



# ENVIRONMENTAL HEALTH & SAFETY

---

## Hydrofluoric Acid Safety Program

*This page intentionally left blank*

**UNIVERSITY OF NEW MEXICO**  
**Department of Environmental Health and Safety**

---

Casey Hall  
Interim Director

---

Zachary Peterson  
Interim Manager, Safety

---

---

---

---

**DOCUMENT REVISION LOG**

Document: **Hydrofluoric Acid Safety**

Rev. No.	Effective Date	Revision Description	Pages Replaced	Completed by:
1	10/26/2020	Created first draft	All	Joe Hazelton
2	12/4/2020	Created second draft with edits from Melissa Terry	All	Joe Hazelton
3	12/17/2020	Created final PDF	All	Joe Hazelton

## ACRONYMS & DEFINITIONS

EHS	Environmental Health and Safety
HF	Hydrofluoric Acid
PI	Principal Investigator (Lead Researcher)
SDS	Safety Data Sheet

## TABLE OF CONTENTS

Hydrofluoric Acid.....	1
1. SCOPE.....	1
2. RESPONSIBILITIES .....	1
3. Hazard Data .....	2
4. PERMISSIBLE EXPOSURE LIMITS .....	3
5. REDUCING EMPLOYEE EXPOSURE TO Hydrofluoric Acid.....	3
6. SIGNAGE AND LABELING .....	4
7. SPECIAL HANDLING PROCEDURES .....	5
9. EMPLOYEE TRAINING.....	6
10. SPILLS.....	6
10.1 SPILL CLEANUP PROCEDURES .....	7
10.1.1. “Self Clean” (Procedure for Small Spills) .....	7
10.1.2. “Call EHS” (Procedure for Large Spills).....	8
11. EXPOSURE PROCEDURES (IN CASE OF EMERGENCY) .....	8
12. STORAGE .....	9
13. DISPOSAL .....	10
14. Sources.....	10

## HYDROFLUORIC ACID

This document establishes University of New Mexico's written safety program for hydrofluoric acid (HF) or hydrofluoric acid generating compounds. The purpose of this program is to identify work activities and personnel with potential exposure to HF and to provide guidance of the safe use of HF.

### 1. SCOPE

This program applies to all locations at the University of New Mexico (UNM) that use aqueous hydrofluoric acid. If you plan to use HF gas please contact EHS for further information.

### 2. RESPONSIBILITIES

#### 2.1. Environmental Health & Safety (EHS) is responsible for:

- Preparing, reviewing and periodically revising this program
- Monitoring compliance with this program
- Providing general hydrofluoric acid safety training
- Conducting occupational exposure assessments
- Providing or coordinating emergency response for chemical spills
- Investigating accidents

#### 2.2. Deans, Directors and Department Heads are responsible for:

- Ensuring departmental compliance with all the procedures outlined in this program

#### 2.3. Supervisors and/or PI's are responsible for:

- Ensuring compliance with this program in their work area(s)
- Developing lab-specific Standard Operating Procedures (SOPs) that address the specific safety measures to be implemented when using HF
- Ensuring employees with potential exposure to HF receive the appropriate training before working with it
- Arranging for immediate emergency response, if necessary, for chemical spills, injuries and overexposures
- Maintaining a Safety Data Sheet (SDS) for HF products and all other hazardous chemicals used in the work area
- Notifying EHS when there is a change in equipment, processes, or controls which may result in additional exposure to HF

- Notifying EHS of any employee incidents involving HF, including but not limited to the filing of Notice of Incident (Record Only) or Workers Compensation Claims

## 2.4. Employees are responsible for:

- Knowing the provisions of the HF Safety Program
- Reporting accidents, possible exposures or unsafe conditions to their supervisor
- Utilizing engineering controls, abiding by administrative controls and wearing appropriate PPE

## 3. HAZARD DATA

Hydrofluoric acid is a highly toxic, potentially fatal substance. Breathing in hydrogen fluoride at high levels or in combination with skin contact can cause death from an irregular heartbeat or from fluid buildup in the lungs. Swallowing only a small amount of highly concentrated hydrogen fluoride will affect major internal organs and may be fatal.

