

***In Situ* Bioventing Treatability Study
Work Plan for 3700 Fuel Yard
Tinker AFB, Oklahoma
Volume II**



**Department of the Air Force
Oklahoma City Air Logistics Center
Tinker Air Force Base, Oklahoma**

December 1994

***In-Situ* Bioventing Treatability Study
Work Plan for 3700 Fuel Yard
Tinker AFB, Oklahoma**

Volume II
Appendix D: Health and Safety Plan

December 1994

Prepared by

Engineering-Science, Inc.
8000 Centre Park Drive, Suite 200
Austin, Texas

Reviewed and approved by

Project manager


Name

12/21/94
Date

ES office health
and safety officer


Name

12/21/94
Date

CONTENTS

	<u>Page</u>
D1.0 Introduction.....	1
D1.1 Purpose and Policy.....	1
D1.2 Site Description, History, and Site Specific Activities.....	1
D1.2.1 Site Location and History.....	1
D1.2.2 Site Specific Activities.....	2
D1.3 Project Team Organization.....	2
D2.0 Safety and Health Risk Analysis.....	6
D2.1 Chemical Hazards.....	6
D2.2 Physical Hazards.....	6
D2.2.1 Motor Vehicles and Heavy Equipment.....	6
D2.2.2 Slip, Trip, and Fall Hazards.....	9
D2.2.3 Drilling Accidents.....	9
D2.2.4 Subsurface Hazards.....	10
D2.2.5 Electrical Line Clearance and Thunderstorms.....	10
D2.2.6 Noise-Induced Hearing Loss.....	10
D2.2.7 Explosion.....	10
D2.2.8 Compressed Gas Safety.....	11
D2.2.9 Storing Cylinders.....	13
D2.2.10 Heat Stress Monitoring.....	14
D2.2.11 Cold-Related Illness.....	17
D2.2.12 Noise.....	21
D2.2.13 Snake and Africanized Bee Hazards.....	21
D2.2.14 Construction Hazards.....	21
D2.3 Electrical Safety.....	21
D2.3.1 General Electrical Safety Rules.....	22
D2.3.2 Holding and Locking Out Electrical Circuits.....	23
D2.4 Fire Safety.....	23
D3.0 Personnel Protection and Monitoring.....	25
D3.1 Medical Surveillance.....	25
D3.2 Site-specific Training.....	25
D3.3 Personal Protective Equipment and Action Levels.....	26
D3.3.1 Level D Operations.....	26
D3.3.2 PPE and Equipment Decontamination Procedures.....	26

D3.3.3 Equipment Needs	27
D3.4 Monitoring Requirements and Instrument Limitations	27
D4.0 Site Control Measures, Accident Prevention, and Contingency Plan	29
D4.1 Site Control Measures	29
D4.2 Site Organization-Operation Zone	29
D4.2.1 Exclusion Zone.....	29
D4.2.2 Support Zone	29
D4.3 Site Security	29
D4.4 Site Communication.....	30
D4.5 Safe Work Practices	30
D4.6 Accident Prevention.....	31
D4.7 Contingency Plan	31
D4.7.1 Emergency Procedures.....	31
D4.7.2 Chemical Exposure	32
D4.7.3 Personal Injury	32
D4.7.4 Evacuation Procedures	33
D4.7.5 Procedures Implemented in the Event of a Major Fire, Explosion, or Onsite Health Emergency Crisis	33
D4.7.6 Procedures Requesting Emergency Care	33

ATTACHMENTS

Exhibit A: Plan Acceptance Form, Accident Report Form, Job Safety and Health Protection Notice

Exhibit B: Material Safety Data Sheets

FIGURES

	<u>Page</u>
D.1 Heat Exhaustion/Heat Cramps.....	18
D.2 Heatstroke	19

TABLES

	<u>Page</u>
D.1 Onsite Personnel	4
D.2 Health and Physical Hazard and Recognition Qualities of Site Contaminants	8
D.3 Storage Locations for Hydrogen Systems	16
D.4 Wind Chill Factors.....	20

EMERGENCY CONTACTS AND AIR MONITORING ACTION LEVELS

EMERGENCY CONTACTS

In the event of any situation or unplanned occurrence requiring assistance, the appropriate contact(s) will be made from the list below. This emergency contacts list must be kept at hand by field members and will be provided to all pilot test field personnel during the weekly site-specific safety briefings.

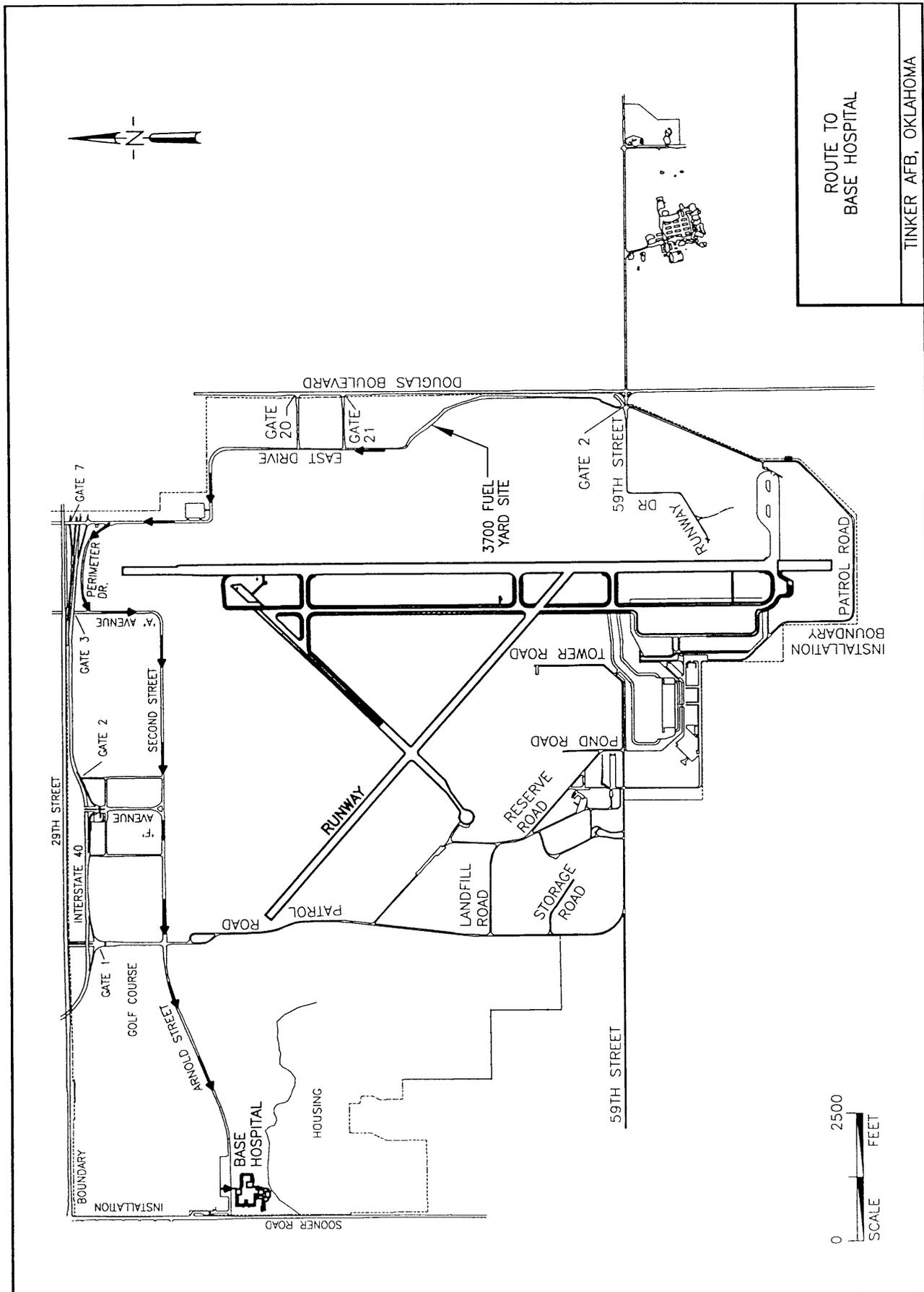
Contact	Phone Number
Mr. Jerry Forste, OC-AFLC/EMR	405/734-3058
Fire Department	405/734-7964
Ambulance	117 (on base)

Medical Emergency

Hospital	Base Hospital
Phone number	405/734-8223
Ambulance service (0730-1600 hrs.)	117 (on base)

Map to hospital is on next page.

Route to hospital: See map on next page identifying hospital location. From the site, go north on Celis Road, turn north (right) onto East Drive, turn west (left) on Perimeter Drive before gate 7. Turn left on "A" Avenue and continue straight on Second and Arnold streets to base hospital on the south (left) before Sooner Road.



AIR MONITORING

The air monitoring action levels listed below define the appropriate response to situations in which these levels are detected.

Action Level (Concentration)	Method of Detection	Action
*>1 ppm	OVA	Check benzene concentration with Sensidyne, or Drager, tubes. If <1 ppm, continue work. If >1 ppm, stop work and call project manager.
*>5-10 ppm	OVA	If benzene is less than 1 ppm, locate personnel upwind of drilling operation. If benzene is greater than 1 ppm, full face respirators will be used.
*>10 ppm	OVA	Stop work.

* Exposure limits based on 1993-1994 TLV for Chemical Substances and Physical Agents, 1993, ACGIH.

Parsons Engineering Science Contacts

Contact	Phone Number
Parsons ES project manager: Brian Vanderglas, Austin, Texas	Work: 512/719-6000 Home: 512/443-9020
Parsons ES site safety officer: Curt Burdorf, Austin, Texas	Work: 512/719-6000 Home: 512/454-8983
Parsons ES technical director: Doug Downy, Denver, Colorado	Work: 303/831-8100 Home: 303/670-0512
Parsons ES office health and safety representative: Randy M. Palachek, Austin, Texas	512/719-6000
Parsons ES corporate health and safety manager: Ed Grunwald, Atlanta, Georgia	404/325-0770

SECTION D1.0 INTRODUCTION

D1.1 PURPOSE AND POLICY

The purpose of this safety plan is to establish personnel protection standards and mandatory safety practices and procedures for all work conducted in association with the bioventing treatability study at Tinker Air Force Base in Oklahoma City, Oklahoma. The plan assigns responsibilities, establishes standard operating procedures, and provides for contingencies that may arise during performance of work tasks at the project site.

The provisions of the plan are mandatory for all onsite Parsons Engineering Science (Parsons ES) field personnel. All Parsons ES personnel will abide by this plan as indicated by their signatures on the plan acceptance form (exhibit A). Any supplemental plans used by subcontractors must at least conform to this plan. All personnel who engage in project activities must be familiar with this plan and comply with its requirements. Accidents specifically related to this project will be reported using the form in Attachment A. In addition, the U.S. Department of Labor Occupational Safety and Health Administration (OSHA) "Job Safety and Health Notice" is presented in Attachment A and must be present and posted on site.

D1.2 SITE DESCRIPTION, HISTORY, AND SITE SPECIFIC ACTIVITIES

D1.2.1 Site Location and History

POL Storage Area C, also referred to as the 3700 Fuel Yard, is located midway along the eastern boundary of the base, between Warehouse Road and Douglas Boulevard. The area of concern within this former jet fuel bulk storage area is located approximately 60 to 200 feet east of Building 3703.

Six underground storage tanks (USTs), each with a capacity of 25,000 gallons, were previously located in POL Storage Area C. After serving in excess of 30 years as a fuel storage depot, the tanks were removed in 1991 along with approximately 1,500 cubic feet of fuel-contaminated backfill material. The excavated area has since been backfilled with clean sand, and the surface has been restored. Surface transportation and storage facilities have replaced the previous underground system. JP-4 jet fuel is now delivered by tanker truck to the site, where it is off-loaded into two aboveground storage tanks located at the southern boundary of the fuel yard.

The USTs, formerly located upgradient of the presently identified contamination, had contained JP-4 jet fuel exclusively in recent years. Petroleum hydrocarbon contamination

presumed to have leaked from these tanks or their pipelines is the target for bioventing treatment at this site.

The primary contaminants at this site are petroleum hydrocarbons, which have been detected in the soils and ground water at depths ranging from 5 to 35 feet bgs. Total recoverable petroleum hydrocarbon (TRPH) concentrations of 1,070 milligrams per kilogram (mg/kg) have been detected in the soils at a depth of 5 to 6 feet. Concentrations of the volatile organic compound benzene were detected at 120 µg/kg in the soils from the boring for well MW-5.

D1.2.2 Site Specific Activities

The purpose of this project is to install and operate a full-scale bioventing system at the 3700 Fuel Yard site. The following construction activities will be performed for the installation of the bioventing system:

- drilling and construction of five air injection vent wells (VW),
- drilling and construction of fifteen vapor monitoring points (MP),
- trenching and installation of approximately 350' of 2" piping at 1.5' below ground level,
- installation of a small shed to house the blower system,
- installation of the blower system,
- testing of system operability.

Field activities for installation are planned to begin in December 1994 and shall be completed in January 1995.

Upon completion of construction, the bioventing system will be used to perform in-situ respiration tests to monitor the long-term performance in remediating TPH contamination. The system is expected to be in operation up to several years with Parsons ES personnel performing tests at least every 4 months during operation.

Weekly system checks will also be performed by Parsons ES personnel for up to one year of operation. Detailed blower system information and a maintenance schedule will be included in the operation and maintenance (O&M) manual provided to the base.

D1.3 PROJECT TEAM ORGANIZATION

Table D.1 describes the responsibilities of all personnel associated with this project. The names of principal onsite personnel associated with this project are listed below.

Project manager:	Brian Vanderglas
Field team leader:	Curt Burdorf
Site safety officer:	Curt Burdorf (or designee)
Field team:	Not Yet Determined

Table D.1. Onsite Personnel

Title	General Description	Responsibilities
Project Manager	<p>Reports to upper-level management.</p> <p>Has authority to direct response operations.</p> <p>Assumes total control over site activities</p>	<p>Prepares and organizes the background review of the situation, the work plan, the site safety plan, and the field team.</p> <p>Obtains permission for site access and coordinates activities with appropriate officials.</p> <p>Ensures that the work plan is completed and on schedule.</p> <p>Briefs the field teams on their specific assignments.</p> <p>Uses the site safety and health officer to ensure that safety and health requirements are met.</p> <p>Prepares the final report and support files on the response activities.</p> <p>Serves as liaison with public officials.</p>
Site Safety Officer	<p>Advises the project manager on all aspects of health and safety on site.</p> <p>Stops work of any operation threatens worker or public health or safety.</p>	<p>Periodically inspects protective clothing and equipment.</p> <p>Ensures that protective clothing and equipment are properly stored and maintained.</p> <p>Controls entry and exit at the access control points.</p> <p>Coordinates safety and health program activities with project safety officer.</p> <p>Confirms each team member's suitability for work based on a physician's recommendation.</p> <p>Monitors the work parties for signs of stress, such as cold exposure, heat stress, and fatigue.</p> <p>Implements the site safety plan.</p> <p>Conducts periodic inspections to determine if the site safety plan is being followed.</p> <p>Knows emergency procedures, evacuation routes, and the telephone numbers of the ambulance, local hospital, poison control center, fire department, and police department.</p> <p>Notifies, when necessary, Tinker AFB emergency officials.</p> <p>Coordinates emergency medical care.</p>

Table D.1. Onsite Personnel (continued)

Title	General Description	Responsibilities
Site Safety Officer, (cont.)		<p>Sets up decontamination lines and the decontamination solution appropriate for the potential type of chemical contamination on site.</p> <p>Controls the decontamination of all equipment, personnel, and samples from the contaminated areas.</p> <p>Assures proper disposal of contaminated clothing and materials.</p> <p>Ensures that all required equipment is available.</p> <p>Advises medical personnel of potential exposures and consequences.</p> <p>Notifies emergency response personnel by telephone or radio in the event of an emergency.</p>
Field Team Leader	Responsible for field team operations and safety.	<p>Manages field operations.</p> <p>Executes the work plan and schedule.</p> <p>Enforces safety procedures.</p> <p>Coordinates with the site safety officer in determining protection level.</p> <p>Enforces site control.</p> <p>Documents field activities and sample collection.</p>
Field Team	Perform field tasks.	<p>Serves as liaison with public officials.</p> <p>Safely complete the onsite tasks required to fulfill the work plan.</p> <p>Notify project health and safety officer or supervisor of suspected unsafe conditions.</p> <p>Take precautions necessary to prevent injury to themselves and other employees.</p> <p>Comply with project health and safety plans.</p> <p>Maintain visual contact between partners (buddy system).</p> <p>Perform only those tasks they believe they can do safely.</p> <p>Immediately report any accidents and/or unsafe conditions, or any deviations from this plan to the field team leader.</p>

SECTION D2.0 SAFETY AND HEALTH RISK ANALYSIS

D2.1 CHEMICAL HAZARDS

The chemicals of primary concern occurring at this site are those originating from jet fuel. Chemicals known or suspected to occur at this site include hydrocarbon fuel components benzene, toluene, ethyl benzene, and xylenes, and total petroleum hydrocarbons. The properties of jet fuel and several of its volatile constituents are summarized in Table D.2. If additional compounds are discovered the site, the health and safety plan shall be amended and pertinent information about the compounds will be provided in site-specific health and safety plan addenda.

The primary routes of exposure for these chemicals are inhalation, skin absorption, and eye contact. The symptoms of exposure can range from irritation of the eyes, nose, and respiratory system, nausea, flushed face, vertigo, dizziness, and headache. Table D.2 also lists some properties of the compounds at the site to be investigated. The table also lists threshold limit values for the chemicals which may be encountered.

The threshold limit value/time-weighted average (TLV-TWA) value represents the time-weighted average concentration for a normal 8-hour workday and a 40-hour work week to which nearly all workers may be repeatedly exposed, day after day, without adverse effect.

D2.2 PHYSICAL HAZARDS

The scope of work for this study involves working outdoors around vehicles and heavy equipment during a portion of the project. Any project involving heavy equipment, unimproved work sites, and outside work can present numerous physical hazards to the work force. Training, adherence to work rules, and careful housekeeping can prevent many problems or accidents arising from physical hazards. The general rules and preventative measures for this work follows. These are spelled out by phase in the site specific addenda.

