

### Lab-Specific Standard Operating Procedure (LSOP)- Hydrofluoric Acid and Solutions Containing Hydrofluoric Acid


Principal Investigator(PI):

Building:

Lab(s) Covered by LSOP:

Department:

Lab Phone Number(s):

Chemical	GHS Pictograms	Definitions
Hydrofluoric Acid (HF)		<p><b>Acute toxicity</b> refers to those adverse effects occurring following oral or dermal administration of a single dose of a substance, or multiple doses given within 24 hours, or an inhalation exposure of 4 hours.</p> <p><b>Skin corrosion</b> is the production of irreversible damage to the skin; namely, visible necrosis through the epidermis and into the dermis, following the application of a test substance for up to 4 hours.</p>

#### Hazard Awareness

Hydrofluoric acid (HF) and solutions containing HF are corrosive to all tissues of the body. Skin contact results in deep, painful burns that are slow to heal. Burns from dilute (<50%) HF do not usually become apparent until several hours after exposure; more concentrated solutions and anhydrous HF cause immediate painful burns and tissue destruction. HF damages underlying tissues through the release of fluoride ions leading to the decalcification of bones (low calcium levels), hyperkalemia (high potassium levels), hypomagnesemia (low magnesium levels), and potentially cardiac arrhythmias or cardiac arrest. HF liquid and vapor exposures to the eyes can lead to severe burns, permanent damage and blindness. Exposure to concentrations of HF above 10ppm can damage the lungs and lead to pulmonary edema after several hours. Brief exposure (5 minutes) to 50-250ppm of HF can be fatal to humans. Strict adherence to standard operating procedures must be followed to ensure health and safety.

#### SECTION 1. ADMINISTRATIVE CONTROLS

1a.	Lab-specific safety training must be provided by the principal investigator (PI) or other qualified personnel to all researchers working with hydrofluoric acid. Documentation of training is required.
1b.	Read the <b>safety data sheet (SDS)</b> for hydrofluoric acid prior to use.
1c.	Whenever possible, find safer substitutes or reduce the quantity of hydrofluoric acid being used.
1d.	Researchers must not work alone with hydrofluoric acid.
1e.	Experiments should be performed during normal business hours (i.e., 8:00 am-5:00 pm Mon-Fri) if possible.
1f.	A <b>DESIGNATED AREA</b> must be established where limited access, special procedures and work practices using hydrofluoric acid are taking place. The designated area must be a fume hood recognized by authorized personnel working in the lab. The designated area must be clearly marked with a sign that identifies the chemical hazard and include an appropriate warning (i.e., <b>DANGER- HYDROFLUORIC ACID- AUTHORIZED PERSONNEL ONLY</b> ).
1g.	2.5% calcium gluconate gels or 0.13% benzalkonium chloride must be stored in the immediate work area where HF is used. Expired calcium gluconate gels and/or benzalkonium chloride solutions must be replaced prior to research.

