Hydrogen Fluoride Safety

A safety course to instruct on the safe use of HF and the proper responses to safety issues.

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Hydrogen Fluoride Safety: Properties and Uses of HF

- Pure HF has a low boiling point (67.14 °F) at atmospheric pressure.
- HF is used in two different forms; as a solution in water and as liquefied compressed gas.
- HF as a solution with water looks identical to water.
Hydrogen Fluoride Safety: Properties and Uses of HF

- HF as a solution
  - The concentrated acid is typically 49% HF by weight.
  - Typically Stored in 10 lb plastic jugs.
  - HF vapors readily come off the liquid, particularly when it is heated.
Hydrogen Fluoride Safety: Properties and Uses of HF

- HF as a liquefied compressed gas.
  - Stored in 5 or 12 lb cylinders
  - Has a pressure of 1 to 4 psig
  - Sinks in the air. Often creates a white cloud in the air.
  - Needs pumped to withdraw gas.
Hydrogen Fluoride Safety: Properties and Uses of HF

- HF should only be used with inert materials, like Teflon, polypropylene, and platinum. Glass or iron based metals should not be used with HF.

- HF can be neutralized with a base to give salt.
Hydrogen Fluoride Safety: Health Effects of HF

- **Odor Threshold**: 0.3 ppm
- **Threshold Limit Value**
  - PEL: 3.0 ppm
  - TWA: 3.0 ppm C
  - IDLH: 30 ppm
- **Acute Toxicity**
  - LC50 (1 hour, rat): 1276 ppm
- **Corrective action should be taken if ANY HF is detected where it is not designed to be.**
Hydrogen Fluoride Safety: Health Effects of HF

- HF causes tissue damage through the corrosive burns (in the same way as other acids) and the chemical burns from the fluoride ions.
- HF is highly lipid soluble, and readily penetrates biological membranes, like skin.
- The fluorine ions lead to a loss of Calcium and Magnesium (called hypocalcemia and hypomagnesemia) in living tissues, and interfere with cell function.
- More than 1,000 cases of HF exposure are reported annually in the USA.
Hydrogen Fluoride Safety: Health Effects of HF

- Burning sensation, which may not be noticed until 24 hours after exposure to HF.
- HF fatalities have occurred due to a spill on the skin of 8 square inches. One drop untreated can lead to a finger amputation.
- Red or putty gray burn marks can indicate a burn. A yellow substance may accumulate under the skin.
- NOT ALL HF BURNS HAVE SIGNIFICANT MARKINGS.
Hydrogen Fluoride Safety: Health Effects of HF

Concentration
– The lower the concentration, the longer the delay in painful sensation.
– Lower concentration exposures can cause more severe burns due to deeper undissociated HF.
– Concentrations of 14.5% have been shown to produce an immediate burning sensation in one study.
Hydrogen Fluoride Safety: Health Effects of HF

- You should suspect HF exposure when you are working with HF and...
  - You feel a burning sensation on your skin.
  - You notice a visible mark.
  - Part of your body is wetted from an unknown source.
Hydrogen Fluoride Safety: Safe Usage of HF

- Aqueous HF should only be used in a vented acid hood
- Anhydrous HF should only be used in the appropriate cabinet that is vented
- Use of HF outside of these areas should rarely occur, and requires respirator use.
Hydrogen Fluoride Safety: Safe Usage of HF

The following should be worn when working with HF.

- Long sleeve Tyvek acid jacket.
- Two layers of gloves, the outermost being Butyl
- Full-Face Respirator (when not working in acid hood)
- Face Shield (except when wearing a respirator)
Hydrogen Fluoride Safety: Safe Usage of HF

Tips for handling HF
- Always add acid to water when diluting
- Always check to make sure HF cylinder is closed before handling.
- Make sure someone knows you are working with HF.
- Take your time and focus on your task: Do not let your mind wander.
Hydrogen Fluoride Safety: Exposure to HF

- Skin Exposure
  - Flush exposed area while removing exposed clothing.
  - Apply Calcium Gluconate Gel using a gloved hand.
  - Contact an ERT Team Member. If possible, the ERT should be contacted during initial treatment.
  - Rinse exposed skin for 30 minutes while continuing to apply Calcium Gluconate
  - Follow-up treatment at hospital
Hydrogen Fluoride Safety: Exposure to HF

- Calcium Gluconate Gel
  - Early use is the best way to treat HF exposure.
  - Always have a tube or jar immediately available when working with HF.
  - Make sure that the Calcium Gluconate has not expired (1 year to 18 month life-span)
Hydrogen Fluoride Safety: Exposure to HF

- **Eye Exposure**
  - Rinse Eyes thoroughly.
  - Contact an ERT Team Member. If possible, the ERT should be contacted during initial treatment.
  - Continue rinsing eyes until medical help arrives.
  - Follow-up treatment at hospital.
Hydrogen Fluoride Safety: Exposure to HF

Inhalation
- Contact an ERT Team Member
- Suspect gas in the room
- Ensure that the area is clear to enter or the proper protective equipment is used. YOU MUST BE TRAINED TO USE THE PROPER PROTECTIVE EQUIPMENT
- Remove to fresh air.
- Give artificial respiration if not breathing (not mouth to mouth) PERFORM THIS ONLY IF QUALIFIED
- Follow-up treatment at hospital

Ingestion
- Contact an ERT Team Member
- DO NOT INDUCE VOMITTING
- If victim is conscious, give 2-4 cupfuls of milk or water
- Follow-up treatment at hospital