Praxair Material Safety Data Sheet

1. Chemical Product and Company Identification

Product Name: Hydrogen fluoride, anhydrous (MSDS No. P-4608-G)

Trade Name: Hydrogen fluoride

Chemical Name: Hydrogen fluoride

Synonyms: Anhydrous hydrofluoric acid, hydrofluoride, fluorohydric acid gas, hydrofluoric acid gas, HF-A

Formula: HF

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 (2002)
Hydrogen Fluoride	7664-39-3	>99%*	3 ppm	3 ppm ceiling**

**The symbol > means "greater than."*
*** Ceiling limits are not Time-Weighted-Average (TWA).*

3. Hazards Identification

EMERGENCY OVERVIEW

DANGER! Corrosive, toxic liquid and gas under pressure.
Harmful or fatal if inhaled.
Causes severe eye, skin, and respiratory tract burns.
Symptoms may be delayed.
May cause liver and kidney damage.
Contact with organic or silica materials or metals may cause fire.
Contact with water may cause violent reaction.
Self-contained breathing apparatus must be worn by rescue workers.
Odor: Sharp, penetrating

THRESHOLD LIMIT VALUE: 3 ppm ceiling (ACGIH, 2002). 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.

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. Concentrations ranging around 120 ppm for 1 minute result in intolerable irritation of the eyes and respiratory tract. High concentrations cause choking, coughing, burning of the throat, and severe irritation of the respiratory tract, with possible pulmonary edema, general lung injury, bronchitis, and death. Symptoms may progress for 1-2 days and gradually diminish over 2-3 months.

SKIN CONTACT–May cause severe irritation and chemical burns associated with severe pain and deeply penetrating tissue destruction. Tissue destruction may persist for several days. With prolonged or widespread contact, harmful amounts may be absorbed.

SWALLOWING–Highly toxic. May cause chemical burns of the mouth, throat, esophagus, stomach, and small bowel, with severe pain, nausea, diarrhea, vomiting, dizziness, weakness, and collapse. Large doses may cause central nervous system involvement with muscle spasms and coma.

EYE CONTACT– May cause pain, tearing, conjunctivitis, and corneal burns. Vapor may be moderately to severely irritating, causing excess tears, discomfort, blinking, and excess redness of the conjunctiva.

EFFECTS OF REPEATED (CHRONIC) OVEREXPOSURE: Prolonged or repeated exposure may decalcify the bones and cause nasal congestion, bronchitis, weight loss, anemia, weakness, and stiffness of joints. Repeated overexposure may also damage the lungs, liver, and kidneys.

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: None known.

CARCINOGENICITY: Hydrogen fluoride 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 immediately.

SKIN CONTACT: Immediately flush affected area with large quantities of cool water while removing contaminated clothing and shoes until all acid is removed. Pay particular attention to skin under nails. Follow by applying iced alcoholic or aqueous 0.2% Zephrian Chloride or Hyamine 1622 solution to affected area; if not available, continue washing in cool water for 2 to 4 hours or until medical attention arrives. Discard contaminated clothing and shoes. Keep victim warm. Call a physician immediately.

SWALLOWING: Give victim at least two glasses of milk or water. Do not induce vomiting. Keep victim warm. Call a physician immediately.

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: *In case of severe exposure, oxygen should be administered under pressure immediately and continued as long as necessary. Close observation should be continued 24-48 hours for pulmonary edema. For skin exposure, the affected areas should be covered with 3% calcium gluconate. If*

the solution was more than 20%, a 10% solution of calcium gluconate should be injected around and underneath the affected area.

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 fluoride cannot catch fire. Use media appropriate for surrounding fire, but note incompatibilities in section 10.

SPECIAL FIRE FIGHTING PROCEDURES: DANGER! Corrosive, toxic liquid and gas (see section 3). Immediately evacuate all personnel from danger area. Do not approach area without self-contained breathing apparatus, protective clothing, and eye protection. 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: Heat of fire can build pressure in cylinder and cause it to rupture. To provide maximum containment up to cylinder burst pressure, hydrogen fluoride cylinders are not equipped with a pressure relief device. No part of cylinder should be subjected to a temperature higher than 125°F (52°C). Liquid and 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! Corrosive, toxic liquid and gas (see section 3). 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. (See section 16.)

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 fluoride, 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–Use a corrosion-resistant system with sufficient air flow to keep the hydrogen fluoride concentration below the TLV in the worker's breathing zone.

MECHANICAL (general)–Not recommended as a primary ventilation system to control worker's exposure.

SPECIAL–A corrosion-resistant, canopy type, forced-draft fume hood may be preferred for some applications.

OTHER–See SPECIAL.

