

HYDROFLUORIC ACID – SAFETY GUIDELINE

1.0 Purpose & Scope

This guideline describes methods for safely using, storing, and disposing of Hydrofluoric acid, Antisal 2B, Hydrofluoride acid, or Fluoric acid (HF). This guideline applies to all Northern Arizona University personnel whose work involves HF.

2.0 Introduction

Hydrofluoric acid, known as HF, is an extremely corrosive 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 in laboratories. This guideline discusses how to protect against the dangers of HF.

HF is very aggressive physiologically because of the fluoride ion. Both anhydrous hydrofluoric acid and its solutions are clear, colorless liquids. When exposed to air, concentrated solutions and anhydrous hydrofluoric acid produce pungent fumes which are especially dangerous.

WARNING: Burns with concentrated HF are usually very serious, with the potential for significant complications due to fluoride toxicity. **Concentrated HF, liquid or vapor, may cause severe burns, metabolic imbalances, pulmonary edema and life threatening cardiac arrhythmias. Even moderate exposures to concentrated HF may rapidly progress to fatality if left untreated.**

Every effort must be made to prevent exposure to HF. Following this guideline will provide the information and tools to protect you and assist in getting necessary medical treatment in the event of an exposure.

3.0 Responsibilities

3.1 Principal investigators (PI)

PIs shall ensure that this guideline is read and implemented in their work areas and labs. All work areas using HF will be marked to alert all persons of the presence of HF. They shall ensure that all workers using HF receive the appropriate training before using HF. PIs will provide all workers with the MSDS, protective equipment and warning signs for HF. PIs will notify the Office of Regulatory Compliance (ORC) of HF use in the laboratory.

3.2 Hydrofluoric Acid (HF) Users

HF Users shall ensure this guideline is read and implemented in all work areas and labs that are using, storing, and disposing of HF. All users will attend a documented training session on the proper handling, storage and first aid procedures for HF. All users will read the MSDS for HF, know the first aid/medical treatment procedures and spill response for HF.

3.3 The Office of Regulatory Compliance (ORC)

ORC will provide training to all workers and PIs prior to HF use in the laboratory.

4.0 Health Hazard Data

Inhalation: Severely corrosive to the respiratory tract and may cause sore throat, coughing, labored breathing and lung congestion/inflammation.

Ingestion: Corrosive to the skin. Skin contact causes serious skin burns which may not be immediately apparent or painful. Symptoms may be delayed 8 hours or longer. The fluoride ion readily penetrates the skin causing destruction of deep tissue layers and even bone.

Eye Contact: Corrosive to the eyes. Symptoms of redness, pain, blurred vision, and permanent eye damage may occur.

Chronic Exposure: Intake of more than 6 mg of fluorine per day may result in fluorosis, bone and joint damage. Hypocalcaemia and hypomagnesaemia can occur from absorption of fluoride ion into blood stream.

Aggravation of Pre-existing Conditions: Persons with pre-existing skin disorders, eye problems, or impaired kidney or respiratory function may be more susceptible to the effects of this substance.

5.0 First Aid

NOTE: Individuals assisting victim should wear appropriate gloves to prevent secondary HF burn.

5.1 Skin Exposure

5.1.1 Move victim immediately under safety shower or other water source and flush affected area. Speed and thoroughness in washing off the acid is of primary importance.

5.1.2 Remove clothing while continuing to flush with water.

5.1.3 Rinse with large amounts of running water for 2-5 minutes. Apply a 2.5% calcium gluconate gel to the affected area. Massage gel into the burn site; apply

frequently and continuously until pain and/or redness disappear or until medical help arrives.

- 5.1.4 While victim is being treated, someone should call x33000 and request immediate medical assistance/transport to Emergency Room (ER)

NOTE: Hospital ER must be notified than an HF victim will be arriving for immediate treatment.

- 5.1.5 Victim must be transported to hospital for additional examination and/or treatment

- 5.1.6 Provide EMT/transport personnel with HF MSDS or other chemical information for hospital.

