

MATERIAL SAFETY DATA SHEET

SECTION 1. PRODUCT IDENTIFICATION

PRODUCT NAME: Hydrogen Fluoride
CHEMICAL NAME: Hydrogen Fluoride **FORMULA:** HF
SYNONYMS: Anhydrous Hydrofluoric Acid, Anhydrous Hydrogen Fluoride
MANUFACTURER: Air Products and Chemicals, Inc.
7201 Hamilton Boulevard
Allentown, PA 18195-1501
PRODUCT INFORMATION: (800) 752-1597
MSDS NUMBER: 1065 **REVISION:** 6
REVIEW DATE: February 2000 **REVISION DATE:** February 2000

SECTION 2. COMPOSITION / INFORMATION ON INGREDIENTS

Hydrogen Fluoride is sold as pure product > 99%.

CAS NUMBER: 7664-39-3

EXPOSURE LIMITS:

OSHA: PEL = 3 ppm

ACGIH: TWATLV = 3 ppm (ceiling)

NIOSH: IDLH = 30 ppm

SECTION 3. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW

Hydrogen Fluoride is a toxic, corrosive, nonflammable, liquefied gas packaged in cylinders under its own vapor pressure of 14.1 psia at 70 °F. The gas is colorless, but generates white fumes in moist air. The degree of fuming is related to the amount of humidity in the air. The reaction with water will produce heat and form very corrosive hydrofluoric acid. It has a repulsive, irritating, acidic odor that usually can be detected at low concentrations. Direct skin contact can cause severe burns that may not be immediately painful or visible. Inhalation of fumes can lead to inflammation and congestion of the lungs, and circulatory collapse. Wear self-contained breathing apparatus (SCBA) and fully protective suits when entering the release area if concentrations are unknown or exceed exposure limits.

EMERGENCY TELEPHONE NUMBERS

(800) 523-9374 Continental U.S., Canada, and Puerto Rico
(610) 481-7711 other locations

ACUTE POTENTIAL HEALTH EFFECTS:

ROUTES OF EXPOSURE:

EYE CONTACT: Irritation and/or burns to the eye that may lead to vision impairment or loss.

INGESTION: Burns to the mouth, esophagus and stomach. Systemic effects may occur and can be fatal.

INHALATION: Hydrogen Fluoride is corrosive and irritating to the respiratory tract and mucous membranes. Deep lung inflammation (chemical pneumonitis), bleeding (pulmonary hemorrhage), abnormal fluid build up in the lungs (pulmonary edema) and a systemic reaction are possible and can be fatal. Appearance of symptoms may be delayed.

SKIN CONTACT: Burns to affected area can cause deep tissue damage and possibly a systemic reaction which can be fatal. Burns may not be immediately painful or visible.

POTENTIAL HEALTH EFFECTS OF REPEATED EXPOSURE:

ROUTE OF ENTRY: Ingestion, inhalation, skin or eye contact.

SYMPTOMS: Chronic fluoride exposure may cause bone or joint changes in humans (fluorosis).

TARGET ORGANS: Eyes, skin, airway, lungs, liver, kidney, heart and bone.

MEDICAL CONDITIONS AGGRAVATED BY OVEREXPOSURE: May aggravate asthma, emphysema or other respiratory diseases.

CARCINOGENICITY: Hydrogen Fluoride is not listed as a carcinogen or potential carcinogen by NTP, IARC or OSHA Subpart Z.

SECTION 4. FIRST AID MEASURES

Prompt medical attention is required in all cases of exposure to Hydrogen Fluoride. Effects may be delayed.

EYE CONTACT: While holding eyelids open, immediately flush eyes with water until calcium gluconate solution is available. Seek medical treatment immediately. Trained personnel should flush the eye with sterile 1% calcium gluconate solution by **continuous** drip.

INGESTION: Do not induce vomiting. Dilute acid by drinking 1-3 glasses of water. Administer several ounces of Milk of Magnesia, Mylanta, or several vials of 10% aqueous calcium gluconate orally. Get immediate medical attention. Gastric lavage with calcium chloride or calcium gluconate may be performed by a physician.

