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Site-Specific Health and Safety Plan

Corrective Action
Vicksburg Chemical Company
Vicksburg, Mississippi

18 October 2007

ARCADIS

Site-Specific Health and Safety Plan

Corrective Action
Vicksburg Chemical Company
Vicksburg, Mississippi

Prepared for:
Mississippi Department of Environmental Quality and Mississippi Bluffs Industrial Park, LLC

Prepared by:
ARCADIS U.S., Inc.10352 Plaza Americana Drive
Baton Rouge
Louisiana 70816
Tel 225 292 1004
Fax 225 218 9677

Our Ref.:
LA002656.0001.00001

Date:
18 October 2007

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Review and Approval

Site Name: **Vicksburg Chemical Company, Vicksburg, Mississippi**

David R. Escudé Project Manager	David R. Escudé' Signature	7/19/07 Date
Dana A. Lawton Construction, Site, or Task Manager	Dana A. Lawton for Signature	7/19/07 Date
John Trahan Site Health and Safety Officer	John Trahan (CAD) Signature	7/19/07 Date
Madeline Rogers Project Health and Safety Manager	Madeline Rogers (CAD) Signature	7/19/07 Date
Craig A. Derouen Designated Health and Safety Plan Writer	Craig A. Derouen Signature	7/19/07 Date
Sam Moyers Designated Health and Safety Plan Reviewer	 Signature	10/27/06 Date

Employee Acknowledgement

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

Site Name: **Vicksburg Chemical Company, Vicksburg, Mississippi**

Name	Signature	Date
Name	Signature	Date
Name	Signature	Date
Name	Signature	Date
Name	Signature	Date
Name	Signature	Date
Name	Signature	Date
Name	Signature	Date
Name	Signature	Date

Health and Safety Plan Addendum Log

Changes in the scope of the project or introduction of new hazards to the project shall require revision of the Health and Safety Plan (HASP) by the HASP writer and reviewer and approval by the Project Manager. The HASP Addendum Form is included as Appendix A. Addenda are to be added to every copy of the HASP and logged in the following table to verify that all copies of the HASP are current:

Addendum Number	Date of Addendum	Reason for Addendum	Person Completing Addendum
1	3/21/07	Sampling of SWMU 2 landfill contents may present exposure to organic vapors and acid gases.	Craig Derouen
2	7/16/07	Tank cleaning activities will require personnel to enter confined spaces and possibly use manlifts or aerial lifts.	Craig Derouen
3	10/18/07	Transportation of electrical transformers off site will require the use of a crane.	Craig Derouen
4	10/18/07	Asbestos located on cooling towers will be removed during cooling tower demolition activities.	Craig Derouen
5			
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Executive Summary

Introduction

The provisions of this Site Health and Safety Plan (HASP) are mandatory for all ARCADIS personnel involved in the Project. 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 HASP meets the requirements for health and safety protection and planning as required by the Occupational Safety and Health Administration (OSHA) in Title 29 Code of Federal Regulations (CFR), Part 1910 and 1926, as applicable.

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.

1. Project Description

1.1 Project Type and Activities

ARCADIS' responsibilities at the site will consist of activities to support delineation of soil and groundwater impacts and oversight of the construction activities associated with site remediation.

The following table shows project tasks as well as approximate start dates for each activity.

X	Type	Start Date	X	Activities	Start Date
X	Remediation			Geophysical Survey	
X	Site Assessment/Investigation		X	Site Visit	
	Phase I Site Assessment		X	Drum Sampling	
	Regulatory Compliance Audit		X	Surveying	
	Compliance Program		X	Excavation	
X	Property Decommission		X	Soil Sampling	
	Demolition		X	Groundwater Sampling	
	Decontamination			Surface Water Sampling	
	Industrial Hygiene Study			Sediment Sampling	
X	Construction			Air Sampling	
	Phase II Site Assessment		X	Drilling	
	Risk Assessment			Desk Work	
X	Site Observations and Inspections			Other	

1.2 Site Background

The Vicksburg Chemical Company (Vicksburg Chemical) was formerly owned by Cedar Chemical Corporation. The facility is located south of Interstate 20 on Rifle Range Road and within the southwest section of the city of Vicksburg, in Warren County, Mississippi. The site is composed of approximately 535 acres located in Sections 4, 5, 8, 9 and 10, township 15 north, range 3 east, Warren County, Mississippi (Latitude: North 32° 18' 01", Longitude: West 90° 53' 57").

The site included two operational plants, North Plant and South Plant, which are situated within a small valley running north-south and adjacent to the Mississippi River. Stouts Bayou and Hatcher Bayou flow through the valley and join, forming Hennessey Bayou, which flows south to the Mississippi River. The Kansas City Southern Railroad line runs north-south through the site with sidetracks for loading areas and warehouses. Notable site features include an inactive hazardous waste landfill, an unlined surface impoundment, numerous warehouses for past storage, buildings and process areas, and areas of contaminated soil. The site is within the 100-year floodplain of the Mississippi River.

A large surface impoundment was previously used to manage storm water within the operating plants. Adjacent to and southeast of the surface impoundment is an inactive hazardous waste landfill approximately 3 acres in size. The hazardous waste landfill and impoundment are adjacent to the confluence of Stouts Bayou and Hatcher Bayou, which form Hennessey Bayou. Hennessey Bayou flows for about 10 miles and into the Mississippi River.

The North Plant began operation in 1961 and produced potassium nitrate, liquid chlorine, and liquid nitrogen tetroxide. The raw materials for the North Plant included potassium chloride and nitric acid. The South Plant began operation in 1953 manufacturing chlorinated pesticides, nitrogen-based herbicides, and other agricultural chemicals. The only active operations at the South Plant after 1992 were the Nitric Acid Unit constructed in 1986 and the Potassium Carbonate Unit constructed in 1994. During various periods prior to 1987, the South Plant produced dinitro butyl phenol (Dinoseb or DNBP), monosodium methane arsenate (MSMA) diethyl hexyl phosphoric acid (DEHPA), 1-hydroxy-ethylidene-1-1-diphosphonic acid (UNIHIB), toxaphene, methyl parathion, cyanazine (bladex), and Atrazine. Toxaphene and methyl parathion are insecticides, while Atrazine, Dinoseb, and MSMA are herbicides. Raw materials for these operating processes included chlorine, camphene, ortho-secondary butyl phenol (OSBP), sodium arsenate, sodium hydroxide, methyl chloride, sulfuric acid, sodium paranitrophenolate, and phosphorus trichloride.

In addition to the above-mentioned operations at the plant, the property was the location of two additional operations: (1) an operation by Reagent Chemical to produce aqueous hydrochloric acid from by-products of the toxaphene operation and (2) the Gulf Oil Formaldehyde Plant.

The Formaldehyde Unit owned and operated by Borden Chemical was located inside the boundary of the South Plant. It was previously owned by Gulf Oil and, later,

Perkins Company. The small portion of the South Plant occupied by the Formaldehyde Unit was not separated from the rest of the plant. There was no fence or other barrier. During an October 2002 visit by the Mississippi Department of Environmental Quality (MDEQ), Comprehensive Environmental Response, Compensation, and Liability Act of 1980 Section, it was observed that the Formaldehyde Unit was removed.

1.3 List of Project Tasks and Scope of Work

1.3.1 Task 1 – Soil and Groundwater Sampling and Drilling

Baseline sampling will be conducted on selected existing groundwater monitor wells. The existing wells were installed during previous assessment activities and may require redevelopment prior to the collection of samples. In addition to the sampling of existing wells, additional soil borings may be advanced to further define hot spot concentrations and/or the boundaries of impacted areas. Some of the soil borings may be converted to temporary wells for the collection of groundwater samples.

As an overview, the assessment program to determine present site conditions will include:

- Soil and groundwater samples will be collected at selected locations surrounding known areas of contamination. Locations may deviate from those proposed within this document based upon a review of analytical data and approval by MDEQ;

- Soil and groundwater samples will be collected at proposed locations based on field conditions and the use of appropriate tools that may include manual hand augers, a Geoprobe® device, and/or a drilling rig;

- Groundwater samples will be collected from permanent and/or temporary monitor wells. Temporary monitor wells will be plugged and abandoned upon completion of the assessment or will be converted to permanent monitor wells;

- Soil samples will be field-screened using an Organic Vapor Analyzer (OVA) or an Organic Vapor Meter (OVM) and samples will be selected for volatile chemical analyses based upon vapor measurement results or by visual observations. Due to the nature of some of the contaminants at the site (i.e., pesticides and herbicides), OVM readings may not provide an accurate, reliable method for sample selection. Therefore, an on-site mobile laboratory may be used to analyze samples at the site during collection activities; and

- Chemical analyses will be performed on soil and groundwater samples for the site-specific chemicals of concern (CoC) as described in the Quality Assurance Project Plan (QAPP). Based on the type of potential impacts identified, the subcontracted off-site environmental laboratory will perform analyses to determine the concentrations of applicable chemical parameters.

1.3.2 Task 2 – Engineered Cap Installation

Based on historic analytical data, portions of the site may require the installation of an engineered clay cap or equivalent. The purpose of the engineered cap is to eliminate contact between receptors and storm water at the surface of the cap and the material underlying the cap. The separation of these two environments prevents contact with and exposure to the capped material. Specific performance criteria for the engineered cap system will be submitted to MDEQ in a work plan prior to the start of capping activities. In general, the clay cap will be constructed of not less than 24 inches of re-compacted clay. Geotechnical tests will be performed on the clay cap to ensure that the cap meets minimum State of Mississippi requirements for final cover. The clay layer will be placed directly above the affected areas. Above the clay layer, an approximately 12-inch layer capable of supporting vegetative growth will be installed. The vegetative growth layer will serve to prevent erosion of the clay cap.

Subcontractors will install the engineered cap. ARCADIS personnel will provide oversight during all installation activities.

1.3.3 Task 3 – Soil Solidification/Stabilization

Solidification/stabilization activities will be performed on soils that are going to be capped in place, but significantly exceed the Tier 1 Target Remediation Goal (TRG) concentrations and require augmentation to reduce the leaching potential. Solidification consists of adding soil amendments, typically cement, lime, and/or fly ash, to sludges or soils. Solidification processes serve to impart strength to a material and/or to prepare materials for transport by reducing liquid content. Stabilization reduces the leachability of contaminants by binding the waste matrix in a stable material. The solidified/stabilized material will be analyzed for the CoC using the synthetic precipitation leaching procedure (SPLP) to evaluate the potential for leachate concentrations to exceed the TRGs.

Prior to solidification/stabilization activities, laboratory and/or field studies will be conducted to determine an appropriate soil amendment mixture(s) for each of the materials to be solidified/stabilized. Hot spot locations may be stabilized in place to

prevent mobility of CoC. The stabilized soils will be tested for leachability by an analytical laboratory. This testing will establish that the CoC are entrained in the soil matrix and will not be re-released to the environment.

Because portions of the clay cap proposed for this area may be placed over the solidified/stabilized material, the solidification/stabilization program may be designed to also enhance the strength characteristics of these materials. These samples will be analyzed for select geotechnical properties. Approximately 5,700 cubic yards (cy) of North Plant Pond sludges will be solidified/stabilized. The solidified/stabilized material will be relocated to the proposed Solid Waste Management Unit (SWMU) 2 landfill area. Subsequent to relocation activities, sampling of the soil underlying the relocated material will be conducted to confirm the removal of the impacted soil, or this material may be capped in place.

Subcontractors will conduct solidification/stabilization activities. ARCADIS personnel will provide oversight during all activities.

1.3.4 Task 4 – Barrier Wall Installation and/or Interceptor Trench

If required, an interceptor trench may be installed to protect Stouts Bayou and Hennessey Bayou from groundwater impacts. An interceptor trench consists of a barrier material and/or a groundwater recovery system. The barrier material will be installed to alter the natural groundwater flow. The redirected groundwater will be recovered by the interceptor trench and treated in the City of Vicksburg's wastewater treatment plant, or by other means, prior to discharge to the environment. In the event that the recovered groundwater is not discharged through the City's treatment plant, it will be discharged as a permitted point source.

Subcontractors will install the interceptor trench and sentinel wells. ARCADIS personnel will provide oversight during all interceptor trench/barrier wall installation activities.

1.3.5 Task 5 – Consolidation of Wastes in SWMU 2 Landfill

In an effort to minimize the areal extent of contaminated material on site, soils in Area 2, Area 3, and Area 5 will be consolidated in the existing SWMU 2 landfill. Approximately 15,000 cy of stockpiled soil that exceeds the TRG, currently located in the southwest corner of SWMU 20 and in SWMU 23, will be moved to the existing SWMU 2 landfill in Area 3. Relocated soil will be incorporated into the existing landfill. The newly placed material will be contoured and compacted. A cap will be placed over

the landfill in accordance with Resource Conservation and Recovery Act (RCRA) Subtitle C requirements.

The existing sentinel well system for the SWMU 2 landfill will be sampled as part of long-term groundwater monitoring at the facility. Additional sentinel wells may be installed if deemed necessary to adequately monitor the landfill and/or known groundwater contamination. Sampling will be conducted at regular intervals as required by MDEQ.

Subcontractors will consolidate the waste in the SWMU 2 landfill. ARCADIS personnel will provide oversight during all consolidation activities.

2. Site Information

Site Name: **Vicksburg Chemical Company – Vicksburg, Mississippi**

Client Safety and Health Contact: **Paul Bunge**

Site Contact Name: **None – Site is inactive**

Operational Description of Site: **Former manufacturer of chlorinated pesticides, nitrogen based herbicides, and other agricultural chemicals.**

Current Site Status: ____ Active __X__ Inactive __X__ Industrial

(check all that apply) ____ Commercial ____ Retail ____ Undeveloped

____ Other (describe) ____

Topography and General Environmental Setting: **Relatively hilly in industrial/commercial area. Pleistocene loess overlying alternating beds of sandy marl, clay marl, montmorillonitic clay, and thin beds of limestone.**

Accessible by:

____ Major Highway __X__ Main Road ____ 2-Lane Road ____ Dirt Road ____ Gravel Road

Description of the Work Area: **Former chemical manufacturing plant. Work areas to be demolished under the direction of a contractor not affiliated with ARCADIS prior to corrective action activities.**

3. Hazard Evaluation and Control

3.1 Project Hazard Analysis

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

Physical Hazards Present: ☐ None	☒ Heat ☒ Cold ☒ Noise ☒ Walking/Working Surfaces (includes Slips/Trips/Falls & Floor/Wall Openings) ☒ Visible Dust ☐ Laser	☐ Holes/Pits ☐ Ionizing Radiation ☐ Non-Ionizing Radiation ☒ Electricity ☒ Severe Weather ☐ Poor Lighting ☐ Overhead Hazards ☐ Other:
Environmental/ Equipment Hazards Present: ☐ None	☒ Heavy Machinery ☒ Trenching/Excavation ☐ Docks – Marine Operations ☐ Docks – Loading ☐ Diving Operations ☒ Drilling ☐ Forklifts ☐ Water Operations Work ☐ Elevated Heights (Includes Fall Protection) ☒ Overhead/Underground Utilities ☐ Confined Spaces ☐ Power Tools ☐ Cranes/Hoists/Rigging	☐ Ladders ☐ Scaffolding ☐ Man Lifts ☐ Welding ☐ Gas Cylinders ☐ Roadway Work ☐ Railroad Work ☒ Energized Equipment (Lockout/Tagout) ☐ Pressurized Equipment (Lockout/Tagout) ☒ Drums and Containers ☒ Other: Contact With Contaminated Materials
Biological Hazards Present: ☐ None	☐ Animal/Human Fluids or Blood ☐ Animal/Human Tissue(s) ☒ Poisonous/Irritating Plants ☐ Other:	☐ Contaminated Needles ☐ Live Bacterial Cultures ☒ Insects/Rodents/Snakes ☐ Other:
Ergonomic Hazards Present: ☐ None	☐ Repetitive Motion ☒ Awkward Position ☒ Heavy Lifting ☒ Frequent Lifting ☐ Other:	☐ Limited Movement ☒ Forceful Exertions ☐ Vibration ☐ Other: ☐ Other:
Personal Safety/ Security: ☐ None	☐ Personal Safety ☐ Security Issue ☒ Project Site In Isolated Area ☒ Employees Working Alone ☐ Other:	☒ Employees Working Early/Late ☐ Potentially Dangerous Wildlife ☐ Guard or Stray Dogs In Area ☐ No/Limited Cell Phone Service ☐ Other:

Training Required:	☒ 40-Hour HAZWOPER ☐ 24-Hour HAZWOPER ☐ HAZWOPER Site Supervisor ☐ OSHA 30-Hour Construction ☐ OSHA 10-Hour Construction ☒ Personal Protective Equipment ☐ Respiratory Protection ☐ Chemical Hygiene ☒ Hazard Communication ☐ Hazardous Waste ☒ First-Aid/CPR ☐ DOT/IATA Hazmat Transportation ☐ Diving ☐ Other:	☒ Bloodborne Pathogens ☐ Confined Space ☐ Lockout/Tagout ☐ Electricity ☐ Fire Extinguishers ☐ Fall Protection ☒ Noise Exposure ☐ Forklifts ☐ Asbestos ☐ Lead ☐ Cadmium ☐ Spill Prevention, Control, and Countermeasure Plan ☐ Radiation Safety ☐ Client-Specific
☐ None		
Medical Screening:	☒ Medical Surveillance Exam (HAZWOPER) ☐ Client Required Drug and/or Alcohol Testing	☐ Blood and/or Urine Screening for Other Hazardous Substances
☐ None		

3.2 Chemical Hazard Information

Chemical	Hazards	TLV/PEL* 8-Hour TWA	Ionization Potential	Symptoms of Overexposure	Special Precautions
Acetophenone 98-86-2	Keep away from incompatibles such as oxidizing and reducing agents and alkalis.	10 ppm	9.28 eV (NIST)	Inflammation of eye/skin irritant	Use of proper PPE: Goggles/ gloves
Arsenic 7440-38-2	Keep away from strong oxidizers. Hydrogen gas can react with inorganic arsenic to form the highly toxic gas arsine.	0.010 mg/m^3 5 mg/m^3 (IDLH)	9.82 eV (NIST-gas phase)	Ulceration of nasal septum/ dermatitis/ GI disturbances/ peripheral neuropathy/ respiratory irritation/hyper-pigmentation of skin	Use of proper PPE: Goggles/latex gloves/long sleeve shirts/ trousers without cuffs

Chemical	Hazards	TLV/PEL* 8-Hour TWA	Ionization Potential	Symptoms of Overexposure	Special Precautions
Atrazine 1912-24-9	Avoid oxidizers, strong acids, and strong bases.	5 mg/m^3	Not available	Eye, skin irritation/ dermatitis/ sensitization skin/difficulty breathing, shortness of breath/ diminished energy/ incoordination/ salivation/ hypothermia/ liver injury	Use of proper PPE: Safety glasses with side shields, butyl rubber, viton, or equivalent gloves
Benzene 71-43-2	Highly flammable. Unsuitable materials consist of natural, butyl, neoprene, or nitrile rubbers	0.5 ppm 500 ppm (IDLH) 2.5 ppm (STEL)	9.24 eV	Eye, skin, nose, respiratory irritation/ dizziness/ headache/ nausea/ staggered gait/ anorexia/ dermatitis/bone marrow depression/ diminished energy	Use of proper PPE: Goggles/ nitrile gloves
Bis (2-ethylhexyl) phthalate 117-81-7	Reacts with nitrates and strong oxidizers, acids, and alkalis.	5 mg/m^3 5000 mg/m^3 (IDLH)	Unknown	Eye, mucous membrane, skin irritation	Use of proper PPE: Goggles/ gloves
Bromodichloro-methane 75-27-4	Avoid bases, oxidizing agents, and magnesium.	200 ppm 2,000 ppm (IDLH)	10.88 eV (NIST)	Eye, mucous membranes, and respiratory tract irritation Nausea, dizziness, and headaches with prolonged exposure	Use of proper PPE: Goggles/ gloves/SCBA in case of emergency
Bromoform 75-25-2	When heated to decomposition, may release irritating vapors. Vapors may be heavier than air. They can spread along the ground and collect in low or confined areas. Contact with metals may evolve flammable hydrogen gas. Containers may explode when heated.	0.5 ppm 850 ppm (IDLH)	10.48 eV	Eye, skin, respiratory system irritation/CNS depression/liver, kidney damage	Use of proper PPE: Rubber gloves, chemical safety glasses

Chemical	Hazards	TLV/PEL* 8-Hour TWA	Ionization Potential	Symptoms of Overexposure	Special Precautions
Carbon Tetrachloride 56-23-5	Reacts explosively with alkali metals and chlorine. Incompatible with zinc and aluminum. Decomposes in open flame or at high temperatures. Inhalation of high concentrations can have a narcotic effect.	5 ppm 10 ppm (STEL) 200 ppm (IDLH)	11.47 eV	Eye, skin irritation/CNS depression/ nausea/ vomiting/liver, kidney injury/ drowsiness/ incoordination	Use of proper PPE: Goggles/viton or polyvinyl-alcohol gloves
Chloroform 67-66-3	Slight fire hazard when exposed to high heat.	10 ppm 500 ppm (IDLH)	11.42 eV	Eye, skin irritation/ dizziness/ mental dullness/ nausea/ confusion/ headache/ diminished energy/ anesthesia/ enlarged liver	Use of proper PPE: Goggles/ gloves/ coveralls
Cyanazine 21725-46-2	Avoid ignition sources and oxidizers.	None established	Not available	No applicable information found	Use of proper PPE: Safety glasses with side shields/ butyl rubber, viton, or equivalent gloves
Dibromochloro-methane 124-48-1	Avoid strong bases, strong oxidizing agents, and magnesium.	None established	10.88 eV (NIST)	Eye, skin, respiratory system irritation Nausea, dizziness, and headaches with prolonged exposure	Use of proper PPE: Safety glasses/ gloves/SCBA if leaked
1,2-Dichloro-ethane 107-06-2	Vapors are heavier than air and may travel to the source of ignition and flash back.	1 ppm (NIOSH REL) 2 ppm (STEL) 50 ppm (IDLH)	11.05 eV	CNS depression/ headache/ dizziness/eye irritation/loss of coordination/ corneal opacity/ liver, kidney, cardiovascular system damage	Use of proper PPE: Goggles/viton or neoprene gloves

Chemical	Hazards	TLV/PEL* 8-Hour TWA	Ionization Potential	Symptoms of Overexposure	Special Precautions
Dinoseb 88-85-7	Vapors can travel to a source of ignition and flash back.	Not available	Not available	Dizziness/ nausea/muscle weakness/ narcosis/ respiratory failure	Use of proper PPE: Safety glasses with side shields/ butyl, viton, or equivalent gloves
Methylene Chloride 75-09-2	Exposure to heat or prolonged exposure to sun may cause bursting.	25 ppm (NIOSH REL) 125 ppm (STEL) 2300 ppm (IDLH)	11.32 eV	Eye, skin irritation/ diminished energy/ drowsiness/ dizziness/ numbness/ tingling limbs/ nausea	Use of proper PPE: Goggles/ neoprene or butyl rubber gloves
4-Nitrophenol 100-02-7	Avoid strong oxidizing agents and strong bases.	None established	8.84 eV (NIST – average)	Skin/eye irritation Nausea, dizziness, and headaches with prolonged exposure	Use of proper PPE: Goggles/ chemical resistant gloves
Pentachloro-phenol 87-86-5	Incompatible with strong oxidizing agents, strong bases, acid chlorides, and acid anhydrides.	0.5 mg/m^3 (skin) 2.5 mg/m^3 (IDLH)	Not available	Eye, nose, throat irritation/ sneezing/ coughing/ diminished energy/ anorexia/weight loss/sweating/ headache/ dizziness/ nausea/ vomiting/ difficulty breathing, shortness of breath/chest pain/high fever/ dermatitis	Use of proper PPE: Goggles/ gloves
1,1,1,2-Tetra-chloroethane 630-20-6	Avoid strong oxidizing agents and strong bases.	None established	11.3 eV (NIST – average)	Eye, skin irritation/ diminished energy/ restlessness/ irregular respiration/ muscle incoordination	Use of proper PPE: Goggles/ gloves

Chemical	Hazards	TLV/PEL* 8-Hour TWA	Ionization Potential	Symptoms of Overexposure	Special Precautions
Tetrachloro-ethene 127-18-4	Reactive with oxidizing agents, metals, acids, and alkalis.	25 ppm 100 ppm (STEL) 150 ppm (IDLH)	9.32 eV	Eye, nose, throat, skin, respiratory system irritation/ nausea/ flush face/neck/ dizziness/ incoordination/ headache/ drowsiness/skin erythema/liver damage	Use of proper PPE: Safety glasses/vapor respirator/ gloves
Toxaphene (Chlorinated Camphene) 8001-35-2	Avoid heat, sparks, and other sources of ignition.	0.5 mg/m^3 200 mg/m^3 (IDLH)	Not available	Nausea/ confusion/ agitation/tremor/ convulsions/ unconscious-ness/dry, red skin	Use of proper PPE: Goggles/ gloves/ cartridge type respirator with organic vapor cartridges and HEPA pre-filter
Trichloro-ethylene 79-01-6	Avoid strong oxidizing and reducing agents, strong bases, and caustics.	100 ppm 200 ppm (CEIL) 1000 ppm (IDLH)	9.45 eV	Eye, skin irritation/ headache/visual disturbance/ diminished energy/tremor/ dizziness/ drowsiness/ nausea/ vomiting/ dermatitis/ cardiac arrhythmias/skin sensations/liver injury	Use of proper PPE: Goggles/viton or neoprene gloves
1,2,4-Trimethyl-benzene 95-63-6	Flammable. Avoid oxidizers and nitric acid.	TLV/PEL not established 25 ppm (NIOSH REL)	8.27 eV	Eye, nose, throat, skin, respiratory system irritation/nausea/ bronchitis/ hypochromic anemia/ headache/ drowsiness/ incoordination/ vomiting/ confusion/ inflammation of the lungs	Use of proper PPE: Goggles/ gloves/full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) as a backup to engineering controls

Chemical	Hazards	TLV/PEL* 8-Hour TWA	Ionization Potential	Symptoms of Overexposure	Special Precautions
1,3,5-Trimethyl-benzene 108-67-8	Flammable liquid and vapor. Avoid oxidizers and nitric acid.	25 ppm/ 123 mg/m^3 (NIOSH REL)	8.39 eV	Eye, nose, throat, skin, respiratory system irritation/nausea/ bronchitis/ hypochromic anemia/ headache/ drowsiness/ dizziness/ incoordination/ vomiting/ confusion/ inflammation of the lungs	Use of proper PPE: Goggles and/or full-face shield
Vinyl Chloride 75-01-4	Vapors are heavier than air and may travel to the source of ignition and flash back.	1 ppm	9.99 eV	Diminished energy/ abdominal pain/ gastro-intestinal bleeding/ enlarged liver/ pallor or cyanosis of extremities/ frostbite	Use of proper PPE: Goggles/ gloves

*The TLV from the American Conference of Governmental Industrial Hygienists is listed unless the PEL, designated by OSHA, is lower.

CEIL	Ceiling Limit.
CNS	Central nervous system.
eV	Electron volt.
GI	Gastrointestinal.
IDLH	Immediately dangerous to life and health.
mg/m^3	Milligram per cubic meter.
NIOSH REL	National Institute for Occupational Safety and Health Recommended Exposure Limit.
NIST	National Institute for Standards and Technology.
PEL	Permissible Exposure Limit.
PPE	Personal protective equipment.
ppm	Parts per million.
SCBA	Self-contained breathing apparatus.
STEL	Short-Term Exposure Limit.
TLV	Threshold Limit Value.
TWA	Time weighted average.

Comments: Material Safety Data Sheets (MSDSs) for the chemicals listed above are available in Appendix B. Additional health and safety information can be obtained from the Project Health and Safety Manager (PHSM).

3.3 Hazard Communication (HazCom)

All project-required chemicals will be handled in accordance with OSHA 29 Code of Federal Regulations (CFR) 1910.1200 and ARCADIS-required procedures. The Site Safety Officer (SSO) will act as the HazCom Program Coordinator for the site and will maintain the Master Inventory List of hazardous chemicals kept on the job site. The SSO will maintain MSDSs on site for all chemicals. **MSDSs will be located in each ARCADIS field vehicle.** The SSO will communicate the location of the MSDSs 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 with 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 that are not properly labeled will not be accepted or allowed on site. If transferred to a secondary container, the new container will be labeled as described.

The SSO will ensure that the personal protective equipment (PPE) necessary for work around the particular chemical is available and that project site employees have been trained in its use.

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

3.4 Task Hazard Analysis

Each hazard is evaluated and rated for the level of risk based on the task of the project. A thorough task hazard analysis is completed for each task using the following 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

Administrative and engineering controls for each hazard are evaluated for hazard abatement. PPE required to protect employees from the hazard are indicated, and a summary checklist is provided in Section 4. Prior to initiating field work, a tailgate safety briefing must be conducted with all field staff to review the hazards with the Project Team. Tailgate safety briefings should be conducted daily, or as tasks/hazards change. The Site Activities Tailgate Safety Briefing Sign-in Log is included in Appendix C.

3.4.1 Task 1 – Soil and Groundwater Sampling and Drilling

HAZARD:	Severe Weather	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Weather, Lightning				
Admin. & Eng. Controls:	Stop work during lightning.			PPE:	NA
HAZARD:	Heat Stress	Level of Risk:	Low	Module Appendix:	Appendix D
Source of Hazard:	Weather				
Admin. & Eng. Controls:	Use work/rest schedule and/or appropriate clothing.			PPE:	Wear layered clothing suitable for weather conditions
HAZARD:	Cold Stress	Level of Risk:	Low	Module Appendix:	Appendix D
Source of Hazard:	Weather				
Admin. & Eng. Controls:	Use work/rest schedule and/or appropriate clothing.			PPE:	Wear layered clothing suitable for weather conditions
HAZARD:	Walking/ Working Surfaces	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Terrain				
Admin. & Eng. Controls:	Use careful footing and assess working conditions.			PPE:	Boots with ankle support
HAZARD:	Poisonous/ Irritating Plants	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Native Flora				
Admin. & Eng. Controls:	Cover exposed skin.			PPE:	NA

HAZARD:	Insects/Rodents/ Snakes	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Native Species				
Admin. & Eng. Controls:	Do not approach or handle rodents or snakes.			PPE:	NA
HAZARD:	Noise	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Drilling Equipment and Machinery				
Admin. & Eng. Controls:	Only essential subcontractor personnel in immediate vicinity of drilling equipment - PPE required.			PPE:	Earplugs
HAZARD:	Overhead/ Underground Utilities	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Underground Utilities				
Admin. & Eng. Controls:	Locate all underground utilities prior to drilling; use correct Lockout/Tagout procedures; keep safe distances from all utilities.			PPE:	NA
HAZARD:	Drilling	Level of Risk:	High	Module Appendix:	Appendix D
Source of Hazard:	Drilling Equipment and Machinery				
Admin. & Eng. Controls:	Do not wear loose clothing and be aware of moving parts.			PPE:	Hard hat, safety gloves, steel toe boots
HAZARD:	Awkward Position	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Drilling Equipment and Machinery, Hand Augering				
Admin. & Eng. Controls:	Use proper lifting technique.			PPE:	Hard hat, safety gloves, steel toe boots
HAZARD:	Heavy Lifting	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Drilling Equipment and Machinery, Hand Augering				
Admin. & Eng. Controls:	Use proper lifting techniques, with a partner, if necessary. Use mechanical devices to aid in lifting.			PPE:	Hard hat, safety gloves, steel toe boots
HAZARD:	Frequent Lifting	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Drilling Equipment and Machinery, Hand Augering, Handling Sample Coolers				
Admin. & Eng. Controls:	Use proper lifting techniques.			PPE:	Hard hat, safety gloves, steel toe boots

HAZARD:	Drums and Containers	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Chemical Exposure, Lifting, Excessive Force				
Admin. & Eng. Controls:	Discard all PPE appropriately and do not attempt to move drums inappropriately.			PPE:	Latex or nitrile gloves, Tyvek coveralls

Is air monitoring required for this task? ☐ YES ☒ NO May be required at SSO discretion.

3.4.2 Task 2 – Clay Cap Installation

HAZARD:	Severe Weather	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Weather, Lightning				
Admin. & Eng. Controls:	Stop work during lightning.			PPE:	NA
HAZARD:	Heat Stress	Level of Risk:	Low	Module Appendix:	Appendix D
Source of Hazard:	Weather				
Admin. & Eng. Controls:	Use work/rest schedule and/or appropriate clothing.			PPE:	Wear layered clothing suitable for weather conditions
HAZARD:	Cold Stress	Level of Risk:	Low	Module Appendix:	Appendix D
Source of Hazard:	Weather				
Admin. & Eng. Controls:	Use work/rest schedule and/or appropriate clothing.			PPE:	Wear layered clothing suitable for weather conditions
HAZARD:	Walking/Working Surfaces	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Terrain				
Admin. & Eng. Controls:	Use careful footing and assess working conditions.			PPE:	Boots with ankle support
HAZARD:	Heavy Machinery	Level of Risk:	High	Module Appendix:	Appendix D
Source of Hazard:	Heavy Machinery				
Admin. & Eng. Controls:	Be aware of moving equipment.			PPE:	Hard hat, safety glasses, steel toe boots, *traffic* vest, hearing protection

HAZARD:	Noise	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Drilling Equipment and Machinery				
Admin. & Eng. Controls:	Only essential subcontractor personnel in immediate vicinity of drilling equipment - PPE required.			PPE:	Earplugs
HAZARD:	Visible Dust	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Drilling Equipment and Machinery				
Admin. & Eng. Controls:	Only essential subcontractor personnel in immediate vicinity of drilling equipment during installation of clay cap - PPE required.			PPE:	Respirator at discretion of SSO
HAZARD:	Contact with Contaminated Soils	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Impacted Soil				
Admin. & Eng. Controls:	Discard all PPE appropriately.			PPE:	Latex or nitrile gloves, Tyvek coveralls

Is air monitoring required for this task? ☐ YES ☒ NO

3.4.3 Task 3 – Soil Solidification/Stabilization

HAZARD:	Severe Weather	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Weather, Lightning				
Admin. & Eng. Controls:	Stop work during lightning.			PPE:	NA
HAZARD:	Heat Stress	Level of Risk:	Low	Module Appendix:	Appendix D
Source of Hazard:	Weather				
Admin. & Eng. Controls:	Use work/rest schedule and/or appropriate clothing.			PPE:	Wear layered clothing suitable for weather conditions
HAZARD:	Cold Stress	Level of Risk:	Low	Module Appendix:	Appendix D
Source of Hazard:	Weather				
Admin. & Eng. Controls:	Use work/rest schedule and/or appropriate clothing.			PPE:	Wear layered clothing suitable for weather conditions

HAZARD:	Walking/Working Surfaces	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Terrain				
Admin. & Eng. Controls:	Use careful footing and assess working *conditions.*			PPE:	Boots with ankle support
HAZARD:	Heavy Machinery	Level of Risk:	High	Module Appendix:	Appendix D
Source of Hazard:	Heavy Machinery				
Admin. & Eng. Controls:	Be aware of moving equipment.			PPE:	Hard hat, safety glasses, steel toe boots, traffic vest, hearing protection
HAZARD:	Noise	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Drilling Equipment and Machinery				
Admin. & Eng. Controls:	Only essential subcontractor personnel in immediate vicinity of drilling equipment - PPE required.			PPE:	Earplugs
HAZARD:	Contact with Contaminated Soils	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Impacted Soil				
Admin. & Eng. Controls:	Discard all PPE appropriately.			PPE:	Latex or nitrile gloves, Tyvek coveralls
HAZARD:	Chemical hazards	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Impacted Soil, Soil Amendments				
Admin. & Eng. Controls:	Discard all PPE appropriately.			PPE:	Goggles/Gloves, Tyvek coveralls
HAZARD:	Awkward Position	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Equipment and Machinery, Lifting of amendments				
Admin. & Eng. Controls:	Operate machinery in accordance with user manuals. Use proper lifting technique, with a partner if necessary.			PPE:	Hard hat, safety gloves, steel toe boots
HAZARD:	Heavy Lifting	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Lifting of amendments				
Admin. & Eng. Controls:	Use proper lifting techniques, with a partner, if necessary. Use mechanical devices to aid in lifting.			PPE:	Hard hat, safety gloves, steel toe boots

HAZARD:	*Frequent Lifting*	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Lifting of amendments				
Admin. & Eng. Controls:	Use proper lifting techniques, with a partner, if necessary. Use mechanical devices to aid in lifting.			PPE:	Hard hat, safety gloves, steel toe boots
HAZARD:	Drums and Containers	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Chemical Exposure, Lifting, Excessive Force.				
Admin. & Eng. Controls:	Discard all PPE appropriately and do not attempt to move drums inappropriately.			PPE:	Latex or nitrile gloves, Tyvek coveralls
HAZARD:	*Visible Dust*	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Contaminated Surficial Dust				
Admin. & Eng. Controls:	Control with wetting methods.			PPE:	Respirator at discretion of SSO

Is air monitoring required for this task? ☒ YES ☐ NO

3.4.4 Task 4 – Interceptor Trench/Barrier Wall Installation

HAZARD:	Severe Weather	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Weather, Lightning				
Admin. & Eng. Controls:	Stop work during lightning.			PPE:	NA
HAZARD:	Heat Stress	Level of Risk:	Low	Module Appendix:	Appendix D
Source of Hazard:	Weather				
Admin. & Eng. Controls:	Use work/rest schedule and/or appropriate clothing.			PPE:	Wear layered clothing suitable for weather conditions
HAZARD:	Cold Stress	Level of Risk:	Low	Module Appendix:	Appendix D
Source of Hazard:	Weather				
Admin. & Eng. Controls:	Use work/rest schedule and/or appropriate clothing.			PPE:	Wear layered clothing suitable for weather conditions

HAZARD:	Walking/Working Surfaces	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Terrain				
Admin. & Eng. Controls:	Use careful footing and assess working conditions.			PPE:	Boots with ankle support
HAZARD:	Heavy Machinery	Level of Risk:	High	Module Appendix:	Appendix D
Source of Hazard:	Heavy Machinery				
Admin. & Eng. Controls:	Be aware of moving equipment.			PPE:	Hard hat, safety glasses, steel toe boots, traffic vest, hearing protection
HAZARD:	Contact with Contaminated Soils	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Impacted soil				
Admin. & Eng. Controls:	Discard all PPE appropriately.			PPE:	Goggles/Gloves, Tyvek coveralls
HAZARD:	Trenching/ Excavation	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Heavy Machinery; Slope Failure				
Admin. & Eng. Controls:	Excavation to be properly shored, trenched, or sloped. Trenching and excavation to be overseen by a competent person.			PPE:	Hard hat, safety glasses, steel toe boots, traffic vest, hearing protection
HAZARD:	Overhead/Under-ground Utilities	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Underground Utilities				
Admin. & Eng. Controls:	Locate all underground utilities prior to activities; use correct Lockout/Tagout procedures; keep safe distances from all utilities.			PPE:	NA

Is air monitoring required for this task? ☐ YES ☒ NO May be required at SSO discretion.

3.4.5 Task 5 – Consolidation of Wastes in SWMU 2 Landfill

HAZARD:	Severe Weather	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Weather, Lightning				
Admin. & Eng. Controls:	Stop work during lightning.			PPE:	NA

HAZARD:	Heat Stress	Level of Risk:	Low	Module Appendix:	Appendix D
Source of Hazard:	Weather				
Admin. & Eng. Controls:	Use work/rest schedule and/or appropriate clothing.			PPE:	Wear layered clothing suitable for weather conditions
HAZARD:	Cold Stress	Level of Risk:	Low	Module Appendix:	Appendix D
Source of Hazard:	Weather				
Admin. & Eng. Controls:	Use work/rest schedule and/or appropriate clothing.			PPE:	Wear layered clothing suitable for weather conditions
HAZARD:	Walking/Working Surfaces	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Terrain				
Admin. & Eng. Controls:	Use careful footing and assess working conditions.			PPE:	Boots with ankle support
HAZARD:	Heavy Machinery	Level of Risk:	High	Module Appendix:	Appendix D
Source of Hazard:	Heavy Machinery				
Admin. & Eng. Controls:	Be aware of moving equipment.			PPE:	Hard hat, safety glasses, steel toe boots, traffic vest, hearing protection
HAZARD:	Contact with Contaminated Soils	Level of Risk:	Medium	Module Appendix:	Appendix D
Source of Hazard:	Impacted soil				
Admin. & Eng. Controls:	Discard all PPE appropriately.			PPE:	Goggles/Gloves, Tyvek coveralls

Is air monitoring required for this task? ☒ YES ☐ NO

4. 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. This section applies primarily to the corrective action, but can also be utilized for the soil and groundwater sampling in Task 1.

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 – Tyvek (optional during drilling and sampling activities)	R		
Chemical Protective Suit – Impervious clothing such as styrene butadiene rubber (SBR), polyvinyl chloride (PVC), Gore-Tex, special Hazmat Splash or Level A, B, or C Protective Suit			
Splash Apron	O		
Rain Suit	O		
Traffic Safety Vest (reflective)	O		
Head			
Hard Hat (if does not create other hazard)	R		
Eyes & Face			
Safety Glasses with Side Shields (incorporate sun protection as necessary)	R		
Goggles (based on hazard)	R		
Splash Guard (based on hazard)			
Full-Face Shield made of polycarbonate, acetate, polycarbonate/acetate, PETG, or thermoplastic			
Ears			
Ear Plugs (drilling, heavy equipment operation)	R		
Ear Muffs (drilling, heavy equipment operation)	O		
Hands and Arms			
Outer Chemical Resistant Gloves – Nitrile, PVC, or Neoprene	R		

Description (Put Specific Material or Type in Box)	Level Of Protection		
	D	C	B
Inner Chemical Resistant Gloves (specify the type of glove based on chemical hazard)		O	
Insulated Gloves		O	
Work Gloves	O		
Foot			
Safety Boots (steel toe and shank)	R		
Rubber, Chemical Resistant Boots – NBR, PVC, Polyurethane, or Neoprene	O		
Rubber Boots – Latex or PVC – RINSE PRIOR TO REMOVAL AND INSPECT FOR LEAKS.	O		
Disposable Boot Covers – NO NYLON BLENDS.	O		
Respiratory Protection (Indicate cartridge type where applicable)			
Half-Mask Air-Purifying Respirator (APR)			
Full-Face APR			
Dust Protection (Worker must have valid fit test to wear a respirator. Cartridge type to be selected from particulate, organic vapor, or pesticide gas as determined by SSO.)		O - ARCADIS employees are required to wear respiratory protection at the discretion of SSO	
Full-Face Canister APR			
Powered APR			
Air Line/Self-Contained Breathing Apparatus			
Other Supplies			
First-Aid Kit	R		
Fire Extinguisher	R		
Mobile Phone	R		
Walkie Talkies			
Traffic Cones			
Water or Other Fluid Replenishment	R		
Eyewash Station	R		
Emergency Shower			
Eyewash Bottle	R		
Wash and Dry Towelettes			
Sunscreen (Sun Protection Factor [SPF] 15 or higher)	O		
Insect Repellant	O		

5. Decontamination Procedures

Equipment leaving the site will be decontaminated. Pumps, tools, and other equipment that comes into contact with chemicals will be decontaminated by flushing with potable water. Contaminated PPE and clothing will be washed prior to reuse. Completely submerge contaminated clothing or other materials prior to drying. Residual contaminants, if allowed to dry on materials such as paper, fabrics, cotton, leather, wood, or other combustibles, can cause materials to ignite and result in a fire.

Level D Decontamination Steps	
1	Equipment Drop
2	Glove and Boot Wash and Rinse
3	Disposable Garment, Outer Boot, and Glove Removal
4	Field Wash

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

Decontamination Equipment Checklist			
X	Scrub Brushes	X	Garbage Bags
X	Waste Containers		Paper Towels
X	Soap		Isopropyl Alcohol
X	Plastic Tubs		Showers
	Plastic Drop Cloths		

6. Emergency Planning

6.1 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 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. 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). These procedures are included in Appendix E, with the map to the hospital, for reference.

Potential emergencies may include:

- Chemical burns;
- Personal injury;
- Personal exposure;
- Fire;
- Vehicle accidents;
- Severe weather; and
- Heat stress.

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

6.2 First-Aid Kits

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. The first-aid kits will be maintained in ARCADIS vehicles.

6.3 Eyewash Units

Eyewash units meeting the latest requirements of American National Standards Institute Standard 2358.1 will be utilized at the site during Task 2 through Task 5. All units will be capable of supplying hands-free irrigation for both eyes for at least 15 minutes at a flow rate of at least 0.4 gallon per minute.

6.4 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, 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. Eyewash bottles will be utilized during all site activities.

6.5 WorkCare

WorkCare is a 24-hour service that provides professional medical assistance over the telephone for non-emergency injuries or illnesses. The WorkCare nurse or doctor may assess the injury or symptoms, advise the employee as to appropriate care, and assist in identifying a medical facility if necessary.

Note: First aid should be administered and, when needed, emergency medical treatment should be sought prior to contacting WorkCare.

POST THIS PAGE IN APPROPRIATE LOCATIONS ON SITE

The SSO 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 Manager.

Emergency Contact	Phone Numbers
Local Police	911
Local Ambulance	911
Local Fire Department	911
Local Hospital (Parkview Regional Medical Center)	601-631-2131
WorkCare	800-455-6155
Poison Control	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 – David Escudé (Mobile)	225-205-8250
Client Contact – Paul Bunge (Mobile)	303-888-9191

Hospital Route

(Parkview Regional Medical Center – 6 miles from 4280 Rifle Range Road)

- North on **Rifle Range Road** and right onto **Warrenton Road**; **Warrenton Road** becomes **Old US-61/Washington Street**;
- Merge onto **I-20 East**;
- **Exit #4B/W. Clay Street** (**US-80**) toward National Park;
- Merge onto **US-80W/Clay Street**;
- Turn **RIGHT** onto **Baldwin Ferry Road**; and
- Turn **LEFT** onto **Grove Street**; end at **Parkview Regional Medical Center**.

See Map to Hospital – Appendix E.

First-Aid and Response Equipment Locations

First-Aid Kit: In Vehicles

Eyewash (Bottle): In Vehicles

Eyewash Station: Near ARCADIS truck for Task 2 through Task 5

The Project Manager will make the following notifications:

Name	Phone Numbers
Corporate Health & Safety Manager – Pat Vollertsen	720-344-3779 (O)
Regional Health & Safety Manager – Mike Ramer	720-344-3766
Area Health & Safety Representative – Madeline Rogers	225-292-1004
Project Physician or Local Physician (if required or requested by Client or project contract)	N/A
Subcontractor's Office – USES – Robbie Brister	(601) 372-3232
Subcontractor's Office –	
Subcontractor's Office –	
Subcontractor's Office –	
Subcontractor's Office –	
Subcontractor's Office –	
Subcontractor's Office –	
Subcontractor's Office –	
Subcontractor's Office –	
Phone Number at Project Site – ARCADIS	

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

Name: Mr. Jere "Trey" Hess

Agency: MDEQ, Mississippi Brownfields Program Coordinator

Date: August 17, 2006

7. Organization and Responsibilities

7.1 ARCADIS Personnel

The following personnel are designated to carry out health and safety (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
David Escudé	**Project Manager (PM)** • Initiates Health and Safety Plan (HASP) development, and reviews and signs the HASP. • *Obtains site-specific H&S information.* • Communicates with the SSO on site H&S issues. • Allocates resources for correction of identified unsafe work conditions. • Communicates with the Client on H&S issues. • Ensures ARCADIS site workers have all training necessary for the project. • Finalizes PM Checklist. • Reports all injuries, illnesses, and near-misses to the Corporate H&S Manager and Area H&S Representative, assists with incident investigations, and ensures that any recommendations made are implemented. • Communicates H&S Program and a copy of the ARCADIS HASP to all subcontractors and receives their acknowledgement of receipt of such information.
George Cook/ Kipper Montgomery	**Site Safety Officer (SSO)** • Reviews and works in accordance with the components of this HASP. • Ensures that the HASP is available to and reviewed by all site personnel and that subcontractors have appropriately communicated H&S information. • Ensures that necessary site-specific training is performed (both initial and "tailgate" safety briefings – Use the Site Activities Tailgate Safety Briefing Sign-In Log in Appendix C). • Ensures that site visitors have been informed of the hazards related to ARCADIS work and precautions to take and have signed the Site Visitor Acknowledgement and Acceptance of HASP log found in Appendix F. • Ensures that work is performed in a safe manner and has authority to stop work when necessary to protect workers and/or the public. • Coordinates activities during emergency situations.

ARCADIS Project Team	Responsibility and Tasks
George Cook/ Kipper Montgomery	**Site Safety Officer (SSO) (Continued)** • 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. • Communicates with the PHSM and the PM on H&S issues. • Report all injuries, illnesses, and near-misses to the PM and PHSM. • Maintains injury/illness reports and other H&S data as required by the Client or regulatory agency (e.g., Mine Safety and Health Administration [MSHA] Quarterly Report). • Ensures that necessary safety equipment is maintained and used at the site.
ARCADIS Site Representatives	**Site Workers** • Read and work in accordance with the components of this HASP. • Report all unsafe working conditions to the SSO. • Report all injuries, no matter how trivial, to the SSO. • Work in a safe manner. • Sign the Employee Acknowledgement log at the beginning of this HASP.
Madeline Rogers	**Project Health and Safety Manager (PHSM)** The designated PHSM is responsible for overseeing all aspects of the site safety program and preparing any site-specific H&S guidance documents or addenda to this HASP. The PHSM does not report to the PM and is separately accountable to the ARCADIS Project Team senior management for site H&S. The PHSM acts as the sole contact to regulatory agencies on matters of H&S. Other responsibilities include: • Overall authority for H&S compliance and HASP conformance for the project. • General H&S program administration. • Conducts project H&S audits as warranted. • Determines the level of personal protection required. • Updates equipment or procedures based on information obtained during site operations. • Establishes air-monitoring parameters based on expected contaminants. • Assists in injury, illness, and near-miss investigation and follow-up.

