

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 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. Cal/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.

Thirty 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 always 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. 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 highly 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 an industrial hygienist from EH&S (642 3073). 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, Cal/OSHA requires a combination eyewash/shower to be nearby and accessible. It must be tested monthly to ensure it will operate 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 should be initiated.

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 the College of Chemistry Chemical Store Room or the Occupational Health Clinic at the Tang Center. 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.



Spill, storage and waste issues

Other fluorine compounds can produce hazards

EH&S can help

Safe Work Practices

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

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 911. If the incident occurs during regular work hours (Monday–Friday, 8 a.m. to 5 p.m.), also call EH&S at 642-3073. 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.

Waste

HF waste should be placed in a chemically compatible container with a sealed lid and clearly labeled. Complete a Materials Packing List (MPL), and send the completed MPL to EH&S. Call EH&S (642-3073) if you need MPL forms or have any questions regarding the disposal of HF waste. See the EH&S Fact Sheet, "Unwanted Hazardous Materials" for general instructions on procedures for disposing of hazardous materials.

Many chemicals containing fluorine, such as ammonium fluoride, sodium fluoride, sulfur tetrafluoride, and ammonium bifluoride, may react with acid or water to produce HF. Review the MSDS of all fluoride compounds carefully for safety precautions to reduce the risk of creating a HF hazard. If the manner in which the fluorine compound is used can create HF, follow the precautions for HF and keep topical antidote on hand.

EH&S is available to help train staff members on the hazards of HF, its proper storage, handling, and cleanup procedures. EH&S can also monitor air concentrations of HF in your work space. If assistance is needed, or if you have any questions about HF or this Fact Sheet, please call EH&S at 642-3073.



Emergency Procedures for HF Exposure

Please post these procedures in work areas where HF is used.

All exposure to or contact with HF should receive immediate first aid and medical evaluation, even if the injury appears minor or no pain is felt. HF can produce delayed effects and serious tissue damage without necessarily producing pain.

First aid for skin contact

- Immediately (within seconds) proceed to the nearest eyewash/shower combination and wash affected area for a *minimum* of 5 minutes.
- While washing the affected area, have someone call 911 for emergency medical assistance.
- Remove all contaminated clothing while in the shower.
- Massage calcium gluconate gel into the affected area. Be sure to wear nitrile gloves on the hand spreading the gel. If calcium gluconate gel is not available, wash affected area for at least 15 minutes or until emergency medical assistance arrives.
- Reapply calcium gluconate gel and massage it into affected area every 15 minutes until assistance arrives or pain completely stops.

First aid for eye contact

- Immediately (within seconds) proceed to the nearest eyewash station.
- Thoroughly wash eyes with water for at least 5 minutes while holding eyelids open.
- Do *not* apply calcium gluconate gel to eyes.
- While washing eyes, have someone call 911 for emergency medical assistance.

First aid for ingestion

- Dilute the acid by drinking large quantities of milk (preferable) or water.
- Call 911 for emergency medical assistance.
- Do *not* induce vomiting.

First aid for inhalation

- Immediately move to area with fresh air. Call 911 for emergency medical assistance.

