	<p>Standard Operating Procedure</p> <p>Working with Hydrofluoric Acid (HF)</p>	<p>OP: DCU/HSO/SOP/011 Rev : 02 Approved by: Page : 1 of 7 Revision date: 20/12/2022 Review Date: 20/12/2025</p>
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1.0 Purpose

Hydrofluoric acid (HF) is an extremely corrosive liquid and vapour with a pungent, irritating odour. HF solutions are extremely hazardous and can cause serious health effects by any route of exposure. Unlike other mineral acids, they pose health hazards in addition to acid burns. The purpose of this procedure is to describe the control measures that must be in place prior to working with this substance.

Note:

All laboratories working with HF are required to have calcium gluconate gel available in the laboratory. The expiration date of the gel should be periodically checked to ensure that the gel has not expired.

It is critical to seek medical attention after any exposure, even if it seems minor and no pain is observed.

2.0 Scope

This Procedure applies to all units of the university, both academic and support, including the campus companies and research centres. These are all hereinafter collectively referred to as the 'university'.

The scope of the procedure includes:

- Responsibilities
- Safe handling and Use
- Storage
- Disposal
- Emergency procedures
- Records

3.0 References

- DCU Framework Safety Statement
- School/Unit/Campus Company Local Safety Statement


4.0 Responsibilities

4.1 Head of School/Unit should;

Ensure that procedures are in place to manage and control work involving the use of HF

4.2 The Principal Investigator (PI)/Researcher should;

- Ensure that before beginning any work with HF, a detailed **Risk assessment-Experimental method Form** is completed

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- Ensure that the Risk assessment has been approved by the School Safety Advisor and that records of same are retained
- Ensure that all research workers intending to work with HF have undergone mandatory specialized training in relation to working with HF which is run by the School Safety Advisor,
- provide and maintain suitable personal protective equipment for general work and also in the event of an emergency
- clearly identify areas within the laboratory approved for handling and use, storage and waste disposal
- ensure that all laboratories working with HF are provided with calcium gluconate gel
- ensure that a system is in place to check the expiration date of the gel to ensure that the gel has not expired
- ensure that emergency procedures are in place and relevant staff know how to respond
- notify Occupational First Aiders in the area of the proposed work and associated hazards
- notify all technical staff in the area of the proposed work and associated hazards
- ensure that there is no deviation from agreed processes and that changes to procedures are notified and approved in advance
- All personnel working in a laboratory where HF is being used, even those not using HF, should be familiar with the hazards and receive training in first aid measures.
- Maintain training records and if requested make them available for review
- Monitor compliance with safe working practices
- Report any incidents to the school safety officer and the Health and Safety Office, <http://www.dcu.ie/safety/emergencies.shtml>.

4.3 Laboratory personnel should;

- read and understand the Risk assessment-Experimental method Form and sign same
- attend specific training in relation to working with HF
- comply with procedures in relation to the working with HF
- At all times use the personal protective equipment prescribed for the task
- be aware of the location of the Safety Data Sheet for HF
- Work with HF only under the buddy system and never when alone in the laboratory
- Know the location of the safety shower/eye wash
- be aware of the location of the spill kit
- report any incidents to the PI

5.0 Safe handling and use

The following safe handling instructions apply to all solutions that contain HF, including buffered oxide etch. It is crucial to avoid any exposure to HF gas or HF solutions, even at low concentrations. Solutions above 50% HF can cause significant HF evaporation.

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5.1 Fume Hood

All handling of HF solutions must be done in a properly functioning fume hood compatible with acid use to prevent exposure by inhalation. If possible, carry out all work in secondary containment to minimize the likelihood and consequences of a spill. If HF is being used frequently, a work area with low foot traffic/disturbance should be dedicated to HF work. Before starting work:

- Post a warning sign on the fume hood: "HF in use in this area,"
- Remove all incompatible material from the hood,
- Verify that the fume hood is functioning properly.

5.2 Work Practices

Never work with HF when alone in the laboratory or outside of normal working hours. Notify others before you start using it. To minimize the chance of collisions and spills, only one person should use the HF work area at a time.

5.3 Personal Protective Equipment (PPE)

Always wear appropriate protective equipment when handling HF:

5.3.1 Gloves - Thin, disposable gloves commonly used in laboratories do not provide sufficient protection against HF. A thicker glove rated to provide good protection from HF should be worn. Wearing a thinner disposable glove underneath the thicker glove is recommended. Many gloves (especially thinner gloves that offer excellent dexterity) provide only short term protection and must be changed frequently and immediately after exposure. Always check the gloves for holes or other signs of degradation before beginning work and periodically while working.

The specific HF MSDS should be sent to the glove vendor/manufacturer so they can determine the appropriate glove with sufficient breakthrough time.


5.3.2 Splash goggles as eye protection are a minimum. A *face shield* must be available and should be worn in conjunction with splash goggles whenever there is no physical barrier preventing splashes to the face, e.g., when the sash of the hood is raised.

5.3.3 An **apron resistant to acids** worn over a **lab coat** or an **acid resistant smock** with long sleeves is required to prevent skin contact.

5.3.4 Appropriate clothing such as long trousers and closed toe shoes are mandatory at all times in a laboratory.

5.3.5 Acid resistant shoe covers are optional and may be required when handling large quantities of concentrated solution

Check PPE for contamination. If no contamination is visible, wash reusable gloves with soap and water and remove. Leave disposable gloves on while removing the remaining PPE in the following order: face shield, splash goggles, apron or smock. Remove disposable gloves and wash hands with soap and water.