8. General Site Safety

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

8.1 Site Access and Control

The SSO will coordinate access and control security at the work site. The SSO will establish a work area perimeter. Only authorized personnel will be allowed beyond the 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 Appendix F.

When 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.

8.2 Hazard Communication (HazCom)

All project-required chemicals will be handled in accordance with Occupational Safety and Health Administration (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 of hazardous chemicals kept on the job site. The SSO will maintain MSDSs on site for all chemicals. MSDSs will be maintained in Appendix B of this HASP and within ARCADIS vehicles. The SSO will communicate the location of the MSDSs 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 with 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 that are not properly labeled will not be accepted or allowed on site. 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 employees have been trained in its use.

The PM will ensure that all project personnel have received HazCom training as required in OSHA 29 CFR 1910.1200(h).

8.3 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 crew members 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.

8.4 Site Awareness

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

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; and
- 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.

8.5 Buddy System

All on-site personnel will operate using the buddy system whenever possible.

8.6 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.

8.7 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 cell phone. 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.

Appendix A

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, and log in the Addendum Log.

Addendum Number: _____ Project Number: _____

Date of Changed Conditions: _____ Date of Addendum: _____

Description of Change that Results in Modifications to HASP:

_____

_____

Hazard Analysis for Change in Work:

HAZARD:		Level of Risk:	
Source of Hazard:			
Admin. & Eng. Controls:		PPE:	
HAZARD:		Level of Risk:	
Source of Hazard:			
Admin. & Eng. Controls:		PPE:	

Signed: _____ Signed: _____

Project Manager Site Safety Officer

Signed: _____ Signed: _____

H&S Plan Writer H&S Plan Reviewer

Make additional copies of this form as necessary.

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, and log in the Addendum Log.

Addendum Number:	1	Project Number:	LA002656.1.16
Date of Changed Conditions:	3/21/07	Date of Addendum:	3/21/07

Description of Change that Results in Modifications to HASP:

These changes are due to proposed sampling through the contents of the SWMU 2 landfill. Based on site knowledge, our sampling personnel have the potential to encounter organic vapors (chloroform and toxaphene aka chlorinated camphene) and acid gas vapors (HCl). Level C personal protective equipment (PPE) upgrades will include the use of acid gas/organic vapor respirator cartridges, Tyvek® coveralls, nitrile gloves, hard hats while drilling, and steel-toed boots. Nitrile gloves are acceptable for routine sample handling. In the event that HCl is encountered as determined through air monitoring, neoprene gloves will be used. Samplers shall avoid tearing gloves when handling Shelby tubes. Air monitoring will be conducted for the first hour of the drilling through the landfill material while the sampling personnel wear respirators. During that first hour, if no concentrations above background are encountered, then the PPE would transition to a substitution of safety goggles for the respirator. Air monitoring would continue throughout the sampling and the respirators would have to be worn in the event that site concentrations reach the National Institute for Occupational Safety and Health Recommended Exposure Limit [NIOSH REL] for these chemicals: Chloroform – 2 parts per million (ppm), 60-minute time weighted average is the Short Term Exposure Limit (STEL) with a ceiling value of 50 ppm; and Hydrogen chloride (HCL) – 5 ppm ceiling value). Air monitoring would be conducted with a flame ionization detector (FID) due to the HCL ionization potential of 12.74 electron volt (eV; HCl). Chloroform has the lowest ionization potential (11.42 eV).

Hazard Analysis for Change in Work:

HAZARD:	Drilling through landfill.	Level of Risk:	Medium
Source of Hazard:	Potential to encounter chloroform, toxaphene, and hydrochloric acid during landfill sampling.		
Admin. & Eng. Controls:	Set-up exclusion zone, contaminant reduction zone, and support zones for drilling activities. Air monitoring to be conducted during drilling through landfill material.	PPE:	Full-face respirator with organic vapor/acid gas cartridges, nitrile gloves. PPE will reduce to goggles instead of respirator if air monitoring concentrations indicate it is safe to do so.
HAZARD:		Level of Risk:	
Source of Hazard:			
Admin. & Eng. Controls:		PPE:	

Signed: _____ Project Manager

Signed: _____ Site Safety Officer

Signed: _____ H&S Plan Writer

Signed: _____ H&S Plan Reviewer

Make additional copies of this form as necessary.

Addendum Page (July 16, 2007)

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 and log in the Addendum Log.

Addendum Number:	2	Project Number:	LA002656.0001.0025
Date of Changed Conditions:	7/16/07	Date of Addendum:	7/16/07

Description of Change that Results in Modifications to HASP:

These changes are due to scheduled tank cleaning activities throughout the plant area. Based on site knowledge, tank cleaning subcontracted personnel will most likely have to enter tanks considered as confined spaces and use manlifts to access some tanks. No ARCADIS employees will enter confined spaces. All confined space entry shall be conducted in accordance with applicable OSHA rules and regulations, ARCADIS' HASP, and the subcontractor's HASP.

The following information was obtained from modules present on the ARCADIS company website:

Permit-Required Confined Spaces

Confined spaces include excavations, storage tanks, bins, sewers, in-ground vaults, vessels, tunnels, manholes, pits, etc. These enclosures, because of inadequate ventilation and/or the introduction of hazardous gases and vapors, may present conditions that could produce asphyxiation or injury.

HAZARD AREA - KEEP OUT

DANGER

- All confined spaces will be identified and marked appropriately including all tanks and vessels.

- Before entering, attending, or supervising a confined space, the SSO and PHSM must be notified of intent to enter, attend, or supervise.

Subcontractor staff will be required to enter, attend, and/or supervise entry into confined spaces. The Project Manager, with assistance from the project H&S staff, will ensure that a program has been developed and implemented, that all applicable employees have received the appropriate training, and that a Permit-Required Confined Space Entry form, or ARCADIS approved contractor equivalent, has been completed and is in place at the site. The SSO will review the subcontractor-provided HASP which will at a minimum comply with the following:

- Removal of Contents: Before entering, confined spaces should be as clean and free of hazardous materials and chemicals as possible. Where appropriate, confined spaces may be purged by water or other suitable means. Purging with hazardous solvents should be avoided where possible.

- Isolation: All input lines, which discharge into the confined space, shall be disconnected and capped or isolated.

  - The use of a single in-line valve shut-off as the sole means of isolating the confined space from any input lines is prohibited. However, the use of a double in-line valving arrangement with a vent or drain in between the two valves is acceptable provided that dangerous air contaminants are not introduced by such venting.

  - Isolation valves shall be locked closed, vent or drain valves shall be locked open, and the person performing the job shall keep the key.

- Electrical Lockout: Where electrical devices located within the confined space (motors, switches, etc.) are to be repaired or worked on, the line-disconnect switches supplying the power must be tagged and locked in the "OFF" position. The lock key is to be kept by the person performing the job, and only this person is authorized to unlock the switch and remove the tag upon completion of the job. Where more than one person is working on the line, each must place a lock on the switch and retain his own key.

  - Where there are multiple sources of power to an electrical device that supplies power to the device through an automatic or manual bus transfer switch, lockout devices must be placed on the breaker nearest to the electrical device that is to be isolated, and an electrician shall test the power supply lines to ensure that power has been secured.

- Line-disconnect switches supplying power to any mechanical apparatus in the confined space (mixers, conveyors, etc.) must also be tagged and locked in the "OFF" position. This must be done for any entry, even though work will not be performed on the apparatus itself.

- Securing of Covers: All manhole and cleanout covers shall be removed and the openings maintained clear of any obstructions. When hinged doors or lids are provided, they shall be secured so they cannot close.

- Testing Atmosphere: The subcontractor, using only equipment approved and tagged for Class 1, Division 1 locations, shall make appropriate tests of the atmosphere in the confined space and place a record of the test results at the entrance to the confined space. Testing shall ensure the following:

  - Toxic gas and vapor levels do not exceed more than 5 parts per million (ppm) as measured with a photoionization detector.

  - Combustible gas and vapor concentrations do not exceed 10 percent of the lower explosive limit.

  - Oxygen content is no less than 19.5 percent and no greater than 23.5 percent.

  - Appropriate respiratory protective equipment and other appropriate personal protective devices have been provided for all employees when concentrations of toxic materials exceed applicable occupational exposure levels.

- Continuous Monitoring: If the nature of the work to be performed introduces, or has the potential to introduce, harmful air contaminants, continuous monitoring of the atmosphere and/or the oxygen content drops below 19.5 percent, all personnel shall evacuate the confined space immediately.

- Ventilation: All confined spaces found to be unsafe must be ventilated by means of mechanical exhaust systems arranged so as to avoid recirculating contaminated air. Personnel shall be evacuated immediately in the event of failure of the mechanical ventilation system. The confined space shall be retested prior to reentry following ventilation system repair.

All entry of permit-required confined spaces will be performed in accordance with the ARCADIS approved subcontractor confined space permit entry procedures. At a minimum, signs with the following wording must be posted around the entrance and exit of confined spaces:

CONFINED SPACE

AUTHORIZED PERSONNEL ONLY

PPE IS REQUIRED IN THIS AREA

MANLIFTS AND AERIAL LIFTS

The following guidelines for working safely on manlifts or aerial lifts are not meant to be all inclusive and ARCADIS employees should be briefed by the client or responsible party in charge regarding the requirements for working safely on this equipment and on emergency and rescue procedures. The subcontractor will be responsible for the safe operation of manlifts and aerial lifts.

Only authorized, properly trained, qualified persons shall ride on or operate this equipment. Load limits should be verified and never exceeded. The subcontractor should verify that equipment has been tested, inspected, and maintained according to OSHA and manufacturer requirements. If verification is not available, the equipment will not be used.

If fall protection is required for any type of manlift operation, fall protection training will be completed prior to initiating operation. Appropriate and properly fitted protection must be available before operations can be initiated.

Manlifts will have appropriate handholds, guards, emergency stops/landings, and warning signs/lights.

When working in an aerial lift, body harness will be worn and a lanyard will be attached to the boom or basket. Climbing or sitting on the edge of the basket/bucket is prohibited.

All aerial devices shall be equipped with flashing warning lights, and all controls must have protective guards to prevent accidental operation of the controls. Lower level controls will not be operated unless permission has been obtained from personnel in the lift, except in the case of an emergency. Ground controls shall be positive override.

Aerial equipment will not be moved with personnel in the bucket/basket. When personnel are in the bucket/basket, the emergency brake will be set and wheels chocked. If outriggers are used, they will be on a solid surface or pads. The operator must always face in the direction in which the basket/bucket is moving and must be able to see that the path is clear.

If the manlift/aerial lift is in the vicinity of energized conductors, lines, or equipment, the lift will maintain a minimum 10-foot clearance from the energized conductor, line, or equipment, and if voltage is higher than 50kV, the clearance will increase 4 feet for every 10kV. The

subcontractor should ensure that the operator of the manlift/aerial lift has checked with the local public service company in regard to their requirements for blanketing the lines. Personnel will not touch any aerial vehicle until it is safely clear of energized conductors. Be aware of where you, the equipment, and tools are in relation to power lines and/or energized equipment, and if in doubt about clearance, do not use the equipment.

Lifts will not be used in snowy, icy, or other slippery working conditions, during high winds, or if lightening is in the area.

Appropriate PPE will be worn, including hard hats, safety vests, eye protection, and steel-toed boots. Hearing protection and gloves may also be required.

HAZARD ANALYSIS FOR CHANGE IN WORK:

The subcontractor will conduct tank cleaning activities in accordance with the guidance provided in the following table. Tailgate safety meetings for project personnel who will enter confined spaces and/or use manlifts or aerial lifts will be conducted daily and incorporate the guidance provided below. ARCADIS will ensure that the subcontractor follows these protocols.

HAZARD:	Limited ingress and egress.	Level of Risk:	High
Source of Hazard:	Confined space entry.		
Admin. & Eng. Controls:	Only trained confined space personnel will be allowed to enter a confined space. No one will enter a confined space without having a second person at the entrance available to help with ingress/egress of the confined space worker.	PPE:	Up to Level A
HAZARD:	Hazardous atmosphere.	Level of Risk:	High
Source of Hazard:	Confined space entry.		
Admin. & Eng. Controls:	Air monitoring will be conducted to ensure that the atmosphere inside the tank is safe for entry and work.	PPE:	Level B PPE may be required if air monitoring indicates that the atmosphere is not initially safe for work.

HAZARD:	Elevated heights.	Level of Risk:	High
Source of Hazard:	Use of manlift.		
Admin. & Eng. Controls:	Manlifts will only be used if there is no other safe means of access to the tank (i.e., stairs). Personnel elevated on the manlift will be secured to the manlift basket or have another means of fall protection in place.	PPE:	Level D

Signed: _____ Project Manager

Signed: _____ Site Safety Officer

Signed: _____ H&S Plan Writer

Signed: _____ H&S Plan Reviewer

– *Make additional copies of this form as necessary.*

Addendum Page (October 18, 2007 – 1 of 2)

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, and log in the Addendum Log.

Addendum Number:	3	Project Number:	LA002656.1.26
Date of Changed Conditions:	10/22/07	Date of Addendum:	10/18/07

Description of Change that Results in Modifications to HASP:

These changes are due to the scheduled usage of a crane to lift electrical transformers onto flatbed or low-boy trailers. Crane operation, to include rigging and lift operations, will be conducted by a subcontractor with ARCADIS oversight. Securing the load to the trailer will be managed by the transportation company and is not covered in this addendum.

The following information was obtained from a module on the ARCADIS company website:

CRANES, HOISTING AND RIGGING

Cranes and Derricks

A crane is a movable machine used for lifting or moving heavy weights by means of a movable projecting arm or boom.

A derrick is a fixed machine used for lifting or moving heavy weights by means of a movable projecting arm or boom.

- All aspects of hoisting/rigging shall be overseen by a competent person provided by the subcontractor.
- Cranes and derricks have ratings that vary with boom length; radius (outreach) or other variables shall have a durable rating chart visible to the operator covering the complete range of manufacturer's capacity ratings.

- The rating chart shall include all operating radii for all-permissible boom lengths and jib lengths and optional ratings for optional equipment affecting such ratings. Precautions or warnings specified by the owner or manufacturer shall be included along with the chart.

- The crane or derrick shall be equipped with a boom angle or radius indicator, visible to the operator, when the rated load varies with the boom radius.

- All lifting devices will be used to hoist material and equipment only. Personnel shall not ride this equipment.

- All equipment will be maintained and operated in accordance with manufacturer-specified procedures; and limits regarding maximum load, height restrictions, etc., shall be adhered to without exception.

- Designated persons shall visually inspect each crane or derrick and lifting devices on each day of use for defects or damage. Any defects found shall be reported and the device or equipment taken out of service until repaired by a competent repairperson or replaced.

- A qualified person shall thoroughly inspect all functional components and accessible structural features of each crane or device at monthly intervals.

- A record of monthly inspections shall be maintained for 6 months in or on the crane or derrick and a copy kept at the field office.

- No crane or derrick with a known or visible defect that affects the safe operation shall be used.

- No crane or derrick shall be used in a manner that exerts side-loading stresses upon the boom.

- Designated work loads shall not be increased beyond the manufacturer's ratings or original design limitations unless such increase receives the manufacturer's approval. When the manufacturer's services are not available or when the equipment is of foreign manufacture, engineering design analysis shall be performed or approved by a person accredited for certificating the equipment. A registered professional engineer competent in the field of cranes and derricks shall perform engineering design analysis. Any structural changes necessitated by the change in rating shall be carried out.

- Personnel will not work or otherwise be located beneath suspended loads to protect against injury resulting from equipment failure. Additionally, workers will use hard hats and safety-toed boots when lifting equipment is in operation.

- The area where the lift or lifts are to be made shall be roped off with proper warning devices.

- When two or more cranes are used together to hoist a load in unison, a designated person shall direct the operation and instruct all personnel in positioning, rigging, and movement of the load being lifted.

- Accessible areas within the swing radius of the body of a revolving crane shall be physically guarded during operations to prevent an employee from being caught between the body of the crane and any fixed structure or between parts of the crane.

- When possible, electrical distribution and transmission lines are to be de-energized and visibly grounded at the point of work unless insulating barriers not part of or attached to the crane have been erected to prevent physical contact with the lines.

- When working around live power distribution lines the following clearances are to be followed: For lines rated 50kV, minimum clearance between the lines and any part of the crane or shall be 10 feet (3.05 m); for lines rated over 50 kV, a minimum clearance between the lines and any part of the crane or load shall be either 10 feet (3.05 m) plus 0.4 inch (10.16 mm) for each 1 kV over 50 kV, or twice the length of the line insulator.

- While in transit, with no load on the equipment and the boom lowered, the clearance between the crane and power line shall be a minimum of 4 feet (1.22 m).

- All material hoists should conform to the most current requirements of ANSI, Safety Requirements for Material Hoists.

- A sign stating "No Riders Allowed" should be posted on the car frame. Employees are prohibited from riding the material hoist except for authorized purposes of inspection and maintenance.

Hoisting and Rigging

All hoisting and rigging equipment utilized must conform and be operated to the standards for hoisting equipment in 29 CFR 1926.550. Additionally, the following safety procedures will be adhered to:

- All lifting devices will be used to hoist material and equipment only. Personnel shall not ride this equipment.

- All equipment will be maintained and operated in accordance with manufacturer-specified procedures; and limits regarding maximum load, height restrictions, etc., shall be adhered to without exception.

- Personnel will not work or otherwise be located beneath suspended loads to protect against injury resulting from equipment failure. Additionally, workers will use hard hats and safety-toed boots when lifting equipment is in operation

- Cranes, hoists, ropes, rigging, etc., shall be inspected at least daily for damage if evidence of wear or if breakage is suspected. If such conditions are noted, equipment will be placed out of service until the equipment is repaired or replaced.

Hoist, Material and Personnel

- Hoist should comply with the manufacturer's specifications and limitations.
- Rated load capacities, recommended operating speeds, and special hazard warnings or instructions should be posted on cars and platforms.
- Hoistway entrances of material hoists should be protected by substantial full wide gates or bars.
- Hoistway doors or gates of personnel hoist should be not less than 6 feet 6 inches high and be protected with mechanical locks which cannot be operated from the landing side and are accessible only to persons on the car.
- Overhead protective coverings should be provided on the top of the hoist cage or platform.
- All material hoists should conform to the most current requirements of ANSI, Safety Requirements for Material Hoists.
- Prior to placing a hoist into service, functions and safety devices should be tested thoroughly under the supervision of the manufacturer's representative or other similarly qualified person. At minimums established by law, a full inspection and test must be made by the manufacturer's representative or other qualified individual. Records of such inspections and tests should be kept on the job site.
- A sign stating "No Riders Allowed" should be posted on the car frame. Employees are prohibited from riding the material hoist except for authorized purposes of inspection and maintenance.

HEAVY MACHINERY AND CERTIFICATION REQUIREMENTS

Purpose

The purpose of this procedure is to present the minimum safety performance requirements for the operation of heavy equipment on ARCADIS project sites. Project Managers are responsible for ensuring all equipment used on an ARCADIS site is certified and that equipment owners have submitted the Machinery and Mechanized Equipment forms in Appendix D.

General Requirements

All equipment shall comply with all applicable requirements for motor vehicles and material handling heavy equipment contained in 29 CFR 1926 Subpart O. Heavy equipment includes, but is not limited to, drill rigs, front-end loaders, backhoes, track hoes, bulldozers, forklifts, cranes, derricks, and similar equipment used for the implementation of the project Statement of Work.

Equipment Safety Inspections

The following presents general guidelines for certifying equipment is in safe operating condition before activities commence at the site and during site operations. The following guidelines are not meant to be all-inclusive.

- All machinery and mechanized equipment will be certified to be in safe operating condition by a competent individual (using the forms in Appendix D).
  - Certification is valid for 1 year.
- Equipment will be inspected on a daily basis by the owner/operator and daily logs will be maintained. All discrepancies shall be corrected prior to placing the equipment in service.
- Inspections shall include, but are not limited to: all hydraulic lines and fittings for wear and damage, all cable systems and pull ropes for damage and proper installation, exhaust systems, brake systems, and drill controls, etc.
- The driller in charge on a daily basis shall inspect drill rigs and related support equipment and vehicles. These inspections shall be recorded/documented.
- Preventive maintenance shall be conducted for all equipment according to manufacturer recommendations and/or established internal policies, schedules, and equipment standard operating procedures.
- Only designated qualified persons shall operate machinery and mechanized equipment.
- Records of tests and inspections shall be maintained at the site by the operating contractor, and shall be made available upon request of the designated authority, and shall become part of the official project file.
- Equipment not found to be in safe operating condition, or when a deficiency affecting the safe *operation* of the equipment is identified, the equipment shall immediately be taken out of service and its use prohibited until safe conditions have been corrected.
- All equipment shall be kept in the exclusion zone until work or the shift has been completed. Equipment will be decontaminated within designated decontamination areas. Note: this not typical for construction sites. It would be for remediation sites.
- All equipment must have an audible alarm that sounds when equipment is moving in reverse.

Hazard Analysis for Change in Work:

HAZARD:	Crane usage	Level of Risk:	High
Source of Hazard:	Potential for material to fall during lifting operation.		
Admin. & Eng. Controls:	All personnel not directly involved with the lift operation will remain at least 50 feet from lifted equipment while the equipment is airborne.	PPE:	Level D

Signed: _____ Project Manager

Signed: _____ Site Safety Officer

Signed: _____ H&S Plan Writer

Signed: _____ H&S Plan Reviewer

Addendum Page (October 18, 2007 – 2 of 2)

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Addendum Number:	4	Project Number:	LA002656.1.28
Date of Changed Conditions:	10/22/07	Date of Addendum:	10/18/07

Description of Change that Results in Modifications to HASP:

These changes are due to scheduled cooling tower demolition activities. Portions of the cooling towers were constructed using asbestos-containing material (ACM). A licensed asbestos abatement subcontractor will conduct both the asbestos abatement and subsequent cooling tower demolition activities while ARCADIS provides oversight. ARCADIS personnel will not enter restricted areas while abatement activities are in progress. The asbestos contractor shall provide an abatement HASP and a work plan. The asbestos contractor shall ensure that all workers in the containment area are equipped with and are using Personal Protective Equipment (PPE).

The following information was obtained from modules present on the ARCADIS company website:

Asbestos-Containing Materials

Asbestos is a naturally occurring mineral that has been historically used in thousands of construction and commercial applications until its ban in 1980. Asbestos is a confirmed human carcinogen and can cause diseases such as asbestosis, lung cancer, and mesothelioma. The primary route of exposure is inhalation; however, fibers may also be ingested. Atmosphere containing potential airborne asbestos shall not be entered without proper PPE in accordance with this HASP.

Site Control and Work Zones

Control zones shall be established by the SSO to cover a large enough area to accommodate work operations where required for the contaminants as outlined by the HAZWOPER regulations. The zones, demarcated as described next, shall be clearly communicated to all project workers.

HAZWOPER requires the development of a site map, with enough detail included to ensure adequate identification of the zones in relation to other site features. These zones are defined as:

- Exclusion Zone (EZ): area where contaminated materials exist;
- Contamination Reduction Zone (CRZ): area where decontamination procedures are performed; and
- Support Zone (SZ): uncontaminated area designated with Access Control Points (ACP) for entry/exit points across the hotline into and out of the work operations.

The hotline is the line of demarcation where the EZ ends and the CRZ begins. Within the boundaries of the ACP, decontamination of personnel and equipment will take place.

The area that lies outside of the CRZ is the SZ and can be considered *uncontaminated* for the purposes of workers performing support duties.

The SSO will determine the extent of each zone and will communicate that information to workers during tailgate briefings. Physical demarcation of zones on the site will be determined by the SSO using a variety of methods including but not limited to signs, tape, flags, etc. ARCADIS personnel will not enter restricted areas.

Scaffolding

Scaffolding is defined as temporary platform or structure used to support personnel and materials utilized in the construction or maintenance industry.

All scaffold systems will be erected under the direction of a competent person qualified in scaffold erection, and should be designed, constructed, and maintained in accordance with the manufacturer's instructions and OSHA Sections 1926.451 and 1926.500. Planking used for scaffold construction shall be scaffold rated lumber. Toeboards, or equivalent devices, shall be used to prevent tools, etc., from falling.

These systems will be inspected each day prior to work activities commencing and these inspections will be recorded and kept in the project files. Scaffolding systems will meet the following requirements:

- Erected to provide safe access and egress, and safe work platforms, to protect workers and those below. Safe access will include provisions for stairways, ladders, or ramps.
  - Access ladders must be permanently installed.
- Made of steel (except platform planks).

- The footing or anchorage for scaffolds will be sound, rigid, and capable of carrying maximum intended load without settling or displacement.
  - Unstable objects such as blocks will not be used to support scaffolds or planks.
  - Poles, legs, or uprights of scaffolds shall be plumb and securely braced to prevent swaying and displacement.
- Placed on a firm surface that is level and not subject to subsidence.
  - Scaffolds will have a firm, level platform capable of bearing the maximum design load and have both mid and top rails in place.
  - All planking will be supported at each end and secured from movement.
  - Bolts, pins, and keepers will be inspected by a supervisor prior to use by any personnel.
- Scaffolds and their components will be capable of supporting, without failure, a minimum of four times the anticipated loads for platforms supported from the ground and six times the expected load for suspended platforms.
- Maintained in safe condition and not altered or moved horizontally while they are in use or occupied.
- Damaged or weakened scaffolding will be immediately repaired or replaced and will not be used until repairs have been completed.
- A tag line should be used when hoisting materials onto a scaffold.
- Work should not be done on scaffolds during storms, high winds, or on ice or snow.
- Tools, materials, and debris must be placed/discarded in areas so that they won't become a hazard.
- Treated or protected fiber rope will be used for or near any work involving the use of corrosive substances or chemicals

Fall Protection

A Fall Arrest System is a combination of safety devices whose purpose is to save a person from serious injury during a fall. The Fall Arrest System is comprised of a safety harness, a lanyard or lifeline, and an anchor point. The Fall Arrest System must be designed, installed, and used under the supervision of a qualified person with a safety factor of 2. The fall protection systems must meet OSHA 1926 Subpart M.

A lanyard or lifeline must be tied off to an appropriate structure capable of supporting five times the weight of the person (nominal 1,000 pounds), and the anchor points must be capable of supporting a load of 5,000 pounds. The maximum deceleration distance to stop an employee is 3.5 feet, and the arresting forces applied to the body during deceleration must be limited. The lanyard and lifelines must have a minimum breaking strength of 5,000 pounds. The horizontal lifelines must be designed, installed, and used under the supervision of a "qualified person" with a safety factor of 2.

Personnel Fall Protection equipment must be inspected for wear, damage, and deterioration prior to each use. Any equipment found defective must be removed from service. If any Personnel Fall Protection equipment is impact loaded, it must be removed from service immediately until repaired by a qualified person.

ARCADIS personnel are to incorporate the use of a safety harness and lanyard when they are exposed to a fall hazard of more than 6 feet.

Appropriate fall protection incorporating safety harnesses and lanyards must be worn when working above 8 feet on straight or extension ladders when the work involves pushing, pulling, or other action that may dislodge the person from the ladder. Safety harnesses are also required on swinging or portable scaffolds when handrails and toeboards are not provided (8 feet or more above ground or floor level).

Safety harnesses and lifelines must be worn on rooftops where there are no guardrails and where the work is within 10 feet of the edge.

Safety harnesses and lifelines (including extraction devices for top-entry spaces) are required on all work performed in confined spaces where an oxygen deficiency or toxic vapors may exist. All lifelines shall be safety secured to stable and adequate supports.

Welding, Cutting, Burning, and Heating

Welding, cutting, burning, and heating operations have a high potential for personal injuries and fires. Precautions should be taken to ensure a safe work environment.

- The Project Manager will check to see whether or not a Hot Work Permit is required and, if so, that a permit has been pulled and is available on site.
- All hot work shall have a fire watch.
- Employees should be instructed in the safe use of welding equipment. Employees who have not received instructions should not be allowed to use the equipment.
- Proper precautions (isolating welding and cutting, removing fire hazards from the vicinity, providing a fire watch, etc.) for fire prevention should be taken in areas where welding or other "hot work" is

being done. No welding, cutting, or heating should be done where the application of flammable paints, or the presence of other flammable compounds, or heavy dust concentrations creates a fire hazard. If you cannot provide the necessary safeguards, check with the supervisor.

- Suitable fire-extinguishing equipment should be available in all work areas.

- Arc welding and cutting operations should be shielded by noncombustible or flameproof shields/barriers/screens to protect other personnel from direct arc rays.

  - Appropriate eye protection may also be required of other personnel in the area.

- When burning or welding, employees should wear approved eye protection with suitable filter lenses.

  - If employees' eyes are exposed to flying objects from chipping slag or other weld-cleaning activity, employees should wear approved eye protection that includes side shields.

- When electrode holders are to be left unattended, the electrodes should be removed and the holder placed or protected so they cannot make electrical contact with employees or conducting objects.

- All arc welding and cutting cables should be completely insulated and be capable of handling the maximum current requirements for the job. There should be no repairs or splices within 10 feet of the electrode holder, except where splices are insulated equal to the insulation of the cable. Defective cable should be repaired or replaced.

- Fuel gas and oxygen hoses should be easily distinguishable and should not be interchangeable. Hoses should be inspected at the beginning of each shift and should be repaired or replaced.

- No welding or burning is allowed in a hazardous area.

- Burning or welding equipment is to be maintained in a safe operating condition.

- All welding leads and burning hoses should be kept off floors, walkways, and stairways or appropriately protect such leads and hoses.

- Never weld or burn on barrels, tanks, piping, or other systems which may have contained either combustible or unknown products without first properly purging and venting the container and obtaining approval from the appropriate supervisor.

- The frames of all welding machines should be grounded.

- Do not use matches or cigarette lighters to light torches. Spark igniters should be used. Torches should not be used to light smoking materials. Employees should wear appropriate protective gloves.

- When a crescent or special wrench is required to operate an acetylene cylinder valve, the wrench should be kept in position on the valve.

- General mechanical or local exhaust ventilation or airline respirators should be provided as required when welding, cutting, or heating.

- Whenever welding, cutting, heating, or burning metals have toxic significance (such as zinc, lead, cadmium, or chromium-bearing metals), a filter-type respirator should be worn whether the work is conducted inside or outside.

Hand and Power Tool Safety

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 manufacturer's 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.

Compressed Gas Cylinders

Valve protection caps should be in place when compressed gas cylinders are transported, moved, or stored. Never move a compressed gas cylinder with just a regulator in place.

- Cylinder valves should be closed when work is finished, when cylinders are empty, or when they are moved.
- Compressed gas cylinders should be secured in an upright position at all times.
- Compressed gas cylinders should be shielded from or secured a safe distance away from any welding operation.
- Compressed gas cylinders should be placed where they cannot become part of an electrical outlet.
- Regulators should be in a proper working order while in use.
- While in storage, oxygen and acetylene (or other fuel gas) cylinders should be separated from each other by a distance of 20 feet or by a barrier that is at least 5 feet tall and has a 1-hour fire rating.
- Compressed gas cylinders should not be taken into confined spaces.
- Compressed gas cylinders should be moved by using a hand truck, forklift, or cylinder pallet.
- Steel-toed safety shoes must be worn when moving or handling compressed gas cylinders.

Hazard Analysis for Change in Work:

HAZARD:	Asbestos-Containing Materials (ACMs)	Level of Risk:	Medium
Source of Hazard:	ACMs may be disturbed during cooling tower abatement and demolition activities, thereby providing a potential worker exposure route.		
Admin. & Eng. Controls:	Only trained personnel allowed in direct proximity of ACMs. Untrained oversight personnel shall observe operations from at least 50 feet away from asbestos abatement activities.	PPE:	Level C for workers in close proximity of ACMs Level D for oversight personnel

HAZARD:	Elevated work surfaces	Level of Risk:	High
Source of Hazard:	Demolition activities may require working on scaffolding.		
Admin. & Eng. Controls:	Workers conducting demolition activities shall be the only personnel allowed on elevated work surfaces (i.e., scaffolds).	PPE:	Level D with Fall Protection
HAZARD:	Cutting torches	Level of Risk:	Medium
Source of Hazard:	Open flame		
Admin. & Eng. Controls:	Be aware of torch flame location at all times.	PPE:	Level D with Protective Eyewear and Gloves
HAZARD:	Power Tools	Level of Risk:	Medium
Source of Hazard:	Rotating, cutting, and/or hammering equipment		
Admin. & Eng. Controls:	Always keep energized hand tools in front of your field of vision.	PPE:	Level D with Protective Eyewear and Gloves
HAZARD:	Compressed Gas Cylinders	Level of Risk:	Medium
Source of Hazard:	Combustible pressurized gases		
Admin. & Eng. Controls:	Cylinders will be kept in a secured upright position.	PPE:	Level D

Signed: _____ Project Manager

Signed: _____ Site Safety Officer

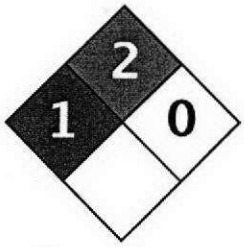
Signed: _____ H&S Plan Writer

Signed: _____ H&S Plan Reviewer

Appendix B

Material Safety Data Sheets

ScienceLab.com
Chemicals & Laboratory Equipment



Health	1
Fire	2
Reactivity	0
Personal Protection	J

Material Safety Data Sheet
Acetophenone MSDS

Section 1: Chemical Product and Company Identification

Product Name: Acetophenone

Catalog Codes: SLA2425

CAS#: 98-86-2

RTECS: AM5250000

TSCA: TSCA 8(b) inventory: Acetophenone

CI#: Not applicable.

Synonym: Ketone methyl phenyl

Chemical Name: 1-Phenyl-ethanone

Chemical Formula: C6H5COCH4

Contact Information:

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

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

Order Online: ScienceLab.com

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

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

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

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Acetophenone	98-86-2	100

Toxicological Data on Ingredients: Acetophenone: ORAL (LD50): Acute: 815 mg/kg [Rat.]. 740 mg/kg [Mouse]. DERMAL (LD50): Acute: 15900 mg/kg [Rabbit].

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of eye contact (irritant). Hazardous in case of skin contact (irritant). Slightly hazardous in case of ingestion, of inhalation. Inflammation of the eye is characterized by redness, watering, and itching.

Potential Chronic Health Effects:
Very hazardous in case of eye contact (irritant).
Hazardous in case of skin contact (irritant).
Slightly hazardous in case of ingestion, of inhalation.
CARCINOGENIC EFFECTS: Not available.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.

Section 4: First Aid Measures

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

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

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

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

Serious Inhalation: Not available.

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

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Combustible.

Auto-Ignition Temperature: 570°C (1058°F)

Flash Points: CLOSED CUP: 77°C (170.6°F). OPEN CUP: 82.2°C (180°F) (Cleveland).

Flammable Limits: Not available.

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

Fire Hazards in Presence of Various Substances: Flammable in presence of open flames and sparks, of heat, of oxidizing materials.

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

Fire Fighting Media and Instructions:
SMALL FIRE: Use DRY chemical powder.
LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards: Store away from direct sunlight. When heated to decomposition it emits acrid smoke and fumes.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

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

container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:
[redacted]bustible material.
[redacted]ep away from heat. Keep away from sources of ignition. Stop leak if without risk. If the product is in its solid form: Use a shovel to put the material into a convenient waste disposal container. If the product is in its liquid form: Absorb with an inert material and put the spilled material in an appropriate waste disposal. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system.

Section 7: Handling and Storage

Precautions:
Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapor/spray. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, reducing agents, alkalis.

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

Section 8: Exposure Controls/Personal Protection

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

[redacted]**onal Protection:** Splash goggles. Lab coat. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Boots. Gloves. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits: Not available.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid. (Liquid.)

Odor: Not available.

Taste: Not available.

Molecular Weight: 120.16 g/mole

Color: Colorless to light yellow.

pH (1% soln/water): 7 [Neutral.]

Boiling Point: 201.7°C (395.1°F)

Melting Point: 19.7°C (67.5°F)

[redacted]**tical Temperature:** Not available.

Specific Gravity: 1.03 (Water = 1)

Vapor Pressure: 0.1 kPa (@ 20°C)

Vapor Density: 4.1 (Air = 1)

[redacted]tility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

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

Solubility:
Soluble in methanol, diethyl ether.
Partially soluble in cold water, hot water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

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

Corrosivity: Non-corrosive in presence of glass.

[redacted]cial Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Eye contact.

Toxicity to Animals:
Acute oral toxicity (LD50): 740 mg/kg [Mouse].
Acute dermal toxicity (LD50): 15900 mg/kg [Rabbit].

Chronic Effects on Humans: Not available.

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

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: 0900 Detected in maternal milk in human.

Special Remarks on other Toxic Effects on Humans:
Material is irritating to mucous membranes and upper respiratory tract. Narcotic in high concentrations.
[redacted]notic.

Section 12: Ecological Information

Ecotoxicity: Not available.

[redacted]5 and COD: Not available.

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

Toxicity of the Products of Biodegradation: The products of degradation are more toxic.

Special Remarks on the Products of Biodegradation: *Not available.*

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: CLASS 3: Combustible liquid

Identification: : FLAMMABLE LIQUIDS, N.O.S. UNNA: UN1993 PG: Not available.

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

[redacted]ral and State Regulations:
Pennsylvania RTK: Acetophenone
Massachusetts RTK: Acetophenone
TSCA 8(b) inventory: Acetophenone
SARA 313 toxic chemical notification and release reporting: Acetophenone
CERCLA: Hazardous substances.: Acetophenone

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

Other Classifications:

WHMIS (Canada):
CLASS B-3: Combustible liquid with a flash point between 37.8°C (100°F) and 93.3°C (200°F).
CLASS D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC):
R22- Harmful if swallowed.
R38- Irritating to skin.
R41- Risk of serious damage to eyes.

HMIS (U.S.A.):

Health Hazard: 1

Fire Hazard: 2

[redacted]activity: 0

Personal Protection: j

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

Health: 1

Flammability: 2

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves.
Lab coat.
Wear appropriate respirator when ventilation is inadequate.
Splash goggles.

Section 16: Other Information

References:
-Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987.
-SAX, N.I. Dangerous Properties of Indutrial Materials. Toronto, Van Nostrand Reinold, 6e ed. 1984.
-The Sigma-Aldrich Library of Chemical Safety Data, Edition II.

Other Special Considerations: Not available.

Created: 10/09/2005 03:36 PM

Last Updated: 10/09/2005 03:36 PM

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AIR PRODUCTS

Material Safety Data Sheet

Version 1.14
Revision Date 11/22/2004

MSDS Number 300000005198
Print Date 11/27/2005

1. PRODUCT AND COMPANY IDENTIFICATION

Product name	:	Arsenic
Chemical formula	:	As
Synonyms	:	Metallic Arsenic, Arsenic Black
Product Use Description	:	Semiconductor Processing
Company	:	Air Products and Chemicals,Inc 7201 Hamilton Blvd. Allentown, PA 18195-1501
Telephone	:	1-800-345-3148 Chemicals 1-800-752-1597 Gases and Electronic Chemicals
Emergency telephone number	:	800-523-9374 USA 01-610-481-7711 International

2. COMPOSITION/INFORMATION ON INGREDIENTS

Components	CAS Number	Concentration (Weight)
Arsenic	7440-38-2	100 %

Concentration is nominal. For the exact product composition, please refer to Air Products technical specifications. Contains no other components or impurities which will influence the classification of the product.

3. HAZARDS IDENTIFICATION

Emergency Overview

Components of the product may affect the nervous system.
Known human carcinogen.
Moderate skin irritant.
Irritating to eyes.
Toxic if swallowed.

Potential Health Effects

Inhalation	:	May cause central nervous system effects, such as headache, nausea, dizziness, confusion, breathing difficulties. Severe cases of overexposure can result in respiratory failure.
Eye contact	:	Contact with eyes may cause irritation. Inflammation of the eye and photophobia can develop.
Skin contact	:	If absorbed through the skin, may cause central nervous system effects, such as headache, nausea, dizziness, confusion, breathing difficulties. Causes skin irritation.

Ingestion	:	May cause central nervous system effects, such as headache, nausea, vomiting, abdominal pain, dizziness, confusion, breathing difficulties. Severe cases of overexposure can result in respiratory failure. May be fatal if swallowed. Toxic if swallowed. Garlic-like odor of breath and feces may be noted.
Chronic Health Hazard	:	*This product contains listed carcinogen(s)* according to IARC, ACGIH, NTP and/or OSHA in concentrations of 0.1 percent or greater. Muscular dysfunction. Chronic poisoning may result in weight loss, muscular weakness, tremors, fever, bronzing of the skin and horizontal white lines on fingernails and toenails. Known human carcinogen.

Exposure Guidelines

Target Organs	:	Skin. Eyes. Respiratory system. Kidney. Liver. Blood. Central nervous system. Lymphatic system. Mucous membranes. Peripheral nervous system.
Symptoms	:	Breathing difficulties. Headache. Nausea. Tingling. Cough. Fatality. Fever. Weakness. Diarrhea. Vomiting. Chest pain. Metallic taste in mouth. Skin abnormalities.

Aggravated Medical Condition

Blood chemistry changes (such as methemoglobinemia *leading to cyanosis or loss of consciousness*). Nervous system disorders (such as narcosis, behavioral changes or decrease in motor function). Liver disorders (such as jaundice or liver enlargement). Kidney disorders (such as edema, or proteinuria). Skin disorders and Allergies. Adverse skin effects (such as rash, irritation or corrosion). Adverse eye effects (such as conjunctivitis or corneal damage). Eye disease

4. FIRST AID MEASURES

General advice	:	Seek medical advice. If breathing has stopped or is labored, give assisted respirations. Supplemental oxygen may be indicated. If the heart has stopped, trained personnel should begin cardiopulmonary resuscitation immediately.
Eye contact	:	Rinse immediately with plenty of water also under the eyelids for at least 20 minutes. Remove contact lenses.
Skin contact	:	Wash off immediately with plenty of water for at least 20 minutes. Immediately remove contaminated clothing, and any extraneous chemical, if possible to do so without delay.
Ingestion	:	Immediately give large quantities of water to drink. Induce vomiting if person is conscious. Prevent aspiration of vomit. Turn victim's head to the side.

Inhalation : Move to fresh air.

5. FIRE-FIGHTING MEASURES

Suitable extinguishing media : Alcohol-resistant foam.
Carbon dioxide (CO2).
Dry chemical.
Dry sand.
Limestone powder.

Specific hazards : Burning produces obnoxious and toxic fumes. A moderate fire hazard exists if crystalline material is exposed to heat or strong oxidizers. A slight explosion hazard exists when dust is exposed to flame.

Special protective equipment for fire-fighters : Use personal protective equipment. Wear self contained breathing apparatus for fire fighting if necessary.

Further information : Do not allow run-off from fire fighting to enter drains or water courses.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions : Use self-contained breathing apparatus and chemically protective clothing. Evacuate personnel to safe areas.

Methods for cleaning up : Approach suspected leak areas with caution. Contact Air Products' Emergency Response Center for advice. Place in appropriate chemical waste container.

Additional advice : Place arsenic and all arsenic-contaminated material in an appropriate chemical waste container. If possible, stop flow of product.

7. HANDLING AND STORAGE

Handling

Do not breathe vapors/dust. Avoid contact with eyes. Use personal protective equipment. When using, do not eat, drink or smoke.

Storage

Keep containers tightly closed in a dry, cool and well-ventilated place.

Storage temperature : 32 - 104 °F (0 - 40 °C)

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Engineering measures

Provide readily accessible eye wash stations and safety showers.
Provide natural or explosion-proof ventilation adequate to ensure concentrations are kept below exposure limits.

Personal protective equipment

Respiratory protection	:	Use a NIOSH/MSHA-approved full-face respirator with a high efficiency particulate air (HEPA) filter when exposure is possible.
Hand protection	:	Impervious gloves. Latex gloves (ketone resistant) The breakthrough time of the selected glove(s) must be greater than the intended use period.
Eye protection	:	Chemical resistant goggles must be worn.
Skin and body protection	:	Long sleeve shirts and trousers without cuffs.

Exposure limit(s)

Arsenic	Time Weighted Average (TWA): ACGIH	-	0.01 mg/m3
Arsenic	Ceiling Limit Value and Time Period (if specified): NIOSH	-	0.002 mg/m3
Arsenic	Time Weighted Average (TWA): OSHA	-	0.01 mg/m3
Arsenic	OSHA Action level: OSHA	-	0.005 mg/m3
Arsenic	PEL: OSHA Z1	-	5 mg/m3
Arsenic	PEL: OSHA Z1	-	15 mg/m3

9. PHYSICAL AND CHEMICAL PROPERTIES

Form	:	Solid.
Color	:	Black.
Odor	:	Garlic-like.
Molecular Weight	:	74.92 g/mol
Relative density	:	5.7327 (water = 1)
Vapor pressure	:	1.33 hPa
Melting point/range	:	1.503 °F (817 °C)
Sublimation point	:	1.135 °F (613 °C)
Water solubility	:	Insoluble.

10. STABILITY AND REACTIVITY

Stability	:	*Stable under normal* conditions.
Conditions to avoid	:	Heat. Dusting.

Materials to avoid	:	Oxidizing agents. Acids. Potassium. Peroxides. Hydrogen. Lithium. Alkali earth metal halogens. Alkaline earth metal halogens. Bromates. Chlorine Fluorine
Hazardous decomposition products	:	Arsenic trioxide.

11. TOXICOLOGICAL INFORMATION

Acute Health Hazard

Ingestion	:	LD50 : 145 mg/kg Species : Mouse. Acute arsenic ingestion usually produces symptoms within 30 minutes but may be delayed several hours if ingested with food. Dehydration, vomiting and diarrhea are common.
Inhalation	:	No data is available on the product itself.
Skin.	:	No data is available on the product itself.
Eye irritation/corrosion	:	Eye irritation.
Acute dermal irritation/corrosion	:	Skin irritation.
Sensitization	:	May cause sensitization by skin contact.

Chronic Health Hazard

Arsenic is primarily absorbed through ingestion but may be absorbed through skin exposure or inhalation. Chronic Effects: Leukemia, reduced number of blood cells and platelets, aplastic anemia, bone marrow depression, intolerance to light, loss of appetite, fever, tremors and muscular weakness. Local keratosis precedes skin cancer. Special risk groups: Children and persons with diabetes or diseases of the skin, blood, liver, kidney, heart or CNS.

Carcinogenicity

Arsenic	IARC	:	1 - Human carcinogen.
	ACGIH	:	Group A1 - Confirmed human carcinogen.
	NTP CARC	:	Known carcinogen.
	OSHA	:	Cancer hazard.

12. ECOLOGICAL INFORMATION

Ecotoxicity effects

Aquatic toxicity	:	No data is available on the product itself.
Toxicity to other organisms	:	No data available.

Persistence and degradability

Mobility	:	Atmospheric conditions are low, ranging from 0.0 to 0.1 mg/m3 in the rural U.S.
Bioaccumulation	:	No data is available on the product itself.

Further information

Arsenic as a free element (0. oxidation state) is rarely encountered in natural waters. Soluble inorganic arsenate (+5. oxidation state) is predominately found under normal conditions.

13. DISPOSAL CONSIDERATIONS

Waste from residues / unused products	:	Possible fire hazards include arsenic dust and exposure to strong oxidants. Contact supplier if guidance is required.
Contaminated packaging	:	Dispose of container and unused contents in accordance with federal, state, and local requirements.

14. TRANSPORT INFORMATION

CFR

Proper shipping name	:	Arsenic
Class	:	6.1
UN/ID No.	:	UN1558
Packing group	:	II

IATA

Proper shipping name	:	Arsenic
Class	:	6.1
UN/ID No.	:	UN1558
Packing group	:	II

IMDG

Proper shipping name	:	ARSENIC
Class	:	6.1
UN/ID No.	:	UN1558
Packing group	:	II

CTC

Proper shipping name	:	ARSENIC
Class	:	6.1
UN/ID No.	:	UN1558
Packing group	:	II

15. REGULATORY INFORMATION

OSHA Hazard Communication Standard (29 CFR 1910.1200) Hazard Class(es)
Toxic Irritant. Sensitizer. Carcinogen.

Country	Regulatory list	Notification
USA	TSCA	Included on Inventory.
EU	EINECS	Included on EINECS inventory or polymer substance, monomers included on EINECS inventory or no longer polymer.
Canada	DSL	Included on Inventory.
Australia	AICS	Included on Inventory.
Japan	ENCS	Not on Inventory.
South Korea	ECL	Included on Inventory.
China	SEPA	Included on Inventory.
Philippines	PICCS	Included on Inventory.

EPA SARA Title III Section 312 (40 CFR 370) Hazard Classification:
Acute Health Hazard Chronic Health Hazard

US. California Safe Drinking Water & Toxic Enforcement Act (Proposition 65)
WARNING! This product contains a chemical known in the State of California to cause cancer.
Arsenic

16. OTHER INFORMATION

NFPA Rating

Health : 3
Fire : 1
Instability : 1

HMIS Rating

Health : 4*
Flammability : 1
Physical hazard : 1

Prepared by : Air Products and Chemicals, Inc. Global EH&S Product Safety Department

For additional information, please visit our Product Stewardship web site at
http//www.airproducts.com/productstewardship/

MATERIAL SAFETY DATA SHEET

MSDS Number
P-005N

AccuStandard
125 Market Street • New Haven, CT USA 06513
Phone No: (203) 786-5290 • Fax No: (203) 786-5287

Emergency Phone Number
203-786-5290
Mon. to Fri. 8am-5pm EDT

Product Number : P-005N

Product Name : Atrazine

Synonyms : Atred, Aatrex

Formula : C8H14ClN5 **Molecular Weight :** 215.72

Section 2 - Composition / Information on Ingredients

Component(s) (1)	CAS #	Appr. %	ACGIH TLV TWA mg/m3	ACGIH TLV SKIN	OSHA PEL TWA mg/m3	OSHA PEL SKIN
Atrazine	1912-24-9	100%	5		5	

Section 3 - Hazards Identification

Symptoms of Exposure:

May be harmful if inhaled, swallowed, or absorbed through the skin.

