



Chemical Safety Summary

Hydrofluoric Acid

This chemical safety summary should be used to complete the process SOP template located on the EH&S website.

Print a copy and insert into your
Laboratory Safety Documents.
Refer to instructions for assistance.

Purpose

The purpose of this document is to establish a specific Standard Operating Procedure (SOP) for handling, storage, and disposal of Hydrofluoric acid (HF). The requirements established in this SOP are in conjunction with the University's Chemical Hygiene Plan

Concentrated hydrofluoric acid is typically 47-51% aqueous solution of hydrogen fluoride gas. In addition to being a corrosive, HF is toxic and is one of the few acids that can react with glass.

Buffered Oxide Etch is typically a 0.5 – 10% solution of hydrofluoric acid mixed with 30-50% Ammonium fluoride in water. Many fluoride salts, such as sodium fluoride and lithium fluoride, are used as fluoride sources, might etch glass in aqueous solutions, and might release HF gas when exposed to water or heat. Please follow the same guidelines for these chemicals as below.

Hydrofluoric acid used in many procedures, primarily is a precursor to almost all fluorine compounds, including pharmaceuticals, Teflon, and elemental fluorine. It is also commonly used to etch glass and as a cleaning agent.

Please post a copy of this SOP with the SDS of the chemical near the work area.

The Department of Environmental Health and Safety reserves the right to cease operation and use upon observing non-compliant activities.

Physical & Chemical Properties/Definition of Chemical Group

CAS#: 7664-39-3

Class: **Toxic, corrosive**

Molecular Formula: HF

Form (physical state): Liquid

Appearance: Colorless clear liquid with acidic odor

Boiling point: 108 °C

pH: <2



NFPA: Health: 4 Flammable: 0 Reactive: 1 Special: Acid

Potential Hazards/Toxicity

Inhalation LC₅₀ (Vapor): 1276ppm/1 hour [Rat]; 342ppm/1H [Mouse]

OSHA Permissible Exposure Limits (PEL): 3 ppm TWA

Hydrofluoric acid is a clear, colorless liquid consisting of HF gas dissolved in water. It is an extremely dangerous material and all forms, including vapors and solutions, can cause severe, slow-healing burns to tissue. At concentrations of less than 50%, the burns may not be felt immediately and at 20% the effects may not be noticed for several hours. At higher concentrations, the burning sensations will become noticeable much more quickly, in a matter of minutes or less. HF burns pose unique dangers distinct from other acids, as it readily penetrates skin, damaging underlying tissue. The fluoride ion can then cause destruction of soft tissues and decalcification of the bones by binding to the calcium in blood, bones, and other tissues. Fluoride ions can reduce serum calcium levels, possibly causing fatal hypocalcemia. HF can cause severe burns to the eyes, which may lead to permanent damage and blindness. HF burns can be very painful and are often lethal. People have died from relatively small exposures to HF. The critical minutes immediately after exposure can greatly affect the chances of a victim's survival. Calcium gluconate is commonly used to treat HF exposure and can be supplied to the laboratory by the Department of Environmental Health and Safety.

HF is Incompatible with glass, ceramics, concrete, fluorine, some oxides, water-reactive materials, sulfuric acid, acetic anhydride, and alkali materials. It may generate flammable hydrogen gas on contact with metals. Toxic gases may be released on contact with carbonates, sulfides, and cyanides. Corrosive to leather, rubber, and many organics are also incompatible. Please avoid the use of the plastic PTFE, as it is slightly permeable to HF.

Some reactions may generate gas, which may produce pressure in the containers. Containers have burst open due to the pressure build-up. Open carefully in a chemical fume hood. The Department of Environmental Health and Safety (EHS) (215-895-5919) can supply laboratories with pressure relief caps upon request, but, at this time, only size **38/439**, which should fit most standard 0.05 to 4L bottles. Please make sure the caps fit the selected containment vessel before its use. Do not use glass containers.

Do not ingest. Do not breathe in gas, fumes, vapor, or spray. Do not add water to this material.

