Praxair Material Safety Data Sheet

1. Chemical Product and Company Identification

Product Name: Hydrogen bromide, anhydrous (MSDS No. P-4605-F)	**Trade Name:** Hydrogen bromide
Chemical Name: Hydrogen bromide	**Synonyms:** Hydrobromic acid, anhydrous hydrobromic acid
Formula: HBr	**Chemical Family:** Inorganic halide

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 Bromide	10035-10-6	>99%*	3 ppm	2 ppm ceiling**

**The symbol > means "greater than."*
*** Ceiling values are not time-weighted average.*

3. Hazards Identification

EMERGENCY OVERVIEW

DANGER! Toxic, corrosive liquid and gas under pressure.
Harmful or fatal if inhaled.
Can cause eye, skin, and respiratory tract burns.
Self-contained breathing apparatus and protective clothing must be worn by rescue workers.
Odor: Irritating

THRESHOLD LIMIT VALUE: 2 ppm ceiling (ACGIH, 2004). NOTE: Ceiling limits 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.

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Revised

EFFECTS OF A SINGLE (ACUTE) OVEREXPOSURE:

INHALATION–Overexposure to vapor concentrations moderately above the Threshold Limit Value (TLV) of 3 ppm irritates the upper respiratory tract. Intolerable concentrations range from 50-100 ppm for 60 minutes to 10-50 ppm for several hours. High concentrations (greater than 50 ppm) severely irritate the respiratory tract, causing the throat to burn and producing choking and coughing. Pulmonary edema, general lung injury, and ulceration of the nose, throat, and larynx may also occur. Exposure to concentrations of 1500-2000 ppm for a few minutes is life-threatening. At higher concentrations, victim may suffocate from lack of oxygen.

SKIN CONTACT–May severely irritate the skin, causing ulceration, chemical burns, and scarring. Repeated exposure may produce cumulative dermatitis. With prolonged or widespread contact, the skin may absorb potentially harmful amounts of material.

SWALLOWING–A highly unlikely route of exposure. This product is a gas at normal temperature and pressure. Highly toxic. May cause chemical burns of the mouth, throat, esophagus, and stomach, with severe abdominal and chest pain, nausea, diarrhea, vomiting, dizziness, drowsiness, weakness, circulatory collapse, and coma.

EYE CONTACT–May cause pain, tearing, and photophobia. The severity of injury depends on the concentration and duration of contact and may range from irritation to conjunctival edema, corneal ulceration, and blindness.

EFFECTS OF REPEATED (CHRONIC) OVEREXPOSURE: Prolonged or repeated exposure may cause tooth erosion followed by jaw necrosis. May irritate the bronchial passages, producing persistent cough and predisposing to respiratory infections. The sense of smell may be diminished.

OTHER EFFECTS OF OVEREXPOSURE: None known.

MEDICAL CONDITIONS AGGRAVATED BY OVEREXPOSURE: Inhalation may aggravate asthma and inflammatory or fibrotic pulmonary disease. Skin contact may aggravate an existing dermatitis.

SIGNIFICANT LABORATORY DATA WITH POSSIBLE RELEVANCE TO HUMAN HEALTH HAZARD EVALUATION: One study indicates nose irritation in 50% of human subjects exposed to 4 ppm hydrogen bromide.

CARCINOGENICITY: Hydrogen bromide is not listed by NTP, OSHA, and IARC.

4. First Aid Measures

INHALATION: Immediately remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, qualified personnel may give oxygen. Keep victim warm. Call a physician.

SKIN CONTACT: Avoid breathing vapor. Immediately flush skin with plenty of warm water while removing contaminated clothing and shoes. Pay particular attention to skin under nails. Follow by applying an iced, saturated solution of Epsom salts. If not available, continue washing in water until medical attention is obtained. Discard clothing and shoes. Call a physician for all exposures.

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

EYE CONTACT: Immediately flush eyes thoroughly with warm 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 victims of exposure under medical observation for 24-48 hours—72 hours for severe exposure. The hazards of this material are mainly due to its severely irritant and corrosive properties on skin and mucosal surfaces. 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)**:**	Not applicable	
AUTOIGNITION TEMPERATURE:	Not applicable	
FLAMMABLE LIMITS IN AIR, % by volume**:**	**LOWER:** Not applicable	**UPPER:** Not applicable

EXTINGUISHING MEDIA: Hydrogen bromide cannot catch fire. Use media appropriate for surrounding fire.

SPECIAL FIRE FIGHTING PROCEDURES: DANGER! Toxic, corrosive liquid and gas under pressure. Immediately 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; then move them away from fire if without risk. If cylinders are leaking, reduce toxic vapors with water spray or fog. Shut off leak if without risk. Reverse flow into cylinders may cause rupture. (See section 16.) On-site fire brigades must comply with OSHA 29 CFR 1910.156.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Nonflammable, toxic, corrosive gas. Heat of fire can build pressure in cylinder and cause it to rupture. No part of cylinder should be subjected to a temperature higher than 125°F (52°C). Hydrogen bromide cylinders are equipped with a pressure relief device. (Exceptions may exist where authorized by DOT.) Vapors are extremely irritating and may burn skin and eyes on contact. Contact with most metals in the presence of moisture produces flammable hydrogen.

HAZARDOUS COMBUSTION PRODUCTS: None known.

