# AIRPORT ROAD WASTE DISPOSAL AREA REMEDIATION SYSTEM INSTALLATION HEALTH AND SAFETY PLAN

THE UNIVERSITY OF NORTH CAROLINA
AT CHAPEL HILL

# Airport Road Waste Disposal Area Remediation System Health and Safety Plan

Prepared for:
The University of North Carolina at Chapel Hill

Prepared by:
ARCADIS G&M, Inc.
801 Corporate Center Drive
Raleigh, North Carolina 27607

Our Ref.:
NC000239.0013.00001

Date:
April 2005

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## Review and Approval

**Site Name:** University of North Carolina at Chapel Hill Airport Road Waste Disposal Area

| | | |
|---|---|---|
| Jimes E. Shilliday, III, LG<br>Project Manager | Signature | 4/20/05<br>Date |
| Christopher Kalinowski, EI<br>Construction, Site, or Task Manager | Signature | 4/20/05<br>Date |
| Christopher Kalinowski, EI<br>Site Health and Safety Officer | Signature | 4/20/05<br>Date |
| Robert J. Ellis, LG<br>Project Health and Safety Manager | Signature FOR | 4/26/2005<br>Date |
| Robert J. Ellis, LG<br>Designated H&S Plan Writer | Signature FOR | 4/26/2005<br>Date |
| Todd Thornton<br>Designated H&S Plan Reviewer | Signature | 4-19-05<br>Date |

## Employee Acknowledgement

**The employee's signature below indicates his/her understanding, acceptance, and compliance with the requirements of this Health and Safety Plan ("HASP").**

**Site Name:** **The University of North Carolina at Chapel Hill Airport Road Waste Disposal Area**

| Name | Signature | Date |
|---|---|---|
| Name | Signature | Date |
| Name | Signature | Date |
| Name | Signature | Date |
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| Name | Signature | Date |
| Name | Signature | Date |

## Subcontractor Acknowledgement of Receipt of this Health and Safety Plan

ARCADIS claims no responsibility for the use of this HASP by others although subcontractors working at the Site may use this HASP as a guidance document. In any event, ARCADIS does not guarantee the health and/or safety of any person entering this Site. Strict adherence to the health and safety guidelines provided herein will reduce, but not eliminate, the potential for injury at this Site. To this end, health and safety becomes the inherent responsibility of personnel working at the Site.

**Client: The University of North Carolina at Chapel Hill**

**Site Name: Airport Road Waste Disposal Area**

**Project Name: Groundwater Remediation System Installation**

**Project Number: NC000239.0013**

**Start Date: April 2005**

**End Date: December 2009**

| Subcontractor Name and Representative | Signature | Date |
|---|---|---|
| Subcontractor Name and Representative | Signature | Date |
| Subcontractor Name and Representative | Signature | Date |
| Subcontractor Name and Representative | Signature | Date |
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## Introduction

The provisions of this Site Health and Safety Plan (HASP) are mandatory for all ARCADIS personnel involved in the Project. This HASP also provides the specification for the minimum acceptable requirements for all subcontractor organizations, and notification of the chemical and physical hazards known to be associated with the project activities addressed in this document.

Operational changes to this HASP that could affect the health or safety of personnel, the community, or the environment will not be made without prior approval of the ARCADIS Project Manager and the cognizant ARCADIS Project Health and Safety Manager (PHSM). This plan meets the requirements for health and safety protection and planning as required by Occupational Safety and Health Administration (OSHA) requirements in Title 29 Code of Federal Regulation, Part 1910 and 1926 as applicable.

ARCADIS subcontractors will be given copies of this plan and will be required, at a minimum, to follow the procedures described herein. Subcontractors will also be required to develop more extensive health and safety plans for the activities for which they are responsible. The subcontractor's H&S plan shall meet at a minimum the ARCADIS G&M H&S plan. The subcontractor shall review the ARCADIS H&S plan and in the event that there are any inconsistencies, deviations or other differences between the Subcontractor's plan and the ARCADIS H&S plan such inconsistencies, deviations or other differences shall be identified by the subcontractor. The ARCADIS SSO shall review the subcontractor's plan. However, such review or failure to object to the subcontractor's plan shall not in any manner be a representation that the subcontractor's plan is sufficient for the subcontractor's work and ARCADIS does not by its review assume any liability for any deficiency in subcontractor's plan.

To the extent possible, subcontractors and the ARCADIS H&S staff will work together to develop adequate procedures where inconsistencies, deviations, or other differences occur prior to the initiation of that activity. ARCADIS claims no responsibility for the use of this HASP by others although other subcontractors working at the Site may use this HASP as a guidance document. In any event, ARCADIS does not guarantee the health and/or safety of any person entering this Site. Strict adherence to the health and safety guidelines provided herein will reduce, but not eliminate, the potential for injury at this Site. To this end, health and safety becomes the inherent responsibility of personnel working at the Site.

## ARCADIS Policy

As a company, we will operate in compliance with all federal, state, and local regulations regarding health and safety. Senior management is responsible for ensuring that adequate resources are available to comply with health and safety regulations. Senior management is responsible for developing health and safety programs that comply with health and safety regulations.

Regional and local management is responsible for implementing and fostering a positive and proactive regard for company health and safety programs and policies. Employees are responsible for complying with company health and safety policies and programs to ensure their own safety as well as the safety of their coworkers.

## A. Emergency Planning

### Emergency and Project Telephone Numbers

In the event of a situation or unplanned occurrence requiring assistance, the appropriate contact(s) should be made from the list on the following pages. The SSO will post the Emergency Contact page at the project as a ready reference. Where mobile telephones are used for emergency communications, active cellular service will be confirmed from the Site before the initiation of daily work activities.

In the event of an emergency, the work site will be evacuated and the appropriate emergency phone numbers shall be called (Page 4). In the event of any emergency situation, Site personnel will immediately notify the SSO who will initiate emergency response actions. The SSO will determine the need for off-site emergency response assistance. If the SSO determines that on-site personnel can adequately respond and control the situation, the SSO will oversee the response and ensure Site personnel are properly protected and use proper procedures. If not, the SSO will contact appropriate emergency response personnel per the phone list and other personnel as required by the client for assistance. Work shall not resume at the Site until the ARCADIS Project Manager, Health and Safety Manager, and Site Manager have been notified of the emergency and they agree that the Site is safe for continued work.

Personal injury or heat/cold exposure requiring immediate medical help, personal medical emergency, or hazardous chemical exposure situations will require the SSO to immediately call the appropriate emergency number for medical assistance (See the emergency phone list).

Potential emergencies may include**:**

- Personal injury
- Personal exposure
- Fire
- Vehicle accidents
- Disturbance of utilities
- Severe weather

The SSO will conduct regular site inspections to identify any potential emergency situations for the purposes of avoiding those emergency situations.

### First-Aid Kits

The SSO will be trained in First Aid and the Site will have first-aid kits that are protected from the weather, available at the Site at all times, and inspected and restocked weekly, as necessary.

### Eyewash Bottles

Eyewash bottles offer a short-term, immediate rinse for personnel who get contamination in their eyes, specifically particulates. Once the eyewash bottle has been used though, personnel should find a plumbed eyewash station or other device (such as a garden hose) to provide continuous flushing to the eyes. Eyewash bottles should be stored protected from direct sunlight and high temperatures. Additionally, eyewash bottles should be checked frequently to ensure that the liquid has not expired.

### Fire Extinguisher

At a minimum, a 10-pound fire extinguisher capable of extinguishing Class A, B, and C fires will be available for use at the Site at all times. The actual number, size, and type of fire extinguishers will be determined by the SSO. Project personnel will be readily aware of the location of the fire extinguisher and will be trained on when and how to use a fire extinguisher. On project Sites where electrical equipment and components may be vulnerable to corrosive ABC extinguishing agents, extinguishers with non-corrosive agents such as carbon dioxide, may be located in the vicinity of this equipment for use in emergencies.

**POST THIS PAGE IN APPROPRIATE LOCATIONS ON SITE**

The Site Safety Officer will coordinate the entry and exit of response personnel during an emergency and make emergency contacts as necessary from the following list. After immediate notifications are made, the SSO will contact the Project Manger.

| Emergency Contact | Phone Numbers |
|---|---|
| Local Police | 911 |
| Local Ambulance | 911 |
| Local Fire Department | 911 |
| Local Hospital (UNC) | (Emergency) 919.966.4721<br>(Main) 919.966.4131 |
| Local Airport (for weather data) Horace Williams Airport | 919.962.1337 |
| Poison Control | 1.800.222.1222 |
| National Response Center (all spills in reportable quantities) | 800.424.8802 |
| U.S. Coast Guard (spills to water) | 804.441.3516 |
| Project Manager – Jim Shilliday | (o) 919.854.1282 (c) 919.606.0797 |
| UNC Project Manager Contact – Larry Daw | (o) 919-962-6666 |
| UNC Health and Safety Office Manager – Dr. Rich Miller | (o) 919-962-5718 |

**Hospital Route:** See Map to Hospital (Figure 1)

| Mile | Instruction | For |
|---|---|---|
| 0.0 | Depart Site onto Municipal Dr (East) | 0.2 mi |
| 0.2 | Turn RIGHT (South) onto SR-86 [Airport Rd] | 2.1 mi |
| 2.3 | Turn RIGHT (West) onto W Cameron Ave | 120 yds |
| 2.3 | Turn LEFT (South) onto Pittsboro St | 0.4 mi |
| 2.8 | Continue (South-East) on Manning Dr | 87 yds |
| 2.8 | Arrive at UNC Hospital | |

**Hospital Name**: The University of North Carolina Hospital 101 Manning Drive Chapel Hill, NC 27514

**First Aid, Fire Protection, and Response Equipment Locations (List all Locations)**

First Aid Kit: Field Truck

Eye Wash (Bottle): Field Truck

Fire Extinguisher: Field Truck

The Project Manager will make the following notifications:

| Name | Phone Numbers |
|---|---|
| Corporate Health & Safety Director – Mike Thomas | 720.344.3835 (O) 720.308.2147 (C) |
| Corporate Health & Safety Manager – Pat Vollertsen | 720.344.3779 (O) |
| Regional Health & Safety Manager – Jerry Revis | 919.544.4535 (O) 919.616.4168 (C) |
| Area Health & Safety Representative – Todd Thornton | 919.544.4595 (O) 919.616.4126 (C) |
| Project Physician or Local Physician (if required or requested by client or project contract) | Not Applicable |
| Subcontractor's Office<br>Company: To be determined<br>Name: | |
| Subcontractor's Office<br>Company: To be determined<br>Name: | |
| Subcontractor's Office<br>Company: To be determined<br>Name: | |
| Phone Number at Project Site – | Field staff cell phones |

The following authorities were contacted and briefed about our activities and the potential hazards:

Name: _____

Agency: _____

Date: _____

Name: _____

Agency: _____

Date: _____

Name: _____

Agency: _____

Date: _____

**Comments and Special Emergency Instructions**

## B. Organization and Responsibilities

### ARCADIS Personnel

The following personnel are designated to carry out H&S job functions on the Site. Their responsibilities and the tasks they will be carrying out on the Site are listed below. The same person may fill more than one role.

| ARCADIS Project Team | Responsibility and Tasks |
|---|---|
| Jim Shilliday | **Project or Task Manager**<br>▪ Initiates HASP development, and reviews and signs the HASP.<br>▪ Obtains Site-specific health and safety information.<br>▪ Communicates with the Site Safety Officer (SSO) on Site health and safety issues.<br>▪ Allocates resources for correction of identified unsafe work conditions.<br>▪ Communicates with the client on health and safety issues.<br>▪ Ensures ARCADIS Site workers have all training necessary for the project (see Appendix B for training & Site specific safety orientation information).<br>▪ Finalizes PM Checklist.<br>▪ Reports all injuries, illnesses and near-misses to the Corporate H&S Manager and Area H&S Representative, assists with incident investigation, and ensures that any recommendations made are implemented.<br>▪ Communicates H&S program and a copy of the ARCADIS H&S Plan to all subcontractors and receives their acknowledgement of the receipt of such information. |
| Chris Kalinowski | **Site Safety Officer (SSO)**<br>▪ Reviews and works in accordance with the components of this HASP.<br>▪ Ensures that the HASP is available to and reviewed by all Site personnel and reviews that subcontractors have appropriately communicated H&S information.<br>▪ Ensures that necessary Site-specific training is performed (both initial and "tailgate" safety briefings – Use tailgate form in Attachment 3)<br>▪ Ensures that site visitors have been informed of the hazards related to ARCADIS work and precautions to take, and have signed the Site Visitors Log found in Attachment 2.<br>▪ Ensures that work is performed in a safe manner and has authority to stop work when necessary to protect workers and/or the public. |

| ARCADIS Project Team | Responsibility and Tasks |
|---|---|
| | ▪ Coordinates activities during emergency situations.<br>▪ Ensures that all necessary permits and safety information provided by the client is disseminated to other Site personnel and is maintained in an organized manner.<br>▪ Communicates with the PHSM and the PM on health and safety issues.<br>▪ Report all injuries, illnesses and near-misses to the PM and PHSM.<br>▪ Maintains injury/illness reports and other H&S data as required by the client or regulatory agency (e.g., MSHA Quarterly Report).<br>▪ Ensures that necessary safety equipment is maintained and used at the Site. |
| Chris Kalinowski And other field staff from the ARCADIS Raleigh, North Carolina Office | **Site Workers**<br>▪ Read and work in accordance with the components of this HASP.<br>▪ Report all unsafe working conditions to the SSO.<br>▪ Report all injuries, no matter how trivial, to the SSO.<br>▪ Work in a safe manner.<br>▪ Sign the acceptance log at the beginning of this HASP. |
| Rob Ellis | **Project Health and Safety Manager (PHSM)**<br>The designated PHSM is responsible for overseeing all aspects of the Site safety program, and preparing any Site-specific health and safety guidance documents or addenda to this plan. The PHSM does not report to the Project Manager, and is separately accountable to the ARCADIS project team senior management for Site health and safety. The PHSM acts as the sole contact to regulatory agencies on matters of safety and health. Other responsibilities include:<br>▪ Overall authority for Health and Safety compliance and HASP conformance for the project.<br>▪ General health and safety program administration.<br>▪ Conducts project health and safety audits as warranted.<br>▪ Determines the level of personnel protection required.<br>▪ Updates equipment or procedures based on information obtained during Site operations.<br>▪ Establishes air-monitoring parameters based on expected contaminants.<br>▪ Assists in injury, illness and near-miss investigation and follow-up. |
| | |
| | |

**Subcontractors**

All ARCADIS subcontractors are responsible for assigning specific work tasks to their employees, providing qualified employees, allocating sufficient time, materials and equipment to safely complete assigned tasks, and equipping its personnel with any required personnel protective equipment.

ARCADIS considers each subcontractor to be an expert in all aspects of the work operations for which they are tasked to provide, and each subcontractor is responsible for compliance with those regulatory requirements which pertain to those services. While the ARCADIS H&S Plan will be the minimum H&S requirements for the work completed by ARCADIS and its subcontractors, each subcontractor, in coordination with ARCADIS H&S personnel, is expected to perform its operations in accordance with its own H&S plans, policies and procedures unique to the subcontractor's work to ensure that hazards associated with the performance of the work activities are properly controlled. Copies of any required safety documentation for a subcontractor's work activities will be provided to ARCADIS for review by the PHSM and SSO prior to the start of on-site activities. Operators of heavy equipment will be required to complete a Heavy Equipment Certification form or similar document.

In the event that the subcontractor's procedures/requirements conflict with requirements specified in this HASP, the more stringent guidance will be adopted after discussion and agreement between the subcontractor and ARCADIS project H&S personnel. Hazards not listed in this HASP, but known to the subcontractor or known to be associated with the subcontractor's services, must be identified and addressed to the ARCADIS Project or Task Manager and SSO prior to beginning work operations.

The Task or Project Manager (or authorized representative) has the authority to halt the subcontractor's operations and to remove the subcontractor or subcontractor employee from the Site for failure to comply with established health and safety procedures or for operating in an unsafe manner.

| Subcontractor and Representative Name | Responsibility | H&S Info on File? |
|---|---|---|
| To be Determined | Drilling and Well Installation | |
| To be Determined | Remediation System Installation | |
| | | |
| | | |

## C. Project Description

### Project Types and Activities

| X | Type | Start Date | X | Activities | Start Date |
|---|---|---|---|---|---|
| X | Remediation System Installation | Sept. 2005 | | Geophysical Survey | |
| X | Site Assessment/Investigation | Feb 2005 | X | Site Visit | Feb. 2005 |
| | Phase I Site Assessment | | | Drum Sampling | |
| | Regulatory Compliance Audit | | | Surveying | Sept. 2005 |
| | Compliance Program | | | Trenching/Excavation | |
| | Property Decommission | | | Soil Sampling | |
| | Demolition | | | Groundwater Sampling | Dec. 2005 |
| X | Decontamination | Sept. 2005 | | Surface Water Sampling | Dec. 2005 |
| | Industrial Hygiene Study | | | Sediment Sampling | |
| X | Construction | Sept. 2005 | | Air Sampling | Sept. 2005 |
| | Phase 2 Site Assessment | | | Drilling | Sept. 2005 |
| | Risk Assessment | | | Desk Work | |
| X | Site Observations and Inspections | Feb. 2005 | | Other | |

## Scope of Work

### Site History

The University used the site from 1973 to 1979 to dispose of wastes from the University's teaching, research, and hospital laboratories. A total of 18 burials in trenches were made at the site between 1973 and 1979. The wastes consisted of a variety of constituents, including halogenated and non-halogenated solvents and other organic compounds, pesticides, metals, acids, bases, and PCBs, based on a Notification of Hazardous Waste Site (EPA Form 8900-1) completed in 1981.

ARCADIS has sampled soil, groundwater, surface water, and sediments during previous investigations at the site. Volatile organic compounds (VOCs) were detected in groundwater at the site. Constituents of concern in groundwater included: acetone; benzene; chloroform; chlorobenzene; 1,2-dichloroethane; diethyl ether; methylene chloride; and toluene; 1,1,2,2-tetrachloroethene; trichloroethene; and vinyl chloride. Several semi-volatile compounds (SVOCs) including, dimethylphthalate, isophorone, and phenol were also detected in groundwater.

### Groundwater Remediation

The proposed groundwater remediation alternative will include groundwater extraction in the shallow aquifer using traditional pump and treat and the vapor extraction recovery (VER) technique. Groundwater in the bedrock aquifer will be recovered using a conventional pumping technique. The recovered water from both shallow and bedrock aquifers will be treated aboveground prior to disposal. Therefore, air stripping with activated carbon polishing has been selected as the most applicable technique to treat the VOCs in the groundwater at the site.

## List of Project Tasks and Associated Activities

The primary field tasks of this project are (1) Installation of a groundwater remediation system; (2) System operation and maintenance and groundwater monitoring; and (3) System deconstruction and abandonment of recovery and monitoring wells.

- Task 1 Installation of a groundwater remediation system
    - Mark all proposed well locations to be cleared by utility contractor
    - Oversight of drilling and recovery well installations
    - Oversight of surveying activities
    - Oversight of system installation including plumbing, electrical and mechanical components of groundwater recover system

- Trouble shooting/minor repairs of plumbing, electrical and mechanical components
- Groundwater and system sampling
- Field analyses of groundwater samples
- Management of IDW (Groundwater)

- Task 3 Deconstruction of groundwater recovery system
  - Oversight of monitor well and recovery well abandonment and any above ground completions (bollards and stick-up casings)
  - Oversight of system equipment removal

## D. Site Information

**Site Name**: The University of North Carolina at Chapel Hill Airport Road Waste Disposal Area

**Client Safety and Health Contact:** Dr. Rich Miller, UNC Chapel Hill Environment, Health & Safety Manager

**Site Contact Name:** Larry Daw, UNC Project Manager

**Operational Description of Site**: The Airport Road Waste Disposal Area is located near Airport Road in northern Chapel Hill, Orange County, North Carolina. The site consists of a 0.489-acre wooded parcel of University property that is located adjacent to the entrance road to the Airport Road Inactive Sanitary Landfill.

**Current Site Status**: ____ Active X Inactive ____ Industrial

____ Commercial ____ Retail ____ Undeveloped

____ Other (describe) ____

**Topography and General Environmental Setting:** The site and surrounding property are relatively flat, sloping gently to the north-northwest in the general direction of Crow Branch Creek. Surface elevations in the vicinity of the site are approximately 485 feet above

mean sea level (ft msl) and slope to approximately 460 ft msl in the vicinity of Crow Branch Creek. A site map that illustrates various site features, including topography, is presented in Figure 2.

**Accessible by:** ___Major Highway _____Main Road _X_2-Lane Road _____Dirt Road

**Description of the Work Area**: An approximately 0.2 acre area within the 0.489-acre parcel was used from 1973 through 1978, with the approval of the State of North Carolina, to dispose of chemical waste from the University's facilities in 16 separate burial trenches. An additional 0.289 acres adjacent to the 0.2-acre area was proposed for use when the original area was full. However, only two burials were conducted in this expanded area, both in 1979. Access to the site is restricted by an 8-foot-high locked fence erected by the University in early 1994. Several warning signs surround the site. The groundwater remediation system will be installed downgradient (north of the burial area and the infiltration gallery will be installed upgradient of the burial area.

## E. Hazard Evaluation and Control

### Project Hazard Analysis

The Project Hazard Analysis below identifies the hazards that are anticipated to be encountered by the project team.

| | | |
|---|---|---|
| Physical Hazards Present:<br><br>☐ None | ☒ Heat<br>☒ Cold<br>☒ Noise<br>☒ Walking/working surfaces (includes slip/trip/fall & floor/wall openings)<br>☐ Visible Dust<br>☐ LASER<br>☐ Other: | ☐ Holes/Pits<br>☐ Ionizing radiation<br>☐ Non-ionizing radiation<br>☒ Electricity<br>☒ Severe Weather<br>☐ Poor lighting<br>☐ Overhead Hazards<br>☐ Other: |
| Chemical Hazards Present:<br><br>☐ None | ☒ Flammable/combustible<br>☐ Compressed gas<br>☐ Explosive<br>☐ Organic peroxide<br>☐ Oxidizer<br>☐ Water reactive<br>☐ Unstable reactive<br>☐ Dust/Fumes/Airborne Particulates | ☒ Corrosive<br>☒ Toxic<br>☒ Highly toxic<br>☒ Irritant<br>☐ Sensitizer<br>☒ Carcinogen<br>☐ Mutagen<br>☐ Other: |
| Environmental/Equipment Hazards Present:<br><br>☐ None | ☐ Heavy machinery/ Drill Rigs<br>☒ Trenching/excavation<br>☐ Docks – marine operations<br>☐ Docks – loading<br>☐ Diving operations<br>☒ Drilling<br>☐ Forklifts<br>☐ Water operations work<br>☐ Elevated heights (includes fall protection)<br>☒ Overhead/Underground utilities<br>☐ Confined spaces<br>☒ Power tools | ☐ Cranes/Hoists/Rigging<br>☐ Ladders<br>☐ Scaffolding<br>☐ Manlifts<br>☐ Welding<br>☐ Gas cylinders<br>☐ Roadway work<br>☐ Railroad work<br>☒ Energized equipment (LO/TO)<br>☐ Pressurized equipment (LO/TO)<br>☒ Drums and containers<br>☐ Other: |
| Biological Hazards Present:<br><br>☐ None | ☐ Animal/human fluids or blood<br>☐ Animal/human tissue(s)<br>☐ Poisonous/irritating plants<br>☐ Other: | ☐ Contaminated needles<br>☐ Live bacterial cultures<br>☒ Insects/rodents/snakes<br>☐ Other: |
| Ergonomic Hazards Present:<br><br>☐ None | ☐ Repetitive motion<br>☐ Awkward position<br>☒ Heavy lifting<br>☐ Frequent lifting<br>☐ Other: | ☐ Limited movement<br>☐ Forceful exertions<br>☐ Vibration<br>☐ Other:<br>☐ Other: |
| Personal Safety/Security:<br><br>☐ None | ☐ Personal safety<br>☐ Security issue<br>☐ Project site in isolated area<br>☒ Employees working alone<br>☐ Other: | ☐ Employees working early/late<br>☐ Potentially dangerous wildlife<br>☐ Guard or stray dogs in area<br>☐ No/limited cell phone service<br>☐ Other: |

| | | |
|---|---|---|
| Training Required:<br><br>☐ None | ☒ 40-hour HAZWOPER (All site workers)<br>☐ 24-hour HAZWOPER<br>☒ HAZWOPER site supervisor (PM, PHSM, and SSO only)<br>☐ OSHA 30-hour Construction<br>☐ OSHA 10-hour Construction<br>☒ PPE<br>☐ Respiratory protection<br>☐ Chemical hygiene<br>☐ Hazard communication<br>☐ Hazardous waste<br>☒ First-aid/CPR<br>☐ DOT/IATA hazmat transportation<br>☐ Diving<br>☐ Other: | ☐ Bloodborne pathogens<br>☐ Confined space<br>☐ Lockout/tagout<br>☐ Electricity<br>☐ Fire extinguishers<br>☐ Fall protection<br>☐ Noise exposure<br>☐ Forklifts<br>☐ Asbestos<br>☐ Lead<br>☐ Cadmium<br>☐ SPCC<br>☐ Radiation safety<br>☐ Client specific |
| Medical Screening | ☒ Medical Surveillance Exam (HAZWOPER)<br>☐ Client required drug and/or alcohol testing | ☐ Blood and/or urine screening for other hazardous substances |

**Chemical Hazard Information**

| Chemical Name | Physical Description | Health Effects | TLV/PEL* 8-hr TWA | Ionization Potential | Physical Properties | Special Precautions |
|---|---|---|---|---|---|---|
| Acetone | **Appearance:** clear, colorless liquid. | Causes eye irritation. Breathing vapors may cause drowsiness and dizziness. Causes respiratory tract irritation. Aspiration hazard if swallowed. Can enter lungs and cause damage. Prolonged or repeated contact may dry the skin and cause irritation. | **ACGIH:** 500 ppm TWA; 750 ppm STEL | 9.69 eV | **Flash Point**: -20 deg C. **pH:** 7 **Vapor Pressure:** 231 mm Hg @ 25 deg C **Vapor Density:** 2.0 (Air=1) **Solubility:** Soluble. **Specific Gravity/Density:** 0.788 @ 25°C **LEL:** 25,000 ppm | **Extremely flammable liquid and vapor. Vapor may cause flash fire.** Monitor vapors as part of the respiratory protection program. **Eyes:** Wear chemical goggles. **Skin:** Wear appropriate protective gloves to prevent skin exposure. **Clothing:** Wear appropriate protective clothing to prevent skin exposure. |

| Chemical Name | Physical Description | Health Effects | TLV/PEL* 8-hr TWA | Ionization Potential | Physical Properties | Special Precautions |
|---|---|---|---|---|---|---|
| Benzene | **Physical State:** Liquid **Appearance:** clear colorless **Odor:** sweetish odor - aromatic odor | Cancer hazard. Harmful if swallowed, inhaled, or absorbed through the skin. Causes eye, skin, and respiratory tract irritation. Aspiration hazard if swallowed. Can enter lungs and cause damage. damage. May cause blood abnormalities. May cause central nervous system effects. | **ACGIH:** 0.5 ppm TWA; 2.5 ppm STEL; skin - potential for cutaneous absorption | 9.24 eV | **pH:** Not applicable. **Flash Point:** -11 deg C. **Vapor Pressure:** 75 mm Hg @ 20 deg C **Vapor Density:** 2.8 (air=1) **Solubility:** 0.180 g/100 ml @ 25°C **Specific Gravity/Density:** 0.8765 @ 20°C **LEL:** 12,000 ppm | **Extremely flammable liquid and vapor.** Vapor may cause flash fire. Monitor vapors as part of the respiratory protection program. **Eyes:** Wear chemical goggles. **Skin:** Wear appropriate protective gloves to prevent skin exposure. **Clothing:** Wear appropriate protective clothing to prevent skin exposure. |
| Chloroform | **Physical State:** Liquid **Appearance:** clear, colorless **Odor:** sweet, fruity odor - ethereal odor | Causes respiratory tract irritation. Causes eye and skin irritation. May be harmful if swallowed. May cause central nervous system depression. May cause cancer based on animal studies. May cause cardiac disturbances. Light sensitive. This substance has caused adverse reproductive and fetal effects in animals. | **ACGIH:** 10 ppm TWA | 11.42eV | **pH:** Not available. **Vapor Pressure:** 160 mm Hg @ 20 deg C **Vapor Density:** 4.12 (Air=1) **Viscosity:** 0.58 cps @ 20 deg C **Solubility:** Slightly soluble. **Specific Gravity/Density:** 1.492 (Water=1) **LEL:** NA | Monitor vapors as part of the respiratory protection program. **Eyes:** Wear appropriate protective eyeglasses or chemical safety goggles. **Skin:** Wear appropriate protective gloves to prevent skin exposure. **Clothing:** Wear appropriate protective clothing to prevent skin exposure. |

| Chemical Name | Physical Description | Health Effects | TLV/PEL* 8-hr TWA | Ionization Potential | Physical Properties | Special Precautions |
|---|---|---|---|---|---|---|
| Chlorobenzene | **Physical State:** Liquid **Appearance:** clear, colorless **Odor:** mild odor - almond-like | May cause eye and skin irritation with possible burns. May be harmful if swallowed. May cause blood abnormalities. May cause severe respiratory and digestive tract irritation with possible burns. May cause central nervous system depression. May cause lung damage. May cause liver and kidney damage. May cause adverse reproductive effects based upon animal studies. | **ACGIH:** TWA 10 ppm TWA | 9.07 eV | **Flash Point:** 29.5 deg C (85.10 deg F) **Vapor Pressure:** 12 mm Hg @ 25 C **Vapor Density:** 3.9 **Evaporation Rate:**1 (butyl acetate=1) **Solubility:** Insoluble in water. **Specific Gravity/Density:** 1.107 @ 4C **LEL:** 13,000 ppm | **Flammable liquid and vapor.** Monitor vapors as part of the respiratory protection program. **Eyes:** Wear appropriate protective eyeglasses or chemical safety goggles. **Skin:** Wear appropriate protective gloves to prevent skin exposure. **Clothing:** Wear appropriate protective clothing to prevent skin exposure. |
| 1,2-Dichloroethane | **Physical State:** Liquid **Appearance:** colorless **Odor:** chloroform-like | Causes respiratory tract irritation. Irritant. Causes eye and skin irritation. May be harmful if swallowed. May cause central nervous system depression. May cause cancer based on animal studies. May cause liver and kidney damage. | **ACGIH:** TWA 10 ppm TWA | 11.05 eV | **Flash Point:** 56 deg F. **Vapor Pressure:** 100 mm Hg @29 deg C **Vapor Density:** 3.4 (Air=1) **Evaporation Rate:**6.5 (Butyl acetate=1) **Viscosity:** Not available. **Solubility:** Insoluble. **Specific Gravity/Density:** 1.25 (Water=1) **LEL:** 62,000 ppm | **Flammable liquid and vapor.** Monitor vapors as part of the respiratory protection program. **Eyes:** Wear chemical goggles. **Skin:** Wear appropriate protective gloves to prevent skin exposure. **Clothing:** Wear appropriate protective clothing to prevent skin exposure. |

| Chemical Name | Physical Description | Health Effects | TLV/PEL* 8-hr TWA | Ionization Potential | Physical Properties | Special Precautions |
|---|---|---|---|---|---|---|
| Diethyl ether | **Physical State:** Clear liquid **Appearance:** APHA: 10 max **Odor:** sweetish odor - aromatic odor | Breathing vapors may cause drowsiness and dizziness. Causes eye irritation. Repeated exposure may cause skin dryness or cracking. Aspiration hazard if swallowed. Can enter lungs and cause damage. May be harmful if swallowed. Hygroscopic (absorbs moisture from the air). May be habit forming. | **ACGIH:** 400 ppm TWA; 500 ppm STEL | 9.53 eV | **Flash Point:** -45 deg C. **Vapor Pressure:** 442 mm Hg @ 20 deg C **Vapor Density:** 2.55 (Air=1) **Solubility:** Slightly soluble. **Specific Gravity/Density:** <.7079 g/ml **LEL:** 19,000 ppm | **Extremely flammable liquid and vapor.** Vapor may cause flash fire. Air sensitive. Light sensitive. May form explosive peroxides. This material has been reported to be susceptible to autoxidation and therefore should be classified as peroxidizable. Monitor vapors as part of the respiratory protection program. **Eyes:** Wear chemical goggles. **Skin:** Wear appropriate protective gloves to prevent skin exposure. **Clothing:** Wear appropriate protective clothing to prevent skin exposure. |

| Chemical Name | Physical Description | Health Effects | TLV/PEL* 8-hr TWA | Ionization Potential | Physical Properties | Special Precautions |
|---|---|---|---|---|---|---|
| Methylene Chloride | **Physical State:** Liquid **Appearance:** colorless **Odor:** ethereal odor - chloroform-like | Methylene chloride is metabolically converted to carbon monoxide after systemic absorption, which yields increased concentrations of carboxyhemoglobin in the blood. Harmful if swallowed. Causes eye, skin, and respiratory tract irritation. May be harmful if inhaled. May cause central nervous system effects. Potential cancer hazard. May cause kidney damage. This substance has caused adverse reproductive and fetal effects in animals. | **OSHA Final PEL:** 25 ppm TWA (8 hr); 125 ppm STEL (15 min); 12.5 ppm Action Level | 11.32 eV | **Flash Point:** Not applicable. **Vapor Pressure:** 350 mm Hg @ 20 deg C **Vapor Density:** 2.93 (Air=1) **Evaporation Rate:**Not available. **Viscosity:** Not available. **Solubility:** Slightly soluble. **Specific Gravity/Density:** 1.33 (Water=1) **LEL:** 130,000 ppm | **Personal Protective Equipment** Monitor vapors as part of the respiratory protection program. **Eyes:** Wear chemical goggles. **Skin:** Wear appropriate protective gloves to prevent skin exposure. **Clothing:** Wear appropriate protective clothing to prevent skin exposure. |
| Toluene | **Physical State:** Liquid **Appearance:** colorless **Odor:** sweetish odor - pleasant odor - benzene-like | Causes eye, skin, and respiratory tract irritation. Breathing vapors may cause drowsiness and dizziness. May be absorbed through intact skin. Aspiration hazard if swallowed. Can enter lungs and cause damage. Possible risk of harm to the unborn child. May cause central nervous system depression. | **ACGIH:** 50 ppm TWA; skin - potential for cutaneous absorption | 8.82 eV | **Vapor Pressure:** 28.4 mm Hg @ 25 deg C **Vapor Density:** 3.1 (Air=1) **Evaporation Rate:**2.4 (Butyl acetate=1) **Viscosity:** 0.59 cps @ 20 deg C **Solubility:** Insoluble. **Specific Gravity/Density:** 0.86 (Water=1) **LEL:** 11,000 ppm | **Flammable liquid and vapor. Eyes:** Wear chemical goggles. Monitor vapors as part of the respiratory protection program. **Skin:** Wear appropriate protective gloves to prevent skin exposure. **Clothing:** Wear appropriate protective clothing to prevent skin exposure. |

| Chemical Name | Physical Description | Health Effects | TLV/PEL* 8-hr TWA | Ionization Potential | Physical Properties | Special Precautions |
|---|---|---|---|---|---|---|
| 1,1,2,2-Tetrachloroethane | **Physical State:** Liquid **Appearance:** clear colorless to pale yellow **Odor:** chloroform-like | Harmful if swallowed. Lachrymator (substance which increases the flow of tears). May cause eye and skin irritation. May cause respiratory and digestive tract irritation. May cause central nervous system depression. May cause cancer based on animal studies. Air sensitive. May cause liver damage. | **ACGIH:** 1 ppm TWA; skin - potential for cutaneous absorption | 11.10 eV | **Flash Point:** Not applicable. **Vapor Pressure:** 6.6 mbar @ 20 C **Vapor Density:** 5.79 **Solubility:** 1g/350ml (25 C) **Specific Gravity/Density:** 1.5860 **LEL:** NA | Monitor vapors as part of the respiratory protection program. **Eyes:** Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166. **Skin:** Wear appropriate gloves to prevent skin exposure. Wear impervious gloves. Wear an impervious apron. **Clothing:** Wear appropriate protective clothing to minimize contact with skin. Wear an impervious apron. |

| Chemical Name | Physical Description | Health Effects | TLV/PEL* 8-hr TWA | Ionization Potential | Physical Properties | Special Precautions |
|---|---|---|---|---|---|---|
| Trichloroethene | **Physical State:** Liquid **Appearance:** clear, colorless **Odor:** sweetish odor - chloroform-like | Causes eye and skin irritation. Aspiration hazard if swallowed. Can enter lungs and cause damage. May cause central nervous system depression. Potential cancer hazard. May cause liver damage. | **ACGIH:** 50 ppm TWA; 100 ppm STEL | 9.45 eV | **Flash Point:** Not applicable. **Vapor Pressure:** 58 mm Hg @20C **Vapor Density:** 4.53 **Solubility:** Insoluble in water. **Specific Gravity/Density:** 1.47 (water=1) **LEL:** 80,000 ppm | Monitor vapors as part of the respiratory protection program. **Eyes:** Wear appropriate protective eyeglasses or chemical safety goggles. **Skin:** Wear appropriate protective gloves to prevent skin exposure. **Clothing:** Wear appropriate protective clothing to prevent skin exposure. |
| Vinyl Chloride | **Physical State**:gas **Appearence**: colorless **Odor**:faint odor, sweet odor | Causes eye and skin irritation. Can enter lungs and cause damage. May cause central nervous system depression. Potential cancer hazard. | **OSHA:** 5 ppm TWA | 9.99 eV | **Flash Point**:-108 F (-78 C) **Vapor Pres**:2515.6 mmHg @ 21.1 C **Vapor Density**:2.2 **Specific Gravity**:0.9106 **LEL:** 36,000 ppm | Monitor vapors as part of the respiratory protection program. **Eyes:** Wear appropriate protective eyeglasses or chemical safety goggles. **Skin:** Wear appropriate protective gloves to prevent skin exposure. **Clothing:** Wear appropriate protective clothing to prevent skin exposure. |

| Chemical Name | Physical Description | Health Effects | TLV/PEL* 8-hr TWA | Ionization Potential | Physical Properties | Special Precautions |
|---|---|---|---|---|---|---|
| Dimethylphthalate | **Physical State:** Liquid **Appearance:** colorless to light yellow **Odor:** ester-like - weak odor | May cause eye irritation. May cause respiratory tract irritation. | **ACGIH:** 5 mg/m3 TWA | 9.64 eV | **Flash Point:** 295e deg F **Vapor Pressure:** .0015 mm Hg @ deg 20 **Vapor Density:** 6.69 (air=1) **Solubility:** 0.4% (20 C) in water. **Specific Gravity/Density:** 1.19 **LEL:** 9,000 ppm | Monitor vapors as part of the respiratory protection program. **Eyes:** Wear chemical goggles. **Skin:** Wear appropriate gloves to prevent skin exposure. **Clothing:** Wear appropriate protective clothing to minimize contact with skin. |
| Isophorone | **Physical State:** Liquid **Appearance:** clear pale yellow **Odor:** peppermint odor - camphor | Causes eye and respiratory tract irritation. May be harmful if swallowed or absorbed through the skin. May cause cancer based on animal studies. | **ACGIH:** 5 ppm Ceiling **OSHA PEL:** 25 ppm TWA; 140 mg/m3 TWA | 9.07 eV | **Flash Point:** 84 deg C (183.20 deg F) **Vapor Pressure:** Not available. **Vapor Density:** 4.8 (air=1) **Solubility:** Slightly soluble in water. **Specific Gravity/Density:** 0.9200 **LEL:** 8,000 ppm | **Combustible liquid and vapor.** Monitor vapors as part of the respiratory protection program. **Eyes:** Wear chemical goggles. **Skin:** Wear appropriate protective gloves to prevent skin exposure. **Clothing:** Wear appropriate protective clothing to prevent skin exposure. |

| Chemical Name | Physical Description | Health Effects | TLV/PEL* 8-hr TWA | Ionization Potential | Physical Properties | Special Precautions |
|---|---|---|---|---|---|---|
| Phenol | **Physical State:** Liquid **Appearance:** colorless **Odor:** sweetish odor | May be fatal if inhaled, absorbed through the skin or swallowed. Causes eye and skin burns. Causes severe respiratory tract irritation with possible burns. Causes severe digestive tract irritation with possible burns. Mutagen. Readily absorbed through the skin. May cause central nervous system depression. May cause liver and kidney damage. | **ACGIH:** 5 ppm TWA; skin - potential for cutaneous absorption | 8.05 ev | **Flash Point:** 175e deg F ( 79.44 deg C) **pH:** 6 aqueous solution. **Vapor Pressure:** .35 mm Hg @25C **Vapor Density:** 3.2 **Solubility:** 6.75% in water **Specific Gravity/Density:** 1.0576 **LEL:** 18,000 ppm | Monitor vapors as part of the respiratory protection program. Air sensitive. Hygroscopic (absorbs moisture from the air). Light sensitive. **Eyes:** Wear appropriate protective eyeglasses or chemical safety goggles. **Skin:** Wear appropriate protective gloves to prevent skin exposure. **Clothing:** Wear appropriate protective clothing to prevent skin exposure. |
| | | | | | | |

*The TLV (Threshold Limit Value) from the American Conference of Governmental Industrial Hygienists is listed unless the PEL (Permissible Exposure Limit), designated by OSHA, is lower.

