



Hydrofluoric Acid

This SOP must be posted or readily available near the hydrofluoric acid use area. The Principle Investigator must ensure that all laboratory personnel using hydrofluoric acid are aware of its hazards and have been trained in accordance with this SOP.

I. Purpose:

This standard operating procedure was created by Syracuse University's Environmental Health & Safety Services to provide standardized safe working, handling and emergency procedures for laboratory personnel when working with hydrofluoric acid. Principle Investigators must include all laboratory specific hydrofluoric acid procedures in Appendix A of this document.

II. Physical and Chemical Properties:

Hydrofluoric acid (HF) is a clear, colorless, fuming, corrosive liquid that can cause severe burns to skin and other tissue, and can decalcify bone and cause hypocalcemia.

CAS:	7664-39-3	
Class:	Very toxic & corrosive	
Molecular Formula:	HF	
Form (physical state):	Liquid	
Color:	Colorless	
Boiling Point:	Not applicable	

Hydrofluoric acid reacts with glass, concrete, many metals, organic materials, leather, natural rubber, and wood. Chemically compatible containers, such as those made from polyethylene or Teflon, must be used for HF. HF must NOT be stored in glass containers. Compatible secondary containment must also always be provided for HF when in use and storage.

III. Potential Hazards:

Hydrofluoric acid has a number of chemical, physical, and toxicological properties that make handling this material particularly hazardous. Use of HF requires extreme care; if not stored, handled, and disposed of properly, HF can pose a serious threat to the health and safety of laboratory personnel, emergency responders and waste handlers.

- HF penetrates tissues on contact. Health hazards can occur when absorbed through skin, tissues, or eyes, and/or when inhaled or swallowed.
- HF is a calcium seeker. When HF enters the body it can decalcify bone and cause hypocalcemia due to fixation of blood calcium.
- Symptoms of HF exposure include eye and skin burns, irritation of the eyes, skin, nose and throat, rhinitis, bronchitis, pulmonary edema, and bone damage.
- HF interferes with nerve function. Skin contact with HF may not initially be painful. Symptoms of exposure to HF may not be immediately evident and accidental exposures can go unnoticed due to nerve function interference.
- Delayed treatment of HF exposures may increase the extent and seriousness of the injury.

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IV. Training:

All laboratory personnel who will use or handle HF must receive HF specific training from the Principle Investigator (PI) or designee prior to conducting any work with HF. This training must, at a minimum, include:

- The PI must provide laboratory personnel working with HF a copy of this SOP and review the contents of this SOP with the laboratory personnel.
- The PI must provide laboratory personnel working with HF any laboratory specific HF SOP(s) (Appendix A) and review these SOP(s) with laboratory personnel.
- The PI must provide laboratory personnel working with HF a copy of the Safety Data Sheet (SDS) specific to the HF to be used, and review the contents of the SDS with laboratory personnel.
- The PI must ensure that laboratory personnel working with HF have attended the general laboratory safety training (CHP) provided by Environmental Health & Safety Services (EHSS).
- The PI must ensure that laboratory personnel working with HF know the location of the nearest eyewash, safety shower, and HF first aid kit.
- The PI must ensure that laboratory personnel working with HF acknowledge on the training log maintained in Appendix C of this SOP, that they have been provided and understand this SOP and the laboratory specific HF SOP(s).

V. Engineering Controls:

1. HF must be used only in an EHSS inspected and functioning chemical fume hood. Sash heights should be maintained as low as possible to minimize escaping fumes and provide a physical barrier.
2. Emergency eyewash stations and safety showers must be readily accessible to HF use areas.

VI. Personal Protective Equipment (PPE):

The following PPE is required, at a minimum, for HF users:

1. Eye Protection:

- Tightly fitting safety goggles.
- If a potential splash hazard is present, a face shield is recommended in addition to safety goggles.

2. Hand Protection:

- **Concentrated HF ($\geq 1\%$ HF):** Use butyl rubber, neoprene rubber, or other HF resistant gloves that cover the hands, wrists, and forearms as an outer layer, with nitrile gloves as the inner layer.
- **Dilute HF ($< 1\%$ HF):** Use a double layer of 11mil or higher thickness nitrile gloves. The use of butyl rubber, neoprene rubber, or other HF resistant gloves is recommended.

