1. IDENTIFICATION OF THE SUBSTANCE/MIXTURE AND THE COMPANY/UNDERTAKING

Identification of the substance/preparation	:	Hydrogen fluoride
Chemical formula	:	HF
Other means of identification	:	Hydrogen fluoride, Anhydrous Hydrofluoric Acid, Anhydrous Hydrogen Fluoride
Use of the Substance/Mixture	:	General Industrial
Restrictions on Use	:	No data available.
Manufacturer/Importer/Distributor	:	Air Products Singapore Industrial Gases Pte. Ltd. 2 International Business Park The Strategy, #03-20 Singapore 609930 Toll Free No: 800 448 1755
Email Address – Technical Information	:	GASTECH@airproducts.com
Telephone	:	6332 2440
Emergency telephone number (24h)	:	+65 6853 6800 +1 610 481 7711 International

2. HAZARDS IDENTIFICATION

GHS classification

Acute toxicity - Oral Category 1
Acute toxicity - Dermal Category 1
Acute toxicity - Inhalation Category 2
Skin corrosion - Category 1A
Serious Eye Damage - Category 1

GHS label elements

Hazard pictograms/symbols

Signal Word: Danger

Hazard Statements:

H300:Fatal if swallowed.

H310:Fatal in contact with skin.
H314:Causes severe skin burns and eye damage.
H330:Fatal if inhaled.
EUH071:Corrosive to the respiratory tract.

Precautionary Statements:

Prevention : P280:Wear protective gloves/protective clothing/eye protection/face protectio
P260:Do not breathe dust/fume/gas/mist/vapours/spray.

Response : P304+P340 :IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P315 :Get immediate medical advice/attention.
P305+P351+P338 :IF IN EYES: Rinse cautiously with water for several minut
Remove contact lenses, if present and easy to do. Continue rinsing.
P303+P361+P353 :IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower.

Storage : P405:Store locked up.
P403:Store in a well-ventilated place.

Other hazards which do not result in classification

Symptoms may be delayed.
Can cause severe burns if inhaled or upon skin contact.
Requires specialized medical treatment procedures.
Wear self-contained breathing apparatus and protective suit.
Direct contact with liquid can cause frostbite.
May react violently with water.
Do not breathe gas.
Corrosive to eyes, respiratory system and skin.
Compressed liquefied gas.

Environmental Effects

Dangerous for the environment.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Substance/Mixture : Substance

Components	Chemical formula	CAS Number	Concentration (Volume)
Hydrogen fluoride	HF	7664-39-3	100 %

Concentration is nominal. For the exact product composition, please refer to technical specifications.

4. FIRST AID MEASURES

General advice : If additional information is needed consult the Safetygram – “Medical treatment Protocol for Hydrofluoric Acid Burns” available on the company website.
Prompt medical attention is required in all cases of exposure. Remove victim to uncontaminated area wearing self contained breathing apparatus. Keep victim warm and rested. Call a doctor. Apply artificial respiration if breathing stopped. Use chemically protective clothing.

Eye contact	:	Seek medical treatment immediately. Irrigate eye intermittently for 20 minutes with an aqueous calcium gluconate 1% solution, if available. In the case of contact with eyes, rinse immediately with plenty of water and seek medical advice. Keep eye wide open while rinsing.
Skin contact	:	A physician should be consulted for all exposures . Burns covering an area greater than 25 square centimeters (4 square inches) require immediate treatment by a medical doctor. Immediately go to a safety shower or other available water and flush with copious amounts of water for a minimum of 5 minutes. This will rinse off excess HF. Speed and thoroughness in washing off the acid is of primary importance, since after 5 minutes the HF is being absorbed into the tissue. Remove contaminated clothing. With gloved hand apply 2.5% calcium gluconate gel to the burn area. Alternative treatment is to soak the affected areas in an iced 0.13% water solution (1:750) of Zephiran® chloride (benzalkonium chloride solution, NF). Use ice cubes, not shaved ice, to prevent frostbite. If soaking is impractical, soaks or compresses may be used. (Do not us Zephiran® for burns of the eye.) 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. Flush with copious amounts of water until treatment is available. Immediate medical treatment is necessary as untreated wounds from corrosion of the skin heal slowly and badly.
Ingestion	:	Drink 1 to 3 glasses of water or milk. Do not induce vomiting. Call a physician immediately. Never give anything by mouth to an unconscious person. Gastric lavage with calcium chloride or calcium g luconate may be performed by a physician. Administer several vials of 10% aqueous calcium g luconate orally. (Calcium carbonate or an antacid containing calcium carbonate or magnesium carbonate or hydroxide may also be used.)
Inhalation	:	As soon as possible give 2.5% to 3% calcium gluconate solution by nebulizer. Move to fresh air. If breathing has stopped or is labored, give assisted respirations. Supplemental oxygen may be indicated. If the heart has stopped, trained personnel should begin cardiopulmonary resuscitation immediately. Mouth to mouth resuscitation is not recommended. Use a barrier device. If unconscious place in recovery position and seek medical advice. In case of shortness of breath, give oxygen. Consult a doctor.

