

SAFE USE OF HYDROFLUORIC ACID

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Introduction

Hydrofluoric acid (HF) is an EXTREMELY dangerous chemical and should be handled with the utmost caution. It is very toxic by inhalation, skin and eye contact, and ingestion and causes severe burns where the effects may not be felt until a few hours after exposure. By this time it is often too late to rescue damaged tissue so emergency procedures should be instituted IMMEDIATELY and whenever there is any reason to suspect exposure to the chemical.

Health Hazards

Skin Contact

Skin contact with concentrations of this acid above 40% will cause immediate burning and intense pain. At concentrations between 20-40% the effects may not be felt for a few minutes but there may still be intense pain. At concentrations less than 20% the effects may be delayed for up to 12 hours at which time extreme pain may be felt. HF is fat soluble meaning it penetrates the skin extremely easily. Consequently in the longer term it binds tissue calcium and decalcifies bones leading to tissue necrosis which may result in amputation. Skin burns may become gangrenous and spread, and depending on the severity of the burn, nerve, heart and intestinal malfunctions may ensue.

Death is usually due to heart failure.

Inhalation

Inhalation of HF fumes results in dilute solutions of the acid being formed in the body. Inhalation of weak vapor concentrations can cause irritations of the nose, throat and respiratory tract, particularly the lungs. Inhalation of higher concentrations can cause internal burns of the respiratory tract leading to bronchitis, pneumonia and pulmonary edema (fluid in the lungs). It can also cause severe damage to the teeth as it binds calcium. At high concentrations inhalation of the fumes can lead to excessive fluid build up in the lungs and death!

Eye contact

Both splashes in the eye and eye exposure to HF vapor / gas fumes in the eyes can cause burns with irreversible effects. The cornea may become clouded and any contact may lead to blindness.

Ingestion

Ingestion of HF causes burns to the intestinal tract. In extreme circumstances it may even cause perforation of the body, literally meaning that it can cause your body to become a sieve.

Working safely with HF

- Always read about the safe work practices, spill control methods and emergency procedures before starting the work
- Always work under a working chemical fume hood. **Before use, always check the fume hood is certified and working properly.** Manipulation involving even small quantities of dilute HF solutions **must not be performed on the lab bench.**
- Work surfaces must be protected from contamination by placing plastic trays or bench paper on before starting HF procedures.
- Always wear personnel protective equipment (PPE) when working with HF.
- Gloves: HF readily penetrates skin and becomes trapped under fingernails. Heavy neoprene or nitrile rubber (recall that HF attacks natural rubber) gloves are best for working with HF; however the increased thickness of the gloves reduces dexterity, increasing the possibility of spills. **Wear two pairs of nitrile exam gloves at a time, changing the outer pair often.** When working with larger quantities of HF in procedures that do not require as much dexterity, wear heavy nitrile or neoprene rubber gloves, with a nitrile exam glove worn under the outer glove.
- Body Protection: long-sleeved shirt, long pants, and closed shoes. Always wear a lab coat, chemical-resistant apron and sleeves.
- Eye Protection: Goggles, along with a face shield, should be worn when handling HF to prevent eye/face exposure.
- Follow buddy system when working with HF and **NO one is allowed to work alone.** For safety reasons the use of hydrofluoric acid by the University staff or students should preferably be limited to **office hours** (You must discuss change in procedures with your supervisor).
- Only persons with suitable training should be allowed to use HF.
- Keep the acid deep inside the fume hood as far away as possible from the user.
- Use plastic beakers and containers for HF manipulations and always check for cracks and brittleness.
- Do not eat, smoke, or drink where HF is handled or used.
- Wash hands thoroughly with soap and water after handling HF.
- Inform any first responder called to deal with an incident involving HF about the hazards associated with this substance, and
- Provided with appropriate protective gloves, and a copy of MSDS to the responder.

Emergency Procedures

Avoid all types of exposure to HF. Contact with dilute HF solutions may not produce immediate pain, but may result in severe burns without immediate treatment.

ALL HYDROFLUORIC ACID EXPOSURES ARE A MEDICAL EMERGENCY! IMMEDIATELY CONTACT THE CAMPUS POLICE at 6911 AND ARRANGE FOR IMMEDIATE MEDICAL TRANSPORT. MSDS MUST BE PROVIDED TO THE MEDICAL PERSONNEL.

All exposure to or contact with HF shall receive immediate first aid and medical evaluation even if the injury appears minor or there is no sense of pain. HF can produce delayed effects and serious tissue damage without necessarily producing pain.

In the event of an HF exposure, immediately start the first aid procedures described below to avoid HF burns or other permanent damage. Once first aid has been started, contact the University Police at **6911**.

Skin Exposure or Burn

- In the event of a burn caused from HF, the following steps must be immediately taken:
- The skin must be copiously washed, beginning immediately after exposure.
- Apply a bulky dressing soaked in a commercially prepared quaternary ammonia compound, calcium gluconate or magnesium oxide topical ointment. Always follow the manufacturers directions supplied with the HF burn ointment/solution if they differ from these.
- Seek immediate medical attention.

