Praxair Material Safety Data Sheet

1. Chemical Product and Company Identification

Product Name: Hydrogen sulfide (MSDS No. P-4611-F)	**Trade Name:** Hydrogen Sulfide
Chemical Name: Hydrogen sulfide	**Synonyms:** Sulfuretted hydrogen, stink damp, sulfur hydride, hydrosulfuric acid, hepatic gas
Formula: H_2S	**Chemical Family:** Sulfide
Telephone: **Emergencies:** 1-800-645-4633* **CHEMTREC:** 1-800-424-9300* **Routine:** 1-800-PRAXAIR	**Company Name:** Praxair, Inc. 39 Old Ridgebury Road Danbury, CT 06810-5113

** Call emergency numbers 24 hours a day only for spills, leaks, fire, exposure, or accidents involving this product. For routine information, contact your supplier, Praxair sales representative, or call 1-800-PRAXAIR (1-800-772-9247).*

2. Composition/Information on Ingredients

See section 16 for important information about mixtures.

INGREDIENT	CAS NUMBER	CONCEN-TRATION	OSHA PEL	ACGIH TLV-TWA (2004)
Hydrogen Sulfide	7783-06-4	>99%*	See section 3.	10 ppm; 15 ppm, 15-min STEL

**The symbol > means "greater than."*

3. Hazards Identification

EMERGENCY OVERVIEW

DANGER! Toxic, 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.
Self-contained breathing apparatus must be worn by rescue workers.
Odor: Rotten eggs

THRESHOLD LIMIT VALUE: TLV-TWA 10 ppm; TLV-STEL 15 ppm, 15 min (ACGIH, 2004). OSHA PEL 20 ppm (ceiling); 50 ppm, 10 min, once only, if no other measurable exposure occurs.

Revised

Ceiling values are not time-weighted average. TLV-TWAs should be used as a guide in the control of health hazards and not as fine lines between safe and dangerous concentrations.

EFFECTS OF A SINGLE (ACUTE) OVEREXPOSURE:

INHALATION–May be fatal if inhaled. Depresses activity of the central nervous system, causing respiratory paralysis. Effects of overexposure include headache, dizziness, vertigo, giddiness, confusion, chest pains, olfactory fatigue, unconsciousness, and death. Rhinitis, pharyngitis, pneumonitis, pulmonary edema, and cyanosis may occur. Lack of oxygen can kill.

SKIN CONTACT–Irritates the skin, causing local redness and swelling. Liquid may be corrosive and cause frostbite, a cryogenic injury resembling a burn.

SWALLOWING–A highly unlikely route of exposure; this product is a gas at normal temperature and pressure, but frostbite of the lips and mouth may result from contact with the liquid.

EYE CONTACT–Irritates the eyes, causing excess redness of the conjunctiva. Prolonged exposure to vapor at low concentrations may cause painful conjunctivitis and corneal injury with vesiculation of the corneal epithelium.

EFFECTS OF REPEATED (CHRONIC) OVEREXPOSURE: Repeated exposure may cause nausea, vomiting, weight loss, persistent low blood pressure, and loss of the sense of smell.

OTHER EFFECTS OF OVEREXPOSURE: Survivors sometimes exhibit neurologic sequelae such as amnesia, intention tremor, neurasthenia, disturbance of equilibrium, or more-serious brain stem and cortical damage.

MEDICAL CONDITIONS AGGRAVATED BY OVEREXPOSURE: Breathing of vapor or mist may aggravate asthma and inflammatory or fibrotic pulmonary disease.

SIGNIFICANT LABORATORY DATA WITH POSSIBLE RELEVANCE TO HUMAN HEALTH HAZARD EVALUATION: Although not demonstrated with hydrogen sulfide, repeated or prolonged maternal hypoxia induced by overexposure to other chemical asphyxiants has produced embryofetal toxicity in laboratory animals.

CARCINOGENICITY: Hydrogen sulfide is not listed by NTP, OSHA, or IARC.

4. First Aid Measures

INHALATION: Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, qualified personnel may give oxygen. Call a physician.

