Instructions:

Please complete the Hydrofluoric Acid Safety Training and fill out this SOP prior to use of Hydrofluoric acid (HF) in the laboratory. All HF users should complete this document and upload it to the user’s Gator TRACS. This document discusses the health and safety hazards of HF and how to protect you from them along with the emergency procedures for handling HF exposures. If you need assistance in completing the HF Training, or this SOP, please contact labsafety@EH&S.ufl.edu Subject: HF Safety

|  |  |
| --- | --- |
| Principle Investigator Name  |  |
| Procedure Name |  |
| Hydrofluoric Acid Percentage |  |
| Procedure Author |  |
| Name of Responsible Person |  |
| Phone Number |  |
| E-mail Address |  |
| Location to be Performed |  |
| Physical Address (not just building number) |  |
| Creation Date |  | Review Date(s) |  | Revision Date(s) |  |

**Emergency contact numbers:**

|  |  |
| --- | --- |
| **Lab Manager** | **xxx-xxx-xxxx** |
| **Building Manager** | **xxx-xxx-xxxx** |
| **Principal Investigator** | **xxx-xxx-xxxx** |
| **Poison Control Center** | **800-222-1222** |
| **Emergency-** | **911** |
| **EH&S Department** | **(352)-392-1591** |
| **Building’s unique street address, if 911 is called** |  |

Introduction:

Hydrofluoric Acid has several chemical, physical, and toxicological properties, which make handling this material especially hazardous. Anhydrous Hydrofluoric Acid is a clear, colorless, fuming, corrosive liquid. Hydrofluoric Acid is also available in the gaseous state. All forms, including the solution, or the vapor, can cause severe burns to tissue and cause serious toxic systemic effects.

***Note: If you are exposed to hydrofluoric acid seek medical attention immediately, even if you do not feel pain.***

Purchasing:

All purchases of this material must have approval from the Principal Investigator (PI) or authorized personnel before ordering. The user is responsible to ensure that a current Safety Data Sheet (SDS) is obtained unless a current one is already available within the laboratory/use location. Quantities will be limited to \_\_\_\_\_, and/or the smallest amount necessary to complete the experiment or be consumed within one year. Please note that UF EHS will review and approve/disapprove all proposed purchases of HF. Once received into the lab, this must be added to the lab’s chemical inventory.

authorized personnel:

Please select the general categories of personnel who could obtain approval to use this material. Undergraduate students are prohibited to use or handle Hydrofluoric Acid:

[ ]  Principal Investigator [ ]  Technical Staff

[ ]  Postdoctoral Employees [ ] Graduate Students

[ ]  Others (Describe): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

***Note: The principal Investigator must be aware of all purchases of this material. The Principal Investigator must assure that there is not an exceedance of the quantity limits.***

All personnel must be authorized by the Principal Investigator.

|  |  |  |
| --- | --- | --- |
|  | [ ]  Purchase | [ ]  Use the Material |
|  | [ ]  Purchase | [ ]  Use the Material |
|  | [ ]  Purchase | [ ]  Use the Material |
|  | [ ]  Purchase | [ ]  Use the Material |
|  | [ ]  Purchase | [ ]  Use the Material |

The Principal Investigator will update this section when any personnel changes occur. If changes occur, document the changes (include the record of training of additional personnel) in the laboratory’s files and submit an addendum to the University of Florida Chemical Hygiene Officer with all the training documentation.

Training Requirements and Preparation

All users must demonstrate competency and familiarity regarding safe handling and use of this material prior to purchase. The Principal Investigator is responsible for maintaining the training records for each user of this material. Training should include the following:

1. All users and laboratory personnel working with or in laboratories where Hydrofluoric Acid is stored and/or used must attend the Environmental Health and Safety’s Hydrofluoric Acid Safety Training every two years. A web-based refresher training is also offered.
2. EHS809 Hazardous Waste Management training
3. EHS861 Chemical Hygiene Plan training
4. EHS809 Hydrofluoric Acid training
5. Review of the current Hydrofluoric Acid SDS.
6. Review steps which need to be followed in the event of an exposure or spill.
7. Special training provided by the department/supervisor.
8. Review of the departmental safety manual, if applicable.
9. Safety meetings and seminars.
10. One-on-one hands-on training with the Principal Investigator or other knowledgeable laboratory personnel.
11. Obtain an HF First Aid Kit.
12. Other lab/procedure specific training: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Hazard Identification:

*Identify potential safety hazards*.