D2.2.1 Motor Vehicles and Heavy Equipment

Working with large motor vehicles and heavy equipment could be a major hazard at these sites. Injuries can result from equipment hitting or running over personnel and impacts from flying objects or overturning of vehicles. Vehicles and heavy equipment design and operation will be in accordance with 29 CFR, Subpart 0, 1926.600 through

TABLE D.2
HEALTH AND PHYSICAL HAZARD AND RECOGNITION QUALITIES OF SITE CONTAMINANTS^a

Contaminant	PEL ^b (ppm)	TLV ^c (ppm)	IDLH ^d (ppm)	Warning		Fire Hazard	Explosion Hazard	Comments
				Conc. ^e (ppm)	IP ^f (eV)			
Benzene ^{g,h}	1	10	3,000	4.68	9.24	Dangerous	Moderate	Eye and nose irritant. Chronic exposure has been linked to leukemia.
Ethylbenzene ^g	100	100	2,000	0.2-200	8.76	Dangerous	Moderate	Eye and mucous membrane irritant. Can cause headache, narcosis, and coma following exposure to high concentrations.
Gasoline ⁱ	300	300	--	<.01-10	--	Dangerous	Moderate	Avoid skin and eye contact.
Jet Fuel ^j	400	300	10,000	0.08	--	Dangerous	Moderate	No exposure limits set. Long-term effects include liver, kidney, and CNS damage.
Toluene ^g	100	100	2,000	0.2-4.0	8.8	Dangerous	Moderate	Fatigue, weakness, confusion, and headache.
Xylene ^g	100	50	2,000	0.2-40	8.82	Moderate	Moderate	Dizziness, drowsiness, irritant and may cause vomiting and abdominal pains.
Isopropyl alcohol ^k	NA	400	12,000	NA	NA	Moderate	Moderate	Mild irritant to eyes, nose, dry cracking skin.

^a Information summarized from Sax, 1979, *Dangerous Properties of Industrial Materials*, Fifth Edition; OSHA regulations contained in *29 CFR 1910.1000*; EPA, 1983. *Response Safety Decision-Making Workshop* manual; American Conference of Governmental Industrial Hygienists (ACGIH). 1991-92 *Threshold Limit Values*; and National Institute for Occupational Safety and Health (NIOSH) OSHA 1990. *Pocket Guide to Chemical Hazards*.

^b PEL: Permissible Exposure Limit expressed as parts per million (ppm) unless otherwise indicated. OSHA limit as found in *29 CFR 1910.1000*.

^c TLV: Threshold Limit Value expressed as ppm unless otherwise indicated. From ACGIH 1993-1994.

^d IDLH: Immediately dangerous to life or health. Expressed as ppm unless otherwise indicated.

^e Warning concentration is the odor threshold of the substance. Different sources listed different warning concentrations. When a range is given, use the highest concentration.

^f IP - Ionization potential expressed in electron volts (eV).

^g Volatile components of gasoline and jet fuel.

^h Potential human carcinogen.

ⁱ Note: Primary constituent of concern in gasoline is Benzene. The OSHA PEL for Benzene is 1 ppm.

^j Based on petroleum distillates (naphtha).

^k Decontamination solvent.

1926.602 in addition to any other state, federal, local or Air Force regulations. In particular, the following precautions will be used to help prevent injuries and accidents:

- Brakes, hydraulic lines, light signals, fire extinguishers, fluid levels, steering, tires, horn, and other safety devices will be checked periodically and at least at the beginning of each week.
- Do not back up large construction motor vehicles unless the vehicle has a reverse signal alarm audible above the surrounding noise level, backup warning lights, or when an observer signals it is safe to do so.
- Heavy equipment or motor vehicle cabs will be kept free of all nonessential items and all loose items will be secured.
- Construction and heavy equipment will be provided with necessary safety equipment including seat belts, roll over protection, emergency shutoff during roll over, backup warning lights, and audible alarms.
- Blades and buckets will be lowered to the ground and parking brakes will be set before shutting off any heavy equipment or vehicle.

D2.2.2 Slip, Trip, and Fall Hazards

The sites could contain a number of slip, trip and fall hazards for site workers, such as:

- Holes, pits, or ditches;
- Slippery surfaces;
- Steep grades;
- Uneven grades; and
- Sharp objects.

Site personnel will be instructed to look for potential safety hazards and immediately inform the site health and safety officer or the task manager about any hazards. If the hazard cannot be immediately removed, actions must be taken to warn site workers about the hazard.

D2.2.3 Drilling Accidents

Hazards associated with drilling activities may occur from suspended loads dropping on employees, being caught behind a load and a stationary object, or being struck by counterweights. Accidents of this type are most likely to occur during drilling operations and can be prevented by the safe operation of drilling equipment, wearing protective equipment including a hard hat and safety boots, and the routine inspection of drilling equipment to identify unsafe conditions (e.g., frayed ropes).

D2.2.4 Subsurface Hazards

Before any drilling or soil gas activity begins, efforts must be made to determine whether underground installations, (e.g., sewers, telephone, water, fuel, and electric lines) will be encountered and, if so, where such underground installations are located. Utility companies or the base engineer will be contacted by the field team leader prior to commencing drilling or soil gas operations and the necessary clearances obtained using Air Force Form 103.

D2.2.5 Electrical Line Clearance and Thunderstorms

Extra precautions will be exercised when drilling near overhead electrical lines. The minimum clearance between overhead electrical lines of 50 kilovolts (kV) or less and the drill rig is 10 feet. For lines rated over 50 kV, the minimum clearance between the lines and any part of the rig is 10 feet plus 0.4 inches for each kV over 50 kV. Drilling operations must cease during thunderstorms.

The Site Health and Safety Officer (SHSO) will provide onsite surveillance of the drilling subcontractor to ensure that personnel meet these requirements. If deficiencies are noted, work will be stopped and corrective actions implemented. Reports of health and safety deficiencies and the corrective actions taken will be forwarded to the installation manager by the SHSO.

D2.2.6 Noise-Induced Hearing Loss

Work onsite may involve the use of heavy equipment such as a drill rig, compressor, generator, and excavation equipment. The unprotected exposure of site workers to this noise or to aircraft noise during activities near runways or aircraft can result in noise induced hearing loss. The SHSO will ensure that either ear muffs or disposable foam earplugs are made available to, and used by, all personnel in the vicinity of the operation of heavy equipment, aircraft noise or other sources of high intensity noise.

D2.2.7 Explosion

Some of the compounds can form explosive mixtures in air. Smoking will not be allowed on site except in areas designated by Tinker AFB.

The lower explosive limit is the lowest concentration of a gas or vapor in air by volume that will explode when there is an ignition source. In accordance with guidelines established by the National Institute for Occupational Safety and Health (NIOSH), work actions will be limited to those that do not generate sparks should air monitoring detect LELs above 10 percent. If the LEL readings are 20 percent or above, all work actions in the area will cease to allow vapors to dissipate. Monitoring will continue during the cessation of work actions. If the LEL readings do not drop below 20 percent, work will be discontinued and the project scope reevaluated.

D2.2.8 Compressed Gas Safety

Cylinders of helium and hydrogen may be required on the system. It is not expected that Parsons ES personnel will be required to transport gas cylinders. However, in the event gas cylinders are required on-site, the following precautions shall apply.

Definition of Compressed Gas

The U.S. Department of Transportation (DOT) regulates the transportation of compressed gases and, by extension, much of the compressed gas industry. DOT defines a compressed gas as "... any material or mixture having in a container an absolute pressure exceeding 40 psia at 70°F or, regardless of the pressure at 70°F, having a pressure exceeding 104 psia at 130°F" In other words, a compressed gas is either a gas under at least 40 psi of absolute pressure at room temperature or a substance that exerts an appreciable pressure at elevated temperatures.

Cylinder and Valve Outlet Caps

The cylinder cap is an essential piece of safety equipment. It must be in place and screwed securely every time the cylinder is moved (even if for a short distance). The cap protects the valve from damage should the cylinder fall. The cap should remain in place until the user is ready to withdraw the cylinder's content.

Where valve outlet caps and/or plugs are provided by the manufacturer, the user shall keep the plugs or caps on the valve outlet at all times except when the container is secured and connected to dispensing equipment. Gas tight outlet caps and plugs serve the purpose of preventing the release of any residual product and are required for toxic and corrosive containers. All containers returned to the supplier shall have a cylinder cap and valve outlet or plugs (if required) secured prior to shipment.

Pressure Regulator

The pressure regulator is the attachment used to withdraw cylinder contents. Regulators are designed to reduce the pressure of the exiting gas to the level that is needed for the specific application. Attach the regulator to the valve outlet without forcing the threads. Ensure that the threads on regulator connections or auxiliary equipment match those of the cylinder valve outlet. For example, only pressure regulating devices approved for use with oxygen shall be used in oxygen service. Choosing a regulator depends upon the delivery pressure range and the accuracy of the pressure and flow rate desired.

Safe Handling and Use of Compressed Gases

Proper handling of the cylinder is important from the moment the cylinder arrives at the site or laboratory until it leaves. There are procedures that must be followed for each step of the cylinder stay on the premises (i.e., receiving, transporting, storing, placing into use, and returning to supplier). Each step will be examined in detail below.

Receiving Cylinders

Every cylinder must be inspected upon receipt. Verify that cylinder is identified as prescribed by DOT and OSHA.

Transporting Cylinders

When moving cylinders caution should be used to guard against dropping or permitting the cylinders to violently strike against each other or other surfaces. A suitable cylinder cart or similar material handling device should be used with container properly secured (e.g., chained, strapped, etc.). Personnel who handle the cylinders shall be instructed never to lift cylinders by their valve cap. Never use ropes, chains, or slings to suspend containers.

Transporting Cylinders to Field - The Compressed Gas Association (CGA) discourages the transportation of compressed gas cylinders in automobiles or in closed body vehicles. Leaks can develop from improper securing of cylinders, inadequate valve protection, or extended confinement in an enclosed compartment where the cylinder can be subjected to excessive heating by the sun in a trunk or passenger compartment. Leaking flammable gases will present a serious explosion hazard whereas a leaking inert gas can result in asphyxiation. Whenever possible, compressed gases required for field investigations (i.e., calibration gas, hydrogen for ID instruments, self contained breathing apparatus (SCBA) air cylinders, etc.) should either be shipped to or purchased at the site. Occasionally it is impractical or impossible to ship or purchase compressed gases in the field, then under these conditions motor vehicle transport may be used. Parsons ES personnel asked to transport compressed gas cylinders must comply with DOT regulations as specified in 49 CAE Part 177. Vehicles must be equipped with brackets or racks to prevent the overturning of cylinders during transport (refer to 49 CFR Part 177.840 [a][1]). Cylinder and valve outlet caps must be secured to containers before transport can proceed. Additionally, vehicles used to transport cylinders must have a bulkhead between cargo and passenger compartments.

Hazardous materials which are incompatible must not be loaded or transported together (refer to segregation and separation chart 49 CFR Part 177.848); thus the transport of flammable and oxidizing liquids or gases in the same vehicle (i.e., mobile laboratory) is prohibited. Only open bodied vehicles equipped with suitable racks or supports to hold cylinders upright may be used to transport hydrogen gas.

Drivers transporting compressed gas cylinders or other hazardous materials must have in their possession shipping papers that meet the requirements of 49 CFR Part 172, Subpart C. Shipping papers must as a minimum contain the following information:

- The proper shipping name prescribed for the material in 49 CFR Parts 172.101 or 172.102.
- The hazard class prescribed for the material in 49 CFR parts 172.101 or 172.102.
- The identification number (preceded by "UN" or "NA").

- Total quantity by weight or volume of the hazardous material (refer to 49 CFR Part 172.202 for exemptions).

Placards must be affixed on the sides and ends of transport vehicles when the gross weight of all hazardous materials (i.e., compressed gas, flammable liquids, corrosives, etc.) being transported exceeds 1000 lbs.

D2.2.9 Storing Cylinders

General Requirements for Indoor Storage

Storage areas shall be designed to accommodate the various gases to be used. Adequate spacing or segregation by partitioning in accordance with applicable codes shall be provided so that containers can be grouped by hazard class. Flammable gases should never be stored adjacent to oxidizers. Store full and empty cylinders separately. Cylinder storage shall be in dry, well-ventilated areas, preferably of fire resistive construction. Storage area temperatures shall not exceed 125°F. The storage of compressed gas cylinders in garages, equipment warehouses, or other location where vans or cars may strike them is prohibited.

General Requirements for Outdoor Storage

Compressed gas cylinders should be stored outdoors during site operations. Preferably, cylinders should be stored on paved surfaces, such as asphalt or concrete which has been graded to prevent the accumulation of water. Cylinder cabinets or cages are often used for protection against vandals and to shield pressure regulators from rain. Always locate the storage area where bottom corrosion to the cylinder can be avoided. Cylinders may be stored in the sun except in locations where extreme temperatures prevail (below -10°F or above 125°F). If the gas manufacturer specifies storage in the shade, such recommendations shall be observed. If a cylinder becomes covered with ice, do not heat to thaw it; allow the cylinder to thaw at room temperature or use warm water (below 125°F) making sure there are no leaks in the delivery system before applying the water.

Containers stored (either inside or outside) shall not obstruct exit routes or other areas normally used or intended for the safe exit of people.

Cylinder Position in Storage

All compressed gas cylinders whether empty or full in service or storage shall be secured to prevent falling. Chaining cylinders to walls or bench brackets are common methods used to secure cylinders. Cylinder cabinets may also be used to prevent cylinders from overturning.

Signs

Container storage areas shall be prominently posted with the hazard class or the name of the gases to be stored. "No Smoking" signs shall be posted where appropriate.

Handling and Storage of Flammable Gases

Flammable gases are frequently used both in laboratory and field operation. Compressed gas cylinders of hydrogen and acetylene are required for the operation of flame ionization detectors and atomic absorption spectrophotometers respectively in the laboratory. Field operations often use hydrogen to recharge organic vapor analyzers used for detecting volatile organic compounds. The CGA has developed general requirements for the handling and storage of flammable compressed gasses. OSHA provides specific regulations for the storage of flammable compressed gasses. OSHA provides specific regulations for the storage and use of hydrogen. CGA recommendations should be followed by Parsons ES personnel when handling flammable gases not covered by OSHA.

The Compressed Gas Association in their publication "Safe Handling of Compressed Gas in Containers" provides general recommendations for the storage of flammable gases. CGA states that flammable gases shall not be used near open flames, sources of heat, adjacent to oxidizers and non-explosion proof electrical systems or near underground electrical equipment. Transportation and use should be in open bodied vehicles and well ventilated areas. Electrical equipment used in areas where flammable gases are stored shall comply with applicable electrical codes. Spark proof tools (i.e., bronze) should be used when working with or on flammable compressed gas cylinders or systems.

Portable fire extinguishers (of carbon dioxide or dry chemical) shall be available for fire emergencies at storage installations. No smoking signs (note: signs outside a hydrogen storage area must read "Hydrogen - Flammable Gas - No Smoking - No Open Flames") shall be posted around the storage area of the building or at all entrances(s) to special storage rooms. Never use a flame for detection of flammable gas leaks; use leak detection instruments or compatible leak detection solutions.

OSHA has promulgated specific requirements for the storage of hydrogen systems with a total content greater than 400 cubic feet (refer to 29 CFR Part 1910.103). OSHA specifies the location of a hydrogen system based upon the maximum total contained volume of hydrogen. Order of location preference is indicated by the roman numerals in Table D.3 (i.e., I represents 1st preference). Hydrogen systems used by Parsons ES may be located outdoors, in a separate building, in a special room, or inside building where they are exposed to occupants.

D2.2.10 Heat Stress Monitoring

Field work is expected to be performed during variable weather. The physical activities required for sampling and field operations are light to moderate. Drinking water will be available on site, and workers should be encouraged to drink frequently to prevent dehydration. Workers will be monitored for signs of heat stress when exposed to the heat for extended periods of time. Monitoring will be conducted at the SHSO discretion or worker's request. Monitoring will also be conducted when a worker's

Table D.3. Storage Locations for Hydrogen Systems

Nature of Location	Size of Hydrogen System		
	Less than 3,000 Cu. Ft.	3,000 Cu. Ft. to 15,000 Cu. Ft.	In Excess of 15,000 Cu. Ft.
Outdoors	I	I	I
In a separate building	II	II	II
In a special room	III	III	Not permitted
Inside buildings, not in a special room and exposed to other occupancies	IV	Not permitted	Not permitted

Reference: Title 29 Code of Federal Regulations, Part 1910.103

performance or mental status changes. The signs of heat stress/stroke are depicted in Figures D.1 and D.2, as well as emergency medical procedures for treating heat exhaustion and heat stroke. The heat injury monitoring plan may involve measurement of worker heart rate and observation of the field team for signs and symptoms of heat injury.

Heart rate (HR) will be measured by the radial pulse for 30 seconds as early as possible during the resting period. The HR at the beginning of the rest period should not exceed 100 beats per minute. If the HR exceeds 100 beats per minute, the next work period will be shortened by one third while the length of the rest period remains the same.

D2.2.11 Cold-Related Illness

Some of the work maybe performed in cold weather, even though the Oklahoma winter is mild. Workers should be aware of symptoms of cold-related illness and take preventive measures. Prevention of cold-related illness depends on adequate nutrition, hot meals and warm fluids, proper clothing, and maintenance of general body temperature. A wind chill chart is provided in Table D.4. Each worker should wear layers of warm (not bulky) clothing and should have a dry change of clothes on site, if exposure to wet conditions is likely. Some of the symptoms of hypothermia, a cold-related illness, are poor motor skills and poor judgment, making this affliction especially hazardous when working around heavy machinery.

Monitoring for Cold-Related Illness

Body temperature recording at the job site can be used to monitor for cold illness. This should be done as follows:

- At the supervisor's discretion based on changes in worker's performance or mental status,
- At the worker's request,
- As a screening measure, two times per shift, when hazardous conditions exist, wind chill below 20°F, or wind chill below 30°F with precipitation, or
- As a screening measure whenever any one worker on the site develops hypothermia.

Any person developing a core body temperature of less than 96°F should seek warm shelter and not return to work until the body temperature has returned to normal.

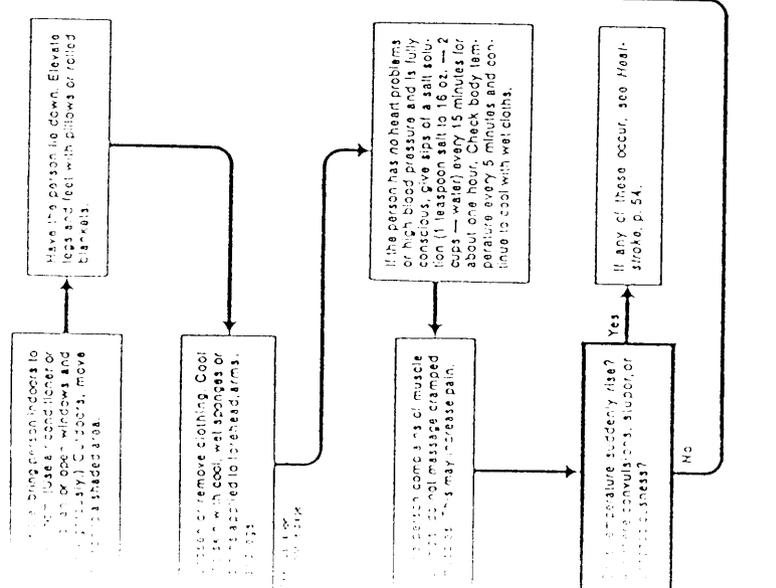
Treatment of Cold-Related Illness

- Get the victim medical attention as soon as possible.
- Provide shelter from wind and administer warm drinks.
- Cover frozen areas with additional clothing or blankets.
- Do not rub or use direct heat on frostbitten area(s).

