Common Name: HYDROGEN FLUORIDE

Synonyms: Fluoric Acid; HFA
Chemical Name: Hydrofluoric Acid
Date: April 2009 Revision: February 2017

Description and Use

Hydrogen Fluoride is a colorless, fuming liquid or gas with a strong, irritating odor. It is used in etching glass and in making other chemicals, including gasoline. It is also used as a catalyst and in fluoridating water.

- ODOR THRESHOLD = 0.04 ppm
- Odor thresholds vary greatly. Do not rely on odor alone to determine potentially hazardous exposures.

Reasons for Citation

- Hydrogen Fluoride is on the Right to Know Hazardous Substance List because it is cited by OSHA, ACGIH, DOT, NIOSH, DEP, IARC, NFPA and EPA.
- This chemical is on the Special Health Hazard Substance List.

FIRST AID

Eye Contact
- Immediately flush with large amounts of water for at least 30 minutes, lifting upper and lower lids. Remove contact lenses, if worn, while flushing. Seek medical attention immediately.

Skin Contact
- Immediately flush with large amounts of water. Continue flushing while removing clothing. Apply 2.5% Calcium Gluconate gel to the affected skin. Massage the gel into the skin while wearing rubber gloves. Continue to reapply and massage until pain is entirely relieved. Seek medical assistance immediately.

Inhalation
- Remove the person from exposure.
- Begin rescue breathing (using universal precautions) if breathing has stopped and CPR if heart action has stopped.
- Transfer promptly to a medical facility.
- Medical observation is recommended for 24 to 48 hours after breathing overexposure, as pulmonary edema may be delayed.

Workplace Exposure Limits

OSHA: The legal airborne permissible exposure limit (PEL) is 3 ppm averaged over an 8-hour workshift.

NIOSH: The recommended airborne exposure limit (REL) is 3 ppm averaged over a 10-hour workshift and 6 ppm, not to be exceeded during any 15-minute work period.

ACGIH: The threshold limit value (TLV) is 0.5 ppm averaged over an 8-hour workshift and 2 ppm, not to be exceeded during any part of the working exposure.

- The above exposure limits are for air levels only. When skin contact also occurs, you may be overexposed, even though air levels are less than the limits listed above.
HYDROGEN FLUORIDE

Determining Your Exposure

- Read the product manufacturer’s Material Safety Data Sheet (MSDS) and the label to determine product ingredients and important safety and health information about the product mixture.
- For each individual hazardous ingredient, read the New Jersey Department of Health Hazardous Substance Fact Sheet, available on the RTK Program website (http://nj.gov/health/workplacehealthandsafety/right-to-know/) or in your facility’s RTK Central File or Hazard Communication Standard file.
- You have a right to this information under the New Jersey Worker and Community Right to Know Act, the Public Employees Occupational Safety and Health (PEOSH) Act if you are a public worker in New Jersey, and under the federal Occupational Safety and Health Act (OSHA) if you are a private worker.
- The New Jersey Right to Know Act and the PEOSH Hazard Communication Standard (N.J.A.C. 12:100-7) requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard (29 CFR 1910.1200) requires private employers to provide similar information and training to their employees.

This Fact Sheet is a summary of available information regarding the health hazards that may result from exposure. Duration of exposure, concentration of the substance and other factors will affect your susceptibility to any of the potential effects described below.

Health Hazard Information

Acute Health Effects
The following acute (short-term) health effects may occur immediately or shortly after exposure to Hydrogen Fluoride:

- **Hydrogen Fluoride** can severely irritate and burn the eyes with possible permanent damage.
- Contact can cause irritation and severe skin and deep tissue burns. The burn may occur hours after contact, even if no pain is felt at the time of the exposure.
- **Hydrogen Fluoride** can irritate the nose and throat.
- Inhaling **Hydrogen Fluoride** can irritate the lungs causing coughing and/or shortness of breath. Higher exposures may cause a build-up of fluid in the lungs (pulmonary edema), a medical emergency, with severe shortness of breath.
- Exposure to **Hydrogen Fluoride** can cause headache, dizziness, nausea and vomiting.
- Very high exposure can cause Fluoride poisoning with stomach pain, weakness, convulsions, collapse and death.

Chronic Health Effects
The following chronic (long-term) health effects can occur at some time after exposure to Hydrogen Fluoride and can last for months or years:

Cancer Hazard
- While Hydrogen Fluoride has been tested, it is not classifiable as to its potential to cause cancer.

Reproductive Hazard
- While Hydrogen Fluoride has been tested, further testing is required to assess its potential to cause reproductive harm.

