

Standard Operating Procedure	North Dakota State University	Chemical Safety
Author(s): WCD	Date: February 1, 2005	SOP-CS-001

Title: Safe Use Of Hydrofluoric acid

Purpose: To insure the safe use of Hydrofluoric Acid, HF, and provide information on spill and emergency procedures.

Equipment: N/A

Procedure: N/A

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.

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, 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.
 - a. 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 gel has been opened, it must be replaced.
 - b. The old container must go through the NDSU hazardous waste program.
 - c. No work with HF can be done with an expired tube of calcium gluconate gel.
2. Two pairs of Stanzoil Neoprene or Stanzoil Nitrile (22mil) gloves.
3. One heavy-duty polyethylene bag to be used for items contaminated by HF.
4. One Waste Label.
5. Copy of these procedures and MSDS to take to the emergency room.
6. Calcium Carbonate (antacid tablets).
7. Additional items:
 - a. HF specific absorbent material.
 - b. A pair of non-reactive tongs.

EMERGENCY RESPONSE PROCEDURES:

General Procedure for *All Exposures*

Activate buddy system response immediately:

1. The buddy should call **911**
 - you have a Hydrofluoric Acid exposure
 - give the exact location
 - instruct them send ambulance and notify hospital of person in transport
2. The buddy should call NDSU OSEH 231-7759

Procedure for Skin Exposure:

1. Help individual to eyewash/safety shower: **Do not contaminate yourself; use PPE)**
 - 1-5 minutes in the safety shower
 - Victim should remove all contaminated items (i.e. clothing, shoes and jewelry)

- while under the shower)
- Remove goggles last, face water and pull over head
2. Buddy should bag all contaminated clothing and supplies (USE PPE)
 3. Victim should self administer calcium gluconate:
 - if the victim is unable to administer, the buddy can assist using the neoprene gloves
 - **NOTE THE TIME OF INITIAL APPLICATION** (may need to apply every 20 minutes until pain subsides or reaches medical facility)
 4. Take 6 Calcium Carbonate tablets (TUMS) if conscious
 5. Inform Emergency Medical Personnel that calcium carbonate and calcium gluconate have been administered

Procedure for Eye Exposure

1. Use eyewash for 15 minutes – holding lid open (both lower and upper) for irrigation and wait for emergency response personnel
2. Conduct this process for both liquid or vapor contamination
3. Take 6 Calcium Carbonate tablets (TUMS) if conscious
4. Inform Emergency Medical Personnel that calcium carbonate was administered.

Procedure for Inhalation Exposure

1. Immediately remove the victim to clean air if it is safe to do so
2. Victim should ingest 6 calcium carbonate tablets if conscious and wait for emergency medical response
3. Inform Emergency Medical Personnel that calcium carbonate has been administered

General Notes:

1. The responding person or assisting lab personnel must escort the victim to the hospital.
2. A copy of the MSDS, the calcium carbonate tablets, the calcium gluconate gel and these emergency procedures must be also taken to the hospital.

General Procedure for *All HF Spills*

Please follow basic spill procedures:

1. Alert others in the area
2. Contain the spill if safe to do so
3. Cordon off area
4. Leave the area and contact 911 or x1-7759 and specify that you have a hydrofluoric acid spill.
5. Let spill response personnel know where you will be so that they can meet you for additional information
6. OSEH is responsible for the clean up of all HF spills.

USING HYDROFLUORIC ACID SAFELY

1. ***Never use Hydrofluoric Acid when working alone or after hours.*** The buddy system must be implemented whenever using HF. Everyone working with or around HF must

have the NDSU HF training before commencing any work and an annual refresher training thereafter.

2. A sign should be posted to alert people that work with Hydrofluoric Acid is in progress.
3. Everyone working with HF must be properly trained on the appropriate waste management.
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. All HF gas cylinders must be kept in vented gas cabinets.
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.
 - a. Before beginning any procedure involving Hydrofluoric Acid, make sure the access to the emergency shower and eyewash is unobstructed.
6. 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.
7. Any exposure to Hydrofluoric Acid must be medically evaluated
8. When working with Hydrofluoric Acid or concentrated HF solutions (> 1%):
 - a. No HF work is to be conducted outside of a properly operating fume hood that has a current certification sticker.
 - b. All work must be conducted in a secondary container inside the chemical fume hood.
 - c. Work in a fume hood with the sash as low as possible.
 - d. 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.

Waste Disposal Procedures

1. **Regardless of the concentration of HF, it may not be put down the drain. It may also not be neutralized and put down the drain.**
2. Collect waste HF in a clearly labeled, appropriate container with a screw cap. Glass and metal are unsuitable containers. Do not mix different kinds of acids together. Hazardous waste labels are available from the Safety Office. When the waste container is sufficiently full or when the experiment using HF is complete, contact the Safety Office (ext. 1-7759) for pick up.