



SAFE USE OF HYDROFLUORIC ACID

PURPOSE: These guidelines establish safe work procedures for staff & students working with hydrofluoric acid (HF), a highly hazardous chemical, and response in case of emergency to minimize health risks.

APPLICABILITY: These guidelines cover all users of Hydrofluoric Acid and other persons present in the lab while it is being used and what first-aid or medical responders need to know in case of an incident involving HF.

EMERGENCY CONTACT NUMBERS:

1. CPS: x2222/2223; 0806502222
2. OHS Officer: Sophie Rees-Jones: x2554 0836167474
3. LHSIS: Monique Muller: x4549; 0836406706
4. UCT OH Unit: Suzanne Keys: x3873

INTRODUCTION to HF: Hydrofluoric Acid (HF) is one of the most corrosive of the inorganic acids. It has the following properties:

- Clear, colourless liquid with a strong irritating odour (pungent odour at < 1 ppm).
- Non flammable
- Volatile
- Very soluble in water
- Vapour Density = 0.7 (lighter than air).
- Boiling Point = 19.5 °C.

HF is also available *as gaseous material*.

- All forms of HF can cause severe burns to tissue, which makes its handling and use especially hazardous.
- HF easily dissolves glass and can attack enamels, pottery, concrete, rubber, leather, many metals and organic compounds.
- Upon reaction with certain metals, explosive hydrogen gas may be formed.
- HF, though a weak *acid*, is physiologically a very potent chemical due to fluoride ions, which can bind with calcium and magnesium ions in tissue and bones.
- Concentrated HF, liquid or vapour, may cause severe burns, electrolyte imbalance, pulmonary edema and/or life-threatening cardiac arrhythmias.
- Even moderate exposure may rapidly progress to fatality if not treated promptly and properly.
- Symptoms of exposure may be delayed for several hours.

Therefore, immediate medical intervention, even in the absence of symptoms, is necessary.

PROCEDURE:

I. Working safely with HF

- Use the most dilute HF solution practicable not greater than 48%; cap the container when not in use. Always use a polyethylene reaction vessel never glass.
- ALWAYS work in a chemical fume hood *at least* 15cm inside the sash.
- Before use, always check that the fume hood is working properly.

Eye protection: wear approved splash goggles and where possible also a face shield.



- Persons wearing seeing specs **MUST** also wear over spec safety splash goggles.

Hand protection: HF readily penetrates skin and becomes trapped under fingernails. Heavy neoprene or nitrile rubber (HF attacks natural rubber) gloves are best for working with HF. However, the increased thickness of the gloves reduces dexterity, increasing the possibility of spills.

- Wear **two pairs of nitrile lab gloves** at a time, changing the outer pair often.
- When working with larger quantities of HF in procedures that do not require as much dexterity, wear heavy nitrile or neoprene rubber gloves, with a nitrile lab glove worn under the outer glove.

Body protection: Wear a long-sleeved shirt, long pants and closed shoes.

- Wear a lab coat over your clothes and consider wearing a **chemical-resistant apron** and sleeves. Do not wear shorts and sandals in the laboratory.
- Wash hands thoroughly with soap and water after handling HF
- **Make sure you have NON-EXPIRED 2.5% Calcium Gluconate Gel or Hexafluorine in the lab's first aid kit.**
- Make sure you have a separate spill kit appropriate for HF acid.
- Make sure you have a copy of the Safety Data Sheet (SDS) in the lab.

II. Limitations on the Use of HF

- Hydrofluoric acid is an extremely hazardous material. Lab staff/students should work using the buddy system and **NO** one must be allowed to work alone. Alert all others in the lab when you are handling HF.
- For safety reasons the use of hydrofluoric acid is limited to office hours. Never purchase HF as a gas.
- Only persons who have read and understood this document and who are suitably trained should be allowed to use this substance.
- Furthermore:
 - Inform any other First aider or the Paramedics that the incident involves HF and about the hazards associated with this substance.
 - Provide a copy of these guidelines and a Safety Data Sheet (SDS) to these responders.
 - Be sure they are also informed of the concentration of the HF involved.

III. Storage of HF

- Keep the amount on hand or being handled to a minimum.
- Keep the *concentration* of the HF to the minimum needed.
- **NEVER STORE HF IN GLASS CONTAINERS!**
- Hydrofluoric acid reacts with many materials, avoid contact with: *glass, concrete, metals, water, oxidizers, reducers, alkalis, combustibles, organics and ceramics.*
- HF must be stored in tightly closed secondary containers made of polyethylene or fluorocarbon plastic, lead or platinum
- Use of further secondary containment such as trays when using or storing HF will assist containing accidental spillages.
- Store away from incompatibles (bases, flammables, combustibles, etc.).
- Store below eye level.
- Be sure ALL containers, original and secondary, are **LABELLED**.
The *label must include the HF concentration.*
- Containers of this material may be hazardous when empty since they retain product residues (vapours, liquid); observe all warnings and precautions listed for the product.



