

Praxair Material Safety Data Sheet

1. Chemical Product and Company Identification

Product Name: Hydrogen fluoride, anhydrous (MSDS No. P-4608-I)	Trade Names: Hydrogen fluoride
Chemical Name: Hydrogen fluoride	Synonyms: Anhydrous hydrofluoric acid, hydrofluoride, fluorohydric acid gas, hydrofluoric acid gas, HF-A
Chemical Family: Inorganic halide	Product Grades: 2.0
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. Hazards Identification

EMERGENCY OVERVIEW



**DANGER! Corrosive, poisonous 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 and protective clothing
must be worn by rescue workers.**

Under ambient conditions, this is a gas with a sharp, penetrating 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. 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 (fluid on the lungs), 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.

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

POTENTIAL ENVIRONMENTAL EFFECTS: 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 Fluoride <i>*The symbol > means "greater than."</i>	7664-39-3	>99%*

4. First Aid Measures

INHALATION: Immediately remove to fresh air. If not breathing, give artificial respiration.

WARNING: Rescuer may receive chemical burns as a result of mouth-to-mouth. If breathing is difficult, qualified personnel may give oxygen. Keep victim warm. Call a physician immediately. Symptoms may be delayed.

SKIN CONTACT: Immediately flush affected area with large quantities of cool water for at least 15 minutes 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 percent 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: If victim is fully conscious, give two glasses of water or milk at once. Never give anything by mouth to an unconscious person. Keep victim warm. Do not induce vomiting. Call a physician immediately.

EYE CONTACT: 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. Seek the advice of 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 percent calcium gluconate. If the solution was more than 20 percent, a 10 percent solution of calcium gluconate should be injected around and underneath the affected area.*

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

5. Fire Fighting Measures

FLAMMABLE PROPERTIES: Hydrogen fluoride cannot catch fire.

SUITABLE EXTINGUISHING MEDIA: Use media appropriate for surrounding fire, but note incompatibilities in section 10.

PRODUCTS OF COMBUSTION: Not applicable.

PROTECTION OF FIREFIGHTERS: DANGER! Corrosive, poisonous liquid and gas under pressure. 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. On-site fire brigades must comply with OSHA 29 CFR 1910.156.

Specific Physical and Chemical 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 the 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.

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! Corrosive, poisonous liquid and gas under pressure.

Personal Precautions. 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.

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: Do not breathe gas. Do not get vapors or liquid in eyes, on skin, or on clothing. Have safety showers and eyewash fountains immediately available. Store and use with adequate ventilation at all times. 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. Close valve after each use; keep closed even when empty. If valve is hard to open, discontinue use and contact your supplier. For other precautions in using hydrogen fluoride, see section 16.

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.

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 (2009)
Hydrogen Fluoride *Hydrogen Fluoride, as F	3 ppm	0.5 ppm*

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 = 30 ppm

ENGINEERING CONTROLS:

Local Exhaust. Use a corrosion-resistant system with sufficient air flow to keep the hydrogen fluoride concentration below the applicable exposure limit 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.

PERSONAL PROTECTIVE EQUIPMENT:

Skin Protection. Wear work gloves for cylinder handling; neoprene, natural rubber, or nitrile gloves where needed. Metatarsal shoes for cylinder handling and protective clothing where needed.

Eye/Face 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.

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

APPEARANCE:	Colorless, fuming liquid and gas	
ODOR:	Sharp, penetrating	
ODOR THRESHOLD:	Not available.	
PHYSICAL STATE:	Gas at normal temperature and pressure	
pH:	Not applicable.	
MELTING POINT at 1 atm:	-118.05°F (-83.36°C)	
BOILING POINT at 1 atm:	67.14°F (19.52°C)	
FLASH POINT (test method):	Not applicable.	
EVAPORATION RATE (Butyl Acetate = 1):	High	
FLAMMABILITY:	Flammable	
FLAMMABLE LIMITS IN AIR , % by volume:	LOWER: Not applicable.	UPPER: Not applicable.
VAPOR PRESSURE at 68°F (20°C):	15 psia (103 kPa abs)	
LIQUID DENSITY at 77°F (25°C) and 1 atm:	58.744 lb/ft ³ (0.941 g/ml)	
SPECIFIC GRAVITY (Air = 1) at 77°F (25°C) and 1 atm:	1.858	
SOLUBILITY IN WATER:	Total	
PARTITION COEFFICIENT: n-octanol/water:	Not available.	
AUTOIGNITION TEMPERATURE:	Not applicable.	
DECOMPOSITION TEMPERATURE:	Not available.	
PERCENT VOLATILES BY VOLUME:	100	
MOLECULAR WEIGHT:	20.01	
MOLECULAR FORMULA:	HF	

10. Stability and Reactivity

CHEMICAL STABILITY: Unstable Stable

CONDITIONS TO AVOID: None known.

INCOMPATIBLE MATERIALS: 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.

POSSIBILITY OF HAZARDOUS REACTIONS: May Occur Will Not Occur

Aqueous hydrogen fluoride can react with metal alloys containing antimony or arsenic to release highly toxic stibine or arsine gas.

11. Toxicological Information

ACUTE DOSE EFFECTS: LC₅₀, 1 hr, rat = 1276 ppm

STUDY RESULTS: None known.

12. Ecological Information

ECOTOXICITY: No known effects.

OTHER ADVERSE EFFECTS: Hydrogen fluoride 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 fluoride, anhydrous

HAZARD CLASS:	PACKING GROUP/Zone:	IDENTIFICATION NUMBER:	PRODUCT RQ:
8	I	UN1052	100 lb (45.4 kg)

SHIPPING LABEL(s): CORROSIVE, POISON INHALATION HAZARD *

PLACARD (when required): CORROSIVE, POISON INHALATION HAZARD *

**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)].

MARINE POLLUTANTS: Hydrogen fluoride 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: 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

Read and understand all labels and instructions supplied with all containers of this product.

OTHER HAZARDOUS CONDITIONS OF HANDLING, STORAGE, AND USE: *Corrosive, poisonous liquid and gas under pressure.* Use piping and equipment adequately designed to withstand pressures to be encountered. Use a backflow prevention device in any piping. 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. Use only in a system constructed of corrosion-resistant materials. 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. Ensure that the 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.

Mixtures. When you mix two or more chemicals, 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, chemicals have properties that can cause serious injury or death.

HAZARD RATING SYSTEMS:

NFPA RATINGS:

HEALTH = 4
 FLAMMABILITY = 0
 INSTABILITY = 1
 SPECIAL = None

HMIS RATINGS:

HEALTH = 3
 FLAMMABILITY = 0
 PHYSICAL HAZARD = 2

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 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*
 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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