

Safe Method of Use: Hazardous Substances of Higher Risk 2 Hydrofluoric Acid

Purpose: This applies to **principal investigators (PIs), sector managers, designated laboratory person (DLPs)**, technical staff and students who use Hydrofluoric Acid within the University of Auckland.

Hydrofluoric acid is a corrosive mineral acid that severely burn skin, eyes and mucous membrane. Vapours from anhydrous HF or its concentrated solutions can burn these tissues.

HF is similar to other acids in that the extent of the burn depends on the concentration, temperature and duration of contact.

HF differs however from other acids because the fluoride ion readily penetrates the skin causing destruction of deep tissue. Unlike other acids which are rapidly neutralised, this process may continue for days if left untreated

WARNING:

Burns with HF are usually very serious with potential for significant complications due to fluoride toxicity. Concentrated HF solutions or vapour may cause severe burns, tissue necrosis, metabolic imbalances, pulmonary oedema and life threatening cardiac arhythmias.

Burns from dilute solution, if left untreated, may progress to tissue necrosis and medical treatment may involve amputation. HF skin burns are accompanied by severe throbbing pain which is thought to be due the irritation of nerve endings by increase in extracellular potassium.

Any exposure to Hydrofluoric Acid MUST be medically evaluated.

Download the MSDS and medical treatment as pdf files and have these on hand

All work with concentrated HF shall be conducted in situations where assistance is readily available. It is imperative that any person who is handling HF arrange to have Calcium Gluconate on hand and another person available to assist if the alarm is raised!

A. Chemical Properties

- Hydrofluoric acid solutions are clear and colourless with a density similar to that of water. The most widely known property of HF is its ability to dissolve glass. It will also attack glazes, enamels, pottery, concrete, rubber, leather, many metals (especially cast iron) and organic compounds.
- Upon reaction with metals, hydrogen gas may be formed.

B. Storage

- Use and store HF in polyethylene, polypropylene, and Teflon containers.
- Containers of concentrated Hydrofluoric acid must have prominent warning signs

Toxicological Properties

- Fluoride ions are both acutely and chronically toxic. Acute effects of HF exposure include extreme respiratory irritation, immediate and severe eye damage and pulmonary edema.
- Skin, eye, or lung exposure to concentrated (>50%) HF solutions will cause immediate, severe, penetrating burns.
- Exposure to less concentrated solutions may have equally serious effects, but the appearance of symptoms can be delayed for up to 24 hours.
- If you are exposed to hydrofluoric acid SEEK MEDICAL ATTENTION IMMEDIATELY.

Personal Protective Equipment

- The ACGIH ceiling limit and OSHA TWA for HF is 3 PPM.
- Fume Hoods **shall** always be used when working with HF. The sash of the fume hood **shall** be as low as reasonably practical
- Eye and Face protection in the form of a face shield **shall** be used.
- Full length or gauntlet Viton/neoprene or butyl neoprene gloves **shall** be worn. (Hydrofluoric Acid burns around the fingernails are extremely painful, difficult to treat, and may require surgical removal of the nail). Latex gloves are not effective.

- A full length acid resistant apron **shall** be used.
- In order to warn and protect others from the hazard of HF, a warning sign indicating the use of HF **shall** be posted.

Using Hydrofluoric Acid Safely

- **Never** use Hydrofluoric Acid when working alone.
- Before beginning work involving HF, another person **shall** be available at all times to assist should assistance be required. This person does not have to be physically present in the laboratory, but **must** be readily available.
- All lab personnel, not just those who will be using Hydrofluoric Acid, should be informed of the dangers of this chemical and the emergency procedures necessary in case of an accident. A sign **shall** be posted to alert people that work with Hydrofluoric Acid is in progress.
- Only experienced persons specifically designated by the Lab Manager who are familiar with its properties **shall** handle the concentrated HF.
- **All persons who will be using Hydrofluoric Acid shall be made aware of its properties and have documented training in proper procedures for use and disposal.**
- Laboratories which keep or use Hydrofluoric Acid gas or solutions of greater than 1% Hydrofluoric Acid **shall** have emergency procedures on hand as well as an MSDS (download from this site).
- Laboratories which keep or use Hydrofluoric Acid gas or solutions of greater than 1% Hydrofluoric Acid **shall** have calcium gluconate, an operational safety shower and eye wash available close to their laboratory.
- Before beginning any procedure involving Hydrofluoric Acid, make sure the access to the calcium gluconate, emergency shower and eyewash is unobstructed.
- All procedures involving HF **shall** be conducted in a certified fume hood

