

 <p>Carnegie Mellon University Environmental Health & Safety FIRE LAB WORK</p>	<p>Environmental Health and Safety Hydrofluoric Acid (HF) Guideline</p>
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1. Purpose

Carnegie Mellon University has developed this guideline to inform Hydrofluoric Acid (HF) users of the health and safety hazards associated with HF and to provide information on proper protection measures and emergency procedures when dealing with HF exposures.

2. Scope

This guideline applies to all Carnegie Mellon faculty, staff and students who work with or may come in contact with HF.

3. Introduction

HF is an extremely corrosive acid used for many purposes including mineral digestion, surface cleaning, etching and biological staining. Both Anhydrous Hydrofluoric acid and aqueous solutions are clear, colorless and highly corrosive liquids. The unique properties of HF, including systemic toxicity, make it significantly more hazardous to handle than many other acids. All forms, including the solution or the vapor can cause severe burns to tissue and cause serious systemic effects.

4. Hazard Overview

The primary hazard of HF is a Health Hazard, it can readily absorb through the skin and signs or symptoms are dependent on the concentration. HF can destroy and decalcify soft tissue and bone, concentrations above 50% will burn immediately. One insidious property is that concentrations lower than 20% may not produce immediate pain or burning. It is this delayed awareness of exposure that poses the most serious risk of HF. If you are exposed to hydrofluoric acid, seek medical attention immediately, even if you do not feel pain.

- a. Exposure to the eyes may result in permanent eye damage or blindness.
- b. Inhaling HF vapor can seriously damage the lungs and may cause fatal pulmonary edema (lungs flooding with fluid).
- c. Chronic exposure to low concentrations to HF may cause fluorosis; syndrome characterized by weight loss, bone embrittlement, anemia and general ill health.

5. Hazardous Material Description

Compound: Hydrofluoric acid
 Synonyms: Hydrogen fluoride, fluoric acid, hydrofluoride, fluorine monohydride
 CAS No: 7664-39-3
 Mol. Formula: HF

Mol. Weight: 20.01
Boiling point: 68°F (20°C) at 760 mmHg
Specific gravity: 0.99 at 19°F
Vapor pressure: 400 mmHg (34°F)
Vapor density: 0.1 (air=1)
Description: Colorless gas or fuming liquid. Disagreeable, pungent odor at <1 ppm
Solubility: Miscible with water with release of heat
Flammability: Nonflammable
Concentrations: HF varies in aqueous phase concentrations

6. Working with Hydrofluoric Acid

a. Training and Preparation:

- i. Any individual who works with HF or works in an area that has HF in its inventory is REQUIRED to receive training on hazards of HF and the steps that need to be followed in the event of an exposure or a spill. Environmental Health and Safety (EHS) provides this in-class training. Individuals can register for the training through [SciShield](#).
- ii. A Safety Data Sheet (SDS) for HF must always be available in an area that has HF in its inventory.
- iii. The Principal Investigator (PI) or Lab Manager must obtain a Hydrofluoric Acid First Aid Kit that contains calcium gluconate gel from EHS before starting work with HF. Please contact EHS for any assistance with training, SDS or First Aid Kit.

b. Engineering Controls:

- i. HF in concentrations above 5% must be used in a chemical fume hood.
- ii. HF as a compressed gas must be contained within a ventilated cabinet (NOTE: HF gas at any percentage is considered Highly Hazardous). Please contact EHS, if you need evaluation of the chemical fume hood for HF use in your lab.

c. Administrative Controls:

- i. If able, use a shield or at a minimum keep the fume hood sash as low as possible to protect from splashes.
- ii. When feasible, minimize the concentration of HF that is to be used. A specific use protocol should be outlined by the Lab PI, or Safety Coordinator. If one does not exist, contact EHS to assist with a Process Safety Review.
- iii. Never work with HF alone - Implement the Buddy System
- iv. Never work with HF after hours - before 8:00 a.m., after 5:00 p.m. or on weekends.
- v. Do not eat, drink or smoke where HF is handled, since the chemical can be transferred from the hands and swallowed. Always wash hands thoroughly after handling HF.

d. Personal Protective Equipment (PPE):

When handling HF, the following PPE must be worn:

- i. **Eye protection:** Goggles and/or a face shield must be worn. Due to HF's high corrosivity, safety glasses with side shields do not provide adequate eye protection.
- ii. **Gloves:** Medium or heavy weight viton/nitrile/natural rubber gloves (recommend 22 mil)

must be worn as the outer glove (note: double gloving should be considered as a best practice). For higher concentrations (>5%), long chemical compatible gloves (12 inches) should be worn. If outer gloves become contaminated they should be washed before removing. Remove gloves in a manner to prevent contamination of the inner glove. Thoroughly wash your hands and check hands for any sign of contamination. Contaminated gloves must be disposed of as HF waste. Consult the glove manufacturer's chemical compatibility chart for best selection.

