



EH&S Guidance Document:

Hydrofluoric Acid



Hydrogen Fluoride is a clear, colorless, liquid or fuming gas. In its liquid state, it is an extremely toxic and corrosive acid called Hydrofluoric Acid (HF). Unlike most acids, HF is aggressively corrosive to glass and is typically used in glass etching processes. Concentrated (>50%) HF exposure to the skin can cause severe burns, excruciating pain, and potentially death. At lower concentrations, visible burns and pain may not occur for up to eight hours after exposure. It is possible for HF to cause burns and even death at concentrations as low as 2% if not effectively washed off.

HF is extremely toxic because it penetrates the body's cells and quickly dissociates into fluoride ions. These ions bind with calcium throughout your body destroying bones and tissue, which can lead to organ failure and potentially death. First aid use of calcium gluconate (Calgonate®) provides free calcium to bind the fluoride ions, protecting the body's calcium.

All laboratory personnel who work with Hydrofluoric Acid must implement the procedures and laboratory design requirements shown below. Contact EH&S if you will be using Hydrogen Fluoride Gas.

IF YOU ARE EXPOSED TO HF ACID:

**FLUSH THE AFFECTED SKIN WITH LARGE AMOUNTS OF WATER
FOR AT LEAST 15 MINUTES AND REMOVE ALL CONTAMINATED CLOTHING.
NEXT, APPLY CALCIUM GLUCONATE GEL TO AFFECTED SKIN AREAS AND SEEK
IMMEDIATE EMERGENCY MEDICAL ATTENTION.**

(See detailed emergency procedures in Section II)

I. PROPER USE, PPE AND STORAGE OF HF ACID

Usage and Workspace

- Contact EH&S prior to obtaining HF acid in order to ensure the lab is properly equipped for its use. Due to its extreme toxicity and extra safety requirements, try to find alternatives to using HF whenever possible.
- HF should only be used within a fume hood, with the sash height no higher than the marked 14 inches.



Usage and Workspace (Cont.)

- Always use proper PPE when handling HF and minimize the amount of uncovered skin, and always wear safety glasses and nitrile or rubber gloves. Full-face shields and rubber aprons are also highly recommended.
- Whenever possible, work with these materials should not occur when campus is closed or outside of normal campus hours (7am-5pm Monday-Friday). Experiments should be planned so that they occur when campus is officially open in order to ensure there will be more people and resources available to help in an emergency.
- You are required to implement the “buddy system” when working with HF with a colleague that is also educated in the hazards, use, and first aid procedure of HF.
- Identify the location of the nearest safety shower and emergency eyewash, and test the eyewash to ensure water is flowing and clear. Safety showers are tested annually by EH&S.
- A tube of 2.5% calcium gluconate gel (Calgonate®) must be immediately available in the lab. EH&S has provided each lab with a tube of Galgonate and can provide more if required.
- All lab personnel, not just those who will be using Hydrofluoric Acid, should be informed of the dangers of this chemical and the emergency procedures necessary in case of an accident.
- We recommend you notify everyone in the lab whenever work with Hydrofluoric Acid is in progress.
- This SOP and an HF acid Safety Data Sheet (SDS) should be made available in the lab.
- Please post the “HF Emergency Procedure Poster” (Appendix 3) next to your lab’s standard emergency procedures sign.

Personal Protective Equipment (PPE)

- **Eye Protection:** Safety goggles are required at all times. Wear a full-face shield whenever possible. EH&S can provide one upon request.
- **Hand Protection:** Two pairs of nitrile gloves must be worn when handling HF. Neoprene, rubber, and butyl rubber gloves provide excellent protection, as well. Change the outer glove often if working for long durations. Please see the PPE chart Appendix 1 for more options.
- **Skin and Body Protection:** Minimize exposed skin as much as possible. Long sleeves and long pants that covers the body to the ankles and closed-toe shoes must be worn. A lab-coat is highly recommended. A rubber apron should be worn over a lab coat to provide extra protection.

