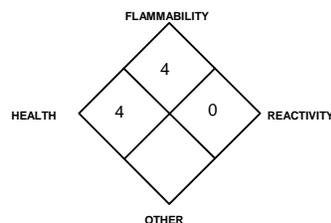


**NFPA RATING****MATERIAL SAFETY DATA SHEET**

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

PART I *What is the material and what do I need to know in an emergency?***1. PRODUCT IDENTIFICATION**CHEMICAL NAME; CLASS:**HYDROGEN SULFIDE - H₂S**

Document Number: P-0029

PRODUCT USE:

For general analytical/synthetic chemical uses.

SUPPLIER/MANUFACTURER'S NAME:**MESA Specialty Gases & Equipment**ADDRESS:3619 Pendleton Avenue, Suite C
Santa Ana, CA 92704BUSINESS PHONE:

1-714-434-7102

EMERGENCY PHONE:

INFOTRAC: 1-800-535-5053

DATE OF PREPARATION:

May 10, 1999

2. COMPOSITION and INFORMATION ON INGREDIENTS

| CHEMICAL NAME | CAS # | mole % | EXPOSURE LIMITS IN AIR | | | | | |
|--------------------|-----------|---------|--|----------|-------------------------------|--|----------|---|
| | | | ACGIH | | OSHA | | IDLH ppm | OTHER |
| | | | TLV ppm | STEL ppm | PEL ppm | STEL ppm | | |
| Hydrogen Sulfide | 7783-06-4 | > 99.0% | 10 | 15 | 20 C 10 (Vacated 1989 PEL) | 50 ppm (10 minute maximum peak) 15 (Vacated 1989 PEL) | 100 | NIOSH REL: 10 ppm C (10 minutes) DFG-MAK: 10 ppm |
| Maximum Impurities | | < 1.0% | None of the trace impurities in this mixture contribute significantly to the hazards associated with the product. All hazard information pertinent to this product has been provided in this Material Safety Data Sheet, per the requirements of the OSHA Hazard Communication Standard (29 CFR 1910.1200) and State equivalent standards. | | | | | |

NE = Not Established

C = Ceiling Limit

See Section 16 for Definitions of Terms Used

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

3. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW: Hydrogen Sulfide is a toxic, flammable gas and has a distinct “rotten-egg” smell. Hydrogen Sulfide is a colorless liquid which rapidly turns into a gas at standard atmospheric temperatures and pressures. Inhalation of high concentrations of this gas can result in unconsciousness, coma, and death. Contact with rapidly expanding gases, or contact with the liquid, may cause frostbite. Both the liquid and gas pose a serious fire hazard when accidentally released. The gas is heavier than air and may spread long distances. Distant ignition and flashback are possible. Flame or high temperature impinging on a localized area of the cylinder of Hydrogen Sulfide can cause the cylinder to rupture without activating the cylinder’s relief devices. Provide adequate fire protection during emergency response situations.

SYMPTOMS OF OVEREXPOSURE BY ROUTE OF EXPOSURE:
The most significant route of overexposure for Hydrogen Sulfide is by inhalation. The following paragraphs describe symptoms of exposure by route of exposure.

INHALATION: Inhalation of high concentrations of Hydrogen Sulfide can cause dizziness, headache, and nausea. Exposure to higher concentrations can result in respiratory arrest, coma, or unconsciousness. Exposure for more than 30 minutes at concentrations of greater than 600 ppm have been fatal. Continuous inhalation of low concentrations may cause olfactory fatigue, so that the odor is no longer an effective warning of the presence of Hydrogen Sulfide. A summary of exposure concentrations and observed effects are as follows:

| CONCENTRATION | EXPOSURE SYMPTOM |
|------------------------------|---|
| 0.3-30 ppm: | Odor is obvious and unpleasant. |
| 50 ppm: | Eye irritation. Dryness and irritation of nose, throat. |
| Slightly higher than 50 ppm: | Irritation of the respiratory system. |
| 100-150 ppm: | Temporary loss of smell. |
| 200-250 ppm: | Headache, vomiting nausea. Prolonged exposure may lead to lung damage. Exposures of 4-8 hours can be fatal. |
| 300-500: | Swifter onset of symptoms. Death occurs in 1-4 hours. |
| 500 ppm: | Headache, excitement, staggering, stomach after brief exposure. Death occurs from 0.5 - 1 hour. |
| > 600 ppm: | Rapid onset of unconsciousness, coma, death. |
| > 1000 ppm: | Immediate respiratory arrest. |

| HAZARDOUS MATERIAL INFORMATION SYSTEM | | | |
|--|---------------|---|---------------|
| HEALTH | | (BLUE) | 4 |
| FLAMMABILITY | | (RED) | 4 |
| REACTIVITY | | (YELLOW) | 0 |
| PROTECTIVE EQUIPMENT | | | D |
| EYES | RESPIRATORY | HANDS | BODY |
|  | See Section 8 |  | See Section 8 |
| For routine industrial applications | | | |

See Section 16 for Definition of Ratings

Severe exposures which do not result in death may cause long-term symptoms such as memory loss, paralysis of facial muscles, or nerve tissue damage.