SKIN CONTACT: Remove contaminated clothing and flush skin with plenty of water. For exposure to liquid, immediately warm frostbite area with warm water, not to exceed 105°F (41° C). In case of massive exposure, remove clothing while showering with warm water. Call a physician. Wash clothing before reuse.

SWALLOWING: An unlikely route of exposure. This product is a gas at normal temperature and pressure.

EYE CONTACT: For contact with the liquid, immediately flush eyes thoroughly with water for at least 15 minutes. Hold the eyelids open and away from the eyeballs to ensure that all surfaces are flushed thoroughly. See a physician, preferably an ophthalmologist, immediately.

NOTES TO PHYSICIAN: *Keep victim under observation for delayed onset of pulmonary edema. There is no specific antidote. Treatment of overexposure should be directed at the control of symptoms and the clinical condition of the patient.*

5. Fire Fighting Measures

FLASH POINT (test method)**:**	Flammable Gas	
AUTOIGNITION TEMPERATURE:	500°F (260°C) @ 1 atm	
FLAMMABLE LIMITS IN AIR, % by volume**:**	**LOWER:** 4.3%	**UPPER:** 46%

EXTINGUISHING MEDIA: CO_2, dry chemicals, water spray, or fog.

SPECIAL FIRE FIGHTING PROCEDURES: DANGER! Toxic, flammable liquid and gas under pressure. Evacuate all personnel from danger area. Do not approach area without self-contained breathing apparatus and protective clothing. Immediately cool cylinders with water spray from maximum distance, taking care not to extinguish flames. Remove ignition sources if without risk. If flames are accidentally extinguished, explosive reignition may occur. Totally evacuate area and reapproach with extreme caution. Reduce corrosive vapors with water spray or fog. Reverse flow into cylinder may cause rupture. (See section 16.) Stop flow of gas if without risk while continuing water spray. Remove all cylinders from area of fire if without risk. Allow fire to burn out. On-site fire brigades must comply with OSHA 29 CFR 1910.156.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Toxic, flammable, corrosive gas. Forms explosive mixtures with air and oxidizing agents. Heat of fire can build pressure in cylinder and cause it to rupture. Hydrogen sulfide cylinders are equipped with a pressure-relief device. (Exceptions may exist where authorized by DOT.) No part of a cylinder should be subjected to a temperature higher than 125°F (52°C). If venting or leaking hydrogen sulfide catches fire, do not extinguish flames. Flammable vapors may spread from leak, creating an explosive re-ignition hazard. Vapors can be ignited by pilot lights, other flames, smoking, sparks, heaters, electrical equipment, static discharge, or other ignition sources at locations distant from product handling point. Explosive atmospheres may linger. Before entering area, especially confined areas, check atmosphere with an appropriate device. Vapors are irritating. Contact may cause skin and eye burns. Hydrogen sulfide deadens the sense of smell; some means of detecting its presence other than smell should be readily available.

HAZARDOUS COMBUSTION PRODUCTS: Sulfur dioxide. Sulfur and hydrogen are products of thermal decomposition. (See section 10.)

6. Accidental Release Measures

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED: DANGER! Toxic, flammable liquid and gas under pressure. Forms explosive mixtures with air. (See section 5.) Immediately evacuate all personnel from danger area. Use self-contained breathing apparatus where needed. Remove all sources of ignition if without risk. Reduce vapors with fog or fine water spray. Reverse flow into cylinder may cause it to rupture. Shut off flow if without risk. Ventilate area or move leaking cylinder to well-ventilated area. Flammable, corrosive, toxic vapors may spread from spill. Hydrogen sulfide deadens the sense of smell. Before entering area, especially confined areas, check atmosphere with an appropriate device.

WASTE DISPOSAL METHOD: Prevent waste from contaminating the surrounding environment. Keep personnel away. Discard any product, residue, disposable container, or liner in an environmentally acceptable manner, in full compliance with federal, state, and local regulations. If necessary, call your local supplier for assistance.