Ingestion of HF

- Immediately call the Police Department at 6911.
- Use the *First Aid Manual for Chemical Accidents* or refer to the MSDS to effectively treat the injured person.
- If the injured person, is unconscious, turn his/her head or entire body onto the left side. Be cautious about performing CPR. This could potentially poison you from the mouth-to-mouth contact. If available, use a mouth-to-mouth resuscitator.

Inhalation of HF

- Evacuate the area and move the victim to fresh air.
- Immediately call the OPS at 6911.
- When the victim is not breathing, perform CPR. Be cautious as the mouth-to-mouth contact can result in the responder becoming poisoned. Where available use a mouth-to-mouth resuscitator.
- When the victim is breathing, loosen his/her clothing and maintain the airway.
- Place one hand under the injured person's neck and gently lift.
- Rotate the injured person's head back to obtain maximum extension of the neck by pressing down on his/her forehead with your free hand.
- If additional airway extension is necessary, pull the injured person's lower jaw into a jutting-out position.
- Treat the person for chemical burns of the eyes and skin.

Contamination on clothing,

- Immediately remove all contaminated clothing, including shoes, undergarments and jewelry, while standing under running water or the safety shower.
- When removing shirts or pullover sweaters, be careful not to contaminate the eyes. Cutting off such clothing will help prevent spreading the contamination.
- Do not put contaminated clothing back on, they still contain chemicals.
- Wash contaminated clothing separately or discard.

- Call UAH Police (i.e., 6911) to have the victim taken to the emergency room for medical attention.

Spill Management

UAH requires persons having responsibility for laboratories that use or store hydrofluoric acid (HF) to maintain a commercially prepared gel of calcium gluconate in the laboratory area. The gel is used for immediate treatment of skin exposures to HF. HF causes serious damage to tissues and bones. The faster the treatment the smaller the chance of serious injury

If greater than 200ml of HF is spilled outside of a chemical hood:

- Evacuate the area;
- Close the doors;
- Post the area with a sign to prevent others from entering; and
- Notify the University Police at **6911**

Laboratory staff can clean up spills less than one liter of HF inside a chemical fume hood by containing the spillage and carefully neutralizing the spill with:

- Spill-X-C caustic neutralizer;
- Caustic soda;
- Powdered calcium carbonate;
- Calcium hydroxide; or
- Using a commercial HF spill kit.

HF Waste Management

HF waste shall be placed in a chemically compatible container (e.g. polyethylene or Teflon®) with a sealed lid and clearly labeled. Do not store HF waste in glass or metal containers. Contact OEHS at 824-2171 for a hazardous waste pick-up.

All areas where HF is used must have proper spill control kit. Small spills can be neutralized by covering with acid neutralizer/sodium bicarbonate, and absorbed with spill control pads/absorbents. Once the spill is contained, isolate the room and leave the area immediately. Call OEHS for guidance.

If it is a large spill immediately evacuate all persons in the area and close all doors. Any type of spill/accidental release of HF must be reported immediately to Campus safety at 6911.

Incompatibles and Storage

Store HF in a cool and dry place away from incompatible materials separated from other chemicals. **NEVER STORE HF IN GLASS CONTAINERS!** Hydrofluoric acid reacts with many materials, therefore avoid contact with glass, concrete, metals, water, oxidizers, reducers, alkalis, combustibles,

organics and ceramics. HF must be stored in tightly closed containers made of polyethylene or fluorocarbon plastic, lead, or platinum. **Secondary containment of polyethylene must also be used.**

Protect containers from physical damage. Storage facilities should have adequate ventilation and be constructed for containment and neutralization of spills. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

MEDICAL SURVEILANCE:

- Immediately wash the contaminated area with copious amount of water then carefully apply calcium gluconate gel as per instructions of the manufacturer.
- The injured person must go to the local hospital for further assessment and treatment by the medical personnel. It is recommended that the person be accompanied.
- If transport is not available an ambulance must be called; speed of treatment is of the essence.

Any Department working with HF must keep Calcium gluconate gel on-site. It is the responsibility of the PI to maintain an up-to-date stock. Minimally, the PI must inform employees about the presence and location of the gel, advice to use it, and this policy before they can work with HF.

DELAY IN FIRST AID OR MEDICAL TREATMENT OR IMPROPER MEDICAL TREATMENT WILL LIKELY RESULT IN GREATER DAMAGE OR MAY, IN SOME CASES, RESULT IN FATAL OUTCOME.

INFORMATION AND TRAINING

- The Principle Investigator shall train employees who handle hydrofluoric acid on the hazards of HF and what to do in the event of an exposure or a spill or other emergency.
- The MSDS together with this policy shall be used to train employees on the hazards of HF.
- A Material Safety Data Sheet (MSDS) on HF must always be kept in the immediate work area where HF is used.