- Before beginning work involving HF, the following items **shall** be readily on hand:
 1. Container of calcium gluconate gel. This gel must be inspected before each use of HF or at least monthly to ensure the gel has not been removed or has not reached the expiration date. If a tube of the gel has been opened, a new container must be purchased and the old container discarded. No work with HF can be done with an expired tube of calcium gluconate gel.
 2. A small supply of calcium carbonate or calcium hydroxide for spills shall also be kept near the fume hood where the work will be conducted.
 3. A spare set of HF acid resistant gloves.
 4. Copy of these procedures and MSDS to take to the Accident and Emergency clinic.

Working with Hydrofluoric Acid or concentrated HF solutions (> 1%):

- Work in a fume hood with the sash as low as possible. Wear correct apron, gloves and a face shield as outlined in section entitled Personal protective Equipment.

Spills

- If a small quantity (100 ml or less) of dilute Hydrofluoric Acid solution is spilled, clean it up by applying powdered calcium carbonate or calcium hydroxide, or use a commercial Hydrofluoric Acid spill kit.
- If a larger amount is spilled, or the acid is concentrated, contain the spill as best you can, evacuate the area, and call 85000. Avoid exposure to the vapours.

Emergency Response Procedures:

Skin Exposure:

- Move the victim immediately under an emergency shower or other water source and flush the affected area with large amounts of cool running water for at least 1 minute. While the victim is flushing with water, they should also take off all clothing, shoes and jewelry, removing goggles last. Close your eyes, face water flow and pull goggles over head. **BE EXTREMELY CAREFUL NOT TO CONTAMINATE YOURSELF** (Use Neoprene gloves).

- Remove all contaminated clothing while flushing with water. Some clothing is able to absorb the toxic material and maintain it close to the skin.
- While the victim is being rinsed with water, someone should call to arrange treatment by medical personnel. Call Unisafe or Emergency Services (111) and tell the dispatcher that a person that has been in exposed to Hydrofluoric Acid and the location. The hospital will need to be alerted.
- Immediately washing off the acid is of primary importance!
- After the affected area is flushed with copious amounts of water for at least 5 minutes, 2.5% calcium gluconate gel is to be applied using these guidelines.
- In order to prevent cross contamination, the victim should self apply the calcium gluconate gel.
- If the victim is unable to self apply, anyone present can apply the gel after putting on the neoprene gloves.
- ***Do not use latex gloves; they are not effective against HF.*** Note the time when the calcium gluconate gel was first applied to the contaminated site. Provide this information to the Emergency Services team.
- A copy of the MSDS and these emergency procedures **must** also be taken to the hospital. It is highly desirable that the victim be escorted to the hospital by the responding person or assisting lab personnel to ensure that this information is provided to the clinician in charge of treatment.

Eye Exposure:

- Immediately flush eyes for at least 5 minutes with copious cool flowing water.
- **EMERGENCY SERVICES SHOULD BE NOTIFIED IMMEDIATELY.** Tell the dispatcher that a person that has been in exposed to Hydrofluoric Acid and the location. The hospital may need to be alerted.
- If a sterile 1% calcium gluconate solution is available and **MEDICAL PERSONNEL** are available then following the 5 minutes wash time, 1% calcium gluconate irrigation should be started.

Inhalation:

If a large volume of Hydrofluoric Acid gas is inhaled:

- Immediately remove the victim to clean air. Call 111.
- **EMERGENCY SERVICES SHOULD BE NOTIFIED IMMEDIATELY.** Tell the dispatcher that a person that has been in exposed to Hydrofluoric Acid and the location. The hospital may need to be alerted.
- Inhalation of Hydrofluoric Acid fumes may cause swelling in the respiratory tract up to 24 hours after exposure. Persons who have inhaled Hydrofluoric Acid vapours may need prophylactic oxygen treatment and must be seen by a physician immediately.