING 10:UNCON, PLACE IN FACE-DOWN POSITION TO AVOID ASPIR OF
VOMITUS. AFTER FIRST AID GET APPROP MEDICAL SUPPORT.
RTECS #:9999999ZZ

Ingred Name:SPILL PROCS:INTO APPROP CNTNRS FOR DISP. LARGE:DIKE FAR
AHEAD OF LIQ TO CONTAIN. AVOID GENERATING DUSTY CONDS. (ING 13)
RTECS #:9999999ZZ

Ingred Name:ING 12:DRY:PROMPTLY WET SWEEP/VACUUM MATL & PLACE IN
SUITABLE CNTNR W/COVER FOR RECLAMATION/DISP. DO NOT FLUSH (ING 14)
RTECS #:9999999ZZ

Ingred Name:ING 13:WASTE TO SEWERS/WATERWAYS SINCE SODIUM BISULFIDE IS
DANGEROUS TO AQUATIC LIFE IN HIGH CONCENTRATIONS.
RTECS #:9999999ZZ

Ingred Name:RESP PROT:PURIFYING RESPIRATORS DO NOT PROTECT WORKERS IN
OXYGEN-DEFICIENT ATMOSPHERES.
RTECS #:9999999ZZ

Ingred Name:VENT: CONTAMINANT DISPERSION INTO WORK AREA BY CONTROLLING
IT AT ITS SOURCE.
RTECS #:9999999ZZ

Ingred Name:EYE PROT:GOGGLES PER OSHA EYE & FACE PROT REGS (29 CFR
1910.133). THIS CAUSTIC CHEMS SLIPPERY NATURE CAN HAMPER (ING 18)
RTECS #:9999999ZZ

Ingred Name:ING 17:CONTACT LENS REMOVAL. CHECK YOUR POLICY ON WEARING
CONTACT LENSES.
RTECS #:9999999ZZ

Ingred Name:HNDLG/STOR PROCS:CNTNRS FROM PHYSICAL DMG. USE NONSPARKING
TOOLS. DO NOT STORE THIS ALKALINE SOLID OR ITS (ING 20)
RTECS #:9999999ZZ

Ingred Name:ING 19:SOLUTIONS IN ZINC, ALUMINUM, COPPER OR ALLOYS OF
THESE METALS. COMPLETELY EMPTY SHIPPING CONTAINERS.
RTECS #:9999999ZZ

Ingred Name:HYGIENE PRAC:PRACTICE GOOD HYGIENE AFTER USING MATL, ESP
BEFORE EATING, DRINKING, SMKNG, USING TOILET/APPLYING (ING 22)
RTECS #:9999999ZZ

Ingred Name:ING 21:COSMETICS. AVOID INHAL DUST/MIST. USE ONLY W/ADEQ
VENT & PROT GEAR. NIOSH REC H*2S GAS DETECTION & ALARM SYS.

RTECS #:9999999ZZ

========== Hazards Identification ==========

LD50 LC50 Mixture:NONE SPECIFIED BY MANUFACTURER.
Routes of Entry: Inhalation:YES Skin:YES Ingestion:YES
Reports of Carcinogenicity:NTP:NO IARC:NO OSHA:NO
Health Hazards Acute and Chronic:SODIUM BISULFIDE IS ALKALINE MATL THAT IS SEVERE SKIN,EYE & RESP TRACT IRRIT. INGEST MAY BE CORR & IRRIT; HYDROGEN SULFIDE IS LIBERATED BY STOM ACID W/POSS PULM & SYSTEMIC EFTS. SYMPS OF EXPOS TO HYDR OGEN SULFIDE GAS INCLUDE HDCH,DIZZ,NAUS& VOMIT; CONTINUED EXPOS CAN LEAD TO UNCON,RESP FAILURE & (SEE EFTS OF OVEREXP)
Explanation of Carcinogenicity:NOT RELEVANT
Effects of Overexposure:HLTH HAZ:DEATH. COLLAPSE,FOLLOWED QUICKLY BY COMA & POSS DEATH CAN RESULT FROM BRTHG ONLY SMALL AMNT AT >1000 PPM. TARGET ORGANS:SKIN, EYES & MUC MEMB. ACUTE:MIST INHAL CAUSES RESP TRACT IRRIT & POSS SYSTEMIC POISONING. LIQ CNTCT CAUSES MARKED EYE IRRIT,ITCHING,TEARING,SWELLING & BLURRED VISION RESULTING FROM (ING 5)
Medical Cond Aggravated by Exposure:NONE REPORTED.

========== First Aid Measures ==========

First Aid:EYE:GENTLY LIFT EYELIDS & FLUSH IMMED & CONTINUOUSLY W/FLOODING AMNTS OF WATER UNTIL TAKEN TO EMERGENCY MED FACILITY. CALL MD IMMED. WHILE WAITING, KEEP IN DARK RM W/ICE COMPRESSES APPLIED TO EYES & F OREHEAD. SKIN:QUICKLY REMOVE CONTAMD CLTHG. RINSE W/FLOODING AMNTS OF WATER FOR AT LEAST 15 MIN. FOR REDDENED/BLISTERED SKIN CALL MD. WASH AFFECTED AREA W/SOAP & WATER. INHAL:REMOVE TO FRESH (ING 8)

========== Fire Fighting Measures ==========

Flash Point:NONE REPORTED
Lower Limits:4.3% V/V
Upper Limits:44% V/V
Extinguishing Media:SMALL:DRY CHEM, CARBON DIOXIDE(CO2),HALON,WATER SPRAY,ALCOHOL FOAM. LARGE:WATER SPRAY, FOG OR STANDARD FOAM.
Fire Fighting Procedures:ISOLATE HAZ AREA & DENY ENTRY. SINCE FIRE MAY PRDCE TOX FUMES, WEAR SCBA W/FULL FACEPIECE OPERATED IN PRESS-DEMAND/POS PRESS MODE & FULL PROT CLTHG. (SUPP DATA)
Unusual Fire/Explosion Hazard:GREAT CAUTION ADVISED IN FIGHTING MATLS SINCE HYDROGEN SULFIDE GAS, BOTH FLAMM & TOX, CAN BE READILY GENERATED BY CNTCT W/ACIDIC MATLS/BY MOISTURE & HEAT.

========== Accidental Release Measures ==========

Spill Release Procedures:NOTIFY SAFETY PERSONNEL, EVAC ALL UNNECESSARY PERSONNEL, REMOVE ALL HEAT & IGNIT SOURCES & PROVIDE ADEQ VENT. CLEANUP PERSONNEL SHOULD PROT AGAINST DUST & VAP INHAL & SKIN/EYE CNTCT. LIQ SPILLS:TAKE U P W/SOME NONCOMBUST ABSORB MATL & PLACE(ING 12)
Neutralizing Agent:CONVERT SULFIDE TO SULFATE W/3% HYDROGEN PEROXIDE BEFORE NEUTRALIZATION W/ACID.

========== Handling and Storage ==========

Handling and Storage Precautions:STORE IN CLOSED CNTNRS IN DRY,WELL-VENT AREA GREATER THAN 63F. KEEP AWAY FROM HEAT & IGNIT SOURCES, ACIDS,OXIDIZING AGENTS & MOISTURE. PROTECT(ING 19)
Other Precautions:PROVIDE ANNUAL MED EXAMS THAT EMPHASIZE SKIN, EYES & RESP TRACT. CONSIDER PRECLUDING FROM EXPOSURE WORKERS W/RESPIRATORY OR CENTRAL NERVOUS SYSTEM PROBLEMS.

========== Exposure Controls/Personal Protection ==========

Respiratory Protection:FULL-FACE TYPE RESP RECOM TO PROT EYES FROM DUST. IF NEC WEAR NIOSH/MSHA APPRVD RESP. USE APPRVD DUST MASK, CANISTER-TYPE RESP APPRVD FOR H*2S WHEN CONCS ARE VERY LOW (<1%) OR SCBA WHEN CONCS ARE UNKN OWN OR VERY HIGH. WARNING:AIR (ING 15)
Ventilation:GENL & LOCAL EXHST VENT SYS TO MAINTAIN AIRBORNE CONCS AS LOW AS POSS. LOCAL EXHST VENT PREFERRED SINCE IT PVNTS(ING 16)
Protective Gloves:IMPERVIOUS GLOVES.
Eye Protection:PROT EYEGLASSES/CHEM SAFETY (ING 17)
Other Protective Equipment:IMPERVIOUS BOOTS, APRONS & GAUNTLETS. EMER EYEWASH STATIONS, SFTY/QUICK-DRENCH SHOWERS & WASH FACILITIES IN WORK AREA.
Work Hygienic Practices:REMOVE MATL FROM SHOES & EQUIP. LAUNDER CONTAMD CLTHG BEFORE WEARING. NEVER EAT, DRINK, SMOKE IN WORK AREAS. (ING 21)
Supplemental Safety and Health
PH:ALKALINE. APPEAR & ODOR:COLORED FLAKES W/HYDROGEN SULFIDE (ROTTEN EGG) ODOR. FIRE FIGHT PROCS:IF FEASIBLE, REMOVE FIRE EXPSD CNTNRS. OTHERWISE USE WATER SPRAY TO COOL FIRE EXPSD CNTNRS. BE AWARE OF RUNOFF FROM FIRE CONTROL METHODS. DO NOT RELEASE TO SEWERS OR WATERWAYS.

========== Physical/Chemical Properties ==========

Boiling Pt:B.P. Text:212F,100C
Melt/Freeze Pt:M.P/F.P Text:662F,350C
Vapor Density:1.79
Spec Gravity:1.79
pH:SUPDAT
Solubility in Water:SOLUBLE.
Appearance and Odor:VERY HYGROSCOPIC (MOISTURE ABSORBING), COLORLESS NEEDLES TO LEMON (SUPP DATA)

========== Stability and Reactivity Data ==========

Stability Indicator/Materials to Avoid:YES
DIAZONIUM SALTS; ACIDIC MATLS LIBERATE H*2S; CO*2 GIVES NA*2CO & H*2S; & W/AIR TO GIVE SODIUM THIOSULFATE.
Stability Condition to Avoid:CONTACT W/ACIDS & HEATING W/MOISTURE.
Hazardous Decomposition Products:THERMAL OXIDATIVE DECOMPOSITION OF SODIUM BISULFIDE CAN PRODUCE HYDROGEN SULFIDE & SULFUR OXIDES.

========== Disposal Considerations ==========

Waste Disposal Methods:CONTACT YOUR SUPPLIER OR A LICENSED CONTACTOR FOR DETAILED RECOMMENDATIONS. FOLLOW APPLICABLE FEDERAL, STATE AND LOCAL REGULATIONS.

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MSDS Number: **S4034** * * * * * *Effective Date:* ***05/04/07*** * * * * * *Supercedes:* ***07/07/04***

MSDS Material Safety Data Sheet

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

Mallinckrodt CHEMICALS J.T.Baker

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

SODIUM HYDROXIDE

1. Product Identification

Synonyms: Caustic soda; lye; sodium hydroxide solid; sodium hydrate
CAS No.: 1310-73-2
Molecular Weight: 40.00
Chemical Formula: NaOH
Product Codes:
J.T. Baker: 1508, 3717, 3718, 3721, 3722, 3723, 3728, 3734, 3736, 5045, 5565
Mallinckrodt: 7001, 7680, 7708, 7712, 7772, 7798

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Sodium Hydroxide	1310-73-2	99 - 100%	Yes

3. Hazards Identification

Emergency Overview

POISON! DANGER! CORROSIVE. MAY BE FATAL IF SWALLOWED. HARMFUL IF INHALED. CAUSES BURNS TO ANY AREA OF CONTACT. REACTS WITH WATER, ACIDS AND OTHER MATERIALS.

SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 4 - Extreme (Poison)
Flammability Rating: 0 - None
Reactivity Rating: 2 - Moderate
Contact Rating: 4 - Extreme (Corrosive)
Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES
Storage Color Code: White Stripe (Store Separately)

Potential Health Effects

Inhalation:
Severe irritant. Effects from inhalation of dust or mist vary from mild irritation to serious damage of the upper respiratory tract, depending on severity of exposure. Symptoms may include sneezing, sore throat or runny nose. Severe pneumonitis may occur.
Ingestion:
Corrosive! Swallowing may cause severe burns of mouth, throat, and stomach. Severe scarring of tissue and death may result. Symptoms may include bleeding, vomiting, diarrhea, fall in blood pressure. Damage may appear days after exposure.
Skin Contact:
Corrosive! Contact with skin can cause irritation or severe burns and scarring with greater exposures.
Eye Contact:
Corrosive! Causes irritation of eyes, and with greater exposures it can cause burns that may result in permanent impairment of vision, even blindness.
Chronic Exposure:
Prolonged contact with dilute solutions or dust has a destructive effect upon tissue.
Aggravation of Pre-existing Conditions:
Persons with pre-existing skin disorders or eye problems or impaired respiratory function may be more susceptible to the effects of the substance.

4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.
Ingestion:
DO NOT INDUCE VOMITING! Give large quantities of water or milk if available. Never give anything by mouth to an unconscious person. Get medical attention immediately.
Skin Contact:
Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Call a physician, immediately. Wash clothing before reuse.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

Note to Physician:
Perform endoscopy in all cases of suspected sodium hydroxide ingestion. In cases of severe esophageal corrosion, the use of therapeutic doses of steroids should be considered. General supportive measures with continual monitoring of gas exchange, acid-base balance, electrolytes, and fluid intake are also required.

5. Fire Fighting Measures

Fire:
Not considered to be a fire hazard. Hot or molten material can react violently with water.
Can react with certain metals, such as aluminum, to generate flammable hydrogen gas.
Explosion:
Not considered to be an explosion hazard.
Fire Extinguishing Media:
Use any means suitable for extinguishing surrounding fire. Adding water to caustic solution generates large amounts of heat.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

6. Accidental Release Measures

Ventilate area of leak or spill. Keep unnecessary and unprotected people away from area of spill. Wear appropriate personal protective equipment as specified in Section 8. Spills: Pick up and place in a suitable container for reclamation or disposal, using a method that does not generate dust. Do not flush caustic residues to the sewer. Residues from spills can be diluted with water, neutralized with dilute acid such as acetic, hydrochloric or sulfuric. Absorb neutralized caustic residue on clay, vermiculite or other inert substance and package in a suitable container for disposal.
US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

7. Handling and Storage

Keep in a tightly closed container. Protect from physical damage. Store in a cool, dry, ventilated area away from sources of heat, moisture and incompatibilities. Always add the caustic to water while stirring; never the reverse. Containers of this material may be hazardous when empty since they retain product residues (dust, solids); observe all warnings and precautions listed for the product. Do not store with aluminum or magnesium. Do not mix with acids or organic materials.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
- OSHA Permissible Exposure Limit (PEL):
2 mg/m3 Ceiling
- ACGIH Threshold Limit Value (TLV):
2 mg/m3 Ceiling
Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.
Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded and engineering controls are not feasible, a half facepiece particulate respirator (NIOSH type N95 or better filters) may be worn for up to ten times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest.. A full-face piece particulate respirator (NIOSH type N100 filters) may be worn up to 50 times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency, or respirator supplier, whichever is lowest. If oil particles (e.g. lubricants, cutting fluids, glycerine, etc.) are present, use a NIOSH type R or P filter. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. WARNING: Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.
Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.
Eye Protection:
Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:
White, deliquescent pellets or flakes.
Odor:
Odorless.
Solubility:

111 g/100 g of water.
Specific Gravity:
2.13
pH:
13 - 14 (0.5% soln.)
% Volatiles by volume @ 21C (70F):
0
Boiling Point:
1390C (2534F)
Melting Point:
318C (604F)
Vapor Density (Air=1):
> 1.0
Vapor Pressure (mm Hg):
Negligible.
Evaporation Rate (BuAc=1):
No information found.

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage. Very hygroscopic. Can slowly pick up moisture from air and react with carbon dioxide from air to form sodium carbonate.
Hazardous Decomposition Products:
Sodium oxide. Decomposition by reaction with certain metals releases flammable and explosive hydrogen gas.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Sodium hydroxide in contact with acids and organic halogen compounds, especially trichloroethylene, may causes violent reactions. Contact with nitromethane and other similar nitro compounds causes formation of shock-sensitive salts. Contact with metals such as aluminum, magnesium, tin, and zinc cause formation of flammable hydrogen gas. Sodium hydroxide, even in fairly dilute solution, reacts readily with various sugars to produce carbon monoxide. Precautions should be taken including monitoring the tank atmosphere for carbon monoxide to ensure safety of personnel before vessel entry.
Conditions to Avoid:
Moisture, dusting and incompatibles.

11. Toxicological Information

Irritation data: skin, rabbit: 500 mg/24H severe; eye rabbit: 50 ug/24H severe; investigated as a mutagen.

--------\Cancer Lists\----------

Ingredient	---NTP Carcinogen--- Known	Anticipated	IARC Category
Sodium Hydroxide (1310-73-2)	No	No	None

12. Ecological Information

Environmental Fate:
No information found.
Environmental Toxicity:
No information found.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: SODIUM HYDROXIDE, SOLID
Hazard Class: 8
UN/NA: UN1823
Packing Group: II
Information reported for product/size: 300LB

International (Water, I.M.O.)