6. Accidental Release Measures

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED: DANGER! Toxic, corrosive liquid and gas under pressure. Immediately evacuate all personnel from danger area. Do not approach area without self-contained breathing apparatus and protective clothing. Reduce vapors with fog or fine water spray. Shut off leak if without risk. Ventilate area of leak or move cylinder to a well-ventilated area. Prevent runoff from contaminating the surrounding environment. Toxic, corrosive vapors may spread from spill. Before entering area, especially a confined area, check atmosphere with an appropriate device. Reverse flow into cylinders may cause rupture.

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. Firmly secure cylinders upright to keep them from falling or being knocked over. Screw valve protection cap firmly in place by hand. 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. 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 bromide, see section 16.

For additional information on storage and handling, refer to Compressed Gas Association (CGA) pamphlet P-1, *Safe Handling of Compressed Gases in Containers*, available from the CGA. Refer to section 16 for the address and phone number along with a list of other available publications.

8. Exposure Controls/Personal Protection

VENTILATION/ENGINEERING CONTROLS:

LOCAL EXHAUST–A corrosion-resistant system is acceptable.

MECHANICAL (general)–Inadequate. See SPECIAL below.

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

OTHER–See SPECIAL.

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.

PROTECTIVE GLOVES: Wear work gloves when handling cylinders, neoprene during cylinder changeout or wherever contact with product may occur.

EYE PROTECTION: Wear safety glasses when handling cylinders; vapor-proof goggles and a face shield during cylinder changeout or wherever contact with product may occur. Select per OSHA 29 CFR 1910.133.

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

9. Physical and Chemical Properties

MOLECULAR WEIGHT:	80.912
LIQUID DENSITY at -88.8°F (-67.1°C) and 1 atm**:**	169.3 lb/ft^3 (2717 kg/m^3)
SPECIFIC GRAVITY (Air = 1) at 77°F (25°C) and 1 atm**:**	2.812
GAS DENSITY at 32°F (0°C) and 1 atm**:**	0.23 lb/ft^3 (3.684 kg/m^3)
VAPOR PRESSURE at 70°F (21.1°C)**:**	334.7 psia (2307 kPa abs)
SOLUBILITY IN WATER, at 68°F (20°C) and 1 atm, wt/wt solution**:**	0.49
PERCENT VOLATILES BY VOLUME:	100
EVAPORATION RATE (Butyl Acetate = 1)**:**	High
BOILING POINT at 1 atm**:**	-88.06°F (-66.7°C)
FREEZING POINT at 1 atm**:**	-124.26°F (-86.81°C)

APPEARANCE, ODOR, AND STATE: Colorless gas at normal temperature and pressure; very irritating odor.

10. Stability and Reactivity

STABILITY: ☐ Unstable ☒ Stable

INCOMPATIBILITY (materials to avoid): Moisture, bases. Reacts with most common metals and their alloys, ammonia, strong oxidizers, and fluorine. Reaction with aluminum may form pyrophoric trimethyl aluminum or aluminum alkyls.

HAZARDOUS DECOMPOSITION PRODUCTS: Bromine, hydrogen

HAZARDOUS POLYMERIZATION: ☐ May Occur ☒ Will Not Occur

CONDITIONS TO AVOID: None known.

11. Toxicological Information

See section 3. One-hour rat and mouse LC_{50} values for vapor are 2858 ppm and 814 ppm, respectively.

12. Ecological Information

Hydrogen bromide does not contain any Class I or Class II ozone-depleting chemicals. Hydrogen bromide is not listed as a marine pollutant by DOT.

13. Disposal Considerations

WASTE DISPOSAL METHOD: Keep waste from contaminating surrounding environment. Keep personnel away. Do not dispose of residual or unused quantities. Return cylinder to supplier.

14. Transport Information

DOT/IMO SHIPPING NAME:	Hydrogen bromide, anhydrous		
HAZARD CLASS: 2.3	**IDENTIFICATION NUMBER:**	UN 1048	**PRODUCT RQ:** None
SHIPPING LABEL(s):	POISON GAS, CORROSIVE*		
PLACARD (when required):	POISON GAS, CORROSIVE*		

**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)].

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): None

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: None
EHS RQ: None

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:** Yes
	FIRE: No

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

Hydrogen bromide does not require reporting under Section 313.

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 bromide is not listed as a regulated substance.

TSCA: TOXIC SUBSTANCES CONTROL ACT: Hydrogen bromide 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 bromide is listed in Appendix A as a highly hazardous chemical in quantities of 5,000 lb (2268 kg) or greater.

STATE REGULATIONS:

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

PENNSYLVANIA: Hydrogen bromide 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, corrosive, liquid and gas under pressure.*** Do not breathe gas. Do not get vapor 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, and open flame. Ground all equipment. Use only spark-proof tools and explosion-proof equipment. ***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. ***Store and use with adequate ventilation at all times.*** Use only in a closed system constructed of corrosion-resistant materials. Close cylinder valve after each use; keep closed even when empty. ***Follow safe practices when returning cylinder to supplier.*** Be sure valve is closed; then install valve outlet cap or plug, leak-tight. ***Never work on a pressurized system.*** If there is a leak, close the cylinder valve. Blow the system down in a safe and environmentally sound manner in compliance with all federal, state, and local laws; then repair the leak***. 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 bromide.*

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.

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	= 3	HEALTH	= 3
FLAMMABILITY	= 0	FLAMMABILITY	= 0
INSTABILITY	= 1	PHYSICAL HAZARD	= 1
SPECIAL	= None		

STANDARD VALVE CONNECTIONS FOR U.S. AND CANADA:

THREADED: CGA-330 connection is standard.
PIN-INDEXED YOKE: Not applicable
ULTRA-HIGH-INTEGRITY CONNECTION: CGA-634

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.

P-1 *Safe Handling of Compressed Gases in Containers*
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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