SKIN and EYE CONTACT: The gas may be irritating to the skin. Inflammation and irritation of the eyes can occur at very low airborne concentration (less than 10 ppm). Exposure over several hours may result in “gas eyes” or “sore eyes” with symptoms of scratchiness, irritation, tearing and burning. Above 50 ppm, there is an intense tearing, blurring of vision, and pain when looking at light. Exposed individuals may see rings around bright lights. Most symptoms disappear when exposure ceases. However, in serious cases, the eyes can be permanently damaged.

OTHER POTENTIAL HEALTH EFFECTS: Contact with liquid or rapidly expanding gases (which are released under high pressure) may cause frostbite. Symptoms of frostbite include change in skin color to white or grayish-yellow. The pain after such contact can quickly subside.

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

ACUTE: Hydrogen Sulfide is irritating to the skin and eyes. Inhalation of high concentrations of Hydrogen Sulfide can cause dizziness, headache, and nausea. Exposure to higher concentrations can result in respiratory arrest, coma, or unconsciousness, and death. Contact with liquid or rapidly expanding gases may cause frostbite.

CHRONIC: Severe exposures which do not result in death may cause long-term symptoms such as memory loss, paralysis of facial muscles, or nerve tissue damage. Chronic overexposure may cause permanent eye damage.

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

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

4. FIRST-AID MEASURES

RESCUERS SHOULD NOT ATTEMPT TO RETRIEVE VICTIMS OF EXPOSURE TO HYDROGEN SULFIDE WITHOUT ADEQUATE PERSONAL PROTECTIVE EQUIPMENT. At a minimum, Self-Contained Breathing Apparatus and gloves should be worn. Under some response circumstances, Fire-Retardant Personal Protective equipment may be necessary. Adequate fire protection must be provided during rescue situations.

Remove victim(s) to fresh air as quickly as possible. Trained personnel should administer supplemental oxygen and/or cardio-pulmonary resuscitation, if necessary. Only trained personnel should administer supplemental oxygen.

In case of frostbite, place the frostbitten part in warm water. **DO NOT USE HOT WATER.** If warm water is not available, or is impractical to use, wrap the affected parts gently in blankets. Alternatively, if the fingers or hands are frostbitten, place the affected area in the armpit. Encourage victim to gently exercise the affected part while being warmed. Seek immediate medical attention.

SKIN EXPOSURE: If liquid is spilled on skin, or if irritation of the skin develops after exposure to liquid or gas, immediately begin decontamination with running water. Minimum flushing is for 15 minutes. Remove exposed or contaminated clothing, taking care not to contaminate eyes. Victim must seek immediate medical attention.

EYE EXPOSURE: If liquid is splashed into eyes, or if irritation of the eye develops after exposure to liquid or gas, open victim's eyes while under gentle running water. Use sufficient force to open eyelids. Have victim "roll" eyes. Minimum flushing is for 15 minutes.

Victim(s) must be taken for medical attention. Rescuers should be taken for medical attention, if necessary. Take copy of label and MSDS to physician or other health professional with victim(s).

5. FIRE-FIGHTING MEASURES

FLASH POINT: Not applicable. Hydrogen Sulfide is a flammable gas.

AUTOIGNITION TEMPERATURE: 260°C (500°F)

FLAMMABLE LIMITS (in air by volume, %):

Lower (LEL): 4.0%

Upper (UEL): 44.0%

FIRE EXTINGUISHING MATERIALS: Extinguish Hydrogen Sulfide fires by shutting-off the source of the gas. Use water spray to cool fire-exposed containers, structures, and equipment. Other appropriate extinguishing media are dry chemical, foam, and carbon dioxide.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Hydrogen Sulfide is a flammable,

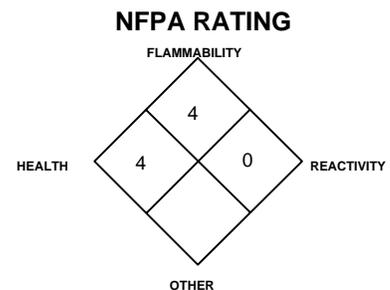
toxic gas and presents an extreme hazard to firefighters. The products of thermal decomposition of this material include water and sulfur dioxide. This gas is heavier than air; it can travel a long distance to a source of ignition and flash back.