Proper Shipping Name: SODIUM HYDROXIDE, SOLID
Hazard Class: 8
UN/NA: UN1823

Packing Group: II
Information reported for product/size: 300LB

15. Regulatory Information

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--------\Chemical Inventory Status - Part 1\---------------------------------
Ingredient                                    TSCA  EC   Japan  Australia
----------------------------------------------  ----  ---  -----  ---------
Sodium Hydroxide (1310-73-2)                   Yes  Yes   Yes      Yes

--------\Chemical Inventory Status - Part 2\---------------------------------
                                                    --Canada--
Ingredient                                    Korea  DSL   NDSL  Phil.
----------------------------------------------  -----  ---   ----  -----
Sodium Hydroxide (1310-73-2)                   Yes   Yes   No     Yes

--------\Federal, State & International Regulations - Part 1\----------------
                                       -SARA 302-     ------SARA 313------
Ingredient                             RQ    TPQ     List  Chemical Catg.
----------------------------------------  ---   -----   ----  --------------
Sodium Hydroxide (1310-73-2)           No    No      No         No

--------\Federal, State & International Regulations - Part 2\----------------
                                                  -RCRA-     -TSCA-
Ingredient                             CERCLA     261.33     8(d)
----------------------------------------  ------     ------    ------
Sodium Hydroxide (1310-73-2)           1000       No         No


