



ENVIRONMENTAL AND OCCUPATIONAL HEALTH AND SAFETY SERVICES

STANDARD OPERATING PROCEDURES

Safe Work Practices for the use of Hydrofluoric Acid in the Laboratory

Effective Date: December 20, 2004

Revision Date:

INSTRUCTIONS: Please have each staff member who will be working on this project review this Standard Operation Procedure (SOP). In Section 6 – Signatures, list each of the personnel assigned to the project, and have them initial in the box provided to indicate that he/she has read and understands this SOP. Send a completed copy to your campus' EOHSS.

Prior to ordering hydrofluoric acid or bringing it into the laboratory, the Principal Investigator is responsible for reviewing this SOP and attached checklist, and ensuring that all required items are immediately available in the laboratory and in good working order.

1. PURPOSE

This policy establishes procedures for safe handling, transport and storage of hydrofluoric acid, also known as HF, HF acid, hydrogen fluoride solution, fluorohydric acid and fluoric acid (GAS # 7664-39-3). HF is extremely corrosive to all body tissues. Exposure to concentrated HF solutions or to vapor can cause severe burns, metabolic imbalances, pulmonary edema, cardiac arrhythmias and death. The fluoride ion readily penetrates skin, allowing it to destroy deep tissue and decalcify bone. Harmful effects may not be immediately apparent. The human inhalation LCLO for hydrofluoric acid is 50 ppm (0.5 hr) and the rat LC₅₀ is 1276 ppm (1 hr). If an alternative to hydrofluoric acid is available, it is highly recommended that substitution with an alternative chemical be evaluated.

2. SCOPE

This SOP addresses the use of HF solutions less than 50% in the laboratory. (Use of concentrated (50-100%) or anhydrous HF is detailed in a separate SOP.) This SOP assumes that all of the UMDNJ minimum safety requirements, as detailed in the latest version of the UMDNJ Laboratory Safety Plan have been implemented.

3. RESPONSIBILITY

- 3.1. Prior to ordering HF or bringing HF into the laboratory, the Principal Investigator is responsible for reviewing the checklist attached to this SOP and ensuring that all required items are immediately available in the laboratory and in good working order.
- 3.2. All staff engaged in the use or handling of HF, or working within a laboratory using HF, is responsible for understanding all hazards associated with its use, first aid procedures, and for using appropriate personal protective equipment (PPE).
- 3.3. The Principal Investigator is responsible for ensuring that his/her staff has been trained in the use, storage, handling and first aid procedures for HF.

HF use is restricted to the specific staff members who have had prior training in proper use, handling and storage, and first aid procedures. Each staff member's name must appear on the listing in Section 6 of this document, and each staff member must initial by his/her name.

4. PROCEDURES

4.1. Training

- 4.1.1. Prior to conducting any work with HF, the Principal Investigator must provide training to all laboratory personnel in his/her laboratory specific to the hazards involved in working with this substance, work area decontamination, and first aid and emergency procedures.

At a minimum, the training program shall consist of the following topics:

- A description of the hazards associated with HF.
- A description of the initial first aid measures.
- A description of the delayed onset of symptoms associated with HF.
- A description of the personal protective equipment available, and a description of its use and limitations.
- The location of Material Safety Data Sheets and other safety, health & environmental information.

- The location of first aid equipment on site.
- The correct response to involvement in an HF incident.
- Emergency procedures, including how to contact UMDNJ Public Safety.
- How/where to get further medical attention.
- The importance of cleaning up and decontaminating surfaces and equipment when work is complete.
- Decontamination procedures including the most effective way to decontaminate tools, equipment, and personal protective equipment.
- The importance of labeling samples or contaminated equipment.
- The importance of reporting all incidents or near misses so that recurrences are prevented.
- A description of the initial first aid procedures.
- A practical demonstration showing how to put the personal protective equipment on.
- A practical demonstration of the decontamination procedures.
- A practical demonstration of the use of calcium gluconate gel.
- Validation of the understanding of each part of the procedure.
- A check that each attendee has a tube of gel available at home (if applicable)
- The importance of reporting any exposure, either while at work or home.