Many fluoride salts, such as Lithium fluoride and Sodium fluoride, are toxic and may react with water and/or heat to form hydrogen fluoride gas. Many of these salts are also incompatible with strong acids and strong oxidizers, and will also etch glass. Fluoride ions can reduce serum calcium levels, possibly causing fatal hypocalcemia. Respiratory irritation may result from inhalation. Contact with the skin and eye may cause serious irritation.

Personal Protective Equipment (PPE)

Respirator Protection

Use a full-face respirator with multi-purpose combination (US) respirator cartridges.

Respirators should be used only under any of the following circumstances:

- As a last line of defense (i.e., after engineering and administrative controls have been exhausted).



- When Permissible Exposure Limit (PEL) has exceeded or when there is a possibility that PEL will be exceeded.
- Regulations require the use of a respirator.
- An employer requires the use of a respirator.
- There is potential for harmful exposure due to an atmospheric contaminant (in the absence of PEL)
- As PPE in the event of a chemical spill clean-up process

Lab personnel intending to use/wear a respirator mask must be trained and fit-tested by EH&S. This is a regulatory requirement.

Hand Protection

Gloves must be worn. Use proper glove removal technique to avoid any skin contact. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands. Neoprene gloves are recommended.

NOTE: Consult with your preferred glove manufacturer to ensure that the gloves you plan on using are compatible with hydrofluoric acid. Wash gloves off with water before removing them.

Refer to glove selection chart from the links below:

<https://www.ansellpro.com/specware/>

OR

<https://www.allsafetyproducts.com/asp-glove-selection-chart-chemical-break-through-times.html>

OR

<https://www.coleparmer.com/safety-glove-chemical-compatibility>

OR

http://www.ansellpro.com/download/Ansell_8thEditionChemicalResistanceGuide.pdf

Eye Protection

ANSI approved, tight-fitting safety glasses/goggles. Face shields are recommended.

Skin and Body Protection

Lab coats must be worn and be appropriately sized for the individual and buttoned to their full length. Laboratory coat sleeves must be of sufficient length to prevent skin exposure while wearing gloves. As outlined in the Chemical Hygiene Plan personnel should also wear full length pants, or equivalent, and close-toed shoes. Full length pants and close-toed shoes must be worn at all times by all individuals that are occupying the laboratory area. The area of skin between the shoe and ankle should not be exposed.

Hygiene Measures

Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product.

Engineering Controls

Hydrofluoric acid must be used in a certified, operational Chemical fume hood. The laboratory must have adequate exhaust. Functioning eyewash station and safety shower must be present in the laboratory.

First Aid Procedures

If inhaled



Move person into fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Consult a physician.

In case of skin contact

- Wash the affected area immediately under running water either under the safety shower or some other source and flush affected area thoroughly with cool running water for at least 5 minutes. Remove all contaminated clothing while flushing.
- Apply a generous amount of Calcium Gluconate Gel to the affected area. Massage the 2.5% calcium gluconate gel into the burn site. Apply every 15 minutes and massage continuously until pain and/or redness disappear or until more definitive medical care is given. It is advisable for the applicator to wear protective gloves.
- Seek immediate medical attention at a hospital

In case of eye contact

- Promptly wash with copious amounts of water for at least 15 minutes while holding the eyelids apart. If a sterile solution of 1 % calcium gluconate is available, washing may be limited to 5 minutes, after which the 1 % calcium gluconate solution should be used repeatedly to irrigate the eye using a syringe.
- If 0.5 % pontocaine hydrochloride is available instead of 1% calcium gluconate, wash the eye at least 15 minutes, after which apply one or two drops of the 0.5 % pontocaine hydrochloride.
- Seek immediate medical attention.

