

Description:

Hydrofluoric acid (HF) is the aqueous form of hydrogen fluoride gas, miscible with water. It is used for etching glass, mineral digestion, surface cleaning, and biological staining. HF is an extremely corrosive and toxic acid that is hazardous to handle with severe health risks upon exposure. Because of the hazards associated with HF, the laboratory should consider substituting a less hazardous chemical or process if possible. The lowest possible concentration of HF should be used.

Hazards:

- HF readily penetrates the skin and mucous membranes and can cause deep tissue damage. The severity and timing of effects depend on the concentration, duration of exposure, and penetrability of the exposed tissue. Symptoms may start immediately or **may be delayed**. Once exposed to HF seek immediate medical attention even if pain is not felt. Life-threatening systemic toxicity may follow exposure with minimal external tissue damage.
- Acute effects of exposure to concentrated (>5%) HF include severe pain, respiratory irritation, severe eye damage, and pulmonary edema. Exposure to less concentrated solutions may have equally serious but delayed effects.
- With HF exposures, the fluoride ion has an affinity for calcium and magnesium. As the fluoride binds with calcium, it consumes the body's supply of this mineral in the blood and also attacks bone structure, forming calcium fluoride salts. As serum calcium levels are depleted in the blood, a condition known as hypocalcemia may occur, followed by organ failure, heart function becomes erratic and can eventually fail, resulting in death.
- Skin contact with HF concentrations in the 20% to 50% range may not produce symptoms for 1 to 8 hours. With concentrations less than 20%, the latency period may be up to 24 hours. A solution of only 1-2% HF exposed to greater than 10% of your body is fatal without medical attention; however dermal burns are not likely immediate.
- HF attacks glass, concrete, rubber, quartz, and alloys containing silica. When HF reacts with metals, explosive hydrogen gas may be formed.
- HF has **poor** warning properties. The odor threshold for humans is 3 parts per million (ppm) and irritation of mucous membranes begins at 5 ppm. If you can smell it, chances are the concentration is too high and immediate steps must be taken to lower it.
- Moderately concentrated solutions of hydrofluoric acid (>40%) tend to fume and emanate hydrogen fluoride gas when exposed to air, producing yet another exposure risk through inhalation.

Documentation and Training:

1. The Principal Investigator must complete a laboratory specific HF standard operating procedure that includes all of the requirements of this Laboratory Safety Guide. The completed SOP must be reviewed and approved by the Principal Investigator's Department Head and Laboratory Safety. Once approved, this document must be uploaded to the "documents" section of the lab's BioRAFT.
2. The Principal Investigator must also document the work involving HF in the [Laboratory Specific Chemical Hygiene Plan](#).

3. All employees handling and working in the area of HF must have annual training given by the Principal Investigator covering:
 - a. The Lab Specific HF SOP
 - b. [The Laboratory Specific Chemical Hygiene Plan](#)
 - c. This HF Laboratory Safety Guide
 - d. Safety Data Sheet available in BioRAFT

Documentation of this training must be uploaded into BioRAFT. Training can be documented using the sheet available on the [Lab Safety Website](#).

Storage:

- Use and store HF in polyethylene or Teflon containers. Glass, metal, or ceramic containers are **not** compatible with HF.
- Store HF in a **locked** corrosive storage cabinet.
- Outside of storage cabinet must be labeled “Warning contains Hydrofluoric Acid”
- HF bottles must have secure caps and lids that can provide gas-tight seals to prevent the escape of hydrogen fluoride gas.
- Purchase and store only the smallest quantity needed.
- Ensure all containers of HF are clearly labeled, following [OSHA’s Hazard Communication Standard](#) requirements.
- Store HF in a chemically compatible secondary containment tray.