7. Handling and Storage

PRECAUTIONS TO BE TAKEN IN STORAGE: Store and use with adequate ventilation. Separate cylinders from oxygen and other oxidizers by at least 20 ft (6.1 m) or use a barricade of noncombustible material. This barricade should be at least 5 ft (1.53 m) high and have a fire resistance rating of at least ½ hr. Firmly secure cylinders upright to keep them from falling or being knocked over. Hydrogen sulfide cylinders designed to accept a valve protection cap must be provided with a cap. Screw cap firmly in place by hand. Post "No Smoking or Open Flames" signs in storage and use areas. There must be no sources of ignition. All electrical equipment in storage areas must be explosion-proof. Storage areas must meet national electric codes for Class 1 hazardous areas. Store only where temperature will not exceed 125°F (52°C). Store full and empty cylinders separately. Use a first-in, first-out inventory system to prevent storing full cylinders for long periods.

PRECAUTIONS TO BE TAKEN IN HANDLING: Protect cylinders from damage. Use a suitable hand truck to move cylinders; do not drag, roll, slide, or drop. All piped systems and associated equipment must be grounded. Electrical equipment must be non-sparking or explosion-proof. Leak check with soapy water; never use a flame. Never attempt to lift a cylinder by its cap; the cap is intended solely to protect the valve. Never insert an object (e.g., wrench, screwdriver, pry bar) into cap openings; doing so may damage the valve and cause a leak. Use an adjustable strap wrench to remove over-tight or rusted caps. Open valve slowly. If valve is hard to open, discontinue use and contact your supplier. For other precautions in using hydrogen sulfide, see section 16.

For further information on storage, handling, and use of this product, see NFPA 55, *Standard for the Storage, Use, and Handling of Compressed and Liquefied Gases in Portable Cylinders*, published by the National Fire Protection Association.

8. Exposure Controls/Personal Protection

VENTILATION/ENGINEERING CONTROLS:

LOCAL EXHAUST–Use an explosion-proof, corrosion-resistant local exhaust system.

MECHANICAL (general)–Inadequate. See SPECIAL.

SPECIAL–Use only in a closed system. An explosion-proof, corrosion resistant, forced-draft fume hood is preferred.

OTHER–None

RESPIRATORY PROTECTION: Use an air-supplied respirator or a full-face, positive-pressure, self-contained breathing apparatus. Respiratory protection must conform to OSHA 29 CFR 1910.134. Select per OSHA 29 CFR 1910.134 and ANSI Z88.2.

SKIN PROTECTION: Wear work gloves when handling cylinders; neoprene, butyl rubber, or PVC gloves where contact with product may occur.

EYE PROTECTION: Select in accordance with OSHA 29 CFR 1910.133.

OTHER PROTECTIVE EQUIPMENT: Metatarsal shoes for cylinder handling; protective clothing where needed. Select in accordance with OSHA 29 CFR 1910.132 and 1910.133. Regardless of protective equipment, never touch live electrical parts.

9. Physical and Chemical Properties

MOLECULAR WEIGHT:	34.08
SPECIFIC GRAVITY (H_2O = 1) at 60°F (15.6°C)**:**	0.79
SPECIFIC GRAVITY (Air = 1) at 59°F (15°C) and 1 atm**:**	1.189
VAPOR PRESSURE at 60°F (15.6°C)**:**	229 psia (1579 kPa abs)
SOLUBILITY IN WATER at 68°F (20°C) and 1 atm**:**	0.317 lb/gal (38 kg/m^3)
PERCENT VOLATILES BY VOLUME:	100
BOILING POINT at 1 atm**:**	-76.63°F (-60.352°C)
MELTING POINT at 1 atm**:**	-121.85°F (-85.47°C)

APPEARANCE, ODOR, AND STATE: Colorless gas at normal temperature and pressure; odor of rotten eggs. Hydrogen sulfide deadens the sense of smell.

10. Stability and Reactivity

STABILITY: ☐ **Unstable** ☒ **Stable**

INCOMPATIBILITY (materials to avoid): Ammonia, bases, bromine pentafluoride, chlorine trifluoride, chromium trioxide and heat, copper (powdered copper and air), fluorine, lead, lead oxide, mercury, nitric acid, nitrogen trifluoride, nitrogen sulfide, organic compounds, oxidizing agents, oxygen difluoride, rubber, sodium and moisture, water

HAZARDOUS DECOMPOSITION PRODUCTS: Thermal decomposition may produce sulfur and hydrogen.