Chemical Weapons Convention:  No     TSCA 12(b):  No     CDTA:  No
SARA 311/312:  Acute: Yes      Chronic: No   Fire: No  Pressure: No
Reactivity: Yes         (Pure / Solid)
```

Australian Hazchem Code: 2R
Poison Schedule: S6
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: **3** Flammability: **0** Reactivity: **1**
Label Hazard Warning:
POISON! DANGER! CORROSIVE. MAY BE FATAL IF SWALLOWED. HARMFUL IF INHALED. CAUSES BURNS TO ANY AREA OF CONTACT. REACTS WITH WATER, ACIDS AND OTHER MATERIALS.
Label Precautions:
Do not get in eyes, on skin, or on clothing.
Do not breathe dust.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.
Label First Aid:
If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. If inhaled, remove to fresh air. If not breathing give artificial respiration. If breathing is difficult, give oxygen. In all cases get medical attention immediately.
Product Use:
Laboratory Reagent.
Revision Information:
No Changes.
Disclaimer:
****
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APPENDIX E

JOB HAZARD ANALYSES FOR SITE/TASK HAZARDS (MACTEC/CONTRACTOR)

APPENDIX E-1

JOB HAZARD ANALYSES FOR SITE/TASK HAZARDS (MACTEC)

Job Hazard Analysis Form

Job Title: Surface Water and Sediment Sampling – From a Boat **Date of Analysis:** 5/22/07

Key Work Steps	Hazards/Potential Hazards	Safe Practices
1. Prepare for site visit	1A) Slips, trips, falls	1A) Slips, trips, falls ▪ Familiarize self with site prior to visit. ▪ Complete appropriate training before going on site. ▪ Provide appropriate person in district office your itinerary. ▪ Prepare listing of emergency phone numbers, both on and offsite. ▪ Identify site/activity PPE needs ▪ Ensure that First Aid training is current, and that tetanus booster are current
2. Check and calibrate sampling equipment.	2A) Muscle Strain - lifting, twisting, tugging	2A) Muscle Strain - lifting, twisting, tugging ▪ Inspect all PPE and equipment and ensure that it is working properly. ▪ Get assistance from a coworker or use mechanical means to move equipment (dolly, cart, etc.)
	2B) Slips, trips and falls	2B) Slips, trips, and falls ▪ Wear proper footwear ▪ Pay attention to where walking
3. Load/carry equipment to the site.	3A) Slips, trips, falls	3A) Slips, trips, falls ▪ See JHA for Mobilization / Demobilization and Site Preparation ▪ Survey and clear the pathway. See JHA for Clearing Brush and Trees
	3B) Muscle Strain - lifting, twisting, tugging	3B) Muscle Strain - lifting, twisting, tugging ▪ Proper lifting, posture, ergonomic practices and body mechanics. ▪ Share the load, move items in smaller shifts, or use cart. ▪ Loading the boat: ensure no twisting. ▪ Use a trailer if possible to launch boat. ▪ Empty boat of gear prior to loading or moving boat to/from vehicle. ▪ Ensure boat is properly secured in the vehicle prior to moving. ▪ Tie a red cloth to the furthest point of the boat if overhanging from the vehicle. ▪ Ensure enough able bodies to move and launch the boat to share the load.
	3C) Irate property owners, pets	3C) Irate property owners, pets ▪ Call property owners in advance. ▪ Check in to introduce yourself upon arrival. ▪ Be courteous and diplomatic
	3D) Crime	3D) Crime ▪ Do not enter areas where threats are present. ▪ Contract security where applicable. Use the buddy system. ▪ Maintain contact with support such as radio or cell phone.
	3E) Struck by traffic – launch boat.	3E) Struck by traffic – launch boat. ▪ Wear hi visibility safety vest, use buddy system. ▪ Use traffic cones and a lookout. Launch from public boat launch facilities.

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	3F) Battery handling – acid exposure	3F) Battery handling – acid exposure ▪ Use care when handling batteries. ▪ Wear gloves and protective clothing when caring batteries. ▪ Check for leaks and damage prior to use of batteries.
	3G) Launch and load boat: Capsize	3G) Launch and load boat: Capsize ▪ Be aware of the boat maximum weight, person capacity, and engine size limit. ▪ Balance the gear and people in the boat. ▪ Personnel must wear approved, properly sized and buckled PFD when on the water. ▪ Ensure lines and body parts are out of the water before operating engine. ▪ Avoid operation within swimming areas. ▪ Provide signal flags and communication to protect the public of your activities. ▪ Test motor prior to shoving away from the pier. ▪ Ensure all appropriate equipment is provided and accessible according to MACTEC EH&S Manual – Boating Safety. ▪ Include bailer, anchor, second means of propulsion, line and throwable floatation.
	3H) Pinch points – attaching/mounting the motor	3H) Pinch points – attaching/mounting the motor ▪ Mind where hands and body parts are when moving and loading equipment.
	3I) Fueling – chemical exposure, fumes, environmental spills.	3I) Fueling – chemical exposure, fumes, environmental spills. ▪ See JHA Gasoline
	3J) Noise – engine (optional)	3J) Noise – engine (optional) ▪ Wear hearing protection. ▪ Provide shielding from noise such as bulkhead, or sound dampening. ▪ Operate with engine box in place to dampen noise
4. Field parameters	4A) Falling into water and capsize	4A) Falling into water and capsize ▪ Use equipment that facilitates reaching the location from a safe distance (extensions, etc.). ▪ Work using the buddy system. ▪ Wear PFD when working on the water. ▪ Balance equipment and people. ▪ Avoid leaning over the side of the boat. ▪ Anchor or secure the vessel to hold station. ▪ Steer boat to meet waves on the bow. ▪ Stay seated while in boat. ▪ If moving about, keep weight low.
	4B) Slips trips and falls	4B) Slips trips and falls ▪ Wear appropriate footwear. ▪ Survey and clear walking area. ▪ Do not walk on slippery surfaces. ▪ Maintain good housekeeping. ▪ Provide walkways, platforms or secure walking surface. ▪ Use the buddy system and maintain communications with support staff. (See JHA for Rescue from Mud footing)
	4C) Vermin, leaches, Insect/animal born	4C) Vermin, leaches, Insect/animal born disease ▪ Survey the area for dens, nests, etc.

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	disease	▪ Identify areas where biological hazards may be present. ▪ Be aware of your surroundings. ▪ Wear insect netting clothing or apply insect repellant on all exposed skin surfaces as appropriate – consider sample contamination ▪ Wear long sleeve shirt and full length pants ▪ Wear appropriate footwear (snake boots, etc.) ▪ Avoid high grass areas if possible ▪ Tuck pants leg into boot ▪ Do not put hand/arm into/under an area that you can not see into/under clearly ▪ Do not touch any suspected contaminant without appropriate hand PPE ▪ Wash hands as soon as possible upon completion of task. ▪ Perform routine inspections for ticks, leaches, etc. of yourself and co-workers. ▪ Contract vermin relocation, if applicable. ▪ Remain vigilant and respectful of wildlife. (See JHA for Insects, Stings and Bites, and JHA for Dog – Wildlife Safety. ▪ Wear wind impervious outerwear ▪ During warm months – wear a long sleeve cotton/breathable fabric shirt and pants.
	4D) Weather – temperature extremes, hypothermia, sun stroke, heat exhaustion, dehydration, sun burn.	4D) Weather – temperature extremes, hypothermia, sun stroke, heat exhaustion, dehydration, sun burn. ▪ Train workers about weather and appropriate precautions. ▪ Heat: Familiarize self with signs of heat related illnesses: cramps, heat rash, dehydration, heat exhaustion, and heat stroke. ▪ Sun: o Keep body protected o Wear sunscreen, wide brimmed hat or hardhat. o Drink plenty of fluids to remain hydrated. (Follow MACTEC guidelines, procedures and training for fluid intake, sunscreen use, proper clothing, work schedule, etc.) o Schedule work for cool part of day. o Take breaks in the shade. ▪ Wind: o Wear layered clothing, gloves, hard hat with winter liner, etc. ▪ Cold: o During cold weather - layer clothing
	4E) Weather – inclement and strong winds	4E) Weather – inclement and strong winds ▪ Watch for clouds and incoming weather. ▪ Monitor weather forecasts. ▪ Have a float plan and communications when on and off the water. ▪ Return to shore if weather threatens. ▪ Stay close to shore if possible and abandon work until winds subside. ▪ Schedule work when weather is calm (early morning or evening.) ▪ Provide proper lighting if working after dark.

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	4F) Run aground – shifting or unbalanced vessel - equipment/personnel/slip/ fall/overboard	4F) Run aground – shifting or unbalanced vessel - equipment/personnel/slip/ fall/overboard ▪ Operate at safe speed. ▪ Post a look out for shallow or submerge obstacles. ▪ Remain seated when under way. ▪ Be wary of tides, flooding, flash floods and dam releases. ▪ Use anchor to kedge or pull back toward the way you came and deeper water. ▪ Use a pole or paddle, lighten the vessel to float off.
5. Sample collection	5A) Same as Item #4 above.	5A) Same as Item #4 above.
	5B) Bending, pulling, twisting	5B) Bending, pulling, twisting ▪ Use a vibrating or wiggling motion on the sample device to break the soil suction. ▪ Proper lifting technique.
	5C) Splash	5C) Splash ▪ Wear appropriate safety glasses (tinted for sun). ▪ Be aware if sampling water through a filter, if it becomes plugged with sediment it may unexpectedly "blow off" the hose and splash. ▪ Change filter prior to sedimentation back pressure. ▪ Minimize pouring distance to limit the splash between containers.
	5D) Chemical exposure	5D) Chemical exposure ▪ Wear PPE including protective gloves, coveralls, safety glasses as appropriate. ▪ Work upwind of the sample location. Minimize exposure using a shovel/spoon or tool to collect the sample. ▪ Review and understand MSDS for all chemicals being handled. ▪ Be careful when handling acids and caustic substances. ▪ Wear adequate PPE and wash hands after completion of task.
	5E) Vegetation, sticks, reeds, - cuts and punctures.	5E) Vegetation, sticks, reeds, - cuts and punctures. ▪ Clear access to site. ▪ Be familiar with toxic plants such as poison ivy. ▪ Avoid such plants. ▪ Wash thoroughly after accidental contact with toxic materials and plants.
6. Vessel Operations	6A) Lack of boating skills, boating incident	6A) Lack of boating skills, boating incident ▪ Complete USCG/Power Squadron or other recognized boating course. ▪ All employees must wear PFDs while underway. ▪ Maintain vessel and proper safety equipment. ▪ Carry cell phone or radio. ▪ File a float plan and work in pairs.
7. Sample preparation.	7A) Lifting heavy objects (covers, pumps, sampling equipment, coolers, etc.) Muscle strain	7A) Lifting heavy objects (covers, pumps, sampling equipment, coolers, etc.) Muscle strain ▪ Use proper ergonomics when lifting heavy objects ▪ Use appropriate mechanical assistance and tools when possible.

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	7B) Chemical Exposure	7B) Chemical Exposure ▪ Wear PPE including protective gloves, coveralls, safety glasses as appropriate. ▪ Wash/wipe or decontaminate exterior of sample containers and equipment. ▪ Use care handling preservatives (acids/bases.)
	7C) Sharps and knives	7C) Sharps and knives ▪ Use care handling tape dispensers, knives and sharp objects. ▪ Use guarded dispensers
	7D) Extreme cold (ice preservation)	7D) Extreme cold (ice preservation) ▪ Minimize exposure to ice. ▪ Use a shovel/spoon or tool to fill bags for preserving samples in coolers.
8. Site exit and drive home or next site.	8A) Vehicle contamination	8A) Vehicle contamination ▪ Wash hands promptly. ▪ Contaminated PPE (Booties, tyvek, latex gloves) should be disposed on-site. ▪ Remove boots and soiled clothing for secure storage in trunk; decontaminate as soon as possible. ▪ Update exposure log.
	8B) Traffic hazards.	8B) Traffic hazards. ▪ Follow JHA for Mobilization / Demobilization and Site Preparation

Completed by: Annette McLean Date: October 6, 2008

Job Hazard Analysis – Short Form

Job Title: Streams and Wetlands **Date of Analysis:** 10/06/08

Minimum Recommended PPE*: Waders, traction devices on shoes, helmets/hardhats, gloves, personal flotation device
*See HASP for all required PPE

Key Work Steps	Hazards/Potential Hazards	Safe Practices
1. Walking to and from stream	1A) Insect bites/stings	1A) Insect bites/stings ▪ Avoid wearing heavy fragrances. ▪ Carry first-aid and sting relief kits. ▪ Make sure all crew members are informed about others who are allergic and what to do if they need assistance. ▪ Carry necessary emergency medication. ▪ See JHA Insect Bites and Stings
	1B) Contact with poisonous plants or the oil from those plants:	1B) Contact with poisonous plants or the oil from those plants: ▪ Look for signs of poisonous plants and avoid. ▪ Ensure all field workers can identify the plants. Mark identified poisonous plants with spray paint if working at a fixed location. ▪ Do not allow plant to touch any part of your body/clothing. ▪ Wear PPE as described in the HASP and wear Tyveks, gloves and boot covers if contact with plant is likely ▪ Always wash gloves before removing them. ▪ Discard PPE in accordance with the HASP. ▪ Use commercially available products such as Ivy Block or Ivy Wash as appropriate.
		 POISON IVY (Rhus toxicondendron L.) POISON OAK (Rhus diversiloba) POISON SUMAC (Rhus toxicondendron vernix)
	1C) Slips and falls	1C) Slips and falls ▪ Use traction devices on shoes. ▪ Move slowly, take your time. ▪ Use a walking staff to provide a three point support.
	1D) Eye injuries	1D) Eye injuries ▪ Travel with care through heavy brush. ▪ Use eye protection in brushy areas.
	1E) Scrapes and punctures	1E) Scrapes and punctures ▪ Wear proper clothing, long sleeved shirts and pants. No shorts.
	1F) Cuts/Lacerations due to machette use	1F) Cuts/Lacerations due to machette use ▪ Wear chaps or snake legs ▪ Cut away from the body ▪ Ensure blade of machette is sharp
	1G) Blow-down / heavy debris	1G) Blow-down / heavy debris ▪ Be aware of your surroundings, including hanging or leaning debris that may be dislodged and fall.

Job Hazard Analysis – Short Form

Job Title: Streams and Wetlands **Date of Analysis:** 10/06/08

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	1H) Animal encounters	1H) Animal encounters ▪ Make noise to avoid encounter. ▪ If you do encounter an animal, leave a lot of room between you and the animal by walking around it if necessary. ▪ Do not look the animal in the eye. ▪ If charged, run away or climb a tree. ▪ Throwing something or shouting may deter an attack. ▪ If bitten seak medical attention immediately.
	1I) Severe injury in remote locations	1I) Severe injury in remote locations ▪ Carry a two-way radio and know how to use it. ▪ Always use the Buddy System and work in teams. ▪ Make sure someone on crew is certified in first aid. ▪ Carry a first aid kit.
2. Entering Stream	2A) Slips and falls	2A) Slips and falls ▪ Use traction devices on shoes and waders. ▪ Move slowly, take your time. ▪ Use a walking staff to provide a three point support.
	2B) Sand or Mud – knee or ankle injury	2B) Sand or Mud ▪ Use shorter steps ▪ Use walking sticks to check firmness of soils ▪ Use buddy system ▪ Snowshoes that dissipate weight may be effective ▪ If leg gets caught, use slight back and forth motion to soften mud and remove slowly. Don't try to pull leg out with twisting or jerking motion. ▪ If possible, aeriate or bubble the mud to help releave suction.
	2C) Equipment	2C) Equipment ▪ Secure packs and hip waders with quick release straps and be ready to discard, if an emergency arises. ▪ Do not work in waders in water greater than 3 feet deep or in swift water. ▪ Wear bike or rafting helmets to protect from blows to the head.
	2D) Hypothermia	2D) Hypothermia ▪ Work in teams of two. ▪ Have warming devices available. ▪ Wear proper equipment that is in good condition. ▪ Be aware of signs of hypothermia, it's prevention, detection and treatment. ▪ Stay in tune to current weather and extended forecasts. ▪ See JHA General Field Work

Job Hazard Analysis – Short Form

Job Title: Streams and Wetlands **Date of Analysis:** 10/06/08

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	2E) High flow velocity	2E) High flow velocity ▪ Evaluate a stream before entering. ▪ Follow the "rule of 10" a. If stream is 1 foot deep and flowing @10 ft./sec, it is too hazardous to wade b. If stream is 2 feet deep and flowing at 5 ft./second, it is too hazardous to wade. c. If you do enter a stream and discover it is too dangerous to wade, back out using your wading pole for balance.
	2F) Severe weather	2F) Severe weather ▪ Suspend measurements during lightning storms or when a storm is approaching.

Completed by: Annette McLean Date: October 6, 2008

Job Hazard Analysis - Short Form HASP

Job Title: Soil Sampling **Date of Analysis:** 07/25/08

Minimum Recommended PPE*: High visibility vest, hard hat, steel-toed boots, safety glasses, hearing protection

*See HASP for all required PPE

Key Work Steps	Hazards/Potential Hazards	Safe Practices
1. Prepare for sampling event	1A) Chemical exposure	1A) Chemical Exposure ▪ Read HASP and determine air monitoring and PPE needs.
2. Carrying equipment to site location	2A) Back or muscle strain	2A) Back or muscle strain ▪ Use proper lifting techniques when lifting pumps or generators ▪ Use mechanical aids if available ▪ Use 2 person lift for heavy items
3. Calibrate monitoring equipment	1A) Exposure to calibration gases	3A) Exposure to calibration gases ▪ Review equipment manuals ▪ Calibrate in a clean, well ventilated area
4. Preparing sampling location	4A) Contact with poisonous plants or the oil from poisonous plants	4A) Contact with poisonous plants or the oil from those plants: ▪ Look for signs of poisonous plants and avoid. ▪ Wear PPE as described in the HASP. ▪ Do not touch anything part of your body/clothing. ▪ Always wash gloves before removing them. ▪ Discard PPE in accordance with the HASP.
	4B) Contact with biting insects (i.e., spiders, bees, etc.)	4B) Contact with stinging/biting insects ▪ Discuss the types of insects expected at the Site and be able to identify them. ▪ Look for signs of insects in and around the well. ▪ Wear Level of PPE as described in the HASP. At a minimum, follow guidelines in the JHA "Insects Stings and Bites." ▪ If necessary, wear protective netting over your head/face. ▪ Avoid contact with the insects if possible. ▪ Inform your supervisor and the Site Health and Safety Supervisor if you have any allergies to insects and insect bites. Make sure you have identification of your allergies with you at all times and appropriate response kits if applicable. ▪ Get medical help immediately if you are bitten by a black widow or brown recluse, or if you have a severe reaction to any spider bite or bee sting.
	4C) Exposure to hazardous Inhalation and contact with hazardous substances (VOC contaminated soil); flammable atmospheres.	4C) Exposure to hazardous substances ▪ Wear PPE as identified in HASP. ▪ Review hazardous properties of site contaminants with workers before sampling operations begin ▪ Monitor breathing zone air in accordance with HASP to determine levels of contaminants present. ▪ When decontaminating equipment wear additional eye/face protection over the safety glasses such as a face shield.
	4D) Back strain due to lifting or moving equipment to sampling locations	4D) Back strain ▪ Use mechanical aids when possible, if mechanical aids are not available, use two person lifts for heavy items. ▪ Use proper lifting techniques

Job Hazard Analysis - Short Form HASP

Job Title: Soil Sampling **Date of Analysis:** 07/25/08

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	4E) Foot injuries from dropped equipment	4E) Foot Injuries ▪ Be aware when moving objects, ensure you have a good grip when lifting and carrying objects. ▪ Do not carry more than you can handle safely ▪ Wear steel toed boots
5. Collecting soil samples	5A) Working around drill rigs	5A) See JHA - Drilling
	5B) Encountering underground or overhead utilities	5B) Have all utilities located.
	5C) Fire/Explosion/Contamination hazard from refueling generators	5C) Fire/Explosion/Contamination hazard from refueling generators ▪ Turn the generator off and let it cool down before refueling ▪ Segregate fuel and other hydrocarbons from samples to minimize contamination potential ▪ Transport fuels in approved safety containers. The use of containers other than those specifically designed to carry fuel is prohibited ▪ See JHA for Gasoline use