Causes severe eye irritation.

CAUSES SKIN IRRITATION.

Potential Health Effects:

No applicable information found.

Routes of Entry:

Inhalation, ingestion or skin contact.

Carcinogenicity:

Proven animal carcinogenic substance. Possible Cancer Hazard.

Section 4 - First Aid Measures

First Aid Procedures:

GET MEDICAL ASSISTANCE FOR ALL CASES OF OVEREXPOSURE.

Skin: Immediately flush thoroughly with large amounts of water.

Eyes: Immediately flush thoroughly with water for at least 15 minutes. Assure adequate flushing by separating the eyelids with fingers.

Inhalation: Remove to fresh air; give artificial respiration if breathing has stopped. Contact a physician

Ingestion: If conscious, drink water and induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person.

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Remove contaminated clothing and wash before reuse.

Section 5 - Fire Fighting Measures

Fire fighting measures for the Compound

Flammable Properties:

Flash Point (°F): N/A
Flammable Limits LEL (%): N/A
Flammable Limits UEL (%): N/A

Thermal decomposition produces toxic fumes.

Extinguishing Media:

Use water spray, dry chemical, CO2, or "alcohol" foam.

Protection of Firefighters:

Wear self-contained breathing apparatus and protective clothing.

Section 6 - Accidental Release Measures

Spill Response:

Wear suitable protective equipment listed under Expose /Personal Protection. Eliminate any ignition sources until the area is determined to be free from explosion or fire hazards. Contain the release and eliminate its source, if this can be done without risk. Dispose as hazardous waste. Comply with Federal, State and local regulations.

Section 7 - Handling and Storage

Keep container closed.
Store in a cool area away from ignition sources and oxidizers.
Do not breathe vapor.
Do not get in eyes, on skin, or on clothing.

Section 8 - Exposure Controls / Personal Protection

Personal Protection Equipment (PPE):

Respiratory Protection: If workplace exposure limit(s) of product or any component is exceeded (see TLV/PEL), a NIOSH/MSHA approved air supplied respirator is advised in absence of proper environmental control. OSHA regulations also permit other NIOSH/MSHA respirators (negative pressure type) under specified conditions (see your safety equipment supplier). Engineering and/or administrative controls should be implemented to reduce exposure.

Material should be handled or transferred in an approved fume hood or with adequate ventilation.

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Protective gloves must be worn to prevent skin contact.

(Butyl Rubber, Viton or equivalent)

Safety glasses with side shields must be worn at all times.

General Hygiene Considerations:

Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available.

Section 9 - Physical and Chemical Properties

Physical and chemical properties for the Compound

Appearance: White powder
Boiling Point: N/A
Melting Point: 175-177C
Specific Gravity (Water = 1): N/A
Vapor Pressure: N/A
Vapor Density (Air = 1): N/A
Percent Volatile (by volume): N/A
Evaporation Rate (Butyl acetate = 1): N/A
Flash Point: N/A
Explosion Limits (%): N/A to N/A
Solubility in water (%): Slightly

Section 10 - Stability and Reactivity

Stability and reactivity for the Compound

Stability: Stable
Materials to Avoid: Oxidizers

Hazardous Decomposition: Oxides of carbon and nitrogen. Hydrogen chloride
Hazardous Polymerization: Does not occur
Conditions to Avoid: None indicated

Section 11 - Toxicological Information

Alteration of any information contained herein without written permission from AccuStandard strictly prohibited.

See section 3 for specific toxicological information for the ingredients of this product.

Section 12 - Ecological Information

By complying with sections 6 and 7 there will be no release to the environment.

Section 13 - Disposal Considerations

Recycle or incinerate at any EPA approved facility or dispose in compliance with Federal, State and local regulations. Empty containers must be triple-rinsed prior to disposal.

Section 14 - Transport Information

DOT	Shipping Class:	6.1	Packing Group:	III	UN Number:	UN2588

Section 15 - Regulatory Information

In addition to Federal and state regulations, local regulations may apply. Check with your local regulatory authorities.

The following regulations apply:

None.

Section 16 - Other Information

This document has been designed to meet the requirements of OSHA, ANSI and CHIPs regulations.

The statements contained herein are offered for informational purposes only and are based on technical data that we believe to be accurate. It is intended for use only by persons having the necessary technical skill and at their own discretion and risk. Since conditions and manner of use are outside our control, we make NO WARRANTY, EXPRESS OR IMPLIED, OF MERCHANTABILITY, FITNESS OR OTHERWISE.

* * * End of document * * *

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Material Safety Data Sheet

1. MATERIAL AND COMPANY IDENTIFICATION

Material Name : **Benzene**
Uses : Raw material for use in the chemical industry.
Product Code : Q9121, Q9112, Q9169

Manufacturer/Supplier : **Shell Chemicals Americas Inc.**
PO Box 670 STN M
CALGARY AB T2P 2J3
Canada

Telephone : 1-888-791-4314
Fax : 1-403-691-3555

Emergency Telephone Number
CHEMTREC (24 hr) : 1-800-424-9300
Canutec (24 hr) : 1-613-996-6666

Material Formal Name : Benzene

2. COMPOSITION/INFORMATION ON INGREDIENTS

Synonyms : Benzol
Cyclohexatriene
CAS No. : 71-43-2

WHMIS Controlled Ingredients

Chemical Name	CAS No.	Conc. W/W
Benzene	71-43-2	100.00 %

Refer to Chapter 8 for Occupational Exposure Guidelines.

3. HAZARDS IDENTIFICATION

WHMIS Class/Description : Class B2 Flammable Liquid
Class D2A Other Toxic Effects - Carcinogen
Class D2B Other Toxic Effects - Mutagen/Chronic/Irritant (Skin and Eye)

Routes of Exposure : *Inhalation is the primary route of exposure* although exposure may occur through skin and eye contact, or following accidental ingestion.

Health Hazards : Slightly irritating to respiratory system. Vapours may cause drowsiness and dizziness. Irritating to skin. Irritating to eyes. Harmful: may cause lung damage if swallowed. Possibility of organ or organ system damage from prolonged exposure; see Chapter 11 for details. Target organ(s): Blood. Blood-forming

		organs. Immune system. May cause cancer. May cause leukaemia (AML - acute myelogenous leukaemia). May cause heritable genetic damage.
Signs and Symptoms	:	Eye irritation signs and symptoms may include a burning sensation, redness, swelling, and/or blurred vision. Skin irritation signs and symptoms may include a burning sensation, redness, swelling, and/or blisters. If material enters lungs, signs and symptoms may include coughing, choking, wheezing, difficulty in breathing, chest congestion, shortness of breath, and/or fever. The onset of respiratory symptoms may be delayed for several hours after exposure. Breathing of high vapour concentrations may cause central nervous system (CNS) depression resulting in dizziness, light-headedness, headache, nausea and loss of coordination. Continued inhalation may result in unconsciousness and death. Damage to blood-forming organs may be evidenced by: a) fatigue and anaemia (RBC), b) decreased resistance to infection, and/or excessive bruising and bleeding (platelet effect).
Aggravated Medical Condition	:	Pre-existing medical conditions of the following organ(s) or organ system(s) may be aggravated by exposure to this material: Blood. Blood-forming organs. Cardiovascular system. Immune system. Eyes. Skin.
Safety Hazards	:	Highly flammable. In use, may form flammable/explosive vapour-air mixture. Electrostatic charges may be generated during pumping. Electrostatic discharge may cause fire.

4. FIRST AID MEASURES

General Information	:	Keep victim calm. Obtain medical treatment immediately.
Inhalation	:	DO NOT DELAY. Remove to fresh air. If rapid recovery does not occur, transport to nearest medical facility for additional treatment.
Skin Contact	:	Remove contaminated clothing. Immediately flush skin with large amounts of water for at least 15 minutes, and follow by washing with soap and water if available. If redness, swelling, pain and/or blisters occur, transport to the nearest medical facility for additional treatment.
Eye Contact	:	Immediately flush eyes with large amounts of water for at least 15 minutes while holding eyelids open. Transport to the nearest medical facility for additional treatment.
Ingestion	:	If swallowed, do not induce vomiting: transport to nearest medical facility for additional treatment. If vomiting occurs spontaneously, keep head below hips to prevent aspiration.
Advice to Physician	:	Potential for chemical pneumonitis. Consider: gastric lavage with protected airway, administration of activated charcoal. Potential for cardiac sensitisation, particularly in abuse situations. Hypoxia or negative inotropes may enhance these effects. Consider: oxygen therapy.

5. FIRE FIGHTING MEASURES

Clear fire area of all non-emergency personnel.

Flash point	:	-11 °C / 12 °F (Abel)
Explosion / Flammability limits in air	:	1.4 - 7.1 %(V)
Auto ignition temperature	:	562 °C / 1,044 °F
Hazardous Combustion Products and Specific Hazards	:	The vapour is heavier than air, spreads along the ground and distant ignition is possible. Will float and can be reignited on surface water. Carbon monoxide may be evolved if incomplete combustion occurs.
Extinguishing Media	:	Foam, water spray or fog. Dry chemical powder, carbon dioxide, sand or earth may be used for small fires only.
Unsuitable Extinguishing Media	:	Do not use water in a jet.
Protective Equipment for Firefighters	:	Wear full protective clothing and self-contained breathing apparatus.
Additional Advice	:	Keep adjacent containers cool by spraying with water.

6. ACCIDENTAL RELEASE MEASURES

Avoid contact with spilled or released material. Immediately remove all contaminated clothing. For guidance on selection of personal protective equipment see Chapter 8 of this Material Safety Data Sheet. For guidance on disposal of spilled material see Chapter 13 of this Material Safety Data Sheet. Observe all relevant local and international regulations.

Protective Measures	:	Isolate hazard area and deny entry to unnecessary or unprotected personnel. Stay upwind and keep out of low areas. Shut off leaks, if possible without personal risks. Remove all possible sources of ignition in the surrounding area. Use appropriate containment (of product and fire fighting water) to avoid environmental contamination. Prevent from spreading or entering drains, ditches or rivers by using sand, earth, or other appropriate barriers. Attempt to disperse the vapour or to direct its flow to a safe location for example by using fog sprays. Take precautionary measures against static discharge. Ensure electrical continuity by bonding and grounding (earthing) all equipment. Ventilate contaminated area thoroughly.
Clean Up Methods	:	For large liquid spills (> 1 drum), transfer by mechanical means such as vacuum truck to a salvage tank for recovery or safe disposal. Do not flush away residues with water. Retain as contaminated waste. Allow residues to evaporate or soak up with an appropriate absorbent material and dispose of safely. Remove contaminated soil and dispose of safely. For small liquid spills (< 1 drum), transfer by mechanical means to a labelled, sealable container for product recovery or safe disposal. Allow residues to evaporate or soak up with an appropriate absorbent material and dispose of safely. Remove contaminated soil and dispose of safely.
Additional Advice	:	Notify authorities if any exposure to the general public or the environment occurs or is likely to occur. Local authorities should be advised if significant spillages cannot be contained. The vapour is heavier than air, spreads along the ground and distant ignition is possible. Vapour may form an explosive mixture with air.

7. HANDLING AND STORAGE

General Precautions : Avoid breathing of or contact with material. Only use in well ventilated areas. Wash thoroughly after handling. For guidance on selection of personal protective equipment see Chapter 8 of this Material Safety Data Sheet. Use the information in this data sheet as input to a risk assessment of local circumstances to help determine appropriate controls for safe handling, storage and disposal of this material.

Handling : Avoid inhaling vapour and/or mists. Avoid contact with skin, eyes, and clothing. Avoid exposure. Obtain special instructions before use. Extinguish any naked flames. Do not smoke. Remove ignition sources. Avoid sparks. Electrostatic charges may be generated during pumping. Electrostatic discharge may cause fire. Ensure electrical continuity by bonding and grounding (earthing) all equipment. Restrict line velocity during pumping in order to avoid generation of electrostatic discharge (<= 1 m/sec until fill pipe submerged to twice its diameter, then <= 7 m/sec). Avoid splash filling. Do NOT use compressed air for filling, discharging, or handling operations.

Storage : Vapours from tanks should not be released to atmosphere. Breathing losses during storage should be controlled by a suitable vapour treatment system. Bulk storage tanks should be diked (bunded). The vapour is heavier than air. Beware of accumulation in pits and confined spaces.

Product Transfer : Electrostatic charges may be generated during pumping. Electrostatic discharge may cause fire. Ensure electrical continuity by bonding and grounding (earthing) all equipment. Restrict line velocity during pumping in order to avoid generation of electrostatic discharge (<= 1 m/sec until fill pipe submerged to twice its diameter, then <= 7 m/sec). Avoid splash filling. Do NOT use compressed air for filling, discharging, or handling operations.

Recommended Materials : For containers, or container linings use mild steel, stainless steel.

Unsuitable Materials : Natural, butyl, neoprene or nitrile rubbers.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Occupational Exposure Limits

Material	Source	Type	ppm	mg/m3	Notation
Benzene	ACGIH	TWA	0.5 ppm		
	ACGIH	STEL	2.5 ppm		
	ACGIH	SKIN_DES			Can be absorbed through the skin.

Consult local authorities for acceptable exposure limits within their jurisdiction.

Additional Information : Skin notation means that significant exposure can also occur by absorption of liquid through the skin and of vapour through the eyes or mucous membranes.

Exposure Controls	:	The level of protection and types of controls necessary will vary depending upon potential exposure conditions. Select controls based on a risk assessment of local circumstances. Appropriate measures include: Use sealed systems as far as possible. Adequate ventilation to control airborne concentrations below the exposure guidelines/limits. Adequate explosion-proof ventilation to control airborne concentrations. Firewater monitors and deluge systems are recommended. Eye washes and showers for emergency use.
Personal Protective Equipment	:	Personal protective equipment (PPE) should meet recommended national standards. Check with PPE suppliers. The following information, while appropriate for the product is general in nature. The selection of Personal Protective Equipment will vary depending on the conditions of use.
Respiratory Protection	:	If engineering controls do not maintain airborne concentrations to a level which is adequate to protect worker health, select respiratory protection equipment suitable for the specific conditions of use and meeting relevant legislation. Check with respiratory protective equipment suppliers. Where air-filtering respirators are suitable, select an appropriate combination of mask and filter. Select a filter suitable for organic gases and vapours [boiling point >65 °C (149 °F)] meeting EN141. Where respiratory protective equipment is required, use a full-face mask. Where air-filtering respirators are unsuitable (e.g., airborne concentrations are high, risk of oxygen deficiency, confined space) use appropriate positive pressure breathing apparatus.
Hand Protection	:	Where hand contact with the product may occur the use of gloves approved to relevant standards (e.g. Europe: EN374, US: F739) made from the following materials may provide suitable chemical protection: Longer term protection: Viton. Incidental contact/Splash protection: Nitrile rubber. Suitability and durability of a glove is dependent on usage, e.g. frequency and duration of contact, chemical resistance of glove material, glove thickness, dexterity. Always seek advice from glove suppliers. Contaminated gloves should be replaced.
Eye Protection	:	Chemical splash goggles (chemical monogoggles).
Protective Clothing	:	Chemical resistant gloves/gauntlets, boots, and apron. Where risk of splashing or in spillage clean up, use chemical resistant one-piece overall with integral hood.
Monitoring Methods	:	Monitoring of the concentration of substances in the breathing zone of workers or in the general workplace may be required to confirm compliance with an OEL and adequacy of exposure controls. For some substances biological monitoring may also be appropriate. Examples of sources of recommended air monitoring methods are given below or contact supplier. Further national methods may be available. National Institute of Occupational Safety and Health (NIOSH), USA: Manual of analytical Methods http://www.cdc.gov/niosh/nmam/nmammenu.html Occupational Safety and Health Administration (OSHA), USA: Sampling and Analytical Methods http://www.osha-slc.gov/dts/sltc/methods/toc.html Health and Safety Executive (HSE), UK: Methods for the Determination of Hazardous

		Substances http://www.hsl.gov.uk/search.htm
Environmental Exposure Controls	:	Local guidelines on emission limits for volatile substances must be observed for the discharge of exhaust air containing vapour.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	:	Colourless. Liquid.
Odour	:	Aromatic.
Odour threshold	:	2.7 ppm
pH	:	Not applicable.
Boiling point	:	80.1 °C / 176.2 °F
Freezing Point	:	5.6 °C / 42.1 °F
Vapour pressure	:	10 kPa at 20 °C / 68 °F
Specific gravity	:	0.8787 at 20 °C / 68 °F
Density	:	885 kg/m3 at 15 °C / 59 °F
Water solubility	:	0.1 g/l Negligible. 1.8 kg/m3 at 25 °C / 77 °F
n-octanol/water partition coefficient (log Pow)	:	1.95 - 2.13
Kinematic viscosity	:	0.65 mm2/s at 20 °C / 68 °F
Vapour density (air=1)	:	2.7 at 15 °C / 59 °F
Electrical conductivity	:	< 50 pS/m at 20 °C / 68 °F
Saturated Vapour concentration (in air)	:	99000 PPM_M at 20 °C / 68 °F
Evaporation rate (nBuAc=1)	:	2.8
Surface tension	:	0.03 N/m
Molecular weight	:	78 g/mol

10. STABILITY AND REACTIVITY

Stability	:	Stable under normal conditions of use. Reacts violently with strong oxidising agents.
Conditions to Avoid	:	Avoid heat, sparks, open flames and other ignition sources. Prevent vapour accumulation.
Materials to Avoid	:	Strong oxidising agents.
Hazardous Decomposition Products	:	Thermal decomposition is highly dependent on conditions. A complex mixture of airborne solids, liquids and gases, including carbon monoxide, carbon dioxide and other organic compounds will be evolved when this material undergoes combustion or thermal or oxidative degradation.
Hazardous Polymerisation	:	No
Sensitivity to Mechanical Impact	:	No
Sensitivity to Static Discharge	:	Yes

11. TOXICOLOGICAL INFORMATION

Basis for Assessment	:	Information given is based on product testing.
Routes of Exposure	:	Inhalation is the primary route of exposure although exposure may occur through skin and eye contact, or following

accidental ingestion.

Routes of Exposure	Material	Values
Oral	Benzene	LD 50: 3,400 mg/kg, Rat
Dermal	Benzene	LD 50: > 8,260 mg/kg, Rabbit
Inhalation	Benzene	LC50: 70000 ppm / 1 hours, Rat

Acute Oral Toxicity : Aspiration into the lungs when swallowed or vomited may cause chemical pneumonitis which can be fatal.

Acute Inhalation Toxicity : High concentrations may cause central nervous system depression resulting in headaches, dizziness and nausea; continued inhalation may result in unconsciousness and/or death.

Skin Irritation : Irritating to skin.

Eye Irritation : Irritating to eyes.

Respiratory Irritation : Inhalation of vapours or mists may cause irritation to the respiratory system.

Sensitisation : Not expected to be a skin sensitiser.

Repeated Dose Toxicity : Blood-forming organs: repeated exposure affects the bone marrow.
Blood: may cause haemolysis of red blood cells and/or anaemia.
Immune System: animal studies on this material or its components have demonstrated immunotoxicity.

Mutagenicity : May cause heritable genetic damage.

Carcinogenicity : Known human carcinogen. May cause leukaemia (AML - acute myelogenous leukaemia).

Material	:	Carcinogenicity Classification
Benzene	:	ACGIH Group A1: Confirmed human carcinogen.
Benzene	:	IARC 1: Human carcinogen.

Reproductive and Developmental Toxicity : Causes foetotoxicity in animals at doses which are maternally toxic.
Does not impair fertility.

Additional Information : Myelodysplastic syndrome (MDS) was observed in individuals exposed to very high levels (50 ppm to 300 ppm range) of benzene over a long period of time in the workplace. The relevance of these results to lower levels of exposure is not known.
Exposure to very high concentrations of similar materials has been associated with irregular heart rhythms and cardiac arrest.

12. ECOLOGICAL INFORMATION

Acute Toxicity

Fish : Toxic: 1 < LC/EC/IC50 <= 10 mg/l

Aquatic Invertebrates : Harmful: 10 < LC/EC/IC50 <= 100 mg/l

Algae : Harmful: 10 < LC/EC/IC50 <= 100 mg/l

Microorganisms : Harmful: 10 < LC/EC/IC50 <= 100 mg/l

Mobility	:	Floats on water.
Persistence/degradability	:	Readily biodegradable meeting the 10 day window criterion.
Bioaccumulation	:	Does not bioaccumulate significantly.
Other Adverse Effects	:	In view of the high rate of loss from solution, the product is unlikely to pose a significant hazard to aquatic life.

13. DISPOSAL CONSIDERATIONS

Material Disposal	:	Recover or recycle if possible. It is the responsibility of the waste generator to determine the toxicity and physical properties of the material generated to determine the proper waste classification and disposal methods in compliance with applicable regulations.
Local Legislation	:	Disposal should be in accordance with applicable regional, national, and local laws and regulations.

14. TRANSPORT INFORMATION

Canadian Road and Rail Shipping Classification

UN/NA Number	UN 1114
Proper shipping name	BENZENE
Class Division	3
Packing group	II
Shipping Description	BENZENE, Class 3, UN 1114, PG II
Emergency Response Guide No	130

15. REGULATORY INFORMATION

The regulatory information is not intended to be comprehensive. Other regulations may apply to this material.

WHMIS Class/Description : Class B2 Flammable Liquid
Class D2A Other Toxic Effects - Carcinogen
Class D2B Other Toxic Effects - Mutagen/Chronic/Irritant (Skin and Eye)

Inventory Status

AICS	:	Listed.	
DSL	:	Listed.	
INV (CN)	:	Listed.	
ENCS (JP)	:	Listed.	(3)-1
TSCA	:	Listed.	
EINECS	:	Listed.	200-753-7
KECI (KR)	:	Listed.	97-1-99
KECI (KR)	:	Listed.	KE-02150
PICCS (PH)	:	Listed.	

16. OTHER INFORMATION

Material Safety Data Sheet

MSDS Version Number	:	3.
MSDS Effective Date	:	12-15-2005
MSDS Revisions	:	A vertical bar (|) in the left margin indicates an amendment from the previous version.
MSDS Regulation	:	The content and format of this (M)SDS is in accordance with the Controlled Product Regulations.
MSDS Prepared By	:	Product Stewardship; Shell Chemicals Americas Inc.; 1-888-791-4314
Uses and Restrictions	:	Raw material for use in the chemical industry.
MSDS Distribution	:	The information in this document should be made available to all who may handle the product
Disclaimer	:	The information contained herein is based on our current knowledge of the underlying data and is intended to describe the product for the purpose of health, safety and environmental requirements only. No warranty or guarantee is expressed or implied regarding the accuracy of these data or the results to be obtained from the use of the product.

MSDS Material Safety Data Sheet

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

Mallinckrodt CHEMICALS

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

National Response in Canada
CANUTEC: 613-996-6666

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

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

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

DIOCTYLPHTHALATE

1. Product Identification

Synonyms: Di-(2-ethylhexyl)phthalate; DEHP; bis(2-ethylhexyl)phthalate; DOP; 1,2-Benzenedicarboxylic acid, bis(2-ethylhexyl)ester; Di-sec-octyl phthalate
CAS No.: 117-81-7
Molecular Weight: 390.56
Chemical Formula: C24H38O4
Product Codes: H187

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Di-sec-octyl Phthalate	117-81-7	100%	Yes

3. Hazards Identification

Emergency Overview

WARNING! HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS THE CENTRAL NERVOUS SYSTEM, LIVER, REPRODUCTIVE SYSTEM, AND GASTROINTESTINAL TRACT. POSSIBLE CANCER HAZARD. MAY CAUSE CANCER BASED ON ANIMAL DATA. Risk of cancer depends on duration and level of exposure. MAY CAUSE ADVERSE REPRODUCTIVE EFFECTS.

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

Health Rating: 2 - Moderate (Cancer)
Flammability Rating: 1 - Slight
Reactivity Rating: 1 - Slight
Contact Rating: 2 - Moderate
Lab Protective Equip: GOGGLES; LAB COAT; VENT HOOD; PROPER GLOVES
Storage Color Code: Green (General Storage)

Potential Health Effects

Inhalation:
The low vapor pressure of this material essentially eliminates inhalation hazards unless the material is heated or misted. Inhalation of mists can cause nausea and is irritating to the respiratory tract.
Ingestion:
Ingestion causes nausea, abdominal cramps, diarrhea. CNS depression - lethargy, drowsiness, staggering and sleepiness - can result from absorbing large amounts.
Skin Contact:
Slight skin irritation may occur from prolonged skin contact. Low levels may be absorbed through the skin.
Eye Contact:
Causes irritation, redness, and pain.
Chronic Exposure:
Material is a suspected carcinogen and a suspected teratogen.
Aggravation of Pre-existing Conditions:
No information found.

4. First Aid Measures

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

5. Fire Fighting Measures

Fire:
Flash point: 215C (419F) OC
Autoignition temperature: 390C (734F)
Flammable limits in air % by volume:
lel: 0.3

Slight fire hazard.
Explosion:
Above the flash point, explosive vapor-air mixtures may be formed.
Fire Extinguishing Media:
Water spray, dry chemical, alcohol foam, or carbon dioxide.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

6. Accidental Release Measures

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

7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Wear special protective equipment (Sec. 8) for maintenance break-in or where exposures may exceed established exposure levels. Wash hands, face, forearms and neck when exiting restricted areas. Shower, dispose of outer clothing, change to clean garments at the end of the day. Avoid cross-contamination of street clothes. Wash hands before eating and do not eat, drink, or smoke in workplace. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
- OSHA Permissible Exposure Limit (PEL):
5 mg/m3 (TWA).
- ACGIH Threshold Limit Value (TLV):
5 mg/m3 (TWA); A3 - animal carcinogen.
Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.
Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded and engineering controls are not feasible, a full facepiece particulate respirator (with NIOSH type P100 or R100 filters) may be worn for up to 50 times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. Please note that N series filters are not recommended for this material. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. WARNING: Air-purifying respirators do not protect workers in oxygen-deficient

atmospheres. Where respirators are required, you must have a written program covering the basic requirements in the OSHA respirator standard. These include training, fit testing, medical approval, cleaning, maintenance, cartridge change schedules, etc. See 29CFR1910.134 for details.

Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection:
Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:
Clear oily liquid.

Odor:
Slightly amine to odorless.

Solubility:
Insoluble in water.

Specific Gravity:
0.9861 @ 20C/20C

pH:
No information found.

% Volatiles by volume @ 21C (70F):
No information found.

Boiling Point:
230C (446F)

Melting Point:
-50C (-58F)

Vapor Density (Air=1):
16

Vapor Pressure (mm Hg):
1.32 @ 200C (392F)

Evaporation Rate (BuAc=1):
No information found.

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage.

Hazardous Decomposition Products:
Carbon dioxide and carbon monoxide may form when heated to decomposition.

Hazardous Polymerization:
Will not occur.

Incompatibilities:
Nitrates, strong oxidizers, acids and alkalis.

Conditions to Avoid:
Heat, flames, ignition sources and incompatibles.

11. Toxicological Information

Oral rat LD50: 30 g/kg; Skin rabbit LD50: 25 g/kg. Irritation Data (rabbit, std Draize, 500mg/24H): Skin, mild; Eye, mild. Investigated as a tumorigen, mutagen, reproductive effector.

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

Ingredient	---NTP Carcinogen--- Known	Anticipated	IARC Category
Di-sec-octyl Phthalate (117-81-7)	No	Yes	3

12. Ecological Information

Environmental Fate:
When released into water, this material may biodegrade to a moderate extent. This material may bioaccumulate to some extent. When released into the air, this material may be removed from the atmosphere to a moderate extent by wet deposition.
Environmental Toxicity:
The LC50/96-hour values for fish are over 100 mg/l.

13. Disposal Considerations

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

14. Transport Information

Not regulated.

15. Regulatory Information

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

Ingredient	TSCA	EC	Japan	Australia
Di-sec-octyl Phthalate (117-81-7)	Yes	Yes	Yes	Yes

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

Ingredient	Korea	--Canada-- DSL	NDSL	Phil.
Di-sec-octyl Phthalate (117-81-7)	Yes	Yes	No	Yes

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

Ingredient	-SARA 302- RQ	TPQ	------SARA 313------ List	Chemical Catg.
Di-sec-octyl Phthalate (117-81-7)	No	No	Yes	No

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

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
Di-sec-octyl Phthalate (117-81-7)	100	U028	No

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

WARNING:
THIS PRODUCT CONTAINS A CHEMICAL(S) KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER.

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

16. Other Information

NFPA Ratings: Health: **1** Flammability: **1** Reactivity: **0**
Label Hazard Warning:
WARNING! HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS THE CENTRAL NERVOUS SYSTEM, LIVER, REPRODUCTIVE SYSTEM, AND GASTROINTESTINAL TRACT. POSSIBLE CANCER HAZARD. MAY CAUSE CANCER BASED ON ANIMAL DATA. Risk of cancer depends on duration and level of exposure. MAY CAUSE ADVERSE REPRODUCTIVE EFFECTS.
Label Precautions:
Do not get in eyes, on skin, or on clothing.
Do not breathe mist.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.
Label First Aid:
If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. In all cases, get medical attention.
Product Use:
Laboratory Reagent.
Revision Information:
MSDS Section(s) changed since last revision of document include: 3.
Disclaimer:
****

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

Scott Specialty Gases

Material Safety Data Sheets

MSDS No: 75-27-4
Date: 03/09/2001

SUPPLIER ADDRESS: 6141 Easton Road, Bldg. 1
PO Box 310
Plumsteadville, PA 18949-0310

EMERGENCY PHONE NUMBER: (215) 766-8861

1. CHEMICAL PRODUCT

PRODUCT NAME: BROMODICHLOROMETHANE

SYNONYMS: Methane-bromodichloro, BDCM, Monobromodicloromethane.

2. COMPOSITION, INFORMATION ON INGREDIENTS

				Exposure Limits (PPM)			
Ingredient Name	Formula	CAS #	Concentration	ACGIH TLV	OSHA PEL	MAC	Other STEL
BROMODICHLOROMETHANE	CHBRCL2	75-27-4	99+%	NE	NE	NE	NE

Note: NE = NONE ESTABLISHED S/A = SIMPLE ASPHYXIANT

3. HAZARD INDENTIFICATION

* * * EMERGENCY OVERVIEW * * *
Nonflammable liquid and vapor.
May cause irritation to eyes, skin, and mucous membranes.
May cause respiratory tract and central nervous system depression.

POTENTIAL HEALTH EFFECTS

ROUTES OF ENTRY: Inhalation , Skin

ACUTE EFFECTS: Inhalation can cause irritation to the eyes, mucous membranes, and respiratory tract. Can be absorbed through the skin. This material is narcotic in high concentrations. Prolonged exposure can cause nausea, dizziness and headaches. Acts as a central nervous system depressant.

CHRONIC EFFECTS: None known Suspected human carcinogen.

MEDICAL CONDITIONS AGGRAVATED BY OVEREXPOSURE: None known

OTHER EFFECTS OF OVEREXPORSURE: None

CARCINOGENICITY (US ONLY):

NTP - Yes
IARC MONOGRAPHS - Yes
OSHA REGULATED - No

4. FIRST AID MEASURES

INHALATION: Immediately remove victim to fresh air. If breathing is difficult, give oxygen. If breathing has stopped, give artificial respiration.

EYE CONTACT: Do not allow victim to rub or keep eyes tightly shut. Immediately flush eyes, including under the eyelids, gently but thoroughly with plenty of running water for at least 15 minutes.

SKIN CONTACT: Immediately remove contaminated clothing. Rinse the affected area with flooding amounts of water and then wash it with soap and water.

INGESTION: Never give anything by mouth to an unconscious person. Contact a poison control center. Unless the poison control center advises otherwise, have the conscious and alert person drink 1 to 2 glasses of water to dilute.

IN EVENT OF EXPOSURE, CONSULT A PHYSICIAN

NOTE TO PHYSICIAN: None

5. FIRE FIGHTING MEASURES

FLASH POINT: Nonflammable

AUTOIGNITION TEMPERATURE: N/Ap

FLAMMABLE LIMITS: Nonflammable

LOWER:
UPPER:

EXTINGUISHING MEDIA: Use what is appropriate for surrounding fire.

SPECIAL FIRE FIGHTING INSTRUCTION AND EQUIPMENT: Wear self-contained breathing apparatus and full protective clothing. Keep fire exposed cylinders cool with water spray.

HAZARDOUS COMBUSTION PRODUCTS: Toxic carbon monoxide, chlorine, phosgene, and bromine gases.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Emits toxic fumes under fire conditions.

6. ACCIDENTAL RELEASE MEASURES

CLEAN UP PROCEDURES: Evacuate and ventilate area. Absorb with sand or vermiculite and place in closed containers for disposal.

SPECIALIZED EQUIPMENT: None

7. HANDLING AND STORAGE

PRECAUTIONS TO BE TAKEN IN HANDLING: Secure cylinder when using to protect from falling. Use suitable hand truck to move cylinders.

PRECAUTIONS TO BE TAKEN IN STORAGE: Store in well ventilated areas. Keep valve protection cap on cylinders when not in use.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS: Provide adequate general and local exhaust ventilation.

EYE / FACE PROTECTION: Goggles. A safety shower and eyewash station should be readily available.

SKIN PROTECTION: Protective gloves. Wear suitable protective clothing.

RESPIRATORY PROTECTION: Use a self-contained breathing apparatus in case of emergency or non-routine use.

OTHER PROTECTIVE EQUIPMENT: Safety shoes when handling cylinders.

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE: Colorless

ODOR: Unknown.

PHYSICAL PRESSURE: Liquid

VAPOR PRESSURE: @20 deg. C: 50 mmHg

VAPOR DENSITY (AIR=1): N/Av

BOILING POINT (C): 90.6

SOLUBILITY IN WATER: 4,500 mg/L

SPECIFIC GRAVITY (H2O=1): @20 deg. C: 1.980

EVAPORATION RATE: N/Av

ODOR THRESHOLD: 1680 mg/m3

10. STABILITY AND REACTIVITY

STABILITY: Stable under normal storage conditions.

CONDITIONS TO AVOID: Storage near a heat source.

MATERIALS TO AVOID: Bases. Oxidizing agents. Magnesium.

HAZARDOUS POLYMERIZATION: Will not occur.

HAZARDOUS DECOMPOSITION: Fumes of carbon monoxide, hydrogen chloride gas and hydrogen bromide gas.

11. TOXICOLOGICAL INFORMATION

LETHAL CONCENTRATION (LC50): NONE ESTABLISHED

LETHAL DOSE 50 (LD50): N/Ap

TERATOGENICITY: N/Ap

REPRODUCTIVE EFFECTS: N/Ap

MUTAGENICITY: N/Ap

12. ECOLOGICAL INFORMATION

No adverse ecological effects are expected.

13. DISPOSAL CONSIDERATIONS

WASTE DISPOSAL METHOD: Return cylinders to supplier with any valve outlet plugs or caps secured and valve protection cap in place. Follow federal, state and local regulations. Non-returnable cylinders must not be refilled. Dispose of non-refillable cylinders in accordance with federal, state, and local regulations.

14. TRANSPORT INFORMATION

CONCENTRATION: 99+%

DOT DESCRIPTION (US ONLY):

PROPER SHIPPING NAME: Environmentally hazardous substances, liquid, n.o.s.
HAZARD CLASS: 9, Packing group III.
INDENTIFICATION NUMBER: UN3082
REPORTABLE QUANTITIES: None
LABELING: CLASS 9

ADR / RID (EU Only): N/Av

SPECIAL PRECAUTIONS: Cylinders should be transported in a secure upright position in a well ventilated truck.

15. REGULATORY INFORMATION

OSHA: Process Safety Management: Material is not listed in appendix A of 29 CFR 1910.119 as highly hazardous chemical.

TSCA: Material is listed in TSCA inventory.

SARA: The threshold planning quantity for material is 10,000 lbs.

EU NUMBER: 200-856-7

NUMBER IN ANNEX 1 OF DIR 67/548: Not listed in annex 1.

EU CLASSIFICATION: N/Av

R: 45,46,20/21/22,36/37/38

S: 45,26,28,27,36/37/39

16. OTHER INFORMATION

OTHER PRECAUTIONS: Protect containers from physical damage. *Do not deface cylinders or labels.* Cylinders should be refilled by qualified producers of compressed gas. Shipment of a compressed gas cylinder which has not been filled by the owner or with his written consent is a violation of federal law (49 CFR).

ABBREVIATIONS: N/Ap - Not Applicable N/Av - Not Available SA - Simple Asphyxiant NE - None Established

DISCLAIMER: Information included in this document is given to the best of our knowledge, however, no warranty is made that the information is accurate or complete. We do not accept any responsibility for damages by the use of the document.

MATERIAL SAFETY DATA SHEET

ALDON CORPORATION
221 Rochester Street
Avon, New York 14414-9409
(585) 226-6177

MSDS No.: BB0203
Effective Date: May 19, 2005

SECTION I NAME

24 HOUR EMERGENCY ASSISTANCE

CHEMTREC 800-424-9300
Day 585-226-6177

Product	Bromoform
Chemical Synonyms	Tribromethane
Formula	$CHBr_3$
Unit Size	up to 20 Lt.
C.A.S. No.	75-25-2

NFPA

Health	3
Fire	0
Reactivity	1

HMIS *

HAZARD RATING

MINIMAL	SLIGHT	MODERATE	SERIOUS	SEVERE
0	1	2	3	4

SECTION II INGREDIENTS OF MIXTURES

Principal Component(s)	%	TLV Units
Bromoform: (CAS No. 75-25-2)	96%	TWA: 0.5 ppm, 5 mg/m^3
Ethyl alcohol: (CAS No. 64-17-5)	4%	TWA: 1000 ppm, 1900mg/m^3
WARNING! LACHRYMATOR. TOXIC. HARMFUL IF		
SWALLOWED, INHALED OR ABSORBED THROUGH SKIN.		

SECTION III PHYSICAL DATA

Melting Point (°F)	8°C (46°F)	Specific Gravity (H_2O = 1)	2.889 @ 20°/4°C
Boiling Point (°F)	150°C (302°F)	Percent Volatile by Volume (%)	100%
Vapor Pressure (mm Hg)	4.4 mm Hg @ 20°C	Evaporation Rate (Ether =1)	N/A
Vapor Density (Air=1)	8.7		
Solubility In Water	0.1%		
Appearance & Odor	Colorless to yellow liquid; chloroform-like odor.		

SECTION IV FIRE AND EXPLOSION HAZARD DATA

			Lower	Upper
Flash Point (Method Used)	Non-combustible.	Flammable Limits in Air % by Volume N/A		
Extinguisher Media	Use dry chemical, carbon dioxide, water spray, fog, regular foam.			

SPECIAL FIREFIGHTING PROCEDURES

In fire conditions, wear a NIOSH/MSHA-approved, self-contained breathing apparatus and protective clothing to prevent contact with skin and eyes.

(1996 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.7, GUIDE PAGE NO. 159)

UNUSUAL FIRE AND EXPLOSION HAZARDS

When heated to decomposition may release *irritating vapors*. Vapors may be heavier than air. They can spread along the ground and collect in low or confined areas. Contact with metals may evolve flammable hydrogen gas. Containers may explode when heated.

D.O.T. Bromoform, 6.1, UN2515, PG III

Approved by U.S. Department of Labor "essentially similar" to form OSHA-20

SECTION V HEALTH HAZARD DATA

Threshold Limited Value ACGIH (2001): TWA 0.5 ppm, 5 mg/m^3

Effects of Overexposure INGESTION/INHALATION: Prolonged exposure to high vapor concentrations or repeated exposures to low vapor concentrations causes CNS depression and may result in liver or kidney injury and possibly cardiac sensitization. May cause headache, nausea, vomiting, dizziness, drowsiness, irritation of respiratory tract, and loss of consciousness. EYES: Contact with eyes causes irritation, conjunctivitis and may be painful. SKIN: Prolonged or repeated contact causes defatting and cracking of the skin. Target organs: Kidneys, central nervous system, liver.

Emergency and First Aid Procedures INGESTION: Call physician or Poison Control Center immediately. Induce vomiting only if advised by appropriate medical personnel. Never give anything by mouth to an unconscious person. EYES: Check for and remove contact lenses. Flush thoroughly with water for at least 15 minutes, lifting upper and lower eyelids occasionally. Get immediate medical attention. SKIN: Remove contaminated clothing. Flush thoroughly with mild soap and water. If irritation occurs, get medical attention. INHALATION: Remove to fresh air. If not breathing, give *artificial respiration*. *If breathing* is difficult, give oxygen. Get medical attention.

SECTION VI REACTIVITY DATA

Stability			Conditions to Avoid
	Unstable		Open flame and excessive temperature.
	Stable	X	

Incompatibility (Materials to Avoid) Oxidizers, bases, metals and acids.

Hazardous Decomposition Products Thermal decomposition may include toxic and corrosive fumes of bromides and oxides of carbon.

Hazardous Polymerization		Conditions to Avoid
May Occur	Will Not Occur	Not applicable.
	X	

SECTION VII SPILL OR LEAK PROCEDURES

Steps to be taken in case material is released or spilled Provide adequate ventilation. Wear suitable protective clothing, absorb spilled material on vermiculite, sand, ground. Place in a suitable chemical waste container. Wash spill area well with soap and water.

Waste Disposal Method Discharge, treatment, or disposal may be subject to Federal, State or Local laws. These disposal guidelines are intended for the disposal of catalog-size quantities only.

Dispose of in accordance with Federal, state and local regulations.

SECTION VIII SPECIAL PROTECTION INFORMATION

Respiration Protection (Specify Type) Work in fume hood. If needed wear a NIOSH/MSHA-approved respirator.

Ventilation				
Local Exhaust	Recommended.	Special	No.	
Mechanical (General)	Recommended.	Other	No.	

Protective Gloves Rubber. **Eye Protection** Chemical safety goggles.

Other Protective Equipment Faceshield, lab coat and apron, vented hood, proper gloves, eye wash station.

SECTION IX SPECIAL PRECAUTIONS

Precautions to be Taken in Handling & Storing Store in a cool place, protect from light. Do not store in metal containers. Wash thoroughly after handling.

Keep container tightly closed when not in use.

Other Precautions Read label on container before using. Do not wear contact lenses when working with chemicals. For laboratory use only. Not for drug, food or household use. Keep out of reach of children.

Avoid breathing vapor. Use with adequate ventilation. Avoid contact with eyes, skin, clothing. Remove and wash contaminated clothing.

Revision No. 4	Date 05/19/05	Approved Michael Raszeja	Chemical Safety Coordinator MR

The information contained herein is furnished without warranty of any kind. Employers should use this information only as a supplement to other information gathered by them and must make independent determinations of suitability and completeness of information from all sources to assure proper use of these materials and the safety and health of employees. * Hazardous Materials Industrial Standards. Printed on recycled paper.

BOC GASES

MATERIAL SAFETY DATA SHEET

PRODUCT NAME: CARBON TETRACHLORIDE

1. Product and Company Identification

BOC Gases,
Division of,
The BOC Group, Inc.
575 Mountain Avenue
Murray Hill, NJ 07974

TELEPHONE NUMBER: (908) 464-8100
24-HOUR EMERGENCY TELEPHONE NUMBER:
CHEMTREC (800) 424-9300

BOC Gases
Division of
BOC Canada Limited
5975 Falbourne Street, Unit 2
Mississauga, Ontario L5R 3W6

TELEPHONE NUMBER: (905) 501-1700
24-HOUR EMERGENCY TELEPHONE NUMBER:
(905) 501-0802
EMERGENCY RESPONSE PLAN NO: 2-0101

PRODUCT NAME: CARBON TETRACHLORIDE
CHEMICAL NAME: Carbon Tetrachloride
COMMON NAMES/SYNONYMS: Carbon Chloride, Carbon Tet, Halon 1040, R 10
TDG (Canada) CLASSIFICATION: 6.1 (9.2)
WHMIS CLASSIFICATION: D1A, D2A, D2B

PREPARED BY: Loss Control (908)464-8100/(905)501-1700
PREPARATION DATE: 6/1/95
REVIEW DATES: 11/12/03

2. Composition, Information on Ingredients

EXPOSURE LIMITS[1]:

INGREDIENT	% VOLUME	PEL-OSHA[2]	TLV-ACGIH[3]	LD_{50} or LC_{50} Route/Species
Carbon Tetrachloride FORMULA: CCl_4 CAS: 56-23-5 RTECS #: FG4900000	100.0	10 ppm TWA 25 ppm Ceiling 200 ppm (max. 5 min. peak above C in any 4 H)	5 ppm TWA 10 ppm STEL Skin	LD_{50}: 2350 mg/kg Ingestion/rat

[1] Refer to individual state or provincial regulations, as applicable, for limits which may be more stringent than those listed here.
[2] As stated in 29 CFR 1910, Subpart Z (revised July 1, 1993)
[3] As stated in the ACGIH 2003 Threshold Limit Values for Chemical Substances and Physical Agents.

OSHA Regulatory Status: This material is classified as hazardous under OSHA regulations.

3. Hazards Identification

EMERGENCY OVERVIEW

Colorless nonflammable poison liquid with strong ethereal odor. Inhalation of high concentrations can have a narcotic effect. Toxic if inhaled, ingested, or absorbed through the skin. Carbon tetrachloride primarily affects the liver and kidneys, but toxic effects in the lungs, and other tissues have been reported. Overexposure can increase the risks of developing cancer. Nonflammable. Decomposes into highly toxic phosgene and hydrogen chloride under fire conditions.

ROUTE OF ENTRY:

Skin Contact	Skin Absorption	Eye Contact	Inhalation	Ingestion
Yes	Yes	Yes	Yes	Yes

HEALTH EFFECTS:

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

Carcinogenicity: -- NTP: Yes IARC: Yes OSHA: No*

*Although OSHA has not promulgated a specific standard for carbon tetrachloride, carbon tetrachloride should be treated as a probable carcinogen for Hazard Communication Purposes (29 CFR 1910.1200 Appendix A (1) (a, b).

EYE EFFECTS: Contact with product may cause mild irritation.

SKIN EFFECTS: Contact with product could cause mild irritation. Prolonged contact may cause defatting of the skin and dermatitis. Can be absorbed through the skin in toxic amounts.

INGESTION EFFECTS: Ingestion effects are similar to effects from inhalation.

INHALATION EFFECTS: High concentrations of carbon tetrachloride may act as a narcotic causing headache, dizziness, drowsiness, and unconsciousness. Moderate concentrations have caused liver and kidney failure. Damage to the kidneys, liver, and lungs may follow recovery from narcotic effects. Workers that have consumed alcoholic beverages may be more susceptible to effects.

Chronic exposures may cause liver and kidney damage. Long term exposures may also increase the risk of developing liver cancer and possibly other forms of cancer.

Acute and chronic exposure may cause a variety of symptoms including nausea, anorexia, vomiting, diarrhea, jaundice, enlarged liver, renal failure, blurred vision, bleeding, dizziness, convulsions, unconsciousness, coma and death.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: May aggravate pre-existing skin, liver, CNS, and kidney conditions.

POTENTIAL ENVIRONMENTAL EFFECTS: A 96-hour LC_{50} in the blugill has been reported as 27 mg/l/. The 96-hour LC50 in the fathead minnow (*Pimephales promelas)* was reported as 41.4 mg/L.

4. First Aid Measures

EYES: Flush eyes immediately with lukewarm water for at least 15 minutes. If irritation persists, seek medical attention.

SKIN: Remove contaminated clothing and flush affected areas with water. Seek medical attention.

INGESTION: CALL LOCAL POISON CONTROL CENTER. If conscious, induce vomiting and continue until vomit is clear. A physician should see the patient promptly.

INHALATION: PROMPT MEDICAL ATTENTION IS MANDATORY IN ALL CASES OF OVEREXPOSURE. RESCUE PERSONNEL SHOULD BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS. Conscious persons should be assisted to an uncontaminated area and inhale fresh air. Quick removal from the contaminated area is most important. Unconscious persons should be moved to an uncontaminated area and given artificial resuscitation and supplemental oxygen. Medical assistance should be sought immediately. Further treatment should be symptomatic and supportive.

5. Fire Fighting Measures

Conditions of Flammability: Nonflammable		
Flash point: None	Method: Not Applicable	Autoignition Temperature: None
LEL(%): None	UEL(%): None	
Hazardous combustion products: hydrochloric acid, phosgene		
Sensitivity to *mechanical shock: None*		
Sensitivity to static discharge: None		

FIRE AND EXPLOSION HAZARDS: Decomposes under fire conditions into phosgene and hydrogen chloride. Container may vent rapidly or rupture violently from pressure under fire conditions.

EXTINGUISHING MEDIA: None required. Use media appropriate for surrounding materials.

FIRE FIGHTING INSTRUCTIONS: Fire fighters should use self-contained breathing apparatus and full turnout gear with additional protective clothing for toxic decomposition products as necessary to prevent exposure. Use water spray to cool containers to prevent rupture. Continue to cool containers until well after flames are extinguished.

6. Accidental Release Measures

Evacuate all personnel from affected area. Use appropriate protective equipment (See Section 8). Stop the flow of gas or remove cylinder to outdoor location if this can be done without risk. Ventilate enclosed areas. Prevent spilled material from coming in contact with heat and open flames. If leak is in user's equipment, be certain to purge piping with inert gas prior to attempting repairs. If leak is in container or container valve, contact the appropriate emergency telephone number listed in Section 1 or call your closest BOC location.