DANGER! Fires impinging (direct flame) on the outside surface of unprotected pressure storage vessels of Hydrogen Sulfide can be very dangerous. Direct flame exposure on the cylinder wall can cause an explosion either by BLEVE (Boiling Liquid Expanding Vapor Explosion), or by exothermic decomposition. This is a catastrophic failure of the vessel releasing the contents into a massive fireball and explosion. The resulting fire and explosion can result in severe equipment damage and personnel injury or death over a large area around the vessel. For massive fires in large areas, use unmanned hose.

Explosion Sensitivity to Mechanical Impact: Not sensitive.

Explosion Sensitivity to Static Discharge: Static discharge may cause Hydrogen Sulfide to ignite explosively.

SPECIAL FIRE-FIGHTING PROCEDURES: Structural firefighters must wear Self-Contained Breathing Apparatus and full protective equipment. The best fire-fighting technique may be simply to let the burning gas escape from the pressurized cylinder, tank car, or pipeline. Stop the leak before extinguishing fire. If the fire is extinguished before the leak is sealed, the leaking gas could explosively re-ignite without warning and cause extensive damage, injury, or fatality. In this case, increase ventilation (in enclosed areas) to prevent flammable mixture formation. Because of the potential for a BLEVE, evacuation of non-emergency personnel is essential. If water is not available for cooling or protection of vessel exposures, evacuate the area. Refer to the North American Emergency Response Guidebook (Guide #117) for additional information.



See Section 16 for Definition of Ratings

6. ACCIDENTAL RELEASE MEASURES

SPILL AND LEAK RESPONSE: Uncontrolled releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used. In case of a release, clear the affected area, protect people, and respond with trained personnel. Adequate fire protection must be provided.

Minimum Personal Protective Equipment should be **Level B: fire-retardant protective clothing, mechanical resistant gloves and Self-Contained Breathing Apparatus**. Use only non-sparking tools and equipment. Locate and seal the source of the leaking gas. Protect personnel attempting the shut-off with water-spray. Allow the gas to dissipate. Monitor the surrounding area for levels of combustible gas, Hydrogen Sulfide, and oxygen. Combustible gas concentration must be below 10% of the LEL (LEL = 4.0%) prior to entry. A colorimetric tube is available for Hydrogen Sulfide. If a colorimetric tube is used to indicate the concentration of Hydrogen Sulfide, the reading obtained should be lower than the limits indicated in Section 2 (Composition and Information on Ingredients). The atmosphere must have at least 19.5 percent oxygen before personnel can be allowed in the area without Self-Contained Breathing Apparatus (SCBA).

Attempt to close the main source valve prior to entering the area. If this does not stop the release (or if it is not possible to reach the valve), allow the gas to release in place or remove it to a safe area and allow the gas to be released there.

THIS IS AN EXTREMELY FLAMMABLE, TOXIC GAS. Protection of all personnel and the area must be maintained.

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

7. HANDLING and STORAGE

WORK PRACTICES AND HYGIENE PRACTICES: As with all chemicals, avoid getting Hydrogen Sulfide IN YOU. Do not eat or drink while handling chemicals. Be aware of any signs of effects of exposure indicated in Section 3 (Hazard Identification); exposures to fatal concentrations of Hydrogen Sulfide could occur rapidly. Working alone with Hydrogen Sulfide should be avoided when possible. All work operations should be monitored in such a way that emergency personnel can be immediately contacted in the event of a release.

STORAGE AND HANDLING PRACTICES: Cylinders should be stored in dry, well-ventilated areas away from sources of heat. Compressed gases can present significant safety hazards. Store containers away from heavily trafficked areas and emergency exits. Post "No Smoking or Open Flames" signs in storage or use areas. Store Hydrogen Sulfide cylinders away from incompatible materials, such as strong oxidizers, metals, and metal oxides.

SPECIAL PRECAUTIONS FOR HANDLING GAS CYLINDERS: Protect cylinders against physical damage. Store in cool, dry, well-ventilated area, away from sources of heat, ignition and direct sunlight. Do not allow area where cylinders are stored to exceed 52°C (125°F). Use a check valve or trap in the discharge line to prevent hazardous backflow. Post "No Smoking or Open Flame" signs in storage and use areas. Cylinders should be stored upright and be firmly secured to prevent falling or being knocked over. Cylinders can be stored in the open, but in such cases, should be protected against extremes of weather and from the dampness of the ground to prevent rusting. Never tamper with pressure relief devices in valves and cylinders. Electrical equipment should be non-sparking or explosion proof. The following rules are applicable to situations in which cylinders are being used :

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

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

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

NOTE: Use only DOT or ASME code containers. Earth-ground and bond all lines and equipment associated with Hydrogen Sulfide. Close valve after each use and when empty. Cylinders must not be recharged except by or with the consent of owner. For additional information refer to the Compressed Gas Association Pamphlet P-1, *Safe Handling of Compressed Gases in Containers*. Additionally, refer to CGA Bulletin SB-2 "Oxygen Deficient Atmospheres" and CGA Pamphlet G-12, "Hydrogen Sulfide".

PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT: Follow practices indicated in Section 6 (Accidental Release Measures). Make certain application equipment is locked and tagged-out safely. Purge gas handling equipment with inert gas (e.g. nitrogen) before attempting repairs.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION

VENTILATION AND ENGINEERING CONTROLS: Use with adequate ventilation. Local exhaust ventilation is preferred, because it prevents Hydrogen Sulfide dispersion into the work place by eliminating it at its source. If appropriate, install automatic monitoring equipment to detect the level of Hydrogen Sulfide, the presence of potentially explosive air-gas mixtures, and oxygen. Eye wash stations/safety showers should be near areas where Hydrogen Sulfide is used or stored.

RESPIRATORY PROTECTION: Maintain Hydrogen Sulfide levels below the exposure limits provided in Section 2 (Composition and Information on Ingredients) and oxygen levels above 19.5% in the workplace. Use supplied air respiratory protection during emergency response to a release of Hydrogen Sulfide. If respiratory protection is required, follow the requirements of the Federal OSHA Respiratory Protection Standard (29 CFR 1910.134), or equivalent State standards. The following NIOSH respiratory protection recommendations for Hydrogen Sulfide are provided for additional information.

CONCENTRATION of HYDROGEN SULFIDE

RESPIRATORY EQUIPMENT

Up to 100 ppm: Powered air-purifying respirator with cartridge(s) to protect against Hydrogen Sulfide, gas mask with canister to protect against Hydrogen Sulfide, Supplied Air Respirator (SAR), or full-facepiece Self-Contained Breathing Apparatus (SCBA).

Emergency or Planned Entry into Unknown Concentration or IDLH Conditions: Positive pressure, full-facepiece SCBA or positive pressure, full-facepiece SAR with an auxiliary positive pressure SCBA.

Escape: Gas mask with canister to protect against Hydrogen Sulfide or escape-type SCBA

The IDLH concentration for Hydrogen Sulfide is 100 ppm.

EYE PROTECTION: Splash goggles or safety glasses, for protection from rapidly expanding gases and splashes of Liquid Hydrogen Sulfide. Additionally, face-shields should be worn if there is a potential for contact with liquid Hydrogen Sulfide.

HAND PROTECTION: Wear mechanical resistant gloves when handling cylinders of Hydrogen Sulfide. Wear chemical resistant gloves when using this gas. Butyl rubber, chlorinated polyethylene, neoprene nitrile, and polyvinyl rubber are recommended.

BODY PROTECTION: Use body protection appropriate for task. Coveralls may be appropriate if splashes from the liquefied gas are anticipated. Transfer of large quantities under pressure may require protective equipment appropriate to protect employees from splashes of liquefied product, as well as fire retardant items.

9. PHYSICAL and CHEMICAL PROPERTIES

VAPOR DENSITY: 1.406 kg/m³ (0.0878 lb/ft³)

SPECIFIC GRAVITY (air = 1): 1.188

SOLUBILITY IN WATER: Soluble.

EVAPORATION RATE (nBuAc = 1): Not applicable.

ODOR THRESHOLD: 0.13-100 ppm.

COEFFICIENT WATER/OIL DISTRIBUTION: Not applicable.

pH: Not applicable.

FREEZING POINT: -85.5°C (-122.0°F)

BOILING POINT @ 1 atm: -60.3°C (-76.6°F)

EXPANSION RATIO: Not applicable

VAPOR PRESSURE (psia): 266.7

SPECIFIC VOLUME (ft³/lb): 11.2

APPEARANCE AND COLOR: Colorless gas. The liquid is also colorless. The odor for both the liquid and gas is similar to that of "rotten eggs".

HOW TO DETECT THIS SUBSTANCE (warning properties): Continuous inhalation of low concentrations may cause olfactory fatigue, so that there are no distinct warning properties. In terms of leak detection, fittings and joints can be painted with a soap solution to detect leaks, which will be indicated by a bubble formation. Wet lead acetate paper can be used for leak detection. The paper turns black in the presence of Hydrogen Sulfide. Cadmium chloride solutions can also be used. The solution will turn yellow upon contact with Hydrogen Sulfide.

10. STABILITY and REACTIVITY

STABILITY: Stable.

DECOMPOSITION PRODUCTS: Water, sulfur dioxide.

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: Hydrogen Sulfide is not compatible with the following materials: oxidizing agents, organic peroxides, alkaline materials, metals (e.g., copper, lead), and metal oxides. Hydrogen Sulfide is corrosive to most metals, because it reacts with these substances to form metal sulfides.