Other Effects
- Inhaling **Hydrogen Fluoride** can irritate the lungs. Repeated exposure may cause bronchitis to develop with coughing, phlegm, and/or shortness of breath.
- **Hydrogen Fluoride** may damage the liver and kidneys.
- Long term exposure to very high concentrations can cause deposits of Fluoride in the bones and teeth, a condition called “Fluorosis” (changes in the bone structure). This can cause bone pain, fractures, disability and mottling of the teeth.

Medical

Medical Testing
For frequent or potentially high exposure (half the TLV or greater), the following are recommended before beginning work and at regular times after that:

- Lung function tests

If symptoms develop or overexposure is suspected, the following are recommended:

- **Fluoride** level in urine. Levels higher than 4 mg/liter indicate overexposure.
- Liver and kidney function tests
- Consider chest x-ray after acute overexposure
- Bone Density (DEXA) Scan

Any evaluation should include a careful history of past and present symptoms with an exam. Medical tests that look for damage already done are not a substitute for controlling exposure.

Request copies of your medical testing. You have a legal right to this information under the OSHA Access to Employee Exposure and Medical Records Standard (29 CFR 1910.1020).

Mixed Exposures
- Smoking can cause heart disease, lung cancer, emphysema, and other respiratory problems. It may worsen respiratory conditions caused by chemical exposure. Even if you have smoked for a long time, stopping now will reduce your risk of developing health problems.
- More than light alcohol consumption can cause liver damage. Drinking alcohol can increase the liver damage caused by Hydrogen Fluoride.
Gloves and Clothing

The following recommendations are only guidelines and may not apply to every situation.

- Avoid skin contact with Hydrogen Fluoride. Wear personal protective equipment made from material which cannot be permeated or degraded by this substance. Safety equipment suppliers and manufacturers can provide recommendations on the most protective glove and clothing material for your operation.
- Safety equipment manufacturers recommend Barrier® for gloves, and Tychem® Responder® and TK, and Trellchem® HPS, or the equivalent, as protective materials for clothing.
- All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

Eye Protection

- Wear non-vented, impact resistant goggles when working with fumes, gases, or vapors.
- Wear a face shield along with goggles when working with corrosive, highly irritating or toxic substances.
- Do not wear contact lenses when working with this substance.

Respiratory Protection

Improper use of respirators is dangerous. Respirators should only be used if the employer has implemented a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing, and medical exams, as described in the OSHA Respiratory Protection Standard (29 CFR 1910.134).

- Where the potential exists for exposure over 0.5 ppm, use a NIOSH approved full facepiece respirator with an acid gas cartridge which is specifically approved for Hydrogen Fluoride. Increased protection is obtained from full facepiece powered-air purifying respirators.
- Leave the area immediately if (1) while wearing a filter or cartridge respirator you can smell, taste, or otherwise detect Hydrogen Fluoride, (2) while wearing particulate filters abnormal resistance to breathing is experienced, or (3) eye irritation occurs while wearing a full facepiece respirator. Check to make sure the respirator-to-face seal is still good. If it is, replace the filter or cartridge. If the seal is no longer good, you may need a new respirator.
- Consider all potential sources of exposure in your workplace. You may need a combination of filters, prefilters or cartridges to protect against different forms of a chemical (such as vapor and mist) or against a mixture of chemicals.
- Where the potential exists for exposure over 5 ppm, use a NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus operated in a pressure-demand or other positive-pressure mode.
- Exposure to 30 ppm is immediately dangerous to life and health. If the possibility of exposure above 30 ppm exists, use a NIOSH approved self-contained breathing apparatus with a full facepiece operated in a pressure-demand or other positive-pressure mode equipped with an emergency escape air cylinder.

Fire Hazards

If employees are expected to fight fires, they must be trained and equipped as stated in the OSHA Fire Brigades Standard (29 CFR 1910.156).

- Hydrogen Fluoride is a noncombustible liquid or gas.
- Extinguish fire using an agent suitable for type of surrounding fire.
- POISONOUS GASES ARE PRODUCED IN FIRE, including Fluorine.
- Use water spray to keep fire exposed containers cool.
Spills and Emergencies
If employees are required to clean-up spills, they must be properly trained and equipped. The OSHA Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120) may apply.