7. Handling and Storage

Store drums and cylinders upright in cool, dry, well-ventilated area of non-combustible construction away from heavily trafficked areas and emergency exits.

Use only in areas equipped with appropriate ventilation systems. Keep container tightly closed when not in use. Protect full and empty drums from physical damage and heat. Do not weld on or near full or empty containers. Do not re-use empty containers. Empty containers contain product residue, recycle and dispose of accordingly. Segregate full and empty drums. Use a "first in-first out" inventory system to prevent product from being stored for excessive periods of time. Do not drag, slide, or roll drums. Use a suitable hand truck, drum truck or other appropriate equipment. Avoid eye contact. Prevent skin contact.

Do not eat, drink, smoke, or apply cosmetics in areas where this product is used or stored. Do not store cigarettes, food or other personal items in storage and use areas. Wash hands and face thoroughly after handling and before meals and breaks. Change contaminated clothing promptly. Segregate contaminated clothing and launder appropriately. Shower at the end of the work shift.

Do not carry this product in an enclosed space such as a car trunk, van or station wagon. A leak can result in a toxic exposure.

8. Exposure Controls, Personal Protection

ENGINEERING CONTROLS: Use enclosures and local exhaust ventilation as necessary to limit exposure below the acceptable exposure limits. Exhaust vapors should be vented to a vapor treatment system.

EYE/FACE PROTECTION: Safety goggles or glasses

SKIN PROTECTION: Appropriate protective and chemical-resistant gloves, clothing and splash protection, or fully encapsulating vapor protective clothing to prevent exposure. For materials of construction, consult protective clothing manufacture's specific data. (Polyvinyl-alcohol and Viton™ are generally effective for > 8 H exposures).

RESPIRATORY PROTECTION: For emergency release and conditions with exposures above the applicable exposure limits use a positive pressure NIOSH approved air-supplying respirator systems (SCBA or airline/escape bottle) using a full-face mask and at a minimum Grade D air.

OTHER/GENERAL PROTECTION: Safety shoes, safety shower, eyewash "fountain."

9. Physical and Chemical Properties

PARAMETER	VALUE	UNITS
Physical state (gas, liquid, solid)	: Liquid	
Vapor pressure at at 70 °F	: 98	mmHg
Vapor density (Air = 1)	: 5.5	
Evaporation point	: Not Available	
Boiling point	: 170	°F
	: 76.5	°C
Freezing point	: -9.4	°F
	: -23	°C
PH	: Not Available	
Specific gravity	: Not Available	
Oil/water partition coefficient	: Not Available	
Solubility (H_20)	: Insoluble (0.08%)	
Odor threshold	: Not Available	
Odor and appearance	: Colorless liquid with strong ethereal odor.	

10. Stability and Reactivity

STABILITY: Stable.

INCOMPATIBLE MATERIALS/CONDITIONS: Reacts explosively with alkali metals and chlorine. Incompatible with zinc and aluminum. Decomposes in open flame or at high temperatures.

HAZARDOUS DECOMPOSITION PRODUCTS: Hydrogen chloride, phosgene.

HAZARDOUS POLYMERIZATION: Will not occur.

11. Toxicological Information

INHALATION: A 4-6 hour LC_{50} of 7300 has been reported for rats and an 8 hour LC_{50} of 9526 ppm has been reported for mice. Toxic effects in the kidney, lung, CNS, reproductive organs, skin, liver, and developing fetus have been reported following acute exposure; however, the liver is most susceptible to damage from exposure to carbon tetrachloride.

SKIN AND EYE: Contact with the skin and eyes may cause irritation. The dermal LD_{50} for carbon tetrachloride is 15,000 mg/kg for guinea pigs.

OTHER: Carbon tetrachloride is listed as a possible human carcinogen (Group 2B) by IARC and by NTP as a substance "reasonably anticipated to be carcinogenic".

Carbon tetrachloride has induced embryotoxic and embryolethal effects at maternally toixc doses. It is not considered to be a teratogen and does not appear to be genotoxic.

Degenerative changes to liver following chronic inhalation exposure in multiple animal studies with mammalian species including rats, mice, rabbits, guinea pigs, dogs and monkeys. Toxic effects to the lungs, immune system and bladder have also been reported in animal studies with mammalian species.

12. Ecological Information

Carbon tetrachloride is a Class I (Group IV) ozone depleting substance. See Section 3 for ecotoxicity information. A measured BCF of 3.2-7.4 indicates the potential for bioconcentration in aquatic organisms is low. Carbon tetrachloride is a CERCLA hazardous substance with a reportable quantity (RQ) of 10 pounds.

13. Disposal Considerations

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

14. Transport Information

PARAMETER	United States DOT	Canada TDG
PROPER SHIPPING NAME:	Carbon Tetrachloride	Carbon Tetrachloride
HAZARD CLASS:	6.1	6.1 (9.2)
IDENTIFICATION NUMBER:	UN 1846	UN 1846
SHIPPING LABEL:	POISON	POISON

PG: II

Additional Marking Requirement: If net weight of product ≥ 10 pounds, the container must be also marked with the letters "RQ".

Additional Shipping Paper Description Requirement: If net weight of product ≥ 10 pounds, the shipping papers must be also marked with the letters "RQ".

15. Regulatory Information

SARA TITLE III NOTIFICATIONS AND INFORMATION
SARA TITLE III - HAZARD CLASSES:
Acute Health Hazard
Chronic Health Hazard

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

CAS NUMBER	INGREDIENT NAME	PERCENT BY VOLUME
56-23-5	CARBON TETRACHLORIDE	100.0

This information must be included on all MSDSs that are copied and distributed for this material.

U.S. TSCA/Canadian DSL: All ingredients are listed on the U.S. Toxic Substances Control Act (TSCA) inventory or exempt from listing and on the Canadian Domestic Substance List (DSL).

California Proposition 65: This product contains ingredient(s) known to the State of California to cause cancer or reproductive toxicity.

Canadian Controlled Products Regulations (CPR): This product has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR.

16. Other Information

NFPA HAZARD CODES		HMIS HAZARD CODES		RATINGS SYSTEM
Health:	3	Health:	3	0 = No Hazard
Flammability:	0	Flammability:	0	1 = Slight Hazard
Instability:	0	Reactivity:	0	2 = Moderate Hazard
				3 = Serious Hazard
				4 = Severe Hazard

Note: The Reactivity Hazard Rating is based on the 2nd Edition of the National Paint and Coatings Association's (NPCA's) Hazardous Materials Identification System (HMIS®). Hazard ratings were based on the best available information at the time of the review. Ratings will be re-assigned in accordance with Compressed Gas Association (CGA) guidelines as published in the future edition of CGA Pamphlet P-19.

ACGIH	American Conference of Governmental Industrial Hygienists
DOT	Department of Transportation
IARC	International Agency for Research on Cancer
NTP	National Toxicology Program
OSHA	Occupational Safety and Health Administration
PEL	Permissible Exposure Limit
SARA	Superfund Amendments and Reauthorization Act
STEL	Short Term Exposure Limit
TDG	Transportation of Dangerous Goods
TLV	Threshold Limit Value
WHMIS	Workplace Hazardous Materials Information System

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

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

MATERIAL SAFETY DATA SHEET

Date Printed: 08/14/2006
Date Updated: 05/19/2006
Version 1.15

Section 1 - Product and Company Information

Product Name	CHLOROFORM, >=99.9%, PRA GRADE
Product Number	324019
Brand	ALDRICH
Company	Sigma-Aldrich
Address	3050 Spruce Street SAINT LOUIS MO 63103 US
Technical Phone:	800-325-5832
Fax:	800-325-5052
Emergency Phone:	314-776-6555

Section 2 - Composition/Information on Ingredient

Substance Name	CAS #	SARA 313
CHLOROFORM	67-66-3	Yes

Formula: CHCl3

Synonyms: Chloroform (ACGIH:OSHA) * Chloroforme (French) * Cloroformio (Italian) * Formyl trichloride * Methane trichloride * Methane, trichloro- * Methenyl trichloride * Methyl trichloride * NCI-C02686 * R 20 (Refrigerant) * RCRA waste number U044 * Trichloormethaan (Dutch) * Trichlormethan (Czech) * Trichloroform * Trichloromethane (OSHA) * Triclorometano (Italian)

RTECS Number: *FS9100000*

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Harmful.

Harmful if swallowed. Irritating to eyes and skin. Limited evidence of a carcinogenic effect. Harmful: danger of serious damage to health by prolonged exposure through inhalation and if swallowed.

Probable Carcinogen (US). Target organ(s): Liver. Cardiovascular system. Calif. Prop. 65 carcinogen.

HMIS RATING

HEALTH: 2*
FLAMMABILITY: 0
REACTIVITY: 1

NFPA RATING

HEALTH: 2
FLAMMABILITY: 0
REACTIVITY: 1

*additional chronic hazards present.

For additional information on toxicity, please refer to Section 11.

Section 4 - First Aid Measures

ORAL EXPOSURE
If swallowed, wash out mouth with water provided person is conscious. Call a physician.

INHALATION EXPOSURE
If inhaled, remove to fresh air. If breathing becomes difficult, call a physician.

DERMAL EXPOSURE
In case of contact, immediately wash skin with soap and copious amounts of water.

EYE EXPOSURE
In case of contact with eyes, flush with copious amounts of water for at least 15 minutes. Assure adequate flushing by separating the eyelids with fingers. Call a physician.

INFORMATION FOR PHYSICIAN
Contamination of the eyes should be treated by immediate and prolonged irrigation with copious amounts of water.

Section 5 - Fire Fighting Measures

AUTOIGNITION TEMP
N/A

FLAMMABILITY
N/A

EXTINGUISHING MEDIA
Suitable: Noncombustible. Use extinguishing media appropriate to surrounding fire conditions.

FIREFIGHTING
Protective Equipment: Wear self-contained breathing apparatus and protective clothing to prevent contact with skin and eyes.
Specific Hazard(s): Emits toxic fumes under fire conditions.

Section 6 - Accidental Release Measures

PROCEDURE TO BE FOLLOWED IN CASE OF LEAK OR SPILL
Evacuate area.

PROCEDURE(S) OF PERSONAL PRECAUTION(S)
Wear self-contained breathing apparatus, rubber boots, and heavy rubber gloves. Wear disposable coveralls and discard them after use.

METHODS FOR CLEANING UP
Absorb on sand or vermiculite and place in closed containers for disposal. Ventilate area and wash spill site after material pickup is complete.

Section 7 - Handling and Storage

HANDLING
User Exposure: Do not breathe vapor. Do not get in eyes, on skin, on clothing. Avoid prolonged or repeated exposure.

STORAGE
Suitable: Keep tightly closed.

Section 8 - Exposure Controls / PPE

ENGINEERING CONTROLS
Use only in a chemical fume hood. Safety shower and eye bath.

PERSONAL PROTECTIVE EQUIPMENT
Respiratory: Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU). Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator.
Hand: Compatible chemical-resistant gloves.
Eye: Chemical safety goggles.

GENERAL HYGIENE MEASURES
Wash contaminated clothing before reuse. Wash thoroughly after handling.

EXPOSURE LIMITS, RTECS

Country	Source	Type	Value
USA	ACGIH	TWA	10 PPM
USA	MSHA Standard	Ceiling co	50 PPM (240 MG/M3)
USA	OSHA.	PEL	CL 50 PPM (240 MG/M3)
New Zealand	OEL		
Remarks: check ACGIH TLV			
USA	NIOSH	STEL	2 PPM/60M

EXPOSURE LIMITS

Country	Source	Type	Value
Poland		NDS	8
Poland		NDSCh	-
Poland		NDSP	-

Section 9 - Physical/Chemical Properties

Appearance	Physical State: Liquid Color: Colorless Form: Clear liquid

Property	Value	At Temperature or Pressure
Molecular Weight	119.38 AMU	
pH	N/A	
BP/BP Range	61 °C	
MP/MP Range	- 63.0 °C	
Freezing Point	N/A	
Vapor Pressure	160 mmHg	20 °C
Vapor Density	4.1 g/l	
Saturated Vapor Conc.	N/A	
SG/Density	1.48 g/cm3	
Bulk Density	N/A	
Odor Threshold	205.0 - 307.0 ppm	
Volatile%	N/A	
VOC Content	N/A	
Water Content	N/A	
Solvent Content	N/A	
Evaporation Rate	N/A	

Viscosity	0.56 Pas	
Surface Tension	27.1 mN/m	20 °C
Partition Coefficient	Log Kow: 1.97	
Decomposition Temp.	N/A	
Explosion Limits	N/A	
Flammability	N/A	
Autoignition Temp	N/A	
Refractive Index	1.445	
Optical Rotation	N/A	
Miscellaneous Data	N/A	
Solubility	Other Solvents: SOLUBLE IN CARBON DISULFIDE BENZENE, CARBON TETRACHLORIDE MISCIBLE WITH ALCOHOL, ET	

N/A = not available

Section 10 - Stability and Reactivity

STABILITY

Stable: Stable.
Conditions of Instability: May decompose on exposure to light.
Materials to Avoid: Strong oxidizing agents, Strong bases, Magnesium, Sodium, Lithium.

HAZARDOUS DECOMPOSITION PRODUCTS

Hazardous Decomposition Products: Carbon monoxide, Carbon dioxide, Phosgene gas, Chlorine.

HAZARDOUS POLYMERIZATION

Hazardous Polymerization: Will not occur

Section 11 - Toxicological Information

ROUTE OF EXPOSURE

Skin Contact: Causes skin irritation.
Skin Absorption: Skin absorption may occur. May be harmful if absorbed through the skin.
Eye Contact: Causes eye irritation.
Inhalation: May be harmful if inhaled. Material may be irritating to mucous membranes and upper respiratory tract.
Ingestion: Harmful if swallowed.

TARGET ORGAN(S) OR SYSTEM(S)

Liver. Blood. Central nervous system. Cardiovascular system. Kidneys.

SIGNS AND SYMPTOMS OF EXPOSURE

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.
Exposure can cause: Vomiting. Gastrointestinal disturbances.
Exposure to and/or consumption of alcohol may increase toxic effects.

CONDITIONS AGGRAVATED BY EXPOSURE

May cause nervous system disturbances.

TOXICITY DATA

Oral
Man
2514 mg/kg
LDLO

Remarks: Behavioral:Muscle contraction or spasticity. Cardiac:Other changes. Kidney, Ureter, Bladder:Changes in tubules (including acute renal failure, acute tubular necrosis).

Inhalation
Human
25,000 ppm
LCLO

Oral
Rat
695 mg/kg
LD50
Remarks: Behavioral:Change in motor activity (specific assay). Behavioral:Ataxia. Lungs, Thorax, or Respiration:Respiratory stimulation.

Inhalation
Rat
47,702 mg/m3
LC50

Intraperitoneal
Rat
894 MG/KG
LD50

Oral
Mouse
36 mg/kg
LD50

Intraperitoneal
Mouse
623 MG/KG
LD50

Subcutaneous
Mouse
704 MG/KG
LD50

Intraperitoneal
Dog
1 GM/KG
LD50
Remarks: Liver:Liver function tests impaired.

Skin
Rabbit
> 20000 mg/kg
LD50

Oral
Guinea pig
820 mg/kg
LD50

IRRITATION DATA

Skin
Rabbit

10 mg
24H
Remarks: Open irritation test

Skin
Rabbit
500 mg
24H
Remarks: Mild irritation effect

Eyes
Rabbit
148 mg

Eyes
Rabbit
20 mg
24H
Remarks: Moderate irritation effect

CHRONIC EXPOSURE - CARCINOGEN
Result: The National Cancer Institute (NCI) has found clear evidence for carcinogenicity. This product is or contains a component that has been reported to be probably carcinogenic based on its IARC, OSHA, ACGIH, NTP, or EPA classification.

Species: Rat
Route of Application: Oral
Dose: 13832 MG/KG
Exposure Time: 2Y
Frequency: C
Result: Tumorigenic:Carcinogenic by RTECS criteria.
Blood:Leukemia

Species: Mouse
Route of Application: Oral
Dose: 127 GM/KG
Exposure Time: 92W
Frequency: I
Result: Tumorigenic:Carcinogenic by RTECS criteria. Liver:Tumors.

Species: Rat
Route of Application: Oral
Dose: 98 GM/KG
Exposure Time: 78W
Frequency: I
Result: Endocrine:Thyroid tumors. Kidney, Ureter, Bladder:Kidney tumors. Tumorigenic:Neoplastic by RTECS criteria.

Species: Mouse
Route of Application: Oral
Dose: 18 GM/KG
Exposure Time: 17W
Frequency: I
Result: Tumorigenic:Neoplastic by RTECS criteria. Liver:Tumors.

Species: Rat
Route of Application: Oral
Dose: 7020 MG/KG
Exposure Time: 78W
Frequency: I
Result: Tumorigenic:Carcinogenic by RTECS criteria.

Liver:Tumors. Kidney, Ureter, Bladder:Kidney tumors.

Species: Rat
Route of Application: Oral
Dose: 70 GM/KG
Exposure Time: 78W
Frequency: I
Result: Endocrine:Thyroid tumors. Kidney, Ureter, Bladder:Kidney tumors. Tumorigenic:Neoplastic by RTECS criteria.

Species: Mouse
Route of Application: Oral
Dose: 24752 MG/KG
Exposure Time: 2Y
Frequency: C
Result: Liver:Tumors. Tumorigenic:Equivocal tumorigenic agent by RTECS criteria.

Species: Rat
Route of Application: Oral
Dose: 58968 MG/KG
Exposure Time: 2Y
Frequency: C
Result: Tumorigenic:Neoplastic by RTECS criteria. Endocrine:Thyroid tumors. Blood:Tumors.

Species: Mouse
Route of Application: Oral
Dose: 130 GM/KG
Exposure Time: 2Y
Frequency: I
Result: Tumorigenic:Neoplastic by RTECS criteria. Kidney, Ureter, Bladder:Tumors. Liver:Tumors.

IARC CARCINOGEN LIST

Rating: Group 2B

NTP CARCINOGEN LIST

Rating: Clear evidence.
Species: Mouse/rat
Route: Gavage

IRIS/EPA CARCINOGEN LIST
Rating: Group B2
Species: Rat, mouse
Route: Gavage

CHRONIC EXPOSURE - TERATOGEN

Species: Rat
Dose: 1260 MG/KG
Route of Application: Oral
Exposure Time: (6-15D PREG)
Result: Specific Developmental Abnormalities: Musculoskeletal system. Effects on Embryo or Fetus: Fetotoxicity (except death, e.g., stunted fetus).

Species: Rat
Dose: 4 GM/KG
Route of Application: Oral

Exposure Time: (6-15D PREG)
Result: Effects on Embryo or Fetus: Fetotoxicity (except death, e.g., stunted fetus).

Species: Rat
Dose: 100 PPM/7H
Route of Application: Inhalation
Exposure Time: (6-15D PREG)
Result: Specific Developmental Abnormalities: Gastrointestinal system. Specific Developmental Abnormalities: Homeostasis

Species: Rat
Dose: 20100 UG/M3/1H
Route of Application: Inhalation
Exposure Time: (7-14D PREG)
Result: Effects on Embryo or Fetus: Fetotoxicity (except death, e.g., stunted fetus). Effects on Embryo or Fetus: Fetal death.

Species: Mouse
Dose: 100 PPM/7H
Route of Application: Inhalation
Exposure Time: (8-15D PREG)
Result: Specific Developmental Abnormalities: Craniofacial (including nose and tongue).

Species: Rabbit
Dose: 260 MG/KG
Route of Application: Oral
Exposure Time: (6-18D PREG)
Result: Effects on Embryo or Fetus: Fetotoxicity (except death, e.g., stunted fetus). Specific Developmental Abnormalities: Musculoskeletal system.

CHRONIC EXPOSURE - MUTAGEN
Result: Laboratory experiments have shown mutagenic effects.

Species: Human
Dose: 19 MMOL/L
Cell Type: HeLa cell
Mutation test: DNA inhibition

Species: Human
Dose: 10 MMOL/L
Cell Type: lymphocyte
Mutation test: Sister chromatid exchange

Species: Rat
Route: Oral
Dose: 4 MMOL/KG
Mutation test: Micronucleus test

Species: Rat
Route: Oral
Dose: 1 GM/KG
Mutation test: Unscheduled DNA synthesis

Species: Rat
Route: Intraperitoneal
Dose: 1200 UG/KG
Mutation test: Cytogenetic analysis

Species: Rat

Route: Oral
Dose: 597 MG/KG
Exposure Time: 5D
Mutation test: Cytogenetic analysis

Species: Rat
Dose: 1 MMOL/L
Cell Type: leukocyte
Mutation test: Sister chromatid exchange

Species: Mouse
Dose: 12 MG/L (+S9)
Cell Type: lymphocyte
Mutation test: Mutation in microorganisms

Species: Mouse
Route: Intraperitoneal
Dose: 50 MG/KG
Mutation test: Unscheduled DNA synthesis

Species: Mouse
Route: Inhalation
Dose: 300 PPM
Exposure Time: 6H
Mutation test: Sister chromatid exchange

Species: Mouse
Route: Oral
Dose: 200 MG/KG
Exposure Time: 4D
Mutation test: Sister chromatid exchange

Species: Mouse
Route: Inhalation
Dose: 400 PPM
Exposure Time: 4H/5D
Mutation test: sperm

Species: Hamster
Dose: 4430 MG/L
Cell Type: kidney
Mutation test: Morphological transformation.

Species: Hamster
Dose: 1 PPH
Cell Type: fibroblast
Mutation test: Other mutation test systems

Species: Hamster
Dose: 100 UMOL/L
Cell Type: Embryo
Mutation test: Sister chromatid exchange

Species: Hamster
Dose: 60 MMOL/L
Cell Type: lung
Mutation test: SLN

Species: Hamster
Dose: 1 MG/L
Cell Type: lung
Mutation test: Mutation in mammalian somatic cells.

Species: Mammal
Dose: 1 MMOL/L
Cell Type: lymphocyte
Mutation test: DNA

CHRONIC EXPOSURE - REPRODUCTIVE HAZARD

Species: Rat
Dose: 30 PPM/7H
Route of Application: Inhalation
Exposure Time: (6-15D PREG)
Result: Effects on Embryo or Fetus: Fetotoxicity (except death, e.g., stunted fetus). Effects on Fertility: Other measures of fertility Specific Developmental Abnormalities: Musculoskeletal system.

Species: Rat
Dose: 300 PPM/7H
Route of Application: Inhalation
Exposure Time: (6-15D PREG)
Result: Effects on Fertility: Female fertility index (e.g., # females pregnant per # sperm positive females; # females pregnant per # females mated). Effects on Fertility: Post-implantation mortality (e.g., dead and/or resorbed implants per total number of implants).

Species: Mouse
Dose: 2177 MG/KG
Route of Application: Oral
Exposure Time: (3W MALE/3W PRE-7D POST)
Result: Effects on Newborn: Growth statistics (e.g., reduced weight gain). Effects on Newborn: Biochemical and metabolic.

Species: Mouse
Dose: 2115 MG/KG
Route of Application: Oral
Exposure Time: (3W MALE/3W PRE-5D POST)
Result: Effects on Newborn: Other postnatal measures or effects.

Species: Mouse
Dose: 100 PPM/7H
Route of Application: Inhalation
Exposure Time: (1-7D PREG)
Result: Effects on Fertility: Post-implantation mortality (e.g., dead and/or resorbed implants per total number of implants). Effects on Fertility: Female fertility index (e.g., # females pregnant per # sperm positive females; # females pregnant per # females mated). Effects on Embryo or Fetus: Fetotoxicity (except death, e.g., stunted fetus).

Section 12 - Ecological Information

ACUTE ECOTOXICITY TESTS

Test Type: EC50 Algae
Time: 24 h
Value: 500 mg/l

Test Type: EC50 Daphnia
Species: Daphnia magna
Time: 24 h

Value: 79 mg/l

Test Type: LC50 Fish
Species: Leuciscus idus
Time: 48 h
Value: 162 mg/l

Test Type: LC100 Fish
Species: Leuciscus idus
Time: 48 h
Value: 220 mg/l

Test Type: LC50 Fish
Time: 4 days
Value: 97 mg/l

Test Type: LC50 Fish
Species: Brachydanio rerio
Time: 96 h
Value: 121 mg/l

Section 13 - Disposal Considerations

APPROPRIATE METHOD OF DISPOSAL OF SUBSTANCE OR PREPARATION
Contact a licensed professional waste disposal service to dispose of this material. Observe all federal, state, and local environmental regulations. (DN)Requires special label: "Contains a substance which is regulated by Dannish work environmental law due to the risk of carcinogenic properties."

Section 14 - Transport Information

DOT
Proper Shipping Name: Chloroform
UN#: 1888
Class: 6.1
Packing Group: Packing Group III
Hazard Label: Toxic Substance
PIH: Not PIH

IATA
Proper Shipping Name: Chloroform
IATA UN Number: 1888
Hazard Class: 6.1
Packing Group: III

Section 15 - Regulatory Information

EU DIRECTIVES CLASSIFICATION
Symbol of Danger: Xn
Indication of Danger: Harmful.
R: 22-38-40-48/20/22
Risk Statements: Harmful if swallowed. Irritating to skin. Limited evidence of a carcinogenic effect. Harmful: danger of serious damage to health by prolonged exposure through inhalation and if swallowed.
S: 36/37
Safety Statements: Wear suitable protective clothing and gloves.

US CLASSIFICATION AND LABEL TEXT
Indication of Danger: Harmful.
Risk Statements: Harmful if swallowed. Irritating to eyes and

skin. Limited evidence of a carcinogenic effect. Harmful: danger of serious damage to health by prolonged exposure through inhalation and if swallowed.
Safety Statements: Wear suitable protective clothing and gloves.
US Statements: Probable Carcinogen (US). Target organ(s): Liver. Cardiovascular system. Calif. Prop. 65 carcinogen.

UNITED STATES REGULATORY INFORMATION
SARA LISTED: Yes
DEMINIMIS: 0.1 %
NOTES: This product is subject to SARA section 313 reporting requirements.
TSCA INVENTORY ITEM: Yes

UNITED STATES - STATE REGULATORY INFORMATION

CALIFORNIA PROP - 65
California Prop - 65: This product is or contains chemical(s) known to the state of California to cause cancer. This product is or contains chemical(s) known to the state of California to cause cancer.

CANADA REGULATORY INFORMATION
WHMIS Classification: This product has been classified in accordance with the hazard criteria of the CPR, and the MSDS contains all the information required by the CPR.
DSL: Yes
NDSL: No

Section 16 - Other Information

DISCLAIMER
For R&D use only. Not for drug, household or other uses.

WARRANTY
The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Inc., shall not be held liable for any damage resulting from handling or from contact with the above product. See reverse side of invoice or packing slip for additional terms and conditions of sale.
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MATERIAL SAFETY DATA SHEET

MSDS Number
P-175N

AccuStandard
125 Market Street • New Haven, CT USA 06513
Phone No: (203) 786-5290 • Fax No: (203) 786-5287

Emergency Phone Number
203-786-5290
Mon. to Fri. 8am-5pm EDT

Product Number : P-175N

Product Name : Cyanazine

Synonyms : 2-Methylpropionitril

Formula : C9H13ClN6 **Molecular Weight :** 240.73

Section 2 - Composition / Information on Ingredients

Component(s) (1)	CAS #	Appr. %	ACGIH TLV TWA mg/m3	ACGIH TLV SKIN	OSHA PEL TWA mg/m3	OSHA PEL SKIN
Cyanazine	21725-46-2	100%				

Section 3 - Hazards Identification

Symptoms of Exposure:

Harmful if inhaled, swallowed, or absorbed through the skin.

Potential Health Effects:

No applicable information found.

Routes of Entry:

Inhalation, ingestion or skin contact.

Carcinogenicity:

The material is not listed (IARC, NTP, OSHA) as cancer causing agent.

Section 4 - First Aid Measures

First Aid Procedures:

GET MEDICAL ASSISTANCE FOR ALL CASES OF OVEREXPOSURE.

Skin: Immediately flush thoroughly with large amounts of water.

Eyes: Immediately flush thoroughly with water for at least 15 minutes. Assure adequate flushing by separating the eyelids with fingers.

Inhalation: Remove to fresh air; give artificial respiration if breathing has stopped. Contact a physician

Ingestion: If conscious, drink water and induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person.

Remove contaminated clothing and wash before reuse.

Section 5 - Fire Fighting Measures

Alteration of any information contained herein without written permission from AccuStandard strictly prohibited.

Flammable Properties:

Flash Point (°F): N/A
Flammable Limits LEL (%): N/A
Flammable Limits UEL (%): N/A

Thermal decomposition produces toxic fumes.

Extinguishing Media:

Use water spray, dry chemical, CO2, or "alcohol" foam.

Protection of Firefighters:

Wear self-contained breathing apparatus and protective clothing.

Section 6 - Accidental Release Measures

Spill Response:

Wear suitable protective equipment listed under Expose /Personal Protection. Eliminate any ignition sources until the area is determined to be free from explosion or fire hazards. Contain the release and eliminate its source, if this can be done without risk. Dispose as hazardous waste. Comply with Federal, State and local regulations.

Section 7 - Handling and Storage

Keep container closed.
Store in a cool area away from ignition sources and oxidizers.
Do not breathe vapor.
Do not get in eyes, on skin, or on clothing.

Section 8 - Exposure Controls / Personal Protection

Personal Protection Equipment (PPE):

Respiratory Protection: If workplace exposure limit(s) of product or any component is exceeded (see TLV/PEL), a NIOSH/MSHA approved air supplied respirator is advised in absence of proper environmental control. OSHA regulations also permit other NIOSH/MSHA respirators (negative pressure type) under specified conditions (see your safety equipment supplier). Engineering and/or administrative controls should be implemented to reduce exposure.

Material should be handled or transferred in an approved fume hood or with adequate ventilation.

Protective gloves must be worn to prevent skin contact.

(Butyl Rubber, Viton or equivalent)

Alteration of any information contained herein without written permission from AccuStandard strictly prohibited.

Safety glasses with side shields must be worn at all times.

General Hygiene Considerations:

Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available.

Section 9 - Physical and Chemical Properties

Physical and chemical properties for the Compound

Appearance: Colorless crystalline solid
Boiling Point: N/A
Melting Point: 167-169C
Specific Gravity (Water = 1): N/A
Vapor Pressure: N/A
Vapor Density (Air = 1): N/A
Percent Volatile (by volume): N/A
Evaporation Rate (Butyl acetate = 1): N/A
Flash Point: N/A
Explosion Limits (%): N/A to N/A
Solubility in water (%): 0.17g/L

Section 10 - Stability and Reactivity

Stability and reactivity for the *Compound*

Stability: Stable
Materials to Avoid: Oxidizers

Hazardous Decomposition: Oxides of carbon and nitrogen, Hydrogen chloride, CN-
Hazardous Polymerization: Does not occur
Conditions to Avoid: None indicated

Section 11 - Toxicological Information

See section 3 for specific toxicological information for the ingredients of this product.

Section 12 - Ecological Information

By complying with sections 6 and 7 there will be no release to the environment.

Alteration of any information contained herein without written permission from AccuStandard strictly prohibited.

Section 13 - Disposal Considerations

Recycle or incinerate at any EPA approved facility or dispose in compliance with Federal, State and local regulations. Empty containers must be triple-rinsed prior to disposal.

Section 14 - Transport Information

DOT	Shipping Class:	6.1	Packing Group:	III	UN Number:	UN2588

Section 15 - Regulatory Information

In addition to Federal and state regulations, local regulations may apply. Check with your local regulatory authorities.

The following regulations apply:

The CAS number of this product is NOT listed on the TSCA Inventory. For reasearch and development use only. Not for manufacturing or commercial purposes.

WARNING: This product contains a chemical(s) known to the state of California to cause birth defects or other reproductive harm.

Section 16 - Other Information

This document has been designed to meet the requirements of OSHA, ANSI and CHIPs regulations.

This statements contained herein are offered for informational purposes only and are based on technical data that we believe to be accurate. It is intended for use only by persons having the necssary technical skill and at their own discretion and risk. Since conditions and manner of use are ouside our control, we make NO WARRANTY, EXPRESS OR IMPLIED, OF MERCHANTABILITY, FITNESS OR OTHERWISE.

* * * End of document * * *

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Scott Specialty Gases

Material Safety Data Sheets

MSDS No: 124-48-1
Date: 03/09/2001

SUPPLIER ADDRESS:	6141 Easton Road, Bldg. 1 PO Box 310 Plumsteadville, PA 18949-0310	**EMERGENCY PHONE NUMBER:**	(215) 766-8861

1. CHEMICAL PRODUCT

PRODUCT NAME: CHLORODIBROMOMETHANE SYNONYMS: Dibromochloromethane *

2. COMPOSITION, INFORMATION ON INGREDIENTS

				Exposure Limits (PPM)			
Ingredient Name	Formula	CAS #	Concentration	ACGIH TLV	OSHA PEL	MAC	Other STEL
CHLORODIBROMOMETHANE	ClBr2CH	124-48-1	99+%	NE	NE	NE	NE

Note: NE = NONE ESTABLISHED S/A = SIMPLE ASPHYXIANT

3. HAZARD INDENTIFICATION

* * * EMERGENCY OVERVIEW * * *
Nonflammable liquid and vapor.
Can cause irritation to the upper respiratory tract.

POTENTIAL HEALTH EFFECTS

ROUTES OF ENTRY: Inhalation , Ingestion

ACUTE EFFECTS: Skin and eye irritation may occur. If inhaled, may be irritating to mucous membrane and upper respiratory tract Prolonged exposure can cause nausea, dizziness and headaches. High concentrations may have a narcotic effect.

CHRONIC EFFECTS: None

MEDICAL CONDITIONS AGGRAVATED BY OVEREXPOSURE: None

OTHER EFFECTS OF OVEREXPORSURE: None

CARCINOGENICITY (US ONLY):

NTP - No
IARC MONOGRAPHS - No
OSHA REGULATED - No

4. FIRST AID MEASURES

INHALATION: Immediately remove victim to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, *give oxygen.*

EYE CONTACT: Immediately flush with copious amounts of water for at least 15 minutes.

SKIN CONTACT: Immediately flush with copious amounts of water for at least 15 minutes while removing contaminated clothing.

INGESTION: Never give anything by mouth to an unconscious person. Do not induce vomiting because of aspiration hazard.

IN EVENT OF EXPOSURE, CONSULT A PHYSICIAN

NOTE TO PHYSICIAN: None

5. FIRE FIGHTING MEASURES

FLASH POINT: Nonflammable

AUTOIGNITION TEMPERATURE: N/Ap

FLAMMABLE LIMITS: Nonflammable

LOWER:
UPPER:

EXTINGUISHING MEDIA: Use what is appropriate for surrounding fire. Use water spray to keep fire exposed cylinders cool.

SPECIAL FIRE FIGHTING INSTRUCTION AND EQUIPMENT: Wear self-contained breathing apparatus and full protective clothing. Keep fire exposed cylinders cool with water spray.

HAZARDOUS COMBUSTION PRODUCTS: Toxic carbon monoxide, hydrogen chloride, and hydrogen bromide.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Cylinder rupture may occur under fire conditions.

6. ACCIDENTAL RELEASE MEASURES

CLEAN UP PROCEDURES: Evacuate and ventilate area. Remove leaking cylinder to exhaust hood or safe outdoor area. Shut off source if possible and remove source of heat.

SPECIALIZED EQUIPMENT: None

7. HANDLING AND STORAGE

PRECAUTIONS TO BE TAKEN IN HANDLING: Secure cylinder when using to protect from falling. Use suitable hand truck to move cylinders.

PRECAUTIONS TO BE TAKEN IN STORAGE: Store in well ventilated areas away from heat and source of ignition. Keep valve protection cap on cylinders when not in use.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS: Provide adequate general and local exhaust ventilation.

EYE / FACE PROTECTION: Safety glasses

SKIN PROTECTION: Protective gloves.

RESPIRATORY PROTECTION: In case of leakage, use self-contained breathing apparatus.

OTHER PROTECTIVE EQUIPMENT: Safety shoes when handling cylinders.

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE: Pale yellow heavy liquid.

ODOR: N/Av

PHYSICAL PRESSURE: Liquid

VAPOR PRESSURE: N/Av

VAPOR DENSITY (AIR=1): N/Av

BOILING POINT (C): 120

SOLUBILITY IN WATER: N/Av

SPECIFIC GRAVITY (H2O=1): @20 deg. celsius: 2.451

EVAPORATION RATE: N/Av

ODOR THRESHOLD: N/Av

10. STABILITY AND REACTIVITY

STABILITY: Stable under normal storage conditions.

CONDITIONS TO AVOID: Storage in poorly ventilated areas. Storage near a heat source.

MATERIALS TO AVOID: Strong bases, strong oxidizing agents and magnesium.

HAZARDOUS POLYMERIZATION: Will not occur.

HAZARDOUS DECOMPOSITION: Fumes of carbon monoxide, hydrogen chloride gas and hydrogen bromide gas.

11. TOXICOLOGICAL INFORMATION

LETHAL CONCENTRATION (LC50): None established

LETHAL DOSE 50 (LD50): N/Ap

TERATOGENICITY: N/Ap

REPRODUCTIVE EFFECTS: N/Ap

MUTAGENICITY: N/Ap

12. ECOLOGICAL INFORMATION

No adverse ecological effects are expected.

13. DISPOSAL CONSIDERATIONS

WASTE DISPOSAL METHOD: Return cylinders to supplier with any valve outlet plugs or caps secured and valve protection cap in place. Empty cylinders will contain hazardous residue.

14. TRANSPORT INFORMATION

CONCENTRATION: 99+%

DOT DESCRIPTION (US ONLY):

PROPER SHIPPING NAME: This material is not hazardous according to DOT definitions. No DOT label or shipping paper work is required.
HAZARD CLASS: N/Ap
INDENTIFICATION NUMBER: N/Ap
REPORTABLE QUANTITIES: None

LABELING: N/Ap

R / RID (EU Only): N/Av

SPECIAL PRECAUTIONS: Cylinders should be transported in a secure upright position in a well ventilated truck.

15. REGULATORY INFORMATION

OSHA: Process Safety Management: Material is not listed in appendix A of 29 CFR 1910.119 as highly hazardous chemical.

TSCA: Material is listed in TSCA inventory.

SARA: The threshold planning quantity for material is 10,000 lbs.

EU NUMBER: N/Av

NUMBER IN ANNEX 1 OF DIR 67/548: Not listed in annex 1.

EU CLASSIFICATION: N/Av

R: N/Av

S: N/Av

16. OTHER INFORMATION

OTHER PRECAUTIONS: Protect containers from physical damage. Do not deface cylinders or labels. Cylinders should be refilled by qualified producers of compressed gas. Shipment of a compressed gas cylinder which has not been filled by the owner or with s written consent is a violation of federal law (49 CFR).

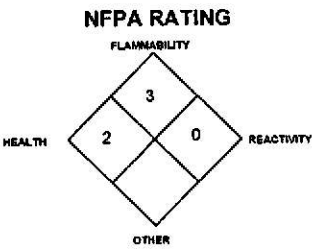
ABBREVIATIONS: N/Ap - Not Applicable N/Av - Not Available SA - Simple Asphyxiant NE - None Established

DISCLAIMER: Information included in this document is given to the best of our knowledge, however, no warranty is made that the information is accurate or complete. We do not accept any responsibility for damages by the use of the document.

Airgas

MATERIAL SAFETY DATA SHEET

Prepared to U.S. OSHA, CMA, ANSI and Canadian WHMIS Standards



PART I *What is the material and what do I need to know in an emergency?*

1. PRODUCT IDENTIFICATION

CHEMICAL NAME; CLASS: **ETHYLENE DICHLORIDE - $C_2H_4Cl_2$**
Document Number: 001068

PRODUCT USE: For general analytical/synthetic chemical uses.

SUPPLIER/MANUFACTURER'S NAME: AIRGAS INC.
ADDRESS: 259 N. Radnor-Chester Road
Suite 100
Radnor, PA 19087-5283

BUSINESS PHONE: 1-610-687-5253
EMERGENCY PHONE: CHEMTREC: 1-800-424-9300
International: 703-527-3887 (Call Collect)

DATE OF PREPARATION: May 5, 1998

2. COMPOSITION and INFORMATION ON INGREDIENTS

CHEMICAL NAME	CAS #	mole %	EXPOSURE LIMITS IN AIR					
			ACGIH		OSHA		IDLH	OTHER
			TLV ppm	STEL ppm	PEL ppm	STEL ppm	ppm	
Ethylene Dichloride	107-06-2	> 98.0	10, A4 (Not Classifiable as a Human Carcinogen)	NE	50	C = 100; 200 (5 *minute* peak in any 3 hours)	3800 (Based on LEL)	NIOSH REL: Carcinogen TWA = 1 ppm STEL = 2 ppm DFG MAK: Danger of Cutaneous Absorption. Carcinogen: EPA-B2; IARC-2B; MAK-A2; NTP-2B
Maximum Impurities		< 2.0	None of the trace impurities in this mixture contribute significantly to the hazards associated with the product. All hazard information pertinent to this product has been provided in this Material Safety Data Sheet, per the requirements of the OSHA Hazard Communication Standard (29 CFR 1910.1200) and State equivalent standards.					

NE = Not Established C = Ceiling Limit See Section 16 for Definitions of Terms Used

NOTE: All WHMIS required information is included. It is located in appropriate sections based on the ANSI Z400.1-1993 format.

3. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW: Ethylene Dichloride is a colorless, flammable, toxic liquid with a pleasant, sweetish odor (similar to chloroform). Inhalation of the vapors of Ethylene Dichloride can cause central nervous system depression and irritation of the tissues of the respiratory system. Severe inhalation exposures can be fatal. Skin and eye contact can be moderately to severely irritating. Ethylene Dichloride is possibly carcinogenic to humans. This liquid is flammable; vapors are heavier than air and may travel long distances to source of ignition and flashback. If involved in a fire Ethylene Dichloride will decompose to produce toxic gases (e.g., carbon monoxide, carbon dioxide, hydrogen chloride, and phosgene). Persons responding to fires or emergencies involving Ethylene Dichloride must have adequate fire protection and wear personal protective equipment to protect.

SYMPTOMS OF OVEREXPOSURE BY ROUTE OF EXPOSURE: The most significant routes of overexposure for Ethylene Dichloride are by inhalation or skin and eye contact. The symptoms of overexposure to Ethylene Dichloride by route of exposure are as follows:

INHALATION: The main effect of inhalation of Ethylene Dichloride is central nervous system depression. Symptoms of such overexposure can include drowsiness, headache, dizziness, and loss of coordination. Exposure to extremely high concentrations can result in lung effects (e.g., pulmonary edema), liver and kidney damage, and death. The vapors can be moderately to severely irritating to the mucous membranes, causing lacrimation, coughing, and breathing difficulties.

CONTACT WITH SKIN or EYES: Ethylene Dichloride is a moderate to severe skin and eye irritant. Eye contact with the liquid or vapors can cause pain, redness, watering, and may result in corneal clouding. Skin contract can result in redness, dryness, and itching. Repeated or prolonged contact can also cause dermatitis, resulting in dry, itchy, cracked skin.

SKIN ABSORPTION: Ethylene Dichloride exposure through skin contact has been reported. Symptoms of absorption may be similar to those described in "Inhalation".

INGESTION: Ingestion of Ethylene Dichloride may cause a burning sensation in the mouth and stomach, nausea, vomiting, excess salivation and vomiting of blood. Ethylene Dichloride is readily absorbed into the body following ingestion exposures, producing symptoms of central nervous system depression and other symptoms similar to those described in "Inhalation". If ingested, Ethylene Dichloride presents a potential aspiration hazard. Aspiration of even small amounts of Ethylene Dichloride into the lungs can result in the development of pulmonary edema (a potentially fatal accumulation of fluid in the lungs), chemical pneumonitis and hemorrhage of pulmonary tissue.

HAZARDOUS MATERIAL INFORMATION SYSTEM

HEALTH	(BLUE)	2
FLAMMABILITY	(RED)	3
REACTIVITY	(YELLOW)	0
PROTECTIVE EQUIPMENT		X

EYES	RESPIRATORY	HANDS	BODY
	See Section 8		See Section 8

For routine industrial applications

See Section 16 for Definition of Ratings

INJECTION: Injection is not anticipated to be a significant route of overexposure for Ethylene Dichloride. If Ethylene Dichloride is "injected" (as may occur through punctures by contaminated, sharp objects), symptoms described in "Inhalation" can occur.

HEALTH EFFECTS OR RISKS FROM EXPOSURE: An Explanation in Lay Terms. Overexposure to may cause the health effects described on the following page.

ACUTE: Acute inhalation overexposure to Ethylene Dichloride will initially act as a narcotic, possibly leading to coma in extreme cases. Following exposure to high concentrations, victims may be unconscious, and if exposure continues, death can follow from respiratory failure, circulatory collapse, or liver and kidney damage. Contact with the skin can cause moderate to severe irritation. Contact with the eyes is moderately to severely irritating, causing burning and watering of the eyes. Ingestion of Ethylene Dichloride will cause gastric distress and central nervous system effects. Aspiration of Ethylene Dichloride into the lungs, following ingestion, can result in severe damage to the lungs; death may result.

3. HAZARD IDENTIFICATION (Continued)

CHRONIC: Repeated inhalation exposure can result in bronchitis and other lung disorders. Repeated skin contact can cause dermatitis. Chronic exposure by all routes may result in liver and kidney damage. Ethylene Dichloride is a possible human carcinogen, based on results from clinical studies on test animals. See Section 11 (Toxicological Information) for further information

TARGET ORGANS: Respiratory system, central nervous system, liver, kidneys, skin, eyes.

PART II *What should I do if a hazardous situation occurs?*

4. FIRST-AID MEASURES

RESCUERS SHOULD NOT ATTEMPT TO RETRIEVE VICTIMS OF EXPOSURE TO ETHYLENE DICHLORIDE WITHOUT ADEQUATE PERSONAL PROTECTIVE EQUIPMENT. If necessary, a Self-Contained Breathing Apparatus should be worn.

INHALATION: If vapors, mists, or sprays of Ethylene Dichloride are inhaled, remove victim to fresh air. Only trained personnel should administer supplemental oxygen and/or cardio-pulmonary resuscitation if necessary. Remove or cover gross contamination to avoid exposure to rescuers.

SKIN EXPOSURE: If Ethylene Dichloride contaminates the skin, immediately begin decontamination with running water. Minimum flushing is for 15 minutes. Remove exposed or contaminated clothing, taking care not to contaminate eyes. Victim must seek medical attention if any adverse reaction occurs.

EYE EXPOSURE: If Ethylene Dichloride or its vapors enter the eyes, open victim's eyes while under gentle running water. Use sufficient force to open eyelids. Have victim "roll" eyes. Minimum flushing is for 15 minutes. Victim must seek immediate medical attention.

INGESTION: If Ethylene Dichloride is swallowed, CALL PHYSICIAN OR POISON CONTROL CENTER FOR MOST CURRENT INFORMATION. If professional advice is not available, do not induce vomiting. Victim should drink milk, egg whites, or large quantities of water. If vomiting occurs naturally, have victim lean forward to reduce risk of aspiration. Never induce vomiting or give diluents (milk or water) to someone who is unconscious, having convulsions, or unable to swallow.

Victims of chemical exposure must be taken for medical attention. Rescuers should be taken for medical attention, if necessary. Physicians should refer to "Recommendations to Physicians" in Section 11 (Toxicological Information). Take copy of label and MSDS to health professional with victim.

5. FIRE-FIGHTING MEASURES

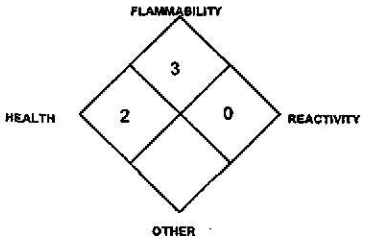
FLASH POINT: 13°C (56°F)
AUTOIGNITION TEMPERATURE: 413°C (775°F)
FLAMMABLE LIMITS (in air by volume, %):

Lower (LEL): 6.2%
Upper (UEL): 15.9%

FIRE EXTINGUISHING MATERIALS:

Water Spray: YES (for cooling only)
Foam: YES
Halon: YES
Carbon Dioxide: YES
Dry Chemical: YES
Other: Any "B" Class.

NFPA RATING



See Section 16 for Definition of Ratings

UNUSUAL FIRE AND EXPLOSION HAZARDS: Ethylene Dichloride is a Class IB flammable liquid and presents a serious fire hazard to firefighters. Due to the low flash point, vapors can form explosive mixtures with air, at room temperature. When involved in a fire, this material ignites to produce toxic gases (e.g., carbon monoxide, carbon dioxide, hydrogen chloride, phosgene). The vapors of Ethylene Dichloride are heavier than air and may spread long distances; distant ignition and flash-back are possible. Containers of Ethylene Dichloride, when involved in fire, may rupture or burst in the heat of the fire.

Explosion Sensitivity to Mechanical Impact: Not sensitive.

Explosion Sensitivity to Static Discharge: Ethylene Dichloride can accumulate static charge by flow or agitation; vapors can be ignited by static discharge.

5. FIRE-FIGHTING MEASURES (Continued)

SPECIAL FIRE-FIGHTING PROCEDURES: In the event of fire, cool containers of Ethylene Dichloride with water to prevent failure. Use a water spray or fog to reduce or direct vapors. Water may not be effective in actually extinguishing a fire involving Ethylene Dichloride, due to its low flash point. Stop the leak or discharge, if possible. For small releases, if it is not possible to stop the leak, and it does not endanger personnel, let the fire burn itself out. Incipient fire responders should wear eye protection. Structural firefighters must wear Self-Contained Breathing Apparatus and full protective equipment, including chemical resistant clothing. Large fires should be fought from a distance with an unmanned hose holder or monitor nozzles. If Ethylene Dichloride is involved in a fire, fire runoff water should be contained to prevent possible environmental damage. If necessary, decontaminate fire-response equipment with soap and water solution. For large releases, consider evacuation. Refer to the North American Emergency Response Guidebook (Guide #129) for additional guidance.