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 (>48%) 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.*** Exposure to hydrofluoric acid can produce harmful health effects that may not be immediately apparent, as follows:

### 3.1. Acute Health Effects

Symptoms that develop rapidly during short-term exposures are considered acute health effects. Acute health effects of HF exposure include:

- A. Inhalation: Severely corrosive to the respiratory tract. May cause sore throat, coughing, labored breathing and lung congestion/inflammation.
- B. Ingestion: Corrosive. Ingestions of more than 20 mg/kg body weight are considered a lethal dose. May cause sore throat, abdominal pain, diarrhea, vomiting, severe burns of the digestive tract, and kidney dysfunction.
- C. Skin Contact: In concentrations greater than 50%, hydrofluoric acid burns are felt immediately, and tissue destruction is rapidly apparent. In concentrations of 20-50%, the burn becomes apparent 1-8 hours following the exposure, and in concentrations less than 20%, the pain and erythema can be latent for as long as 24 hours after the exposure. Latent symptoms can seriously delay proper treatment.
- D. Eye Contact: Corrosive to the eyes. Symptoms of redness, pain, blurred vision, and permanent eye damage may occur.
- E. Aggravation of Pre-existing Conditions: Persons with pre-existing skin disorders, eye problems, or impaired kidney or respiratory function may be more susceptible to the effects of this substance.



### 3.2. Chronic Health Effects

Symptoms that develop slowly due to long-term exposures to low concentrations of a hazardous substance are considered chronic health effects. Chronic health effects of HF exposure include:

- A. Intake of more than 6 mg of fluorine per day may result in fluorosis, bone and joint damage. Hypocalcemia and hypomagnesemia can occur from absorption of fluoride ion into blood stream.
- B. People who survive HF inhalation may develop lingering chronic lung disease.
- C. Long term HF exposure has been reported to damage the kidneys and liver.

## 4. PERMISSIBLE EXPOSURE LIMITS

- **NIOSH REL:**
  - TWA (10-hour): 3 ppm (2.5 mg/m<sup>3</sup>)
  - Ceiling (15-minute): 6 ppm (5 mg/m<sup>3</sup>)
- **OSHA PEL:**
  - TWA (8-hour): 3 ppm
- **ACGIH TLV:** 3 ppm
- **NIOSH IDLH:** 30 ppm
- **DOE TEEL:**
  - TEEL-0: 0.818 mg/m<sup>3</sup>
  - TEEL-1: 0.818 mg/m<sup>3</sup>
  - TEEL-2: 19.6 mg/m<sup>3</sup>
  - TEEL-3: 36 mg/m<sup>3</sup>
- **AIHA ERPG:**
  - ERPG-1: 2 ppm
  - ERPG-2: 20 ppm
  - ERPG-3: 50 ppm

## 5. REDUCING EMPLOYEE EXPOSURE TO HYDROFLUORIC ACID

### 5.1. Substitution

Suitable substitutes for HF are process-dependent and include:

- Fluoroboric acid
- Sodium fluoride
- Ammonium persulfate solution

## 5.2. Engineering Controls

1. Always work with HF in a properly functioning fume hood
2. Restrict all other activities in the fume hood while working with HF

## 5.3. Administrative Controls

1. Employees be trained on hazard data before using HF
2. Employees who use HF must abide by the lab-specific HF SOP

## 5.4. Personal Protective Equipment (PPE)

The purpose for PPE is to shield the individual in the event of a release of vapor, a spill or other incident. PPE is not a substitute for safe work practices. All personnel who use any quantity of HF must use the following PPE:

1. Splash-proof goggles.
2. Thick, HF-resistant gloves over latex or nitrile gloves(double gloves)
3. An acid resistant suit or apron
4. Closed toe shoes and pants

## 5.5. HF Exposure Kit

All labs that use and/or store HF must keep a kit on hand in case of accidental exposure to HF. The kit must include:

1. HF-resistant gloves
2. Tube of calcium gluconate
  - o Note that calcium gluconate dries out easily and typically has a shelf-life of about two years
3. Emergency response instructions

## 5.6. Emergency Eyewash and Shower

Confirm emergency eyewash and/or shower are located within HF working area and have a current certification date.