Handling:

- HF use is permitted 8am to 5pm Monday through Friday. Never handle HF after hours or on weekends or holidays.
- A minimum of 2 trained employees must always be present when handling HF. Never work with HF alone.
- Someone from the lab must be available to accompany potentially exposed employee to hospital in ambulance to administer calcium gluconate (see Exposure information below).
- All lab occupants must be made aware that HF is being used while work is in progress and must be trained as indicated above.
- HF in Use sign, available on the [Lab Safety website](#), must be placed on the door to the lab when using HF.
- A Hydrofluoric Acid Emergency First Aid (see Exposures below for ordering information) equipped with calcium gluconate gel, must be available near the point of use in every lab that stores or handles this acid. Replace the calcium gluconate gel before it expires or when opened.
- Only the Principal Investigator is permitted to work with HF. Students are not permitted to handle HF.
- HF handling and storage areas must be in Designated Areas. Refer to [Rowan’s Chemical Hygiene Plan Section 7.C.](#) for further information.
- All work with HF must be conducted in a properly operating chemical fume hood with the sash closed as much as possible. Always work at least 6 inches into the fume hood.
- The fume hood must have been certified within the past year.
- HF should be used in a fume hood with a sash that is resistant to acid etching.
- Review HF use for consideration of how fume hood exhaust may be impacted. Note in Lab Specific HF SOP if procedures may need modification for HF condensate capture.
- If a hood monitor goes into alarm during normal use, DO NOT mute or ignore the alarm for any reason. Discontinue all work in the hood and immediately place a work order with Facilities to have the system inspected and repaired. For further information refer to [Rowan’s Chemical Fume Hood Monitor Guidelines](#) available on the Lab Safety website.

- Clean and decontaminate work area routinely.
- No other procedures should be done in the fume hood until all HF work is complete, waste has been collected and equipment and materials have been cleaned, properly discarded, or removed from the area.
- Before beginning any procedure involving HF, make sure the nearest safety shower and eyewash are accessible and are in proper working condition. Contact Laboratory Safety if shower/eyewash has not been inspected within the last year.
- Lab Safety must be present for the first use of HF.

Disposal:

HF waste is hazardous waste and must be disposed following the procedures implemented by the Lab Safety department. See the [Hazardous Waste Disposal Information](#) on the Lab Safety website.

- All waste containers must be kept closed after use.
- Containers should be labeled with the [Rowan University Hazardous Waste label](#), available on the Lab Safety website, as soon as you start putting waste into the container.
- Ensure waste containers are compatible with HF, polyethylene or Teflon containers are recommended.
- Dispose HF that is no longer used.
- Immediately after collecting HF waste, contact Lab Safety for pickup by completing the [“Waste Determination and Pickup Request Form”](#) available on the Laboratory Waste website.

Personal Protective Equipment:

- All personal protective equipment must be approved for use by reviewing the manufacturer’s testing results and resistance to HF. There should be no exposed skin.
- Workers must wear, at a minimum, at all times:
 1. Neoprene gloves (10-20mil if you don’t need dexterity) or nitrile gloves (4.6-8 mil - consider double gloving), or other type of appropriate HF glove material is required. ***Note nitrile gloves are not recommended for handling concentrations greater than 30% HF.***
 2. Buttoned long-sleeved cotton lab coat
 3. Acid-resistant apron
 4. Pants or long skirt
 5. Closed-toe shoes that are leather or durable non-porous material
 6. Chemical splash goggles
- When strong concentrations >30%, large quantities or splashes are possible workers must also wear:
 - A face shield
 - Double gloves
 - Chemically protective arm sleeves
- Wash hands and forearms with soap and water each time gloves are removed.

Exposures and Spills:

***Time is of the essence as exposure to HF is a life-threatening emergency.
Delay in first aid or medical treatment will result in greater damage or possibly death.***

- An HF Emergency First Aid Kit must be available in all locations where HF is used and stored. It is the responsibility of the laboratory to purchase and maintain this kit. The following items must be added to this kit:
 - 4 tubes of Calgonate Hydrofluoric Acid Burn Relief Gel – 2.5% topical calcium gluconate, available from [VWR](#) or [Grainger](#). Replace gel before it expires.