Comments:
Material Safety Data Sheets (MSDS) for the chemicals listed above are available in Attachment 4. Additional health and safety information can be obtained from your PHSM.

### Task Hazards and Control

A general summary of the hazards and an evaluation of those hazards are presented below. More detailed control procedures are provided in the appendices to this plan for each of the identified hazards. The appropriate appendix is listed next to the hazard.

| Task | Hazards | Appendix | Relative Hazard Rating* (Low, Medium, High) |
|---|---|---|---|
| All Tasks | Heat/Cold | C.1 | Medium |
| | Noise | C.2 | Medium |
| | Walking/working surfaces | C.3 | Medium |
| | Severe Weather | C.4 | Low |
| | Insects | C.5 | Low |
| | Heavy Equipment / Drill Rig | C.6 | Medium |
| | Trenching/excavation | C.7 | Medium |
| | Underground/Overhead Utilities | C8 | Medium (drilling and trenching) |
| | Hand/Power Tools | C.9 | Medium |
| | Lockout/Tagout Safety (LO/TO) | C.10 | Medium |
| | Drums and Containers | C.11 | Medium |
| | Decontamination | C.12 | Medium |
| | Lifting/Materials Handling | C.13 | Medium |
| | Chemical Hazards | See Chemical Hazard Information Table. MSDSs are in Attachment 4 | High |
| | Personal Safety | C.14 | Low |

***Relative Hazard Rating Scale**

| Hazard is/has… | Minimal health effects | Moderate health effects | Severe health effects |
|---|---|---|---|
| Rarely present | LOW | LOW | MED |
| Sometimes present | LOW | MED | HIGH |
| Constantly present | MED | HIGH | HIGH |

## F. Air Monitoring

This section specifies the monitoring equipment to be used on Site and the action levels to upgrade to higher levels of personal protection. All monitoring equipment will be maintained and calibrated in accordance with manufacturer recommendations. All pertinent monitoring data will be logged on the Real Time Air Monitoring Data Form (Attachment 5) and maintained on Site for the duration of project activities. Calibration of all monitoring equipment will be conducted **daily** and logged on the same form.

| Monitoring Equipment | Monitoring Frequency | Action Level | | |
|---|---|---|---|---|
| | | D → C | C → B | Stop Work |
| Photoionization Detector (PID) | Continuous during drilling, trenching and excavating in source areas. Continuous near product recover tank during O&M, repairs, and unloading/disposal activities.<br><br>When measurements of 1 ppm total VOCs are recorded in breathing space using PID, then check benzene concentrations using detector tubes | 10 ppm total volatile hydrocarbons (Also see detector tube criteria) | 25 ppm total volatile hydrocarbons (Also see detector tube criteria) | 50 ppm total volatile organic compounds in breathing space (Also see detector tube criteria) |
| Organic Vapor Analyzer (FID) | | | | |
| Detector Tubes (Benzene and 1,1,2,2 Tetrachloroethene) | One Benzene detector tube sample per hour while PID readings exceed 1ppm in breathing space | 1 ppm Benzene | 10 ppm Benzene | 25 ppm Benzene |
| Explosimeter | Not applicable | Not applicable | Not applicable | Not applicable. Work will stop due to potential toxicity before 10% LEL is reached for any compound |
| Combustible Gas Indicator | | | | |
| Carbon Monoxide Meter | | | | |
| Hydrogen Sulfide Meter | | | | |
| Oxygen Meter | | | | |
| Particulate Monitor | | | | |
| Personal Sampling Pumps | | | | |

## G. General Site Safety

The following general requirements apply to all on-site activities.

### Site Access and Control

The SSO will coordinate access and control security at the work Site. The SSO will establish a work area perimeter around the drill rig and/or other heavy equipment

during system installation activities (i.e., well installation, trenching activities, etc) at each drilling or trench location. The work area perimeter will be designated by traffic cones, barricades, signs, caution tape, or other means effective in identifying the work area. The lateral extent of the work zone will be determined by the SSO and will be established and modified as needed based on the current site hazards (total reach of excavation equipment, height of boom on drill rig, etc.).

Only authorized personnel will be allowed beyond the work area perimeter. Other site workers and visitors to the Site should be kept out of the work Site. If visitors need access to the Site, the SSO, or his/her designee, will escort the visitor at all times. All visitors will log in and out with the SSO. Visitor log sheets are included in Attachment 2.

If Level C PPE or greater is required on-site, the SSO will establish control boundaries for the Exclusion Zone, Contamination Reduction Zone, and the Support Zone. The zones will be designated by traffic cones, barricades, signs, caution tape, or other means effective in identifying the different areas. The zones will be identified by the SSO during tailgate meetings. Entrance and exit to the Exclusion Zone will only be through controlled access points established for each work area.

### Hazard Communication (HazCom)

All project required chemicals will be handled in accordance with OSHA 29 CFR 1910.1200 and ARCADIS-required procedures. The SSO will act as the HazCom Program Coordinator for the Site and will maintain the Master Inventory List (MIL) of hazardous chemicals kept on the job Site. The SSO will maintain Material Safety Data Sheets (MSDS) on Site for all chemicals. MSDS will be located **in the field truck on Site**. The SSO will communicate the location of the MSDS and the hazards associated with these chemicals to all project Site ARCADIS employees and subcontractors during the safety orientation. This information will be reviewed during tailgate briefings, especially if new chemicals or materials are introduced on Site.

The SSO will ensure that all containers of chemicals (including drums, bags, pails, tanks, vessels, etc.), are labeled appropriately: The contents of the container, the proper name of the chemical, associated hazards and appropriate hazard warnings, and the name and address of the manufacturer/importer. Chemicals will not be accepted or allowed on Site that are not properly labeled. If transferred to a secondary container, the new container will be labeled as described.

The SSO will ensure that the PPE necessary for work around the particular chemical is available and that project Site employee have been trained in its use.

The Project Manager will ensure that all project personnel have received Hazard Communication training as required in OSHA 29 CFR 1910.1200 (h).

### Personal Hygiene

Field personnel should avoid contact with potentially contaminated substances, such as puddles, pools, mud, etc. Monitoring equipment should not be placed on a potentially contaminated surface, including the ground surface.

Smoking, eating and drinking will not be permitted within any controlled work area at any time. Field workers will wash their hands and face after leaving any controlled work area prior to eating or drinking. Consumption of alcoholic beverages is prohibited at the Site.

### Site Awareness

All field crewmembers should remain alert for any indications of potentially dangerous situations, (e.g., strong, irritating, or nauseating odors; heavy equipment; conditions of an excavation; etc.).

Field crew members will be familiar with the physical characteristics and requirements of the work Site, including:

- Accessibility to equipment and vehicles
- Communication (i.e., methods, restrictions, or limitations)
- Hot zones (areas of known or suspected contamination)
- Site access
- Emergency procedures and evacuation assembly points
- Activities of other contractors and personnel on Site that may affect or be affected by tasks being performed
- Location of protective and emergency equipment and relevant first-aid procedures.

The number of personnel and equipment in controlled work areas should be minimized, consistent with Site operations. The SSO will review this information during the Site orientation and periodically during the tailgate meetings.

### Buddy System

All on-site personnel will operate using the buddy system whenever possible. If ARCADIS personnel must work alone, refer to the Personal Safety Module in Appendix C.

### Housekeeping

During Site activities work areas will be continuously policed for identification of excess trash and unnecessary debris. Excess debris and trash will be collected and stored in an appropriate container (e.g., plastic trash bags, garbage can, roll-off bin) prior to disposal. At no time will debris or trash be intermingled with waste PPE or contaminated materials. Additionally, project equipment and supplies will be kept in an orderly manner so as not to create a trip hazard.

### Communication

Effective communication is essential to safe working conditions and the successful completion of field projects. During on-site activities, cellular phones will be used by ARCADIS Site personnel to maximize communications with emergency response units. Active cellular telephone service will be confirmed from the Site prior to the initiation of work activities. In the event of a catastrophic event, any notice to evacuate will be given verbally by the SSO and via air horn or radio as appropriate. Communication details will be provided at the Site safety orientation.

Personnel in the project work area will attempt to remain in communication or within sight of the ARCADIS SSO or designee. The ARCADIS SSO will indicate the need to evacuate the Site by verbal command or through radio or telephone communication.

## H. Personal Protective Equipment

This section lists the equipment that must be present on the Site and used during the specified protection level. This checklist is used when preparing for the field, and is completed with the type of equipment to be worn based on the hazards present. **R** = Equipment required to be present on the Site. **O** = Optional equipment. Subcontractors must have the same equipment listed here as a minimum.

| Description (Put Specific Material or Type in Box) | Level Of Protection | | |
|---|---|---|---|
| | D | C | B |
| **Body** | | | |
| Coveralls | O | O | NA |
| Chemical Protective Suit (include type in cell, e.g., Tyvek.) | O (Tyvek) | R (Tyvek) | NA |
| Splash Apron | O | O | NA |
| Rain Suit | O | O | NA |
| Traffic Safety Vest (reflective) | O | O | NA |
| **Head** | | | |
| Hard Hat (if does not create other hazard) | R | R | NA |
| Head Warmer (depends on temperature and weather conditions) | O | O | NA |
| **Eyes & Face** | | | |
| Safety Glasses (incorporate sun protection as necessary) | R | R | NA |
| Goggles (based on hazard) | O | R | NA |
| Splash Guard (based on hazard) | O | O | NA |
| **Ears** | | | |
| Ear Plugs | R | R | NA |
| Ear Muffs | O | O | NA |
| **Hands and Arms** | | | |
| Outer Chemical Resistant Gloves (Use when potential for direct contact with free product exists) | O Low | R (Polyvinyl alcohol or Viton) | NA |
| Inner Chemical Resistant Gloves (Nitrile) | R | R | NA |
| Insulated Gloves | O | O | NA |
| Work Gloves | O | O | NA |
| **Foot** | | | |
| Safety Boots (steel toe and shank) | R | R | NA |
| Rubber, Chemical Resistant Boots | O | O | NA |
| Rubber Boots | O | O | NA |
| Disposable Boot Covers | O | O | NA |
| **Respiratory Protection** | | | |
| 1/2 Mask APR | NA | NA | NA |
| Full Face APR | NA | R (Organic Vapor Cartridge) | NA |
| Dust Protection | O | NA | NA |

| Description (Put Specific Material or Type in Box) | Level Of Protection | | |
|---|---|---|---|
| | D | C | B |
| Full Face Canister APR | NA | NA | NA |
| Powered APR | NA | NA | NA |
| Air Line/SCBA | NA | NA | R |
| **Other Supplies** | | | |
| First Aid Kit | R | R | NA |
| Fire Extinguisher | R | R | NA |
| Mobile Phone | R | R | NA |
| Walkie Talkies | O | O | NA |
| Water or Other Fluid Replenishment | R | R | NA |
| Eye Wash Station | O | O | NA |
| Eye Wash Bottle | R | R | NA |
| Wash and Dry Novelettes | O | O | NA |
| Sunscreen (SPF 15 or higher) | O | O | NA |
| Insect Repellant | O | O | NA |
| | | | NA |
| | | | |

## I. Decontamination Procedures

Personnel and equipment leaving the Exclusion Zone will be decontaminated. Level C and D decontamination protocols as necessary based on hazards present will be used with the following decontamination stations:

| Level C Decontamination Steps | | Level D Decontamination Steps | |
|---|---|---|---|
| 1 | Equipment Drop | 1 | Equipment Drop |
| 2 | Outer Garment, Boots, and Glove Wash and Rinse | 2 | Glove and Boot Wash and Rinse |
| 3 | Disposable Garment, Boots, and Glove Removal | 3 | Disposable Garment, Outer Boot, and Glove Removal |
| 4 | Cartridge Change (if necessary) | 4 | Field Wash |
| 5 | Remove Respiratory Protection | | |
| 6 | Field Wash | | |

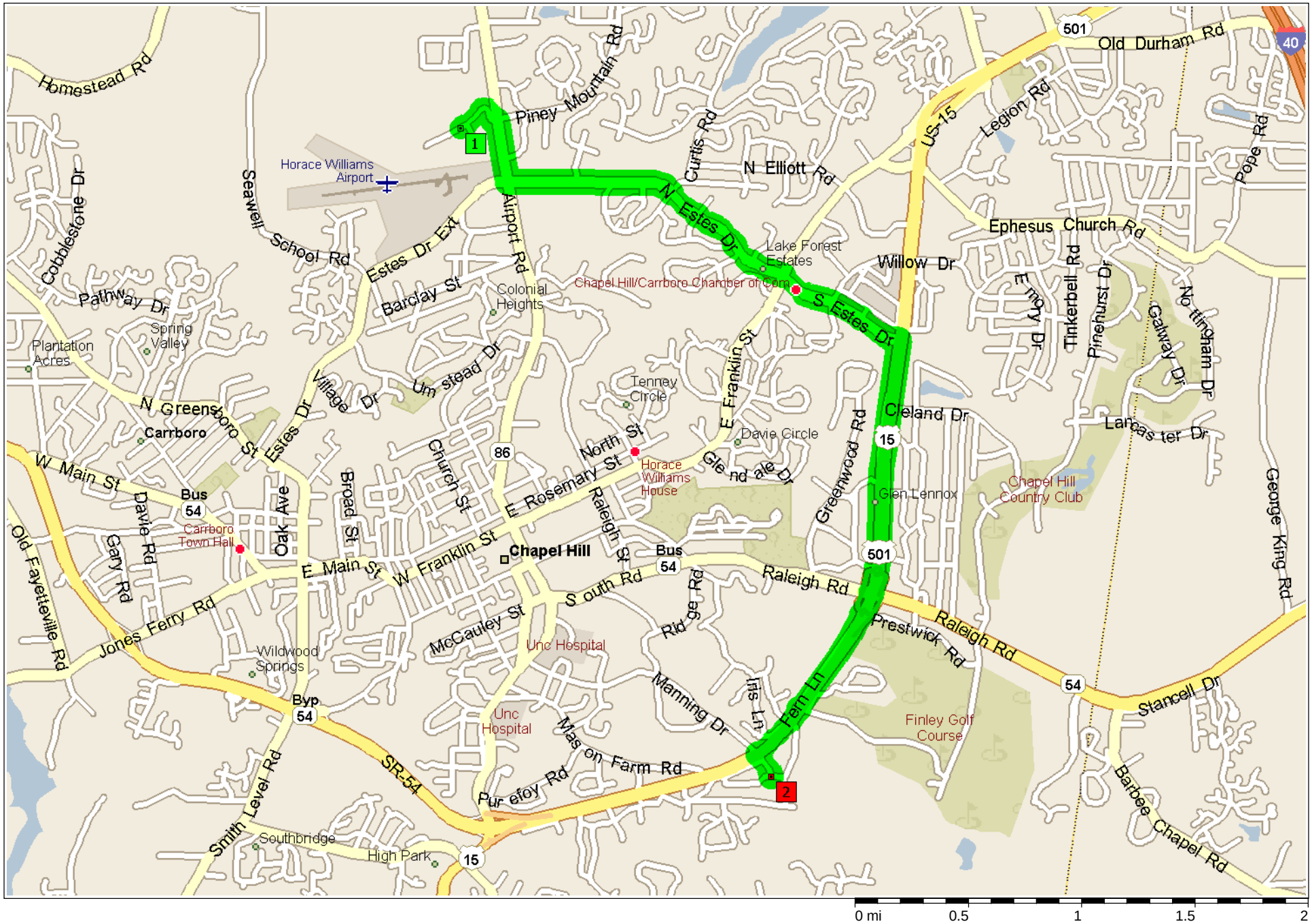
Place an X by all decontamination equipment that is required at the Site.

| Decontamination Equipment Checklist | | | |
|---|---|---|---|
| | Scrub Brushes | | Garbage Bags |
| | Waste Containers | | Paper Towels |
| | Soap | | Isopropyl Alcohol |
| | Plastic Tubs | | Pump Spray Bottles |
| | Plastic Drop Cloths | | Pump Spray Bottles (water) |
| | | | |

## J. Summary: Air Monitoring, Levels of Protection, and Decontamination by Project Task

| Project Task | Level of Protection | Air Monitoring Requirements | Decontamination Procedures | Modifications |
|---|---|---|---|---|
| Task 1: Installation of a groundwater remediation system | D (or C during drilling and well installation, as appropriate) | Continuous during drilling and recovery well installation | D or C | |
| Task 2: System operation and maintenance and groundwater monitoring | D (or C during work near air stripper, as appropriate) | Continuous during work near air stripper | D or C | |
| Task 3: Deconstruction of recover system | D | None | D | |
| | | | | |
| | | | | |
| | | | | |

Figure 1. Route to hosptal.

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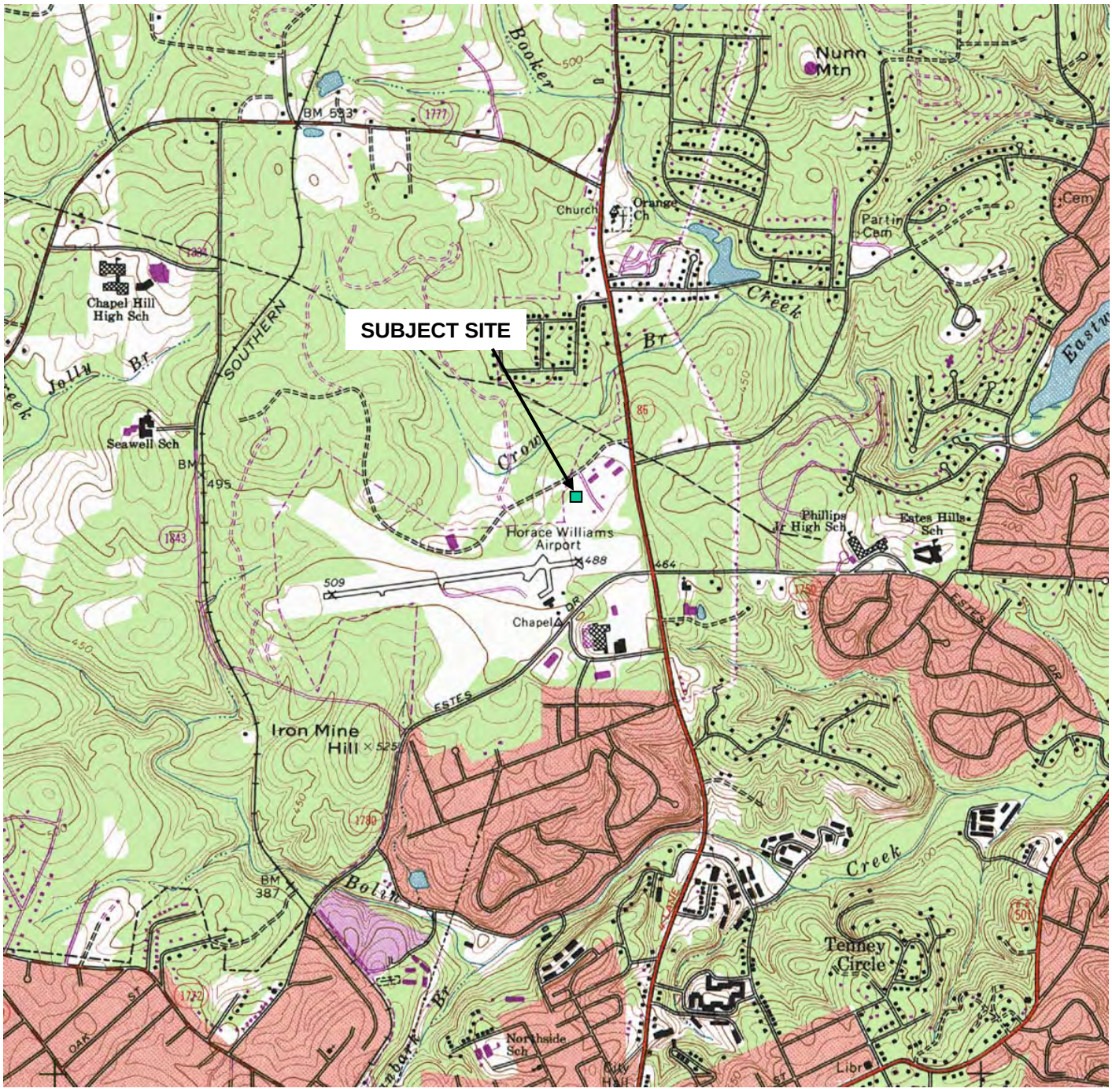


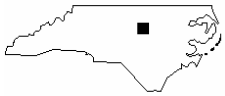

QUADRANGLE LOCATION

SCALE 1:24,000

0 2000 4000

SCALE IN FEET

CONTOUR INTERVAL 10-FOOT DATUM IS MEAN SEA LEVEL

SOURCE: TOPOGRAPHY TAKEN FROM USGS 7.5 MINUTE QUADRANGLE CHAPEL HILL 1967 (PHOTOREVISED 1988), NC MAP

N

ARCADIS
801 Corporate Center Drive,
Suite 300
Raleigh, NC 27607
919-854-1282
*Infrastructure, buildings, environment, communications*

| REV. | DRAWING DATE: | ACAD FILE: |
|---|---|---|
| | 02/11/05 | |

## SITE LOCATION

| | | |
|---|---|---|
| **CLIENT:** THE UNIVERSITY OF NORTH CAROLINA AT CHAPEL HILL | | **PM:** JES |
| **LOCATION:** UNC AIRPORT ROAD WASTE DISPOSAL AREA CHAPEL HILL, NORTH CAROLINA | | **PE/RG:** |
| **DESIGNED:** | **DETAILED:** JAP | **PROJECT NO:** NC000239.0013 | **FIGURE:** 2 |

# Appendix A

Definitions

| Term or Acronym | Definition |
|---|---|
| Confined space | Any enclosed area not designed for human occupancy that has a limited means of entry and egress. |
| DOT | Department of Transportation – specifies the proper and legal methods of shipping and transporting hazardous materials by highway, railway, and by sea in the USA. |
| HASP | Health and Safety Plan |
| IATA | International Air Transportation Association - specifies the proper shipment of hazardous materials by air internationally. Many of these regulations are incorporated by reference in the US DOT regulations. |
| Ionizing radiation | Any one of several types of particles and rays given off by radioactive material, high-voltage equipment, and nuclear reactions. The types that are normally important to your health are alpha particles, beta particles, x rays, and gamma rays. |
| Level B | A level of protection that requires personal protective equipment including chemically resistant body coverings and supplied air respiratory protective equipment |
| Level C | A higher level of protection than Level D, requiring some sort of air purifying respirator |
| Level D | The minimum amount of personal protective equipment ensemble to be worn on a project Site. It does not include respiratory protection. |
| LO/TO | Lockout/Tagout – a procedure which isolates equipment from energy sources, such as electricity or stored pneumatic energy, by locking and tagging out energy isolating devices. |
| Mutagen | A chemical that causes changes in the genetic material of living cells. |
| Nonionizing Radiation | Electromagnetic energy such as ultraviolet, laser, infrared, microwave, and radio. |
| Oxidizer | A material that releases oxygen and supports combustion. |
| PEL | Permissible Exposure Limit – an airborne exposure limit set by the U.S. Occupational Safety and Health Administration |
| PHSM | Project Health and Safety Manager |
| PPE | Personal Protective Equipment |
| Sensitizer | A material which, upon exposure, causes a bodily response (i.e. irritation) that increases in severity upon each subsequent exposure. |
| SPCC | Spill Prevention, Control, and Countermeasures – EPA rule that attempts to prevent oil from entering the national waterways. |
| SSO | Site Safety Officer |
| TLV | Threshold Limit Value – an airborne exposure limit set by the American Conference of Governmental Industrial Hygienists |
| | |

## Appendix B

Training and Orientation

## Training and Safety Orientation

### Training Requirements

For information on training requirements, please refer to the Health and Safety Training Matrix located on the Health and Safety page of "The Resource".

### Site Specific Safety Orientation

Health and safety orientation will be an on-going activity during the project and will consist of a variety of techniques to ensure that every member of the ARCADIS team is fully aware of and understands the health and safety mission, goals, and targets and all applicable H&S procedures. These techniques include:

- Initial Project H&S Orientation
- Daily Tailgate Safety Briefings, Safety Huddles or Tool Box talks
- Weekly H&S Reviews
- Visitor H&S Orientation
- Other H&S sessions as necessary

All project team members will be required to attend the Initial Project H&S Orientation which will include a review of the project activities, H&S Plan, Emergency procedures, Site procedures, Site security (if applicable), project organization and communications, personal protective equipment, and Site work areas. This orientation will be presented by the Project H&S Manager and the Project Manager with all other project management staff in attendance. All participants will be required to sign in to show proof of their attendance. Any new team member will be required to attend this orientation prior to beginning work on the Site.

At the start of each day, each project team supervisor and H&S officer will lead a safety huddle, tailgate briefing (see Attachment 3) or tool box talk which will include, as applicable:

- Review the day's activities;
- Review of the hazards associated with the work;
- Protective controls required for the day's activities;
- Review of the equipment, permits, and air monitoring requirements for the planned activities; and

- Other critical information the project H&S manager and other H&S team members feel is required.

Participants will all be required to sign in for these sessions to ensure they record their attendance and understanding.

Weekly H&S reviews will be held with team members to review the previous week's activities and H&S performance, and this meeting will take the place of that day's safety huddle, tailgate or toolbox meeting. During this meeting, the project team will have open discussions about the previous week's activities, the effectiveness of the H&S plan, changes to H&S procedures, a review of the week's planned activities, an analysis of the hazards associated with those activities, and a review of the procedures established to control those hazards. All attendees will be required to sign in to record their attendance and understanding.

All visitors who are authorized to enter the Site, will be required to attend a visitor orientation session which will be presented by the SSO. While all visitors will be escorted by a trained, designated ARCADIS team member, visitors will be oriented to Site procedures regarding hazard control, emergency procedures, Site work zones and prohibited areas, and other information specific to the reasons the visit is being made.

The Project H&S Manager or Project Manager has the authority to call safety meetings or orientation at any time. The subject of these sessions will vary based on the reasons resulting in the meeting. However, all of these sessions will be documented in meeting minutes with a full list of attendees and signatures.

## Appendix C

Safety Modules (referenced in Section E of the Task Hazards and Control)

## C.1 Heat

### Heat Stress

Heat stress can be a significant hazard, especially for workers wearing protective clothing. Depending on the ambient conditions and the work being performed, heat stress can occur very rapidly, within as little as 15 minutes. Site personnel will be instructed in the identification of a heat stress victim, the first-aid treatment procedures for the victim and the prevention of heat stress incidents. Workers will be encouraged to immediately report any heat-related problems that they experience or observe in fellow workers.

During breaks, workers should be encouraged to drink plenty of water or other liquids to replace lost fluids and to help cool off.

Any worker exhibiting signs of heat stress and exhaustion should be made to rest in a cool location and drink plenty of water. Emergency help by a medical professional is required immediately for anyone exhibiting symptoms of heat stroke, such as red, dry skin, confusion, delirium or unconsciousness. Heat stroke is a life threatening condition that must be treated by competent medical authority.

#### Prevention

Whenever possible or within the control of ARCADIS, engineering controls should be utilized to protect workers from heat related hazards. For example, isolation from the heat source, ventilation such as open windows, fans or other methods of creating air flow, and heat shielding such as awnings or umbrellas.

Appropriate work practices can also lessen the chances of heat related hazards. Some of these include:

- Water intake should be about equal to the amount of sweat produced (i.e., drinking 5-7 ounces of water every 15-20 minutes).
    - Electrolyte fluids may also be necessary.

- Whenever possible, gradual exposure to heat is preferred.

- Whenever possible, adjust the work schedule. For example, postpone nonessential or heavier work to another day or a cooler part of the day.
- Whenever possible, rotate personnel.
- Increase the number and/or duration of rest breaks, but do not increase individual work periods when longer and/or more rest breaks periods are given.

    - Whenever possible, rest break areas should be in a cool area and as close to the work area as is feasible.

PPE is available, such as thermally conditioned clothing including self-contained air conditioning in a backpack and plastic jackets/vests with pockets that can be filled with dry ice or ice. However, the type of work being done, other required PPE, and where the work is being done may prohibit or make the use of this PPE impossible or impractical.

## Heat-Related Illnesses

The following guidance can be used in the identification and treatment of heat related illness.

**Heat Stress**: This is the mildest heat-related illness, but prompt action may prevent a more severe heat-related illness. Symptoms include irritability, lethargy, significant sweating, headache or nausea.

First Aid:

- Take the victim to a protected (e.g., shaded) area, remove any excess protective clothing, and provide cool fluids.
- If an air-conditioned spot is available, this is an ideal break location.
- Once the victim shows improvement he/she may resume working, however the work pace and practices (e.g., does fluid intake need to be increased) should be moderated to prevent recurrence of the symptoms.
-

**Heat Exhaustion**: Usually begins with muscular weakness, dizziness, nausea, and a staggering gait. Symptoms include pale, clammy skin, and profuse sweating, vomiting, and the bowels may move involuntarily. The pulse is weak and fast, breathing is shallow. Fainting can occur.

First Aid:

- Immediately remove the victim from the work area to a shady or cool area with good air circulation (avoid drafts or sudden chilling – you do not want the victim to shiver).
- Call a physician or emergency service, or transport the victim to medical care.
- Remove all protective outerwear.
- If the victim is conscious, it may be helpful to give him/her sips of water.

**Heat Stroke**: Heat stoke is a severe medical condition requiring first aid and emergency treatment by a medical professional as death can occur without appropriate care. Heat Stroke represents the collapse of the body's cooling mechanisms. As a result, body temperatures often rise to between 105°-110°F. As the victim progresses toward heat stroke symptoms include hot and usually dry, red and spotted skin, headache, dizziness, nausea, mental confusion, delirium, possible convulsions and loss of consciousness.

First Aid:

- Immediately remove the victim from the work area to a shady or cool area with good air circulation (avoid drafts or sudden chilling - you do not want the victim to shiver).
- Summon emergency medical help to provide on-site treatment and transportation to a medical facility.
- Remove all protective outerwear and loosen personal clothing.
- Give no stimulants or hot drinks.
- Apply cool wet towels, ice bags, etc. to the head, armpits, and thighs. Sponge off the bare skin with cool water or rubbing alcohol, if available, or even place the victim in a tub of cool water.
    - The main objective is to cool without chilling the victim or causing him/her to shiver.

### Skin Hazards

Sunburn and prickly heat are both symptoms of skin irritation/damage produced through exposure to sunlight and operating in hot work environments.

- Protect exposed skin with an appropriate sunscreen. A sunscreen with a sun protection factor (SPF) of 15 or greater is required for work in the sun with reapplication at breaks and lunch.
- Heat rash, also known as prickly heat, can be prevented by the application of a hydrophobic, water repellent barrier cream such as Kerodex 71.

## Cold Stress

The four environmental conditions that cause cold-related stress are low temperatures, high/cool winds (wind chill), dampness or cold water. One, all or a combination of these factors can cause cold-related hazards. Cold stress, including frostbite and hypothermia, can result in severe health effects. Exposed skin is highly susceptible to wind chill and low temperatures.

Engineering controls should be utilized whenever possible to protect workers from cold related hazards. For example, on-site heat sources, heated shelter, work areas shielded from drafty or windy conditions, and the use of thermal insulating material on equipment handles.

Effects arising from cold exposure will be minimized by the following control measures:

- Personnel will be trained to recognize cold stress symptoms.
- Field activities will be curtailed or halted if the equivalent chill temperature is below $20^{\circ}$ F.
    - As much as possible, work that exposes personnel to the cold will be done during the warmest hours of the day.
    - Inactivity in cold conditions will be kept to a minimum.

- Frequent short breaks in warm, dry shelters will be taken.
- Vehicles will be equipped with supplies in case the vehicle becomes inoperable (e.g., blanket, dry clothing, water, food, a shovel, etc.).

The following PPE will be provided during work in cold environments

- Workers will be provided with insulated dry clothing when the equivalent chill temperature is less the 30° F.
- Feet, hands, the face, and the head should be protected (40% of the body's heat can be lost when the head is exposed).
    - Foot and hand wear may also need to be waterproof.

- Clothing should be layered so that adjustments can be made to changing environmental temperatures and conditions. For example, an outer layer to break the wind, a middle layer that will absorb sweat and retain insulation when wet, and an inner layer that allows ventilation.

## Cold-Related Illnesses

**Hypothermia**: Hypothermia occurs when the body temperature falls to a level where normal muscular and cerebral functions are impaired. Although it usually occurs in freezing air and water temperatures, it can occur in any climate if a person's temperature falls below normal. Symptoms should not be ignored and a supervisor, or whomever is available, should be notified as soon as hypothermia is suspected.

Initially, symptoms may include shivering, an inability to do complex motor functions, sluggishness and mild confusion as the body temperature drops to around 95° F. As the body temperature falls, speech may become slurred and behavior may be irrational, simple motor functions may be difficult to do and a state of "dazed consciousness" may exist. In severe states (below 90° F), heart rate, blood flow and breathing will slow. Unconsciousness and full heart failure can occur.

First Aid**:**

**On land:**

- Call for emergency help and move the victim (unless other injuries prohibit their being moved) to a warm, dry area and replace wet clothing with warm, dry clothing or a blanket. Move the person carefully because movement can increase the irritability of the heart.
- If the person is conscious and lucid, warm liquids can be provided but **not** alcohol or caffeinated drinks. If possible, have them to move their arms and legs to create muscle heat.
- If the person is unconscious or unable to assist, place warm bottles/packs in the person's arm pits, groin, neck and head areas.
- **Do not** rub the person's body or place them in warm water.

**In water** (the body loses heat up to 25 times faster than on land):

- Call for emergency help and get the victim out of the water. Move the person carefully because movement can increase the irritability of the heart.
- **Do not** remove clothing- button, buckle, zip and tighten collars, cuffs, shoes and hoods as the water trapped next to the body provides a layer of insulation that may slow the loss of heat.
- If it is you in the water, **do not** swim unless a floating object or person can be reached quickly as swimming uses the body's heat and reduces survival time by about 50%.

  - If you are in the water and is not possible to get out, conserve body heat by folding arms across the chest, keeping thighs together, bending knees and crossing ankles. If another person is in the water with you, huddle together.

**Frostbite:** Frostbite occurs when the skin actually freezes, and deep frostbite can affect deeper tissues such as tendons and muscles. Frostbite usually occurs when temperatures drop below 30° F, but wind chill effects can cause frostbite at above-freezing temperatures. The ears, fingers, toes, cheeks and nose are the most commonly affected body parts.

Initially, symptoms include an uncomfortable sensation of coldness. Tingling, stinging or an aching feeling of the exposed area is followed by numbness. Frostbitten areas appear white and cold to the touch and with deeper frostbite, the area becomes numb, painless and hard and can turn black.

First Aid:

- Seek medical attention as soon as possible and treat any existing hypothermia first.
- Warm liquid can be provided, but **not** alcohol or caffeinated drinks such as tea and coffee.
- **Do not** rub the affected areas, but cover them with dry, sterile gauze or soft, clean bandages.
- **Do not try rewarming the affected area if you have not been specifically trained to do so** and/or if there is a chance the affected area will get cold again.

**Trench Foot:** Trench Foot is caused by a continuous exposure to a wet, cold environment. Symptoms include tingling and/or itching sensation, burning pain and swelling and, in more extreme cases, blisters.

First Aid:

- Seek medical attention as soon as possible and move the victim to a warm, dry area.
- Affected tissue can be treated with careful washing and drying, slight elevation. **Do not try rewarming the affected area if you have not been specifically trained to do so.**

## Cold Stress Monitoring

Monitoring for cold stress is difficult and will be completed by the SSO by monitoring for symptoms and the weather conditions on a daily basis.

## C.2 Noise Exposure

OSHA generally considers any environmental condition where a person must shout to be heard from a distance of 3 feet, a hazardous noise environment. Under these conditions, personnel must be protected through the use of appropriate hearing protective devices.

Hearing protection shall be worn:

- In any situation where normal conversation cannot be heard at a distance of 3 feet regardless of the source of the noise or where noise levels as measured with approved noise monitoring equipment is above 85 dBA.

- When operating gasoline or electric powered machinery.

- When working within 25 feet of operating heavy equipment (earth working equipment, etc.) as working around this type of equipment can result in exposure to hazardous levels of noise (levels greater than 90 dBA).

    - Earplugs or earmuffs will be worn.

The PHSM may also choose to monitor employee exposure to potentially hazardous noise levels. Additional site-specific hearing conservation information is presented in Appendix E – CHSP-18 "Hearing Conservation Procedure".

## C.3 Walking/Working Surfaces

Hazards from floor and wall openings, and from careless movements, protruding objects, debris, spills, placement of materials on paths or foot traffic areas, present a problem with regard to slips, trips, falls, and puncture wounds. If any such hazards are identified, correct them immediately and if that is not possible, report the hazard to your Site Safety Officer or Project Manager as soon as possible.

### Slip, Trip and Fall Hazards

Personnel should stay alert at all times and if tired or distracted, take this into account when working at the site. To minimize the possibility of injury:

- 8" sturdy work boots with good tread are required and steel toed boots are recommended.

- Don’t run.
- Slide feet when walking on slick/wet surfaces.
- Don’t walk up or down steep embankments/hills if possible.
    - If not possible, walk at an angle when going up/down embankments/hills.

- Don’t carry items that block your vision.
- Use handrails/grips when available and maintain 3-point contact whenever possible.
- Don’t jump down from equipment and look down before you step down.
- Use appropriate fall protection when working at elevation.
- Report any floor openings that are not clearly marked and/or guarded to the SSO or Project Manager.
- Don’t use ladders/scaffolds during high winds or when ice or snow is on the rungs/work surface.
- Don’t use ladder substitutes like a box or truck fender, and don’t use ladders/scaffolding that is not in good condition.
- Keep paths and work areas clear of tools, equipment, boxes, cords, etc. Tape or secure cords, wires, etc. to minimize trip/fall hazard.
- If a protruding object can not be moved, make sure the object can be easily seen or guard/pad the object if possible.
- Use ancillary lighting such as flashlights & headband lights when necessary.

