C2. Handling Hydrofluoric Acid

BACKGROUND

This procedure is to be used when handling hydrofluoric acid. Its purpose is to minimize the occurrence and impact of accidents that could occur when using hydrofluoric acid.

Hydrofluoric acid is a clear, colorless liquid. It is an extremely dangerous material and all forms, including vapors and solutions can cause severe, slow-healing burns to tissue. At concentrations of less than 50%, the burns may not be felt immediately and at 20% the effects may not be noticed for several hours. At higher concentrations, the burning sensations will become noticeable much more quickly, in a matter of minutes or less. HF burns pose unique dangers distinct from other acids, it readily penetrates skin, damaging underlying tissue. The fluoride ion can then cause destruction of soft tissues and decalcification of the bones. HF can cause severe burns to the eyes, which may lead to permanent damage and blindness

HAZARD ACCORDING TO CONCENTRATION

- Concentrations of 40% or higher produce hazardous vapors
- Concentrations of less than 40% normally do not produce hazardous vapors unless heated
- Concentrations of more than 50% cause immediate severe burning, and throbbing pain
- Concentrations from 20-50% may not produce clinical signs or symptoms (including pain) after skin contact for 1-8 hours
- Concentrations less than 20% may not produce clinical signs or symptoms after skin contact for up to 24 hours.
- Concentrations as low as 2% may cause symptoms if the skin contact time is long enough.

WARNING SIGNS

Must be posted on the chemical hood and laboratory door until the HF has been returned to storage. Signs will include the information shown below:

Sample fume hood sign	*Sample door sign for when HF is in use*
Designated Area	**Designated Area**
Caution	**Caution**
Hydrofluoric Acid in Use	**Hydrofluoric Acid in Use**
Extremely Corrosive	**Extremely Corrosive**
Toxic	**Toxic**
	Authorized Personnel Only
	Safety Data Sheets are available in Room_____
	For more information, please contact:_____
	In event of a chemical spill, contact 911

STORAGE

1. Concentrated HF should be stored in an acid cabinet in a secondary containment container.
2. Secondary containment container should be constructed of polyethylene (i.e. plastic).
3. Do not store HF with incompatible materials such as glass, ceramics, and metals. Reactions with metals may generate potentially explosive hydrogen gas.
4. Due to the hazardous nature of the material only minimal quantities of material should be purchased and stored.

EXPOSURE CONTROL

The American Conference of Governmental Industrial Hygienists (ACGIH) ceiling limit for HF is 3 PPM. Local exhaust ventilation should always be used when working with HF.

PERSONAL PROTECTIVE EQUIPMENT

The following minimum Personal Protective Equipment must be worn during operations involving HF:

- Eye/face protection: Splash-proof chemical goggles with plastic face shield. Contact lenses should not be worn.
- Gloves: long, Best Ultraflex Neoprene 32 gloves over Best NDex 8005 nitrile gloves. Double-gloving is required when working with HF. Inspect gloves frequently. Change gloves frequently and immediately whenever contaminated, punctured or torn. If gloves are to be reused, rinse thoroughly after use and then dip them into a saturated solution of sodium bicarbonate.
- Wash hands immediately after removing gloves.
- A standard or disposable laboratory coat or disposable coveralls. A standard laboratory coat may be reused before laundering if it has not been contaminated with HF. A chemical-resistant apron with attached sleeves should be worn over the laboratory coat.
- Closed-toed, leather shoes (not fabric or mesh). Alternatively, boots made of polyvinyl alcohol (PVA) may be worn.

HANDLING

1. All operations involving concentrated HF will be performed in a fully functioning chemical fume hood.
2. Use secondary containment tray in fume hood for chemical and equipment, to contain potential spill
3. The laboratory worker must use all personal protective equipment (particularly gloves) specified.
4. No work with concentrated HF will be performed alone. 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.
5. Perform detailed hazard assessment of all the steps of the procedure, introduce control measures, have decontamination neutralization procedure for equipment, and tools. Perform decontamination in the fume hood. Have detailed disposal procedure in place.