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID: Contact with incompatible materials and exposure to heat, sparks and other sources of ignition. Avoid exposing cylinders to extremely high temperatures, which could cause the cylinders to rupture.

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

11. TOXICOLOGICAL INFORMATION

TOXICITY DATA: The following information is for Hydrogen Sulfide.

LCLo (inhalation, human) = 600 ppm/30 minutes

LCLo (inhalation, human) = 800 ppm/5 minutes

LC₅₀ (inhalation, mouse) = 634 ppm/1 hour

LDLo (inhalation, man) = 5.7 mg/kg; central nervous system, pulmonary effects

LC₅₀ (inhalation, rat) = 444 ppm

LCLo (inhalation, mammal) = 800 ppm/5 minutes

TCLo (inhalation, rat) = 20 ppm (female, 6-22 days post), reproductive effects

SUSPECTED CANCER AGENT: Hydrogen Sulfide is not found on the following lists: FEDERAL OSHA Z LIST, NTP, IARC, CAL/OSHA, and therefore is neither considered to be nor suspected to be a cancer-causing agent by these agencies.

IRRITANCY OF PRODUCT: Hydrogen Sulfide is severely irritating to the eyes, and may be mildly to severely irritating to the skin.

SENSITIZATION TO THE PRODUCT: Hydrogen Sulfide is not known to cause sensitization in humans with prolonged or repeated contact.

REPRODUCTIVE TOXICITY INFORMATION: Listed below is information concerning the effects of Hydrogen Sulfide and its components on the human reproductive system.

Mutagenicity: No mutagenicity effects for humans have been described for Hydrogen Sulfide.

Embryotoxicity: No embryotoxic effects for humans have been described for Hydrogen Sulfide.

Teratogenicity: No teratogenic effects for humans have been described for Hydrogen Sulfide.

Reproductive Toxicity: No reproductive toxicity effects for humans have been described for Hydrogen Sulfide. Animal reproductive data are available for Hydrogen Sulfide; these data were obtained during clinical studies on specific animal tissues exposed to this compound.

*A **mutagen** is a chemical which causes permanent changes to genetic material (DNA) such that the changes will propagate through generation lines. An **embryotoxin** is a chemical which causes damage to a developing embryo (i.e. within the first eight weeks of pregnancy in humans), but the damage does not propagate across generational lines. A **teratogen** is a chemical which causes damage to a developing fetus, but the damage does not propagate across generational lines. A **reproductive toxin** is any substance which interferes in any way with the reproductive process.*

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Conditions relating to the target organs may be aggravated by overexposures to Hydrogen Sulfide. See Section 3 (Hazard Identification) for information on these conditions.

RECOMMENDATIONS TO PHYSICIANS: Administer oxygen, if necessary. Treat symptoms and eliminate exposure. Be observant for initial signs of pulmonary edema.

BIOLOGICAL EXPOSURE INDICES (BEIs): Currently, Biological Exposure Indices (BEIs) are not applicable for Hydrogen Sulfide.

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL STABILITY: This gas will be dissipated rapidly in well-ventilated areas. Additional environmental data are available for Hydrogen Sulfide as follows:

HYDROGEN SULFIDE: Water Solubility = 1 g/242 mL at 20°C

EFFECT OF MATERIAL ON PLANTS or ANIMALS: Any adverse effect on animals would be related to oxygen-deficient environments, respiratory system damage, and central nervous system effects. See Section 11 (Toxicological Information) for additional information on the effects on animals. Additional information on the effects of Hydrogen Sulfide on plants are available as follows:

Continuous fumigation of plants with 300 or 3000 ppb Hydrogen Sulfide caused leaf lesions, defoliation, and reduced growth with severity of injury correlated to dose. At higher (3.25 and 5.03 ppm) Hydrogen Sulfide, significant reductions in leaf CO₂ and water vapor exchanges occurred, and stomatal openings were depressed. When Hydrogen Sulfide gas was applied to 29 species of green plants for 5 hours, young, rapidly elongating tissues were more sensitive to injury than older tissues. Symptoms included scorching of young shoots and leaves, basal and marginal scorching of older leaves. Mature leaves were unaffected. Seeds exposed to Hydrogen Sulfide gas showed delay in germination.