6. ACCIDENTAL RELEASE MEASURES

SPILL AND LEAK RESPONSE: Evacuate immediate area. Uncontrolled releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used. In case of a release, clear the affected area and protect people. Minimum Personal Protective Equipment should be **Level B: triple-gloves (rubber gloves and nitrile gloves, over latex gloves), chemical resistant suit and boots, hard-hat, and Self-Contained Breathing Apparatus.** Monitor the surrounding area for combustible vapor levels. Combustible vapor levels must be below 10% of the LEL for Ethylene Dichloride (LEL = 6.2%) before personnel are permitted to enter the area. If necessary, ventilate area.

Monitoring should be done for the levels of Ethylene Dichloride and oxygen. Colorimetric tubes are available to detect the presence of Ethylene Dichloride. Levels of Ethylene Dichloride should be below levels listed in Section 2 (Composition and Information on Ingredients) and the atmosphere must have at least 19.5 percent oxygen before personnel can be allowed in the area without Self-Contained Breathing Apparatus.

Eliminate all sources of ignition before clean-up operations begin. Use non-sparking tools. Absorb spilled liquid with activated carbon, polypads or other suitable absorbent materials. Prevent material from entering sewer or confined spaces. Decontaminate the area thoroughly. Place all spill residue in an appropriate container and seal. If necessary, decontaminate spill-response equipment with soap and water solution. Dispose of in accordance with U.S. Federal, State, and local hazardous waste disposal regulations, or the applicable standards of Canada and its Provinces (see Section 13, Disposal Considerations).

THIS IS A FLAMMABLE, TOXIC LIQUID: Protection of all personnel and the area must be maintained. All responders must be adequately protected from exposure.

PART III *How can I prevent hazardous situations from occurring?*

7. HANDLING and STORAGE

WORK PRACTICES AND HYGIENE PRACTICES: As with all chemicals, avoid getting Ethylene Dichloride IN YOU. Do not eat or drink while handling chemicals. Be aware of any signs of effects of Ethylene Dichloride exposure indicated in Section 3 (Hazard Identification); exposures to fatal concentrations of Ethylene Dichloride could occur rapidly.

STORAGE AND HANDLING PRACTICES: All employees who handle this material should be trained to handle it safely. Avoid breathing vapors or mists generated by Ethylene Dichloride. Use in a well-ventilated location. Cylinders of Ethylene Dichloride must be properly labeled. If Ethylene Dichloride is used in other types of containers, only use portable containers and dispensing equipment (faucet, pump, drip can) approved for flammable liquids.

Store cylinders of Ethylene Dichloride in a cool, dry location, away from direct sunlight, sources of intense heat, or where freezing is possible. Do not allow area where cylinders are stored to exceed 52°C (125°F). Material should be stored in secondary containers, or in a diked area, as appropriate. Store containers away from incompatible chemicals. Keep container tightly closed when not in use. Storage areas should be made of fire-resistant materials. Inspect all incoming containers before storage, to ensure containers are properly labeled and not damaged. Refer to NFPA 30, Flammable and Combustible Liquids Code, for additional information on storage.

Empty containers may contain residual flammable liquid or vapors. Therefore, empty containers should be handled with care. Do not expose "empty" containers to welding touches, or any other source of ignition.

7. HANDLING and STORAGE (Continued)

SPECIAL PRECAUTIONS FOR HANDLING CYLINDERS: Protect cylinders of Ethylene Dichloride against physical damage. If appropriate, cylinders should be stored in an up-right position. Cylinders should be firmly secured to prevent falling or being knocked over. Cylinders can be stored in the open, but in such cases, should be protected against extremes of weather and from the dampness of the ground to prevent rusting. Never tamper with pressure relief devices in valves and cylinders. Electrical equipment should be non-sparking or explosion proof. The following rules are applicable to situations in which cylinders are being used:

Before Use: If appropriate, move cylinders with a suitable hand-truck. Do not drag, slide or roll cylinders. Do not drop cylinders or permit them to strike each other. Secure cylinders firmly. Leave the valve protection cap in-place until cylinder is ready for use.

During Use: Use designated CGA fittings and other support equipment. Do not use adapters. Do not heat cylinder by any means to increase the discharge rate of the product from the cylinder. Use check valve or trap in discharge line to prevent hazardous backflow into the cylinder. Do not use oils or grease on gas-handling fittings or equipment.

After Use: Close main cylinder valve. Replace valve protection cap. Mark empty cylinders "EMPTY".

NOTE: Use only DOT or ASME code containers. Earth-ground and bond all lines and equipment associated with Ethylene Dichloride. Close valve after each use and when empty. Cylinders must not be recharged except by or with the consent of owner. For additional information refer to the Compressed Gas Association Bulletin SB-2 "*Oxygen Deficient Atmospheres*".

PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT: Follow practices indicated in Section 6 (Accidental Release Measures). Make certain application equipment is locked and tagged-out safely. Always use Ethylene Dichloride in areas where adequate ventilation is provided. Decontaminate equipment using soapy water before maintenance begins. Collect all rinsates and dispose of according to applicable Federal, State, or local procedures.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION

VENTILATION AND ENGINEERING CONTROLS: Use with adequate ventilation. Local exhaust ventilation is preferred, because it prevents Ethylene Dichloride dispersion into the work place by eliminating it at its source. If appropriate, install automatic monitoring equipment to detect the presence of potentially explosive air-gas mixtures and the level of oxygen.

RESPIRATORY PROTECTION: Maintain oxygen levels above 19.5% in the workplace. Use supplied air respiratory protection if oxygen levels are below 19.5% or during emergency response to a release of Ethylene Dichloride. If respiratory protection is required, follow the requirements of the Federal OSHA Respiratory Protection Standard (29 CFR 1910.134), or equivalent U.S. State standards, or the applicable regulations of Canada and its Provinces. The following NIOSH respiratory protection recommendations are for Ethylene Dichloride for further information.

CONCENTRATION	RESPIRATORY EQUIPMENT
AT CONCENTRATIONS ABOVE THE NIOSH REL:	Positive pressure, full-facepiece SCBA; or positive pressure, full-facepiece SAR with an auxiliary positive pressure SCBA.
ESCAPE:	Gas mask with organic vapor canister; or escape-type SCBA.
NOTE:	The NIOSH Recommended Exposure Limit (REL) for Ethylene Dichloride is 1 ppm (4 mg/m3) time-weighted average *concentration*; 2 ppm (8 mg/m3) short-term exposure limit.

EYE PROTECTION: Splash goggles or safety glasses, for protection from rapidly expanding gases and contact with liquid.

HAND PROTECTION: Wear mechanically-resistant, chemically compatible gloves when handling cylinders of Ethylene Dichloride. Viton or neoprene gloves are recommended for operations in which exposure to liquid may occur.

BODY PROTECTION: Use body protection appropriate for task. An apron or coveralls may be necessary if splashes of liquid may be anticipated. Transfer of large quantities under pressure may require protective equipment appropriate to protect employees from gas spraying, as well as fire-retardant items.

9. PHYSICAL and CHEMICAL PROPERTIES

RELATIVE VAPOR DENSITY (air = 1): 3.4
SPECIFIC GRAVITY(@ 68°F (20°C) (water = 1): 1.256
SOLUBILITY IN WATER @ 77°F (25°C): 0.8g/100 mL
EVAPORATION RATE (diethyl ether = 1): Not established.
ODOR THRESHOLD: 26 ppm(detection); 87 ppm (recognition)
LOG COEFFICIENT WATER/OIL DISTRIBUTION: Log P (oct) = 1.48
VAPOR PRESSURE @ 68°F (20°C): 66.1 mm Hg: 10 kPa

pH: Not applicable.
FREEZING/MELTING POINT: -35.5°C (-32°F)
BOILING POINT: 83.5°C (182.3°F)
SPECIFIC VOLUME: Not applicable.
EXPANSION RATIO Not applicable.

9. PHYSICAL and CHEMICAL PROPERTIES (Continued)

APPEARANCE AND COLOR: Colorless, flammable liquid, with a pleasant, sweetish odor.

HOW TO DETECT THIS SUBSTANCE (warning properties): The odor of Ethylene Dichloride is not a good warning property as a the odor threshold is above the TLV.

10. STABILITY and REACTIVITY

STABILITY: Normally stable in air, but will slowly decompose and darken in color. In the presence of steam, Ethylene Dichloride hydrolyzes slowly to form hydrochloric acid

DECOMPOSITION PRODUCTS: Carbon monoxide, carbon dioxide, vinyl chloride, hydrogen chloride gas and phosgene gas.

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: Ethylene Dichloride reacts violently with strong caustics, liquid ammonia, alkali metals (e.g., potassium, sodium), and *powdered* metals (e.g., aluminum, zinc, magnesium). Ethylene Dichloride also posses an explosion or fire risk in the presence of strong oxidizers. Ethylene Dichloride can attack many plastics.

HAZARDOUS POLYMERIZATION: Not expected to occur.

CONDITIONS TO AVOID: Contact with incompatible materials and exposure to heat, sparks and other sources of ignition. Cylinders exposed to high temperatures or direct flame can rupture or burst.

PART IV *Is there any other useful information about this material?*

11. TOXICOLOGICAL INFORMATION

TOXICITY DATA: The following toxicology data are available for Ethylene Dichloride:

Open irritation test - skin - rabbit: 625 mg: Mild

Standard Draize test: skin - rabbit: 500 mg/: Mild

Standard Draize test - eye - rabbit: 63 mg: Severe

Standard Draize test - eye - rabbit: 500 mg/24 hours: Mild

TCLo - Inhalation - man: 4000 ppm/1 hour: Peripheral Nerve and Sensation - flaccid paralysis without anesthesia (usually neuromuscular blockage) Behavioral - coma Gastrointestinal - nausea or vomiting

LDLo - Oral - Human: 286 mg/kg: Gastrointestinal - ulceration or bleeding from stomach; Gastrointestinal - nausea or vomiting; Liver - fatty liver degeneration

TDLo - Oral -Human: 428 mg/kg: Behavioral - somnolence (general depressed activity) Lungs, Thorax, or Respiration - cough Gastrointestinal - nausea or vomiting

TDLo - Oral - man: 892 mg/kg: Gastrointestinal - hypermotility, diarrhea Gastrointestinal - nausea or vomiting Liver - jaundice, other or unclassified

LDLo - Oral - *man*: 714 *mg/kg*: Behavioral - somnolence (general depressed activity) Cardiac - change in rate Lungs, Thorax, or Respiration - cyanosis

LD_{50} - Oral - rat: 670 mg/kg:

LC_{50} - Inhalation - rat: 1000 ppm/7 hours: Behavioral - coma Lungs, Thorax, or Respiration - cyanosis Nutritional and Gross Metabolic - body temperature decrease

LD_{50} - Intraperitoneal - rat: 807 mg/kg:

LD_{50} - Subcutaneous - rat: 1 gm/kg: Sense Organs and Special Senses (Eye) - lacrimation Behavioral - general anesthetic Behavioral - ataxia:

LDLo - Intratracheal - rat: 120 mg/kg

LD_{50} - Oral - mouse: 413 mg/kg: Lungs, Thorax, or Respiration - other changes Liver - other changes

LCLo - Inhalation - mouse: 5 gm/m3/2 hours

LD_{50} - Intraperitoneal - mouse: 470 mg/kg:

LDLo - Subcutaneous - mouse: 380 mg/kg

LD_{50} - Oral - dog: 5700 mg/kg: Sense Organs (Eye) - lacrimation Behavioral - general anesthetic, ataxia

LDLo - Intravenous - dog: 175 mg/kg:

LC_{50} - Inhalation - monkey: 3000 ppm/7 hours

LC - Inhalation - cat: >3000 ppm/7 hours

LD_{50} - Oral - rabbit: 860 mg/kg

LCLo Inhalation - rabbit: 3000 ppm/7 hours: Behavioral - somnolence ; Lungs, Thorax, or Respiration - dyspnea Lungs, Thorax, or Respiration - other *changes*

LD_{50}- skin - rabbit: 2800 mg/kg: Sense Organs and Special Senses (Eye) - lacrimation Behavioral - general anesthetic Behavioral - ataxia

LDLo - Subcutaneous - rabbit: 1200 mg/kg

LCLo - Inhalation - pig: 3000 ppm/7 hours: Sense Organs and Special Senses (Eye) - lacrimation Behavioral - somnolence (general depressed activity) Lungs, Thorax, or Respiration - dyspnea

LCLo - Inhalation - guinea pig; 1500 ppm/7 hours: Sense Organs and Special Senses (Eye) - lacrimation Behavioral - somnolence ; Kidney, Ureter, Bladder - changes In tubules (including acute renal failure, acute tubular necrosis)

LDLo - Intraperitoneal - guinea pig: 600 mg/kg: Biochemical - Enzyme inhibition, induction, or change in blood or tissue levels - other transferases

LC - Inhalation: Mammal - species unspecified: >3000 ppm/7 hours:

TDLo - Oral - rat: 21840 mg/kg/13 weeks-Continuous: Liver - changes in liver weight Kidney, Ureter, Bladder - changes in bladder weight

TDLo - Oral - rat: 1 gm/kg/10 weeks - Intermittent: Blood - changes in serum composition (e.g. TP, bilirubin, cholesterol) Liver - changes in liver *weight* Reproductive - Tumorigenic effects - other reproductive system tumors

11. TOXICOLOGICAL INFORMATION (Continued)

TOXICITY DATA (continued):

TCLo - Inhalation - rat: 200 ppm/7 hours/6 weeks - Intermittent: Reproductive - Tumorigenic effects - other reproductive system tumors

TCLo - Inhalation - rat: 1500 ppm/7 hours/5 days - Intermittent: Lungs, Thorax, or Respiration - respiratory depression Kidney, Ureter, Bladder - changes in tubules (including acute renal failure, acute tubular necrosis) Reproductive - Tumorigenic effects - other reproductive system tumors

TDLo - Oral-mouse: 43680 mg/kg/13 weeks - Continuous: Liver - changes in liver weight Kidney, Ureter, Bladder - changes in tubules (including acute renal failure, acute tubular necrosis) Kidney, Ureter, Bladder - changes in bladder weight

TCLo - Inhalation - mouse: 200 ppm/7H/9 days - Intermittent: Reproductive - Tumorigenic effects - other reproductive system tumors

TDLo - Oral - mouse: 685 mg/kg/14 days - Intermittent: Blood - changes in leukocyte (WBC) count Immunological Including Allergic - decrease in humoral immune

TCLo - Inhalation - dog: 1500 ppm/7 hours/5 days - Intermittent: Sense Organs and Special Senses (Eye) - corneal damage Reproductive - Tumorigenic effects - other reproductive system

TCLo - Inhalation - monkey: 1000 ppm/7 hours/9 weeks - Intermittent: Behavioral - coma Reproductive - Tumorigenic effects - other reproductive system tumors

TCLo - Inhalation - cat: 1000 ppm/7 hours/11 weeks - Intermittent: Reproductive - Tumorigenic effects - other reproductive system tumors

TCLo - Inhalation - rabbit: 400 ppm/7 hours/19 weeks - Intermittent: Reproductive - Tumorigenic effects - other reproductive system tumors

TCLo - Inhalation - guinea pig: 200 ppm/7 hours/25 weeks - Intermittent: Reproductive - Tumorigenic effects - other reproductive system tumors

T TCLo - Inhalation: Rodent - guinea pig: 1500 ppm/7 hours/5 days - Intermittent: Cardiac - other changes Kidney, Ureter, Bladder - changes in tubules (including acute renal failure, acute tubular necrosis) Reproductive - Tumorigenic effects - other reproductive system tumors

LDLo - Oral - rat: 5286 mg/kg/69 weeks - Intermittent: Tumorigenic; Gastrointestinal - tumors Skin and Appendages - tumors

TCLo - Inhalation - rat: 5 ppm/7 hours/78 weeks - Intermittent: Tumorigenic - equivocal tumorigenic agent; Blood - leukemia Skin and Appendages - tumors

TDLo - Oral - mouse: 3536 mg/kg/78 weeks - Intermittent: Tumorigenic - Carcinogenic; Lungs, Thorax, or Respiration - tumors Skin and Appendages - tumors

TCLo - Inhalation - mouse: 5 ppm/7H/78 weeks - Intermittent: Tumorigenic - equivocal tumorigenic agent; Lungs, Thorax, or Respiration - tumors Skin and Appendages - tumors

TDLo - skin - mouse: 1120 gm/kg/74 weeks - Intermittent: Tumorigenic - neoplastic; Lungs, Thorax, or Respiration - tumors Skin and Appendages - tumors

TD - Oral - rat: 38 gm/kg/78 weeks - Intermittent: Tumorigenic; Vascular - tumors Gastrointestinal - tumors

TD - Oral - mouse: 76 gm/kg/78 weeks - Intermittent: Tumorigenic; Skin and Appendages - tumors Reproductive - Tumorigenic effects - uterine tumors:

TD - Oral - rat 18 gm/kg/78 weeks - Intermittent: Tumorigenic; Vascular - tumors Gastrointestinal - tumors

TD - Oral - mouse: 38 gm/kg/78 weeks - Intermittent: Tumorigenic; Skin and Appendages - tumors Reproductive - Tumorigenic effects - uterine tumors

TCLo - Inhalation - rat: 300 ppm/7 hours: female 6-15 day(s) after conception: Reproductive - Fertility - post-implantation mortality

TCLo - Inhalation - rat 208 mg/m3/6 hours: female 2 week(s) pre-mating female 1-21 day(s) after conception: Reproductive - Fertility - pre-implantation mortality

Mutation in microorganisms: Bacteria - Salmonella typhimurium: 10 umol/plate

Mutation in microorganisms: Bacteria - Salmonella typhimurium: 10 ug/plate

DNA damage: Bacteria - Salmonella typhimurium: 7060 umol/L

Mutation test systems -: Bacteria - Escherichia coli: 316 mmol/L

DNA repair: Bacteria - Escherichia coli; 10 mg/plate

Specific locus test Oral: Insect - Drosophila melanogaster: 1000 ppm

Specific locus test: Inhalation: Insect - Drosophila melanogaster: 250 mg/m3

Sex chromosome loss and nondisjunction: Oral: Insect - Drosophila melanogaster: 120 mmol/

Sex chromosome loss and nondisjunction : Inhalation : Insect - Drosophila melanogaster: 2 ppm/96 hours

Sex chromosome loss and nondisjunction: Mold - Aspergillus nidulans: 2000 ppm

DNA inhibition: Human Lymphocyte: 5 mL/L

Mutation in mammalian somatic: Human Lymphocyte: 100 mg/L

DNA damage: Oral - rat: 150 mg/kg

DNA damage - Inhalation - rat: 150 ppm/6 hours

Unscheduled DNA synthesis - rat Liver: 130 umol/L

Specific locus test - Intraperitoneal - mouse 300 mg/kg

DNA damage - Intraperitoneal - mouse: 2 mmol/kg

DNA damage Oral - mouse: 100 mg/kg

DNA inhibition - Intraperitoneal: Rodent - mouse: 29 mg/kg

Body fluid assay - mouse Bacteria - Salmonella typhimurium: 80 mg/kg

Mutation in microorganisms - hamster Ovary: 2 mmol/L

Morphological transformation - hamster Embryo: 200 uL/plate

Cytogenetic analysis - hamster Lung: 1 gm/L

Mutation in mammalian somatic cells - hamster Ovary 40 mmol/L

SUSPECTED CANCER AGENT: Ethylene Dichloride is listed as follows:

ACGIH-A4; Not Classifiable as a Human Carcinogen
EPA-B2; Probable Human Carcinogen/Sufficient Animal Evidence
IARC-2B; Possibly Carcinogenic to Humans
MAK-A2; Unmistakably Carcinogenic in Animal Experiments
NIOSH-X; Carcinogen
NTP-2B; Reasonably Anticipated to be a Carcinogen/Based on Animal Evidence.

IRRITANCY OF PRODUCT: Ethylene Dichloride is moderately to severely irritating to all skin tissue.

SENSITIZATION TO THE PRODUCT: Ethylene Dichloride is not reported to be a sensitizer after prolonged or repeated exposures.

11. TOXICOLOGICAL INFORMATION (Continued)

REPRODUCTIVE TOXICITY INFORMATION: Listed below is information concerning the effects of Ethylene Dichloride on the human reproductive system.

Mutagenicity: No human mutagenicity effects have been described for Ethylene Dichloride. Mutagenic data are available for Ethylene Dichloride; these data were obtained during clinical studies on test animal tissue or micro-organisms exposed to this substance.

Embryotoxicity: No human embryotoxic effects have been described for Ethylene Dichloride.

Teratogenicity: No human teratogenicity effects have been described for Ethylene Dichloride.

Reproductive Toxicity: No human reproductive toxicity effects have been described for Ethylene Dichloride. Reproductive toxicity data are available for Ethylene Dichloride; these data were obtained during clinical studies on test animals exposed to this substance. The effects include uterine tumors and most-implantation mortality.

A mutagen is a chemical which causes permanent changes to genetic material (DNA) such that the changes will propagate through generation lines. An embryotoxin is a chemical which causes damage to a developing embryo (i.e. within the first eight weeks of pregnancy in humans), but the damage does not propagate across generational lines. A teratogen is a chemical which causes damage to a developing fetus, but the damage does not propagate across generational lines. A reproductive toxin is any substance which interferes in any way with the reproductive process.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Conditions relating to the target organs may be aggravated by overexposures to Ethylene Dichloride. See Section 3 (Hazard Identification) for information on these conditions.

RECOMMENDATIONS TO PHYSICIANS: Administer oxygen, if necessary. Treat symptoms and eliminate exposure. Be observant for pulmonary edema, and liver and kidney damage. Specific laboratory tests should include prothombine time, serum glucose, electrolytes, CBC, and tests for renal and liver function. Victims experiencing respiratory tract irritation should have arterial blood gases monitored and a chest X-ray is suggested. Pulmonary function test can be useful.

ACGIH BIOLOGICAL EXPOSURE INDICES (BEIs): Currently, Biological Exposure Indices (BEIs) are not applicable for Ethylene Dichloride.

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL STABILITY: Ethylene Dichloride will be degraded over time into other organic compounds. The following environmental data are available for Ethylene Dichloride:

Persistence: Biodegrades at moderate rate. Stable to water, acids, and some active chemicals. In presence of air, moisture, and light, becomes acidic, and darkens. 1,2-dichloroethane undergoes volatilization readily. The half-life is approximately 30-minutes at 25°C. Once volatilized, it undergoes oxidation by hydroxyl radicals to form chloracetyl chloride. The chloracetyl chloride is then hydrolyzed to hydrochloric acid and the carboxylic acid. The half-life for oxidation of 1,2-dichloroethane vapor ranges from 1.5 weeks to 4 months.

Biodegradation: Biodegradability tests with 1,2-dichloroethane resulted in little or no biodegradation in aerobic systems using sewage seed or activated sludge. The one river die-away test reported no degradation. The percent BOD produced in 5-10 days was 0-7% (2,3,4). Another investigator reported slow to moderate biodegradation activity. The extent of biodegradation is difficult to assess due to compound's susceptibility to volatilization. No degradation occurred in an acclimated anaerobic system after 4 months incubation.

Bioconcentration: 1,2-Dichloroethane is not expected to bioconcentrate in fish due to its low octanol/water partition function. The measured log BCF in bluegill sunfish is 0.30.

EFFECT OF MATERIAL ON PLANTS or ANIMALS: Ethylene Dichloride may be harmful or fatal to contaminated plant and animal-life (especially if large quantities of Ethylene Dichloride are released). Refer to Section 11 (Toxicology Information).

EFFECT OF CHEMICAL ON AQUATIC LIFE: Ethylene Dichloride can be harmful or fatal to contaminated aquatic plant and animal life. The following aquatic toxicity data are available for Ethylene Dichloride.

- LC_{50} (*Daphnia magna* water flea) 218,000 mg/L 48 hours (conditions of bioassay not specified)
- LC_{50} (mysid shrimp) 113,000 mg/L/96 hours in salt water (conditions of bioassay not specified)
- LC_{50} (*Gammarus fasciatus* scud) greater than 100 mg/L/96 hours at 21°C, age mature, static bioassay
- LC_{50} (*Pteronarcys* stonefly) greater than 100 mg/L/96 hours at 15°C, second year class, static bioassay
- LC_{50} (*Salmo gairdneri* rainbow trout) 225 mg/L/96 hours at 13°C, wt 1.8 g, static bioassay
- LC_{50} (*Lepomis macrochirus* bluegill) 430 mg/L/96 hours (95% confidence limit 230-710 mg/L)
- LC_{50} (*Lepomis macrochirus* bluegill) 600 mg/L/24 hours, static bioassay, temp 21-23°C, pH 7.9-6.5
- LC_{50} (*Cyprinodon variegatus* sheepshead minnows) 130 ppm but ppm at 24 hours, 48 hours, 72 hours, and 96 hour
- LC_{50} (*Pimephales promelas* fathead minnow) 136 mg/L/96 hours
- LC_{50} (*Crangon crangon* brown shrimp) 75 mg/L/24 hours, 65 mg/L/48 hours, 65 mg/L/96 hours
- LC_{50} (*Gobius minutus* gobi) 185 mg/L/60-minutes, 3 hours; and up to 96 hours in sea water at 15°C
- LC_{50} (*Poecilia reticulata* guppy) 106 ppm/7 days
- toxicity threshold (cell multiplication inhibition test): bacteria (*Pseudomonas putida*): 135 mg/L. Algae (*Microcystis aeruginosa*): 105 mg/L Green algae (*Scenedesmus quadricuda*): 719 mg/L. Protozoa (*Entosiphon sulcatum*): 1,127 mg/L.
- NOEC (rainbow trout, bluegill): 24 hours = 5 mg/L
- NOEC (*Limanda limanda* dab): 96 hours = 60 mg/L

13. DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL: Waste disposal must be in accordance with appropriate U.S. Federal, State, and local regulations or with regulations of Canada and its Provinces. Return cylinders with residual product to Airgas, Inc. Do not dispose of locally.

14. TRANSPORTATION INFORMATION

THIS MATERIAL IS HAZARDOUS AS DEFINED BY 49 CFR 172.101 BY THE U.S. DEPARTMENT OF TRANSPORTATION.

PROPER SHIPPING NAME:	Ethylene dichloride
HAZARD CLASS NUMBER and DESCRIPTION:	3 (Flammable Liquid)
UN IDENTIFICATION NUMBER:	UN 1184
PACKING GROUP:	PG II
DOT LABEL(S) REQUIRED:	*Primary Hazard*: Flammable Liquid Subsidiary Hazard: Toxic Material

NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (1996): 129

MARINE POLLUTANT: Ethylene Dichloride is not classified by the DOT as a Marine Pollutant (as defined by 49 CFR 172.101, Appendix B).

TRANSPORT CANADA, TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: THIS MATERIAL IS CONSIDERED AS DANGEROUS GOODS. Use the above information for the preparation of Canadian Shipments. Also, there is an additional Hazard Class: 9.2 (Substance Hazardous to the Environment).

15. REGULATORY INFORMATION

ADDITIONAL U.S. REGULATIONS:

U.S. SARA REPORTING REQUIREMENTS: The components of this gas mixture are subject to the reporting requirements of Sections 302, 304 and 313 of Title III of the Superfund Amendments and Reauthorization Act, as follows:

COMPONENT	SARA 302 (40 CFR 355, Appendix A)	SARA 304 (40 CFR Table 302.4)	SARA 313 (40 CFR 372.65)
Ethylene Dichloride	NO	YES	YES

U.S. SARA THRESHOLD PLANNING QUANTITY: Not applicable.

U.S. CERCLA REPORTABLE QUANTITY (RQ): Ethylene Dichloride = 100 lb.

U.S. TSCA INVENTORY STATUS: Ethylene Dichloride is listed on the TSCA Inventory.

OTHER U.S. FEDERAL REGULATIONS: Compliance with the OSHA Process Safety Standard (29 CFR 1910.119) may be applicable to operations involving the use of Ethylene Dichloride. Under this regulation Ethylene Dichloride is not listed in Appendix A; however, any process that involves a flammable gas on-site, in one location, in quantities of 10,000 lb. (4,553 kg) or greater is covered under this regulation unless it is used as a fuel.

U.S. STATE REGULATORY INFORMATION: Ethylene Dichloride is covered under specific State regulations, as denoted below:

Alaska - Designated Toxic and Hazardous Substances: Ethylene Dichloride.
California - Permissible Exposure Limits for Chemical Contaminants: Ethylene *Dichloride*.
Florida - Substance List: Ethylene Dichloride.
Illinois - Toxic Substance List: Ethylene Dichloride.
Kansas - Section 302/313 List: No.
Massachusetts - Substance List: Ethylene Dichloride.
Michigan Critical Materials Register: Ethylene Dichloride.
Minnesota - List of Hazardous Substances: Ethylene Dichloride.
Missouri - Employer Information/Toxic Substance List: *Ethylene* Dichloride.
New Jersey - Right to Know Hazardous Substance List: Ethylene Dichloride.
North Dakota - List of Hazardous Chemicals, Reportable Quantities: No.
Pennsylvania - Hazardous Substance List: No.
Rhode Island - Hazardous Substance List: Ethylene Dichloride.
Texas - Hazardous Substance List: Ethylene Dichloride.
West Virginia - Hazardous Substance List: Ethylene Dichloride.
Wisconsin - Toxic and Hazardous Substances: Ethylene Dichloride.

CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65): Ethylene Dichloride is on the California Proposition 65 lists. WARNING: This product contains a chemical known to the State of California to cause cancer.

15. REGULATORY INFORMATION (Continued)

ANSI LABELING (per Z129.1): **WARNING!** FLAMMABLE LIQUID AND VAPOR. FLASH POINT = 13°C (56°F). HARMFUL IF INHALED. HARMFUL OR FATAL IF SWALLOWED. PROLONGED OR REPEATED SKIN CONTACT MAY DRY SKIN AND CAUSE IRRITATION. CAN CAUSE CENTRAL NERVOUS SYSTEM EFFECTS. CHRONIC EXPOSURE MAY CAUSE ADVERSE EFFECTS ON THE RESPIRATORY SYSTEM, LIVER, KIDNEYS. CAN CAUSE DEATH IF TOO MUCH IS BREATHED. ASPIRATION HAZARD IF SWALLOWED - CAN ENTER LUNGS AND CAUSE DAMAGE. SUSPECTED CANCER HAZARD, BASED ON ANIMAL TESTS. Risk of cancer depends on concentration and duration of exposure. Keep away from heat, sparks and flame. Keep container closed. Use only with adequate ventilation. Avoid contact with skin and clothing. Avoid exposure to vapor. Wash thoroughly after handling. FIRST-AID: In case of contact, immediately flush skin with plenty of water. Remove contaminated clothing and shoes. Get medical attention if irritation develops or persists. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of fire, use water fog, foam, dry chemical, or CO_2. In case of spill: Absorb spill with inert materials (e.g. activated carbon, dry sand). Flush residual spill with water. Consult Material Safety Data Sheet for additional information.

ADDITIONAL CANADIAN REGULATIONS:

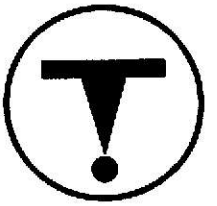
CANADIAN DSL/NDSL INVENTORY STATUS: Ethylene Dichloride is on the DSL Inventory.

OTHER CANADIAN REGULATIONS: Not applicable.

CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA) PRIORITIES SUBSTANCES LISTS: Ethylene Dichloride is on the CEPA Priorities Substances Lists, as follows: First Priority Substances List; Toxic under CEPA Section 11 [25].

CANADIAN WHMIS SYMBOLS:

Class B2: Flammable Liquid
Class D2A/B: Other Toxic Effects



16. OTHER INFORMATION

PREPARED BY:

CHEMICAL SAFETY ASSOCIATES, Inc.
9163 Chesapeake Drive, San Diego, CA 92123-1002
619/565-0302

The information contained herein is based on data considered accurate. However, no warranty is expressed or implied regarding the accuracy of these data or the results to be obtained from the use thereof. AIRGAS, Inc. assumes no responsibility for injury to the vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, AIRGAS, Inc. assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the material even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in his use of the material.

DEFINITIONS OF TERMS

A large number of abbreviations and acronyms appear on a MSDS. Some of these which are commonly used include the following:

CAS #: This is the Chemical Abstract Service Number which uniquely identifies each constituent. It is used for computer-related searching.

EXPOSURE LIMITS IN AIR:

ACGIH - American Conference of Governmental Industrial Hygienists, a professional association which establishes exposure limits. **TLV** - Threshold Limit Value - an airborne concentration of a substance which represents conditions under which it is generally believed that nearly all workers may be repeatedly exposed without adverse effect. The duration must be considered, including the 8-hour Time Weighted Average **(TWA)**, the 15-minute Short Term Exposure Limit, and the instantaneous Ceiling Level **(C)**. Skin absorption effects must also be considered.

OSHA - U.S. Occupational Safety and Health Administration.

PEL - Permissible Exposure Limit - This exposure value means exactly the same as a TLV, except that it is enforceable by OSHA. The OSHA Permissible Exposure Limits are based in the 1989 PELs and the June, 1993 Air Contaminants Rule (Federal Register: 58: 35338-35351 and 58: 40191). Both the current PELs and the vacated PELs are indicated. The phrase, "Vacated 1989 PEL," is placed next to the PEL which was vacated by Court Order. **IDLH** - Immediately Dangerous to Life and Health - This level represents a concentration from which one can escape within 30-minutes without suffering escape-preventing or *permanent injury*. **The DFG - MAK** is the Republic of Germany's Maximum Exposure Level, similar to the U.S. PEL. **NIOSH** is the National Institute of Occupational Safety and Health, which is the research arm of the U.S. Occupational Safety and Health Administration **(OSHA)**. NIOSH issues exposure guidelines called Recommended Exposure Levels **(RELs)**. When no exposure guidelines are established, an entry of **NE** is made for reference.

HAZARD RATINGS:

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM: Health Hazard: **0** (minimal acute or chronic exposure hazard); **1** (slight acute or chronic exposure hazard); **2** (moderate acute or significant chronic exposure hazard); **3** (severe acute exposure hazard; onetime overexposure can result in permanent injury and may be fatal); **4** (extreme acute exposure hazard; onetime overexposure can be fatal). Flammability Hazard: **0** (minimal hazard); **1** (materials that require substantial pre-heating before burning); **2** (combustible liquid or solids; liquids with a flash point of 38-93°C [100-200°F]); **3** (Class IB and IC flammable liquids with flash points below 38°C [100°F]); **4** (Class IA flammable liquids with flash points below 23°C [73°F] and boiling points below 38°C [100°F]. Reactivity Hazard: **0** (normally stable); **1** (material that can become unstable at elevated temperatures or which can react slightly with water); **2** (materials that are unstable but do not detonate or which can react violently with water); **3** (materials that can detonate when initiated or which can react explosively with water); **4** (materials that can detonate at normal temperatures or pressures).

NATIONAL FIRE PROTECTION ASSOCIATION: Health Hazard: **0** (material that on exposure under fire conditions *would offer no* hazard beyond that of ordinary combustible materials); **1** (materials that on exposure under fire conditions could cause irritation or minor residual injury); **2** (materials that on intense or continued exposure under fire conditions could cause temporary incapacitation or possible residual injury); **3** (materials that can on short exposure could cause serious temporary or residual injury); **4** (materials that under very short exposure causes death or major residual injury). Flammability Hazard and Reactivity Hazard: Refer to definitions for "Hazardous Materials Identification System".

FLAMMABILITY LIMITS IN AIR:

Much of the information related to fire and explosion is derived from the National Fire Protection Association **(NFPA)**. Flash Point - Minimum temperature at which a liquid gives off sufficient vapors to form an ignitable mixture with air. Autoignition Temperature: The minimum temperature required to initiate combustion in air with no other source of ignition. LEL - the lowest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source. UEL - the highest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source.

TOXICOLOGICAL INFORMATION:

Human and Animal Toxicology: Possible health hazards as derived from human data, animal studies, or from the results of studies with similar compounds are presented. Definitions of some terms used in this section are: **LD_{50}** - Lethal Dose (solids & liquids) which kills 50% of the exposed animals; **LC_{50}** - Lethal Concentration (gases) which kills 50% of the exposed animals; **ppm** concentration expressed in parts of material per million parts of air or water; **mg/m^3** concentration expressed in weight of substance per volume of air; **mg/kg** quantity of material, by weight, administered to a test subject, based on their body weight in kg. Other measures of toxicity include **TDLo**, the lowest dose to cause a symptom and **TCLo** the lowest concentration to cause a symptom; **TDo, LDLo**, and **LDo**, or **TC, TCo, LCLo**, and **LCo**, the lowest dose (or concentration) to cause lethal or toxic effects. **Cancer Information:** The sources are: **IARC** - the International Agency for Research on Cancer; **NTP** - the National Toxicology Program, **RTECS** - the Registry of Toxic Effects of Chemical Substances, **OSHA** and **CAL/OSHA**. IARC and NTP rate chemicals on a scale of decreasing potential to cause human cancer with rankings from 1 to 4. Subrankings (2A, 2B, etc.) are also used. **Other Information: BEI** - ACGIH Biological Exposure Indices, represent the levels of determinants which are most likely to be observed in specimens collected from a healthy worker who has been exposed to chemicals to the same extent as a worker with inhalation exposure to the TLV. **Ecological Information:** EC is the effect concentration in water. **BCF** = Bioconcentration Factor, which is used to determine if a substance will concentrate in lifeforms which consume contaminated plant or animal matter. Coefficient of Oil/Water Distribution is represented by **log K_{ow}** or **log K_{oc}** and is used to assess a substance's behavior in the environment.

REGULATORY INFORMATION:

This section explains the impact of various laws and regulations on the material. **U.S.: EPA** is the U.S. Environmental Protection Agency. **DOT** is the U.S. Department of Transportation. **SARA** is the Superfund Amendments and Reauthorization Act. **TSCA** is the U.S. Toxic Substance Control Act. **CERCLA (or Superfund)** refers to the *Comprehensive* Environmental Response, Compensation, and Liability Act. Labeling is per the American National Standards Institute **(ANSI Z129.1)**. **CANADA: CEPA** is the Canadian Environmental Protection Act. **WHMIS** is the Canadian Workplace Hazardous Materials Information System. **TC** is Transport Canada. **DSL/NDSL** are the Canadian Domestic/Non-Domestic Substances Lists.

MATERIAL SAFETY DATA SHEET

SECTION 1 - PRODUCT AND COMPANY IDENTIFICATION

Manufacturer: AccuStandard, Inc.
125 Market Street
New Haven, CT 06513

Date MSDS Printed: 1/12/2006
Preparation Date: 5/19/2004
Information Phone Number: 203-786-5290
Emergency Phone Number: 203-786-5290
Hours: Mon. to Fri. 8am-5pm EDT

MSDS Number: P-144S-10X
Product Name: Dinoseb
Synonyms: N/A
Formula: N/A
Molecular Weight: N/A

SECTION 2 - COMPOSITION / INFORMATION ON INGREDIENTS

Component(s) (2)	CAS #	Appr. %	ACGIH-TLV (mg/m3) TWA	ACGIH-TLV (mg/m3) STEL skin	OSHA-PEL (mg/m3) TWA	OSHA-PEL (mg/m3) STEL skin
Dinoseb	88-85-7	0.1%				
Methanol	67-56-1	99.9%	262	328 x	260	

SECTION 3 - HAZARDS IDENTIFICATION

Symptoms of Exposure:

After ingestion or inhalation, initial symptoms may be only that of mild intoxication, but may become severe after 12 or 18 hours.

Over exposure may cause dizziness, nausea, muscle weakness, narcosis and respiratory failure.

May irritate skin on prolonged contact.

Potential Health Effects:

May cause eye, kidney, liver, and skin damage.

Toxic if inhaled, absorbed through skin, or swallowed.

May cause central nervous system, kidney, and liver damage.

Poison, May be fatal or cause blindness if swallowed.

Fetal development abnormalities and effects on embryo or fetus have been reported from prolonged exposure to methanol in laboratory tests involving pregnant rats.

Routes of Entry:

Inhalation, ingestion or skin contact.

Alteration of any information contained herein without written permission from AccuStandard strictly prohibited.

For full page MSDS please visit www.accustandard.com

Carcinogenicity:

This product is or contains a component that is not listed (ACGIH, IARC, NTP, OSHA) as a cancer causing agent.

SECTION 4 - FIRST AID MEASURES

Emergency First Aid:

Get medical assistance for all cases of overexposure.

Skin contact: Wash thoroughly with soap and water.

Eye contact: Immediately flush with plenty of water. After initial flushing, remove and contact lenses and continue flushing for at least 15 minutes. Assure adequate flushing by separating the eyelids with fingers.

Inhalation: Remove to fresh air. If not breathing, give artificial respiration or give oxygen by trained personnel. Seek immediate medical attention.

Ingestion: Drink water and induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention immediately.

Remove contaminated clothing and wash before reuse.

SECTION 5 - FIRE FIGHTING MEASURES

Flammable Properties:

Flash Point: 52F (tcc)
Flammable Limits LEL (%): 6.7
Flammable Limits UEL (%): 36.5
Autoignition Temperature: N/A
Dangerous fire and explosive hazard.

Containers can build up pressure if exposed to heat.

Vapors can travel to a source of ignition and flash back.

Extinguishing Media:

Use alcohol foam, carbon dioxide, dry chemical, or water spray when fighting fires involving this material.

Fire Fighting Procedures:

As in any fire, wear self-contained breathing apparatus pressure demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

SECTION 6 - ACCIDENTAL RELEASE MEASURES

Spill Response:

Wear suitable protective equipment listed under Exposure Controls / Personal Protection. Eliminate any ignition sources until the area is determined to be free from explosion or fire hazards. Contain the release and eliminate its source, if this can be done without risk. Dispose as hazardous waste. Comply with Federal, State and local regulations.

SECTION 7 - HANDLING AND STORAGE

Keep container closed when not in use.

Alteration of any information contained herein without written permission from AccuStandard strictly prohibited.

For full page MSDS please visit www.accustandard.com

Store in a cool area away from ignition sources and oxidizers.

Do not breathe vapor or mist.

Do not get in eyes, on skin, or on clothing.

SECTION 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

Engineering Controls and Personal Protection Equipment (PPE):

Respiratory Protection: If workplace exposure limit(s) of product or any component is exceeded (see TLV/PEL), a NIOSH/MSHA approved air supplied respirator is advised in absence of proper environmental control. OSHA regulations also permit other NIOSH/MSHA respirators (negative pressure type) under specified conditions (see your safety equipment supplier). Engineering and/or administrative controls should be implemented to reduce exposure.

Material should be handled or transferred in an approved fume hood or with adequate ventilation.

Protective gloves must be worn to prevent skin contact.

(Butyl, viton or equivalent)

Safety glasses with side shields must be worn at all times.

General Hygiene Considerations:

Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available.

SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES

Appearance: *Clear liquid*
Odor: N/A
pH: N/A
Vapor Pressure: 97 20C
Vapor Density (Air = 1): 1.1
Boiling Point: 65
Melting Point: -98
Solubility in Water (%): Soluble
Specific Gravity (H_2O = 1): 0.791
Flash Point: 52F (tcc)
Explosion Limits (%): 6.7 to 36.5
Autoignition Temperature: N/A
Percent Volatile: 99.9+
Evaporation Rate (BuAc = 1): 5.9
Molecular Weight: N/A
Molecular Formula: N/A

For full page MSDS please visit www.accustandard.com

SECTION 10 - STABILITY AND REACTIVITY

Stability: Stable
Conditions To Avoid: Heat; contact with ignition sources
Materials To Avoid: Acids
Oxidizers

Reactive metals
Hazardous Decomposition: CO>>x<<, Formaldehyde
Hazardous Polymerization: Does not occur

SECTION 11 - TOXICOLOGICAL INFORMATION

See section 3 for specific toxicological information for the ingredients of this product.

SECTION 12 - ECOLOGICAL INFORMATION

By complying with sections 6 and 7 there will be no release to the environment.

SECTION 13 - DISPOSAL CONSIDERATIONS

Recycle or incinerate at any EPA approved facility or dispose in compliance with Federal, State and local regulations. Empty containers must be triple-rinsed prior to disposal.

SECTION 14 - TRANSPORT INFORMATION

DOT UN Number: UN1230 Shipping Class: 3 Packing Group: II CARCINOGENIC

SECTION 15 - REGULATORY INFORMATION

In addition to Federal and state regulations, local regulations may apply. Check with your local regulatory authorities.

The following regulations apply:
WARNING: This product contains chemical(s) known to the state of California to cause cancer and to cause birth defects or other reproductive harm.

SECTION 16 - OTHER INFORMATION

This document has been designed to meet the requirements of OSHA, ANSI and CHIPs regulations.

The statements contained herein are offered for informational purposes only and are based on technical data that we believe to be accurate. It is intended for use only by persons having the necessary technical skill and at their own discretion and risk. Since conditions and manner of use are outside our control, we make
NO WARRANTY, EXPRESSED OR IMPLIED, OF MERCHANTABILITY, FITNESS OR OTHERWISE.

Legend : N/A = Not Available ND = Not Determined NR = Not regulated

* * * End of Document * * *

For full page MSDS please visit www.accustandard.com

PRODUCT NAME: 13003-13023 COLOR COAT CLEAR AEROSOLS
PRODUCT CODE: CCCLRAEROMSDS **2 4 0 G**
Non Methylene Chloride formula

========== SECTION I - MANUFACTURER IDENTIFICATION ==========

MANUFACTURER'S NAME: SEM PRODUCTS, INC.
ADDRESS : 651 MICHAEL WYLIE DR.
CHARLOTTE, NC 28217

EMERGENCY PHONE : CHEMTRC 800-424-9300 DATE REVISED : 9/23/2002
INFORMATION PHONE : (800) 831-1122 NAME OF PREPARER : CG

========== SECTION II - HAZARDOUS INGREDIENTS/SARA III INFORMATION ==========

REPORTABLE COMPONENTS	CAS NUMBER	VAPOR PRESSURE mm Hg @ TEMP		WEIGHT PERCENT
ACETONE OSHA PEL: 1000 PPM, ACGIH TLV: 750 PPM, OTHER: N/A LD50: 9750MG/KG:RAT-ORL, LC50: N/A	67-64-1	186	68	40-45%
PROPANE (HYDROCARBON PROPELLANT) OSHA PEL: 1000 PPM, ACGIH TLV: 1000 PPM, OTHER: N/A LD50: N/A, LC50: N/A	74-98-6	108 PSIG	68	15-20%
* TOLUENE OSHA PEL: 100 PPM-8HR, STEL: 200 PPM, OTHER: 300 PPM CEILING LD50: 5000MG/KG:RAT-ORL, LC50: 5320PPM/8H:MUS-IHL	108-88-3	22	68	5-10%
[redacted]BUTYL ACETATE OSHA PEL: 150 PPM, ACGIH TLV: 150 PPM, OTHER: N/A LD50: 15GM/KG:RAT-ORL, LC50: N/A	110-19-0	12.8	68	5-10%
METHYL ISOBUTYL KETONE LD50: 2080MG/KG:RAT ORL LC50 23300MG/M3MUS-IHL OSHA PEL: 75PPM	108-10-1	16.00	68 F	5-10%
* METHYL ETHYL KETONE OSHA PEL: 200 PPM, ACGIH TLV: 200 PPM, OTHER: N/A LD50: 3400MG/KG:RAT-ORL, LC50: N/A	78-93-3	70	68	1-5%
1-METHOXY-2-PROPANOL ACETATE OSHA PEL: N/A, ACGIH TLV: N/A, OTHER: N/A LD50: N/A, LC50: N/A	108-65-6	3.7	68	1-5%
ETHYL 3- ETHOXYPROPIONATE (3-ETHOXYPROPIONATE) OSHA PEL: 50 PPM TWA, ACGIH TLV: 100 PPM, OTHER: N/A LD50: N/A, LC50: N/A	763-69-9	1.11	77	1-5%
ETHYLENE GLYCOL MONOPROPYL ETHER OSHA PEL: N/A, ACGIH TLV: N/A, OTHER: N/A LD50: 4890MG/KG:RAT-ORL, LC50: 1530PPM/4H:MUS-IHL	2807-30-9	1.3	68	1-5%

* Indicates toxic chemical(s) subject to the reporting requirements of section 313 of Title III and of 40 CFR 372.
WARNING: CONTAINS CHEMICALS KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER AND/OR BIRTH DEFECTS OR OTHER REPRODUCTIVE HARM. TSCA CERTIFICATION: All chemicals in this product are listed, or are exempt from listing on the TSCA inventory.

========== SECTION III - PHYSICAL/CHEMICAL CHARACTERISTICS ==========

[redacted]OILING RANGE: < 0 - 238 F
[redacted]APOR DENSITY: HEAVIER THAN AIR
SPECIFIC GRAVITY (H2O=1): .75
EVAPORATION RATE: FASTER THAN n-BUTYL ACETATE

COATING V.O.C.: 5.25 lb/gl
MATERIAL V.O.C.: 3.23 lb/gl

SOLUBILITY IN WATER: INSOLUBLE
APPEARANCE AND ODOR: CLEAR LIQUID - SOLVENT

========== SECTION IV - FIRE AND EXPLOSION HAZARD DATA ==========

FLASH POINT: PROPELLENT < 0 F METHOD USED: TCC
FLAMMABLE LIMITS IN AIR BY VOLUME- LOWER: 1.0 UPPER: 13.0

EXTINGUISHING MEDIA: FOAM, ALCOHOL FOAM, CO2, DRY CHEMICAL, WATER FOG

SPECIAL FIREFIGHTING PROCEDURES
WATER SPRAY MAY BE INEFFECTIVE, BUT MAY BE USED TO COOL CONTAINERS EXPOSED TO HEAT. WEAR SELF-CONTAINED BREATHING APPARATUS.