Storage Requirements

- HF must be kept in its own plastic secondary containment tub in order to avoid it corroding the glass of neighboring bottles in a spill. EH&S can provide a small tub upon request.
- HF containers are required to be stored in an approved vented corrosive cabinet. Label this cabinet with the “DANGER” sign that is at the end of this document as Appendix 2. Mark on the sign the location of the HF bottle within the cabinet.



II. EMERGENCY PROCEDURES

Please post the “**HF Emergency Procedure Poster**” (Appendix 3) in your lab next to the exit.

Skin Exposure

1. Immediately wash all affected areas with water for 15 minutes.
 - a. Remove all clothing or jewelry that could trap HF.
 - b. While the victim is being rinsed with water, someone should call 911 and inform them that a person has been exposed to hydrofluoric acid.
 - c. Rinsing may be limited to 5 minutes if calcium gluconate gel is available (see step 2). If calcium gluconate gel is not available, continue flushing with water for at least 15 minutes or until medical treatment is given.
 - d. Those non-affected should wear gloves when helping the victim and handling contaminated items.
2. With a gloved hand, apply calcium gluconate gel freely 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.
 - a. Calcium gluconate gel should be reapplied continually every 10-15 minutes and massaged into the skin until medical treatment is given by a physician or EMS.
3. Take note of and provide the following information to the EMS team, and/or physician.
 - a. The concentration of the HF involved
 - b. Date and time of exposure, duration of exposure, and how it occurred.
 - c. The time when calcium gluconate gel was first applied to the contaminated area, and how many times it was applied in total.
 - d. Body parts exposed, and the percent of body surface area affected.
 - e. Summary of first aid measures given.

*Vapor exposures can cause skin and mucous membrane burns, as well as damage to pulmonary tissue. Treat vapor burns the same way as liquid HF burns.

Eye Exposure

1. Immediately flush the eyes with water as absolute priority!
 - a. Flush eyes for at least 15 minutes with cool flowing water. Hold the eyelids open and away from the eye during irrigation to allow thorough flushing of the eyes.
 - b. Take care to not contaminate the other eye if only one is affected.
 - c. If sterile 1% calcium gluconate eyewash solution is available, washing may be limited to 5 minutes, after which the 1% calcium gluconate solution should be used repeatedly to irrigate the eye. DO NOT apply calcium gluconate gel directly to the eye.
2. Contact 911 and inform dispatcher that eye exposure occurred involving HF.
3. Continue to rinse in eyewash, or with 1% calcium gluconate solution, until EMS arrives.



Inhalation Exposure

1. Immediately move the victim to fresh air and get medical attention.
 - a. A pungent odor will be noticeable at 3 ppm
 - b. Victim will feel irritation of eyes, nose and respiratory tract at 30 ppm
 - c. Immediately evacuate area and get to fresh air
2. Contact 911 and inform dispatcher of the exposure involving HF.
3. Keep victim warm, quiet, and comfortable while waiting for EMS to arrive.
4. Always seek medical attention because inhalation of HF may cause swelling in the respiratory tract up to 24 hours after exposure.

Ingestion

1. Do not induce vomiting
2. Flush mouth out thoroughly with water, DO NOT swallow the mouth wash water.
3. If acid has been swallowed, give water or milk to drink along with 6 calcium carbonate tablets (Tums)
4. Contact 911 and inform dispatcher that HF acid was ingested.

Large Accidental Spills

1. Life Safety First
 - Remove all affected clothing and rinse exposed skin/eyes for at least 15 minutes in a nearby emergency shower/eyewash.
2. Evacuate the immediate area.
3. Pull the nearest fire or chemical alarm in the hallway as you vacate the building.
4. Execute a 911 call from a safe location.
5. Remain available for emergency personnel.

Small Accidental Spills

1. If anyone is affected by HF Acid at all, call 911 and follow the previous emergency procedures.
2. If the spill is small and nobody was injured, contact EH&S at 303-492-6025. If after normal campus hours, contact 911.
3. Small spills of HF inside a chemical fume hood can be cleaned up by laboratory staff if they fully understand the hazards, are confident in their ability to clean up the spill safely, and dispose of the waste properly.