INHALATION: Move exposed personnel to uncontaminated area. Seek immediate medical attention. If not breathing, give artificial respiration. **Mouth to mouth resuscitation is not recommended.** If breathing is difficult, give oxygen. Continue with administration of oxygen while waiting for medical attention. If airway obstruction occurs, the placement of an artificial airway by an emergency medical technician may be necessary. Trained personnel should administer 2.5% calcium gluconate by nebulizer with patient in sitting position.

SKIN CONTACT: Immediately flush with copious amounts of water until treatment is available. Remove contaminated clothing. With gloved hand apply 2.5% calcium gluconate gel to the burn area. An alternative treatment is immersion in an iced solution of 0.13% Zephiran (benzalkonium chloride solution, NF). If immersion is impractical, soaked compresses of the same solution should be applied to the area. Immersion or compresses must be used continuously for two hours. Compresses should be changed every two minutes. Burns covering an area greater than eight square inches require immediate treatment by a physician. A physician should be consulted for all exposures.

NOTES TO PHYSICIAN: If pain persists after above topical treatments, it may be necessary to inject 5% aqueous calcium gluconate beneath, around and into the burn area. This will more likely be necessary in the treatment of extensive burns or small burns where treatment has been delayed. Do not use local anesthetics. Resolution of pain is means to determine effective medical treatment.

The patient should be observed for clinical symptoms of hypocalcemia following ingestion or inhalation or following extensive burns. Serum calcium, potassium and magnesium determinations must be performed immediately and periodically to monitor for hypocalcemia and electrolyte imbalance. EKGs should be done immediately and periodically to monitor for arrhythmias, hypocalcemia and hyperkalemia.

If additional information is needed call the Air Products' Emergency Number (Section 3) or consult the Air Products' Safetygram 29 "Treatment Protocol for Hydrofluoric Acid Burns."

SECTION 5. FIRE FIGHTING MEASURES

FLASH POINT:

Not applicable

AUTOIGNITION:

Not applicable

FLAMMABLE RANGE:

Not applicable

See UNUSUAL FIRE AND EXPLOSION HAZARDS for additional information

EXTINGUISHING MEDIA: This product is nonflammable and does not support combustion. Use extinguishing media appropriate for surrounding fire.

SPECIAL FIRE FIGHTING INSTRUCTIONS: Evacuate all personnel from area. If possible without risk, move cylinders away from fire area. Cool cylinders with water spray until well after fire is out. Self-contained breathing apparatus (SCBA) required.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Anhydrous Hydrogen Fluoride in cylinders reacts very slowly with the iron in the steel to form iron fluoride and hydrogen. Over time, the hydrogen collects in the vapor space and builds pressure. Hydrogen is a flammable gas. Hydrogen's flammable range is 4-74%. Cylinders exposed to high heat or flame may rupture violently. Runoff from fire fighting may be contaminated; check pH.

HAZARDOUS COMBUSTION PRODUCTS: None

SECTION 6. ACCIDENTAL RELEASE MEASURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED: Evacuate all personnel from affected area. Increase ventilation to the release area and monitor Hydrogen Fluoride levels. Significant releases may require considerable downwind evacuation. Use appropriate protective equipment. Water spray may be used for mitigation. If leak is from cylinder or cylinder valve call the Air Products' emergency telephone number. If the leak is in the user's system, close the cylinder valve, safely vent the pressure, and purge with an inert gas before attempting repairs.

SECTION 7. HANDLING AND STORAGE

STORAGE: Store cylinders in a well-ventilated, secure area, protected from the weather. Secured cylinders should be stored upright with properly installed valve outlet seals and valve protection caps in place. Do not allow storage temperature to exceed 125 °F (52 °C). Storage should be away from heavily traveled areas and emergency exits. Full and empty cylinders should be segregated. Use a first-in first-out inventory system to prevent full containers from being stored for long periods of time. Local codes may have special requirements for toxic gas storage.

HANDLING: Do not drag, roll, or slide cylinder. Use a suitable handtruck designed for cylinder movement. Never attempt to lift a cylinder by its cap. Secure cylinders at all times while in use. Use a separate control valve to safely discharge gas from cylinder. Use a check valve to prevent reverse flow into the cylinder. Never apply flame or localized heat directly to any part of the cylinder. Do not allow any part of the cylinder to exceed 125 °F (52 °C). When preparing to connect cylinder for use, always loosen valve outlet seal slowly. Once cylinder has been connected to process, open cylinder valve slowly and carefully. If user experiences any difficulty operating the cylinder valve, discontinue use and contact supplier. Never insert an object (e.g., wrench, screwdriver, etc.) into valve cap openings. Doing so may damage valve causing a leak to occur. Use an adjustable strap-wrench to remove over-tight or rusted caps.