HAZARDOUS POLYMERIZATION: ☐ **May Occur** ☒ **Will Not Occur**

CONDITIONS TO AVOID: None known.

11. Toxicological Information

LC_{50} = 750 ppm, 1 hr, rat. See section 3.

12. Ecological Information

No adverse ecological effects expected. Hydrogen sulfide does not contain any Class I or Class II ozone-depleting chemicals. Hydrogen sulfide is not listed as a marine pollutant by DOT.

13. Disposal Considerations

WASTE DISPOSAL METHOD: Do not attempt to dispose of residual or unused quantities. Return cylinder to supplier.

14. Transport Information

DOT/IMO SHIPPING NAME: Hydrogen sulfide

HAZARD CLASS: 2.3	**IDENTIFICATION NUMBER:** UN 1053	**PRODUCT RQ:** 100 lb (45.4 kg)
SHIPPING LABEL(s):	POISON GAS, FLAMMABLE GAS*	
PLACARD (when required):	POISON GAS, FLAMMABLE GAS*	

**The words in the POISON GAS diamond are INHALATION HAZARD.*

SPECIAL SHIPPING INFORMATION: Cylinders should be transported in a secure position, in a well-ventilated vehicle. Cylinders transported in an enclosed, nonventilated compartment of a vehicle can present serious safety hazards.

Additional Marking: INHALATION HAZARD

Shipment of compressed gas cylinders that have been filled without the owner's consent is a violation of federal law [49 CFR 173.301(b)].

15. Regulatory Information

The following selected regulatory requirements may apply to this product. Not all such requirements are identified. Users of this product are solely responsible for compliance with all applicable federal, state, and local regulations.

U.S. FEDERAL REGULATIONS:

EPA (ENVIRONMENTAL PROTECTION AGENCY)

CERCLA: COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT OF 1980 (40 CFR Parts 117 and 302):

Reportable Quantity (RQ): 100 lb (45.4 kg)

SARA: SUPERFUND AMENDMENT AND REAUTHORIZATION ACT:

SECTIONS 302/304: Require emergency planning based on Threshold Planning Quantity (TPQ) and release reporting based on Reportable Quantities (RQ) of Extremely Hazardous Substances (EHS) (40 CFR Part 355):

TPQ: 500 lb (277 kg)
EHS: 100 lb (45.4 kg)

SECTIONS 311/312: Require submission of MSDSs and reporting of chemical inventories with identification of EPA hazard categories. The hazard categories for this product are as follows:

IMMEDIATE: Yes
DELAYED: Yes
PRESSURE: Yes
REACTIVITY: No
FIRE: Yes

SECTION 313: Requires submission of annual reports of release of toxic chemicals that appear in 40 CFR Part 372.

Hydrogen sulfide is subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA) and 40CFR Part 372.

40 CFR 68: RISK MANAGEMENT PROGRAM FOR CHEMICAL ACCIDENTAL RELEASE PREVENTION: Requires development and implementation of risk management programs at facilities that manufacture, use, store, or otherwise handle regulated substances in quantities that exceed specified thresholds.

Hydrogen sulfide is listed as a regulated substance in quantities of 10,000 lb (4536 kg) or greater.

TSCA: TOXIC SUBSTANCES CONTROL ACT: This product is listed on the TSCA inventory.

OSHA: OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION**:**

29 CFR 1910.119: PROCESS SAFETY MANAGEMENT OF HIGHLY HAZARDOUS CHEMICALS: Requires facilities to develop a process safety management program based on Threshold Quantities (TQ) of highly hazardous chemicals.

Hydrogen sulfide is listed in Appendix A as a highly hazardous chemical in quantities of 1,500 lb (681 kg) or more.

STATE REGULATIONS:

CALIFORNIA: This product is not listed by California under the SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT OF 1986 (Proposition 65).

PENNSYLVANIA: This product is subject to the PENNSYLVANIA WORKER AND COMMUNITY RIGHT-TO-KNOW ACT (35 P.S. Sections 7301-7320).