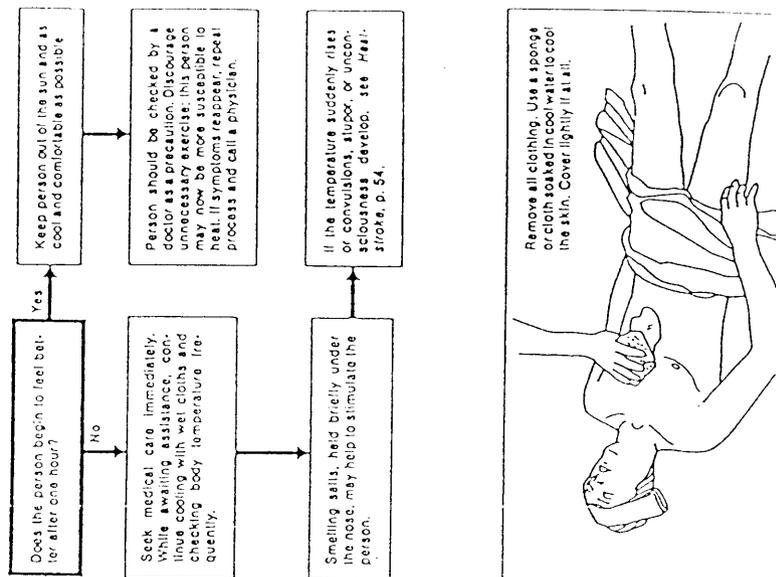
Heat Exhaustion/ Heat Cramps

Signs & Symptoms: cool, pale, clammy skin; dizziness and lightheadedness; heavy sweating; weak pulse/normal-normal body temperature/nausea. **Causes:** dehydration.

If person is unconscious, see *Heartstroke*, p. 54.



Calm the person by talking while attending to the problem. Explain what you are doing. Try not to show anxiety; act with confidence. Your calm behavior can help to reassure the sick person.



Reproduced from *Emergency Medical Procedures for the Home, Auto & Workplace*, revised edition, by The Dallas Institute - New York: Prentice-Hall Press, 1987.

FIGURE D.1
**HEAT EXHAUSTION/
 HEAT CRAMPS**
 TINKER AFB, OKLAHOMA
 ENGINEERING—SCIENCE, INC.
 AUSTIN, TEXAS



Heatstroke

Signs & Symptoms: red, hot, dry skin/no perspiration/body temperature around 106°F for very warm to the touch/strong rapid pulse/supraventricular tachycardia

If there are two or more rescuers, one should obtain emergency assistance while the other follows the procedures outlined below.

1. Move the person indoors to a cool room. Use air conditioner or fans. (If no air conditioner or fans, previously 1). Get into a shaded area.

2. Remove all clothing. Use a sponge or cloth soaked in cool water to cool the skin.

3. Do not give anything by mouth. If there are breathing problems, if any steps - see Artificial Respiration, p. 4.

4. Check temperature every 5-10 minutes. When it reaches 100-102°F, stop active cooling or limit it. If you have no thermometer, continue cooling process until person feels cool.

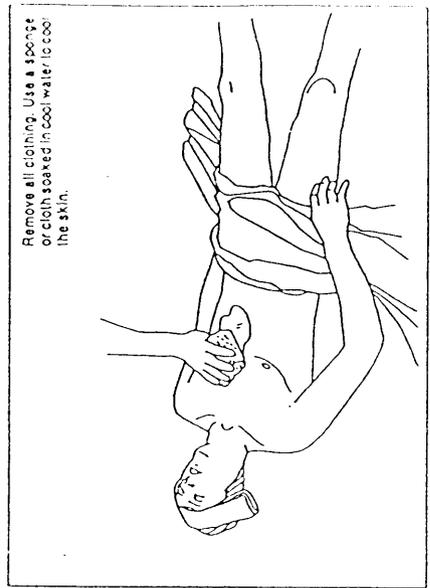
Do convulsions occur?

No
Remove objects that may cause injury and place pillows or rolled blankets around head to prevent injury. Do not try to hold person down. Do not place anything between teeth.

Is there a history of heart problems?

Yes
Have the person sit or lie in a comfortable position with a pillow behind head and shoulders.

Calm the person by talking while attending to the problem. Explain what you are doing. Try not to show anxiety; act with confidence. Your calm behavior can help to reassure the sick person.



While awaiting assistance, keep person as cool and comfortable as possible and continue to watch for breathing problems. Check temperature frequently.

If temperature begins to rise again, repeat the cooling process.

Have the person lie flat. Do not cover unless chilled. Then cover lightly.

If emergency assistance has not been summoned, obtain help now.

Reproduced from *Emergency Medical Procedures for the Home, Auto & Workplace*, revised edition, by The Deltekron Institute, New York: Prentice-Hall Press, 1987.

FIGURE D.2
HEATSTROKE
TINKER AFB, OKLAHOMA
ENGINEERING—SCIENCE, INC.
Austin, Texas



- Encourage gradual, gentle movement, but do not allow the person to walk if the feet are frozen.
- Do not put frostbitten areas under warm or hot water.

D2.2.12 Noise

The field team may be exposed to excessive noise levels during drilling operations. Hearing protection will be available, and all workers within the exclusion zone around drilling operations will be required to use it.

D2.2.13 Snake and Africanized Bee Hazards

Snakes and Africanized bees may be encountered at the site. Workers should use caution and avoid walking in overgrown areas and rocky spots.

If a worker is bitten, the following steps should be taken:

1. Keep the victim calm.
2. Minimize movement.
3. Apply ice to the area bitten being careful not to freeze the tissue.
4. Transport victim to the nearest medical facility.

D2.2.14 Construction Hazards

While working on site, employees must implement safe work practices in accordance with OSHA regulations. Work areas should be kept clear of stockpiled materials except as necessary to perform specific tasks.

D2.3 ELECTRICAL SAFETY

The equipment used in the bioventing system is electrically operated. Maintenance and day-to-day activities require personnel to handle and control this equipment. Unless safe work practices are strictly observed, serious injury or death can result.

Ordinary 120 volt (V) alternating current may be fatal. Extensive studies have shown that currents as low as 10 to 15 milliamps (mA) can cause loss of muscle control and that 12 V AC may, on good contact, cause injury. Therefore, all voltages should be considered dangerous. All electricity should be treated cautiously by trained personnel.

Electricity kills by paralyzing the nervous system and stopping muscular action. Frequently, electricity may hit the breathing center at the base of the brain and interrupt the transmission of the nervous impulses to the muscles responsible for breathing. In other cases, the electrical current directly affects the heart, causing it to cease pumping blood. Death follows from lack of oxygen in the body. It cannot be determined which action has taken place, therefore, a victim must be freed from the live conductor promptly by use of a dry stick or other nonconductor or by turning off the electricity to at least this

point of contact. Never use bare hands to remove a live wire from a victim or a victim from an electrical source. CPR or artificial respiration should be applied immediately and continuously until breathing is restored, or until a doctor or emergency medical technician arrives.

D2.3.1 General Electrical Safety Rules

- While working on electrical circuits, do not touch the switch box cabinet or any other object, such as a pipe, that will give electric current a path through your body. Do not stand in water and, if possible, place a rubber mat under your feet.
- Allow only authorized people to work on electrical panels.
- Keep rubber mats in front of electrical panels.
- Treat all electrical wires and circuits as "live," unless you are certain they are not.
- Use approved rubber gloves.
- Electrical control panels should never be opened unless the job requires it.
- No part of the body should be used to test a circuit.
- Always work from a firm base as loss of balance may cause a fall onto energized busses or parts. Energized busses and parts should be covered with a good electrical insulator such as a rubber blanket while exposed.
- No safety device should be made inoperative by removing guards, using oversized fuses, blocking or bypassing protective devices, unless it is absolutely essential to the repair or maintenance activity, and then only after alerting operating personnel and the maintenance supervisor. Follow OSHA lockout/tagout requirements.
- All tools should have insulated handles, be electrically grounded, or double insulated.
- Jewelry should never be worn when working on electric circuits.
- Use fuse pullers to change fuses.
- Never use metal ladders, metal tape measures, or other metal tools around electrical equipment.
- Keep wires from becoming a tripping hazard.
- When performing electrical work, even simply energizing a piece of equipment, observe "No Smoking" signs.
- When working around electrical equipment, keep your mind on the potential hazards at all times.

D2.3.2 Holding and Locking Out Electrical Circuits

The most important safety requirement in electrical maintenance is to have and adhere to a good system for locking out electrical circuits when equipment is being repaired. Unexpected operation of electrical equipment that can be started by automatic or manual remote control may cause injuries to persons who happen to be close enough to be struck.

When motors or electrical equipment require repair, the circuit should be opened at the switch box, and the switch should be padlocked in the "OFF" position.

All personnel involved in maintenance work should be instructed in the following lockout procedure:

- Alert the affected personnel.
- Before starting work on an engine, motor line shaft, or other power transmission equipment, or power driven machine, make sure it cannot be set in motion without your permission.
- Place your own padlock on the control switch, lever, or valve, even though someone may have already locked the control. You will not be protected unless you put your own padlock on it.
- When through working at the end of your shift, remove your padlock; never permit someone else to remove it for you; and be sure you are not exposing another person to danger by removing your padlock.

After repair, clear personnel from area BEFORE closing the breaker.

Further information concerning lockout/tag out procedures can be found in 54 CFR Part 169.

D2.4 FIRE SAFETY

Jet fuel and possibly some solvents have been released into the soils at these sites and vapors escaping from the soils may be flammable or explosive (if in a confined space). Therefore, precautions should be taken when doing field work (drilling or system construction/installation) to ensure that combustible or explosive vapors have not accumulated or that an ignition source is not introduced into a flammable atmosphere.

OSHA standards for fire protection and prevention are contained in 29 CFR Subpart F, 1926.150 through 1926.154. Of particular concern on this site are:

- Proper storage of flammables;
- Adequate numbers and types of fire extinguishers;
- Use of intrinsically safe or explosion proof equipment where appropriate; and
- Monitoring for development of an explosive atmosphere.

- Prevention of explosive atmospheres by placing blower equipment in well-ventilated enclosures.

SECTION D3.0 PERSONNEL PROTECTION AND MONITORING

D3.1 MEDICAL SURVEILLANCE

To perform the medical examinations and surveillance specified herein, Parsons Engineering Science uses the services of a licensed occupational health physician (Medical Service Network) with knowledge of or experience in the hazards associated with the work.

Personnel involved in this operation undergo medical surveillance at 12-month intervals. The medical exam is performed under the direction of a licensed occupational health physician, who issues a medical certification of each worker's fitness or unfitness for employment on hazardous waste projects, identifying any restrictions on worker activity that may be indicated. This evaluation will be repeated as indicated by substandard performance or evidence of particular stress that is evident by injury or time-loss illness on the part of any worker.

D3.2 SITE-SPECIFIC TRAINING

The SHSO will be responsible for developing a site-specific occupational hazard training program and for training all Parsons ES personnel who are to work at Tinker AFB. This training will cover the following topics at a minimum:

- Names of personnel responsible for site safety and health,
- Safety, health, and other hazards at the site,
- Proper use of personal protective equipment (PPE),
- Work practices by which the employee can minimize risk from hazards,
- Safe use of engineering controls and equipment on the site,
- Acute effects of chemicals at the site, and
- Decontamination procedures.

All personnel on the job will receive initial site-specific safety training. Safety meetings will also be held and documented at least once per week while conducting field work, or more frequently as necessary.

D3.3 PERSONAL PROTECTIVE EQUIPMENT AND ACTION LEVELS

D3.3.1 Level D Operations

Level D protection will be worn for initial entry on site and initially for all activities. Level D PPE will consist of:

- Hard hat when working around heavy equipment.
- Standard work clothes. Tyvek coveralls are recommended if there is a possibility of contact with liquids from the decontamination rinse, purge water from wells, or contaminated soils.
- Rubber or leather steel-toed boots.
- Hearing protection around drilling activities.
- Safety glasses with side shields when sampling and drilling.
- Nitrile or latex protective gloves when handling soil or water samples.

When level D personnel protection is being used, onsite monitoring for volatile organics will be performed using a photoionization detector (PID) or flame ionization detector (FID) during drilling and sampling. If the PID or FID indicates a level of 1 ppm or greater, specific monitoring for benzene will be performed using a Drager, or Sensidyne, tube. If the tube indicates a reading of greater than 1 ppm, then work actions at the site will cease and the project manager will be notified.

D3.3.2 PPE and Equipment Decontamination Procedures

The Parsons ES field team will have available a portable decontamination station. It will be set up during field activities if PPE (Tyvek suits, gloves, etc.) is being used or if equipment has been contaminated. The decontamination station will have provisions for collecting disposable personal protective equipment; for washing boots, gloves, respirators (if used), and field instruments and tools; and for washing hands, face, and other exposed body parts. Disposable PPE such as protective gloves and Tyvek suits will be considered as refuse from decontamination and will be properly disposed of at Tinker AFB.

Decontamination equipment will include, as necessary:

- Plastic buckets,
- Scrub brushes,
- Alconox detergent,
- Isopropyl alcohol,
- Paper towels,
- Plastic garbage bags, and
- Potable water.

Decontamination procedures for equipment will be as follows:

- Step 1. Wash with Alconox soap and potable water.
- Step 2. Rinse with potable water.
- Step 3. Rinse with deionized water.
- Step 4. Rinse with isopropyl alcohol.
- Step 5. Allow to air dry or rinse with deionized water.

Rinsate from the decontamination procedures will be collected and contained on site. The rinsate will be disposed of at the wastewater treatment facility.

D3.3.3 Equipment Needs

The field team will have the following items readily available:

- Copy of this site health and safety plan,
- First aid kit,
- Hearing protection (as necessary),
- Eyewash bottle,
- Eye protection (as necessary),
- Potable water,
- Hard hat (as necessary),
- Fire extinguisher (type A, B, C),
- Decontamination equipment,
- PID or FID (as necessary), and
- Pump with Drager, or Sensidyne, tubes for benzene.

D3.4 MONITORING REQUIREMENTS AND INSTRUMENT LIMITATIONS

During typical field activities, the field team members should position themselves upwind of the potential source. In the event workers must be stationed near the source, the site health and safety officer (or designee) will use a PID or FID to monitor for organic vapors in the breathing zone. Monitor readings will be taken and calibrations performed under the following circumstances and recorded in the field logbook:

- At least twice per day (morning and afternoon) and as field conditions warrant, and
- When weather conditions change.

Air monitoring for combustible gases and vapors using an explosimeter will be conducted periodically during drilling, well and monitoring point installation and sampling, but at least one per hole. When readings exceed the 10 percent lower explosive limit on the explosimeter, all activities must cease to allow time for the combustible gases to vent. If additional readings exceed 20 percent LEL, all equipment must be shut down, the area evacuated, and the site work reevaluated.

The HMX 271 explosimeter used by Parsons ES is susceptible to the low levels of oxygen to which the instrument is calibrated. At less than 15 percent oxygen, LEL readings calibrated to a normal range of oxygen are no longer accurate. This situation should not arise as Parsons ES personnel are to leave the site when levels are less than the OSHA minimum of 19.5 percent oxygen.

Site monitoring will be conducted during soil sampling (the action with the most potential for exposure to contaminants) via use of a personal breathing zone monitor at least once during the onsite work. An organic vapor monitor will be clipped to a field worker's clothing and kept in the work zone. The monitor will then be sent for laboratory analysis for benzene. Records of the laboratory analysis will be kept in project files and in each worker's file.

SECTION D4.0 SITE CONTROL MEASURES, ACCIDENT PREVENTION, AND CONTINGENCY PLAN

D4.1 SITE CONTROL MEASURES

The following site control measures will be followed to minimize potential contamination of workers, protect the public from potential site hazards, and control access to the sites. Site control involves the physical arrangement and control of operation zones and methods for removing contaminants from workers and equipment. Site organization is discussed in this section.

D4.2 SITE ORGANIZATION-OPERATION ZONE

D4.2.1 Exclusion Zone

An exclusion zone will be established on the site around drilling and soil sampling locations, any time respirators are worn or the level of PPE is upgraded or during drilling activities to keep bystanders away if warranted. The field team leader will establish the perimeters of the exclusion zone. Within the exclusion zone, prescribed levels of protection must be worn by all personnel.

Under some circumstances, the exclusion zone may be subdivided into zones based on environmental measurements of expected onsite work conditions.

D4.2.2 Support Zone

The support zone is the outermost area of the site and is considered a noncontaminated or clean area. The support zone contains the command post for field operations. Normal work clothes are appropriate apparel within this zone; potentially contaminated personnel clothing, equipment, etc., are not permitted. Except for those specific field activities mentioned above which require an exclusion zone, all other activities for this project should occur primarily in the support zone.

D4.3 SITE SECURITY

Site security will be enforced by the site health and safety officer, who will ensure that only authorized personnel are allowed in the work area and that those personnel have the required level of PPE. Site security is necessary to prevent exposure of unauthorized, unprotected individuals in the work area.

D4.4 SITE COMMUNICATION

Internal site communication is necessary to alert field team members in the exclusion zone and contamination reduction zone of emergency conditions, to convey safety information, and to communicate changes or clarification in the work to be performed. Communication will be performed via verbal exchange or simple hand signals to be determined by the site safety officer and established with field personnel on the first day of field work.

D4.5 SAFE WORK PRACTICES

To ensure a strong safety awareness program during the groundwater sampling and subsurface investigation activities, personnel must have adequate training, this health and safety plan must be communicated to the employees, and standing work orders must be developed and communicated to the employees. Sample standing orders for personnel entering the exclusion zone are as follows:

- No smoking, eating, or drinking.
- No matches or lighters in zone.
- No use of sparking tools.
- Use the buddy system.
- Wear appropriate PPE.
- Avoid walking through puddles or stained soil.
- Avoid leaning, sitting, or kneeling on contaminated surfaces.
- Discovery of unusual or unexpected conditions calls for immediate evaluation and reassessment of site conditions and health and safety practices.
- Conduct safety briefings prior to onsite work.
- Conduct weekly safety meetings as necessary.
- Take precautions to reduce injuries from heavy equipment and other tools.
- The following guidelines will be followed while working on site:
 - Heavy equipment: Only qualified operators will be allowed to operate heavy equipment. Subcontractors will be required to use the safe work guidelines in the OSHA general industry (29 CFR 1910) and construction industry (29 CFR 1926) standards and other applicable regulations.
 - Power lines: Any overhead or underground utility lines must be located, and appropriate measures taken before any excavation work is done.
 - Swing radius: All swing equipment, such as cranes or backhoes, will have the swing radius guarded to prevent workers from being struck by the rotating machinery.

