

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
- **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](#).