Enbridge Line 6B 608 Pipeline Release
Marshall, Michigan
Health and Safety Plan

August 2, 2010

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PART 1 - GENERAL

1.01 Overview

The Unified Command is committed to excellence in safety performance. We strive for continuous improvement in safety performance, and require, as a minimum, industry standards and legislative requirements be met. All response, company, contract, and regulatory personnel share in the successful implementation of this philosophy.

This Health & Safety Plan has been developed to present a consolidated set of rules, safe work practices, and procedures related to the response activities. These rules and procedures were drawn from the various responding entities, government regulations and accepted industry standard practices.

It is not possible to address all work activities or potentially hazardous situations in a procedures manual. However, it is the intent to present key procedures and methods which the Unified Command expects to be utilized in accomplishing the work. In addition, the Unified Command expects all contractors, employees and responders to bring a safe work attitude to the job site.

The Unified Command Safety Program is a minimum standard and - where exceeded by Government Safety Acts, Regulations, and Codes - the more stringent shall apply. Conversely, where the plan is more stringent than regulatory requirements, this plan shall govern.

The Unified Command is committed to working together with all responders to ensure all workers arrive home safely.

1.02 Applicability

To ensure consistent and comprehensive health and safety compliance this plan is applicable to all Enbridge employees, contractors of any company or agency, regulators, responders or any other individual accessing the affected areas being managed within this response.

START –ERRS Contractors/Workers will operate under their response specific Health & Safety Plans attached as Appendices.

1.03 Scope of Work

For the purposes of responder, regulator, employee and contractor protection the following work categories have been developed and are covered in more detail in the Work Practices Section and Job Task Hazard Assessment Appendix. These work practices will be evaluated using the Enbridge Hazard Assessment process and Safe Work Permits issued when applicable.

Work Practices:

- Crude Oil Recovery (subtasks)
    - Vacuum Truck Operations
    - Booming
    - Skimming
    - Shoreline/Adjacent Lands Cleanup
    - Swamp/Wetland Cleanup
- Heavy Equipment Operation
- Pipeline Repair
- Sampling and Observation/Documentation related activity

Job Tasks not covered within this document should be evaluated and documented through the Enbridge Hazard Assessment Process (or other equal Hazard Assessment process) and a Safe Work Permit issued when applicable.

1.04 Applicable Standards

A. United States Department of Labor Publications
   29 Code of Federal Regulations (CFR) Part 1910 Occupational Safety and Health Standards for General Industry
   29 CFR Part 1926 Occupational Safety and Health Regulations for Construction
   49 CFR Part 195 Department of Transportation Pipeline and Hazardous Materials Safety

B. State and Local Publications
   MIOSHA Regulations
   MDEQ Regulations

C. Enbridge O&MPs
   Book 1 – General Reference
   Book 2 – Safety
   Book 7 – Emergency Response / Region Specific / ERD

D. Contractor Safety Program
   Safety and Environmental Guidelines for Contractors Handbook

1.05 Documentation

This Health & Safety Plan will be maintained by the Safety Officer under the control of the incident commander in the Unified Command.

Working copies shall be maintained in the Unified Command Center and Operations Command Center. These copies will be the working copies utilized in the field. The working copies will be maintained by Enbridge employees, responders, regulators and contractors during all on-site activities. Additionally, the Health and Safety Plan will be communicated to contractors, responders and regulators during the contractor safety orientation to ensure that they will become familiar with the plan and site hazards.

1.06 Responsibilities

Responsibilities will follow the Incident Command System per the Incident Command Structure established by the Unified Command.

1.07 Site History

Enbridge Energy Partners reported that a leak was detected on a pipeline on its Lakehead System near the company's Marshall, Michigan pump station on July 26, 2010. Initial estimates at the time were that approximately 19,500 barrels of crude oil may have been released as a result of the leak. The pipeline was shut down and isolation valves were closed, stopping the source of the oil. Oil was released into Talmadge Creek, a tributary of the Kalamazoo River, and entered the river.

Enbridge crews, emergency response and containment personnel, and water quality specialists were dispatched to the site and deployed oil skimmers and absorbent booms on the creek and

river to minimize environmental impacts. The pipeline will be repaired and tested before being returned to service.

1.08 Site Description

The location of the release is Enbridge's Line 6B, at Milepost 608 near the town of Marshall in Calhoun County, Michigan. From the site of the release, crude oil flowed through a marshy area into Talmadge Creek, a tributary to the Kalamazoo River. Enbridge established control points in the marshy area, along Talmadge Creek and the Kalamazoo River. These control points were divided into five divisions with Division A being the leak site itself extending to Division E in Kalamazoo County terminating at the West end of Morrow Lake. There are more than thirty control points ranging from earthen berm/flume configurations to containment and absorbent boom sites with vacuum trucks and skimmers. Enbridge has worked extensively with regulators and consultants to determine the most effective sites to use as control points and to deploy the most appropriate containment and collection equipment at these sites.

PART 2 - EXECUTION

2.01 Introduction

A. The purpose of the plan is to provide guidance in order to prevent incidents and injuries to site workers/responders from possible contamination or exposure that may be encountered during oil recovery or response activities. Any employee, responder, regulator or contractor is responsible to stop any work that they believe places any worker in danger. Surface contamination may be encountered in numerous areas under assessment/recovery. The following information was completed by the Safety Officer:

B. Operational Dates: July 27, 2010 - TBD.

The Safety Officer (SOFR) and Safety Officer Assistants (SOFR-A) shall discuss/delegate compliance with the Health and Safety Plan to all emergency response personnel who shall be working at the site(s) (affected areas) during assessment and recovery operations. All site workers and responders and regulators shall sign the log (appendix B) to signify they understand the Health and Safety Plan through their management structure. Personnel shall not be allowed on-site until thoroughly briefed on anticipated hazards, any additional safety practices to be followed and the Safety Orientation has been completed.

2.02 Potential Hazards

Some potential hazards that field personnel may be exposed to during field activities are chemical and physical. The potential chemical hazards at the site are petroleum vapors, hydrogen sulfide, carbon monoxide, benzene, and n-hexane. Chemical hazards are those typically associated with the following products, for which the Material Safety Data Sheets (MSDS) are included in the Appendices:

- Heavy Crude Oil – Heavy Crude Oil/Diluent Mix – Christina/Foster Creek
- Benzene – Potential byproduct of Heavy Crude Oil (See MSDS above)
- H_2S – Potential byproduct of Heavy Crude Oil (See MSDS above)
- Hexane – Potential byproduct of Heavy Crude Oil (See MSDS above)

Exposure pathways to chemical hazards include skin contact, inhalation of vapors, and ingestion.

Potential physical hazards include excavation around buried utilities, overhead power lines, all hazards associated with heavy equipment operations, vacuum trucks, and the recovery of contaminated soil, vegetation, and surface/groundwater. Additional physical hazards are manual lifting of booms and other containment equipment; slips, trips, and falls from uneven terrain; and fire.

Other hazards that employees and contractors may be exposed to at the site include heat stress, heat exhaustion, and heat stroke; hazards from exposure to sunlight (sunburn); hazards associated with operating a motorized vehicle; water hazards (i.e. drowning) associated with working adjacent to the river, including fast moving water; and hazards from animals and insects.

A job task hazard assessment (appendix C) is developed to cover the overall job's hazards however, work site hazards will be identified with appropriate control measures documented and maintained on the field level hazard assessment/safe work permit maintained at each site.

Cold work (work that does not involve risk of product ignition) activities that do not agitate the crude oil may be exempt from FR clothing based on the site hazard assessment.

2.03 Site Control

Orientation:

All workers will receive orientation training prior to commencing work. The Company's video "Your Safety is On the Line" must be viewed. The subjects covered in a safety orientation shall include, but are not limited to, the following:

- .
- Potential hazards and special safety requirements.
- The worker's right to refuse to do unsafe work or work in unsafe conditions.
- Communication of the safety responsibilities for personnel.
- Review of the Company's Health and Safety Plan for this incident.
- Review of additional safety and environmental requirements (for example "Safety and Environmental Guidelines" and "Your Safety is On the Line videos).

Upon completion of the safety orientation, each worker will provide their signature as proof that they attended the safety orientation and understand the safety hazards and required mitigations identified in the Health and Safety Plan.

Only personnel with appropriate training may enter the hot work zones.

General Rules:

1. Contractors, employees and regulators that are recovering oil shall use caution tape/barricades/fencing, etc. to cordon off sufficient space around the work area, as defined by initial and periodic atmospheric testing for lower explosive limit, to prevent unprotected or unauthorized personnel from entering the work area.
2. No eating, drinking, smoking, gum or tobacco chewing, or any other practice in the work area that increases the probability of hand-to-mouth transfer of contaminants is permitted. The site supervisor shall designate safe areas away from the work area where eating, drinking, gum and tobacco chewing can be done. The entire site is designated a no smoking zone.
3. Hands shall be thoroughly washed upon leaving the work area and before eating, drinking, chewing gum or tobacco or any other non-working activity can commence.
4. During recovery activities, on site workers shall act as the safety backup to each other.
5. Entrance and exit locations shall be designated and emergency escape routes away from the operations areas shall be delineated by the site supervisor. The following hand signals will be used where verbal communications cannot occur or are not practical:

Signal	Translation
Hand gripping throat	**Out of air/can't breath**
Grip partners wrist or both hands around waist	**Leave area immediately**
Hands on top of head	**Need assistance**
Thumbs up	**O.K., I'm all right, I understand**
Thumbs down	**No, negative**
Raised clenched fist	**Stop**

6. Potable water shall be available on-site for drinking and cleaning purposes.
7. There shall be at a minimum of two 30#, or four 20# ABC dry-chemical fire extinguisher on-site at each operational area.
8. All excavations (if needed) shall be in accordance with OSHA and all applicable regulations. These regulations include that workers shall not enter any excavation deeper than 4 feet, unless acceptable sloping, shoring, or other means of protection are provided. Open excavations deeper than 4 feet shall not be entered unless appropriate entry precautions are taken with trained staff.
9. Employees will not be permitted to work alone in a deemed "hot zone" or adjacent (within six feet) to water.
10. When employees are working during the night, light plants will be utilized to ensure the site is appropriately illuminated.

General Personal Protective Equipment:

Based on the evaluation of potential hazards, the level of protection deemed appropriate for this site is general level D for all operations as follows (unless air monitoring dictates that PPE upgrades or ventilation are required):

- Hard Hat
- Safety Glasses
- Steel-Toed Boots
- Disposable suits (e.g. Tyvek)/booties, as needed
- Rubber or Latex Gloves, as needed
- Full length pants

For more detailed information regarding Personal Protective Equipment and determinations on when to wear PPE, please see Section 2.17. The level of protection may be increased to include fire retardant (FR) clothing if atmospheric monitoring results or activities that have the potential increase LEL levels (e.g., agitation, product skimming, release of free product, and product in water etc.) during any phase of the work. As a minimum, the hot zone is defined by initial and periodic atmospheric testing that is equal to or greater than 3% of the lower explosive limit. Work within the hot zone requires FR clothing.

Any items that come into contact with contaminants shall either be disposed of properly or thoroughly washed before reuse.

Working Near Water:
OSHA Construction Industry Standards (1926) state: "employees working over or near water, where the danger of drowning exists, shall be provided a Coast Guard-approved PFD (Personal Flotation Device)." An approved PFD will be required to be worn any time an employee is in a

boat. A PFD may also be required at the discretion of the site supervisor when working adjacent to swift moving water, or when entering slow moving water above the waist during daylight hours.

When working at night, all employees working on or adjacent (within six feet) to water shall wear a Coast Guard- approved PFD.

Monitoring:
Ambient air monitoring will be provided on a continuous basis with a personal four gas monitor (LEL, H_2S, CO, O_2). Periodic samples will be performed with a PID, Drager CMS, or Ultra Rae devices in the breathing zone and area of the recovery workers for benzene. The results will be documented on the gas test record form, daily or field reports, or through computer data retrievable (download) methods.

Personal samples will be taken in representative locations using both passive methods, 3M badges, and active methods, sampling pumps and charcoal tubes for 25 contaminants.

The acceptable level for work on this site under level D protection is 0.5 ppm for benzene.

Permissible exposure limits (PEL)

Petroleum vapors	Not Established (500 ppm reference petroleum distillates)	Ign, Resp, Flam, Cont
Hydrogen Sulfide	10 ppm	Inhalation
Benzene	1 ppm	Inhalation, ingestion, absorption
n-hexane	500 ppm	Inhalation, absorption

Should levels exceed the established PELs all personnel shall stop work activities, move upwind, and contact the site supervisor and safety officer in that specific recovery area.

Respiratory Protection:
A respiratory protection program will be followed as per OSHA regulations in 1910.134.

Medical Evaluations
All new field employees who may be required to wear a tight fitting respirator must have an initial medical evaluation that is reviewed by a physician (i.e., baseline pulmonary function test or spirometry examination).

Respirator Fit
Physical conditions (e.g., facial hair or temple pieces on glasses) must allow an effective facial seal with the respirator.

Specifically, all workerswho may be required to wear respiratory protection that depends on an effective seal, must be clean-shaven where the face piece contacts the skin; this may require trimming or removing mustaches.

Fit-Testing
Before wearing a respirator, all workers must be fit-tested for the brand and model used.

Before each use of a respirator, all workers must perform a positive and negative pressure field fit-test to check the seal of the face mask.

Inspection and Maintenance
Inspect and maintain respiratory equipment in accordance with the manufacturer's specifications.

Visually inspect all respirators before and after each use.

For shared respiratory equipment, disinfect after each use and clean as necessary. For all other respirators, sanitize after each use and clean as necessary.

Workers may perform minor maintenance on hose line breathing equipment (e.g., replace headbands, valves, gaskets, hoses, and clamps). Major maintenance and repairs must be performed by (a) a qualified worker (i.e., trained in cleaning, inspecting, and maintaining respirators), or (b) a certified technician from the supplier or manufacturer.

Cartridges
Replace organic vapor (OV) cartridges and organic vapor/acid gas (OV/AG) cartridges after a total of 6 hours of use.

Immediately replace OV/AG cartridges if:

- used for escape from H_2S concentrations >10 ppm
- damaged
- there is odor breakthrough

Replace filters when plugged, damaged, or soiled, or when breathing is difficult. If used in environments containing oil aerosols, replace oil-resistant filters after a total of 40-hrs use or 30 days, whichever comes first.

Enbridge
Respiratory Protection for Exposure Concentrations

Breathing Hazard	Exposure Concentration	Respiratory Protection	Model
Benzene	0 to 0.5 ppm	none	
	0.6 to 5 ppm	half-mask APR with OV cartridge	3M 6000 with 6003 cartridge
	6 to 25 ppm	full-face APR[1] with OV cartridge or SAR	3M 6000 or 7000 full-face with 6003 cartridge
	greater than (>) 25 ppm	SCBA or SAR	Scott Air-Pak
	greater than (>) 500 ppm (IDLH)[2]	planned work is not permitted[3]	
carbon monoxide	25 ppm to 500 ppm	SCBA or SAR	Scott Air-Pak
	greater than (>) 500 ppm	planned work is not permitted[3]	
hydrogen sulfide (H_2S)[4]	0 to 10 ppm	none	
	11 to 99 ppm	SCBA or SAR with escape pak[6]	Scott Air-Pak or Type C SAR
	greater than (>) 100 ppm (IDLH)	planned work is not permitted[3]	
oxygen deficiency	less than (<) 19.5%	SCBA	Scott Air Pak
petroleum vapors	less than (<) 3% LEL	none	
	greater than or equal to (≥) 3% LEL to less than (<) 10% LEL	half-mask APR with OV cartridge	3M 6000 with 6003 cartridge
	greater than or equal to (≥) 10% LEL to less than (<) 20% LEL	SCBA (or equivalent) for cold work; hot work is not permitted	Scott Air-Pak
	greater than or equal to (≥) 20% LEL	planned work is not permitted[3]	

NOTES

1 If quantitative fit test performed.
2 Immediately dangerous to life and health.
3 Emergency work is allowed if SCBA or SAR with escape pack is used and all ignition sources are eliminated.
4 If the concentration exceeds the maximum detection limit of the H_2S detector, planned work is not permitted until the concentration has been verified.
5 Where possible, reset gas detectors monitoring H_2S to alarm at 10 ppm (low level) and 100 ppm (high level).
6 A safety watch with SCBA or SAR must be present.

Hearing protection:

Hearing protection will be utilized during recovery operations when noise levels exceed 85-decibels.

2.04 Equipment

Operation of vacuum trucks and other equipment:
Verification must be performed of the site to confirm understanding of site safety plan by the individual in charge of the site.

- A JHA/hazard assessment must be performed to identify specific hazards and controls at the site prior to work beginning.
- All vacuum trucks and other similar equipment utilized when collecting crude will be appropriately grounded and bonded.

Operation of Boats:
When operating boats during the day, the following criteria must be met:

- Verification must be performed of the site to confirm understanding of site safety plan by the individual in charge of the site.
- A JHA/hazard assessment must be performed to identify specific hazards and controls at the site prior to work beginning.
- A shore watch/water safety inspector must be present with the responsibility of tracking hazards in the water, and to coordinate boats in the event an individual would fall overboard.
- A rope and buoy will be with the shore watch at all times.
- A Float Plan will be included with each boat.