## C.4 Severe Weather

During threatening weather, the SSO will monitor radio weather forecasts and heed any warnings. In addition, in the event of lightning in the vicinity of the site, the SSO will stop all activities and have site personnel take cover. Other severe weather such as high winds, hail or heavy rain will be evaluated by the SSO, PHSM and the Task Manager to determine how site activities should proceed.

## C.5 Insects

Care will be taken by all site workers to avoid stinging or biting insects such as ticks, spiders, bees, wasps, hornets, and yellow jackets. Workers allergic to any particular insect sting or bite should seek medical attention if stung or bitten and may need to carry emergency medicine prescribed by their doctor.

Care should always be taken to avoid these insects and increased vigilance is necessary:

- During high infestation seasons;
- When opening protective casings of monitor wells; and
- When walking through areas of heavy vegetation or areas known to be infested.

To minimize the chance of bites/stings:

- Wear appropriate PPE:
- Light colored clothing so you can see insects;
    - Long pants and boots with pants tucked into boots;
    - Long sleeves when possible;
    - A hat; and
    - Gloves if you are cutting brush or need to handle or move vegetation.

- Check your body and clothing for insects, shower after work and wash/dry clothes at as high temperature as possible.
- Don't swat at insects and don't eat in areas where there are insects.
- Avoid sweet smelling personal hygiene products and, unless contraindicated by the work being performed (e.g., sampling, data collection); and
- Wear EPA approved repellants such as those containing DEET.

Spider bites generally cause only localized reactions such as swelling, pain, and redness. However, bites from a Black Widow or Brown Recluse or if you are allergic to spiders, can cause more serious symptoms. If nausea, vomiting, difficulty breathing or swallowing occurs, medical attention should be sought immediately. Otherwise, clean the bite area with soap and water or alcohol and place a cold pack over the bite area.

Ticks are common, especially in the warmer weather months and may carry diseases such as Rocky Mountain Spotted Fever and Lyme Disease. If a tick is found on the body:

- Use a fine tipped tweezers, grasp tick firmly as close to skin as possible and pull the body away from skin. Avoid crushing the body and don't twist.

- If tick mouth parts remain in skin, don't be alarmed as the mouth will dislodge as skin sloughs off.

- Wash the area with soap and water and apply antiseptic or antibiotic ointment to prevent infection.

- If unexplained symptoms develop such as severe headaches, fever, or rash within 10 days of the bite, seek medical attention.

Mosquitoes are common, especially in areas with standing water and in damp, humid environments in the warmer months, and generally appear between dusk and dawn.

## C.6 Heavy Equipment / Drill Rig Safety

This project will utilize heavy equipment on Site. All Site personnel will be made aware of equipment that will be used on Site during Tailgate meetings or Project Safety training. ARCADIS personnel should, under no circumstances, operate or ride on heavy equipment which is being used by a subcontractor. Site personnel will maintain a safe distance of at least 20 feet, or more as dictated by the SSO, from all heavy equipment in operation.

If activities warrant closer proximities to operating equipment, such as air monitoring, personnel will don brightly colored vests and a second person will watch over the first to keep him/her out of the path of equipment while performing the required activity. Eye contact with the equipment operator will be maintained.

## Drill Rig Safety

Although ARCADIS personnel do not operate or have control over the operation of drilling equipment, it is every employees responsibility to recognize potential or existing hazards related to drill rigs and to **walk away from any unsafe operation**.

### General Requirements

Working within the vicinity of operating drill rigs poses unique safety situations such as high pressure hazards from hoses, pipes or the well, and gas releases. Also, other hazards may be present such as falls from elevation, electrical contact, improper machine guarding. Therefore, given the potential hazards, it is important for some type of preliminary site survey to be completed prior to ARCADIS employee involvement.

It is critical to confirm that the client or contractor has had all utilities located and marked, and there should be documentation on site that verifies that this has been done.

### Preliminary Site Survey

Depending upon the work to be done by ARCADIS personnel, a preliminary site field survey may need to be performed prior to ARCADIS involvement in drilling operations. If this is the case, the drill rig supervisor or lead driller should accompany the ARCADIS staff member if possible. The survey should include verification that utilities and any hazardous buried material or structures have been located and

marked and that the nearest emergency facility has been provided. It may also include information on safe access to the drilling areas, hazards on-site, location of a clean water source and weather conditions and related shelter areas.

### Employee Restrictions and Responsibilities

Under no circumstances will an ARCADIS employee operate a drilling rig or portion thereof, or any piece of contractor equipment. In addition, employees will not:

- Guide a drill rig to a drill location, assist in the movement of equipment or participate in the movement or breaking down of any portion of the rig.
- Climb on the rig, stand too close to the rig (especially its moving parts), stand below or close to a pipe hoist, walk on drilling rods or casing, or walk on the edge of a mud pit.
- Watch a driller arc-weld.
- Smoke while at a drilling rig site.
- Refuel an engine while it is still running or hot, siphon gasoline, or park near a rig exhaust.
- Wear loose fitting clothing or PPE in the vicinity of the drill rod or stem.

ARCADIS employees will not place tools, meters, etc. in a position that could create a fall, trip or slip hazard. As much as is possible, employees will work with the appropriate site personnel to ensure the area in the vicinity of the drill rig is clean, orderly and free of slip, trip and fall hazards.

If the drilling is being done at a hazardous waste site, the PPE requirements will be followed as noted in the site health and safety plan. Clean water will be kept available for decontamination, washing, and dust control. Kneeling, lying in or sitting on contaminated ground or materials must be avoided or a protective barrier must be used.  Avoid or minimize handling of contaminated materials.

**HEAVY EQUIPMENT CERTIFICATION REQUIREMENTS**

**Initial Equipment Inspection Checklist**

TO: DATE:

FROM:

Project Name:

Project Location:

1. This form provides certification of machinery and mechanized equipment to be used on the referenced project for the following work:

| | |
|---|---|
| Description of equipment work: | |
| Project Site: | |
| Owner of equipment:<br>Address: | |
| Dates (duration) of equipment work: | |

2. Inspection and certification of machinery and mechanized equipment, as required by ARCADIS Project Team has been made prior to, but within seven calendar days advance of, use on the project site. Re-certification will be required for equipment that is used on the project site for more than one year.

| Identification of equipment (make, model, serial no.) | | Date of Certification |
|---|---|---|
| 1 | | |
| 2 | | |
| 3 | | |

3. The above listed equipment has been inspected and tested as indicated above, and is CERTIFIED TO BE IN SAFE OPERATING CONDITION BY THE FOLLOWING COMPETENT INDIVIDUAL:

| | | | |
|---|---|---|---|
| Name | | Title | |
| Company | | | |
| Signature | | Date | |

4. If there are any questions regarding this certification, please contact the following ARCADIS Project Team representative: _____.

**DAILY HEAVY EQUIPMENT INSPECTION CHECKLIST**

EQUIPMENT I.D. NO:_____

EQUIPMENT NAME: _____

DATE: ____/____/_____ PROJECT #: _____ CONTRACT #: _____

| ITEM INSPECTED | Inspectors Initials |
|---|---|
| Falling Object Protective Structure (FOP) | |
| Roll-Over Protective Structure (ROP) | |
| Seat Belts | |
| Operators Seat Bar(s) | |
| Side Shields, Screens or Cabs | |
| Lift Arm Restraining Device | |
| Grab Handles | |
| Back Up Alarm(s) – Working | |
| Lights | |
| Guards | |
| Horn | |
| Anti-Skid Tread Steps Clear of Mud | |
| Safety Signs (Counterbalance swing area) | |
| Fire Extinguisher (arrow in green, monthly inspection) | |
| General Condition | |
| Fuel Condition | |
| Oil (Full, No Leaks) | |
| Clear of Extra Materials | |
| Controls Function Properly | |
| Damaged Parts | |
| Hydraulic System (Full, No Leaks) | |
| Parking Brake | |
| Lift Arm and Bucket | |
| Tires/Tracks | |
| Steering | |
| Hours at Time of Inspection | |
| Time Inspected | |
| Site Name | |
| Inspectors Name (Printed) | |

INSTRUCTIONS – Inspect all applicable items indicated each shift prior to use. Note any unsatisfactory conditions on the back of this sheet and bring to the attention of the supervisor immediately. Operators are required to sign in on this sheet the first time that they operator the equipment each day.

## C.7 Trenching/Excavation

### Trenching and Excavation Safety

All trenching and excavation operations will be accomplished in accordance with requirements of 29 CFR 1926.650. The following safe operating guidelines apply to open trenches or excavations exceeding four (4) feet in depth **or** of any depth if in unstable soil conditions, as required by 29 CFR 1926.650. An excavation is any man-made cut, cavity, trench, or depression in an earth surface, formed by earth removal; a trench is a narrow excavation (in relation to its length) made below the surface of the ground.

#### Excavation Construction Guidelines

The following requirements are minimum requirements and must be met before any personnel are permitted to enter any excavation.

- Excavated materials will be stored and retained at least 2 feet from the edge of the excavation (Note: This procedure must be observed even when excavation/trench entry will not occur).
- Trees, boulders, and other surface encumbrances that create a hazard will be removed or made safe before excavation is begun.
- Special precautions will be taken in sloping or shoring the sides of excavations adjacent to a previously backfilled excavation.
- Except in hard rock, excavations below the level of the base of the footing of any foundation or retaining wall will not be permitted unless the wall is underpinned and all other precautions have been taken to ensure the stability of the adjacent walls.
- All ladders used in excavation operations will be in accordance with the requirements of 29 CFR 1926 Subpart L.
- Excavations will be inspected at least daily, or more often as conditions warrant, by a competent person to ensure that changes in temperature, precipitation, shallow groundwater, overburden, nearby building weight, vibrations, or nearby equipment operation has not caused weakening of sides, faces, and flows. The SSO will accompany the competent person and document this inspection in the daily safety log.
- Diversion ditches, dikes, or other suitable means will be used to prevent water from entering an excavation and for drainage of the excavation.
- When mobile equipment is used or allowed adjacent to excavations, stop logs or barricades will be installed. The grade will always be away from the excavation.
- Dust conditions during excavation will be kept to a minimum. Wetting agents shall be used upon the direction of the SSO.

- Field personnel shall not enter any excavation, without specific direction, for any reason except to rescue injured individuals who have fallen into the excavated area.
- All excavations will be marked and protected at all times to ensure site personnel, visitors, or unauthorized personnel do not enter without permission or fall into the trench.
- Personnel will work in pairs when working around an excavation of 2' or more.

## Trench Entry Requirements

The following requirements must be met before any personnel are permitted to enter any excavation.

- Expected hazardous ground movement areas and banks more than four (4) feet high (or less if soil is deemed unstable by the competent person) shall be shored, laid back to a stable slope, shielded, or equivalent.
- Sides of trenches or excavations in unstable or soft material four (4) feet or more in depth (or less if soil is deemed unstable by the competent person) shall be shored, sheeted, braced, sloped, or equivalent.
- Sides of excavations in hard compact soil, including embankments, are shored or otherwise supported when the trench is four (4) feet or more in depth (less if soil is deemed unstable by the qualified person).
- Materials used for sheeting, sheet piling, bracing, shoring, and underpinning shall be in good, serviceable condition.
- A means of egress (ladder, ramps, stairways, etc.) shall be accessible at any location inside the excavation without requiring more than 25 feet of lateral travel distance.
- Additional precautions by way of shoring and bracing shall be taken to prevent slides or cave-ins when the competent person subjects excavations to vibrations as deemed necessary.

## Atmosphere & Testing

Also, before an employee enters an excavation greater than four (4) feet in depth (or less if soil is deemed unstable by the competent person), the atmosphere must be tested to ensure that an oxygen deficient or hazardous atmosphere does not exist. If the concentration of any airborne contaminant exceeds one-half its permissible exposure limit (PEL) or other applicable occupational exposure limit (OEL), the airborne oxygen concentration is less than 19.5 percent, or explosivity exceeds ten percent of the lower explosive limit (LEL), then no personnel shall be permitted to enter the excavation

until such engineering controls or other hazard controls are instituted to eliminate or control hazard.

## C.8 Above ground and Underground Utilities

Various forms of underground and aboveground utility lines or pipes (carrying water, wastewater, gas and or electricity) may be encountered during work activities. Prior to the start of intrusive operations activities, all utilities must be located and measures must be instituted to avoid contact with these structures. All utility line and or piping will be identified and rendered controlled (through lockout/tagout procedures) or protected from damage.

Should any operations cause equipment to come into contact with utility lines, the SSO and the PHSM will be notified immediately and an Incident Report will be completed. Work will be suspended until the appropriate actions for the particular situations can be taken.

Work involving machinery with high extensions (backhoes, etc.) in vicinity of overhead power lines shall not be conducted within the limits prescribed in the table below. The distance may be lengthened if directed by the client or the electric company and any specified distances will be strictly followed.

Safe distances from overhead power lines are as follows:

| Voltage range (phase to phase, RMS) | Approach distance (inches) |
|---|---|
| 300 V and less | Avoid contact |
| Over 300V, not over 750V | 12 |
| Over 750V not over 2 kV | 18 |
| Over 2 kV, not over 15 kV | 24 |
| Over 15 kV, not over 37 kV | 36 |
| Over 37 kV, not over 87.5 kV | 42 |
| Over 87.5 kV, not over 121 kV | 48 |
| Over 121 kV, not over 140 kV | 54 |

*From 1910.238(b)(7)(iii)*

A utilities location checklist is attached and may be used to verify that all utilities have been marked.

**Instructions.** This checklist may be used as a safety measure to insure that all underground utility lines, other underground structures as well as above-ground power lines are clearly marked out in the area selected for boring or excavation. **DRILLING OR EXCAVATION WORK MAY NOT PROCEED UNTIL LINES ARE MARKED AND THIS CHECKLIST HAS BEEN COMPLETED.**

Arrangements for underground utility markouts are best made at the time of the preliminary site visit to allow client and/or utility company sufficient time. Keep completed checklist and maps on site; send copy to Project Manager.

**Assignment of Responsibility.** Client is responsible for having underground utilities and structures located and marked. Preferably, the utilities themselves should mark out the lines.

**Drilling or Excavation Sites.** Attach a map of the property showing the proposed drilling or excavation site (or if sites are widely separated, several maps) clearly

indicating the area(s) checked for underground utilities or underground structures and the location of above-ground power lines.

**UTILITIES AND STRUCTURES CHECKLIST**

| **Project:** | **Prepared By:** |
|---|---|
| **Location:** | **Date:** |

**Utilities and Structures**

| **Type** | **Not Present** | **Present** | **How Marked** |
|---|---|---|---|
| Petroleum products line | | | |
| Natural gas line | | | |
| Steam line | | | |
| Water line | | | |
| Sewer line | | | |
| Storm drain | | | |
| Telephone cable | | | |
| Electric power line | | | |
| Product tank | | | |
| Septic tank/drain field | | | |
| Overhead power line | | | |

**Name and affiliation of person who marked out underground lines or structures**

_____ _____ _____

Name Organization Phone

## C.9 Hand and Power Tools

The use of hand and portable power tools during site activities is a potential source of accidents. A fundamental program of using the right tool in a correct manner together with proper maintenance and storage is necessary to prevent personal injury and property damage.

The following procedures should be used when performing operations involving portable hand and power tools:

- Protective eyewear will be worn.
- Guards are not to be removed or rendered inoperative, unless written permission is obtained from the Health and Safety Professional.
- Only personnel who have been appropriately trained in the use, operation and proper handling of hand and portable power tools will be permitted to do so.
    - The SSO will ensure that only trained personnel perform work activities with portable hand and power tools.
- Each type of portable hand or power-operated tool should be operated using the manufacturers recommended operating procedures.
    - Where the manufacturer has not developed specific operating procedures, only personnel familiar with the safe operating procedures of that equipment should be permitted to operate it.
- The SSO should conduct periodic inspection of hand and portable power tools that are used at the PROJECT. Inspections should include both powered and non-powered equipment.

Any damaged, worn, or improper tool should be removed from service immediately and remain out of service until it is repaired or replaced

## C.10 Lockout/Tagout Safety (LO/TO)

This section establishes the minimum requirements for lockout of energy sources that could cause injury to personnel due to unexpected energizing, start-up, or release of stored energy during the operation, repair, or maintenance of equipment or a process. This process may be required when maintenance is required on pumps or other electrical or energized equipment on site. While it is anticipated that much of the energized equipment will be connected to the power source with electrical cords to a generator, this equipment will be protected during maintenance or repair by unplugging them from the power source and tagged to ensure that they are not inadvertently plugged in during the repair period.

Where complexity of the equipment/process requires a more comprehensive procedure, it will be developed and included as part of the site-specific safety guidance document. Only authorized employees will perform the lockout procedure. All authorized employees will receive training in recognition of the applicable hazardous energy sources and in adequate methods and means for their isolation. Employees authorized to perform lockout will be certain as to which switch, valve, or other energy-isolating devices apply to the equipment being locked out. More than one energy source (electrical, mechanical, etc.) may be involved and project management will clear any questionable identification of sources.

## Instructions

The following lockout procedures shall be observed:

- Notify all affected employees of the need and requirement for a lockout.
- Shut down operating equipment by normal stopping procedures (depress stop button, open toggle switch, etc.).
- Make sure power sources (electrical, mechanical, hydraulic, etc.) are disconnected or isolated from the equipment. Stored energy, such as that in capacitors, springs, elevated machine members, rotating flywheels, hydraulic systems, and air, gas, steam, or water pressure, etc., must also be dissipated or restrained by methods such as grounding, repositioning, blocking, bleeding down, etc.
- Lockout the energy-isolating devices with an assigned individual lock. If the device(s) cannot accommodate a lock, contact the SSO to approve any alternate methods of protection or warning (e.g., tagout, barricade, etc.).
- After ensuring that no personnel are exposed, and to ensure that all energy sources have been disconnected, operate the push button or other normal operating controls to make certain the equipment will not operate.

**CAUTION:**
**Return Operating Control To Neutral Position After The Test**

### Restoring Equipment to Service

When the operation is complete and equipment is ready for testing or normal service, check the equipment area to see that no one is exposed. When the equipment is all clear, remove all locks. The energy-isolating devices may be operated to restore energy to equipment.

**SPECIAL CAUTION:**
**When Restoring Pressurized Air To An Equipment/Process**
**Keep all personnel clear of machine pinch points**

### Procedure Involving more than One Person

If more than one individual is involved in the work operation-requiring lockout, each person involved will separately place his/her locking device on the energy isolating control, or a multi-person locking device attachment will be used. In no case will a single lockout device serve multiple individuals. Prior to re-energizing of the equipment, all involved personnel will have properly removed their locks. Removal by one person of any lockout device belonging to the other will require specific permission of the SSO and the Task Manager, and is permissible only where it can be positively established that the owner of the device is not present on the PROJECT.

## C.11 Use of Drums and Containers

OSHA defines "anything that holds hazardous chemicals except pipes and piping systems" as a container (48 FR 228 p. 53335). OSHA does not concern itself with non-hazardous materials; however, that does not mean that drums or containers containing non-hazardous materials cannot cause injury to workers. Examples of non-hazardous materials stored in drums and containers would include a drum of molasses rolling or falling and striking a worker.

### Training

Prior to any movement of drums or containers containing hazardous materials or otherwise posing a threat to the safety of employees, all employees are required to be informed of the potential hazards associated the contents of the drums or containers. As applicable, additional activities requiring appropriate training of employees include:

- Sampling procedures
- Communication methods

- Methods for relieving pressure from drums and containers or for shielding when pressure cannot be relieved from a remote location
- Emergency response to accidents on site.
- Characterization of wastes to be bulked, and
- Use of monitoring equipment.

## Labeling of Drums and Containers

Drums and containers shall be identified and classified prior to packaging for shipment.

## Procedures for Handling Drums and Containers

### A. Handling Drums and Containers

Where containers of capacity greater than 5 gallons are used for containerizing chemical products or waste materials, handling of the containers will be accomplished in accordance with the following:

- When not in use, drums/containers will be covered with tight fitting lids.
- At the conclusion of each work shift all drums/containers will be placed in a designated storage area. This area will be properly marked and secured.
- Mechanical or powered drum handling equipment will be used to move "filled" drums/containers. Manual handling of the drums leads to musculo-skeletal injuries and will be avoided to the maximum extent possible.

### B. Opening Drums and Containers

Only a couple of pounds of "built up" pressure to cause a loosened fitting to fly into the air like a rocket. This projectile can cause injury to site workers, and can puncture adjacent containers or drums, causing rupture and leakage. If the drum or container is filled to or near the level of the opening, material can spew from the opening causing injury to site personnel, formation of hazardous/flammable atmospheres at the work site and/or environmental damage. The procedure for opening of drums and containers needs to incorporate the minimum safeguards listed below:

- Employees not actually involved in the opening of the drum or container must be kept a safe distance from the drum or container during the process of opening it.

- Where there is the reasonable probability of a flammable atmosphere being present or developing on site, all equipment and tools must be of a type to prevent sources of ignition (non-sparking, explosion proof, intrinsically safe) and grounding/bonding of containers needs to be considered.
- If the pressure within a drum or container cannot be relieved from a remote location, the employee opening the drum or container needs to be protected by an appropriate shield to reduce the risk of injury.
- Drums and containers are not stepladders. Employees are not allowed to stand on or work off of drums or containers.
- Material handling equipment used to move drums and containers needs to selected, positioned and operated in a manner that minimizes the potential for the equipment to act as a source of ignition in the event that a drum or container should rupture.
- When a drum or container exhibits signs of over-pressurization such as swelling or bulging, the drum or container is not to be moved until the cause of the over-pressurization has been determined and proper containment procedures have been implemented.
- It is necessary to limit the number of areas where drums and containers are staged in order to identify and classify them.
- Areas where drums and containers are staged need to be provided with adequate routes for access and egress from the staging area.

## Use of Approved Drums or Containers

Drums and containers are required to meet the appropriate DOT, OSHA and EPA regulations for the materials that they contain. Large containers or drums shall carry either a DOT approval or a nationally recognized testing laboratory approval or both. The use of approved drums and containers provides some assurance that the drum or container will not fail due to incompatibility with the stored material and that the drum or container is structurally suitable for designated duty.

## Drum Condition

The following apply to the assessment of drum condition:

- When practical, drums and containers must be inspected and their integrity assured prior to being moved. Drums and containers that cannot be inspected prior to being moved due to storage conditions (i.e. buried, in a pile, stacked several tiers high, etc.) must be moved to an accessible location and inspected prior to further handling.

- Drums and containers that cannot be moved without risk of rupture, leakage or spillage must be emptied into a sound container using a device classified (i.e. intrinsically safe or explosion proof for the class of flammable material) for use around the material being transferred.
- Drums and containers are to be opened in a manner that safely relieves excess internal pressure.
- If crystalline material is noted on any container, the contents of the container are to be handled as a shock-sensitive waste until positive identification of the contents determines otherwise.

### Other Considerations

Unlabeled drums and containers must be considered to contain hazardous substances and are to be handled accordingly until positive identification of the contents has been made.

Polyethylene drums and containers are not equipped with a means for electrical grounding. When transferring flammable materials, the polyethylene container (or any other container for that matter) needs to be equipped with a mechanism that allows for grounding. A grounded suction pump (approved only) or a grounded metallic self-closing faucet can be used to accomplish safe transfer of flammable materials from these containers.

Where leaking drums or containers may be present, or ruptures or spills may occur, U.S. DOT specified salvage drums or containers must be available on site along with suitable quantities of an appropriate absorbent material.

## C.12 Decontamination

All personnel and equipment entering any controlled work area (see Section 10.0 for description of work zones) must be adequately decontaminated prior to exiting the area. The procedures should be adopted for site-specific decontamination procedures.

### Personnel Decontamination

Decontamination procedures must be carried out on all personnel who have been in contact with contaminated materials. Under no circumstances (except emergency evacuations) will personnel be allowed to leave a controlled work area where contaminants are exposed without performing decontamination.

Decontamination of personnel should be performed at a Personal Decontamination Station on the PROJECT and should consist primarily of soap and water washing and water rinse of exterior protective gear to remove contaminants, followed by doffing of the gear. Coveralls should be

removed by turning the clothing inside out. A procedure appropriate to the degree of contamination should be established. The extent of washing required, or modifications to the sequence, may be specified as appropriate.

The designated decontamination areas will be located between the lines, which mark the boundaries of the exclusion Zone (EZ) and the Contamination Reduction Zone (CRZ). This configuration will ensure that all personnel and equipment leaving the clean side of the decontamination area will be entering the Support Zone (SZ) which will be considered a contaminant free area.

### Level D Personnel Decontamination

Personnel exiting the Exclusion Zone while site activities require the use of Level D PPE will perform decontamination in the designated decontamination area in accordance with the following guidelines:

- Place tools, instruments, samples and trash at an appropriate location. The equipment drop area should be clean and dry and at a minimum, plastic bags should be available for trash. Waste PPE will not be placed in the same containers as general trash.
- Inspect equipment, samples, and if applicable, tools for signs of residual amounts of contamination or excessive soil buildup. If present, soils and contamination must be completely cleaned off of equipment, samples, and tools prior to removal from the decontamination areas back into the support zone.
- Personnel will visually check themselves for signs of excessive soils and possible contamination. If observed, soils and contamination will be completely removed before further decontamination is performed.
- Prior to exiting the decontamination areas, personnel will wash their hands with soap and water in order to minimize the potential for contaminant exposure from the final handling of equipment and PPE.

## Modified Level D Personnel Decontamination

Where activities are performed in Modified Level D PPE personnel will perform decontamination using the following guidelines:

- Place tools, instruments, samples and trash at an appropriate location. The equipment drop area should be clean and dry and at a minimum, plastic bags should be available for trash. Waste PPE will not be placed in the same containers as general trash.

- Inspect equipment, samples, and if applicable, tools for signs of residual amounts of contamination or excessive soil buildup. If present, soils and contamination must be completely cleaned off of equipment, samples, and tools prior to removal from the decontamination areas.
- Personnel will visually check themselves for signs of excessive soils and possible contamination. If observed, soils and contamination will be completely removed before further decontamination is performed.
- Untape wrists and ankles.
- Remove outer work gloves and place in an appropriate container specified for waste PPE.
- Remove outer Tyvek coveralls and place them in an appropriate container specified for waste PPE.
- Remove inner protective gloves and place them in an appropriate container specified for waste PPE.
- Wash hands using soap and water (separate from other decontamination cleaners/solutions).

## Level C Personnel Decontamination

Personnel involved in activities that require the use of Level C PPE will observe the following decontamination guidelines:

- Place tools, instruments, samples and trash at an appropriate location. These areas should be clean and dry, and at a minimum contain plastic bags for trash. Waste PPE will not be placed in the same containers as general trash.
- Inspect equipment, samples and if applicable, tools for signs of residual amounts of contamination or excessive soil buildup. If present, soils and contamination must be completely cleaned off of equipment, samples and tools prior removal from the decontamination areas. Personnel will visually check themselves for signs of excessive soils and possible contamination. If observed, soils and contamination will be completely removed before further decontamination is performed.
- Untape wrists and ankles.
- Remove outer work gloves and place them in an appropriate container specified for waste PPE.
- Remove outer Tyvek coveralls and place them in an appropriate container specified for waste PPE.
- Wipe off and remove respirator mask (also goggles if worn).

- Remove inner protective gloves and place them in an appropriate container specified for waste PPE.
- Wash hands using soap and water (separate from other decontamination cleaners/solutions).

### Equipment Decontamination

Heavy equipment used for this project is expected to contact hazardous substances as defined by HAZWOPER and therefore, will require decontamination procedures. Proper decommissioning procedures of heavy equipment will be instituted by the SSO.

### Decontamination During Emergencies

Often during emergencies the need to quickly respond to an accident or injury must be weighed against the risk to the injured party from chemical exposure. It may be that the time lost or the additional handling of an injured person during the decontamination process may cause greater harm to the individual than the exposure that would be received by undressing that person without proper decontamination.

An additional consideration to include when bypassing decontamination of injured personnel is the acceptance of contaminated personnel at emergency medical facilities. Many facilities will not accept contaminated personnel. Site response personnel should accompany contaminated victims to the medical facility to advise on matters involving decontamination.

### Disposal of Decontamination Wastes and PPE

Disposal of waste associated with the project will be handled in accordance with the specification for each identified contaminant. The SSO will determine the disposal requirements as the situation arises.

## C.13 Lifting

#### Summary

Lifting, carrying and lowering objects represents a potential physical hazard to ARCADIS personnel. Therefore, it is every employee's responsibility to think before moving any object and to realistically evaluate the object to determine if the weight of the object exceeds the employee's ability to lift, move or carry it. To eliminate or minimize the risk of lifting hazards, reasonable

effort should be made to utilize proper techniques and, where necessary, a helper or mechanical aid such as hand trucks and carts will be used.

ARCADIS does not recommend the use of backbelts as these devices are not recognized by OSHA or NIOSH as an approved form of personal protective equipment when lifting. If they are used, proper lifting techniques will be followed.

### General Considerations Prior to Lifting, Lowering or Carrying Objects

Think before moving any object. Objects should be realistically evaluated to determine if the weight of the objects exceeds the employee's ability to move the object. Objects should always be lifted, lowered and carried as close to the body as possible. Mechanical aids like hand trucks and carts or the buddy system should be used to move heavy objects, objects with poor hand holds or large bulky objects. Some other things to consider:

- Evaluate the object for the presence of any physical hazards such as pinch points, sharp or jagged edges, burrs or rough and slippery surfaces.
- The route in which the object will be moved should be free of obstructions which could cause difficulty in moving the object.
- If an object is stored at a level higher than five feet or on the floor, an appropriate mechanical device may be necessary to move the object.
- Recognized lifting hazards should be designed out of the work process whenever possible.

### Lifting, Lowering and Carrying Objects

The following sections point out basic techniques that are meant to reduce the potential physical hazard from lifting, carrying or lowering an object.

#### Lifting and Lowering Objects

Proper lifting and lowering techniques should be followed even if the object or material to be lifted is of lighter weight. Keep the object as close to the body as possible and:

- Establish a firm footing with feet at approximately shoulder width and one foot slightly ahead of the other. This posture will aid in keeping good balance and will establish a stable lifting base.

- Always bend at the knees, not at the waist when lifting or lowering an object. Keep your back as straight and upright as possible.
- Obtain a good secure grip on the object.
- When beginning to lift, tighten your stomach muscles and use your legs to lift the object as leg muscles are generally stronger than back muscles.
- Lift slowly and smoothly.
- If you need to turn as you lift, do not twist at the waist but instead pivot with the feet.

When lowering the object, reverse the procedure.

### Carrying Objects

When carrying objects, evaluate the route to assess if there are any obstructions in your path. If so, move the obstruction if you can do so safely, and if that is not possible, select another route. Also, assess for other hazards such as stairs before you move the object and consider smaller loads with multiple trips as a safe alternative. Keep the object as close to the body as possible and:

If possible, face the direction in which the object is to be carried prior to lifting the object.

Never twist the body when carrying an object, always pivot with the feet.

Maintain a secure grip take small steps and move slowly.

Objects should not be so large and bulky as to obstruct vision.

### Non-Powered Hand Trucks

Non-powered hand trucks should be used whenever feasible to move heavy objects, objects with poor hand holds or large bulky objects. Some things to consider are:

- Keep the center of gravity of the load as low as possible, and place heavy objects below lighter ones.
- Place the load where the weight of the load will be carried by the axle not the handles, and where it will not slip, shift or fall during movement.
- Load only to height which will allow a clear view ahead. Only walk backwards with a hand truck in specific instances such as when going up an incline.

- When going down an incline the hand truck should be in front of the operator and when going up an incline it should be downhill from the operator.
- Move the hand truck at a safe speed.

## C.14 Personal Safety

If there are issues of personal safety at a project site, resources such as the client, local law enforcement officials, Park or Wildlife Service, and Animal Control will be utilized as necessary to ensure the safest possible work environment. Some general guidelines are provided here, but each situation is different and actions must be taken based on the specifics of each.

### Personal Safety

If it is deemed that a work site is in an area where an employee's personal safety may be at risk from potential criminal acts, the PM or SSO will work with the client and local law enforcement officials to evaluate the risk and determine what steps can be taken to minimize the risk. For example, can local law enforcement be present or make frequent drive-bys while the work is being done, should outside security be hired, should work only occur during certain times of the day, or should work not proceed at all.

In areas of risk such as this and if work proceeds, employees will not work alone and will have the ability to communicate with local law enforcement and the PM through cell phones or 2-way radios. Employees will check-in with the PM (or other specific individual) at predetermined times throughout each work day, and if employees do not call in, the PM will attempt to contact the team. If unsuccessful, the PM will notify local law enforcement.

If while on the project site and despite the other precautions set forth, an employee feels that their personal safety is at risk from potential criminal acts, the employee should leave the site immediately if possible and report their concerns to the PM or SSO so that appropriate steps can be taken as described above

### Project Site In Isolated Area and Employees Working Alone

Whenever possible, employees will not work alone in isolated areas. If the isolated area involves hiking/walking into areas that are unmarked or if there is potential to become directionally disoriented (e.g., no trails, unmarked trails, forested or highly vegetated areas), employees will be trained on the use of a compass and trail/topography maps and, if necessary, will take wilderness

safety training. The PM or SSO will work with the Park/Wildlife service on what emergency planning is necessary (e.g., unexpected weather, animal attack, and search/rescue).

Communication through cell phones or 2-Way Radios will be utilized whenever possible. In addition, if employees are unable to check in on a daily basis because of the project location and cell phones or 2-Way Radios do not work, consider the use of some type of transponder or GPS locator device that can be used to locate the team if necessary.

Employees will check-in with the PM (or other specific individual) at predetermined times throughout each work day and if employees do not call in, the PM will attempt to contact the team. If unsuccessful, the PM will notify the appropriate authorities. In addition, and especially if communication is not possible during the day, the PM will know the planned start and estimated finish times and employees will check in with the PM at the end of the work day.

If employees will be moving from isolated area to isolated area, for each day that this will occur:

- There will be established beginning and ending locations;
- Planned start and estimated finish times; and
- Planned routes that will be followed throughout the day.

Employees will not deviate from this schedule without first contacting the PM. It may also be appropriate and necessary to notify the client, law enforcement or Park/Wildlife officials of these schedules.

The PM should also check with local authorities in regard to any hunting season that may be in session and if it is possible that hunters may be present in the area in which ARCADIS personnel will be working. If so, employees will wear brightly colored hardhats/hats and reflective vests, will not work before dusk and work will end 30 minutes before dusk, and employees will be advised to make lots of noise by talking loudly at regular intervals or carrying a radio to help ensure that they aren't mistaken for an animal/bird.

## Employees Working Late/Early Hours

Whenever possible, employees will not work before dusk and work will be completed before dark. If this is not possible, employees will wear appropriate reflective apparel and have appropriate lighting, such as portable lighting, flashlights, or headlamps as appropriate for the activity being conducted. Personal security will be assessed and measures taken as discussed above if appropriate.

## Attachment 1

HASP Addendum Pages

## Addendum Page

This form should be used to document any changes required to this HASP. These changes may be a result of changes to the scope of services, changes in field conditions, new hazards identified on the Site, higher or lower hazards than anticipated, etc. Please complete this form prior to the next work day once the changes have been identified. Review the modifications with all Site staff, including subcontractors, during the daily tailgate briefing, and complete the tailgate briefing form as required. Attach a copy of the addendum to all copies of the HASP including the Site copy.

Date of Changed Conditions: _____ Date of Addendum: _____

**Description of Change that Results in Modifications to HASP:**

_____

_____

_____

_____

_____

_____

**Describe in Detail the Changes Required to the HASP:**

_____

_____

_____

_____

_____

_____

_____

Signed: _____ Signed: _____

Project Manager Site Safety Officer

Signed: _____ Signed: _____

Project H&S Manager H&S Plan Reviewer

Make additional copies of this form as necessary.

## Attachment 2

Visitor Sign-In Log

## HASP Acceptance and Site Visitor Log

By signing below, I waive, release and discharge the Owner of the Site and ARCADIS G&M, Inc. and their employees from any future claims for bodily and personal injuries which may result from my presence at, entering, or leaving the Site and in any way arising from or related to any and all known and unknown conditions on the Site.

| Name | Company | Reason for Visit | Date/Time On Site | Date/Time Off Site |
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Make additional copies of this form as necessary.

## Attachment 3

Site Activities Tailgate Safety Briefing Sign-In Log

| ARCADIS | | | |
|---|---|---|---|
| **Site Activities Tailgate Safety Briefing Sign-in Log** | | | |
| **Project Number:** | | **Project Name:** | |
| **Date:** | | **Time:** | |
| **Briefing Conducted by:** | **Signature:** | **Company:** | |

This sign-in log documents the tailgate briefing conducted in accordance with the HASP. Personnel who perform work operations on Site are required to attend each briefing and to acknowledge receipt of each briefing, daily.

**TOPICS COVERED (check all those covered):**

| | | |
|---|---|---|
| ☐ General PPE Usage | ☐ Confined Space | ☐ Excavation Safety |
| ☐ Hearing Conservation | ☐ Slips, Trips, Falls | ☐ Confined Space |
| ☐ Respiratory Protection | ☐ Heat Stress | ☐ Traffic Safety |
| ☐ Personal Hygiene | ☐ Thermal Stresses | ☐ Changes to the HASP |
| ☐ Exposure Guidelines | ☐ Site Control | ☐ Initial Review of Hazard Evaluation |
| ☐ Decon Procedures | ☐ Work Zones | ☐ Other (specify): |
| ☐ Emergency Procedures (include route to hospital) | ☐ Lockout/Tagout | ☐ Other (specify): |

**Personnel Sign-in List**

| Printed Name | Signature | Company Name |
|---|---|---|
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**ARCADIS**

## Site Activities Tailgate Safety Briefing Sign-in Log

| | | | |
|---|---|---|---|
| **Project Number:** | | **Project Name:** | |
| **Date:** | | **Time:** | |

| | | |
|---|---|---|
| **Briefing Conducted by:** | **Signature:** | **Company:** |

This sign-in log documents the tailgate briefing conducted in accordance with the HASP. Personnel who perform work operations on Site are required to attend each briefing and to acknowledge receipt of each briefing, daily.

**TOPICS COVERED (check all those covered):**

| | | |
|---|---|---|
| ☐ General PPE Usage | ☐ Confined Space | ☐ Excavation Safety |
| ☐ Hearing Conservation | ☐ Slips, Trips, Falls | ☐ Confined Space |
| ☐ Respiratory Protection | ☐ Heat Stress | ☐ Traffic Safety |
| ☐ Personal Hygiene | ☐ Thermal Stresses | ☐ Changes to the HASP |
| ☐ Exposure Guidelines | ☐ Site Control | ☐ Initial Review of Hazard Evaluation |
| ☐ Decon Procedures | ☐ Work Zones | ☐ Other (specify): |
| ☐ Emergency Procedures (include route to hospital) | ☐ Lockout/Tagout | ☐ Other (specify): |

**Personnel Sign-in List**

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**ARCADIS**

## Site Activities Tailgate Safety Briefing Sign-in Log

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| **Date:** | | **Time:** | |

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| **Briefing Conducted by:** | **Signature:** | **Company:** |

This sign-in log documents the tailgate briefing conducted in accordance with the HASP. Personnel who perform work operations on Site are required to attend each briefing and to acknowledge receipt of each briefing, daily.

