Trent University

Standard Operating Procedures

**Hydrofluoric Acid**

*This standard operating procedure (SOP) is intended to provide general guidance on how to safely work with Hydrofluoric Acid. This SOP is generic in nature and only addresses safety issues specific to Hydrofluoric Acid. In some instances, several general use SOPs may be applicable for a specific chemical. Always refer to the SDS for more detailed information. This SOP requires a signature of the Supervisor or PI for the use of HF acid. Once completed, forward a signed copy of this SOP to the EHSO, Human Resources for approval.*

**Introduction:**

Hydrofluoric acid (HF) has a number of chemical, physical and toxicological properties that can make handling this particular material very hazardous. Anhydrous HF is a clear, colorless, fuming, corrosive liquid with a density similar to that of water. HF is also available in the gaseous state . All forms including the solution or the vapor can cause severe burns to tissue. HF is a contact poison.

Concentrated hydrofluoric acid is used in the fabrication of electronic components, to etch glass and in the manufacture of semiconductors. It is also used by geologists to dissolve sedimentary rock . Dilute hydrofluoric acid solutions are used in some biological staining procedures . 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,

explosive hydrogen gas may be formed. HF must be used and stored in polyethylene, polypropylene, Teflon, wax, lead or platinum containers.

**Toxicology:**

Anhydrous hydrogen fluoride and hydro fluoric acid are extremely corrosive to all tissues of the body. Skin contact results in painful deep-seated burns that are slow to heal. Burns from dilute (<50%) HF solutions do not usually become apparent until several hours after exposure; more concentrated solutions and anhydrous HF cause immediate painful burns and tissue destruction. HF burns pose unique dangers distinct from other acids such as HCl or H2SO4: un-dissociated HF readily penetrates the skin, damaging underlying tissue; fluoride ion can then cause destruction of soft tissues and decalcification of the bones. HF acid and vapour can cause severe burns to the eyes, which may lead to permanent damage and blindness. At 10-15 ppm, HF vapour is irritating to the eyes, skin and respiratory tract. Exposure to higher concentrations can result in serious damage to the lungs, and fatal pulmonary edema may develop after a delay of several hours. Brief exposures (5 min) to 50-250 ppm may be fatal to humans. Ingestion of HF can produce severe injury to the mouth, throat and gastrointestinal tract and may be fatal. [ from Laboratory Chemical Safety Summary: Hydrogen Fluoride and Hydrofluoric acid, NRC , July 1994].



HF burns, not evident until a day after (dilute solutions).

**All work with HF should be done in a fumehood.**

Users must familiarize themselves with the specific hazards and toxicity of the compounds they are working with, which can be found on the chemical’s Safety Data Sheet (SDS). SDSs are available through the ChemWatch link on Trent’s Science Safety Webpages: www.trentu.ca/scienceservices

**Exposure Control:**

The ACGIH ceiling limit and OSHA TWA for HF is 3 ppm. Local exhaust ventilation should always be used when working with HF**.**

**Personal Protective Equipment**:

The purpose of personal protective equipment (PPE) is to shield the individual in the event of a release of a vapor, a spill or other incident. PPE is not a substitute for safe work practices.

**Eye protection**: must be used during handling of any quantity of HF. The following eye protection will be used: Chemical goggles together with a face shield are recommended.

**Skin Protection**: Thick Neoprene or Nitrile gloves or other HF-resistant gloves should be worn. HF burns around the fingernails are extremely painful, difficult to treat, and may require surgical removal of the nail.

It is also recommended that an acid resistant suit or apron be used since some clothing can absorb HF solutions and maintain it close to the skin. A fastened lab coat (or equivalent) would normally be considered a minimum.

**Respiratory Protection**: All work with HF must be in a fumehood or fume containing device.

 **Handling Procedures**

* Never use Hydrofluoric Acid when working alone after hours. Hydrofluoric Acid may be used when working alone during normal working hours provided knowledgeable laboratory personnel have been alerted and at least one is in the general vicinity to provide assistance if necessary. The Lab Supervisor/Principle Investigator (LS/PI) must be notified prior to any unaccompanied use of HF.
* All lab personnel, not just those who will be using Hydrofluoric Acid, must be informed of the dangers of this chemical and the emergency procedures necessary in case of an accident. A sign should be posted on the lab door to alert people that work with Hydrofluoric Acid is in progress.
* All persons who use Hydrofluoric Acid must be made aware of its properties and trained in proper procedures for use and disposal. The LS/PI is responsible for providing this training. Records of the training should be maintained by the LS/PI.
* Laboratories which keep or use Hydrofluoric Acid gas or concentrated solutions (>1% Hydrofluoric Acid) must have these emergency procedures on hand as well as the appropriate MSDS.
* Laboratories which keep or use Hydrofluoric Acid gas or concentrated solutions (>1% Hydrofluoric Acid) must have an operational safety shower and eye wash in their laboratory. Before beginning any procedure involving Hydrofluoric Acid, make sure the access to the emergency shower and eyewash is unobstructed.
* Undergraduate students should never be given the task of mixing Hydrofluoric Acid solutions.
* Only experienced persons familiar with its properties should handle the concentrated acid. The LS/PI is responsible for ensuring appropriately trained individuals mix hydrofluoric acid solutions.
* A small supply of appropriate neutralizer for spills should be kept near the fume hood where the work will be conducted. If a small quantity (100 ml o r less ) of dilute Hydrofluoric Acid solution is spilled, clean it up by absorbing spilled material with the supplies in the Chemical Response Kit, and apply neutralizer to decontaminate surfaces. In some instances, powdered calcium carbonate or calcium hydroxide may be used to neutralizes pilled material. If a larger amount is spilled, or if the acid is concentrated, contain the spill as best as you can using supplies in the Chemical Response Kit, evacuate the area, and call Security at 1333. Avoid exposure to the vapors.
* Dispose of unwanted hydrofluoric acid through the Chemical Waste Procedures.
* When working with Hydrofluoric Acid or concentrated HF solutions (> 1%):
	1. Work in a fume hood with the sash as low as possible .
	2. Wear PPE as defined above or in the SDS.
	3. Wear a long -sleeved , fastened lab coat, pants or long skirt, and closed- toe shoes.
	4. Wear thick Neoprene or Nitrile gloves or HF-resistant gloves (see SDS).
* The LS/PI must be notified before any work with hydrofluoric acid occurs outside the chemical fume hood.
* Any exposure to Hydrofluoric Acid must be medically evaluated.

