Guidelines for Working with Hydrofluoric Acid (HF)

**Introduction**

Hydrofluoric acid (HF) is a weakly corrosive but highly toxic acid used for many purposes including mineral digestion, surface cleaning, etching, and biological staining. HF’s unique properties make it significantly more hazardous than many of the other acids used on campus. This document discusses how to protect against the dangers of HF.

All persons working in the lab (not only those working with HF) should know:

* The hazards of HF.
* Where HF supplies are kept.
* How to carry out first aid procedures for an HF exposure.

Persons should not work alone when handling HF, but should use a buddy system instead.

**HEALTH HAZARDS**

*Eye and skin exposure*

HF is corrosive and readily destroys tissue *via* its high toxicity. Exposure of the eyes to HF may result in blindness or permanent eye damage. HF readily penetrates skin, allowing it to destroy soft tissues and decalcify bone. Chemical burns from HF are typically very painful and slow to heal. Skin exposure to higher concentrations of HF (approximately 50% or greater) immediately results in serious and painful destruction of tissue. Not only can skin contact cause burns, but systemic fluoride poisoning is deadly. One of HF’s most insidious properties is that skin contact at lower concentrations may not produce pain or burning sensations until hours after the exposure. Because of the ability of HF to produce severe delayed tissue damage without necessarily producing pain, all skin, eye, or tissue contact with HF should receive immediate first aid and medical evaluation, even if the injury appears minor or no pain is felt.

*Inhalation of HF vapor*

Inhaling HF vapors can seriously damage the lungs. Delayed reactions up to and including fatal pulmonary edema (flooding of the lungs with body fluids) may not be apparent for hours after the initial exposure. Airborne concentrations of 10 to 15 ppm will irritate the eyes, skin, and respiratory tract. Exposures of 30 ppm is considered immediately dangerous to life and health and may have irreversible health effects. At airborne concentrations above 50 ppm, even brief exposure may be fatal.

**CHEMICAL FUME HOOD**

* HF must be used with adequate ventilation to minimize inhalation of vapor. Concentrations greater than 5% should always be handled inside a properly functioning chemical fume hood. The chemical fume hood needs to have a current calibration sticker.
* Prevent contamination of the work surfaces by placing plastic trays on the work surface before starting HF procedures.

**PERSONAL PROTECTIVE EQUIPMENT (PPE)**

*Eye Protection*

* Chemical splash goggles in addition to face shield when handling concentrated HF. Due to HF’s highly toxic nature, safety glasses with side shields do not provide adequate eye protection.

*Gloves*

* Medium or heavyweight viton, nitrile, or natural rubber gloves should be worn when working with HF. Silver Shield® gloves are the best option. Always consult the manufacturer’s glove selection guide when selecting a glove for HF. If you have any questions about which glove to choose, contact HSE at researchsafety@kaust.edu.sa.
* A second pair of nitrile exam gloves should be worn under the gloves for protection against leaks.
* Gloves that have not been contaminated with HF may be disposed of in the common trash. If gloves become contaminated with HF, remove them immediately, thoroughly wash your hands, and check your hands for any sign of contamination. Contaminated gloves must be disposed of as HF hazardous waste.

*Body Protection*

* Wear a laboratory coat with a chemical splash apron made out of natural rubber, neoprene, or viton. Never wear shorts or open-toed shoes when handling HF or other corrosive chemicals.

**FIRST AID**

***All exposures to HF require immediate first aid and prompt medical treatment.***

*Skin Exposure*

1) Move the victim immediately under an emergency shower or other water source and flush the affected area with large amounts of cool running water. *Immediately washing off the acid is of primary importance.*

2) Remove all contaminated clothing while flushing with water.

3) While the victim is being rinsed with water, someone shall call 911 (012-808-0911 from mobile) for emergency medical assistance. Inform 911 that the accident involves exposure to hydrofluoric acid.

4) Immediately after flushing with water begin massaging Calcium gluconate gel into the burn site. Apply the gel every 15 minutes and massage until pain/redness resolve or until medical care is available. *Wear gloves when applying the gel to prevent transfer of HF and secondary burns.*

*Eye Exposure*

1) Immediately flush eyes for at least 15 minutes with copious cool flowing water.

2) If only one eye is affected, be careful not to flush contaminated water into the other eye.

3) Call 911 (012-808-0911 from mobile).

4) Apply ice water compresses during transport.

*Inhalation*

1) Ensure the victim's clothing or skin has not been contaminated by HF before removing him to fresh air.

2) If breathing has stopped, begin artificial respiration.

3) Call 911 (02-808-0911 from mobile) for immediate medical assistance.

*Swallowing*

1) Rinse the mouth with cold water. Do not induce vomiting.

2) If the victim is conscious, have them drink lots of water to dilute the acid. Follow with milk or milk of magnesia if available.

3) Call 911 (02-808-0911 from mobile) for immediate medical assistance.

**CALCIUM GLUCONATE GEL**

Calcium gluconate gel is a topical antidote for HF skin exposure. Calcium gluconate works by combining with HF to form insoluble calcium fluoride, thus preventing the extraction of calcium from tissues and bones. Keep calcium gluconate gel nearby whenever you’re working with HF. Calcium gluconate  has a limited shelf life and should be stored in a refrigerator if possible and replaced with a fresh supply after its expiration date has passed. Use disposable nitrile gloves to apply calcium gluconate gel. Even after applying calcium gluconate, it is essential that a medical evaluation be made.

**HF FIRST AID KIT**

Every lab that handles HF must have an HF spill kit available.

 *HF Kit Contents:*

* Calcium gluconate gel.
* Disposable coveralls (to wear if clothing becomes contaminated).
* 2 pairs nitrile gloves.
* SDS and medical treatment instructions.
* Heavy plastic waste bag for waste items.

**SPILLS**

If HF is spilled outside a chemical hood, evacuate the area, close the doors, post the area with a sign to prevent others from entering, and call 911 (012-808-0911 mobile).  Small spills of HF inside a chemical fume hood can be cleaned up by laboratory staff if they have received spill clean-up training from HSE, have the correct equipment, understand the hazards, and are confident in their ability to clean up the spill safely and dispose of the waste properly. Calcium carbonate, 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 tetrafluoride, a toxic gas.