4.1.2. The Principal Investigator must provide his/her laboratory personnel with a copy of this SOP and a copy of the HF MSDS provided by the manufacturer.

4.1.3. The Principal Investigator must ensure that his/her laboratory personnel have attended initial laboratory safety training or refresher training within the last two years.

NOTE: EOHSS is available to assist in the education and/or training of personnel concerning safe work practices.

4.2. Antidote

4.2.1. The Principal Investigator must ensure that an adequate supply of 2.5% calcium gluconate gel (within expiration date) is available and all staff is aware of its location. It is suggested that anyone using HF, or who could possibly come in to accidental contact with it (e.g. people working in the same laboratory or regular visitors), keep a fresh tube of gel at home at all times.

4.3. Signage

4.3.1. When HF is in use, warning signs must be posted on the chemical hood and laboratory door until the HF has been returned to storage.
4.3.2. Signs will include the information shown in the following sample:

Sample Chemical Hood Sign

Designated Area
Caution
Hydrofluoric Acid In Use
Extremely Corrosive
Toxic

Sample Door Sign for When HF Is In Use

Caution
Hydrofluoric Acid in Use
Extremely Corrosive and Toxic
Authorized Personnel Only
Material Safety Data Sheets are available in Room _____
For more information, please contact: _____
In the event of a chemical spill, contact Public Safety at _____
and ask for EOHSS to respond.

4.4. Storage

- 4.4.1. HF must be stored in a location that is secure to unauthorized access. Examples are a locked cabinet, or within a laboratory that is locked when authorized personnel are not present. A cabinet containing HF must be labeled with a caution sign noting the presence of HF and its hazards (extremely corrosive).
- 4.4.2. Store HF in appropriate, sealed containers within unbreakable, compatible secondary containment (i.e., a polyethylene tub or tray). HF reacts with glass, ceramics, silica-containing compounds and metals; store HF separate from these materials. Label all containers, including secondary containment, with the chemical name and hazard warning.

4.5. Handling and Solution Preparation

- 4.5.1. HF should be purchased in the smallest practical amount, and in no instance should bottle size exceed 500mL.
- 4.5.2. It should not be heated. When heated, highly corrosive HF vapor is emitted.
- 4.5.3. Prior to beginning work with HF, review the checklist attached to this SOP. Ensure that all items are immediately available and in good working order.
- 4.5.4. A minimum of two individuals trained per Section 4.1 must be present whenever HF is used. Each individual must be familiar with the applicable first aid procedures, maintain visual contact with the other, and be ready to assist in the event of an accident.
- 4.5.5. HF must be opened and handled only in a chemical hood that has been certified within the last 12 months. Bench top use of HF is prohibited. Just before use, the operation of the chemical hood must be verified by the use of an installed chemical hood monitoring device, a smoke test using a smoke generating tube, or a mechanical or electronic device that indicates air flow. During use, the sash must be lowered to operating height or below. Containers of HF must not be left open since vapors can etch the glass of the hood sash.
- 4.5.6. Do not use glass lab ware for work with HF. Use lab ware with a wide base (such as Erlenmeyer flask) to increase stability. Rinse lab ware thoroughly after use and then dip them into a saturated solution of sodium bicarbonate.

- 4.5.7. Work with HF will take place over polyethylene secondary containers or spill trays.
- 4.5.8. Wash hands thoroughly immediately after working with any concentration of HF.
- 4.6. The following minimum Personal Protective Equipment must be worn during operations involving HF:
 - 4.6.1. Splash-proof chemical goggles with plastic face shield. Contact lenses should not be worn.
 - 4.6.2. Long, gauntlet-type Best Ultraflex Neoprene 32 gloves over Best N-Dex 8005 nitrile gloves. Double-gloving is required when working with HF. Inspect gloves frequently. Change gloves frequently and immediately whenever contaminated, punctured or torn. If gloves are to be reused, rinse thoroughly after use and then dip them into a saturated solution of sodium bicarbonate.
 - 4.6.3. Wash hands immediately after removing gloves.
 - 4.6.4. A standard or disposable laboratory coat or disposable coveralls. A standard laboratory coat may be reused before laundering if it has not been contaminated with HF.
 - 4.6.5. A chemical-resistant apron with attached sleeves should be worn over the laboratory coat.
 - 4.6.6. Closed-toed, leather shoes (not fabric or mesh). Alternatively, boots made of polyvinyl alcohol (PVA) may be worn.