Notes to physician

Treatment	:	This advice is provided to the attending physician because of the specific properties of hydrogen fluoride and hydrofluoric acid. All cases of ingestion and airway exposure, and skin burns with hydrofluoric acid >20% should be regarded as potentially fatal. Patients who have burns and pain within minutes of exposure can be assumed to have been exposed to concentrated acid and are at risk of rapid clinical deterioration and death. Burns can be accompanied by absorption of fluoride through the skin with sequestration of circulating calcium leading to hypocalcemia and hyperkalemia from the release of cell contents. Fatal cardiac dysrhythmias may ensue. A person who has HF burns greater than 25 square inches or who has been burned with concentrated HF should be admitted immediately to an intensive care unit and carefully monitored by EKG for 24 to 48 hours. Blood sampling should be taken to monitor circulating fluoride, potassium and calcium levels. Hemodialysis may be necessary for fluoride removal and correction of hyperkalemia. HF inhaled in high concentrations may cause acute inflammation and edema of the airway and acute pulmonary edema. Anyone

who has been exposed to HF gas or mists and experiences respiratory irritation should be admitted to and monitored in an intensive care unit. In some cases, if the eyes are exposed to HF, it may penetrate to internal structures resulting in irreversible damage. HF skin burns are usually accompanied by severe, throbbing pain, which is thought to be due to irritation of nerve endings by increased levels of potassium ions entering the extracellular space to compensate for the reduced levels of calcium ions, which have been bound to the fluoride. Do NOT use local anesthetic or analgesic. RELIEF OF PAIN IS AN IMPORTANT GUIDE TO THE SUCCESS OF TREATMENT. If exposed or concerned: Get medical attention/advice.

5. FIRE-FIGHTING MEASURES

Suitable extinguishing media	:	All known extinguishing media can be used.
Specific hazards	:	Product is nonflammable and does not support combustion. Upon exposure to intense heat or flame, cylinder will vent rapidly and or rupture violently. Product is nonflammable and does not support combustion. Use of water may result in the formation of very toxic aqueous solutions. Move away from container and cool with water from a protected position. Keep containers and surroundings cool with water spray. Do not allow run-off from fire fighting to enter drains or water courses. If possible, stop flow of product.
Special protective equipment for fire-fighters	:	Use self-contained breathing apparatus and chemically protective clothing. Standard EN 137 - Self-contained open-circuit compressed air breathing apparatus with full face mask. EN 943-2: Protective clothing against liquid and gaseous chemicals, aerosols and solid particles. Gas-tight chemical protective suits for emergency teams.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions	:	Use chemically protective clothing. Evacuate personnel to safe areas. Ventilate the area. Approach suspected leak areas with caution. Use self-contained breathing apparatus or positive pressure air line with mask and escape pack in areas where concentration is unknown or above the exposure limits.
Environmental precautions	:	Should not be released into the environment. Prevent further leakage or spillage if safe to do so. Prevent from entering sewers, basements and workpits, or any place where its accumulation can be dangerous.
Methods for cleaning up	:	Ventilate the area. Wash contaminated equipment or sites of leaks wit h copious quantities of water. Reduce vapor with fog or fine water spray.
Additional advice	:	Reduce vapor with fog or fine water spray. Large releases may require considerable downwind evacuation. If possible, stop flow of product. Increase ventilation to the release area and monitor concentrations. If leak is from cylinder or cylinder valve, call the 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.

