

## Praxair Material Safety Data Sheet

### 1. Chemical Product and Company Identification

<b>Product Name:</b> Hydrogen sulfide (MSDS No. P-4611-G)	<b>Trade Names:</b> Hydrogen Sulfide
<b>Chemical Name:</b> Hydrogen sulfide	<b>Synonyms:</b> Sulfuretted hydrogen, stink damp, sulfur hydride, hydrosulfuric acid, hepatic gas
<b>Chemical Family:</b> Sulfide	<b>Product Grades:</b> 2.6
<b>Telephone:</b> <b>Emergencies:</b> 1-800-645-4633* <b>CHEMTREC:</b> 1-800-424-9300* <b>Routine:</b> 1-800-PRAXAIR	<b>Company Name:</b> 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. 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.  
Under ambient conditions, this colorless gas has a rotten egg odor.**

**OSHA REGULATORY STATUS:** This material is considered hazardous by the OSHA Hazard Communications Standard (29 CFR 1910.1200).

#### POTENTIAL HEALTH EFFECTS:

##### 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.

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

**POTENTIAL ENVIRONMENTAL EFFECTS:** None known. For further information, see section 12, Ecological Information.

### 3. Composition/Information on Ingredients

See section 16 for important information about mixtures.

COMPONENT	CAS NUMBER	CONCENTRATION
Hydrogen Sulfide	7783-06-4	>99%*

\*The symbol > means "greater than."

### 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.*

Contact the Poison Control Center in your area for additional information on patient management and follow-up.

## 5. Fire Fighting Measures

**FLAMMABLE PROPERTIES:** Toxic, flammable, corrosive gas.

**SUITABLE EXTINGUISHING MEDIA:** CO<sub>2</sub>, dry chemicals, water spray, or fog.

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

**PROTECTION OF FIREFIGHTERS: 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. 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.

**Specific Physical and Chemical Hazards.** 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.

**Protective Equipment and Precautions for Firefighters.** Firefighters should wear self-contained breathing apparatus and full fire-fighting turnout gear.

## 6. Accidental Release Measures

**STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED:**

**DANGER! Toxic, flammable liquid and gas under pressure.**

**Personal Precautions.** Forms explosive mixtures with air. 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.

**Environmental Precautions.** 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 HANDLING:** May be fatal if inhaled. Do not breathe gas. Do not get vapors or liquid in eyes, on skin, or on clothing. **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. Keep away from oxidizing agents and from other flammables. Have safety showers and eyewash fountains immediately available. 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.

**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.

**RECOMMENDED PUBLICATIONS:** For further information on storage, handling, and use, see Praxair publication P-14-153, *Guidelines for Handling Gas Cylinders and Containers*. Obtain from your local supplier.

## 8. Exposure Controls/Personal Protection

COMPONENT	OSHA PEL	ACGIH TLV-TWA (2008)
Hydrogen Sulfide	20 ppm (c)*; 50 ppm, 10 min, once only, if no other measurable exposure occurs.	10 ppm; 15 ppm, 15-min STEL

\*(c) – ceiling. Ceiling values are not Time-Weighted-Average (TWA).

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

IDLH = 100 ppm

### 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

#### PERSONAL PROTECTIVE EQUIPMENT:

**Skin Protection.** Wear work gloves when handling cylinders; neoprene, butyl rubber, or PVC gloves where contact with product may occur. 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.

**Eye/Face Protection.** Select in accordance with OSHA 29 CFR 1910.133.

**Respiratory Protection.** A respiratory protection program that meet OSHA 29 CFR 1910.134, ANSI Z88.2, or MSHA 30 CFR 72.710 (where applicable) requirements must be followed whenever workplace conditions warrant respirator use. Use an air-supplied or air-purifying cartridge if the action level is exceeded. Ensure the respirator has the appropriate protection factor for the exposure level. If cartridge type respirators are used, the cartridge must be appropriate for the chemical exposure (e.g., an organic vapor cartridge). For emergencies or instances with unknown exposure levels, use a self-contained breathing apparatus.