Use proper glove removal technique to avoid potential skin contact with HF from contaminated gloves (i.e. removal without touching outer surface of the gloves). Thoroughly wash and dry hands after removing gloves. Dispose of single use gloves as dry hazardous waste.

Reusable gloves must be decontaminated after use. Gloves that come in contact with HF shall be decontaminated and inspected for degradation and/or shall be replaced with new gloves.

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VI. Personal Protective Equipment (PPE) (Cont'd):

3. Body Protection:

- Wear long sleeve shirts, long pants, and closed toed shoes.
- Knee-length lab coat.
- A chemical resistant apron if a potential splash hazard is present.

4. Respiratory Protection:

- Contact EHSS if a laboratory process involving HF has the potential to generate an airborne fume or vapor. EHSS will perform a process specific risk assessment to determine if respiratory protection is necessary.
- If respiratory protection is deemed necessary for a specific HF process, the PI will be responsible for providing full-face air-purifying respirators to laboratory personnel performing that HF process.
- Laboratory personnel assigned respirators must abide by the Syracuse University Respiratory Protection program and receive required training, fit testing and medical evaluations.

VII. Required Emergency Response Supplies:

The following materials must be readily available in the laboratory using HF.

1. First aid kit containing 2.5% calcium gluconate.
2. Calcium carbonate, calcium hydroxide, or a compatible neutralizer from a commercial HF spill kit.

VIII. Best Practices for the Safe Handling of HF:

1. At least one additional person that is trained in the contents of this SOP must be present and remain in the general vicinity of the work area when HF is being used. This person can be the PI, or another member of the laboratory or shared space that has received all training described in *Section IV* and has completed the training acknowledgment in *Appendix C*. Never use HF when working alone.
2. HF may be used only during Syracuse University standard business hours.
3. Undergraduate students may NOT handle HF.
4. All persons using HF must wear, at a minimum, the PPE required in *Section VI* of this SOP and any other PPE required in the laboratory specific procedures included in *Appendix A*.
5. HF must always be stored, transported, used and disposed of in chemically compatible containers, such as those made from polyethylene or Teflon. Never use glass containers with HF.
6. All HF containers must be clearly labeled, securely supported to avoid tip overs and spills, and kept closed when not in use.
7. Always use chemically compatible secondary containment (e.g. tray, absorbent pad) when working with or storing HF.
8. HF emergency response supplies must be readily available and maintained near the HF work area(s) (*Section VII*).
9. HF warning signs, emergency response procedures, and emergency contact information must be posted in HF storage and use areas (*Section X-XI, Appendix B*).

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IX. Storage & Disposal Procedures:

1. Chemical Storage:

- Storage areas must be labeled with an HF warning sign (*Appendix B*).
- Store HF containers in a corrosive / acid storage cabinet within chemically compatible secondary containment.
- Store HF only in chemically compatible containers, such as those made from polyethylene or Teflon. Never store HF in glass containers.
- Keep storage container closed (air-tight).
- DO NOT store HF at or above eye level.
- DO NOT store HF with oxides, organic chemicals, bases or metals.
- Procure and store only the smallest practical quantities for the experiment being performed.

2. Waste Disposal:

- Waste HF must be stored in a compatible container labeled with a hazardous waste tag provided by EHSS. DO NOT store waste HF in glass containers.
- Place the waste container in the satellite accumulation area in secondary containment. Ensure the waste bottle is fitted with a proper screw cap and notify EHSS for disposal.

X. Spill & Accident Response Procedure:

1. **Evacuate:** Immediately notify personnel in the affected area and evacuate the area.
2. **Notify:** Call DPS (315.443.2224 or 711 from campus landline or #78 from mobile phone) from a safe location outside of the affected area.
3. **Stay:** Stay in the safe location to meet emergency responders.
4. **Decontaminate:** Individuals exposed to a hazardous material should remove contaminated clothing and wash contaminated body area(s) with water. Follow HF First Aid Procedures (*Section XI*).
5. **Do not re-enter the affected area.** First responders and EHSS will evaluate the incident, direct the clean-up, and alert personnel when it is safe to re-enter.