IV. Guidelines for Handling and Treatment of Exposed Persons

- HF is a serious systemic poison, a true medical emergency. On contact with live tissue in high concentrations exposed person will experience immediate necrosis and PAIN.
- Burns may involve underlying bone.
- When working with HF, pay close attention to the task at hand and do not allow yourself to become distracted.
- Contact with dilute HF solutions (<50%) may not produce immediate pain, but may result in delayed health effects.
- If a large amount is spilled or if the HF is concentrated (>50%), contain the spill as much as possible, evacuate the area immediately and inform the SHE Representative.
- SHE Representative to contact OHS Officer.
- OHS Officer to WhatsApp First Responders & HAZMAT team.
- It may be necessary to contact CPS to call the ambulance service immediately.
- Explain what happened what chemical is involved; it is highly urgent and exactly where ambulance responders must go to.
- **Rescuers and responders should wear the proper personal protective equipment and clothing (PPE) before coming in contact with a contaminated individual and clothing.**

SKIN EXPOSURE

- Immediately wash all affected areas with water for at least 15 minutes.
- **While flushing with water remove all clothing or jewellery that could trap HF.**
- Rapid decontamination is critical to minimize/prevent injury as HF is readily absorbed through the skin and deep tissue penetration by the fluoride ion may occur causing HF to bind to the calcium and magnesium in the body.
- After washing the affected areas, apply the 2.5% calcium gluconate first-aid gel. Calcium gluconate binds HF and prevents it from penetrating deeper into tissues.
- **Affected area does not need to be dried prior to application.**
Note the time of initial application and reapply every 15 minutes until further medical treatment.
- Vapour burns to the skin are treated the same way as liquid HF burns.

EYE EXPOSURE

- Immediately flush eyes for at least 15 minutes with large amounts of water.
- If **1% calcium gluconate solution** is on hand flush eyes for 5 minutes with water then repeatedly with the solution.
- Continue to irrigate with the 1% calcium gluconate solution or ice compresses until ambulance arrives.
- Person **MUST** see an eye specialist ASAP.

INHALATION

- HF's volatility makes it a high risk for inhalation injury. It is extremely destructive to the tissue of the mucous membranes and upper respiratory tract. Severity can range from mild airway irritation to severe burning and dyspnea.
- **If inhalation occurs or is suspected, ensure you wear a respirator to remove victim to clean air until emergency services arrives on scene.**
- Inhalation exposure is a serious medical emergency as it is more problematic because **there are no immediate decontamination procedures.**
- Keep person calm or in recovery position until ambulance services arrives.



INGESTION

- Drink large amounts of water as quickly as possible to dilute the acid.
- **DO NOT induce vomiting.**
- **NEVER give anything by mouth to an unconscious person.**
- **Drink several glasses of milk or several millimeters of:**
 - **Milk of Magnesia, Mylanta, Maalox**
 - **or eat up to 30 Caltrate or any other antacid tablet.****The calcium or magnesium in these compounds may act as an antidote.**
- After decontamination, properly protected First Responders should remove the exposed person from the contaminated area, then transport the exposed person to the nearest Emergency Room.
- First Responders **must be given** a copy of these guidelines and a Safety Data Sheet and concentration of the HF involved.
- Contaminated clothing should be removed, double bagged and labelled as hazardous waste.

V. Waste disposal procedures and accidental releases

- Spent HF solutions are disposed of as hazardous waste through WasteMart.
- Consult WasteMart for disposal methods.
- Disposal down the drain is strictly forbidden.

VI. Spill Management

- All areas where HF is used must have a proper chemical spill control kit.
- Small spills can be neutralized by covering it with an acid neutralizer/calcium carbonate, and absorbed with spill absorbent pads or vermiculite.
- Once the spill is contained isolate the room and leave the area immediately and close all doors.
- Place “Do Not Enter, HF spill” sign on door.
- Call the SHE Representative or OHS Officer for assistance.
- Any type of a HF spill/accidental release must be reported to CEM OHSE Unit.

VII. INFORMATION AND TRAINING

- The SHE Representatives shall train and ensure annual refresher training is completed by those who handles hydrofluoric acid on: 1) the hazards of HF and 2) what to do in the event of an exposure or a spill or other emergency.
- The SDS together with these guidelines shall be used to train persons on the hazards of HF.
- A Safety Data Sheet (SDS) on HF and copy of these guidelines must always be kept in the immediate work area where HF is used.

VIII. RESPONSIBILITIES

SHE Representative:

- Must ensure personnel are trained in the safe use of HF and these guidelines.
- Require persons to work in a buddy system when using HF.
- Ensure the fume hoods are working properly and tested at least 3-monthly and log a call for repairs when needed.
- Review and update these guidelines, as necessary.



- Log incident online and complete incident HS02 forms following an incident and exposure and a WCL2 forms in case of staff member exposure.
- Ensure HF spill kit is present and persons know what to do in case of a spill.

First Aider

- Ensure stock of non-expired 2.5% calcium gluconate are in first-aid kit in case of emergency.
- Are familiar what to do in an HF exposure emergency.