Operation of Boats after Dusk:
Boats may be operated after dusk only if it is necessary to deploy boom, or in the event that damages to boom will need to be repaired. In the event a boat is operated after dusk, all of the above items must be met in addition to the following conditions:

- Only sites that have already been confirmed to be free of underwater obstacles and other hazards through a job hazard assessment during daylight hours will be allowed to have boats operating on them at night.
- A minimum of two light plants will be utilized for each work crew
- A stable boat, preferably a flat bottom, will be utilized if possible
- A secondary manned boat must be in the water at the location to potentially act as a rescue boat.
- Boats must be equipped with running lights appropriate for night use and a spotlight
- All employees must wear appropriate PPE, including a Coast Guard-approved PFD, illumination devices will be attached to PFD's when operating at night.
- Radio contact must be maintained between the shore watch and boats.
- A Float Plan will be included with each boat.

2.05 Emergency Procedures and First Aid

During containment and recovery activities, a certified Emergency Medical Technician (EMT) will be dedicated to the workforce and supply on-scene assessments. Should the need arise, the EMT will direct workers requiring specialized services such as decontamination or Emergency Room treatment to the appropriate locations.

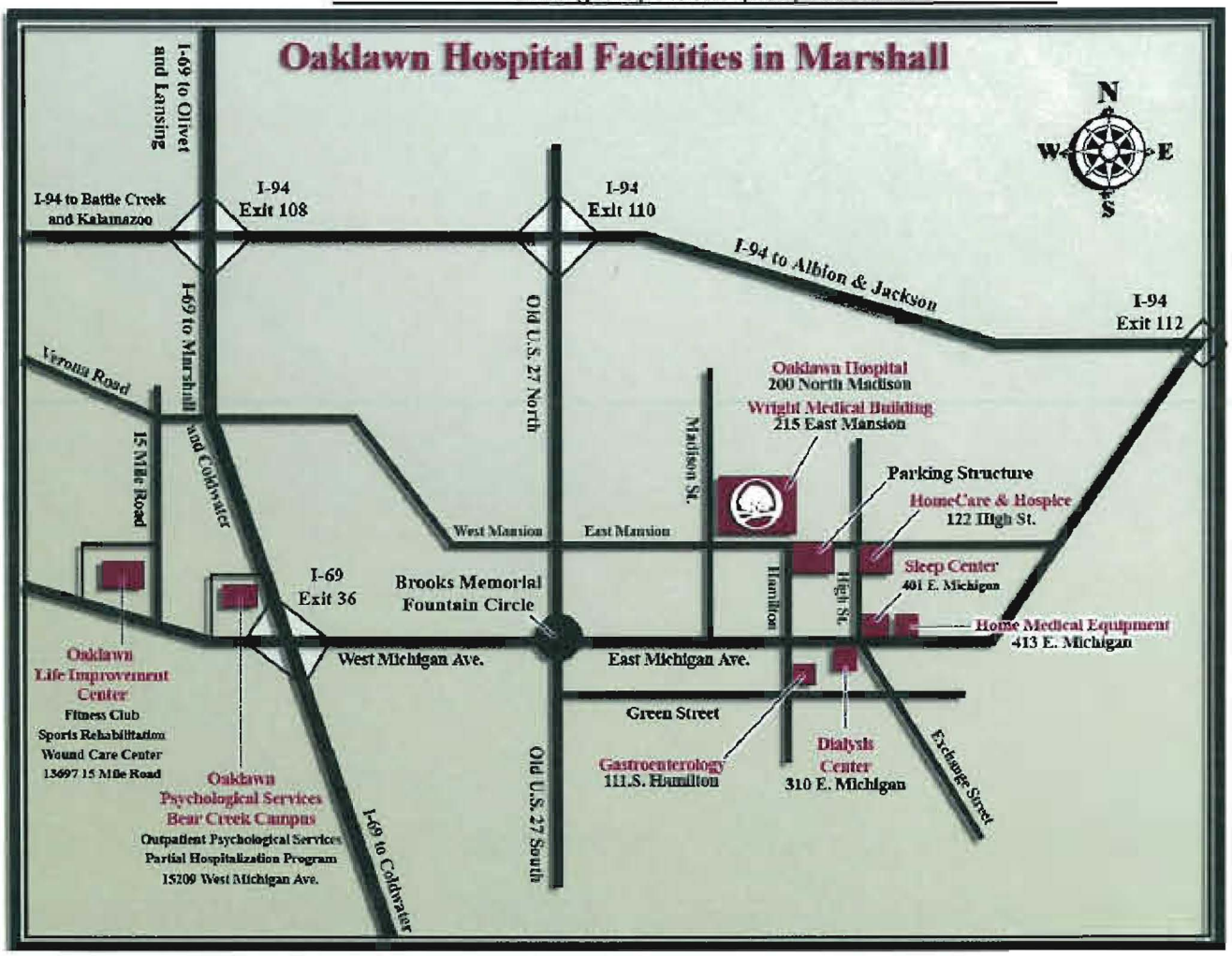
The following emergency contacts shall be maintained for problems at the site. Each respective site will have site specific safety plans , which include Site Safety Plot Plans, Maps to Medical Facilities, Safe Work Permits and other miscellaneous safety materials.

A. Emergency Communication:

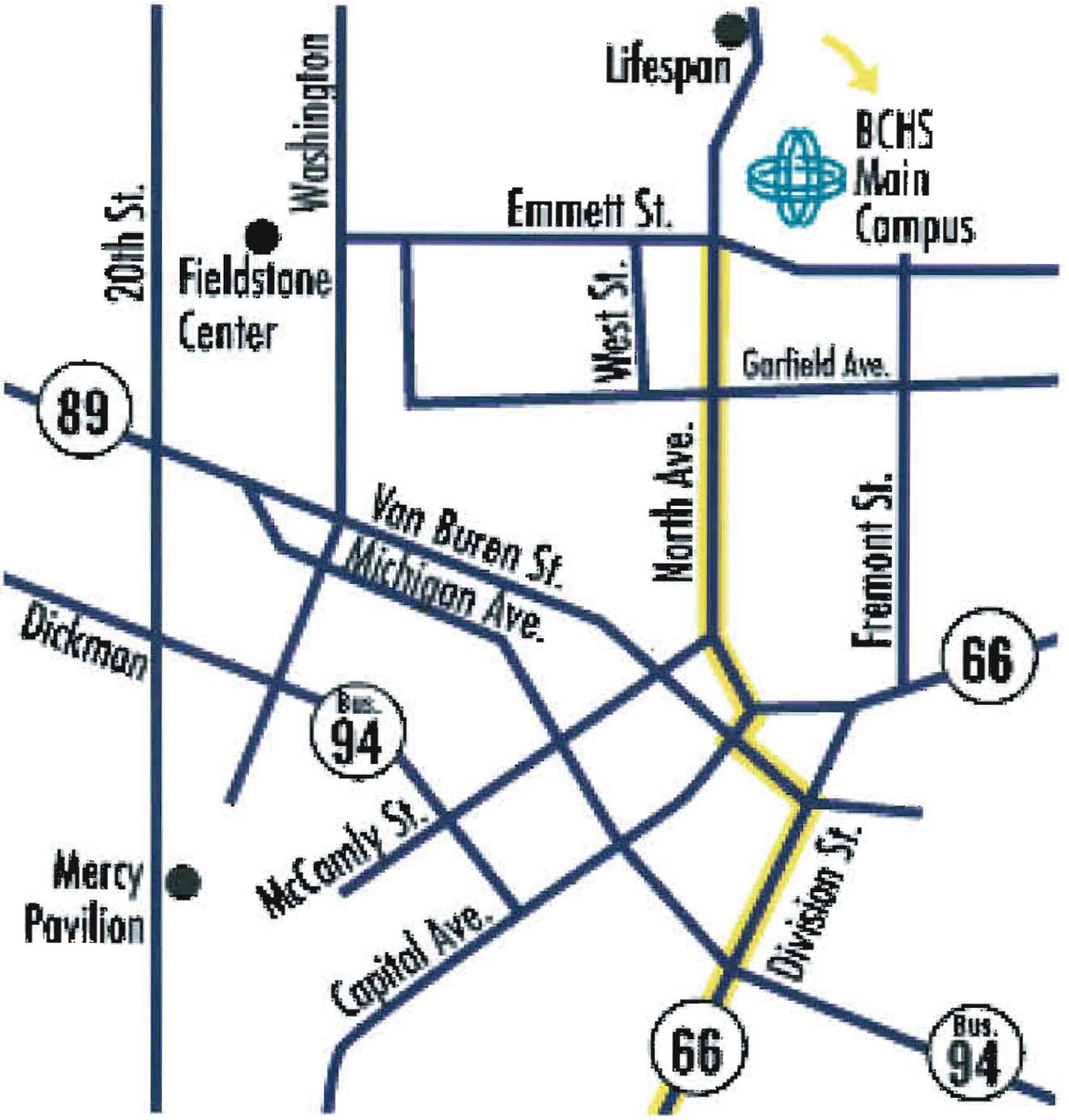
Fire Department	911
Ambulance	911
Police Department	911

Emergency Planning Coordinator: 911

Hospital: Oaklawn Hospital (269) 781-4271
200 N. Madison, Marshall, MI
Emergency Room (269) 789-3916



Battle Creek Health System 300 North Avenue
Battle Creek, MI 49017 269-966-8000



Emergency Care and Trauma Services at Bronson Methodist Hospital
Hours of Operation: 24 hours a day, 7 days a week
601 John Street
1st Floor, West Pavilion
Kalamazoo, MI 49007
Phone: (269) 341-6386
Fax: (269) 341-6248

B. Incident Reporting:

In the event of an incident or close call, the responsible Safety Representative will investigate to identify both the immediate and all underlying causes. Any incident resulting in personal injury, close call, or property damage shall be verbally reported immediately to the site supervisor. The site supervisor will communicate the information to the safety officer.

C. First Aid

If appropriate, injuries sustained shall be initially assessed and based on the nature of the illness/injury may be treated on-site . A fully-stocked first aid kit shall be available to all recovery personnel to treat minor injuries. As required, an ambulance shall be called (911) for emergencies and transportation to a hospital. All efforts will be made to ensure that there is at least one individual trained in first aid/CPR at each location. In addition Emergency Medical Technicians (EMT) will be provided at various locations throughout the response area. The following procedures shall be followed for correct first aid treatment on-site:

1. SKIN - Prolonged or repeated exposure to contaminated soil or fluid may cause skin irritation. Repeated contact may cause drying or flaking of the skin.

   If a worker's skin is irritated, the area shall be washed for 15 minutes before applying dressings secured by adhesive tape. Keep contaminated material away from open wounds.

2. BREATHING - Excessive inhalation of vapors can cause nasal and respiratory irritation; central nervous system effects including dizziness, weakness, fatigue, nausea, headache and possible unconsciousness, and even death.

   If a worker experiences dizziness, headache, or nausea from inhalation of vapors, they shall leave the work area immediately. If dizziness, headache or nausea persists obtain medical attention. If breathing stops, administer CPR and obtain medical attention.

3. EYES - Contaminants may cause pain and slight corneal injury. Vapors may irritate the eyes. Wash irritated eyes with abundant amounts of clean water by holding the eye open and flooding it with water (eye wash bottles will be available in all vehicles and at all sites). All surfaces shall be washed thoroughly, then repeat the process. Seek medical attention.

4. SWALLOWING - Aspiration of material into the lungs can cause chemical pneumonitis which can be fatal. If aspirated, material may be rapidly absorbed through the lungs and result in injury to other body systems.

   Medical attention shall be requested for all victims of sickness due to ingestion of contaminated materials. Do not induce vomiting. Drink two glasses of water.

5. GENERAL SAFETY - Immediately report all safety problems to the Site Supervisor. The Site Supervisor shall keep a permanent record of all such occurrences and shall report serious problems to the Health and Safety Coordinator. All occurrences shall be documented by the completion of an accident report.

D. Evacuation

If the site activities require evacuation because of fire, security purposes, personnel injury, excessive vapors, or lightning hazards, the site supervisor shall immediately direct the personnel along the evacuation routes. Workers shall observe wind direction such as smoke movement, and then proceed upwind for a sufficient distance to be out of range of the incident. All personnel shall assemble at a point established by the site supervisor, and await further instructions.

Inclement Weather
Check weather reports before issuing and approving safe work permits. If potential or imminent weather is in the forecast, these hazards need to be identified and controls implemented in the hazard assessment.

The 30-30 rule

- The 30-30 rule is recommended when working outside with lightning in the area.
- When you can count 30 seconds or less between lightning and thunder, head for safe shelter
- Remain sheltered for 30 minutes after the last thunder.

If lightning is encountered, it is further recommended to:

- Go inside a fully enclosed building or vehicle
- Avoid water and boats
- Stay away from doors, windows, metal indoor fixtures and electrical devices
- Stay off the telephone
- Avoid open high ground and isolated large trees
- Avoid contact with metal objects, such as vehicles

E. Fire Response

- Good housekeeping is an important part of fire prevention. Garbage shall be collected and secured daily until it can be properly disposed of.
- Workers shall take all necessary precautions to prevent fires, including but not limited to the following:
- Fuels, volatile solvents or any other flammable substances must be stored in containers that are clearly labeled, approved for their contents and located in a safe place away from any source of ignition.
- Flammable liquid containers shall be electrically bonded when liquids are being transferred from one to another.
- Flammable substances and quantities of chemical in excess of that needed for one day's work shall be stored in an approved storage facility, isolated from the actual work areas.
- Workers shall guard against any part of their clothing becoming contaminated with flammable liquids.

- Clean up spills promptly.
- Rags contaminated with flammable substances shall be stored in an approved metal container with a tight fitting lid
- Smoking is permitted only in designated smoking areas.
- A designated fire watch is required under the following circumstances and as per the completed Hazard Assessment
    - A fire watch is required when engaged in hot work activities such as:
        - Welding, flame cutting, or grinding in hazardous areas;
        - Any hot work on or around open systems;

For each work area the Contractor is required to supply and maintain adequate firefighting equipment sufficient to handle expected fire emergencies that might occur during the work activity. The Contractor shall ensure that workers are competent in the proper use of site Fire Fighting equipment.

Each fire extinguisher shall have a tag or label securely attached that indicates the month and the year the maintenance was performed and that identifies the person (or company) performing the service.

All work activities in the general vicinity of the fire shall be stopped and site / operations management shall be notified immediately. Workers may attempt to extinguish a fire only if safe to do so and they are confident in their abilities to effectively fight the fire. If workers cannot ensure their own safety or if there is a risk of being trapped in the fire, workers must immediately evacuate.

F. Training Requirements

All workers shall be up-to-date on the requirements set forth in 29 CFR 1910.120. It is the responsibility of all recovery workers to take and maintain the required training, including the annual 8 hours of refresher training.

2.06 Site Safety Plans / Tailgate Meetings

For all projects related to the Marshall Area Oil Pipeline Release, Enbridge employees, contractors, volunteers, and regulators shall prepare a project orientation, covering specific health, safety, and environmental policies, site specific hazards and project requirements. This orientation shall be discussed with Unified Command, prior to commencement of the project.

Site specific orientations for operations projects will be provided to employees, contractors, volunteers, regulators, etc. by Unified Command representatives through the delivery of Site Safety Plans and/or presentation of material during Tailgate Meetings.

A Site/Project Specific Orientation is required for each Contractor/Subcontractor worker prior to work commencing. The Site/Project Specific Orientation includes a review of the following pertinent information:

- Importance of safety to Unified Command.
- Safety objectives and zero tolerance of rules violations
- Work permit requirements.
- Right and responsibility to refuse dangerous work.

- Parking and backing-in policy.
- Security requirements and restricted access areas.
- Location of designated smoking areas.
- Location of designated eating and other non-work related activities areas.
- Cellular phones are not allowed in hazardous or restricted areas.
- Location of hazardous areas as specified on the site safety plot plans (i.e., oil contaminated areas, heavy equipment, water (river / banks), etc.).
- Required personal protective equipment.
- Vehicles and equipment requirements, i.e. backup alarms, positive air shutoffs, and spark arrestors.
- Specific work site hazards.
- Appropriate safe work procedures or practices for project.
- Location of government regulations, safety manuals, and copy of all safe work practices and procedures.
- Stop work if an incident occurs and where to report it.
- Review of following emergency procedures:
    - Review of site safety plot plan.
    - Location of control room to report emergencies.
    - Evacuation procedures. Evacuation alarms, sirens, or horns.
    - Requirement and location of fire fighting equipment.
    - Emergency phone numbers.
    - Location and distance of nearest hospital.
    - Identify first aid attendants and location of first aid station.
    - Location of wind socks.
    - Location of emergency exit gates / gate override locations; and
    - Location of assembly areas

NOTE: Contractors, volunteers and regulators brought in for emergency work shall be given a safety orientation going over the specifics of the situation before starting work.

2.07 Personal Conduct

Horseplay, fighting and disregard for the safety requirements will result in removal of those involved from the Site.

2.08 Smoking

Smoking in hazardous or restricted areas of the project / spill response area will only be permitted in outdoor areas that are posted. Designated smoking areas shall be kept clean and equipped with a proper waste container and at a minimum of 1 20lb ABC fire extinguisher. Ensure that the location of the designated smoking location is not located near any doors or windows.

2.09 Visitors to the Site

The Contractor shall provide the Unified Command notification of their intent to bring visitors on site. Unauthorized persons will not be allowed in command centers, at areas affected by the spill or in the immediate area of the spill response activities.

All visitors shall report to the site or station office or control room prior to visiting any Unified Command location, pipeline construction area, spill response location, or maintenance site.

All visitors are subject to the same regulations related to conduct and protective equipment as other Contractor workers

The Contractor shall provide visitors all necessary control and guidance to ensure their protection and, where necessary, provide appropriate personal protective equipment for their use. Visitors to any site will be for work specific purposes only. All workers and visitors shall have site specific orientation before entry into a work area and wear visible visitor identification at all times.