APPENDIX 1: PPE CHARTS

* All PPE Listed Below Has Been Rated For 48% HF, Unless Otherwise Noted

GLOVES:

Manufacturer	Product Name/Material(s)	Degradation Rating	Vendor(s)
Stansolv	Nitrile (22 mil)	Excellent	Fisher Scientific
Stanzoil	Stanzoil/Neoprene (22 mil)	Excellent	Fisher Scientific
	Natural Rubber (18 mil)	Excellent	Fisher Scientific
Pylox	PVC (20 mil)	Excellent	Fisher Scientific
Silver Shield	(50% HF) Norfoil (4 mil)	Good	Fisher Scientific
	(50% HF) Viton Fluoroelastomer (9 mil)	Good	Fisher Scientific
	(50% HF) Butyl (17 mil)	Fair	Fisher Scientific
4H Gloves	(10 % - 70% HF) Polyethylene/EVOH	Varies w/Temp. & Conc. of HF	Fisher Scientific
Best	Viton (30 mil)	3 hr. Breakthrough Time	Lab Safety Supply
North	SilverShield (4 mil)	>6 hr. Breakthrough Time	Lab Safety Supply
Ansell Edmont	Barrier	>8 hr. Breakthrough Time	Lab Safety Supply
Lab Safety Supply	Butyl (25 mil)	Excellent, None Detected for Breakthrough	Lab Safety Supply
MAPA Professional	Stanzoil/Neoprene (22 mil)	>8 hr. Breakthrough Time	Lab Safety Supply
Ansell Edmont	Neoprene (17 mil)	1 hr. Breakthrough Time	Lab Safety Supply
Best	Ultriflex/Neoprene	Excellent, None Detected for Breakthrough	Lab Safety Supply
Best	Neoprene (17 mil)	Excellent, None Detected for Breakthrough	Lab Safety Supply
Best	Hustler/PVC	110 min. Breakthrough Time	Lab Safety Supply
Lab Safety Supply	Nitrile (22 mil)	134 min. Breakthrough Time	Lab Safety Supply
Ansell Edmont	Nitrile (22 mil)	2 hr. Breakthrough Time	Lab Safety Supply

APRONS:

Manufacturer	Product Name/Material(s)	Resistance Rating	Vendor(s)
Hycar	Nitrile/PVC Blend	Excellent	Fisher Scientific
Ansell Edmont	Neoprene	Excellent	Fisher Scientific
FisherBrand	Rubber	Good	Fisher Scientific
Ansell	Vinyl (PVC)	Excellent	Fisher Scientific

APPENDIX 2: HF Storage Cabinet Sign



HYDROFLUORIC ACID
CORROSIVE/TOXIC LIQUID

Causes **SEVERE BURNS** which may not be immediately painful or visible.

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

CALL 911 IN AN EMERGENCY
IMMEDIATELY wash exposed skin with water for 15 minutes,
then apply 2.5% Calcium Gluconate "Caigonate" gel on
burn TO **REDUCE SKIN and BONE DAMAGE.**

HF Acid Location Within Cabinet: _____



Visit ehs.colorado.edu for a full guidance document



APPENDIX 3: HF Acid Emergency Procedure Poster

Hydrofluoric Acid Emergency Procedure

**FOR ANY EXPOSURE INVOLVING HYDROFLUORIC (HF) ACID,
FOLLOW THESE STEPS:**

1. CALL 911 and get victim to emergency shower/eyewash

*Notify the operator that the spill involved Hydrofluoric Acid

**2. IMMEDIATELY wash contaminated skin/eyes with water for
15 minutes**

- a. Remove all contaminated clothing when showering
- b. Shower may be limited to 5 minutes if calcium gluconate gel is available (see step 3)
- c. Do not touch eyes with contaminated hands

**3. After rinsing, apply 2.5% Calcium
Gluconate "Calgonate" gel on burn
TO REDUCE SKIN and BONE DAMAGE.**

*You do not need to dry skin before applying the gel



4. Continue applying gel every 5 minutes until EMS arrives

- a. Get victim to hospital as soon as possible.
- b. Wear nitrile gloves when handling contaminated victim and materials.

CU EH&S Phone: 303-492-6025 (Business Hours Only)