INTRODUCTION

Hydrofluoric acid (HF) has a number of chemical, physical and toxicological properties, which make handling this material especially hazardous. Anhydrous HF is a clear, colorless, fuming, corrosive liquid. HF is also available in the gaseous state. All forms including the solution or the vapor can cause severe burns to tissue. If a laboratory wishes to use Hydrofluoric Acid, Contact EH&S for proper training and to arrange for delivery of calcium gluconate gel.

USES

Concentrated hydrofluoric acid is used in the fabrication of electronic components, to etch glass and in the manufacture of semiconductors. Dilute hydrofluoric acid solutions are used in some biological staining procedures.

CHEMICAL PROPERTIES

Hydrofluoric acid solutions are clear and colorless with a density similar to that of water. 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. Use and store HF in polyethylene, polypropylene, Teflon, wax, lead or platinum containers.

TOXICOLOGICAL PROPERTIES

Fluoride ions are both acutely and chronically toxic. Acute effects of HF exposure include extreme respiratory irritation, immediate and severe eye damage and pulmonary edema. Skin, eye, or lung exposure to concentrated (>50%) HF solutions will cause immediate, severe, penetrating burns. Exposure to less concentrated solutions may have equally serious effects, but the appearance of symptoms can be delayed for up to 24 hours. If you are exposed to hydrofluoric acid seek medical attention immediately, even if you do not feel pain.

EXPOSURE CONTROL, PPE AND WORK PRACTICES

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

The purpose for personal protective equipment (PPE) is to shield the individual in the event of a release of vapor, a spill or other incident. PPE is not a substitute for safe work practices. Eye protection in the form of safety glasses or goggles and a face shield should be used. Stanzoil Neoprene or Stanzoil Nitrile (22mil) gloves or other HF resistant gloves should be worn. It is also recommended that an acid resistant suit or apron be used (Some clothing is able to absorb the toxic material and maintain it close to the skin).
In order to warn and protect others from the hazard of HF, a warning sign indicating the use of HF should be posted.

**HF Exposure Kit**
Before beginning work involving HF an exposure kit must be available and located in the laboratory area. The exposure kit must contain the following items:

1. Container of calcium gluconate gel.
   - This gel must be inspected before each use of HF or at least monthly to ensure the gel has not been removed or has not reached the expiration date. If a tube of the gel has been opened, a new container must be purchased and the old container discarded. No work with HF can be done with an expired tube of calcium gluconate gel.

2. 2 pairs of Stanzoil Neoprene or Stanzoil Nitrile (22mil) gloves.

3. 1 heavy-duty polyethylene bag to be used for items contaminated by HF.

4. 1 HF Contaminated Waste Label.

5. Copy of these procedures and MSDS to take to the emergency room.

**Emergency 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 1 minute. While the victim is flushing with water, they should also take off all clothing, shoes and jewelry that has been impacted by the acid or that can be a collection point for acid as one washes. Removing goggles last. Close your eyes face water flow and pull goggles over head. BE EXTREMELY CAREFUL NOT TO CONTAMINATE YOURSELF (USE Stanzoil Neoprene or Stanzoil Nitrile (22mil) gloves LOCATED IN THE HF EXPOSURE KIT TO ASSIST).

2. Remove all contaminated clothing while flushing with water. Some clothing is able to absorb the toxic material and maintain it close to the skin.

3. While the victim is being rinsed with water, someone should call to arrange treatment by medical personnel. Call 911 and tell the dispatcher the following:
   a. There is a person that has been in exposed to Hydrofluoric Acid and the victim is in this location.
   b. Please send paramedics and an ambulance.
Immediately washing off the acid is of primary importance!

4. After the affected area is flushed with copious amounts of water for at least one minute, calcium gluconate gel is to be applied using these guidelines. A 2.5% calcium gluconate gel will be located inside the HF exposure kit within the laboratory. 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 putting on the **STANZOIL NEOPRENE OR STANZOIL NITRILE (22MIL) GLOVES** in the HF exposure kit. Do not use latex gloves; they are not effective against HF. Note the time when the calcium gluconate gel was first applied to the contaminated site. Provide this information to the Emergency Management Services (EMS) team.