- Electrical equipment: All electrical equipment will be properly grounded. Guidelines as outlined in section 6.3.1.
- Machine guarding: All machinery on site will be properly guarded to prevent worker contact with rotating shafts, blades, or gears.
- Flammable materials: When work involves flammable materials, adequate ventilating and control of all ignition sources will be maintained. This may include:
 - Nonsparking tools,
 - Explosion-proof equipment (intrinsically safe),
 - Grounding and bonding of static electricity sources,
 - No smoking or open fire, and
 - No welding,
 - Compressed gas cylinders.

D4.6 ACCIDENT PREVENTION

All field personnel will receive health and safety training prior to the initiation of any site activities. On a day-to-day basis, individual personnel should be constantly alert for indicators of potentially hazardous situations and for signs and symptoms in themselves and others that warn of hazardous conditions and exposures. Rapid recognition of dangerous situations can avert an emergency. Before beginning daily work assignments, the team leader will conduct a meeting to discuss at least the following:

- Tasks to be performed,
- Time constraints (e.g., rest breaks),
- Hazards that may be encountered, including their effects, how to recognize symptoms or monitor them, concentration limits, or other danger signals, and
- Emergency procedures.

D4.7 CONTINGENCY PLAN

D4.7.1 Emergency Procedures

In the event that an emergency develops on site, the procedures delineated herein are to be immediately followed. Emergency conditions are considered to exist if:

- Any member of the field crew is involved in an accident or experiences any adverse effects or symptoms of exposure while on site.
- A condition is discovered that suggests the existence of a situation more hazardous than anticipated.

General emergency procedures and specific procedures for personal injury and chemical exposure are described below.

D4.7.2 Chemical Exposure

Parsons ES adopts the buddy system in the field. If a member of the field crew demonstrates symptoms of chemical exposure, the procedures outlined below will be followed:

- Another team member will remove the individual from the immediate area of contamination. The member will alert the field team leader by shouting or hand signals. The field team leader will contact the appropriate emergency response agency.
- Precautions will be taken to avoid exposure of other individuals to the chemical.
- If the chemical is on the individual's clothing, the chemical will be neutralized or removed if it is safe to do so.
- If the chemical has contacted the skin, the skin will be washed with copious amounts of water.
- In case of eye contact, an emergency eyewash will be used. Eyes will be washed for at least 15 minutes.
- If necessary, the victim will then be transported to the base hospital (see map in front section of safety plan). If necessary, an ambulance will be called at (405) 734-8223 to transport the victim. See Procedures Requesting Emergency Care Section.
- All chemical exposure incidents must be reported in writing to the office health and safety representative. The site safety officer or field team leader is responsible for completing the accident report (see exhibit A).

D4.7.3 Personal Injury

In case of personal injury at the site, the following procedures will be followed:

- Another team member will signal the field team leader that an injury has occurred.
- A field team member trained in first aid can administer treatment to an injured worker.
- The victim will then be transported to the base hospital (see map in front section of safety plan). If necessary, an Army ambulance will be called at (405)734-8223 to transport the victim. See Procedures Requesting Emergency Care Section.
- The field team leader or site safety officer is responsible for making certain that an accident report form is completed (exhibit A). This form is to be submitted to the office health and safety representative. Follow-up action will be taken to correct the situation that caused the accident.

D4.7.4 Evacuation Procedures

If site evacuation is necessary:

- The field team leader will initiate the evacuation procedure by signaling the team.
- All personnel in the work area will evacuate the area and meet in the common area designated during the first onsite health and safety meeting.
- All personnel suspected to be in or near the contract work area will be accounted for and the whereabouts of missing persons determined immediately.
- Further instructions will then be given by the field team leader.

D4.7.5 Procedures Implemented in the Event of a Major Fire, Explosion, or Onsite Health Emergency Crisis

- Notify the paramedics and/or fire department, as necessary.
- Evacuate and isolate the area.
- Stay upwind of any fire.
- Keep area surrounding the problem source clear after the incident occurs.
- Complete accident report form and distribute to appropriate personnel.

D4.7.6 Procedures Requesting Emergency Care¹

The following procedures should be used when summoning help in emergency situations:

- a) Supervisors should call the Hospital Emergency Room at extension 48223, advise them of the nature of the problem, the location, and Supervisor's extension. A spotter should then be placed in a highly visible area to direct the response team to the patient. It is desirable for the spotter to remain in his/her location until all responding teams have arrived.
- b) The Emergency Room will dispatch an ambulance and notify the Fire Rescue Team of the problem and the location. In Building 3001, they will notify the Occupational Medicine Service (OMS), who will also respond during the day shift. Stickers with Emergency Numbers to attach to telephones can be obtained from the Fire Department.
- c) In the past, some supervisors in Building 3001 have phoned directly to the Occupational Medicine Service for an emergency response. This could result in a delayed response and could be of concern in serious emergencies where a combined response is necessary.

¹ Copied from Memorandum for Parsons Engineering Science, Inc., 12 September 1994, from OC-ALC/PKOSS, Tinker AFB.

Exhibit A

**Plan Acceptance Form,
Accident Report Form
Job Safety and Health Protection Notice**

PLAN ACCEPTANCE FORM

SUMMARY OF ACTIVITIES

Activities to be performed at Tinker AFB are drilling and subsurface soil sampling, and bioventing test pilot system installation. All work will be performed in level D, as defined by this plan.

ACCEPTANCE

I have read the health and safety plan for the field activities mentioned above at Tinker Air Force Base 3700 Fuel Yard site and agree to abide by the rules and guidelines contained therein.

_____	_____	_____
Name	Signature	Date
_____	_____	_____
Name	Signature	Date
_____	_____	_____
Name	Signature	Date
_____	_____	_____
Name	Signature	Date
_____	_____	_____
Name	Signature	Date
_____	_____	_____
Name	Signature	Date
_____	_____	_____
Name	Signature	Date

DISTRIBUTION

Original signatures are to go in the Parsons Engineering Science contract file, 726447. Copies will be retained by the Parsons ES project manager and by the health and safety coordinator.

Project: _____

EMPLOYER

1. Name: _____

2. Mail Address: _____
(No. and Street) (City or Town) (State)

3. Location, if different from mail address: _____

INJURED OR ILL EMPLOYEE

4. Name: _____ Social Security Number: _____
(First) (Middle) (Last)

5. Home Address: _____
(No. and Street) (City or Town) (State)

6. Age: _____ 7. Sex: Male () Female ()

8. Occupation: _____
(Specific job title, not the specific activity employee was performing at time of injury)

9. Department: _____
(Enter name of department in which injured persons is employed, even though they may have been temporarily working in another department at the time of injury)

THE ACCIDENT OR EXPOSURE TO OCCUPATIONAL ILLNESS

10. Place of accident or exposure: _____
(No. and Street) (City or Town) (State)

11. Was place of accident or exposure on employer's premises? Yes () No ()

12. What was the employee doing when injured? _____
(Be specific - Was employee

_____ using tools or equipment or handling material?)

13. How did the accident occur? _____
(Describe fully the events that resulted in the
injury or occupational illness. Tell what happened and how. Name objects
and substances involved. Give details on all factors that led to accident.
Use separate sheet for additional space.)

14. Time of accident: _____

15. ES WITNESS TO ACCIDENT

_____	(Name)	(Affiliation)	(Phone No.)
_____	(Name)	(Affiliation)	(Phone No.)
_____	(Name)	(Affiliation)	(Phone No.)

OCCUPATIONAL INJURY OR OCCUPATIONAL ILLNESS

16. Describe injury or illness in detail; indicate part of body affected:

17. Name the object or substance that directly injured the employee. (For example, object that struck employee; the vapor or poison inhaled or swallowed; the chemical or radiation that irritated the skin; or in cases of strains, hernias, etc., the object the employee was lifting, pulling, etc.).

18. Date of injury or initial diagnosis of occupational illness _____
(Date)

19. Did the accident result in employee fatality? Yes () No ()

OTHER

20. Name and address of physician _____

21. If hospitalized, name and address of hospital _____

Date of report _____ Prepared by _____

Official position _____

JOB SAFETY & HEALTH PROTECTION

The Occupational Safety and Health Act of 1970 provides job safety and health protection for workers by promoting safe and healthful working conditions throughout the Nation. Provisions of the Act include the following:

Employers

All employers must furnish to employees employment and a place of employment free from recognized hazards that are causing or are likely to cause death or serious harm to employees. Employers must comply with occupational safety and health standards issued under the Act.

Employees

Employees must comply with all occupational safety and health standards, rules, regulations and orders issued under the Act that apply to their own actions and conduct on the job.

The Occupational Safety and Health Administration (OSHA) of the U.S. Department of Labor has the primary responsibility for administering the Act. OSHA issues occupational safety and health standards, and its Compliance Safety and Health Officers conduct jobsite inspections to help ensure compliance with the Act.

Inspection

The Act requires that a representative of the employer and a representative authorized by the employees be given an opportunity to accompany the OSHA inspector for the purpose of aiding the inspection.

Where there is no authorized employee representative, the OSHA Compliance Officer must consult with a reasonable number of employees concerning safety and health conditions in the workplace.

Complaint

Employees or their representatives have the right to file a complaint with the nearest OSHA office requesting an inspection if they believe unsafe or unhealthful conditions exist in their workplace. OSHA will withhold, on request, names of employees complaining.

The Act provides that employees may not be discharged or discriminated against in any way for filing safety and health complaints or for otherwise exercising their rights under the Act.

Employees who believe they have been discriminated against may file a complaint with their nearest OSHA office within 30 days of the alleged discriminatory action.

Citation

If upon inspection OSHA believes an employer has violated the Act, a citation alleging such violations will be issued to the employer. Each citation will specify a time period within which the alleged violation must be corrected.

The OSHA citation must be prominently displayed at or near the place of alleged violation for three days, or until it is corrected, whichever is later, to warn employees of dangers that may exist there.

Proposed Penalty

The Act provides for mandatory civil penalties against employers of up to \$7,000 for each serious violation and for optional penalties of up to \$7,000 for each nonserious violation. Penalties of up to \$7,000 per day may be proposed for failure to correct violations within the proposed time period and for each day the violation continues beyond the prescribed abatement date. Also, any employer who willfully or repeatedly violates the Act may be assessed penalties of up to \$70,000 for each such violation. A minimum penalty of \$5,000 may be imposed for each willful violation. A violation of posting requirements can bring a penalty of up to \$7,000.

There are also provisions for criminal penalties. Any willful violation resulting in the death of any employee, upon conviction, is punishable by a fine of up to \$250,000 (or \$500,000 if the employer is a corporation), or by imprisonment for up to six months, or both. A second conviction of an employer doubles the possible term of imprisonment. Falsifying records, reports, or applications is punishable by a fine of \$10,000 or up to six months in jail or both.

Voluntary Activity

While providing penalties for violations, the Act also encourages efforts by labor and management, before an OSHA inspection, to reduce workplace hazards voluntarily and to develop and improve safety and health programs in all workplaces and industries. OSHA's Voluntary Protection Programs recognize outstanding efforts of this nature.

OSHA has published Safety and Health Program Management Guidelines to assist employers in establishing or perfecting programs to prevent or control employee exposure to workplace hazards. There are many public and private organizations that can provide information and assistance in this effort, if requested. Also, your local OSHA office can provide considerable help and advice on solving safety and health problems or can refer you to other sources for help such as training.

Consultation

Free assistance in identifying and correcting hazards and in improving safety and health management is available to employers, without citation or penalty, through OSHA-supported programs in each State. These programs are usually administered by the State Labor or Health department or a State university.

Posting Instructions

Employers in States operating OSHA approved State Plans should obtain and post the State's equivalent poster.

Under provisions of Title 29, Code of Federal Regulations, Part 1903.2(a)(1) employers must post this notice (or facsimile) in a conspicuous place where notices to employees are customarily posted.

More Information

Additional information and copies of the Act, specific OSHA safety and health standards, and other applicable regulations may be obtained from your employer or from the nearest OSHA Regional Office in the following locations:

Atlanta, GA	(404) 347-3573
Boston, MA	(617) 565-7164
Chicago, IL	(312) 353-2220
Dallas, TX	(214) 767-4731
Denver, CO	(303) 844-3061
Kansas City, MO	(816) 426-5861
New York, NY	(212) 337-2378
Philadelphia, PA	(215) 596-1201
San Francisco, CA	(415) 744-6670
Seattle, WA	(206) 442-5930

Lynn Martin

Lynn Martin, Secretary of Labor

U.S. Department of Labor

Occupational Safety and Health Administration

Washington, DC
1991 (Reprinted)
OSHA 2203



Exhibit B

Material Safety Data Sheets

Common Synonyms Benzol Benzole		Watery liquid Colorless Gasoline-like odor	
Elevation water. Flammable, irritating vapor is produced. Freezing point is 42°F.			
Avoid contact with liquid and vapor. Keep people away. Wear goggles and self-contained breathing apparatus. Shut off ignition sources and call fire department. Stop discharge if possible. Stay upwind and use water spray to "knock down" vapor. Isolate and remove discharged material. Notify local health and pollution control agencies.			
Fire	FLAMMABLE. Flashback along vapor trail may occur. Vapor may explode if ignited in an enclosed area. Wear goggles and self-contained breathing apparatus. Extinguish with dry chemical, foam, or carbon dioxide. Water may be ineffective on fire. Cool exposed containers with water.		
Exposure	CALL FOR MEDICAL AID. VAPOR Irritating to eyes, nose and throat. If inhaled, will cause headache, difficult breathing, or loss of consciousness. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen. LIQUID Irritating to skin and eyes. Harmful if swallowed. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.		
Water Pollution	HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.		
1. RESPONSE TO DISCHARGE (See Response Methods Handbook, CG 446, 4.) Use water spray - high pressure only. Restrict access.		2. LABEL  Red	
3. CHEMICAL DESIGNATIONS 3.1 Synonyms: Benzol Benzole 3.2 Coast Guard Compatibility Classification: Aromatic hydrocarbon 3.3 Chemical Formula: C ₆ H ₆ 3.4 IMCO/United Nations Numerical Designation: 12/1114		4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless 4.3 Odor: Aromatic, rather pleasant aromatic odor; characteristic odor	
5. HEALTH HAZARDS 5.1 Personal Protective Equipment: Hydrocarbon vapor canister, supplied air or a hose mask; hydrocarbon-insoluble rubber or plastic gloves; chemical goggles or face splash shield; hydrocarbon-insoluble apron such as neoprene. 5.2 Symptoms Following Exposure: Dizziness, exaltation, pallor, followed by flushing, weakness, headache, breathlessness, chest constriction. Coma and possible death. 5.3 Treatment for Exposure: SKIN: flush with water followed by soap and water; remove contaminated clothing and wash skin. EYES: flush with plenty of water until irritation subsides. INHALATION: remove from exposure immediately. Call a physician. If breathing is irregular or stopped, start resuscitation, administer oxygen. 5.4 Toxicity by Inhalation (Threshold Limit Value): 25 ppm 5.5 Short-Term Inhalation Limits: 75 ppm for 30 min 5.6 Toxicity by Ingestion: Grade 3.1 D ₅₀ , 50 to 500 mg/kg 5.7 Late Toxicity: Leukemia 5.8 Vapor (Gas) Irritant Characteristics: If present in high concentrations, vapors may cause irritation of eyes or respiratory system. The effect is temporary. 5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin. 5.10 Odor Threshold: 4.68 ppm			

6. FIRE HAZARDS 6.1 Flash Point: 127°C (C) 6.2 Flammable Limits in Air: 1.2% - 7.6% 6.3 Fire Extinguishing Agents: Dry chemical, foam, carbon dioxide. 6.4 Fire Extinguishing Agents Not to be Used: Water, alcohol, halohydrocarbons. 6.5 Special Hazards of Combustion Products: Not pertinent. 6.6 Behavior in Fire: Vapor is heavier than air and may travel considerable distance to a source of ignition and flashback. 6.7 Ignition Temperature: 500°C (C) 6.8 Electrical Hazard: None. (Rating 0) 6.9 Burning Rate: 6.0 mm/min		8. WATER POLLUTION 8.1 Aquatic Toxicity: 24 ppm (4 hr. minimum) LD ₅₀ for fish 24 ppm (24 hr. minimum) LD ₅₀ for daphnia 8.2 Waterway Toxicity: Deleterious to fish 8.3 Biological Oxygen Demand (BOD): 1.20 (6-10 days) 8.4 Food Chain Concentration Potential: None																																					
7. CHEMICAL REACTIVITY 7.1 Reactivity with Water: No reaction 7.2 Reactivity with Common Materials: No reaction 7.3 Stability During Transport: Stable 7.4 Neutralizing Agents for Acids and Caustics: Not pertinent 7.5 Polymerization: Not pertinent 7.6 Inhibitor of Polymerization: Not pertinent		9. SELECTED MANUFACTURERS 1. Companies with Oil Refineries in the Commonwealth of Puerto Rico: Petrochem - Ponce, P.R. 00714 2. Phillips Petroleum Co. Phillips Puerto Rico Corp., Inc. Banco Popular Center Hato Rey, P.R. 00936 3. Shell Chemical Co. Petrochemicals Div. P.O. Box 2463 Houston, Texas 77001																																					
11. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook, CG 446, 3) A 1.1 A W		10. SHIPPING INFORMATION 10.1 Grades or Purity: Industrial pure 99.4% Thiouphene-free 99.4% Nitration 99.4% Industrial 90% 85.4% Reagent 99.4% 10.2 Storage Temperature: Ambient 10.3 Inert Atmosphere: No requirement 10.4 Venting: Pressure/vacuum																																					
12. HAZARD CLASSIFICATIONS 12.1 Code of Federal Regulations: Flammable liquid 12.2 NAS Hazard Rating for Bulk Water Transportation: <table border="1"> <thead> <tr> <th>Category</th> <th>Rating</th> </tr> </thead> <tbody> <tr> <td>Fire</td> <td>3</td> </tr> <tr> <td>Health</td> <td>1</td> </tr> <tr> <td>Vapor Irritant</td> <td>1</td> </tr> <tr> <td>Liquid or Solid Irritant</td> <td>1</td> </tr> <tr> <td>Poisons</td> <td>3</td> </tr> <tr> <td>Water Pollution</td> <td>1</td> </tr> <tr> <td>Human Toxicity</td> <td>1</td> </tr> <tr> <td>Aquatic Toxicity</td> <td>3</td> </tr> <tr> <td>Aesthetic Effect</td> <td>2</td> </tr> <tr> <td>Reactivity</td> <td>0</td> </tr> <tr> <td>Other Chemicals</td> <td>1</td> </tr> <tr> <td>Water</td> <td>0</td> </tr> <tr> <td>Self-Reaction</td> <td>0</td> </tr> </tbody> </table> 12.3 MFPA Hazard Classifications: <table border="1"> <thead> <tr> <th>Category</th> <th>Classification</th> </tr> </thead> <tbody> <tr> <td>Health Hazard (Blue)</td> <td>2</td> </tr> <tr> <td>Flammability (Red)</td> <td>3</td> </tr> <tr> <td>Reactivity (Yellow)</td> <td>0</td> </tr> </tbody> </table>		Category	Rating	Fire	3	Health	1	Vapor Irritant	1	Liquid or Solid Irritant	1	Poisons	3	Water Pollution	1	Human Toxicity	1	Aquatic Toxicity	3	Aesthetic Effect	2	Reactivity	0	Other Chemicals	1	Water	0	Self-Reaction	0	Category	Classification	Health Hazard (Blue)	2	Flammability (Red)	3	Reactivity (Yellow)	0	13. PHYSICAL AND CHEMICAL PROPERTIES 13.1 Physical State at 15°C and 1 atm: Liquid 13.2 Molecular Weight: 78.11 13.3 Boiling Point at 1 atm: 176°F = 80.1°C = 353.1°K 13.4 Freezing Point: 42.0°F = 5.5°C = 278.7°K 13.5 Critical Temperature: 552.0°F = 288.9°C = 562.1°K 13.6 Critical Pressure: 710 psia = 48.3 atm = 4.89 MN/m ² 13.7 Specific Gravity: 0.879 at 20°C (liquid) 13.8 Liquid Surface Tension: 28.9 dynes/cm = 0.0289 N/m at 20°C 13.9 Liquid-Water Interfacial Tension: 35.0 dynes/cm = 0.035 N/m at 20°C 13.10 Vapor (Gas) Specific Gravity: 2.7 13.11 Ratio of Specific Heats of Vapor (Gas): 1.061 13.12 Latent Heat of Vaporization: 169 Btu/lb = 94.1 cal/g = 3.94 × 10 ⁴ J/kg 13.13 Heat of Combustion: -17,460 Btu/lb = -9698 cal/g = -406.0 × 10 ³ J/kg 13.14 Heat of Decomposition: Not pertinent 13.15 Heat of Solution: Not pertinent 13.16 Heat of Polymerization: Not pertinent	
Category	Rating																																						
Fire	3																																						
Health	1																																						
Vapor Irritant	1																																						
Liquid or Solid Irritant	1																																						
Poisons	3																																						
Water Pollution	1																																						
Human Toxicity	1																																						
Aquatic Toxicity	3																																						
Aesthetic Effect	2																																						
Reactivity	0																																						
Other Chemicals	1																																						
Water	0																																						
Self-Reaction	0																																						
Category	Classification																																						
Health Hazard (Blue)	2																																						
Flammability (Red)	3																																						
Reactivity (Yellow)	0																																						
NOTES																																							