**TOPICS COVERED (check all those covered):**

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|---|---|---|
| ☐ General PPE Usage | ☐ Confined Space | ☐ Excavation Safety |
| ☐ Hearing Conservation | ☐ Slips, Trips, Falls | ☐ Confined Space |
| ☐ Respiratory Protection | ☐ Heat Stress | ☐ Traffic Safety |
| ☐ Personal Hygiene | ☐ Thermal Stresses | ☐ Changes to the HASP |
| ☐ Exposure Guidelines | ☐ Site Control | ☐ Initial Review of Hazard Evaluation |
| ☐ Decon Procedures | ☐ Work Zones | ☐ Other (specify): |
| ☐ Emergency Procedures (include route to hospital) | ☐ Lockout/Tagout | ☐ Other (specify): |

**Personnel Sign-in List**

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**ARCADIS**

## Site Activities Tailgate Safety Briefing Sign-in Log

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| **Briefing Conducted by:** | **Signature:** | **Company:** |

This sign-in log documents the tailgate briefing conducted in accordance with the HASP. Personnel who perform work operations on Site are required to attend each briefing and to acknowledge receipt of each briefing, daily.

**TOPICS COVERED (check all those covered):**

| | | |
|---|---|---|
| ☐ General PPE Usage | ☐ Confined Space | ☐ Excavation Safety |
| ☐ Hearing Conservation | ☐ Slips, Trips, Falls | ☐ Confined Space |
| ☐ Respiratory Protection | ☐ Heat Stress | ☐ Traffic Safety |
| ☐ Personal Hygiene | ☐ Thermal Stresses | ☐ Changes to the HASP |
| ☐ Exposure Guidelines | ☐ Site Control | ☐ Initial Review of Hazard Evaluation |
| ☐ Decon Procedures | ☐ Work Zones | ☐ Other (specify): |
| ☐ Emergency Procedures (include route to hospital) | ☐ Lockout/Tagout | ☐ Other (specify): |

**Personnel Sign-in List**

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| **Date:** | | **Time:** | |
| **Briefing Conducted by:** | **Signature:** | **Company:** | |

This sign-in log documents the tailgate briefing conducted in accordance with the HASP. Personnel who perform work operations on Site are required to attend each briefing and to acknowledge receipt of each briefing, daily.

**TOPICS COVERED (check all those covered):**

| | | |
|---|---|---|
| ☐ General PPE Usage | ☐ Confined Space | ☐ Excavation Safety |
| ☐ Hearing Conservation | ☐ Slips, Trips, Falls | ☐ Confined Space |
| ☐ Respiratory Protection | ☐ Heat Stress | ☐ Traffic Safety |
| ☐ Personal Hygiene | ☐ Thermal Stresses | ☐ Changes to the HASP |
| ☐ Exposure Guidelines | ☐ Site Control | ☐ Initial Review of Hazard Evaluation |
| ☐ Decon Procedures | ☐ Work Zones | ☐ Other (specify): |
| ☐ Emergency Procedures (include route to hospital) | ☐ Lockout/Tagout | ☐ Other (specify): |

**Personnel Sign-in List**

| Printed Name | Signature | Company Name |
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## Attachment 4

Material Safety Data Sheets

# Material Safety Data Sheet

Acetone

ACC# 00140

## Section 1 - Chemical Product and Company Identification

MSDS Name: Acetone
Catalog Numbers: AC167640000, AC167640025, AC167645000, AC176800000, AC176800010, AC176800025, AC176805000, AC177170000, AC177170010, AC177170025, AC177170250, AC177179090, AC268310000, AC268310010, AC268310025, AC268310040, AC326570000, AC326570010, AC326570025, AC326700000, AC326700010, AC326700025, AC326740000, AC326740010, AC326740025, AC326800000, AC326800010, AC326801000, AC326802500, AC327840000, AC327840010, AC327840040, AC400100000, AC400100010, AC400100025, AC400100040, AC400105000, AC423240000, AC423240010, AC423240040, AC423245000, AC611010040, A19RS115, S70090, S70091, S70091-1, S93106, A11-1, A11-20, A11-200, A11-4, A11S-4, A16F-1GAL, A16P-4, A16P1GAL, A16S-20, A16S-4, A18-1, A18-20, A18-200, A18-4, A18-500, A18CU-1300, A18FB115, A18FB19, A18FB200, A18FB50, A18J500, A18P-4, A18POP19, A18POP200, A18POP50, A18POPB19, A18POPB200, A18POPB50, A18RB-115, A18RB-19, A18RB-200, A18RB-50, A18RS-115, A18RS-200, A18RS-28, A18RS-50, A18S-4, A18SK-4, A18SS-115, A18SS-200, A18SS-28, A18SS-50, A18SS115, A18SS1350, A18SS19, A19-1, A19-4, A40-4, A404LC, A920, A9200, A928-4, A929-1, A929-4, A929J1, A929J4, A929POP19, A929POP200, A929POP50, A929RS-19, A929RS-200, A929RS-50, A929SS-115, A929SS-200, A929SS-28, A929SS-50, A929SS19, A94, A946-4, A9464LC, A946FB19, A946FB200, A946FB50, A946POPB19, A946POPB200, A946POPB50, A946RB115, A946RB19, A946RB200, A946RB50, A949-1, A949-4, A9491LC, A949CU50, A949J1, A949J4, A949N119, A949N219, A949NB219, A949POP19, A949POP200, A949POP50, A949POPN19, A949RS-115, A949RS-28, A949RS-50, A949SK-1, A949SK-4, A949SK4LC, A949SS-115, A949SS-200, A949SS-28, A949SS-50, A949SS19, BP24011, BP240320, BP24034, BP2403500, BP24044, BP2404SK1, BP2404SK4, BPA19-1 EMW, BPA949-4-EMD, HC3001GAL, JONA18, NC9060899, NC9096457, NC9120377, NC9173151, NC9245927, NC9475452, NC9614315, NC9905244, PS03488, PS03489, S70091HPLC, S70091SPEC
Synonyms: Dimethylketone; 2-Propanone.
Company Identification:

Fisher Scientific
1 Reagent Lane
Fair Lawn, NJ 07410

For information, call: 201-796-7100
Emergency Number: 201-796-7100
For CHEMTREC assistance, call: 800-424-9300
For International CHEMTREC assistance, call: 703-527-3887

## Section 2 - Composition, Information on Ingredients

| CAS# | Chemical Name | Percent | EINECS/ELINCS |
|---|---|---|---|
| 67-64-1 | Acetone | >99 | 200-662-2 |

## Section 3 - Hazards Identification

### EMERGENCY OVERVIEW

Appearance: clear, colorless liquid. Flash Point: -20 deg C.
Danger! Extremely flammable liquid and vapor. Vapor may cause flash fire. Causes eye irritation. Breathing vapors may cause drowsiness and dizziness. Causes respiratory tract irritation. Aspiration hazard if swallowed. Can enter lungs and cause damage. Prolonged or repeated contact may dry the skin and cause irritation.
Target Organs: Central nervous system, respiratory system, eyes, skin.

### Potential Health Effects

Eye: Produces irritation, characterized by a burning sensation, redness, tearing, inflammation, and possible corneal injury. Vapors cause eye irritation.
Skin: May be absorbed through the skin. Repeated or prolonged exposure may cause drying and cracking of the skin.
Ingestion: May cause irritation of the digestive tract. May cause central nervous system depression, characterized by excitement, followed by headache, dizziness, drowsiness, and nausea. Advanced stages may cause collapse, unconsciousness, coma and possible death due to respiratory failure. Aspiration of material into the lungs may cause chemical pneumonitis, which may be fatal.
Inhalation: Inhalation of high concentrations may cause central nervous system effects characterized by nausea, headache, dizziness, unconsciousness and coma. Causes respiratory tract irritation. May cause motor incoordination and speech abnormalities.
Chronic: Prolonged or repeated skin contact may cause dermatitis. Chronic inhalation may cause effects similar to those of acute inhalation. Matsushita et al. exposed human volunteers 6 hours/day for 6 days at 500 ppm and found hematologic changes including significantly increased leukocyte and eosinophil counts and decreased neutrophil phagocytic activity.

## Section 4 - First Aid Measures

Eyes: In case of contact, immediately flush eyes with plenty of water for a t least 15 minutes. Get medical aid.
Skin: In case of contact, flush skin with plenty of water. Remove contaminated clothing and shoes. Get medical aid if irritation develops and persists. Wash clothing before reuse.
Ingestion: Potential for aspiration if swallowed. Get medical aid immediately. Do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person.
Inhalation: If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.

Notes to Physician: Treat symptomatically and supportively.

## Section 5 - Fire Fighting Measures

General Information: Containers can build up pressure if exposed to heat and/or fire. As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion. Use water spray to keep fire-exposed containers cool. Extremely flammable liquid and vapor. Vapor may cause flash fire. Vapors are heavier than air and may travel to a source of ignition and flash back. Vapors can spread along the ground and collect in low or confined areas.
Extinguishing Media: Use dry chemical, carbon dioxide, or appropriate foam. Water may be ineffective because it will not cool material below its flash point.
Flash Point: -20 deg C ( -4.00 deg F)
Autoignition Temperature: 465 deg C ( 869.00 deg F)
Explosion Limits, Lower:2.5%
Upper: 12.8%
NFPA Rating: (estimated) Health: 1; Flammability: 3; Instability: 0

## Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.
Spills/Leaks: Absorb spill with inert material (e.g. vermiculite, sand or earth), then place in suitable container. Avoid runoff into storm sewers and ditches which lead to waterways. Wear appropriate protective clothing to minimize contact with skin. Remove all sources of ignition. Provide ventilation. A vapor suppressing foam may be used to reduce vapors. Water spray may reduce vapor but may not prevent ignition in closed spaces. Use only non-sparking tools and equipment.

## Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Ground and bond containers when transferring material. Avoid contact with eyes, skin, and clothing. Empty containers retain product residue, (liquid and/or vapor), and can be dangerous. Keep container tightly closed. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose empty containers to heat, sparks or open flames. Use only with adequate ventilation. Keep away from heat, sparks and flame. Avoid breathing vapor.
Storage: Keep away from sources of ignition. Store in a tightly closed container. Store in a cool, dry, well-ventilated area away from incompatible substances. Flammables-area.

## Section 8 - Exposure Controls, Personal Protection

Engineering Controls: Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits. Ventilation fans and other electrical service must be non-sparking and have an explosion-proof design.

Exposure Limits

| Chemical Name | ACGIH | NIOSH | OSHA - Final PELs |
|---|---|---|---|
| Acetone | 500 ppm TWA; 750 ppm STEL | 250 ppm TWA; 590 mg/m3 TWA<br>2500 ppm IDLH | 1000 ppm TWA; 2400 mg/m3 TWA |

OSHA Vacated PELs: Acetone: 750 ppm TWA; 1800 mg/m3 TWA

Personal Protective Equipment

Eyes: Wear chemical goggles.

Skin: Wear appropriate protective gloves to prevent skin exposure.

Clothing: Wear appropriate protective clothing to prevent skin exposure.

Respirators: Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Always use a NIOSH or European Standard EN 149 approved respirator when necessary.

## Section 9 - Physical and Chemical Properties

Physical State: Liquid

Appearance: clear, colorless

Odor: sweetish odor

pH: 7

Vapor Pressure: 231 mm Hg @ 25 deg C

Vapor Density: 2.0 (Air=1)

Evaporation Rate:5.6 (n-Butyl acetate=1)

Viscosity: 0.32 cps @ 20 deg C

Boiling Point: 56 deg C

Freezing/Melting Point:-94 deg C

Decomposition Temperature:Not available.

Solubility: Soluble.

Specific Gravity/Density:0.788 @ 25°C

Molecular Formula:C3H6O

Molecular Weight:58.08

## Section 10 - Stability and Reactivity

Chemical Stability: Stable at room temperature in closed containers under normal storage and handling conditions.
Conditions to Avoid: High temperatures, ignition sources, confined spaces.
Incompatibilities with Other Materials: Strong oxidizing agents, strong reducing agents, strong bases, nitric acid, hexachloromelamine, sulfur dichloride, potassium tert-butoxide, chloroform + alkali, sulfuric acid + nitric acid.
Hazardous Decomposition Products: Carbon monoxide, carbon dioxide.
Hazardous Polymerization: Will not occur.

## Section 11 - Toxicological Information

RTECS#:
CAS# 67-64-1: AL3150000
LD50/LC50:
CAS# 67-64-1:
- Dermal, guinea pig: LD50 = >9400 uL/kg;
- Draize test, rabbit, eye: 20 mg Severe;
- Draize test, rabbit, eye: 20 mg/24H Moderate;
- Draize test, rabbit, eye: 10 uL Mild;
- Draize test, rabbit, skin: 500 mg/24H Mild;
- Inhalation, mouse: LC50 = 44 gm/m3/4H;
- Inhalation, rat: LC50 = 50100 mg/m3/8H;
- Oral, mouse: LD50 = 3 gm/kg;
- Oral, rabbit: LD50 = 5340 mg/kg;
- Oral, rat: LD50 = 5800 mg/kg;

Carcinogenicity:
CAS# 67-64-1: Not listed by ACGIH, IARC, NTP, or CA Prop 65.

Epidemiology: No information available.
Teratogenicity: No information available.
Reproductive Effects: During the Stewart et al. study, four adult female volunteers were exposed 7.5 hours to acetone vapor at a nominal concentration of 1000 ppm. Three of the four women experienced premature menstrual periods which were attributed to the acetone exposure.
Neurotoxicity: No information available.
Mutagenicity: Sex chromosome loss and nondisjunction(Yeast - Saccharomyces cerevisiae) = 47600 ppm; Cytogenetic analysis (Rodent - hamster Fibroblast)= 40 gm/L.

Other Studies: Standard Draize Test: Administration onto the skin (human) = 500 mg/7days (Mild). Standard Draize Test: Administration onto the skin (rabbit) = 500 mg/24H (Mild). Standard Draize Test( Eye, Rabbit) = 20 mg; Severe.

## Section 12 - Ecological Information

Ecotoxicity: Fish: Rainbow trout: 5540 mg/l; 96-hr; LC50Fish: Bluegill/Sunfish: 8300 mg/l; 96-hr; LC50 No data available.
Environmental: Volatilizes, leeches, and biodegrades when released to soil. TERRESTRIAL FATE: If released on soil, acetone will both volatilize and leach into the ground. Acetone readily biodegrades and there is evidence suggesting that it biodegrades fairly rapidly in soils. AQUATIC FATE: If released into water, acetone will probably biodegrade. It is readily biodegradable in screening tests, although data from natural water are lacking. It will also be lost due to volatilization (estimated half-life 20 hr from a model river). Adsorption to sediment should not be significant.
Physical: ATMOSPHERIC FATE: In the atmosphere, acetone will be lost by photolysis and reaction with photochemically produced hydroxyl radicals. Half-life estimates from these combined processes are 79 and 13 days in January and June, respectively, for an overall annual average of 22 days. Therefore considerable dispersion should occur. Being miscible in water, wash out by rain should be an important removal process. This process has been confirmed around Lake Shinsei-ko in Japan. There acetone was found in the air and rain as well as the lake.
Other: No information available.

## Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.
RCRA P-Series: None listed.
RCRA U-Series:
CAS# 67-64-1: waste number U002 (Ignitable waste).

## Section 14 - Transport Information

| | US DOT | Canada TDG |
|---|---|---|
| Shipping Name: | ACETONE | ACETONE |
| Hazard Class: | 3 | 3 |
| UN Number: | UN1090 | UN1090 |
| Packing Group: | II | II |

## Section 15 - Regulatory Information

### US FEDERAL

TSCA
CAS# 67-64-1 is listed on the TSCA inventory.
Health & Safety Reporting List
None of the chemicals are on the Health & Safety Reporting List.
Chemical Test Rules
CAS# 67-64-1: Test for Health Effects
Section 12b
None of the chemicals are listed under TSCA Section 12b.
TSCA Significant New Use Rule
None of the chemicals in this material have a SNUR under TSCA.
CERCLA Hazardous Substances and corresponding RQs
CAS# 67-64-1: 5000 lb final RQ; 2270 kg final RQ
SARA Section 302 Extremely Hazardous Substances
None of the chemicals in this product have a TPQ.
SARA Codes
CAS # 67-64-1: acute, flammable.
Section 313 No chemicals are reportable under Section 313.
Clean Air Act:
This material does not contain any hazardous air pollutants.
This material does not contain any Class 1 Ozone depletors.
This material does not contain any Class 2 Ozone depletors.
Clean Water Act:
None of the chemicals in this product are listed as Hazardous Substances under the CWA.
None of the chemicals in this product are listed as Priority Pollutants under the CWA.
None of the chemicals in this product are listed as Toxic Pollutants under the CWA.
OSHA:
None of the chemicals in this product are considered highly hazardous by OSHA.
STATE
CAS# 67-64-1 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

California Prop 65

California No Significant Risk Level: None of the chemicals in this product are listed.

## European / International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols:

XI F

Risk Phrases:

R 11 Highly flammable.
R 36 Irritating to eyes.
R 66 Repeated exposure may cause skin dryness or cracking.
R 67 Vapours may cause drowsiness and dizziness.

Safety Phrases:

S 16 Keep away from sources of ignition - No smoking.
S 26 In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
S 9 Keep container in a well-ventilated place.

WGK (Water Danger/Protection)

CAS# 67-64-1: 0

Canada - DSL/NDSL

CAS# 67-64-1 is listed on Canada's DSL List.

Canada - WHMIS

This product has a WHMIS classification of B2, D2B.

Canadian Ingredient Disclosure List

CAS# 67-64-1 is listed on the Canadian Ingredient Disclosure List.

## Section 16 - Additional Information

MSDS Creation Date: 7/26/1999
Revision #15 Date: 3/05/2004

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.

# Material Safety Data Sheet
Benzene

ACC# 02610

## Section 1 - Chemical Product and Company Identification

MSDS Name: Benzene
Catalog Numbers: AC167660000, AC167660010, AC167660025, AC167660250, AC167665000, AC168650025, AC168650250, AC295330000, AC295330010, AC295330025, AC295330250, AC296880000, AC296880010, AC296880025, AC296880250, AC610230010, AC610231000, AC610510190, AC610510500, AC610511150, AC610512000, AC610710000, AC610710190, AC610710500, AC610711150, AC610712000, AC611001000, B243-4, B243J, B245-4, B245-500, B245J4, B411-1, B411-4, B412-1, B414-1, BP2601-100, S79920ACS
Synonyms: Benzol; Cyclohexatriene; Phenyl hydride.
Company Identification:

Fisher Scientific
1 Reagent Lane
Fair Lawn, NJ 07410

For information, call: 201-796-7100
Emergency Number: 201-796-7100
For CHEMTREC assistance, call: 800-424-9300
For International CHEMTREC assistance, call: 703-527-3887

## Section 2 - Composition, Information on Ingredients

| CAS# | Chemical Name | Percent | EINECS/ELINCS |
|---|---|---|---|
| 71-43-2 | Benzene | > 99 | 200-753-7 |

## Section 3 - Hazards Identification

### EMERGENCY OVERVIEW

Appearance: clear colorless liquid. Flash Point: -11 deg C.
Danger! Cancer hazard. Extremely flammable liquid and vapor. Vapor may cause flash fire. Harmful if swallowed, inhaled, or absorbed through the skin. Causes eye, skin, and respiratory tract irritation. Aspiration hazard if swallowed. Can enter lungs and cause

damage. May cause blood abnormalities. May cause central nervous system effects.
Target Organs: Blood, central nervous system, respiratory system, eyes, bone marrow, immune system, skin.

### Potential Health Effects

Eye: Causes eye irritation.
Skin: Causes skin irritation. Harmful if absorbed through the skin. Prolonged and/or repeated contact may cause defatting of the skin and dermatitis.
Ingestion: May cause central nervous system depression, characterized by excitement, followed by headache, dizziness, drowsiness, and nausea. Advanced stages may cause collapse, unconsciousness, coma and possible death due to respiratory failure. May cause effects similar to those for inhalation exposure. Aspiration of material into the lungs may cause chemical pneumonitis, which may be fatal.
Inhalation: Causes respiratory tract irritation. May cause drowsiness, unconsciousness, and central nervous system depression. Exposure may lead to irreversible bone marrow injury. Exposure may lead to aplastic anemia. Potential symptoms of overexposure by inhalation are dizziness, headache, vomiting, visual disturbances, staggering gait, hilarity, fatigue, and other symptoms of CNS depression.
Chronic: May cause bone marrow abnormalities with damage to blood forming tissues. May cause anemia and other blood cell abnormalities. Chronic exposure to benzene has been associated with an increased incidence of leukemia and multiple myeloma (tumor composed of cells of the type normally found in the bone marrow). Immunodepressive effects have been reported. This substance has caused adverse reproductive and fetal effects in laboratory animals.

## Section 4 - First Aid Measures

Eyes: In case of contact, immediately flush eyes with plenty of water for a t least 15 minutes. Get medical aid.
Skin: In case of contact, flush skin with plenty of water. Remove contaminated clothing and shoes. Get medical aid if irritation develops and persists. Wash clothing before reuse.
Ingestion: Potential for aspiration if swallowed. Get medical aid immediately. Do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person.
Inhalation: If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.
Notes to Physician: Treat symptomatically and supportively.

## Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Use water spray to keep fire-exposed containers cool. Extremely flammable liquid and vapor.

Vapor may cause flash fire. Approach fire from upwind to avoid hazardous vapors and toxic decomposition products. Vapors are heavier than air and may travel to a source of ignition and flash back. Vapors can spread along the ground and collect in low or confined areas. This liquid floats on water and may travel to a source of ignition and spread fire. May accumulate static electricity.
Extinguishing Media: Use water spray, dry chemical, carbon dioxide, or appropriate foam.
Flash Point: -11 deg C ( 12.20 deg F)
Autoignition Temperature: 498 deg C ( 928.40 deg F)
Explosion Limits, Lower:1.3 vol %
Upper: 7.1 vol %
NFPA Rating: (estimated) Health: 2; Flammability: 3; Instability: 0

## Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.
Spills/Leaks: Absorb spill with inert material (e.g. vermiculite, sand or earth), then place in suitable container. Avoid runoff into storm sewers and ditches which lead to waterways. Remove all sources of ignition. Provide ventilation. Approach spill from upwind. Use water spray to cool and disperse vapors, protect personnel, and dilute spills to form nonflammable mixtures.

## Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Ground and bond containers when transferring material. Avoid contact with eyes, skin, and clothing. Empty containers retain product residue, (liquid and/or vapor), and can be dangerous. Take precautionary measures against static discharges. Keep container tightly closed. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose empty containers to heat, sparks or open flames. Use only with adequate ventilation. Keep away from heat, sparks and flame. Avoid breathing vapor.
Storage: Keep away from sources of ignition. Store in a tightly closed container. Keep from contact with oxidizing materials. Store in a cool, dry, well-ventilated area away from incompatible substances.

## Section 8 - Exposure Controls, Personal Protection

Engineering Controls: Use process enclosure, local exhaust ventilation, or other engineering controls to control airborne levels below recommended exposure limits. Use explosion-proof ventilation equipment. Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. See 29CFR 1910.1028 for the regulatory requirements for the control of employee exposure to benzene.

Exposure Limits

| Chemical Name | ACGIH | NIOSH | OSHA - Final PELs |
|---|---|---|---|
| Benzene | 0.5 ppm TWA; 2.5 ppm STEL; skin - potential for cutaneous absorption | 0.1 ppm TWA 500 ppm IDLH | 10 ppm TWA (apply only to exempt industry segments); 25 ppm Ceiling; 1 ppm PEL; 5 ppm STEL; 0.5 ppm Action Level (Cancer hazard, Flammable - see 29 C FR 1910.1028) |

OSHA Vacated PELs: Benzene: 10 ppm TWA (unless specified in 1910.1028)
Personal Protective Equipment
Eyes: Wear chemical goggles.
Skin: Wear appropriate protective gloves to prevent skin exposure.
Clothing: Wear appropriate protective clothing to prevent skin exposure.
Respirators: A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant a respirator's use.

## Section 9 - Physical and Chemical Properties

Physical State: Liquid
Appearance: clear colorless
Odor: sweetish odor - aromatic odor
pH: Not applicable.
Vapor Pressure: 75 mm Hg @ 20 deg C
Vapor Density: 2.8 (air=1)
Evaporation Rate:Not available.
Viscosity: 0.647mPa @ 20 deg C
Boiling Point: 80.1 deg C
Freezing/Melting Point:5.5 deg C
Decomposition Temperature:Not available.
Solubility: 0.180 g/100 ml @ 25°C
Specific Gravity/Density:0.8765 @ 20°C
Molecular Formula:C6H6
Molecular Weight:78.11

## Section 10 - Stability and Reactivity

Chemical Stability: Stable under normal temperatures and pressures.
Conditions to Avoid: Ignition sources, excess heat, confined spaces.
Incompatibilities with Other Materials: Strong oxidizing agents.
Hazardous Decomposition Products: Carbon monoxide, carbon dioxide.
Hazardous Polymerization: Has not been reported.

## Section 11 - Toxicological Information

RTECS#:
CAS# 71-43-2: CY1400000
LD50/LC50:
CAS# 71-43-2:
Dermal, guinea pig: LD50 = >9400 uL/kg;
Draize test, rabbit, eye: 88 mg Moderate;
Draize test, rabbit, eye: 2 mg/24H Severe;
Draize test, rabbit, skin: 20 mg/24H Moderate;
Inhalation, mouse: LC50 = 9980 ppm;
Inhalation, mouse: LC50 = 24 mL/kg/2H;
Inhalation, rat: LC50 = 10000 ppm/7H;
Inhalation, rat: LC50 = 34 mL/kg/2H;
Inhalation, rat: LC50 = 6.5 mL/kg/4H;
Oral, mouse: LD50 = 4700 mg/kg;
Oral, rat: LD50 = 930 mg/kg;
Oral, rat: LD50 = 1 mL/kg;
Oral, rat: LD50 = 1800
Carcinogenicity:
CAS# 71-43-2:

- ACGIH: A1 - Confirmed Human Carcinogen
- California: carcinogen, initial date 2/27/87
- NTP: Known carcinogen
- IARC: Group 1 carcinogen

Epidemiology: IARC has concluded that epidemiological studies have established the relationship between benzene exposure and the development of acute myelogenous leukemia, and that there is sufficient evidence that benzene is carcinogenic to humans.
Teratogenicity: Inhalation, rat: TCLO = 50 ppm/24H (female 7-14 day(s) after conception) Effects on Embryo or Fetus - extra-

embryonic structures (e.g., placenta, umbilical cord) and Effects on Embryo or Fetus - fetotoxicity (except death, e.g., stunted fetus).; Inhalation,mouse: TCLo = 5 ppm (female 6-15 day(s) after conception) Effects on Embryo or Fetus - cytological changes (including somatic cell genetic material) and Specific Developmental Abnormalities - blood and lymphatic systems (including spleen and marrow).

Reproductive Effects: Inhalation, rat: TCLO = 670 mg/m3/24H (female 15 day(s) pre-mating and female 1-22 day(s) after conception) female fertility index (e.g. # females pregnant per # sperm positive females; # females pregnant per # females mated).; Oral, mouse: TDLo = 12 gm/kg (female 6-15 day(s) after conception) Fertility - post-implantation mortality (e.g. dead and/or resorbed implants per total number of implants).
Neurotoxicity: See actual entry in RTECS for complete information.
Mutagenicity: DNA Inhibition: Human, Leukocyte = 2200 umol/L.; DNA Inhibition: Human, HeLa cell = 2200 umol/L.; Mutation Test Systems - not otherwise specified: Human, Lymphocyte = 5 umol/L.; Cytogenetic Analysis: Inhalation, Human = 125 ppm/1Y.; Cytogenetic Analysis: Human, Leukocyte = 1 mmol/L/72H.; Cytogenetic Analysis: Human, Lymphocyte = 1 mg/L.
Other Studies: No data available.

## Section 12 - Ecological Information

Ecotoxicity: Fish: Mosquito Fish: TLm = 395 mg/L; 24 Hr; UnspecifiedFish: Goldfish: LC50 =46 mg/L; 24 Hr; Modified ASTM D 1345Fish: Fathead Minnow: LC50 = 15.1 mg/L; 96 Hr; Flow-through at 25°C (pH 7.9-8.0)Fish: Rainbow trout: LC50 = 5.3 mg/L; 96 Hr; Flow-through at 25°C (pH 7.9-8.0)Fish: Bluegill/Sunfish: LD50 = 20 mg/L; 24-48 Hr; Unspecified If benzene is released to soil, it will be subject to rapid volatilization near the surface and that which does not evaporate will be highly to very highly mobile in the soil and may leach to groundwater. If benzene is released to water, it will be subject to rapid volatilization. It will not be expected to significantly adsorb to sediment, bioconcentrate in aquatic organisms or hydrolyze. It may be subject to biodegradation.
Environmental: If benzene is released to the atmosphere, it will exist predominantly in the vapor phase. Gas-phase benzene will not be subject to direct photolysis but it will react with photochemically produced hydroxyl radicals with a half-life of 13.4 days. The reaction time in polluted atmospheres which contain nitrogen oxides or sulfur dioxide is accelerated with the half-life being reported as 4-6 hours. Benzene is fairly soluble in water and is removed from the atmosphere in rain.
Physical: Products of photooxidation include phenol, nitrophenols, nitrobenzene, formic acid, and peroxyacetyl nitrate.
Other: No information available.

## Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.
RCRA P-Series: None listed.
RCRA U-Series:
CAS# 71-43-2: waste number U019 (Ignitable waste, Toxic waste).

## Section 14 - Transport Information

| | US DOT | Canada TDG |
|---|---|---|
| Shipping Name: | BENZENE | BENZENE |
| Hazard Class: | 3 | 3 |
| UN Number: | UN1114 | UN1114 |
| Packing Group: | II | II |
| Additional Info: | | FLASHPOINT -11 C |

## Section 15 - Regulatory Information

### US FEDERAL

TSCA
CAS# 71-43-2 is listed on the TSCA inventory.
Health & Safety Reporting List
None of the chemicals are on the Health & Safety Reporting List.
Chemical Test Rules
None of the chemicals in this product are under a Chemical Test Rule.
Section 12b
None of the chemicals are listed under TSCA Section 12b.
TSCA Significant New Use Rule
None of the chemicals in this material have a SNUR under TSCA.
CERCLA Hazardous Substances and corresponding RQs
CAS# 71-43-2: 10 lb final RQ (receives an adjustable RQ of 10 lbs based on potential carc
SARA Section 302 Extremely Hazardous Substances
None of the chemicals in this product have a TPQ.
SARA Codes
CAS # 71-43-2: acute, chronic, flammable.
Section 313
This material contains Benzene (CAS# 71-43-2, > 99%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.
Clean Air Act:
CAS# 71-43-2 is listed as a hazardous air pollutant (HAP).
This material does not contain any Class 1 Ozone depletors.
This material does not contain any Class 2 Ozone depletors.

Clean Water Act:
CAS# 71-43-2 is listed as a Hazardous Substance under the CWA. CAS# 71-43-2 is listed as a Priority Pollutant under the Clean Water Act. CAS# 71-43-2 is listed as a Toxic Pollutant under the Clean Water Act.
OSHA:
None of the chemicals in this product are considered highly hazardous by OSHA.
STATE
CAS# 71-43-2 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

California Prop 65
The following statement(s) is(are) made in order to comply with the California Safe Drinking Water Act:
WARNING: This product contains Benzene, a chemical known to the state of California to cause cancer. WARNING: This product contains Benzene, a chemical known to the state of California to cause male reproductive toxicity.
California No Significant Risk Level: CAS# 71-43-2: 6.4 æg/day NSRL (oral); 13 æg/day NSRL (inhalation)

## European/International Regulations

European Labeling in Accordance with EC Directives
Hazard Symbols:
T F
Risk Phrases:
R 11 Highly flammable.
R 45 May cause cancer.
R 48/23/24/25 Toxic : danger of serious damage to health by prolonged exposure through inhalation, contact with skin and if swallowed.

Safety Phrases:
S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).
S 53 Avoid exposure - obtain special instructions before use.

WGK (Water Danger/Protection)
CAS# 71-43-2: 3
Canada - DSL/NDSL
CAS# 71-43-2 is listed on Canada's DSL List.
Canada - WHMIS
This product has a WHMIS classification of B2, D2A, D2B.
Canadian Ingredient Disclosure List
CAS# 71-43-2 is listed on the Canadian Ingredient Disclosure List.

## Section 16 - Additional Information

MSDS Creation Date: 6/11/1999
Revision #6 Date: 1/29/2004

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.

# Material Safety Data Sheet

## Chloroform, preserved with 0.75% Ethanol

ACC# 95979

## Section 1 - Chemical Product and Company Identification

MSDS Name: Chloroform, preserved with 0.75% Ethanol
Catalog Numbers: AC158210000, AC158210010, AC158210025, AC158210250, AC232090000, AC232090010, AC232090025, AC326670000, AC326670010, AC326670025, AC326820000, AC326820010, AC326821000, AC326822500, AC404630000, AC404635000, AC423550000, AC423550040, AC423550250, AC423555000, AC610030040, S79960, S799601, S79960HPLC1, S79960SPEC1, S79960SPEC2, S79969ACS1, S79969ACS2, S93175, S93403, BP1145-1, BP2606-100, C294-1, C294-4, C295-20, C295-4, C295S-4, C298-1, C298-20, C298-200, C298-4, C298-500, C29820LC, C298FB115, C298FB19, C298FB200, C298FB50, C298J1, C298POP19, C298POP200, C298POP50, C298POPB19, C298POPB200, C298POPB50, C298RB115, C298RB200, C298RS115, C298RS19, C298RS200, C298RS28, C298RS50, C298S-4, C298SK-4, C298SS19, C574-1, C574-4, C574SK-4, C606-1, C606-4, C606POP19, C606POP200, C606POP50, C606RS115, C606RS28, C606SK-1, C606SK-4, C606SS115, C606SS19, C606SS200, C606SS28, C606SS50, NC9002591, NC9229128, NC9543674, XXC6060200LI-0
Synonyms: Formyl trichloride; Methane trichloride; Methenyl trichloride; Methyl trichloride; Trichloroform; Trichloromethane.
Company Identification:

Fisher Scientific
1 Reagent Lane
Fair Lawn, NJ 07410

For information, call: 201-796-7100
Emergency Number: 201-796-7100
For CHEMTREC assistance, call: 800-424-9300
For International CHEMTREC assistance, call: 703-527-3887

## Section 2 - Composition, Information on Ingredients

| CAS# | Chemical Name | Percent | EINECS/ELINCS |
|---|---|---|---|
| 67-66-3 | Chloroform | 99+ | 200-663-8 |
| 64-17-5 | Ethyl alcohol | 0.75 | 200-578-6 |

## Section 3 - Hazards Identification

## EMERGENCY OVERVIEW

Appearance: clear, colorless liquid.
Warning! Causes respiratory tract irritation. Causes eye and skin irritation. May be harmful if swallowed. May cause central nervous system depression. May cause cancer based on animal studies. May cause cardiac disturbances. Light sensitive. This substance has caused adverse reproductive and fetal effects in animals.
Target Organs: Kidneys, heart, central nervous system, liver, eyes, reproductive system, skin.

### Potential Health Effects

Eye: Causes moderate eye irritation. Contact with liquid causes immediate burning pain, tearing, and reddening of the conjunctiva.
Skin: Causes mild skin irritation. May be absorbed through the skin in harmful amounts. May cause severe skin irritation with possible burns, especially if skin is wet or moist. Absorption of liquid through intact skin is possible and may cause systemic poisoning if contact with liquid is prolonged.
Ingestion: Causes gastrointestinal irritation with nausea, vomiting and diarrhea. May cause liver damage. May cause cardiac disturbances. Aspiration of material into the lungs may cause chemical pneumonitis, which may be fatal. Possible aspiration hazard. May be harmful if swallowed. May cause hallucinations and distorted perceptions.
Inhalation: Inhalation of high concentrations may cause central nervous system effects characterized by nausea, headache, dizziness, unconsciousness and coma. May cause cardiac sensitization and possible failure. Inhalation of large amounts may cause respiratory stimulation, followed by respiratory depression, convulsions and possible death due to respiratory paralysis. May be absorbed through the lungs. Causes irritation of the mucous membrane and upper respiratory tract.
Chronic: Possible cancer hazard based on tests with laboratory animals. Prolonged or repeated skin contact may cause defatting and dermatitis. May cause reproductive and fetal effects. Effects may be delayed. Laboratory experiments have resulted in mutagenic effects. Toxicity may be increased by exposure to alcohol, steroids, and ketones. Prolonged exposure may cause liver, kidney, and heart damage.

## Section 4 - First Aid Measures

Eyes: Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid.
Skin: Get medical aid. Flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse.
Ingestion: Do not induce vomiting. If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid immediately.
Inhalation: Get medical aid immediately. Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.
Notes to Physician: Causes cardiac sensitization to endogenous catelcholamines which may lead to cardiac arrhythmias. Do NOT use adrenergic agents such as epinephrine or pseudoepinephrine. Persons with liver, kidney, or central nervous system diseases may be at

increased risk from exposure to this product. Alcoholic beverage consumption may enhance the toxic effects of this substance. Effects may be delayed.

## Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion. Use water spray to keep fire-exposed containers cool. Substance is nonflammable. Vapors may be heavier than air. They can spread along the ground and collect in low or confined areas. Containers may explode when heated. Non-combustible, substance itself does not burn but may decompose upon heating to produce corrosive and/or toxic fumes. Non-combustible, substance itself does not burn but may decompose upon heating to produce irritating, corrosive and/or toxic fumes. Approach fire from upwind to avoid hazardous vapors and toxic decomposition products. Not combustible, but if involved in a fire, decomposes to produce hydrogen chloride.
Extinguishing Media: Use extinguishing media most appropriate for the surrounding fire.
Flash Point: Not available.
Autoignition Temperature: Not available.
Explosion Limits, Lower:Not available.
Upper: Not available.
NFPA Rating: (estimated) Health: 2; Flammability: 0; Instability: 0

## Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.
Spills/Leaks: Absorb spill with inert material (e.g. vermiculite, sand or earth), then place in suitable container. Avoid runoff into storm sewers and ditches which lead to waterways. Clean up spills immediately, observing precautions in the Protective Equipment section. Provide ventilation. Approach spill from upwind.

## Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Use only in a well-ventilated area. Avoid contact with eyes, skin, and clothing. Do not breathe dust, vapor, mist, or gas. Do not ingest or inhale. Store protected from light.
Storage: Do not store in direct sunlight. Store in a cool, dry, well-ventilated area away from incompatible substances. Keep away

from acids. Do not store near alkaline substances. Separate from strong mineral acids.

## Section 8 - Exposure Controls, Personal Protection

Engineering Controls: Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits.
Exposure Limits

| Chemical Name | ACGIH | NIOSH | OSHA - Final PELs |
|---|---|---|---|
| Chloroform | 10 ppm TWA | 500 ppm IDLH | 50 ppm Ceiling; 240 mg/m3 Ceiling |
| Ethyl alcohol | 1000 ppm TWA | 1000 ppm TWA; 1900 mg/m3 TWA<br>3300 ppm IDLH | 1000 ppm TWA; 1900 mg/m3 TWA |

OSHA Vacated PELs: Chloroform: 2 ppm TWA; 9.78 mg/m3 TWA Ethyl alcohol: 1000 ppm TWA; 1900 mg/m3 TWA
Personal Protective Equipment
Eyes: Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.
Skin: Wear appropriate protective gloves to prevent skin exposure.
Clothing: Wear appropriate protective clothing to prevent skin exposure.
Respirators: A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant a respirator's use.

## Section 9 - Physical and Chemical Properties

Physical State: Liquid
Appearance: clear, colorless
Odor: sweet, fruity odor - ethereal odor
pH: Not available.
Vapor Pressure: 160 mm Hg @ 20 deg C
Vapor Density: 4.12 (Air=1)
Evaporation Rate:11.6 (Butyl acetate=1)
Viscosity: 0.58 cps @ 20 deg C
Boiling Point: 60.5-61.5 deg C
Freezing/Melting Point:-63 deg C
Decomposition Temperature:Not available.
Solubility: Slightly soluble.

