

## Working Safely with Hydrofluoric Acid

### 1. OVERVIEW

This safe work procedure applies to working directly with HF as a reagent as well as procedures where HF is a by-product.

Hydrofluoric acid (HF) is an extremely dangerous chemical, and can cause death from a skin exposure of less than 3% of body area. Special training, preparation, personal protective equipment, and handling precautions are needed when handling HF.

### 2. RESPONSIBILITY

Supervisors and members of research groups who are using HF must:

- Plan work in the knowledge that any exposure may cause permanent incapacity or death
- Ensure all personnel working in the laboratory containing HF are familiar with the properties and hazards of HF
- Document all required training
- Create and document a risk assessment prior to HF use
- Document and follow the appropriate safe work procedure.

### 3. TRAINING REQUIRED

All employees working with HF must receive appropriate training covering:

- Health effects resulting from HF exposure
- Safe work procedures
- Personal protection
- How to clean an HF spill
- Emergency procedures

Laboratory workers, who are not actually handling HF, but are working in a laboratory where HF is used, must receive HF First aid and emergency procedure training.

### 4. HAZARD



**Acute toxicity:** fatal if swallowed, in contact with skin or if inhaled.

The seriousness of poisoning caused by hydrogen fluoride depends on the amount, route, and length of time of exposure, as well as the age and preexisting medical condition of the person exposed.

Swallowing only a small amount of highly concentrated hydrogen fluoride will affect major internal organs and may be fatal.

Even small splashes of high-concentration hydrogen fluoride products on the skin can be fatal.

Breathing hydrogen fluoride can damage lung tissue and cause swelling and fluid accumulation in the lungs (pulmonary edema).



**Corrosive:** causes severe skin burns and eye damage.

Skin contact with hydrogen fluoride may not cause immediate pain or visible skin damage (signs of exposure). Often, patients exposed to low concentrations of hydrogen fluoride on the skin do not show effects or experience pain immediately. Severe pain at the exposure site may be the only symptom for several hours - visible damage may not appear until 12 to 24 hours after the exposure. The skin damage caused by concentrated hydrogen fluoride may take a long time to heal and may result in severe scarring.

Eye exposure to hydrogen fluoride may cause prolonged or permanent visual defects, blindness, or total destruction of the eye.

WorkSafe BC regulation states the ceiling limit (the concentration in air which may not be exceeded at any time during the work period) for HF is 2 ppm. Solutions of HF at concentrations of 40% or higher are capable of producing vapors.

The symptoms observed after accidental dermal exposure to HF depend on the concentration of the acid and the duration of exposure. Symptoms are delayed for concentrations under 50%; concentrations as low as 2% may cause symptoms if the skin contact time is long enough.

#### Dermal Exposure Symptoms Following HF Exposure

Concentration	Dermal Exposure Health Effects	Timing of symptoms
Less than 20%	Erythema (skin redness) and pain	Delayed up to 24 hours
20 to 50%	Erythema (skin redness) and pain	Delayed from 1 to 8 hours
Greater than 50%	Erythema, severe pain, rapid tissue destruction	Immediate

## 5. MATERIALS/EQUIPMENT

HF burn kit – must contain calcium gluconate

Spill kit – must contain HF specific absorbent (non-silicone based) and neutralizer

Personal protective equipment – see below

### A. Engineering/Ventilation Controls

All operations involving HF must be performed in a fully functional chemical fume hood.

### B. Personal Protective Equipment (PPE)

- 1) Eye Protection –A combination of safety glasses and face shield must be used when transferring and /or cleaning HF. Safety goggles must be used for any other tasks (e.g. pipetting).
- 2) Skin and Body Protection - Wear chemical resistant lab coat, long pants, and closed-toe shoes. A chemical resistant Neoprene or PVC apron must be worn on top of the lab coat.
- 3) Hand Protection - Long neoprene gloves over nitrile gloves – inspect gloves frequently and change them immediately whenever contaminated, punctured or torn. To reuse outer gloves, rinse thoroughly after use and then dip them into a saturated solution of sodium bicarbonate.
- 4) Respiratory protection – A respirator used for HF protection must be approved by SRS. A ½ face elastomeric respirator fitted with HF cartridges must be used. Respirators must be fit tested prior to use. Information on respiratory protection can be found on the [SRS website](#).