|  |  |
| --- | --- |
| Corrosive to metals: Category 1Acute oral toxicity: Category 2Acute dermal toxicity: Category 1Acute Inhalation Toxicity-Vapors: Category 2Skin Corrosion/Irritation: Category 1 ASerious Eye Damage/Eye Irritation: Category 1Specific target organ toxicity (single exposure): Category 3Target Organs – Respiratory system | A picture containing text, clipart  Description automatically generated |
| [ ] Explosive[ ] Pyrophoric[ ] Flammable (liquid, solid, gas or aerosol)[ ] Self-Reactive[ ] Peroxide Forming[ ] Oxidizing (liquid, solid or gas)[ ] Organic Peroxides [ ] Water-Reactive[ ] Compressed Gases [ ] Cryogen[x] **Corrosion to Metals**[ ] Radionuclides [ ] Other: Click or tap here to enter text. | [ ] Carcinogen[ ] Sensitizer (respiratory and/or skin)[ ] Irritant (skin and/or eye)[x] **Corrosive (skin and/or eye damage**)[x] **Acute Toxicity (oral, dermal and/or inhalation)**[ ] Germ Cell Mutagen[ ] Reproductive Toxicity[x] **Target Organ Systemic Toxicity: Single Exposure**[ ] Target Organ Systemic Toxicity: Repeated Exposure[ ] Other: Click or tap here to enter text. |
| **Notes** (include Permissible Exposure Limits): The primary hazard of HF is as a Health Hazard; it can readily absorb through the skin and signs or symptoms are dependent on the concentration. HF can destroy and decalcify soft tissue and bone, concentrations above 50% will burn immediately. One of HF’s insidious properties is that concentrations lower than 20% may not produce immediate pain or burning. It is this delayed awareness of exposure that poses the most serious risk of HF. Exposure to less concentrated solutions may have equally serious effects, but the appearance of symptoms can be delayed for up to 24 hours. Exposure of the eyes of HF may result in blindness or permanent eye damage. Inhalation of HF vapor can seriously damage the lungs and may cause fatal pulmonary edema (lungs flooding with fluid). Again, the increased risk being that signs and symptoms may not be apparent for hours after the exposure. Chronic (long term exposure) of low concentrations to HF may cause fluorosis; syndrome characterized by weight loss, bone embrittlement, anemia, and general ill health. ***Note: If you are exposed to hydrofluoric acid seek medical attention immediately, even if you do not feel pain.*** |

Step-by-Step Procedure

*Provide a sequential description of work, including details such as chemical storage locations, identify the designated work area(s), chemical concentrations and amount used (mass, volume) and when special safety equipment is to be utilized. Include temperature, pressure, and other experimental conditions. Pictures and schematics are recommended for complex setups.* ***Highlight the steps with the highest hazards.***

* **Work with HF should only be done during business hours and when there is someone else available to assist with procedures and emergencies.**
* Implement the Buddy System when using HF in the lab.
* Do not eat or drink where HF is handled, since it can be swallowed. Be aware of and avoid cross contamination in the lab.
* Always wash hands thoroughly after handling HF.
* All staff working with HF must be trained on this SOP prior to starting work. All training must be documented and maintained by the PI or their designee.
* The designated work area for HF is XXX. Signage must be posted indicating that HF is used in the designated area.

Preparation

* For use, transport HF from the storage area to the fume hood in a labeled, sealed non-breakable secondary container. Always remove HF from its secondary container in a fume hood in order to safely vent any accumulated vapor.
* All preparation of HF will be performed over plastic-backed absorbent pads in a fume hood. Pads will be disposed of as hazardous waste immediately upon contamination and after completion of tasks.
* Ensure compatibility of HF before mixing with other chemicals or disposing in a hazardous waste container.
* Review the SDS for incompatibilities. HF reacts with some metals and liberates flammable hydrogen gas.
* Review or create a Standard Operating Procedure (SOP) for the process in which HF is used.
* Check your spill kit contents and location. Ensure you have ready access to a good supply of running water and know the location of the safety shower and eyewash.
* Check expiration date of the calcium gluconate.
* Prior to first time HF use, conduct a dry run before the actual process.
* Read the Safety Data Sheet (SDS) for HF and keep it readily available.
* All lab workers who will be using HF must be made aware of its properties and trained well in proper procedures for use and disposal.
* Never use HF when working alone or after hours. Always ensure that knowledgeable lab personnel are close/present in the lab.
* Emergency procedures must be written, approved by PI and trained to staff.
* All lab personnel should be informed of the dangers of this chemical and emergency procedures necessary in case of an accident.
* A sign should be posted to alert people that work with HF is in progress.

