



# Hydrofluoric Acid

Hydrofluoric acid (HF) is an extremely corrosive acid used for many purposes including mineral digestion, surface cleaning, etching, and biological staining. HF's unique properties make it significantly more hazardous than many of the other acids used on campus. This fact sheet discusses how to protect yourself against the dangers of HF. Attached you'll also find emergency procedures for dealing with HF exposures. Please post these procedures or HF exposure kit poster wherever HF is used or handled.

## Health Hazards

The health hazards of HF are dependent upon the type of exposure and the concentration.

### Eye and skin exposure

HF is corrosive and readily destroys tissue. Exposure of the eyes to HF may result in blindness or permanent eye damage. HF readily penetrates human skin, allowing it to destroy soft tissues and decalcify bone. Chemical burns from HF are typically very painful and slow to heal. Skin exposure to high concentrated HF (approximately 50% or greater) immediately results in serious and painful destruction of tissue. Not only can skin contact cause burns, but systemic fluoride poisoning may also result.

One of HF's most insidious properties is that skin contact at lower concentrations may not produce pain or burning sensations until hours after the exposure. Because of the ability of HF to produce severe delayed tissue damage without necessarily producing pain, all skin, eye, or tissue contact with HF should receive immediate first aid and medical evaluation, even if the injury appears minor or no pain is felt.

### Inhalation of HF vapor

Inhaling HF vapors can seriously damage the lungs. Delayed reactions up to and including fatal pulmonary edema (flooding of the lungs with body fluids) may not be apparent for hours after the initial exposure. OSHA limits employees' exposure to airborne concentrations of HF to an average of 3 parts per million (ppm) over an 8-hour work day. Airborne concentrations of 10 to 15 ppm will irritate the eyes, skin, and respiratory tract.

30 ppm is considered immediately dangerous to life and health and may have irreversible health effects. At airborne concentrations above 50 ppm, even brief exposure may be fatal.

### Chronic HF exposure

Long-term or chronic exposure to HF may result in fluorosis, a syndrome characterized by weight loss, bone embrittlement, anemia, and general ill health.

## Safety precautions for HF use

### **Employee Information and Training**

HF is a colorless liquid with a strong irritating odor at low concentrations (3 ppm). Employees who handle HF must receive documented training on the hazards of HF and what to do in the event of an exposure or a spill. A Material Safety Data Sheet (MSDS) on HF should be kept in the immediate work area where HF is used. The MSDS, together with this Fact Sheet, is an excellent basis for training employees on the hazards of HF. This fact sheet should be referenced in the Chemical Hygiene Plan for labs that use HF. EH&S is available for providing assistance with training.

### **Ventilation**

*HF should be used with adequate ventilation* to minimize inhalation of vapor. Concentrations greater than 5% should always be handled inside a properly functioning chemical fume hood.

### **Eye Protection**

Always use chemical goggles together with a face shield when handling concentrated HF. Due to HF's corrosive nature, safety glasses with side shields do not provide adequate eye protection.

### **Body Protection**

Wear a laboratory coat with a chemical splash apron made out of natural rubber, neoprene, or viton. Never wear shorts or open-toed shoes when handling HF or other corrosive chemicals.

### **Gloves**

Typically, medium or heavyweight viton, nitrile, or natural rubber gloves are worn when working with HF. Always consult the manufacturer's glove selection guide when selecting a glove for HF. If you have any questions about which glove to choose, contact EHS or consult the MSDS. A second pair of nitrile exam gloves should be worn under the gloves for protection against leaks.

Gloves that have not been contaminated with HF may be disposed of in the common trash. If gloves become contaminated with HF, remove them immediately, thoroughly wash your hands, and check your hands for any sign of contamination. Contaminated gloves must be disposed of as HF waste (see "Spill, Storage, and Waste Issues" section).

### **Eyewash/Shower Combination**

Since HF is corrosive and rapidly damages tissue, OSHA requires a combination eyewash/shower to be nearby and accessible. The eyewash must be flushed monthly to ensure it will operate properly when needed. The combination eyewash/shower should be used to rinse the exposed area for 5 minutes, and then treatment of skin with calcium gluconate gel antidote should be initiated, then seek medical attention.

### **Calcium Gluconate Gel**

Calcium gluconate gel is a topical antidote for HF skin exposure. Calcium gluconate works by combining with HF to form insoluble calcium fluoride, thus preventing the extraction of calcium from tissues and bones. Keep calcium gluconate gel nearby whenever you're working with HF.

Calcium gluconate can be ordered through scientific supply companies. Calcium gluconate has a limited shelf life and should be stored in a refrigerator if possible and replaced with a fresh supply after its expiration date has passed. Use disposable exam gloves to apply calcium gluconate gel. Even after applying calcium gluconate, it is essential that a medical evaluation be made.

### **Safe Work Practices**

If possible, avoid working alone when you're using HF. Do not eat, smoke, or drink where HF is handled. Wash hands thoroughly after handling HF.

## **Spill, storage and Waste issue**

### **HF Spills**

If HF is spilled outside a chemical hood, evacuate the area, close the doors, post the area with a sign to prevent others from entering, and call Public Safety. If the incident occurs during regular work hours (Monday–Friday, 8 a.m. to 5 p.m.), call EH&S at 683-4495. Small spills of HF inside a chemical fume hood can be cleaned up by laboratory staff if they have the correct equipment, understand the hazards, and know how to clean up the spill safely and dispose of the waste properly. Lime soda, ash, sodium bicarbonate, or a spill absorbent specified for HF should be used for clean up. Organic spill kits that contain Floor-dri, kitty litter, or sand should *not* be used because HF reacts with silica to produce silicon tetrafluoride, a toxic gas.

