

Hydrofluoric Acid Training

Environmental Health and Safety
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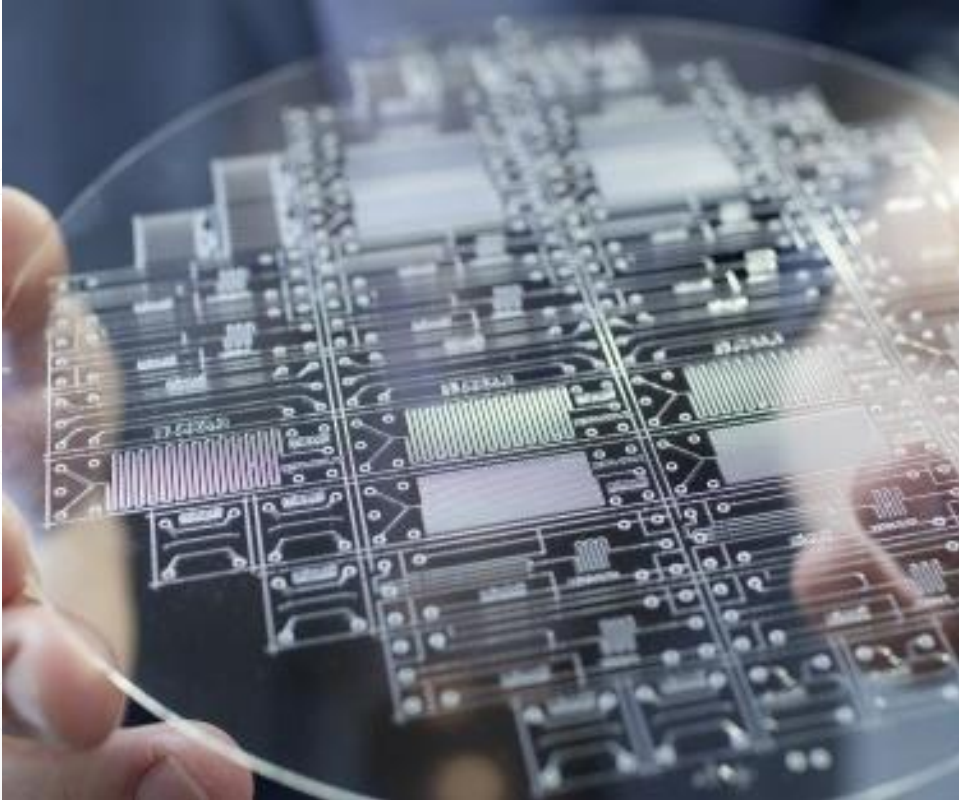
Agenda

- Introduction
 - Exposure Limits
 - Health Effects
 - Safe Work Practices
 - Personal Protective Equipment
 - First Aid
 - Spill Response
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Introduction

- Hydrofluoric Acid (HF)- a weak inorganic acid used in refrigerants, herbicides, pharmaceuticals, high-octane gasoline, aluminum, plastics, electrical components, and fluorescent light bulbs. Hydrogen fluoride is also used for etching glass and metal.
 - Properties:
 - Clear, colorless and highly corrosive liquid
 - Miscible in water
 - Acrid, irritating odor
 - Noncombustible
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Properties



- HF etches glass by forming strong bonds between the fluoride anions and the silicon molecules in glass
 - HF is reactive with concrete, enamels, glazes, rubber and many organic compounds
 - Upon reactions with metals, HF generates hydrogen gas which could pose an explosion hazard
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Exposure Limits

EXPOSURE LIMIT	VALUE
OSHA Permissible Exposure Limit	3ppm
OSHA Short Term Exposure Limit	6ppm
NIOSH IDLH	30ppm

Corrosivity

- Extremely corrosive liquid and vapor that can cause severe injury via skin and eye contact, inhalation or ingestion.
- Mechanisms
 - Release of free H^+ ions
 - Penetration of fluoride ions



Toxicity

- Upon skin contact, HF readily penetrates through the skin and forms insoluble salts with calcium and magnesium
- Soluble salts are also formed but dissociate rapidly. Consequently, fluoride ions continue to release, leading to further deep tissue destruction.
- Pain is believed to result from nerve irritation caused by the influx of potassium ions compensating for the depletion of calcium ions.