FIRST AID REQUIREMENTS

1. All labs having concentrated HF must have the following:
2. All laboratory personnel working in the area must be informed of the special hazards involving the use of concentrated HF and know where the calcium gluconate gel is located.
    - For skin contact a tube of 2.5% calcium gluconate gel present within the laboratory.
    - For eye contact a sterile solution of 1% calcium gluconate or dropper bottle of 0.5 % pontocaine hydrochloride.

HF SPILLS

- If HF is spilled outside a chemical hood, evacuate the area, close the doors, post a sign to prevent others from entering, and call 911 and Campus Security (250-807-8111)
- Small spills of HF inside a chemical fume hood can be cleaned up by laboratory staff if they have the correct equipment, understand the hazards, and know how to clean up the spill safely and dispose of the waste properly. Lime soda, ash, sodium bicarbonate, or a spill absorbent specified for HF should be used for clean-up. Organic spill kits that contain Floor-dri, kitty litter, or sand should **not** be used because HF reacts with silica to produce silicon tetra fluoride, a **toxic gas**.

EMERGENCY PROCEDURES

1. In case of skin contact with concentrated HF:
    - Wash the affected area immediately under running water under either the safety shower or some other source 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. 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
2. In case of eye contact:
    - Promptly wash with copious amounts of water for at least 15 minutes while holding the eyelids apart. If the sterile solution of 1 % calcium gluconate is available, washing may be limited to 5 minutes, after which the 1 % calcium gluconate solution should be used repeatedly to irrigate the eye using a syringe.
    - If the 0.5 % pontocaine hydrochloride is available, wash the eye at least 15 minutes, after which apply one or two drops of the 0.5 % pontocaine hydrochloride.
    - Seek immediate medical attention.
3. If HF is ingested, obtain medical attention immediately.
4. If HF vapor is inhaled, move the person to fresh air and seek medical attention at once.
5. After making sure that the affected laboratory worker is capable of washing the affected area, the backup safety person should dial 911 immediately and Campus Security (250-807-8111).

WARNING: CONTACT WITH HYDROFLUORIC ACID IS EXTREMELY DANGEROUS

- Burns from small amounts of concentrated HF (48-50%) can be lethal. Read the safety literature.
- Wear heavy nitrile gloves, apron, sleeve guards and face shield.
- Wear sturdy clothes and shoes when working with HF and around the HF process bath.
- Know where the calcium gluconate is kept and how to use it to initiate treatment for any contact with HF.
- Know where the eyewash stands and emergency shower are located.
- Wipe up any drops (even suspect droplets) with multiple wet paper wipes and soak under running water for several minutes before discarding.
- Never dispose of HF-contaminated material in the trash. Neutralize waste solutions in the HF waste container.

Hydrofluoric Acid Checklist

Note: Prior to ordering hydrofluoric acid or bringing it into the laboratory, review this checklist and ensure that all required items mentioned below are immediately available in the laboratory and in good working order.

- ☐ Arrangements with local medical resources have been made to ensure that medical personnel are familiar with the toxicity and treatment of HF exposure.
- ☐ A colleague is available and aware that work with HF will be conducted.
- ☐ First aid, spill procedures and HF MSDS are immediately available in HF work area.
- ☐ Proper functioning of chemical hood has been verified (by the use of an installed chemical hood monitoring device, a smoke test using a smoke generating tube, or a mechanical or electronic device that indicates air flow).
- ☐ Eyewash and emergency shower are functioning and access is unobstructed.
- ☐ An adequate supply of calcium gluconate gel is available and within its expiration date. Neoprene or nitrile gloves are stored with the gel.
- ☐ Personal protective equipment items specified are available.
- ☐ Powdered calcium carbonate or calcium hydroxide, plastic scoop and polyethylene container (or commercial HF spill kit) are available in case of spill.