Specific Gravity/Density:1.492 (Water=1)
Molecular Formula:CHCl3
Molecular Weight:119.366

## Section 10 - Stability and Reactivity

Chemical Stability: Stable at room temperature in closed containers under normal storage and handling conditions. Light sensitive.
Conditions to Avoid: High temperatures, incompatible materials, light.
Incompatibilities with Other Materials: Alkali metals, fluorine, caustics (e.g. ammonia, ammonium hydroxide, calcium hydroxide, potassium hydroxide, sodium hydroxide), dinitrogen tetraoxide, sodium hydroxide + methanol, potassium tert-butoxide, chemically active metals, powdered aluminum, nitrogen tetroxide, powdered magnesium, acetone + alkali, disilane, perchloric acid + phosphorus pentoxide, sodium methylate, triisopropylphosphine.
Hazardous Decomposition Products: Hydrogen chloride, carbon monoxide, carbon dioxide, chlorine, phosgene gas.
Hazardous Polymerization: Will not occur.

## Section 11 - Toxicological Information

RTECS#:
CAS# 67-66-3: FS9100000
CAS# 64-17-5: KQ6300000
LD50/LC50:
CAS# 67-66-3:
Draize test, rabbit, eye: 148 mg;
Draize test, rabbit, eye: 20 mg/24H Moderate;
Draize test, rabbit, skin: 500 mg/24H Mild;
Inhalation, mouse: LC50 = 17200 mg/m3/2H;
Inhalation, mouse: LC50 = 6000 mg/m3/6H;
Inhalation, rat: LC50 = 47702 mg/m3/4H;
Inhalation, rat: LC50 = 6000 mg/m3/6H;
Oral, mouse: LD50 = 36 mg/kg;
Oral, rat: LD50 = 695 mg/kg;
Oral, rat: LD50 = 1250 mg/kg;
Skin, rabbit: LD50 = >20 gm/kg;
CAS# 64-17-5:
Draize test, rabbit, eye: 500 mg Severe;
Draize test, rabbit, eye: 500 mg/24H Mild;

Draize test, rabbit, skin: 20 mg/24H Moderate;
Inhalation, mouse: LC50 = 39 gm/m3/4H;
Inhalation, rat: LC50 = 20000 ppm/10H;
Oral, mouse: LD50 = 3450 mg/kg;
Oral, rabbit: LD50 = 6300 mg/kg;
Oral, rat: LD50 = 7060 mg/kg;
Oral, rat: LD50 = 9000 mg/kg;

Carcinogenicity:
CAS# 67-66-3:

- ACGIH: A3 - Confirmed animal carcinogen with unknown relevance to humans
- California: carcinogen, initial date 10/1/87
- NTP: Suspect carcinogen
- IARC: Group 2B carcinogen

CAS# 64-17-5: Not listed by ACGIH, IARC, NTP, or CA Prop 65.

Epidemiology: Oral, rat: TDLo = 13832 mg/kg/2Y-C (Tumorigenic - Carcinogenic by RTECS criteria - Blood - leukemia).; Oral, mouse: TDLo = 127 gm/kg/92W-I (Tumorigenic - Carcinogenic by RTECS criteria - Liver - tumors).; Oral, rat: TD = 98 gm/kg/78W-I (Tumorigenic - neoplastic by RTECS criteria - Kidney, Ureter, Bladder - Kidney tumors and Endocrine - thyroid tumors).; Oral, mouse: TD = 18 gm/kg/17W-I (Tumorigenic - neoplastic by RTECS criteria - Liver - tumors).;
Teratogenicity: Oral, rat: TDL0 = 1260 mg/kg (female 6-15 day(s) after conception) Effects on Embryo or Fetus - fetotoxicity (except death, e.g., stunted fetus) Specific Developmental Abnormalities - musculoskeletal system.; Inhalation, rat: TCLo = 100 ppm/7H (female 6-15 day(s) after conception) Specific Developmental Abnormalities - gastrointestinal system and homeostasis.; Inhalation, mouse: TCLo = 100 ppm/7H (female 8-15 day(s) after conception) Specific Developmental Abnormalities - craniofacial (including nose and tongue).
Reproductive Effects: Inhalation, rat: TCLo = 30 ppm/7H (female 6-15 day(s) after conception) Fertility - other measures of fertility.; Inhalation, rat: TCLo = 300 ppm/7H (female 6-15 day(s) after conception) Fertility - female fertility index (e.g. # females pregnant per # sperm positive females; # females pregnant per # females mated) and post-implantation mortality (e.g. dead and/or resorbed implants per total number of implants).
Neurotoxicity: No information available.
Mutagenicity: DNA Inhibition: Human, HeLa cell = 19 mmol/L.; Sister Chromatid Exchange: Human, Lymphocyte = 10 mmol/L.; Micronucleus Test: Oral, rat = 4 mmol/kg.; Unscheduled DNA Synthesis: Oral, rat = 1 gm/kg.; Sister Chromatid Exchange: Hamster, Embryo = 100 umol/L.
Other Studies: Open irritation test: Administration onto the skin (rabbit) 10 mg/24H (Mild). Standard Draize Test: Administration onto the skin (rabbit) = 500 mg/24H (Mild). Standard Draize Test: Administration into the eye (rabbit) = 20 mg/24H (Moderate).

## Section 12 - Ecological Information

Ecotoxicity: Fish: Channel catfish: LC50 = 75 ppm; 96 Hr; UnspecifiedFish: Rainbow trout: LC50 = 43.8 mg/L; 96 Hr; Static bioassayFish: Fathead Minnow: LC50 = 129.0 mg/L; 96 Hr; Static bioassay (pH = 7.6-8.3)Fish: Bluegill/Sunfish: LC50 = 100.0 mg/L; 96 Hr; Static bioassayWater flea Daphnia: EC50 = 28.9 mg/L; 48 Hr; Static bioassay The majority of the environmental releases from industrial uses are to the atmosphere; releases to water and land will be primarily lost by evaporation and will end up in the atmosphere. Release to the atmosphere may be transported long distances and will photodegrade with a half-life of a few months. Spills and other releases on land will also leach into the groundwater where it will reside for long periods of time.
Environmental: Chloroform will not be expected to bioconcentrate into the food chain but contamination of food is likely due to its use as an extractant and its presence in drinking water.
Physical: No information available.
Other: No information available.

## Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.
RCRA P-Series: None listed.
RCRA U-Series:
CAS# 67-66-3: waste number U044.

## Section 14 - Transport Information

| | US DOT | Canada TDG |
|---|---|---|
| Shipping Name: | CHLOROFORM | CHLOROFORM |
| Hazard Class: | 6.1 | 6.1 |
| UN Number: | UN1888 | UN1888 |
| Packing Group: | III | III |

## Section 15 - Regulatory Information

### US FEDERAL

TSCA
CAS# 67-66-3 is listed on the TSCA inventory.

CAS# 64-17-5 is listed on the TSCA inventory.

Health & Safety Reporting List

CAS# 67-66-3: Effective 6/1/87, Sunset 6/1/97

Chemical Test Rules

None of the chemicals in this product are under a Chemical Test Rule.

Section 12b

None of the chemicals are listed under TSCA Section 12b.

TSCA Significant New Use Rule

None of the chemicals in this material have a SNUR under TSCA.

CERCLA Hazardous Substances and corresponding RQs

CAS# 67-66-3: 10 lb final RQ; 4.54 kg final RQ

SARA Section 302 Extremely Hazardous Substances

CAS# 67-66-3: 10000 lb TPQ

SARA Codes

CAS # 67-66-3: acute, chronic.

CAS # 64-17-5: acute, chronic, flammable.

Section 313

This material contains Chloroform (CAS# 67-66-3, 99+%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.

Clean Air Act:

CAS# 67-66-3 is listed as a hazardous air pollutant (HAP).

This material does not contain any Class 1 Ozone depletors.

This material does not contain any Class 2 Ozone depletors.

Clean Water Act:

CAS# 67-66-3 is listed as a Hazardous Substance under the CWA. CAS# 67-66-3 is listed as a Priority Pollutant under the Clean Water Act. CAS# 67-66-3 is listed as a Toxic Pollutant under the Clean Water Act.

OSHA:

None of the chemicals in this product are considered highly hazardous by OSHA.

STATE

CAS# 67-66-3 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

CAS# 64-17-5 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

California Prop 65

The following statement(s) is(are) made in order to comply with the California Safe Drinking Water Act:

WARNING: This product contains Chloroform, a chemical known to the state of California to cause cancer. WARNING: This product contains Ethyl alcohol, a chemical known to the state of California to cause developmental reproductive toxicity.

California No Significant Risk Level: CAS# 67-66-3: 20 æg/day NSRL (oral); 40 æg/day NSRL (inhalation)

## European / International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols:

XN

Risk Phrases:

R 22 Harmful if swallowed.
R 38 Irritating to skin.
R 40 Limited evidence of a carcinogenic effect.
R 48/20/22 Harmful : danger of serious damage to health by prolonged exposure through inhalation and if swallowed.

Safety Phrases:

S 36/37 Wear suitable protective clothing and gloves.

WGK (Water Danger/Protection)

CAS# 67-66-3: 3
CAS# 64-17-5: 0

Canada - DSL/NDSL

CAS# 67-66-3 is listed on Canada's DSL List.
CAS# 64-17-5 is listed on Canada's DSL List.

Canada - WHMIS

This product has a WHMIS classification of D2A, D1B.

Canadian Ingredient Disclosure List

CAS# 67-66-3 is listed on the Canadian Ingredient Disclosure List.
CAS# 64-17-5 is listed on the Canadian Ingredient Disclosure List.

## Section 16 - Additional Information

MSDS Creation Date: 6/09/1999
Revision #8 Date: 4/13/2004

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.

# Material Safety Data Sheet
## Chlorobenzene

ACC# 04730

## Section 1 - Chemical Product and Company Identification

MSDS Name: Chlorobenzene
Catalog Numbers: B254-20, B254-4, B25420LC, B2544LC, B2544LOT001, B254POP200, B254RS200, B254SS200, B255-1, B255-500, NC9568417
Synonyms: Benzene Chloride; Chlorobenzene; Chlorobenzol; MCB; Monochlorobenzene; Phenyl Chloride.
Company Identification:

Fisher Scientific
1 Reagent Lane
Fair Lawn, NJ 07410

For information, call: 201-796-7100
Emergency Number: 201-796-7100
For CHEMTREC assistance, call: 800-424-9300
For International CHEMTREC assistance, call: 703-527-3887

## Section 2 - Composition, Information on Ingredients

| CAS# | Chemical Name | Percent | EINECS/ELINCS |
|---|---|---|---|
| 108-90-7 | Chlorobenzene | 100 | 203-628-5 |

## Section 3 - Hazards Identification

### EMERGENCY OVERVIEW

Appearance: clear, colorless liquid. Flash Point: 29.5 deg C.
Warning! May cause eye and skin irritation with possible burns. Flammable liquid and vapor. May be harmful if swallowed. May cause blood abnormalities. May cause severe respiratory and digestive tract irritation with possible burns. May cause central nervous system depression. May cause lung damage. May cause liver and kidney damage. May cause adverse reproductive effects based upon animal studies.
Target Organs: Kidneys, central nervous system, liver, lungs, blood forming organs, bone marrow.

### Potential Health Effects

Eye: Contact produces irritation, tearing, and burning pain.
Skin: Causes skin irritation. Prolonged and/or repeated contact may cause defatting of the skin and dermatitis. Produces acneiform eruptions.
Ingestion: May cause liver and kidney damage. May cause central nervous system depression, characterized by excitement, followed by headache, dizziness, drowsiness, and nausea. Advanced stages may cause collapse, unconsciousness, coma and possible death due to respiratory failure. May be harmful if swallowed. May cause hemolysis.
Inhalation: Inhalation of high concentrations may cause central nervous system effects characterized by nausea, headache, dizziness, unconsciousness and coma. Causes respiratory tract irritation. May cause effects similar to those described for ingestion. Exposure may cause bone marrow changes. Exposure may cause blood abnormalities.
Chronic: Chronic inhalation and ingestion may cause effects similar to those of acute inhalation and ingestion. Repeated contact may result in skin burns.

## Section 4 - First Aid Measures

Eyes: Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid.
Skin: Flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Get medical aid if irritation develops or persists. Wash clothing before reuse.
Ingestion: Do not induce vomiting. If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid immediately.
Inhalation: Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid. Do NOT use mouth-to-mouth resuscitation.
Notes to Physician: Treat symptomatically and supportively.

## Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Vapors may form an explosive mixture with air. Vapors can travel to a source of ignition and flash back. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion. Use water spray to keep fire-exposed containers cool. Flammable liquid and vapor. Vapors may be heavier than air. They can spread along the ground and collect in low or confined areas. Containers may explode when heated.
Extinguishing Media: Use water spray to cool fire-exposed containers. Water may be ineffective. Do NOT use straight streams of water. For small fires, use dry chemical, carbon dioxide, water spray or regular foam. Cool containers with flooding quantities of water

until well after fire is out. For large fires, use water spray, fog or regular foam.
Flash Point: 29.5 deg C ( 85.10 deg F)
Autoignition Temperature: 638.8 deg C ( 1,181.84 deg F)
Explosion Limits, Lower:1.8
Upper: 9.6
NFPA Rating: (estimated) Health: 2; Flammability: 3; Instability: 0

## Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.
Spills/Leaks: Absorb spill with inert material (e.g. vermiculite, sand or earth), then place in suitable container. Avoid runoff into storm sewers and ditches which lead to waterways. Clean up spills immediately, observing precautions in the Protective Equipment section. Remove all sources of ignition. A vapor suppressing foam may be used to reduce vapors. Water spray may reduce vapor but may not prevent ignition in closed spaces.

## Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Use with adequate ventilation. Ground and bond containers when transferring material. Avoid contact with eyes, skin, and clothing. Empty containers retain product residue, (liquid and/or vapor), and can be dangerous. Keep container tightly closed. Keep away from heat, sparks and flame. Avoid ingestion and inhalation. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose empty containers to heat, sparks or open flames.
Storage: Keep away from heat and flame. Keep away from sources of ignition. Store in a tightly closed container. Keep from contact with oxidizing materials. Store in a cool, dry, well-ventilated area away from incompatible substances.

## Section 8 - Exposure Controls, Personal Protection

Engineering Controls: Use process enclosure, local exhaust ventilation, or other engineering controls to control airborne levels below recommended exposure limits. Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower.
Exposure Limits

| Chemical Name | ACGIH | NIOSH | OSHA - Final PELs |
|---|---|---|---|
| Chlorobenzene | 10 ppm TWA | 1000 ppm IDLH | 75 ppm TWA; 350 mg/m3 TWA |

OSHA Vacated PELs: Chlorobenzene: 75 ppm TWA; 350 mg/m3 TWA
Personal Protective Equipment
Eyes: Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.
Skin: Wear appropriate protective gloves to prevent skin exposure.
Clothing: Wear appropriate protective clothing to prevent skin exposure.
Respirators: Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Always use a NIOSH or European Standard EN 149 approved respirator when necessary.

## Section 9 - Physical and Chemical Properties

Physical State: Liquid
Appearance: clear, colorless
Odor: mild odor - almond-like
pH: Not available.
Vapor Pressure: 12 mm Hg @ 25 C
Vapor Density: 3.9
Evaporation Rate:1 (butyl acetate=1)
Viscosity: 0.8 mPa s 20 C
Boiling Point: 132 deg C
Freezing/Melting Point:-46 deg C
Decomposition Temperature:Not available.
Solubility: Insoluble in water.
Specific Gravity/Density:1.107 @ 4C
Molecular Formula:C6H5Cl
Molecular Weight:112.488

## Section 10 - Stability and Reactivity

Chemical Stability: Stable.
Conditions to Avoid: Incompatible materials, ignition sources, excess heat.
Incompatibilities with Other Materials: Contact with oxidizing agents may cause fires and explosions. Reacts violently with dimethyl sulfoxide, silver perchlorate, powdered sodium and phosphorus trichloride + sodium.
Hazardous Decomposition Products: Hydrogen chloride, phosgene, carbon monoxide, carbon dioxide.
Hazardous Polymerization: Has not been reported.

## Section 11 - Toxicological Information

RTECS#:
CAS# 108-90-7: CZ0175000
LD50/LC50:
CAS# 108-90-7:
Inhalation, rat: LC50 = 2965 ppm;
Oral, mouse: LD50 = 2300 mg/kg;
Oral, rabbit: LD50 = 2250 mg/kg;
Oral, rat: LD50 = 1110 mg/kg;
Carcinogenicity:
CAS# 108-90-7:

- ACGIH: A3 - Confirmed animal carcinogen with unknown relevance to humans
  Epidemiology: No information found.
  Teratogenicity: Experimental teratogen
  Reproductive Effects: Studies in rats exposed up to 450ppm via inhalation resulted in no significant impact on reproductive performance or fertility.
  Neurotoxicity: May be a nervous system depressant.
  Mutagenicity: No information found.
  Other Studies: See actual entry in RTECS for complete information.

## Section 12 - Ecological Information

Ecotoxicity: No data available. No information available.
Environmental: Once released, concentration lowered due to dilution. May percolate into groundwater if soil is sandy and poor in organic matter. Little bioconcentration expected into fish and food products.
Physical: Photooxidant.
Other: For more information, see "HANDBOOK OF ENVIRONMENTAL FATE AND EXPOSURE DATA."

## Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local

hazardous waste regulations to ensure complete and accurate classification.
RCRA P-Series: None listed.
RCRA U-Series:
CAS# 108-90-7: waste number U037.

## Section 14 - Transport Information

| | US DOT | Canada TDG |
|---|---|---|
| Shipping Name: | CHLOROBENZENE | No information available. |
| Hazard Class: | 3 | |
| UN Number: | UN1134 | |
| Packing Group: | III | |

## Section 15 - Regulatory Information

### US FEDERAL

TSCA
CAS# 108-90-7 is listed on the TSCA inventory.
Health & Safety Reporting List
None of the chemicals are on the Health & Safety Reporting List.
Chemical Test Rules
CAS# 108-90-7: Testing required by manufacturers, processors
Section 12b
CAS# 108-90-7: Section 4
TSCA Significant New Use Rule
None of the chemicals in this material have a SNUR under TSCA.
CERCLA Hazardous Substances and corresponding RQs
CAS# 108-90-7: 100 lb final RQ; 45.4 kg final RQ
SARA Section 302 Extremely Hazardous Substances
None of the chemicals in this product have a TPQ.
SARA Codes
CAS # 108-90-7: acute, chronic, flammable.
Section 313
This material contains Chlorobenzene (CAS# 108-90-7, 100%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR
Clean Air Act:

CAS# 108-90-7 is listed as a hazardous air pollutant (HAP).
This material does not contain any Class 1 Ozone depletors.
This material does not contain any Class 2 Ozone depletors.

Clean Water Act:

CAS# 108-90-7 is listed as a Hazardous Substance under the CWA. CAS# 108-90-7 is listed as a Priority Pollutant under the Clean Water Act.

None of the chemicals in this product are listed as Toxic Pollutants under the CWA.

OSHA:

None of the chemicals in this product are considered highly hazardous by OSHA.

STATE

CAS# 108-90-7 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

California Prop 65

California No Significant Risk Level: None of the chemicals in this product are listed.

## European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols:

XN N

Risk Phrases:

R 10 Flammable.
R 20 Harmful by inhalation.
R 51/53 Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Safety Phrases:

S 24/25 Avoid contact with skin and eyes.
S 61 Avoid release to the environment. Refer to special instructions/safety data sheets.

WGK (Water Danger/Protection)

CAS# 108-90-7: 2

Canada - DSL/NDSL

CAS# 108-90-7 is listed on Canada's DSL List.

Canada - WHMIS

This product has a WHMIS classification of B2, D2A.

Canadian Ingredient Disclosure List

CAS# 108-90-7 is listed on the Canadian Ingredient Disclosure List.

## Section 16 - Additional Information

MSDS Creation Date: 12/12/1997
Revision #4 Date: 3/18/2003

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.

# Material Safety Data Sheet
## 1,2-Dichloroethane

ACC# 09390

## Section 1 - Chemical Product and Company Identification

MSDS Name: 1,2-Dichloroethane
Catalog Numbers: AC113360000, AC113360010, AC113360025, AC113360250, AC113361000, AC167760000, AC167760025, AC167760250, AC167765000, AC326840000, AC326840010, AC326841000, AC326842500, AC327860000, AC327860010, AC406810000, AC406810010, AC406810030, AC406810500, AC406815000, AC406820000, AC406820040, AC406820250, AC406825000, AC406830000, AC406835000, S79997, BP1100-500, E175-20, E175-4, E175-500, E175J4, E175POP19, E175POP50, E175RS19, E175RS50, E175SS19, E175SS50, E190-4
Synonyms: Ethylene dichloride; 1,2-Ethylene dichloride; Glycol dichloride; EDC; sym-Dichloroethane; 1,2-Dichloroethane; Ethylene chloride.
Company Identification:

Fisher Scientific
1 Reagent Lane
Fair Lawn, NJ 07410

For information, call: 201-796-7100
Emergency Number: 201-796-7100
For CHEMTREC assistance, call: 800-424-9300
For International CHEMTREC assistance, call: 703-527-3887

## Section 2 - Composition, Information on Ingredients

| CAS# | Chemical Name | Percent | EINECS/ELINCS |
|---|---|---|---|
| 107-06-2 | 1,2-Dichloroethane | >99 | 203-458-1 |

## Section 3 - Hazards Identification

### EMERGENCY OVERVIEW

Appearance: colorless liquid. Flash Point: 56 deg F.
Warning! Flammable liquid and vapor. Causes respiratory tract irritation. Irritant. Causes eye and skin irritation. May be harmful

if swallowed. May cause central nervous system depression. May cause cancer based on animal studies. May cause liver and kidney damage.
Target Organs: Central nervous system, liver, eyes, skin.

### Potential Health Effects

Eye: Causes eye irritation. Vapors may cause eye irritation. May cause chemical conjunctivitis and corneal damage.
Skin: Causes skin irritation. May be absorbed through the skin. May cause irritation and dermatitis. May cause cyanosis of the extremities.
Ingestion: May cause central nervous system depression, kidney damage, and liver damage. May cause gastrointestinal irritation with nausea, vomiting and diarrhea. May cause effects similar to those for inhalation exposure. May be harmful if swallowed.
Inhalation: Inhalation of high concentrations may cause central nervous system effects characterized by nausea, headache, dizziness, unconsciousness and coma. Causes respiratory tract irritation. May cause liver and kidney damage. Aspiration may lead to pulmonary edema. Vapors may cause dizziness or suffocation. Can produce delayed pulmonary edema. Exposure to high concentrations may produce narcosis, nausea and loss of consciousness. May cause burning sensation in the chest.
Chronic: Possible cancer hazard based on tests with laboratory animals. Prolonged or repeated skin contact may cause dermatitis. Prolonged or repeated eye contact may cause conjunctivitis. May cause liver and kidney damage. Effects may be delayed.

## Section 4 - First Aid Measures

Eyes: Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid.
Skin: Get medical aid. Flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse.
Ingestion: Never give anything by mouth to an unconscious person. Get medical aid. Do NOT induce vomiting. If conscious and alert, rinse mouth and drink 2-4 cupfuls of milk or water.
Inhalation: Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid. Do NOT use mouth-to-mouth resuscitation.
Notes to Physician: Treat symptomatically and supportively.

## Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Vapors may form an explosive mixture with air. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion. Use water spray to keep fire-exposed containers cool. Flammable liquid and vapor. Approach fire from upwind to avoid hazardous vapors and toxic decomposition products. Vapors are heavier than air and

may travel to a source of ignition and flash back. Vapors can spread along the ground and collect in low or confined areas.
Extinguishing Media: For small fires, use dry chemical, carbon dioxide, water spray or alcohol-resistant foam. For large fires, use water spray, fog, or alcohol-resistant foam. Water may be ineffective. Do NOT use straight streams of water.
Flash Point: 56e deg F ( 13.33 deg C)
Autoignition Temperature: 775 deg F ( 412.78 deg C)
Explosion Limits, Lower:6.2%
Upper: 15.9%
NFPA Rating: (estimated) Health: 2; Flammability: 3; Instability: 0

## Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.
Spills/Leaks: Absorb spill with inert material (e.g. vermiculite, sand or earth), then place in suitable container. Avoid runoff into storm sewers and ditches which lead to waterways. Clean up spills immediately, observing precautions in the Protective Equipment section. Remove all sources of ignition. Use a spark-proof tool. Provide ventilation. A vapor suppressing foam may be used to reduce vapors.

## Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Ground and bond containers when transferring material. Use spark-proof tools and explosion proof equipment. Avoid contact with eyes, skin, and clothing. Empty containers retain product residue, (liquid and/or vapor), and can be dangerous. Keep container tightly closed. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose empty containers to heat, sparks or open flames. Use only with adequate ventilation. Keep away from heat, sparks and flame. Avoid breathing vapor or mist.
Storage: Keep away from heat, sparks, and flame. Keep away from sources of ignition. Store in a tightly closed container. Keep from contact with oxidizing materials. Store in a cool, dry, well-ventilated area away from incompatible substances. Flammables-area. Storage under a nitrogen blanket has been recommended.

## Section 8 - Exposure Controls, Personal Protection

Engineering Controls: Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate general or local explosion-proof ventilation to keep airborne levels to acceptable levels.
Exposure Limits

| Chemical Name | ACGIH | NIOSH | OSHA - Final PELs |
|---|---|---|---|
| 1,2-Dichloroethane | 10 ppm TWA | 1 ppm TWA; 4 mg/m3 TWA 50 ppm IDLH | 50 ppm TWA; 100 ppm Ceiling |

OSHA Vacated PELs: 1,2-Dichloroethane: 1 ppm TWA; 4 mg/m3 TWA
Personal Protective Equipment
Eyes: Wear chemical goggles.
Skin: Wear appropriate protective gloves to prevent skin exposure.
Clothing: Wear appropriate protective clothing to prevent skin exposure.
Respirators: A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant a respirator's use.

## Section 9 - Physical and Chemical Properties

Physical State: Liquid
Appearance: colorless
Odor: chloroform-like
pH: Not available.
Vapor Pressure: 100 mm Hg @29 deg C
Vapor Density: 3.4 (Air=1)
Evaporation Rate:6.5 (Butyl acetate=1)
Viscosity: Not available.
Boiling Point: 81-85 deg C
Freezing/Melting Point:-35 deg C
Decomposition Temperature:Not available.
Solubility: Insoluble.
Specific Gravity/Density:1.25 (Water=1)
Molecular Formula:C2H4Cl2
Molecular Weight:98.96

## Section 10 - Stability and Reactivity

Chemical Stability: Stable at room temperature in closed containers under normal storage and handling conditions.
Conditions to Avoid: Light, ignition sources, excess heat, electrical sparks.
Incompatibilities with Other Materials: Aluminum, bases, alkali metals, ketones, organic peroxides, nitric acid, strong oxidizing agents, strong reducing agents, liquid ammonia, amines.

Hazardous Decomposition Products: Hydrogen chloride, phosgene, carbon monoxide, irritating and toxic fumes and gases, carbon dioxide.
Hazardous Polymerization: Has not been reported.

## Section 11 - Toxicological Information

RTECS#:
CAS# 107-06-2: KI0525000
LD50/LC50:
CAS# 107-06-2:

Draize test, rabbit, eye: 63 mg Severe;
Draize test, rabbit, eye: 500 mg/24H Mild;
Draize test, rabbit, skin: 500 mg/24H Mild;
Inhalation, mouse: LC50 = 1060 mg/m3/6H;
Inhalation, rat: LC50 = 1000 ppm/7H;
Inhalation, rat: LC50 = 5100 mg/m3/6H;
Oral, mouse: LD50 = 413 mg/kg;
Oral, mouse: LD50 = 413 mg/kg;
Oral, rabbit: LD50 = 860 mg/kg;
Oral, rabbit: LD50 = 0.7 mL/kg;
Oral, rat: LD50 = 500 mg/kg;
Skin, rabbit: LD50 = 2800 mg/kg;

Carcinogenicity:
CAS# 107-06-2:

- California: carcinogen, initial date 10/1/87
- NTP: Suspect carcinogen
- IARC: Group 2B carcinogen

Epidemiology: IARC Group 2B: Proven animal carcinogenic substance of potential relevance to humans. IARC Group 2B: No data available on human carcinogenicity, however sufficient evidence of carcinogenicity in animals.
Teratogenicity: See actual entry in RTECS for complete information.
Reproductive Effects: No information found.
Neurotoxicity: No information found.
Mutagenicity: No information found.
Other Studies: See actual entry in RTECS for complete information.

## Section 12 - Ecological Information

Ecotoxicity: Water flea Daphnia: 218mg/L; 48H; Fish: Bluegill/Sunfish: 430mg/L; 96H; StaticFish: Fathead Minnow: 136mg/L; 96H; Static No data available.
Environmental: Terrestrial: Smaller releases on land will evaporate fairly rapidly. Larger releases may leach rapidly through sandy soil into groundwater. Aquatic: If released to surface water, its primary loss will be by evaporation. The half-life for evaporation will depend on wind and mixing conditions and was of the order of hours in the laboratory. However a modeling study using the EXAMS model for a eutrophic lake gave a half-life of 10 days. Atmospheric: Will degrade by reaction with hydroxyl radicals formed photochemically in the atmosphere. Half-life over one month.
Physical: Not expected to biodegrade or bioconcentrate.
Other: No information available.

## Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.
RCRA P-Series: None listed.
RCRA U-Series:
CAS# 107-06-2: waste number U077.

## Section 14 - Transport Information

| | US DOT | Canada TDG |
|---|---|---|
| Shipping Name: | ETHYLENE DICHLORIDE | ETHYLENE DICHLORIDE |
| Hazard Class: | 3 | 3(6.1) |
| UN Number: | UN1184 | UN1184 |
| Packing Group: | II | II |
| Additional Info: | | FLASHPOINT 13 C |

## Section 15 - Regulatory Information

US FEDERAL

TSCA
CAS# 107-06-2 is listed on the TSCA inventory.
Health & Safety Reporting List
CAS# 107-06-2: Effective 6/1/87, Sunset 6/1/97
Chemical Test Rules
CAS# 107-06-2: Testing required by manufacturers, processors; Test for Heal
Section 12b
CAS# 107-06-2: Section 4
TSCA Significant New Use Rule
None of the chemicals in this material have a SNUR under TSCA.
CERCLA Hazardous Substances and corresponding RQs
CAS# 107-06-2: 100 lb final RQ; 45.4 kg final RQ
SARA Section 302 Extremely Hazardous Substances
None of the chemicals in this product have a TPQ.
SARA Codes
CAS # 107-06-2: acute, chronic, flammable.
Section 313
This material contains 1,2-Dichloroethane (CAS# 107-06-2, >99%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR
Clean Air Act:
CAS# 107-06-2 is listed as a hazardous air pollutant (HAP).
This material does not contain any Class 1 Ozone depletors.
This material does not contain any Class 2 Ozone depletors.
Clean Water Act:
CAS# 107-06-2 is listed as a Hazardous Substance under the CWA. CAS# 107-06-2 is listed as a Priority Pollutant under the Clean Water Act. CAS# 107-06-2 is listed as a Toxic Pollutant under the Clean Water Act.
OSHA:
None of the chemicals in this product are considered highly hazardous by OSHA.
STATE
CAS# 107-06-2 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

California Prop 65
The following statement(s) is(are) made in order to comply with the California Safe Drinking Water Act:
WARNING: This product contains 1,2-Dichloroethane, a chemical known to the state of California to cause cancer.
California No Significant Risk Level: CAS# 107-06-2: 10 æg/day NSRL

## European/International Regulations

European Labeling in Accordance with EC Directives
Hazard Symbols:

T F

Risk Phrases:

R 11 Highly flammable.
R 22 Harmful if swallowed.
R 36/37/38 Irritating to eyes, respiratory system and skin.
R 45 May cause cancer.

Safety Phrases:

S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).
S 53 Avoid exposure - obtain special instructions before use.

WGK (Water Danger/Protection)

CAS# 107-06-2: 3

Canada - DSL/NDSL

CAS# 107-06-2 is listed on Canada's DSL List.

Canada - WHMIS

This product has a WHMIS classification of B2, D1B.

Canadian Ingredient Disclosure List

CAS# 107-06-2 is listed on the Canadian Ingredient Disclosure List.

## Section 16 - Additional Information

MSDS Creation Date: 12/12/1997
Revision #9 Date: 3/26/2004

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.

# Material Safety Data Sheet

Ethyl ether

ACC# 90868

## Section 1 - Chemical Product and Company Identification

MSDS Name: Ethyl ether
Catalog Numbers: AC326860000, AC326860010, AC326861000, AC326862500, AC364330000, AC364330010, AC364331000, AC610600190, AC610600500, AC610601150, AC610602000, AC610800190, AC610800500, AC610801150, AC610802000, AC615070040, AC615080010, AC615080040, AC615080200, AC615085000, S73990, S73990ACS-1, S73990ACS-2, S73990ANES-1, S73990ANES-2, E134-1, E134-20, E134-4, E136-150, E137POP19, E137POP200, E137POP50, E137RS-19, E137RS-200, E137RS-50, E137SS19, E137SS200, E137SS50, E138-1, E138-20, E138-4, E138-500, E1381U, E138ALC, E138J4, E138POP19, E138RS19, E138RS50, E138SS19, E188-20, E188-4, E188-500, E197-1, E197-4, E1974U, E198-4, E198J4, E198RS19, E199-4, E492-20, E492-4, E49220LC, NC9118371, S17573MF, S73990-1, S73990-2, S73990SPEC
Synonyms: Ethane, 1,1'-oxybis-; Anesthetic ether; Diethyl ether; Ethoxyethane; Diethyl oxide; Ethyl ether; Ether; Ethyl oxide.
Company Identification:

Fisher Scientific
1 Reagent Lane
Fair Lawn, NJ 07410

For information, call: 201-796-7100
Emergency Number: 201-796-7100
For CHEMTREC assistance, call: 800-424-9300
For International CHEMTREC assistance, call: 703-527-3887

## Section 2 - Composition, Information on Ingredients

| CAS# | Chemical Name | Percent | EINECS/ELINCS |
|---|---|---|---|
| 60-29-7 | Ethyl ether | >99 | 200-467-2 |

## Section 3 - Hazards Identification

### EMERGENCY OVERVIEW

Appearance: APHA: 10 max clear liquid. Flash Point: -45 deg C.

Danger! Extremely flammable liquid and vapor. Vapor may cause flash fire. Breathing vapors may cause drowsiness and dizziness. Causes eye irritation. Repeated exposure may cause skin dryness or cracking. Aspiration hazard if swallowed. Can enter lungs and cause damage. May be harmful if swallowed. May form explosive peroxides. This material has been reported to be susceptible to autoxidation and therefore should be classified as peroxidizable. Hygroscopic (absorbs moisture from the air). Air sensitive. Light sensitive. May be habit forming.
Target Organs: Central nervous system, respiratory system, eyes, skin.

### Potential Health Effects

Eye: Causes moderate eye irritation. Causes redness and pain.
Skin: Causes skin irritation. May be absorbed through the skin. Repeated or prolonged exposure may cause drying and cracking of the skin.
Ingestion: Aspiration hazard. Symptoms may include: headache, excitement, fatigue, nausea, vomiting, stupor, and coma. May cause central nervous system depression, characterized by excitement, followed by headache, dizziness, drowsiness, and nausea. Advanced stages may cause collapse, unconsciousness, coma and possible death due to respiratory failure. Aspiration of material into the lungs may cause chemical pneumonitis, which may be fatal.
Inhalation: Exposure to high concentrations may produce narcosis, nausea and loss of consciousness. Inhalation of vapors may cause drowsiness and dizziness.
Chronic: Prolonged or repeated skin contact may cause defatting and dermatitis. Prolonged or repeated exposure can cause psychic abnormalities such as anxiety, depression and excitability. Laboratory experiments have resulted in mutagenic effects. Prolonged exposure to high vapor concentrations may cause eye injury. Repeated exposures may be habit forming. Prolonged or repeated inhalation or ingestion may result in liver and kidney changes.

## Section 4 - First Aid Measures

Eyes: In case of contact, immediately flush eyes with plenty of water for a t least 15 minutes. Get medical aid.
Skin: In case of contact, immediately flush skin with plenty of water. Remove contaminated clothing and shoes. Get medical aid. Wash clothing before reuse.
Ingestion: Potential for aspiration if swallowed. Get medical aid immediately. Do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person.
Inhalation: If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.
Notes to Physician: Persons with kidney disease, chronic respiratory disease, liver disease, or skin disease may be at increased risk from exposure to this substance. Alcoholic beverage consumption may enhance the toxic effects of this substance. Treat symptomatically and supportively.

## Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Vapors may form an explosive mixture with air. Extremely flammable. Material will readily ignite at room temperature. Use water spray to keep fire-exposed containers cool. Water may be ineffective. Material is lighter than water and a fire may be spread by the use of water. Containers may explode in the heat of a fire. May form explosive peroxides. Will be easily ignited by heat, sparks or flame. May re-ignite after fire is extinguished. Vapors are heavier than air and may travel to a source of ignition and flash back. Vapors can spread along the ground and collect in low or confined areas. This liquid floats on water and may travel to a source of ignition and spread fire.
Extinguishing Media: For small fires, use dry chemical, carbon dioxide, water spray or alcohol-resistant foam. Water may be ineffective. For large fires, use water spray, fog or alcohol-resistant foam. Do NOT use straight streams of water. Cool containers with flooding quantities of water until well after fire is out.
Flash Point: -45 deg C ( -49.00 deg F)
Autoignition Temperature: 180-190 deg C
Explosion Limits, Lower:1.9 vol %
Upper: 36.0 vol %
NFPA Rating: (estimated) Health: 1; Flammability: 4; Instability: 1

## Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.
Spills/Leaks: Absorb spill with inert material (e.g. vermiculite, sand or earth), then place in suitable container. Avoid runoff into storm sewers and ditches which lead to waterways. Remove all sources of ignition. Use a spark-proof tool. Place under an inert atmosphere. A vapor suppressing foam may be used to reduce vapors.

## Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Ground and bond containers when transferring material. Avoid contact with eyes, skin, and clothing. Empty containers retain product residue, (liquid and/or vapor), and can be dangerous. Take precautionary measures against static discharges. Keep container tightly closed. Keep away from heat, sparks and flame. Handle under an inert atmosphere. If peroxide formation is suspected, do not open or move container. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose empty containers to heat, sparks or open flames. Use only with adequate ventilation. Avoid breathing vapor.
Storage: Keep away from heat, sparks, and flame. Keep away from sources of ignition. Do not store near combustible materials. Do not store in direct sunlight. Store in a tightly closed container. Store in a cool, dry, well-ventilated area away from incompatible

substances. Flammables-area. Do not expose to air. Store protected from light. Store under an inert atmosphere. Keep away from oxidizing agents. Containers should be dated when opened and tested periodically for the presence of peroxides. Should crystals form in a peroxidizable liquid, peroxidation may have occurred and the product should be considered extremely dangerous. In this instance, the container should only be opened remotely by professionals. Store at room temperature or below. Do not exceed 86°F. Do not open unless contents are at 72°F or below for at least 24 hours. Ethyl ether may form explosive peroxides on long standing or after exposure to air or light. All peroxidizable substances should be stored away from heat and light and be protected from ignition sources.

## Section 8 - Exposure Controls, Personal Protection

Engineering Controls: Use process enclosure, local exhaust ventilation, or other engineering controls to control airborne levels below recommended exposure limits. Use explosion-proof ventilation equipment. Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower.

Exposure Limits

| Chemical Name | ACGIH | NIOSH | OSHA - Final PELs |
|---|---|---|---|
| Ethyl ether | 400 ppm TWA; 500 ppm STEL | 1900 ppm IDLH | 400 ppm TWA; 1200 mg/m3 TWA |

OSHA Vacated PELs: Ethyl ether: 400 ppm TWA; 1200 mg/m3 TWA

Personal Protective Equipment

Eyes: Wear chemical goggles.