2.10 Fatigue Management

Fatigue Management Plan plans will be developed when workers are at an increased risk from fatigue-related effects. This increased risk can be due to:

- Extended length of shift worked (beyond 12 hours).
- Extended consecutive days worked (beyond 10 consecutive days).
- Extended travel time to and from the work site (total work day, including travel, exceeds 14 hours).
- Excessive physical effort required as part of normal work activity.
- Environmental extremes (heat, cold, noise, vibration, lighting, etc).
    - Plan and follow a work/rest schedule based on the hourly estimated Heat Index, workload and other climatic conditions.
    - Schedule heavy work for the cool times of the day
    - Increase staffing on heavy work jobs and jobs in hot environments
    - Have workers drink at set intervals – e.g. 6 oz (3/4 cup or 180 ml) cool water or sport drinks every 20 minutes to maintain a fluid/electrolyte balance.
    - Use area refrigeration, cooling fans, ice pack, cool vests and phase change vests, whichever is feasible. DO NOT use fans if air temperature is > 95°F since air movement across skin hinders evaporative perspiration.
    - Provide sun shielding, tents, or canopies to shade a rest spot or small work site.
    - Offer first aid assistance when symptoms or injuries occur
    - Constantly monitor employees to detect signs and symptoms of heat stress. Use the buddy system.
    - Reduce alcohol, caffeine, and nicotine intake.
    - Get medical conditions under control.
    - Report any conditions of possible heat stress immediately (see Appendix E for information on heat stress/heat stroke)

- The fatigue management program should consider the following:
    - Identification of the factors that lead to fatigue.
    - Assessment of the risks associated with the workplace factors that contribute to fatigue.
    - Identification of control measures to manage exposure to fatigue.
    - Implementation of the selected control measures.
    - Rehabilitation / Return to work.
    - Management approval processes.

2.11 Work in the Dark

Work after dusk (with the exception of security) generally is not permitted and, if necessary, will only be allowed if the following conditions are met:

- Prior approval from Unified Command.
- There is a minimum of two workers, or communications exist to outside areas to request assistance if required.
- Adequate lighting is provided to illuminate the work area that meets OSHA standard 29 CFR 1926.56(a) of 5 foot candles. Additionally light stands and lighting shall have proper electrical connections per OSHA standards.
- Regular "night shift" work will require prior approval from the Unified Command.
- For night security work, one person shall be allowed to work alone so long as they have adequate communication to outside areas and approval by Unified Command. Communications must be maintained and checked at least every two hours with a control room or other appropriate personnel.

2.12 Working Alone

Unified Command will take specific precautions for those workers working alone, both during normal and unexpected work situations. This would include workers required to travel alone to remote location or where there is no routine interaction with other people.

Unified Command, especially the Safety and Security Coordinators, must ensure that the required hazard assessments have been completed prior to the work taking place.

Where any worker is required to work alone, Unified Command must ensure that all legislated requirements are adhered to. Measures can include, but are not limited to the following:

- Effective radio, telephone or other electronic communications shall be provided.
- Workers shall not work alone in hazardous conditions (e.g. potential for exposure to hazardous gases, severe weather, dangerous water conditions) without first making certain that appropriate safety precautions are taken (e.g. personal gas monitors, frequent communications, PFDs).
- Workers shall not work alone under conditions which are deemed to be immediately dangerous to life and health (IDLH).
- Safe work procedures shall be in place and workers must be suitably trained.
- Equipment shall be in safe condition and workers are to have appropriate first aid and emergency supplies.
- Workers working alone shall inform co-workers of their whereabouts and expected movement/travel.

A designated person shall periodically make contact with those who are working alone and should be alert for any unusual delays in re-establishing contact.

2.13 Security

Unified Command must communicate Security expectations to all personnel and compliance will not be compromised.

Vehicles and trailers belonging to workers are subject to unannounced searches while performing work related to the spill response activities.

Special attention is necessary when any of the following are present:

- Protests and/or picket lines
- Historical safety / security issues (known criminal activity, evidence of unauthorized access, missing / stolen equipment)
- Threats received
- Elevated security threat levels by DHS

2.14 Drug and Alcohol Use

The use, possession or being under the influence of alcoholic beverages or illicit drugs, by any worker (Inspector, Contractor or Contract worker) is strictly prohibited. Violators will be removed from the project site immediately.

Unified Command reserves the right to request any worker or visitor have drug and alcohol tested based on reasonable cause.

Workers under the influence of prescription drugs causing impairment may also be removed from the site and may be subject to the disciplinary measures.

2.15 Disciplinary Measures

Unified Command expects and will enforce compliance with the Health and Safety Plan. Contractors shall ensure compliance by all Contractor and Subcontractor personnel with the Contractor's Safety Manual, as well as the Health and Safety Plan accepted by Unified Command.

Any personnel involved in the spill response effort is authorized to halt a construction / work activity in circumstances where, in the judgment of that person, the construction / work activity is not being conducted in accordance with the Health and Safety Plan, federal, state or local regulations and codes, or is creating a hazard to any person or facility infrastructure at the construction site.

In addition, the Unified Command has the authority to request any worker who blatantly violates the Health and Safety Plan to leave the site permanently. Disciplinary measures for non-compliance will be strictly enforced.

There are two levels of action that may be initiated depending on the severity of the infraction.

Level One

Includes offenses which will result in the immediate removal of the worker from the work site:

- Workers under the influence of alcohol or illicit drugs.
- Workers possessing, using or distributing illegal substances or alcohol during spill response activities.
- Fighting or uttering threats.
- Any instance of sexual harassment.
- Criminal activity
- Actions of gross negligence which results in injury, fatality or property damage.
- Behavior or attitude which could cause severe injury or damage.
- Blatant disobedience of any of the Health and Safety Plan's policies and procedures.
- Failure to wear and use the required personal protective equipment (PPE/PFD).
- Failure to use the necessary safety equipment when needed, required or prescribed.

- Smoking in an area not designated as a smoking area.
- Possessing a firearm on site (on person or inside a vehicle).

Level Two

Includes offenses which require use of a formal disciplinary system:

- All actions in which the worker willfully disregards the Health and Safety Plan or federal, state, or local safety regulations and recommendations.

Discipline:

- **First Offense –** not limited to a documented verbal or written warning.
- **Second Offense –** REMOVAL FROM THE PROJECT.

Written warnings and removal letters for projects shall be issued by Unified Command.

2.16 Incident Reporting

The Unified Command and Enbridge are committed to ensuring a safe and healthy work environment for its workers, contractors and subcontractors. The goal of any investigation is not to establish blame but rather to put the necessary controls in place to remove or reduce the hazards and potential for a recurrence.

In the event of any incident or close call, a detailed investigation identifying both the immediate and all underlying causes will be completed.

All incidents must be reported to the Unified Command. They will be documented and reviewed by the Unified Command. Findings of the review and incident investigation will be distributed to necessary personnel.

Verbal Report - Immediately

Any incident resulting in personal injury *(first aid incident - refer below),* close call, or property damage shall be reported verbally to the Site Inspector / Project Safety Inspector or Operations Project Coordinator.

Enbridge will be notified of any off site serious incident such as a motor vehicle incident or personal injury that is an indirect result of the project. The purpose of the notification is a courtesy for information only, as it may or may not be recordable to the project. Internal notification may be required depending on incident severity. The decision will be made by the respective Safety Coordinator or designate.

Written Report – within 48 hours

A written report shall be completed and provided to the Unified Command Safety Coordinator or its designee within 48 hours of the incident. This report must include all details of the incident including but not limited to:

- Date/ Time / Location of the incident
- Type of occurrence
- Who was involved
- Injured worker information
- Nature of injury
- Body part and location
- Root Cause or Systems need
- Detailed incident description
- Loss of Company property or other property damage
- Immediate causes
- Substandard practices or conditions
- Basic cause including personal and job factors
- Preventative actions
- Statements, photographs and drawings
- Follow up actions
- Signatures

The Safety Coordinator shall report incidents to the applicable Authorities Having Jurisdiction, e.g. OSHA, Workers' Compensation Board, etc., where required by legislation.

The Safety Coordinator shall regularly update the Unified Command on the status of follow-up actions. In addition, the Contractor and Enbridge shall cooperate and provide all required information to assist the internal investigation of any incident.

Contractors are responsible for their Sub-Contractors and shall conduct a detailed incident investigation when necessary. A copy of the report shall be submitted to the Unified Command Inspector / Safety Inspector / Safety Coordinator within the required time frame.

* For First Aid incidents, a First Aid Log will be maintained and an incident report will be completed.

The Unified Command reserves the right to request any Contractor / Subcontractor worker to be Drug and Alcohol Tested following any incident or close call. The Drug and Alcohol Test shall be conducted in accordance with the approved Drug and Alcohol policy of Enbridge.

2.17 PERSONAL PROTECTIVE EQUIPMENT / APPAREL

Unified Command will ensure workers are trained in proper fitting, use, limitations, cleaning, maintenance, and storage of personal protective equipment.

The minimum Personal Protective Equipment/appropriate apparel required for all company sites and projects shall be:

- Safety glasses or prescription safety glasses with fitted side shields and protective lenses
- Safety boots (Steel Toe)
- Full length pants
- Approved Hard Hat
- Additional PPE/Apparel may be required depending on the specific site requirements or activities (Flame Resistant Clothing).

Note: Muscle shirts, tank tops, and cut offs are not permitted on any work site.

2.17.1 Eye and Face Protection

Approved eye protection such as safety glasses with side shields or appropriate goggles shall be worn at all times. Additional eye and face protection shall be worn when performing any work or in any area where there is danger of injury or irritation of a worker's eyes or face. This may include safety glasses with side shields, impact goggles, or splash goggles as per the completed Task Hazard Assessment. All protective equipment shall meet ANSI standards.

All workers shall ensure that the protective eyewear fits properly is clean and in good condition. Prescription safety glasses shall have fitted ANSI approved side shields attached while on site.

NOTE: Pancake style welding helmets are acceptable providing the helmet is ANSI approved. Safety glasses do not have to be worn when actively using the pancake style helmet; however, safety glasses must be donned immediately after a pancake helmet is flipped up or removed.

NOTE: Safety eyewear (glasses) shall be worn in addition to the proper face shield or welder's shield when grinding or welding.

The following is a list of activities where there is exposure to eye and face hazards, and the minimum eye and face protection required:

Table 1 Minimum Requirements for Eye and Face Protection	
Activity	**Protection Required**
Abrasive blasting	• Blasting hood complete with supplied air
Arc Welding and gouging	• Welder – welding helmet and safety glasses c/w side shields under the helmet • Helper – as above, or full face shield and safety glasses with side shields (minimum shade 3) or full face shield and welder/cutter goggles (minimum shade 3)
CAD Welding activities	• Full face shield and safety glasses with side shields
Chipping, hammering metal, sledge hammering, jack hammering, using compressed air, using electric and/or hand saws, concrete work, material handling of particles, and in windy/dusty conditions	• Safety glasses with side shields or • Impact goggles • Face shield when using a chipping hammer
Handling asbestos-containing materials	• Full face shield and safety glasses with side shields or • Goggles
Handling hazardous substances (e.g. toluene, NGL)	• Chemical splash goggles ***and*** • Any additional protective equipment indicated on container labels or MSDS, and face shield when handling large quantities, exposed to liquid spray, or transferring liquids
Handling PCB's	• Full face shield and safety glasses with side shields or • Chemical resistant goggles
Operating chainsaws, using weed trimmers	• Full face shield and safety glasses with side shields or impact goggles (mesh face shields are recommended when operating chainsaws)
Oxy-acetylene welding, cutting, brazing or soldering	• Welder – welder's/cutter's goggles (eye-cup or mono-goggles) or safety glasses with side shields (minimum shade 3) and a face shield • NOTE: A welding helmet with a flip-up lens can substitute a face shield. • Helper – same as welder
Pneumatic or electric grinding and buffering (includes cut-off and concrete saws)	• Welding helmet and safety glasses with side shields under helmet or • Full face shield and safety glasses with side shields or • Full face shield and impact goggles
Working in windy conditions	• Protection as required

2.17.2 Foot Protection

Safety footwear must have a minimum CSA Grade I (ANSI Class 75) safety toe, a puncture resistant sole, and have a minimum 6" in height.

All workers performing electrical work or any worker entering within a substation require safety footwear marked with EH (Electrical Hazard) designation that incorporates an electric shock resistant sole.

Metatarsal/shin guards shall be used where workers are exposed to impact by portable compactors such as jumping jacks and jackhammers, etc.

2.17.3 Head Protection

As dictated by the applicable ANSI Z89.1-2003 Type 1, Class E, approved hard hats will be worn at all times, except when in a vehicle or equipment with enclosed cabs or while in control rooms, offices, lunch rooms, or change rooms, or welders actively engaged in welding.

NOTE: Cowboy style hardhats are prohibited on the work site.

2.17.4 Hearing Protection

Workers will follow their company Hearing Protection program as outlined in their company H&S programs. The following guidelines will be used for the determination of hearing protection applicability. When performing jobs where hearing thresholds may be exceeded, all personnel will be provided with appropriate hearing protection.

When equipment is operating or when operating any tool or piece of equipment where the noise level at the operator's location exceeds occupational exposure limits (85 dBA), plug and/or muff-type hearing protection must be worn. Hearing protection must be worn in all posted areas.

2.17.5 Limb and Body Protection

Where there is a danger of injury to worker's hands, arms, legs or the trunk of the body, workers shall wear proper hand, arm, leg, or body protection equipment that is appropriate to the work being done and the nature of the hazard involved.

Workers that handle rough, sharp-edged abrasive materials or are performing work activities that subject the workers' hands to lacerations, punctures, burns, vibration/impact, chemical absorption, must wear appropriate hand protection suitable for the work being performed.

2.17.6 High-Visibility Apparel

High-visibility apparel must meet or exceed the Class 2 standard as specified in ANSI/ISEA Standard 107-2004. Such high-visibility apparel must be worn when a worker is a designated signaller or spotter, when working on or adjacent to roadways, while working around mobile earth moving/heavy equipment, and as determined on the Hazard Assessment.

2.17.7 Fire Retardant Clothing

Approved Fire Retardant (FR) clothing shall be worn for:

- Electrical work
- Work within hazardous or restricted areas, including work inside fenced or operating facilities
- Persons involved in, or any persons within 100 feet of mechanical ground disturbance work (e.g. stumping, stripping, grading, excavating, boring/drilling, backfilling, etc.) within ten feet of operating facilities, i.e. gas or oil pipelines, whether above or below-ground.

- Welding/cutting on an existing Company or foreign pipeline and/or, any piping system that has recently been hydro-tested using a water-methanol mix and may still contain a flammable atmosphere.
- Areas with potential for flash fire or explosion, or where required by the Project Hazard Assessment and Task Hazard assessment.
- Investigating facilities for known or suspected anomalies;
- Repairing facilities with leaks, defects or corrosion pits/clusters where the calculated rupture pressure ratio is less than one;
- Welding directly to the parent pipe (i.e., mainline or station piping);
- Welding on a pressurized split tee with longitudinal fillet-weld check-straps;
- Welding on a pressurized Morrison sleeve; and
- Working near open systems (within 100 feet). An open system is any component of the pipeline system which is open to the atmosphere and has not been gas-freed and isolated.
  Examples include, but are not limited to:
  - Open strainers;
  - Open pumps;
  - Open scraper traps;
  - Open pipes;
  - Sumps;
  - Storage tanks;
  - Open valve bonnets; and
  - Open prover pipes.

Where FRC is required, the full length sleeves and front of the garments must be fastened as completely as designed.

2.17.7.1 Fabric Requirements

Approved fire retardant clothing fabrics shall meet the intent of NFPA 2112.

Approved fire retardant clothing for electrical workers shall meet the minimum arc thermal protection of 8 cal/cm2 (HRC 2).

Leather shoulder and sleeve covers should be worn during welding and cutting operations.
Sleeves and the front of clothing must be fastened during welding activities.

2.17.7.2 Outerwear

Workers shall wear fire retardant clothing as the outer garment (including hard hat liners and hooded jackets) and must fully cover any non fire retardant clothing being worn, except where permitted otherwise within the requirements of this policy.

Non fire retardant outerwear may be worn over approved fire retardant clothing only when other safety concerns exceed the fire hazard (e.g., protection against asbestos, drowning, visibility or corrosive materials).

Where there is a potential for the fire retardant outerwear to become contaminated with flammable products, impermeable FR rain suits or FR Tyvek coveralls may be worn over the fire retardant outerwear.

2.17.7.3 Rainwear and Disposable Coveralls

Fire retardant rainwear that meets the intent of the NFPA 2112 standard may be worn as an approved outer garment without any other approved fire retardant clothing underneath.

NOTE:	Rainwear and disposable coveralls that do not meet the entire standard is acceptable providing it is not required in the Hazard Assessment for the work, and is worn over approved FR clothing.

2.17.7.4 Laundering

Follow the laundering instructions and temperature limits for fire retardant clothing identified on the garment care tag. Clothing must be kept reasonably free from grease and oil.

2.17.7.5 Audits of Clothing Program

All workers shall routinely inspect / audit fire retardant clothing to ensure it is kept in good condition for its intended use. Results of the inspections/audits shall be in writing and made available to the Unified Command upon request.

> **NOTE:** Fire retardant clothing that is threadbare or torn does not provide sufficient protection.

