

Western Carolina University

Standard Operating Procedure for the use of Hydrofluoric acid

This is an SOP template for a specific chemical or class of chemicals and is not complete until: 1) lab specific information is entered in the fields below, 2) lab specific procedures are detailed in Section 6, and 3) the SOP is read and signed by the relevant lab personnel.

Section 1. Contact Information

Procedure Title:

Procedure Author:

Date of SOP Creation/Revision:

Name of Responsible Person:

Location of Procedure:

Location of Safety Data Sheet (SDS):

Approval Signatures:

(If required, refer to Sec. 10)

Section 2. This SOP is for a:

- Specific laboratory procedure or experiment** (Ex. Synthesis of chemiluminescent esters, folate functionalization of polymeric micelles, etc.)
- Generic use of specific chemical or class of chemicals with similar hazards** (Ex. carcinogens, flammables, etc.)

Section 3. Process or Experiment Description

Provide a brief description of your process or experiment, including a purpose. A more detailed description will be covered in Section 6.

List all references you are using for the safe and effective design of your process or experiment, including peer reviewed articles and safety literature:

Frequency of Procedure: Once weekly monthly other (explain):

Duration of Procedure:

(minutes/hours/days)

Section 4. Safety Literature Review and Hazard Summary

Hazard Summary:

Hydrofluoric acid (HF) is a highly corrosive liquid and is a contact poison. It should be handled with extreme care (i.e., beyond what is generally required to handle other mineral acids). Owing to its low dissociation constant, HF as a neutral lipid-soluble molecule penetrates tissue more rapidly than typical mineral acids. Because of the ability of hydrofluoric acid to penetrate tissue, poisoning can occur readily through exposure of skin or eyes, or when inhaled or swallowed. Symptoms of exposure to hydrofluoric acid may not be immediately evident. HF interferes with nerve function, meaning that burns may not initially be painful. Accidental exposures can go unnoticed, delaying treatment and increasing the extent and seriousness of the injury.

HF is a calcium seeker. A person cannot sense when it comes in contact with the skin. But, it dissolves the calcium in the bone. HF burns are not evident until a day later. If not stored, handled and disposed of properly, HF can pose a serious threat to the health and safety of laboratory personnel, emergency responders and waste handlers. Hence, it is important to thoroughly understand the properties of HF and follow all safety protocols to properly store and handle HF.

Personal Protective Equipment (PPE):

Respiratory Protection. Where risk assessment shows air-purifying respirators are appropriate, use a full-face respirator with multi-purpose combination (US) respirator cartridges as a backup to engineering controls. 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. Contact the Safety Office.

Hand Protection.

It is recommended that HF users double glove. Use gloves that cover the hands, wrists, and forearms. It is recommended hydrofluoric acid (HF) users wear a primary glove that has good to excellent degradation and permeation properties established by the manufacturer for HF use (Example - Nitrile, neoprene). It is recommended medium to heavy weight gloves be worn over the primary gloves when utilizing large qualities of HF regardless of HF concentration (Example - barrier gloves (laminated gloves), nitrile gloves, neoprene gloves, butyl rubber gloves, and butyl/viton gloves). Glove use will be dependent on HF concentration, quantity of HF used, and activities being conducted. Gloves that come in contact with HF shall be cleaned and inspected for degradation or shall be replaced with new gloves. If utilizing other chemicals with HF, the user should contact the specific glove manufacturer to determine if additional chemical(s) may change the primary glove degradation and permeation rating.

NOTE: Gloves must be inspected prior to each use. Use proper glove removal technique (without touching outer surface of the gloves) to avoid skin contact with HF on the contaminated gloves. *Dispose of inner nitrile gloves* after use as hazardous waste. **Inner Butyl Viton gloves can be reused carefully* (i.e., without touching the outer surface of the gloves). Wash hands thoroughly with warm water and soap.

Consult with your preferred glove manufacturer to ensure that the gloves you plan on using are compatible with the chemical you are using. A glove selection chart from Ansell is provided as a reference below:

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

Eye Protection. Wear NIOSH approved safety glasses or goggles and a face shield.

Skin & Body Protection. Wear flame resistant or retardant lab coats – lab coats must be buttoned to their full length and coat sleeves must be of a sufficient length to prevent skin exposure while wearing gloves. Wear full-length pants and close-toed shoes. The area of skin between the shoe and ankle should not be exposed.

Hygiene Measures. Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin, eyes, and clothing. Wash hands before breaks and immediately after handling the product.

Engineering Controls: Must be used within an annually certified chemical fume hood. Ensure that eyewash stations and safety showers are in close proximity to the workstation.