7. HANDLING AND STORAGE

Handling

Inexperienced or first time users of product should contact supplier for additional information on the storage, handling and use of this product. Systems that contain moisture may form hydrofluoric acid. Carbon steel, stainless steel, Monel or copper are suitable materials of construction when no moisture is present. Hastelloy, platinum or gold offer good resistance to corrosion when moisture is present. Use equipment rated for cylinder pressure. Cylinders should be stored upright with valve protection cap in place and firmly secured to prevent falling or being knocked over. Protect cylinders from physical damage; do not drag, roll, slide or drop. Do not allow storage area temperature to exceed 50°C (122°F). Only experienced and properly instructed persons should handle compressed gases/cryogenic liquids. Before using the product, determine its identity by reading the label. Know and understand the properties and hazards of the product before use. When doubt exists as to the correct handling procedure for a particular gas, contact the supplier. Do not remove or deface labels provided by the supplier for the identification of the cylinder contents. When moving cylinders, even for short distances, use a cart (trolley, hand truck, etc.) designed to transport cylinders. Leave valve protection caps in place until the container has been secured against either a wall or bench or placed in a container stand and is ready for use. Use an adjustable strap wrench to remove over-tight or rusted caps. Before connecting the container, check the complete gas system for suitability, particularly for pressure rating and materials. Before connecting the container for use, ensure that back feed from the system into the container is prevented. Ensure the complete gas system is compatible for pressure rating and materials of construction. Ensure the complete gas system has been checked for leaks before use. Employ suitable pressure regulating devices on all containers when the gas is being emitted to systems with lower pressure rating than that of the container. Never insert an object (e.g. wrench, screwdriver, pry bar, etc.) into valve cap openings. Doing so may damage valve, causing a leak to occur. Open valve slowly. If user experiences any difficulty operating cylinder valve discontinue use and contact supplier. Close container valve after each use and when empty, even if still connected to equipment. Never attempt to repair or modify container valves or safety relief devices. Damaged valves should be reported immediately to the supplier. Close valve after each use and when empty. Replace outlet caps or plugs and container caps as soon as container is disconnected from equipment. Do not subject containers to abnormal mechanical shock. Never attempt to lift a cylinder by its valve protection cap or guard. Do not use containers as rollers or supports or for any other purpose than to contain the gas as supplied. Never strike an arc on a compressed gas cylinder or make a cylinder a part of an electrical circuit. Keep container valve outlets clean and free from contaminates particularly oil and water. Do not smoke while handling product or cylinders. Never re-compress a gas or a gas mixture without first consulting the supplier. Never attempt to transfer gases from one cylinder/container to another. Always use backflow protective device in piping. Purge air from system before introducing gas. Purge system with dry inert gas (e.g. helium or nitrogen) before gas is introduced and when system is placed out of service. Avoid suckback of water, acid and alkalis. Installation of a cross purge assembly between the cylinder and the regulator is recommended. When returning cylinder install valve outlet cap or plug leak tight. Never use direct flame or electrical heating devices to raise the pressure of a container. Containers should not be subjected to temperatures above 50°C (122°F). Never attempt to increase liquid withdrawal rate by pressurizing the container without first checking with the supplier. Never permit liquefied gas to become trapped in parts of the system as this may result in hydraulic rupture.

Storage

Full containers should be stored so that oldest stock is used first. Containers should be stored in a purpose build compound which should be well ventilated, preferably in the open air. Observe all regulations and local requirements regarding storage of containers. Stored containers should be periodically checked for general condition and leakage. Local codes may have special requirements for toxic gas storage. Protect containers stored in the open against rusting and extremes of weather. Containers should not be stored in conditions likely to encourage corrosion. Containers should be stored in the vertical position and properly secured to prevent toppling. The container valves should be tightly closed and where appropriate valve outlets should be capped or plugged. Container valve guards or caps should be in place. Keep containers tightly closed in a cool, well-ventilated place. Full and empty cylinders should be segregated. Do not allow storage temperature to exceed 50°C (122°F). Return empty containers in a timely manner.

Technical measures/Precautions

Provide sufficient air exchange and/or exhaust in work rooms. Containers should be segregated in the storage area according to the various categories (e.g. flammable, toxic, etc.) and in accordance whit local regulations.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Engineering measures

Handle product only in closed system or provide appropriate exhaust ventilation at machinery.
Provide natural or mechanical ventilation to prevent accumulation above exposure limits.
Provide readily accessible eye wash stations and safety showers.