<p>Common Synonyms: Toluol Methylbenzene Methyltoluol</p>		<p>Watery liquid Colorless Pleasant odor</p>																																					
<p>Fluorescent in water. Flammable; irritating vapor is produced.</p>																																							
<p>Stop discharge if possible. Keep people away. Shut off ignition sources and call fire department. Stay upwind and use water spray to "knock down" vapor. Avoid contact with liquid and vapor. Isolate and remove discharged material. Notify local health and pollution control agencies.</p>																																							
<p>Fire</p>		<p>FLAMMABLE: Flashback along vapor trail may occur. Vapor may explode if ignited in an enclosed area. Wear goggles and self-contained breathing apparatus. Extinguish with dry chemical, foam, or carbon dioxide. Water may be ineffective on fire. Cool exposed containers with water.</p>																																					
<p>Exposure</p>		<p>CALL FOR MEDICAL AID VAPOR: Irritating to eyes, nose and throat. If inhaled, will cause nausea, vomiting, headache, dizziness, difficult breathing, or loss of consciousness. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing difficult, give oxygen. LIQUID: Irritating to skin and eyes. If swallowed, will cause nausea, vomiting or loss of consciousness. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk. DO NOT INDUCE VOMITING.</p>																																					
<p>Water Pollution</p>		<p>Dangerous to aquatic life in high concentrations. Fouling to shoreline. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.</p>																																					
<p>1. RESPONSE TO DISCHARGE (See Response Methods Handbook, CG 446.4.) Issue warning: high flammability. Evacuate area.</p>		<p>2. LABEL</p> <div style="text-align: center;">  </div>																																					
<p>3. CHEMICAL DESIGNATIONS</p> <p>3.1 Synonyms: Methylbenzene Methylbenzol Toluol</p> <p>3.2 Coast Guard Compatibility Classification: Aromatic hydrocarbon</p> <p>3.3 Chemical Formula: C₇H₈</p> <p>3.4 IMCO/United Nations Numerical Designation: 3.2/1294</p>		<p>4. OBSERVABLE CHARACTERISTICS</p> <p>4.1 Physical State (as shipped): Liquid</p> <p>4.2 Color: Colorless</p> <p>4.3 Odor: Pungent, aromatic, benzene-like, distinct, pleasant</p>																																					
<p>5. HEALTH HAZARDS</p> <p>5.1 Personal Protective Equipment: Air-supplied mask; goggles or face shield; plastic gloves</p> <p>5.2 Symptoms Following Exposure: Vapors irritate eyes and upper respiratory tract, cause dizziness, headache, anesthesia, respiratory arrest. Liquid irritates eyes and causes drying of skin. If aspirated, causes coughing, gagging, distress, and rapidly developing pulmonary edema. If ingested causes vomiting, griping, diarrhea, depressed respiration.</p> <p>5.3 Treatment for Exposure: INHALATION: remove to fresh air, give artificial respiration and oxygen if needed, call a doctor. INGESTION: do NOT induce vomiting, call a doctor. EYES: flush with water for at least 15 min. SKIN: wipe off, wash with soap and water.</p> <p>5.4 Toxicity by Inhalation (Threshold Limit Value): 100 ppm</p> <p>5.5 Short-Term Inhalation Limits: 600 ppm for 30 min.</p> <p>5.6 Toxicity by Ingestion: Grade 2, LD₅₀ 0.5 to 5 g/kg</p> <p>5.7 Late Toxicity: Kidney and liver damage may follow ingestion</p> <p>5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.</p> <p>5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.</p> <p>5.10 Odor Threshold: 0.17 ppm</p>																																							
<p>6. FIRE HAZARDS</p> <p>6.1 Flash Point: 40°F (4°C) (E.C.)</p> <p>6.2 Flammable Limits in Air:</p> <p>6.3 Fire Extinguishing Agents: Water, dry chemical, foam, carbon dioxide, clean agent. Use water spray to knock down vapors. Use foam for large fires.</p> <p>6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective.</p> <p>6.5 Special Hazards of Combustion Products: Not pertinent.</p> <p>6.6 Behavior in Fire: Vapor is heavier than air and may travel a considerable distance to a source of ignition and ignite it.</p> <p>6.7 Ignition Temperature: 500°F</p> <p>6.8 Electrical Hazard: Class I, Group D</p> <p>6.9 Burning Rate: 2.5 in/min</p>		<p>8. WATER POLLUTION</p> <p>8.1 Aquatic Toxicity: Toxic to fish and aquatic life.</p> <p>8.2 Biological Oxygen Demand (BOD): 0% (5 days, 20°C theoretical)</p> <p>8.4 Food Chain Concentration Potential: None</p>																																					
<p>7. CHEMICAL REACTIVITY</p> <p>7.1 Reactivity with Water: No reaction</p> <p>7.2 Reactivity with Common Materials: No reaction</p> <p>7.3 Stability During Transport: Stable</p> <p>7.4 Neutralizing Agents for Acids and Caustics: Not pertinent</p> <p>7.5 Polymerization: Not pertinent</p> <p>7.6 Inhibitor of Polymerization: Not pertinent</p>		<p>9. SELECTED MANUFACTURERS</p> <p>1. Exxon Chemical Co. Houston, Tex. 77001</p> <p>2. Shell Chemical Co. Petrochemical Division Houston, Tex. 77001</p> <p>3. Sun Oil Co. St. Davids, Pa. 19087</p>																																					
<p>11. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook, CG 446.3) A-T-U</p>		<p>10. SHIPPING INFORMATION</p> <p>10.1 Grades or Purity: Research reagent nitration: all 99.84%, industrial: contains 94.4%, with 5% xylene and small amounts of benzene and nonaromatic hydrocarbons, 90/120: less pure than industrial.</p> <p>10.2 Storage Temperature: Ambient</p> <p>10.3 Inert Atmosphere: No requirement</p> <p>10.4 Venting: Open (flame arrester) or pressure-vacuum</p>																																					
<p>12. HAZARD CLASSIFICATIONS</p> <p>12.1 Code of Federal Regulations: Flammable liquid</p> <p>12.2 NAF Hazard Rating for Bulk Water Transportation:</p> <table border="1"> <thead> <tr> <th>Category</th> <th>Rating</th> </tr> </thead> <tbody> <tr> <td>Fire</td> <td>3</td> </tr> <tr> <td>Health</td> <td>0</td> </tr> <tr> <td>Vapor Irritant</td> <td>1</td> </tr> <tr> <td>Liquid or Solid Irritant</td> <td>1</td> </tr> <tr> <td>Poison</td> <td>2</td> </tr> <tr> <td>Water Pollution</td> <td>0</td> </tr> <tr> <td>Human Toxicity</td> <td>1</td> </tr> <tr> <td>Aquatic Toxicity</td> <td>3</td> </tr> <tr> <td>Aesthetic Effect</td> <td>2</td> </tr> <tr> <td>Reactivity</td> <td>0</td> </tr> <tr> <td>Other Chemicals</td> <td>1</td> </tr> <tr> <td>Water</td> <td>0</td> </tr> <tr> <td>Self-Reaction</td> <td>0</td> </tr> </tbody> </table> <p>12.3 MFPA Hazard Classifications:</p> <table border="1"> <thead> <tr> <th>Category</th> <th>Classification</th> </tr> </thead> <tbody> <tr> <td>Health Hazard (Blue)</td> <td>2</td> </tr> <tr> <td>Flammability (Red)</td> <td>3</td> </tr> <tr> <td>Reactivity (Yellow)</td> <td>0</td> </tr> </tbody> </table>		Category	Rating	Fire	3	Health	0	Vapor Irritant	1	Liquid or Solid Irritant	1	Poison	2	Water Pollution	0	Human Toxicity	1	Aquatic Toxicity	3	Aesthetic Effect	2	Reactivity	0	Other Chemicals	1	Water	0	Self-Reaction	0	Category	Classification	Health Hazard (Blue)	2	Flammability (Red)	3	Reactivity (Yellow)	0	<p>13. PHYSICAL AND CHEMICAL PROPERTIES</p> <p>13.1 Physical State at 15°C and 1 atm: Liquid</p> <p>13.2 Molecular Weight: 92.14</p> <p>13.3 Boiling Point at 1 atm: 231.1°F = 110.6°C = 383.8°K</p> <p>13.4 Freezing Point: -139°F = -95.0°C = 178.2°K</p> <p>13.5 Critical Temperature: 605.4°F = 318.6°C = 591.8°K</p> <p>13.6 Critical Pressure: 596.1 psia = 40.55 atm = 4.108 MN/m²</p> <p>13.7 Specific Gravity: 0.867 at 20°C (liquid)</p> <p>13.8 Liquid Surface Tension: 29.0 dynes/cm = 0.0290 N/m at 20°C</p> <p>13.9 Liquid-Water Interfacial Tension: 36.1 dynes/cm = 0.0361 N/m at 25°C</p> <p>13.10 Vapor (Gas) Specific Gravity: Not pertinent</p> <p>13.11 Ratio of Specific Heats of Vapor (Gas): 1.089</p> <p>13.12 Latent Heat of Vaporization: 155 Btu/lb = 86.1 cal/g = 3.61 × 10⁵ J/kg</p> <p>13.13 Heat of Combustion: -17,430 Btu/lb = -9686 cal/g = -405.5 × 10³ J/kg</p> <p>13.14 Heat of Decomposition: Not pertinent</p> <p>13.15 Heat of Solution: Not pertinent</p> <p>13.16 Heat of Polymerization: Not pertinent</p>	
Category	Rating																																						
Fire	3																																						
Health	0																																						
Vapor Irritant	1																																						
Liquid or Solid Irritant	1																																						
Poison	2																																						
Water Pollution	0																																						
Human Toxicity	1																																						
Aquatic Toxicity	3																																						
Aesthetic Effect	2																																						
Reactivity	0																																						
Other Chemicals	1																																						
Water	0																																						
Self-Reaction	0																																						
Category	Classification																																						
Health Hazard (Blue)	2																																						
Flammability (Red)	3																																						
Reactivity (Yellow)	0																																						
<p>NOTES</p>																																							

<p>Common Synonyms Phenylethane EB</p> <p>Liquid Colorless Sweet, gasoline-like odor</p> <p>Floats on water. Flammable; irritating vapor is produced.</p>		<p>6 FIRE HAZARDS</p> <p>6.1 Flash Point: 100°F (38°C)</p> <p>6.2 Fire Extinguishing Agents: Foam (most effective); water for carbon dioxide or dry chemical.</p> <p>6.3 Fire Extinguishing Agents Not to be Used: Not pertinent.</p> <p>6.4 Special Hazards of Combustion Products: Irritating vapors are generated when heated.</p> <p>6.5 Behavior in Fire: Vapor is heavier than air and may collect in low areas, forming a source of ignition and flashback.</p> <p>6.6 Ignition Temperature: 860°F</p> <p>6.7 Electrical Hazard: Not pertinent.</p> <p>6.8 Burning Rate: 5.8 mm/min</p>		<p>8 WATER POLLUTION</p> <p>8.1 Aquatic Toxicity:</p> <p>8.2 Waterfowl Toxicity: Data not available.</p> <p>8.3 Biological Oxygen Demand (BOD): 2.5% (over 30 days)</p> <p>8.4 Food Chain Concentration Potential: None.</p>																																			
<p>Avoid contact with liquid and vapor. Keep people away. Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves). Shut off ignition sources and call fire department. Stop discharge if possible. Stay upwind and use water spray to "knock down" vapor. Isolate and remove discharged material. Notify local health and pollution control agencies.</p>		<p>9. SELECTED MANUFACTURERS</p> <p>1. Amoco Chemical Corp. 130 East Randolph Drive Chicago, IL 60601</p> <p>2. Dow Chemical Co. Midland, Mich. 48660</p> <p>3. Monsanto Co. 800 North Lindbergh Blvd. St. Louis, Mo. 63106</p>																																					
<p>Fire</p> <p>FLAMMABLE. Flashback along vapor trail may occur. Vapor may explode if ignited in an enclosed area. Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves). Extinguish with dry chemical, foam, or carbon dioxide. Water may be ineffective on fire. Cool exposed containers with water.</p>		<p>7 CHEMICAL REACTIVITY</p> <p>7.1 Reactivity with Water: No reaction.</p> <p>7.2 Reactivity with Common Materials: No reaction.</p> <p>7.3 Stability During Transport: Stable.</p> <p>7.4 Neutralizing Agents for Acids and Caustics: Not pertinent.</p> <p>7.5 Polymerization: Not pertinent.</p> <p>7.6 Inhibitor of Polymerization: Not pertinent.</p>																																					
<p>Exposure</p> <p>CALL FOR MEDICAL AID.</p> <p>VAPOR Irritating to eyes, nose and throat. If inhaled, will cause dizziness or difficult breathing. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen.</p> <p>LIQUID Will burn skin and eyes. Harmful if swallowed. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk. DO NOT INDUCE VOMITING.</p>		<p>10 SHIPPING INFORMATION</p> <p>10.1 Grades or Purity: Research grade 99.9%; pure grade 99.5%; technical grade 99.0%</p> <p>10.2 Storage Temperature: Ambient</p> <p>10.3 Inert Atmosphere: No requirement</p> <p>10.4 Venting: Open (flame arrester) or pressure-vacuum</p>																																					
<p>Water Pollution</p> <p>HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS. Fouling to shoreline. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.</p>		<p>11 HAZARD ASSESSMENT CODE (See HAZARD ASSESSMENT HANDBOOK, CG 446-3) A-T-U</p>																																					
<p>1. RESPONSE TO DISCHARGE (See Response Methods Handbook, CG 446-4) Mechanical containment Should be removed Chemical and physical treatment</p>		<p>2. LABEL</p> <div style="text-align: center;">  <p>Red</p> </div>																																					
<p>3. CHEMICAL DESIGNATIONS</p> <p>3.1 Synonyms: EB Phenylethane</p> <p>3.2 Coast Guard Compatibility Classification: Aromatic hydrocarbon</p> <p>3.3 Chemical Formula: C₈H₁₀</p> <p>3.4 IMCO/United Nations Numerical Designation: 3.3/1175</p>		<p>4. OBSERVABLE CHARACTERISTICS:</p> <p>4.1 Physical State (as shipped): Liquid</p> <p>4.2 Color: Colorless</p> <p>4.3 Odor: Aromatic</p>																																					
<p>5. HEALTH HAZARDS</p> <p>5.1 Personal Protective Equipment: Self-contained breathing apparatus; safety goggles.</p> <p>5.2 Symptoms Following Exposure: Inhalation may cause irritation of nose, dizziness, depression. Moderate irritation of eye with corneal injury possible. Irritates skin and may cause blisters.</p> <p>5.3 Treatment for Exposure: INHALATION: if ill effects occur, remove victim to fresh air, keep him warm and quiet, and get medical help promptly; if breathing stops, give artificial respiration. INGESTION: induce vomiting only upon physician's approval, material in lung may cause chemical pneumonitis. SKIN AND EYES: promptly flush with plenty of water (15 min. for eyes) and get medical attention; remove and wash contaminated clothing before reuse.</p> <p>5.4 Toxicity by Inhalation (Threshold Limit Value): 100 ppm</p> <p>5.5 Short-Term Inhalation Limits: 200 ppm for 30 min</p> <p>5.6 Toxicity by Ingestion: Grade 2; LD₅₀ 0.5 to 5 g/kg (rat)</p> <p>5.7 Late Toxicity: Data not available</p> <p>5.8 Vapor (Gas) Irritant Characteristics: Vapors cause moderate irritation such that personnel will find high concentrations unpleasant. The effect is temporary.</p> <p>5.9 Liquid or Solid Irritant Characteristics: Causes smarting of the skin and first-degree burns on short exposure; may cause secondary burns on long exposure.</p> <p>5.10 Odor Threshold: 140 ppm</p>																																							
<p>12. HAZARD CLASSIFICATIONS</p> <p>12.1 Code of Federal Regulations: Flammable Liquid</p> <p>12.2 NAS Hazard Rating for Bulk Water Transportation:</p> <table border="1"> <thead> <tr> <th>Category</th> <th>Rating</th> </tr> </thead> <tbody> <tr> <td>Fire</td> <td>3</td> </tr> <tr> <td>Health</td> <td>0</td> </tr> <tr> <td>Vapor Irritant</td> <td>2</td> </tr> <tr> <td>Liquid or Solid Irritant</td> <td>2</td> </tr> <tr> <td>Poisons</td> <td>2</td> </tr> <tr> <td>Water Pollution</td> <td>0</td> </tr> <tr> <td>Human Toxicity</td> <td>1</td> </tr> <tr> <td>Aquatic Toxicity</td> <td>3</td> </tr> <tr> <td>Aesthetic Effect</td> <td>2</td> </tr> <tr> <td>Reactivity</td> <td>0</td> </tr> <tr> <td>Other Chemicals</td> <td>1</td> </tr> <tr> <td>Water</td> <td>0</td> </tr> <tr> <td>Self-Reaction</td> <td>0</td> </tr> </tbody> </table> <p>12.3 NFPA Hazard Classifications:</p> <table border="1"> <thead> <tr> <th>Category</th> <th>Classification</th> </tr> </thead> <tbody> <tr> <td>Health Hazard (Blue)</td> <td>2</td> </tr> <tr> <td>Flammability (Red)</td> <td>3</td> </tr> <tr> <td>Reactivity (Yellow)</td> <td>0</td> </tr> </tbody> </table>		Category	Rating	Fire	3	Health	0	Vapor Irritant	2	Liquid or Solid Irritant	2	Poisons	2	Water Pollution	0	Human Toxicity	1	Aquatic Toxicity	3	Aesthetic Effect	2	Reactivity	0	Other Chemicals	1	Water	0	Self-Reaction	0	Category	Classification	Health Hazard (Blue)	2	Flammability (Red)	3	Reactivity (Yellow)	0	<p>13. PHYSICAL AND CHEMICAL PROPERTIES</p> <p>13.1 Physical State at 15°C and 1 atm: Liquid</p> <p>13.2 Molecular Weight: 106.17</p> <p>13.3 Boiling Point at 1 atm: 177.2°F = 79.2°C = 40°C</p> <p>13.4 Freezing Point: -139°F = -95°C = 178°K</p> <p>13.5 Critical Temperature: 651.0°F = 343.9°C = 617.1°K</p> <p>13.6 Critical Pressure: 523 psia = 35.6 atm = 3.61 MN/m²</p> <p>13.7 Specific Gravity: 0.867 at 20°C (liquid)</p> <p>13.8 Liquid Surface Tension: 29.2 dyne/cm = 0.0292 N/m at 20°C</p> <p>13.9 Liquid-Water Interfacial Tension: 35.4 dyne/cm = 0.0354 N/m at 20°C</p> <p>13.10 Vapor (Gas) Specific Gravity: Not pertinent</p> <p>13.11 Ratio of Specific Heats of Vapor (Gas): 1.071</p> <p>13.12 Latent Heat of Vaporization: 144 Btu/lb = 80.1 cal/g = 3.35 × 10⁵ J/kg</p> <p>13.13 Heat of Combustion: = 17,760 Btu/lb = -9877 cal/g = -413.5 × 10³ J/kg</p> <p>13.14 Heat of Decomposition: Not pertinent</p> <p>13.15 Heat of Solution: Not pertinent</p> <p>13.16 Heat of Polymerization: Not pertinent</p>	
Category	Rating																																						
Fire	3																																						
Health	0																																						
Vapor Irritant	2																																						
Liquid or Solid Irritant	2																																						
Poisons	2																																						
Water Pollution	0																																						
Human Toxicity	1																																						
Aquatic Toxicity	3																																						
Aesthetic Effect	2																																						
Reactivity	0																																						
Other Chemicals	1																																						
Water	0																																						
Self-Reaction	0																																						
Category	Classification																																						
Health Hazard (Blue)	2																																						
Flammability (Red)	3																																						
Reactivity (Yellow)	0																																						
<p>NOTES</p>																																							