2.17.8 Respiratory Protection

Workers will follow their company Respiratory Protection program as outlined in their company H&S programs. The following guidelines will be used for the determination of respiratory protection applicability. When performing jobs where breathing hazards may be encountered, all personnel will be provided with appropriate respiratory protection.

Appropriate respiratory protection shall be selected based on the completed Task Hazard Assessment which must consider gas/particle monitoring results, physical conditions or when the potential hazard level is unknown.

The Unified Command shall:

- Ensure workers who have passed a medical evaluation.
- Have had a respirator fit-test for each tight fitting respirator that will be used.
- Received training in the use of respiratory protection.
- Review and understand the completed Hazard assessment
- The contractor shall make available upon request fit test documentation and training documentation.

All Respiratory Protection training will meet or exceed all applicable legislation.

Workers shall be clean-shaven where the respiratory equipment forms a seal with the face.

Only NIOSH approved respiratory protection shall be used and all respiratory equipment must be cleaned and inspected after each use.

Guide to Respiratory Selection
Air Purifying Respirator (APR), Self-Contained Breathing Apparatus (SCBA), High-Efficiency Particulate Air Filter (HEPA), Supplied-Air Respirator (SAR).

Task/Exposure	Hazards	Respiratory Protection	Comments
Abrasive blasting	Silica dust, non-silica dust (e.g., slag, steel grit), lead (from removal of lead-based paint)	Mandatory minimum for blaster: supplied-air hood or helmet with apron (also called cape or bib) operated in a continuous flow mode Mandatory minimum for helper if positioned in the immediate blast area of blasting operations: half mask APR with HEPA dust filter (see Comments)	Contact appropriate safety coordinator for additional requirements if lead paint is involved. If blasting in a confined space or if positioned in the immediate blast area of blasting operations, the helper's protection must be identical to the blaster's.
Confined Space Entry	Hazardous atmospheres due to materials or substances present or the task (e.g., oxygen deficiency, mists, fumes, dusts, toxic vapors or gases)	Mandatory minimum for initial entry: SCBA during initial atmosphere testing from inside the area, and as required during initial air testing from outside the area Mandatory minimum for ongoing work: protection requirements depend on the results of initial atmosphere testing and the type of atmospheric hazard created by the task	See Ventilation, Air Testing and Air Monitoring in Confined Spaces, and Personal Protective Equipment for Confined Spaces, for further requirements. To determine the minimum protection for ongoing work, refer to the appropriate hazard (e.g., petroleum vapors) or task (e.g., abrasive blasting, painting and coating, welding) in this table.
Applying herbicide and pesticides	Toxic organic vapors or mists	Mandatory minimum: half mask APR with organic vapor cartridge and dust/mist pre-filter	Consult product MSDS for additional information.

Task/Exposure	Hazards	Respiratory Protection	Comments
Cutting, grinding, buffing (metals, plastic, wood)	Dusts and fumes	Recommended minimum: disposable dust mask (see Comments)	Respiratory protection is mandatory if conditions are very dusty or irritating.
Gauging	Toxic organic vapors (e.g., benzene, petroleum vapors), hydrogen sulfide	Mandatory minimum if LEL >4% and <10%, and H_2S <10 ppm: half mask APR with organic vapor cartridge	
		Mandatory minimum if LEL >10% or H_2S >10 ppm: SCBA	
Handling acids/caustics (e.g., hydrochloric acid, sulfuric acid, sodium hydroxide)	Corrosive mist or gas	Recommended minimum: half mask APR with acid gas cartridge (see comments)	Respiratory protection is mandatory if activity generates mist or vapor.
Lab operations	Toxic organic vapors (e.g., benzene, toluene)	Recommended minimum: half mask APR with organic vapor cartridge if high vapor concentration is present	A respirator is not required if a fume hood is used.

Task/Exposure	Hazards	Respiratory Protection	Comments
Painting and coating (not applicable to water-based coatings)	Toxic organic mists (spraying), toxic organic vapors (spraying and brush/roller application), isocyanates (two-part coatings containing isocyanates)	Mandatory minimum for spraying: half mask APR with organic vapor cartridge and dust/mist pre-filter	A full face piece APR with the same cartridge is recommended where eye irritation occurs. Check MSDS for additional information.
		Recommended minimum for brush/roller application: half mask APR with organic vapor cartridge	Respiratory protection is mandatory in enclosed areas and confined spaces with poor ventilation. Check MSDS for additional information.
		Mandatory minimum for two-part coatings containing isocyanates: SCBA or full face piece SAR if coating is sprayed; half mask APR with organic vapor cartridge if brush or roller application	Check MSDS to determine if catalyst/accelerator contains isocyanates.
Tank cleaning	Toxic organic vapors (e.g., benzene, petroleum vapors, H_2S), oxygen deficiency	Mandatory minimum for initial entry: SCBA or SAR	
		Mandatory minimum for ongoing work, LEL <10%, H_2S <10 ppm, with oil residue present: half mask APR with organic vapor cartridge	
		Mandatory minimum for ongoing work, LEL >10%, H_2S >10 ppm: SCBA or full face piece SAR	No work is permitted if LEL >20%.
Welding	Toxic dusts and fumes	Recommended dust mask	Respiratory protection is mandatory when welding inside tanks or in areas with poor ventilation.

2.17.9 PERSONAL FALL ARREST AND TRAVEL RESTRAINT SYSTEMS

2.17.9.1 Personal Fall Arrest Systems

Where workers are required to install, use or remove a personal fall arresting system, the Contractor performing the work shall prepare a written fall protection plan for the safe installation, use, or removal of the system. The plan must also include the method of rescue appropriate to the work. The Contractor must also have appropriately trained employees to conduct rescue operations.

Personnel that are required to use any fall protection equipment must be trained competent in its correct use and application.

NOTE: Ironworkers will follow Subpart M (Fall Protection) of the OSHA Standards.

Full Body Harness	In situations where a person could fall a vertical distance greater than 6 feet and it is impractical to provide adequate work platforms, scaffolds, staging, and guardrails, ANSI approved fall arresting full body harness shall be used in conjunction with a lanyard.
Lanyard	ANSI approved lanyards shall be arranged in such a way to prevent a person from falling freely for more than 4 feet. These lanyards shall be used to secure persons wearing a full body harness to an approved drop line, lifeline, or fixed anchorage point. Shock absorbers are required on a personal fall arrest system unless if by adding the device the worker can hit the ground when he or she falls.
Anchorage Points	Fixed anchorage points must be capable of withstanding a force of 5,000 pound-force minimum, or as otherwise required by applicable Regulations.
Horizontal Lifelines	The contractor must ensure that, before using a horizontal lifeline system that they installed, a professional engineer, a competent person authorized by the professional engineer, the manufacturer, or a competent person authorized by the manufacturer, certifies that the system has been properly installed according to the manufacturer's specifications or to specifications certified by a professional engineer.

Safety harnesses and shock absorbing lanyard devices exposed to a fall impact load shall be immediately removed from service and all components destroyed. The user shall visually inspect fall arresting equipment prior to each use.

2.17.9.2 Travel Restraint Systems

"Travel Restraint System" means a type of fall protection system, including guard rails or similar barriers that prevent a worker from travelling to the edge of a structure or to a work position from which the worker could fall.

Safety Belts	**SHALL NOT BE USED UNDER ANY CIRCUMSTANCES**
Lifelines	Temporary lifelines used for worker restraint shall be independently secured to suitable attachment points having adequate strength of at least 5000 pounds per worker attached. Lines must be padded at points of attachment and elsewhere, as necessary, to protect against chafing or abrasion caused by contact with sharp edges.

2.17.10 Lifejacket / Personal Flotation Devices

All Lifejacket and Personnel Flotation Device must meet or exceed all applicable regulations and approvals (United States Coast Guard Type II).

Lifejackets and/or Personal Floatation Devices (PFDs) shall be worn when working over water (ponds, rivers, creeks, etc.) adjacent to water (within six feet or based on the Hazard Assessment of the site) and where there is a danger of drowning. When working at night illumination devices shall be attached to PFDs.

2.17.11 PPE Levels of Protection

When response activities are conducted where atmospheric contamination is known or suspected to exist, personal protective equipment must be worn.

Personal protective equipment is designed to prevent/reduce skin and eye contact as well as inhalation or ingestion of the chemical substance.

Protective equipment to protect the body against contact with known or anticipated chemical hazards has been divided into four categories.

The below levels of protection will be considered when establishing PPE through the Hazard Assessment Process and documented on the Safe Work Permit. Standardized PPE requirements have been established for the Hot and Warm Zones but will vary dependent on air contaminates as established in the Industrial Hygiene Section and local work tasks and hazards.

LEVEL A

Level A protection should be worn when the highest level of respiratory, skin, eye and mucous membrane protection is needed.

Personal Protective Equipment

Positive pressure (pressure demand), self contained breathing apparatus (NIOSH approved), or positive-pressure supplied air respirator with escape SCBA.
Fully encapsulating chemical protective suit.
Gloves, inner, chemical resistant.
Gloves, outer, chemical resistant.
Boots, chemical resistant, steel toe and shank; (depending on suit boot construction, worn over or under suit boot.)
Underwear, cotton, long-john type.*
Hard hat (under suit).*
Coveralls (under suit).*
Two-way radio communications (intrinsically safe/non-sparking).*

*** Optional**

LEVEL B

Level B protection should be selected when the highest level of respiratory protection is needed, but a lesser level of skin and eye protection. Level B protection is the minimum level recommended on initial site entries until the hazards have been further identified and defined by monitoring, sampling, and other reliable methods of analysis, and equipment corresponding with those findings utilized.

Personal Protective Equipment

Positive-pressure (pressure-demand), self-contained breathing apparatus (NIOSH approved), or positive-pressure supplied air respirator with escape SCBA.
Chemical resistant clothing (overalls and long-sleeved jacket, coveralls, hooded two-piece chemical splash suit, disposable chemical resistant coveralls.)
Coveralls (under splash suit).*
Gloves, outer, chemical resistant.
Gloves, inner, chemical resistant.
Boots, outer, chemical resistant, steel toe and shank.
Boot-covers, chemical resistant (disposable).*
Two-way radio communications (intrinsically safe).*
Hard hat. *
Faceshield.*

*** Optional**

LEVEL C

Level C protection should be selected when the type of airborne substance is known, concentration measured, criteria for using air-purifying respirators met, and skin and eye exposure is unlikely. Periodic monitoring of the air must be performed.

Personal Protective Equipment

Full-face or half-mask, air-purifying respirator (NIOSH approved).
Chemical resistant clothing (one piece coverall, hooded two piece chemical splash suit, chemical resistant hood and apron, disposable chemical resistant coveralls.)

Gloves, outer, chemical resistant.
Gloves, inner, chemical resistant.
Boots, steel toe and shank, chemical resistant.
Boot-covers, chemical resistant.*
Cloth coveralls (inside chemical protective clothing).*
Two-way radio communications (intrinsically safe).*
Hard hat. *
Escape mask. *
Faceshield.*

*** Optional**

LEVEL D

Level D is primarily a work uniform and is used for nuisance contamination only. It requires only coveralls and safety shoes/boots. Other PPE is based upon the situation (types of gloves, etc.). It should not be worn on any site where respiratory or skin hazards exist. Refer to The Office of Emergency and Remedial Response. Environmental Response, Division. See "Interim Standard Operating Safety Procedures" for full details.

The type of environment and the overall level of protection should be reevaluated periodically as the amount of information about the site increases and as workers are required to perform different tasks.

Reasons to upgrade to a higher level (D is lowest, A is highest)

Known or suspected presence of dermal hazards
Occurrence or likely occurrence of gas or vapor emission
Change in work task that will increase contact or potential contact with hazardous materials
Request of the individual performing the task

Reasons to downgrade:

New information indicating that the situation is less hazardous than was originally thought
Change in site conditions that decreases the hazard
Change in work task that will reduce contact with hazardous materials

2.18 Contractor Safety Qualification

Proper Health and Safety Qualification will be required for response workers per contracting company/agency guidelines.

Enbridge is requesting safety qualification information from response workers upon arrival at site. Response workers shall self certify training levels and certification dates for use in determining qualifications during the Emergency Response stage.

As response activities progress training certifications verification will be reevaluated.

2.19 Mobil Lifting Equipment

This section focuses on the following types of mobile hoisting equipment; cranes with a lifting capacity of 15 tons or greater, boom trucks with a lifting capacity of 5 tons or greater, and all side boom tractor pipe layers.

The Contractor shall ensure all lifting practices meet or exceed all applicable legislative requirements.

General

- The Contractor shall ensure that only competent and qualified workers operate Mobile Hoisting Equipment.
- The Contractor shall assign a competent worker to be the rigger. The employee must be properly trained in rigging and copies of the training and certification shall be given to the Company Site Inspector prior to the lift. The level of training and experience shall be consistent with the requirements of the lift to be made.
- Only authorized competent and qualified workers assigned by the site supervisor shall operate mobile hosting equipment.
- Prior to performing any lift, the operator shall determine the weight of the lift (including the load and rigging) and ensure that the lifting device and all components are of sufficient size and strength to support the weight of the load. The operator shall ensure that the planned lift does not exceed the manufactures recommendations based on the current operating conditions. Under no circumstances shall the Manufacturers' ratings be exceeded.
- The Contractor shall ensure that operation of a crane is suspended when the wind velocity at the elevation of the crane exceeds the limit recommended by the manufacturer or when the ambient temperature is below that recommended by the manufacturer. Contractors shall have a policy of de-rating capacities of the crane below certain temperatures.
- All lifting devices shall be properly assembled using the appropriate rigging components as required for the intended lift, (i.e. four-part vs. a two-part line).
- Each piece of lifting equipment shall be equipped with a load and radius chart that can be easily read by the operator from his operating position. This chart shall be permanently attached to the equipment.
- A preventative maintenance program shall be in place for all lifting or hoisting devices to ensure that components are in safe operating condition (i.e. brakes, cables, connections, sheaves, etc.). All load bearing components shall be non-destructive tested under the direction and control of a Professional Engineer in accordance with the manufacturers' specifications.
- Written records including certifications, maintenance records, and inspection results for each crane, hoist, side-boom, etc. intended for lifting materials shall be available upon request.
- Operators shall perform daily equipment checks to verify that the lifting device and all components are in safe condition, and shall maintain a written record (logbook) of these inspections.
- All hoisting hooks shall be free of bends, cracks, corrosion, and enlarged throat openings. Hook swivel action shall be free and the hook shall be equipped with an operational safety latch.
- Winch lines shall be free of knots.

- When lifting a load, the operator of the lifting equipment shall ensure the hoisting line is in a vertical position and is over the centre of the load in such a manner as to reduce the danger to workers from a swing or uncontrolled movement of the load.
- Loads shall never be moved, carried, or swung over workers.
- Loads shall never be picked up or lowered while any worker is between the machine and the load.
- No person shall be allowed to ride on any part of the equipment except in the seats provided.
- No worker is to be in the ditch, on the pipe, or between the pipe and the ditch when lowering the pipe (or anything else) into the ditch.
- Booms shall be kept clear of overhead power lines and maintain the safe limits of approach to any utility at all times.
- The operator of any lifting device shall remain at the controls while equipment is holding a suspended load. If it is necessary for the operator to leave the controls, the suspended load shall be secured (e.g. skidded or blocked up). All locking and safety devices shall be set as necessary to safely secure the machine.
- Where rotation or uncontrolled motion of a load being hoisted is anticipated, one or more tag lines shall be used. Tag lines shall be knot free and shall never be wrapped or secured in any form to a worker's hands.

NOTE: At no time shall the worker physically contact a suspended load unless the load is in place and must be guided by hand. At no time shall the worker physically contact a suspended load unless tag line use creates an unsafe condition as determined by the hazard assessment.

Signalers/spotters shall be used when:

- The operator cannot clearly see the work.
- Equipment is backing up or moving, and the operator cannot see all parts of the machine and its path of travel; and/or
- The fully extended boom may come within the safe limit of approach distance to an overhead power line.
- When the view of the operator is obscured, the signaler will alert workers to any hazards that arise while material is being moved.
- The signaler shall be able to communicate with the operator, either verbally or through standard hand or horn signals.
- The operator shall take direction from only one signaler. The signal person shall be clearly identified and distinguishable from other workers (i.e. high-visibility vest of a different color and/or reflective arm bands) and shall be competent in crane and hoisting hand signals.
- The operator shall be protected from the danger of flying cables by a suitable cable guard when working on tractors and other equipment with a winch.
- All hydraulic hoses, fittings, and tubing, shall be inspected prior to use each day. Equipment showing Leakage at the surface of flexible hoses, blistering of hoses, evidence of abrasion, or scrubbing on outer surfaces of hoses, tubing, and fittings shall be immediately replaced or repaired.

NOTE: Any worker can give the STOP signal and the operator must comply.

Cranes and Boom Trucks

- The operator shall be competent in the equipment in which they are operating.
- The operator shall possess and keep available for inspection, an operator's license or certificate.
- All machine ratings are based on the machine being level in both directions and outriggers extended. If this is not possible, the operator shall take this into account when loading and handling.
- Avoid two-blocking, which may cause the load line to fail.
- Cranes will be equipped with an anti-two-block warning device.
- Whenever possible, cranes traveling with suspended loads shall be avoided. If travel is necessary, the load shall be carried as close to the ground as possible, and the boom carried in line with the direction of travel. In addition, tag lines shall be used to control any load swing.
- Loads carried on boom trucks shall be adequately secured. Boom lines are not to be used for securing the loads.
- Whenever cranes and boom-trucks are traveling around the site, booms, knuckles, etc., shall be in its proper resting position to avoid damage to overhead power lines, cable trays, etc.