XI. First Aid Procedures:

All exposure to HF must receive immediate first aid and medical evaluation even if the injury appears minor or there is no sense of pain. Symptoms may manifest as long as 24 hours after exposure. Contact DPS immediately (315.443.2224 or 711 from campus landline or #78 from mobile phone) in the event of an exposure. The manufacturer's Safety Data Sheet (SDS) for the HF used in the laboratory must be available in the laboratory and used as a reference for determining appropriate first aid measures. First aid providers must use gloves and appropriate PPE to avoid secondary contamination. The following information provides typical first aid measures recommended for HF exposures:

1. Inhalation:

Move to fresh air. If the person is not breathing, give artificial respiration. Avoid mouth-to-mouth contact. Seek medical attention immediately.

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XI. First Aid Procedures (Cont'd):

2. Skin Contact:

Immediately remove all contaminated clothing and rinse affected area with water for at least 15 minutes. Any contaminated clothing that has to be pulled over the head should be cut off the body. After rinsing affected area(s), apply generous amounts of 2.5% calcium gluconate gel. White specks appearing around the burned region indicates the formation of calcium fluoride and that the gel is working. Re-apply every 15 minutes until medical help arrives.

NOTE: HF is readily absorbed through the skin. Medical treatment is still necessary after rinsing with water and applying 2.5% calcium gluconate.

3. Eye Contact:

Flush with water at an emergency eyewash station for at least 15 minutes. Hold eyelids open while flushing. Seek medical attention and continue rinsing eyes during transport to hospital. If you wear contacts, remove them after first washing your hands and proceed to flush eyes with water. Do not return contacts to eyes.

4. Ingestion:

Do not induce vomiting. If vomiting occurs naturally, help the person so they do not choke.

XII. Clean-up Protocol:

EHSS, the PI and/or first responders will oversee and direct an HF spill clean-up. Depending on the location and/or severity of the spill, EHSS may seek assistance from an outside emergency response services provider.

- Only personnel who understand the hazards of HF and are confident in their ability to safely and properly clean up the spill may perform the spill clean-up.
- Wear all PPE described in Section VI and avoid exposure to the vapors during spill clean-up.
- Neutralize the spill by covering with powdered calcium carbonate or calcium hydroxide, or use a neutralizer from a commercial HF spill kit.

CAUTION: DO NOT ATTEMPT TO NEUTRALIZE HF SPILLS WITH:

1. Potassium carbonate, sodium carbonate, potassium hydroxide or sodium hydroxide. HF contact with these compounds may yield gaseous HF.
 2. Silicon-based absorbent materials (common in most solvent spill kits). HF contact with these materials may yield silicon tetrafluoride, a toxic and corrosive gas.
- Dispose of all contaminated material and PPE as hazardous waste in a compatible waste container.

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Appendix A: Laboratory Specific Hydrofluoric Acid Procedures.

Department:	
Principal Investigator:	Emergency Phone:
Laboratory Manager:	Emergency Phone:
Laboratory locations covered by this SOP (building / room number):	
Describe the laboratory application of hydrofluoric acid:	

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Appendix B: Hydrofluoric Acid Signage.




DANGER

**HYDROFLUORIC ACID
HAZARDOUS LIQUID**

Causes SEVERE BURNS which may not be IMMEDIATELY PAINFUL or VISIBLE.

**AVOID CONTACT WITH EYES,
SKIN AND CLOTHING!!**

Use 2.5% Calcium Gluconate Gel IMMEDIATELY on burn TO REDUCE SKIN and BONE DAMAGE.



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Appendix C: Hydrofluoric Acid User Training Log and Acknowledgement.

By signing below, I acknowledge that I have reviewed and understand the contents of this SOP, any laboratory specific HF SOPs and the contents of the SDS specific to the HF used in this laboratory.

Name: _____	Signature: _____	Date: _____
Name: _____	Signature: _____	Date: _____
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Name: _____	Signature: _____	Date: _____

Hydrofluoric Acid SOP

EHSS Use Only:

Laboratory Standard Operating Procedure: Hydrofluoric Acid (HF)		
EHSS Preparer(s): Tim Coughlin and Michael Bradley	Effective: October 2017	Supersedes:
EHSS Administration Approval: Rebecca Ponza		
Faculty Reviewer(s): Eric Finkelstein		