If Hydrogen Fluoride gas or liquid is spilled or leaked, take the following steps:

- Evacuate personnel and secure and control entrance to the area.
- Eliminate ignition sources.
- Ventilate area of leak to disperse the gas.
- Stop flow of gas. If source of leak is a cylinder and the leak cannot be stopped in place, remove the leaking cylinder to a safe place in the open air, and repair leak or allow cylinder to empty.
- If a liquid spill, allow to vaporize and disperse, or cover with sodium carbonate or an equal mixture of soda ash and slaked lime. After mixing, add water, if necessary, to form a slurry.
- Water spray can be used to absorb Hydrogen Fluoride vapors escaping from leaking containers of anhydrous Hydrogen Fluoride. Use water in flooding quantities.
- DO NOT wash into sewer.
- It may be necessary to contain and dispose of Hydrogen Fluoride as a HAZARDOUS WASTE. Contact your state Department of Environmental Protection (DEP) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.

Handling and Storage
Prior to working with Hydrogen Fluoride you should be trained on its proper handling and storage.

- Hydrogen Fluoride reacts violently with STRONG BASES (such as SODIUM HYDROXIDE and POTASSIUM HYDROXIDE) and many other compounds.
- Hydrogen Fluoride reacts with WATER and STEAM to produce toxic and corrosive gases.
- Hydrogen Fluoride reacts with METALS (such as IRON and STEEL) to produce flammable and explosive Hydrogen gas.
- Hydrogen Fluoride is not compatible with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDE, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE); STRONG ACIDS (such as HYDROCHLORIC, SULFURIC and NITRIC); AMINES; METAL SALTS; and SILICON COMPOUNDS.
- Store in tightly closed containers in a cool, well-ventilated area away from HEAT, SUNLIGHT and COMBUSTIBLES.
- Carefully purge and/or vent containers which have held Hydrogen Fluoride prior to cleaning with WATER.
- Metal containers of Hydrogen Fluoride should be vented regularly to prevent the build-up of Hydrogen gas.

Occupational Health Information Resources
The New Jersey Department of Health, Occupational Health Service, offers multiple services in occupational health. These services include providing informational resources, educational materials, public presentations, and industrial hygiene and medical investigations and evaluations.

For more information, please contact:

New Jersey Department of Health
Right to Know Program
PO Box 368
Trenton, NJ 08625-0368
Phone: 609-984-2202
Fax: 609-984-7407
E-mail: rtk@doh.nj.gov
Web address: http://nj.gov/health/workplacehealthandsafety/right-to-know/

The Right to Know Hazardous Substance Fact Sheets are not intended to be copied and sold for commercial purposes.
GLOSSARY

**ACGIH** is the American Conference of Governmental Industrial Hygienists. They publish guidelines called Threshold Limit Values (TLVs) for exposure to workplace chemicals.

**Acute Exposure Guideline Levels (AEGLs)** are established by the EPA. They describe the risk to humans resulting from one-in-a-lifetime, or rare, exposure to airborne chemicals.

**Boiling point** is the temperature at which a substance can change its physical state from a liquid to a gas.

A **carcinogen** is a substance that causes cancer.

The **CAS number** is unique, identifying number, assigned by the Chemical Abstracts Service, to a specific chemical.

**CFR** is the Code of Federal Regulations, which are the regulations of the United States government.

A **combustible** substance is a solid, liquid or gas that will burn.

A **corrosive** substance is a gas, liquid or solid that causes destruction of human skin or severe corrosion of containers.

**DEP** is the New Jersey Department of Environmental Protection.

**DOT** is the Department of Transportation, the federal agency that regulates the transportation of chemicals.

**EPA** is the Environmental Protection Agency, the federal agency responsible for regulating environmental hazards.

**ERG** is the Emergency Response Guidebook. It is a guide for emergency responders for transportation emergencies involving hazardous substances.

**Emergency Response Planning Guideline (ERPG) values** provide estimates of concentration ranges where one reasonably might anticipate observing adverse effects.

A **fetus** is an unborn human or animal.

A **flammable** substance is a solid, liquid, vapor or gas that will ignite easily and burn rapidly.

The **flash point** is the temperature at which a liquid or solid gives off vapor that can form a flammable mixture with air.

**IARC** is the International Agency for Research on Cancer, a scientific group.

**Ionization Potential** is the amount of energy needed to remove an electron from an atom or molecule. It is measured in electron volts.

**IRIS** is the Integrated Risk Information System database on human health effects that may result from exposure to various chemicals, maintained by federal EPA.

**LEL or Lower Explosive Limit**, is the lowest concentration of a combustible substance (gas or vapor) in the air capable of continuing an explosion.

**mg/m³** means milligrams of a chemical in a cubic meter of air. It is a measure of concentration (weight/volume).

A **mutagen** is a substance that causes mutations. A **mutation** is a change in the genetic material in a body cell. Mutations can lead to birth defects, miscarriages, or cancer.