<p>Common Synonyms 1,3-Dimethylbenzene Xylol</p>	<p>Watery liquid</p>	<p>Colorless</p>	<p>Sweet odor</p>
<p>Fluoresces in water. Flammable, irritating vapor is produced.</p>			

Stop discharge if possible. Keep people away.
Call fire department.
Avoid contact with liquid and vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire	<p>FLAMMABLE Flashback along vapor trail may occur. Vapor may explode if ignited in an enclosed area. Wear self-contained breathing apparatus. Extinguish with foam, dry chemical, or carbon dioxide. Water may be ineffective on fire. Cool exposed containers with water.</p>
-------------	--

Exposure	<p>CALL FOR MEDICAL AID VAPOR Irritating to eyes, nose, and throat. If inhaled, will cause headache, difficult breathing, or loss of consciousness. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen. LIQUID Irritating to skin and eyes. If swallowed, will cause nausea, vomiting, or loss of consciousness. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk. DO NOT INDUCE VOMITING.</p>
-----------------	--

Water Pollution	<p>HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS Fouling to shoreline. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.</p>
------------------------	---

<p>1. RESPONSE TO DISCHARGE (See Response Methods Handbook, CG 446.4) Issue warning - high flammability. Evacuate area. Should be removed. Chemical and physical treatment.</p>
--

<p>2. LABEL</p> <div style="text-align: center;">  <p>Red</p> </div>
--

<p>3. CHEMICAL DESIGNATIONS</p> <p>3.1 Synonyms: 1,3-Dimethylbenzene Xylol</p> <p>3.2 Coast Guard Compatibility Classification: Aromatic hydrocarbon</p> <p>3.3 Chemical Formula: m-C₈H₁₀(CH₃)₂</p> <p>3.4 IMCO/United Nations Numerical Designation: 3.2/1307</p>

<p>4. OBSERVABLE CHARACTERISTICS</p> <p>4.1 Physical State (as shipped): Liquid</p> <p>4.2 Color: Colorless</p> <p>4.3 Odor: Like benzene, characteristic aromatic</p>
--

<p>5. HEALTH HAZARDS</p> <p>5.1 Personal Protective Equipment: Approved canister or air-supplied mask, goggles or face shield, plastic gloves and boots.</p> <p>5.2 Symptoms Following Exposure: Vapors cause headache and dizziness. Liquid irritates eyes and skin. If taken into lungs, causes severe coughing, distress, and rapidly developing pulmonary edema. If ingested, causes nausea, vomiting, cramps, headache, and coma; can be fatal. Kidney and liver damage can occur.</p> <p>5.3 Treatment for Exposure: INHALATION: remove to fresh air, administer artificial respiration and oxygen if required; call a doctor. INGESTION: do NOT induce vomiting; call a doctor. EYES: flush with water for at least 15 min. SKIN: wipe off, wash with soap and water.</p> <p>5.4 Toxicity by Inhalation (Threshold Limit Value): 100 ppm</p> <p>5.5 Short-Term Inhalation Limits: 300 ppm for 30 min</p> <p>5.6 Toxicity by Ingestion: Grade 3; LD₅₀ 50 to 500 g/kg</p> <p>5.7 Late Toxicity: Kidney and liver damage</p> <p>5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.</p> <p>5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.</p> <p>5.10 Odor Threshold: 0.05 ppm</p>
--

<p>6. FIRE HAZARDS</p> <p>6.1 Flash Point: 84°F (30°C)</p> <p>6.2 Flammable Limits in Air: 1.1% - 7.0%</p> <p>6.3 Fire Extinguishing Agents: Not pertinent</p> <p>6.4 Fire Extinguishing Agents Not to Be Used: Water may be ineffective.</p> <p>6.5 Special Hazards of Combustion Products: Not pertinent</p> <p>6.6 Behavior in Fire: Vapors heavier than air and may travel considerable distances to a source of ignition (22)(23)(24)</p> <p>6.7 Ignition Temperature: 550°F</p> <p>6.8 Electrical Hazard: Not pertinent</p> <p>6.9 Burning Rate: Not pertinent</p>
--

<p>8. WATER POLLUTION</p> <p>8.1 Aquatic Toxicity: Not pertinent</p> <p>8.2 Water-fowl Toxicity: Not pertinent</p> <p>8.3 Biological Oxygen Demand (BOD): 0.06 lbs/day/100 lbs (0.0001)</p> <p>8.4 Food Chain Concentration Potential: Data not available</p>
--

<p>7. CHEMICAL REACTIVITY</p> <p>7.1 Reactivity with Water: No reaction</p> <p>7.2 Reactivity with Common Materials: No reaction</p> <p>7.3 Stability During Transport: Stable</p> <p>7.4 Neutralizing Agents for Acids and Caustics: Not pertinent</p> <p>7.5 Polymerization: Not pertinent</p> <p>7.6 Inhibitor of Polymerization: Not pertinent</p>

<p>9. SELECTED MANUFACTURERS</p> <p>1. ABC Chemicals 200 South Broad St. Philadelphia, PA 19102</p> <p>2. Chemicals International 1000 Chemical Building 299 Bay St. San Francisco, CA 94111</p> <p>3. Elex Chemical Corp. 460 Park Ave. New York, N.Y. 10017</p>
--

<p>11. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook, CG 446.3) A 1 1</p>

<p>10. SHIPPING INFORMATION</p> <p>10.1 Grades or Purity: Not pertinent Purity: 99.9% (1.0% min)</p> <p>10.2 Storage Temperature: Ambient</p> <p>10.3 Inert Atmosphere: No requirement</p> <p>10.4 Venting: Open flame, restera, or pressure/vacuum</p>
--

<p>12. HAZARD CLASSIFICATIONS</p> <p>12.1 Code of Federal Regulations: Flammable liquid</p> <p>12.2 NAS Hazard Rating for Bulk Water Transportation:</p> <table border="1"> <thead> <tr> <th>Category</th> <th>Rating</th> </tr> </thead> <tbody> <tr> <td>Fire</td> <td>3</td> </tr> <tr> <td>Health</td> <td></td> </tr> <tr> <td>Vapor Irritant</td> <td>1</td> </tr> <tr> <td>Liquid or Solid Irritant</td> <td>1</td> </tr> <tr> <td>Poisons</td> <td>2</td> </tr> <tr> <td>Water Pollution</td> <td></td> </tr> <tr> <td>Human Toxicity</td> <td>1</td> </tr> <tr> <td>Aquatic Toxicity</td> <td>3</td> </tr> <tr> <td>Aesthetic Effect</td> <td>2</td> </tr> <tr> <td>Reactivity</td> <td></td> </tr> <tr> <td>Other Chemicals</td> <td>1</td> </tr> <tr> <td>Water</td> <td>0</td> </tr> <tr> <td>Self-Reaction</td> <td>0</td> </tr> </tbody> </table> <p>12.3 NFPA Hazard Classifications:</p> <table border="1"> <thead> <tr> <th>Category</th> <th>Classification</th> </tr> </thead> <tbody> <tr> <td>Health Hazard (Blue)</td> <td>2</td> </tr> <tr> <td>Flammability (Red)</td> <td>3</td> </tr> <tr> <td>Reactivity (Yellow)</td> <td>0</td> </tr> </tbody> </table>	Category	Rating	Fire	3	Health		Vapor Irritant	1	Liquid or Solid Irritant	1	Poisons	2	Water Pollution		Human Toxicity	1	Aquatic Toxicity	3	Aesthetic Effect	2	Reactivity		Other Chemicals	1	Water	0	Self-Reaction	0	Category	Classification	Health Hazard (Blue)	2	Flammability (Red)	3	Reactivity (Yellow)	0
Category	Rating																																			
Fire	3																																			
Health																																				
Vapor Irritant	1																																			
Liquid or Solid Irritant	1																																			
Poisons	2																																			
Water Pollution																																				
Human Toxicity	1																																			
Aquatic Toxicity	3																																			
Aesthetic Effect	2																																			
Reactivity																																				
Other Chemicals	1																																			
Water	0																																			
Self-Reaction	0																																			
Category	Classification																																			
Health Hazard (Blue)	2																																			
Flammability (Red)	3																																			
Reactivity (Yellow)	0																																			

<p>13. PHYSICAL AND CHEMICAL PROPERTIES</p> <p>13.1 Physical State at 15°C and 1 atm: Liquid</p> <p>13.2 Molecular Weight: 106.16</p> <p>13.3 Boiling Point at 1 atm: 269.4°F = 131.9°C = 405.1°K</p> <p>13.4 Freezing Point: -54.2°F = -47.9°C = 225.3°K</p> <p>13.5 Critical Temperature: 650.8°F = 343.8°C = 617.0°K</p> <p>13.6 Critical Pressure: 513.8 atm = 34.95 psia = 3,540 MN/m²</p> <p>13.7 Specific Gravity: 0.864 at 20°C (liquid)</p> <p>13.8 Liquid Surface Tension: 28.6 dynes/cm = 0.0286 N/m at 20°C</p> <p>13.9 Liquid-Water Interfacial Tension: 36.4 dynes/cm = 0.0364 N/m at 30°C</p> <p>13.10 Vapor (Gas) Specific Gravity: Not pertinent</p> <p>13.11 Ratio of Specific Heats of Vapor (Gas): 1.071</p> <p>13.12 Latent Heat of Vaporization: 147 Btu/lb = 31.9 cal/g = 1.33 × 10⁵ J/kg</p> <p>13.13 Heat of Combustion: -17,884 Btu/lb = -9752.4 cal/g = -40.31 × 10³ J/kg</p> <p>13.14 Heat of Decomposition: Not pertinent</p> <p>13.15 Heat of Solution: Not pertinent</p> <p>13.16 Heat of Polymerization: Not pertinent</p>
--

NOTES

Common Synonyms 1,2-Dimethylbenzene Xylo		Waters: liquid	Colorless	Sweet odor
Floats on water. Flammable; irritating vapor is produced.				
<p>Stop discharge if possible. Keep people away. Call fire department. Avoid contact with liquid and vapor. Isolate and remove discharged material. Notify local health and pollution control agencies.</p>				
Fire		<p>FLAMMABLE Flashback along vapor trail may occur. Vapor may explode if ignited in an enclosed area. Vapor self-ignites on burning apparatus. Extinguish with foam, dry chemical, or carbon dioxide. Water may be ineffective on fire. Cool exposed containers with water.</p>		
Exposure		<p>CALL FOR MEDICAL AID VAPOR Irritating to eyes, nose and throat. If inhaled, will cause headache, difficult breathing, or loss of consciousness. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen. LIQUID Irritating to skin and eyes. If swallowed, will cause nausea, vomiting, or loss of consciousness. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. If EYES: hold eyelids open and flush with plenty of water. If SWALLOWED and victim is CONSCIOUS, have victim drink water or milk. DO NOT INDUCE VOMITING.</p>		
Water Pollution		<p>Dangerous to aquatic life in high concentrations. Floating to shoreline. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.</p>		
<p>1. RESPONSE TO DISCHARGE (See Response Methods Handbook, CG 444, 4.) Evacuate area. Should be removed. Chemical and physical treatment.</p>		<p>2. LABEL</p> 		
<p>3. CHEMICAL DESIGNATIONS 3.1 Synonyms: 1,2-Dimethylbenzene 3.2 Coast Guard Compatibility Classification: Aromatic hydrocarbon 3.3 Chemical Formula: C_8H_{10} 3.4 IMCO/United Nations Numerical Designation: 3.2/1307</p>		<p>4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless 4.3 Odor: Benzene-like, characteristic aromatic</p>		
<p>5. HEALTH HAZARDS</p> <p>5.1 Personal Protective Equipment: Approved canister or air-supplied mask, goggles or face shield, plastic gloves and boots.</p> <p>5.2 Symptoms Following Exposure: Vapors cause headache and dizziness. Liquid irritates eyes and skin. If taken into lungs, causes severe coughing, distress, and rapidly developing pulmonary edema. If ingested, causes nausea, vomiting, cramps, headache, and coma. Can be fatal. Kidney and liver damage can occur.</p> <p>5.3 Treatment for Exposure: INHALATION: remove to fresh air, administer artificial respiration and oxygen if required; call a doctor. INGESTION: do NOT induce vomiting; call a doctor. EYES: flush with water for at least 15 min. SKIN: wipe off, wash with soap and water.</p> <p>5.4 Toxicity by Inhalation (Threshold Limit Value): 100 ppm</p> <p>5.5 Short-Term Inhalation Limits: 300 ppm for 30 min</p> <p>5.6 Toxicity by Ingestion: Grade 3.1 D₅₀ 50 to 500 mg/kg</p> <p>5.7 Late Toxicity: Kidney and liver damage.</p> <p>5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.</p> <p>5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.</p> <p>5.10 Odor Threshold: 0.05 ppm</p>				