PART 3 – WORK PRACTICES

The following work practices identify the typical hazards associated with these activities. However, a task specific hazard assessment will be conducted before conducting these activities and safe work permits will be issued when applicable.

3.01 Boom Deployment

Boom deployment consists of accessing the water body and deploying boom across the water body. Accessing the water body could involve the use of motor vehicles, trailers, boats, and clearing equipment/heavy machinery. Once the access point is established, a boom trailer is typically backed into position to allow the boom to be pulled into place. Workers near the shoreline or walking across shallow rivers and creeks may require knee boots, hip boots or waders. Where a risk of drowning exists, workers must have appropriate Personal Floatation Devices (PDFs). Boats may be required to pull the boom across larger bodies of water, and the appropriate level of training and PPE are required for workers involved in those activities.

Boom sites may have contamination from crude oil, and as such must be assessed for hazards and the appropriate level of respiratory protection per the Industrial Hygiene Plan in Appendix E.

Boom sites may also include vacuum trucks, skimmers, light plants, compressors, and decontamination stations. Employees involved in the use of such equipment shall have orientation in their proper operation and have appropriate personal protective equipment per the task hazard assessment.

3.02 Vacuuming and Skimming

Once booms are set in place, skimmers and vacuum trucks may be employed to collect crude oil and contaminated water from waterways. These activities may also be conducted in low lying areas and in locations where oil has pooled. This work involves operating the equipment, lifting hoses and fittings, moving in contaminated areas that are often slippery with uneven footing, and repositioning equipment to maximize collection efforts. Sites may have contamination from crude oil, and as such must be assessed for hazards and the appropriate level of respiratory protection.

3.03 Sampling and Observation/Documentation related activity

Throughout the collection and remediation process, sampling and observation will be required at various sites including air sampling, water sampling and soil sampling. This work is typically non-intrusive and involves accessing the desired site and collecting samples. As such, workers involved in sampling and observation must be aware of the hazards of each site and be equipped with proper PPE. Sampling conducted on or in water may require the use PFDs.

3.04 Pipeline Repair

The pipeline repair will be conducted using Enbridge Pipeline Maintenance workers augmented with pipeline contract crews. Pipeline repair will consist of pipe drain-up, site preparation, cut-out of the damaged pipe, heavy lifting, measurement and preparation of replacement pipe, aligning replacement pipe, welding and filling once complete. Enbridge Pipeline Maintenance workers involved in this aspect of the work are trained in Enbridge's Operating and Maintenance Procedures, which include specific and detailed descriptions of the work and the procedures involved. All work will be completed under the direction of Enbridge Pipeline Maintenance Supervision and will include the Enbridge Job Planning Tool.

3.05 Shoreline/Adjacent Lands Cleanup

Cleanup of crude oil is anticipated at the leak site and surrounding lowlands, throughout the Talmadge Creek and along affected shoreline of the Kalamazoo River. As such, workers involved in shoreline and adjacent land cleanup must be aware of the hazards of each site and be equipped with proper PPE and PFD. Typical cleanup activity includes water washing of contaminated shoreline, use of absorbent pads and booms and potentially excavation. This work

involves operating cleanup equipment such as pressure washers, lifting hoses and booms, moving in contaminated areas that are often slippery with uneven footing, and repositioning equipment to maximize collection efforts. Sites may have contamination from crude oil, and as such must be assessed for hazards and the appropriate level of respiratory protection.

3.06 Heavy Equipment Operation

Throughout the cleanup and repair efforts, a variety of heavy equipment will be used. This includes trucks, trailers, backhoes, cranes, vacuum trucks, welding trucks, etc. Each worker involved in the use of heavy equipment will have training in the use of that specific piece of equipment. Depending on the location, each worker will be aware of the hazards and utilize the proper PPE.

3.07 Decontamination Procedures

Personnel decontamination areas and equipment decontamination areas have been established on site for the duration of the response. The number of units will vary by needs related to response activities. The decontamination areas have been established to be strategically near work areas for personnel and equipment. Boat/vessel decontamination areas have been established on-site in areas accessible to boat/vessel launch locations.

1. Personnel

Entrance and egress from the hot zones will require donning and doffing personnel protective equipment. A decontamination station will be established nearby for areas where the potential for personnel contamination exists. Such stations shall be set up to accommodate individuals entering under their own power or in the event that they become disabled. Contaminated clothing will be removed from the outermost layer and turned inside out while removing. Skin surfaces will be rinsed with a mild detergent and rinsed thoroughly. Gloves will be removed last. Contaminated clothing and debris will be collected and bagged for proper disposal.

These decontamination stations are also to be utilized for emergency decontamination of workers should an incident occur. EMT members and workers will be briefed on the procedure to use these locations for public emergency decontamination needs.

Each personnel decontamination area will be contained within a 20 yard roll off box. These locations will also have at a minimum the following components.

- Sorbent wipers
- Plastic buckets with scrub brush
- Child wading pool
- Labels for disposal containers
- Containment for decontamination waste water

2. Equipment Decontamination Areas

The Decontamination Unit within the Operation Section will periodically clean equipment during response operations. Cleaning systems for skimmers, hand tools, and heavy machinery are established at the decontamination unit.

The equipment decontamination area will have a pool or other diked impoundment for cleaning equipment and, a frac tank for storage of liquids. The Cleaning pool or dike area will be lined with secondary containment to capture any spilled material.

Equipment that cannot safely be moved will be decontaminated on-site using soap and water with a water rinse; this process will be repeated until visible contamination is removed. Aras used for

cleaning will be bermed and lined to prevent additional contamination, and the resulting water will be collected and properly disposed.

Expendable equipment (e.g., rope mops, brushes, tarps, etc.) will not be decontaminated but will be drummed as waste.

2. Equipment

Following work activity, all other field/sampling equipment shall be properly decontaminated with a phosphate-free solution and water rinse.

Appendix A

MSDS for Crude Oil

EnCana Corporation Material Safety Data Sheet
Heavy Crude Oil/Diluent Mix – Christina Lake/Foster Creek Page 1 of 2

SECTION 1 – MATERIAL IDENTIFICATION AND USE
Material Name: HEAVY CRUDE OIL/DILUENT MIX (CHRISTINA LAKE/FOSTER CREEK)
Use: Process stream, fuels and lubricants production
WHMIS Classification: Class B, Div. 2, Class D, Div. 2, Sub-Div. A and B
NFPA: Fire: 2 **Reactivity**: 0 **Health**: 3
TDG Shipping Name: Petroleum Crude Oil
TDG Class: 3 **UN**: 1267
TDG Packing Group: II (boiling point 35 deg. C or above, and flash point less than 23 deg. C)
Manufacturer/Supplier: ENCANA CORPORATION
#1800, 855 - 2nd Street S.W., P.O. BOX 2850,
CALGARY, ALBERTA, T2P 2S5
Emergency Telephone: 403-645-3333
Chemical Family: Crude oil/condensate mix

SECTION 2 – HAZARDOUS INGREDIENTS OF MATERIAL
Hazardous Approximate C.A.S. LD50/LC50 Exposure
Ingredients Concentrations (%) Nos. Specify Species Limits
& Route
Crude oil 50 - 70 8002-05-9 LD50,rat, skin,>2 g/kg 5 mg/m3 (OEL,TLV)
Hydrocarbon Diluent 30 - 50 N.Av. N.Av. 900 mg/m3 (OEL)*
Benzene 0.03 - 0.3 71-43-2 LD50,rat,oral,930 mg/kg 1 ppm (OEL),
LC50,rat,4 hr,13200 ppm 0.5 ppm (TLV)
Hydrogen Sulphide <0.5 7783-06-04 LC50, rat, 4 hrs, 444 ppm 10 ppm (OEL,TLV)
OEL = 8 hr. Alberta Occupational Exposure Limit; TLV = Threshold Limit Value (8 hrs) *OEL for gasoline

SECTION 3 – PHYSICAL DATA FOR MATERIAL
Physical State: Liquid **Vapor Pressure (kPa)**: 2.5 – 36.5 @ 20C
Specific Gravity: 0.65 – 0.75 **Odor Threshold (ppm)**: N.Av.
Vapor Density (air=1): 2.5 -5.0 **Evaporation Rate**: N.Av.
Percent Volatiles, by volume: 20 - 30 (estimated) **Boiling Pt. (deg.C)**: 40 - 180
pH: N.Av. **Freezing Pt. (deg.C)**: <0
Coefficient of Water/Oil Distribution: <0.1
Odor & Appearance: Brown/black liquid, hydrocarbon odor
(N.Av. = not available N.App. = not applicable)

SECTION 4 – FIRE AND EXPLOSION
Flammability: Yes **Conditions**: Material will ignite at normal temperatures.
Means of Extinction: Foam, CO2, dry chemical. Explosive accumulations can build up in areas of poor ventilation.
Special Procedures: Use water spray to cool fire-exposed containers, and to disperse vapors if spill has not ignited. Cut off fuel and allow flame to burn out.
Flash Point (deg.C) & Method: <-35 (PMCC)
Upper Explosive Limit (% by vol.): 8 (estimated) **Sensitivity to Impact**: No
Lower Explosive Limit (% by vol.): 0.8 (estimated) **Sensitivity to Static Discharge**: Yes, at normal temperatures
Auto-Ignition Temp. (deg.C): 250 (estimated) **TDG Flammability Classification**: 3
Hazardous Combustion Products: Carbon monoxide, carbon dioxide, sulphur oxides

SECTION 5 – REACTIVITY DATA
Chemical Stability: Stable **Conditions**: Heat

Incompatibility: Yes **Substances**: Oxidizing agents (e.g. chlorine)
Reactivity: Yes **Conditions**: Heat, strong sunlight
Hazardous Decomposition Products: Carbon monoxide, carbon dioxide, sulphur oxides
EnCana Corporation Material Safety Data Sheet
Heavy Crude Oil/Diluent Mix – Christina Lake/Foster Creek Page 2 of 2

SECTION 6 – TOXICOLOGICAL PROPERTIES OF PRODUCT
Routes of Entry:
Skin Absorption : Yes **Skin Contact**: Yes **Eye Contact**: Yes
Inhalation: **Acute**: Yes **Chronic**: Yes **Ingestion**: Yes
Effects of Acute Exposure: Vapor may cause irritation of eyes, nose and throat, dizziness and drowsiness. Contact with skin may cause irritation and possibly dermatitis. Contact of liquid with eyes may cause severe irritation/burns.
Effects of Chronic Exposure: Due to presence of benzene, long term exposure may increase the risk of anemia and leukemia. Repeated skin contact may increase the risk of skin cancer.
Sensitization to Product: No.
Exposure Limits of Product: 1 ppm (Alberta 8 hr OEL for benzene)
Irritancy: Yes
Synergistic Materials: None reported
Carcinogenicity: Yes **Reproductive Effects**: Possibly **Teratogenicity**: Possibly **Mutagenicity**: Possibly

SECTION 7 – PREVENTIVE MEASURES
Personal Protective Equipment: Use positive pressure self-contained breathing apparatus, supplied air breathing apparatus or cartridge air purifying respirator approved for organic vapors where concentrations may exceed exposure limits (note: cartridge respirator not suitable for hydrogen sulphide, oxygen deficiency or IDLH situations) – see also Storage below).
Gloves: Viton (nitrile adequate for short exposure to liquid)
Eye: Chemical splash goggles. **Footwear**: As per safety policy **Clothing**: As per fire protection policy
Engineering Controls: Use only in well ventilated areas. Mechanical ventilation required in confined areas. Equipment must be explosion proof.
Leaks & Spills: Stop leak if safe to do so. Use personal protective equipment. Use water spray to cool containers. Remove all ignition sources. Provide explosion-proof clearing ventilation, if possible. Prevent from entering confined spaces. Dyke and pump into containers for recycling or disposal. Notify appropriate regulatory authorities.
Waste Disposal: Contact appropriate regulatory authorities for disposal requirements.
Handling Procedures & Equipment: Avoid contact with liquid. Avoid inhalation. Bond and ground all transfers. Avoid sparking conditions.
Storage Requirements: Store in a cool, dry, well ventilated area away from heat, strong sunlight, and ignition sources.
Caution: hydrogen sulphide may accumulate in headspaces of tanks and other equipment, even when concentrations in the liquid product are low. Overexposure to hydrogen sulphide may cause dizziness, headache, nausea and possibly knockdown and death. Factors increasing this risk include heating, agitation and contact of the liquid with acids or acid salts. Assess the exposure risk by gas monitoring. Wear air supplying breathing apparatus if necessary.
Special Shipping Provisions: N.App.

SECTION 8 – FIRST AID MEASURES
Skin: Flush skin with water, removing contaminated clothing. Get medical attention if irritation persists or large area of contact. Decontaminate clothing before re-use.
Eye: Immediately flush with large amounts of luke warm water for 15 minutes, lifting upper and lower lids at intervals. Seek medical attention if irritation persists.
Inhalation: Ensure own safety. Remove victim to fresh air. Give oxygen, artificial respiration, or CPR if needed. Seek medical attention immediately.
Ingestion: Give 2-3 glasses of milk or water to drink. DO NOT INDUCE VOMITING. Keep warm and at rest. Get immediate medical attention.

SECTION 9 – PREPARATION DATE OF MSDS

Prepared By: EnCana Environment, Health and Safety (EHS)
Phone Number: (403) 645-2000 Preparation Date: October 15, 2008 Expiry Date: October 15, 2011

MATERIAL SAFETY DATA SHEET
1. Chemical Product and Company Identification
24-HOUR EMERGENCY TELEPHONE NUMBER:
CHEMTREC (800) 424-9300
PRODUCT NAME: HYDROGEN SULFIDE
CHEMICAL NAME: Hydrogen Sulfide
COMMON NAMES/SYNONYMS: Dihydrogen Sulfide, Sulfur Hydride
TDG (Canada) CLASSIFICATION: 2.3 (2.1)
PREPARATION DATE: 6/1/95
REVIEW DATES: 6/7/96
2. Composition, Information on Ingredients
INGREDIENT % VOLUME PEL-OSHA1 TLV-ACGIH2 LD50 or LC50 Route/Species
Hydrogen Sulfide
FORMULA: H2S
CAS: 7783-06-4
> 99.0 20 ppm Ceiling 10 ppm TWA
15 ppm STEL LC50 444 ppm (rat)
1 As stated in 29 CFR 1910, Subpart Z (revised July 1, 1993)
2 As stated in the ACGIH 1994-95 Threshold Limit Values for Chemical Substances and Physical Agents
3. Hazards Identification
EMERGENCY OVERVIEW
Irritating to the eyes, mucous membranes and respiratory system. Inhaled gas inhibits cellular respiration resulting in pulmonary paralysis, sudden collapse and death. Extremely flammable.
ROUTE OF ENTRY:

Skin Contact	Yes
Skin Absorption	No
Eye Contact	Yes
Inhalation	Yes
Ingestion	Yes

HEALTH EFFECTS:

Exposure Limits	Yes
Irritant	Yes
Sensitization	No
Teratogen	Yes
Reproductive Hazard	Yes
Mutagen	No
Synergistic Effects	None Reported

Carcinogenicity: -- NTP: No IARC: No OSHA: No
EYE EFFECTS:
Low concentrations will generally cause irritation to the conjunctiva. Repeated exposure to low concentrations is reported to cause conjunctivitis, photo phobia, corneal bullae, tearing, pain and blurred vision.
SKIN EFFECTS:
May irritate the skin upon contact.
INGESTION EFFECTS:
Ingestion is unlikely. Hydrogen sulfide will irritate the mucous membranes causing a burning feeling with excess salivation likely. Irritation of the gastrointestinal tract may also occur.
INHALATION EFFECTS:
Hydrogen sulfide reacts with enzymes in the bloodstream and inhibits cellular respiration resulting in pulmonary paralysis, sudden collapse and death. Continuous exposure to low (15-50 ppm) concentrations will generally cause irritation to mucous membranes, and may also cause headache, dizziness or nausea. Higher concentrations (200-300 ppm) may result in respiratory arrest leading to coma or unconsciousness. Exposures for more than 30 minutes at concentrations greater than 700 ppm have been fatal. Continuous inhalation of low concentrations may cause olfactory fatigue or paralysis of the sense of smell. Thus, detection of hydrogen sulfide by its odor is not effective.
MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE:

Blood disorders.

NFPA HAZARD CODES HMIS HAZARD CODES RATINGS SYSTEM

Health: 4 Health: 4 0 = No Hazard
Flammability: 4 Flammability: 4 1 = Slight Hazard
Reactivity: 0 Reactivity: 0 2 = Moderate Hazard
3 = Serious Hazard
4 = Severe Hazard

4. First Aid Measures

EYES:

PERSONS WITH POTENTIAL EXPOSURE TO HYDROGEN SULFIDE SHOULD NOT WEAR CONTACT LENSES. Flush contaminated eyes with large amounts of water for at least 15 minutes. Part eyelids with fingers to ensure complete flushing. If irritation persists, seek medical attention immediately.

SKIN:

Flush affected area with water. If irritation persists, consult a physician.

INGESTION:

Treat in a manner similar to inhalation exposure. Seek medical attention as soon as possible.