Personal protective equipment

Respiratory protection	:	Keep self contained breathing apparatus readily available for emergency use. Users of breathing apparatus must be trained. Use gas filters and full face mask, where exposure limits may be exceeded for a short-term period, e.g. connecting or disconnecting containers. Gas filters do not protect against oxygen deficiency. Gas filters may be used if all surrounding conditions e.g. type and concentration of the contaminant(s) and duration of use are known. Standard EN 14387 - Gas filter(s), combined filter(s) and full face mask - EN 136. Consult respiratory device supplier´s product information for the selection of the appropriate device. Self contained breathing apparatus is recommended, where unknown exposure may be expected, e.g. during maintenance activities on installation systems. Standard EN 137 - Self-contained open-circuit compressed air breathing apparatus with full face mask.
Hand protection	:	Wear neoprene, polyvinyl chloride [PVC], nitrile, or other acid resistant gloves to prevent contact with hydrofluoric acid. Wearing a thin inner glove in addition to heavy acid resistant outer glove is recommended. Wear working gloves when handling gas containers. Standard EN 388 - Protective gloves against mechanical risk. Wear chemically resistant protective gloves. Standard EN 374 - Protective gloves against chemicals. Consult glove manufacturer´s product information on material suitability and material thickness. The breakthrough time of the selected gloves must be greater than the intended use period.
Eye protection	:	Wear safety glasses with side shields. Wear goggles and a face shield when transfilling or breaking transfer connections. Standard EN 166 - Personal eye-protection.
Skin and body protection	:	Acid resistant gloves (e.g. butyl rubber, neoprene, polyethylene) and splash suit when connecting, disconnecting or opening cylinders. Safety shoes are recommended when handling cylinders. Standard EN ISO 20345 - Personal protective equipment - Safety footwear. Keep suitable chemically resistant protective clothing readily available for emergency use. Standard EN943-1 - Full protective suits against liquid, solid and gaseous chemicals.

Special instructions for protection and hygiene : Keep suitable chemically resistant protective clothing readily available for emergency use. Keep self contained breathing apparatus readily available for emergency use. Ensure adequate ventilation, especially in confined areas. Provide good ventilation and/or local exhaust to prevent accumulation of concentrations above exposure limits.

Exposure limit(s)

Hydrogen fluoride	Time Weighted Average (TWA): EH40 WEL	1.8 ppm	1.5 mg/m3
Hydrogen fluoride	Short Term Exposure Limit (STEL): EH40 WEL	3 ppm	2.5 mg/m3
Hydrogen fluoride	Time Weighted Average (TWA): EU ELV	1.8 ppm	1.5 mg/m3
Hydrogen fluoride	Short Term Exposure Limit (STEL): EU ELV	3 ppm	2.5 mg/m3
Hydrogen fluoride	Time Weighted Average (TWA): EU SCOELS	-	1.5 mg/m3
Hydrogen fluoride	Short Term Exposure Limit (STEL): EU SCOELS	3 ppm	2.5 mg/m3

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance : Liquefied gas. Gives off white fumes in moist air

Odor : Pungent.

Odor : Mixture contains one or more component(s) which have the following odor: Pungent.

Odor threshold : No data available.

pH : Not applicable.

Melting point/range : -117 °F (-83 °C)

Boiling point/range : 67 °F (19.5 °C)

Flash point : Not applicable.

Evaporation rate : Not applicable.

Flammability (solid, gas) : Refer to product classification in Section 2

Upper/lower explosion/flammability limit : No data available.

Vapor pressure : 14.50 psia (1.00 bara) at 68 °F (20 °C)

Water solubility : Hydrolyses.
Reacts violently with water.

Relative vapor density : 0.7 (air = 1)

Relative density : 0.97 (water = 1)

Partition coefficient (n-octanol/water) : Not applicable.

Auto-ignition temperature	:	No data available.
Decomposition temperature	:	No data available.
Viscosity	:	Not applicable.
Molecular Weight	:	20 g/mol
Density	:	0.175 lb/ft3 (0.0028 g/cm3) at 70 °F (21 °C) Note: (as vapor)
Specific Volume	:	5.65 ft3/lb (0.3527 m3/kg) at 70 °F (21 °C)

10. STABILITY AND REACTIVITY

Chemical Stability	:	Stable under normal conditions.
Reactivity/Incompatible Materials	:	Water. Aluminium. Materials made of glass or ceramic. Brass. May react violently with alkalis. Zinc.
Hazardous decomposition products	:	Gives off hydrogen by reaction with metals.

11. TOXICOLOGICAL INFORMATION

Likely routes of exposure

Effects on Eye	:	May cause blindness. Irritating to eyes. Causes severe eye burns. May cause permanent eye injury.
Effects on Skin	:	Causes severe burns which may not be immediately painful or visible. Contact with liquid may cause cold burns/frostbite. Causes skin irritation. Causes skin burns.
Inhalation Effects	:	Irritating to respiratory system. Can cause severe lung damage. May be fatal if inhaled. Delayed adverse effects possible. Prolonged exposure to small concentrations may result in pulmonary edema. Delayed fatal pulmonary edema possible.
Ingestion Effects	:	Causes severe digestive tract burns.May be fatal if swallowed.
Symptoms	:	No data available.