[Describe how HF will be prepared.]

Use and Storage

[Describe how HF will be used.]

• HF will be stored in designated areas [specify location(s)]. Store and/or label HF so it will only be handled by those trained to use it. If gloves become contaminated with HF, remove them immediately, thoroughly wash your hands and dispose of the gloves as a hazardous waste. If HF has come in contact with the skin or you believe you have been exposed, apply calcium gluconate gel as instructed in the HF Spill and Exposure Procedures Pamphlet in the first aid kit.

• Clean the fume hood upon completion of tasks with a 10% calcium carbonate solution, followed by soap and water.

• Clean all contaminated surfaces with a 10% calcium carbonate solution, followed by soap and water.

• Place all contaminated disposable items in appropriate laboratory waste for disposal.

• Non-disposable/re-usable utensils, containers, and other surfaces contaminated with HF must be decontaminated using a 10% calcium carbonate solution, followed by soap and water, at the end of the laboratory work session. Complete this inside the fume hood before removing any of the items.

• When work is completed, dispose of gloves and wash hands with soap and water.

* HF should always be handled inside of a properly operating chemical fume hood that is identified with a sign stating “Danger, Hydrofluoric Acid Used in this Area.”
* Work at least 6” from the edge of the fume hood.
* When working with HF only one individual should be using the fume hood.
* If possible, substitute a less hazardous substance for HF. Always use the most dilute solution of HF possible.
* Label every container, including waste, with the common chemical name and the percentage.
* Order and store/use the smallest quantity possible.
* Cap all bottles when not in use, even during the actual process.
* Implement the buddy system and never work alone.
* When using HF, you must wear protective clothing:
* Proper lab attire- Laboratory coat. Consider an acid resistant apron if you do not have a horizontal hood sash or if the process requires large quantities or concentrated solutions.
* Long pants and close-toed shoes. No shorts, sandals (open-toed or perforated shoes), short skirts.
* Always use ANSI approved splash goggles or safety glass with face shield.
* Consider full face shields for high concentrations (>5%) of HF.
* Gloves:
* Recommend 22 mil neoprene or nitrile gloves. (Remember: Breakthrough time! This is the time it takes for a substance to pass through the protective material of the glove). Consider arm covers or the length of the glove if there is a possibility of splash.

Gloves:

* **Brief use of dilute solutions:** nitrile exam gloves can be employed. Consider double gloving. Nitrile rubber gloves are not recommended for handling ≥30% HF.
* **Use of concentrated solutions**: use gloves that cover the hands, wrists, and forearms.
* **Hydrofluoric acid (30-70%) for 4 hours or more**: Butyl rubber, neoprene rubber, Viton®/butyl rubber,Barrier® (PE/PA/PE), Silver Shield/4H® (PE/EVAL/PE), Trellchem® HPS, Trellchem® VPS, Tychem® SL (Saranex®), Tychem® CPF3, Tychem® BR/LV,Tychem® Responder®, Tychem® TK.
* **Hydrofluoric acid (>70%) for 4 hours or more:** Neoprene rubber, Barrier® (PE/PA/PE), Trellchem® HPS, Tychem® TK

Glass containers should not be used to store or transfer HF, as HF reacts with glass, metal, ceramic, concrete, or other silicon containing materials. The materials must never be used to store or transfer it. Ensure all HF containers are clearly labeled. Use chemically compatible secondary containers to store HF in the cabinet or to transport HF vials or bottles from one lab to another. Keep all HF containers closed and secured properly. Use proper PPEs, moving carts and precautions while transporting HF.

Materials will be stored according to compatibility and label recommendations in designated area.

1. Please list compounds that this chemical is incompatible with:
	* Material is corrosive to most metals and glass
	* Segregate from alkalis, oxidizing agents and chemicals readily decomposed by acids, i.e. Cyanides, sulfides, carbonates and metal oxides.
	* Segregate for organic materials including solvents, flammable liquids and organic acids (acetic acid, formic acid, etc.)
	1. Other: \_\_\_\_\_\_
2. Please list special storage requirements (I.E. Refrigerated, inert atmosphere, desiccated, etc.)