UNUSUAL FIRE AND EXPLOSION HAZARDS
VAPORS MAY IGNITE EXPLOSIVELY. EXPOSURE TO HEAT OR PROLONGED EXPOSURE TO SUN MAY CAUSE BURSTING. DO NOT EXPOSE TO HEAT OR STORE AT TEMPERATURES ABOVE 120 F DO NOT PUNCTURE OR INCINERATE (BURN) CONTAINER.

========== SECTION V - REACTIVITY DATA ==========

STABILITY: STABLE
CONDITIONS TO AVOID
EXCESSIVE HEAT, OPEN FLAMES, SPARK SOURCES

INCOMPATIBILITY (MATERIALS TO AVOID)
OXIDIZING AGENTS

HAZARDOUS DECOMPOSITION OR BYPRODUCTS
CARBON DIOXIDE, CARBON MONOXIDE, VARIOUS HYDROCARBONS, OXIDES OF NITROGEN

HAZARDOUS POLYMERIZATION: WILL NOT OCCUR

========== SECTION VI - HEALTH HAZARD DATA ==========

INHALATION HEALTH RISKS AND SYMPTOMS OF EXPOSURE
NASAL AND RESPIRATORY IRRITATION, DIZZINESS, HEADACHE, NAUSEA, POSSIBLE UNCONSCIOUSNESS, AND ASPHYXIATION.

SKIN AND EYE CONTACT HEALTH RISKS AND SYMPTOMS OF EXPOSURE
MODERATE IRRITATION, REDNESS,ITCHING AND BLURRED VISION. EXCESSIVE SKIN EXPOSURE MAY CAUSE BURNING SENSATION.

SKIN ABSORPTION HEALTH RISKS AND SYMPTOMS OF EXPOSURE
MODERATE IRRITATION, REDNESS, DERMATITIS.

INGESTION HEALTH RISKS AND SYMPTOMS OF EXPOSURE
GASTROINTESTINAL IRRITATION, VOMITING, DIARRHEA.

HEALTH HAZARDS (ACUTE AND CHRONIC)
EYES: IRRITATION, BLURRED VISION. SKIN: MODERATE IRRITATION, DERMATITIS. INHALATION: NASAL AND RESPIRATORY IRRITATION, NAUSEA, POSSIBLE UNCONSCIOUSNESS, ASPHYXIATION. INGESTION: GASTROINTESTINAL IRRITATION, VOMITING, DIARRHEA. CNS: INTOXICATION CAUSING SLIGHT EUPHORIA, DIZZINESS AND HEADACHE. OTHER: OVEREXPOSURE TO ETHYLENE GLYCOL MONOPROPYL ETHER CAN AFFECT LIVER AND KIDNEYS

CARCINOGENICITY: NTP CARCINOGEN: No IARC MONOGRAPHS: No OSHA REGULATED: No

N/A

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE
BRONCHITIS, CNS DISORDERS, ALLERGIES, NAUSEA.

EMERGENCY AND FIRST AID PROCEDURES
EYES: FLUSH WITH LARGE AMOUNTS OF WATER LIFTING UPPER AND LOWER LIDS. GET MEDICAL ATTENTION. SKIN: THOROUGHLY WASH EXPOSED AREA WITH SOAP AND WATER. INHALATION: REMOVE TO FRESH AIR, GIVE ARTIFICIAL RESPIRATION IF NECESSARY. INGESTION KEEP PERSON WARM AND QUIET. SEEK IMMEDIATE MEDICAL ADVICE REGARDING INDUCTION OF VOMITING.

========== SECTION VII - PRECAUTIONS FOR SAFE HANDLING AND USE ==========

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
REMOVE ALL SOURCES OF IGNITION. ALLOW VOLATILE PORTION TO EVAPORATE COMPLETELY. AVOID BREATHING VAPORS AND REMOVE WITH INERT ABORBENT.

WASTE DISPOSAL METHOD
DO NOT INCINERATE. DISPOSE OF IN ACCORDANCE WITH LOCAL, STATE AND FEDERAL REGULATION. DO NOT CONTAMINATE LAKES, STREAMS OR OTHER WATER SUPPLY.

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING
DO NOT STORE OR USE NEAR HEAT, SPARKS OR FLAME. STORE IN WELL VENTILATED AREA. KEEP CLOSURE TIGHT AND CONTAINER UPRIGHT TO PREVENT LEAKAGE. DO NOT PUNCTURE OR INCINERATE. DO NOT SPRAY NEAR FIRE OR OPEN FLAMES.

OTHER PRECAUTIONS
REPORTS HAVE ASSOCIATED REPEATED AND PROLONGED OCCUPATIONAL OVER-EXPOSURE TO SOLVENTS WITH PERMANENT BRAIN AND NERVOUS SYSTEM DAMAGE. INTENTIONAL MISUSE BY DELIBERATELY CONCENTRATING AND INHALING THE CONTENTS MAY BE HARMFUL OR FATAL. AVOID SPONTANEOUS COMBUSTION OF CONTAMINATED RAGS OR OTHER IGNITABLE MATERIAL BY IMMEDIATE IMMERSION IN WATER. KEEP OUT OF THE REACH OF CHILDREN.

========== SECTION VIII - CONTROL MEASURES ==========

RESPIRATORY PROTECTION
USE OF A NIOSH APPROVED CHEMICAL/MECHANICAL FILTER, DESIGNED TO REMOVE A COMBINATION OF PARTICLES AND VAPOR.

VENTILATION
PROVIDE SUFFICIENT MECHANICAL (GENERAL AND/OR LOCAL EXHAUST) VENTILATION TO MAINTAIN EXPOSURE BELOW TLV(S).

PROTECTIVE GLOVES
NEOPRENE OR BUTYL RUBBER GLOVES.

EYE PROTECTION
GOGGLES OR SIDE-SHIELD SAFETY GLASSES.

OTHER PROTECTIVE CLOTHING OR EQUIPMENT
TO PREVENT REPEATED OR PROLONGED SKIN CONTACT, WEAR IMPERVIOUS CLOTHING AND BOOTS. WASH CONTAMINATED CLOTHING BEFORE RE-USE.

WORK/HYGIENIC PRACTICES
WASH HANDS BEFORE EATING, SMOKING OR USING THE WASHROOM.

========== *SECTION IX* - DISCLAIMER ==========

THE INFORMATION ACCUMULATED HEREIN IS BELIEVED TO BE ACCURATE AND RELIABLE AS OF THE DATE INDICATED ABOVE, HOWEVER SEM PRODUCTS, INC., MAKES NO REPRESENTATION, WARRANTY OR GUARANTEE NOR ASSUMES ANY LEGAL RESPONSIBILITY AS TO ITS ACCURACY, RELIABILITY OR COMPLETENESS. ULTIMATE DETERMINATION OF SUITABILITY FOR INTENDED USE IS THE RESPONSIBILITY OF THE USER.

The MSDS format adheres to the standards and regulatory requirements of the United States and may not meet regulatory requirements in other countries.

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p-Nitrophenol
1066CR Revised 27-JUN-1989

CHEMICAL PRODUCT/COMPANY IDENTIFICATION

Material Identification

Corporate MSDS Number	: DU000305
CAS Number	: 100-02-7
Formula	: NO2C6H4-OH
Molecular Weight	: 139.11
CAS Name	: PHENOL, 4-NITRO-
Grade	: TECHNICAL

Tradenames and Synonyms

PNP
4-Hydroxynitrobenzene

Company Identification

MANUFACTURER/DISTRIBUTOR
DuPont
1007 Market Street
Wilmington, DE 19898

PHONE NUMBERS

Product Information	: 1-800-441-7515 (outside the U.S. 302-774-1000)
Transport Emergency	: CHEMTREC 1-800-424-9300(outside U.S. 703-527-3887)
Medical Emergency	: 1-800-441-3637 (outside the U.S. 302-774-1000)

COMPOSITION/INFORMATION ON INGREDIENTS

Components

Material	CAS Number	%
*P-NITROPHENOL	100-02-7	99

* Disclosure as a toxic chemical is required under Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR part 372.

HAZARDS IDENTIFICATION

Potential Health Effects

Harmful if inhaled, swallowed or absorbed through skin; reduces blood's oxygen carrying capacity. Symptoms may be delayed. Causes eye and skin irritation.

HUMAN HEALTH EFFECTS

Overexposure may initially include: skin irritation with discomfort or rash; nonspecific discomfort such as nausea, headache, or weakness; reduction of the blood's oxygen carrying capacity with cyanosis (bluish discoloration), weakness, or shortness of breath by formation of methemoglobin; abnormal blood forming system function with anemia, or red blood cell destruction. There are no reports of human sensitization.

Individuals with preexisting diseases of the cardiovascular system or bone marrow may have increased susceptibility to the toxicity of excessive exposures.

In its "Notice of Intent to Establish", ACGIH gives a BEI for methemoglobin inducers of 1.5% methemoglobin in blood.

Carcinogenicity Information

None of the components present in this material at concentrations equal to or greater than 0.1% are listed by IARC, NTP, OSHA or ACGIH as a carcinogen.

FIRST AID MEASURES

First Aid

If inhaled: Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

If swallowed: Induce vomiting immediately by giving two glasses of water and sticking finger down throat. Call a physician. Never give anything by mouth to an unconscious person.

In case of contact: Immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Call a physician. Wash clothing before reuse and destroy contaminated shoes.

Note to Physician:

Absorption of this product into the body leads to the formation of methemoglobin which, in sufficient

(FIRST AID MEASURES - Continued)

concentration causes cyanosis. In case of skin absorption, symptoms may be delayed. Since reversion of methemoglobin to hemoglobin occurs spontaneously after termination of exposure, moderate degrees of cyanosis need be treated only by supportive measures such as bed rest and oxygen inhalation. Thorough cleansing of the entire contaminated area of body including scalp and nails is of utmost importance. If cyanosis is severe, intravenous injection of methylene blue, 1 mg/kg of body weight, may be of value. Cyanocobalamin (Vitamin B-12), 1 mg intramuscularly, will speed recovery. Intravenous fluids and blood transfusions may be indicated in very severe exposures.

FIRE FIGHTING MEASURES

Flammable Properties

Autoignition : 283 C (541 F)

Fire and Explosion Hazards:

PNP will burn and may release hazardous oxides of nitrogen.

Extinguishing Media

Small fires: Water, carbon dioxide (CO2)
Large fires: Water, water spray

Fire Fighting Instructions

Isolate hazard and evacuate area. Stay upwind and avoid smoke and fumes. Use water spray to cool containers. p-Nitrophenol provides its own oxygen for combustion; flood fire with water. If smoke and fumes cannot be avoided wear chemical proof suit with hood and breathing air supply. Fight fire from maximum distance. Use caution in approaching large or advanced fire; product may decompose violently. Run-off from fire may cause pollution.

ACCIDENTAL RELEASE MEASURES

Safeguards (Personnel)

NOTE: Review FIRE FIGHTING MEASURES and HANDLING (PERSONNEL) sections before proceeding with clean-up. Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean-up.

(ACCIDENTAL RELEASE MEASURES - Continued)

Accidental Release Measures

Sweep up spillage; transfer to covered metal containers for disposal. Flush spill area with detergent and water. Comply with Federal, State, and Local regulations on reporting releases.

HANDLING AND STORAGE

Handling (Personnel)

Avoid breathing vapor or dust. Avoid contact with eyes, skin, and clothing. Wash thoroughly after handling.

Storage

Store inside a cool place away from heat, sparks, and flame. Keep containers dry and tightly closed. Do not store with flammable or oxidizing materials. Handle in a manner to prevent human contact. Do not roll drums on side.

EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls

Good general ventilation should be provided to minimize contact with vapors of dust.

Personal Protective Equipment

Have available and wear as appropriate: hard hat with brim; safety spectacles (side shields preferred); chemical splash goggles; full length face shield; Butyl Rubber gauntlet gloves, apron, and safety shoes, or Butyl Rubber boots over leather shoes. If there is a possibility of direct contact with dust or vapor, wear a Butyl Rubber suit with hood and breathing air supply.

Exposure Guidelines

Exposure Limits
p-Nitrophenol

PEL	(OSHA)	: None Established
TLV	(ACGIH)	: None Established

PHYSICAL AND CHEMICAL PROPERTIES

Physical Data

Boiling Point	: Decomposes
Vapor Pressure	: 0.6 mm Hg @ 120 C (248 F) 6.9 mm Hg @ 165 C (329 F)
Melting Point	: 114 C (237 F)
Evaporation Rate	: <1 (Butyl Acetate = 1)
Solubility in Water	: 3.3 WT% @ 40 C (104 F) 4.3% wt @ 50 deg C (122 deg F)
pH	: 4.1 (Water extract)
Odor	: Phenolic
Form	: Solid, flakes
Color	: Buff
Specific Gravity	: 1.48 at 20 C (68 F) 1.27 at 120 C (248 F)

STABILITY AND REACTIVITY

Chemical Stability

Stable at normal temperatures and storage conditions.

Decomposes if overheated.

Incompatibility with Other Materials

Incompatible with oxidizing agents.

Decomposition

May release hazardous smoke, fumes, and nitrogen oxide gases if overheated.

Polymerization

Polymerization will not occur.

TOXICOLOGICAL INFORMATION

Animal Data

Skin Absorption ALD: 1,500-2,000 mg/kg in rabbits
Oral LD50: 350 mg/kg in rats

The compound is a skin and eye irritant. Tests for mutagenic activity in bacterial or mammalian cell cultures have been inconclusive, with positive results in some studies, and negative results in others.

ECOLOGICAL INFORMATION

Ecotoxicological Information

Aquatic Toxicity

PNP is slightly toxic (96 hour LC50 - 50-500 mg/L)
96 hour LC50, fathead minnows: 61 mg/L

DISPOSAL CONSIDERATIONS

Waste Disposal

Comply with Federal, State, and Local regulations. If approved, may be incinerated or transferred to a disposal contractor. Very dilute solutions are biodegradeable by specially acclimated bacteria.

TRANSPORTATION INFORMATION

Shipping Information

DOT
Proper Shipping Name : RQ, HAZARDOUS SUBSTANCE, SOLID, N.O.S.
Hazard Class : ORM-E
I.D. No. (UN/NA) : NA 9188

DOT/IMO
Proper Shipping Name : NITROPHENOLS
Hazard Class : POISON B, 6.1
UN No. : UN 1663

Shipping Containers

Fiber drums
Reportable Quantity : 100 lbs./45.4 kg.

REGULATORY INFORMATION

U.S. Federal Regulations

TSCA Inventory Status : Reported/Included.

Superfund reportable discharge = 100 lb.

TITLE III HAZARD CLASSIFICATIONS SECTIONS 311, 312

Acute : Yes
Chronic : Yes
Fire : No
Reactivity : No
Pressure : No

(REGULATORY INFORMATION - Continued)

Lists:

Extremely Hazardous Substance	-	No
CERCLA Hazardous Substance	-	Yes
Toxic Chemical	-	Yes

OTHER INFORMATION

NFPA, NPCA-HMIS

NFPA Rating	
Health	: 3
Flammability	: 1
Reactivity	: 0
NPCA-HMIS Rating	
Health	: 2
Flammability	: 1
Reactivity	: 1

Personal Protection rating to be supplied by user depending on use conditions.

Additional Information

For further information, see DuPont "p-Nitrophenol, Technical" Data Sheet.

The data in this Material Safety Data Sheet relates only to the specific material designated herein and does not relate to use in combination with any other material or in any process.

Responsibility for MSDS : J. C. Watts
Address : DuPont Company, C & P Dept.
P. O. Box 80709, Chestnut Run
Wilmington, De 19880-0709
Telephone : 302-999-4946

This information is based upon technical information believed to be reliable. It is subject to revision as additional knowledge and experience is gained.

End of MSDS

Valid 11/1999 - 01/2000

gma Chemical Co.
.O. Box 14508
St. Louis, MO 63178 USA
Tel: 314-771-5765

M A T E R I A L S A F E T Y D A T A S H E E T

SECTION 1. - - - - - - - - - CHEMICAL IDENTIFICATION- - - - - - - - - -

CATALOG #: P1045

NAME: PENTACHLOROPHENOL

SECTION 2. - - - - - COMPOSITION/INFORMATION ON INGREDIENTS - - - - - -

CAS #: 87-86-5

MF: C6HCL5O

EC NO: 201-778-6

SYNONYMS

AD 73 * CHEM-PENTA * CHEM-TOL * CHLON * CHLOROPHEN * CM 613 * CP 1309 * DOWICIDE 7 * DOWICIDE EC-7 * DOW PENTACHLOROPHENOL DP-2 ANTIMICROBIAL * DUROTOX * EP 30 * FUNGIFEN * GRUNDIER ARBEZOL * 1-HYDROXYPENTACHLOROBENZENE * LAUXTOL * LAUXTOL A * LIROPREM * MB 333 * NCI-C54933 * NCI-C55378 * NCI-C56655 * PCP (PESTICIDE) * PENCHLOROL * PENTA * PENTACHLOORFENOL (DUTCH) * PENTACHLOROFENOL * PENTACLOROFENOLO (ITALIAN) * PENTACHLOROPHENOL * 2,3,4,5,6-PENTACHLOROPHENOL * PENTACHLOROPHENOL (ACGIH:OSHA) * PENTACHLOROPHENOL, DP-2 * PENTACHLORPHENOL (GERMAN) * PENTACON * PENTA-KIL * PENTA READY * PENTA WR * PENWAR * PERATOX * PERMACIDE * PERMAGARD * PERMASAN * PERMATOX DP-2 * PERMATOX PENTA * PERMITE * POLE TOPPER FLUID * POL NU * PREVENTOL P * RCRA WASTE NUMBER U242 * SANTOPHEN 20 * THOMPSON'S WOOD FIX * WEEDONE * WITOPHEN P * WOODTREAT A *

SECTION 3. - - - - - - - - - - HAZARDS IDENTIFICATION - - - - - - - - -

LABEL PRECAUTIONARY STATEMENTS

HIGHLY TOXIC (USA)

TOXIC (EU)

TOXIC BY INHALATION, IN CONTACT WITH SKIN AND IF SWALLOWED.

POSSIBLE RISK OF HARM TO THE UNBORN CHILD.

POSSIBLE RISK OF IRREVERSIBLE EFFECTS.

IRRITATING TO EYES, RESPIRATORY SYSTEM AND SKIN.

CALIF. PROP. 65 CARCINOGEN.

POSSIBLE MUTAGEN.

READILY ABSORBED THROUGH SKIN.

TARGET ORGAN(S):

LIVER

KIDNEYS

AVOID EXPOSURE - OBTAIN SPECIAL INSTRUCTIONS BEFORE USE.

IN CASE OF ACCIDENT OR IF YOU FEEL UNWELL, SEEK MEDICAL ADVICE IMMEDIATELY (SHOW THE LABEL WHERE POSSIBLE).

WEAR SUITABLE PROTECTIVE CLOTHING, GLOVES AND EYE/FACE PROTECTION.

DO NOT BREATHE DUST.

ECTION 4. - - - - - - - - - - FIRST-AID MEASURES- - - - - - - - - - -

IN CASE OF CONTACT, IMMEDIATELY FLUSH EYES OR SKIN WITH COPIOUS AMOUNTS OF WATER FOR AT LEAST 15 MINUTES WHILE REMOVING CONTAMINATED CLOTHING AND SHOES.

IF INHALED, REMOVE TO FRESH AIR. IF NOT BREATHING GIVE ARTIFICIAL

RESPIRATION. IF BREATHING IS DIFFICULT, GIVE OXYGEN.
IF SWALLOWED, WASH OUT MOUTH WITH WATER PROVIDED PERSON IS CONSCIOUS.
CALL A PHYSICIAN.
WASH CONTAMINATED CLOTHING BEFORE REUSE.

SECTION 5. - - - - - - - - - - FIRE FIGHTING MEASURES - - - - - - - - - -

EXTINGUISHING MEDIA

WATER SPRAY.
CARBON DIOXIDE, DRY CHEMICAL POWDER OR APPROPRIATE FOAM.

SPECIAL FIREFIGHTING PROCEDURES

WEAR SELF-CONTAINED BREATHING APPARATUS AND PROTECTIVE CLOTHING TO PREVENT CONTACT WITH SKIN AND EYES.

UNUSUAL FIRE AND EXPLOSIONS HAZARDS

EMITS TOXIC FUMES UNDER FIRE CONDITIONS.

SECTION 6. - - - - - - - - - ACCIDENTAL RELEASE MEASURES- - - - - - - - -

EVACUATE AREA.
WEAR SELF-CONTAINED BREATHING APPARATUS, RUBBER BOOTS AND HEAVY RUBBER GLOVES.
COVER WITH DRY LIME OR SODA ASH, PICK UP, KEEP IN A CLOSED CONTAINER AND HOLD FOR WASTE DISPOSAL.
VENTILATE AREA AND WASH SPILL SITE AFTER MATERIAL PICKUP IS COMPLETE.

SECTION 7. - - - - - - - - - - HANDLING AND STORAGE- - - - - - - - - -

REFER TO SECTION 8.

ADDITIONAL INFORMATION

MAY BE CONTAMINATED WITH A MIXTURE OF POLYCHLOROBENZODIOXINS.

SECTION 8. - - - - - - - EXPOSURE CONTROLS/PERSONAL PROTECTION- - - - - -

WEAR APPROPRIATE NIOSH/MSHA-APPROVED RESPIRATOR, CHEMICAL-RESISTANT GLOVES, SAFETY GOGGLES, OTHER PROTECTIVE CLOTHING.
SAFETY SHOWER AND EYE BATH.
USE ONLY IN A CHEMICAL FUME HOOD.
DO NOT BREATHE DUST.
DO NOT GET IN EYES, ON SKIN, ON CLOTHING.
AVOID PROLONGED OR REPEATED EXPOSURE.
WASH THOROUGHLY AFTER HANDLING.
KEEP TIGHTLY CLOSED.
STORE IN A COOL DRY PLACE.

SECTION 9. - - - - - - - PHYSICAL AND CHEMICAL PROPERTIES - - - - - - -

APPEARANCE AND ODOR

OFF-WHITE POWDER

PHYSICAL PROPERTIES

BOILING POINT: 310 C
MELTING POINT: 188 C TO 191 C
VAPOR PRESSURE: 40MM 211.2 C
SOLUBILITY:

WATER -INSOLUBLE	ETHANOL -SOLUBLE
ETHER -SOLUBLE	ACETONE -SOLUBLE
BENZENE -SOLUBLE	PINE OIL: SOLUBLE

CARBON TETRACHLORIDE: SLIGHTLY
SPECIFIC GRAVITY: 1.978
VAPOR DENSITY: 9.2

SECTION 10. - - - - - - - - -STABILITY AND REACTIVITY - - - - - - - - -

INCOMPATIBILITIES

STRONG OXIDIZING AGENTS
STRONG BASES
ACID CHLORIDES
ACID ANHYDRIDES

HAZARDOUS COMBUSTION OR DECOMPOSITION PRODUCTS

TOXIC FUMES OF:
CARBON MONOXIDE, CARBON DIOXIDE
HYDROGEN CHLORIDE GAS

HAZARDOUS POLYMERIZATION

WILL NOT OCCUR.

SECTION 11. - - - - - - - - - TOXICOLOGICAL INFORMATION - - - - - - - -

ACUTE EFFECTS

MAY BE FATAL IF INHALED, SWALLOWED, OR ABSORBED THROUGH SKIN.
CAUSES EYE AND SKIN IRRITATION.
MATERIAL IS IRRITATING TO MUCOUS MEMBRANES AND UPPER RESPIRATORY TRACT.
EXPOSURE CAN CAUSE:
CONVULSIONS
DERMATITIS
READILY ABSORBED THROUGH SKIN.

CHRONIC EFFECTS

THE EVIDENCE FOR CARCINOGENICITY OF PENTACHLOROPHENOL (PCP) IS BASED ON ASSAYS THAT UTILIZED LESS THAN PURE PCP. CONTAMINANTS OF PCP INCLUDE: TRI- OR TETRA- CHLOROPHENOL, HEXACHLOROBENZENE, POLYCHLORINATED DIBENZO-P-DIOXINS OR POLYCHLORINATED DIBENZOFURANS. INDICATIONS ARE THAT POSITIVE EVIDENCE FOR CARCINOGENICITY IS FROM THE CONTAMINANT(S) AND NOT THE PCP.
LABORATORY EXPERIMENTS HAVE SHOWN MUTAGENIC EFFECTS.
OVEREXPOSURE MAY CAUSE REPRODUCTIVE DISORDER(S) BASED ON TESTS WITH LABORATORY ANIMALS.
TARGET ORGAN(S):
LIVER
KIDNEYS
TO THE BEST OF OUR KNOWLEDGE, THE CHEMICAL, PHYSICAL, AND TOXICOLOGICAL PROPERTIES HAVE NOT BEEN THOROUGHLY INVESTIGATED.

RTECS #: SM6300000
PHENOL, PENTACHLORO-

IRRITATION DATA

SKN-RBT 10 MG/24H OPEN MLD	AIHAAP 23,95,1962
EYE-RBT 100 UL/24 MLD	NTIS** OTS0546023

TOXICITY DATA

ORL-MAN LDLO:401 MG/KG	EESADV 1,343,1977
ORL-RAT LD50:27 MG/KG	JPETAB 76,104,1942
IHL-RAT LC50:355 MG/M3	GTPZAB 13(9),58,1969
SKN-RAT LD50:96 MG/KG	GTPZAB 13(9),58,1969
IPR-RAT LD50:56 MG/KG	BJPCAL 13,20,1958
ORL-MUS LD50:36 MG/KG	ARTODN 40,63,1978
IHL-MUS LC50:225 MG/M3	GTPZAB 13(9),58,1969
IPR-MUS LD50:32 MG/KG	ARTODN 40,63,1978
UNR-DOG LD50:70 MG/KG	PHPHA6 1,3,1953
UNR-GPG LD50:100 MG/KG	PHPHA6 1,3,1953
ORL-HAM LD50:168 MG/KG	TXAPA9 48,A192,1979
ORL-GRB LD50:294 MG/KG	ARTODN 40,63,1978
ORL-DCK LD50:380 MG/KG	DOEAAH 35,25,1979
UNR-FRG LD50:36 MG/KG	PHPHA6 1,3,1953

TARGET ORGAN DATA

BEHAVIORAL (CONVULSIONS OR EFFECT ON SEIZURE THRESHOLD)
BEHAVIORAL (EXCITEMENT)
BEHAVIORAL (CHANGE IN MOTOR ACTIVITY)
BEHAVIORAL (MUSCLE WEAKNESS)
BEHAVIORAL (MUSCLE CONTRACTION OR SPASTICITY)
VASCULAR (BP ELEVATION NOT CHARACTERIZED IN AUTONOMIC SECTION)
LUNGS, THORAX OR RESPIRATION (DYSPNAE)
LUNGS, THORAX OR RESPIRATION (TUMORS)
LIVER (TUMORS)
KIDNEY, URETER, BLADDER (URINE VOLUME INCREASED)
ENDOCRINE (HYPERGLYCEMIA)
SKIN AND APPENDAGES (SWEATING)
EFFECTS ON EMBRYO OR FETUS (FETOTOXICITY)
EFFECTS ON EMBRYO OR FETUS (FETAL DEATH)
SPECIFIC DEVELOPMENTAL ABNORMALITIES (MUSCULOSKELETAL SYSTEM)
SPECIFIC DEVELOPMENTAL ABNORMALITIES (HOMEOSTASIS)
EFFECTS ON NEWBORN (DELAYED EFFECTS)
NUTRITIONAL AND GROSS METABOLIC (BODY TEMPERATURE INCREASE)
TUMORIGENIC (EQUIVOCAL TUMORIGENIC AGENT BY RTECS CRITERIA)

ONLY SELECTED REGISTRY OF TOXIC EFFECTS OF CHEMICAL SUBSTANCES (RTECS) DATA IS PRESENTED HERE. SEE ACTUAL ENTRY IN RTECS FOR COMPLETE INFORMATION.

SECTION 12. - - - - - - - - - - ECOLOGICAL INFORMATION - - - - - - - - - -

DATA NOT YET AVAILABLE.

SECTION 13. - - - - - - - - - - DISPOSAL CONSIDERATIONS - - - - - - - - -

DISSOLVE OR MIX THE MATERIAL WITH A COMBUSTIBLE SOLVENT AND BURN IN A CHEMICAL INCINERATOR EQUIPPED WITH AN AFTERBURNER AND SCRUBBER. OBSERVE ALL FEDERAL, STATE AND LOCAL ENVIRONMENTAL REGULATIONS.

SECTION 14. - - - - - - - - - - TRANSPORT INFORMATION - - - - - - - - -

CONTACT SIGMA CHEMICAL COMPANY FOR TRANSPORTATION INFORMATION.

SECTION 15. - - - - - - - - - - REGULATORY INFORMATION - - - - - - - - - -

EUROPEAN INFORMATION

EC INDEX NO: 604-002-00-8

TOXIC

R 24/25

TOXIC IN CONTACT WITH SKIN AND IF SWALLOWED.

R 26

VERY TOXIC BY INHALATION.

R 36/37/38

IRRITATING TO EYES, RESPIRATORY SYSTEM AND SKIN.

R 40

POSSIBLE RISK OF IRREVERSIBLE EFFECTS.

R 50/53

VERY TOXIC TO AQUATIC ORGANISMS, MAY CAUSE LONG-TERM ADVERSE EFFECTS IN THE AQUATIC ENVIRONMENT.

S 22

DO NOT BREATHE DUST.

S 36/37

WEAR SUITABLE PROTECTIVE CLOTHING AND GLOVES.

S 45

IN CASE OF ACCIDENT OR IF YOU FEEL UNWELL, SEEK MEDICAL ADVICE IMMEDIATELY (SHOW THE LABEL WHERE POSSIBLE).

S 52

NOT RECOMMENDED FOR INTERIOR USE ON LARGE SURFACE AREAS.

S 60

THIS MATERIAL AND ITS CONTAINER MUST BE DISPOSED OF AS *HAZARDOUS WASTE*.

S 61

AVOID RELEASE TO THE ENVIRONMENT. REFER TO SPECIAL INSTRUCTIONS/ SAFETY DATA SHEETS.

REVIEWS, STANDARDS, AND REGULATIONS

OEL=MAK

ACGIH TLV-ANIMAL CARCINOGEN	DTLVS* TLV/BEI,1997
ACGIH TLV-TWA 0.5 MG/M3 (SKIN)	DTLVS* TLV/BEI,1997
IARC CANCER REVIEW:HUMAN LIMITED EVIDENCE	IMEMDT 41,319,1986
IARC CANCER REVIEW:ANIMAL SUFFICIENT EVIDENCE	IMEMDT 53,371,1991
IARC CANCER REVIEW:ANIMAL INADEQUATE EVIDENCE	IMEMDT 20,303,1979
IARC CANCER REVIEW:HUMAN INADEQUATE EVIDENCE	IMEMDT 53,371,1991
IARC CANCER REVIEW:GROUP 2B	IMEMDT 53,371,1991

EPA FIFRA 1988 PESTICIDE SUBJECT TO REGISTRATION OR RE-REGISTRATION
FEREAC 54,7740,1989

MSHA STANDARD-AIR:TWA 0.5 MG/M3 (SKIN)
DTLVS* 3,198,1971

OSHA PEL (GEN INDU):8H TWA 0.5 MG/M3 (SKIN)
CFRGBR 29,1910.1000,1994

OSHA PEL (CONSTRUC):8H TWA 0.5 MG/M3 (SKIN)
CFRGBR 29,1926.55,1994

OSHA PEL (SHIPYARD):8H TWA 0.5 MG/M3 (SKIN)
CFRGBR 29,1915.1000,1993

OSHA PEL (FED CONT):8H TWA 0.5 MG/M3 (SKIN)
CFRGBR 41,50-204.50,1994

OEL-AUSTRALIA:TWA 0.5 MG/M3;SKIN JAN 1993

OEL-AUSTRIA: SKIN, CARCINOGEN, JAN1999
OEL-BELGIUM:TWA 0.5 MG/M3;SKIN JAN 1993
OEL-DENMARK: TWA 0.005 PPM (0.05 MG/M3), SKIN, JAN1999
OEL-FINLAND:TWA 0.5 MG/M3;STEL 1.5 MG/M3;SKIN JAN 1993
OEL-GERMANY:TWA 0.005 PPM (0.05 MG/M3);SKIN JAN 1993
OEL-JAPAN: OEL 0.5 MG/M3, SKIN, JAN1999
OEL-HUNGARY:TWA 0.2 MG/M3;STEL 0.4 MG/M3;SKIN JAN 1993
OEL-JAPAN:TWA 0.5 MG/M3;SKIN JAN 1993
OEL-THE NETHERLANDS:TWA 0.5 MG/M3;SKIN JAN 1993
OEL-POLAND: MAC(TWA) 0.5 MG/M3, MAC(STEL) 1.5 MG/M3, JAN1999
OEL-THE PHILIPPINES:TWA 0.5 MG/M3;SKIN JAN 1993
OEL-RUSSIA:STEL 0.1 MG/M3;SKIN JAN 1993
OEL-SWEDEN:TWA 0.5 MG/M3;STEL 1.5 MG/M3;SKIN JAN 1993
OEL-SWITZERLAND:TWA 0.05 PPM (0.5 MG/M3);STEL 0.1 PPM;SKIN JAN 1993
OEL-TURKEY:TWA 0.5 MG/M3;SKIN JAN 1993
OEL-UNITED KINGDOM:TWA 0.5 MG/M3;STEL 1.5 MG/M3;SKIN JAN 1993
OEL IN BULGARIA, COLOMBIA, JORDAN, KOREA CHECK ACGIH TLV
OEL IN NEW ZEALAND, SINGAPORE, VIETNAM CHECK ACGIH TLV
NIOSH REL TO PENTACHLOROPHENOL-AIR:10H TWA 0.5 MG/M3 (SK)
NIOSH* DHHS #92-100,1992
NOHS 1974: HZD 54160; NIS 47; TNF 3548; NOS 42; TNE 29154
NOES 1983: HZD 54160; NIS 29; TNF 2248; NOS 38; TNE 26806; TFE 4191
ATSDR TOXICOLOGY PROFILE (NTIS** PB/90/182163/AS)
EPA GENETOX PROGRAM 1988, POSITIVE: CELL TRANSFORM.-SA7/SHE; S CEREVISIAE GENE CONVERSION
EPA GENETOX PROGRAM 1988, POSITIVE: S CEREVISIAE-FORWARD MUTATION
EPA GENETOX PROGRAM 1988, NEGATIVE: HOST-MEDIATED ASSAY; MOUSE SPOT TEST
EPA GENETOX PROGRAM 1988, NEGATIVE: HISTIDINE REVERSION-AMES TEST; S CEREVISIAE-HOMOZYGOSIS
EPA TSCA SECTION 8(B) CHEMICAL INVENTORY
EPA TSCA SECTION 8(D) UNPUBLISHED HEALTH/SAFETY STUDIES
ON EPA IRIS DATABASE
EPA TSCA TEST SUBMISSION (TSCATS) DATA BASE, JUNE 1999
NIOSH ANALYTICAL METHOD, 1994: PENTACHLOROPHENOL, 5512; IN BLOOD, 8001; IN URINE, 8303
NTP CARCINOGENESIS STUDIES (FEED);CLEAR EVIDENCE;MOUSE
NTPTR* NTP-TR-349,1989
OSHA ANALYTICAL METHOD #39

U.S. INFORMATION

THIS PRODUCT IS SUBJECT TO SARA SECTION 313 REPORTING REQUIREMENTS - CHLOROPHENOLS.
CALIFORNIA PROPOSITION 65:
THIS PRODUCT IS OR CONTAINS CHEMICAL(S) KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER.

SECTION 16. - - - - - - - - - - OTHER INFORMATION- - - - - - - - - - -

THE ABOVE INFORMATION IS BELIEVED TO BE CORRECT BUT DOES NOT PURPORT TO BE ALL INCLUSIVE AND SHALL BE USED ONLY AS A GUIDE. SIGMA, ALDRICH, FLUKA SHALL NOT BE HELD LIABLE FOR ANY DAMAGE RESULTING FROM HANDLING OR FROM CONTACT WITH THE ABOVE PRODUCT. SEE REVERSE SIDE OF INVOICE OR PACKING SLIP FOR ADDITIONAL TERMS AND CONDITIONS OF SALE.

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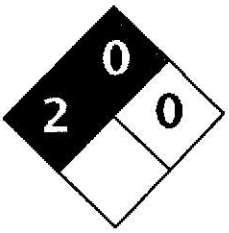

Health	2
Fire	0
Reactivity	0
Personal Protection	G

Material Safety Data Sheet
Tetrachloroethylene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Tetrachloroethylene

Catalog Codes: SLT3220

CAS#: 127-18-4

RTECS: KX3850000

TSCA: TSCA 8(b) inventory: Tetrachloroethylene

CI#: Not available.

Synonym: Perchloroethylene; 1,1,2,2-Tetrachloroethylene; Carbon bichloride; Carbon dichloride; Ankilostin; Didakene; Dilatin PT; Ethene, tetrachloro-; Ethylene tetrachloride; Perawin; Perchlor; Perclene; Perclene D; Percosolvel; Tetrachloroethene; Tetraleno; Tetralex; Tetravec; Tetroguer; Tetropil

Chemical Name: Ethylene, tetrachloro-

Chemical Formula: C2-Cl4

Contact Information:

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

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

Order Online: ScienceLab.com

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

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

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Tetrachloroethylene	127-18-4	100

Toxicological Data on Ingredients: Tetrachloroethylene: ORAL (LD50): Acute: 2629 mg/kg [Rat]. DERMAL (LD): Acute: >3228 mg/kg [Rabbit]. MIST(LC50): Acute: 34200 mg/m 8 hours [Rat]. VAPOR (LC50): Acute: 5200 ppm 4 hours [Mouse].

Section 3: Hazards Identification

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

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Classified A3 (Proven for animal.) by ACGIH. Classified 2A (Probable for human.) by IARC, 2 (anticipated carcinogen) by NTP.
MUTAGENIC EFFECTS: Mutagenic for bacteria and/or yeast.
TERATOGENIC EFFECTS: Not available.

DEVELOPMENTAL TOXICITY: Not available.
The substance may be toxic to kidneys, liver, peripheral nervous system, respiratory tract, skin, central nervous system (CNS).
Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.

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

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

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

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

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

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: Not applicable.

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

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

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

Large Spill:
Absorb with an inert material and put the spilled material in an appropriate waste disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

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

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

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value.

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

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

Exposure Limits:
TWA: 25 (ppm) from OSHA (PEL) [United States]
TWA: 25 STEL: 100 (ppm) from ACGIH (TLV) [United States]
TWA: 170 (mg/m3) from OSHA (PEL) [United States]
Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Ethereal.

Taste: Not available.

Molecular Weight: 165.83 g/mole

Color: Clear Colorless.

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

Boiling Point: 121.3°C (250.3°F)

Melting Point: -22.3°C (-8.1°F)

Critical Temperature: 347.1°C (656.8°F)

Specific Gravity: 1.6227 (Water = 1)

Vapor Pressure: 1.7 kPa (@ 20°C)

Vapor Density: 5.7 (Air = 1)

Volatility: Not available.

Odor Threshold: 5 - 50 ppm

Water/Oil Dist. Coeff.: The product is more soluble in oil; log(oil/water) = 3.4

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility:
Miscible with alcohol, ether, chloroform, benzene, hexane.
It dissolves in most of the fixed and volatile oils.
Solubility in water: 0.015 g/100 ml @ 25 deg. C
It slowly decomposes in water to yield Trichloroacetic and Hydrochloric acids.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials

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

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Oxidized by strong oxidizing agents.
Incompatible with sodium hydroxide, finely divided or powdered metals such as zinc, aluminum, magnesium, potassium, chemically active metals such as lithium, beryllium , barium.
Protect from light.

Special Remarks on Corrosivity: Slowly corrodes aluminum, iron, and zinc.

Polymerization: Will not occur.

Section 11: Toxicological Information

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

Toxicity to Animals:
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE.
Acute oral toxicity (LD50): 2629 mg/kg [Rat].
Acute dermal toxicity (LD50): >3228 mg/kg [Rabbit].
Acute toxicity of the vapor (LC50): 5200 4 hours [Mouse].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified A3 (Proven for animal.) by ACGIH. Classified 2A (Probable for human.) by IARC, 2 (Some evidence.) by NTP.
MUTAGENIC EFFECTS: Mutagenic for bacteria and/or yeast.
May cause damage to the following organs: kidneys, liver, peripheral nervous system, upper respiratory tract,

skin, central nervous system (CNS).

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

Special Remarks on Toxicity to Animals:
Lowest Publishe Lethal Dose/Conc:
LDL [Rabbit] - Route: Oral; Dose: 5000 mg/kg
LDL [Dog] - Route: Oral; Dose: 4000 mg/kg
LDL [Cat] - Route: Oral; Dose: 4000 mg/kg

Special Remarks on Chronic Effects on Humans:
May cause adverse reproductive effects and birth defects(teratogenic).
May affect genetic material (mutagenic).
May cause cancer.

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects:
Skin: Causes skin irritation with possible dermal blistering or burns. Symtoms may include redness, itching, pain, and possible dermal blistering or burns. It may be absorbed through the skin with possible systemic effects. A single prolonged skin exposure is not likely to result in the material being absorbed in harmful amounts.
Eyes: Contact causes transient eye irritation, lacrimation. Vapors cause eye/conjunctival irritation. Symptoms may include redness and pain.
Inhalation: The main route to occupational exposure is by inhalation since it is readily absorbed through the lungs. It causes respiratory tract irritation, . It can affect behavior/central nervous system (CNS depressant and anesthesia ranging from slight inebriation to death, vertigo, somnolence, anxiety, headache, excitement, hallucinations, muscle incoordination, dizziness, lightheadness, disorentiation, seizures, enotional instability, stupor, coma). It may cause pulmonary edema
Ingestion: It can cause nausea, vomiting, anorexia, diarrhea, bloody stool. It may affect the liver, urinary system (proteinuria, hematuria, renal failure, renal tubular disorder), heart (arrhythmias). It may affect behavior/central nervous system with symptoms similar to that of inhalation.
Chronic Potential Health Effects:
Skin: Prolonged or repeated skin contact may result in excessive drying of the skin, and irritation.
Ingestion/Inhalation: Chronic exposure can affect the liver(hepatitis,fatty liver degeneration), kidneys, spleen, and heart (irregular heartbeat/arrhythmias, cardiomyopathy, abnormal EEG), brain, behavior/central nervous system/peripheral nervous system (impaired memory, numbness of extremeties, peripheral neuropathy and other

Section 12: Ecological Information

Ecotoxicity:
Ecotoxicity in water (LC50): 18.4 mg/l 96 hours [Fish (Fatthead Minnow)]. 18 mg/l 48 hours [Daphnia (daphnia)]. 5 mg/l 96 hours [Fish (Rainbow Trout)]. 13 mg/l 96 hours [Fish (Bluegill sunfish)].

BOD5 and COD: Not available.

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

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

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

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

Section 14: Transport Information

DOT Classification: CLASS 6.1: Poisonous material.

Identification: : Tetrachloroethylene UNNA: 1897 PG: III

Special Provisions for Transport: Marine Pollutant

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Tetrachloroethylene
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Tetrachloroethylene
Connecticut hazardous material survey.: Tetrachloroethylene
Illinois toxic substances disclosure to employee act: Tetrachloroethylene
Illinois chemical safety act: Tetrachloroethylene
New York release reporting list: Tetrachloroethylene
Rhode Island RTK hazardous substances: Tetrachloroethylene
Pennsylvania RTK: Tetrachloroethylene
Minnesota: Tetrachloroethylene
Michigan critical material: Tetrachloroethylene
Massachusetts RTK: Tetrachloroethylene
Massachusetts spill list: Tetrachloroethylene
New Jersey: Tetrachloroethylene
New Jersey spill list: Tetrachloroethylene
Louisiana spill reporting: Tetrachloroethylene
California Director's List of Hazardous Substances: Tetrachloroethylene
TSCA 8(b) inventory: Tetrachloroethylene
TSCA 8(d) H and S data reporting: Tetrachloroethylene: Effective date: 6/1/87; Sunset date: 6/1/97
SARA 313 toxic chemical notification and release reporting: Tetrachloroethylene
CERCLA: Hazardous substances.: Tetrachloroethylene: 100 lbs. (45.36 kg)

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

Other Classifications:

WHMIS (Canada):
CLASS D-1B: Material causing immediate and serious toxic effects (TOXIC).
CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):
R40- Possible risks of irreversible effects.
R51/53- Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
S23- Do not breathe gas/fumes/vapour/spray
S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
S37- Wear suitable gloves.
S61- Avoid release to the environment. Refer to special instructions/Safety data sheets.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 0

Reactivity: 0

Personal Protection: g

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

Health: 2

Flammability: 0

Reactivity: 0

Specific hazard:

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

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:29 PM

Last Updated: 10/10/2005 08:29 PM

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SIGMA-ALDRICH

MATERIAL SAFETY DATA SHEET

Date Printed: 08/10/2006
Date Updated: 01/31/2006
Version 1.5

Section 1 - Product and Company Information

Product Name	1,1,1,2-TETRACHLOROETHANE
Product Number	46254
Brand	RIEDEL
Company	Sigma-Aldrich
Address	3050 Spruce Street SAINT LOUIS MO 63103 US
Technical Phone:	800-325-5832
Fax:	800-325-5052
Emergency Phone:	314-776-6555

Section 2 - Composition/Information on Ingredient

Substance Name	CAS #	SARA 313
1,1,1,2-TETRACHLOROETHANE	630-20-6	Yes

Formula	C2H2Cl4
Synonyms	NCI-C52459 * RCRA waste number U208 * 1,1,1,2-Tetrachloroethane
RTECS Number:	KI8450000

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Harmful.
Harmful if swallowed. Limited evidence of a carcinogenic effect.
Risk of serious damage to eyes.
Possible Carcinogen (US). Target organ(s): Liver. Kidneys.

HMIS RATING

HEALTH: 2*
FLAMMABILITY: 0
REACTIVITY: 0

NFPA RATING

HEALTH: 2
FLAMMABILITY: 0
REACTIVITY: 0

*additional chronic hazards present.

For additional information on toxicity, please refer to Section 11.

Section 4 - First Aid Measures

ORAL EXPOSURE

If swallowed, wash out mouth with water provided person is conscious. Call a physician.

INHALATION EXPOSURE

If inhaled, remove to fresh air. If breathing becomes difficult,

call a physician.

DERMAL EXPOSURE
In case of contact, immediately wash skin with soap and copious amounts of water.

EYE EXPOSURE
In case of contact with eyes, flush with copious amounts of water for at least 15 minutes. Assure adequate flushing by separating the eyelids with fingers. Call a physician.

Section 5 - Fire Fighting Measures

AUTOIGNITION TEMP
N/A

FLAMMABILITY
N/A

EXTINGUISHING MEDIA
Suitable: Water spray. Carbon dioxide, dry chemical powder, or appropriate foam.

FIREFIGHTING
Protective Equipment: Wear self-contained breathing apparatus and protective clothing to prevent contact with skin and eyes.
Specific Hazard(s): Emits toxic fumes under fire conditions.

Section 6 - Accidental Release Measures

PROCEDURE TO BE FOLLOWED IN CASE OF LEAK OR SPILL
Evacuate area.

PROCEDURE(S) OF PERSONAL PRECAUTION(S)
Wear self-contained breathing apparatus, rubber boots, and heavy rubber gloves.

METHODS FOR CLEANING UP
Absorb on sand or vermiculite and place in closed containers for disposal. Ventilate area and wash spill site after material pickup is complete.

Section 7 - Handling and Storage

HANDLING
User Exposure: Do not breathe vapor. Avoid contact with eyes, skin, and clothing. Avoid prolonged or repeated exposure.

STORAGE
Suitable: Keep tightly closed.
Store at 2-8°C

Section 8 - Exposure Controls / PPE

ENGINEERING CONTROLS
Safety shower and eye bath. Mechanical exhaust required.

PERSONAL PROTECTIVE EQUIPMENT
Respiratory: Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU). Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose

combination (US) or type AXBEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator.
Hand: Compatible chemical-resistant gloves.
Eye: Chemical safety goggles.

GENERAL HYGIENE MEASURES
Wash thoroughly after handling.

Section 9 - Physical/Chemical Properties

Appearance	Color: Colorless Form: Clear liquid	
Property	Value	At Temperature or Pressure
Molecular Weight	167.85 AMU	
pH	N/A	
BP/BP Range	138 °C	
MP/MP Range	- 70.2 °C	
Freezing Point	N/A	
Vapor Pressure	14 mmHg	25 °C
Vapor Density	N/A	
Saturated Vapor Conc.	N/A	
SG/Density	1.553 g/cm3	
Bulk Density	N/A	
Odor Threshold	N/A	
Volatile%	N/A	
VOC Content	N/A	
Water Content	N/A	
Solvent Content	N/A	
Evaporation Rate	N/A	
Viscosity	N/A	
Surface Tension	N/A	
Partition Coefficient	Log Kow: 2.66	
Decomposition Temp.	N/A	
Explosion Limits	N/A	
Flammability	N/A	
Autoignition Temp	N/A	
Refractive Index	1.483	
Optical Rotation	N/A	
Miscellaneous Data	N/A	
Solubility	Solubility in Water:Slightly. Other Solvents: ALCOHOL, ETHER, ACETONE	

N/A = not available

Section 10 - Stability and Reactivity

STABILITY
Stable: Stable.
Materials to Avoid: Strong oxidizing agents, Strong bases.

HAZARDOUS DECOMPOSITION PRODUCTS
Hazardous Decomposition Products: Carbon monoxide, Carbon dioxide, Hydrogen chloride gas.