EFFECT OF CHEMICAL ON AQUATIC LIFE: Hydrogen Sulfide is soluble in water and is toxic to terrestrial life. Therefore, all work practices should be aimed at eliminating contamination of aquatic environments with Hydrogen Sulfide. Additional information on effects of Hydrogen Sulfide on aquatic life are as follows on the next page:

12. ECOLOGICAL INFORMATION (Continued)

EFFECT OF CHEMICAL ON AQUATIC LIFE:

| | | |
|---|--|---|
| TLm (Asellus sp) = 0.111 mg/L/96 hour | TLm (Pimephales promelas, fathead minnow) = 0.0071-0.55 mg/L/96 hour | LC ₅₀ (northern pike, <i>Esox lucius</i>) = 0.026-0.159 mg/L, 96-24 hours, flow-through test |
| TLm (Cranfngonyx sp) = 1.07 mg/L/96 hour | TLm (Salvelinus fontinalis, brook trout) = 0.0160-0.515 mg/L/96 hour at 6-12.5 °C | LC ₅₀ (walleye, <i>Stizostedion vitreum</i>) = 0.007-0.020 mg/L, 72-96 hours, flow-through test |
| TLm (Gammarrus) = 0.84 mg/L/96 hour | LC ₅₀ (goldfish, <i>Carassius auratus</i>) = 51-95 mg/L, flow-through test, varied oxygen, 96 hours | LC ₅₀ (bluegill, <i>Lepomis macrochirus</i>) = 0.0090-0.032 mg/L, 96 hours, temperatures 8-22°C |
| LC ₅₀ (fly inhalation) = 380 mg/m ³ /960 minutes | LC ₅₀ (white suckers, <i>Catostomus commersonii</i>) = 0.018-0.034 mg/L, 24-120 hours, flow-through test | |
| LC ₅₀ (fly inhalation) = 1500 mg/m ³ /77 minutes | | |
| TLm (Lepomis macrochirus, bluegill sunfish) = 0.0478 mg/L/96 hour | | |
| TLm (Lepomis macrochirus, bluegill sunfish) = 0.0448 mg/L/96 hour at 21-22 °C | | |

13. DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL: Waste disposal must be in accordance with appropriate Federal, State, and local regulations. Return cylinders with any residual product to MESA Specialty Gases & Equipment Do not dispose of locally.

14. TRANSPORTATION INFORMATION

THIS MATERIAL IS HAZARDOUS AS DEFINED BY 49 CFR 172.101 BY THE U.S. DEPARTMENT OF TRANSPORTATION.

PROPER SHIPPING NAME: Hydrogen sulfide, liquefied
HAZARD CLASS NUMBER and DESCRIPTION: 2.3 (Poison Gas)
UN IDENTIFICATION NUMBER: UN 1053
PACKING GROUP: Not Applicable
DOT LABEL(S) REQUIRED: Poison Gas, Flammable Gas
NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (1996): 117
SPECIAL PROVISION: Hydrogen Sulfide is poisonous by inhalation. Shipments must be properly described as inhalation hazards. ZONE B.
MARINE POLLUTANT: Hydrogen Sulfide is not classified by the DOT as a Marine Pollutant (as defined by 49 CFR 172.101, Appendix B).

TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: THIS MATERIAL IS CONSIDERED AS DANGEROUS GOODS. Use the above information for the preparation of Canadian Shipments. Note: There is an alternative shipping name spelling for Canadian shipments: Hydrogen sulphide.

15. REGULATORY INFORMATION

U.S. SARA REPORTING REQUIREMENTS: Hydrogen Sulfide is subject to the reporting requirements of Sections 302, 304 and 313 of Title III of the Superfund Amendments and Reauthorization Act, as follows:

| CHEMICAL NAME | SARA 302 (40 CFR 355, Appendix A) | SARA 304 (40 CFR Table 302.4) | SARA 313 (40 CFR 372.65) |
|------------------|--------------------------------------|----------------------------------|-----------------------------|
| Hydrogen Sulfide | YES | YES | YES |

U.S. SARA THRESHOLD PLANNING QUANTITY: Hydrogen Sulfide = 500 lb.

U.S. CERCLA REPORTABLE QUANTITY (RQ): Hydrogen Sulfide CERCLA RQ = 100 lb; Hydrogen Sulfide EHS (Extremely Hazardous Substance) RQ = 100 lb; Hydrogen Sulfide RCRA Code = U135.

CANADIAN DSL/NDL INVENTORY STATUS: Hydrogen Sulfide is on the DSL Inventory.

U.S. TSCA INVENTORY STATUS: Hydrogen Sulfide is listed on the TSCA Inventory.

OTHER U.S. FEDERAL REGULATIONS: Hydrogen Sulfide is subject to the reporting requirements of Section 112(r) of the Clean Air Act. The Threshold Quantity for this gas is 10,000 lb. Compliance with the OSHA Process Safety Standard (29 CFR 1910.119) may be applicable to operations involving the use of Hydrogen Sulfide. Under this regulation Hydrogen Sulfide is listed in Appendix A. The Threshold Quantity of Hydrogen Sulfide under this regulation is 1500 lb.

15. REGULATORY INFORMATION (Continued)

U.S. STATE REGULATORY INFORMATION: Hydrogen Sulfide is covered under specific State regulations, as denoted below:

Alaska - Designated Toxic and Hazardous Substances: Hydrogen Sulfide.