Skin: Wear appropriate protective gloves to prevent skin exposure.

Clothing: Wear appropriate protective clothing to prevent skin exposure.

Respirators: A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant a respirator's use.

## Section 9 - Physical and Chemical Properties

Physical State: Clear liquid

Appearance: APHA: 10 max

Odor: sweetish odor - aromatic odor

pH: Not available.

Vapor Pressure: 442 mm Hg @ 20 deg C

Vapor Density: 2.55 (Air=1)

Evaporation Rate:37.5 (Butyl acetate=1)

Viscosity: 0.2448 cp @20 deg C

Boiling Point: 34.6 deg C

Freezing/Melting Point:-116.3 deg C
Decomposition Temperature:Not available.
Solubility: Slightly soluble.
Specific Gravity/Density:<.7079 g/ml
Molecular Formula:C4H10O
Molecular Weight:74.12

## Section 10 - Stability and Reactivity

Chemical Stability: Under normal storage conditions, peroxidizable compounds can form and accumulate peroxides which may explode when subjected to heat or shock. This material is most hazardous when peroxide levels are concentrated by distillation or evaporation.
Conditions to Avoid: Light, ignition sources, exposure to air, electrical sparks, exposure to flame, heat.
Incompatibilities with Other Materials: Strong oxidizing agents, strong acids.
Hazardous Decomposition Products: Carbon monoxide, irritating and toxic fumes and gases, carbon dioxide, peroxides.
Hazardous Polymerization: Will not occur.

## Section 11 - Toxicological Information

RTECS#:
CAS# 60-29-7: KI5775000
LD50/LC50:
CAS# 60-29-7:
Draize test, rabbit, eye: 100 mg Moderate;
Inhalation, mouse: LC50 = 31000 ppm/30M;
Oral, mouse: LD50 = 1760 mg/kg;
Oral, rat: LD50 = 1215 mg/kg;
Skin, rabbit: LD50 = >20 mL/kg;
Carcinogenicity:
CAS# 60-29-7: Not listed by ACGIH, IARC, NTP, or CA Prop 65.

Epidemiology: No information available.
Teratogenicity: No information available.
Reproductive Effects: No information available.
Neurotoxicity: No information available.
Mutagenicity: DNA Repair: Escherichia coli = 35670 ug/well/16H.; DNA Inhibition: Mouse, Embryo = 2850 mg/L.; Mutation Test

Systems - not otherwise specified: Hamster, Fibroblast = 1 pph.
Other Studies: Open Irritation Test: Administration onto the skin (rabbit) = 360 mg (Mild). Standard Draize Test: Administration into the eye (rabbit) = 100 mg (Moderate). Standard Draize Test: Administration onto the skin (rabbit) = 50 mg/24H (Severe). Standard Draize Test: Administration into the eye (human) = 100 ppm.

## Section 12 - Ecological Information

Ecotoxicity: Fish: Fathead Minnow: LC50 = 2600 mg/L; 96 Hr; Flow-through bioassayFish: Bluegill/Sunfish: LC50 >10000 mg/L; 96 Hr; Static bioassayBacteria: Phytobacterium phosphoreum: EC50 = 5625 mg/L; 15 min; Microtox test If ethyl ether is released to soil, it will be subject to volatilization. It will be expected to exhibit high mobility in soil and, therefore, it may leach to groundwater. If ethyl ether is released to water, it will not be expected to significantly adsorb to sediment or suspended particulate matter, bioconcentrate in aquatic organisms or hydrolyze.
Environmental: Ethyl ether will not significantly photooxidize via reaction with photochemically produced hydroxyl radicals in the water. Ethyl ether in surface water will be subject to rapid volatilization with estimated half-lives of 3.1 hr and 1.5 days. It will not be expected to hydrolyze in water or soil. If ethyl ether is released to the atmosphere, it will be expected to exist almost entirely in the vapor phase.It will be susceptible to photooxidation via vapor phase reaction with photochemically produced hydroxyl radicals with a half-life of 29 hours.
Physical: No information available.
Other: No information available.

## Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.
RCRA P-Series: None listed.
RCRA U-Series:
CAS# 60-29-7: waste number U117 (Ignitable waste).

## Section 14 - Transport Information

| | US DOT | Canada TDG |
|---|---|---|
| Shipping Name: | DIETHYL ETHER | DIETHYL ETHER |
| Hazard Class: | 3 | 3 |

| | | |
|---|---|---|
| UN Number: | UN1155 | UN1155 |
| Packing Group: | I | I |
| Additional Info: | | FLASHPOINT -40 C |

## Section 15 - Regulatory Information

### US FEDERAL

TSCA
CAS# 60-29-7 is listed on the TSCA inventory.
Health & Safety Reporting List
None of the chemicals are on the Health & Safety Reporting List.
Chemical Test Rules
None of the chemicals in this product are under a Chemical Test Rule.
Section 12b
None of the chemicals are listed under TSCA Section 12b.
TSCA Significant New Use Rule
None of the chemicals in this material have a SNUR under TSCA.
CERCLA Hazardous Substances and corresponding RQs
CAS# 60-29-7: 100 lb final RQ; 45.4 kg final RQ
SARA Section 302 Extremely Hazardous Substances
None of the chemicals in this product have a TPQ.
SARA Codes
CAS # 60-29-7: acute, flammable, sudden release of pressure, reactive.
Section 313 No chemicals are reportable under Section 313.
Clean Air Act:
This material does not contain any hazardous air pollutants.
This material does not contain any Class 1 Ozone depletors.
This material does not contain any Class 2 Ozone depletors.
Clean Water Act:
None of the chemicals in this product are listed as Hazardous Substances under the CWA.
None of the chemicals in this product are listed as Priority Pollutants under the CWA.
None of the chemicals in this product are listed as Toxic Pollutants under the CWA.
OSHA:
None of the chemicals in this product are considered highly hazardous by OSHA.
STATE
CAS# 60-29-7 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

California Prop 65

California No Significant Risk Level: None of the chemicals in this product are listed.

## European / International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols:

XN F+

Risk Phrases:

R 12 Extremely flammable.
R 19 May form explosive peroxides.
R 22 Harmful if swallowed.
R 66 Repeated exposure may cause skin dryness or cracking.
R 67 Vapours may cause drowsiness and dizziness.

Safety Phrases:

S 16 Keep away from sources of ignition - No smoking.
S 29 Do not empty into drains.
S 33 Take precautionary measures against static discharges.
S 9 Keep container in a well-ventilated place.

WGK (Water Danger/Protection)

CAS# 60-29-7: 1

Canada - DSL/NDSL

CAS# 60-29-7 is listed on Canada's DSL List.

Canada - WHMIS

This product has a WHMIS classification of B2.

Canadian Ingredient Disclosure List

CAS# 60-29-7 is listed on the Canadian Ingredient Disclosure List.

## Section 16 - Additional Information

MSDS Creation Date: 6/02/1999
Revision #6 Date: 5/05/2004

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.

# Material Safety Data Sheet
## Dichloromethane

ACC# 14930

## Section 1 - Chemical Product and Company Identification

MSDS Name: Dichloromethane
Catalog Numbers: AC326600040, AC326852500, AC406910010, AC406910040, AC406910200, AC406920040, AC610050040, AC610160040, AC610300010, AC61030019, AC61030019, AC61030050, AC61030050, AC610301000, AC61030115, AC61030115, AC61030200, AC610520190, AC610520500, AC610521150, AC610522000, AC610720190, AC610720500, AC610721150, AC610722000, AC610931000, S41712, S80084, S80084-1, BP1186-4, BP1186POP20, BP1186SS-50, BP2608-100, BW4250RT50, D1381, D1384, D138SK4, D142-4, D142RS115, D142RS200, D142RS28, D142RS50, D142SS-115, D142SS-200, D142SS-28, D142SS-50, D143-1, D143-4, D143J1, D143N219, D143RS-19, D143RS115, D143RS200, D143RS28, D143RS50, D143SK-1, D143SK-4, D143SK4LC, D143SS-115, D143SS-200, D143SS-28, D143SS19, D149-1, D149RS-19, D149RS-50, D150-1, D150-4, D1504LC, D150J-4, D150SK-1, D150SK-4, D151-1, D151-4, D151J1, D151RS-19, D151RS-200, D151RS-28, D151RS-50, D151RS115, D151SS-115, D151SS-200, D151SS-28, D151SS-50, D154-4, D1544LC, D158-4, D35-1, D35-4, D37-1, D37-20, D37-200, D37-4, D37-500, D37200LC, D37FB-115, D37FB-19, D37FB-200, D37FB-50, D37J1, D37POP19, D37POPB200, D37POPB50, D37RB-115, D37RB-200, D37RB-50, D37RS-115, D37RS-200, D37RS-28, D37RS-50, D37RS19, D37SK-4, D37SS-200, D37SS13150, D37SS1350, NC9026865, NC9195811, NC9206961, NC9325934, NC9964976, PS03502, PS03503, XXD1584LI
Synonyms: Methylene chloride; Methane dichloride; Methylene bichloride; Methylene dichloride; Dichloromethane; DCM.
Company Identification:

Fisher Scientific
1 Reagent Lane
Fair Lawn, NJ 07410
For information, call: 201-796-7100
Emergency Number: 201-796-7100
For CHEMTREC assistance, call: 800-424-9300
For International CHEMTREC assistance, call: 703-527-3887

## Section 2 - Composition, Information on Ingredients

| CAS# | Chemical Name | Percent | EINECS/ELINCS |
|---|---|---|---|
| 75-09-2 | Methylene chloride | >99.5 | 200-838-9 |

## Section 3 - Hazards Identification

### EMERGENCY OVERVIEW

Appearance: colorless liquid.
Warning! Methylene chloride is metabolically converted to carbon monoxide after systemic absorption, which yields increased concentrations of carboxyhemoglobin in the blood. Harmful if swallowed. Causes eye, skin, and respiratory tract irritation. May be harmful if inhaled. May cause central nervous system effects. Potential cancer hazard. May cause kidney damage. This substance has caused adverse reproductive and fetal effects in animals.
Target Organs: Blood, central nervous system.

### Potential Health Effects

Eye: Contact with eyes may cause severe irritation, and possible eye burns.
Skin: May be absorbed through the skin. Causes irritation with burning pain, itching, and redness. Prolonged exposure may result in skin burns.
Ingestion: Causes gastrointestinal irritation with nausea, vomiting and diarrhea. May cause kidney damage. May cause central nervous system depression, characterized by excitement, followed by headache, dizziness, drowsiness, and nausea. Advanced stages may cause collapse, unconsciousness, coma and possible death due to respiratory failure. May cause carboxyhemoglobinemia.
Inhalation: Inhalation of high concentrations may cause central nervous system effects characterized by nausea, headache, dizziness, unconsciousness and coma. Causes respiratory tract irritation. May cause narcotic effects in high concentration. Vapors may cause dizziness or suffocation. May cause blood changes. Overexposure may cause an increase in carboxyhemoglobin levels in the blood. Can produce delayed pulmonary edema. Because of its high volatility, airborne concentrations of methylene chloride can accumulate in poorly ventilated areas. Odor is a poor indicator of possibly dangerous air concentrations of methylene chloride.
Chronic: Possible cancer hazard based on tests with laboratory animals. Prolonged or repeated skin contact may cause dermatitis. May cause reproductive and fetal effects. Laboratory experiments have resulted in mutagenic effects. Chronic exposure may cause lung, liver, and pancreatic tumors. May cause conjunctivitis and/or corneal burns.

## Section 4 - First Aid Measures

Eyes: In case of contact, immediately flush eyes with plenty of water for a t least 15 minutes. Get medical aid.
Skin: In case of contact, flush skin with plenty of water. Remove contaminated clothing and shoes. Get medical aid if irritation develops and persists. Wash clothing before reuse.
Ingestion: If swallowed, do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Get medical aid.
Inhalation: If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.

Notes to Physician: Treat symptomatically and supportively.

## Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Use water spray to keep fire-exposed containers cool. No flash point in conventional closed tester, but forms flammable vapor-air mixtures in larger volumes and may be an explosion hazard in a confined space.
Extinguishing Media: Use water spray, dry chemical, carbon dioxide, or appropriate foam.
Flash Point: Not applicable.
Autoignition Temperature: 556 deg C ( 1,032.80 deg F)
Explosion Limits, Lower:13 vol %
Upper: 23 vol %
NFPA Rating: (estimated) Health: 2; Flammability: 1; Instability: 0

## Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.
Spills/Leaks: Absorb spill with inert material (e.g. vermiculite, sand or earth), then place in suitable container. Avoid runoff into storm sewers and ditches which lead to waterways. Clean up spills immediately, observing precautions in the Protective Equipment section. Remove all sources of ignition. Provide ventilation.

## Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Avoid contact with eyes, skin, and clothing. Keep container tightly closed. Keep away from heat, sparks and flame. Use only with adequate ventilation. Avoid breathing vapor or mist.
Storage: Store in a tightly closed container. Keep from contact with oxidizing materials. Store in a cool, dry, well-ventilated area away from incompatible substances. Store below 40°C. Keep away from active metals.

## Section 8 - Exposure Controls, Personal Protection

Engineering Controls: Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits.
Exposure Limits

| Chemical Name | ACGIH | NIOSH | OSHA - Final PELs |
|---|---|---|---|
| Methylene chloride | 50 ppm TWA | 2300 ppm IDLH | 25 ppm TWA (8 hr); 125 ppm STEL (15 min); 12.5 ppm Action Level (See 29 CFR 1910 .1052) |

OSHA Vacated PELs: Methylene chloride: 500 ppm TWA
Personal Protective Equipment
Eyes: Wear chemical goggles.
Skin: Wear appropriate protective gloves to prevent skin exposure.
Clothing: Wear appropriate protective clothing to prevent skin exposure.
Respirators: A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant a respirator's use.

## Section 9 - Physical and Chemical Properties

Physical State: Liquid
Appearance: colorless
Odor: ethereal odor - chloroform-like
pH: Not available.
Vapor Pressure: 350 mm Hg @ 20 deg C
Vapor Density: 2.93 (Air=1)
Evaporation Rate:Not available.
Viscosity: Not available.
Boiling Point: 40 deg C
Freezing/Melting Point:-97 deg C
Decomposition Temperature:Not available.
Solubility: Slightly soluble.
Specific Gravity/Density:1.33 (Water=1)
Molecular Formula:CH2Cl2
Molecular Weight:84.93

## Section 10 - Stability and Reactivity

Chemical Stability: Stable at room temperature in closed containers under normal storage and handling conditions. May form explosive mixtures in atmospheres having high oxygen content.
Conditions to Avoid: Excess heat, attacks some plastics, rubber, and coatings, confined spaces, When no water is present, dichloromethane is not corrosive to metals. At high temperatures and in the presence of water (causing slow decomposition forming HCl), corrosion of iron, some stainless steels, copper and aluminum can occur..
Incompatibilities with Other Materials: Strong oxidizing agents, strong bases, chemically active metals.
Hazardous Decomposition Products: Hydrogen chloride, phosgene, carbon monoxide, carbon dioxide.
Hazardous Polymerization: Will not occur.

## Section 11 - Toxicological Information

RTECS#:
CAS# 75-09-2: PA8050000
LD50/LC50:
CAS# 75-09-2:
Draize test, rabbit, eye: 162 mg Moderate;
Draize test, rabbit, eye: 10 mg Mild;
Draize test, rabbit, eye: 500 mg/24H Mild;
Draize test, rabbit, skin: 810 mg/24H Severe;
Draize test, rabbit, skin: 100 mg/24H Moderate;
Inhalation, mouse: LC50 = 14400 ppm/7H;
Inhalation, mouse: LC50 = 49100 mg/m3/6H;
Inhalation, mouse: LC50 = 54000 mg/m3/2H;
Inhalation, mouse: LC50 = 56220 mg/m3/7H;
Inhalation, rat: LC50 = 52 gm/m3;
Inhalation, rat: LC50 = 76000 mg/m3/4H;
Inhalation, rat: LC50 =
Carcinogenicity:
CAS# 75-09-2:

- ACGIH: A3 - Confirmed animal carcinogen with unknown relevance to humans
- California: carcinogen, initial date 4/1/88
- NTP: Suspect carcinogen
- IARC: Group 2B carcinogen

Epidemiology: There are few reports of injury despite widespread use of dichloromethane (ACGIH, 1991). Solvent abuse has led to death (Harbison, 1998).
Teratogenicity: Inhalation, rat: TCLo = 4500 ppm/24H (female 1-17 day(s) after conception) Effects on Newborn - behavioral.; Inhalation, rat: TCLo = 1250 ppm/7H (female 6-15 day(s) after conception) Specific Developmental Abnormalities - musculoskeletal system and urogenital system.
Reproductive Effects: Reproductive effects have occurred in experimental animals.
Neurotoxicity: No information available.
Mutagenicity: DNA inhibition: Human, Fibroblast = 5000 ppm/1H (Continuous).; Morphological transformation: Rat, Embryo = 160 umol/L.; DNA damage: Oral, rat = 1275 mg/kg.; Inhalation, mouse: TCLo = 2000 ppm/5H/2Y-C (Tumorigenic - Carcinogenic by RTECS criteria--Lungs, Thorax, or Respiration - Tumors).
Other Studies: See actual entry in RTECS for complete information.

## Section 12 - Ecological Information

Ecotoxicity: Fish: Bluegill/Sunfish: 230mg/L; 24H; StaticFish: Fathead Minnow: 196mg/L; 96H; This chemical has a moderate potential to affect some aquatic organisms. It is resistant to biodegradation, and has a low potential to persist in the aquatic environment. 96-hr. EC50 (loss of equilibrium); Fathead minnow: 99mg/L; 96-hr. EC10: 66.3 mg/L. Bluegill sunfish: 96-hr. LC50=220 mg/L; Water flea: 24-hr. LC50=2270 mg/L; No observed effect level:1550 mg/L.
Environmental: Terrestrial: Expected to evaporate from near surface soil into the atmosphere; expected to leach. Aquatic: Primarily lost by evaporation to the atmosphere which should take several hours depending on wind and mixing conditions. Atmospheric: Will degrade by reaction with hydroxyl radicals with a half life of several months. . Dichloromethane is reported to completely biodegrade under aerobic conditions with sewage seed or activated sludge between 6 hours to 7 days. Not expected to bioconcentrate due to its low octanol/water coefficient.
Physical: No information available.
Other: No information available.

## Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.
RCRA P-Series: None listed.
RCRA U-Series:
CAS# 75-09-2: waste number U080.

## Section 14 - Transport Information

| | US DOT | Canada TDG |
|---|---|---|
| Shipping Name: | DICHLOROMETHANE | DICHLOROMETHANE |
| Hazard Class: | 6.1 | 6.1 |
| UN Number: | UN1593 | UN1593 |
| Packing Group: | III | III |

## Section 15 - Regulatory Information

### US FEDERAL

TSCA

CAS# 75-09-2 is listed on the TSCA inventory.

Health & Safety Reporting List

CAS# 75-09-2: Effective 10/4/82, Sunset 10/4/92

Chemical Test Rules

None of the chemicals in this product are under a Chemical Test Rule.

Section 12b

None of the chemicals are listed under TSCA Section 12b.

TSCA Significant New Use Rule

None of the chemicals in this material have a SNUR under TSCA.

CERCLA Hazardous Substances and corresponding RQs

CAS# 75-09-2: 1000 lb final RQ; 454 kg final RQ

SARA Section 302 Extremely Hazardous Substances

None of the chemicals in this product have a TPQ.

SARA Codes

CAS # 75-09-2: acute, chronic.

Section 313

This material contains Methylene chloride (CAS# 75-09-2, >99.5%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.

Clean Air Act:

CAS# 75-09-2 is listed as a hazardous air pollutant (HAP).

This material does not contain any Class 1 Ozone depletors.

This material does not contain any Class 2 Ozone depletors.

Clean Water Act:

None of the chemicals in this product are listed as Hazardous Substances under the CWA. CAS# 75-09-2 is listed as a Priority

Pollutant under the Clean Water Act. CAS# 75-09-2 is listed as a Toxic Pollutant under the Clean Water Act.

OSHA:

None of the chemicals in this product are considered highly hazardous by OSHA.

STATE

CAS# 75-09-2 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

California Prop 65

The following statement(s) is(are) made in order to comply with the California Safe Drinking Water Act:
WARNING: This product contains Methylene chloride, a chemical known to the state of California to cause cancer.
California No Significant Risk Level: CAS# 75-09-2: 200 æg/day NSRL (inhalation); 50 æg/day NSRL (except inhalation)

## European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols:

XN

Risk Phrases:

R 40 Limited evidence of a carcinogenic effect.

Safety Phrases:

S 23 Do not inhale gas/fumes/vapour/spray.
S 24/25 Avoid contact with skin and eyes.
S 36/37 Wear suitable protective clothing and gloves.

WGK (Water Danger/Protection)

CAS# 75-09-2: 2

Canada - DSL/NDSL

CAS# 75-09-2 is listed on Canada's DSL List.

Canada - WHMIS

This product has a WHMIS classification of D2A.

Canadian Ingredient Disclosure List

CAS# 75-09-2 is listed on the Canadian Ingredient Disclosure List.

## Section 16 - Additional Information

MSDS Creation Date: 4/20/1999
Revision #5 Date: 2/20/2003

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the

suitability of the information for their particular purposes. In no event shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.

# Material Safety Data Sheet
Toluene

ACC# 23590

## Section 1 - Chemical Product and Company Identification

MSDS Name: Toluene
Catalog Numbers: AC326982500, AC421160040, AC421170040, AC610110040, AC610460010, AC610461000, AC610590190, AC610590500, AC610591150, AC610592000, AC610790190, AC610790500, AC610791150, AC610792000, AC610951000, S80229, S80229-1, S80229-2, S80229HPLC, NC9200227, T288POP19, T288POP200, T288POP50, T288RS19, T288SS19, T288SS200, T288SS50, T290-1, T290-4, T2901LC, T290N219, T290NB219, T290POP19, T290POP200, T290POP50, T290POPN19, T290RS19, T290RS200, T290RS28, T290SK-1, T290SK-4, T290SS115, T290SS19, T290SS200, T290SS28, T290SS50, T291-4, T2914LC, T291RS200, T313-4, T313SK-4, T323-20, T323-4, T324-1, T324-20, T324-200, T324-4, T324-500, T324200LC, T32420LC, T324CU1300, T324FB115, T324FB19, T324FB200, T324FB50, T324J500, T324POP19, T324POP200, T324POP50, T324POPB19, T324POPB200, T324POPB50, T324RB115, T324RB19, T324RB200, T324RS115, T324RS19, T324RS200, T324RS28, T324RS50, T324S-4, T324SK-4, T324SS115, T324SS19, T324SS200, T324SS28, T324SS50, T326-P4, T326F1GAL, T326S20, T330-4, XXT32418LI
Synonyms: Methylbenzene; Methylbenzol; Phenylmethane; Toluol.
Company Identification:

Fisher Scientific
1 Reagent Lane
Fair Lawn, NJ 07410

For information, call: 201-796-7100
Emergency Number: 201-796-7100
For CHEMTREC assistance, call: 800-424-9300
For International CHEMTREC assistance, call: 703-527-3887

## Section 2 - Composition, Information on Ingredients

| CAS# | Chemical Name | Percent | EINECS/ELINCS |
|---|---|---|---|
| 108-88-3 | Toluene | >99 | 203-625-9 |

## Section 3 - Hazards Identification

### EMERGENCY OVERVIEW

Appearance: colorless liquid. Flash Point: 4 deg C.
Warning! Flammable liquid and vapor. Causes eye, skin, and respiratory tract irritation. Breathing vapors may cause drowsiness and dizziness. May be absorbed through intact skin. Aspiration hazard if swallowed. Can enter lungs and cause damage. Possible risk of harm to the unborn child. May cause central nervous system depression.
Target Organs: Central nervous system, respiratory system, eyes, skin.

### Potential Health Effects

Eye: Causes eye irritation. Vapors may cause eye irritation.
Skin: Causes skin irritation. May be absorbed through the skin. Repeated or prolonged exposure may cause drying and cracking of the skin. Not expected to cause an allergic skin reaction.
Ingestion: May cause effects similar to those for inhalation exposure. Aspiration of material into the lungs may cause chemical pneumonitis, which may be fatal. May cause central nervous system depression.
Inhalation: Causes respiratory tract irritation. Inhalation of high concentrations (>200 ppm) of toluene are clearly associated with CNS encephalopathy, headache, depression, lassitude (weakness, exhaustion), impaired coordination, transient memory loss, and impaired reaction time.
Chronic: Prolonged or repeated skin contact may cause defatting and dermatitis. Repeated exposure in combination with constant, loud noise can produce hearing loss and dizziness. Chronic hydrocarbon abuse (for example, sniffing glue or light hydrocarbons such as contained in this material) has been associated with irregular heart rhythms and potential cardiac arrest. Toluene abuse has been linked with kidney disease, as evidenced by blood, protein, & pus in the urine, accompanied by elevated serum creatinine, decreased urinary output, & metabolic & renal tubular acidosis. Although kidney toxicity has not been common in cases of occupational toluene exposure, there has been at least one report of renal toxicity following a 40-year occupational toluene exposure. Toluene does not cause the severe injury to the bone marrow that is characteristic of benzene poisoning. Intentional abuse of toluene vapors has been linked to damage of the brain, liver, kidney and to death. Repeated inhalation exposure of toluene to animals causes histological changes in the brain, degeneration of the heart tissue, and possible immune suppression.

## Section 4 - First Aid Measures

Eyes: In case of contact, immediately flush eyes with plenty of water for a t least 15 minutes. Get medical aid.
Skin: In case of contact, flush skin with plenty of water. Remove contaminated clothing and shoes. Get medical aid if irritation develops and persists. Wash clothing before reuse.
Ingestion: Potential for aspiration if swallowed. Get medical aid immediately. Do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person.
Inhalation: If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.
Notes to Physician: Causes cardiac sensitization to endogenous catelcholamines which may lead to cardiac arrhythmias. Do NOT use adrenergic agents such as epinephrine or pseudoepinephrine.

## Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Water runoff can cause environmental damage. Dike and collect water used to fight fire. Use water spray to keep fire-exposed containers cool. Water may be ineffective. Material is lighter than water and a fire may be spread by the use of water. Flammable liquid and vapor. Vapors are heavier than air and may travel to a source of ignition and flash back. Vapors can spread along the ground and collect in low or confined areas. This liquid floats on water and may travel to a source of ignition and spread fire. May accumulate static electricity.
Extinguishing Media: Use water spray, dry chemical, carbon dioxide, or appropriate foam. Solid streams of water may be ineffective and spread material.
Flash Point: 4 deg C ( 39.20 deg F)
Autoignition Temperature: 480 deg C ( 896.00 deg F)
Explosion Limits, Lower:1.1 vol%
Upper: 7.1 vol%
NFPA Rating: (estimated) Health: 2; Flammability: 3; Instability: 0

## Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.
Spills/Leaks: Absorb spill with inert material (e.g. vermiculite, sand or earth), then place in suitable container. Remove all sources of ignition. Provide ventilation. Use only non-sparking tools and equipment. Control runoff and isolate discharged material for proper disposal. Use water spray to cool and disperse vapors and protect personnel.

## Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Ground and bond containers when transferring material. Avoid contact with eyes, skin, and clothing. Empty containers retain product residue, (liquid and/or vapor), and can be dangerous. Keep container tightly closed. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose empty containers to heat, sparks or open flames. Use only with adequate ventilation. Keep away from heat, sparks and flame. Avoid breathing vapor or mist.
Storage: Keep away from sources of ignition. Store in a tightly closed container. Store in a cool, dry, well-ventilated area away from incompatible substances. Separate from oxidizing materials.

## Section 8 - Exposure Controls, Personal Protection

Engineering Controls: Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits. Ventilation fans and other electrical service must be non-sparking and have an explosion-proof design.

Exposure Limits

| Chemical Name | ACGIH | NIOSH | OSHA - Final PELs |
|---|---|---|---|
| Toluene | 50 ppm TWA; skin - potential for cutaneous absorption | 100 ppm TWA; 375 mg/m3 TWA<br>500 ppm IDLH | 200 ppm TWA; 300 ppm Ceiling |

OSHA Vacated PELs: Toluene: 100 ppm TWA; 375 mg/m3 TWA

Personal Protective Equipment

Eyes: Wear chemical goggles.

Skin: Wear appropriate protective gloves to prevent skin exposure.

Clothing: Wear appropriate protective clothing to prevent skin exposure.

Respirators: Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Always use a NIOSH or European Standard EN 149 approved respirator when necessary.

## Section 9 - Physical and Chemical Properties

Physical State: Liquid

Appearance: colorless

Odor: sweetish odor - pleasant odor - benzene-like

pH: Not applicable.

Vapor Pressure: 28.4 mm Hg @ 25 deg C

Vapor Density: 3.1 (Air=1)

Evaporation Rate:2.4 (Butyl acetate=1)

Viscosity: 0.59 cps @ 20 deg C

Boiling Point: 110.6 deg C

Freezing/Melting Point:-95 deg C

Decomposition Temperature:Not available.

Solubility: Insoluble.

Specific Gravity/Density:0.86 (Water=1)

Molecular Formula:C7H8

Molecular Weight:92.14

## Section 10 - Stability and Reactivity

Chemical Stability: Stable under normal temperatures and pressures.
Conditions to Avoid: Ignition sources, excess heat, confined spaces.
Incompatibilities with Other Materials: Strong oxidizing agents, nitric acid, sulfuric acid.
Hazardous Decomposition Products: Carbon monoxide, carbon dioxide.
Hazardous Polymerization: Has not been reported.

## Section 11 - Toxicological Information

RTECS#:
CAS# 108-88-3: XS5250000
LD50/LC50:
CAS# 108-88-3:
Draize test, rabbit, eye: 870 ug Mild;
Draize test, rabbit, eye: 2 mg/24H Severe;
Draize test, rabbit, skin: 435 mg Mild;
Draize test, rabbit, skin: 500 mg Moderate;
Draize test, rabbit, skin: 20 mg/24H Moderate;
Inhalation, mouse: LC50 = 400 ppm/24H;
Inhalation, mouse: LC50 = 30000 mg/m3/2H;
Inhalation, mouse: LC50 = 19900 mg/m3/7H;
Inhalation, mouse: LC50 = 10000 mg/m3;
Inhalation, rat: LC50 = 49 gm/m3/4H;
Oral, rat: LD50 = 636 mg/kg;
Skin, rabbit: LD50 = 14100
Carcinogenicity:
CAS# 108-88-3: Not listed by ACGIH, IARC, NTP, or CA Prop 65.

Epidemiology: No information available.
Teratogenicity: In an epidemiologic study of toluene and pregnancy, occupational exposures to toluene were said to be associated with an increased incidence of renal, urinary, gastrointestinal, and cardiac anomalies.
Reproductive Effects: Many reports of reproductive effects of toluene abuse or heavy occupational exposure are confounded by mixed solvent exposure or fetal alcohol syndrome. Women exposed to toluene in lab work had a 4.7-fold increased risk of spontaneous abortions.
Neurotoxicity: No information available.

Mutagenicity: No information available.
Other Studies: See actual entry in RTECS for complete information.

## Section 12 - Ecological Information

Ecotoxicity: No data available. Bluegill LC50=17 mg/L/24H Shrimp LC50=4.3 ppm/96HFathead minnow LC50=36.2 mg/L/96HSunfish (fresh water) TLm=1180 mg/L/96H
Environmental: From soil, substance evaporates and is microbially biodegraded. In water, substance volatilizes and biodegrades.
Physical: Photochemically produced hydroxyl radicals degrade substance.
Other: No information available.

## Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.
RCRA P-Series: None listed.
RCRA U-Series:
CAS# 108-88-3: waste number U220.

## Section 14 - Transport Information

| | US DOT | Canada TDG |
|---|---|---|
| Shipping Name: | TOLUENE | TOLUENE |
| Hazard Class: | 3 | 3 |
| UN Number: | UN1294 | UN1294 |
| Packing Group: | II | II |
| Additional Info: | | FLASHPOINT 4C |

## Section 15 - Regulatory Information

US FEDERAL

TSCA
CAS# 108-88-3 is listed on the TSCA inventory.
Health & Safety Reporting List
CAS# 108-88-3: Effective 10/4/82, Sunset 10/4/92
Chemical Test Rules
None of the chemicals in this product are under a Chemical Test Rule.
Section 12b
None of the chemicals are listed under TSCA Section 12b.
TSCA Significant New Use Rule
None of the chemicals in this material have a SNUR under TSCA.
CERCLA Hazardous Substances and corresponding RQs
CAS# 108-88-3: 1000 lb final RQ; 454 kg final RQ
SARA Section 302 Extremely Hazardous Substances
None of the chemicals in this product have a TPQ.
SARA Codes
CAS # 108-88-3: acute, flammable.
Section 313
This material contains Toluene (CAS# 108-88-3, >99%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.
Clean Air Act:
CAS# 108-88-3 is listed as a hazardous air pollutant (HAP).
This material does not contain any Class 1 Ozone depletors.
This material does not contain any Class 2 Ozone depletors.
Clean Water Act:
CAS# 108-88-3 is listed as a Hazardous Substance under the CWA. CAS# 108-88-3 is listed as a Priority Pollutant under the Clean Water Act. CAS# 108-88-3 is listed as a Toxic Pollutant under the Clean Water Act.
OSHA:
None of the chemicals in this product are considered highly hazardous by OSHA.
STATE
CAS# 108-88-3 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

California Prop 65
WARNING: This product contains Toluene, a chemical known to the state of California to cause developmental reproductive toxicity.
California No Significant Risk Level: None of the chemicals in this product are listed.

## European / International Regulations

European Labeling in Accordance with EC Directives
Hazard Symbols:
XN F
Risk Phrases:

R 11 Highly flammable.
R 20 Harmful by inhalation.

Safety Phrases:
S 16 Keep away from sources of ignition - No smoking.
S 25 Avoid contact with eyes.
S 29 Do not empty into drains.
S 33 Take precautionary measures against static discharges.

WGK (Water Danger/Protection)
CAS# 108-88-3: 2
Canada - DSL/NDSL
CAS# 108-88-3 is listed on Canada's DSL List.
Canada - WHMIS
This product has a WHMIS classification of B2, D2A, D2B.
Canadian Ingredient Disclosure List
CAS# 108-88-3 is listed on the Canadian Ingredient Disclosure List.

## Section 16 - Additional Information

MSDS Creation Date: 6/01/1999
Revision #7 Date: 10/06/2004

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.

# Material Safety Data Sheet

## 1,1,2,2-Tetrachloroethane, 97%

ACC# 96737

## Section 1 - Chemical Product and Company Identification

MSDS Name: 1,1,2,2-Tetrachloroethane, 97%
Catalog Numbers: AC147940000, AC147940250
Synonyms: Acetosal; Bonoform; Cellon; Westron.
Company Identification:

Acros Organics N.V.
One Reagent Lane
Fair Lawn, NJ 07410

For information in North America, call: 800-ACROS-01
For emergencies in the US, call CHEMTREC: 800-424-9300

## Section 2 - Composition, Information on Ingredients

| CAS# | Chemical Name | Percent | EINECS/ELINCS |
|---|---|---|---|
| 79-34-5 | 1,1,2,2-Tetrachloroethane | 97 | 201-197-8 |

## Section 3 - Hazards Identification

### EMERGENCY OVERVIEW

Appearance: clear colorless to pale yellow liquid.
Warning! Harmful if swallowed. Lachrymator (substance which increases the flow of tears). May cause eye and skin irritation. May cause respiratory and digestive tract irritation. May cause central nervous system depression. May cause cancer based on animal studies. Air sensitive. May cause liver damage.
Target Organs: Central nervous system, liver.

### Potential Health Effects

Eye: May cause eye irritation. Lachrymator (substance which increases the flow of tears).
Skin: May cause skin irritation.

Ingestion: Harmful if swallowed. May cause liver damage. May cause digestive tract disturbances. Effects may be delayed.
Inhalation: Effects may be delayed. May cause respiratory tract irritation. Inhalation may produce coughing, nausea, and pulmonary edema.
Chronic: Chronic ingestion may cause liver damage. Repeated exposure may cause central nervous system damage.

## Section 4 - First Aid Measures

Eyes: Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid.
Skin: Get medical aid. Flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse.
Ingestion: Never give anything by mouth to an unconscious person. Do NOT induce vomiting. If conscious and alert, rinse mouth and drink 2-4 cupfuls of milk or water.
Inhalation: Get medical aid immediately. Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Do NOT use mouth-to-mouth resuscitation.
Notes to Physician: Treat symptomatically and supportively.

## Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Combustion generates toxic fumes. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion. Substance is noncombustible. Containers may explode in the heat of a fire. Vapors may be heavier than air. They can spread along the ground and collect in low or confined areas.
Extinguishing Media: Substance is noncombustible; use agent most appropriate to extinguish surrounding fire. Do NOT get water inside containers. Do NOT use straight streams of water. For small fires, use dry chemical, carbon dioxide, or water spray. For large fires, use water spray, fog or regular foam. Cool containers with flooding quantities of water until well after fire is out.
Flash Point: Not applicable.
Autoignition Temperature: Not applicable.
Explosion Limits, Lower:Not available.
Upper: Not available.
NFPA Rating: (estimated) Health: 3; Flammability: 0; Instability: 0

## Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.
Spills/Leaks: Absorb spill with inert material (e.g. vermiculite, sand or earth), then place in suitable container. Avoid runoff into storm sewers and ditches which lead to waterways. Provide ventilation. Do not get water inside containers.

## Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Wash hands before eating. Avoid breathing dust, vapor, mist, or gas. Keep container tightly closed. Handle under an inert atmosphere. Store protected from air. Avoid mechanical shock and friction.
Storage: Do not store in direct sunlight. Keep containers tightly closed. Do not expose to air. Store under an inert atmosphere.

## Section 8 - Exposure Controls, Personal Protection

Engineering Controls: Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits.
Exposure Limits

| Chemical Name | ACGIH | NIOSH | OSHA - Final PELs |
|---|---|---|---|
| 1,1,2,2-Tetrachloroethane | 1 ppm TWA; skin - potential for cutaneous absorption | 1 ppm TWA; 7 mg/m3 TWA 100 ppm IDLH | 5 ppm TWA; 35 mg/m3 TWA |

OSHA Vacated PELs: 1,1,2,2-Tetrachloroethane: 1 ppm TWA; 7 mg/m3 TWA
Personal Protective Equipment
Eyes: Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.
Skin: Wear appropriate gloves to prevent skin exposure. Wear impervious gloves. Wear an impervious apron.
Clothing: Wear appropriate protective clothing to minimize contact with skin. Wear an impervious apron.
Respirators: Wear a NIOSH/MSHA or European Standard EN 149 approved full-facepiece airline respirator in the positive pressure mode with emergency escape provisions.

## Section 9 - Physical and Chemical Properties

Physical State: Liquid

Appearance: clear colorless to pale yellow
Odor: chloroform-like
pH: Not available.
Vapor Pressure: 6.6 mbar @ 20 C
Vapor Density: 5.79
Evaporation Rate:0.65(butyl acetate=1)
Viscosity: 1.7 mPa s 28 C
Boiling Point: 147 deg C
Freezing/Melting Point:-43 deg C
Decomposition Temperature:Not available.
Solubility: 1g/350ml (25 C)
Specific Gravity/Density: 1.5860
Molecular Formula:C2H2Cl4
Molecular Weight:167.826

## Section 10 - Stability and Reactivity

Chemical Stability: Stable under normal temperatures and pressures.
Conditions to Avoid: Mechanical shock, incompatible materials, exposure to air.
Incompatibilities with Other Materials: Strong oxidizing agents - strong bases - sodium - potassium.
Hazardous Decomposition Products: Hydrogen chloride, phosgene, carbon monoxide, irritating and toxic fumes and gases, carbon dioxide.
Hazardous Polymerization: Has not been reported.