HAZARDOUS POLYMERIZATION
Hazardous Polymerization: Will not occur

Section 11 - Toxicological Information

ROUTE OF EXPOSURE
Skin Contact: May cause skin irritation.
Skin Absorption: May be harmful if absorbed through the skin.
Eye Contact: Causes severe eye irritation.
Inhalation: Material may be irritating to mucous membranes and upper respiratory tract. May be harmful if inhaled.
Ingestion: Harmful if swallowed.

TARGET ORGAN(S) OR SYSTEM(S)
Nerves. Kidneys. Liver.

SIGNS AND SYMPTOMS OF EXPOSURE
To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

TOXICITY DATA

Oral
Rat
670 mg/kg
LD50

Inhalation
Rat
2,100 ppm
LC50
Remarks: Gastrointestinal:Hypermotility, diarrhea.

Oral
Mouse
1500 mg/kg
LD50

Intraperitoneal
Mouse
1275 MG/KG
LD50

Inhalation
Rabbit
2,800 ppm
LC50
Remarks: Gastrointestinal:Hypermotility, diarrhea.

Skin
Rabbit
20000 mg/kg
LD50

IRRITATION DATA

Skin
Rabbit
500 mg
24H

Eyes
Rabbit
100 mg
Remarks: Severe irritation effect

CHRONIC EXPOSURE - CARCINOGEN

Result: This product is or contains a component that has been reported to be possibly carcinogenic based on its IARC, ACGIH, NTP, or EPA classification.

IARC CARCINOGEN LIST

Rating: Group 3

CHRONIC EXPOSURE - MUTAGEN

Species: Mouse
Dose: 200 MG/L (+S9)
Cell Type: lymphocyte
Mutation test: Mutation in microorganisms

Species: Mouse
Route: Oral
Dose: 1 GM/KG
Mutation test: Other mutation test systems

Species: Mouse
Dose: 200 MG/L
Cell Type: lymphocyte
Mutation test: Mutation in mammalian somatic cells.

Species: Hamster
Dose: 158 MG/L
Cell Type: ovary
Mutation test: Sister chromatid exchange

Species: Human
Dose: 100 MG/L
Cell Type: lung
Mutation test: SLN

Section 12 - Ecological Information

ACUTE ECOTOXICITY TESTS

Test Type: EC50 Daphnia
Species: Daphnia magna
Time: 48 h
Value: 17.0 - 30.0 mg/l

Test Type: LC50 Fish
Species: Lepomis macrochirus (Bluegill)
Time: 96 h
Value: 16.0 - 24.0 mg/l

Section 13 - Disposal Considerations

APPROPRIATE METHOD OF DISPOSAL OF SUBSTANCE OR PREPARATION
Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber. Observe all federal, state, and local environmental regulations.

Section 14 - Transport Information

DOT
Proper Shipping Name: Toxic, liquids, organic, n.o.s.

UN#: 2810
Class: 6.1
Packing Group: Packing Group III
Hazard Label: Toxic substances.
PIH: Not PIH

IATA
Proper Shipping Name: Toxic liquid, organic, n.o.s.
IATA UN Number: 2810
Hazard Class: 6.1
Packing Group: III

Section 15 - Regulatory Information

EU ADDITIONAL CLASSIFICATION
Symbol of Danger: Xn
Indication of Danger: Harmful.
R: 22-40-41
Risk Statements: Harmful if swallowed. Limited evidence of a carcinogenic effect. Risk of serious damage to eyes.
S: 26-36
Safety Statements: In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. Wear suitable protective clothing.

US CLASSIFICATION AND LABEL TEXT
Indication of Danger: Harmful.
Risk Statements: Harmful if swallowed. Risk of serious damage to eyes. Limited evidence of a carcinogenic effect.
Safety Statements: In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. Wear suitable protective clothing.
US Statements: Possible Carcinogen (US). Target organ(s): Liver. Kidneys.

UNITED STATES REGULATORY INFORMATION
SARA LISTED: Yes
DEMINIMIS: 1 %
NOTES: This product is subject to SARA section 313 reporting requirements.
TSCA INVENTORY ITEM: Yes

CANADA REGULATORY INFORMATION
WHMIS Classification: This product has been classified in accordance with the hazard criteria of the CPR, and the MSDS contains all the information required by the CPR.
DSL: Yes
NDSL: No

Section 16 - Other Information

DISCLAIMER
For R&D use only. Not for drug, household or other uses.

WARRANTY
The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Inc., shall not be held liable for any damage resulting from handling or

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MATERIAL SAFETY DATA SHEET

IDENTITY: Toxaphene

SECTION I

Manufacturer: Cerilliant Corporation
811 Paloma, Suite A
Round Rock, TX 78664

Emergency Telephone Number: (512) 238-9974
Date Prepared: March 2, 2006

SECTION II - HAZARDOUS COMPONENTS/IDENTITY INFORMATION

Hazardous Components	Synonyms	CAS Number	%
Toxaphene	M 5055; Agricide; agricide maggot killer (f); alltex; Alltox; attac 4-2; attac 4-4; attac 6; attac 6-3; attac 8; camphechlor; Campheclor; Camphene, chlorinated; camphochlor; camphoclor; camphofene huileux; chem-phene; Chlorocamphene; Chlorinated Camphene; Chlorinated Camphenes; CHLORINATED CAMPHENE (TOXAPHENE) (CAMPHECHOR); chlorinated champhene; clor chem t-590; compound 3956; Coopertox; crestoxo; cristoxo; cristoxo 90; estonox; fasco-terpene; Geniphene; gy-phene; Hercules 3956; hercules toxaphene; kamfochlor; mellpax; Motox; octachlorocamphene; Penphene; phenacide; Phenatox; polychlorocamphene; *Polychlorinated camphenes*; Polychorinated camphenes; Strobane-T; strobane t-90; toxadust; toxakil; toxaphene; Toxaphene ; toxon 63; toxyphen; vertac toxaphene 90	8001-35-2	100

SECTION III – Hazard Identification

Toxic. Dangerous for the environment. Harmful in contact with skin. Toxic if swallowed. Irritating to respiratory system and skin. Limited evidence of a carcinogenic effect. Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

SECTION IV – First Aid Measures

Eye Contact: Flush eyes with copious amounts of water for a minimum of 15 minutes and transport to a medical facility.
Ingestion: Do not induce vomiting. Give victim large quantities of liquid and transport to a medical facility.
Skin Contact: Wash affected areas with copious amounts of water and transport to a medical facility.
Inhalation: Remove to fresh air. If breathing is disturbed, give artificial respiration while transporting to a medical facility.

SECTION V- Fire Fighting Measures

Flash Point: N/A
Method Used: N/A

Flammable Limits
LEL: N/A **UEL:** N/A

Extinguishing Media: Dry chemical, carbon dioxide or Halon extinguisher
Special Fire Fighting Procedures: Wear SCBA and protective clothing to prevent contact with skin and eyes.
Unusual Fire and Explosion Hazards: N/A

SECTION VI- Accidental Release Measures

Evacuate area. Remove all sources of ignition. Use inert absorbent to pick up all spilled material. Transfer to a suitable waste container with non-sparking tools. Wash spill site with appropriate cleaning agent to removal residual traces of spilled material.

SECTION VII- Handling and Storage

Handling: Do not breathe vapor. Avoid contact with eyes, skin, and clothing. Avoid prolonged repeated exposure. Wash thoroughly after handling.

Storage: Room temperature. Protect from light. Keep container closed. Keep away from ignition sources.

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SECTION VIII-Exposure Controls/Personal Protection

As appropriate to quantity handled.
Ventilation - Local Exhaust: Use with forced ventilation.
General Mechanical: Normal laboratory air exchange.
Special: N/A
Respiratory Protection: NIOSH approved cartridge type respirator with organic vapor cartridges with HEPA pre-filter recommended.
Eye Protection: Safety glasses with side shields or chemical safety goggles.
Protective Gloves: Compatible chemical resistant gloves.
Other Protective Clothing or Equipment: Lab Coat
Work/Hygienic Practices: Only experienced personnel should be allowed to handle this material.

Exposure Limits				
	OSHA PEL	**ACGIH TLV**	**DFG MAK**	**Other Limits**
Toxaphene	TWA 0.5 mg/m^3; STEL 1 mg/m^3 (skin)	TWA 0.5 mg/m^3; STEL 1 mg/m^3 (skin)	Animal Carcinogen, Suspected Human Carcinogen	N/A

SECTION IX-Physical/Chemical Properties

Boiling Point (degrees C): N/A
Melting Point (degrees C): 65-90
Specific Gravity (Water=1): N/A
Vapor Pressure (mmHg):N/A
Vapor Density (Air=1): N/A
Evaporation Rate (Butyl Acetate=1): N/A
Solubility in Water: insoluble
Appearance and Odor: white solid

SECTION X-Stability and Reactivity

Stability: Stable
Conditions to Avoid: Heat, sparks or other sources of ignition.
Incompatible Materials: N/A
Hazardous Dcmp Pdts: Toxic fumes of carbon monoxide and carbon dioxide.
Hazardous Polymerization: Will not occur.
Conditions to Avoid: N/A

SECTION XI-Toxicological Information

Routes of Entry: **Inhalation?** Yes **Skin?** Yes **Ingestion?** Yes

Carcinogenicity:
NTP? Anticipated carcinogen
IARC? *Probable Human Carcinogen*
OSHA? N/A

Symptoms of Exposure: NA

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Toxicity Data:

skin-mam 500 mg MOD	intraperitoneal-rat LDLo:70 mg/kg
mmo-sat 100 µg/plate	oral-mouse LD50:112 mg/kg
mma-sat 500 µg/plate	ihl-mouse LCLo:2000 mg/m3/2H
sce-human:lym 10 µmol/L	intraperitoneal-mouse LD50:47 mg/kg
otr-mouse:emb 12,400 µg/L	unreported-mouse LD50:45 mg/kg
oral-human LDLo:28 mg/kg:CNS	oral-dog LD50:15 mg/kg
oral-man LDLo:29 mg/kg	oral-rabbit LD50:75 mg/kg
skin-human TDLo:657 mg/kg:SKIN	skin-rabbit LD50:1025 mg/kg
unreported-man LDLo:44 mg/kg	oral-guniea pig LD50:250 mg/kg
oral-rat LD50:50 mg/kg	oral-ham LD50:200 mg/kg
skin-rat LD50:600 mg/kg	oral-duck LD50:31 mg/kg

The toxicological properties of Toxaphene have not been fully investigated. It should be assumed to have toxic effects and, therefore, procedures appropriate for the safe handling of hazardous chemicals should be followed.

SECTION XII-Ecological Information

Data not available

SECTION XIII-Disposal Considerations

Waste materials should be disposed of under conditions that meet Federal, State, and Local environmental control regulations. Contact a licensed waste disposal specialist to dispose of this material.

SECTION XIX- Transportation Information

DOT	IATA
Proper Shipping Name: Organochlorine pesticide, solid, toxic	Proper Shipping Name: Organochlorine pesticide, solid, toxic
UN #: 2761	UN #: 2761
Class: 6.1	Class: 6.1
Packing Group: II	Packing Group: II
Small quantities exempted	Small quantities exempted

SECTION XV-Regulatory Information

EU Directives Classification
Symbol of Danger: T N
Indication of Danger: Toxic. Dangerous for the environment.
R: 21 25 37/38 40 50/53
Risk Statements:
Harmful in contact with skin. Toxic if swallowed. Irritating to respiratory system and skin. Limited evidence of a carcinogenic effect. Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
S: 36/37 45 60
Safety Statements: Wear suitable protective clothing and gloves. In case of accident or if you feel unwell seek medical advice immediately (show the label where possible). This material and its container must be disposed of as hazardous waste

SECTION XVI-Other Information

The information contained herein is believed to be accurate and is supplied in good faith. Cerilliant Corporation makes no warranty with respect to and assumes no legal responsibility for use of or reliance upon this information. Individuals receiving this data must exercise their own judgement in determining its suitability for a particular purpose.

SECTION I PRODUCT INFORMATION

PRODUCT IDENTIFIER : TRICHLOROETHYLENE TECH
CHEMICAL NAME AND SYNONYMS : Trichloroethylene, *trichloroethene.*
IDENTIFICATION NUMBER : UN 1710
PRODUCT USE : Industrial solvent, cleaner, degreaser.

SUPPLIER : Amplex Chemical Products Ltd.
ADDRESS : 600 Delmar Avenue
Pointe-Claire, QC
H9R 4A8
TELEPHONE : (514) 630-3309

EMERGENCY : Newalta Industrial Services Inc
1-800-567-7455 (24h/24)

SECTION II HAZARDOUS INGREDIENTS

INGREDIENT	CONC.	CAS NUMBER	LD50(oral)	LC50(ihl)
Trichloroethylene	99 - 100%	79-01-6	5650 mg/kg Rat 2402 mg/kg Mouse	8450 ppm (4h) Mouse

SECTION III WHMIS CLASSIFICATION

CLASS D1B

CLASS D1A - CLASS D2B

SECTION IV PHYSICAL DATA

PHYSICAL STATE	Liquid	pH (WATER=7)	Not applicable
ODOUR AND APPEARANCE	Ether odour, clear, colourless liquid	SPECIFIC GRAVITY	1,46
ODOUR THRESHOLD	82 ppm	VAPOUR DENSITY	4,54 (air=1)
BOILING POINT	≈ 87 •C	VAPOUR PRESSURE	57,8 mmHg @ 20 •C
FREEZING POINT	≈ - 86 •C	EVAPORATION RATE	3.1 (ether=1)
COEFFICIENT OF WATER/OIL DISTRIBUTION	0.00513		

SECTION V FIRE OR EXPLOSION

CONDITION OF FLAMMABILITY: Non flammable. Vapours concentrated in a confined or poorly ventilated area can be ignited upon contact with a spark, flame or high intensity source of heat.

MEANS OF EXTINCTION: Water fog, dry chemicals, foam, CO_2. Fire fighters should use pressure-demand self contained breathing apparatus due to possible exposure to hydrogen chloride and phosgene gas. Use water spray to disperse vapours and cool fire-exposed containers or structures.

FLASH POINT	None (TCC method)	AUTO-IGNITION TEMPERATURE	410 •C
UPPER FLAMMABLE LIMIT	10.5 % at 25 °C	MECHANICAL IMPACT SENSITIVITY	Not Available
LOWER FLAMMABLE LIMIT	8.0 % at 25 °C	STATIC DISCHARGE SENSITIVITY	Not Available

HAZARDOUS COMBUSTION PRODUCTS: Thermal decomposition products are toxic and may include chlorine, hydrogen chloride, phosgene and oxides of carbon.

SECTION VI REACTIVITY DATA

CHEMICAL INSTABILITY CONDITIONS: Stable under normal conditions.

INCOMPATIBLE SUBSTANCES AND CONDITIONS OF REACTIVITY: Avoid oxygen-enriched atmosphere, open flames, hot glowing surfaces, electric arcs or other hot surfaces which can cause thermal decomposition. Avoid strong oxidizing and reducing agents. Lewis or mineral acids. Strong bases. Caustics. May react violently with metals such as: sodium, potassium, barium, magnesium and titanium, particularly if they are finely divided. May decompose with strong alkalis to give spontaneously flammable and highly toxic chloroacetylenes. May be corrosive to aluminium. Aluminum and its alloys should not be used in equipment for storage, handling or transportation.

HAZARDOUS DECOMPOSITION PRODUCTS: Thermal decomposition products are toxic and may include chlorine, hydrogen chloride, phosgene and oxides of carbon.

SECTION VII TOXICOLOGICAL PROPERTIES

SKIN CONTACT/ABSORPTION: *Can irritate skin due to defatting* action, drying and cracking of the skin. Burns can occur if material is not promptly removed. Repeated on prolonged contact may lead to dermatitis. Can be absorbed through intact skin.

EYE CONTACT: Liquid can cause transient pain, lacrimation. May cause severe irritation, corneal burns, and conjunctivitis, possible corneal damage. Vapors may cause the same effects.

INHALATION: Vapours are irritating to nose, throat, and respiratory tract. Exposure to high concentrations can cause nausea, headache, and dizziness. Overexposure may lead to coma and death from cardiac or respiratory failure. TCE may sensitize myocardium and cause cardiac arrhythmia. May cause convulsions, CNS depression, visual disturbances, systemic poisoning, kidney damage, and peripheral nervous system effects.

INGESTION: May cause irritation and burning of the mouth, throat, respiratory tract, and esophagus. Can cause convulsions, CNS depression (headache, dizziness, drowsiness, nausea, vomiting, abdominal pain, liver damage, myocardial damage, kidney failure, and incoordination), cardiac arrhythmia, visual disturbances, and systemic poisoning. Severe exposure may cause death.

ACUTE EXPOSURE EFFECTS: Severe overexposures may lead to coma and possible death due to respiratory failure. Mild blurring of vision to complete blindness may occur, including changes in colour perception and conjunctivitis.

CHRONIC EXPOSURE EFFECTS: Chronic exposure to trichloroethylene has caused toxic effect in the liver, lymphatic (one species), kidneys, and cardiovascular system of animals. Humans exposed to trichloroethylene can become intolerant to ethyl alcohol, with small quantities causing inebriation and skin blotching. Exposure to 40 - 270 ppm can cause fatigue, headache, irritability, vomiting, intolerance to alcohol, and electrocardiographic changes. Prolonged and repeated exposure may lead to dermatitis. See also acute exposure effects.

EXPOSURE LIMIT	50 ppm	SHORT TERM EXPOSURE LIMIT	200 ppm
CARCINOGENICITY	Yes	SENSITIZATION TO PRODUCT	None known
TERATOGENICITY	Not available	MUTAGENICITY	Yes
SYNERGISTIC PRODUCTS	Alcohols	REPRODUCTIVE TOXICITY	Not available
IRRITANCY OF PRODUCT	Yes		

SECTION VIII PREVENTIVE MEASURES

PROTECTIVE GLOVES: Protective gloves made from viton, neoprene.

EYE PROTECTION: Chemical goggles and/or face shield where splashing is possible. Do not wear contact lenses.

RESPIRATORY PROTECTION: A NIOSH/MSHA approved full facepiece self-contained breathing apparatus required for any concentrations *above permissible exposure limits.*

OTHER PROTECTIVE EQUIPMENT: Impervious apron (or viton clothing) and boots. Safety shower and eye bath located close to chemical exposure area.

ENGINEERING CONTROLS: Local ventilation required to maintain below 50 ppm (Exposure limit).

PROCEDURES TO BE FOLLOWED IN CASE OF SPILL OR LEAK: Immediately evacuate the area and provide maximum ventilation. Turn off heating and/or air-conditioning systems to prevent vapours from contaminating entire building. Only properly equipped personnel should be permitted in area. Dike area to contain spill. Take precautions as necessary to prevent contamination of ground and surface waters. Recover or absorb spilled material on vermiculite and sweep into closed containers for disposal. After all visible traces have been removed, thoroughly wet vacuum the area. Do not flush into sewer. If area of spill is porous, remove as much contaminated earth and gravel, etc., as necessary and place in closed containers for disposal.

WASTE DISPOSAL: Contaminated vermiculite or porous surfaces must be disposed of in a licence hazardous waste management facility. Care must be taken when using or disposing of chemical materials and/or their containers to prevent environmental contamination. In accordance with federal, provincial and municipal regulations.

HANDLING AND STORAGE PROCEDURES: Ground and bond equipment and containers to prevent a static charge buildup. Use spark-resistant tools and avoids "splash-filling" of containers. Store in a cool place. Solvents should not be stored in low areas because of the risk of accumulation of heavy solvent vapours. Do not enter confined spaces such as tanks or pits without following proper entry procedures such as ASTM D-4276. Store in labelled, sealed containers in a cool, dry, well-ventilated area. Prevent water or moist air from entering storage tanks or containers. Do not cut or weld on empty or full drums. Aluminum equipment should not be used for storage and/or transfer. Contact with aluminum parts in a pressurizable fluid system may cause violent reactions.

SPECIAL SHIPPING INFORMATION:

Shipping Name:	Trichloroethylene
Class/Division :	UN 1710, Class 6.1, Packing group III

SECTION IX FIRST AID MEASURES

SKIN: Flush with soap and water then continue flushing with running water for a minimum of 15 minutes. Start flushing while removing contaminated clothing. If irritation persists, repeat flushing. Obtain medical attention immediately.

EYES: Immediately flush eyes with running water for a minimum of 15 minutes. Hold eyelids open during flushing. If irritation persists, repeat flushing. Obtain medical attention immediately.

INHALATION: Move victim to fresh air. Give artificial respiration if breathing has stopped. Give cardio pulmonary resuscitation if there is no breathing and no pulse. Obtain medical attention immediately.

INGESTION: If victim is alert and not convulsing, give ½ to 1 glass of water to dilute material. If spontaneous vomiting occurs, have victim lean forward with head down to avoid breathing in of vomitus. Rinse mouth and administer more water. Immediately contact a Poison Control Center. Do not induce vomiting. Obtain medical attention immediately.

NOTE TO PHYSICIAN: This product contains materials that may cause severe pneumonitis if aspired. If ingestion has occurred less than 2 hours earlier, carry out careful gastric lavage; use endotracheal cuff if available, to prevent aspiration. Observe patient for respiratory difficulty from aspiration pneumonitis. Give artificial resuscitation and appropriate chemotherapy is depressed. Never administer adrenaline following trichloroethylene overexposure. Delayed effects can occur a few hours after exposure. Keep patient under observation for 48 hours.

SECTION X PREPARATION INFORMATION

PREPARED BY	:	Amplex Chemical Products Ltd.
TELEPHONE	:	(514) 630-3309
DATE	:	June 19, 2006

IMPORTANT: The information presented herein is believed to be accurate and is offered only as a guide. Users should make their own tests to determine the suitability of these products for their own particular purposes. Users assume all risk of use, storage and handling of the product. No warranty, express or implied, is made including, but not limited to, implied warranties of merchantability and fitness for a particular purpose. Nothing contained herein shall be construed as a license to operate under, or recommendation to infringe any patents.

SIGMA-ALDRICH

MATERIAL SAFETY DATA SHEET

Date Printed: 08/10/2006
Date Updated: 03/24/2006
Version 1.5

Section 1 - Product and Company Information

Product Name	1,2,4-TRIMETHYLBENZENE, 98%
Product Number	T73601
Brand	ALDRICH
Company	Sigma-Aldrich
Address	3050 Spruce Street SAINT LOUIS MO 63103 US
Technical Phone:	800-325-5832
Fax:	800-325-5052
Emergency Phone:	314-776-6555

Section 2 - Composition/Information on Ingredient

Substance Name	CAS #	SARA 313
1,2,4-TRIMETHYLBENZENE	95-63-6	Yes

Formula	C9H12
Synonyms	Asymmetrical trimethylbenzene * Benzene, 1,2,5-trimethyl- * psi-Cumene * Pseudocumene * Pseudocumol * as-Trimethylbenzene
RTECS Number:	DC3325000

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Combustible (USA) Flammable (EU). Harmful. Dangerous for the environment.
Harmful by inhalation. Flammable. Irritating to eyes, respiratory system and skin. Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
Target organ(s): Central nervous system.

HMIS RATING

HEALTH: 2*
FLAMMABILITY: 2
REACTIVITY: 0

NFPA RATING

HEALTH: 2
FLAMMABILITY: 2
REACTIVITY: 0

*additional chronic hazards present.

For additional information on toxicity, please refer to Section 11.

Section 4 - First Aid Measures

ORAL EXPOSURE

If swallowed, wash out mouth with water provided person is conscious. Call a physician.

INHALATION EXPOSURE
If inhaled, remove to fresh air. If not breathing give artificial respiration. If breathing is difficult, give oxygen.

DERMAL EXPOSURE
In case of contact, immediately wash skin with soap and copious amounts of water.

EYE EXPOSURE
In case of contact, immediately flush eyes with copious amounts of water for at least 15 minutes.

Section 5 - Fire Fighting Measures

FLAMMABLE HAZARDS
Flammable Hazards: Yes

EXPLOSION HAZARDS
Vapor may travel considerable distance to source of ignition and flash back. Container explosion may occur under fire conditions.

FLASH POINT
118.4 °F 48 °C Method: closed cup

EXPLOSION LIMITS
Lower: 0.9 % Upper: 6.4 %

AUTOIGNITION TEMP
515 °C

FLAMMABILITY
N/A

EXTINGUISHING MEDIA
Suitable: For small (incipient) fires, use media such as "alcohol" foam, dry chemical, or carbon dioxide. For large fires, apply water from as far as possible. Use very large quantities (flooding) of water applied as a mist or spray; solid streams of water may be ineffective. Cool all affected containers with flooding quantities of water.

FIREFIGHTING
Protective Equipment: Wear self-contained breathing apparatus and protective clothing to prevent contact with skin and eyes. Specific Hazard(s): Flammable liquid. Emits toxic fumes under fire conditions.

Section 6 - Accidental Release Measures

PROCEDURE TO BE FOLLOWED IN CASE OF LEAK OR SPILL
Evacuate area. Shut off all sources of ignition.

PROCEDURE(S) OF PERSONAL PRECAUTION(S)
Wear respirator, chemical safety goggles, rubber boots, and heavy rubber gloves.

METHODS FOR CLEANING UP
Cover with dry-lime, sand, or soda ash. Place in covered containers using non-sparking tools and transport outdoors. Ventilate area and wash spill site after material pickup is complete.

Section 7 - Handling and Storage

HANDLING
User Exposure: Avoid breathing vapor. Avoid contact with eyes, skin, and clothing. Avoid prolonged or repeated exposure.

STORAGE
Suitable: Keep container closed. Keep away from heat, sparks, and open flame.

Section 8 - Exposure Controls / PPE

ENGINEERING CONTROLS
Safety shower and eye bath. Use nonsparking tools. Mechanical exhaust required.

PERSONAL PROTECTIVE EQUIPMENT
Respiratory: Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU). Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator.
Hand: Compatible chemical-resistant gloves.
Eye: Chemical safety goggles.

GENERAL HYGIENE MEASURES
Wash thoroughly after handling. Wash contaminated clothing before reuse.

EXPOSURE LIMITS

Country	Source	Type	Value
Poland		NDS	100 mg/m3
Poland		NDSCh	170 mg/m3
Poland		NDSP	

Section 9 - Physical/Chemical Properties

Appearance	Physical State: Clear liquid Color: Colorless	
Property	Value	At Temperature or Pressure
Molecular Weight	120.2 AMU	
pH	N/A	
BP/BP Range	168.0 - 169.0 °C	
MP/MP Range	- 43.7 °C	
Freezing Point	- 44.0 °C	
Vapor Pressure	7 mmHg	44.4 °C
Vapor Density	4.2 g/l	
Saturated Vapor Conc.	N/A	
SG/Density	0.876 g/cm3	
Bulk Density	N/A	
Odor Threshold	N/A	
Volatile%	N/A	
VOC Content	N/A	
Water Content	N/A	
Solvent Content	N/A	
Evaporation Rate	N/A	
Viscosity	N/A	

Surface Tension	N/A
Partition Coefficient	N/A
Decomposition Temp.	N/A
Flash Point	118.4 °F 48 °C Method: closed cup
Explosion Limits	Lower: 0.9 % Upper: 6.4 %
Flammability	N/A
Autoignition Temp	515 °C
Refractive Index	1.505
Optical Rotation	N/A
Miscellaneous Data	N/A
Solubility	Solubility in Water:Insoluble.

N/A = not available

Section 10 - Stability and Reactivity

STABILITY
Stable: Stable.
Materials to Avoid: Strong oxidizing agents.

HAZARDOUS DECOMPOSITION PRODUCTS
Hazardous Decomposition Products: Carbon monoxide, Carbon dioxide.

HAZARDOUS POLYMERIZATION
Hazardous Polymerization: Will not occur

Section 11 - Toxicological Information

ROUTE OF EXPOSURE
Skin Contact: Causes skin irritation.
Skin Absorption: May be harmful if absorbed through the skin.
Eye Contact: Causes eye irritation.
Inhalation: May be harmful if inhaled. Material is irritating to mucous membranes and upper respiratory tract.
Ingestion: May be harmful if swallowed.

TARGET ORGAN(S) OR SYSTEM(S)
Central nervous system.

SIGNS AND SYMPTOMS OF EXPOSURE
To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated. Headache, nausea, drowsiness, and fatigue. Bronchitis. Narcotic effect. Prolonged exposure can cause:

TOXICITY DATA

Oral
Rat
5000 mg/kg
LD50

Inhalation
Rat
18,000 mg/m3
LC50

CHRONIC EXPOSURE - MUTAGEN

Species: Mouse
Route: Intraperitoneal

Dose: 900 MG/KG
Mutation test: Sister chromatid exchange

Section 12 - Ecological Information

Section 13 - Disposal Considerations

APPROPRIATE METHOD OF DISPOSAL OF SUBSTANCE OR PREPARATION
Contact a licensed professional waste disposal service to dispose of this material. Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Observe all federal, state, and local environmental regulations.

Section 14 - Transport Information

DOT
Proper Shipping Name: Hydrocarbons, liquid, n.o.s.
UN#: 3295
Class: 3
Packing Group: Packing Group III
Hazard Label: Flammable liquid
PIH: Not PIH

IATA
Proper Shipping Name: Hydrocarbons, liquid, n.o.s.
IATA UN Number: 3295
Hazard Class: 3
Packing Group: III

Section 15 - Regulatory Information

EU DIRECTIVES CLASSIFICATION
Symbol of Danger: Xn-N
Indication of Danger: Harmful. Dangerous for the environment.
R: 10-20-36/37/38-51/53
Risk Statements: Flammable. Harmful by inhalation. Irritating to eyes, respiratory system and skin. Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
S: 26-61
Safety Statements: In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. Avoid release to the environment. Refer to special instructions/safety data sheets.

US CLASSIFICATION AND LABEL TEXT
Indication of Danger: Combustible (USA) Flammable (EU). Harmful. Dangerous for the environment.
Risk Statements: Harmful by inhalation. Flammable. Irritating to eyes, respiratory system and skin. Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
Safety Statements: In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. Avoid release to the environment. Refer to special instructions/safety data sheets.
US Statements: Target organ(s): Central nervous system.

UNITED STATES REGULATORY INFORMATION
SARA LISTED: Yes
DEMINIMIS: 1 %
NOTES: This product is subject to SARA section 313 reporting

requirements.
TSCA INVENTORY ITEM: Yes

CANADA REGULATORY INFORMATION
WHMIS Classification: This product has been classified in accordance with the hazard criteria of the CPR, and the MSDS contains all the information required by the CPR.
DSL: Yes
NDSL: No

Section 16 - Other Information

DISCLAIMER
For R&D use only. Not for drug, household or other uses.

WARRANTY
The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Inc., shall not be held liable for any damage resulting from handling or from contact with the above product. See reverse side of invoice or packing slip for additional terms and conditions of sale.
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MSDS Number: **M1664** * * * * * *Effective Date: 07/06/06* * * * * *Supercedes: 08/10/04*

MSDS **Material Safety Data Sheet**

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

J.T.Baker

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300
National Response In Canada
CANUTEC: 613-996-6666
Outside U.S. And Canada
Chemtrec: 703-527-3887

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

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

MESITYLENE

1. Product Identification

Synonyms: Benzene, 1,3,5-trimethyl; mesitylene 99+%; trimethylbenzol
CAS No.: 108-67-8
Molecular Weight: 120.20
Chemical Formula: C9H12
Product Codes: P649

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Benzene, 1,3,5-trimethyl-	108-67-8	90 - 100%	Yes

3. Hazards Identification

Emergency Overview

DANGER! HARMFUL OR FATAL IF SWALLOWED. FLAMMABLE LIQUID AND VAPOR. HARMFUL IF INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS THE BLOOD AND CENTRAL NERVOUS SYSTEM.

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

Health Rating: 2 - Moderate

Flammability Rating: 2 - Moderate
Reactivity Rating: 0 - None
Contact Rating: 2 - Moderate
Lab Protective Equip: GOGGLES; LAB COAT; VENT HOOD; PROPER GLOVES; CLASS B EXTINGUISHER.
Storage Color Code: Red (Flammable)

Potential Health Effects

Inhalation:
Inhalation of vapors irritates the respiratory tract. May cause sore throat, coughing, headache and nausea. *Affects central nervous system.*
Ingestion:
Not expected to be very acutely toxic. Care should be taken due to potential irritant effects. May cause risk of chemical pneumonia from droplets entering lungs. Affects central nervous system.
Skin Contact:
Causes irritation to skin. Symptoms include redness, itching, and pain.
Eye Contact:
Liquid and vapor causes irritation, redness, and pain.
Chronic Exposure:
Repeated inhalation may cause chronic bronchitis of the asthmatic type. High concentrations of vapors causes blood effects.
Aggravation of Pre-existing Conditions:
No information found.

4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.
Ingestion:
If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Get medical attention immediately.
Skin Contact:
In case of contact, immediately flush skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. Call a physician.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

5. Fire Fighting Measures

Fire:
Flash point: 50C (122F)
Autoignition temperature: 559C (1038F)
Flammable liquid and vapor.
Contact with strong oxidizers may cause fire.
Explosion:
Above the flash point, explosive vapor-air mixtures may be formed. Sensitive to static discharge.

Fire Extinguishing Media:
Water spray, dry chemical, alcohol foam, or carbon dioxide. Water may be ineffective.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Vapors can flow along surfaces to distant ignition source and flash back. Water spray may be used to keep fire exposed containers cool.

6. Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer!

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

7. Handling and Storage

Protect against physical damage. Outside or detached storage is preferred. Inside storage should be in a standard flammable liquids storage room or cabinet. Separate from oxidizing materials. Storage and use areas should be No Smoking areas. Control ignition sources. Employ grounding, bonding, venting and explosion relief provisions in accord with accepted engineering practices in any process capable of generating an explosion due to static discharge. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
- ACGIH Threshold Limit Value (TLV): 25 ppm, 123 mg/m3 (TWA)
- NIOSH (REL): 25 ppm; 125 mg/m3 (TWA)

Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.
Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded and engineering controls are not feasible, a half-face organic vapor respirator may be worn for up to ten times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. A full-face piece organic vapor respirator may be worn up to 50 times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-face piece positive-pressure, air-supplied respirator. WARNING: Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.
Skin Protection:

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection:

Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area. Use chemical safety goggles and/or full face shield where dusting or splashing of solutions is possible.

9. Physical and Chemical Properties

Appearance:
Clear, colorless liquid.
Odor:
Characteristic odor.
Solubility:
Negligible; 0.002% in water.
Specific Gravity:
0.864 @ 20C/4C
pH:
No information found.
% Volatiles by volume @ 21C (70F):
99
Boiling Point:
165C (329F)
Melting Point:
-45C (-49F)
Vapor Density (Air=1):
1.006 @ 20C
Vapor Pressure (mm Hg):
1.86 @ 20C (68F)
Evaporation Rate (BuAc=1):
No information found.

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage.
Hazardous Decomposition Products:
Carbon dioxide and carbon monoxide may form when heated to decomposition.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Nitric Acid, strong oxidizers.
Conditions to Avoid:
Heat, flames, ignition sources and incompatibles.

11. Toxicological Information

Inhalation rat LC50: 24 mg/m3/4H

Irritation: rabbit skin (std Draize), 20 mg/24 H, moderate

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

Ingredient	---NTP Carcinogen--- Known	Anticipated	IARC Category
Benzene, 1,3,5-trimethyl- (108-67-8)	No	No	None

12. Ecological Information

Environmental Fate:
No information found.
Environmental Toxicity:
No information found.

13. Disposal Considerations

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

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: 1,3,5-TRIMETHYLBENZENE
Hazard Class: 3
UN/NA: UN2325
Packing Group: III
Information reported for product/size: 500ML

International (Water, I.M.O.)

Proper Shipping Name: 1,3,5-TRIMETHYLBENZENE
Hazard Class: 3
UN/NA: UN2325
Packing Group: III
Information reported for product/size: 500ML

International (Air, I.C.A.O.)

Proper Shipping Name: 1,3,5-TRIMETHYLBENZENE
Hazard Class: 3
UN/NA: UN2325
Packing Group: III
Information reported for product/size: 500ML

15. Regulatory Information

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

Ingredient	TSCA	EC	Japan	Australia
Benzene, 1,3,5-trimethyl- (108-67-8)	Yes	Yes	Yes	Yes

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

Ingredient	Korea	--Canada-- DSL	NDSL	Phil.
Benzene, 1,3,5-trimethyl- (108-67-8)	Yes	Yes	No	Yes

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

Ingredient	-SARA 302- RQ	TPQ	------SARA 313------ List	Chemical Catg.
Benzene, 1,3,5-trimethyl- (108-67-8)	No	No	No	No

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

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
Benzene, 1,3,5-trimethyl- (108-67-8)	No	No	No

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

Australian Hazchem Code: 3[Y]
Poison Schedule: None allocated.
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: **1** Flammability: **2** Reactivity: **0**
Label Hazard Warning:
DANGER! HARMFUL OR FATAL IF SWALLOWED. FLAMMABLE LIQUID AND VAPOR. HARMFUL IF INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS THE BLOOD AND CENTRAL NERVOUS SYSTEM.
Label Precautions:
Keep away from heat, sparks and flame.
Keep container closed.
Use only with adequate ventilation.
Avoid contact with eyes, skin and clothing.
Avoid breathing vapor or mist.
Wash thoroughly after handling.
Label First Aid:
In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. Call a physician. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth

to an unconscious person.

Product Use:

Laboratory Reagent.

Revision Information:

No Changes.

Disclaimer:

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

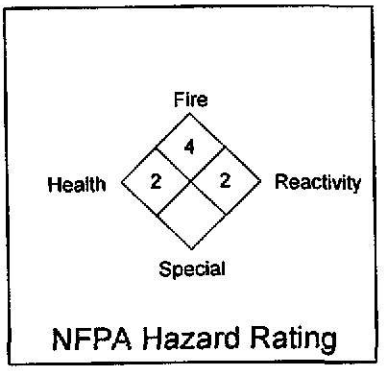
Georgia Gulf

Chemicals and Vinyls, LLC

Material Safety Data Sheet: Vinyl Chloride Monomer

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product name	**Vinyl Chloride Monomer**
Effective date	April 15, 2004
Synonyms	Chloroethene, chloroethylene, ethylene monochloride, monochloroethylene, VCM
Chemical formula	CH_2CHCL
CAS name & no.	Ethene, chloro-, 75-01-4
Manufacturer's name and address	Georgia Gulf Chemicals and Vinyls, LLC P.O. Box 629 Plaquemine, LA 70765-0629
Emergency telephone number	For transportation emergencies: CHEMTREC (800) 424-9300 For all other emergencies: (225) 685-2500
MSDS contact	Corporate Health & Safety Department P.O. Box 629 Plaquemine, LA 70765-0629 Phone Number (225) 685-2500



NFPA Hazard Rating

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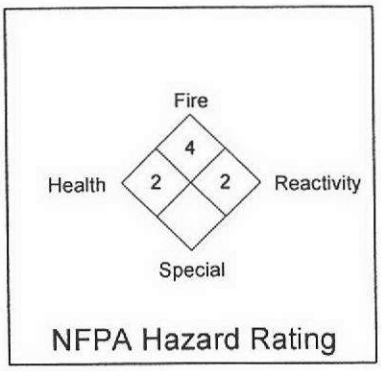


NFPA Hazard Rating

2. COMPOSITION/INFORMATION ON INGREDIENTS

Component	CAS No.	Wt. %.
Vinyl Chloride Monomer (VCM)	75-01-4	>99.99

3. HAZARDS IDENTIFICATION

PRECAUTIONARY INFORMATION

Extremely flammable liquified gas. Possible cancer hazard. Eye and skin burns on contact. Liver and kidney toxin. Inhalation may cause central nervous system effects and narcosis. Heavier than air flammable gas.

POTENTIAL HEALTH EFFECTS

Primary Routes of Entry

Inhalation, skin, and eye contact.

Acute Effects

Acute toxicity is most often due to depression of the central nervous system, but these effects rarely occur at low concentrations. Symptoms include depression, fatigue, headache, vertigo, ataxia, euphoria, visual disturbances, dizziness, numbness and tingling in the extremities, narcosis, and loss of consciousness. Death may result from respiratory depression. Gastrointestinal symptoms include nausea, vomiting, epigastric pain, anorexia, and diarrhea. Skin problems associated with vinyl chloride exposure include allergic dermatitis and scleroderma (hardening or thickening of the skin). Contact with escaping, compressed gas or the liquid can result in frostbite.

Chronic Effects

A number of different toxic effects have been noted following chronic exposure to VCM, including coughing, sneezing, and lung inflammation. Gastrointestinal symptoms include abdominal pain, gastrointestinal bleeding, nausea, vomiting, indigestion, diarrhea, jaundice, weight loss, and anorexia. Increase in liver and spleen size has been noted. Other symptoms include fatigue, blood clotting disorders, and a cold, tingling sensation in the hands and feet. A condition in which the small bones of the hand weaken has also been noted. Occupational exposure is associated with an increased incidence of angiosarcoma of the liver (see below, Carcinogen Status).

Potential Adverse Chemical Interactions

VCM is known to be toxic to the lungs and liver. Persons chronically exposed to VCM should have liver enzyme studies, blood counts, electrocardiograms, chest x-rays, and urinalysis conducted on a periodic basis (refer to 29 CFR 1910.1017). Smoking activity, alcohol consumption, and previous episodes of hepatitis could increase the toxicity associated with VCM exposure. Ethanol exposure may increase the carcinogenic activity of VCM (IARC, Vol. 19, 1979).

HAZARD CLASSIFICATION

Carcinogen Status

IARC has determined that there is sufficient evidence of the carcinogenicity of VCM in both animals and man. This chemical has been rated as a carcinogen IARC (Group I), EPA (Group A), ACGIH (A1), NIOSH, OSHA and NTP.

4. FIRST AID MEASURES

Inhalation

Move the person to fresh air at once. Get emergency medical attention as soon as possible. Monitor for respiratory distress. If breathing has stopped, give artificial respiration and provide supplemental 100% humidified oxygen. Keep the person quiet and maintain normal body temperature. If cough or respiratory distress develops, evaluate for respiratory tract irritation, bronchitis, and pneumonitis. Transfer to a medical facility. Get medical attention as soon as possible.

Skin Contact

Remove any contaminated clothing and immediately wash the exposed area thoroughly with water for at least 15 minutes. Get medical attention.

Eye Contact

If the chemical contacts the eye, eyes should be irrigated with copious amounts of room temperature water for at least 15 minutes, occasionally lifting both the upper and lower lids. Have the individual examined by an ophthalmologist. Contact lenses should not be worn when working with this chemical.

Ingestion: Not Applicable

5. FIRE FIGHTING MEASURES

Flash Point	-77.8° C (Cleveland open cup)
Flammable Limits (% By Vol.)	
Lower Explosive Limit (LEL)	3.6%
Upper Explosive Limit (UEL)	33%
Autoignition Temperature	472° C

Fire Fighting Procedures/Fire Extinguishing Media

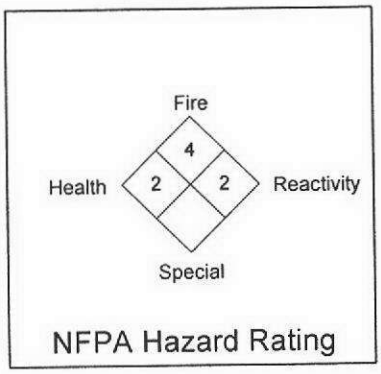
Keep unnecessary people away; isolate hazard area and deny entry. Avoid breathing vapors, stay upwind. Wear NIOSH approved self-contained respirator in the positive pressure mode and do not enter area without structural firefighters' protective equipment. Fight fire from protected location or maximum distance possible. Use flooding quantities of water as fog, carbon dioxide extinguishers, or alcohol foam for fires. Use water spray to cool containers exposed to fire. Large VCM fires are very difficult to extinguish. Stay away from ends of tanks. Withdraw immediately in case of rising sound from venting safety device or any discoloration of tanks due to fire. Isolate for 1/2 mile in all directions if tank car or truck is involved in fire.

Unusual Fire and Explosion Hazards

Dangerous fire and explosion hazard when exposed to heat or flame. VCM is extremely flammable and forms explosive mixtures with air. Vapors are heavier than air and may travel to the source of ignition and flash back. Containers may explode in heat of fire.

5. FIRE FIGHTING MEASURES CONTINUED

National Fire Protection Association Hazard Rating



4 = Extreme
3 = High
2 = Moderate
1 = Slight
0 = Insignificant

Note: NFPA Health Hazard Rating is a 2, and the rating does not consider carcinogenicity. Vinyl Chloride Monomer is classified by several organizations as a carcinogen. Please see Section 3, Carcinogen Status.

6. ACCIDENTAL RELEASE MEASURES

Shut off all sources of ignition. No smoking or flares allowed in the spill area. Immediately evacuate area and move unprotected personnel upwind of the area. Keep out of low areas. Allow only trained personnel wearing NIOSH approved self-contained respirator operated in the positive pressure mode with full protective clothing in the spill area. Do not touch spilled material; stop leak if you can without risk. Prevent VCM from entering water bodies, drains, or any sewage collection systems. Use water spray to disperse vapors and protect personnel. Control runoff and isolate discharge for disposal. Dispose all spill material in accordance with federal, state, and local regulations. VCM spills over the reportable quantity (1 lb.) should be reported to the National Response Center (800-424-8802).

7. HANDLING AND STORAGE

Possible cancer hazard. Store in a well ventilated place away from sources of ignition and oxidizing materials in accordance with 29 CFR 1910.106 and 1910.1017. Ground and/or bond storage containers. Use spark resistant equipment (tools) in the vinyl chloride monomer area. Containers of this material may be hazardous when emptied due to emptied containers retaining product residues. Assume emptied containers to have the same hazards as full containers. Follow all federal, state, and local regulations as well as all insurance codes when storing and handling VCM.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Respiratory Protection

Use appropriate NIOSH approved respirator in accordance with 29 CFR 1910.132, 1910.134 and 1910.1017, to prevent overexposure. Respirators must be selected based on the airborne levels found in the workplace and must not exceed the working limits of the respirator.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION (continued)

Eye Protection
Use splash proof chemical safety goggles or appropriate full-face respirator. Follow the eye and face protection guidelines of 29 CFR 1910.132 and 1910.133. Where there is any possibility that individuals' eyes may be exposed to VCM, an eye wash fountain (in accordance with 29 CFR 1910.151) should be within the immediate work area for emergency use. Contact lenses should not be worn when working with this chemical.

Protective Gloves
Use gloves in accordance with 29 CFR 1910.132 and 29 CFR 1910.138.

Ventilation
Provide local ventilation to maintain exposure levels below recommended exposure limits, and to prevent accumulation of vinyl chloride in explosive levels. Use explosion proof ventilation equipment. Local exhaust ventilation should comply with OSHA regulations and the American Conference of Governmental Industrial Hygienists, Industrial Ventilation - A Manual of Recommended Practice.

Exposure Controls
The OSHA-PEL is 1 ppm (8-hr TWA) and the ACGIH-TLV is 1 ppm (8-hr TWA). The OSHA Ceiling/STEL value is 5ppm (Average, not exceeding any 15-min period of time).

Other
All personal protective equipment and procedures must follow the requirements of 29 CFR 1910.132, 1910.133, and 1910.1017. Where there is a possibility of exposure of an individual's body to vinyl chloride monomer, facilities for quick drenching of the body should be provided (in accordance with 29 CFR 1910.151) within the immediate work area for emergency use. Such individuals should be provided with and required to use impervious clothing in accordance with 29 CFR 1910.132 and 1910.1017.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	Colorless gas
Odor	Mild, sweet
Molecular Weight	62.5
Boiling Point	-14°C
Melting Point	-154°C
Solubility	Slightly soluble in water (0.11%), soluble in hydrocarbons, oil, alcohol, chlorinated solvents, and most common organic liquids
Specific Gravity (Water = 1.0)	0.91 at 20° C
Vapor Density (Air = 1.0)	2.15
Vapor Pressure	2,524 mm Hg at 20° C
pH	7.0 - 8.5

10. STABILITY AND REACTIVITY

Stability
Stable under normal conditions.

Polymerization
Hazardous polymerization of vinyl chloride monomer may occur with oxidizing materials, peroxides, and at elevated temperatures.

Hazardous Decomposition Products
VCM burns to form toxic and corrosive gases such as hydrogen chloride, phosgene, and carbon monoxide.

Incompatible Materials
Copper, aluminum, aluminum alloys, and peroxides.

11. TOXICOLOGICAL INFORMATION

Animal Toxicity

Oral:	Rat LD_{50}	500 mg/kg
Inhalation:	Rat LC_{50}	18 pph/15 min
	Guinea Pig LC_{50}	44,183 ppm (2hr)

LC_{50} = Air concentration that is lethal to 50% of a given species in a given period.
LD_{50} = Dose that is lethal to 50% of a given species by a given route of exposure.

12. ECOLOGICAL INFORMATION

Environmental Fate: The following information on vinyl chloride is extracted from the TOXNET database maintained by the National Library of Medicine.

Atmosphere: If released to air, a vapor pressure of 2,980 mm Hg at 25 deg C indicates vinyl chloride will exist solely as a gas in the ambient atmosphere. Gas-phase vinyl chloride will be degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals; the half-life for this reaction in air is estimated to be 55 hours. Direct photolysis is not expected to be an important environmental fate process since this compound only absorbs light weakly in the environmental UV spectrum.

Terrestrial: If released to soil, vinyl chloride is expected to have high mobility based upon an estimated Koc value of 57. Volatilization from moist soil surfaces is expected to be an important fate process based upon a Henry's Law constant of 0.0278 atm-cu m/mole. Vinyl chloride may volatilize from dry soil surfaces based upon its vapor pressure. The volatilization half-life of vinyl chloride was estimated as 0.2 days when incorporated in a soil at a depth of 1 cm and 0.5 days at a depth of 10 cm. Biodegradation is expected to occur slowly in the environment under both aerobic and anaerobic conditions.