RESPIRATORY PROTECTION: Use air-supplied respirators for concentrations up to 10 times the applicable permissible exposure limit. For higher concentrations, a full-face, self-contained breathing apparatus operated in the pressure demand mode is required. Select per OSHA 29 CFR 1910.134 and ANSI Z88.2.

PROTECTIVE GLOVES: Wear work gloves for cylinder handling; neoprene, natural rubber, or nitrile gloves where needed.

EYE PROTECTION: Wear safety glasses when handling cylinders; vapor-proof goggles and a face shield during cylinder changeout or wherever contact with product is possible. 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:	20.01
LIQUID DENSITY at 77°F (25°C)**:**	58.744 lb/ft^3 (0.941 g/ml)
SPECIFIC GRAVITY (Air = 1) at 77°F (25°C) and 1 atm**:**	1.858
VAPOR PRESSURE at 68°F (20°C)**:**	15 psia (103 kPa abs)
SOLUBILITY IN WATER:	Reacts violently with water
PERCENT VOLATILES BY VOLUME:	100
EVAPORATION RATE (Butyl Acetate = 1)**:**	High
BOILING POINT at 1 atm**:**	67.14°F (19.52°C)
MELTING POINT at 1 atm**:**	-118.43°F (-83.57°C)

APPEARANCE, ODOR, AND STATE: Colorless, fuming liquid and gas at normal temperature and pressure; sharp, penetrating odor.

10. Stability and Reactivity

STABILITY: ☐ Unstable ☒ Stable

INCOMPATIBILITY (materials to avoid): Bases, moisture, organic compounds, silica bearing compounds, concrete, aluminum and its alloys, titanium, tin, austenitic stainless steels, tantalum, sodium, metal oxides, glass, acids. Aqueous hydrogen fluoride can react with metal alloys containing antimony or arsenic to release highly toxic stibine or arsine gas.

HAZARDOUS DECOMPOSITION PRODUCTS: Hydrogen, fluorine or fluorides.

HAZARDOUS POLYMERIZATION: ☐ May Occur ☒ Will Not Occur

CONDITIONS TO AVOID: None known.

11. Toxicological Information

LC_{50}, 1 hr, rat = 1276 ppm. See section 3.

12. Ecological Information

Hydrogen fluoride does not contain any Class I or Class II ozone-depleting chemicals. Hydrogen fluoride 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 unused quantities. Return cylinder to supplier.

14. Transport Information

DOT/IMO SHIPPING NAME:	Hydrogen fluoride, anhydrous	
HAZARD CLASS: 8	**IDENTIFICATION NUMBER:** UN 1052	**PRODUCT RQ:** 100 lb (45.4 kg)
SHIPPING LABEL(s):	CORROSIVE, POISON*	
PLACARD (when required):	CORROSIVE, POISON*	

**The words In the POISON 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): 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):

Threshold Planning Quantity (TPQ): 100 lb (45.4 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
DELAYED: Yes
PRESSURE: No
REACTIVITY: No`
FIRE: No

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

Hydrogen fluoride 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 fluoride is listed as a regulated substance in quantities of 1000 lb (454 kg) or greater.

TSCA: TOXIC SUBSTANCES CONTROL ACT: Hydrogen fluoride 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 fluoride is listed in Appendix A as a highly hazardous chemical in quantities of 1000 lb (454 kg) or greater.

STATE REGULATIONS:

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

PENNSYLVANIA: Hydrogen fluoride 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: ***Corrosive, toxic liquid and gas under pressure.*** 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. ***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 system constructed of corrosion-resistant materials. Close valve after each use; keep closed even when empty. ***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. ***Follow safe practices when returning cylinder to supplier.*** Make sure valve is closed; then install valve outlet cap or plug, leak-tight. ***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 fluoride.*

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	= 4	HEALTH	= 3
FLAMMABILITY	= 0	FLAMMABILITY	= 0
INSTABILITY	= 1	PHYSICAL HAZARD	= 1
SPECIAL	= None		

STANDARD VALVE CONNECTIONS FOR U.S. AND CANADA:

THREADED: CGA-670 connection is standard. CGA-660 limited standard.

PIN-INDEXED YOKE: Not applicable

ULTRA-HIGH-INTEGRITY CONNECTION: CGA-638

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.

AV-1	*Safe Handling and Storage of Compressed Gases*
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.

Praxair MSDSs are furnished on sale or delivery by Praxair or the independent distributors and suppliers who package and sell our products. To obtain current Praxair MSDSs for these products, contact your Praxair sales representative or local distributor or supplier. If you have questions regarding Praxair MSDSs, would like the form number and date of the latest MSDS, or would like the names of the Praxair suppliers in your area, phone or write the Praxair Call Center (**Phone:** 1-800-PRAXAIR; **Address:** Praxair Call Center, Praxair, Inc., PO Box 44, Tonawanda, NY 14151-0044).

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