



Safe Handling, Storage, and Disposal of Hydrofluoric Acid User's Guide

Presented by UAB Occupational Health and Safety (OH&S)

Introduction

Welcome to the **Safe Handling, Storage, and Disposal of Hydrofluoric Acid User's Guide**. This User's Guide is presented by the UAB Department of Occupational Health and Safety (OH&S).

Anyone that works with Hydrofluoric Acid must adhere to the guidelines and procedures presented here. The ultimate goal of this User Guide is to advise any laboratory personnel how to safely handle, store, and dispose of Hydrofluoric Acid properly.

Information and Training

The Principal Investigator (PI) is **required** to train employees or personnel on how to handle Hydrofluoric Acid, the potential hazards, and what to do in the event of an exposure, spill, or emergency. A Safety Data Sheet (SDS) on Hydrofluoric Acid **must** always be kept in the immediate work area where Hydrofluoric Acid is used.

Standard Operating Procedures (SOPs)

Any area, lab, department that uses Hydrofluoric Acid **must** have an up-to-date written Standard Operating Procedure (SOP). Contact OH&S at 205-934-2487 if you need assistance.

Hydrofluoric Acid (HF)

Description

Hydrofluoric Acid (HF) is a highly corrosive inorganic acid. Therefore, it must be handled with extreme caution. HF can penetrate the skin extremely easily and decalcifies bones leading to tissue necrosis, which may result in amputation and death.

The level of severity and speed of signs and symptoms showing up depends on the route of exposure, concentration of the acid, duration, of exposure, and the penetrability of the exposed skin. Concentrated HF (liquid or vapor) can cause severe burns, electrolyte imbalance, pulmonary edema, and life threatening cardiac arrhythmias.

Symptoms of exposure may be delayed in some cases for several hours, therefore, immediate medical attention is necessary even in the absence of any symptoms. Even moderate exposure may rapidly progress to a fatal injury if not treated immediately. The faster the treatment, the smaller the chance of serious injury.

Exposure Limits

The recommended Exposure Limits for Hydrofluoric Acid are:

- OSHA Permissible Exposure Limit (PEL) – General Industries: **3 ppm (2mg/m³) TWA**
- National Institute for Occupational Safety and Health (NIOSH) Recommended Exposure Limit (REL): **3ppm (2.5 mg/m³) TWA, 6 ppm (5 mg/m³) Ceiling (15 minutes)**
- American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV) (2005): **0.5 ppm TWA, 2 ppm Ceiling**
- NIOSH Immediately Dangerous To Life or Health Concentration (IDLH): **30 ppm**

Hazards and Safety

Health Hazards

Minimum Lethal Exposure

- **Oral:** Death has occurred after ingestion of 1.5 grams of Hydrofluoric Acid (concentration unknown) within 6.5 hours of ingestion.
- **Dermal:** A dermal exposure to 70% Hydrofluoric Acid over a 2.5% total body surface area resulted in death.
- **Inhalation:** The lowest lethal concentrations for Hydrogen Fluoride range from 50-250 ppm for a 5-minute exposure and are based on accidental, voluntary and occupational exposure.

Handling

Preparing to Work with HF

Before starting any work with Hydrofluoric Acid, you **must** do the following:

1. Read the entire Safe Handling, Storage, and Disposal of Hydrofluoric Acid User Guide.
2. Read the whole Safety Data Sheet (SDS) for Hydrofluoric Acid.
3. Review your labs Standard Operating Procedure (SOP). If an SOP does not exist, then one **must** be created **immediately**.
4. Locate the [HF Specific First Aid Kit](#) for your lab.
 - a. It is the responsibility of the PI to maintain an up-to-date kit. The PI must inform the employees and personnel about Calcium Gluconate Gels presence, location, and how to use it before any work is conducted with HF.
5. Locate the [HF Specific Spill Kit](#) for your lab.

Working Safely with HF

Make sure to read the SOP, SDS, safe work practices, spill control methods, and emergency procedures before starting any work with Hydrofluoric Acid. Always work inside a functioning chemical fume hood. Before conducting work in a chemical fume hood, **always** check the fume hood is certified for the current year and is working properly. Manipulation involving even small quantities of diluted HF solutions **must** be performed inside the hood. Keep the acid deep inside the fume hood and as far away as possible from the user.