Aquatic: If released into water, vinyl chloride is not expected to adsorb to suspended solids and sediment in water based upon the estimated Koc. The biodegradation half-life of vinyl chloride in aerobic and anaerobic waters was reported as 28 and 110 days, respectively. Volatilization from water surfaces is expected to be an important fate process based upon this compound's Henry's Law constant. Estimated volatilization half-lives for a model river and model lake are 1 hour and 3 days, respectively. A measured BCF value of less than 10 in fish suggest bioconcentration in aquatic organisms is low. Hydrolysis is not expected to be an important environmental fate process based on a hydrolysis half-life of 9.91 years at pH 7 and 25 deg C.

12. ECOLOGICAL INFORMATION CONTINUED

Biodegradation: (Aerobic) Limited existing data indicate that vinyl chloride is resistant to biodegradation in aerobic systems. Vinyl chloride was approximately 50% and 100% degraded in 4 and 11 weeks, respectively, in the presence of sand by methanogenic microorganisms under anaerobic conditions in laboratory scale experiments. In the absence of sand 20% and 55% degradation occurred in 4 and 11 weeks, respectively.

(Anaerobic) Studies have shown that anaerobic bacteria can reduce tetrachloroethylene and trichloroethylene to vinyl chloride via reductive dechlorination. The resultant vinyl chloride is further reduced to ethene, but the dechlorination of vinyl chloride to ethene is very slow and as a result an accumulation of vinyl chloride is noticed. The biodegradation half-life of vinyl chloride in aerobic and anaerobic waters was reported as 28 and 110 days, respectively. The first-order anaerobic biodegradation rate constant of vinyl chloride was reported to range from 0.0062-0.00096 day-1. These rate constants correspond to half-lives in the range of 112 to 722 days.

Ecotoxicity: Some data indicated that vinyl chloride is too readily volatilized to undergo bioaccumulation, except perhaps in the most extreme exposure conditions. Studies on five bacterial, three fungal, and two single organism cultures from natural aquatic systems did not show bioaccumulation to be an appreciable process. The BCF value of vinyl chloride in golden ide fish was reported as less than 10. The BCF value of vinyl chloride in green algae was reported as 40. According to a classification scheme, the BCF data suggest that bioconcentration in aquatic organisms is low.

13. DISPOSAL CONSIDERATIONS

Waste Management Information: Do not dump into any sewers, on the ground, or into any body of water. Any disposal practice must be in compliance with local, state and federal laws and regulations (contact local or state environmental agency for specific rules). Waste characterization and compliance with applicable laws are the responsibility of the waste generator.

14. TRANSPORTATION INFORMATION

Proper Shipping Name	Vinyl Chloride, stabilized
DOT Hazard class	2.1, (Flammable gas)
DOT Shipping I.D. No.	UN 1086
PG	N/A
DOT Labeling	Flammable gas
DOT Placard	Flammable gas

15. REGULATORY INFORMATION

SARA Title III

Section 302 and 304 of the Act; Extremely Hazardous Substances (40 CFR 355)

COMPONENT	CAS No.	TPQ (lbs)	RQ (lbs)
None	Not Applicable	Not Applicable	Not Applicable

Note: TPQ - Threshold Planning Quantity RQ - Reportable Quantity

Section 311 Hazard Categorization (40 CFR 370)

ACUTE	CHRONIC	FIRE	PRESSURE	REACTIVE
X	X	X	X	X

Section 313 Toxic Chemicals (40 CFR 372.65)

COMPONENT	CAS No.	WT.%
VCM	75-01-4	>99.99

CERCLA

Section 102(a) Hazardous Substances (40 CFR 302.4)

COMPONENT	CAS No.	WT.%	RQ (lbs)
VCM	75-01-4	>99.99	1

RCRA

40 CFR 261.33 Hazardous waste number:

VCM waste is regulated as hazardous waste material under the hazardous waste number U043. Material contaminated with 0.2 mg/L of VCM using the hazardous waste toxicity test would be regulated as hazardous waste material under the hazardous waste number D043.

TSCA

Vinyl chloride is listed on the TSCA inventory.

CA Proposition 65

This product contains substances known to the State of California to cause cancer and/or reproductive toxicity.

Canadian Environmental Protection Act (CEPA)

All substances in this product are listed on the Canadian Domestic Substances (DSL) list or are not required to be listed.

15. REGULATORY INFORMATION (continued)

Canada Regulations (WHMIS)

This product has been classified according to the hazard criteria of the Canadian Controlled Products Regulations, Section 33 and the MSDS contains all information required by this regulation.

Class A – Compressed Gas, Class B1 – Flammable Gas, Class D (2A) – Possible, probable or known human carcinogen according to classifications by IARC or ACGIH

OSHA 29 CFR 1910.1017:

(1) Entrances to regulated areas shall be posted with legible signs bearing the legend:

CANCER-SUSPECT AGENT AREA
AUTHORIZED PERSONNEL ONLY

(2) Areas containing hazardous operations or where an emergency currently exists shall be posted with legible signs bearing the legend:

CANCER-SUSPECT AGENT IN THIS AREA
PROTECTIVE EQUIPMENT REQUIRED
AUTHORIZED PERSONNEL ONLY

(3) Containers of VCM shall be legibly labeled either (I):

VINYL CHLORIDE
EXTREMELY FLAMMABLE GAS UNDER PRESSURE
CANCER-SUSPECT AGENT

or (ii) In accordance with 49 CFR 170-189, with additional legend:

CANCER-SUSPECT AGENT

applied near the label or placard.

16. OTHER INFORMATION

IMPORTANT: The information and data herein are believed to be accurate and have been compiled from sources believed to be reliable. It is offered for your consideration, investigation and verification. Buyer assumes all risk of use, storage and handling of the product in compliance with applicable federal, state and local laws and regulations. **GEORGIA GULF CHEMICALS AND VINYLS, LLC MAKES NO WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, CONCERNING THE ACCURACY OR COMPLETENESS OF THE INFORMATION AND DATA HEREIN.** Georgia Gulf will not be liable for claims relating to any party's use of or reliance on information and data contained herein regardless of whether it is claimed that the information and data are inaccurate, incomplete or otherwise misleading. This information relates to the material designated and may not be valid for such material used in combination with any other materials nor in any process.

MSDS Status: Revision Date: 4/15/04 Supersedes: 7/24/00

Appendix C

Site Activities Tailgate Safety Briefing
Sign-in Log

ARCADIS

Site Activities Tailgate Safety Briefing Sign-In Log

Project Number: LA002656.0001.00001	**Project Name:** Mississippi Bluffs
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
- ☐ Hearing Conservation
- ☐ Respiratory Protection
- ☐ Personal Hygiene
- ☐ Exposure Guidelines
- ☐ Decon Procedures
- ☐ Emergency Procedures (include route to hospital)
- ☐ Confined Space
- ☐ Slips, Trips, Falls
- ☐ Heat Stress
- ☐ Thermal Stresses
- ☐ Site Control
- ☐ Work Zones
- ☐ Lockout/Tagout
- ☐ Excavation Safety
- ☐ Confined Space
- ☐ Traffic Safety
- ☐ Changes to the HASP
- ☐ Initial Review of Hazard Evaluation
- ☐ Other (specify):
- ☐ Other (specify):

Personnel Sign-in List

Printed Name	Signature	Company Name

Appendix D

Safety Modules

A. Biological Hazards

Biological hazards are any virus, bacteria, fungus, parasite, or any living organism that can cause disease in human beings. Diseases can be transmitted from animals and insects to humans and from exposure to contaminated water and people. The biological hazards present at the site are common for all work tasks and may include the following:

A.1 Poisonous Plants

Perhaps the most common biological hazard is contact with poisonous plants including poison ivy, poison oak, and poison sumac. These plants can cause mild to severe skin irritation upon contact depending upon the individual, and in extreme cases may require medical evaluation.

- Poison ivy may be found as a low-growing plant, shrub, or vine that grows in sunny and shaded areas. It has three shining green leaflets usually with coarse teeth. During the fall months, leaves turn a bright red, then yellow.

- Poison oak is a close relative to poison ivy and has three, five, or seven lobed leaflets that are hairy underneath. Poison oak is not shade tolerant.

- Poison sumac is a tall shrub or small tree with 6 to 12 leaflets arranged in pairs. It is most likely found in peat bogs in the north and some southern swamps. Unlike other varieties of sumac, poison sumac has leaflets that are smooth and grow in a V-shape from the midrib.

To avoid contact:

- Learn to recognize these plants;

- Wear long pants;

- Wear long sleeves whenever possible;

- Wear a hat; and

- Wear gloves if cutting or handling vegetation.

If contact is made with these plants, the individual should wash exposed skin immediately with cold water and as soon as possible with soap and water. Clothing should be washed as soon as possible and all gear and equipment should be washed in hot, soapy water.

A.2 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 personal protective equipment (PPE):
- Wear 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;
- Do not 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), wear U.S. Environmental Protection Agency (USEPA)-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 symptoms that are more serious. If nausea, vomiting, or 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:

- Using 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 because the mouth will dislodge as skin sloughs off;

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

- 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.

A.3 Snakes

The snakes of most concern in the project area are water moccasins, copperheads, coral snakes, and rattlesnakes. Leave snakes alone – many people are bitten because they try to kill a snake or get a closer look at it. If you see a snake, even if you know it's not poisonous, walk away quietly giving it a wide berth (at least 6 feet).

- Be especially cautious when opening monitor well casings and other enclosed field objects;

- The use of a heavy high-top work boot, denim work pants, etc., will help reduce the severity if bitten; and

- Whenever possible:

  - Stay out of tall grass;

  - Remain on paths as much as possible;

  - Keep hands and feet out of areas you can't see; and

  - Do not pick up rocks, timber, or other vegetation.

If bitten by a poisonous snake, the following is recommended:

- Seek medical attention immediately;

- Wash area with soap and water;

- Stay calm and remain as motionless as possible;

- Keep the bite area below the heart, if possible;

- Do not use cold packs or ice on the bite area; and

- Do not make incisions or try to suck the venom out.

B. 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.

B.1 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 to 7 ounces of water every 15 to 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; and
- 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 the location in which the work is being done may prohibit or make the use of this PPE impossible or impractical.

B.2 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; and
- 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

Heat exhaustion usually begins with muscular weakness, dizziness, nausea, and a staggering gait. Symptoms include pale, clammy skin, profuse sweating and 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; and
- If the victim is conscious, it may be helpful to give him/her sips of water.

Heat Stroke

Heat stroke is a severe medical condition requiring first-aid and emergency treatment by a medical professional, because 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 to 110 degrees Fahrenheit (°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; and
- 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.

B.3 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; and
- Heat rash, also known as prickly heat, can be prevented by the application of a hydrophobic, water-repellent barrier cream such as Kerodex 71.

C. 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°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).

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 than 30°F.

- Feet, hands, face, and head should be protected (40 percent 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.

C.1 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 whoever 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, 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 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 armpits, 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 because 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 because swimming uses the body's heat and reduces survival time by about 50 percent.

  - If you are in the water and it 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 liquids 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 re-warming 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 and slight elevation. **Do not try re-warming the affected area if you have not been specifically trained to *do so*.**

C.2 Cold Stress Monitoring

Monitoring for cold stress is difficult and will be completed by the Site Safety Officer (SSO) by monitoring for symptoms and monitoring the weather conditions on a daily basis. The following table may be used as a guideline for establishing a work/rest regimen.

THRESHOLD LIMIT VALUES WORK/WARM-UP SCHEDULE FOR FOUR-HOUR SHIFT

Air Temperature-Sunny Sky		No Noticeable Wind		5 mph Wind		10 mph Wind		15 mph Wind		20 mph Wind	
°C (approx.)	°F (approx.)	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks
-26° to -28°	-15° to -19°	Normal	1	Normal	1	75 min	2	55 min	3	40 min	4
-29° to -31°	-20° to -24°	Normal	1	75 min	2	55 min	3	40 min	4	30 min	5
-32° to -34°	-25° to -29°	75 min	2	55 min	3	40 min	4	30 min	5	Non-emergency work should cease	
-35° to -37°	-30° to -34°	55 min	3	40 min	4	30 min	5	Non-emergency work should cease			
-38° to -39°	-35° to -39°	40 min	4	30 min	5	Non-emergency work should cease					
-40° to -42°	-40° to -44°	30 min	5	Non-emergency work should cease							
-43° & below	-45° & below	Non-emergency work should cease									

D. Noise Exposure

The Occupational Safety and Health Administration (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 A-weighted decibels (dBA);
- When operating gasoline- or electric-powered machinery; and

- When working within 25 feet of operating heavy equipment (earth working equipment, etc.) because 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 Project Health and Safety Manager (PHSM) may also choose to monitor employee exposure to potentially hazardous noise levels.

E. 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 Remediation Task Manager to determine how site activities should proceed.

F. Walking/Working Surfaces (Slips, Trips, Falls, and Protruding Objects)

Hazards from floor and wall openings and from careless movements, protruding objects, debris, spills, and 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. If that is not possible, report the hazard to your SSO or Project Manager (PM) 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-inch sturdy work boots with good tread are required and steel-toed boots are recommended;
- Do not run;
- Slide feet when walking on slick/wet surfaces;
- Do not walk up or down steep embankments/hills if possible:
  - If not possible, walk at an angle when going up/down embankments/hills;
- Do not carry items that block your vision;
- Use handrails/grips when available and maintain 3-point contact whenever possible;
- Do not jump down from equipment and look down before you step down;
- Use appropriate fall protection when working at elevation;
- Report to the SSO or PM any floor openings that are not clearly marked and/or guarded;

- Do not use ladders/scaffolds during high winds or when ice or snow is on the rungs/work surface;
- Do not use ladder substitutes like a box or truck fender, and do not use ladders/scaffolding that are not in good condition;
- Keep paths and work areas clear of tools, equipment, boxes, cords, etc.
  - Tape or secure cords, wires, etc., to minimize a trip/fall hazard;
- If a protruding object cannot be moved, ensure that the object can be easily seen or guard/pad the object if possible; and
- Use ancillary lighting such as flashlights and headband lights when necessary.

G. Use of Drums and Containers

OSHA defines "anything that holds hazardous chemicals except pipes and piping systems" as a container (48 Federal Register [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.

G.1 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.

G.2 Labeling of Drums and Containers

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

G.3 Procedures for Handling Drums and Containers

Handling Drums and Containers

Where containers of a 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; and
- 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.

Opening Drums and Containers

Only a couple of pounds of "built up" pressure can 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; and

- Areas where drums and containers are staged need to be provided with adequate routes for access and egress from the staging area.

G.4 Use of Approved Drums or Containers

Drums and containers are required to meet the appropriate Department of Transportation (DOT), OSHA, and USEPA 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 ensured 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) 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; and

- 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.

G.5 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, DOT-specified salvage drums or containers must be available on site along with suitable quantities of an appropriate absorbent material.

H. Heavy Machinery and Certification Requirements

H.1 Purpose

The purpose of this procedure is to present the minimum safety performance requirements for the operation of heavy equipment on ARCADIS project sites. Project managers are responsible for ensuring all equipment used on an ARCADIS site is certified and that equipment owners have submitted the attached Initial Equipment Inspection Checklist.

H.2 General Requirements

All equipment shall comply with all applicable requirements for motor vehicles and material handling heavy equipment contained in 29 Code of Federal Regulations (CFR) 1926 Subpart O. Heavy equipment includes, but is not limited to, drill rigs, front-end loaders, backhoes, track hoes, bulldozers, forklifts, cranes, derricks, and similar equipment used for the implementation of the project Statement of Work.

H.3 Equipment Safety Inspections

The following presents general guidelines for certifying equipment is in safe operating condition before activities commence at the site and during site operations. The following guidelines are not meant to be all-inclusive.

- All machinery and mechanized equipment will be certified to be in safe operating condition by a competent individual (using the attached Initial Equipment Inspection Checklist), within 7 days of initial on-site operation.
- Certification is valid for 1 year.
- Equipment will be inspected on a daily basis by the owner/operator and daily logs will be maintained. All discrepancies shall be corrected prior to placing the equipment in service.
- Inspections shall include, but are not limited to, all hydraulic lines and fittings for wear and damage, all cable systems and pull ropes for damage and proper installation, exhaust systems, brake systems, and drill controls, etc.
- The driller in charge on a daily basis shall inspect drill rigs and related support equipment and vehicles. These inspections shall be recorded/documented.
- Preventive maintenance shall be conducted for all equipment according to manufacturer recommendations and/or established internal policies, schedules, and equipment standard operating procedures (SOPs).
- Only designated qualified persons shall operate machinery and mechanized equipment.
- Records of tests and inspections shall be maintained at the site by the operating contractor, shall be made available upon request of the designated authority, and shall become part of the official project file.

- Equipment not found to be in safe operating condition, or when a deficiency affecting the safe operation of the equipment is identified, the equipment shall immediately be taken out of service and its use prohibited until safe conditions have been corrected.

- All equipment shall be kept in the Exclusion Zone until work or the shift has been completed. Equipment will be decontaminated within designated decontamination areas. Note: This not typical for construction sites. It would be for remediation sites.

- All equipment must have an audible alarm that sounds when the equipment is moving in reverse.

I. Trenching and Excavation Safety

All trenching and excavation operations will be accomplished in accordance with the requirements of 29 CFR 1926.650. The following safe operating guidelines apply to open trenches or excavations exceeding 4 feet in depth **or** of any depth if in unstable soil conditions, as required by 29 CFR 1926.650. An excavation is any manmade 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.

I.1 *Excavation Construction Guidelines*

The following 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 have 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 feet or more.

I.2 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 which are more than 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 which are 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 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.

I.3 Atmosphere & Testing

Before an employee enters an excavation that is greater than 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 10 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.

HEAVY EQUIPMENT CERTIFICATION REQUIREMENTS

Initial Equipment Inspection Checklist

TO: _____ DATE: _____

FROM: **ARCADIS**

Project Name: **Mississippi Bluffs**

Project Location: **Vicksburg, Mississippi**

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: Address:	
Dates (Duration) of Equipment Work:	

2. Inspection and certification of machinery and mechanized equipment, as required by the ARCADIS Project Team, have been made prior to but within 7 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 1 year.

	Identification of Equipment (Make, Model, Serial Number)	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	INSPECTOR'S 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	
Inspector's 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.

J. Underground and Aboveground 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 lines 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 the 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 300 V, not over 750 V	12
Over 750 V 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 and Structures Checklist is attached and may be used to verify that all utilities have been marked.

Utilities and Structures Checklist

Project: **Mississippi Bluffs** Prepared By: _____

Location: **Vicksburg, Mississippi** Date: _____

Instructions. This checklist may be used as a safety measure to ensure that all underground utility lines and other underground structures, as well as aboveground 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 mark-outs 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 the PM.

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 aboveground power lines.

Utilities and Structures			
Type	**Not Present**	**Present**	**How Marked** (flags, paint, wooden stakes, etc.)
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

K. Visible Dust Suppression

In the event that airborne concentrations of dust and dust-laden chemical contaminants are found to exceed established action levels, the SSO will implement appropriate mitigation measures to include water-suppression techniques. If mitigation measures are found to be inadequate (contaminant concentrations cannot be reduced below Health and Safety Plan [HASP] requirements), the SSO will halt on-site operations until effective control can be achieved.

L. Chemicals and Other Hazardous Substances

L.1 Benzene

Benzene is a known human carcinogen. Prolonged skin contact with benzene or excessive inhalation of its vapor may cause headache, weakness, loss of appetite, and lassitude. Continued exposure can cause collapse, bronchitis, and pneumonia. The most important health hazards are cancer (leukemia), bone marrow effects, and injuries to the blood-forming tissue from chronic low-level exposure.

Benzene is a colorless liquid with a sweet odor. It evaporates into the air very quickly and dissolves slightly in water. It is highly flammable and is formed from both natural processes and human activities.

Benzene is widely used in the United States; it ranks in the top 20 chemicals for production volume. Some industries use benzene to make other chemicals that are used to make plastics, resins, and nylon and synthetic fibers. Benzene is also used to make some types of rubbers, lubricants, dyes, detergents, drugs, and pesticides. Natural sources of benzene include volcanoes and forest fires. Benzene is also a natural part of crude oil, gasoline, and cigarette smoke.

- Industrial processes are the main source of benzene in the environment.
- Benzene can pass into the air from water and soil.
- It reacts with other chemicals in the air and breaks down within a few days.
- Benzene in the air can attach to rain or snow and be carried back down to the ground.
- It breaks down more slowly in water and soil and can pass through the soil into underground water.

Benzene does not build up in plants or animals.

Chemical Name	Physical Description	Health Effects	TLV 8-hr TWA	Physical Properties	Special Precautions
Benzene	Colorless to light yellow liquid with aromatic odor	Irritant to eyes, skin, and lungs; affects nervous system; considered carcinogen	0.5 ppm	Flammable liquid LEL 1.2% Flash point – 12°F	Known to cause leukemia in humans

°F Degrees Fahrenheit. ppm Parts per million. TWA Time weighted average.
LEL Lower explosive level. TLV Threshold limit value.

L.2 Heavy Metals

Heavy metals that are potentially found on site include arsenic, barium, cadmium, chromium, lead, molybdenum, selenium, silver. Areas where potential exposure to these metals may occur include laboratory hood and liquid in laboratory sinks. Routes of exposure include ingestion and inhalation. Heavy metals are toxic and can cause severe organ damage and can affect the central nervous system. The likelihood of exposure to elevated levels of these metals during this project is low; however, precaution should be taken when performing activities in identified areas. Atmosphere containing potential airborne heavy metals shall not be entered without proper PPE in accordance with this HASP.

L.3 Pentachlorophenol (PCP)

PCP is a manufactured chemical that does not occur naturally. Pure PCP exists as colorless crystals. Impure PCP (the form usually found at hazardous waste sites) is dark gray to brown and exists as dust, beads, or flakes. PCP was widely used as a pesticide and wood preservative. Since 1984, the purchase and use of PCP has been restricted to certified applicators. It is no longer available to the general public. It is still used industrially as a wood preservative for utility poles, railroad ties, and wharf pilings.

Studies in workers show that exposure to high levels of PCP can cause the cells in the body to produce excess heat. When this occurs, a person may experience a very high fever, profuse sweating, and difficulty breathing. The body temperature can increase to dangerous levels, causing injury to various organs and tissues and even death. Liver effects and damage to the immune system have also been observed in humans exposed to high levels of PCP for a long time. Damage to the thyroid and reproductive system has been observed in laboratory animals exposed to high doses of PCP. Some of the harmful effects of PCP are caused by the other chemicals present in technical grade PCP. The USEPA has determined that PCP is a probable human carcinogen and the International Agency for Cancer Research (IARC) considers it possibly carcinogenic to humans.

L.4 Perchloroethylene (PCE) (aka Tetrachloroethene)

High concentrations of PCE (particularly in closed, poorly ventilated areas) can cause dizziness, headache, sleepiness, confusion, nausea, difficulty in speaking and walking, unconsciousness, and death.

Irritation may result from repeated or extended skin contact with it. These symptoms occur almost entirely in work (or hobby) environments when people have been accidentally exposed to high concentrations or have intentionally used PCE to get a "high."

In industry, most workers are exposed to levels lower than those causing obvious nervous system effects. The health effects of breathing in air or drinking water with low levels of PCE are not known.

Results of animal studies, conducted with amounts much higher than those that most people are exposed to, show that PCE can cause liver and kidney damage. Exposure to very high levels of PCE can be toxic to the unborn pups of pregnant rats and mice. Changes in behavior were observed in the offspring of rats that breathed high levels of the chemical while they were pregnant.

PCE is a manufactured chemical that is widely used for dry cleaning of fabrics and for metal-degreasing. It is also used to make other chemicals and is used in some consumer products.

Other names for PCE include tetrarchloroethylene and tetrachloroethene. It is a nonflammable liquid at room temperature. It evaporates easily into the air and has a sharp, sweet odor. Most people can smell PCE when it is present in the air at a level of 1 part PCE per million parts of air or more, although some can smell it at even lower levels.

- Much of the PCE that gets into water or soil evaporates into the air.
- Microorganisms can break down some of the PCE in soil or underground water.

In the air, it is broken down by sunlight into other chemicals or brought back to the soil and water by rain.

Chemical Name	Physical Description	Health Effects	TLV 8-hr TWA	Physical Properties	Special Precautions
PCE	Colorless liquid with a chloroform-like odor	Irritant to eyes, skin, and lungs; affects nervous system	25 ppm	Noncombustible liquid	Animal carcinogen Chlorinated solvent

ppm Parts per million. TLV Threshold limit value. TWA Time weighted average

L.5 Phthalates

Phthalates such as bis(2-ehtylhexl)phthalate have very low acute toxicities and only in high doses can they cause weight loss, breathing difficulties, and drowsiness.

L.6 Polychlorinated Biphenyl (PCBs)

PCBs are usually found as a mixture of the chlorinated phenyl compounds—the exact mix determines the desired performance criteria. PCBs have a low vapor pressure, making inhalation an unlikely exposure route. Skin contact can lead to the production of an acne-like condition known as chloracne. Additionally, PCBs are absorbed through the skin, so contact should be avoided. Chronic exposure can lead to liver damage and possible reproductive effects. PCBs have also been identified as a potential human carcinogen.

Information on PCB compounds is presented for site contaminant awareness. While the potential for site personnel to sustain significant inhalation exposures to volatilized PCB compounds during the site activities of this project is minimal, there is the potential for inhalation of PCB-contaminated dust and from skin contact. Handling of contaminated soil presents skin exposure hazards. Use of dust suppression techniques (as appropriate) and the proper use of PPE will adequately protect personnel. Atmosphere containing potential airborne PCBs shall not be entered without proper PPE in accordance with this HASP.

L.7 Polycyclic Aromatic Hydrocarbons (PAHs)

PAHs are a group of more than 100 different chemicals that are formed during the incomplete burning of coal, oil and gas, garbage, or other organic substances like tobacco or charbroiled meat. PAHs are usually found as a mixture containing two or more of these compounds, such as soot. Some PAHs are manufactured. These pure PAHs usually exist as colorless, white, or pale yellow-green solids. PAHs are

found in coal tar, crude oil, creosote, and roofing tar, but a few are used in medicines or to make dyes, plastics, and pesticides.

Mice that were fed high levels of one PAH during pregnancy had difficulty reproducing and so did their offspring. These offspring also had higher rates of birth defects and lower body weights. It is not known whether these effects occur in people. Animal studies have also shown that PAHs can cause harmful effects on the skin, body fluids, and ability to fight disease after both short- and long-term exposure, but these effects have not been seen in people. The Department of Health and Human Services has determined that some PAHs may reasonably be expected to be carcinogens. Some people who have breathed or touched mixtures of PAHs and other chemicals for long periods of time have developed cancer. Some PAHs have caused cancer in laboratory animals when they breathed air containing them (lung cancer), ingested them in food (stomach cancer), or had them applied to their skin (skin cancer).

L.8 Trichloroethene (TCE)

Breathing small amounts of TCE may cause headaches, lung irritation, dizziness, poor coordination, and difficulty concentrating. Breathing large amounts of TCE may cause impaired heart function, unconsciousness, and death. Breathing it for long periods may cause nerve, kidney, and liver damage. Skin contact with TCE for short periods may cause skin rashes.

TCE is a nonflammable, colorless liquid with a somewhat sweet odor and a sweet, burning taste. It is used mainly as a solvent to remove grease from metal parts, but it is also an ingredient in adhesives, paint removers, typewriter correction fluids, and spot removers.

TCE is not thought to occur naturally in the environment. However, it has been found in underground water sources and many surface waters as a result of the manufacture, use, and disposal of the chemical.

- TCE dissolves a little in water, but it can remain in groundwater for a long time.
- TCE quickly evaporates from surface water, so it is commonly found as a vapor in the air.
- TCE evaporates less easily from the soil than from surface water. It may stick to particles and remain for a long time.
- TCE may stick to particles in water, which will cause it to eventually settle to the bottom sediment.
- TCE does not build up significantly in plants and animals.

Chemical Name	Physical Description	Health Effects	TLV 8-hr TWA	Physical Properties	Special Precautions
TCE	Colorless liquid with a chloroform-like odor	Irritant to eyes, skin, and lungs; affects nervous system	50 ppm	Combustible liquid LEL 8%	Animal carcinogen Chlorinated solvent

LEL Lower explosive level.
ppm Parts per million.
TLV Threshold limit value.
TWA Time weighted average.

L.9 Vinyl Chloride

Breathing high levels of vinyl chloride can cause you to feel dizzy or sleepy. Breathing very high levels can cause you to pass out, and breathing extremely high levels can cause death.

People who work frequently with vinyl chloride have developed nerve damage and immune reactions. Other workers have developed problems with the blood flow in their hands; the tips of their fingers turn white and hurt when they are in cold temperatures. Sometimes, the bones in the tips of their fingers have broken down. Vinyl chloride on your skin can cause numbness, redness, and blisters.

Animal studies have shown that long-term (365 days or longer) exposure to vinyl chloride can damage the sperm and testes. It has not been proven that vinyl chloride causes birth defects in humans, but animal studies have shown that breathing vinyl chloride can harm unborn offspring and may also cause increases in early miscarriages.

Vinyl chloride is a colorless, flammable gas at normal temperatures with a mild, sweet odor. It is a manufactured substance that is used to make polyvinyl chloride (PVC). PVC is used to make a variety of plastic products, including pipes, wire and cable coatings, and furniture and automobile upholstery.

Vinyl chloride also results from the breakdown of other substances, such as trichloroethane, trichloroethylene, and tetrachloroethylene. Vinyl chloride is also known as chloroethene, chloroethylene, and ethylene monochloride.

In the environment:

- Liquid vinyl chloride evaporates easily into the air. Vinyl chloride, if it is near the surface of soil or water, can also evaporate.
- Vinyl chloride in the air can break down within a few days to other substances, some of which can be harmful.
- Small amounts of vinyl chloride can dissolve in water.
- Vinyl chloride formed from the breakdown of other chemicals can enter groundwater.
- Vinyl chloride is unlikely to build up in plants or animals.

Chemical Name	Physical Description	Health Effects	TLV 8-hr TWA	Physical Properties	Special Precautions
Vinyl Chloride	Colorless gas or liquid with a pleasant odor at high concentrations	Weakness, abdominal pain, gastrointestinal bleeding, affects liver and nervous system	1 ppm	Flammable gas LEL 3.6%	Carcinogen of the liver

LEL Lower explosive level.
ppm Parts per million.
TLV Threshold limit value.
TWA Time weighted average.

M. Decontamination

All personnel and equipment entering any controlled work area must be adequately decontaminated prior to exiting the area. The procedures should be adopted for site-specific decontamination procedures.

M.1 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 site 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 EZ 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).

M.2 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.

N. Dust, Fumes, and Mists

Many materials can become airborne and create hazards when they are inhaled, when they contact the skin or mucous membranes, or when they settle out of the air onto surfaces that people come into contact with or onto food or other items from which we ingest the materials. It is important that these hazards are controlled to avoid these routes of exposure. Below is a detailed discussion of each.

N.1 Dust

Dust is small particles of dry matter. Dust can be generated by handling, crushing, grinding, rapid impact, detonation, and breakdown of certain organic or inorganic materials, such as rocks, ore, metal, coal, wood, and grains. Under certain conditions such as wind and disturbances such as driving, drilling, earth moving, etc., these dusts can become airborne. The hazards associated with the dust greatly depend on the size of the dust particles and their content. Dusts laden with metals such as lead, cadmium, arsenic, or chromium or dusts that have semivolatile compounds adsorbed on to them such as PCB, pesticides, or others increase the hazards above inert materials. It is important to understand the potential contaminants and their concentrations in the source from which the dust is being formed.

Dust particles may be small enough that they are respirable, capable of being drawn deep into the lungs when inhaled. Some dusts, such as certain forms of asbestos, chrystalline silica, cotton dust, wood dust, metal dusts, and coal dust, remain lodged deep inside the lungs where they can eventually cause cancer or other chronic health effects such as emphysema, pneumoconiosis, and bronchitis. At the very least, most dusts are respiratory irritants. They can also cause mucous membrane irritation in the eyes and nose. Dusts that are not respirable can lead to hazards associated with skin contact and ingestion and cause physical hazards from visibility problems, equipment deterioration or malfunction, complaints from neighbors of the site, or regulatory compliance issues.

Some dusts can form explosive mixtures in air. Grain dust or flour are combustible materials that can be reduced to a dust that has an extremely high surface area and can burn quite rapidly. When the concentrations of air and dust fall within the explosive limits and are ignited, fire and explosion occur. Essentially any material that can burn can explode as a dust.

OSHA and the American Conference of Governmental Industrial Hygienists (ACGIH) exposure levels for dusts are as follows (several other compounds have PELs and threshold limit values [TLVs]; see the respective reference for more details). If the dusts generated on the site have any of these hazardous constituents, additional procedures and requirements may apply and these constituents should be further identified and assessed.

Type of Dust	OSHA PEL 8-Hour TWA (mg/m^3)
Inert Dust or Particulates Not Otherwise Regulated (PNOR)	15
Respirable Inert Dust or PNOR	5
Lead	0.050 (PEL); 0.030 (AL)
Silica	See note below
Cotton	Ranges from 0.2 to 0.75 depending on type
Cadmium	0.005 (PEL); 0.0025 (AL)
Arsenic (Inorganic)	0.010 (PEL); 0.005 (AL)
Calcium Carbonate	15 for total; 5 for respirable
Coal	See note below
Portland Cement	15 for total; 5 for respirable
Aluminum Metal	15 for total; 5 for respirable
Boron Oxide	15 for total
Calcium Hydroxide	15 for total; 5 for respirable
Calcium Sulfate	15 for total; 5 for respirable
Copper Dust	1
Grain Dust	10
Gypsum	15 for total; 5 for respirable
Limestone	15 for total; 5 for respirable
Malathion	15
Starch	15 for total; 5 for respirable
Sucrose	15 for total; 5 for respirable

AL	Action level where specific regulatory requirements are applicable.
Coal	Depends on the amount of crystalline silica (See Table Z-3 of OSHA 1910.1000).
mg/m^3	Milligram per cubic meter.
Mppcf	Millions of particles per cubic foot of air.
PEL	Permissible Exposure Level based on an 8-hour Time Weighted Average (TWA).
Silica	The PEL is calculated from the percent of crystalline silica in the material (See Table Z-3 of OSHA 1910.1000).

By calculating the ratio of total dust to the content of specific compounds in the soil or dust producing media, the measurement of airborne total dust can provide some rough estimates of the airborne concentrations of those particular compounds without having to complete laboratory analysis. However, it still may be necessary to conduct sampling to determine actual exposure or measurements of airborne contaminants based on regulatory, client, and project requirements.

Control of dust at its source is the most appropriate means of controlling the hazard. This may include wetting the source with water or surfactant, covering it, or removing it. Based on site conditions including weather and site activities, the SSHO and the PM will determine the most appropriate control process.

Appropriate PPE is outlined in the PPE section of this HASP.

N.2 Fumes

Fume refers to small particulate or liquid droplets given off by a substance as a result of a chemical transformation such as reaction, heating, explosion, or detonation. The term applies particularly to very fine solid or liquid particles as a suspension in air. Activities that can create fumes include welding, soldering, brazing, and other activities that generally convert a solid material to a vapor stage for a short period of time with condensation taking place to convert the vapor back to a solid, very small particle in a very short period of time. Often fume is made up of a metal like lead, arsenic, cadmium and others. Chemical reactions can result in a fume of hydrochloric acid or other corrosive compound. The hazards associated with fumes are similar to that of dusts; however, the fume is smaller, which means it can get deeper into the lungs, and is generally more concentrated with the material from which it was formed.

The hazard controls for fumes will greatly depend on the makeup of the fume and should be addressed elsewhere in this HASP. There are OSHA PELs and ACGIH TLVs that have been developed for certain types of fumes. For example, copper has a PEL for both dust and fume and they are different reflecting the different points of exposure that can occur from the two.

N.3 Mists

Mists are small, airborne droplets of liquid and could be made up of one or several compounds. Typically, these liquids become airborne through some type of mechanical force that aerosolizes the liquid. These droplets can coagulate forming larger droplets and fall out of the air. However, they can also remain suspended and become an exposure issue via inhalation or dermal contact. The specific hazards will be dependent on the compounds making up the mist. Those hazards are identified in other sections of this HASP.

O. Ergonomic Hazards

O.1 Hazards

- Low back pain.
- Musculoskeletal disorders.
- Repetitive strain injuries.
- Tension neck syndrome.
- Carpal tunnel syndrome.
- White finger.

O.2 Definitions

Carpal Tunnel Syndrome: The compression and entrapment of the median nerve where it passes through the wrist into the hand in the carpal tunnel. The median nerve is the main nerve that extends down the arm to the hand and provides the sense of touch to most of the hand.

Ergonomics: The science of fitting the jobs to the people who work in them, rather than the person to the job.

Occupational Overuse Injuries: A range of conditions such as discomfort, strains, and sprains that affect mainly the back, neck, and limbs and which are related to the working environment or the task performed. Some of these conditions are referred to as Repetitive Strain Injuries (RSI).

Raynaud's Syndrome or White Finger: Blood vessels of the hand may be damaged from repeated exposure to vibration over a long period of time. The skin and muscles do not get the necessary oxygen from the blood and eventually die.

Tendonitis: Tendon inflammation that occurs when a muscle or tendon is repeatedly stressed by overuse or unaccustomed use.

Work-related Musculoskeletal Disorder (WMSD): An injury or illness that includes muscle strains and tears, ligament sprains, joint and tendon inflammation, pinched nerves, and spinal disc degeneration and medical conditions such as rotator cuff syndrome, trigger finger, carpal tunnel syndrome, and hand-arm vibration syndrome (HAVS) that are associated with workplace risk factors.

O.3 Procedures

Recognition

Workplace risk factors include:

- Repetitive, forceful, or prolonged motions.
- Frequent or heavy lifting.
- Pushing, pulling, or carrying heavy objects.
- Fixed or awkward work postures.
- Contact stress.
- Localized or whole body vibration.
- Cold temperatures.
- Poor lighting.
- Noise.

These factors can be intensified by work characteristics such as:

- Inadequate work-rest cycles.
- Excessive work pace or duration.
- Lack of task variability.
- Machine-paced work.
- Improper tool design.

O.4 Control Practices

Workstations

- Make workstations adjustable, enabling both large and small persons to fit comfortably and reach materials readily.
- Locate all materials in front of the worker to reduce twisting motions. Provide enough workspace.
- Avoid static loads and fixed work postures.

- The work surface should be set above elbow height for tasks involving fine visual details and below elbow height for tasks involving downward movement and heavy physical effort.
- Provide adjustable and properly designed chairs.
- Allow employees to alternate between sitting and standing.

Hand and Wrist Tasks

- Reduce the number of repetitive motions per shift.
- Maintain a neutral wrist position.
- Reduce the force or pressure on the wrists and hands.
- Avoid reaching above shoulder height, below waist level, or behind the body to minimize shoulder stress.
- Avoid repetitive work that requires full arm extension.
- Isolate hands from heat, cold, and vibration.

Hand Tool Use

- Maintain straight wrists through the work movement.
- Avoid static muscle loading.
- Reduce grip force requirements.
- Avoid sharp edges and pinch points.
- Avoid repetitive trigger-finger actions.
- Wear gloves that fit.

Lifting and Lowering

- Reduce manual lifting where possible.
- Eliminate the need to lift or lower manually by using appropriate machines.
- Reduce the weight or capacity of the object to be handled.
- Provide grips or handles to enable a load to be held closer to the body.
- Reduce load lifting, carrying, and lowering by using conveyors, hand trucks, and carts.

O.5 Training

Employees should be trained in ergonomically sound work practices:

- General awareness training
- Specific training for employees whose jobs require repetitive motions.
- Task-specific training for repetitive tasks and lifting tasks.

P. 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.

P.1 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

P.2 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 global positioning system (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 sunrise 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.

P.3 Employees Working Late/Early Hours

Whenever possible, employees will not work before sunrise 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.

P.4 No or Limited Cell Phone Service

The PM will assess if any other type of communication such as 2-way radios is appropriate for the area. If not, 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. In addition, if employees are unable to check in on a daily basis because of the project location and 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.

If employees will be moving from area to area within a day or over several days, each time the crew moves, the team will:

- Establish beginning and ending locations;

- Plan start and estimated finish times; and
- Plan routes that will be followed throughout the period.

Employees will not deviate from the schedule or planned route 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 and routes.

P.5 Potentially Dangerous Wildlife

The local park or wildlife service should be contacted to verify what type of potentially dangerous wildlife may be in or around the work site, to provide their recommendations on avoiding contact, and, if contact is made, how to react appropriately. If the chance for contact with potentially dangerous wildlife is high, it may be necessary to work with the park/wildlife service to have a member of their staff on site while work is being performed and/or to have personnel receive additional training on avoiding and reacting to the particular animal(s). Protection from wildlife may require specific protection devices like pepper spray, bear-proof canisters, or other devices as recommended by wildlife experts.

P.6 Guard or Stray Dogs

If the client utilizes guard dogs at the site, the PM or SSO will work with the client each day to ensure that the dogs are unable to gain access to any area in which ARCADIS personnel will or could be working. ARCADIS personnel will also carry pepper spray or a similar product that can be used to protect themselves in case a guard dog does come into the work area.

If stray dogs are known to be in an area in which ARCADIS personnel will be working, the PM or SSO will work with local animal control to have the dogs removed from the area. ARCADIS personnel will carry pepper spray or similar product as recommended by animal control that can be used to protect themselves from a dog that may become aggressive.

Appendix E

Map to Hospital/Emergency Care

MAPQUEST.

Start: **4280 Rifle Range Rd**
Vicksburg, MS 39180-5502, US

End: **Parkview Regional Medical Ctr**: 601-631-2131
100 Mcauley Dr, Vicksburg, MS 39183, US

Notes:

Directions		Distance
Total Est. Time: 8 minutes	**Total Est. Distance:** 6.04 miles	
START	**1:** Start out going NORTH on RIFLE RANGE RD toward GREY OAKS DR.	0.1 miles
	2: Turn RIGHT onto WARRENTON RD.	<0.1 miles
	3: WARRENTON RD becomes OLD US-61 / WASHINGTON ST.	<0.1 miles
EAST 20	**4:** Merge onto I-20 E.	4.3 miles
4B EXIT	**5:** Take the W. CLAY ST exit- EXIT 4B- toward NATIONAL PARK.	0.1 miles
WEST 80	**6:** Merge onto US-80 W / CLAY ST.	1.0 miles
	7: Turn RIGHT onto BALDWIN FERRY RD.	<0.1 miles
	8: Turn LEFT onto GROVE ST.	0.1 miles
END	**9:** End at **Parkview Regional Medical Ctr** 100 Mcauley Dr, Vicksburg, MS 39183, US	
Total Est. Time: 8 minutes	**Total Est. Distance:** 6.04 miles	

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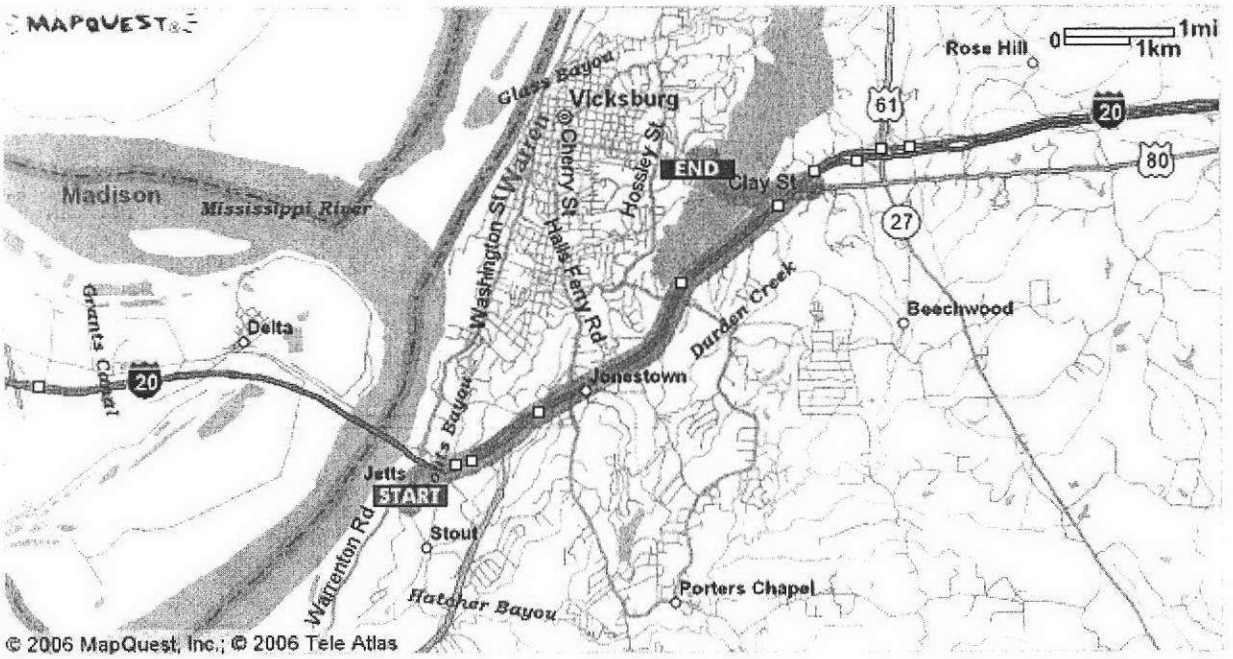
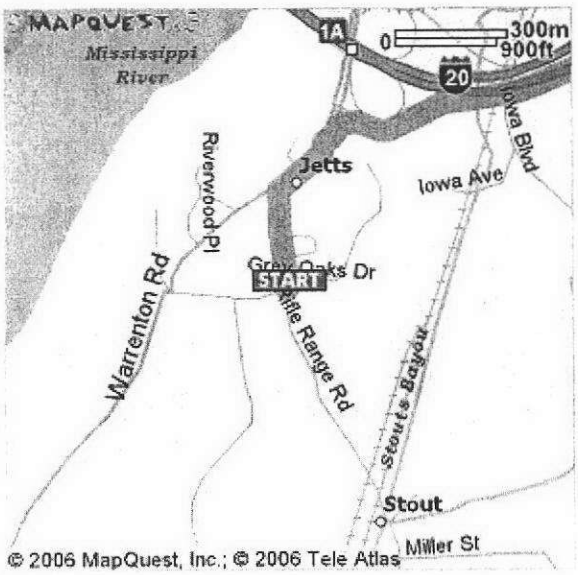
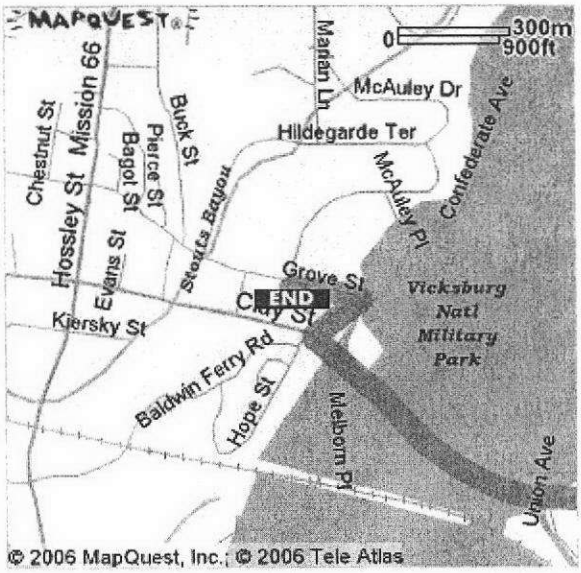


Start:
4280 Rifle Range Rd
Vicksburg, MS 39180-5502, US

End:
Parkview Regional Medical Ctr:
601-631-2131
100 Mcauley Dr, Vicksburg, MS 39183, US





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These directions are informational only. No representation is made or warranty given as to their content, road conditions or route usability or expeditiousness. User assumes all risk of use. MapQuest and its suppliers assume no responsibility for any loss or delay resulting from such use.

WorkCare 1-800-455-6155
(24 hours/day, 7 days/week)

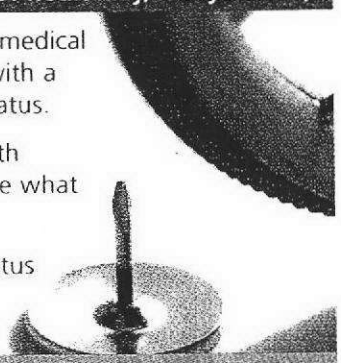
What to do when an injury or illness occurs on-the-job

- If you have experienced a work-related injury or illness, **prior to** seeking medical treatment (beyond first aid), contact your supervisor or office administrator (OA) *and* contact WorkCare.
- Why call WorkCare? WorkCare provides initial medical assistance and advice to ARCADIS employees who have sustained a work-related injury or illness.
- If it is decided that professional medical treatment is warranted, WorkCare will assist you in identifying a clinic.
- If your supervisor or OA is not available, **do not wait**; contact WorkCare before seeking professional medical treatment.

If you require emergency care, seek medical treatment first and then contact your supervisor or OA and WorkCare.

Things to remember ...

WorkCare 1-800-455-6155
(24 hours/day, 7 days/week)



- If you sustain a work-related injury and seek professional medical treatment, you need to provide your OA and supervisor with a medical release from your doctor that notes your work status.
- If the doctor has told you that you can return to work with restrictions, be sure that the doctor outlines on the release what work restrictions you are to follow.
- Keep your OA and supervisor advised as to your work status and upcoming medical appointments.

Questions about incident/near miss reporting? Contact your regional Health & Safety (H&S) manager or the corporate H&S department.

Imagine the result

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infrastructure, environment, facilities

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Appendix F

Visitor Acknowledgement and Acceptance of HASP

Visitor Acknowledgement and Acceptance of HASP

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