1h.	An eyewash and safety shower must be in the immediate work area where hydrofluoric acid is used.
1i.	<b>Add additional administrative controls specific to the laboratory.</b>
<b>SECTION 2. ENGINEERING CONTROLS</b>	
2a.	All research with hydrofluoric acid must be conducted in a chemical fume hood, over a spill tray if possible, with the sash at the lowest working height and with sliding sash panels (if applicable) aligned to form a barrier between the researcher and the experiment.
2b.	Chemical fume hoods must be running between 80-120 linear feet/minute and tested by EHS within the last year. If the hood is not working properly, contact Facilities (486-3113) to repair the hood or EHS to retest (486-3613).
2c.	PIs must determine if glove boxes or other types of local exhaust ventilation can be used as a substitute for chemical fume hoods. Use of hydrofluoric acid outside of chemical fume hoods must be reported to EHS for evaluation prior to research.
2d.	<b>Add additional engineering controls specific to the laboratory.</b>
<b>SECTION 3. WORK PRACTICES</b>	
3a.	HF must be handled and stored in chemically-compatible containers made of polyethylene or Teflon. <b>GLASS CONTAINERS MUST NEVER BE USED TO STORE OR TRANSFER HF.</b>
3b.	All containers of HF must be clearly labeled with the chemical name and hazard classes and kept tightly-sealed.
3c.	All work with HF must be performed on a chemically-compatible secondary containment tray.
3d.	Empty containers of HF must be handled carefully since product residues (vapors, liquid) are still harmful.
3e.	<b>Add additional work practices specific to the laboratory.</b>
<b>SECTION 4. PERSONAL PROTECTIVE EQUIPMENT</b>	
4a.	At a minimum, chemical splash goggles or safety glasses that meet <i>American National Standards Institute</i> (ANSI) standard Z-87.1 must be worn when handling HF.
4b.	PIs must determine when or if full-face shields are required when working with HF.
4c.	Gloves indicated in the safety data sheet (SDS) must be worn while handling small quantities of hydrofluoric acid. PIs must determine if additional protection for the hands (e.g., heavy-duty gloves, wearing two pairs of gloves, using longer gloves that cover the hands, wrists, and forearms, etc.) is required.
4d.	A lab coat must be worn when working with HF. Lab coats must be buttoned and fit properly to cover as much skin as possible. Acid-resistant aprons are recommended.
4e.	Long pants must be worn while using HF. Shorts, skirts or other clothing that expose the skin of the legs is not allowed.
4f.	Closed-toed footwear, which covers the entire foot, must be worn when working with HF.
4g.	<b>Add additional personal protective equipment requirements specific to the laboratory.</b>
<b>SECTION 5. STORAGE</b>	
5a.	Store hydrofluoric acid as indicated in safety data sheets (SDSs).
5b.	Ensure labels on original bottles remain legible and prominently displayed to identify contents.
5c.	Ensure both original and secondary containers remain intact and are stored with tight-fitting caps or lids.
5d.	Store HF away from ceramics, concrete, enamels, heat, glass, leather, metals, and rubber.

5e.	Store HF away from acetic anhydride, aliphatic amines, alcohols, alkanolamines, alkylene oxides, aromatic amines, amides, 2-aminoethanol, ammonia, ammonium hydroxide, arsenic trioxide, bismuthic acid, calcium oxide, ethylene diamine, ethyleneimine, epichlorohydrin, isocyanates, metal acetylides, nitrogen trifluoride, oleum, organic anhydrides, oxygen difluoride, phosphorus pentoxide, sulfuric acid, strong oxidizers, vinyl acetate, vinylidene fluoride. <b>Check safety data sheet for further incompatibilities.</b>
5f.	Do not store hydrofluoric acid with flammable materials, oxidizers or near water sources.
5g.	<b>Add additional lines for storage requirements specific to the laboratory.</b>
<b>SECTION 6. SPILLS AND ACCIDENTS PROCEDURES</b>	
1.	Evacuate the laboratory.
2.	Close door(s) to lab and post a <b>"NO ENTRY"</b> sign(s) or other warning information on the door.
3.	Call <b>911</b> .
4.	Do not re-enter area until instructed to do so by UCFD or other emergency personnel.
5.	Report accident to PI/Supervisor and EHS.
<b>SECTION 7. FIRST AID PROCEDURES</b>	
First Aid- Eyes	<ol style="list-style-type: none"> <li>1. Immediately move to the eyewash station, hold eyelids open and flush with water. Remove contact lenses while flushing (if applicable).</li> <li>2. Have another person from the lab dial <b>911</b> and specifically mention HF exposure.</li> <li>3. Continue flushing the eyes until emergency personnel arrives.</li> <li>4. Report incident to PI/Supervisor and EHS.</li> </ol>
First Aid- Skin	<ol style="list-style-type: none"> <li>1. Immediately move to safety shower or other water source and begin rinsing affected area(s). Remove contaminated clothing (if applicable) while flushing.</li> <li>2. Have another person from the lab dial <b>911</b> and specifically mention HF exposure.</li> <li>3. Flush affected area(s) under safety shower for <b>5 minutes</b>. Then use <b>one</b> of the following methods: <ol style="list-style-type: none"> <li>a. If 2.5% calcium gluconate gels are available, put on chemically-resistant gloves and continuously rub the ointment onto the affected area(s). <b>Pay particular attention to areas under the fingernails (if applicable)</b>. If gels are not available, continue flushing the affected area(s) with water.</li> <li>b. If a 0.13% benzalkonium chloride (Zephiran) solution is available, submerge affected area into a container with the solution and ice cubes. If immersion is not practical, soak a towel in the iced Zephiran solution and apply compresses to the affected area. Change compresses every 2 to 4 minutes. If Zephiran is not available, continue flushing the affected area(s) with water.</li> </ol> </li> <li>4. Keep applying ointment or rinsing affected area(s) until emergency personnel arrives</li> <li>5. Report incident to PI/Supervisor and EHS.</li> </ol>
First Aid- Ingestion	<ol style="list-style-type: none"> <li>1. Immediately rinse the mouth with cold water. <b>Do NOT induce vomiting. Do NOT give emetics or baking soda.</b></li> <li>2. Have another person from the lab dial <b>911</b> and specifically mention HF exposure.</li> <li>3. If the victim is conscious, have them drink several glasses of milk or several ounces of milk of magnesia, Mylanta®, Maalox®, etc. If milk or antacids are not available continue drinking water.</li> <li>4. Keep drinking water and/or milk/antacids until emergency personnel arrives.</li> <li>5. Report incident to PI/Supervisor and EHS.</li> </ol>