5.2 Eye Contact

- 5.2.1 Immediately flush the eyes for at least 15 minutes with large amounts of gently flowing water. Hold the eyelids open and away from the eye during irrigation to allow for thorough flushing of the eyes.

- 5.2.2 If the person is wearing contact lenses, the lenses should be removed, if possible. However, flushing with water should not be interrupted.

NOTE: Do not use skin treatment gel for eye contact burns.

- 5.2.3 While victim is being treated, someone should call x33000 and request immediate medical assistance/transport to Emergency Room (ER)

NOTE: Hospital ER must be notified than an HF victim will be arriving for immediate treatment.

- 5.2.4 Victim must be transported to hospital for additional examination and/or treatment

- 5.2.5 Provide EMT/transport personnel with HF MSDS or other chemical information

5.3 Inhalation of Vapors

- 5.3.1 Immediately move victim to fresh air and get medical attention

- 5.3.2 Keep victim warm, quiet and comfortable. If breathing has stopped, start CPR at once.

- 5.3.3 Check victim for vapor burns to the skin and treat as in 4.1.

- 5.3.4 While victim is being treated, someone should call x33000 and request immediate medical assistance/transport to Emergency Room (ER)

NOTE: Hospital ER must be notified than an HF victim will be arriving for immediate treatment.

- 5.3.5 Victim must be transported to hospital for additional examination and/or treatment
- 5.3.6 Provide EMT/transport personnel with HF MSDS or other chemical information

5.4 Ingestion of Acid

- 5.4.1 Have the victim drink large amounts of water as quickly as possible to dilute acid. DO NOT induce vomiting. Never give anything by mouth to an unconscious person.
- 5.4.2 Giver several glasses of milk or several ounces of milk of magnesia or grind up and administer 30 antacid tablets with water. The calcium or magnesium in these compounds may act as an antidote.
- 5.4.3 While victim is being treated, someone should call x33000 and request immediate medical assistance/transport to Emergency Room (ER)

NOTE: Hospital ER must be notified that an HF victim will be arriving for immediate treatment.

- 5.4.4 Victim must be transported to hospital for additional examination and/or treatment.
- 5.4.5 Provide EMT/transport personnel with HF MSDS or other chemical information.

6.0 Safety Controls:

All personnel who work with HF should undergo safety training prior to working with this chemical, have access to and have read the Material Safety Data Sheet (MSDS), review and understand this guideline and understand emergency first aid treatment for HF exposure.

6.1 Substitution:

Determine if a less hazardous substance can be substituted for HF or use a less concentrated solution in the applied research or application.

6.2 Work in the Fume Hood:

All HF work must be conducted in a HF designated and properly function fume hood.

6.3 Safety Equipment:

The area must be equipped with a safety shower (may be in hall) or drench hose (within lab space) and HF spill kit, which includes a 2.5% calcium gluconate gel. (The PI must ensure that the calcium gluconate gel is not expired).

6.4 Warnings:

Post warning signs on designated fume hood.

6.5 General Safety

- Do not work alone, if possible.
- Do not eat, drink or smoke where HF is handled.
- Wash hands thoroughly after handling (after glove removal).
- Store according to proper procedures (see section 8.0)
- Transport in an appropriate secondary container.
- Ensure a working phone is in the lab space.

7.0 Personal Protective Equipment (PPE)

Be sure that you are using personal protective equipment that has been shown to effectively protect against HF exposure. Always double check your equipment before each use of HF.

7.1 Respiratory Protection

HF should be used within a properly functioning fume hood to minimize inhalation of vapor. (The hood sash should be kept as low as possible.) If a fume hood is not practical for the operation, contact the Office of Regulatory Compliance (ORC) prior to working with HF for a mandatory safety audit (includes respiratory protection plan).

7.2 Eye Protection

All users must wear a full-face shield when working in a hood with the sash pulled down below the face. This will prevent splash hazards in a spill situation. Splash goggles must be worn with a full-face shield when work is performed outside of a hood.