	5D) Electrocution	5D) Electrocution ▪ A ground fault circuit interrupter (GFCI) device must protect all AC electrical circuits. ▪ Use only correctly grounded equipment. Never use three-pronged cords which have had the third prong broken off. ▪ Make sure that the electrical cords from generators and power tools are not allowed to be in contact with water ▪ Do not stand in wet areas while operating power equipment ▪ Always make sure all electrically-powered sampling equipment is in good repair. Report any problems so the equipment can be repaired or replaced. ▪ When unplugging a cord, pull on the plug rather than the cord. ▪ Never do repairs on electrical equipment unless you are both authorized and qualified to do so.
	5E) Exposure to contaminants	5E) Exposure to Contaminants ▪ Stand up wind when sampling ▪ Monitor breathing zone with appropriate monitoring equipment (see HASP) ▪ Wear chemical resistant PPE as identified in HASP ▪ See section 4C) under Safe Practices above
	5F) Exposure to preservatives	5F) Exposure to preservatives ▪ Work in a well ventilated area, upwind of samples ▪ Wear chemical resistant PPE as identified in HASP ▪ Review MSDSs
	5G) Slips/trips/falls	5G) Slips/trips/falls ▪ Ground can become wet/muddy ▪ Wear good slip resistant footwear

Job Hazard Analysis - Short Form HASP

Job Title: Soil Sampling **Date of Analysis:** 07/25/08

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	5H) Lifting Injury	5H) Lifting injury ▪ Use proper lifting techniques when carrying quantities of samples ▪ Use proper ergonomics when hand digging for samples
	5I) Eye injury	5I) Eye Injury ▪ Wear eye protection when using picks or similar devices to loosen soil
	5J) Fire	5J) Fire ▪ When using gas powered auger, maintain fire watch whenever fueling or otherwise handling gasoline ▪ See JHA - Gasoline
6. Soil sampling using floor corer	6A) Back injury	6A) Back Injury ▪ Use proper lifting techniques when moving floor corer and generator ▪ Use mechanincal aids if available ▪ Use two person lift for heavy items.
	6B) Electric Shock	6B) Electric Shock ▪ Use electric cords free from defects ▪ Keep cords out of water ▪ Ensure all electrical equipment is properly grounded ▪ Use GFCI
	6C) Hearing	6C) Hearing ▪ Wear hearing protection
	6D) Fire	6D) Fire ▪ When using generator, maintain fire watch whenever refueling or otherwise handling gasoline ▪ See JHA - Gasoline
	6E) Contamination	6E) Contamination ▪ Use appropriate PPE for the contaminants of concern (see HASP). ▪ Minimize sample contact ▪ Label sample in accordance with procedures ▪ Monitor breathing zone levels.

Completed by: Annette McLean Date: October 6, 2008

Job Hazard Analysis Short Form

Job Title: Poisonous Plants – For the Site **Date of Analysis:** 5/23/07

Key Work Steps	Hazards/Potential Hazards	Safe Practices
1) Mobilization	1A) See JHA Mobilization/ Demobilization/Site Preparation	1A) See JHA Mobilization/Demobilization/Site Preparation
2) Preparation	2A) Training – Identifying Poisonous Plants	2A) Provide training on identifying the specific poisonous plants that could be present at the site
		
	2B) Poison Ivy 	2B) Poison Ivy: ▪ Grows everywhere in United States except Hawaii and Alaska. ▪ In the East, Midwest, and the South, it grows as a vine. ▪ In the Northern and Western United States, it grows as a shrub. ▪ Each leaf has three leaflets. ▪ Leaves are green in the summer and red in the fall. ▪ In the late summer and fall, white berries may grow from the stems.
	2C) Poison Oak 	2C) Poison Oak: ▪ Oak-like fuzzy leaves in clusters of three. ▪ It has two distinct kinds: ▪ Eastern poison oak (New Jersey to Texas) grows as a low shrub. ▪ Western poison oak (Pacific Coast) grows to six-foot-tall clumps or vines up to 30 feet long. ▪ It may have clusters of yellow berries.
	2D) Poison Sumac 	2D) Poison Sumac ▪ Grows in standing water in peat bogs in the Northeast and Midwest and in swampy areas in parts of the Southeast. ▪ Each leaf has clusters of seven to 13 smooth-edged leaflets. ▪ The plants can grow up to 15 feet tall. ▪ The leaves are orange in spring, green in summer and red, and orange or yellow in fall. ▪ There may be clumps of pale yellow or cream-colored berries.

Key Work Steps	Hazards/Potential Hazards	Safe Practices
3A) Contact with poisonous plants	3A) Hand Contact	3A) Hand Contact ▪ Apply IvyX (or similar product) to hands, forearms and other potentially exposed parts of the body, prior to starting work in the morning and again right after lunch. ▪ Leather Gloves must be worn at all times when digging, screening or carrying field equipment. ▪ Leather gloves should be of sufficient length to cover the entire wrist and cuff of the shirt. ▪ Carefully remove gloves, without touching the exterior surface, when taking notes and prior to lunch or restroom breaks. ▪ Gloves that become worn should be replaced immediately. ▪ Do not scratch or rub the face or other exposed skin while wearing gloves. ▪ Workers will apply Tecnu (or similar product) to the hands and forearms immediately after removing their gloves, prior to lunch and again at the end of the day. Tecnu will help cleanse the urushiol oil from the skin before it can be absorbed. Sensitive individuals can also apply prior to showering in the evening.
	3B) Arm Contact	3B) Arm Contact ▪ Apply IvyX (or similar product) to hands, forearms and other potentially exposed parts of the body, prior to starting work in the morning and again right after lunch. ▪ Wear light weight, long sleeved shirts as the sleeves will provide a physical barrier between the skin and any urushiol oil encountered. Disposable gauntlets may we worn over arms to keep oil from clothing as well. ▪ Have the sleeves pulled down to the base of the hand, covering the forearm and wrist (all exposed skin). ▪ Workers will apply Tecnu (or similar product) to the hands and forearms immediately after removing their gloves, prior to lunch and again at the end of the day. Tecnu will help cleanse the urushiol oil from the skin before it can be absorbed. Sensitive individuals can also apply prior to showering in the evening.
	3C) Leg Contact	3C) Leg Contact ▪ Wear long pants and boots. ▪ Assume boots are contaminated with the urushiol oil and only handle with gloved hands.
4) Handling Contaminated Equipment and Clothing	4A) Exposure from Handling Contaminated Equipment	4A) Exposure from Handling Contaminated Equipment ▪ Do not handle any field equipment that may have come in contact with poison ivy/oak/sumac without gloves. ▪ Decontaminate all equipment at the end of each workday with a solution of water and dish soap. ▪ Scrub all surfaces of the screens and shovels with a brush. ▪ Rinse with cool water using a portable garden sprayer.

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	4B) Exposure from Handling Contaminated Clothing	4B) Exposure from Handling Contaminated Clothing ▪ Wash clothing potentially contaminated with urushiol oil prior to wearing again. ▪ Handle contaminated clothing with gloves as the oil can remain on environmental surfaces for up to 5 years.

Completed by: Annette McLean 10/06/08

Job Hazard Analysis - Short Form

Job Title: Mobilization/Demobilization and Site Preparation **Date of Analysis:** 5/21/2008

Minimum Recommended PPE*: High visibility vest, hard hat, steel-toed boots, safety glasses, hearing protection
*See HASP for all required PPE

Key Work Steps	Hazards/Potential Hazards	Safe Practices
1. Prepare for Site Visit	1A) N/A	1A) Prior to leaving for site ▪ Obtain and review HASP prior to site visit, if possible ▪ Determine PPE needs – bring required PPE to the site, if not otherwise being provided at the site (e.g., steel toed boots) ▪ Determine training and medical monitoring needs and ensure all required Health and Safety training and medical monitoring has been received and is current ▪ If respiratory protection is required/potentially required, ensure that training and fit-testing has occurred within the past year. ▪ Familiarize yourself with route to the site
	1B) Vehicle defects	1B) Inspect company owned/leased vehicle for defects such as: ▪ Flat tires ▪ Windshield wipers worn or torn ▪ Oil puddles under vehicle ▪ Headlights, brake lights, turn signals not working
	1C) Insufficient emergency equipment, unsecured loads	1C) Insufficient emergency equipment, unsecured loads ▪ Ensure vehicle has first aid kit and that all medications are current (if first aid kits are not provided at the site) ▪ Ensure you have sufficient potable water for the duration of field work ▪ Ensure vehicle is equpped with warning flashers and/or flares and that the warning flashers work ▪ Cell phones are recommended to call for help in the event of an emergency ▪ Vehicles carrying tools must have a safety cage in place. All tools must be properly secured ▪ Vehicles must be equipped with chocks if the vehicle is to be left running, unattended. ▪ Ensure sufficient gasoline is in the tank
2. Operating vehicles – general	2A) Collisions, unsafe driving conditions	2A) Drive Defensively! ▪ Seat belts must be used at all times when operating any vehicle on company business. ▪ Drive at safe speed for road conditions ▪ Maintain adequate following distance ▪ Pull over and stop if you have to look at a map ▪ Try to park so that you don't have to back up to leave.
3. Driving to the jobsite	3A) Dusty, winding, narrow roads	3A) Dusty, winding, narrow roads ▪ Drive confidently and defensively at all times. ▪ Go slow around corners, occasionally clearing the windshield.
	3B) Rocky or one-lane roads	3B) Rocky or one-lane roads ▪ Stay clear of gullies and trenches, drive slowly over rocks. ▪ Yield right-of-way to oncoming vehicles---find a safe place to pull over.
	3C) Stormy weather, near confused tourists	3C) Stormy weather, near confused tourists ▪ Inquire about conditions before leaving the office. ▪ Be aware of oncoming storms. ▪ Drive to avoid accident situations created by the mistakes of others.

Job Hazard Analysis - Short Form

Job Title: Mobilization/Demobilization and Site Preparation **Date of Analysis:** 5/21/2008

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	3D) When angry or irritated	3D) When angry or irritated ▪ Attitude adjustment; change the subject or work out the problem before driving the vehicle. Let someone else drive.
	3E) Turning around on narrow roads	3E) Turning around on narrow roads ▪ Safely turn out with as much room as possible. ▪ Know what is ahead and behind the vehicle. ▪ Use a backer if available.
	3F) Sick or medicated	3F) Sick or medicated ▪ Let others on the crew know you do not feel well. ▪ Let someone else drive.
	3G) On wet or slimy roads	3G) On wet or slimy roads ▪ Drive slow and safe, wear seatbelts.
	3H) Animals on road	3H) Animals on road ▪ Drive slowly, watch for other animals nearby. ▪ Be alert for animals darting out of wooded areas
4. Gain permission to enter site	4A) Hostile landowner, livestock, pets	4A) Hostile landowner, livestock, pets ▪ Talk to land owner, be courteous and diplomatic ▪ Ensure all animals have been secured away from work area
5. Mobilization/ Demobilization of Equipment and Supplies	5A) Struck by Heavy Equipment/Vehicles	5A) Struck by heavy equipment ▪ Be aware of heavy equipment operations. ▪ Keep out of the swing radius of heavy equipment. ▪ Ground personnel in the vicinity of heavy equipment operations will be within the view of the operator at all times ▪ Employees shall wear a high visibility vest or T-shirt (reflective vest required if working at night). ▪ Ground personnel will be aware of the counterweight swing and maintain an adequate buffer zone. ▪ Ground personnel will not stand directly behind heavy equipment when it is in operation.
	5B) Struck by Equipment/Supplies	5B) Struck by Equipment/Supplies ▪ Workers will maintain proper space around their work area, if someone enters it, stop work. ▪ When entering another worker's work space, give a verbal warning so they know you are there.
	5C) Overexertion Unloading/Loading Supplies	5C) Overexertion Unloading/Loading Supplies ▪ Train workers on proper body mechanics, do not bend or twist at the waist while exerting force or lifting. ▪ Tightly secure all loads to the truck bed to avoid load shifting while in transit.
	5D) Caught in/on/between	5D) Caught in/on/between ▪ Do not place yourself between two vehicles or between a vehicle and a fixed object.

Job Hazard Analysis - Short Form

Job Title: Mobilization/Demobilization and Site Preparation **Date of Analysis:** 5/21/2008

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	5E) Slip/Trip/Fall	5E) 1E). Slip/Trip/Fall ▪ Mark all holes and low spots in area with banner tape. Instruct personnel to avoid these areas. ▪ Drivers will maintain 3 point contact when mounting/dismounting vehicles/equipment. ▪ Drivers will check surface before stepping, not jumping down.
	5F) Vehicle accident	5F) Vehicle accident ▪ Employees should follow MACTEC vehicle operation policy and be aware of all stationary and mobile vehicles.
6. Site Preparation	6A) Slip/Trip/Fall	6A) Slip/Trip/Fall ▪ Mark all holes and low spots in area with banner tape. Instruct personnel to avoid these areas ▪ Drivers will maintain 3 point contact when mounting/dismounting vehicles/equipment. ▪ Drivers will check surface before stepping, not jumping down.
7. Installation of soil erosion and sediment controls	7A) Overexertion	7A) Overexertion ▪ Workers will be trained in the proper method of placing erosion controls. ▪ Do not bend and twist at the waist while lifting or exerting force.
	7B) Struck by Equipment/Supplies	7C) Struck by Equipment/Supplies ▪ Workers will maintain proper space around their work area, if someone enters it, stop work. ▪ When entering another worker's work space, give a verbal warning so they know you are there.
8. Driving back from the jobsite	8A) See hazards listed under item #3	8A) See safe work practices under item #3

Completed by: Annette McLean Date: October 6, 2008

Job Hazard Analysis - Short Form

Job Title: Groundwater Sampling **Date of Analysis:** 8/20/07

Key Work Steps	Hazards/Potential Hazards	Safe Practices
1. Mobilization	1A) See JHA Mobilization/Demobilization/Site Preparation	1A) See JHA Mobilization/Demobilization/Site Preparation
2. General Site Hazards	2A) See JHA Field Work - General	2A) See JHA Field Work - General
	2B) Chemical exposure	2B) Chemical Exposure ▪ Read HASP and determine air monitoring and PPE needs.
3. Calibrate monitoring equipment	3A) Exposure to calibration gases	3A) Exposure to calibration gases ▪ Review equipment manuals ▪ Calibrate in a clean, well ventilated area
4. Opening the well cap, taking water level readings	4A) Contact with poisonous plants or the oil from poisonous plants	4A) Contact with poisonous plants or the oil from those plants: ▪ Look for signs of poisonous plants and avoid. ▪ Ensure all field workers can identify the plants. Mark identified poisonous plants with spray paint if working at a fixed location. ▪ Wear PPE as described in the HASP. ▪ Do not touch any part of your body/clothing. ▪ Always wash gloves before removing them. ▪ Discard PPE in accordance with the HASP. ▪ Use commercially available products such as Ivy Block or Ivy Wash as appropriate.
	4B) Contact with biting insects (i.e., spiders, bees, etc.) which may have constructed a nest in the well cap/well.	4B) Contact with stinging/biting insects ▪ Discuss the types of insects expected at the Site and be able to identify them. ▪ Look for signs of insects in and around the well. ▪ Wear Level of PPE as described in the HASP. At a minimum, follow guidelines in the JHA "Insects Stings and Bites." ▪ If necessary, wear protective netting over your head/face. ▪ Avoid contact with the insects if possible. ▪ Inform your supervisor and the Site Health and Safety Supervisor if you have any allergies to insects and insect bites. Make sure you have identification of your allergies with you at all times and appropriate response kits if applicable. ▪ Get medical help immediately if you are bitten by a black widow or brown recluse, or if you have a severe reaction to any spider bite or bee sting.
	4C) Exposure to hazardous Inhalation and contact with hazardous substances (VOC contaminated groundwater/ soil); liquid splash; flammable atmospheres.	4C) Exposure to hazardous substances ▪ Wear PPE as identified in HASP. ▪ Review hazardous properties of site contaminants with workers before sampling operations begin ▪ Immediately monitor breathing zone after opening well to determine exposure and verify that level of PPE is adequate – see Action Levels in HASP ▪ Monitor headspace in well. After the initial headspace reading (if required by the Work Plan), allow the well to vent for several minutes before obtaining water level and before sampling. ▪ When decontaminating equipment wear additional eye/face protection over the safety glasses such as a face shield.
	4D) Back strain due to lifting bailers or pumps and from moving equipment to well locations	4D) Back strain ▪ Use mechanical aids when possible, if mechanical aids are not available, use two person lifts for heavy items. ▪ Use proper lifting techniques

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	4E) Foot injuries from dropped equipment	4E) Foot Injuries ▪ Be aware when moving objects, ensure you have a good grip when lifting and carrying objects. ▪ Do not carry more than you can handle safely ▪ Wear Steel toed boots
5. Collecting water samples	5A) Fire/Explosion/Contamination hazard from refueling generators	5A) Fire/Explosion/Contamination hazard from refueling generators ▪ Turn the generator off and let it cool down before refueling ▪ Segregate fuel and other hydrocarbons from samples to minimize contamination potential ▪ Transport fuels in approved safety containers. The use of containers other than those specifically designed to carry fuel is prohibited ▪ See JHA for Gasoline use
	5B) Electrocution	5B) Electrocution ▪ A ground fault circuit interrupter (GFCI) device must protect all AC electrical circuits. ▪ Use only correctly grounded equipment. Never use three-pronged cords which have had the third prong broken off. ▪ Make sure that the electrical cords from generators and power tools are not allowed to be in contact with water ▪ Do not stand in wet areas while operating power equipment ▪ Always make sure all electrically-powered sampling equipment is in good repair. Report any problems so the equipment can be repaired or replaced. ▪ When unplugging a cord, pull on the plug rather than the cord. ▪ Never do repairs on electrical equipment unless you are both authorized and qualified to do so.
	5C) Exposure to contaminants	5C) Exposure to Contaminants ▪ Stand up wind when sampling ▪ Monitor breathing zone with appropriate monitoring equipment (see HASP) ▪ Wear chemical resistant PPE as identified in HASP ▪ See section 4C) under Safe Practices above
	5D) Infectious water born diseases	5D) Infectious water born diseases ▪ Wear chemical resistant gloves and other PPE – as identified in HASP ▪ Prevent water from contacting skin ▪ Wash exposed skin with soap and water ASAP after sampling event ▪ Ensure that all equipment is adequately decontaminated using a 10% bleach solution
	5E) Exposure to water preservatives	5E) Exposure to water preservatives ▪ Work in a well ventilated area, upwind of samples ▪ Wear chemical resistant PPE as identified in HASP ▪ When preserving samples always add acid to water, avoid the opposite. ▪ See JHA Working with Preservatives

Completed by: Annette McLean Date: October 6, 2008

Job Hazard Analysis - Short Form

Job Title: Field Work - General **Date of Analysis:** 09/05/08

Minimum Recommended PPE*: hard hat, steel-toed boots, safety glasses

*See HASP for all required PPE

Key Work Steps	Hazards/Potential Hazards	Safe Practices
1. Mobilization/ See Mobilization/Demobilization and Site Preparation JHA Demobilization and Site Preparation	1A) See Mobilization/Demobilization and Site Preparation JHA	1A) See Mobilization/Demobilization and Site Preparation JHA
2. Communication	2A) Safety, crew unity	2A) Talk to each other. ▪ Let other crewmembers know when you see a hazard. ▪ Avoid working near known hazard trees. ▪ Always know the wherabouts of fellow crewmembers. ▪ Carry a radio and spare batteries or cell phone ▪ Review Emergency Evacuation Procedures (see below).