INHALATION:

PROMPT MEDICAL ATTENTION IS MANDATORY IN ALL CASES OF OVEREXPOSURE. RESCUE PERSONNEL SHOULD BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS AND SHOULD RECOGNIZE THE HAZARDS OF OVEREXPOSURE DUE TO OLFACTORY FATIGUE. An extreme fire hazard exists when rescuing semiconscious or unconscious persons due to the flammability hazard. Avoid use of rescue equipment which may contain ignition sources or cause static discharge. Victims should be assisted to an uncontaminated area and inhale fresh air. Quick removal from the contaminated area is most important. If breathing has stopped administer artificial resuscitation and supplemental oxygen or a mixture of 5% carbon dioxide in oxygen. Keep victim calm and warm. Further treatment should be symptomatic and supportive. Seek medical assistance immediately.

5. Fire Fighting Measures

Conditions of Flammability: Flammable
Flash point: Not Available
Method: Not Applicable
Autoignition Temperature: 554°F (290°C)
LEL(%): 4.0 UEL(%): 44.0
Hazardous combustion products: Sulfur Compounds
Sensitivity to mechanical shock: None
Sensitivity to static discharge: None

FIRE AND EXPLOSION HAZARDS:

Hydrogen sulfide is heavier than air and may accumulate in low areas and may travel a considerable distance to a source of ignition. Should flame be extinguished and flow of gas continue, increase ventilation to prevent flammable mixture formation in low areas or pockets. Product may explode or burn over a wide range of mixtures in air.

EXTINGUISHING MEDIA:

Water, carbon dioxide, dry chemicals.

FIRE FIGHTING INSTRUCTIONS:

If possible, stop the flow of hydrogen sulfide. Use water spray to cool surrounding containers. Fire fighters should use self-contained breathing apparatus.

6. Accidental Release Measures

Evacuate all personnel from affected area. Use appropriate protective equipment. If leak is in user's equipment, be certain to purge piping with inert gas prior to attempting repairs. If leak is in container or container valve, contact the appropriate emergency telephone number listed in Section 1 or call your closest BOC location.

7. Handling and Storage

Earth-ground and bond all lines and equipment associated with the Hydrogen Sulfide system. All electrical equipment should be non-sparking or explosion proof. Do not rely on the olfactory sense to detect the presence of hydrogen sulfide. Analytical devices and instrumentation are readily available for this purpose. Perform frequent analytical tests to be certain that the TWA is not exceeded. Many metals corrode rapidly with wet hydrogen sulfide. Anhydrous hydrogen sulfide can be handled in carbon steel, aluminum Inconel ®, Stellite ® and 304 and 316 stainless steels. Avoid hard steels which are highly

stressed since they may be susceptible to hydrogen embrittlement from hydrogen sulfide. Use only in well-ventilated areas. Valve protection caps must remain in place unless container is secured with valve outlet piped to use point. Do not drag, slide or roll cylinders. Use a suitable hand truck for cylinder movement. Use a pressure reducing regulator when connecting cylinder to lower pressure (<750 psig) piping or systems. Do not heat cylinder by any means to increase the discharge rate of product from the cylinder. Use a check valve or trap in the discharge line to prevent hazardous back flow into the system. Protect cylinders from physical damage. Store in cool, dry, well-ventilated area away from heavily trafficked areas and emergency exits. Do not allow the temperature where cylinders are stored to exceed 130oF (54oC). Cylinders should be stored upright and firmly secured to prevent falling or being knocked over. Full and empty cylinders should be segregated. Use a "first in-first out" inventory system to prevent full cylinders being stored for excessive periods of time. Post "NO SMOKING OR OPEN FLAMES" signs in the storage area or use area. There should be no sources of ignition in the storage or use area.
For additional storage recommendations, consult Compressed Gas Association Pamphlets P-1 and G-12.
Never carry a compressed gas cylinder or a container of a gas in cryogenic liquid form in an enclosed space such as a car trunk, van or station wagon. A leak can result in a fire, explosion, asphyxiation or a toxic exposure.

8. Exposure Controls, Personal Protection

EXPOSURE LIMITS1:

INGREDIENT % VOLUME PEL-OSHA2 TLV-ACGIH3 LD50 or LC50 Route/Species

Hydrogen Sulfide
FORMULA: H2S
CAS: 7783-06-4
> 99.0 20 ppm Ceiling 10 ppm TWA
15 ppm STEL LC50 444 ppm (rat)

1 Refer to individual state of provincial regulations, as applicable, for limits which may be more stringent than those listed here.
2 As stated in 29 CFR 1910, Subpart Z (revised July 1, 1993)
3 As stated in the ACGIH 1994-1995 Threshold Limit Values for Chemical Substances and Physical Agents.

ENGINEERING CONTROLS:

Hood with forced ventilation. Use local exhaust to prevent accumulation above exposure limit.

EYE/FACE PROTECTION:

Gas tight chemical goggles or full-face piece respirator.

SKIN PROTECTION:

Protective gloves: Neoprene, butyl rubber, PVC, polyethylene.

RESPIRATORY PROTECTION:

Positive pressure air line with full-face mask and escape bottle or self-contained breathing apparatus should be available for emergency use.

OTHER/GENERAL PROTECTION:

Safety shoes, safety shower, eyewash "fountain".

9. Physical and Chemical Properties

PARAMETER VALUE UNITS

Physical state (gas, liquid, solid): Vapor
Vapor pressure: 267 (1840 kPa) psia
Vapor density at STP (Air = 1): 1.21
Evaporation point: Not Available
Boiling point: -76 °F: -60 °C
Freezing point: -117.8 °F: -82.2 °C
pH: Not Available
Specific gravity: Not Available
Oil/water partition coefficient: Not Available
Solubility (H20): Soluble
Odor threshold: Not Available
Odor and appearance: Colorless vapor with rotten egg odor.

10. Stability and Reactivity

STABILITY:

Stable

INCOMPATIBLE MATERIALS:

Dangerously reactive when mixed with concentrated nitric acid or other strong oxidizing agents. Vapors will ignite spontaneously when mixed with vapors of chlorine, oxygen difluoride or nitrogen trifluoride.

HAZARDOUS DECOMPOSITION PRODUCTS:

Oxides of sulfur.

HAZARDOUS POLYMERIZATION:

Will not occur.

11. Toxicological Information

REPRODUCTIVE:

Toxic effects observed in newborn rats after exposure of pregnant female to 20 ppm Hydrogen Sulfide.

12. Ecological Information

No data given.

13. Disposal Considerations

Do not attempt to dispose of residual waste or unused quantities. Return in the shipping container PROPERLY LABELED, WITH ANY VALVE OUTLET PLUGS OR CAPS SECURED AND VALVE PROTECTION CAP IN PLACE to BOC Gases or authorized distributor for proper disposal.

14. Transport Information

PARAMETER United States DOT Canada TDG

PROPER SHIPPING NAME: Hydrogen Sulfide, liquefied Hydrogen Sulfide, liquefied

HAZARD CLASS: 2.3 2.3 (2.1)

IDENTIFICATION NUMBER: UN 1053 UN 1053

SHIPPING LABEL: POISON GAS, FLAMMABLE GAS POISON GAS, FLAMMABLE GAS

Additional Marking Requirement: "Inhalation Hazard" If net weight of product > 100 pounds, the container must be also marked with the letters "RQ".

Additional Shipping Paper Description Requirement: "Poison-Inhalation Hazard, Zone B"
If net weight of product > 100 pounds, the shipping papers must be also marked with the letters "RQ".

15. Regulatory Information

Hydrogen sulfide is listed under the accident prevention provisions of section 112(r) of the Clean Air Act (CAA) with a threshold quantity (TQ) of 10,000 pounds.

SARA TITLE III NOTIFICATIONS AND INFORMATION

Hydrogen sulfide is listed as an extremely hazardous substance (EHS) subject to state and local reporting under Section 304 of SARA Title III (EPCRA). The presence of hydrogen sulfide in quantities in excess of the threshold planning quantity (TPQ) of 100 pounds requires certain emergency planning activities to be conducted. Releases of hydrogen sulfide in quantities equal to or greater than the reportable quantity (RQ) of 100 pounds are subject to reporting to the National Response Center under CERCLA, Section 304 SARA Title III.

SARA TITLE III - HAZARD CLASSES:

Acute Health Hazard
Chronic Health Hazard
Fire Hazard
Sudden Release of Pressure Hazard

SARA TITLE III - SECTION 313 SUPPLIER NOTIFICATION:

This product contains the following toxic chemicals subject to the reporting requirements of section 313 of the Emergency Planning and Community Right-To-Know Act (EPCRA) of 1986 and of 40 CFR 372:
CAS NUMBER INGREDIENT NAME PERCENT BY VOLUME 7783-06-4 Hydrogen sulfide > 99.0
This information must be included on all MSDSs that are copied and distributed for this material.

16. Other Information

Compressed gas cylinders shall not be refilled without the express written permission of the owner. Shipment of a compressed gas cylinder which has not been filled by the owner or with his/her (written) consent is a violation of transportation regulations.

DISCLAIMER OF EXPRESSED AND IMPLIED WARRANTIES:

Although reasonable care has been taken in the preparation of this document, we extend no warranties and make no representations as to the accuracy or completeness of the information contained herein, and assume no responsibility regarding the suitability of this information for the user's intended purposes or for the consequences of its use. Each individual should make a determination as to the suitability of the information for their particular purpose(s).

Material Safety Data Sheet
Hexanes MSDS
Section 1: Chemical Product and Company Identification
Product Name: Hexanes
CAS#: 110-54-3
TSCA: TSCA 8(b) inventory: Hexane
Synonym:
Chemical Name: Hexane
Chemical Formula: C6-H14
Contact Information:
CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300
International CHEMTREC, call: 1-703-527-3887
Section 2: Composition and Information on Ingredients
Composition:
Name CAS # % by Weight
Hexanes 110-54-3 98.5-99.9
Toxicological Data on Ingredients: Hexane: ORAL (LD50): Acute: 25000 mg/kg [Rat].
Section 3: Hazards Identification
Potential Acute Health Effects:
Hazardous in case of skin contact (permeator), of ingestion, of inhalation. Slightly hazardous in case of skin contact (irritant), of eye contact (irritant).
Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Mutagenic for bacteria and/or yeast. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to peripheral nervous system, skin, central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage.
Section 4: First Aid Measures
Eye Contact:
Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Get medical attention if irritation occurs.
Skin Contact: Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops.
Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.
Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if symptoms appear.
Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.
Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.
Serious Ingestion: Not available.
Section 5: Fire and Explosion Data
Flammability of the Product: Flammable.
Auto-Ignition Temperature: 225°C (437°F)
Flash Points: CLOSED CUP: -22.5°C (-8.5°F). (TAG)
Flammable Limits: LOWER: 1.15% UPPER: 7.5%
Products of Combustion: These products are carbon oxides (CO, CO2).
Fire Hazards in Presence of Various Substances:
Highly flammable in presence of open flames and sparks, of heat. Non-flammable in presence of shocks.
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:

Flammable liquid, insoluble in water. SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray or fog.

Special Remarks on Fire Hazards:

Extremely flammable liquid and vapor. Vapor may cause flash fire.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:

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

Section 7: Handling and Storage

Precautions:

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

Storage:

Store in a segregated and approved area. Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

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

Personal Protection:

Safety glasses. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves (impervious).

Personal Protection in Case of a Large Spill:

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

Exposure Limits:

TWA: 500 (ppm) from OSHA (PEL) [United States] Inhalation TWA: 1800 (mg/m3) from OSHA (PEL) [United States] Inhalation TWA: 176 (mg/m3) from ACGIH (TLV) [United States] SKIN TWA: 50 (ppm) from ACGIH (TLV) [United States] SKIN TWA: 500 STEL: 1000 (ppm) from ACGIH (TLV) [United States] Inhalation TWA: 1760 STEL: 3500 (mg/m3) from ACGIH (TLV) [United States] Inhalation Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Gasoline-like or petroleum-like (Slight.)

Taste: Not available.

Molecular Weight: 86.18g/mole

Color: Clear Colorless.

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

Boiling Point: 68°C (154.4°F)

Melting Point: -95°C (-139°F)

Critical Temperature: Not available.

Specific Gravity: 0.66 (Water = 1)

Vapor Pressure: 17.3 kPa (@ 20°C)

Vapor Density: 2.97 (Air = 1)

Volatility: Not available.
Odor Threshold: 130 ppm
Water/Oil Dist. Coeff.: The product is more soluble in oil; log(oil/water) = 3.9
Ionicity (in Water): Not available.
Dispersion Properties: See solubility in water, diethyl ether, acetone.
Solubility:
Soluble in diethyl ether, acetone. Insoluble in cold water, hot water.
Section 10: Stability and Reactivity Data
Stability: The product is stable.
Instability Temperature: Not available.
Conditions of Instability: Heat, ignition sources, incompatibles.
Incompatibility with various substances: Reactive with oxidizing agents.
Corrosivity: Not available.
Special Remarks on Reactivity: Hexane can react vigorously with strong oxidizers (e.g. chlorine, bromine, fluorine)
Special Remarks on Corrosivity: Not available.
Polymerization: Will not occur.
Section 11: Toxicological Information
Routes of Entry: Absorbed through skin. Dermal contact. Inhalation. Ingestion.
Toxicity to Animals:
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute oral toxicity (LD50): 25000 mg/kg [Rat]. Acute toxicity of the gas (LC50): 48000 ppm 4 hours [Rat].
Chronic Effects on Humans:
MUTAGENIC EFFECTS: Mutagenic for bacteria and/or yeast. May cause damage to the following organs: peripheral nervous system, skin, central nervous system (CNS).
Other Toxic Effects on Humans:
Very hazardous in case of ingestion, of inhalation. Hazardous in case of skin contact (permeator). Slightly hazardous in case of skin contact (irritant).
Special Remarks on Toxicity to Animals: Not available.
Special Remarks on Chronic Effects on Humans:
May cause adverse reproductive effects based on animal data. May be tumorigenic based on animal data. May affect genetic material. Passes through the placental barrier in animal.
Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects: Skin: May cause mild skin irritation. It can be absorbed through the skin in harmful amounts. Eyes: May cause mild eye irritation. Inhalation: May be harmful if inhaled. Inhalation of vapors may cause respiratory tract irritation. Overexposure may affect, brain, spinal cord, behavior/central and peripheral nervous systems (lightheadedness, dizziness, hallucinations, paralysis, blurred vision, memory loss, headache, euphoria, general anesthetic, muscle weakness, numbness of the extremities, asphyxia, unconsciousness and possible death), metabolism, respiration, blood, cardiovascular system, gastrointestinal system (nausea) Ingestion: May be harmful if swallowed. May cause gastrointestinal tract irritation with abdominal pain and nausea. May also affect the liver, blood, brain, peripheral and central nervous systems. Symptoms of overexposure by ingestion are similar to that of overexposure by inhalation.
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 product itself and its products of degradation are not toxic.
Special Remarks on the Products of Biodegradation: Not available.
Section 13: Disposal Considerations
Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.
Section 14: Transport Information

DOT Classification: CLASS 3: Flammable liquid.
Identification: Hexane UNNA: 1208 PG: II
Special Provisions for Transport: Not available.
Section 15: Other Regulatory Information
Federal and State Regulations:
Connecticut hazardous material survey.: Hexanes Illinois toxic substances disclosure to employee act: Hexanes Illinois chemical safety act: Hexanes New York release reporting list: Hexanes Rhode Island RTK hazardous substances: Hexanes Pennsylvania RTK: Hexanes Florida: Hexanes Minnesota: Hexanes Massachusetts RTK: Hexanes Massachusetts spill list: Hexanes New Jersey: Hexanes New Jersey spill list: Hexanes Louisiana spill reporting: Hexanes TSCA 8(b) inventory: Hexanes SARA 313 toxic chemical notification and release reporting: Hexanes CERCLA: Hazardous substances: Hexanes: 5000 lbs. (2268 kg)
Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.
Other Classifications:
WHMIS (Canada):
CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F). CLASS D-2B: Material causing other toxic effects (TOXIC).
DSCL (EEC):
R11- Highly flammable. R20- Harmful by inhalation. R38- Irritating to skin. R51/53- Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. R62- Possible risk of impaired fertility. R65- Harmful: may cause lung damage if swallowed. R67- Vapors may cause drowsiness or dizziness. S9- Keep container in a well-ventilated place. S16- Keep away from sources of ignition - No smoking. S29- Do not empty into drains. S33- Take precautionary measures against static discharges. S36/37- Wear suitable protective clothing and gloves. S61- Avoid release to the environment. Refer to special instructions/Safety data sheets. S62- If swallowed, do not induce vomiting: seek medical advice immediately and show this
HMIS (U.S.A.):
Health Hazard: 2
Fire Hazard: 3
Reactivity: 0
Personal Protection: g
National Fire Protection Association (U.S.A.):
Health: 1
Flammability: 3
Reactivity: 0
Specific hazard:
Protective Equipment:
Gloves (impervious). Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Safety glasses.
Section 16: Other Information
References: Not available.
Other Special Considerations: Not available.
Created: 10/10/2005 08:19 PM
Last Updated: 11/06/2008 12:00 PM
The information above is believed to be accurate and represents the best information currently available to us.