5. EMERGENCIES

- 5.1. Spill of HF Outside of the Chemical Hood:
 - 5.1.1. Phone the Public Safety Emergency number (Newark: 2-4490; Piscataway/New Brunswick: 5-4000; Camden and Stratford: 7-7777) immediately. Ask them to have EOHSS respond. DO NOT attempt to clean up a spill.
 - 5.1.2. Isolate the area to prevent the spread of contamination (e.g., close doors to affected area and post a warning sign).
 - 5.1.3. Alert personnel in the immediate area to evacuate.
 - 5.1.4. Attend to any injured personnel.
 - 5.1.5. Direct the EOHSS response team to the location of the spill and HF spill cleanup materials.

NOTE: Personnel must not attempt to clean up a spill of HF that occurs outside of a chemical hood.

5.2. Spill of HF Inside the Chemical Hood:

- 5.2.1. Using the PPE outlined in Section 4.6, absorb/neutralize the spill with powdered calcium carbonate or calcium hydroxide, or commercially available HF neutralizer.
- 5.2.2. Scoop the material into a polyethylene container and dispose of as hazardous waste. Clean the area with water.
- 5.2.3. Notify EOHSS of the spill and spill cleanup procedure.
- 5.2.4. If the spill is large or you are unsure of your ability to thoroughly address it, call the Public Safety Emergency number (above, Section 5.1.1) and ask EOHSS to respond.

5.3. Accidental Exposure to HF

- 5.3.1. HF exposure requires immediate and specialized first aid and medical treatment. Prompt first aid is essential, even if the victim does not exhibit any signs or symptoms, or feel any pain. First aid procedures must be initiated if any contact is suspected because burns from weak HF solutions may not be noticed immediately. **First aid must be followed by treatment by a physician as soon as possible.**
- 5.3.2. Arrangements with local medical resources should be made ahead of time to ensure that medical personnel are familiar with the toxicity and treatment of HF exposure. Medical treatment for HF exposure is specialized and differs from treatment of other inorganic acid exposures.
- 5.3.3. If HF vapor has been inhaled, move the victim to fresh air immediately. If breathing has stopped, start artificial respiration. Oxygen should be administered as soon as possible.
- 5.3.4. If HF has been spilled on skin or clothing, immediately rinse the affected area with water using a safety shower for a minimum of 15 minutes until medical treatment is provided (or limit rinsing to 5 minutes if 2.5% calcium gluconate gel is available, see 5.3.5). During washing, remove all contaminated clothing while wearing protective gloves. Remove goggles last. A disposable laboratory coat or jumpsuit should be available for the exposed individual to wear after using a safety shower. Colleagues must be careful not to become contaminated while assisting the victim.

- 5.3.5. After rinsing for 5 minutes, victim should self-apply 2.5% calcium gluconate gel and massage into the contact site and adjacent area, while wearing protective gloves. (If victim is unable to self-apply the gel, a trained colleague wearing protective gloves should apply the gel.) Apply gel frequently (every 15 minutes) and continuously massage into skin. Continue until at least 15 minutes after pain is relieved or until medical treatment is provided. Continue applying and massaging calcium gluconate gel during transport to a medical facility. [Note: Iced 0.13% benzalkonium chloride (Zephiran) solution is also effective for skin exposure to HF. If gel is not available, a calcium solution (20 g calcium in 2 liters of water) can also be used for soaking the contact site.]
- 5.3.6. If HF liquid or vapor has contacted the eyes, immediately flush for at least 15-20 minutes. Hold upper and lower eyelids open and away from the eye during irrigation. Remove contact lenses if possible. Continue flushing with a personal eyewash or apply ice water compresses during transport to medical facility or eye specialist. Avoid rubbing of the eyes.
- 5.3.7. If HF is ingested drink large amounts of water as quickly as possible to dilute the acid (if conscious). Do not induce vomiting, use emetics or baking soda. Drink several glasses of milk or several ounces of Mylanta, Maalox or milk of magnesia.
- 5.3.8. Notify the victim's supervisor, if immediately available. The supervisor, a co-worker, or the victim must contact the campus Employee /Occupational Health Program to determine what additional steps should be taken. If so advised, call Public Safety to have an ambulance respond to the scene or report directly to Employee /Occupational Health office.
- 5.3.9. Newark: Employee Health (973) 972-2900
Piscataway/New Brunswick: EOHSI Employee Health Services (732) 445-0123
Stratford: Kennedy Hospital (856) 346-7816
Camden: Cooper Occupational Health Services (856) 342-2990
- 5.3.10. If the incident occurs off-hours, or an ambulance is needed because of injury, contact Public Safety to advise them of the medical emergency.