Symptom Onset

- Concentrations:
 - >50% solutions lead to immediate, severe burning pain with blisters
 - 20-50% solutions lead to redness, swelling, and blistering after 8 hours
 - <20% solutions may not produce symptoms for up to 24 hours
 - Deaths have been reported from burns of less than 2.0% body surface area.
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Health Effects

Route of Entry	Health Effects
Skin Contact	Tissue destruction, necrosis, hypocalcemia, hypomagnesemia, hyperkalemia
Eye Contact	Severe burns, cornea destruction, blindness
Ingestion	Severe burns to the mouth, esophagus, and stomach
Inhalation	Coughing, choking, bronchospasms, acute pulmonary edema

Work Practices

- Prior to use of HF, lab personnel must review the:
 1. Safety Data Sheet (SDS)
 2. [Standard Operating Procedure](#)
 3. Emergency Response Procedures
 - Never work alone or after hours with HF
 - Never heat HF
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Work Practices

- ALWAYS work in a chemical fume hood at least 6" from the edge
 - Substitute a less hazardous substance whenever possible
 - Use the most dilute HF solution feasible
 - Set up a Designated Area for work with HF
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Work Practices

- Label all compatible secondary containers of HF with the chemical name and hazard class
- HF must **ONLY** be stored in polyethylene or Teflon containers (e.g., no glass, metal, etc.)
- HF containers must be tightly-sealed when not in use and kept away from other glassware



Personal Protective Equipment

- **Eyes-** Tight-fitting ANSI Z87.1-certified safety goggles and/or full-face shield in conjunction with goggles
- **Body-** lab coat, acid-resistant apron, and clothing that covers the legs
- **Feet-** Closed toed footwear (i.e., no sandals, flip-flops, etc.)



Personal Protective Equipment

- **Hands-** medium or heavyweight butyl rubber, neoprene rubber, Viton®/butyl rubber, Silver Shield/4H®, or other gloves recommended by the chemical manufacturer.
 - Use gloves that cover the hands, wrists, and forearms when using concentrated solutions of HF
 - Always consult the manufacturer's glove selection guide/safety data sheet
 - **Note: Nitrile gloves are not recommended for handling $\geq 30\%$ HF.**
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Hazardous Waste Management and Disposal

- Place HF and HF-contaminated waste in tightly-sealed plastic containers
 - Label HF waste containers with the words “Hazardous Waste” and “Hydrofluoric Acid”
 - Submit a chemical waste pick-up request form to EHS
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First Aid

■ Eye Contact

1. Immediately flush eyes with water
 2. While flushing eyes, have someone from the lab call **911**
 3. If 1% calcium gluconate solution is available, irrigate the eyes following 5 minutes of flushing with water (**Do NOT put calcium gluconate gels in eyes**)
 4. If the solution is not available, keep flushing the eyes with water until emergency personnel arrive
 5. Notify the principal investigator as soon as possible.
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1. Do NOT induce vomiting.
2. Do NOT give anything by mouth to an unconscious person
3. Immediately drink large amounts of water to dilute the acid
4. Call **911**. Ensure the caller specifically mentions HF and the concentration.
5. If available, have the victim drink several glasses of milk or several ounces of milk of magnesia, Mylanta, Maalox or similar products, or consume a number of Tums, Caltrate or other antacid tablets.
6. Notify the principal investigator as soon as possible.

First Aid - Ingestion

First Aid

■ Skin Contact

1. Immediately move to the nearest wash station/eyewash and rinse with water
 2. While rinsing, remove/cut off contaminated clothing
 3. Have someone else in the lab call **911**. Ensure the caller specifically mentions HF and the concentration.
 4. Continue rinsing with water for 5 minutes
 5. If available, don a new pair of new chemical resistant gloves (to prevent possible secondary HF burns) and massage calcium gluconate gel (2.5%) freely into the affected areas. The gel will turn white upon contact with the acid.
 6. If calcium gluconate gel is not available, continue rinsing the affected area under water until emergency personnel arrives
 7. Notify the principal investigator as soon as possible.
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1. Move the affected person to fresh air
2. Call 911 for emergency assistance
3. Stay with victim
4. Notify emergency personnel that exposure was from HF
5. Emergency personnel may administer oxygen upon arrival due to swelling of the respiratory tract
6. Notify the principal investigator as soon as possible.

First Aid- Inhalation

Hydrofluoric Acid- Spills

- In the event of a hydrofluoric acid spill:
 1. Evacuate the lab
 2. Close all doors
 3. Post **Emergency Door Hangtag** on the door
 4. Call **911** to alert emergency responders
 5. Report to the lab's designated meeting place



Contact Information

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References

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