California - Permissible Exposure Limits for Chemical Contaminants: Hydrogen Sulfide.

Florida - Substance List: Hydrogen Sulfide.

Illinois - Toxic Substance List: Hydrogen Sulfide.

Kansas - Section 302/313 List: Hydrogen Sulfide.

Massachusetts - Substance List: Hydrogen Sulfide.

Michigan - Critical Materials Register: Hydrogen Sulfide.

Minnesota - List of Hazardous Substances: Hydrogen Sulfide.

Missouri - Employer Information/Toxic Substance List: Hydrogen Sulfide.

New Jersey - Right to Know Hazardous Substance List: Hydrogen Sulfide.

North Dakota - List of Hazardous Chemicals, Reportable Quantities: Hydrogen Sulfide.

Pennsylvania - Hazardous Substance List: Hydrogen Sulfide.

Rhode Island - Hazardous Substance List: Hydrogen Sulfide.

Texas - Hazardous Substance List: Hydrogen Sulfide.

West Virginia - Hazardous Substance List: Hydrogen Sulfide.

Wisconsin - Toxic and Hazardous Substances: Hydrogen Sulfide.

CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65): Hydrogen Sulfide is not on the California Proposition 65 lists.

LABELING:

DANGER:

POISONOUS, FLAMMABLE LIQUID AND GAS UNDER PRESSURE.
MAY BE FATAL IF INHALED.
CAN FORM EXPLOSIVE MIXTURES WITH AIR.
MAY CAUSE RESPIRATORY TRACT AND CENTRAL NERVOUS SYSTEM DAMAGE.
CAN CAUSE EYE IRRITATION.
GAS DEADENS SENSE OF SMELL.
SYMPTOMS MAY BE DELAYED.

ODOR:

ROTTEN EGGS.
Do not breath gas.
Do not depend on odor to detect presence of gas.
Store and use with adequate ventilation, and use in closed systems.
Keep away from heat, flames, and sparks.
Avoid contact with eyes.
Cylinder temperature should not exceed 52°C (125°F).
Close valve after each use and when empty.
Use in accordance with the Material Safety Data Sheet.

POISON

CALL A PHYSICIAN



FIRST AID:

IF INHALED, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.

IN CASE OF CONTACT, immediately flush eyes or skin with water for at least 15 minutes while removing contaminated clothing and shoes. Call a physician.

DO NOT REMOVE THIS PRODUCT LABEL.

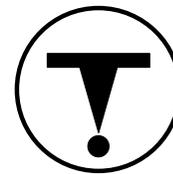
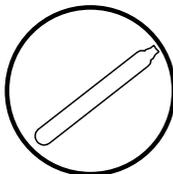
CANADIAN WHMIS SYMBOLS:

Class A: Compressed Gas

Class B1: Flammable Gas

Class D1A: Toxic Material/Immediate and Serious Effects

Class D2B: Other Toxic Effects



16. OTHER INFORMATION

The information contained herein is based on data considered accurate. However, no warranty is expressed or implied regarding the accuracy of these data or the results to be obtained from the use thereof. MESA SPECIALTY GASES & EQUIPMENT, assumes no responsibility for injury to the vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, MESA SPECIALTY GASES & EQUIPMENT, assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the material even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in his use of the material.

DEFINITIONS OF TERMS

A large number of abbreviations and acronyms appear on a MSDS. Some of these which are commonly used include the following:

CAS #: This is the Chemical Abstract Service Number which uniquely identifies each constituent. It is used for computer-related searching.

EXPOSURE LIMITS IN AIR:

ACGIH - American Conference of Governmental Industrial Hygienists, a professional association which establishes exposure limits. **TLV** - Threshold Limit Value - an airborne concentration of a substance which represents conditions under which it is generally believed that nearly all workers may be repeatedly exposed without adverse effect. The duration must be considered, including the 8-hour Time Weighted Average (**TWA**), the 15-minute Short Term Exposure Limit, and the instantaneous Ceiling Level (**C**). Skin absorption effects must also be considered.

OSHA - U.S. Occupational Safety and Health Administration. **PEL** - Permissible Exposure Limit - This exposure value means exactly the same as a TLV, except that it is enforceable by OSHA. The OSHA Permissible Exposure Limits are based in the 1989 PELs and the June, 1993 Air Contaminants Rule (Federal Register: 58: 35338-35351 and 58: 40191). Both the current PELs and the vacated PELs are indicated. The phrase, "Vacated 1989 PEL," is placed next to the PEL which was vacated by Court Order.