5. If the victim is not conscious they must be escorted to the hospital by the responding person or assisting lab personnel.

6. If hydrofluoric acid is mixed with other substances that information must be provided to the attending physician. A copy of the MSDS(s) must be also taken to the hospital.

7. All clothing and items contaminated with HF will be handled as hazardous waste. An attempt to clean personal items (wallets, rings, watches) will be attempted. If successful the will be turned over to the victim. If they cannot be cleaned then their disposal will be documented. Uncontaminated items left with clothing will be turned over to the University Police.

**EYE EXPOSURE** *(THERE IS NO EXCUSE FOR THIS TO OCCUR)*

1. Immediately flush eyes for at least 5 minutes with copious cool flowing water. The victim should then be transported to a medical facility.

2. Inform Emergency Responders of Hydrofluoric Acid exposure and instruct them to notify hospital of person in transport.

3. The victim must be escorted to the hospital by the responding person or assisting lab personnel.

4. If hydrofluoric acid is mixed with other substances that information must be provided to the attending physician. A copy of the MSDS(s) must be also taken to the hospital.

**INHALATION**

If a large volume of Hydrofluoric Acid gas is inhaled:

1. Immediately remove the victim to clean air. Call 911.
2. Inform the emergency responders of Hydrofluoric Acid exposure.

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.

4. USING HYDROFLUORIC ACID SAFELY

1. *Never use Hydrofluoric Acid when working alone or 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.

2. All lab personnel, not just those who will be using Hydrofluoric Acid, should be informed of the dangers of this chemical and the emergency procedures necessary in case of an accident. A sign should be posted to alert people that work with Hydrofluoric Acid is in progress.

3. All persons who will be using Hydrofluoric Acid must be made aware of its properties and trained in proper procedures for use and disposal.

4. Laboratories which keep or use Hydrofluoric Acid gas or concentrated solutions (>1% Hydrofluoric Acid) should have these emergency procedures on hand as well as an MSDS.

5. 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.

6. Only experienced persons familiar with its properties should handle the concentrated acid.

7. Transporting HF in glass beakers between labs. This should be conducted when hallways are empty. The beaker will be covered with parafilm (no holes) and place the beaker inside a secondary plastic container and cover it as appropriate. Two people should be present to transport the HF, one to transport the HF and one to open doors and keep any one who happens by away.

8. A small supply of calcium carbonate or calcium hydroxide for spills should also be kept near the fume hood where the work will be conducted. If a small quantity (100 ml or less) of dilute Hydrofluoric Acid solution is spilled, clean it up by applying powdered calcium carbonate or calcium hydroxide, or use a commercial Hydrofluoric Acid spill kit. If a larger amount is spilled, or the acid is concentrated, contain the spill as best you can, evacuate the area, and call EH&S. If EH&S can not be reached contact the Work Order Desk or Campus Police and they will be able to contact EH&S personnel. Avoid exposure to the vapors.
9. When working with Hydrofluoric Acid or concentrated HF solutions (> 1%):
   - Work in a fume hood with the sash as low as possible. Wear goggles and a face shield.
     Wear a long-sleeved, buttoned lab coat, pants or long skirt, and closed-toe shoes. Wear
     Stanzoil Neoprene or Stanzoil Nitrile (22mil) gloves or other Hydrofluoric Acid
     resistant gloves (Hydrofluoric Acid burns around the fingernails are extremely painful,
     difficult to treat, and may require surgical removal of the nail). A chemically resistant
     apron is also recommended.

10. Any exposure to Hydrofluoric Acid must be medically evaluated.

11. All personnel working with HF must read, acknowledge, and abide by all of the
    aforementioned rules, policies, procedures and safe work practices.

Reference: Material Adapted from the University of Delaware.

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