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Disposable equipment that is contaminated, and reusable equipment that is contaminated and cannot be safely decontaminated, should be discarded. Put the contaminated item into a plastic bag and label it "PPE contaminated with hydrofluoric acid". Dispose of it through a licenced waste disposal contractor.

5.4 Calcium Gluconate Gel

All laboratories working with HF are required to have calcium gluconate gel available in the laboratory. Periodically check the expiration date to ensure that the gel has not expired. These checks should be recorded. Once opened and used, the gel must be discarded. Calcium gluconate gel is available for purchase from vendors such as Fisher Scientific, Sigma.

6.0 Storage

Store HF solutions and all HF waste in polyethylene or fluorocarbon plastic containers. **NEVER** store HF solutions in glass or metal containers.

Store HF solutions in a cool, dry, and well ventilated place away from incompatible materials. Use secondary containment e.g. a spill tray. An acid neutralizer such as calcium carbonate can be added to the secondary containment to absorb spilled product.

Designate a storage area for HF and label it clearly with "Hydrofluoric Acid, extremely corrosive and toxic" (not just "HF") on the outside of the cabinet.

HF is *incompatible* with:


- Glass
- metals
- strong bases
- alkalis
- silica
- cyanides
- carbonates
- reducers
- *ceramics*

7.0 Disposal

When your work with HF is done, collect spent and excess solution as HF waste. Rinse used and emptied containers with a small amount of water and add the rinsing solution to the HF waste. The containers can then be rinsed thoroughly with soap and water. Ensure suitable PPE is worn as outlined in Section 5.3.

Aqueous HF waste solutions should be collected in polyethylene containers and labelled accordingly. Dispose of all waste through a licenced waste contractor.

Any HF-contaminated items should be collected separately in plastic bags and disposed of as HF-contaminated debris. Contact the school safety advisor for information.

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8.0 Emergency procedures

8.1 Contact with HF

Immediate first aid is critical to avoid or minimize further injury. Any exposure to HF or HF solution should receive first aid treatment and medical evaluation even if no pain is felt. Delayed onset of deep tissue damage, bone damage, or systemic effects can occur up to 24 hours after exposure.

If you are exposed to HF, have someone call 999 immediately.

8.1.1 Skin Contact

Rinse off affected skin immediately with copious amounts of water for 5 minutes; if necessary, use the safety shower. Remove contaminated clothes under running water. Apply calcium gluconate gel to the affected area while wearing a disposable glove. Repeat the application every 15 minutes until medical assistance arrives.

8.1.2 Eye Contact

Use an eye wash to rinse the eye thoroughly for at least 15 minutes, occasionally lifting the upper and lower eyelids and rolling the eyeballs. If sterile 1% calcium gluconate eye wash solution is available, use the eye wash for a first thorough rinse and then use the solution to repeatedly irrigate the eye.

8.1.3 Inhalation

Move into fresh air immediately.

8.1.4 Ingestion

Do not induce vomiting. Do not take activated charcoal. Drink water or milk.

Provide the medical team, the ambulance service and or hospital with the Safety Data Sheet (SDS) for HF.

8.2 Spillage


Only persons trained in handling of HF should attempt to clean up spillages.

Ensure a suitable spill kit is readily available before working with HF.

The use of solid calcium carbonate is recommended to absorb spills. Calcium will form an insoluble salt with fluoride and prevent fluoride absorption through the skin. Do not use sand, as HF reacts with it forming toxic tetrafluorosilane.

The spill kit should also contain:

- A plastic container with lid or heavy duty plastic bag to collect any contaminated material,
- Gloves resistant to HF,

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- Dust pan and broom.

Commercial spill kits are also available. They must be rated for HF use, not just acid use.

Spills inside the fume hood should be neutralized immediately and the area cleaned up thoroughly after neutralization. If you do not feel confident that you can perform the clean-up adequately, ask for assistance.

In the case of a spill outside the fume hood, that cannot be neutralized safely, evacuate the area immediately and alert others. If possible, close the door to prevent vapors from spreading to other spaces and call 911 immediately.

In the case of splashes on clothes, gloves, or shoes with no contact to skin, remove the item carefully, avoiding contact to skin. Put the items into a heavy-duty plastic bag, seal and label the bag. Wash the affected skin area with soap and water even if no skin contact is evident.

9.0 Records

Written records of the following should be retained by the PI:

- Risk assessment-Experimental method Form is completed and read signed and dated by all relevant staff
- Current HF Safety Data Sheet
- Training records for relevant staff signed and dated
- Calcium gluconate expiry date checks
- HF Inventory
- Waste inventory
- Fume hood inspection checks
- Incident Investigation reports

These records are retained for the duration of the work otherwise for a period of not greater than 5 years following completion.

10.0 Contact

For clarification or requests for update to this procedure contact
Health & Safety Office
Email: safety@dcu.ie

11.0 HISTORY

Revision No:	Date:	Purpose of Revision:
01	April 2019	New SOP
02	Sept 2019	Section 5.3.1 edited and draft watermark removed for general issue.
03	Dec 2022	Sections numbers corrected



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Training acknowledgement

I confirm that I have read, and understood the standard operating procedure, and I understand that as an employee, it is my responsibility to work in accordance with the procedure.

If I have questions about the procedure, I understand it is my responsibility to seek clarification from my supervisor.

PRINT NAME	School/Unit	Signature	Date