## Section 11 - Toxicological Information

RTECS#:
CAS# 79-34-5: KI8575000
LD50/LC50:
CAS# 79-34-5:
    Inhalation, mouse: LC50 = 4500 mg/m3/2H;
    Oral, rat: LD50 = 200 mg/kg;
Carcinogenicity:
CAS# 79-34-5:

- ACGIH: A3 - Confirmed animal carcinogen with unknown relevance to humans
- California: carcinogen, initial date 7/1/90

Epidemiology: No information available.
Teratogenicity: No information available.
Reproductive Effects: No information available.
Neurotoxicity: No information available.
Mutagenicity: Not known to be a mutagen.
Other Studies: No data available.

## Section 12 - Ecological Information

Ecotoxicity: No data available. No information available.
Environmental: Highly mobile in soil and may leach into groundwater. Practically inert in the trophosphere but rapidly photodissociates in the stratosphere. Evaporation is primary loss mechanism in water and may undergo minor biodegradation.
Physical: No information available.
Other: No information available.

## Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.
RCRA P-Series: None listed.
RCRA U-Series:
CAS# 79-34-5: waste number U209.

## Section 14 - Transport Information

| | US DOT | Canada TDG |
|---|---|---|
| Shipping Name: | DOT regulated - small quantity provisions apply (see 49CFR173.4) | TETRACHLOROETHANE |
| Hazard Class: | | 6.1 |
| UN Number: | | UN1702 |
| Packing Group: | | II |

## Section 15 - Regulatory Information

### US FEDERAL

TSCA
CAS# 79-34-5 is listed on the TSCA inventory.
Health & Safety Reporting List
None of the chemicals are on the Health & Safety Reporting List.
Chemical Test Rules
CAS# 79-34-5: Test for Health Effects
Section 12b
None of the chemicals are listed under TSCA Section 12b.
TSCA Significant New Use Rule
None of the chemicals in this material have a SNUR under TSCA.
CERCLA Hazardous Substances and corresponding RQs
CAS# 79-34-5: 100 lb final RQ; 45.4 kg final RQ
SARA Section 302 Extremely Hazardous Substances
None of the chemicals in this product have a TPQ.
SARA Codes
CAS # 79-34-5: acute, chronic, reactive.
Section 313
This material contains 1,1,2,2-Tetrachloroethane (CAS# 79-34-5, 97%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40
Clean Air Act:
CAS# 79-34-5 is listed as a hazardous air pollutant (HAP).
This material does not contain any Class 1 Ozone depletors.
This material does not contain any Class 2 Ozone depletors.
Clean Water Act:
None of the chemicals in this product are listed as Hazardous Substances under the CWA. CAS# 79-34-5 is listed as a Priority Pollutant under the Clean Water Act. CAS# 79-34-5 is listed as a Toxic Pollutant under the Clean Water Act.
OSHA:
None of the chemicals in this product are considered highly hazardous by OSHA.
STATE
CAS# 79-34-5 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

California Prop 65
The following statement(s) is(are) made in order to comply with the California Safe Drinking Water Act:

WARNING: This product contains 1,1,2,2-Tetrachloroethane, a chemical known to the state of California to cause cancer.
California No Significant Risk Level: CAS# 79-34-5: 3 æg/day NSRL

## European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols:

T+ N

Risk Phrases:

R 26/27 Very toxic by inhalation and in contact with skin.

Safety Phrases:

S 2 Keep out of reach of children.
S 38 In case of insufficient ventilation, wear suitable respiratory equipment.
S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

WGK (Water Danger/Protection)

CAS# 79-34-5: 3

Canada - DSL/NDSL

CAS# 79-34-5 is listed on Canada's DSL List.

Canada - WHMIS

This product has a WHMIS classification of D1A, D2A.

Canadian Ingredient Disclosure List

CAS# 79-34-5 is listed on the Canadian Ingredient Disclosure List.

## Section 16 - Additional Information

MSDS Creation Date: 1/23/1998
Revision #4 Date: 3/18/2003

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.

# Material Safety Data Sheet
## Trichloroethylene

ACC# 23850

## Section 1 - Chemical Product and Company Identification

MSDS Name: Trichloroethylene
Catalog Numbers: S80232, S80327ACS-1, S80327ACS-2, NC932384B, NC9494003, NC9494591, NC9981849, S80237ACS-1, S80237ACS-2, T340-4, T341-20, T341-4, T341-500, T341J4, T403-4, XXT341SK4LIX48
Synonyms: Ethylene trichloride; triclene; trichloroethene; benzinol cecolene
Company Identification:

Fisher Scientific
1 Reagent Lane
Fair Lawn, NJ 07410

For information, call: 201-796-7100
Emergency Number: 201-796-7100
For CHEMTREC assistance, call: 800-424-9300
For International CHEMTREC assistance, call: 703-527-3887

## Section 2 - Composition, Information on Ingredients

| CAS# | Chemical Name | Percent | EINECS/ELINCS |
|---|---|---|---|
| 79-01-6 | Trichloroethylene | 99.5 | 201-167-4 |

## Section 3 - Hazards Identification

### EMERGENCY OVERVIEW

Appearance: clear, colorless liquid.
Warning! Causes eye and skin irritation. Aspiration hazard if swallowed. Can enter lungs and cause damage. May cause central nervous system depression. May cause cancer based on animal studies. Potential cancer hazard. May cause liver damage.
Target Organs: Central nervous system, liver, eyes, skin.

### Potential Health Effects

Eye: Causes moderate eye irritation. May result in corneal injury. Contact produces irritation, tearing, and burning pain.
Skin: Causes mild skin irritation. Prolonged and/or repeated contact may cause defatting of the skin and dermatitis. May cause peripheral nervous system function impairment including persistent neuritis, and temporary loss of touch. Damage to the liver and other organs has been observed in workers who have been overexposed.
Ingestion: Aspiration hazard. May cause irritation of the digestive tract. Aspiration of material into the lungs may cause chemical pneumonitis, which may be fatal.
Inhalation: Inhalation of high concentrations may cause central nervous system effects characterized by nausea, headache, dizziness, unconsciousness and coma. May cause respiratory tract irritation. May cause liver abnormalities. May cause peripheral nervous system effects.
Chronic: Possible cancer hazard based on tests with laboratory animals. Chronic inhalation may cause effects similar to those of acute inhalation. Prolonged or repeated skin contact may cause defatting and dermatitis. May cause peripheral nervous system function impairment including persistent neuritis, and temporary loss of touch. Damage to the liver and other organs has been observed in workers who have been overexposed.

## Section 4 - First Aid Measures

Eyes: Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid imme diately.
Skin: Get medical aid if irritation develops or persists. Flush skin with plenty of soap and water.
Ingestion: If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Possible aspiration hazard. Get medical aid immediately.
Inhalation: Get medical aid immediately. Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Do NOT use mouth-to-mouth resuscitation.
Notes to Physician: Treat symptomatically and supportively.

## Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Vapors can travel to a source of ignition and flash back. Combustion generates toxic fumes. Containers may explode in the heat of a fire.
Extinguishing Media: Use water spray to cool fire-exposed containers. Use water spray, dry chemical, carbon dioxide, or chemical foam.
Flash Point: Not applicable.
Autoignition Temperature: 778 deg F ( 414.44 deg C)
Explosion Limits, Lower:12.5

Upper: 90.0
NFPA Rating: (estimated) Health: 2; Flammability: 1; Instability: 0

## Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.
Spills/Leaks: Absorb spill with inert material (e.g. vermiculite, sand or earth), then place in suitable container. Remove all sources of ignition. Provide ventilation.

## Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Use only in a well-ventilated area. Ground and bond containers when transferring material. Avoid contact with eyes, skin, and clothing. Empty containers retain product residue, (liquid and/or vapor), and can be dangerous. Avoid ingestion and inhalation. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose empty containers to heat, sparks or open flames.
Storage: Keep away from sources of ignition. Store in a tightly closed container. Keep from contact with oxidizing materials. Store in a cool, dry, well-ventilated area away from incompatible substances.

## Section 8 - Exposure Controls, Personal Protection

Engineering Controls: Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits.
Exposure Limits

| Chemical Name | ACGIH | NIOSH | OSHA - Final PELs |
|---|---|---|---|
| Trichloroethylene | 50 ppm TWA; 100 ppm STEL | 1000 ppm IDLH | 100 ppm TWA; 200 ppm Ceiling |

OSHA Vacated PELs: Trichloroethylene: 50 ppm TWA; 270 mg/m3 TWA
Personal Protective Equipment
Eyes: Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.
Skin: Wear appropriate protective gloves to prevent skin exposure.
Clothing: Wear appropriate protective clothing to prevent skin exposure.

Respirators: Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Always use a NIOSH or European Standard EN 149 approved respirator when necessary.

## Section 9 - Physical and Chemical Properties

Physical State: Liquid
Appearance: clear, colorless
Odor: sweetish odor - chloroform-like
pH: Not available.
Vapor Pressure: 58 mm Hg @20C
Vapor Density: 4.53
Evaporation Rate:0.69 (CCl4=1)
Viscosity: 0.0055 poise
Boiling Point: 189 deg F
Freezing/Melting Point:-121 deg F
Decomposition Temperature:Not available.
Solubility: Insoluble in water.
Specific Gravity/Density:1.47 (water=1)
Molecular Formula:C2HCl3
Molecular Weight:131.366

## Section 10 - Stability and Reactivity

Chemical Stability: Stable under normal temperatures and pressures.
Conditions to Avoid: Incompatible materials, ignition sources, oxidizers.
Incompatibilities with Other Materials: Alkalis (sodium hydroxide), chemically active metals (aluminum, beryllium, lithium, magnesium), epoxies and oxidants. Can react violently with aluminum, barium, lithium, magnesium, liquid oxygen, ozone, potassium hydroxide, potassium nitrate, sodium, sodium hydroxide, titanium, and nitrogen dioxide. Reacts with water under heat and pressure to form hydrogen chloride gas.
Hazardous Decomposition Products: Hydrogen chloride, carbon dioxide, chloride fumes.
Hazardous Polymerization: Has not been reported.

## Section 11 - Toxicological Information

RTECS#:
CAS# 79-01-6: KX4550000
LD50/LC50:
CAS# 79-01-6:
Draize test, rabbit, eye: 20 mg/24H Moderate;
Draize test, rabbit, skin: 2 mg/24H Severe;
Inhalation, mouse: LC50 = 8450 ppm/4H;
Inhalation, mouse: LC50 = 220000 mg/m3/20M;
Inhalation, mouse: LC50 = 262000 mg/m3/30M;
Inhalation, mouse: LC50 = 40000 mg/m3/4H;
Inhalation, rat: LC50 = 140700 mg/m3/1H;
Oral, mouse: LD50 = 2402 mg/kg;
Oral, mouse: LD50 = 2400 mg/kg;
Oral, rat: LD50 = 4920 mg/kg;
Skin, rabbit: LD50 = >20 gm/kg;
Skin, rabbit: LD50 = 20 mL/kg;
Carcinogenicity:
CAS# 79-01-6:

- California: carcinogen, initial date 4/1/88
- NTP: Suspect carcinogen
- IARC: Group 2A carcinogen

Epidemiology: Suspected carcinogen with experimental carcinogenic, tumorigenic, and teratogenic data.
Teratogenicity: No information available.
Reproductive Effects: Experimental reproductive effects have been observed.
Neurotoxicity: No information available.
Mutagenicity: Human mutation data has been reported. IARC and the National Toxicology Program (NTP) stated that variability in the mutagencity test results with thichloroethylene may be due to the presence of various stabilizers used in TCE which are mutagens (e.g. epoxybutane, epichlorohydrin).
Other Studies: None.

## Section 12 - Ecological Information

Ecotoxicity: No data available. Bluegill sunfish, LD50= 44,700 ug/L/96Hr. Fathead minnow, LC50=40.7 mg/L/96Hr.
Environmental: In air, substance is photooxidized and is reported to form phosgene, dichloroacetyl chloride, and formyl chloride. In water, it evaporates rapidly.

Physical: No information available.
Other: None.

## Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.
RCRA P-Series: None listed.
RCRA U-Series:
CAS# 79-01-6: waste number U228.

## Section 14 - Transport Information

| | US DOT | Canada TDG |
|---|---|---|
| Shipping Name: | TRICHLOROETHYLENE | TRICHLOROETHYLENE |
| Hazard Class: | 6.1 | 6.1(9.2) |
| UN Number: | UN1710 | UN1710 |
| Packing Group: | III | III |

## Section 15 - Regulatory Information

### US FEDERAL

TSCA
CAS# 79-01-6 is listed on the TSCA inventory.
Health & Safety Reporting List
None of the chemicals are on the Health & Safety Reporting List.
Chemical Test Rules
None of the chemicals in this product are under a Chemical Test Rule.
Section 12b
None of the chemicals are listed under TSCA Section 12b.
TSCA Significant New Use Rule
None of the chemicals in this material have a SNUR under TSCA.
CERCLA Hazardous Substances and corresponding RQs

CAS# 79-01-6: 100 lb final RQ; 45.4 kg final RQ

SARA Section 302 Extremely Hazardous Substances

None of the chemicals in this product have a TPQ.

SARA Codes

CAS # 79-01-6: acute, chronic, reactive.

Section 313

This material contains Trichloroethylene (CAS# 79-01-6, 99.5%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR

Clean Air Act:

CAS# 79-01-6 is listed as a hazardous air pollutant (HAP).

This material does not contain any Class 1 Ozone depletors.

This material does not contain any Class 2 Ozone depletors.

Clean Water Act:

CAS# 79-01-6 is listed as a Hazardous Substance under the CWA. CAS# 79-01-6 is listed as a Priority Pollutant under the Clean Water Act. CAS# 79-01-6 is listed as a Toxic Pollutant under the Clean Water Act.

OSHA:

None of the chemicals in this product are considered highly hazardous by OSHA.

STATE

CAS# 79-01-6 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

California Prop 65

The following statement(s) is(are) made in order to comply with the California Safe Drinking Water Act:

WARNING: This product contains Trichloroethylene, a chemical known to the state of California to cause cancer.

California No Significant Risk Level: CAS# 79-01-6: 50 æg/day NSRL (oral); 80 æg/day NSRL (inhalation)

## European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols:

T

Risk Phrases:

R 36/38 Irritating to eyes and skin.

R 45 May cause cancer.

R 52/53 Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

R 67 Vapours may cause drowsiness and dizziness.

Safety Phrases:

S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

S 53 Avoid exposure - obtain special instructions before use.

S 61 Avoid release to the environment. Refer to special instructions/safety data sheets.

WGK (Water Danger/Protection)
CAS# 79-01-6: 3

Canada - DSL/NDSL
CAS# 79-01-6 is listed on Canada's DSL List.

Canada - WHMIS
This product has a WHMIS classification of D1B, D2B.

Canadian Ingredient Disclosure List
CAS# 79-01-6 is listed on the Canadian Ingredient Disclosure List.

## Section 16 - Additional Information

MSDS Creation Date: 2/01/1999
Revision #3 Date: 8/05/2002

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.

# Material Safety Data Sheet

## Vinylidene chloride, 99.9%, stabilized with 200 ppm MEHQ

ACC# 76910

## Section 1 - Chemical Product and Company Identification

MSDS Name: Vinylidene chloride, 99.9%, stabilized with 200 ppm MEHQ
Catalog Numbers: AC172290000, AC172290010, AC172290025, AC172290250
Synonyms: 1,1-Dichloroethylene; Vinylidene dichloride; 1,1-Dichloroethene; VDC; Vinylidene chloride; asym-Dichloroethylene.
Company Identification:

Acros Organics N.V.
One Reagent Lane
Fair Lawn, NJ 07410

For information in North America, call: 800-ACROS-01
For emergencies in the US, call CHEMTREC: 800-424-9300

## Section 2 - Composition, Information on Ingredients

| CAS# | Chemical Name | Percent | EINECS/ELINCS |
|---|---|---|---|
| 75-35-4 | Vinylidene chloride | 99.9 | 200-864-0 |
| 150-76-5 | MEHQ | .02 | 205-769-8 |

## Section 3 - Hazards Identification

### EMERGENCY OVERVIEW

Appearance: clear, colorless liquid. Flash Point: -19 deg F.
Danger! Air sensitive. Oxidizes readily in air to form unstable peroxides that may explode spontaneously. Extremely flammable liquid and vapor. Vapor may cause flash fire. Harmful if swallowed. Causes respiratory tract irritation. Causes eye and skin irritation. May be harmful if inhaled. May cause central nervous system depression. May cause liver and kidney damage. Keep refrigerated. (Store below 4°C/39°F.) Marine pollutant.
Target Organs: Kidneys, central nervous system, liver, respiratory system, eyes, skin.

Potential Health Effects

Eye: Causes eye irritation. Vinylidene chloride is moderately irritating to the eyes. Contact can cause pain, irritation of the eyelids, iritis, and slight corneal injury. Permanent damage is unlikely.
Skin: Causes skin irritation. Prolonged or repeated skin contact may cause severe exacerbation. A single prolonged skin exposure is not likely to result in the material being absorbed in harmful amounts. Vinylidene chloride can be difficult to remove from belts, shoes, watchbands, and other leather items. Chemical burns may result if removal is not complete; therefore, contaminated leather goods should be destroyed.
Ingestion: Harmful if swallowed. Possible aspiration hazard.
Inhalation: May cause liver and kidney damage. Causes irritation of the mucous membrane and upper respiratory tract. Vinylidene chloride is highly volatile. Its odor is not adequate as a warning characteristic. Overexposure produces central nervous system depression. Central nervous system depression, with accompanying symptoms of inebriation that may have progressed to unconsciousness, has been observed in humans acutely exposed at concentrations of approximately 4000 ppm VDC. Complete recovery occurred if exposure was of short duration.
Chronic: May cause liver and kidney damage. Chronic exposure may cause lung damage. Laboratory experiments have resulted in mutagenic effects. Studies indicate vinylidene chloride does not represent a significant cancer risk in humans. Did not cause cancer in most animal studies. Positive findings are believed to be secondary to chronic irritation/tissue injury. Birth defects are unlikely. Exposures having no effect on the mother should have no effect on the fetus. In animal studies, vinylidene chloride has been shown not to interfere with reproduction.

## Section 4 - First Aid Measures

Eyes: In case of contact, immediately flush eyes with plenty of water for a t least 15 minutes. Get medical aid.
Skin: In case of contact, flush skin with plenty of water. Remove contaminated clothing and shoes. Get medical aid if irritation develops and persists. Wash clothing before reuse.
Ingestion: Potential for aspiration if swallowed. Get medical aid immediately. Do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person.
Inhalation: If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.
Notes to Physician: Treat symptomatically and supportively.
Antidote: None reported.

## Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Vapors may form an explosive mixture with air. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion. Use water spray to keep fire-exposed containers cool. Fire or excessive heat may result in violent rupture of the container due to bulk polymerization. Extremely flammable liquid and vapor. Vapor may cause

flash fire. Vapors are heavier than air and may travel to a source of ignition and flash back. Vapors can spread along the ground and collect in low or confined areas. Fight fire from protected location or maximum possible distance.
Extinguishing Media: Use water spray, dry chemical, carbon dioxide, or appropriate foam.
Flash Point: -19e deg F ( -28.33 deg C)
Autoignition Temperature: 1058 deg F ( 570.00 deg C)
Explosion Limits, Lower:6.5 vol %
Upper: 15.5 vol %
NFPA Rating: (estimated) Health: 2; Flammability: 4; Instability: 2

## Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.
Spills/Leaks: Absorb spill with inert material (e.g. vermiculite, sand or earth), then place in suitable container. Avoid runoff into storm sewers and ditches which lead to waterways. Clean up spills immediately, observing precautions in the Protective Equipment section. Remove all sources of ignition. Use a spark-proof tool. Provide ventilation. Place under an inert atmosphere. A vapor suppressing foam may be used to reduce vapors.

## Section 7 - Handling and Storage

Handling: Remove contaminated clothing and wash before reuse. Ground and bond containers when transferring material. Avoid contact with eyes, skin, and clothing. Empty containers retain product residue, (liquid and/or vapor), and can be dangerous. Keep container tightly closed. Handle under an inert atmosphere. Store protected from air. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose empty containers to heat, sparks or open flames. Use only with adequate ventilation. Keep away from heat, sparks and flame. Avoid breathing vapor or mist. Destroy contaminated leather clothing. Pure vapor will be uninhibited and may polymerize in vents or other confined spaces. Materials of construction recommended for vinylidene chloride monomer include steel, stainless steel, and baked phenolic-lined steel. Recommended gasketing materials include Teflon and Viton fluoroelastomers.
Storage: Keep away from sources of ignition. Do not store in direct sunlight. Store in a tightly closed container. Purge container with nitrogen before resealing. Keep dry. Store in a cool, dry, well-ventilated area away from incompatible substances. Refrigerator/flammables. Do not expose to air. Do not store in aluminum containers. Long-term storage is not recommended. Do not store in copper or copper alloy storage vessels.

## Section 8 - Exposure Controls, Personal Protection

Engineering Controls: Use process enclosure, local exhaust ventilation, or other engineering controls to control airborne levels below recommended exposure limits. Use explosion-proof ventilation equipment. Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower.

Exposure Limits

| Chemical Name | ACGIH | NIOSH | OSHA - Final PELs |
|---|---|---|---|
| Vinylidene chloride | 5 ppm TWA | none listed | none listed |
| MEHQ | 5 mg/m3 TWA | 5 mg/m3 TWA | none listed |

OSHA Vacated PELs: Vinylidene chloride: 1 ppm TWA; 4 mg/m3 TWA MEHQ: 5 mg/m3 TWA

Personal Protective Equipment

Eyes: Wear chemical goggles.

Skin: Wear appropriate protective gloves to prevent skin exposure.

Clothing: Wear appropriate protective clothing to prevent skin exposure.

Respirators: A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant a respirator's use.

## Section 9 - Physical and Chemical Properties

Physical State: Liquid

Appearance: clear, colorless

Odor: sweetish odor - chloroform-like

pH: Not available.

Vapor Pressure: 600 mm Hg @ 25 deg C

Vapor Density: 3.4 (air=1)

Evaporation Rate:Not available.

Viscosity: 0.33 cps @ 20 deg C

Boiling Point: 31.2-31.7 deg C @ 760 mm Hg

Freezing/Melting Point:-122 deg C

Decomposition Temperature:Not available.

Solubility: Insoluble.

Specific Gravity/Density:1.2180 g/cm3

Molecular Formula:C2H2Cl2

Molecular Weight:96.94

## Section 10 - Stability and Reactivity

Chemical Stability: Peroxide formation may occur in containers that have been opened and remain in storage. May form explosive peroxides on contact with air or may undergo hazardous polymerization without an inhibitor.
Conditions to Avoid: High temperatures, light, ignition sources, exposure to air, exposure to moist air or water, loss of inhibitor, Water contact produces a polymer..
Incompatibilities with Other Materials: Strong oxidizing agents, strong bases, aluminum, copper, copper alloys, oxygen, ozone, chlorosulfonic acid, oleum, aluminum alloys.
Hazardous Decomposition Products: Hydrogen chloride, phosgene, carbon monoxide, irritating and toxic fumes and gases, carbon dioxide, formaldehyde, white polymeric powder.
Hazardous Polymerization: May occur.

## Section 11 - Toxicological Information

RTECS#:
CAS# 75-35-4: KV9275000
CAS# 150-76-5: SL7700000
LD50/LC50:
CAS# 75-35-4:
Inhalation, rat: LC50 = 6350 ppm/4H;
Inhalation, rat: LC50 = 10000 mg/m3;
Oral, mouse: LD50 = 194 mg/kg;
Oral, rat: LD50 = 200 mg/kg;
CAS# 150-76-5:
Draize test, rabbit, skin: 6 gm/12D (Intermittent) Mild;
Draize test, rabbit, skin: 10%;
Oral, rat: LD50 = 1600 mg/kg;
Carcinogenicity:
CAS# 75-35-4: Not listed by ACGIH, IARC, NTP, or CA Prop 65.
CAS# 150-76-5: Not listed by ACGIH, IARC, NTP, or CA Prop 65.

Epidemiology: No data available.
Teratogenicity: See actual entry in RTECS for complete information.
Reproductive Effects: See actual entry in RTECS for complete information.
Neurotoxicity: No information available.
Mutagenicity: DNA Damage: Inhalation, rat = 10 ppm.; Specific Locus Test: Mouse, Lymphocyte = 160 ppm/48H (Continuous).; Unscheduled DNA Synthesis: Inhalation, mouse = 50 ppm.; Cytogenetic Analysis: Hamster, Lung = 250 mg/L.
Other Studies: No data available.

## Section 12 - Ecological Information

Ecotoxicity: Fish: Fathead Minnow: LC50 = 108 mg/L; 96 Hr; Flow-through bioassayFish: Bluegill/Sunfish: LC50 = 74 mg/L; 96 Hr; Static bioassay at 21-21°C (pH 6.7-7.8)Algae: Green algae: EC50 > 798 mg/L; 96 Hr; UnspecifiedWater flea Daphnia: EC50 = 11.6 mg/L; 48 Hr; Static bioassayFish: Sheepshead minnow: LC50=249 mg/L; ; No data available.
Environmental: Once in the atmosphere it will degrade rapidly by photooxidation with a half-life of 11 hours in relatively clean air or under 2 hours in polluted air. If spilled on land, part of the vinylidene chloride will evaporate and part will leach into the groundwater where its fate is unknown, but degradation is expected to be slow based upon microcosm studies. Vinylidene chloride would not be expected to bioconcentrate into fish.
Physical: No information available.
Other: No information available.

## Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.
RCRA P-Series: None listed.
RCRA U-Series:
CAS# 75-35-4: waste number U078.

## Section 14 - Transport Information

| | US DOT | Canada TDG |
|---|---|---|
| Shipping Name: | VINYLIDENE CHLORIDE, STABILIZED | VINYLIDENE CHLORIDE STABILIZED |
| Hazard Class: | 3 | 3 |
| UN Number: | UN1303 | UN1303 |
| Packing Group: | I | I |
| Additional Info: | | FLASHPOINT -28 C |

## Section 15 - Regulatory Information

## US FEDERAL

TSCA

CAS# 75-35-4 is listed on the TSCA inventory.

CAS# 150-76-5 is listed on the TSCA inventory.

Health & Safety Reporting List

None of the chemicals are on the Health & Safety Reporting List.

Chemical Test Rules

CAS# 75-35-4: Testing required by manufacturers, processors CAS# 150-76-5: Testing required by manufacturers, processors

Section 12b

CAS# 75-35-4: Section 4 CAS# 150-76-5: Section 4

TSCA Significant New Use Rule

None of the chemicals in this material have a SNUR under TSCA.

CERCLA Hazardous Substances and corresponding RQs

CAS# 75-35-4: 100 lb final RQ; 45.4 kg final RQ

SARA Section 302 Extremely Hazardous Substances

None of the chemicals in this product have a TPQ.

SARA Codes

CAS # 75-35-4: acute, chronic, flammable, reactive.

CAS # 150-76-5: acute.

Section 313

This material contains Vinylidene chloride (CAS# 75-35-4, 99.9%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.

Clean Air Act:

CAS# 75-35-4 is listed as a hazardous air pollutant (HAP).

This material does not contain any Class 1 Ozone depletors.

This material does not contain any Class 2 Ozone depletors.

Clean Water Act:

CAS# 75-35-4 is listed as a Hazardous Substance under the CWA. CAS# 75-35-4 is listed as a Priority Pollutant under the Clean Water Act. CAS# 75-35-4 is listed as a Toxic Pollutant under the Clean Water Act.

OSHA:

None of the chemicals in this product are considered highly hazardous by OSHA.

STATE

CAS# 75-35-4 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

CAS# 150-76-5 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

California Prop 65

California No Significant Risk Level: None of the chemicals in this product are listed.

## European / International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols:

XN F+

Risk Phrases:

R 12 Extremely flammable.
R 19 May form explosive peroxides.
R 20 Harmful by inhalation.
R 68 Possible risk of irreversible effects.

Safety Phrases:

S 16 Keep away from sources of ignition - No smoking.
S 29 Do not empty into drains.
S 7 Keep container tightly closed.

WGK (Water Danger/Protection)

CAS# 75-35-4: 3
CAS# 150-76-5: 1

Canada - DSL/NDSL

CAS# 75-35-4 is listed on Canada's DSL List.
CAS# 150-76-5 is listed on Canada's DSL List.

Canada - WHMIS

This product has a WHMIS classification of B2, D1B, F.

Canadian Ingredient Disclosure List

CAS# 75-35-4 is listed on the Canadian Ingredient Disclosure List.
CAS# 150-76-5 is listed on the Canadian Ingredient Disclosure List.

## Section 16 - Additional Information

MSDS Creation Date: 6/18/1999
Revision #5 Date: 8/28/2002

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.

# Material Safety Data Sheet
## Dimethyl phthalate

ACC# 07740

## Section 1 - Chemical Product and Company Identification

MSDS Name: Dimethyl phthalate
Catalog Numbers: D65 4, D65-4, D654
Synonyms: Dimethyl 1,2-benzenedicarboxylate; Phthalic acid, dimethyl ester; DMP; plasticizer; Palatinol M; Fermine; Avolin; Mipax; Dimethyl o-phthalate.
Company Identification:

Fisher Scientific
1 Reagent Lane
Fair Lawn, NJ 07410

For information, call: 201-796-7100
Emergency Number: 201-796-7100
For CHEMTREC assistance, call: 800-424-9300
For International CHEMTREC assistance, call: 703-527-3887

## Section 2 - Composition, Information on Ingredients

| CAS# | Chemical Name | Percent | EINECS/ELINCS |
|---|---|---|---|
| 131-11-3 | Dimethyl phthalate | 100 | 205-011-6 |

## Section 3 - Hazards Identification

### EMERGENCY OVERVIEW

Appearance: colorless to light yellow liquid.
Caution! May cause eye irritation. May cause respiratory tract irritation.
Target Organs: Central nervous system, respiratory system, eyes, mucous membranes.

Potential Health Effects

Eye: Produces irritation, characterized by a burning sensation, redness, tearing, inflammation, and possible corneal injury. May cause transient corneal injury.
Skin: Prolonged and/or repeated contact may cause irritation and/or dermatitis. Dimethyl phthalate has low acute toxicity in experimental animals exposed by the oral, inhalation and dermal routes. In other words, it is not acutely toxic. However, repeated and/or prolonged skin contact may result in the absorption of harmful amounts. Dimethyl phthalate was not a sensitizer in guinea pigs and has not been reported to be a sensitizer from its use during WWII as an insect repellent; however, it has been called an allergen in one Russian study of human patch testing.
Ingestion: Causes gastrointestinal irritation with nausea, vomiting and diarrhea. May cause central nervous system depression.
Inhalation: Inhalation of high concentrations may cause central nervous system effects characterized by nausea, headache, dizziness, unconsciousness and coma. May cause respiratory tract irritation. Exposure to dimethyl phthalate occurs from spray or mist, rather than from the vapor, unless heat is applied. Intermittent exposure produced blood, liver and kidney changes in rats.
Chronic: Some adverse reproductive effects were seen in animal studies. Few defects occurred when rats were given injections of dimethyl phthalate intraperitoneally on gestational days 5, 10 and 15.

## Section 4 - First Aid Measures

Eyes: In case of contact, immediately flush eyes with plenty of water for a t least 15 minutes. Get medical aid.
Skin: In case of contact, flush skin with plenty of water. Remove contaminated clothing and shoes. Get medical aid if irritation develops and persists. Wash clothing before reuse.
Ingestion: If swallowed, do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Get medical aid.
Inhalation: If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.
Notes to Physician: Treat symptomatically and supportively.

## Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear.
Extinguishing Media: In case of fire, use water, dry chemical, chemical foam, or alcohol-resistant foam.
Flash Point: 295e deg F ( 146.11 deg C)
Autoignition Temperature: 460 deg C ( 860.00 deg F)
Explosion Limits, Lower:0.9
Upper: 8.0%
NFPA Rating: (estimated) Health: 1; Flammability: 1; Instability: 0

## Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.
Spills/Leaks: Absorb spill with inert material (e.g. vermiculite, sand or earth), then place in suitable container.

## Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Use with adequate ventilation. Avoid contact with eyes, skin, and clothing. Avoid breathing spray or mist.
Storage: Keep from contact with oxidizing materials. Store in a cool, dry, well-ventilated area away from incompatible substances.

## Section 8 - Exposure Controls, Personal Protection

Engineering Controls: Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits.
Exposure Limits

| Chemical Name | ACGIH | NIOSH | OSHA - Final PELs |
|---|---|---|---|
| Dimethyl phthalate | 5 mg/m3 TWA | 5 mg/m3 TWA 2000 mg/m3 IDLH | 5 mg/m3 TWA |

OSHA Vacated PELs: Dimethyl phthalate: 5 mg/m3 TWA
Personal Protective Equipment
Eyes: Wear chemical goggles.
Skin: Wear appropriate gloves to prevent skin exposure.
Clothing: Wear appropriate protective clothing to minimize contact with skin.
Respirators: Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Always use a NIOSH or European Standard EN 149 approved respirator when necessary.

## Section 9 - Physical and Chemical Properties

Physical State: Liquid

Appearance: colorless to light yellow
Odor: ester-like - weak odor
pH: Not available.
Vapor Pressure: .0015 mm Hg @ deg 20
Vapor Density: 6.69 (air=1)
Evaporation Rate:Negligible.
Viscosity: 17.2 cP 25 deg C
Boiling Point: 282 deg C
Freezing/Melting Point:2 deg C
Decomposition Temperature:Not available.
Solubility: 0.4% (20 C) in water.
Specific Gravity/Density:1.19
Molecular Formula:C10H10O4
Molecular Weight:194.19

## Section 10 - Stability and Reactivity

Chemical Stability: Stable.
Conditions to Avoid: No specific conditions to avoid noted.
Incompatibilities with Other Materials: Oxidizing agents, acids, bases, and nitrates.
Hazardous Decomposition Products: Carbon monoxide, carbon dioxide.
Hazardous Polymerization: Has not been reported.

## Section 11 - Toxicological Information

RTECS#:
CAS# 131-11-3: TI1575000
LD50/LC50:
CAS# 131-11-3:
Dermal, guinea pig: LD50 = >10 mL/kg;
Draize test, rabbit, eye: 119 mg;
Oral, mouse: LD50 = 6800 mg/kg;
Oral, rabbit: LD50 = 4400 uL/kg;
Oral, rat: LD50 = 6800 mg/kg;
Skin, rabbit: LD50 = >20 mL/kg;
Skin, rat: LD50 = >4800 mg/kg;

Carcinogenicity:
CAS# 131-11-3: Not listed by ACGIH, IARC, NTP, or CA Prop 65.

Epidemiology: No information found.
Teratogenicity: See actual entry in RTECS for complete information.
Reproductive Effects: See actual entry in RTECS for complete information.
Neurotoxicity: No information found.
Mutagenicity: See actual entry in RTECS for complete information.
Other Studies: See actual entry in RTECS for complete information.

## Section 12 - Ecological Information

Ecotoxicity: No data available. No information available.
Environmental: No information available.
Physical: Log P(oct) = 2.12
Other: No information available.

## Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.
RCRA P-Series: None listed.
RCRA U-Series:
CAS# 131-11-3: waste number U102.

## Section 14 - Transport Information

| | US DOT | Canada TDG |
|---|---|---|
| Shipping Name: | Not regulated as a hazardous material | No information available. |
| Hazard Class: | | |
| UN Number: | | |
| Packing Group: | | |

## Section 15 - Regulatory Information

### US FEDERAL

TSCA
CAS# 131-11-3 is listed on the TSCA inventory.
Health & Safety Reporting List
None of the chemicals are on the Health & Safety Reporting List.
Chemical Test Rules
CAS# 131-11-3: Test for Environmental Effects
Section 12b
None of the chemicals are listed under TSCA Section 12b.
TSCA Significant New Use Rule
None of the chemicals in this material have a SNUR under TSCA.
CERCLA Hazardous Substances and corresponding RQs
CAS# 131-11-3: 5000 lb final RQ; 2270 kg final RQ
SARA Section 302 Extremely Hazardous Substances
None of the chemicals in this product have a TPQ.
SARA Codes
CAS # 131-11-3: acute, chronic.
Section 313
This material contains Dimethyl phthalate (CAS# 131-11-3, 100%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.
Clean Air Act:
CAS# 131-11-3 is listed as a hazardous air pollutant (HAP).
This material does not contain any Class 1 Ozone depletors.
This material does not contain any Class 2 Ozone depletors.
Clean Water Act:
None of the chemicals in this product are listed as Hazardous Substances under the CWA. CAS# 131-11-3 is listed as a Priority Pollutant under the Clean Water Act.
None of the chemicals in this product are listed as Toxic Pollutants under the CWA.
OSHA:
None of the chemicals in this product are considered highly hazardous by OSHA.
STATE
CAS# 131-11-3 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

California Prop 65

California No Significant Risk Level: None of the chemicals in this product are listed.

## European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols:

XI

Risk Phrases:

R 36/37 Irritating to eyes and respiratory system.

Safety Phrases:

S 26 In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.

S 39 Wear eye/face protection.

WGK (Water Danger/Protection)

CAS# 131-11-3: 1

Canada - DSL/NDSL

CAS# 131-11-3 is listed on Canada's DSL List.

Canada - WHMIS

This product has a WHMIS classification of D2B.

Canadian Ingredient Disclosure List

CAS# 131-11-3 is listed on the Canadian Ingredient Disclosure List.

## Section 16 - Additional Information

MSDS Creation Date: 12/12/1997

Revision #3 Date: 3/18/2003

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.

# Material Safety Data Sheet
## Isophorone

ACC# 23994

## Section 1 - Chemical Product and Company Identification

MSDS Name: Isophorone
Catalog Numbers: AC122640000, AC122640010, AC122640025, AC122640050, AC122640200, AC122645000 AC122645000
Synonyms: 3,5,5-Trimethyl-2-cyclohexene-1-one.
Company Identification:

Acros Organics N.V.
One Reagent Lane
Fair Lawn, NJ 07410

For information in North America, call: 800-ACROS-01
For emergencies in the US, call CHEMTREC: 800-424-9300

## Section 2 - Composition, Information on Ingredients

| CAS# | Chemical Name | Percent | EINECS/ELINCS |
|---|---|---|---|
| 78-59-1 | Isophorone | 98 | 201-126-0 |

## Section 3 - Hazards Identification

### EMERGENCY OVERVIEW

Appearance: clear pale yellow liquid. Flash Point: 84 deg C.
Warning! Causes eye and respiratory tract irritation. Combustible liquid and vapor. May be harmful if swallowed or absorbed through the skin. May cause cancer based on animal studies.
Target Organs: Central nervous system, respiratory system, eyes.

### Potential Health Effects

Eye: Contact with eyes may cause severe irritation, and possible eye burns. Lachrymator (substance which increases the flow of tears).
Skin: May cause skin irritation. May be harmful if absorbed through the skin.

Ingestion: Causes gastrointestinal irritation with nausea, vomiting and diarrhea. May be harmful if swallowed.
Inhalation: Causes narcotic effects including headache, dizziness, weakness, unconsciousness.
Chronic: Possible cancer hazard based on tests with laboratory animals. Prolonged or repeated skin contact may cause dermatitis. Prolonged or repeated exposure may cause adverse reproductive effects.