<p>6. FIRE HAZARDS</p> <p>6.1 Flash Point: 23°C (73°F) (C)</p> <p>6.2 Flammable Limits in Air: 1.1% (L); 7.6% (U)</p> <p>6.3 Fire Extinguishing Agents Not to be Used: Water (may intensify)</p> <p>6.4 Special Hazards of Combustion Products: None</p> <p>6.5 Behavior in Fire: Vapor is heavier than air and may collect in low areas; distillates may be present in some materials being burned.</p> <p>6.6 Ignition Temperature: 250°C</p> <p>6.7 Electrical Hazard: Not pertinent</p> <p>6.8 Burning Rate:</p>		<p>8. WATER POLLUTION</p> <p>8.1 Aquatic Toxicity: Not pertinent</p> <p>8.2 Waterfowl Toxicity: 1%</p> <p>8.3 Biological Oxygen Demand (BOD): 0.00% (at 20°C, 5-day incubation)</p> <p>8.4 Food Chain Concentration Potential: Data not available</p>																																					
<p>7. CHEMICAL REACTIVITY</p> <p>7.1 Reactivity with Water: No reaction</p> <p>7.2 Reactivity with Common Materials: No reaction</p> <p>7.3 Stability During Transport: Stable</p> <p>7.4 Neutralizing Agents for Acids and Caustics: Not pertinent</p> <p>7.5 Polymerization: Not pertinent</p> <p>7.6 Inhibitor of Polymerization: Not pertinent</p>		<p>9. SELECTED MANUFACTURERS</p> <p>1. American Alcolac Co. ARCOC Chemical Co., Division 700 North Howard St. Philadelphia, Pa. 19106</p> <p>2. Celanese Chemical Co., Inc. Petroleum Products Division 60 Wall St. New York, N.Y. 10005</p> <p>3. Shell Chemical Co. Petroleum Products Division Houston, Tex. 77001</p>																																					
<p>11. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook, CG 444, 3.) A 1.1</p>		<p>10. SHIPPING INFORMATION</p> <p>10.1 Grades or Purity: Research 99.99% Pure 99.7% Commercial 99.5%</p> <p>10.2 Storage Temperature: Ambient</p> <p>10.3 Inert Atmosphere: Not required</p> <p>10.4 Venting: Open flame arrester or pressure vacuum</p>																																					
<p>12. HAZARD CLASSIFICATIONS</p> <p>12.1 Code of Federal Regulations: Flammable liquid</p> <p>12.2 NAS Hazard Rating for Bulk Water Transportation:</p> <table border="1"> <thead> <tr> <th>Category</th> <th>Rating</th> </tr> </thead> <tbody> <tr> <td>Fire</td> <td>3</td> </tr> <tr> <td>Health</td> <td></td> </tr> <tr> <td>Vapor Irritant</td> <td>1</td> </tr> <tr> <td>Liquid or Solid Irritant</td> <td>1</td> </tr> <tr> <td>Poison</td> <td>2</td> </tr> <tr> <td>Water Pollution</td> <td></td> </tr> <tr> <td>Human Toxicity</td> <td>1</td> </tr> <tr> <td>Aquatic Toxicity</td> <td>3</td> </tr> <tr> <td>Aesthetic Effect</td> <td>2</td> </tr> <tr> <td>Reactivity</td> <td></td> </tr> <tr> <td>Other Chemicals</td> <td>1</td> </tr> <tr> <td>Water</td> <td>0</td> </tr> <tr> <td>Self-Reaction</td> <td>0</td> </tr> </tbody> </table> <p>12.3 NFPA Hazard Classifications:</p> <table border="1"> <thead> <tr> <th>Category</th> <th>Classification</th> </tr> </thead> <tbody> <tr> <td>Health Hazard (Blue)</td> <td>2</td> </tr> <tr> <td>Flammability (Red)</td> <td>3</td> </tr> <tr> <td>Reactivity (Yellow)</td> <td>0</td> </tr> </tbody> </table>		Category	Rating	Fire	3	Health		Vapor Irritant	1	Liquid or Solid Irritant	1	Poison	2	Water Pollution		Human Toxicity	1	Aquatic Toxicity	3	Aesthetic Effect	2	Reactivity		Other Chemicals	1	Water	0	Self-Reaction	0	Category	Classification	Health Hazard (Blue)	2	Flammability (Red)	3	Reactivity (Yellow)	0	<p>13. PHYSICAL AND CHEMICAL PROPERTIES</p> <p>13.1 Physical State at 15°C and 1 atm: Liquid</p> <p>13.2 Molecular Weight: 106.16</p> <p>13.3 Boiling Point at 1 atm: 291.9°F = 144.4°C = 417.6°K</p> <p>13.4 Freezing Point: -13.3°F = -25.2°C = 248.0°K</p> <p>13.5 Critical Temperature: 674.5°F = 357.5°C = 630.7°K</p> <p>13.6 Critical Pressure: 541.5 atm = 36.84 psia = 3.732 MN/m²</p> <p>13.7 Specific Gravity: 0.880 at 20°C (liquid)</p> <p>13.8 Liquid Surface Tension: 30.53 dynes/cm = 0.03053 N/m at 15°C</p> <p>13.9 Liquid-Water Interfacial Tension: 36.06 dynes/cm = 0.03606 N/m at 20°C</p> <p>13.10 Vapor (Gas) Specific Gravity: Not pertinent</p> <p>13.11 Ratio of Specific Heats of Vapor (Gas): 1.068</p> <p>13.12 Latent Heat of Vaporization: 149 Btu/lb = 82.9 cal/g = 347 × 10³ J/kg</p> <p>13.13 Heat of Combustion: -17,558 Btu/lb = -9754.7 cal/g = -408.41 × 10³ J/kg</p> <p>13.14 Heat of Decomposition: Not pertinent</p> <p>13.15 Heat of Solution: Not pertinent</p> <p>13.16 Heat of Polymerization: Not pertinent</p>	
Category	Rating																																						
Fire	3																																						
Health																																							
Vapor Irritant	1																																						
Liquid or Solid Irritant	1																																						
Poison	2																																						
Water Pollution																																							
Human Toxicity	1																																						
Aquatic Toxicity	3																																						
Aesthetic Effect	2																																						
Reactivity																																							
Other Chemicals	1																																						
Water	0																																						
Self-Reaction	0																																						
Category	Classification																																						
Health Hazard (Blue)	2																																						
Flammability (Red)	3																																						
Reactivity (Yellow)	0																																						
<p>NOTES</p>																																							

<p>Common Synonyms 1,4-Dimethylbenzene Xylol</p>		Watery liquid	Colorless	Sweet odor																																				
<p>Stop discharge if possible. Keep people away. Call fire department. Avoid contact with liquid and vapor. Isolate and remove discharged material. Notify local health and pollution control agencies.</p>																																								
Fire	<p>FLAMMABLE Flashback along vapor trail may occur. Vapor may explode if confined in an enclosed area. Wear self-contained breathing apparatus. Extinguish with foam, dry chemical, or carbon dioxide. Water may be ineffective on fire. Cool exposed containers with water.</p>																																							
Exposure	<p>CALL FOR MEDICAL AID</p> <p>VAPOR Irritating to eyes, nose and throat. If inhaled, will cause dizziness, difficult breathing, or loss of consciousness. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen.</p> <p>LIQUID Irritating to skin and eyes. If swallowed, will cause nausea, vomiting, loss of consciousness. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES: hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS: have victim drink water or milk. DO NOT INDUCE VOMITING.</p>																																							
Water Pollution	<p>HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS. Fouling to shoreline. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.</p>																																							
<p>1. RESPONSE TO DISCHARGE (See Response Methods Handbook, CG 446.4) Issue warning - high flammability. Evacuate area. Should be removed. Chemical and physical treatment.</p>		<p>2. LABEL</p>  <p>Red</p>																																						
<p>3. CHEMICAL DESIGNATIONS</p> <p>3.1 Synonyms: 1,4-Dimethylbenzene 3.2 Coast Guard Compatibility Classification: Aromatic hydrocarbon 3.3 Chemical Formula: p-C₆H₄(CH₃)₂ 3.4 IMCO/United Nations Numerical Designation: 32/1307</p>		<p>4. OBSERVABLE CHARACTERISTICS</p> <p>4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless 4.3 Odor: Like benzene, characteristic aromatic</p>																																						
<p>5. HEALTH HAZARDS</p> <p>5.1 Personal Protective Equipment: Approved canister or air-supplied mask, goggles or face shield, plastic gloves and boots. 5.2 Symptoms Following Exposure: Vapors cause headache and dizziness. Liquid irritates eyes and skin. If taken into lungs, causes severe coughing, distress, and rapidly developing pulmonary edema. If ingested, causes nausea, vomiting, cramps, headache, and coma. Can be fatal. Kidney and liver damage can occur. 5.3 Treatment for Exposure: INHALATION: remove to fresh air, administer artificial respiration and oxygen if required, call a doctor. INGESTION: do NOT induce vomiting, call a doctor. EYES: flush with water for at least 15 min. SKIN: wipe off, wash with soap and water. 5.4 Toxicity by Inhalation (Threshold Limit Value): 100 ppm 5.5 Short-Term Inhalation Limits: 300 ppm for 30 min 5.6 Toxicity by Ingestion: Grade 3.1 D₅₀ 50 to 500 mg/kg 5.7 Late Toxicity: Kidney and liver damage. 5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary. 5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin. 5.10 Odor Threshold: 0.05 ppm</p>																																								
<p>6. FIRE HAZARDS</p> <p>6.1 Flash Point: 41°F (5°C) 6.2 Flammable Limits in Air: 1.1% (lower) - 7.0% (upper) 6.3 Extinguishing Agents: foam, dry chemical, carbon dioxide 6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective. 6.5 Special Hazards of Combustion Products: Not pertinent. 6.6 Behavior in Fire: Vapor is heavier than air and may travel considerable distance, a source of ignition and flash-back. 6.7 Ignition Temperature: 870°F 6.8 Electrical Hazard: Class I, Group D 6.9 Burning Rate: 5.5 mm/min</p>																																								
<p>7. CHEMICAL REACTIVITY</p> <p>7.1 Reactivity with Water: No reaction. 7.2 Reactivity with Common Materials: No reaction. 7.3 Stability During Transport: Stable. 7.4 Neutralizing Agents for Acids and Caustics: Not pertinent. 7.5 Polymerization: Not pertinent. 7.6 Inhibitor of Polymerization: Not pertinent.</p>																																								
<p>8. WATER POLLUTION</p> <p>8.1 Aquatic Toxicity: Data not available. 8.2 Biological Oxygen Demand (BOD): 0 lb/lb in 5 days. 8.3 Food Chain Concentration Potential: Data not available.</p>																																								
<p>9. SELECTED MANUFACTURERS</p> <p>1. Amoco Chemicals Corp. 130 East Randolph Drive Chicago, Ill. 60601 2. API Chemical Co. 200 South Broad St. Philadelphia, Pa. 19101 3. Chevron Chemical Co. Industrial Chemicals Division 200 Bush St. San Francisco, Calif. 94102</p>																																								
<p>10. SHIPPING INFORMATION</p> <p>10.1 Grades or Purity: Research 99.99% Pure 99.8%; Technical 99.0% 10.2 Storage Temperature: Ambient 10.3 Inert Atmosphere: No requirement 10.4 Venting: Open (flame arrester), or pressure/vacuum</p>																																								
<p>11. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook, CG 446.3) A-T-U</p>																																								
<p>12. HAZARD CLASSIFICATIONS</p> <p>12.1 Code of Federal Regulations: Flammable liquid 12.2 NAS Hazard Rating for Bulk Water Transportation:</p> <table border="1"> <thead> <tr> <th>Category</th> <th>Rating</th> </tr> </thead> <tbody> <tr> <td>Fire</td> <td>3</td> </tr> <tr> <td>Health</td> <td>1</td> </tr> <tr> <td>Vapor Irritant</td> <td>1</td> </tr> <tr> <td>Liquid or Solid Irritant</td> <td>1</td> </tr> <tr> <td>Poisons</td> <td>2</td> </tr> <tr> <td>Water Pollution</td> <td>1</td> </tr> <tr> <td>Human Toxicity</td> <td>1</td> </tr> <tr> <td>Aquatic Toxicity</td> <td>3</td> </tr> <tr> <td>Aesthetic Effect</td> <td>2</td> </tr> <tr> <td>Reactivity</td> <td>1</td> </tr> <tr> <td>Other Chemicals</td> <td>1</td> </tr> <tr> <td>Water</td> <td>0</td> </tr> <tr> <td>Self-Reaction</td> <td>0</td> </tr> </tbody> </table> <p>12.3 NFPA Hazard Classifications:</p> <table border="1"> <thead> <tr> <th>Category</th> <th>Classification</th> </tr> </thead> <tbody> <tr> <td>Health Hazard (Blue)</td> <td>2</td> </tr> <tr> <td>Flammability (Red)</td> <td>3</td> </tr> <tr> <td>Reactivity (Yellow)</td> <td>0</td> </tr> </tbody> </table>					Category	Rating	Fire	3	Health	1	Vapor Irritant	1	Liquid or Solid Irritant	1	Poisons	2	Water Pollution	1	Human Toxicity	1	Aquatic Toxicity	3	Aesthetic Effect	2	Reactivity	1	Other Chemicals	1	Water	0	Self-Reaction	0	Category	Classification	Health Hazard (Blue)	2	Flammability (Red)	3	Reactivity (Yellow)	0
Category	Rating																																							
Fire	3																																							
Health	1																																							
Vapor Irritant	1																																							
Liquid or Solid Irritant	1																																							
Poisons	2																																							
Water Pollution	1																																							
Human Toxicity	1																																							
Aquatic Toxicity	3																																							
Aesthetic Effect	2																																							
Reactivity	1																																							
Other Chemicals	1																																							
Water	0																																							
Self-Reaction	0																																							
Category	Classification																																							
Health Hazard (Blue)	2																																							
Flammability (Red)	3																																							
Reactivity (Yellow)	0																																							
<p>13. PHYSICAL AND CHEMICAL PROPERTIES</p> <p>13.1 Physical State at 15°C and 1 atm: Liquid 13.2 Molecular Weight: 106.16 13.3 Boiling Point at 1 atm: 280.9°F = 138.3°C = 411.5°K 13.4 Freezing Point: 55.9°F = 13.3°C = 286.5°K 13.5 Critical Temperature: 649.4°F = 343.0°C = 616.2°K 13.6 Critical Pressure: 509.4 atm = 34.65 psia = 3.510 MN/m² 13.7 Specific Gravity: 0.861 at 20°C (liquid) 13.8 Liquid Surface Tension: 28.3 dynes/cm = 0.0283 N/m at 20°C 13.9 Liquid-Water Interfacial Tension: 37.8 dynes/cm = 0.0378 N/m at 20°C 13.10 Vapor (Gas) Specific Gravity: Not pertinent. 13.11 Ratio of Specific Heats of Vapor (Gas): 1.071 13.12 Latent Heat of Vaporization: 150 Btu/lb = 81 cal/g = 3.4 × 10⁷ J/kg 13.13 Heat of Combustion: -17,559 Btu/lb = -9754.7 cal/g = -408.41 × 10³ J/kg 13.14 Heat of Decomposition: Not pertinent 13.15 Heat of Solution: Not pertinent 13.16 Heat of Polymerization: Not pertinent</p>																																								
<p>NOTES</p>																																								

DOD Hazardous Materials Information System
DoD 6050.5-LR
AS OF May 1994
Proprietary Version - For U.S. Government Use Only

FSC: 6830
NIIN: 006600026
Manufacturer's CAGE: 36346
Part No. Indicator: A
Part Number/Trade Name: HELIUM, (CRYOGENIC LIQUID)

=====
General Information
=====

Item Name: HELIUM (CRYOGENIC LIQUID)
Manufacturer's Name: UNION CARBIDE CORPORATION
Manufacturer's Street: 39 OLD RIDGEBURY ROAD
Manufacturer's P. O. Box: NA
Manufacturer's City: DANBURY
Manufacturer's State: CT
Manufacturer's Country: US
Manufacturer's Zip Code: 06817-0001
Manufacturer's Emerg Ph #: 1-800-822-4357 CANADA 514-640-6400
Manufacturer's Info Ph #: ROUTINE INFO CONTACT LOCAL SUPPLIER
Distributor/Vendor # 1: HAMPTON ROADS WELDERS SUPPLY CO., INC.
Distributor/Vendor # 1 Cage: 7D711
Distributor/Vendor # 2:
Distributor/Vendor # 2 Cage:
Distributor/Vendor # 3:
Distributor/Vendor # 3 Cage:
Distributor/Vendor # 4:
Distributor/Vendor # 4 Cage:
Safety Data Action Code:
Safety Focal Point: G
Record No. For Safety Entry: 011
Total Safety Entries This Stk#: 014
Status:
Date MSDS Prepared: 19JUN89
Safety Data Review Date: 21NOV89
Supply Item Manager: GSA
MSDS Preparer's Name: NK
Preparer's Company: UNION CARBIDE CORPORATION
Preparer's St Or P. O. Box: 39 OLD RIDGEBURY ROAD
Preparer's City: DANBURY
Preparer's State: CT
Preparer's Zip Code: 06817-0001
Other MSDS Number:
MSDS Serial Number: BHDRZ
Specification Number: NK
Spec Type, Grade, Class: NK
Hazard Characteristic Code:
Unit Of Issue: CY
Unit Of Issue Container Qty: 1 CY
Type Of Container: METAL
Net Unit Weight: NK
ARC/State License Number: NK
Net Explosive Weight: NK
Net Propellant Weight-Ammo: NK
Coast Guard Ammunition Code: NK

HELIUM CONT'D

=====
Ingredients/Identity Information
=====

Proprietary: NO
Ingredient: HELIUM
Ingredient Sequence Number: 01
Percent: 100
Ingredient Action Code:
Ingredient Focal Point: G
MSH (RTECS) Number: NH6520000
CAS Number: 7440-59-7
OSHA PEL: NONE ESTABLISHED
AUGIH TLV: NONE ESTABLISHED
Other Recommended Limit: NK

=====
Physical/Chemical Characteristics
=====

Appearance And Odor: COLORLESS, ODORLESS LIQUID
Boiling Point: -268.9C
Melting Point: NK
Vapor Pressure (MM Hg/70 F): GAS @ 20C
Vapor Density (Air=1): 0.138@ 21C
Specific Gravity: 0.147 @ -270.8C
Decomposition Temperature: NK
Evaporation Rate And Ref: HIGH @ BUTYL ACETATE
Solubility In Water: NEGLIGIBLE
Percent Volatiles By Volume: 100
Viscosity: NK
pH: NK
Radioactivity: NK
Form (Radioactive Matl): NK
Magnetism (Milligauss): NK
Corrosion Rate (IPY): NK
Autoignition Temperature: NK

=====
Fire and Explosion Hazard Data
=====

Flash Point: N/A
Flash Point Method: N/A
Lower Explosive Limit: N/A
Upper Explosive Limit: N/A
Extinguishing Media: HELIUM CANNOT CATCH FIRE. USE MEDIA APPROPRIATE FOR SURROUNDING FIRE.
Special Fire Fighting Proc: EVAC ALL PER FM DANGER AREA. IMMED DELUGE CONT'S W/WATER SPRAY FM MAX DIST UNTIL COOL/MOVE CONT'S AWAY FM FIRE AREA IF W/O RISK. DO NOT DISCHARGE WATER INTO HEL.
Usual Fire And Expl Hazrds: CLOSED CONT MAY RUPTURE FM FIRE HEAT. TO PREV IGNITION OF GREASE/OIL/OTHER COM- BUSTIBLE MATLS ON LIQ HELIUM SUR, AIR CONDENSATION S/B KEPT FREE OF THESE MATLS.

=====
Reactivity Data
=====

Stability: YES
Cond To Avoid (Stability): OBTAIN/EVALUATE SAFETY INFO FOR EACH COMPONENT BEFORE MIXING LIQUID HELIUM AND OTHER LIQUIFIED GASES.
Materials To Avoid: NONE CURRENTLY KNOWN.
Hazardous Decomp Products: NONE

HELIUM CONT'D

Hazardous Poly Occur: NO
Conditions To Avoid (Poly): NONE CURRENTLY KNOWN.

Health Hazard Data

ID50-LC50 Mixture: NK
Route Of Entry - Inhalation: YES
Route Of Entry - Skin: NO
Route Of Entry - Ingestion: NO
Health Haz Acute And Chronic: SWALLOWING: FROSTBITE OF THE LIPS AND MOUTH
MAY RESULT FROM CONTACT WITH LIQUID INHALATION: ASPHYXIANT. MODERATE
CONCENTRATIONS MAY CAUSE HEADACHE/DROWSINESS/ DIZZINESS/EXCITATION/EXCESS
SALIVATION/VOMITING/UNCONSCIOUSNESS. SKIN: LIQUID MAY CAUSE FROSTBITE.
EYES: LIQUID MAY CAUSE FROSTBITE.
Carcinogenicity - NTP: NO
Carcinogenicity - IARC: NO
Carcinogenicity - OSHA: NO
Explanation Carcinogenicity: NK
Signs/Symptoms Of Overexp: HELIUM IS AN ASPHYXIANT. LACK OF OXYGEN CAN
CAUSE DEATH.
Med Cond Aggravated By Exp: A KNOWLEDGE OF THE AVAILABLE TOXICOLOGY
INFORMA- TION AND OF THE PHYSICAL AND CHEMICAL PROPERTIES OF THE MATERIAL
SUGGEST THAT OVEREXPOSURE IS UN- LIKELY TO AGGRAVATE EXISTING MEDICAL
CONDITIONS.
Emergency/First Aid Proc: SWALLOWING: PROD A GAS AT NORMAL TEMP/ PRESSURE.
SKIN: FOR EXPOSURE TO LIQ, IMME-DIATELY WARM FROSTBITE AREA W/ WARM WATER
(NOT TO EXCEED 105F). WITH MASSIVE EXPORREMOVE CLOTHING WHILE SHOWERING
W/ WARM WATER. GET MED ATTN. INHALATION: REMOVE TO FRESH AIR. GIVE CPR IF
NOT BREATHING. GIVE OXYGEN IF BREATHING IS DIFFICULT. GET MED ATTN. EYES:
FLUSH THOROUGHLY W/WATER FOR 15 MIN. SEE A PHYSICIAN.