Place plastic trays or bench paper on the work surface before starting HF procedures to prevent contamination of the work surfaces.

Use plastic beakers and containers for HF manipulations, and ensure that there are neither cracks nor brittleness. Also, wash your hands thoroughly with soap and water after handling HF.



Never work alone with HF and limit all HF manipulations to regular office hours. Only trained personnel are allowed to work with HF.

Personal Protective Equipment (PPE)

Gloves

Neoprene or Nitrile rubber gloves are the best for working with HF, but the thickness may reduce agility.

Wear two pairs of Nitrile exam gloves, and change them often instead. When working with larger quantities of HF in procedures that do not require as much agility, wear heavy Nitrile or Neoprene rubber gloves, with a Nitrile exam glove underneath. Check the gloves for leaks by inflating the glove and then closing the cuff. An intact glove should hold air. To guarantee that there are no holes, submerge them in water and look for bubbles.

Body

You should wear a long-sleeved shirt, long pants, and closed toed-shoes. Always wear a lab coat, chemical-resistant apron and sleeves.

Eye

When handling HF, the proper eye protection is ANSI approved safety goggles and a face shield.

Transporting

If you have a solution that contains HF that needs to be transported you **must** do the following:

1. Place the object in a clean, chemically compatible secondary container, and close the lid.
2. Remove your gloves before transporting the container to avoid the possibility of chemical contamination on your gloves spreading to door handles and other objects. Also, consider putting on a single clean glove to carry the container with leaving an ungloved hand to open doors and handle other objects. You also may have a fellow lab member walk with you to open doors and handle objects for you.

Storage

Hydrofluoric Acid must be stored in a:

- tightly closed container made from either Polyethylene, Fluorocarbon, or Lead.
- cool dry place away from other chemicals or materials.
- cabinet with warning signs posted outside of it.
- facility with adequate ventilation.
- secondary containment made of Polyethylene.

HF should **never** be stored in glass containers! Hydrofluoric Acid reacts with many materials; therefore, HF should avoid contact with:

- Glass
- Concrete
- Metals
- Water
- Oxidizers
- Alkalis
- Combustibles
- Organics
- Ceramics

Containers of HF may be hazardous when empty since they retain product residues (vapors liquid). Make sure that you observe all warnings and precautions listed for the product.

Ordering

Prior to any work conducted with Hydrofluoric Acid in the laboratory, the PI is responsible for reviewing this checklist and ensuring that all required items mentioned below are immediately available in the laboratory and in good working order.

Each day before beginning work involving HF, you should:

- Locate your labs:
 - First Aid Kit, spill procedures, Spill Kit, and SDS.
 - Eyewash and emergency showers. Check to see if they are functioning and access to them is unobstructed.
 - Personal Protective Equipment (PPE)
 - Phone. A note beside the phone should have emergency phone numbers, the name of the building, the building number, and room number.
- Verify your lab:
 - Has a colleague that is knowledgeable with the lab's HF SOP, is available at all times while working is being performed, and is aware where the HF will be conducted.
 - Has a functional chemical fume hood and has been annually certified.
 - If the date on the fume hood is not up-to-date, please call OH&S at (205) 934-2487 immediately.
 - Has an adequate supply of Calcium Gluconate available and has not expired.

Labeling

Clearly label containers containing Hydrofluoric Acid with the correct chemical name in English including appropriate hazard warnings.

Waste Management

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.

Emergencies

Procedures

Medical personnel should be warned about the HF, and a copy of SDS must be provided to them. All exposure 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 in this document to avoid HF burns or other permanent damage. Call 911 immediately from a campus phone for assistance.

Equipment

Areas where HF is used must have access to an eyewash and safety shower within 10 seconds from any point in the lab or work area. The eyewash shall be located on the same level as the hazard, and the path of travel shall be free of obstructions that may inhibit its immediate use. Handheld eyewash bottles or self-contained units are not acceptable alternatives to plumbed eyewash units.