First Aid Procedures:

If inhaled... Move to fresh air. If the person is not breathing, give artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device and call 828-227-8911 (on campus) or 911 (off campus).

In case of skin contact... Remove all contaminated clothing. Immediately (within seconds) flush affected area for FIVE (5) minutes. Call 828-227-8911 (on campus police) or 911 (off campus).

Wearing compatible gloves, massage calcium gluconate gel into the affected area. Re-apply every 15 minutes until medical help arrives. Note: hydrofluoric acid exposure is often treated with calcium gluconate, a source of Ca²⁺ that sequesters the fluoride ions. HF chemical burns can be treated with a water wash and 2.5% calcium gluconate gel, or special rinsing solutions. However, because it is absorbed, medical treatment is necessary; rinsing off is not enough. Intra-arterial infusions of calcium chloride have also shown great effectiveness in treating burns. In some cases, amputation may be required.

In case of eye contact... In the event of eye contact, the eye should be immediately flushed with water. If the chemical is very irritating, it is likely that the affected individual will require assistance to hold the eye open during the flushing. Use the nearest emergency eyewash immediately. Call 828-227-8911 (on campus police) or 911 (off campus).

If swallowed... DO NOT induce vomiting. Give large quantities of water and milk (if available). Never give anything by mouth to an unconscious person. Get medical attention immediately, call 828-227-8911 (on campus) or 911 (off campus).

Section 5. Special Storage & Handling Requirements

Storage

- HF must always be stored in plastic (Nalgene or polypropylene) containers.
- Ensure the container is tightly closed at all times.
- DO NOT store HF in glass bottles / containers.
- Store in corrosive / acid storage cabinet within a secondary containment tub made of Nalgene or polypropylene.
- DO NOT store on the top most shelf of the storage cabinet.
- DO NOT store with oxides, organic chemicals, bases or metals.

Handling

- Verify tube of at least 30 grams of 2.5% Calcium gluconate gel is readily available, in a gel-like condition, and the shelf life has not been exceeded.
- The lab where the material is being handled has an approved / certified emergency eyewash and safety shower.
- Ensure you are wearing the following minimum PPE: tightly fitting safety goggles and face shield, lab coat & natural rubber apron, full length pants, closed-toe rubber or leather shoes, gauntlet style (or arm length) natural rubber gloves over a pair of nitrile gloves.
- Carefully carry the stock bottle in a rubber maid bottle carrier / Nalgene secondary container to the chemical fume hood and pour out desired amount into a smaller container.
- Place stock bottle back in corrosive chemical storage cabinet with cap tightly closed.

- Do not work alone with hazardous materials, hazardous equipment, or hazardous processes (unless authorized by the Principal Investigator). A buddy system is highly recommended when handling HF.
- Lab emergency contact information must be readily posted. Easy access to a cellular phone or land line is readily available.

Spill and Accident Procedure

Personal precautions

Avoid breathing vapors, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Do not attempt clean-up without minimum PPE.

Environmental precautions

Prevent further leakage or spillage – if safe to do so. Do not allow product to enter drains.

Methods and materials for containment and clean-up

Consider material compatibility prior to clean-up. Verify an HF spill kit is available which contains the following: neutralizing agent, disposable scoop and a compatible waste collection container or plastic bag.

1. Immediately assess amount spilled, follow WCU Emergency Response Guide procedures for hazardous materials incidents. Call 828-227-8911 (on campus police) or 911 (off campus).
2. If HF exposure has occurred, call 828-227-8911 (on campus police) or 911 (off campus)
3. If safe to remain and address the spill, use a specific HF neutralizing agent to cover the spilled liquid.
4. A liquid binding material (vermiculite, sand, kitty litter) may be used to absorb the liquid.
5. Pick up contaminated material with a disposable scoop into a double-bagged ziplock or other compatible container.
6. Label and tag as hazardous waste. Call the Safety Office to pick up the waste (828-227-7443).