SPECIAL PRECAUTIONS: Most metals are corroded by Hydrogen Fluoride in the presence of moisture. Systems should be kept free of moisture. Purge system with dry inert gas (i.e., helium or nitrogen) before Hydrogen Fluoride is introduced and when system is out of service.

Carbon steel, stainless steel, Monel or copper are suitable materials of construction for use when no moisture is present under normal temperature conditions. Do not use brass or aluminum. Hastelloy, platinum or gold offer good resistance to corrosion when moisture is present. Teflon, calcium-filled teflon or lead are the preferred gasket materials. Glass and ceramics are corroded by Hydrogen Fluoride.

CAUTION: There is a potential over-pressure hazard with the long term storage of carbon steel cylinders containing anhydrous Hydrogen Fluoride (AHF). AHF in the cylinder reacts very slowly with the iron in the steel to form iron fluoride and hydrogen. The hydrogen collects in the vapor space and builds pressure. Carbon steel cylinders containing AHF should not be stored for extended periods of time without monitoring pressure and cylinder condition. Extreme caution should be taken during the handling of any AHF cylinders that have been stored for extended periods of time. Air Products recommends a pressure check be conducted every two years for continued storage of unused product. Excess pressure must be vented through an appropriate scrubber system. If user wishes to return cylinder after two years, please contact your supplier for return.

Always store and handle compressed gases in accordance with Compressed Gas Association, Inc. (ph. 703-412-0900) pamphlet CGA P-1, *Safe Handling of Compressed Gases in Containers*. Local regulations may require specific equipment for storage or use.

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

ENGINEERING CONTROLS:

VENTILATION: Provide adequate ventilation and/or local exhaust to prevent accumulation of Hydrogen Fluoride concentrations above exposure limits.

RESPIRATORY PROTECTION:

Emergency Use: Self-contained breathing apparatus (SCBA) or a combination full-face supplied air respirator equipped with an escape SCBA.

EYE PROTECTION: Safety glasses for handling cylinders. A full faceshield should be worn in addition to safety glasses or goggles when connecting, disconnecting or opening cylinders.

SKIN PROTECTION: Leather gloves for handling cylinders. Acid resistant gloves (e.g. butyl rubber, Neoprene, polyethylene) and splash suit when connecting, disconnecting or opening cylinders. Encapsulating chemical protective suit for emergencies.

OTHER PROTECTIVE EQUIPMENT: Safety shoes, safety shower, eyewash fountain.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE, ODOR AND STATE: Colorless liquefied gas that fumes white and has a sharp suffocating acidic odor.

MOLECULAR WEIGHT: 20.1

BOILING POINT (1 atm): 67.1 °F (19.5 °C)

SPECIFIC GRAVITY (also called vapor density) (Air =1): 1.3-1.9

SPECIFIC GRAVITY (Water =1): 0.97

FREEZING POINT / MELTING POINT: -118.4 °F (-83.6 °C)

VAPOR PRESSURE (At 70 °F (21.1 °C)): 14.1 psia

GAS DENSITY (At 70 °F (21.1 °C) and 1 atm): 0.177 lb/ft³

LIQUID DENSITY (At 68 °F): 8.12 lb/g

SOLUBILITY IN WATER (Vol./Vol. at 32° F (0°C) and 1 atm): Very soluble (violent reaction)

SECTION 10. STABILITY AND REACTIVITY

CHEMICAL STABILITY: Stable

CONDITIONS TO AVOID: Cylinders should not be exposed to temperatures in excess of 125 °F (52 °C).

INCOMPATIBILITY (Materials to Avoid): Water, alkaline solutions, glass, concrete and other silicon bearing materials, carbonates, sulfides, cyanides, and common metals. Corrosive to many materials including leather and rubber.

REACTIVITY:

- A) HAZARDOUS DECOMPOSITION PRODUCTS:** Hydrogen over an extended period of time in steel cylinders and systems.
- B) HAZARDOUS POLYMERIZATION:** Non-hazardous endothermic polymerization may occur in gas phase.