Spills

Management

All areas where HF is used must have proper [Spill Kit](#). Small spills inside a fume hood can be neutralized by covering with acid neutralizer (such as sodium bicarbonate), and absorbed with spill control pads and/or absorbents. Proper PPE must be donned before starting the cleanup.

If HF has spilled outside of a chemical hood, you should **never** attempt to clean the spill up. You should contact OH&S **immediately!**

You should:

- Evacuate the area
- Close the doors
- Post the area with a sign to prevent others from entering
- Notify OH&S at 205-934-2487 from a cell phone or emergency responders by dialing 911 from campus phone

Laboratory staff can clean up spills of up to 50 ml of HF inside a chemical fume hood by containing the spillage and carefully neutralizing the spill with:

- Spill-X-C caustic neutralizer
- Caustic soda
- Powdered calcium carbonate
- Calcium hydroxide
- Using a commercial HF spill kit

In the event of a burn caused from HF, the following steps must be immediately taken:

- Wash the affected skin area with copious amounts of water.

Skin Exposure or Burns

- Remove all clothing while in the shower (remove goggles last; double-bag contaminated clothes, when removing shirts or pullover sweaters, be careful not to contaminate the eyes. Cutting off such clothing will help prevent spreading the contamination. Do not put contaminated cloths back; they may still contain chemical residue. Wash contaminated clothing separately or discard). While you are in the shower, someone should call 911 **immediately** from a campus phone or 205-934-2487 from a cell phone.
 - If 2.5% calcium gluconate gel or 0.13% benzalkonium chloride is available, washing can be stopped after 5 minutes, and start applying the ointment. 5 minutes of washing will effectively remove all the HF from the body. Extra washing will only delay the treatment. If the neutralizing agents are not available keep rinsing until medical help arrive.

- Apply calcium gluconate gel (2.5%) while wearing gloves. Massage the gel promptly and repeatedly into burned area. Always follow the manufactures directions supplied with the HF burn ointment/solution if they differ from these.
- Seek immediate medical attention.

Contamination on Clothing

- Remove all contaminated clothing, including shoes, undergarments and jewelry immediately, while standing under running water or the safety shower.
 - When removing shirts or pullover sweaters, be careful not to contaminate the eyes. Cutting off such clothing will help prevent spreading the contamination.
 - Do not put contaminated clothing back on. They still contain chemicals
- Wash contaminated clothing separately or discard.
- Dial 911 from a campus phone to have the victim taken to the emergency room for medical attention.

Ingestion

- Dial 911 **immediately** from a campus phone.
- Drink large amounts of water. **Do not** induce vomiting.
 - If the injured person is unconscious, turn his/her head or entire body onto the left side. Be cautious about performing CPR. This could potentially poison you from the mouth-to-mouth contact. If available, use a mouth-to-mouth resuscitator.
- Evacuate the area and move the victim to fresh air.

Inhalation

- Dial 911 **immediately** from a campus phone.
- Breathe 100% oxygen (10 to 12 L/min flow rate) as soon as possible.
- Trained personnel should provide calcium gluconate (2.5%) by nebulizer.
- Seek medical attention
- Treat the person for chemical burns of the eyes and skin.

Conclusion

This concludes the *Safe Handling, Storage, and Disposal of Hydrofluoric Acid Policy Guide*. You should follow all of the Hydrofluoric Acid policies and procedures in order to work at the highest level of safety.

If you have any questions or concerns regarding the handling, storing, or disposing of Hydrofluoric Acid please call UAB Occupational Health and Safety (OH&S) at (205) 934-2487.

Want to Learn More?

OH&S has many training courses available to all UAB active employees and students. This includes topics such as in-depth radiation training, biosafety, bloodborne pathogens, chemical safety, Controlled Substances, building life safety, hazardous and medical waste, universal waste, PPE, Hazard Communication, etc.

We have a [decision tree](#) to assist you in choosing the right course to match the knowledge/skills you may need at work every day as well. If you have any questions or comments, please feel free to contact OH&S at 205-934-2487.