If swallowed

Do not induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

Special Handling and Storage Requirements

Precautions for safe handling:

1. The laboratory's principal investigator must develop specific written experimental procedures for the use of Hydrofluoric acid in the laboratory before any work can be permitted to begin. These are to be included in this Standard Operating Procedure (SOP) The written procedures must be approved by the Department of Environmental Health and Safety.
2. The principal investigator must provide proper training to the laboratory personnel specific to the hazards involved in working with this substance, work area decontamination, and emergency procedures. Records of the training must be kept.
3. No lab personnel may begin to work with hydrofluoric acid (HF) until both they and the principal investigator complete the Hydrofluoric Acid online safety training course.
4. The Material Safety Data Sheet and SOP for this material must be reviewed before its use in the laboratory.
5. Hydrofluoric Acid (HF) may only be handled by experienced and properly trained personnel. Lab personnel may not work with or near HF until both they and the Principal Investigator (PI) have completed the appropriate online training on BioRAFT, <https://drexel.bioraft.com/>. The PI is required to train the lab personnel regarding any specific hazards or procedures with this material.
6. Never work in the laboratory alone.
7. All manipulations with hydrofluoric acid must be done in a chemical fume hood.
8. Avoid incompatible materials, such as glass, metals, ceramics, concrete, moisture, oxidizers, organic materials, sulfuric acid, chlorosulfonic acid, acetic anhydride, carbonates, sulfides, cyanides, fluorine, some oxides, water-reactive materials, mercuric oxide, and alkalis.
9. Use spark-proof tools and explosion-proof equipment.
10. Handle and open with care.



11. Proper personal protection equipment (PPE) must be worn at all times to prevent eye and skin contact. The minimum requirements for PPE are safety glasses with side shields, disposable coveralls, and protective gloves.
12. Be sure to inspect all PPE prior to and after use.
13. Designate an area in the laboratory specific for Hydrofluoric acid manipulations. This area must be inside a chemical fume hood. This area must be labeled with the appropriate hazard communication labels (i.e. HF in use; Corrosive, Toxic in use area).
14. Please use a plastic tray for containment while working with HF, in case of a spill.
15. HF containers must be kept closed when not in active use as the HF may etch the glass of the fume hood sash, making it difficult to see through.
16. Store all solutions of hydrofluoric acid in polystyrene (plastic) containers only. Never use glass.
17. Keep good housekeeping procedures. All disposable materials contaminated with hydrogen fluoride must be disposed as hazardous waste.
18. The laboratory must be equipped with a working eyewash station and safety shower.
19. Always practice good laboratory hygiene. Wash hands, face, neck, and forearms frequently. Wash hands before eating.
20. Do not eat, drink, or smoke in the laboratory.
21. Any amount of hydrofluoric acid spilled must be immediately reported as a Major Spill Event

Conditions for safe storage:

1. Hydrofluoric acid must be stored in a tightly closed secondary containment container in a cool, dry, and well-ventilated area.
2. Hydrofluoric acid containers must be stored in a polyethylene (plastic) secondary containment device.
3. Do not store this material with incompatible materials, such as glass, metals, ceramics, concrete, moisture, oxidizers, organic materials, sulfuric acid, chlorosulfonic acid, acetic anhydride, carbonates, sulfides, cyanides, fluorine, some oxides, water-reactive materials, mercuric oxide, and alkalis.
4. Do not store in direct sunlight or near heat sources.
5. Storage cabinets containing this material must be labeled with the appropriate hazard communication label (i.e. Toxic, Corrosive).
6. Any containers of hydrogen fluoride must be labeled according to University guidelines (i.e. full chemical name; hazard warning words – Toxic, Corrosive).
7. Due to the hazardous nature of the material, only minimal quantities of material should be purchased and stored.
8. All cabinets containing hydrofluoric acid must be clearly marked and have a completed copy of this SOP and the MSDS posted prominently.

Spill and Accident Procedure

Chemical Spill Dial 215-895-2222

Spill – Review chemical spill procedure in Chemical Hygiene Plan. Assess the extent of danger. Help contaminated or injured persons. Evacuate the spill area. Avoid breathing vapors. If possible, confine the spill to a small area using a spill kit or absorbent material. Keep others from entering contaminated area (e.g., use caution tape, barriers, etc.). A hydrofluoric acid spill kit may be required for clean-up.