## Section 4 - First Aid Measures

Eyes: Flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid.
Skin: Flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Get medical aid if irritation develops or persists. Wash clothing before reuse.
Ingestion: Never give anything by mouth to an unconscious person. Get medical aid. Do NOT induce vomiting. If conscious and alert, rinse mouth and drink 2-4 cupfuls of milk or water.
Inhalation: Get medical aid immediately. Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Do NOT use mouth-to-mouth resuscitation.
Notes to Physician: Treat symptomatically and supportively.

## Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Use water spray to keep fire-exposed containers cool. Vapors may be heavier than air. They can spread along the ground and collect in low or confined areas. Containers may explode when heated. Combustible liquid and vapor.
Extinguishing Media: In case of fire, use water, dry chemical, chemical foam, or alcohol-resistant foam. Use water spray to cool fire-exposed containers.
Flash Point: 84 deg C ( 183.20 deg F)
Autoignition Temperature: Not applicable.
Explosion Limits, Lower:0.8
Upper: 3.8
NFPA Rating: (estimated) Health: 2; Flammability: 2; Instability: 0

## Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.
Spills/Leaks: Absorb spill with inert material (e.g. vermiculite, sand or earth), then place in suitable container. Avoid runoff into

storm sewers and ditches which lead to waterways. Scoop up with a nonsparking tool, then place into a suitable container for disposal. Remove all sources of ignition. Provide ventilation. Clean up residual material by washing area with a 2-5% solution of soda ash.

## Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Use only in a well-ventilated area. Avoid contact with skin and eyes. Empty containers retain product residue, (liquid and/or vapor), and can be dangerous. Keep container tightly closed. Keep away from heat, sparks and flame. Avoid ingestion and inhalation. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose empty containers to heat, sparks or open flames.
Storage: Keep away from heat, sparks, and flame. Keep away from sources of ignition. Store in a tightly closed container. Store in a cool, dry, well-ventilated area away from incompatible substances.

## Section 8 - Exposure Controls, Personal Protection

Engineering Controls: Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits.
Exposure Limits

| Chemical Name | ACGIH | NIOSH | OSHA - Final PELs |
|---|---|---|---|
| Isophorone | 5 ppm Ceiling | 4 ppm TWA; 23 mg/m3 TWA 200 ppm IDLH | 25 ppm TWA; 140 mg/m3 TWA |

OSHA Vacated PELs: Isophorone: 4 ppm TWA; 23 mg/m3 TWA
Personal Protective Equipment
Eyes: Wear chemical goggles.
Skin: Wear appropriate protective gloves to prevent skin exposure.
Clothing: Wear appropriate protective clothing to prevent skin exposure.
Respirators: Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Always use a NIOSH or European Standard EN 149 approved respirator when necessary.

## Section 9 - Physical and Chemical Properties

Physical State: Liquid
Appearance: clear pale yellow

Odor: peppermint odor - camphor
pH: Not available.
Vapor Pressure: Not available.
Vapor Density: 4.8 (air=1)
Evaporation Rate:Not available.
Viscosity: Not available.
Boiling Point: 213-214 deg C
Freezing/Melting Point:-8 deg C
Decomposition Temperature:Not available.
Solubility: Slightly soluble in water.
Specific Gravity/Density:0.9200
Molecular Formula:C9H14O
Molecular Weight:138.21

## Section 10 - Stability and Reactivity

Chemical Stability: Stable under normal temperatures and pressures.
Conditions to Avoid: Ignition sources, excess heat, confined spaces.
Incompatibilities with Other Materials: Strong oxidizing agents.
Hazardous Decomposition Products: Carbon monoxide, irritating and toxic fumes and gases, carbon dioxide.
Hazardous Polymerization: Has not been reported.

## Section 11 - Toxicological Information

RTECS#:
CAS# 78-59-1: GW7700000
LD50/LC50:
CAS# 78-59-1:
Draize test, rabbit, eye: 920 ug Severe;
Draize test, rabbit, eye: 100 mg/24H Moderate;
Draize test, rabbit, skin: 100 mg/24H Mild;
Draize test, rabbit, skin: 0.5 mL/24H Moderate;
Inhalation, rat: LC50 = 7 gm/m3;
Oral, mouse: LD50 = 2690 mg/kg;
Oral, rabbit: LD50 = 1420 mg/kg;
Oral, rat: LD50 = 1870 mg/kg;

Skin, rabbit: LD50 = 1500 uL/kg;
Skin, rat: LD50 = 1390 mg/kg;
Carcinogenicity:
CAS# 78-59-1:

- ACGIH: A3 - Confirmed animal carcinogen with unknown relevance to humans

Epidemiology: No information available.
Teratogenicity: No information available.
Reproductive Effects: No information available.
Neurotoxicity: No information available.
Mutagenicity: No information available.
Other Studies: No data available.

## Section 12 - Ecological Information

No information available.

## Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.
RCRA P-Series: None listed.
RCRA U-Series: None listed.

## Section 14 - Transport Information

| | US DOT | Canada TDG |
|---|---|---|
| Shipping Name: | Not reviewed. | MERCURIC IODIDE |
| Hazard Class: | | 6.1 |
| UN Number: | | UN1638 |
| Packing Group: | | II |

## Section 15 - Regulatory Information

### US FEDERAL

TSCA
CAS# 78-59-1 is listed on the TSCA inventory.
Health & Safety Reporting List
CAS# 78-59-1: Effective 10/4/82, Sunset 10/4/92
Chemical Test Rules
CAS# 78-59-1: Testing required by manufacturers, processors
Section 12b
CAS# 78-59-1: Section 4
TSCA Significant New Use Rule
None of the chemicals in this material have a SNUR under TSCA.
CERCLA Hazardous Substances and corresponding RQs
CAS# 78-59-1: 5000 lb final RQ; 2270 kg final RQ
SARA Section 302 Extremely Hazardous Substances
None of the chemicals in this product have a TPQ.
SARA Codes
CAS # 78-59-1: acute, chronic, flammable, reactive.
Section 313 No chemicals are reportable under Section 313.
Clean Air Act:
CAS# 78-59-1 is listed as a hazardous air pollutant (HAP).
This material does not contain any Class 1 Ozone depletors.
This material does not contain any Class 2 Ozone depletors.
Clean Water Act:
None of the chemicals in this product are listed as Hazardous Substances under the CWA. CAS# 78-59-1 is listed as a Priority Pollutant under the Clean Water Act. CAS# 78-59-1 is listed as a Toxic Pollutant under the Clean Water Act.
OSHA:
None of the chemicals in this product are considered highly hazardous by OSHA.
STATE
CAS# 78-59-1 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

California Prop 65

California No Significant Risk Level: None of the chemicals in this product are listed.

### European / International Regulations

European Labeling in Accordance with EC Directives
Hazard Symbols:
XN
Risk Phrases:
R 21/22 Harmful in contact with skin and if swallowed.
R 36/37 Irritating to eyes and respiratory system.
R 40 Limited evidence of a carcinogenic effect.

Safety Phrases:
S 13 Keep away from food, drink and animal feeding stuffs.
S 23 Do not inhale gas/fumes/vapour/spray.
S 36/37/39 Wear suitable protective clothing, gloves and eye/face protection.
S 46 If swallowed, seek medical advice immediately and show this container or label.

WGK (Water Danger/Protection)
CAS# 78-59-1: 1
Canada - DSL/NDSL
CAS# 78-59-1 is listed on Canada's DSL List.
Canada - WHMIS
WHMIS: Not available.
Canadian Ingredient Disclosure List
CAS# 78-59-1 is listed on the Canadian Ingredient Disclosure List.

## Section 16 - Additional Information

MSDS Creation Date: 3/16/1999
Revision #3 Date: 3/18/2003

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.

# Material Safety Data Sheet
## Dichloromethane

ACC# 14930

## Section 1 - Chemical Product and Company Identification

MSDS Name: Dichloromethane
Catalog Numbers: AC326600040, AC326852500, AC406910010, AC406910040, AC406910200, AC406920040, AC610050040, AC610160040, AC610300010, AC61030019, AC61030019, AC61030050, AC61030050, AC610301000, AC61030115, AC61030115, AC61030200, AC610520190, AC610520500, AC610521150, AC610522000, AC610720190, AC610720500, AC610721150, AC610722000, AC610931000, S41712, S80084, S80084-1, BP1186-4, BP1186POP20, BP1186SS-50, BP2608-100, BW4250RT50, D1381, D1384, D138SK4, D142-4, D142RS115, D142RS200, D142RS28, D142RS50, D142SS-115, D142SS-200, D142SS-28, D142SS-50, D143-1, D143-4, D143J1, D143N219, D143RS-19, D143RS115, D143RS200, D143RS28, D143RS50, D143SK-1, D143SK-4, D143SK4LC, D143SS-115, D143SS-200, D143SS-28, D143SS19, D149-1, D149RS-19, D149RS-50, D150-1, D150-4, D1504LC, D150J-4, D150SK-1, D150SK-4, D151-1, D151-4, D151J1, D151RS-19, D151RS-200, D151RS-28, D151RS-50, D151RS115, D151SS-115, D151SS-200, D151SS-28, D151SS-50, D154-4, D1544LC, D158-4, D35-1, D35-4, D37-1, D37-20, D37-200, D37-4, D37-500, D37200LC, D37FB-115, D37FB-19, D37FB-200, D37FB-50, D37J1, D37POP19, D37POPB200, D37POPB50, D37RB-115, D37RB-200, D37RB-50, D37RS-115, D37RS-200, D37RS-28, D37RS-50, D37RS19, D37SK-4, D37SS-200, D37SS13150, D37SS1350, NC9026865, NC9195811, NC9206961, NC9325934, NC9964976, PS03502, PS03503, XXD1584LI
Synonyms: Methylene chloride; Methane dichloride; Methylene bichloride; Methylene dichloride; Dichloromethane; DCM.
Company Identification:

Fisher Scientific
1 Reagent Lane
Fair Lawn, NJ 07410
For information, call: 201-796-7100
Emergency Number: 201-796-7100
For CHEMTREC assistance, call: 800-424-9300
For International CHEMTREC assistance, call: 703-527-3887

## Section 2 - Composition, Information on Ingredients

| CAS# | Chemical Name | Percent | EINECS/ELINCS |
|---|---|---|---|
| 75-09-2 | Methylene chloride | >99.5 | 200-838-9 |

## Section 3 - Hazards Identification

### EMERGENCY OVERVIEW

Appearance: colorless liquid.
Warning! Methylene chloride is metabolically converted to carbon monoxide after systemic absorption, which yields increased concentrations of carboxyhemoglobin in the blood. Harmful if swallowed. Causes eye, skin, and respiratory tract irritation. May be harmful if inhaled. May cause central nervous system effects. Potential cancer hazard. May cause kidney damage. This substance has caused adverse reproductive and fetal effects in animals.
Target Organs: Blood, central nervous system.

### Potential Health Effects

Eye: Contact with eyes may cause severe irritation, and possible eye burns.
Skin: May be absorbed through the skin. Causes irritation with burning pain, itching, and redness. Prolonged exposure may result in skin burns.
Ingestion: Causes gastrointestinal irritation with nausea, vomiting and diarrhea. May cause kidney damage. May cause central nervous system depression, characterized by excitement, followed by headache, dizziness, drowsiness, and nausea. Advanced stages may cause collapse, unconsciousness, coma and possible death due to respiratory failure. May cause carboxyhemoglobinemia.
Inhalation: Inhalation of high concentrations may cause central nervous system effects characterized by nausea, headache, dizziness, unconsciousness and coma. Causes respiratory tract irritation. May cause narcotic effects in high concentration. Vapors may cause dizziness or suffocation. May cause blood changes. Overexposure may cause an increase in carboxyhemoglobin levels in the blood. Can produce delayed pulmonary edema. Because of its high volatility, airborne concentrations of methylene chloride can accumulate in poorly ventilated areas. Odor is a poor indicator of possibly dangerous air concentrations of methylene chloride.
Chronic: Possible cancer hazard based on tests with laboratory animals. Prolonged or repeated skin contact may cause dermatitis. May cause reproductive and fetal effects. Laboratory experiments have resulted in mutagenic effects. Chronic exposure may cause lung, liver, and pancreatic tumors. May cause conjunctivitis and/or corneal burns.

## Section 4 - First Aid Measures

Eyes: In case of contact, immediately flush eyes with plenty of water for a t least 15 minutes. Get medical aid.
Skin: In case of contact, flush skin with plenty of water. Remove contaminated clothing and shoes. Get medical aid if irritation develops and persists. Wash clothing before reuse.
Ingestion: If swallowed, do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Get medical aid.
Inhalation: If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.

Notes to Physician: Treat symptomatically and supportively.

## Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Use water spray to keep fire-exposed containers cool. No flash point in conventional closed tester, but forms flammable vapor-air mixtures in larger volumes and may be an explosion hazard in a confined space.
Extinguishing Media: Use water spray, dry chemical, carbon dioxide, or appropriate foam.
Flash Point: Not applicable.
Autoignition Temperature: 556 deg C ( 1,032.80 deg F)
Explosion Limits, Lower:13 vol %
Upper: 23 vol %
NFPA Rating: (estimated) Health: 2; Flammability: 1; Instability: 0

## Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.
Spills/Leaks: Absorb spill with inert material (e.g. vermiculite, sand or earth), then place in suitable container. Avoid runoff into storm sewers and ditches which lead to waterways. Clean up spills immediately, observing precautions in the Protective Equipment section. Remove all sources of ignition. Provide ventilation.

## Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Avoid contact with eyes, skin, and clothing. Keep container tightly closed. Keep away from heat, sparks and flame. Use only with adequate ventilation. Avoid breathing vapor or mist.
Storage: Store in a tightly closed container. Keep from contact with oxidizing materials. Store in a cool, dry, well-ventilated area away from incompatible substances. Store below 40°C. Keep away from active metals.

## Section 8 - Exposure Controls, Personal Protection

Engineering Controls: Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits.
Exposure Limits

| Chemical Name | ACGIH | NIOSH | OSHA - Final PELs |
|---|---|---|---|
| Methylene chloride | 50 ppm TWA | 2300 ppm IDLH | 25 ppm TWA (8 hr); 125 ppm STEL (15 min); 12.5 ppm Action Level (See 29 CFR 1910 .1052) |

OSHA Vacated PELs: Methylene chloride: 500 ppm TWA
Personal Protective Equipment
Eyes: Wear chemical goggles.
Skin: Wear appropriate protective gloves to prevent skin exposure.
Clothing: Wear appropriate protective clothing to prevent skin exposure.
Respirators: A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant a respirator's use.

## Section 9 - Physical and Chemical Properties

Physical State: Liquid
Appearance: colorless
Odor: ethereal odor - chloroform-like
pH: Not available.
Vapor Pressure: 350 mm Hg @ 20 deg C
Vapor Density: 2.93 (Air=1)
Evaporation Rate:Not available.
Viscosity: Not available.
Boiling Point: 40 deg C
Freezing/Melting Point:-97 deg C
Decomposition Temperature:Not available.
Solubility: Slightly soluble.
Specific Gravity/Density:1.33 (Water=1)
Molecular Formula:CH2Cl2
Molecular Weight:84.93

## Section 10 - Stability and Reactivity

Chemical Stability: Stable at room temperature in closed containers under normal storage and handling conditions. May form explosive mixtures in atmospheres having high oxygen content.
Conditions to Avoid: Excess heat, attacks some plastics, rubber, and coatings, confined spaces, When no water is present, dichloromethane is not corrosive to metals. At high temperatures and in the presence of water (causing slow decomposition forming HCl), corrosion of iron, some stainless steels, copper and aluminum can occur..
Incompatibilities with Other Materials: Strong oxidizing agents, strong bases, chemically active metals.
Hazardous Decomposition Products: Hydrogen chloride, phosgene, carbon monoxide, carbon dioxide.
Hazardous Polymerization: Will not occur.

## Section 11 - Toxicological Information

RTECS#:
CAS# 75-09-2: PA8050000
LD50/LC50:
CAS# 75-09-2:
Draize test, rabbit, eye: 162 mg Moderate;
Draize test, rabbit, eye: 10 mg Mild;
Draize test, rabbit, eye: 500 mg/24H Mild;
Draize test, rabbit, skin: 810 mg/24H Severe;
Draize test, rabbit, skin: 100 mg/24H Moderate;
Inhalation, mouse: LC50 = 14400 ppm/7H;
Inhalation, mouse: LC50 = 49100 mg/m3/6H;
Inhalation, mouse: LC50 = 54000 mg/m3/2H;
Inhalation, mouse: LC50 = 56220 mg/m3/7H;
Inhalation, rat: LC50 = 52 gm/m3;
Inhalation, rat: LC50 = 76000 mg/m3/4H;
Inhalation, rat: LC50 =
Carcinogenicity:
CAS# 75-09-2:

- ACGIH: A3 - Confirmed animal carcinogen with unknown relevance to humans
- California: carcinogen, initial date 4/1/88
- NTP: Suspect carcinogen
- IARC: Group 2B carcinogen

Epidemiology: There are few reports of injury despite widespread use of dichloromethane (ACGIH, 1991). Solvent abuse has led to death (Harbison, 1998).
Teratogenicity: Inhalation, rat: TCLo = 4500 ppm/24H (female 1-17 day(s) after conception) Effects on Newborn - behavioral.; Inhalation, rat: TCLo = 1250 ppm/7H (female 6-15 day(s) after conception) Specific Developmental Abnormalities - musculoskeletal system and urogenital system.
Reproductive Effects: Reproductive effects have occurred in experimental animals.
Neurotoxicity: No information available.
Mutagenicity: DNA inhibition: Human, Fibroblast = 5000 ppm/1H (Continuous).; Morphological transformation: Rat, Embryo = 160 umol/L.; DNA damage: Oral, rat = 1275 mg/kg.; Inhalation, mouse: TCLo = 2000 ppm/5H/2Y-C (Tumorigenic - Carcinogenic by RTECS criteria--Lungs, Thorax, or Respiration - Tumors).
Other Studies: See actual entry in RTECS for complete information.

## Section 12 - Ecological Information

Ecotoxicity: Fish: Bluegill/Sunfish: 230mg/L; 24H; StaticFish: Fathead Minnow: 196mg/L; 96H; This chemical has a moderate potential to affect some aquatic organisms. It is resistant to biodegradation, and has a low potential to persist in the aquatic environment. 96-hr. EC50 (loss of equilibrium); Fathead minnow: 99mg/L; 96-hr. EC10: 66.3 mg/L. Bluegill sunfish: 96-hr. LC50=220 mg/L; Water flea: 24-hr. LC50=2270 mg/L; No observed effect level:1550 mg/L.
Environmental: Terrestrial: Expected to evaporate from near surface soil into the atmosphere; expected to leach. Aquatic: Primarily lost by evaporation to the atmosphere which should take several hours depending on wind and mixing conditions. Atmospheric: Will degrade by reaction with hydroxyl radicals with a half life of several months. . Dichloromethane is reported to completely biodegrade under aerobic conditions with sewage seed or activated sludge between 6 hours to 7 days. Not expected to bioconcentrate due to its low octanol/water coefficient.
Physical: No information available.
Other: No information available.

## Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.
RCRA P-Series: None listed.
RCRA U-Series:
CAS# 75-09-2: waste number U080.

## Section 14 - Transport Information

| | US DOT | Canada TDG |
|---|---|---|
| Shipping Name: | DICHLOROMETHANE | DICHLOROMETHANE |
| Hazard Class: | 6.1 | 6.1 |
| UN Number: | UN1593 | UN1593 |
| Packing Group: | III | III |

## Section 15 - Regulatory Information

### US FEDERAL

TSCA

CAS# 75-09-2 is listed on the TSCA inventory.

Health & Safety Reporting List

CAS# 75-09-2: Effective 10/4/82, Sunset 10/4/92

Chemical Test Rules

None of the chemicals in this product are under a Chemical Test Rule.

Section 12b

None of the chemicals are listed under TSCA Section 12b.

TSCA Significant New Use Rule

None of the chemicals in this material have a SNUR under TSCA.

CERCLA Hazardous Substances and corresponding RQs

CAS# 75-09-2: 1000 lb final RQ; 454 kg final RQ

SARA Section 302 Extremely Hazardous Substances

None of the chemicals in this product have a TPQ.

SARA Codes

CAS # 75-09-2: acute, chronic.

Section 313

This material contains Methylene chloride (CAS# 75-09-2, >99.5%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.

Clean Air Act:

CAS# 75-09-2 is listed as a hazardous air pollutant (HAP).

This material does not contain any Class 1 Ozone depletors.

This material does not contain any Class 2 Ozone depletors.

Clean Water Act:

None of the chemicals in this product are listed as Hazardous Substances under the CWA. CAS# 75-09-2 is listed as a Priority

Pollutant under the Clean Water Act. CAS# 75-09-2 is listed as a Toxic Pollutant under the Clean Water Act.

OSHA:

None of the chemicals in this product are considered highly hazardous by OSHA.

STATE

CAS# 75-09-2 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

California Prop 65

The following statement(s) is(are) made in order to comply with the California Safe Drinking Water Act:
WARNING: This product contains Methylene chloride, a chemical known to the state of California to cause cancer.
California No Significant Risk Level: CAS# 75-09-2: 200 æg/day NSRL (inhalation); 50 æg/day NSRL (except inhalation)

## European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols:

XN

Risk Phrases:

R 40 Limited evidence of a carcinogenic effect.

Safety Phrases:

S 23 Do not inhale gas/fumes/vapour/spray.
S 24/25 Avoid contact with skin and eyes.
S 36/37 Wear suitable protective clothing and gloves.

WGK (Water Danger/Protection)

CAS# 75-09-2: 2

Canada - DSL/NDSL

CAS# 75-09-2 is listed on Canada's DSL List.

Canada - WHMIS

This product has a WHMIS classification of D2A.

Canadian Ingredient Disclosure List

CAS# 75-09-2 is listed on the Canadian Ingredient Disclosure List.

## Section 16 - Additional Information

MSDS Creation Date: 4/20/1999
Revision #5 Date: 2/20/2003

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the

suitability of the information for their particular purposes. In no event shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.

# Material Safety Data Sheet
## Phenol Liquid

ACC# 18384

## Section 1 - Chemical Product and Company Identification

MSDS Name: Phenol Liquid
Catalog Numbers: S93321, A88I-500, A931I-1, A931I-200, A931I-4, A931I-500, S801181, S801181MF
Synonyms: Carbolic acid; Phenylic acid; Hydroxybenzene; Monohydroxybenzene; Phenyl hydroxide
Company Identification:

Fisher Scientific
1 Reagent Lane
Fair Lawn, NJ 07410

For information, call: 201-796-7100
Emergency Number: 201-796-7100
For CHEMTREC assistance, call: 800-424-9300
For International CHEMTREC assistance, call: 703-527-3887

## Section 2 - Composition, Information on Ingredients

| CAS# | Chemical Name | Percent | EINECS/ELINCS |
|---|---|---|---|
| 108-95-2 | Phenol | 89 | 203-632-7 |
| 7732-18-5 | Water | 11 | 231-791-2 |
| 6153-56-6 | Oxalic acid, dihydrate | 0.01 | unlisted |

## Section 3 - Hazards Identification

### EMERGENCY OVERVIEW

Appearance: colorless liquid. Flash Point: 175 deg F.
Danger! May be fatal if inhaled, absorbed through the skin or swallowed. Causes eye and skin burns. Causes severe respiratory tract irritation with possible burns. Causes severe digestive tract irritation with possible burns. Mutagen. Readily absorbed through the skin. Combustible liquid and vapor. May cause central nervous system depression. May cause liver and kidney damage. Air sensitive.

Hygroscopic (absorbs moisture from the air). Light sensitive.
Target Organs: Blood, kidneys, central nervous system, liver, eyes, skin.

### Potential Health Effects

Eye: Contact with liquid or vapor causes severe burns and possible irreversible eye damage.
Skin: May be fatal if absorbed through the skin. Direct skin contact results in white, wrinkled discoloration, followed by severe burns. Phenol may be absorbed through the skin rapidly to cause systemic poisoning and possible death due to effects on the CNS system, heart, blood vessels, lungs and kidneys.
Ingestion: May cause liver and kidney damage. May cause central nervous system depression, characterized by excitement, followed by headache, dizziness, drowsiness, and nausea. Advanced stages may cause collapse, unconsciousness, coma and possible death due to respiratory failure. May cause perforation of the digestive tract. Causes digestive tract burns with immediate pain, swelling of the throat, convulsions, and possible coma. Methemoglobinemia is characterized by dizziness, drowsiness, headache, shortness of breath, cyanosis (bluish discoloration of skin due to deficient oxygenation of the blood), rapid heart rate and chocolate-brown colored blood. Overexposure may cause methemoglobinemia. Human fatalities have been reported from acute poisoning. May cause cardiac abnormalities.
Inhalation: Causes severe irritation of upper respiratory tract with coughing, burns, breathing difficulty, and possible coma. May be fatal if exposed to high concentrations. Aspiration may lead to pulmonary edema. May also cause pallor, loss of appetite, nausea, vomiting, diarrhea, weakness, darkened urine, headache, sweating, convulsions, cyanosis (bluish skin due to deficient oxygenation of the blood), unconsciousness, fatigue, pulmonary edema & coma. Inhalation at high concentrations may cause CNS depression and asphixiation.
Chronic: Chronic inhalation and ingestion may cause effects similar to those of acute inhalation and ingestion. May cause reproductive and fetal effects. Effects may be delayed. Laboratory experiments have resulted in mutagenic effects. Repeated skin contact may cause dermatitis with dark pigmentation of the skin. Animal studies have reported the development of tumors. Chronic exposures have been reported to cause death from liver and kidney damage.

## Section 4 - First Aid Measures

Eyes: Get medical aid immediately. Do NOT allow victim to rub eyes or keep eyes closed. Extensive irrigation with water is required (at least 30 minutes).
Skin: Get medical aid immediately. Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Discard contaminated clothing in a manner which limits further exposure. SPEEDY ACTION IS CRITICAL! Destroy contaminated shoes.
Ingestion: Do not induce vomiting. If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. SPEED IS ESSENTIAL. A DOCTOR MUST BE NOTIFIED AT ONCE.
Inhalation: Remove from exposure and move to fresh air immediately. If breathing is difficult, give oxygen. Do NOT use mouth-to-mouth resuscitation. If breathing has ceased apply artificial respiration using oxygen and a suitable mechanical device such as a bag and a mask. SPEED IS ESSENTIAL, OBTAIN MEDICAL AID IMMEDIATELY.

Notes to Physician: Persons with liver or kidney disease should not be exposed to phenol for any length of time.
Antidote: Activated charcoal, followed by cathartic, may be preferred to ipecac induced emesis or lavage in decontamination of the GI tract and preventing systemic absorption of phenol.

## Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion. Vapors may be heavier than air. They can spread along the ground and collect in low or confined areas. Containers may explode when heated. Runoff from fire control or dilution water may cause pollution. Combustible liquid and vapor.
Extinguishing Media: In case of fire, use water, dry chemical, chemical foam, or alcohol-resistant foam. Use water spray to cool fire-exposed containers.
Flash Point: 175e deg F ( 79.44 deg C)
Autoignition Temperature: 1319 deg F ( 715.00 deg C)
Explosion Limits, Lower:1.8
Upper: 8.6
NFPA Rating: (estimated) Health: 4; Flammability: 2; Instability: 0

## Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.
Spills/Leaks: Absorb spill with inert material (e.g. vermiculite, sand or earth), then place in suitable container. Avoid runoff into storm sewers and ditches which lead to waterways. Clean up spills immediately, observing precautions in the Protective Equipment section. Remove all sources of ignition. Use a spark-proof tool. Provide ventilation.

## Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Do not get in eyes, on skin, or on clothing. Empty containers retain product residue, (liquid and/or vapor), and can be dangerous. Keep container tightly closed. Keep away from heat, sparks and flame. Do not ingest or inhale. Store protected from light. Use only in a chemical fume hood. Discard contaminated shoes. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose empty containers to heat, sparks or open flames.
Storage: Keep away from heat, sparks, and flame. Keep away from sources of ignition. Keep container closed when not in use. Store

in a tightly closed container. Keep from contact with oxidizing materials. Keep refrigerated. (Store below 4°C/39°F.) Store protected from moisture. Store protected from light.

## Section 8 - Exposure Controls, Personal Protection

Engineering Controls: Use explosion-proof ventilation equipment. Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits.

Exposure Limits

| Chemical Name | ACGIH | NIOSH | OSHA - Final PELs |
|---|---|---|---|
| Phenol | 5 ppm TWA; skin - potential for cutaneous absorption | 5 ppm TWA; 19 mg/m3 TWA 250 ppm IDLH | 5 ppm TWA; 19 mg/m3 TWA |
| Water | none listed | none listed | none listed |
| Oxalic acid, dihydrate | none listed | none listed | none listed |

OSHA Vacated PELs: Phenol: 5 ppm TWA; 19 mg/m3 TWA Water: No OSHA Vacated PELs are listed for this chemical. Oxalic acid, dihydrate: No OSHA Vacated PELs are listed for this chemical.

Personal Protective Equipment

Eyes: Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin: Wear appropriate protective gloves to prevent skin exposure.

Clothing: Wear appropriate protective clothing to prevent skin exposure.

Respirators: A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant a respirator's use.

## Section 9 - Physical and Chemical Properties

Physical State: Liquid
Appearance: colorless
Odor: sweetish odor
pH: 6 aqueous solution.
Vapor Pressure: .35 mm Hg @25C
Vapor Density: 3.2
Evaporation Rate:<0.01 (butyl acetate=1)
Viscosity: 1.51 cp@80C

Boiling Point: 360 deg F
Freezing/Melting Point:109 deg F
Decomposition Temperature:Not available.
Solubility: 6.75% in water
Specific Gravity/Density:1.0576
Molecular Formula:C6H5OH
Molecular Weight:94.1

## Section 10 - Stability and Reactivity

Chemical Stability: Stable.
Conditions to Avoid: Light, ignition sources, excess heat, exposure to moist air or water.
Incompatibilities with Other Materials: Strong oxidizing agents, isocyanates, acetaldehyde, calcium hypochlorite, peroxomonosulfuric acid, nitrobenzene, sodium nitrite, aluminum chloride, peroxydisulfuric acid, 1,3-butadiene, boron trifluoride diethyl ether.
Hazardous Decomposition Products: Carbon monoxide, carbon dioxide.
Hazardous Polymerization: Has not been reported.

## Section 11 - Toxicological Information

RTECS#:
CAS# 108-95-2: SJ3325000
CAS# 7732-18-5: ZC0110000
CAS# 6153-56-6 unlisted.
LD50/LC50:
CAS# 108-95-2:
Draize test, rabbit, eye: 5 mg Severe;
Draize test, rabbit, skin: 500 mg/24H Severe;
Draize test, rabbit, skin: 100 mg Mild;
Inhalation, mouse: LC50 = 177 mg/m3;
Inhalation, mouse: LC50 = 177 mg/m3/4H;
Inhalation, rat: LC50 = 316 mg/m3;
Inhalation, rat: LC50 = 316 mg/m3/4H;
Oral, mouse: LD50 = 270 mg/kg;
Oral, rat: LD50 = 317 mg/kg;
Oral, rat: LD50 = 512 mg/kg;

Skin, rabbit: LD50 = 630 mg/kg;
Skin, rat: LD50 = 669 mg/kg;
Skin, rat: LD50 = 1500 mg/kg;
CAS# 7732-18-5:
Oral, rat: LD50 = >90 mL/kg;
CAS# 6153-56-6:
Carcinogenicity:
CAS# 108-95-2: Not listed by ACGIH, IARC, NTP, or CA Prop 65.
CAS# 7732-18-5: Not listed by ACGIH, IARC, NTP, or CA Prop 65.
CAS# 6153-56-6: Not listed by ACGIH, IARC, NTP, or CA Prop 65.

Epidemiology: The predominant acute action of a toxic dose of phenol in man appears to be to the central nervous system, leading to sudden collapse and unconsciousness.
Teratogenicity: Oral, rat: TDLo = 1200 mg/kg (female 6-15 day(s) after conception) Effects on Embryo or Fetus - fetotoxicity (except death, e.g., stunted fetus).; Oral, mouse: TDLo = 4 gm/kg (female 6-15 day(s) after conception) Specific Developmental Abnormalities - musculoskeletal system.
Reproductive Effects: Oral, rat: TDLo = 300 mg/kg (female 6-15 day(s) after conception) Fertility - post-implantation mortality (e.g. dead and/or resorbed implants per total number of implants).
Neurotoxicity: No data available.
Mutagenicity: Mutation Test Systems - not otherwise specified: Human, HeLa cell = 17 mg/L.; DNA Inhibition: Human, HeLa cell = 1 mmol/L.; Mutation Test Systems - not otherwise specified: Human, Lymphocyte = 5 umol/L.; Sister Chromatid Exchange: Human, Lymphocyte = 5 umol/L.
Other Studies: Standard Draize Test: Administration onto the skin (rabbit) = 500 mg/24H (Severe). Standard Draize Test: Administration into the eye (rabbit) = 5 mg (Severe).

## Section 12 - Ecological Information

Ecotoxicity: Water flea Daphnia: EC50=12 mg/l; 48-hour; CAS# 108-95-2: UnspecifiedWater flea Daphnia: EC50=4.0 mg/l; 96-hour; CAS# 108-95-2: UnspecifiedFish: Fathead Minnow: LC50 > 50 mg/l; 1 Hr; CAS# 108-95-2 Static @ 18-22°CFish: Fathead Minnow: TLm = 41 mg/L; 48-hour; CAS# 108-95-2: Flow-through @ 15°CFish: Bluegill/Sunfish: TLm = 19 / 5.7 mg/L; 96 Hr; CAS# 108-95-2: Flow-through If released to the environment, phenol's primary removal mechanism is biodegradation which is generally rapid (days). If phenol is released to soil, it will readily leach and biodegrade. The biodegradation in soil is generally rapid with half-lives of under 5 days even in subsurface soils.
Environmental: Phenol does not bioconcentrate in aquatic organisms. In the atmosphere, phenol occurs as a vapor and reacts with photochemically-produced hydroxyl radicals resulting in a half-life of approximately 15 hours. During the nighttime, it reacts with nitrate radicals with a resulting half-life of 12 minutes. Phenol has also been shown to be readily removed from the atmosphere by rain.
Physical: No information available.

Other: No information available.

## Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.
RCRA P-Series: None listed.
RCRA U-Series:
CAS# 108-95-2: waste number U188.

## Section 14 - Transport Information

| | US DOT | Canada TDG |
|---|---|---|
| Shipping Name: | PHENOL SOLUTIONS | PHENOL, SOLID |
| Hazard Class: | 6.1 | 6.1(9.2) |
| UN Number: | UN2821 | UN1671 |
| Packing Group: | II | II |

## Section 15 - Regulatory Information

### US FEDERAL

TSCA
CAS# 108-95-2 is listed on the TSCA inventory.
CAS# 7732-18-5 is listed on the TSCA inventory.
CAS# 6153-56-6 is not on the TSCA Inventory b It is considered to be listed if the CAS number for the anhydrous form is on the inventory (40CFR720.3(u)(2)).
Health & Safety Reporting List
CAS# 108-95-2: Effective 6/1/87, Sunset 6/1/97
Chemical Test Rules
None of the chemicals in this product are under a Chemical Test Rule.
Section 12b
CAS# 108-95-2: Section 4
TSCA Significant New Use Rule

None of the chemicals in this material have a SNUR under TSCA.

CERCLA Hazardous Substances and corresponding RQs

CAS# 108-95-2: 1000 lb final RQ; 454 kg final RQ

SARA Section 302 Extremely Hazardous Substances

CAS# 108-95-2: 500 lb TPQ (lower threshold); 10000 lb TPQ (upper thres hold)

SARA Codes

CAS # 108-95-2: acute, chronic, flammable.

CAS # 6153-56-6: acute, chronic.

Section 313

This material contains Phenol (CAS# 108-95-2, 89%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.

Clean Air Act:

CAS# 108-95-2 is listed as a hazardous air pollutant (HAP).

This material does not contain any Class 1 Ozone depletors.

This material does not contain any Class 2 Ozone depletors.

Clean Water Act:

CAS# 108-95-2 is listed as a Hazardous Substance under the CWA. CAS# 108-95-2 is listed as a Priority Pollutant under the Clean Water Act. CAS# 108-95-2 is listed as a Toxic Pollutant under the Clean Water Act.

OSHA:

None of the chemicals in this product are considered highly hazardous by OSHA.

STATE

CAS# 108-95-2 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

CAS# 7732-18-5 is not present on state lists from CA, PA, MN, MA, FL, or NJ.

CAS# 6153-56-6 can be found on the following state right to know lists: Pennsylvania.

California Prop 65

California No Significant Risk Level: None of the chemicals in this product are listed.

## European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols:

T

Risk Phrases:

R 34 Causes burns.

R 24/25 Toxic in contact with skin and if swallowed.

Safety Phrases:

S 28 After contact with skin, wash immediately with...
S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

WGK (Water Danger/Protection)
CAS# 108-95-2: 2
CAS# 7732-18-5: No information available.
CAS# 6153-56-6: 1

Canada - DSL/NDSL
CAS# 108-95-2 is listed on Canada's DSL List.
CAS# 7732-18-5 is listed on Canada's DSL List.

Canada - WHMIS
This product has a WHMIS classification of D1A, E, D2B, B3.

Canadian Ingredient Disclosure List
CAS# 108-95-2 is listed on the Canadian Ingredient Disclosure List.

## Section 16 - Additional Information

MSDS Creation Date: 6/01/1999
Revision #6 Date: 10/30/2003

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.

## Attachment 5

Air Monitoring Records

## Real Time Air Monitoring Data Collection Form

Document all air monitoring conducted on the Site below based on Section E of the HASP. Keep this form with the project files.

Site Name: _____ Date: _____

Instrument: _____ Model: _____ Serial #: _____

| | |
|---|---|
| Calibration Method: (material used, settings, etc.) | |
| Calibration Results: | |
| Calibrated By: | |

| Activity Being Monitored | Compounds Monitored | Time | Reading | Action Required? Y/N |
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**Describe Any Actions Taken as a Result of this Air Monitoring and Why:**

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Signed: _____

Site Safety Officer

## Real Time Air Monitoring Data Collection Form

Document all air monitoring conducted on the Site below based on Section E of the HASP. Keep this form with the project files.

Site Name: _____ Date: _____

Instrument: _____ Model: _____ Serial #: _____

| | |
|---|---|
| Calibration Method: (material used, settings, etc.) | |
| Calibration Results: | |
| Calibrated By: | |

| Activity Being Monitored | Compounds Monitored | Time | Reading | Action Required? Y/N |
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**Describe Any Actions Taken as a Result of this Air Monitoring and Why:**

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Signed: _____

Site Safety Officer

Make additional copies of this form as necessary.

## Real Time Air Monitoring Data Collection Form

Document all air monitoring conducted on the Site below based on Section E of the HASP. Keep this form with the project files.

Site Name: _____ Date: _____

Instrument: _____ Model: _____ Serial #: _____

| | |
|---|---|
| Calibration Method: (material used, settings, etc.) | |
| Calibration Results: | |
| Calibrated By: | |

| Activity Being Monitored | Compounds Monitored | Time | Reading | Action Required? Y/N |
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**Describe Any Actions Taken as a Result of this Air Monitoring and Why:**

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Signed: _____

Site Safety Officer

Make additional copies of this form as necessary.

## Real Time Air Monitoring Data Collection Form

Document all air monitoring conducted on the Site below based on Section E of the HASP. Keep this form with the project files.

Site Name: _____ Date: _____

Instrument: _____ Model: _____ Serial #: _____

| | |
|---|---|
| Calibration Method: (material used, settings, etc.) | |
| Calibration Results: | |
| Calibrated By: | |

| Activity Being Monitored | Compounds Monitored | Time | Reading | Action Required? Y/N |
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**Describe Any Actions Taken as a Result of this Air Monitoring and Why:**

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Signed: _____

Site Safety Officer

Make additional copies of this form as necessary.