First Aid- Inhalation	<ol style="list-style-type: none"> <li>1. Move to fresh air.</li> <li>2. Dial <b>911</b>.</li> <li>3. Inform emergency responders that the accident involved HF.</li> <li>4. Report incident to PI/Supervisor and EHS.</li> </ol>
First Aid- Other	<i>Describe additional first aid procedures based on hazards.</i>

## SECTION 8. HAZARDOUS WASTE MANAGEMENT

1.	All hydrofluoric acid waste must be labeled with "Hazardous Waste" stickers or tags, use full chemical names to describe the waste (i.e., no chemical abbreviations or symbols), be stored in sturdy, plastic containers with tight-fitting caps or lids, and be stored alone or with other compatible chemicals.
2.	Hazardous wastes must be stored at or near a green "Satellite Accumulation Area" sign prior to disposal by EHS.

## SECTION 9. DECONTAMINATION PROCEDURES (*Attach or insert steps. Add more lines as necessary.*)

Equipment	<i>Describe how equipment will be decontaminated after use (e.g. use manufacturer instructions, specifications, etc.).</i>
Work Area	<i>Describe how the work area (e.g. fume hoods, trays, etc.) will be decontaminated after use.</i>
Personal Hygiene	<i>Describe how the researchers will decontaminate after procedure.</i>

## SECTION 10. SPECIFIC PROCEDURE

*List or attach a copy of the steps and appropriate safety controls for procedures using hydrofluoric acid.*

## SECTION 11A. APPROVAL

I have reviewed, understand and agree to follow this lab-specific standard operating procedure (LSOP) regarding hydrofluoric acid (HF) and solutions containing HF. Failure to follow the LSOP and lab-specific training guidelines for research with hydrofluoric acid is a violation of the [University Health & Safety Policy](#) and [University Code of Conduct](#). Further approval from the PI is required if any of the following events occur:

- A change in amount (**Add volume**) or substitution of the chemicals in the procedure is planned
- A change in the agreed-upon experimental set-up is planned
- Signs of a failure in safety design or equipment are observed
- Signs or symptoms of a chemical exposure to any personnel are observed
- Unexpected and/or potentially dangerous experimental results occur (e.g., fire, uncontrolled buildup of heat and/or pressure, etc.)

Researcher Signature	Date	Trainer Signature	Training Date

<b>SECTION 11B. PRINCIPAL INVESTIGATOR CERTIFICATION</b>			
<i>I approve the contents of the lab-specific standard operating procedure listed above regarding the use of hydrofluoric acid and solutions containing hydrofluoric acid.</i>			
<b>PI Signature:</b>			<b>Date:</b>
<b>A HARD OR ELECTRONIC COPY OF EACH LAB-SPECIFIC STANDARD OPERATING PROCEDURE MUST BE READILY AVAILBALE IN THE LAB.</b>			