**Emergency Response**

 Hydrofluoric Acid Exposure Kit:

Before beginning work involving HF an exposure kit should be available and located in the laboratory area.

Spill Exposure Kit.

The exposure kit should contain the following items:

A. Container (tube) of 2.5% calcium gluconate gel. This gel is available from several suppliers. The gel must be inspected at least monthly to ensure that it is available and has not reached the expiration date. If the gel has exceeded its shelf life or has been opened (i.e., used ), a new tube must be purchased and the oldcontainer discarded.

B. Two pairs of thick Neoprene or Nitrile gloves.

C. Chemical Spill Kit (see Lab Chemical Spill Kit)

D. Copy of these procedures and MSDS to provide to emergency response personnel.

E. Calcium Carbonate (antacid tablets).

**Emergency Medical Response Procedures**:

**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 for at least 5 minutes.

Clothing, shoes and jewelry should be removed while the water is flowing on to the victim. Goggles should be removed last while the victim is facing the water flow. Colleagues must be EXTREMELY CAREFUL not to become contaminated while assisting the victim. Thick Neoprene or Nitrile must be worn.

2. While the victim is being rinsed with water, call Security at 1333 and request 911 and inform the emergency dispatcher of the exposure and request emergency transport. Ensure emergency responders and treating physicians are aware of the nature of the chemical exposure. Provide a copy of the MSDS to emergency responders.

3. After the affected area is flushed with copious amounts of water for at least five minute, apply 2.5% calicum gluconate gel according to this procedure. Massage gel into affected areas. Flush skin surfaces with water for at least 15 minute s if calcium gluconate gel is not available. 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 first putting on thick neoprene or nitrile gloves. **Do not** use latex gloves because they are **not** an effective barrier against HF . Note the time when the calcium gluconate gel was first applied to the contaminated skin and provide this information to the emergency responders. Re-apply gel every 15 minutes until medical assistance arrives.

4. After the emergency responders arrive they will call the Emergency Room doctor for

instructions and may administer the calcium carbonate tablets.

Spill Exposure Kit.

**Eye Exposure**:

1. Immediately flush eyes for at least 5 minutes with copious cool flowing water. Call Security at 1333 and request 911, inform the emergency dispatcher of the exposure and request emergency transport. The victim should then be transported to a medical facility. MEDICAL PERSONNAL may apply a sterile 1% calcium gluconate solution to the victim’s eyes after irrigation.

2. Ensure emergency responders and treating physicians are aware of the nature of the

chemical exposure. Provide a copy of the MSDS to emergency responders.

**Inhalation**:

If a large volume of Hydrofluoric Acid gas is inhaled:

1. Immediately remove the victim to clean air. Call Security and request 911, inform the emergency dispatcher of the exposure and request emergency transport.

2. Ensure emergency responders and treating physicians are aware of the nature of the

chemical exposure. Provide a copy of the MSDS to emergency responders.

3. Inhalation of Hydrofluoric Acid fumes may cause swelling in the respiratory tract up to 24 hours after exposure. Persons who have inhaled Hydrofluoric Acid vapors may need

prophylactic oxygen treatment and must be seen by a physician as soon as possible.

**Disposal of Waste HF**:

HF acid (irregardless of concentration) is to be disposed of as Hazardous Chemical waste. As HF acid reacts with Glass, all waste HF should be stored in containers made of Polypropylene, polyethylene, Teflon or other non-reacting material. Containers used to store waste HF must be labelled “Waste HF Acid Danger” with the approximate v/v or w/v concentration. Ensure the outside of the container is not contaminated in any way and always wear eye protection, appropriate gloves and lab wear when handling the waste. In addition to following the Hazardous Chemical Waste procedures as described in the Chemical Use, Storage and Waste Guide, the chemical waste personnel must be informed that waste HF will be left in the waste vestibules prior to the material being delivered so that it can be immediately secured and inventoried.

**Please list the compounds used by this research group which are covered by this procedure. The list should also include the building/room where they are used.**

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**Lab Specific Protocol/Procedure:**

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 I agree that I have read this SOP and will follow the procedures described above. Any deviation from this SOP or the SDS for the specific chemical(s) in use will only occur to make a safer situation.

Principal Investigator’s Signature/Date

**Once completed, this form should be forwarded to the ESHO, Human Resources for approval.**

**EHSO approval: Signature/Date**

Precautionary information in the SDS always takes precedence over information provided in this SOP.

Last revised Dec. 2019.