## 6. SIGNAGE AND LABELING

- **Shipping Name:**  
Hydrogen fluoride, anhydrous (1052)  
Hydrofluoric acid, *with not more than 60 percent strength* (1790)
- **Identification Number:**  
1052 (hydrogen fluoride, anhydrous) (Guide 125)  
1790 (hydrofluoric acid) (Guide 157)

- **Hazardous Class or Division:**  
8(1052)
- **Subsidiary Hazardous Class or Division:**  
6.1, Inhalation Hazard (1790)
- **Label:**  
Corrosive, Poison (Toxic) (1052)  
Corrosive, Poison (Toxic), Inhalation Hazard (1790)

**Placard Image:**



**7. SPECIAL HANDLING PROCEDURES**

1. Never use Hydrofluoric Acid when working alone after hours. Hydrofluoric Acid 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.
2. All lab personnel, not just those who will be using Hydrofluoric Acid, must be informed of the dangers of this chemical and the emergency procedures necessary in case of an accident. A sign should be posted to alert people that work with Hydrofluoric Acid is in progress.
3. All persons who use Hydrofluoric Acid must be made aware of its properties and trained in proper procedures for use and disposal. The Lab Supervisor/PI is responsible for providing this training.
4. Laboratories which keep or use Hydrofluoric Acid gas or concentrated solutions (>48% Hydrofluoric Acid) must have these emergency procedures on hand as well as the appropriate SDS.
5. Laboratories which keep or use Hydrofluoric Acid gas or concentrated solutions (>48% Hydrofluoric Acid) must have an operational safety shower and eye wash in their laboratory. Before beginning any procedure involving Hydrofluoric Acid, make sure the access to the emergency shower and eyewash is unobstructed.
6. Undergraduate students should never be given the task of mixing Hydrofluoric Acid solutions. Only experienced persons familiar with its properties should handle the concentrated acid.

7. A small supply of appropriate neutralizer for spills should be kept near the fume hood where the work will be conducted. If a small quantity (100 ml or less) of dilute Hydrofluoric Acid solution is spilled, clean it up by absorbing spilled material with the supplies in the Chemical Response Kit, and apply neutralizer to decontaminate surfaces. In some instances, powdered calcium carbonate or calcium hydroxide may be used to neutralize spilled material. If a larger amount is spilled, or if the acid is concentrated, contain the spill as best as you can use supplies in the Chemical Response Kit, evacuate the area, and call 911. Avoid exposure to the vapors.
8. Dispose of unwanted hydrofluoric acid or spill cleanup materials by submitting online waste pickup requests.
9. When working with Hydrofluoric Acid or concentrated HF solutions (> 48%):
  - a. Work in a fume hood with the sash as low as possible.
  - b. Wear PPE as defined above.
  - c. Wear a long-sleeved, buttoned lab coat, pants or long skirt, and closed-toe shoes.
  - d. Wear thick Neoprene or Nitrile gloves or HF-resistant gloves.
  - e. The Lab Supervisor/PI must be notified before any work with hydrofluoric acid occurs outside the chemical fume hood.
10. Exclusively transport HF in a labeled and sealed non-breakable secondary container.
11. Any exposure to Hydrofluoric Acid must be treated immediately by medical personnel

## 9. EMPLOYEE TRAINING

Supervisors are responsible for ensuring that employees with potential exposure to hydrofluoric receive the appropriate training before working with it. Further on the job training must be done. Supervisors should review this information with employees annually. Training will cover the following:

- Explanation of UNM's Hydrofluoric Acid Safety SOP
- Contents of the Safety Data Sheet(s) for all HF in the workspace
  - (Multiple SDS's may be required for the manufacturer dilutions of HF)

If desired, supervisors can contact EHS for lab training as a group. Call (505) 277-2753 during business hours (M-F/8-5).