Newark: 2-4490
Piscataway/New Brunswick: 5-4000
Camden and Stratford: 7-7777

8. SIGNATURES

Principal Investigators: Use the following table to list all personnel who will handle HF. The staff member's initials indicate that the staff member has read this SOP and understands the hazards and safe work practices as detailed in this therein.

Name	Job Title	Lab Staff Initials*

Principal /Responsible Investigator (Print): _____

Principal /Responsible Investigator (Signature): _____

Date: _____

6. IF ADDITIONAL ASSISTANCE IS REQUIRED

- 7.1. The current version of this form and additional information is posted at:
<http://www2.umdnj.edu/eohssweb/forms.htm>
- 7.2. EOHSS Campus Contact Information:

Newark

65 Bergen Street
Bergen Building Room 443
Newark, NJ 07107
(973) 972-4812
Fax (973) 972-3694

Piscataway

675 Hoes Lane - Trailer #1
Piscataway, NJ 08854
(732) 235-4058
Fax (732) 235-5270

New Brunswick

Liberty Plaza Building Suite 2119
335 George Street
New Brunswick, NJ 08903
(732) 235-8376
Fax (732) 235-8370

Camden/Stratford

University Educational Center
40 E. Laurel Road Suite 1031
Stratford, NJ 08084
(856) 566-6189
Fax (856) 566-6352

8. REFERENCES

- 8.1. Mallinckrodt Baker Inc. MSDS #H3994, Hydrofluoric Acid 48-52%, 7/7/2004.
- 8.2. Recommended Medical Treatment for Hydrofluoric Acid Exposure, Honeywell, Morristown, NJ. <http://www.hfacid.com> (click on "Literature").
- 8.3. *Prudent Practices in the Laboratory: Handling and Disposal of Chemicals.* 1995, National Academy of Sciences, National Academy Press, Washington, D.C. Laboratory Chemical Safety Summary (LCSS), Hydrogen Fluoride and Hydrofluoric Acid.
<http://www.hhmi.org/research/labsafe/lcss/lcss.html>

HYDROFLUORIC ACID CHECKLIST

Note: Prior to ordering hydrofluoric acid or bringing it into the laboratory, the Principal Investigator 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 any work involving HF, ensure that the following items are in place:

- Arrangements with local medical resources have been made to ensure that medical personnel are familiar with the toxicity and treatment of HF exposure.
- A colleague with training as specified in Section 4.1 of the HF SOP is available and aware that work with HF will be conducted.
- First aid, spill procedures and HF MSDS are immediately available in HF work area.
- Proper functioning of chemical hood has been verified (by the use of an installed chemical hood monitoring device, a smoke test using a smoke generating tube, or a mechanical or electronic device that indicates air flow).
- Eyewash and emergency shower are functioning and access is unobstructed.
- An adequate supply of calcium gluconate gel is available and within its expiration date. Neoprene or nitrile gloves are stored with the gel.
- A personal (portable) eyewash is available for use during transport to a medical facility.
- Personal protective equipment items specified in Section 4.6 of the HF SOP are available.
- Maalox, Mylanta and/or milk of magnesia are available.
- Powdered calcium carbonate or calcium hydroxide, plastic scoop and polyethylene container (or commercial HF spill kit) are available in case of spill.