SECTION 11. TOXICOLOGICAL INFORMATION

LC₅₀ (Inhalation): 1276 ppm (rat, 1 hour)

LD₅₀ (Oral): Not available

LD₅₀ (Dermal): Not available

SKIN CORROSIVITY: Hydrogen Fluoride can cause severe burns that may not be immediately painful or visible.

ADDITIONAL NOTES: Animals exposed to hydrogen fluoride have exhibited kidney, lung, heart and liver damage.

SECTION 12. ECOLOGICAL INFORMATION

AQUATIC TOXICITY: There is no definitive aquatic toxicity data available.

MOBILITY: Unknown

PERSISTENCE AND BIODEGRADABILITY: Unknown

POTENTIAL TO BIOACCUMULATE: Unknown

REMARKS: Do not release large amounts of Hydrogen Fluoride to the atmosphere. This product does not contain any Class I or Class II ozone depleting chemicals.

SECTION 13. DISPOSAL CONSIDERATIONS

UNUSED PRODUCT / EMPTY CONTAINER: Return cylinder and unused product to supplier. Do not attempt to dispose of unused product.

DISPOSAL INFORMATION: Scrubbing via caustic is the most common method of disposal.

SECTION 14. TRANSPORT INFORMATION

DOT SHIPPING NAME: Hydrogen Fluoride, Anhydrous
Poison - Inhalation Hazard, Zone C

HAZARD CLASS: 8

IDENTIFICATION NUMBER: UN1052

PACKING GROUP: I

SHIPPING LABEL(s): Corrosive, Poison Inhalation Hazard

PLACARD (All quantities): Corrosive, Poison Inhalation Hazard

ADDITIONAL MARKING: Hydrogen Fluoride is also a hazardous substance regulated by the EPA. When shipping quantities of 100 lbs. or more in one cylinder, add the prefix "RQ" to the DOT shipping name on the documentation and clearly mark "RQ" on the cylinder near the label.

SPECIAL SHIPPING INFORMATION: Cylinders should be transported in a secure upright position in a well-ventilated truck. Never transport in passenger compartment of a vehicle. Ensure cylinder valve is properly closed, valve outlet cap has been reinstalled, and valve protection cap is secured before shipping cylinder.

CAUTION: Compressed gas cylinders shall not be refilled except by qualified producers of compressed gases. The filling and shipping of a compressed gas cylinder without the written consent of the owner is in violation of federal law (49 CFR 173.301).

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SECTION 15. REGULATORY INFORMATION

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 lbs (45.4 kgs)

SARA TITLE III: Superfund Amendment and Reauthorization Act

SECTIONS 302/304: Emergency Planning and Notification (40 CFR Part 355)

Extremely Hazardous Substances: Hydrogen Fluoride is listed.

Threshold Planning Quantity (TPQ): 100 lbs (45.4 kgs)

Reportable Quantity (RQ): 100 lbs (45.4 kgs.)

SECTIONS 311/312: Hazardous Chemical Reporting (40 CFR Part 370)

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

SECTION 313: Toxic Chemical Release Reporting (40 CFR Part 372)

Hydrogen Fluoride does require reporting under Section 313.

CLEAN AIR ACT:

SECTION 112 (r): Risk Management Programs for Chemical Accidental Release
(40 CFR PART 68)

Hydrogen Fluoride is listed as a regulated substance.

Threshold Quantity (TQ): 1000 lbs

TSCA: Toxic Substance Control Act

Hydrogen Fluoride is listed on the TSCA inventory.

OSHA - OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION:

29 CFR Part 1910.119: Process Safety Management of Highly Hazardous Chemicals

Hydrogen Fluoride is listed as a highly hazardous chemical.

Threshold Quantity (TQ): 1000 lbs (454 kgs)

STATE REGULATIONS:

CALIFORNIA:

Proposition 65: This product is not a listed substance which the State of California requires warning under this statute.

SECTION 16. OTHER INFORMATION

NFPA RATINGS:

HEALTH: = 4
FLAMMABILITY: = 0
INSTABILITY: = 1
SPECIAL:

HMIS RATINGS:

HEALTH: = 3
FLAMMABILITY: = 0
REACTIVITY: = 2