Material Safety Data Sheet
Benzene MSDS
Section 1: Chemical Product and Company Identification
Product Name: Benzene
CAS#: 71-43-2
TSCA: TSCA 8(b) inventory: Benzene
Synonym: Benzol; Benzine
Chemical Name: Benzene
Chemical Formula: C6-H6
Contact Information:
CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300
International CHEMTREC, call: 1-703-527-3887
Section 2: Composition and Information on Ingredients
Composition:
Name CAS # % by Weight
Benzene 71-43-2 100
Toxicological Data on Ingredients: Benzene: ORAL (LD50): Acute: 930 mg/kg [Rat]. 4700 mg/kg [Mouse]. DERMAL (LD50):
Acute: 9400 mg/kg [Rabbit]. VAPOR (LC50): Acute: 10000 ppm 7 hours [Rat].
Section 3: Hazards Identification
Potential Acute Health Effects:
Very hazardous in case of eye contact (irritant), of inhalation. Hazardous in case of skin contact (irritant, permeator), of ingestion. Inflammation of the eye is characterized by redness, watering, and itching.
Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Classified A1 (Confirmed for human.) by ACGIH, 1 (Proven for human.) by IARC. MUTAGENIC EFFECTS: Classified POSSIBLE for human. Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast.
TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Classified Reproductive system/toxin/female [POSSIBLE]. The substance is toxic to blood, bone marrow, central nervous system (CNS). The substance may be toxic to liver, Urinary System. 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 immediately.
Skin Contact:
In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.
Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.
Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if symptoms appear.
Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.
Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. 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: Flammable.
Auto-Ignition Temperature: 497.78°C (928°F)
Flash Points: CLOSED CUP: -11.1°C (12°F). (Setaflash)
Flammable Limits: LOWER: 1.2% UPPER: 7.8%
Products of Combustion: These products are carbon oxides (CO, CO2).
Fire Hazards in Presence of Various Substances:
Highly flammable in presence of open flames and sparks, of heat. Slightly flammable to flammable in presence of oxidizing materials. Non-flammable in presence of shocks.
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. Explosive in presence of oxidizing materials, of acids.
Fire Fighting Media and Instructions:
Flammable liquid, soluble or dispersed in water. SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use alcohol foam, water spray or fog.
Special Remarks on Fire Hazards:
Extremely flammable liquid and vapor. Vapor may cause flash fire. Reacts on contact with iodine heptafluoride gas. Dioxygenyl tetrafluoroborate is as very powerful oxidant. The addition of a small particle to small samples of benzene, at ambient temperature, causes ignition. Contact with sodium peroxide with benzene causes ignition. Benzene ignites in contact with powdered chromic anhydride. Vigorous or incandescent reaction with hydrogen + Raney nickel (above 210 C) and bromine trifluoride.
Special Remarks on Explosion Hazards:
Benzene vapors + chlorine and light causes explosion. Reacts explosively with bromine pentafluoride, chlorine, chlorine trifluoride, diborane, nitric acid, nitryl perchlorate, liquid oxygen, ozone, silver perchlorate. Benzene + pentafluoride and methoxide (from arsenic pentafluoride and potassium methoxide) in trichlorotrifluoroethane causes explosion. Interaction of nitryl perchlorate with benzene gave a slight explosion and flash. The solution of permanganic acid (or its explosive anhydride, dimaganese heptoxide) produced by interaction of permanganates and sulfuric acid will explode on contact with benzene. Peroxodisulfuric acid is a very powerful oxidant. Uncontrolled contact with benzene may cause explosion. Mixtures of peroxomonsulfuric acid with benzene explodes.
Section 6: Accidental Release Measures
Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.
Large Spill:
Flammable liquid. Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.
Section 7: Handling and Storage
Precautions:
Keep locked up. Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapor/spray. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, acids.
Storage:
Store in a segregated and approved area. Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame).
Section 8: Exposure Controls/Personal Protection
Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.
Personal Protection:
Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.
Personal Protection in Case of a Large Spill:

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

Exposure Limits:

TWA: 0.5 STEL: 2.5 (ppm) from ACGIH (TLV) [United States] TWA: 1.6 STEL: 8 (mg/m3) from ACGIH (TLV) [United States] TWA: 0.1 STEL: 1 from NIOSH TWA: 1 STEL: 5 (ppm) from OSHA (PEL) [United States] TWA: 10 (ppm) from OSHA (PEL) [United States] TWA: 3 (ppm) [United Kingdom (UK)] TWA: 1.6 (mg/m3) [United Kingdom (UK)] TWA: 1 (ppm) [Canada] TWA: 3.2 (mg/m3) [Canada] TWA: 0.5 (ppm) [Canada]Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Aromatic. Gasoline-like, rather pleasant. (Strong.)

Taste: Not available.

Molecular Weight: 78.11 g/mole

Color: Clear Colorless. Colorless to light yellow.

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

Boiling Point: 80.1 (176.2°F)

Melting Point: 5.5°C (41.9°F)

Critical Temperature: 288.9°C (552°F)

Specific Gravity: 0.8787 @ 15 C (Water = 1)

Vapor Pressure: 10 kPa (@ 20°C)

Vapor Density: 2.8 (Air = 1)

Volatility: Not available.

Odor Threshold: 4.68 ppm

Water/Oil Dist. Coeff.: The product is more soluble in oil; log(oil/water) = 2.1

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, diethyl ether, acetone.

Solubility:

Miscible in alcohol, chloroform, carbon disulfide oils, carbon tetrachloride, glacial acetic acid, diethyl ether, acetone. Very slightly soluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Heat, ignition sources, incompatibles.

Incompatibility with various substances: Highly reactive with oxidizing agents, acids.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:

Benzene vapors + chlorine and light causes explosion. Reacts explosively with bromine pentafluoride, chlorine, chlorine trifluoride, diborane, nitric acid, nitryl perchlorate, liquid oxygen, ozone, silver perchlorate. Benzene + pentafluoride and methoxide (from arsenic pentafluoride and potassium methoxide) in trichlorotrifluoroethane causes explosion. Interaction of nitryl perchlorate with benzene gave a slight explosion and flash. The solution of permanganic acid (or its explosive anhydride, dimaganese heptoxide) produced by interaction of permanganates and sulfuric acid will explode on contact with benzene. Peroxodisulfuric acid is a very powerful oxidant. Uncontrolled contact with benzene may cause explosion. Mixtures of peroxomonsulfuric acid with benzene explodes.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

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

Toxicity to Animals:

WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute oral toxicity (LD50): 930 mg/kg [Rat]. Acute dermal toxicity (LD50): >9400 mg/kg [Rabbit]. Acute toxicity of the vapor (LC50): 10000 7 hours [Rat].

Chronic Effects on Humans:

CARCINOGENIC EFFECTS: Classified A1 (Confirmed for human.) by ACGIH, 1 (Proven for human.) by IARC. MUTAGENIC EFFECTS: Classified POSSIBLE for human. Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast.

DEVELOPMENTAL TOXICITY: Classified Reproductive system/toxin/female [POSSIBLE]. Causes damage to the following organs: blood, bone marrow, central nervous system (CNS). May cause damage to the following organs: liver, Urinary System.

Other Toxic Effects on Humans:

Very hazardous in case of inhalation. Hazardous in case of skin contact (irritant, permeator), of ingestion.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans:

May cause adverse reproductive effects (female fertility, Embryotoxic and/or phototoxic in animal) and birth defects. May affect genetic material (mutagenic). May cause cancer (tumorigenic, leukemia)) Human: passes the placental barrier, detected in maternal milk.

Special Remarks on other Toxic Effects on Humans:

Acute Potential Health Effects: Skin: Causes skin irritation. It can be absorbed through intact skin and affect the liver, blood, metabolism, and urinary system. Eyes: Causes eye irritation. Inhalation: Causes respiratory tract and mucous membrane irritation. Can be absorbed through the lungs. May affect behavior/Central and Peripheral nervous systems (somnolence, muscle weakness, general anesthetic, and other symptoms similar to ingestion), gastrointestinal tract (nausea), blood metabolism, urinary system. Ingestion: May be harmful if swallowed. May cause gastrointestinal tract irritation including vomiting. May affect behavior/Central and Peripheral nervous systems (convulsions, seizures, tremor, irritability, initial CNS stimulation followed by depression, loss of coordination, dizziness, headache, weakness, pallor, flushing), respiration (breathlessness and chest constriction), cardiovascular system, (shallow/rapid pulse), and blood.

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 less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

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

Section 14: Transport Information

DOT Classification: CLASS 3: Flammable liquid.

Identification: : Benzene UNNA: 1114 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:

California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Benzene California prop. 65 (no significant risk level): Benzene: 0.007 mg/day (value) California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Benzene Connecticut carcinogen reporting list.: Benzene Connecticut hazardous material survey.: Benzene Illinois toxic substances disclosure to employee act: Benzene Illinois chemical safety act: Benzene New York release reporting list: Benzene Rhode Island RTK hazardous substances: Benzene Pennsylvania RTK: Benzene Minnesota: Benzene Michigan critical material: Benzene Massachusetts RTK: Benzene Massachusetts spill list: Benzene New Jersey: Benzene New Jersey spill list: Benzene Louisiana spill reporting: Benzene California Director's list of Hazardous Substances: Benzene TSCA 8(b) inventory: Benzene SARA 313 toxic chemical notification and release reporting: Benzene CERCLA: Hazardous substances.: Benzene: 10 lbs. (4.536 kg)

Other Regulations:

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

Other Classifications:

WHMIS (Canada):

CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F). CLASS D-2A: Material causing other toxic effects (VERY TOXIC).
DSCL (EEC):
R11- Highly flammable. R22- Harmful if swallowed. R38- Irritating to skin. R41- Risk of serious damage to eyes. R45- May cause cancer. R62- Possible risk of impaired fertility. S2- Keep out of the reach of children. S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S39- Wear eye/face protection. S46- If swallowed, seek medical advice immediately and show this container or label. S53- Avoid exposure - obtain special instructions before use.
HMIS (U.S.A.):
Health Hazard: 2
Fire Hazard: 3
Reactivity: 0
Personal Protection: h
National Fire Protection Association (U.S.A.):
Health: 2
Flammability: 3
Reactivity: 0
Specific hazard:
Protective Equipment:
Gloves. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.
Section 16: Other Information
References: Not available.
Other Special Considerations: Not available.
Created: 10/10/2005 08:35 PM
Last Updated: 11/06/2008 12:00 PM
The information above is believed to be accurate and represents the best information currently available to us.

Appendix B

SITE HEALTH AND SAFETY PLAN

Company Name	Signature	Date

SITE HEALTH AND SAFETY PLAN

Company Name	Signature	Date

Appendix C

TASK HAZARD ASSESSMENT

Job Position &/or Task : Site Prep ,vacuum truck, Boom Deployment, Hydrocarbon Skimmer, Creek Diversion, Contaminated soil, contaminated material handling, Liquid waste holding, Tank set up and transfer operation.
Position Status : Company x Contractor X
Project & Site Location : Marshall Leak sites
Date Completed &/or Revised : July 29, 2010

KEY JOB FUNCTIONS &/OR TASKS	EQUIPMENT, MATERIALS,TOOLS & MACHINERY UTILIZED	RISKS (HEALTH & SAFETY HAZARDS)	HAZARD CONTROLS (PROTECTIVE DEVICES & EQUIPMENT, SAFE WORK PROCEDURES)
Access Site	Personnel, Trucks , Vacuum Trucks, Frac Tanks, and Tanker Trucks.	No Site contact. LEL 10%, H_2S 10 PPM, CO 35 ppm and Benzene 0.5 ppm levels to high	Security in place for access control. All personnel must have site contact; all personnel must have site orientation to access site. Safe work permit with Initial atmospheric testing required Equipment to meet spark arrestor / shut- off requirements. Site conditions to be checked for soft areas and gravel or matting in place for access to be maintained
Control zones	Cold zone Staging areas Hot zone	No site access approval No control of work zones No control of equipment Risk of spreading contaminated material	Cold zone- security, orientation decals, equipment tracing and assignment. Staging area- Tool and equipment storage, PPE. Supplies. Hot zone area cordoned off restricted access - permit required area monitoring .
MSDS	Heavy Crude Diluent Mix (i.e. Cold Lake)	Fire , exposure to H_2S, Benzene Light hydrocarbons vapors will release from product at normal temperatures creating an explosive atmosphere.	Ventilation (natural or mechanical) may be required. Gas detection equipment for continuous LEL monitoring is required. Proper binding techniques to prevent static. Proper bins for hydrocarbon waste store as vapors may release from waste materials.
Labor Personnel	Response workers Personnel exposure to LEL, H_2S, benzene. Uneven ground Working with loose product. Vegetation clean up at stream banks Booms	No training records, Exposure greater than 3% LEL Strains, slips, trips falls, eye injuries, Worker exposed to crude oil, LEL, H_2S,CO, benzene No respirator fit testing.	Identify training requirements. Respirator fit testing required Fit testing records. Review Christina Lake (Cold Lake) MSDS for product leaked and surrounding area. Spill cleanup meets precautions higher risk of exposure for working with hydrocarbons. Continuous Atmospheric monitoring for LEL and H_2S and spot sample for benzene. Safe work permits required for all work in restricted areas. Life jackets when required.

Site excavation for culvert installation for stream diversion	Heavy equipment	Line strike , ignition source, excavation slough in	Excavation checklist, Line locates, stake out excavation. Spotters Continuous gas monitoring Proper rigging techniques High visibility vests
Dry shrub, grass area	Trucks	Fire	Vehicles equipped with fire extinguishers. Monitor area Check area for equipment staging to prevent ignition of dry grass. Smoking in designated areas only.
Staging vacuum trucks	Vacuum truck	Limited truck access, striking property, Backing incidents, static, hose rupture, gasket leaks, worker exposed to crude oil, LEL, H_2S, benzene, noise levels above 85DbA	Drive through preferable, Use spotters for backing and positioning, Trucks bond to ground. Check hose condition, ensure gaskets are the proper material and in good condition and use a spill pail for drip containment. Exhaust hose to safe location. Continuous gas monitoring. Ensure workers have current Hazard Communication training and respiratory fit testing. Hearing protection
Leak containment	Boom Deployment	Drowning, Slips, trips and falls. Potential to be pinned in current against dams or barrier in the stream. Manual lifting and carrying of equipment and supplies. Personnel exposure, Contaminated clothing. Unstable stream banks. Underwater hazards.	Stream, Booms/dams to be at checked for potential hazards, life jackets to be worn on boats and at night adjacent to waterways, in high current areas. Booms to be checked for breech. Stages to be monitored to maintain containment and boom control. Area monitoring LEL H_2S. Proper PPE to be worn. Decontamination zone- remove outer layer of clothing to prevent spreading oil contamination. Fast currents by hidden underwater terrain – no entry (risk of someone getting pinned.)
Material transfer Tank farm operation	Skimmers, Vacuum Trucks, Tanker trucks.	Fire, over fill, vents overflow. Leaks. Workers not trained for tank loading or unloading. Exposure to LEL, H_2S, benzene. Tank overflow-spill Over pressure tank vacuum. Static build-up potential ignition source. Valve left open or closed or operated by unauthorized worker.	Personal protection standard leak site PPE. Continuous gas monitoring, open vents at all time to prevent over pressure/ vacuum. Exhaust vents hose to safe location. Valve to be in good operating order. Tank setup stable ground. Grounding in place for tanks. Known tank volume Level gage and log book. Tank transfer to be operated by tanker personnel at all time while truck loading and unloading. Proper bonding techniques to be used while transferring products. All personnel to be on Safe work

			permits. Safety eye wear, respirator fit testing, Hearing protection Proper PPE to worn at all times during transfers if required. Continuous gas monitoring and checks for benzene.
Contaminated soil and contaminated material.	Heavy haul trucks	Spill contaminated ground in clean zones. Hot material fire hazard, over exposure Containment area loading. Contaminated material in trucks. Contaminates Uneven loads on trucks Truck over turn, Jack knife. People walking in area No Identification on tank bins	100% containment. Soil testing to confirm soil characterization- Flash point-hydrocarbon content, area monitoring for LEL H_2S, benzene. Assess truck loading ramp for slope, slippage and turning radius for loading and unloading verify with test runs. Line trucks with poly Uneven loads on trucks Wind and weather conditions may effect -off loading. Proper bonding techniques to be used while transferring products. All personnel to be on Safe work permits. Safety eye wear, respirator fit testing, Hearing protection Proper PPE to worn at all times during transfers if required. Continuous gas monitoring and checks for benzene. No foot traffic on rig mats Waste manifest and labels if required.
Leak site excavation	Heavy equipment	Hazardous area, Chemical exposure, Fire, Trench walls unstable. Contact pipeline.	Soft terrain rig matting where required for unstable ground. Atmosphere monitoring for benzene, H_2S, LEL. Cordon off hot zone area applicable signage in place No smoking Wind socks in place Fire watch, spotters Fit testing requirement may apply for respirators.
Site Grading and material handling	Heavy equipment Culvert piping Transport trucks	Fire, Noise, equipment strike , underground cables, overhead line, towing vehicles, people traffic	Fire watch with reflective vests and fire extinguisher, Hearing protection, good communication practice to be followed between equipment operators for operating in congested areas. Continuous monitoring for LEL Spotters to wear high visibility vest. Proper rigging techniques. Proper signal persons, Proper use of tag lines. Transport trucks fit for transporting wet waste material.
Tank farm set up	Holding tank and Piping	Spill containment, static charge, truck loading, Fire, wrong valve operation in tank farm.	Lining for containment, piping off loading using proper rigging practices, Grounding in place for tanks and truck loading. Only workers in charge of operating tanks operate tank farm valve header

			and operate off loading pump. Only worker operating trucks operate truck valves. Vac unit must have drip pans in place spill containment.
Vehicle Maintenance	Heavy equipment	Worker not involved in clean up create hazard	All work at site to be permitted and authorized.
Air monitoring	Public concerns	Odors , fugitive emissions Vehicle traffic. Pedestrian traffic.	Maintain good communication with landowners, environment to set up perimeter air sampling for fugitive emission measurement. Drive within speed limits. Monitor roads for debris. Share awareness to work force. Limit parking alongside Leggitt Road leading to Marshall PLM shop.
Health	People	Mosquitoes Heat Stress	Use insect repellant with 10-25% DEET. Follow procedures for working in extreme temperatures (frequent water breaks)

Worker (Print Name) : _____

Worker Signature : _____

Site Supervisor : _____

Site Supervisor Signature : _____

Supporting Information and Sources
CCOHS Volume 5, Issue 6 - June 2007, Environment Canada, National Weather Service, US

Lightning incidents can be prevented by having a preparedness plan and taking some basic safety measures.