Transport and receiving requirements

*Describe transport and receiving requirements. Include secondary containment, transport devices (carts, carriers, etc.), segregation requirements, any special temperature or atmospheric requirements, and container compatibility requirements.*

If an HF containing solution must be transported from one lab area to another:

* Place the object in a clean, chemically compatible container and close the lid.
* Remove your gloves before transporting the container to avoid the possibility of chemical contamination on your gloves spreading to door handles and other objects.
* Or consider putting on a single clean glove with which to carry the container, leaving an ungloved hand to open doors and handle other objects.
* Or have a lab mate open doors and handle objects for you.

Waste disposal

Type of waste generated by this procedure/process (*check all that apply*):

[ ] Solid [x] Liquid ☐Mixed (Bio and Radiation)

Waste hazard determination (*check all that apply*):

|  |  |
| --- | --- |
| *Type of Waste* | *Hazard Determination* |
| Solid  | [ ] Flammable [ ] Oxidizer [x] Corrossive [ ] Reactive [x] Toxic |
| Liquid | [ ] Flammable [ ] Oxidizer [x] Corrossive [ ] Reactive [x] Toxic |
| Gas | [ ] Flammable [ ] Oxidizer [x] Corrossive [ ] Reactive [x] Toxic |

* Satellite Accumulation Area is located XX.
* All HF waste (liquid and solid) must be handled as hazardous waste.
* Store waste in compatible plastic containers (do not use glass or metal).
* Label all containers appropriately.
* When ready, submit a chemical waste pickup request.
* If the lab has a gas cylinder to dispose of, contact Hazardous Waste Management: 352-392-8400

Disposal procedure and location of Satellite Accumulation Area:

All concentrations of HF must be collected according to the University of Florida Environmental Health & Safety Hazardous Waste. This includes gloves, paper towels, absorbing pads, and other spill cleanup materials. Labware should be cleaned and decontaminated, or it should be collected as hazardous waste. Hazardous waste containing HF should be stored in chemically compatible containers, e.g. Polyethylene or Teflon (NO glass, metal or ceramic). Hazardous wastes containing HF should be segregated from incompatible wastes including wastes containing ammonia and alkaline materials. All waste containers must have a hazardous waste label during use and a hazardous waste tag for collection. HF and the concentration should be clearly indicated on the label and tag. Contact EH&S if you need additional information or have any questions regarding the disposal of HF waste.

Emergency procedures

*Indicate how spills, personnel exposure/injury, and other accidents should be handled and by whom.*

**Life-threatening emergencies** (fire, explosion, large-scale spill or release)

**Activate the building’s fire alarm system if the spill represents a threat to human life or may cause a fire or explosion.**

• Notify all persons in the workspace that a spill has occurred and evacuate all personnel from the workspace to a safe location.

• Isolate the workspace to prevent inadvertent entry: lock any access doors, place signs on doors reading “DO NOT ENTER-CHEMICAL SPILL”

• Call EH&S at 352-392-8400. If the emergency occurs outside of normal work hours, contact the University Police Department at 352-392-1111.

**HF Exposures:**

**Eyewash/Emergency Shower:** Since HF is corrosive and rapidly damages tissue, EH&S recommends a combination eyewash/shower to be nearby and accessible. The eyewash must be tested weekly to ensure it will operate when needed. The combination eyewash/ shower should be used to rinse the exposed area for at least 15 minutes, and then treatment of skin with calcium gluconate gel should be initiated.

**Skin Exposure:** EH&S provides a First Aid Kit to all users for exposure to HF. Calcium gluconate gel is a topical antidote for HF skin exposure. It works by combining with HF to form insoluble calcium fluoride, thus preventing the extraction of calcium from tissues and bones. Always keep calcium gluconate gel nearby whenever you’re working with HF. Please note the expiration date of the calcium gluconate. Expired calcium gluconate should be replaced by contacting EH&S.

**HF Spills**

Please follow the EH&S Hydrofluoric Acid Spill and Splash Guidelines and Procedures, available in your HF First-aid Kit. Contact EH&S to report the accident/incident involving HF, for any HF spill cleanup or if you have any question or require more information regarding HF spill and exposure response.

**Emergency contact numbers:**

|  |  |
| --- | --- |
| **Lab Manager** | **xxx-xxx-xxxx** |
| **Building Manager** | **xxx-xxx-xxxx** |
| **Principal Investigator** | **xxx-xxx-xxxx** |
| **Poison Control Center** | **800-222-1222** |
| **Emergency-** | **911** |
| **EH&S Department** | **(352)-392-1591** |
| **Building’s unique street address, if 911 is called** |  |

Building’s unique street address, if 911 is called: [*Address Here*]