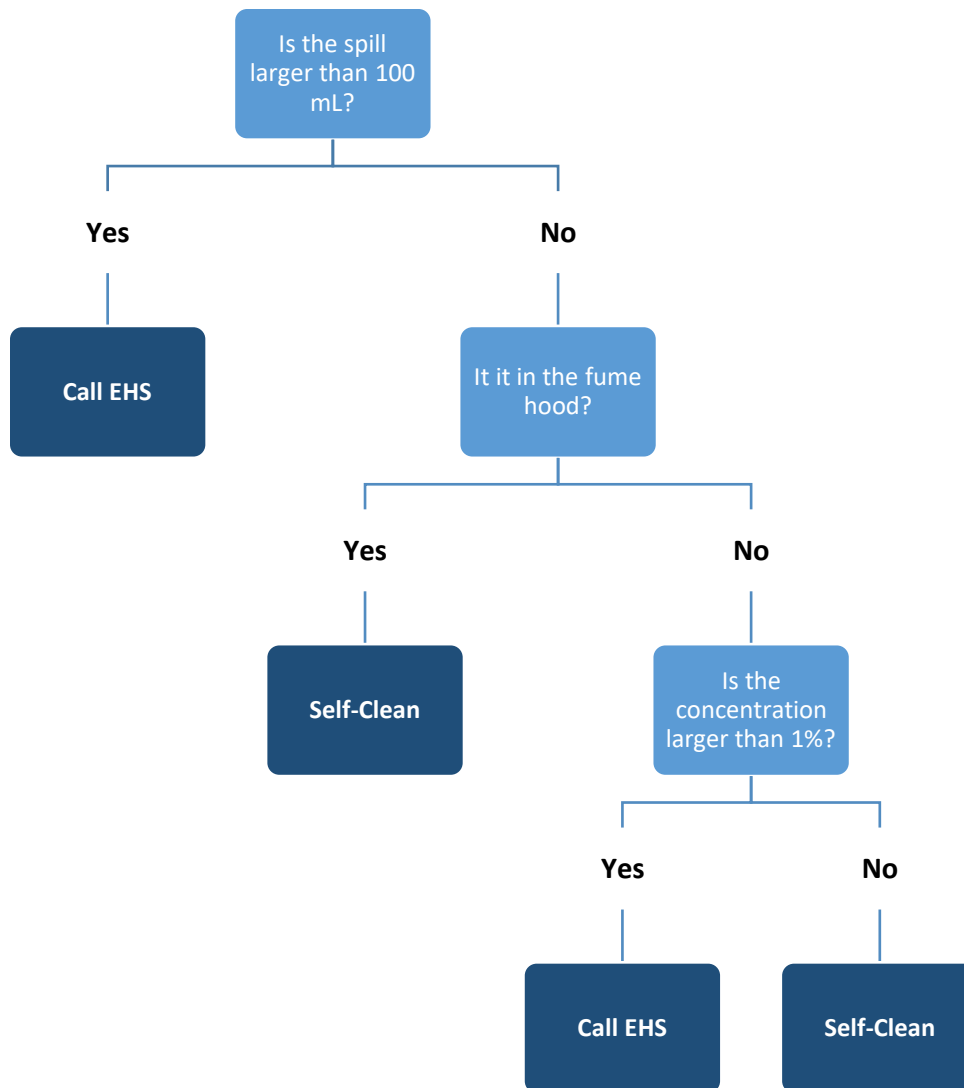
## 10. SPILLS

Chemical spills must be cleaned up as soon as possible by properly protected and trained personnel. All other persons should leave the area. Spill response procedures must be developed based on the chemical and potential spill or release conditions. Clean up spills using contents of the laboratory spill kit. Do not attempt to clean up any spill if not trained or comfortable. If trained and equipped, only clean up small (less than 100 ml) and dilute (less than 1%) spills that occur in a fume hood. If the spill is larger or more concentrated or people

have been exposed, evacuate the area and call 911\* on campus phone for help. If a person is exposed follow EXPOSURE PROCEDURES below.

### 10.1 SPILL CLEANUP PROCEDURES

*In the event of a spill use this decision tree to find the appropriate spill procedure (listed in dark blue).*



#### 10.1.1. “Self Clean” (Procedure for Small Spills)

1. Close hood sash, cordon off spill area.
2. If you need help, call EH&S (during business hours (M-F/8-5) (505) 277-2753, outside business hours (505) 951-0194). Tell them that a [chemical] spill has occurred and you need advice or assistance. Notify supervisor.

3. Personnel must wear a lab coat with rubber, neoprene or Viton apron/Tyvek sleeve covers or a Tyvek suit, safety goggles and face shield. Wear 6 mil nitrile inner gloves and 22 mil (nominal) gauge neoprene or butyl rubber gloves or SilverShield outer gloves. Optional to use nitrile gloves as a layer on top of SilverShield gloves for dexterity.
4. Wipe up spilled liquids with absorbent pads.
5. Clean the spill area thoroughly with a 10% calcium carbonate solution, followed by soap and water. Dry.

