THE UNIVERSITY OF CHICAGO | Office of Research Safety

Standard Operating Procedure

HF Use in the PNF

Lab specific information

Department	Institute for Molecular Engineering
Principal Investigator	Peter Duda
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Lab Phone	28903
Building	ERC
Locations covered by this SOP	Pritzker Nanofabrication Facility LL170
Emergency Contact	Peter Duda
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Date SOP was approved by PI	**3/17/2016**

Scope of the SOP

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 Pritzker Nanofabrication Facility users who work with Hydrofluoric Acid (HF) directly or on equipment in which HF is used 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 Safety Data Sheet (SDS) on HF shall always be kept in the immediate work area where HF is used. The SDS together with this policy shall be used to train employees on the hazards of HF.

Personal Protective Equipment

- **Eye Protection** Always use **chemical splash goggles** together with a **face shield** when handling any form of HF. Due to the highly corrosive nature of HF, safety glasses with side shields do not provide adequate eye protection.
- **Body Protection** All users must wear a **chemical splash apron** over their cleanroom garment. A tube of calcium gluconate gel will always be on hand for topical use in the case of skin exposure.
- **Gloves** Users must wear the MAPA TRIonic E-194 Gloves on top of regular nitrile glove when working with HF. Gloves that have not been contaminated with HF may be disposed of in the common trash. If gloves become contaminated with HF, rinse the gloves thoroughly, remove them as soon as possible, inspect the inner gloves for any sign of contamination and remove and replace the second pair of gloves.
- **Eyewash and Shower** Users must be aware of where the eyewash and shower stations are located in the PNF.

Use Procedures

- Fluoride reagents should only be used **in the two approved HF wet bench fume hoods in bay 6.** 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. This is a violation of the PNF CHP.** 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 are informed** of the dangers of this chemical and the emergency procedures necessary in case of an accident during CHP training.

- Non staff shall not be required or should not attempt to change or maintain the dedicated Buffered HF bath.

- **HF must be used in polyethylene, polypropylene, Teflon, wax, lead or platinum containers.** HF reacts with glass, ceramics, and some metals

HF Waste Disposal

- HF waste shall be disposed down the drain only in the bench in which it is authorized to be used.

- Users should thoroughly wash the sink down for 2 minutes after disposing of HF.

- If the aspirator is used to dispose of HF – a minimum of one liter of water must be aspirated after the HF to ensure no HF remains in the aspirator.

HF spills

- If any amount of concentrated HF or greater than one liter of dilute HF is spilled outside of a chemical hood: Evacuate the area; close the doors; post the area with a sign to prevent others from entering; and Notify the University Police at **123** or **773-702-8181**.

- PNF staff should be alerted to clean up a spill of any amount of HF inside a chemical fume hood. Staff will neutralize amounts larger than one liter prior to washing the bench top down the drain. Smaller than one liter should just be rinsed down the drain. HF can be neutralized 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.

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 **123** or **773-702-8181**.

Bring Honeywell's Recommended Treatment for HF Exposure with you to the Emergency Room.

First Aid for Skin Contact

• Immediately proceed to the nearest emergency shower and flush affected area only long enough to remove the HF from the skin.;

• Remove all contaminated clothing while in the shower;

• Immediately apply calcium gluconate gel to the affected area as soon as possible; and

• Contact the University Police at **123** or **773-702-8181** 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 **123** or **773-702-8181** 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 Rolaids®;

• Contact the University Police at **123** or **773-702-8181** 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 **123** or **773-702-8181** for medical assistance.

Storage

HF is only allowed to be stored in its original container. Always place HF on a low protected shelf or other location where it will not be accidentally spilled or knocked over. Always store HF with appropriate double containment.

Documentation of Training (signature of all users is required)

• Prior to conducting any work with HF, users must receive training regarding the hazards involved in working with this substance, work area decontamination, and emergency procedures. Users will be required to sign the HF Use in the PNF Addendum – User Authorization Form.

Additional Resources

(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)