

Standard Operating Procedure for Hydrofluoric Acid (HF)

(Reference: www.des.umd.edu/ls/sop/HydrofluoricAcid.doc, http://safety.uchicago.edu/pp/labsafety/hydrofluoric_acid.shtml,
www.cchem.berkeley.edu/rsgrp/SOPs/Hydrogen%20Fluoride.doc)

1. General

When working with a chemical for the first time, please consult a safety data sheet (SDS) to identify the material hazards and proper handling and storage procedures. If you have additional questions, please contact the UAF Environmental Health and Safety Office at **907-474-5413** or UAF-EHSRM@alaska.edu.

Hydrofluoric acid (HF) has a number of chemical, physical and toxicological properties that make handling this material particularly hazardous. Anhydrous HF is a clear, colorless, fuming, corrosive liquid. HF is also available in the gaseous state. All forms including the solution or the vapor can cause severe burns to tissue. Concentrated hydrofluoric acid is used in the fabrication of electronic components, for etching glass and in the manufacture of semiconductors. It is also used by geologists to dissolve sedimentary rock. Dilute hydrofluoric acid solutions are used in some biological staining procedures. Hydrofluoric acid solutions are clear and colorless with a density similar to that of water. The most widely known property of HF is its ability to dissolve glass. It will also attack glazes, enamels, pottery, concrete, rubber, leather, many metals (especially cast iron) and organic compounds. Upon reaction with metals, explosive hydrogen gas may be formed.

[Toxicology] Fluoride ions are both acutely and chronically toxic. Acute effects of HF exposure include extreme respiratory irritation, immediate and severe eye damage and pulmonary edema. Skin, eye, or lung exposure to concentrated (>50%) HF solutions will cause immediate, severe, penetrating burns. Exposure to less concentrated solutions may have equally serious effects, but the appearance of symptoms can be delayed for up to 24 hours. If you are exposed to hydrofluoric acid seek medical attention immediately, even if you do not feel pain.

[Policy] All University of Alaska Fairbanks employees who work with Hydrofluoric Acid (HF) shall adhere to the work practices identified in this policy.

[Information and Training] Employees who handle hydrofluoric acid shall be trained on the hazards of HF and what to do in the event of an exposure or a spill by the Researcher or Principle Investigator. A Material/ Safety Data Sheet (MSDS) on HF shall always be kept in the immediate work area where HF is used. The MSDS together with this policy shall be used to train employees on the hazards of HF.

2. Personal Protective Equipment

[Eye Protection] Always use **chemical splash goggles** together with a **face shield** when handling concentrated HF. Due to the highly corrosive nature of HF, 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. Also, keep a tube of calcium gluconate gel on hand for topical use in the case of skin exposure.

[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. 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.

[Eyewash and Shower] Since HF is corrosive and rapidly damages tissue, an eyewash and shower must be nearby and accessible. Eyewash stations must be tested weekly by laboratory staff and safety showers must be tested at least annually by facilities services to ensure it will operate when needed.

3. Use Procedures

- Fluoride reagents should only be used **in a fume hood** with a **safety shower and eye wash station close by**. Before beginning any procedure involving HF, make sure the access to the emergency shower and eyewash is unobstructed.
- **Never use HF when working alone after hours.** HF may be used when working alone during normal working hours provided knowledgeable laboratory personnel have been alerted and at least one is in the general vicinity to provide assistance if necessary.
- **All lab personnel**, not just those who will be using HF, **must be informed** of the dangers of this chemical and the emergency procedures necessary in case of an accident.
- Undergraduate students should never be given the task of mixing HF solutions. Only experienced persons familiar with its properties should handle the concentrated acid.
- Set up a **designated area for HF** use and post a **warning sign during use**.
- **HF must be used in polyethylene, polypropylene, Teflon, wax, lead or platinum containers.** HF reacts with glass, ceramics, and some metals

4. HF Waste Disposal

- HF waste shall be placed in a chemically compatible container (e.g. polyethylene or Teflon®) with a sealed lid and clearly labeled. Do not store HF waste in glass or metal containers.
- Waste containers should no more than 95% full, and should stay in the lab for no more than 6 months from the day the waste container is started. Waste containers must be marked to identify the contents, hazards, and accumulation start and end dates. To request waste pickup, log-on to the EH&S Assistant or contact Emily Reiter for assistance. Please contact UAF EHSRM at x5413 if you have questions about a specific type of waste.

5. HF spills

- If greater than one liter of HF is spilled outside of a chemical hood:
 - o Evacuate the area; close the doors; post the area with a sign to prevent others from entering; and Notify the University Police at **911**.
- Laboratory staff can clean up spills less than one liter of HF inside a chemical fume hood by containing the spillage and carefully neutralizing the spill with:
 - o Spill-X-C caustic neutralizer (found in University provided spill kits in corridors);
 - o Caustic soda;
 - o Powdered calcium carbonate
 - o Calcium hydroxide; or
 - o Using a commercial HF spill kit.

6. Emergency Procedures

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

In the event of an HF exposure, immediately start the first aid procedures described below to avoid HF burns or other permanent damage. Once first aid has been started, contact the University Police at **911 or 907-474-7721**.

[First Aid for Skin Contact]

- Immediately proceed to the nearest emergency shower and flush affected area for at least 15 minutes;
- Remove all contaminated clothing while in the shower;
- If available apply calcium gluconate gel to the affected area as soon as possible; and
- Contact the University Police at **911 or 907-474-7721** for medical assistance.

Note: Those who assist HF victims shall be careful not to contaminate themselves and wear proper PPE while assisting after an HF exposure.

[First Aid for Eye Contact]

- Immediately proceed to the nearest eyewash or sink and while holding the eyelids open, flush the eyes for at least 15 minutes with large amounts of water; and
- Contact the University Police at **911 or 907-474-7721** for medical assistance.

[First Aid for Ingestion]

- First, dilute the acid by giving large quantities of water;
- Give several glasses of milk or several ounces of milk of magnesia or eight to twelve Tums® or Roloids®;
- Contact the University Police at **911 or 907-474-7721** for medical assistance;
- Do not induce vomiting;
- Never give anything by mouth to an unconscious or convulsing person.

[First Aid for Inhalation]

- Remove victim to fresh air; and
- Contact the University Police at **911 or 907-474-7721** for medical assistance.

7. 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.