Section 6. Step-by-step Operating Procedure

Describe the possible risks involved with failure to follow a step in the SOP in the right hand column.

| Step-by-Step Description of Your Process or Experiment | Potential risks if step is not done or is done incorrectly |
|--|---|
| <p>Don personal protective equipment:</p> <p><input type="checkbox"/> appropriate street clothing (long pants, closed-toe shoes)</p> <p><input type="checkbox"/> gloves; indicate type: _____</p> <p><input type="checkbox"/> safety goggles <input type="checkbox"/> safety glasses <input type="checkbox"/> face shield</p> <p><input type="checkbox"/> lab coats</p> <p><input type="checkbox"/> Other: _____</p> | |

Check the location/accessibility/certification of the safety equipment that serves your lab:

| | | |
|--|-----------|--|
| Laboratory Fume Hood/Glove Box or other Ventilation Control. | Location: | |
| Eyewash/Safety Shower | Location: | |
| First Aid Kit | Location: | |
| Chemical Spill Kit | Location: | |
| Fire Extinguisher | Location: | |
| Fire Alarm Manual Pull Station | Location: | |
| Nearest Available Telephone | Location: | |

List the procedure steps and note in the column to the right any potential hazards for omitting or doing them incorrectly.

List the clean-up procedures for the work area and equipment:

Remove PPE and wash hands before leaving the lab.

Section 7. Waste Disposal

Label waste. Attach a completed Hazardous Waste label to all waste containers as soon as the waste is added to the container.

Store waste. Store hazardous waste in closed containers, in secondary containment and in a designated storage location. Double-bag dry waste using sealable transparent bags. Waste must be under the control of the person generating and disposing of it.

Describe the quantities of waste you anticipate generating and appropriate waste disposal procedures. Include any special handling or storage requirements. Explain final neutralization procedures, hazard waste labeling, etc.

Section 8. Training Requirements

Prior to conducting any work with Hydrofluoric acid (HF), Principal Investigator or designee must provide to his/her laboratory personnel specific to the hazards involved in working with this substance, work area decontamination, and emergency procedures.

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

The Principal Investigator must ensure that his/her laboratory personnel have attended appropriate/required laboratory safety training or refresher training within the last one year.

List all required safety training, such as chemical safety, lab specific CHP, SOPs, & general lab safety, etc.

The PI must ensure that his/her lab personnel have completed the required lab safety training (initial and refresher training). Location where training documents & records are maintained:

Section 9. Emergency Procedures

A. Health-Threatening Emergencies (ex: fire, explosion, health-threatening hazardous material spill or release, compressed gas leak, or valve failure)

1. **On Campus Call 828-227-8911 or Off Campus 911**
2. Alert people in the vicinity and activate the local alarm systems.
3. Evacuate the area.
4. Elect someone familiar with the process to stay nearby to advise emergency responders.
5. Once personal safety is established, call the Safety Office at 828-227-7443.

For personnel exposure or injury:

1. Remove the injured/exposed individual from the area, unless it is unsafe to do so because of the medical condition of the victim or the potential hazard to rescuers.
2. **Call 828-227-8911** (if immediate medical attention is required.)
3. Administer first aid as appropriate. Consult the SDS(s) to determine appropriate first aid.
4. Remove any contaminated clothing and flush contamination from eyes/skin using the nearest emergency eyewash/shower for a minimum of 15 minutes.
5. Bring copies of SDSs for all chemicals the victim was exposed to for the emergency responders/medical providers.
6. Call 828-227-7443 to report the incident to the Safety Office.

B. Non-Health Threatening Emergencies

For non-health threatening injuries and exposures

Call University Health Services for more information and to schedule an appointment (828-227-7640)

For hazardous material spills or releases which have impacted the environment (via the storm drain, soil, or air outside the building) or for a spill or release that cannot be cleaned up by local personnel:

Notify your PI/lab supervisor and the Safety Office at 828-227-7443 immediately.

C. Small Spills/Local Cleanup:

In the event of a minor spill or release that can be cleaned up by local personnel using readily available equipment

1. Notify personnel in the area and restrict access. Eliminate all sources of ignition.
2. Review the SDS for the spilled material, or use your knowledge of the hazards of the material to determine the appropriate level of protection.
3. Wearing appropriate personal protective equipment, clean up the spill. Collect spill cleanup materials in a tightly closed container. Manage spill cleanup debris as hazardous waste.

D. Building Maintenance Emergencies (e.g., power outages, plumbing leaks):

Call Facilities Operations at 828-227-7224

Describe any additional safety/emergency response information for this lab procedure (hazardous chemical antidotes for particular first aid treatment, chemical neutralizers to use, etc.).

Section 10. Prior Approvals

You must seek prior approval from the Safety and Risk Management Office if you intend to use **high risk** chemicals and operations, as special safety precautions may be required. For guidance on **high risk procedures**, consult the University Chemical Hygiene Plan (Section 6). Approval can be indicated with a signature in Section 1 above.

Enter additional comments:

Standard Operating Procedure for the Use of Hydrofluoric acid

Procedure Title: _____

"I have read and understand this SOP and I agree to fully adhere to its requirements."