**NFPA** is the National Fire Protection Association. It classifies substances according to their fire and explosion hazard.

**NIOSH** is the National Institute for Occupational Safety and Health. It tests equipment, evaluates and approves respirators, conducts studies of workplace hazards, and proposes standards to OSHA.

**NTP** is the National Toxicology Program which tests chemicals and reviews evidence for cancer.

**OSHA** is the federal Occupational Safety and Health Administration, which adopts and enforces health and safety standards.

**PEOSHA** is the New Jersey Public Employees Occupational Safety and Health Act, which adopts and enforces health and safety standards in public workplaces.

**Permeeated** is the movement of chemicals through protective materials.

**ppm** means parts of a substance per million parts of air. It is a measure of concentration by volume in air.

**Protective Action Criteria (PAC)** are values established by the Department of Energy and are based on AEGLs and ERPGs. They are used for emergency planning of chemical release events.

A **reactive** substance is a solid, liquid or gas that releases energy under certain conditions.

**STEL** is a Short Term Exposure Limit which is usually a 15-minute exposure that should not be exceeded at any time during a work day.

A **teratogen** is a substance that causes birth defects by damaging the fetus.

**UEL or Upper Explosive Limit** is the highest concentration in air above which there is too much fuel (gas or vapor) to begin a reaction or explosion.

**Vapor Density** is the ratio of the weight of a given volume of one gas to the weight of another (usually Hydrogen), at the same temperature and pressure.

The **vapor pressure** is a force exerted by the vapor in equilibrium with the solid or liquid phase of the same substance. The higher the vapor pressure the higher concentration of the substance in air.
Common Name: HYDROGEN FLUORIDE
Synonyms: Fluoric Acid; HFA
CAS No:  7664-39-3
Molecular Formula: HF
RTK Substance No: 3759
Description: Colorless, fuming liquid or gas

HAZARD DATA

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<th>Firefighting</th>
<th>Reactivity</th>
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<td>4 - Health</td>
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<td>1 - Reactivity</td>
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DOT#: UN 1052
ERG Guide #: 125
Hazard Class: 8 (Corrosive)

SPILL/LEAKS

Isolation Distance:
Spill: 100 meters (330 feet)
Fire: 1,600 meters (1 mile)
If a gas leak, evacuate area and stop flow of gas. If source of leak is a cylinder and the leak cannot be stopped in place, remove the leaking cylinder to a safe place in the open air, and repair leak or allow cylinder to empty.
If a liquid spill, allow to vaporize and disperse, or cover with sodium carbonate or an equal mixture of soda ash and slaked lime.
Water spray can be used to absorb Hydrogen Fluoride vapors escaping from leaking containers of anhydrous Hydrogen Fluoride. Use water in flooding quantities.

PHYSICAL PROPERTIES

Odor Threshold: 0.04 ppm
Flash Point: Nonflammable
Vapor Density: 0.7 (air = 1)
Vapor Pressure: 760 mm Hg at 68°F (20°C)
Specific Gravity: 0.99 (water = 1)
Water Solubility: Miscible
Boiling Point: 67°F (19.4°C)
Freezing Point: -117.4°F (-83°C)
Ionization Potential: 15.98 eV
Molecular Weight: 20.1

EXPOSURE LIMITS

ACGIH: 0.5 ppm, 8-hr TWA; 2 ppm, Ceiling
IDLH: 30 ppm
The Protective Action Criteria values are:
PAC-1 = 1 ppm; PAC-2 = 24 ppm; PAC-3 = 44 ppm

PROTECTIVE EQUIPMENT

Gloves: Barrier® (>8-hr breakthrough)
Coveralls: Tychem® Responder® and TK; and Trellchem HPS (>8-hr breakthrough)
Respirator: SCBA

HEALTH EFFECTS

Eyes: Severe irritation, burns and possible eye damage
Skin: Irritation and severe burns
Inhalation: Nose, throat and lung irritation with coughing, and severe shortness of breath (pulmonary edema)
Headache, dizziness, weakness, and convulsions

FIRST AID AND DECONTAMINATION

Remove the person from exposure.
Flush eyes with large amounts of water for at least 30 minutes. Remove contact lenses if worn. Seek medical attention immediately.
Immediately flush skin with large amounts of water. Apply 2.5% Calcium Gluconate gel to the affected skin. Seek medical assistance immediately.
Begin artificial respiration if breathing has stopped and CPR if necessary.
Transfer promptly to a medical facility.
Medical observation is recommended as symptoms may be delayed.