NOTE: Safety glasses with side protectors do not protect from splashes.

7.3 Body Protection

Wear a laboratory coat with a chemical splash apron made out of neoprene or Titon®. Never wear shorts, skirts, or open toes shoes in the lab or when handling HF.

7.4 Hand Protection

7.4.1 Nitrile gloves are sufficient for use with HF, and hands should be double gloves. Other gloves recommended for use with HF that do not require double gloves include:

- 22 mil nitrile
- 25 mil Butyl rubber (recommended for incidental spill clean-up)

- Polyvinyl chloride (PVC)
 - Neoprene
 - Viton®
- 7.4.2 If possible, double glove at all times to protect against pin holes or tears.
- 7.4.3 **DO NOT use latex gloves**; they are not effective against HF.
- 7.4.4 Discard used gloves, after rinsing with water, into a trash receptacle. If gloves are significantly contaminate with HF, discard into hazardous waste disposal container to prevent secondary contamination to person using regular trash receptacles.
- 7.4.5 Thoroughly wash hands after glove removal and check hands for any sign of contamination.

8.0 Storage Requirements

HF should be stored in its original container with all markings intact.

HF should be kept in tightly closed polyethylene containers. These containers should be stored in a cool, dry, well-ventilated place away from other chemicals. Empty containers can be hazardous, since residual vapors or liquid may be present.

HF transfer from larger container to smaller container should take place in a designated fume hood. The small container must be identified with the NFPA label and chemical name according to labeling procedures in NAU's Chemical Hygiene Plan. The smaller container must be of a compatible material to hold and store the HF.

NOTE: Do not use squirt or squeeze bottles because overpressure may force HF out of the nozzle. It is recommended to use a dropper bottle in these situations.

9.0 Spill Cleanup

9.1 Definitions

In general, two types of chemical spills (a.k.a releases) can occur at NAU facilities:

- Incidental Spill – a small chemical spill that the user can clean up safely, easily and without assistance from emergency response personnel.
- Hazardous Spill – a chemical spill requiring the assistance of the emergency response team or outside responders (call x33000)

9.2 Incidental Spill

An incidental spill of HF, in the work area, may be cleaned by the user if they are knowledgeable of the material and have the ability and equipment to safely accomplish this. In the event of a spill, consult the MSDS again to ensure that you and others follow the recommended cleanup procedures. HF spill kits are required in areas where the chemical is used.

9.2.1 Incidental Spill Cleanup

- Attend to any person that has been exposed to HF, utilizing emergency drench hoses, eyewashes, or showers, and phoning for assistance. Follow first aid procedures in Section 5.
- Keep fume hoods operating to remove vapors.
- Limit the area of the spill as much as possible by using absorbent materials that are available in the HF spill kit (see section 9.4 for minimum contents).
- After cleanup, manage the contaminated materials as hazardous waste and request a waste pickup (Contact ORC).

9.3 Hazardous Spills

A hazardous spill is any spill of HF that is not considered by the user to be an incidental spill. Follow these steps:

- Report the emergency by calling x33000 (cellular phones call 928-523-3000)
- Warn other in the spill area to evacuate. Generally, the spill area is defined by the extent and location of the spill. For example: 1) if the spill is within the lab – evacuate the lab; and 2) if the spill is within the hall – evacuate immediate area of hall.
- Evacuate to a safe area and prevent entry to spill area.
- Attend to any person that has been exposed to HF if safe to do so (See section 5).

9.4 HF Spill Kit Contents

- 2.5% calcium gluconate gel
- Antacid tablets
- Hydrofluoric acid MSDS
- Color-change neutralizer with instructions
- Nitrile gloves
- Apron
- Shoe covers
- Goggles
- Hazardous waste container and tag
- Spill scoop and brush

10.0 Waste Disposal

HF is a corrosive substance and must be collected for disposal. Use a polyethylene container for collected HF waste and store in the satellite accumulation area and ensure cap is closed tightly. Complete the hazardous waste tag, affix to container, and request a waste pickup by calling ORC.