16. Other Information

Be sure to read and understand all labels and instructions supplied with all containers of this product.

OTHER HAZARDOUS CONDITIONS OF HANDLING, STORAGE, AND USE: ***Toxic, flammable liquid and gas under pressure.*** May be fatal if inhaled. Do not breathe gas. Do not get vapors or liquid in eyes, on skin, or on clothing. (See section 3.) Have safety showers and eyewash fountains immediately available. Use piping and equipment adequately designed to withstand pressures to be encountered. ***May form explosive mixtures with air.*** Keep away from heat, sparks, or open flame. Ground all equipment. Use only spark-proof tools and explosion-proof equipment. Store and use with adequate ventilation at all times. Use only in a closed system constructed only of corrosion-resistant materials. Close valve after each use; keep closed even when empty. Keep away from oxidizing agents and from other flammables. ***Prevent reverse flow.*** Reverse flow into cylinder may cause rupture. Use a check valve or other protective device in any line or piping from the cylinder. ***Never work on a pressurized system.*** If there is a leak, close the cylinder valve. Blow the system down in an environmentally safe manner in compliance with all federal, state, and local laws; then repair the leak. ***Follow safe practices when returning cylinder to supplier.*** Be sure valve is closed; then install valve outlet plug tightly. ***Never place a compressed gas cylinder where it may become part of an electrical circuit.***

Recommended Equipment: In semiconductor process gas and other suitable applications, Praxair recommends the use of engineering controls such as gas cabinet enclosures, automatic gas panels (used to purge systems on cylinder changeout), excess-flow valves throughout the gas distribution system, double containment for the distribution system, and continuous gas monitors.

NOTE: *Prior to using any plastics, confirm their compatibility with hydrogen sulfide.*

MIXTURES: When you mix two or more gases or liquefied gases, you can create additional, unexpected hazards. Obtain and evaluate the safety information for each component before you produce the mixture. Consult an industrial hygienist or other trained person when you evaluate the end product. Remember, gases and liquids have properties that can cause serious injury or death.

HAZARD RATING SYSTEMS:

NFPA RATINGS:		**HMIS RATINGS:**	
HEALTH	= 4	HEALTH	= 2
FLAMMABILITY	= 4	FLAMMABILITY	= 4
INSTABILITY	= 0	PHYSICAL HAZARD	= 2
SPECIAL	= None		

STANDARD VALVE CONNECTIONS FOR U.S. AND CANADA:

THREADED:	CGA-330
PIN-INDEXED YOKE:	Not applicable
ULTRA-HIGH-INTEGRITY CONNECTION:	CGA-722

Use the proper CGA connections. **DO NOT USE ADAPTERS.** Additional limited-standard connections may apply. See CGA pamphlet V-1 listed below.

Ask your supplier about free Praxair safety literature as referred to in this MSDS and on the label for this product. Further information about this product can be found in the following pamphlets published by the Compressed Gas Association, Inc. (CGA), 4221 Walney Road, 5th Floor, Chantilly, VA 20151-2923, Telephone (703) 788-2700, http://www.cganet.com/Publication.asp.

AV-1	*Safe Handling and Storage of Compressed Gases*
P-1	*Safe Handling of Compressed Gases in Containers*
SB-2	*Oxygen-Deficient Atmospheres*
V-1	*Compressed Gas Cylinder Valve Inlet and Outlet Connections*
—	*Handbook of Compressed Gases, Fourth Edition*

Praxair asks users of this product to study this MSDS and become aware of product hazards and safety information. To promote safe use of this product, a user should (1) notify employees, agents, and contractors of the information in this MSDS and of any other known product hazards and safety information, (2) furnish this information to each purchaser of the product, and (3) ask each purchaser to notify its employees and customers of the product hazards and safety information.

The opinions expressed herein are those of qualified experts within Praxair, Inc. We believe that the information contained herein is current as of the date of this Material Safety Data Sheet. Since the use of this information and the conditions of use of the product are not within the control of Praxair, Inc., it is the user's obligation to determine the conditions of safe use of the product.

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