

## Hydrofluoric Acid: Guidance for Laboratories

Hydrofluoric acid (HF) is a solution of hydrogen fluoride dissolved in water that is colorless, highly corrosive, and has a strong, irritating odor. Hydrogen fluoride has many uses within industry including the manufacture of refrigerants, herbicides, high-octane gasoline, etching, and biological staining. Exposure to HF can occur in storage facilities, industrial sites, retail locations, and even as part of a hobby. This document provides pertinent information for users of hydrofluoric acid as exposure can prove fatal.

- **Health Hazards**

- The seriousness of HF poisoning depends on the amount, route, and length of time of exposure, as well as the age and pre-existing medical conditions of the exposed person.
- Exposure to HF can produce harmful health effects and some are not immediately apparent.
- Always take into consideration the concentration of HF that is being used and the type of exposure present.
- The chemical safety data sheet (SDS) for HF can be found online and all users should be familiar with this document.

- **Exposure Routes**

- **Skin:**
  - HF is highly corrosive and readily destroys bone and cells within the body by depleting their capacity to function properly.
  - Depending on the concentration and duration of exposure, skin contact with HF can cause pain, a rash, and deep, slow-healing burns.
    - Burns do not have to be visible to experience pain at the site of contact.
  - Concentrated HF (50 % or greater) destroys skin and tissue upon contact causing severe pain.
    - Even small splashes of a high concentration of HF can be fatal.
  - Skin contact with lower concentrations (less than 20%) can have pain and burning beginning hours after exposure.
    - Visible damage may not appear until 12 to 24 hours after the exposure incident.
  - Skin damaged by HF may have a long healing process and result in severe scarring.
    - Injuries involving the fingertips may result in persistent pain, bone loss, and nail bed damage.

- **Ingestion:**
  - Swallowing a small amount of highly concentrated HF will affect major organs and may be fatal.
    - Extensive damage can be done to the esophagus and stomach as it progresses for several weeks resulting in narrowing of the esophagus.
  - Systemic fluoride poisoning can occur.
- **Inhalation:**
  - HF gas or vapor can irritate the eyes, nose, and respiratory tract even at low levels.
  - Inhalation of HF causes damage to lung tissue, swelling, and the accumulation of fluid in the lungs (pulmonary edema).
    - Damage can be delayed until hours after exposure.
  - Breathing in HF at a high level in combination with skin exposure can result in death from an irregular heartbeat and pulmonary edema.
  - Exposure limits can be found in the SDS.
- **Eyes:**
  - Exposure to the eyes can cause prolonged or permanent damage including visual defects, blindness, or destruction of the eye.
    - This can be caused by HF vapor or a splash into the eyes.
- **Protection**
  - Proper personal protective equipment while handling HF includes:
    - Lab Coat and/or a chemical splash apron.
    - Attire that fully covers exposed skin (no shorts, skirts, or open-toed shoes).
    - Neoprene gloves are recommended, but a double layer of nitrile gloves can be used.
    - Chemical goggles along with a face shield are recommended when handling HF. Safety glasses with side shields may not provide adequate protection.
    - When using HF at a concentration greater than 5%, it must always be handled inside of a certified chemical fume hood.
  - Lab personnel must be familiar with safety feature location and operation.
    - Eyewash/ Drench hose
    - Safety Shower
    - These safety features will be accessible anywhere that HF is approved for use.
  - Do **NOT** work with HF alone.

- Lab personnel must note that fluorine containing compounds can produce HF upon contact with water. Some examples include:
  - Ammonium Fluoride
  - Sodium Fluoride
  - Sulfur Tetrafluoride
  - Ammonium Bifluoride
- Do **NOT** eat, drink, or apply cosmetics in the area.
- Anyone working with HF must have knowledge of detailed first aid procedures **BEFORE** work begins.
  - Areas **MUST** have calcium gluconate available.
    - Calcium gluconate is an external topical antidote for HF skin exposure that prevents the extraction of calcium from bones and tissues when applied per SDS instructions.
    - Calcium gluconate must always be kept in the refrigerator and replaced among expiration as it has a limited shelf life.
- Wash hands thoroughly.
- **Emergency Procedures for Exposure**
  - First aid should be provided immediately based on the HF SDS.
  - Seek medical treatment as soon as possible.
  - See the references section below for SDS sheets and recommended medical treatment for exposure by the world leading producer of HF, Honeywell.
  - Further information can be obtained by contacting:
    - Regional poison control center: 1-800-222-1222
    - Centers for Disease Control and Prevention
      - 1-800-CDC-INFO
      - 1-888-232-6348
      - cdcinfo@cdc.gov
- **Storage**
  - Store in a place accessible to authorized users only.
  - Containers should remain tightly closed in a cool, well-ventilated space.
  - Keep on low, protective shelving that prevents accidental spills or knocking over.
  - Never store with ammonia or alkaline materials.
  - All HF and HF waste must be in a labeled and chemically compatible container such as polyethylene or teflon.
    - Glass, metal, and ceramic materials are **NOT** compatible with HF.
- **Spills**
  - Follow instructions per the chemical SDS.
  - Many spill kits/pads are not adequate for HF spills.
    - Specifically ask a vendor for a kit compatible with HF.

- Evacuate the area and contact UA Environmental Health and Safety for large spills.
- Neutralize small spills with caustics, lime, soda ash, or baking soda.
  - Knowledge of incompatible materials from the SDS is critical.
    - For example, use of silica products ( Floor Dri, cat litter, or sand) can produce the toxic gas silicon tetrafluoride.
    - Exothermic reactions may take place.
- **References**
  - [CDC | Facts About Hydrogen Fluoride \(Hydrofluoric Acid\)](#)
  - [MSDS Resource Centre \(honeywell.com\)](#)- 70 %
  - [MSDS Resource Centre \(honeywell.com\)](#) – 49 %
  - [MSDS Resource Centre \(honeywell.com\)](#)- Anhydrous
  - [2734-Medical-Treatment-for-HF-Acid-Exposure\\_v7-WEB.pdf \(honeywell-hfacid.com\)](#)
- **Training**
  - EHS requires in-person training for use, handling, and storage of hydrofluoric acid in laboratories on UA campus.

**For further questions, contact the [EHS Laboratory Safety Team](#).**