Major (>500 g/500 ml of a non-acutely hazardous material, or any amount of an acutely hazardous chemical):

1. Notify persons in the immediate area that a release has occurred
2. Avoid breathing vapors, fumes, mists, dusts, or gases
3. If it can safely be done, turn off all ignition sources
4. If injured or contaminated, immediately proceed with decontamination procedures



5. Evacuate and close the door
6. From a safe area, contact the 24-hour help line, 215-895-2222
7. Please provide the following information:
 - a. Name and Call back number
 - b. Location of the release (Campus, building, room number)
 - c. Type of material released
 - d. Amount released
8. If there is a life-threatening injury, contact either 911 or 215-895-2222
9. Remain on or near the phone until you have received instructions from the emergency operator, Public Safety, Security, or the Department of Environmental Health and Safety

Chemical Spill on Body or Clothes – Remove clothing and rinse body thoroughly in emergency shower for at least 15 minutes. Seek medical attention. *Notify supervisor and EH&S at 215-895-5919 immediately.*

Chemical Splash Into Eyes – Immediately rinse eyeball and inner surface of eyelid with water from the emergency eyewash station for 15 minutes by forcibly holding the eye open. Treat with calcium gluconate or pontocaine hydrochloride eye drops as described above. Seek medical attention. *Notify supervisor and EH&S at 215-895-5919 immediately.*

Medical Emergency Dial 911 or 215-895-2222

Life Threatening Emergency, After Hours, Weekends And Holidays – Dial **911**, then Public Safety at 215-895-2222. *Note: All serious injuries must be reported to EH&S at 215-895-5919 within 8 hours.*

Non-Life Threatening Emergency – Notify your supervisor, who will contact Public Safety at 215-895-2222. Seek medical attention, if necessary, at Work Net; Hours: M – F, 8:00 a.m. to 5:00 p.m. Located at Hahnemann Hospital, Bobst Building, room 113, or One Reed Street, Philadelphia, PA. Public Safety can arrange transportation to Worknet facilities for employees. All other times, report to nearest emergency room.

Needle stick/puncture exposure (as applicable to chemical handling procedure) – Wash the affected area with antiseptic soap and warm water for 15 minutes. For mucous membrane exposure, flush the affected area for 15 minutes using an eyewash station. Seek medical attention, if necessary, at Work Net; Hours: M – F, 8:00 a.m. to 5:00 p.m. Located at Hahnemann Hospital, Bobst Building, room 113, or One Reed Street, Philadelphia, PA. Public Safety can arrange transportation to Worknet facilities for employees. All other times, report to nearest emergency room. *Note: All needle stick/puncture exposures must be reported to EH&S at 215-895-5919 within 8 hours.*

Decontamination/Waste Disposal Procedure

Wearing proper PPE, decontaminate equipment and bench tops using soap and water. Absorb spills with inert material. Dispose of the used chemical and contaminated disposables as hazardous waste following the guidelines below.

General hazardous waste disposal guidelines:

Label Waste

- Follow the labeling guidelines in the Chemical Hygiene Plan and the Hazardous Waste Management Plan
- Drexel EHS can supply waste labels upon request



Store Waste

- Store hazardous waste in closed containers, in polyethylene (plastic) secondary containment and in a designated location
- Segregate waste from incompatible materials.
- Waste containers must be polyethylene (plastic) . Do not use glass or metal.
- Waste must be under the control of the person generating & disposing of it

Dispose of Waste

- All waste of hydrofluoric acid must be collected in a sealable compatible container (i.e. brown glass bottle) and disposed as hazardous waste as per University Hazardous Waste Guidelines.
- All residual materials and rinse water from empty containers of this material must be collected and disposed as hazardous waste.
- The rinse water from decontamination of all non-disposable equipment must be collected and disposed as hazardous waste.
- All disposable materials contaminated with this material must be disposed as hazardous waste.
- Submit chemical pick-up requests when have full containers or 5 gallons combined:
<http://www.drexel.edu/facilities/healthSafety/serviceRequests/ChemicalPickupRequest/>
- Drain disposal of any of these materials is strictly forbidden.

Safety Data Sheet (SDS) Location

Online SDS can be accessed at <http://hq.msdonline.com/drex3646/Search/Default.aspx>.