- This HF Laboratory Safety Guide
- Safety Data Sheet for HF, available in BioRAFT.
- [Recommended Medical Treatment for Hydrofluoric Acid Exposure by Honeywell](#)
- Neoprene and nitrile gloves
- Disposable jumpsuit
- DO NOT ENTER HF SPILL SIGN, available on the [Lab Safety website](#).
- **Immediately report all exposures by calling 911. Give the emergency medical responders the following information:**
 - HF Safety Data Sheet
 - HF Recommended Medical Treatment document
 - Concentration of HF, time of exposure, duration, and how the exposure occurred
 - Times calcium gluconate gel was applied
- Someone from the lab must accompany the exposed employee in the ambulance to the hospital to continue to apply calcium gluconate. EMTs are not permitted to apply calcium gluconate.
- **When calling 911 tell the dispatcher the following:**
 - There is a person that has been exposed to Hydrofluoric Acid and type of exposure (skin, eyes, inhalation, ingestion).
 - Location of exposed individual
 - Send a Rowan police officer and ambulance
 - Ask the dispatcher to notify the hospital and tell them that a person with exposure to hydrofluoric acid will be arriving.
- If you suspect you have been exposed to hydrofluoric acid, seek **immediate** medical attention, even if you do not feel pain.
- **Responders and anyone assisting the exposed individual must take care to not become contaminated themselves. Wear thick neoprene or nitrile gloves that cover the wrists, lab coat, and closed-toe shoes. Gloves are available in the HF Emergency First Aid Kit.**
- **Report all exposures to Lab Safety (856-256-5105 or labsafety@rowan.edu).**
- **Complete the [Rowan Incident Report Form](#).**

Skin Exposure:

1. Washing off the acid immediately is crucial. Move the exposed individual under an emergency shower or other water source and flush the affected area for 5 minutes with large amounts of water. Remove any potentially contaminated clothing, shoes and jewelry while flushing with water. If any clothing was contaminated or suspected to be contaminated, have the exposed individual wear the disposable jumpsuit provided in the HF Emergency First Aid Kit.
2. While the victim is rinsing with water, have someone call **911** for emergency medical treatment.
3. Apply and start massaging 2.5% calcium gluconate gel, available in the HF Emergency First Aid Kit, into the burn site. To prevent cross contamination, the victim should self-apply the calcium gluconate gel. Whoever applies the gel, should wear neoprene or nitrile gloves available in the HF Emergency First Aid Kit to prevent secondary burns.
4. Apply the calcium gluconate gel every 15 minutes and massage into the burn site until emergency medical responders arrive. Note the time when the calcium gluconate gel was applied for every application and provide this information to the emergency responders.

Eye Exposure:

1. Immediately flush eyes for at least 15 minutes with flowing water. Continue flushing the eyes until medical responders arrive.
2. While the victim is rinsing with water, call **911** for emergency medical treatment.

Inhalation:

1. Immediately move the exposed individual to fresh air.
2. Call **911** for emergency medical treatment.

Ingestion:

1. Do not induce vomiting.
2. Call **911** for emergency medical treatment.

Spills:

- Close fume hood sash. Activate emergency exhaust located on fume hood monitor.
- Notify Public Safety by calling **911** for any spill of HF. Lab staff are not responsible for cleaning up an HF spill. Public Safety will contact appropriate personnel to clean up spill.
- Alert others in the area.
- Evacuate and close doors to the area. Place “DO NOT ENTER HF SPILL” sign on the door.
- Stay by lab area, if safe to do so, to provide spill information to emergency responders.
- **Report all spills to Lab Safety (856-256-5105 or labsafety@rowan.edu) and complete a [Laboratory Incident Report Form](#).**

Additional Information:

Contact Lab Safety via phone at: 856-256-5105 or via email at: labsafety@rowan.edu for further assistance with hydrofluoric acid. To contact Lab Safety after hours for non-emergency issues call Public Safety at 856-256-4922.

For Additional Information refer to:

- [Safety Data Sheet – Fisher Scientific](#)
- [NIOSH Pocket Guide to Hazardous Chemicals](#)
- [NJ Right to Know Hazardous Substance Fact Sheet](#)
- [Calgonate](#)
- [Recommended Medical Treatment for Hydrofluoric Acid Exposure by Honeywell](#)
- [Rowan’s Lab Safety Website](#)