Precautions for Safe Handling and Use

Steps If Matl Released/Spill: EVAC ALL PERSONNEL FM DANGER AREA. ALLOW
SPILLED LIQ TO EVAP. SHUT OFF LEAK IF W/O RISK. MOVE LEAK-ING ASSEMBLY TO
VENT'D AREA OR VENTI AREA OF LEAK.USE SELF-CONTAINED BREATHING APPAR WHERE
NEEDED. TEST AREA FOR SUFF OXY PRIOR TO PERMIT'G RE-ENTRY.
Neutralizing Agent: NK
Waste Disposal Method: DISCARD ANY PRODUCT, RESIDUE, DISPOSABLE
CONTAINEROR LINER IN AN ENVIRONMENTALLY ACCEPTABLE MANNER IN FULL
COMPLIANCE WITH FEDERAL, STATE AND LOCAL REGULATIONS.
Precautions-Handling/Storing: CONTACT W/LIQ/COLD GAS-SEVERE FROSTBITE.
VAPOR- SUFFOCATION. DO NOT STRIKE ARC/GROUND ON CONT'ER. CLOSE VALVE W/ NOT
IN USE/EMPTY. PROTECT FM DAMAGE.
Other Precautions: NEVER WORK ON A PRESSURIZED SYSTEM. IF THERE IS A LEAK,
CLOSE THE CYLINDER VALVE, BLOW DOWN THE SYSTEM BY VENTING TO A SAFE PLACE,
THEN REPAIR THE LEAK. USE PIPING/EQUIP DESIGNED TO WITHSTAND PRESS/TEMPS.
STORE/USE W/ADEQUATE VENTIL.

Control Measures

Respiratory Protection: SELECT IN ACCORDANCE WITH OSHA 29 CFR 19140.134.
RESPIRATORS SHALL BE ACCEPTABLETO MSHA AND NIOSH.
Ventilation: LOCAL EXHAUST-PREFERRED. MECHANICAL (GENERAL)-ADEQUATE.
SPECIAL-NOT APPLICABLE. OTHER-NOT APPLICABLE.
Protective Gloves: LOOSE FITTING CRYOGENIC GLOVES.
Eye Protection: SELECT IAW OSHA 29 CFR 1910.133.

HXX

HYDROGEN, LIQUEFIED

Common Synonyms Liquid hydrogen		Liquefied compressed gas Colorless Odorless
Floats and boils on water. Flammable visible vapor cloud is produced.		
Shut off ignition sources. Call fire department. Avoid contact with liquid. Keep people away. Stop discharge if possible. Stay upwind. Use water spray to "knock down" vapor.		
Fire	FLAMMABLE Flame is almost invisible. Flashback along vapor trail may occur. Vapor may explode if ignited in an enclosed area. Evacuate surrounding area. Stop flow of gas if possible. Cool exposed containers and protect men effecting shutoff with water.	
Exposure	VAPOR If inhaled in high concentrations will cause difficult breathing, or loss of consciousness. Move victim to fresh air. If breathing has stopped, give artificial respiration.	
	LIQUID Will cause frostbite. Flush affected areas with plenty of water. DO NOT RUB AFFECTED AREAS.	
Water Pollution	Not harmful to aquatic life	
1. RESPONSE TO DISCHARGE <small>(See Response Methods Handbook CG 446 4)</small> Issue warning - high flammability. Restrict access. Evacuate area.		2. LABEL  Red
3. CHEMICAL DESIGNATIONS 3.1 Synonyms: Liquid hydrogen para Hydrogen 3.2 Coast Guard Competibility Classification: Not applicable. 3.3 Chemical Formula: H ₂ 3.4 IMCO/United Nations Numerical Designation: 2.1966.		4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless 4.3 Odor: None
5. HEALTH HAZARDS 5.1 Personal Protective Equipment: Safety goggles or face shield, insulated gloves and long sleeves, cuffless trousers with no side pockets, or over high top shoes to shed spilled liquid, self contained breathing apparatus for confined and oxygen deficient areas. 5.2 Symptoms Following Exposure: If atmosphere does not contain enough oxygen, inhalation can cause dizziness, unconsciousness, or even death. Contacted liquid with eyes or skin causes freezing similar to a burn. 5.3 Treatment for Exposure: If low level of exposure to liquid hydrogen is that caused by its unusually low temperature and it when in a simple, splashant, INHALATION of victim is unconscious due to oxygen deficiency, move him to fresh air, and apply resuscitation method, if available. IF IN contact with the LIQUID, or if frostbite, seek lukewarm water, get medical attention if burn is severe. 5.4 Toxicity by Inhalation (Threshold Limit Value): None known, but can act as a simple		
5.6 Toxicity by Ingestion: Not pertinent - liquid is too cold to swallow. 5.7 Late Toxicity: None. 5.8 Vapor (Gas) Irritant Characteristics: None available. 5.9 Liquid or Solid Irritant Characteristics: Data not available. 5.10 Odor Threshold: Not pertinent.		

6. FIRE HAZARDS 6.1 Flash Point: Not pertinent. 6.2 Flammable Limits in Air: 4.0% - 75.0% 6.3 Fire Extinguishing Agents: Let fire burn, shut off gas supply. 6.4 Fire Extinguishing Agents Not to be Used: Carbon dioxide. 6.5 Special Hazards of Combustion Products: Not pertinent. 6.6 Behavior in Fire: Burns with an almost invisible flame. 6.7 Ignition Temperature: 1,065°F. 6.8 Electrical Hazard: Class I, Group B. 6.9 Burning Rate: 9.9 mm/min.		8. WATER POLLUTION 8.1 Aquatic Toxicity: None. 8.2 Waterfowl Toxicity: None. 8.3 Biological Oxygen Demand (BOD): None. 8.4 Food Chain Concentration Potential: None.									
7. CHEMICAL REACTIVITY 7.1 Reactivity with Water: Ambient temperature of water will cause vigorous vaporization of hydrogen. 7.2 Reactivity with Common Materials: No chemical reaction, but low temperature causes most materials to become very brittle. 7.3 Stability During Transport: Stable. 7.4 Neutralizing Agents for Acids and Caustics: Not pertinent. 7.5 Polymerization: Not pertinent. 7.6 Inhibitor of Polymerization: Not pertinent.		9. SELECTED MANUFACTURERS 1. Union Carbide Corporation Linde Division Morristown, N. J. 03057 2. Air Products and Chemicals, Inc. Specialty Gases Division P. O. Box 538 Allentown, Pa. 18105 3. Chemetron Corp. Industrial Gases Division 111 E. Wacker Drive Chicago, Ill. 60601.									
11. HAZARD ASSESSMENT CODE <small>(See Hazard Assessment Handbook CG 446 3)</small> A-B-C-D-E-F-G		10. SHIPPING INFORMATION 10.1 Grades or Purity: Commercial. 10.2 Storage Temperature: -414°F. 10.3 Inert Atmosphere: No requirement. 10.4 Venting: Safety relief.									
12. HAZARD CLASSIFICATIONS 12.1 Code of Federal Regulations: Flammable compressed gas. 12.2 NAS Hazard Rating for Bulk Water Transportation: Not listed. 12.3 NFPA Hazard Classifications: <table border="1"> <thead> <tr> <th>Category</th> <th>Classification</th> </tr> </thead> <tbody> <tr> <td>Health Hazard (Blue)</td> <td>0</td> </tr> <tr> <td>Flammability (Red)</td> <td>4</td> </tr> <tr> <td>Reactivity (Yellow)</td> <td>0</td> </tr> </tbody> </table>		Category	Classification	Health Hazard (Blue)	0	Flammability (Red)	4	Reactivity (Yellow)	0	13. PHYSICAL AND CHEMICAL PROPERTIES 13.1 Physical State at 15°C and 1 atm: Gas. 13.2 Molecular Weight: 2.0. 13.3 Boiling Point at 1 atm: -423°F = -253°C = 20°K. 13.4 Freezing Point: -434°F = -259°C = 14°K. 13.5 Critical Temperature: -400°F = -240°C = 33°K. 13.6 Critical Pressure: 188 psia = 12.8 atm = 1.30 MN/m ² . 13.7 Specific Gravity: 0.071 at -253°C (liquid). 13.8 Liquid Surface Tension: 2.3 dynes/cm = 0.023 N/m at -253°C. 13.9 Liquid-Water Interfacial Tension: Not pertinent. 13.10 Vapor (Gas) Specific Gravity: 0.067. 13.11 Ratio of Specific Heats of Vapor (Gas): 1.3962. 13.12 Latent Heat of Vaporization: 190.5 Btu/lb = 105.8 cal/g = 4.427 x 10 ³ J/kg. 13.13 Heat of Combustion: -50,080 Btu/lb = -27,823 cal/g = -114.1 x 10 ³ J/kg. 13.14 Heat of Decomposition: Not pertinent. 13.15 Heat of Solution: Not pertinent. 13.16 Heat of Polymerization: Not pertinent.	
Category	Classification										
Health Hazard (Blue)	0										
Flammability (Red)	4										
Reactivity (Yellow)	0										

<p>Common Synonyms</p> <p>Isopropanol 2-Propanol Dimethylcarbinol sec-Propyl alcohol Rubbing alcohol</p>		<p>Waterly liquid</p> <p>Colorless</p> <p>Unpleasant alcohol odor like rubbing alcohol</p>
<p>Floats and mixes with water. Flammable, irritating vapor is produced.</p>		
<p>Stop discharge if possible. Keep people away. Shut off ignition sources and call fire department. Stay upwind and use water spray to "knock down" vapor. Avoid contact with liquid and vapor. Isolate and remove discharged material. Notify local health and pollution control agencies.</p>		
Fire	<p>FLAMMABLE. Flashback along vapor trail may occur. Vapor may explode if ignited in an enclosed area. Extinguish with dry chemical, alcohol foam, or carbon dioxide. Water may be ineffective on fire. Cool exposed containers with water.</p>	
CALL FOR MEDICAL AID		
Exposure	<p>VAPOR Irritating to eyes, nose and throat. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen.</p> <p>LIQUID Irritating to eyes. Harmful if swallowed. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.</p>	
Water Pollution	<p>Dangerous to aquatic life in high concentrations. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.</p>	
<p>1. RESPONSE TO DISCHARGE (See Response Methods Handbook, CG 446.4.)</p> <p>Issue warning - high flammability. Disperse and flush.</p>		<p>2. LABEL</p> <div style="text-align: center;">  <p>Red</p> </div>
<p>3. CHEMICAL DESIGNATIONS</p> <p>3.1 Synonyms: Dimethylcarbinol 2-Propanol Isopropanol sec-Propyl alcohol Petrohol Rubbing alcohol</p> <p>3.2 Coast Guard Compatibility Classification: Alcohol</p> <p>3.3 Chemical Formula: CH₃CH(OH)CH₃</p> <p>3.4 IMCO/United Nations Numerical Designation: 3.2/1219</p>		<p>4. OBSERVABLE CHARACTERISTICS</p> <p>4.1 Physical State (as shipped): Liquid</p> <p>4.2 Color: Colorless</p> <p>4.3 Odor: Like ethyl alcohol, sharp, somewhat unpleasant, characteristic mild alcoholic, nonresidual</p>
5. HEALTH HAZARDS		
<p>5.1 Personal Protective Equipment: Organic vapor canister or air-supplied mask, chemical goggles or face splash shield</p> <p>5.2 Symptoms Following Exposure: Vapors cause mild irritation of eyes and upper respiratory tract, high concentrations may be anesthetic. Liquid irritates eyes and may cause injury, harmless to skin, if ingested causes drunkenness and vomiting</p> <p>5.3 Treatment for Exposure: INHALATION: if victim is overcome by vapors, remove from exposure immediately, call a physician, if breathing is irregular or has stopped, start resuscitation and administer oxygen. EYES: flush with water for at least 15 min.</p> <p>5.4 Toxicity by Inhalation (Threshold Limit Value): 400 ppm</p> <p>5.5 Short-Term Inhalation Limits: 400 ppm for 10 min.</p> <p>5.6 Toxicity by Ingestion: Grade I, LD₅₀ 5 to 15 g/kg (rat); LD₅₀ 5.84 g/kg</p> <p>5.7 Late Toxicity: Data not available</p> <p>5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary</p> <p>5.9 Liquid or Solid Irritant Characteristics: No appreciable hazard. Practically harmless to the skin</p> <p>5.10 Odor Threshold: 90 mg/m³</p>		

<p>6. FIRE HAZARDS</p> <p>6.1 Flash Point: 65°F (19°C) 55°F (14°C)</p> <p>6.2 Flammable Limits in Air: 2.3% - 12.7%</p> <p>6.3 Fire Extinguishing Agents: Alcohol foam, dry chemical, or carbon dioxide</p> <p>6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective</p> <p>6.5 Special Hazards of Combustion Products: Not pertinent</p> <p>6.6 Behavior in Fire: Not pertinent</p> <p>6.7 Ignition Temperature: 750°F</p> <p>6.8 Electrical Hazard: Class I, Group D</p> <p>6.9 Burning Rate: 2.0 in/min</p>		<p>8. WATER POLLUTION</p> <p>R.1 Aquatic Toxicity: 900-1000 ppm/24 hr/club (100% fish) Fresh water</p> <p>R.2 Waterfowl Toxicity: Data not available</p> <p>R.3 Biological Oxygen Demand (BOD): 1330 5 days</p> <p>R.4 Food Chain Concentration Potential: None</p>																																					
<p>7. CHEMICAL REACTIVITY</p> <p>7.1 Reactivity with Water: No reaction</p> <p>7.2 Reactivity with Common Materials: No reaction</p> <p>7.3 Stability During Transport: Stable</p> <p>7.4 Neutralizing Agents for Acids and Caustics: Not pertinent</p> <p>7.5 Polymerization: Not pertinent</p> <p>7.6 Inhibitor of Polymerization: Not pertinent</p>		<p>9. SELECTED MANUFACTURERS</p> <p>1. ARCO Chemical Co. 260 South Broad St. Philadelphia, Pa. 19101</p> <p>2. Shell Chemical Co. Industrial Chemical Division Houston, Tex. 77001</p> <p>3. Union Carbide Corp. Chemicals and Plastics Division 270 Park Ave. New York, N. Y. 10017</p>																																					
<p>11. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook, CG 446.3.)</p> <p>A-P-Q-R-S</p>		<p>10. SHIPPING INFORMATION</p> <p>10.1 Grades or Purity: 91% 95% Anhydrous</p> <p>10.2 Storage Temperature: Ambient</p> <p>10.3 Inert Atmosphere: No requirement</p> <p>10.4 Venting: Open (flame arresters or pressure vacuum)</p>																																					
<p>12. HAZARD CLASSIFICATIONS</p> <p>12.1 Code of Federal Regulations: Flammable liquid</p> <p>12.2 NAS Hazard Rating for Bulk Water Transportation:</p> <table border="1"> <thead> <tr> <th>Category</th> <th>Rating</th> </tr> </thead> <tbody> <tr> <td>Fire</td> <td>3</td> </tr> <tr> <td>Health</td> <td></td> </tr> <tr> <td> Vapor Irritant</td> <td>1</td> </tr> <tr> <td> Liquid or Solid Irritant</td> <td>0</td> </tr> <tr> <td> Poisons</td> <td>2</td> </tr> <tr> <td>Water Pollution</td> <td></td> </tr> <tr> <td> Human Toxicity</td> <td>2</td> </tr> <tr> <td> Aquatic Toxicity</td> <td>2</td> </tr> <tr> <td> Aesthetic Effect</td> <td>1</td> </tr> <tr> <td>Reactivity</td> <td></td> </tr> <tr> <td> Other Chemicals</td> <td>2</td> </tr> <tr> <td> Water</td> <td>0</td> </tr> <tr> <td> Self-Reaction</td> <td>0</td> </tr> </tbody> </table> <p>12.3 NFPA Hazard Classifications:</p> <table border="1"> <thead> <tr> <th>Category</th> <th>Classification</th> </tr> </thead> <tbody> <tr> <td>Health Hazard (Blue)</td> <td>1</td> </tr> <tr> <td>Flammability (Red)</td> <td>3</td> </tr> <tr> <td>Reactivity (Yellow)</td> <td>0</td> </tr> </tbody> </table>		Category	Rating	Fire	3	Health		Vapor Irritant	1	Liquid or Solid Irritant	0	Poisons	2	Water Pollution		Human Toxicity	2	Aquatic Toxicity	2	Aesthetic Effect	1	Reactivity		Other Chemicals	2	Water	0	Self-Reaction	0	Category	Classification	Health Hazard (Blue)	1	Flammability (Red)	3	Reactivity (Yellow)	0	<p>13. PHYSICAL AND CHEMICAL PROPERTIES</p> <p>13.1 Physical State at 15°C and 1 atm: Liquid</p> <p>13.2 Molecular Weight: 60.10</p> <p>13.3 Boiling Point at 1 atm: 180.1°F = 82.3°C = 355.4°K</p> <p>13.4 Freezing Point: -127.3°F = -88.5°C = 184.7°K</p> <p>13.5 Critical Temperature: 455.4°F = 235.2°C = 508.4°K</p> <p>13.6 Critical Pressure: 691 psia = 47.0 atm = 4.76 MN/cm²</p> <p>13.7 Specific Gravity: 0.785 at 20°C (liquid)</p> <p>13.8 Liquid Surface Tension: Not pertinent</p> <p>13.9 Liquid-Water Interfacial Tension: Not pertinent</p> <p>13.10 Vapor (Gas) Specific Gravity: 2.1</p> <p>13.11 Ratio of Specific Heats of Vapor (Gas): 1.105</p> <p>13.12 Latent Heat of Vaporization: 286 Btu/lb = 159 cal/g = 6.66 × 10³ J/kg</p> <p>13.13 Heat of Combustion: -12,960 Btu/lb = -7,201 cal/g = -301.5 × 10³ J/kg</p> <p>13.14 Heat of Decomposition: Not pertinent</p> <p>13.15 Heat of Solution: (est.) -9 Btu/lb = -5 cal/g = -0.2 × 10³ J/kg</p> <p>13.16 Heat of Polymerization: Not pertinent</p>	
Category	Rating																																						
Fire	3																																						
Health																																							
Vapor Irritant	1																																						
Liquid or Solid Irritant	0																																						
Poisons	2																																						
Water Pollution																																							
Human Toxicity	2																																						
Aquatic Toxicity	2																																						
Aesthetic Effect	1																																						
Reactivity																																							
Other Chemicals	2																																						
Water	0																																						
Self-Reaction	0																																						
Category	Classification																																						
Health Hazard (Blue)	1																																						
Flammability (Red)	3																																						
Reactivity (Yellow)	0																																						
NOTES																																							