3. Walking and working in the field	3A) Falling down, twisted ankles and knees, poor footing	3A) Always watch your footing. ▪ Slow down and use extra caution around logs, rocks, and animal holes. ▪ Extremely steep slopes (>50%) can be hazardous under wet or dry conditions; consider an alternate route. ▪ Wear laced boots with a minimum 8" high upper and non-skid Vibram-type soles for ankle support and traction.
	3B) Falling objects	3B) Protect head agains falling objects. ▪ Wear your hardhat for protection from falling limbs and pinecones, and from tools and equipment carried by other crewmembers. ▪ Stay out of the woods during extremely high winds.
	3C) Damage to eyes	3C) Protect eyes: ▪ Watch where you walk, ecpecially around trees and brush with limbs sticking out. ▪ Exercise caution when clearing limbs from tree trunks. Advise wearing eye protection. ▪ Ultraviolet light from the sun can be damaging to the eyes; look for sunglasses that specify significant protection from UV-A and UV-B radiation. If safety glasses require, use one's with tinted lenses
	3D) Bee and wasp stings	3D) See JHA for Insect Stings and Bites
	3E) Ticks and infected mosquitos	3E) See JHA for Insect Stings and Bites
	3F) Lifting Injuries (e.g., Back Injuries)	3F) Lifting Injuries (e.g., Back Injuries) • Site personnel will be instructed on proper lifting techniques. • Perform warm-up excercises before starting work. • DO NOT EXCEED THE MACTEC LIFTING LIMIT OF 50 POUNDS. • Use two people to lift, lower, or carry equipment or materials heavier than 50 pounds. • Mechanical devices should be used to reduce manual handling of materials. • Drive the field vehicle as close to the point that the heavy equipment/material will be used as long as the area is safe to drive into and you do not create hazards to you, your co-worker, or the vehicle.

Job Hazard Analysis - Short Form

Job Title: Field Work - General **Date of Analysis:** 09/05/08

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	3G) Slips/Trips/Falls	3G) Slips/Trips/Falls • Maintain work areas safe and orderly; unloading areas should be on even terrain; mark or repair possible tripping hazards. • Site SHSO inspect the entire work area to identify and mark hazards.
	3H) Vehicular Traffic	3H) Vehicular Traffic ▪ Spotters will be used when backing up trucks and heavy equipment and when moving equipment. ▪ High visibility vests will be worn when workers are exposed to vehicular traffic at the site or on public roads.
	3I) Overhead Hazards	3I) Overhead Hazards ▪ Personnel will be required to wear hard hats that meet ANSI Standard Z89.1. ▪ All ground personnel will stay clear of suspended loads. ▪ All equipment will be provided with guards, canopies or grills to protect the operator from falling or flying objects. ▪ All overhead hazards will be identified prior to commencing work operations.
	3J) Dropped Objects	3J) Dropped Objects ▪ Steel toe boots meeting ANSI Standard Z41 will be worn.
	3K) Noise	3K) Noise ▪ Hearing protection will be worn with a noise reduction rating capable of maintaining personal exposure below 85 dBA (ear muffs or plugs); all equipment will be equipped with manufacturer's required mufflers. Hearing protection shall be worn by all personnel working in or near heavy equipment.
	3L) Eye Injuries	3L) Eye Injuries ▪ Safety glasses meeting ANSI Standard Z87 will be worn.
	3M) Heavy Equipment (overhead hazards, spills, struck by or against)	3M) Heavy Equipment ▪ Equipment will have seat belts. ▪ Operators will wear seat belts when operating equipment. ▪ Do not operate equipment on grades that exceed manufacturer's recommendations. ▪ Equipment will have guards, canopies or grills to protect from flying objects. ▪ Ground personnel will stay clear of all suspended loads. ▪ Ground personnel will wear high visibility vests ▪ Spill and absorbent materials will be readily available. ▪ Drip pans, polyethylene sheeting or other means will be used for secondary containment. ▪ Ground personnel will stay out of the swing radius of excavators. ▪ Eye contact with operators will be made before approaching equipment. ▪ Operator will acknowledge eye contact by removing his hands from the controls. ▪ Equipment will not be approached on blind sides. ▪ All equipment will be equipped with backup alarms and use spotters when significant physical movement of equipment occurs on-site, (i.e., other than in place excavation or truck loading).

Job Hazard Analysis - Short Form

Job Title: Field Work - General **Date of Analysis:** 09/05/08

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	3N) Struck by vehicle/equipment	3N) Struck by vehicle/equipment ▪ Be aware of heavy equipment operations. ▪ Keep out of the swing radius of heavy equipment. ▪ Ground personnel in the vicinity of heavy equipment operations will be within the view of the operator at all times and will wear high visibility vests. ▪ Ground personnel will be aware of the counterweight swing and maintain an adequate buffer zone. ▪ Ground personnel will not stand directly behind heavy equipment when it is in operation. ▪ Drivers will keep workers on foot in their vision at all times, if you lose sight of someone, Stop!
	3O) Struck/cut by tools	3O) Struck/cut by tools ▪ Cut resistant work gloves will be worn when dealing with sharp objects. ▪ All hand and power tools will be maintained in safe condition. ▪ Guards will be kept in place while using hand and power tools.
	3P) Caught in/on/between	3P) Caught in/on/between ▪ Workers will not position themselves between equipment and a stationary object. ▪ Workers will not wear long hair down (place in pony-tail and tuck into shirt) or jewelry if working with tools/machinery.
	3Q) Contact with Electricity/Lightning	3Q) Contact with Electricity/Lighting ▪ All electrical tools and equipment will be equipped with GFCI. ▪ Electrical extension cords will be of the "Hard" or "Extra Hard" service type. ▪ All extension cords shall have a three-blade grounding plug. ▪ Personnel shall not use extension cords with damaged outer covers, exposed inner wires, or splices. ▪ Electrical cords shall not be laid across roads where vehicular traffic may damage the cord without appropriate guarding. ▪ All electrical work will be conducted by a licensed electrician. ▪ All utilities will be marked prior to excavation activities. ▪ All equipment will stay a minimum of 10 feet from overhead energized electrical lines (50 kV). This distance will increase by 4 inches for each 10 kV above 50 kV. Rule of Thumb: Stay 10 feet away from all overhead powerlines known to be 50 kV or less and 35 feet from all others.) ▪ The SHSO shall halt outdoor site operations whenever lightning is visible, outdoor work will not resume until 30 minutes after the last sighting of lightning.
	3R) Equipment failure	3R) Equipment failure ▪ All equipment will be inspected before use. If any safety problems are noted, the equipment should be tagged and removed from service until repaired or replaced.
	3S) Hand & power tool usage.	3S) Hand & power tool usage ▪ Daily inspections will be performed. ▪ Remove broken or damaged tools from service. ▪ Use the tool for its intended purpose. ▪ Use in accordance with manufacturers instructions.

Job Hazard Analysis - Short Form

Job Title: Field Work - General **Date of Analysis:** 09/05/08

Key Work Steps	Hazards/Potential Hazards	Safe Practices
4. Environmental health considerations	4A) HEAT Stress	4A) Take precautions to prevent heat stress ▪ Remain constantly aware of the four basic factors that determine the degree of heat stress (air temperature, humidity, air movement, and heat radiation) relative to the surrounding work environmental heat load. ▪ Know the signs and symptoms of heat exhaustion, heat cramps, and heat stroke. Heat stroke is a true medical emergency requiring immediate emergency response action. NOTE: The severity of the effects of a given environmental heat stress is decreased by reducing the work load, increasing the frequency and/or duration of rest periods, and by introducing measures which will protect employees from hot environments. ▪ Maintain adequate water intake by drinking water periodically in small amounts throughout the day (flavoring water with citrus flavors or extracts enhances palatability). ▪ Allow approximately 2 weeks with progressive degrees of heat exposure and physical exertion for substantial acclimatization. ▪ Acclimatization is necessary regardless of an employee's physical condition (the better one's physical condition, the quicker the acclimatization). Tailor the work schedule to fit the climate, the physical condition of employees, and mission requirements. ▪ A reduction of work load markedly decreases total heat stress. ▪ Lessen work load and/or duration of physical exertion the first days of heat exposure to allow gradual acclimatization. ▪ Alternate work and rest periods. More severe conditions may require longer rest periods and electrolyte fluid replacement.
	4B) Wet Bulb Globe Temperature (WBGT) Index	4B) WBGT ▪ Curtail or suspend physical work when conditions are extremely severe (see attached Heat Stress Index). ▪ Compute a Wet Bulb Globe Temperature Index to determine the level of physical activity (take WBGT index measurements in a location that is similar or closely approximates the environment to which employees will be exposed). WBGT THRESHOLD VALUES FOR INSTITUTING PREVENTIVE MEASURES 80-90 degrees F — Fatigue possible with prolonged exposure and physical activity. 90-105 degrees F — Heat exhaustion and heat stroke possible with prolonged exposure and physical activity. 105-130 degrees F — Heat exhaustion and heat stroke are likely with prolonged heat exposure and physical activity.

Job Hazard Analysis - Short Form

Job Title: Field Work - General **Date of Analysis:** 09/05/08

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	4C) Cold Extremes	4C) Take precautions to prevent cold stress injuries ▪ Cover all exposed skin and be aware of frostbite. While cold air will not freeze the tissues of the lungs, slow down and use a mask or scarf to minimize the effect of cold air on air passages. ▪ Dress in layers with wicking garments (those that carry moisture away from the body – e.g., cotton) and a weatherproof slicker. A wool outer garment is recommended. ▪ Take layers off as you heat up; put them on as you cool down. ▪ Wear head protection that provides adequate insulation and protects the ears. ▪ Maintain your energy level. Avoid exhaustion and over-exertion which causes sweating, dampens clothing, and accelerates loss of body heat and increases the potential for hypothermia. ▪ Acclimate to the cold climate to minimize discomfort. ▪ Maintain adequate water/fluid intake to avoid dehydration.
	4D) Wind	4D) Effects of the wind ▪ Wind chill greatly affects heat loss (see attached Wind Chill Index). ▪ Avoid marking in old, defective timber, especially hardwoods, during periods of high winds due to snag hazards.
	4E) Thunderstorms	4E) Thunderstorms ▪ Monitor weather channels to determine if electrical storms are forcased. ▪ Plan ahead and identify safe locations to be in the event of a storm. (e.g., sturdy building, vehicle, etc.) ▪ Suspend all field work at the first sound of thurnder. You should be in a safe place when the time between the lightning and thunder is less than 30 seconds. ▪ Only return to work 30 minutes after the after the last strike or sound of thunder
5. Check and calibrate industrial hygiene and other field instruments and	5A) Exposure to Calibration Gases/Chemicals due to: • Use of damaged instruments.	5A) Verify proper operation of the instrument prior to calibration. Calibrate instruments in an area with adequate ventilation and follow the manufacturer's recommendations. ▪ Wear appropriate PPE to conduct calibrations as specified in the instrument manual.

Job Hazard Analysis - Short Form

Job Title: Field Work - General **Date of Analysis:** 09/05/08

Key Work Steps	Hazards/Potential Hazards	Safe Practices
equipment as required and as recommended by the manufacturer	5B) Exposure to Site contaminants due to: • Improper instrument calibration; • Misinterpretation of calibration results; • Improper instrument repair; • Improper use of instrument due to lack of training.	5B) Calibrate the instrument in accordance with the manufacturer's recommendations (see instrument manual) using the applicable calibration standard and calibration procedure. • Perform calibrations at a frequency recommended by the manufacturer. Be aware of the instrument's limitations (e.g., detection limit, maximum sensitivity) and the conditions (e.g., humidity) that may affect correct operation or accuracy of that equipment. Possible sources of error that may affect the correct calibration of the instrument. • Use only calibration materials recommended by the manufacturer for calibration. Do not use substitutions. • Confirm that the connections between the instrument and the calibration gas/material is leak-free. • Record all instrument calibrations in the field logbook. Include the instrument ID (type/manufacture/serial number/lamp eV, etc.), calibration gas used (chemical and concentration), and instrument result. • Do not attempt to repair instrument. Return to the vendor for replacement. Report any damaged or malfunctioning instrument to the vendor. • All personnel must be familiar with operation of the instrument and understand: - Theroy of its operation including any alarms and their setpoints - Materials the instrument can and cannot detect, - Instrument's limitations - The expected responses to calibration gases/materials - Interfering gases/chemicals and their affects on the instrument readings - When re-zeroing is appropriate

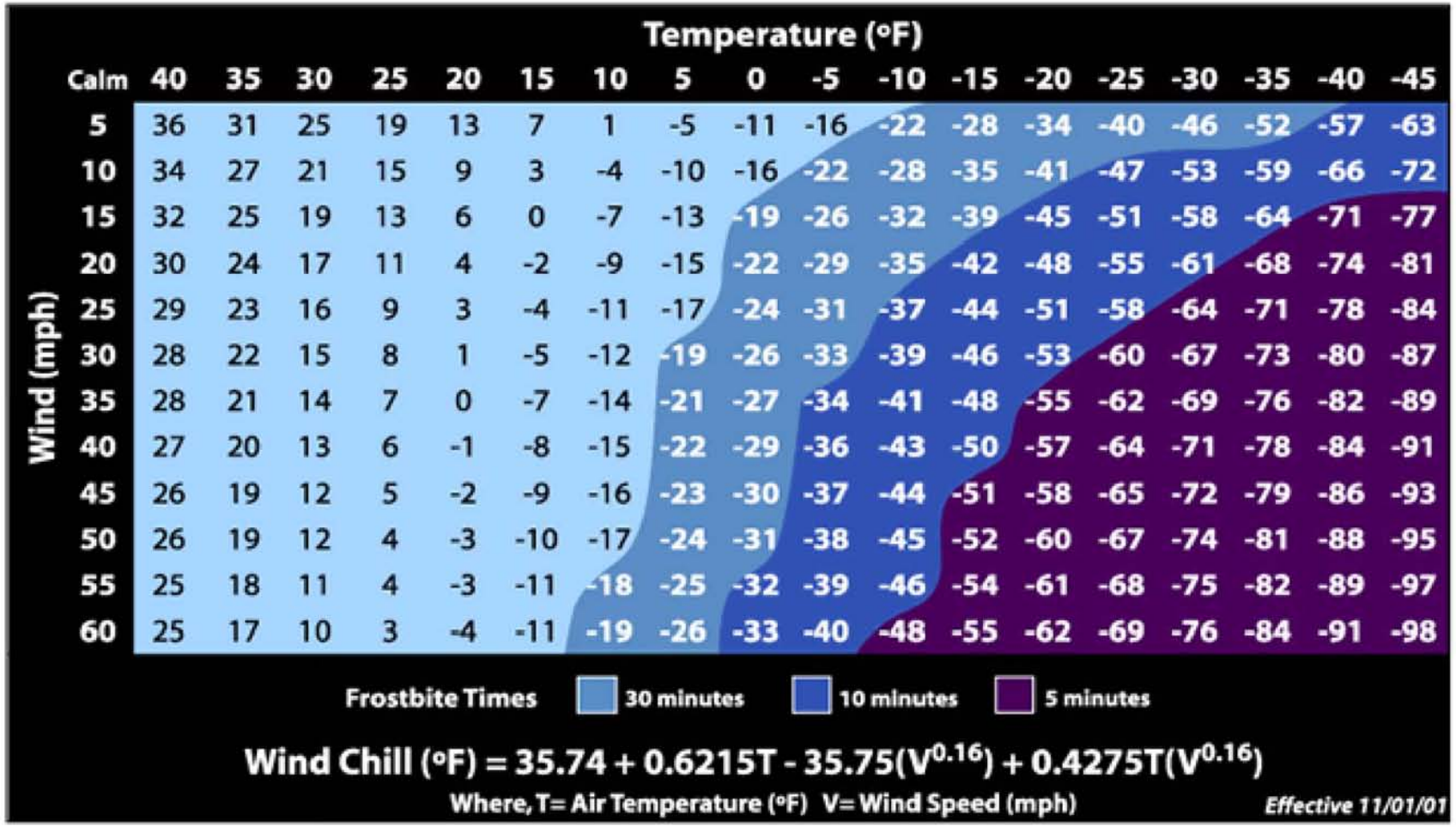
Heat Index Chart

Temperature	% Relative Humidity																
		15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90
	110	108	112	117	123	130											
	105	102	105	108	113	117	122	130									
	100	97	98	102	104	107	110	115	120	126	132						
	95	91	93	95	96	98	100	104	106	109	113	119	124	130			
	90	86	87	88	90	91	92	95	97	98	100	103	106	110	114	117	121
	85	81	82	83	84	85	86	87	88	89	90	92	94	96	97	100	102
	80	76	77	78	78	79	79	80	81	82	83	84	85	86	87	88	89

Legend

80-89 degrees	Fatigue is possible with prolonged exposure and/or physical activity.
90-104 degrees	Sunstroke, heat cramps and heat exhaustion are possible with prolonged exposure and/or physical activity.
105-129 degrees	Sunstroke, heat cramps and heat exhaustion are likely. Heat stroke is possible with prolonged exposure and/or physical activity.
130+ degrees	Heatstroke/sunstroke is highly likely with continued exposure.

Wind Chill Chart



Wind (mph) \ Temperature (°F)	Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5		36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10		34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15		32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20		30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25		29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30		28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35		28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40		27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45		26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50		26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55		25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60		25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite Times: 30 minutes; 10 minutes; 5 minutes

$$\text{Wind Chill (°F)} = 35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$$

Where, T= Air Temperature (°F) V= Wind Speed (mph)

Effective 11/01/01

Completed by: Annette McLean

Date: October 6, 2008

Job Hazard Analysis – Short Form

Job Title: Excavation and Backfilling **Date of Analysis:** January 17, 2008

Applicable ES&H Programs:

2.9.A - Hazardous Waste Operations and Emergency Response Program
2.9.B - Hearing Conservation Program
2.9.C - Respiratory Protection Program
2.9.D - Personal Protective Equipment Program
2.9.E - Hazard Communication Program

Applicable ES&H Procedures:

2.5.2 - Heavy Equipment
2.5.2A - Conducting Safe Drilling Operations
2.9.9 - Excavating and Trenching
2.9.11 - Exposure Monitoring
2.13.1 - Medical Surveillance
2.13.2 - Medical Emergencies and First Aid
2.14.2 - Handling, Storage, and Control of Hazardous Chemicals
2.14.5 - Collection of Field Samples

Minimum Recommended PPE*: High visibility vest, hard hat, steel-toed boots, safety glasses, hearing protection
*See HASP for all required PPE

Key Work Steps	Hazards/Potential Hazards	Safe Practices
1. Identify location of underground utilities	1A) Encountering electrical, gas, communications, water, or other underground utility lines	1A) Identify utility locations prior to mobilizing: ▪ Contact "Dig Safe" and obtain a permit (or one call center) to have underground utilities located and marked prior to any subsurface work on site. ▪ Confirm other utility providers (e.g., local water, sewer, etc.) have been notified and the utilities marked. ▪ Use facility engineers and/or employ a private utility locator for utilities on private property. ▪ Maintain utility markings throughout the duration of the field work. If the site activity will remove/destroy the original markers of underground installation(s), place offset markers prior any intrusive work to mark the location of the utilities. Pin flags in colors corresponding to the color code used by Dig Safe will be used to mark the offset and the path of all site utilities. ▪ Work at adequate offsets from utility locations. For areas where utility locations cannot be verified, hand dig for the first 3 feet. Immediately cease work if unknown utility markings are discovered.
2. Excavation of impacted soils	2A) Underground utilities	2A) Underground utilities ▪ Work at adequate offsets from utility locations ▪ For areas where utility locations cannot be verified, workers must hand dig for the first 3 feet ▪ Immediately cease work if unknown utility markings are discovered. ▪ Conform to utility clearances based on voltage of lines. For powerlines of 50 KV or less stay at least 10 feet away. For powerlines of > 50 KV, add an additional 0.4 inches per KV over 50 KV. Rule of thumb: Stay 10 feet away if powerline known to be 50 KV or less. Stay 35 feet away for lines > 50 KV or if voltage is unknown.

Job Hazard Analysis – Short Form

Job Title: Excavation and Backfilling **Date of Analysis:** January 17, 2008

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	2B) Vapor/Dust Exposure	2B) Vapor/Dust Exposure ▪ Conduct breathing zone air monitoring as described in the HASP. ▪ Implement dust control measures as applicable as described in the HASP. ▪ Wear proper PPE as described in the HASP.
	2C) Odors	2C) Odors ▪ If applicable, implement odor control mitigation in accordance with the Site Management Plan.
	2D) Heavy Equipment	2D) Heavy Equipment ▪ See General Site Hazards described in the HASP.
	2E) Cave-ins	2E) Cave-ins Excavation work must be conduct in accordance with OSHA 1926 Subpart P (650-652) Excavations including but not limited to: ▪ Designate a competent person to inspect, decide soil classification, proper sloping, the correct shoring, or sheeting for the excavation ▪ Walls and faces of trenches 5 feet or more deep, and all excavations in which employees may be exposed to danger from moving ground or cave-in shall be guarded by a shoring system, sloping of the ground, or some other equivalent means. ▪ Cordon-off the perimeter of the excavation to delineate cave-in hazard area. ▪ Construct diversion ditches or dikes to prevent surface water from entering excavation and provide good drainage of the areas surrounding the excavation. ▪ Collect ground water/rain water from excavation and dispose of properly ▪ Store spoils, materials and equipment at least 2 feet from the edge of the excavation; prevent excessive loading of the excavation face. ▪ Inspect excavations (when personnel entry is required) daily, any time conditions change and document the inspection.
	2F) Slips/Trips/Falls	2F) Slips/Trips/Falls ▪ Provide sufficient egress (stairs, ladders, or ramps) when workers enter excavations over 4 feet in depth, and place these structures so that workers travel no more than 25 feet to reach ladders. Provide at least two means of exit for personnel working in excavations. ▪ Maintain minimum safe distance from the excavation and only approach the excavation on the short side.
