



UNIVERSITY OF  
SASKATCHEWAN

# Safety Resources

Title: **Hydrofluoric Acid/Hydrogen Fluoride Emergency Protocol**

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## 2. Introduction

Most fluorides produce hydrogen fluoride (HF) when coming into contact with moisture and produce burns and similar health effects. Both liquid and vapour can cause severe burns, which may not be immediately painful or visible. If HF remains on the dermis too long it will penetrate the skin and attack underlying tissues.

Exposures to HF are usually very serious; HF will penetrate any tissue it comes in contact with and have the potential for significant complications due to the injury produced in the contact area and the systemic toxic effects basically due to fluoride toxicity. Concentrated HF, liquid or vapour, may cause severe burns, metabolic imbalances, pulmonary edema, blindness and life threatening cardiac arrhythmias. Even moderate exposures to concentrated HF may rapidly progress to a fatality if left untreated. Burns caused by weak hydrofluoric acid may go unnoticed for several hours. Therefore, first aid procedures must be followed if any contact is suspected.

Fluoride compounds can enter the body either through: dermal contact (i.e. skin burns), eye exposure, inhalation, oral ingestion, and nail burns. This procedure outlines the first aid steps a responder should take to assist a victim of HF exposure.

This protocol applies to fluoride compounds as well as both anhydrous and aqueous HF.

## 3. Definitions

HF	hydrogen fluoride
HF Safety kit	kit readily available and stocked with appropriate ingredients to medically respond to an HF exposure
PPE	personal protective equipment
PVC	polyvinyl chloride

## 4. Authorized Personnel

Persons authorized to work with HF must be trained in the appropriate handling of HF; the operational procedures; and the use of the appropriate personal protective equipment (PPE).

Supervisors of staff using HF must prepare operational procedures for the safe use of this substance; be trained in the use of PPE; understand the hazards and effects of HF; and knowledgeable in this emergency response procedure.

## 5. Safety

At all times, persons touching the injured person must wear safety glasses and protective gloves (Rubber-Neoprene or PVC, in the emergency kit). First priority is to secure the area. The primary responder should attend to the injured person, a secondary responder should call for emergency medical services, and a tertiary responder should maintain area security for spill and equipment clean-up. Speedy treatment is essential. Delays in first aid care or medical treatment or improper medical treatment will likely result in greater damage.

## 6. First Aid Response Procedure

### 6.1 Skin exposure

- Contact emergency medical services.
- Remove all clothing coming into contact with the acid and discard in a manner which limits further exposure.
- Immediately flush area with copious amounts of tempered water from either tap or safety shower. Quickly and thoroughly wash the acid off the affected areas. ***Speedy action is critical!***
- Wash for a maximum of 5 minutes.
- Wearing gloves continuously rub 2.5% calcium gluconate gel on the exposed area.
- Note the time of initiation.
- If pain significantly decreases or disappears within 20 to 30 minutes stop and observe.

### 6.2 Eye exposure

- Contact emergency medical personnel immediately!
- Do not allow victim to rub eyes or keep eyes closed.
- Flush immediately with tempered water for a maximum of 5 minutes while holding eyelids open.
- Do not use oils, salves, ointments or other HF skin burn treatments.
- Irrigate each eye with 1000 cc of a 1% calcium gluconate solution (no higher than 1%) for a minimum period of 15 minutes or if necessary until medical aid is available.

### 6.3 Inhalation:

- Ensure your safety first before entering the room. Shut off the source of HF fumes.
- Remove victim from source of HF fumes and place in a well ventilated area or administer O<sub>2</sub> by mask 12 L.
- If exposed to HF vapours, should expect to see skin and eye exposure.
- If not breathing, begin artificial respiration immediately.
- Nebulize 2.5% calcium gluconate in normal saline for 15 to 20 minutes.
- Keep victim quiet and warm.

### 6.4 Ingestion

- **Do not** induce vomiting
- **Do not** give victim any baking soda or emetics.
- If victim is able to swallow, give water to drink.
- Offer 3 tablets of calcium carbonate (Tums) to the victim.
- Contact emergency medical personnel and remain with victim until they arrive.

## 7. Materials to send with Emergency Medical Services

- *Guidelines in case of a Hydrogen Fluoride Exposure* written by Comité Technique Européen du Fluor.
- Summary of treatment given and details of the incident.
- Tube of gluconate gel used for additional first-aid in transit.

## 8. Materials in HF Safety Kit

A HF Safety Kit must be available at each location HF is used. The kit shall contain the following:

- Safety Glasses
- Several pair of rubber (Neoprene) or PVC gloves for persons treating HF burns/injuries
- 2 - 4 tubes of 2.5% calcium gluconate gel, HF antidote gel for external use only
- 1 liter of a 1% calcium gluconate irrigation solution.
- Tums/ calcium carbonate
- 1 O<sub>2</sub> portable cylinder (if inhalation is possible)
- Nebulizer with ¾ inch corrugated tubing and mask (if inhalation is possible)
- 500 ml of a 2.5% calcium gluconate nebulizing solution (if inhalation is possible)
- The U of S Hydrofluoric acid/ Hydrogen Fluoride Emergency Protocol

- *Guidelines in case of a Hydrogen Fluoride Exposure* written by Comité Technique Européen du Fluor 2<sup>nd</sup> edition.

Also recommended the following:

- First-aid shears/ scissors to assist in clothing removal
- Eye irrigator
- Pocket mask to give rescue breathing

Emergency Contact Numbers.

**(9) 911** Emergency Services. Call an ambulance, all injured persons **MUST** be treated by a physician

**5555** University of Saskatchewan Protective Services

**4675** Safety Resources General Office

Additional numbers that may be used:

**1-866-454-1212** Saskatchewan Poison Control Center. Alert them of nature of the contact, they will liaise with Royal University Hospital

**363-7474** Royal University Hospital Emergency. Alert them of the type of injury and nature of contact.

## 9. Reporting

Complete a summary of the first aid administered to the injured person. Provide this summary to the attending emergency medical personnel.

Complete the University of Saskatchewan incident report (on line) and worker's compensation report.

## 10. Further Emergency Care

Further emergency care procedures should only be performed by a physician or a licensed emergency medical provider. Send with the patient the guidelines document on HF exposure to the hospital where definitive treatment will be provided. Attending physicians that have no or little experience with HF exposures will greatly benefit from the information provided by avoiding loss of time and improving patient prognosis.

## **11. How to Make Calcium Gluconate solutions**

### **11.1 Calcium gluconate 1% eye irrigation solution**

To obtain 1000 cc's (1 L) of a 1% calcium gluconate solution mix 900 ml of normal saline solution with 100 ml of a 10% calcium gluconate.

### **11.2 Calcium gluconate 2.5% solution for nebulization**

To obtain 100 ml of a 2.5% calcium gluconate solution mix 75 ml of a normal saline solution with 25 ml of a 10 % solution of calcium gluconate.

## **12. References**

McMaster University Hydrogen Fluoride Emergency Protocol (Appendix 1 of the McMaster University Laboratory Safety Handbook (2nd edition 1996))

Air Products and Chemicals Inc. Hydrofluoric Acid Burns: Health Effects and Treatment Plan for Medical Professionals and Emergency Responders; Approved 1/97, Rev. 6/02 and 6/03

Guidelines in case of a Hydrogen Fluoride exposure, CEFIC CTEF STS 94/96, 2<sup>nd</sup> edition, Comité Technique Européen du Fluor, June 2007

Seastar Chemicals Inc, MSDS – Hydrofluoric acid, dated July 2008