### C. Emergency Equipment

Safety shower and eye wash station must be located in the immediate vicinity of the area where HF is handled. Eye wash bottles are not acceptable.

A burn kit to be used in case of HF exposure must be present in the immediate vicinity of the experiment using HF.

## 6. SAFE WORK PRACTICES

### 6.1. Handling

- All operations involving HF must be performed in a fully functioning chemical fume hood
- The fume hood must be in the immediate vicinity of a safety shower and emergency eyewash station
- An HF spill kit and an HF first aid kit must be nearby
- A warning sign must be posted on the fume hood (Caution: Hydrofluoric Acid in use)
- Secondary containment trays are used in the fume hood to contain accidental spills
- Laboratory workers must use all personal protective equipment (particularly gloves) specified – inspect gloves frequently and change them immediately whenever contaminated, punctured or torn. To reuse outer gloves, rinse thoroughly after use and then dip them into a saturated solution of sodium bicarbonate.
- Never work alone with HF. A second person cognizant of the dangers and emergency procedures for handling HF contact must be present at all times within the laboratory while the operations with concentrated HF are being carried out.
- Work with HF should only involve plastic lab ware
- Perform detailed hazard assessment of all the steps of the procedure, introduce control measures, have decontamination neutralization procedure for equipment, and tools.
- Perform decontamination of all lab ware and equipment in the fume hood. Have detailed disposal procedure in place.

### 6.2. Storage

- Concentrated HF must be stored in an acid cabinet in a secondary containment container.
- HF containers must be clearly labelled with the arrival date.
- Secondary containment container must be constructed of polyethylene (i.e. plastic). NEVER store in glass containers.
- Do not store HF with incompatible materials such as ammonia (aqueous or anhydrous), glass, ceramics, and metals. Reactions with metals may generate potentially explosive hydrogen gas.
- Minimal quantities of material should be purchased and stored.

### 6.3. Waste

- Waste HF should be placed in a chemically compatible container and disposed of as [hazardous waste](#)
- Never dispose of HF contaminated material in the trash

## 7. EMERGENCY PROCEDURES

### 7.1. Spills

- Alert supervisor and personnel in the immediate area and ask a co-worker to bring the HF spill kit
- Isolate spill area (caution tape, signage)
- Put on PPE (face shield over safety goggles, disposable gloves, neoprene gloves on top, PVC apron over lab coat, rubber boots – if necessary)
- Follow safe work procedure for cleaning up an [acidic spill](#).
- Collect HF waste and all materials used in the clean-up in a sealed plastic container. Label the container “HF clean-up waste” and arrange for disposal as [hazardous waste](#).
- Decontaminate the PVC gloves, face shield and goggles for re-use (if not heavily contaminated); other contaminated PPE should be disposed of as [hazardous waste](#).

### 7.2. Personal contact

Exposure to this chemical is potentially life threatening! In case of skin, eye contact, inhalation or ingestion first call 911 followed by 2-4444. Show this SWP and the SDS of hydrofluoric acid to emergency responders.

#### Skin contact

- Wash the affected area immediately under running water (safety shower could be needed) and flush affected area thoroughly with cool running water for at least 5 minutes. Remove all contaminated clothing while flushing.
- Apply a generous amount of calcium gluconate gel to the affected area; the gel will turn white upon reaction with the acid. Massage the 2.5% calcium gluconate gel into the burn site. Apply every 15 minutes and massage continuously until pain and/or redness disappear or until more definitive medical care is given. It is advisable for the applier to wear protective gloves.
- Seek immediate medical attention at a hospital; continue applying gel during transport to the medical facility.

#### Eye contact

- If HF liquid or vapor has contacted the eyes, immediately flush for at least 15-20 minutes. Hold upper and lower eyelids open and away from the eye during irrigation.

#### Inhalation

- Immediately move affected person to fresh air and call 911 for medical assistance.

Always report spill and/or personal exposures in UBC Centralized Accident/Incident Reporting System [UBC CAIRS](#).

## 8. DOCUMENT INFORMATION

Written / Reviewed by: SRS Advisor, Chemical Safety  
Contact: [research.safety@ubc.ca](mailto:research.safety@ubc.ca)