	2G) Confined Space	2G) Confined Space **MACTEC personnel are not authorized to enter excavations.** ▪ Treat excavations over 4 feet deep as confined spaces and implement confined space permit entry procedure prior to entry. ▪ Monitor atmosphere in excavation for oxygen, flammable then toxic vapors, in that order. ▪ Implement confined space entry JHA.

Job Hazard Analysis – Short Form

Job Title: Excavation and Backfilling **Date of Analysis:** January 17, 2008

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	2H) Site Security	2H) Site Security ▪ Fill in excavation prior to leaving the site or provide barricades or fencing (able to withstand 200 lbs. of vertical pressure) to protect the excavation from the public and place warning signs on fence/barricade. ▪ Consider hiring a security guard ▪ If cover excavation with plywood or other material, ensure cover is labeled with the words "cover" or "hole."
3). Backfilling of Soils	3A) Heavy Equipment	3A) Heavy Equipment ▪ See General Site Hazards (Heavy Equipment)
	3B) Cave-ins	3B) Cave-ins ▪ See 2E above.

Completed by: Annette McLean Date: October 6, 2008

Job Hazard Analysis - HASP Format

Job Title: Drilling – Pre-ground Disturbance and Clearance Activities **Date of Analysis:** 7/26/06

Minimum Recommended PPE*: Steel Toed, Slip Resistant Boots; Safety Glasses; Face Shield (if danger to face due to flying particles); Leather and/or Nitrile Gloves, Snake Chaps (if required); High visibility vest; Hard Hat; Hearing Protection; Insulated Gloves (if hand digging to identify underground electrical lines)

*See HASP for all required PPE

Key Work Steps	Hazards/Potential Hazards	Safe Practices
1. All Pre-Ground Disturbance Clearance Activities including Site Inspection, Subsurface Features Mark-out, Removal of Surface Cover and Ground Clearance	1A) Slips/Trips/Falls	1A) Slips/Trips/Falls ▪ Keep work area free of excess material and debris ▪ Remove all trip hazards by keeping materials/objects organized and out of walkways ▪ Keep work surfaces dry when possible ▪ Wear appropriate PPE (see HASP) including non-slip rubber boots if working on wet or slick surfaces ▪ Install rough work surface covers where possible ▪ Stay aware of footing and do not run
	1B) Heat/Cold Stress	1B) Heat/Cold Stress ▪ Take breaks if feeling faint or overexerted ▪ Consume adequate food/beverages (water, sports drinks) ▪ If possible, adjust work schedule to avoid temperature extremes
	1C) Biological Hazards: Insects, Snakes, Wildlife, Vegetation	1C) Biological Hazards: Insects, Snakes, Wildlife, Vegetation ▪ See JHA – Insect Bites and Stings ▪ Inspect work areas when arrive at site to identify hazard(s) ▪ Use insect repellant if observe mosquitoes/gnats ▪ Survey site for presence of biological hazards and maintain safe distance ▪ Wear appropriate PPE including leather gloves, long sleeves and pants, and snake chaps as warranted by site conditions
	1D) Traffic (including pedestrian)	1D) Traffic (including pedestrian) ▪ Notify attendant or site owner/manager of work activities and location ▪ Use cones, signs, flags or other traffic control devices as outlined in the Traffic Control Plan ▪ Set up exclusion zone surrounding work area using cones, signs, flags or other traffic control devices ▪ Wear appropriate PPE including high visibility clothing such as reflective vest ▪ Inspect area behind vehicle prior to backing and use spotter
	1E) Fire/Explosion	1E) Fire/Explosion ▪ Post No Smoking signs around work area ▪ Establish designated smoking area away from work area ▪ Ensure type ABC, 20-lb, fully charged fire extinguisher on-site and within inspection period ▪ As site conditions/activities warrant, establish Hot Work Permit including air monitoring using direct-reading, real-time instruments such as LEL/O meter (see HASP) ▪ Stop work if hazardous conditions (explosive atmosphere) are identified

Job Hazard Analysis - HASP Format

Job Title: Drilling – Pre-ground Disturbance and Clearance Activities **Date of Analysis:** 7/26/06

Key Work Steps	Hazards/Potential Hazards	Safe Practices
2. Ambient Air Monitoring	2A) Vapors	2A) Vapors ▪ Approach area where vapors are suspected from upwind direction and stay upwind/crosswind of from potential sources of vapors (use flagging or similar device to indicate wind direction) ▪ See HASP for monitoring requirements and action limits
	2B) Ineffective Air Monitoring	2B) Ineffective Air Monitoring ▪ Ensure personnel using have been trained on instrument use ▪ Calibrate instrument prior to use
3. Breaking-Up and Removing Asphalt/ Concrete Cover by Saw Cutting or with Heavy Equipment	3A) Heavy Equipment Movement	3A) Heavy Equipment Movement ▪ Heavy equipment should be equipped with back-up alarm or use horn when backing ▪ Do not allow personnel to stand within the swing radius of equipment booms/arms when equipment is in operation ▪ Stay clear of operating equipment and heavy equipment when moving ▪ When approaching heavy equipment, approach should be made from the front ensuring eye contact is made with operator
	3B) Suspended Loads	3B) Suspended Loads ▪ Do not walk under suspended loads ▪ Wear appropriate PPE including hard hat
	3C) Ignition Sources	3C) Ignition Sources ▪ Ensure electrical equipment properly grounded ▪ Apply water as necessary to address surface sparking potential ▪ Equip heavy equipment with non-sparking bucket/blade
	3D) High Noise Levels	3D) High Noise Levels ▪ Hearing protection required when working around operating equipment if levels are suspected to be >85 dBA (if have to yell to person at a dist of 3 ft to be heard, likely exceeding 85 dBA).
	3E) Airborne Particulates and Debris	3E) Airborne Particulates and Debris ▪ Use water as necessary to control dust in area ▪ Wear appropriate PPE including face shield or safety glasses with side shields, dust mask, leather gloves and long sleeves
	3F) Heavy Material Lifting	3F) Heavy Material Lifting ▪ Use heavy equipment to lift ▪ Do not lift or move heavy materials (greater than 50 lbs) without adequate assistance ▪ Bend and lift with legs and arms, keeping back straight ▪ Wear appropriate PPE including leather gloves, long sleeves and pants, and steel-toed boots
	3G) Impact to Subsurface Lines	3G) Impact to Subsurface Lines ▪ Ensure all underground features have been identified in area per Subsurface Clearance Protocol (SCP) prior to start of activities
	3H) Equipment Rollover	3H) Equipment Rollover ▪ If soil appears unstable, the soil should be assessed by a qualified professional engineer to ensure safe conditions with implementation of design control measures prior to start of work

Job Hazard Analysis - HASP Format

Job Title: Drilling – Pre-ground Disturbance and Clearance Activities **Date of Analysis:** 7/26/06

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	3I) Heavy Equipment Movement	3I) Heavy Equipment Movement ▪ Heavy equipment should be equipped with back-up alarm ▪ When approaching heavy equipment, approach should be made from the front ensuring eye contact is made with operator
	3J) Physical Injury from Managing Equipment	3J) Physical Injury from Managing Equipment ▪ Take breaks if feeling faint or overexerted
	3K) Ignition Sources	3K) Ignition Sources ▪ Ensure equipment properly bonded and grounded ▪ Use sufficient hose so that equipment does not have to be located in critical zone ▪ Apply water as necessary to address sparking potential if equipment comes in contact with rocks/buried objects ▪ Equip heavy equipment with non-sparking bucket/blade
	3L) High Noise Levels	3L) High Noise Levels ▪ Hearing protection required when working around operating equipment if levels are suspected to be >85 dBA (if have to yell to person at a dist of 3 ft to be heard, likely exceeding 85 dBA).
	3M) Airborne Debris	3M) Airborne Debris ▪ Wear appropriate PPE including leather gloves, long sleeves and pants, and face shield or safety glasses with side shields (see HASP)
	3N) Vapors and Airborne Particulates	3N) Vapors and Airborne Particulates ▪ Monitor air concentrations using direct-reading, real-time instruments such as OVM and Dräger tubes (See HASP for monitoring equipment and action limits) ▪ Stop work if hazardous conditions (explosive atmosphere, O2 deficient atmosphere) identified until precautions are taken (See HASP) ▪ Wear appropriate PPE including dust masks and respirators (See HASP) ▪ Stay upwind (use flagging or similar device to indicate wind direction)
	3O) Impact to Underground Lines/Tanks	3O) Impact to Underground Lines/Tanks ▪ Ensure underground features in area have been identified to extent possible per SCP (line locators, drawing review,) ▪ Wear insulating gloves or stand on insulating mat when advancing hand tools
	3P) Open Excavation	3P) Open Excavation ▪ Personnel should stay at least two feet away from edge ▪ Install orange construction fence or temporary chain link fence around excavated area if to be left unattended
4. Solid Waste Management/ Disposal	4A) Vapors and Airborne Particulates	4A) Vapors and Airborne Particulates ▪ Monitor air concentrations using direct-reading, real-time instruments such as OVM and Dräger tubes (See HASP for required monitoring instruments and action limits) ▪ Stop work if hazardous conditions (explosive atmosphere, O2 deficient atmosphere) identified until precautions are taken (See HASP) ▪ Wear appropriate PPE including safety glasses with side shields, dust masks and respirators (See HASP) ▪ Stay upwind (use flagging or similar device to indicate wind direction)

Job Hazard Analysis - HASP Format

Job Title: Drilling – Pre-ground Disturbance and Clearance Activities **Date of Analysis:** 7/26/06

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	4B) Contaminated Materials and Container Pinch Points	4B) Contaminated Materials and Container Pinch Points ▪ Wear appropriate PPE including nitrile and leather gloves (See HASP) ▪ Position hands/fingers to avoid pinching/smashing/crushing when closing drum rings
	4C) Heavy Materials and Container Lifting/Moving	4C) Heavy Materials and Container Lifting/Moving ▪ Do not lift or move heavy containers without assistance ▪ Use proper bending/lifting techniques by lifting with arms and legs and not with back ▪ If possible, use powered lift truck, drum cart, or other mechanical means to move containers ▪ Take breaks if feeling faint or overexerted ▪ Spot drums in storage area prior to filling ▪ Wear appropriate PPE including leather gloves and steel-toed boots (See HASP)

Completed by: Annette McLean Date: October 6, 2008

Job Hazard Analysis - HASP Format

Job Title: Environmental Drilling/Boring and Associated Soil Sampling **Date of Analysis:** 7/26/06

Minimum Recommended PPE*: Steel Toed, Slip Resistant Boots; Safety Glasses; Face Shield (if danger to face due to flying particles); Leather and/or Nitrile Gloves, Snake Chaps (if required); High visibility vest; Hard Hat; Hearing Protection; Insulated Gloves (if hand digging to identify underground electrical lines)

*See HASP for all required PPE

Key Work Steps	Hazards/Potential Hazards	Safe Practices
1. All Drilling/Boring Activities	2A) Slips, Trips, Falls	1A) Slips, Trips, Falls ▪ Keep work area free of excess material and debris ▪ Remove all trip hazards by keeping materials/objects organized and out of walkways ▪ Keep work surfaces dry when possible ▪ Wear appropriate PPE (See HASP) including non-slip rubber boots if working on wet or slick surfaces ▪ Install rough work surface covers where possible ▪ Stay aware of footing and do not run
	2B) Heat/Cold Stress	1B) Heat/Cold Stress ▪ Take breaks if feeling faint or overexerted ▪ Consume adequate food/beverages (water, sports drinks) ▪ If possible, adjust work schedule to avoid temperature extremes
	2C) Biological Hazards: Insects, Snakes, Wildlife, Vegetation	1C) Biological Hazards: Insects, Snakes, Wildlife, Vegetation ▪ Inspect work areas when arrive at site to identify hazard(s) ▪ Use insect repellant if observe mosquitoes/gnats ▪ Open enclosures slowly ▪ Survey site for presence of biological hazards and maintain safe distance ▪ Wear appropriate PPE including leather gloves, long sleeves and pants, and snake chaps as warranted by site conditions (See HASP)
	2D) Traffic (including pedestrian)	1D) Traffic (including pedestrian) ▪ Notify attendant or site owner/manager of work activities and location ▪ Use cones, signs, flags or other traffic control devices as outlined in the ▪ Traffic Control Plan ▪ Set up exclusion zone surrounding work area using cones, signs, flags or other traffic control devices ▪ Wear appropriate PPE including high visibility clothing such as reflective vest (See HASP) ▪ Inspect area behind vehicle prior to backing and use spotter
	2E) Fire/ Explosion	1E) Fire/ Explosion ▪ Post No Smoking signs around work area ▪ Establish designated smoking area away from work area ▪ Ensure type ABC, 20-lb, fully charged fire extinguisher on-site and within inspection period ▪ As site conditions/activities warrant, establish Hot Work Permit including air monitoring using direct-reading, real-time instruments such as LEL/ O2 meter (See HASP for required monitoring instruments and action limits) ▪ Stop work if hazardous conditions (explosive atmosphere) are identified
2. Ambient Air Monitoring	2A) Vapors	2A) Vapors ▪ Approach area where vapors are suspected from upwind direction and stay upwind/crosswind of from potential sources of vapors (use flagging or similar device to indicate wind direction)

Job Hazard Analysis - HASP Format

Job Title: Environmental Drilling/Boring and Associated Soil Sampling **Date of Analysis:** 7/26/06

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	2B) Ineffective Air Monitoring	2B) Ineffective Air Monitoring ▪ Ensure personnel using have been trained on instrument use ▪ Calibrate instrument prior to use
3. Concrete Coring	3A) Ignition Sources	3A) Ignition Sources ▪ Ensure electrical equipment properly grounded ▪ Apply water as necessary to address surface sparking potential
	3B) High Noise Levels	3B) High Noise Levels ▪ Hearing protection required when working around operating equipment if levels are suspected to be >85 dBA (if have to yell to person at a dist of 3 ft to be heard, likely exceeding 85 dBA).
	3C) Airborne Particulates and Debris	3C) Airborne Particulates and Debris ▪ Use water as necessary to control dust in area ▪ Wear appropriate PPE including face shield or safety glasses with side shields, dust mask, leather gloves and long sleeves (See HASP)
	3D) Sharp Rough Materials	3D) Sharp Rough Materials ▪ Wear appropriate PPE including leather gloves, long sleeves and pants, and steel-toed boots (See HASP)
	3E) Impact to Subsurface Lines	3E) Impact to Subsurface Lines ▪ Ensure all underground features have been identified in area per SCP prior to start of activities
4. Drill Rig Set-Up	4A) Contact with Electric Lines and Other Overhead Obstacles	4A) Contact with Electric Lines and Other Overhead Obstacles ▪ Position rig to avoid overhead utility lines by distance defined by voltage and local regulations ▪ Use a spotter when raising mast to confirm clearance of overhead lines and other obstructions
	4B) Rig Movement	4B) Rig Movement ▪ Heavy equipment should be equipped with back-up alarm or use horn when backing - use spotter when available ▪ Stay clear of operating equipment and rig when moving
	4C) Heavy Equipment Lifting/ Carrying	4C) Heavy Equipment Lifting/ Carrying ▪ Use at least 2 people to lift and carry sections, use mechanical lift devices whenever possible, bend and lift with legs and arms, not back
	4D) Sharp or Elevated Equipment	4D) Sharp or Elevated Equipment ▪ Wear appropriate PPE including steel-toed safety boots, leather gloves and hard hat (See HASP) ▪ Establish communication system between workers involved in moving/attaching sections
5. Ground Disturbance: Auger/Boring Advancement	5A) Faulty or Inappropriate Equipment	5A) Faulty or Inappropriate Equipment ▪ Qualified driller must inspect drill rig prior to use, if faulty or inappropriate, do not proceed until repaired or replaced ▪ Inspect all hand tools prior to use, if faulty or inappropriate, do not proceed until repaired or replaced. Tag out all defective tools

Job Hazard Analysis - HASP Format

Job Title: Environmental Drilling/Boring and Associated Soil Sampling **Date of Analysis:** 7/26/06

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	5B) Moving Equipment	5B) Moving Equipment ▪ Clear area of obstructions and communicate with all workers involved that drilling is beginning ▪ Do not exceed manufacturer's recommended speed, force, torque, or other specifications. and penetrate the ground slowly with hands on the controls for at least the first foot of soil to minimize chance of auger kick-out ▪ Stay clear of rotating auger ▪ Use long-handled shovel to clear away cuttings when auger has stopped ▪ Do not wear loose clothing ▪ Wear appropriate PPE including leather gloves and steel-toed boots (See HASP)
	5C) Suspended Loads	5C) Suspended Loads ▪ Do not walk under suspended loads ▪ When possible, remove overhead hazards promptly ▪ Wear appropriate PPE including hard hat and steel-toed boots (See HASP)
	5D) High Noise Levels	5D) High Noise Levels ▪ Use hearing protection if within 20 feet of active drill rig
	5E) Ground Disturbance: Auger/Boring Advancement Vapors and Airborne	5E) Ground Disturbance: Auger/Boring Advancement Vapors and Airborne ▪ Monitor air concentrations using direct-reading, real-time instruments such as OVM and Dräger tubes (See HASP for required monitoring instruments and action limits)
	5F) Particulates	5F) Particulates ▪ Stop work if hazardous conditions (explosive atmosphere, O2 deficient atmosphere) identified until precautions are taken (See HASP for required monitoring instruments and action limits) ▪ Wear appropriate PPE including face shield or safety glasses with side shields, dust masks or respirators, long sleeves and pants (See HASP) ▪ Stay upwind (use flagging or similar device to indicate wind direction)
	5G) Impact to Subsurface Lines/Tanks	5G) Impact to Subsurface Lines/Tanks ▪ Only drill in areas where underground features have been identified and cleared per Subsurface Clearance Protocol (SCP) if hole has to be moved, clear new location first ▪ Wear appropriate PPE including insulating gloves or stand on an insulating mat when in contact with drill rig ▪ Ensure first aid responders are trained to deal with electric shock and flash burns
6. Ground Intrusion: Split Spoon	6A) Faulty Equipment	6A) Faulty Equipment ▪ Inspect rope/cable/rod for wear, fraying, oils and moisture prior to use, do not use if faulty until repaired or replaced. ▪ Inspect cathead for rust and rope grooves prior to use, do not use if faulty until repaired or replaced ▪ Report any defects to your supervisor

Job Hazard Analysis - HASP Format

Job Title: Environmental Drilling/Boring and Associated Soil Sampling **Date of Analysis:** 7/26/06

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	6B) Moving Equipment	6B) Moving Equipment ▪ Do not wrap rope around any part of the hand or body ▪ Maintain distance of at least 18-inches from in-running points on running/reciprocating equipment ▪ Eliminate excess rope ▪ Do not wear loose clothing ▪ Wear appropriate PPE including leather gloves (See HASP)
7. Soil Sampling	6C) Contaminated Materials	6C) Contaminated Materials ▪ Wear appropriate PPE including Nitrile gloves (See HASP)
	6D) Sharp Sampling Tools	6D) Sharp Sampling Tools ▪ Use correct tools for opening sleeves ▪ When opening sleeve, cut away from body ▪ Place soil core on sturdy surface prior to cutting
	6E) Vapors	6E) Vapors ▪ Wear appropriate PPE including respirator if conditions warrant
	6F) Sample Cross Contamination	6F) Sample Cross Contamination ▪ Decontaminate or dispose of sampling equipment between sampling locations ▪ Double-check sample labels to ensure accuracy and adhesion to containers
8. Solid/Liquid Waste Management/ Disposal	6G) Vapors and Airborne Particulates	6G) Vapors and Airborne Particulates ▪ Monitor air concentrations using direct-reading, real-time instruments such as OVM and Dräger tubes (See HASP for required monitoring instruments and action limits) ▪ Stop work if hazardous conditions (explosive atmosphere, O2 deficient atmosphere) identified until precautions are taken ▪ Wear appropriate PPE including safety glasses with side shields, dust masks and respirators (See HASP) ▪ Stay upwind (use flagging or similar device to indicate wind direction)