Lightning tends to strike higher ground and prominent objects, especially materials that are good conductors of electricity, such as metal. Thunder can be a good indicator of lightning - loud crackling means its close, whereas rumbling means it's further away.

Because light travels faster than sound, you will see lightning before you hear the thunder. Each second between the flash and the thunderclap represents about 1000 feet. As a rule of thumb, if you can count less than 30 seconds between the lightning strike and the thunder, the storm is less than 6 miles away. There is an 80% chance that the next strike will happen within that 6 miles, and if you can hear thunder, you are within striking distance. Run immediately to the nearest safe building or a fully enclosed, metal-topped vehicle ... there is NO safe place to be outside in a thunderstorm.

Safe Shelters from Lightning
The safest place to be in a thunderstorm is in a safe building. A safe building is one that is fully enclosed and serviced. Keep as many walls as possible between you and the outside. Stay away from doors, windows, fireplaces, and anything that will conduct electricity such as radiators, stoves, sinks and metal pipes. Avoid handling electrical appliances and telephones. Use battery operated appliances only.

The next best source of shelter is an enclosed metal car, truck or van (but NOT a tractor, golf cart, topless or soft top vehicle). Make sure the vehicle is not parked near trees or other tall objects that could fall over during a storm. When inside a vehicle during a lightning storm, roll up the windows and sit with hands in lap, waiting out the storm. Don't touch any part of the metal frame or any wired device in the vehicle (including the steering wheel or plugged-in cell phone). A direct strike to your car will flow through the frame of the vehicle and usually jump over or through the tires to reach ground.

Be aware of downed power lines that may be touching your car. You are safe inside the car, but you may receive a shock if you step outside.

Unsafe Shelters
Buildings or structures without electricity or plumbing to ground the lightning do not provide any lightning protection. Shelters that are unsafe include covered picnic shelters, carports, tents, baseball dugouts as well as other small non-metal buildings (sheds and greenhouses).

If you absolutely can't get to safety ...
There is no safe place to be outdoors during a thunderstorm. However, there are areas that might be less dangerous - and help reduce the risk of being struck by lightning outside.

Stay away from things that are tall (trees, flagpoles or posts), water, and other objects that conduct electricity (tractors, metal fences, lawnmowers, golf clubs).

You do not want to become a prime target by being the highest object on the landscape. Take shelter in low-lying areas such as valleys or ditches but watch for flooding.

If you are in a group in the open, spread out several feet apart from one another.

If you get caught in a level field far from shelter and you feel your hair stand on end, lightning may be about to hit you. Crouch down on the balls of your feet immediately, with feet together, place your arms around your knees and bend forward. Be the smallest target possible, and minimize your contact with the ground. Don't lie flat.

Lightning is an electrical discharge caused when static electricity builds up between thunderclouds, or thunderclouds and the ground. Lightning strokes carry up to 100 million volts of electricity and leap from cloud to cloud, or cloud to ground and vice versa. Lightning tends to strike higher ground and prominent objects, especially good conductors of electricity such as metal.

Thunder is the noise caused by the explosive expansion of air due to the heat generated by a lightning discharge. Thunder may have a sharp cracking sound when lightning is close by, compared to a rumbling noise produced by more distant strokes.

Because light travels at a faster speed than sound, you can see a lightning bolt before the sound of thunder reaches you.

Lightning may strike several miles away from the parent cloud and precautions should be taken even if the thunderstorm is not directly overhead.

If caught outdoors:
Keep a safe distance from tall objects, such as trees, hilltops, and telephone poles.

Avoid projecting above the surrounding landscape. Seek shelter in low-lying areas such as valleys, ditches and depressions but be aware of flooding.

Stay away from water. Don't go boating or swimming if a storm threatens and land as quickly as possible if you are on the water. Lightning can strike the water and travel some distance from its point of contact. Don't stand in puddles even if you are wearing rubber boots.

Stay away from objects that conduct electricity, such as tractors, golf carts, golf clubs, metal fences, motorcycles, lawnmowers and bicycles.

Avoid being the highest point in an open area. Swinging a golf club or holding an umbrella or fishing rod can make you the tallest object and a target for lightning. Take off shoes with metal cleats.

You are safe inside a car during lightning, but don't park near or under trees or other tall objects which may topple over during a storm. Be aware of downed power lines which may be touching your car. You are safe inside the car, but you may receive a shock if you step outside.

In a forest, seek shelter in a low-lying area under a thick growth of small trees or bushes.

Keep alert for flash floods, sometimes caused by heavy rainfall, if seeking shelter in a ditch or low-lying area.
If caught in a level field far from shelter and you feel your hair stand on end, lightning may be about to hit you.

Kneel on the ground immediately, with feet together, place your hands on your knees and bend forward. Don't lie flat.

If you are in a group in the open, spread out, keeping people several yards apart.

Indoor Precautions:
Before the storm hits, disconnect electrical appliances including radios and television sets. Do not touch them during the storm.

Don't go outside unless absolutely necessary.

Keep away from doors, windows, fireplaces, and anything that will conduct electricity, such as radiators, stoves, sinks, and metal pipes. Keep as many walls as possible between you and the outside.

Don't handle electrical equipment or telephones. Use battery operated appliances only.

Note: Persons who have been struck by lightning receive an electrical shock but do not carry an electrical charge and can be safely handled. Victims may be suffering from burns or shock and should receive medical attention immediately. If breathing has stopped, mouth-to-mouth resuscitation should be administered. If breathing and pulse are absent, cardio-pulmonary resuscitation is required.

In the United States, there are an estimated 25 million lightning flashes each year. During the past 30 years, lightning killed an average of 58 people per year. This is higher than 57 deaths per year caused by tornadoes and average 48 deaths to hurricanes. Yet because lightning usually claims only one or two victims at a time and does not cause mass destruction of property, it is underrated as a risk. While documented lightning injuries in the United States average about 300 per year, undocumented injuries are likely much higher.

Watch for Developing Thunderstorms: Thunderstorms are most likely to develop on spring or summer days but can occur year round. As the sun heats the air, pockets of warmer air start to rise and cumulus clouds form. Continued heating can cause these clouds to grow vertically into towering cumulus clouds, often the first sign of a developing thunderstorm.

When to Seek Safe Shelter: Lightning can strike as far as 10 miles from the area where it is raining. That's about the distance you can hear thunder. If you can hear thunder, you are within striking distance. Seek safe shelter immediately.

Outdoor Activities: Minimize the risk of being struck. Most lightning deaths and injuries occur in the summer. Where organized outdoor sports activities take place, coaches, camp counselors and other adults must stop activities at the first roar of thunder to ensure everyone has time to get to a large building or enclosed vehicle. Leaders of outdoors events should have a written plan that all staff are aware of and enforce.

Indoor Activities: Inside buildings, stay off corded phones, computers and other electrical equipment that put you in direct contact with electricity. Stay away from pools (indoor or outdoor), tubs, showers and other plumbing. Buy surge suppressors for key equipment. Install ground fault protectors on circuits near water or outdoors. When inside, wait 30 minutes after the last clap of thunder, before going outside again.

Helping a Lightning Strike Victim: Lightning victims do not carry an electrical charge, are safe to touch, and need urgent medical attention. Cardiac arrest is the immediate cause of death for those who die. Some deaths can be prevented if the victim receives the proper first aid immediately. Call 911 immediately and perform CPR if the person is unresponsive or not breathing. Use an Automatic External Defibrillator if one is available.

Summary: Lightning is dangerous. With common sense, you can greatly increase your safety and the safety of those you are with. At the first clap of thunder, go to a large building or fully enclosed vehicle and wait 30 minutes after the last clap of thunder before you to go back outside.

Appendix E Marshall Spill Industrial Hygiene Plan

Industrial Hygiene Air Monitoring/Sampling

Initial air testing requirements

- Testing shall be performed twice where the product accumulation is greatest. Except where the spill site is too small to do so, these samples should be taken at least 10 ft apart.
- Measurements should be taken 3 ft above the surface of the product and 1 ft inside the downwind side of the leak site boundary. Measurements should also be taken at the exact jobsite where activities could generate additional chemical emissions.
- For each test:
    - Perform two (2) measurements for benzene with a grab sampling instrument such as Drager CMS, UltraRae 3000, or Gastec.
    - Perform two (2) measurements for total hydrocarbons (TVOCs) with a PID instrument such as ppbRae, UltraRae 3000, or UltraRae.
    - Perform two (2) measurements for hydrogen sulfide (H_2S) with a Drager CMS.
- Monitoring shall be conducted to delineate the perimeter where air contaminants or combustible vapors are at or below detectable levels. The *cold zone* must be established outside of this perimeter.
- Monitoring shall also be conducted at nearby facilities, commercial buildings, waterways, and residential houses.
- Air testers shall wear half-face respirator for the initial air testing. Respiratory protection requirements for repeating this sampling (as per the *Ongoing Air Testing* subsection below) shall be in accordance with Book 2: 13-02-07 and based upon previous air monitoring results (initial air testing, area or personal air monitoring).
- Respiratory Protection:
    - Half-face respirator: 0.5 ppm ≤ benzene <5.0 ppm; total VOCs ≥ 300 ppm; H_2S ≥ 10.0 ppm
    - Full-face respirator: 5.0 ppm ≤ benzene ≤ 25.0 ppm; total VOCs ≥ 500 ppm;
    - Supplied air respirator: benzene ≥ 25.0 ppm, or H_2S: 10.0 - 100 ppm
    - Cartridge replacement schedule: every one (1) hour when benzene ≥ 5.0 ppm; or total VOCs ≥ 1000 ppm; every two (2) hours when benzene ≥ 2.0 ppm; or total VOCs ≥ 500 ppm; every four (4) hours when benzene ≥ 1.0 ppm; or total VOCs ≥ 300 ppm; every eight (8) hours when benzene ≥ 0.5 ppm; or total VOCs ≥ 150 ppm.
- Hot Zone: where benzene ≥ 0.5 ppm, or H_2S ≥ 1.0 ppm, or TVOCs ≥ 300 ppm.
- Warm Zone: where benzene < 0.5 ppm, or H_2S < 1.0 ppm, or TVOCs < 300 ppm
- Cold Zone: where benzene < detection limit (0.2 ppm for Drager CMS, 0.05 ppm for UltraRae 3000), or H_2S < detection limit (0.2 ppm for Drager CMS), or TVOCs < 10 ppm.

Warning: suspend the activity and withdraw to a safe position if conditions encountered by the air tester exceed the level of respiratory protection worn, as detailed in Book 2: 13-02-07, or if any of the following conditions are found:

$H_2S \geq 100$ ppm
$O_2 < 19.5\%$
LEL ≥ 10%

Record the condition and location in the Incident Log – Safety.

Warning: Low-lying areas (trenches, depressions) and enclosed spaces that need to be entered (hollows, buildings, etc.) have an increased risk of containing immediately dangerous to life and health (IDLH) atmospheres.

NOTE: For more information, see *Book 2 Safety, 13-02-07 Respiratory Protection* and Book 2, Safety: *14-02-02 Portable Gas Detectors*

Sample Results from responders, regulators and workers will be provided to the Safety Officer for consolidation. Enbridge sample data will be updated to the ftp:// site.

Ongoing Air Testing

Upon completion of the initial air testing:

- Ongoing area and personal air monitoring shall continue for the life of the emergency with the multi-head gas detectors as per Book 2, 14-02-02.
- Take a measurement at jobsites for benzene when the shift starts and ends
- Repeat benzene air monitoring every two hours if the initial reading of the shift is above 0.5 ppm, repeat benzene air monitoring every one hour if the initial reading of the shift is above 2.0 ppm
- Additional monitoring should be performed in response to any changes in work activity or climatic conditions (temperature, moisture, rain, wind speed and direction, etc.).

Exposure Assessment

Exposure to chemicals:
Area sampling:
- Sampling locations: jobsites, leak boundary, waterways, and station areas
- Sampling methods: 3M organic vapor monitors, charcoal tubes with pumps, Orbo 34 with sampling pumps, summa canisters, and cassettes

Personal sampling:
- Sampling targets: employees, contractors, and Federal/State officials
- Sampling methods: 3M organic vapor monitors, charcoal tubes with pumps, Orbo 34 with sampling pumps, summa canisters, and cassettes

Community sampling:
- Sampling locations: residential houses, commercial buildings, and roads
- Sampling methods: summa canisters

Charcoal tube sample analytes: 25 VOCs including benzene, toluene, ethylene, xylenes (BTEX), n-hexane, etc.
Orbo tube sample analyte: H_2S
Cassettes: welding fumes (heavy metals, total fume particulates)

Exposure to noise:
Area sampling:
- Sampling locations: vacuum trucks, bulldozers, and any other stationery noise sources
- Sampling methods: sampling with sound level meters

Personal Sampling:
- Sampling targets: employees, contractors, and Federal/State officials
- Sampling methods: sampling with noise dosimeters for workers working around the noisy equipment

Exposure to heat stress:
- Sampling locations: jobsites
- Sampling methods:
  - Obtaining hourly climatic conditions from the local weather forecast office or preferably using a thermo hygrometer to measure the temperature and relative humidity at the jobsite and consulting Table 1, or
  - Using a Thermal Environment Monitor to determine the workplace's WBGT and converting it to Heat Index according to the following formula:
    Heat Index = 1.94 × WBGT – 11.3
  - Determining the final Heat Index by considering the following correction factors:
    - Radiant heat: percent of clouds, adding 4-6 ^{0}F
    - FR clothing: adding 9 ^{0}F
    - Half-face respirators: adding 4 ^{0}F
    - Workload: heavy to very heavy, adding 4-6 ^{0}F
- Consulting Table 2 to determine heat stress risk level and a regimen of work time and rest time
- Repeating the assessment process whenever climatic conditions change

IMPORTANT: NEVER ignore anyone's signs or symptoms of heat-related disorders regardless of heat stress assessment results.

Table 1: Heat Index from Temperature and Relative Humidity Readings*

Relative Humidity	Actual Temperature °F (°C)								
	70 (21.1)	75 (23.9)	80 (26.7)	85 (29.4)	90 (32.2)	95 (35)	100 (37.8)	105 (40.6)	110 (43.3)
0%	70 (21.1)	75 (23.9)	80 (26.7)	85 (29.4)	90 (32.2)	95 (35)	100 (37.8)	105 (40.6)	110 (43.3)
10%	70 (21.1)	75 (23.9)	80 (26.7)	85 (29.4)	90 (32.2)	95 (35.0)	100 (37.8)	105 (40.6)	110 (43.3)
20%	70 (21.1)	75 (23.9)	80 (26.7)	85 (29.4)	90 (32.2)	96.8 (36.0)	102.2 (39.0)	109.4 (43.0)	116.6 (47.0)
30%	70 (21.1)	75 (23.9)	80.6 (27.0)	87.8 (31.0)	95 (35.0)	102.2 (39.0)	109.4 (43.0)	118.4 (48.0)	125.6 (52.0)
40%	70 (21.1)	77.0 (25.0)	84.2 (29.0)	91.4 (33.0)	98.6 (37.0)	107.6 (42.0)	116.6 (47.0)	125.6 (52.0)	
50%	71.6 (22.0)	80.6 (27.0)	87.8 (31.0)	95 (35.0)	104 (40.0)	113 (45.0)	122 (50.0)		
60%	75.2 (24.0)	82.4 (28.0)	91.4 (33.0)	98.6 (37.0)	109.4 (43.0)	118.4 (48.0)	129.2 (54.0)		
70%	77.0 (25.0)	86 (30.0)	95 (35.0)	104 (40.0)	113 (45.0)	123.8 (51.0)			
80%	80.6 (27.0)	87.8 (31.0)	98.6 (37.0)	107.6 (42.0)	118.4 (48.0)				
90%	82.4 (28.0)	91.4 (33.0)	100.4 (38.0)	111.2 (44.0)	122 (50.0)				
100%	84.2 (29.0)	95 (35.0)	104 (40.0)	114.8 (46.0)	127.4 (53.0)				

*This table is based on work with little or no radiant heat, assuming wearing regular summer clothing, moderate work for unacclimatized workers or heavy work for acclimatized workers).

Table 2. Work/Rest Schedule for Hot Work Environment

Heat Index °F (°C)	Risk of Heat Disorders	Work/Rest Regimen
130+ (55+)	Extreme danger	Discontinue work
113-129 (45-55)	Heat stroke highly likely	Only medically supervised work
107.6-111.2 (42-44)	Heat stroke, heat cramps, and/or heat exhaustion very likely	Work 15 min and rest 45 min every hour
104-105.8 (40-41)	Heat stroke, heat cramps, and/or heat exhaustion likely	Work 30 min and rest 30 min every hour
100.4-102.2 (38-39)	Heat stroke, heat cramps and/or heat exhaustion possible	Work 45 min and rest 15 min every hour
93.2-98.6 (34-37)	Extreme caution	Warn for symptoms and extra water
86-91.4 (30-33)	Fatigue possible	Alert for symptoms and extra water
77-84.2 (25-29)	Caution	Water as needed

Appendix F
Hazard Assessment/Safe Work Permit

Appendix F
Weston Solutions, Inc.
Site Safety Plan