IDLH - Immediately Dangerous to Life and Health - This level represents a concentration from which one can escape within 30-minutes without suffering escape-preventing or permanent injury. **The DFG - MAK** is the Republic of Germany's Maximum Exposure Level, similar to the U.S. PEL. **NIOSH** is the National Institute of Occupational Safety and Health, which is the research arm of the U.S. Occupational Safety and Health Administration (**OSHA**). NIOSH issues exposure guidelines called **Recommended Exposure Levels (RELs)**. When no exposure guidelines are established, an entry of **NE** is made for reference.

HAZARD RATINGS:

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM: Health Hazard: **0** (minimal acute or chronic exposure hazard); **1** (slight acute or chronic exposure hazard); **2** (moderate acute or significant chronic exposure hazard); **3** (severe acute exposure hazard; onetime overexposure can result in permanent injury and may be fatal); **4** (extreme acute exposure hazard; onetime overexposure can be fatal). Flammability Hazard: **0** (minimal hazard); **1** (materials that require substantial pre-heating before burning); **2** (combustible liquid or solids; liquids with a flash point of 38-93°C [100-200°F]); **3** (Class IB and IC flammable liquids with flash points below 38°C [100°F]); **4** (Class IA flammable liquids with flash points below 23°C [73°F] and boiling points below 38°C [100°F]). Reactivity Hazard: **0** (normally stable); **1** (material that can become unstable at elevated temperatures or which can react slightly with water); **2** (materials that are unstable but do not detonate or which can react violently with water); **3** (materials that can detonate when initiated or which can react explosively with water); **4** (materials that can detonate at normal temperatures or pressures).

NATIONAL FIRE PROTECTION ASSOCIATION: Health Hazard: **0** (material that on exposure under fire conditions would offer no hazard beyond that of ordinary combustible materials); **1** (materials that on exposure under fire conditions could cause irritation or minor residual injury); **2** (materials that on intense or continued exposure under fire conditions could cause temporary incapacitation or possible residual injury); **3** (materials that can on short exposure could cause serious temporary or residual injury); **4** (materials that under very short exposure causes death or major residual injury).

NATIONAL FIRE PROTECTION ASSOCIATION (Continued): Flammability Hazard and Reactivity Hazard: Refer to definitions for "Hazardous Materials Identification System".

FLAMMABILITY LIMITS IN AIR:

Much of the information related to fire and explosion is derived from the National Fire Protection Association (**NFPA**). Flash Point - Minimum temperature at which a liquid gives off sufficient vapors to form an ignitable mixture with air. Autoignition Temperature: The minimum temperature required to initiate combustion in air with no other source of ignition. LEL - the lowest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source. UEL - the highest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source.

TOXICOLOGICAL INFORMATION:

Possible health hazards as derived from human data, animal studies, or from the results of studies with similar compounds are presented. Definitions of some terms used in this section are: **LD₅₀** - Lethal Dose (solids & liquids) which kills 50% of the exposed animals; **LC₅₀** - Lethal Concentration (gases) which kills 50% of the exposed animals; **ppm** concentration expressed in parts of material per million parts of air or water; **mg/m³** concentration expressed in weight of substance per volume of air; **mg/kg** quantity of material, by weight, administered to a test subject, based on their body weight in kg. Data from several sources are used to evaluate the cancer-causing potential of the material. The sources are: **IARC** - the International Agency for Research on Cancer; **NTP** - the National Toxicology Program, **RTECS** - the Registry of Toxic Effects of Chemical Substances, **OSHA** and **CAL/OSHA**. IARC and NTP rate chemicals on a scale of decreasing potential to cause human cancer with rankings from 1 to 4. Subrankings (2A, 2B, etc.) are also used. Other measures of toxicity include **TDLo**, the lowest dose to cause a symptom and **TCLo** the lowest concentration to cause a symptom; **TDo**, **LDLo**, and **LDo**, or **TC**, **TCo**, **LCLo**, and **LCo**, the lowest dose (or concentration) to cause lethal or toxic effects. **BEI** - Biological Exposure Indices, represent the levels of determinants which are most likely to be observed in specimens collected from a healthy worker who has been exposed to chemicals to the same extent as a worker with inhalation exposure to the TLV. Ecological Information: **EC** is the effect concentration in water.

REGULATORY INFORMATION:

This section explains the impact of various laws and regulations on the material. **EPA** is the U.S. Environmental Protection Agency. **WHMIS** is the Canadian Workplace Hazardous Materials Information System. **DOT** and **TC** are the U.S. Department of Transportation and the Transport Canada, respectively. Superfund Amendments and Reauthorization Act (**SARA**); the Canadian Domestic/Non-Domestic Substances List (**DSL/NDSL**); the U.S. Toxic Substance Control Act (**TSCA**); Marine Pollutant status according to the **DOT**; the Comprehensive Environmental Response, Compensation, and Liability Act (**CERCLA** or **Superfund**); and various state regulations.