	6H) Contaminated Materials and Container Pinch Points	6H) Contaminated Materials and Container Pinch Points ▪ Wear appropriate PPE including Nitrile and leather gloves (See HASP) ▪ Position hands/fingers to avoid pinching/smashing/crushing when closing drum rings
	6I) Heavy Materials and Containers Lifting/ Moving	6I) Heavy Materials and Containers Lifting/ Moving ▪ Do not lift or move heavy containers without assistance ▪ Use proper bending/lifting techniques by lifting with arms and legs and not with back ▪ If possible, use powered lift truck, drum cart, or other mechanical means Take breaks if feeling faint or overexerted ▪ Spot drums in storage area prior to filling ▪ Wear appropriate PPE including leather gloves and steel-toed boots

Completed by: Annette McLean Date: October 6, 2008

Job Hazard Analysis – Short Form

Job Title: Drilling Operation **Date of Analysis:** 4/21/06

NOTE: THE FOLLOWING JHA IS PROVIDED FOR INFORMATION PURPOSES ONLY AS NO MACTEC PERSONNEL WILL BE OPERATING A DRILL RIG.

Minimum Recommended PPE*: High visibility vest, hard hat, steel-toed boots, safety glasses, hearing protection, leather gloves

*See HASP for all required PPE

Key Work Steps	Hazards/Potential Hazards	Safe Practices
1. Drive drilling rig onto site	1A) Malfunction of vehicle/equipment	1A) Drivers shall perform a pre-operational check of equipment, read and be familiar with any operator's manual. ▪ Report all needed repairs promptly. ▪ Operators shall not use defective/unsafe equipment.
	1B) Wreck of drill rig while being driven	1B) Wreck of drill rig while being driven ▪ All drivers shall be properly licensed. ▪ Supervisors shall verify that drivers are capable and qualified on each type of equipment before allowing the equipment to be used unsupervised. ▪ Keep wind shields, windshield wipers, side mirrors and side windows clean ▪ Drivers shall conduct a pre-operation vehicle safety check ▪ Drivers shall plan ahead to minimize or eliminate the need for backing. Always check to the rear before backing and use an observer when available. If an observer is not available, the driver shall walk around the vehicle to make sure rear is clear prior to backing. ▪ Seat belts shall be worn when driving by driver and passengers. ▪ Choose the safest location possible to park equipment. Avoid parking in blind spots of other equipment. ▪ Driver is to be sure the back-up alarm is working ▪ Adjust vehicle speed for load and weather. Tire chains should be utilized as dictated by weather conditions. ▪ Operators should always check and be sure of load height. ▪ When operating a vehicle off the roadway, be aware of possible hidden objects in the grass and unstable terrain. ▪ The mast shall always be in a lowered position when moving the drill rig. ▪ Never allow anyone between truck and trailer when backing to hook trailer ▪ Make sure tilt beds or ramps are secured before putting trailer in use ▪ Perform periodic checks of equipment on long trips to assure the load is secure. ▪ Do not leave equipment unattended with the engine running. Shut off engine and set the parking brake when equipment is not in use.
2. Mounting and dismounting equipment	2A) Fall while mounting and dismounting equipment	2A) When mounting and dismounting equipment, use steps and handhold. Do not jump from vehicle.
3. Loading/unloading of equipment	3A) Crush and pinch points created when loading/unloading equipment	3A) Crush and pinch points created when loading/unloading equipment ▪ Be aware of crushing and pinching hazards when loading, unloading and fastening down equipment. ▪ Make sure cargo is properly loaded, secured and covered using only approved chain and load binders. Check for loose material on bed and trailer. Secure loose material. ▪ Wear protective equipment consistent with the hazard (hard hats,

Job Hazard Analysis – Short Form

Job Title: Drilling Operation **Date of Analysis:** 4/21/06

Key Work Steps	Hazards/Potential Hazards	Safe Practices
		safety glasses, leather gloves, safety shoes, etc.) ▪ Hook/unhook on stable ground with the trailer secure.
4. Rig equipment operation.	4A) Crushing injuries, slip trips and falls, material under stress, power equipment operations, utility lines, overhead loads, flying particles, rope or cable blocks, equipment limitations, lifting and pinch points	4A) Rig equipment operation. ▪ Before use, inspect cable, chain or wire for wear and replace if necessary. ▪ Observe OSHA guidelines for use of cable clamps, safety latches, chains and slings. ▪ Know rated capacity of chain, cable or wire rope being used and never exceed the rating. ▪ Avoid overloading and sudden jerks. ▪ Wear appropriate personal protective equipment with the hazard, including hard hats, safety glasses, leather gloves and safety shoes. ▪ Check loads to be lifted for balance and have the rigging inspected to ensure a safe and balanced condition exists. ▪ Do not allow employees to stand or work under suspended loads. ▪ Awkward loads shall have taglines attached to control the load. ▪ Review signals and operator communications with crew. Only one person shall direct the operator. ▪ Review the area for utility lines, tree limbs and other overhead hazards. Work no closer than 10 feet to active overhead power lines. Follow OSHA guidelines. ▪ Personnel working tag lines shall review the area for slipping, tripping and falling hazards. If not possible to eliminate the hazards, take precautions to avoid them.
5. Stabilize rig with hydraulic jack/pads	5A) Crushing injuries, slip, trip, fall hazards and potential back injuries.	5A) Crushing injuries, slip, trip, fall hazards and potential back injuries. ▪ Use proper lifting techniques. ▪ Ensure jack is rated for weight/operation with safe limits ▪ Assure that area is clear of personnel and obstacles. ▪ Place pads under jacks to prevent them from sinking into the ground.
6. Start/operate drill rig	6A) Moving machinery parts, buried and overhead utilities, drill rod stacking, lifting, winching, cathead operations, moving equipment, noise, adverse weather conditions, animals, slippery surfaces, uneven terrain, poisonous plants/snakes/insects and overhead hazards	6A) Moving machinery parts, buried and overhead utilities, drill rod stacking, lifting, winching, cathead operations, moving equipment, noise, adverse weather conditions, animals, slippery surfaces, uneven terrain, poisonous plants/snakes/insects and overhead hazards ▪ Wear appropriate personal protective equipment consistent with the hazard (hard hat, safety glasses, leather gloves, safety shoes, etc.) ▪ Avoid contact with rotating equipment ▪ When cathead is in use, assure a safe travel path for the rope by using proper techniques. Avoid standing on the rope. ▪ Observe and stay clear (minimum of 10 feet for nominal system voltage, utility lines, rated 50kV and an additional 0.4 inch for each kV over 50kV or twice the length of the line insulator, but never less than 10 feet) of overhead utility lines. - In transit with no load and boom lowered, the equipment clearance shall be a minimum of 4 feet for voltage less than 50kV and 10 feet for voltages over 50kV up to and including 345kV and 16 feet for voltages up to and including 750kV. - A person shall be designated to observe clearance of the equipment and give timely warning for all operations where it is difficult for the operator to maintain the desired clearance by visual means. - Have underground utility lines properly located and marked prior to drilling. ▪ Employees on foot must use extreme caution to stay clear of operating

Job Hazard Analysis – Short Form

Job Title: Drilling Operation **Date of Analysis:** 4/21/06

Key Work Steps	Hazards/Potential Hazards	Safe Practices
		equipment. Always establish eye contact with the operator before approaching the equipment. ▪ Be aware of drop-offs, uneven ground and potential hidden objects which may cause loss of control when maneuvering drill rigs or create unstable drill set-ups. In heavily wooded area, scout to locate hidden objects. ▪ Drill rod stacking must not exceed a length of 1.5 times the height of the tower. ▪ Be aware of poisonous plants, insects, snakes, animals and animal waste products and carcasses. Wear long sleeve shirts, gloves, and high top boots when hazards cannot be avoided. Proper first aid supplies, insect repellents shall accompany field crews. ▪ Be alert to conditions that can lead to slippery surfaces. Examples: high groundwater resulting in muddy soils brought to the surface by augers and the utilization of bentonite drilling fluid. ▪ Inspect all cables and clamps prior to winching operation. Stand clear of winching operations. ▪ Use proper lifting techniques. Get help or use lifting equipment. ▪ Suspend drilling operations during electrical storms ▪ Be aware of overhead hazards which may come in contact with the drill rig, when moving or setting up equipment. ▪ Complete a daily operations checklist to ensure that equipment is working properly. Make special note of emergency kill switches.
	6B) Contaminated soils, buried power or gas lines, landfills and containment of spills	6A) Contaminated soils, buried power or gas lines, landfills and containment of spills ▪ During drilling operations, always be aware of the possibility of encountering potentially hazardous materials, such as petroleum hydrocarbons, herbicides, pesticides, chemical manufacturing by-products or solid waste materials. ▪ In the event that any unknown or questionable materials are encountered, then the drilling operations are to be suspended immediately until further instructions are received from supervision. ▪ Do not handle any suspected contaminated materials unless trained to do so and proper protective methods are followed. ▪ During drilling operations, always be aware of the possibility of striking an unlocated or improperly located gas or power line. ▪ In the event a buried utility line is struck, drilling operations are to be suspended **immediately**. - If the utility line is electric, keep personnel at least 10 feet from all metal surfaces connected with the drill rig. - If the utility is gas, then the area is to be evacuated and secured. Immediate notification to the utility company is MANDATORY. ▪ In the event of a gas or oil spill, the proper authorities are to be contacted immediately so that containment operations can be implemented.
7. Attach auger to drill	7A) Auger coming loose from drill	7A) Auger coming loose from drill Insert a holding pin in auger ▪ Insert a holding pin in auger ▪ Use personal protective equipment such as leather gloves, safety glasses, hard hat and safety shoes. ▪ Be aware of hand and finger positions when inserting holding pin
8. Start drill by lever operations	8A) Operation of wrong lever	8A) Label levers as to their operation and review equipment manual.
9. Maintain proper auger drill speed	9A) Unstable rig from improper speed of auger	9A) Use of trained drill rig personnel and follow equipment manual specification.

Job Hazard Analysis – Short Form

Job Title: Drilling Operation **Date of Analysis:** 4/21/06

Key Work Steps	Hazards/Potential Hazards	Safe Practices
with down hole pressure speed.		
10. When auger has dug into ground unhook pin and insert another auger on top of the previous auger	10A) Auger coming loose (reference item #7)	10A) Insert another catch pin into newly installed auger (reference item #7)
11. Insert PVC pipe into hollow stem auger in 10 foot sections	11A) Reference Hazard item #6a	11A) Reference Control item #6A
12. Install filter pack (50 pound bags of sand) into hole (by pouring) to filter water into screen	12A) Back injuries, slips and falls	12A) Proper lifting procedures, team lifting and use of mechanical devices. Wear proper foot wear and maintain area in good housekeeping condition.
13. Reverse auger after each five foot section of sand is installed	13A) Reference hazard item #4	14A) Reference Control item #4
14. Install Betonies on top of sand (3 foot) to seal up area above sand.	14A) Reference hazard item #12	14B) Reference control item #12
15. Remove auger	15A) Auger falling	15A) Insert auger- maintain auger at ground surface to prevent auger from falling into hole.
16. Release auger tension and remove pins. Remove auger from hole.	16A) Reference hazard item #4	16A) Reference control item #4
17. Lower drill head attached to auger remaining in bore hole attach with a pin	17A) Reference hazard in item #4	17A) Reference control in item #4
18. Decontamination of drill equipment- usually pressure water	18A) Contamination of personnel and environment	18A) Follow health and safety plan, dress to proper EPA level, contain material washed from contaminated equipment with proper containment materials. Trained/authorized personnel to use pressure washer and assure area is clean of personnel prior to operation of pressure water device.
19. Mix grout on site and fill/place in hole between the well pipe and bore hole wall	19A) Reference hazard item #12	19A) Reference control item #12
20. Cut PVC pipe off at determined height with a hand saw	20A) cutting of hand with hand saw	20A) Be aware of where hands are placed prior and during cutting with hand saw
21. Install a protective cover and fill with grout.	21A) Reference hazard item #12	21A) Reference control item #12
22. Driving drilling rig offsite.	22A) Reference item # 1	22A) Reference item #1.

Completed by: Annette McLean 10/06/08

Job Hazard Analysis - Short Form

Job Title: Decontamination **Date of Analysis:** 10/3/2008

Minimum Recommended PPE*: High visibility vest, hard hat, steel-toed boots, safety glasses, hearing protection

*See HASP for all required PPE

Key Work Steps	Hazards/Potential Hazards	Safe Practices
1. Establish Decontamination Station	1A) Materials Handling	1A) Materials Handling ▪ Use proper lifting techniques ▪ Use mechanical aids, if available, to move heavy items.
2. Decontamination / Steam cleaning.	2A) Struck by steam/hot water/pressure washing	2A) Struck by steam/hot water ▪ Workers not directly engaged in steam cleaning operations must stay clear. ▪ Workers using steam cleaning equipment must be trained on operation and safety devices/procedures using the owners/operators manual. ▪ Use face shield **and** safety glasses or goggles, if steam cleaning. ▪ Stay out of the splash/steam radius. ▪ Pressure washer must have dead man switch. ▪ Do not direct steam at anyone. ▪ Do not hold objects with your feet or hands. ▪ Ensure that direction of spray minimizes spread of contaminants of concern. ▪ Use shielding as necessary.
	2B) Exposure to contaminants	2B) Exposure to contaminants ▪ Conduct air monitoring (see HASP). ▪ Wear proper PPE. ▪ See MSDSs for hazards associated with the decon solutions used (if other than water alone us used).
	2C) Slips/Trips/Falls	2C) Slips/Trips/Falls ▪ Be cautious as ground/plastic can become slippery ▪ Use boots or boot covers with good traction
3. Vehicle Decontamination	3A) Vehicle traffic in and out of the CRZ	3A) Large Vehicle Traffic ▪ Always wear a hard hat, steel toe boots, and a high visibility vest (unless Tyveks are used and are high visibility). ▪ Vehicle drivers are not to exit the vehicle in the CRZ. ▪ Identify an individual to communicate with vehicle drivers and maintain order ▪ Trucks will be lined with plastic and kept out of direct contact with any contaminated materials during loading. Wear PPE when removing plastic lining from truck beds. ▪ If not in the vehicle, obtain eye contact with the driver, so he is aware of your presence and location in the CRZ. ▪ If you are driving the vehicle, be aware of personnel in the CRZ and maintain communication with the identified personnel.

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	3B) Exposure to contaminants	3B) Exposure to contaminants ▪ Use safety glasses or goggles, Polycoated Tyvek (if level of contamination poses dermal hazard or to keep work clothes dry), high visibility vest (if high visibility Tyveks are not used) hard hats, steel toe boots, and gloves while cleaning contaminated materials. ▪ Do not doff PPE until decontamination of the vehicle is complete and a decontamination certificate has been issued by the HSO. ▪ Conduct air monitoring (see HASP). ▪ See MSDSs for hazards associated with the decon solutions (if other than water alone is used).
	3C) Slips/Trips/Falls	3C) Slips/Trips/Falls ▪ Be cautious as ground/plastic can become slippery ▪ Use boots or boot covers with good traction
4. Equipment and Sample Decontamination	4A) Chemical exposure when handling contaminated sample jars and equipment	4A) Chemical exposure ▪ Wear PPE. ▪ Refer to MSDS for specific hazards associated with decon solutions ▪ Monitor breathing zone for contaminants ▪ Monitor breathing zone for decon solutions (e.g., methanol, hexane, etc.) if appropriate (see HASP)
	4B) Materials Handling related injuries	4B) Materials Handling related injuries ▪ Use proper lifting techniques when lifting heavy equipment ▪ Use two person lift for heavy coolers

5. Personal Decontamination	5A) Exposure to contaminants	5A) Exposure to contaminants
		▪ Avoid bringing contaminated materials via shoes and clothing into the CRZ by examining such prior to exiting the EZ.
		▪ Removal of PPE will be performed by the following tasks in the listed order:
		  ▪ Gross boot wash and rinse and removal
		  ▪ Outer glove removal
		  ▪ Suit removal
		  ▪ Respirator removal (if worn).
		  ▪ Inner glove removal
		▪ Contaminated PPE is to be placed in the appropriate, provided receptacles.
		▪ Respirators will be removed and decontaminated at a specified location within the CRZ by a designated technician, then placed in storage bag.
		▪ Employees will wash hands, face, and any other exposed areas with soap and water.
		▪ Portable eyewash stations and showers will be available should employees come into direct contact with contaminated materials.
		▪ See MSDSs for hazards associated with the decontamination solutions used.
		▪ Decon solutions will be disposed of according to the work plan.

Completed by: Annette McLean Date: October 6, 2008

Job Hazard Analysis - Short Form HASP

Job Title: Clearing weeds, brush and trees **Date of Analysis:** 6/20/08

Minimum Recommended PPE*: Hard hat, chaps, safety glasses/goggles and face shield, steel toed boots, long pants, long sleeve shirt, cotton or leather gloves

*See HASP for all required PPE

Key Work Steps	Hazards/Potential Hazards	Safe Practices
1. Going to site, work preparation	1A) General	1A) See Mobilization/demobilization and Site Preparation JHA
	1B) Chemical Exposures	1B) If clearing is to be conducted at a hazardous waste site, see HASP for monitoring procedures and required PPE.
2. Clearing light brush with Machete **NOTE**: MACTEC will not be conducting this task; the subcontractor will be doing the clearing of weeds, brush, and small trees. MACTEC has included this JHA for informational purposes only.	2A) Cuts and Lacerations	2A) Cuts and Lacerations ▪ The machete should be used only to cut light brush. Do not use machetes for heavy cutting. Use long-handed lopping shears or brush hooks instead of machetes for cutting thorny bushes and briars. ▪ Remove vines and low hanging limbs that might catch machete and cause it to fly out of your hand or strike your body. ▪ Never use a machete while in a tree. ▪ Always use sharp tools. Dull tools are likely to slip or rebound. Sharpen machete blades only from six (6) inches from the butt of the handle to within two (2) inches of the point. The end of the machete blade should not be sharpened. To reduce the possibility of injury, it can even be blunted. ▪ Station machete users at no closer than ten (10) feet intervals. Under no conditions should party members who are using sharp-edged tools simultaneously be within 10 feet of each other. Protect yourself by retaining this minimum safety zone. ▪ Always have a firm footing before swinging the machete. While chopping, if possible, lean forward. ▪ Strokes should be made away from the body. No cut should ever be directed downward toward the feet or toward any other part of the body. ▪ Swing with a full swing at an approximate 45º, but do not overswing or swing too hard. ▪ Right-handed: Right foot forward - when swinging downward toward the left or when swinging upward to the right. Left foot forward - when swinging downward toward the right or when swinging upward to the left. ▪ Left-handed - reverse the right-handed procedure. ▪ When not in use, the machete should be placed in a stout scabbard to reduce the chance of injury and to protect its cutting edge.