Acute toxicity

Acute Oral Toxicity	:	No data is available on the product itself.
Inhalation	:	LC50 (1 h) : 1276 ppm Species : Rat.
Acute Dermal Toxicity	:	No data is available on the product itself.

Serious eye damage/eye irritation	:	No data available.
Sensitization.	:	No data available.

Chronic toxicity or effects from long term exposures

Carcinogenicity	:	No data available.
Reproductive toxicity	:	No data is available on the product itself.
Germ cell mutagenicity	:	No data is available on the product itself.
Specific target organ systemic toxicity (single exposure)	:	Eyes., Lungs., Kidney., Liver., Heart., Teeth and bone.
Specific target organ systemic toxicity (repeated exposure)	:	Animals exposed to hydrogen fluoride have exhibited kidney, lung, heart and liver damage.
Aspiration hazard	:	No data available.

12. ECOLOGICAL INFORMATION

Ecotoxicity effects

Aquatic toxicity	:	Toxic to aquatic organisms.May cause pH changes in aqueous ecological systems.
Toxicity to other organisms	:	No data available.

Persistence and degradability

Biodegradability	:	No data is available on the product itself.
Mobility	:	No data available.
Bioaccumulation	:	Refer to Section 9 "Partition Coefficient (n-octanol/water)".
Bioaccumulation - Components		
Hydrogen fluoride		Negligible bioaccumulation potential.

13. DISPOSAL CONSIDERATIONS

Waste from residues / unused products	:	Do not attempt to dispose of residual or unused quantities. Small quantities may be disposed by slowly flowing gas in to a caustic liquid or solid scrubber. Soda lime, a sodium hydroxide-calcium oxide mixture, or calcium carbonate are suitable solid scrubber media. In accordance with local and national regulations. Return unused product in original cylinder to supplier. Contact supplier if guidance is required. Must not be discharged to atmosphere. Refer to

the EIGA code of practice Doc. 30 "Disposal of Gases", downloadable at http://www.eiga.org for more guidance on suitable disposal methods. List of hazardous waste codes: 16 05 04: Gases in pressure containers (including halons) containing dangerous substances.

Contaminated packaging : Return cylinder to supplier.

14. TRANSPORT INFORMATION

ADR

UN/ID No.	:	UN1052
Proper shipping name	:	HYDROGEN FLUORIDE, ANHYDROUS
Class or Division	:	8
Packing group	:	I
Tunnel Code	:	(C/D)
Label(s)	:	8 (6.1)
ADR/RID Hazard ID no.	:	886
Marine Pollutant	:	No

IATA

Transport Forbidden

IMDG

UN/ID No.	:	UN1052
Proper shipping name	:	HYDROGEN FLUORIDE, ANHYDROUS
Class or Division	:	8
Packing group	:	I
Label(s)	:	8 (6.1)
RQ Substance	:	Yes
Marine Pollutant	:	No
Segregation Group:	:	Acids

* NOTE: This product contains a USDOT Hazardous Substance and will meet the Reportable Quantity definition when shipped to, from, or within the United States, in the amount specified in 49CFR 172.101 Appendix A.

RID

UN/ID No.	:	UN1052
Proper shipping name	:	HYDROGEN FLUORIDE, ANHYDROUS
Class or Division	:	8
Packing group	:	I
Label(s)	:	8 (6.1)
Marine Pollutant	:	No

Further Information

Avoid transport on vehicles where the load space is not separated from the driver's compartment. Ensure vehicle driver is aware of the potential hazards of the load and knows what to do in the event of an accident or an emergency. The transportation information is not intended to convey all specific regulatory data relating to this material. For complete transportation information, contact customer service.

15. REGULATORY INFORMATION

Workplace Safety and Health Act & Workplace Safety and Health (General Provisions) Regulations

Workplace Health and Safety Act , SS586 Labeling.

Poison Act (Health Sciences Authority).

Country	Regulatory list	Notification
USA	TSCA	Included on Inventory.
EU	EINECS	Included on Inventory.
Canada	DSL	Included on Inventory.
Australia	AICS	Included on Inventory.
Japan	ENCS	Included on Inventory.
South Korea	ECL	Included on Inventory.
China	SEPA	Included on Inventory.
Philippines	PICCS	Included on Inventory.

16. OTHER INFORMATION

Ensure all national/local regulations are observed.

Prepared by : Air Products and Chemicals, Inc. Global EH&S Department

For additional information, please visit our Product Stewardship web site at
http://www.airproducts.com/productstewardship/