### **Storage**

Store all HF and HF waste in labeled chemically compatible containers (e.g., polyethylene or Teflon). Glass, metal, and ceramic containers are not compatible with HF. HF should never be stored with incompatible chemicals such as ammonia or other alkaline materials. Always place HF on a low protected shelf or other location where it will not be accidentally spilled or knocked over.

**HF should always be handled inside of a fume hood which is identified with a sign stating “Warning: Designated Area Hydrofluoric Acid in Use”.**

### **Waste**

HF waste should be placed in a chemically compatible container with a sealed lid and clearly labeled. Complete a Hazardous Waste Disposal form and fax or mail to EH&S office.

Call EH&S (683-4495) if have any questions regarding the disposal of HF waste.

## **EH&S can help**

EH&S is available to help train staff members on the hazards of HF, its proper storage, handling, and cleanup procedures. If assistance is needed, or if you have any questions about HF or this Fact Sheet, please call EH&S at 683-4495.

**EMERGENCY RESPONSE PROCEDURES**  
**FOR HF EXPOSURE:**

**Skin Exposure:**

**Immediately washing off the acid is a priority!**

1. Immediately wash all affected areas with water. While flushing with water, remove all clothing or jewelry that could trap HF. (Remove goggles last, close eyes, face water flow and pull goggles over head.)
2. While the victim is being rinsed with water, someone should call ODU Police at **683-4000** provide the following information to the dispatcher:
  - a. There is a person that has been exposed to hydrofluoric acid.
  - b. The person can be found at [give location of victim].
  - c. Please send an ambulance or arrange transportation.
3. Rinsing may be limited to 5 minutes if Calgonate® Gel is available. If 2.5% calcium gluconate gel is not available, continue flushing with water for at least 15 minutes or until medical treatment is given.
4. Apply Calgonate® Gel freely and massage it into the affected site. Apply the gel as soon as the washing is done. Affected area does not need to be dried prior to application. After these actions have begun, the victim should be re-examined to ensure no exposure / burn sites have been overlooked.
5. Calgonate® 2.5% Calcium Gluconate Gel should be reapplied continually every 10-15 minutes and massaged into the skin until the ambulance arrives or medical treatment is given by a physician or EMT.
6. Take note of and provide the following information to the EMS team, and/or physician.
  - a. The concentration of the Hydrofluoric Acid and its MSDS.
  - b. Date and time of exposure, duration of exposure, and how it occurred.
  - c. The time when Calgonate® Gel was first applied to the contaminated area, and how many times it was applied in total.
  - d. Body parts affected or exposed, and the percent of body surface area affected.
  - e. Summary of first aid measures given.

## **Eye Exposure:**

Because HF penetrates deep into tissue, exposure of hydrofluoric acid solution or vapor to the eye can produce more extensive damage than other acids in similar concentrations. For example, hydrochloric acid damages the superficial structures of the eye, but its penetration is generally limited by a precipitated protein barrier. HF is not blocked by that same natural barrier. Immediate action is critical.

1. Immediately flush eyes for at least 5 minutes with cool flowing water. Hold the eyelids open and away from the eye during irrigation to allow thorough flushing of the eyes. If sterile 1% calcium gluconate solution is available, washing may be limited to 5 minutes, after which the 1% calcium gluconate solution should be used repeatedly to irrigate the eye.
2. Immediately take the victim to a doctor, preferably an eye specialist. Clean water, eyewash, 1% calcium gluconate solution, or ice water compresses should be used to continue to irrigate the eye(s) while transporting the victim.

## **Inhalation:**

If a large volume of hydrofluoric acid gas is inhaled:

1. Immediately move the victim to fresh air and get medical attention.
2. Keep victim warm, quiet, and comfortable.
3. If breathing has stopped, begin CPR at once. Make sure mouth and throat are free of foreign material.
4. 100% oxygen (10 to 12 L/min flow rate) should be administered as soon as possible by a trained individual. Continue oxygen while waiting for medical attention.
5. A nebulized solution of 2.5% calcium gluconate may be administered with oxygen by inhalation.
6. Do not give stimulants unless instructed to do so by a physician.
7. The victim should be examined by a doctor and held for observation for at least 24 hours. The reason is that inhalation of HF fumes may cause swelling in the respiratory tract up to 24 hours after exposure. A person who has inhaled HF vapors may require prophylactic oxygen treatment.

Vapor exposures can cause skin and mucous membrane burns as well as damage to pulmonary tissue. Vapor burns to the skin are treated the same way as liquid HF burns.

**Ingestion:**

1. Have the victim drink large amounts of water as quickly as possible to dilute the acid. **Do not induce vomiting.** Do not give emetics (vomit inducing agents) or baking soda.

**Never give anything by mouth to an unconscious person.**

2. Drink several glasses of milk or several ounces of Milk of Magnesia, Mylanta, Maalox or similar product, or eat up to 30 Tums, Caltrate or other antacid tablet. The calcium or magnesium in these compounds may act as an antidote.
3. Seek immediate medical attention.