- iii. **Body protection:** Wear a lab coat with a chemical splash apron (NOTE: there should be no exposed skin when working with HF). Wear closed-toe shoes and long pants.
- iv. **Storage and transport:** Glass containers must not be used to store or transport HF, as HF reacts with glass. Ensure all containers are clearly labeled. Use chemically compatible secondary containers to store HF in a cabinet or to transport HF vials or bottles from one lab to another. Keep all HF containers closed and secured properly. Use proper PPE, moving carts and precautions while transporting HF.
- v. **Emergency Eyewash/Shower:** Since HF is corrosive and rapidly damages tissue, EHS requires that a combination eyewash/shower be nearby and accessible. The unit must be tested weekly to ensure it will operate when needed.

e. HF Splash/Spill Kit

The kit will have:

- i. Calcium Gluconate tube
- i. Calcium Carbonate Tablets
- ii. 22 mil Stanzoil Neoprene/Nitrile Gloves
- iii. Protective Goggles
- iv. Polyethylene Waste Bag
- v. Chemical Waste Labels
- vi. Copy of Hydrofluoric Acid SOP
- vii. Copy of the [Honeywell Recommended Medical Treatment for Hydrofluoric Acid Exposure Guide](#)
- viii. Spill Material Specific for Hydrofluoric Acid Spill
- ix. SDS for Hydrofluoric Acid

7. Emergency Procedures (Exposures and Spills)

a. General Procedures for all exposures:

- i. The buddy must assist the victim to the safety shower/eye wash and get the spill/exposure kit.
- ii. The buddy must call CMU Police at (412) 268-2323.
- iii. Let the dispatcher know of the HF exposure. Give the exact location, including building name and room number.
- iv. Evaluation from an approved medical provider is strongly recommended.
- v. Give the *Honeywell Recommended Medical Treatment for Hydrofluoric Acid Exposure Guide* directly to Emergency Medical Personnel to help them with treatment.

b. Response to Skin Exposure:

- i. The combination eyewash/shower should be used to rinse the exposed area for at least 5 minutes. The exposed individual should remove all contaminated items (i.e., clothing, shoes and jewelry) while under the shower. Remove eye protection last. The buddy must bag all contaminated clothing and supplies while wearing the proper personal protective equipment.
- ii. After rinsing, calcium gluconate gel must be applied to the affected area. Calcium gluconate gel is a topical antidote for HF skin exposure. It works by combining with HF to form insoluble calcium fluoride, thus preventing the extraction of calcium from tissues and bones. Always keep calcium gluconate gel nearby whenever working with HF. Users must inspect kits and assure that they are properly stocked prior to working with HF. Please note the expiration date of the calcium gluconate. Expired calcium gluconate should be replaced by contacting EHS. EHS provides a First Aid Kit that contains calcium gluconate gel to all areas that have HF in its inventory.
 1. Note the time of the initial application of the calcium gluconate gel and reapply every 20 minutes.
 2. Inform emergency personnel that calcium gluconate has been applied and give the *Honeywell Recommended Medical Treatment for Hydrofluoric Acid Exposure Guide* directly to Emergency Medical Personnel to help them with treatment.
- iii. The exposed individual should ingest 6 Calcium Carbonate (TUMS) tablets, only if conscious.

c. Procedure for Liquid and Vapor Exposure to the Eyes:

- i. Decontaminate the eyes and face using the eye wash for 15 minutes — holding both eyes open for proper decontamination.
- ii. Apply calcium gluconate to exposed areas of the face. Note the time of the initial application and reapply every 20 minutes.
- iii. The exposed individual should ingest 6 Calcium Carbonate (TUMS) tablets, only if conscious.
- iv. Inform emergency personnel that calcium gluconate has been applied and give the *Honeywell Recommended Medical Treatment for Hydrofluoric Acid Exposure Guide* directly to Emergency Medical Personnel to help them with treatment.

d. Procedure for Inhalation Exposure:

- i. The buddy should immediately remove the victim to clean air — ONLY IF IT IS SAFE TO DO SO.
- ii. Activate the eye wash or safety shower, depending on where the vapor exposure occurred and rinse for 5 minutes.
- iii. The exposed individual should ingest 6 Calcium Carbonate (TUMS) tablets, only if conscious.
- iv. Inform emergency personnel that calcium gluconate has been applied and give the *Honeywell Recommended Medical Treatment for Hydrofluoric Acid Exposure Guide* directly to Emergency Medical Personnel to help them with treatment.

e. Spill Response:

- i. Alert others in the area.
- ii. Contain the spill if it is safe to do so.

- iii. Leave the laboratory and contact EHS (412-268-8182) and specify that you have a hydrofluoric acid spill. Stay by the laboratory (if safe to do so) to provide information and support.
- iv. EHS is responsible for the cleanup of all hydrofluoric acid spills.

8. Waste Management

All concentrations of HF must be collected according the [EHS Regulated Waste Management Guidelines](#). This includes, gloves, paper towels, absorbing pads and other spill cleanup materials. Glassware should be cleaned and decontaminated, or it should be collected as hazardous waste. Hazardous waste containing HF should be stored in chemically compatible containers, eg. Polyethylene or Teflon - NO glass, metal or ceramic and must be segregated from incompatible wastes, including wastes containing ammonia and alkaline materials. All waste containers must contain a hazardous waste label during use and a hazardous waste certification tag for collection. HF and the concentration should be clearly indicated on the label and tag. Contact [EHS](#) if you need additional information or have any questions regarding HF waste management.

9. Designated Use Area

HF shall be used in designated fume hoods marked with proper signage to warn others of the possible risk for contamination and exposure. Ensure that the fume hood is working properly and has current certification (within last 12 months). Work areas should be cleaned and decontaminated routinely. Contact [EHS](#) when there is a known area of contamination needing to be cleaned.

10. Detailed Use

Please reference the Specific Use Protocol for the way/manner in which you will be using HF. NOTE: this should come from your PI or Lab Safety Representative.

11. Revisions

Date	Documented Changes	Initials