Do not attempt to neutralize HF with the following because of potential adverse reactions: sodium or potassium carbonate, potassium or sodium hydroxide, silicon-based absorbent materials such as sand, vermiculite or kitty litter.

6. If spill is extensive within the containment, clean all interior surfaces after completion of the spill cleanup.
7. Double bag all waste in plastic bags labeled as “HF spill debris” and store in fume hood away from incompatible chemicals or procedures. Submit request to EH&S for hazardous waste pickup.

#### 10.1.2. “Call EHS” (Procedure for Large Spills)

1. Evacuate all personnel from the laboratory and restrict access. Call 911\*.
2. As soon as possible report the spill by notifying EH&S (during business hours (M-F/8-5) (505) 277-2753, outside business hours (505) 951-0194); tell them that a spill has occurred, and that you need help managing the spill. Notify supervisor.
3. Be prepared to provide the following information:
  - Name and phone number of knowledgeable person that can be contacted
  - Name of chemical spilled, concentration and amount spilled (if known)
  - Number of injured, if any (refer below to EXPOSURE PROCEDURES)
  - Location of spill

## 11. EXPOSURE PROCEDURES (IN CASE OF EMERGENCY)

1. **Provide First Aid Immediately**
  - For **inhalation** exposure, move out of contaminated area. Call 911\*.
  - For **skin** exposure, call 911\*. If calcium gluconate gel is available, use the nearest safety shower for 5 minutes. Stay under the shower and remove clothing. Use a clean lab coat or spare clothing for cover-up. With gloved hands, apply calcium gluconate gel to the skin liberally and massage it into the affected site. Apply the gel as soon as the washing is done. Affected area does not need to be dried prior to application. Reapply gel continually every 10-15 minutes and massage into the skin

until medical treatment is given. If calcium gluconate gel is not available, continue flushing with water for at least 15 minutes or until medical treatment is given.

- For **eye** exposure, call 911\*. If sterile 1% calcium gluconate emergency eyewash solution is available, use the nearest safety eyewash for 5 minutes while holding eyelids open. Then apply the calcium gluconate solution as a continuous drip into eyes (do NOT apply calcium gluconate GEL to eyes). If sterile 1% calcium gluconate solution is not available, use the safety eyewash for at least 15 minutes or until medical treatment is given.

## 2. Get Help

- Call 911\* or go to nearest Emergency Department (ED). Give details of exposure:
  - Chemical name and concentration
  - Amount of exposure
  - Route of exposure (skin, eyes, respiratory)
  - Time since exposure
- Bring the SDS and SOP or HF Focus Sheet to the ED.
- Notify your supervisor as soon as possible for assistance.
- Secure area before leaving. Lock doors and indicate spill if needed.

## 3. Report Incident to Environmental Health & Safety

- As soon as possible report the spill by notifying EH&S (during business hours (M-F/8-5) (505) 277-2753, outside business hours (505) 951-0194); tell them that a spill has occurred, and that you need help managing the spill. Notify supervisor.
- Be prepared to provide the following information:
  - a. Name and phone number of knowledgeable person that can be contacted
  - b. Name of chemical spilled, concentration and amount spilled (if known)
  - c. Number of injured, if any
  - d. Location of spill

## 12. STORAGE

Store HF in labeled, chemically compatible containers (polyethylene or Teflon). All HF containers must be kept in a corrosive cabinet within its own secondary containment/spill tray.

- Do not store HF in glass, metal and ceramic containers are not compatible with HF
- Do not store HF near incompatible chemicals such as organic acids, ammonia or other alkaline chemicals.
- If possible, store on a lower shelf within the corrosive chemical cabinet

## 13. DISPOSAL

All chemical waste must be disposed of according to federal and state regulations and UNM's Chemical Hygiene Plan. Hydrofluoric acid-containing wastes should be placed in a labeled waste container and stored within its own secondary containment/spill tray. Call EHS at (505) 277-2753 to schedule a pickup of chemical waste.

## 14. SOURCES

[NIOSH Guide 125: Hydrofluoric Acid](#)

[ThermoFisher SDS for Hydrofluoric Acid](#)

[University of Washington SOP for Hydrofluoric Acid](#)