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.
o **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.

o **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.

o **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](#).