### 9. Physical and Chemical Properties

<b>APPEARANCE:</b>	Colorless gas
<b>ODOR:</b>	Rotten eggs. Hydrogen sulfide deadens the sense of smell.
<b>ODOR THRESHOLD:</b>	Not available.
<b>PHYSICAL STATE:</b>	Gas at normal temperature and pressure
<b>pH:</b>	Not applicable.
<b>MELTING POINT</b> at 1 atm:	-121.85°F (-85.47°C)
<b>BOILING POINT</b> at 1 atm:	-76.63°F (-60.35°C)
<b>FLASH POINT</b> (test method):	Not available.
<b>EVAPORATION RATE</b> (Butyl Acetate = 1):	Not available.
<b>FLAMMABILITY:</b>	Flammable
<b>FLAMMABLE LIMITS IN AIR</b> , % by volume:	<b>LOWER:</b> 4.3% <b>UPPER:</b> 46.0%
<b>VAPOR PRESSURE</b> at 68°F (20°C):	258.4 psia (1781 kPa abs)
<b>VAPOR DENSITY</b> at 70°F (21.1°C) and 1 atm:	0.0881 lb/ft <sup>3</sup> (1.411 kg/m <sup>3</sup> )
<b>SPECIFIC GRAVITY</b> (H <sub>2</sub> O = 1) at 60°F (15.6°C):	0.79
<b>SPECIFIC GRAVITY</b> (Air = 1) at 59°F (15°C) and 1 atm:	1.18
<b>SOLUBILITY IN WATER</b> at 68°F (20°C) and 1 atm:	0.317 lb/gal (38 kg/m <sup>3</sup> )
<b>PARTITION COEFFICIENT: n-octanol/water:</b>	Not available.
<b>AUTOIGNITION TEMPERATURE:</b>	500°F (260°C)
<b>DECOMPOSITION TEMPERATURE:</b>	Not available.
<b>PERCENT VOLATILES BY VOLUME:</b>	100
<b>MOLECULAR WEIGHT:</b>	34.08
<b>MOLECULAR FORMULA:</b>	H <sub>2</sub> S

### 10. Stability and Reactivity

**CHEMICAL STABILITY:**     Unstable     Stable

**CONDITIONS TO AVOID:** None known.

**INCOMPATIBLE MATERIALS:** 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.

**POSSIBILITY OF HAZARDOUS REACTIONS:**     May Occur     Will Not Occur

Thermal decomposition may produce sulfur and hydrogen.

### 11. Toxicological Information

**ACUTE DOSE EFFECTS:** LC<sub>50</sub>, 1 hr, rat = 712 ppmv

**STUDY RESULTS:** 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.

### 12. Ecological Information

**ECOTOXICITY:** No known effects.

**OTHER ADVERSE EFFECTS:** Hydrogen sulfide does not contain any Class I or Class II ozone-depleting chemicals.

### 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

<b>HAZARD CLASS:</b>	2.3	<b>PACKING GROUP/Zone:</b>	NA/B	<b>IDENTIFICATION NUMBER:</b>	UN1053	<b>PRODUCT RQ:</b>	100 lb (45.4 kg)
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**SHIPPING LABEL(s):** POISON GAS, FLAMMABLE GAS \*\*

**PLACARD (when required):** POISON GAS, FLAMMABLE GAS \*\*

\*NA=Not applicable.

\*\*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 Requirement:** 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)].

**MARINE POLLUTANTS:** Hydrogen sulfide is not listed as a marine pollutant by DOT.

## 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 RQ (40 CFR 355):** 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

**PRESSURE:** Yes

**DELAYED:** 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:** Hydrogen sulfide 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:** Hydrogen sulfide is not listed by California under the SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT OF 1986 (Proposition 65).

**PENNSYLVANIA:** Hydrogen sulfide 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.* Use piping and equipment adequately designed to withstand pressures to be encountered. 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. **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.**

**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.

**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.

**HAZARD RATING SYSTEMS:****NFPA RATINGS:**

HEALTH = 4  
FLAMMABILITY = 4  
INSTABILITY = 0  
SPECIAL = None

**HMIS RATINGS:**

HEALTH = 2  
FLAMMABILITY = 4  
PHYSICAL HAZARD = 2

**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 can be found in the following materials published by the Compressed Gas Association, Inc. (CGA), 4221 Walney Road, 5<sup>th</sup> 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.

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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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