	2B) Eye Injury	2B) Eye Injury ▪ Maintain a distance of at least 10 feet between party members when walking through dense vegetation or woods so that rebounding branches don't cause eye injuries. ▪ Wear eye protection.
	2C) Slips/Trips/Falls	2C) Slips/Trips/Falls ▪ Be particularly careful when walking along a cleared survey line having protruding sharp stubs. They can cause serious injury if fallen upon.\ ▪ Wear sturdy work boots with high ankles and with good traction.

Job Hazard Analysis - Short Form HASP

Job Title: Clearing weeds, brush and trees **Date of Analysis:** 6/20/08

Key Work Steps	Hazards/Potential Hazards	Safe Practices
3. Clearing small trees or limbs with Axes	3A) Cuts/Lacerations	3A) Cuts/Lacerations ▪ Axes are for cutting trees with trunks or limbs greater than one inch in diameter. ▪ Remove vines and low hanging limbs that might catch the axe and cause it to fly out of your hand or strike your body. ▪ Make sure that the head of the axe is tight on the handle. ▪ Always use sharp tools. Dull tools are likely to slip or rebound. ▪ Never use an axe while in a tree. ▪ Proper grip of the handle is important. Where working space is ample and full-force chopping is necessary, place one hand near the end of the handle and move the other toward the head as the axe is being lifted; on the down stroke, this hand should slide toward the end of the handle. In crowded locations, hold the handle near its center with both hands. Strokes with this grip are easily controlled but are not too powerful. ▪ Keep your eyes on the spot you're aiming for. ▪ Warm the blade of an axe slightly before using it in cold weather. This can be done by holding the axe in gloved hands for a short period of time. A tempered steel blade, when cold, can fracture and cause particles of metal to fly. ▪ Do not chop frozen wood or very hard knots. They can cause the blade to rebound. ▪ When cutting a dead, hardwood tree, be very careful because many of them are extremely hard. ▪ To trim limbs from a fallen tree trunk, stand to the side of the tree opposite the limb. ▪ Carry an axe by gripping the handle just behind the head and turning the sharp edge outward. The axe should be sheathed.
	3B) Eye Injury	3B) Eye Injury ▪ Maintain a distance of at least 10 feet between party members when walking through dense vegetation or woods so that rebounding branches don't cause eye injuries. ▪ Wear eye protection.
	3C) Slips/Trips/Falls	3C) Slips/Trips/Falls ▪ Be particularly careful when walking along a cleared survey line having protruding sharp stubs. They can cause serious injury if fallen upon.\ ▪ Wear sturdy work boots with high ankles and with good traction.

Job Hazard Analysis - Short Form HASP

Job Title: Clearing weeds, brush and trees **Date of Analysis:** 6/20/08

Key Work Steps	Hazards/Potential Hazards	Safe Practices
4. Clearing brush using a Brush Hook	4A) Cuts/Lacerations	4A) Cuts/Lacerations ▪ The brush hook functions like an axe that has its cutting head reversed. It is used for rough work in brush too thick for an axe and finds its best use in thick underbrush where a low cut, requiring a long cutting edge, is needed. ▪ Always use sharp tools. Dull tools are likely to slip or rebound. ▪ Remove vines and low hanging limbs that might catch brush hooks and cause them to fly out of your hand or strike your body. ▪ Never use a brush hook while in a tree. ▪ To keep the head solidly on the handle, workers should carry a tool to adjust the collar or clamp. ▪ Hold the brush hook like you would an axe, except keep your upper hand a little more toward the cutting edge to give better balance when making a low cut. ▪ When cutting, try not to fight the foliage but, rather, strike at the base of the plants. Aim carefully and keep your body balance. ▪ Make sure adequate clearance is maintained. The brush hook can be more easily deflected than the axe because of the shape of its blade. ▪ Carry a brush hook like you would carry an axe. Keep your hand close to the head. Because the beak easily catches on vines and wires when the brush hook is carried with its head pointing backward, always point the head to the front. Never carry a brush hook on your shoulder. ▪ Because of their shape, brush hooks are difficult to store in trucks or tool houses unless special provisions are made. Sheathes should be provided to protect workmen and to keep the blades from being nicked.
	4B) Eye Injury	4B) Eye Injury ▪ Maintain a distance of at least 10 feet between party members when walking through dense vegetation or woods so that rebounding branches don't cause eye injuries. ▪ Wear eye protection.
	4C) Slips/Trips/Falls	4C) Slips/Trips/Falls ▪ Be particularly careful when walking along a cleared survey line having protruding sharp stubs. They can cause serious injury if fallen upon.\ ▪ Wear sturdy work boots with high ankles and with good traction.

Completed by: Annette McLean Date: October 6, 2008

Job Hazard Analysis – Short Form

Job Title: Working with Preservatives **Date of Analysis:** 5/16/07

Key Work Steps	Hazards/Potential Hazards	Safe Practices
1. Opening the box of ampoules	1A) Cuts or punctures with a knife	1A) Cuts or punctures with a knife ▪ Use appropriate techniques when handling a knife. Always cut away from you.
	1B) Broken ampoules in the box. Cuts from the broken glass.	1B) Broken ampoules in the box. Cuts from the broken glass. ▪ Wear safety goggles and protective gloves. ▪ Dispose of the preservative and broken glass by approved methods.
	1C) Broken ampoules in the box. Breathing fumes.	1C) Broken ampoules in the box. Breathing fumes. ▪ Wear safety goggles and protective gloves. ▪ Always work in a well-ventilated area.
2. Breaking top of glass ampoule	2A) Cuts from the broken glass.	2A) Cuts from the broken glass ▪ Wear safety goggles and protective gloves. ▪ Use a paper towel to wrap ampoule in to snap the top or use an ampoule breaker. ▪ Always point the ampoule away from you when you snap off the top.
	2B) Skin contact chemical burns.	2B) Skin contact chemical burns. ▪ Wear safety goggles and protective gloves. ▪ Fumes may come into contact with the perspiration on your skin and rehydrate to form an acid. ▪ If your skin itches, flush affected area for 15 minutes with water.
	2C) Eye contact	2C) Eye contact ▪ Wear safety goggles. ▪ If acid splashes in the eyes, flush eyes for 15 minutes with water. Seek medical advice.
	2D) Breathing fumes	2D) Breathing fumes ▪ HNO_3 and HCL have high vapor pressure. Always work in a well-ventilated area.
3. Adding acid to sample	3A) Chemical reaction	3A) Chemical reaction ▪ Wear safety goggles and protective gloves. Acid may react with high alkaline sample and fizz (releases CO_2).
	3B) Eye contact	3B) Eye contact ▪ Wear safety goggles. ▪ If acid splashes in the eyes, flush eyes for 15 minutes with water. Seek medical advice.
	3C) Skin contact chemical burns.	3C) Skin contact chemical burns. ▪ Wear safety goggles and protective gloves.
4. Ampoule disposal	4A) Cuts from the broken glass.	4A) Cuts from the broken glass. ▪ Wear safety goggles and protective gloves. ▪ Place used ampoules in an empty, non-reactive container in the field and bring it back to the office. Dispose of the preservative and broken glass by approved methods.
5. Opening the box of ampoules	1D) Cuts or punctures with a knife	1D) Cuts or punctures with a knife ▪ Use appropriate techniques when handling a knife. Always cut away from you.

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	1E) Broken ampoules in the box. Cuts from the broken glass.	1E) Broken ampoules in the box. Cuts from the broken glass. ▪ Wear safety goggles and protective gloves. ▪ Dispose of the preservative and broken glass by approved methods.
	1F) Broken ampoules in the box. Breathing fumes.	1F) Broken ampoules in the box. Breathing fumes. ▪ Wear safety goggles and protective gloves. ▪ Always work in a well-ventilated area.

Completed by: Annette McLean Date: October 6, 2008

APPENDIX E-2

JOB HAZARD ANALYSES FOR SITE/TASK HAZARDS (CONTRACTOR)

APPENDIX F

PERSONAL MONITORING FORM
(For Use When Upgrading From Modified Level D to Level C)

MACTEC ENGINEERING AND CONSULTING, INC.

Page ___ of ____

PERSONAL MONITORING FORM

Project: _____ Project No.: _____

Site Health & Safety Supervisor: _____ Project Location: _____

Date: ____/____/____ Temp: _____ Weather: _____ Wind: _____

MACTEC Employee (performing monitoring): _____

Instrument(s): _____ Serial No.: _____ MACTEC No.: _____

Calibrated: Method(s): _____ Result Before: _____ Result After: _____

Instrument(s): _____ Serial No.: _____ MACTEC No.: _____

Calibrated: Method(s): _____ Result Before: _____ Result After: _____

Sample type: ☐ Area ☐ Personal

Agent(s) Monitored: _____

MACTEC Employee(s) represented by this exposure: _____ _____

_____ _____ _____

_____ _____ _____

Subcontractor(s) on-Site during activity: Subcontractor Personnel (list full names): _____

_____

Comments: _____

Please indicate START and STOP time for each activity:

Time (Military)	Activity (i.e., soil boring, soil gas, etc.)	LOP/PPE	Breathing Zone* Reading	Background Reading	LHSR Actions/Comments

***NOTE: Refer to HASP for upgrade specifications**
LOP = Level of Protection (A, B, C or D)
PPE = Personal Protective Equipment
Signature: _____ **Date:** _____
(of person performing monitoring)

PERSONAL MONITORING FORM

Please indicate START and STOP time for each activity: Page ___ of _____

Time (Military)	Activity (i.e., soil boring, soil gas, etc.)	LOP/PPE	Breathing Zone* Reading	Background Reading	LHSR Actions/Comments

*NOTE: Refer to HASP for upgrade specifications
LOP = Level of Protection (A, B, C or D)
PPE = Personal Protective Equipment

To be completed by or in conjunction with the LHSR.

Agent: _____

TWA_8 = _____ =
480 Min

Agent: _____

TWA_8 = _____ =
480 Min

Agent: _____

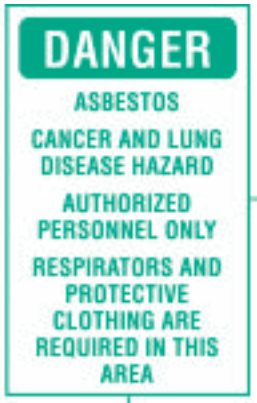
TWA_8 = _____ =
480 Min

Agent: _____

TWA_8 = _____ =
480 Min

ATTACMENT A

ASBESTOS INFORMATION



OSHA FACT Sheet

Asbestos

What is asbestos?

Asbestos is the name given to a group of naturally occurring minerals used in certain products, such as building materials and vehicle brakes, to resist heat and corrosion. Asbestos includes chrysotile, amosite, crocidolite, tremolite asbestos, anthophyllite asbestos, actinolite asbestos, and any of these materials that have been chemically treated and/or altered.

What are the dangers of asbestos exposure to workers?

The inhalation of asbestos fibers by workers can cause serious diseases of the lungs and other organs that may not appear until years after the exposure has occurred. For instance, asbestosis can cause a buildup of scar-like tissue in the lungs and result in loss of lung function that often progresses to disability and death. Asbestos fibers associated with these health risks are too small to be seen with the naked eye, and smokers are at higher risk of developing some asbestos-related diseases.

Are you being exposed to asbestos?

General industry employees may be exposed to asbestos during the manufacture of asbestos-containing products or when performing brake and clutch repairs. In the construction industry, exposure occurs when workers disturb asbestos-containing materials during the renovation or demolition of buildings. Employees in the maritime environment also may be exposed when renovating or demolishing ships constructed with asbestos-containing materials. In addition, custodial workers may be exposed through contact with deteriorating asbestos-containing materials in buildings.

Are there any OSHA standards that cover workers exposed to asbestos?

Yes. The Occupational Safety and Health Administration (OSHA) has the following three standards to protect workers from exposure to asbestos in the workplace:

- 29 *CFR* 1926.1101 covers construction work, including alteration, repair, renovation, and demolition of structures containing asbestos.
- 29 *CFR* 1915.1001 covers asbestos exposure during work in shipyards.
- 29 *CFR* 1910.1001 applies to asbestos exposure in general industry, such as exposure during brake and clutch repair, custodial work, and manufacture of asbestos-containing products.

The standards for the construction and shipyard industries classify the hazards of asbestos work activities and prescribe particular requirements for each classification:

- **Class I** is the most potentially hazardous class of asbestos jobs and involves the removal of thermal system insulation and sprayed-on or troweled-on surfacing asbestos-containing materials or presumed asbestos-containing materials.
- **Class II** includes the removal of other types of asbestos-containing materials that are not thermal system insulation, such as resilient flooring and roofing materials containing asbestos.
- **Class III** focuses on repair and maintenance operations where asbestos-containing or presumed asbestos-containing materials are disturbed.
- **Class IV** pertains to custodial activities where employees clean up asbestos-containing waste and debris.

There are equivalent regulations in states with OSHA-approved state plans.

What are the permissible exposure limits for asbestos?

Employee exposure to asbestos must not exceed 0.1 fiber per cubic centimeter (f/cc) of air, averaged over an 8-hour work shift. Short-term exposure must also be limited to not more than 1 f/cc, averaged over 30 minutes. Rotation of employees to achieve compliance with either permissible exposure limit (PEL) is prohibited.

Are employers required to conduct exposure monitoring?

In construction and shipyard work, unless you are able to demonstrate that employee exposures will be below the PELs (a "negative exposure assessment"), you are generally required to conduct daily monitoring for workers in Class I and II regulated areas. For workers in other operations where exposures are expected to exceed one of the PELs, you must conduct periodic monitoring. In general industry, you must perform initial monitoring for workers who may be exposed above a PEL or above the excursion limit. You must conduct subsequent monitoring at reasonable intervals, and in no case at intervals greater than 6 months for employees exposed above a PEL.

Must employers create regulated areas?

You must create controlled zones known as regulated areas that are designed to protect employees where certain work with asbestos is performed. You must limit access to regulated areas to authorized persons who are wearing appropriate respiratory protection. You must also prohibit eating, smoking, drinking, chewing tobacco or gum, and applying cosmetics in these areas. You must display warning signs at each regulated area. In construction and shipyards, workers must perform Class I, II, and III asbestos work (and all other

Asbestos

operations where asbestos concentrations may exceed a PEL) within regulated areas. In general industry, you must establish regulated areas wherever asbestos concentrations may exceed a PEL.

What compliance methods must employers use to control exposures?

You must control exposures to or below the PELs using engineering controls and work practices to the extent feasible. Where feasible engineering controls and work practices do not ensure worker protection at the exposure limits, you must reduce employee exposures to the lowest levels achievable and then supplement them with respiratory protection to meet the PELs. In construction and shipyards, each work classification has specific control method requirements. In general industry, specific controls are prescribed for brake and clutch repair work. For example, you must prohibit certain practices, such as the use of compressed air, to remove asbestos.

When are employers required to provide respiratory protection for workers?

You must provide and ensure the use of respirators when a PEL is exceeded. In construction and shipyards, you must require workers to use respirators when performing certain work. Generally, the level of exposure determines the type of respirator needed. In addition, the standards specify the type of respirator to be used for certain asbestos work. (See *CFR* 1910.134.) Employees must get respirator training and medical clearance to use respirators.

Are employers required to provide protective clothing for workers?

Yes. For any employee exposed to airborne concentrations of asbestos that exceed a PEL, you must provide and require the use of protective clothing such as coveralls or similar full-body clothing, head coverings, gloves, and foot coverings. You must provide face shields, vented goggles, or other appropriate protective equipment wherever the possibility of eye irritation exists and require workers to wear them.

Must employers provide hygiene facilities?

Yes. You must establish decontamination areas and hygiene practices for employees exposed above a PEL. In addition, employees may not smoke in work areas that might expose them to asbestos.

Do OSHA standards require employers to provide training?

Yes. In construction and shipyards, you must provide training for employees exposed above a PEL and for employees involved in each identified work classification. The specific training requirements depend upon the particular class of work being performed. In general industry, you must provide training to all employees exposed above a PEL. You must also provide asbestos awareness training to employees who perform housekeeping operations covered by the standard. You must place warning labels on all asbestos products, containers, and installed construction materials when feasible.

What are employers required to provide concerning medical examinations?

In construction and shipyards, you must provide medical examinations for workers who, for 30 or more days per year, engage in Class I, II, or III work or experience exposure above a PEL. In general industry, you must provide medical examinations for workers who are exposed above a PEL.

What are the recordkeeping requirements for asbestos exposures?

You must keep accurate records of the following:

- All measurements taken to monitor employee exposure to asbestos—30 years;
- Medical records, including physician's written opinions—duration of the employee's employment plus 30 years; and
- Training records—1 year beyond the last date of employment.

How can you get more information on safety and health?

OSHA has various publications, standards, technical assistance, and compliance tools to help you, and offers extensive assistance through workplace consultation, voluntary protection programs, grants, strategic partnerships, state plans, training, and education. OSHA's *Safety and Health Program Management Guidelines* (*Federal Register* 54:3904-3916, January 26, 1989) detail elements critical to the development of a successful safety and health management system. This and other information are available on OSHA's website.

- For one free copy of OSHA publications, send a self-addressed mailing label to OSHA Publications Office, P.O. Box 37535, Washington, DC 20013-7535; or send a request to our fax at (202) 693-2498, or call us at (202) 693-1888.
- To order OSHA publications online at **www.osha.gov**, go to **Publications** and follow the instructions for ordering.
- To file a complaint by phone, report an emergency, or get OSHA advice, assistance, or products, contact your nearest OSHA office under the "U.S. Department of Labor" listing in your phone book, or call toll-free at **(800) 321-OSHA (6742)**. The teletypewriter (TTY) number is (877) 889-5627.
- To file a complaint online or obtain more information on OSHA federal and state programs, visit OSHA's website.

This is one in a series of informational fact sheets highlighting OSHA programs and standards. It does not impose any new compliance requirements or carry the force of legal opinion. For compliance requirements of OSHA standards or regulations, refer to *Title 29 of the Code of Federal Regulations*. This information will be made available to sensory impaired individuals upon request. Voice phone is (202) 693-1999. See also OSHA's website at **www.osha.gov**.

U.S. Department of Labor
Occupational Safety and Health Administration
2002