





LABORATORY SAFETY GUIDELINE

Hydrofluoric Acid (HFA) [CAS No. 7664-39-3]

All users of hydrofluoric acid (HFA) solutions must review this document. Users of concentrations $\geq 52\%$ w/w should contact their EHS Laboratory Safety Advisor and department safety officer. This document does not address the use, handling and storage of anhydrous hydrogen fluoride gas (HF). HFA can dissolve glass and other silicon containing compounds to produce silicon tetrafluoride, a hazardous colorless gas. HFA dissolves most metals.

HAZARDS

	Causes unique chemical burns upon contact with skin and eyes. These burns are very painful and can penetrate deeply into body tissues. Exposures to dilute solutions are particularly dangerous because symptoms are delayed and exposures can go untreated for hours. Symptoms may be delayed up to 8-hours for 20-40% HFA solutions and 24-hours for 1-20% HFA solutions. Unlike other mineral acid burns, HFA chemical burns are not self-limiting. If not promptly treated, effects may continue for hours or days after initial exposure. Damage to airways and lungs can occur if aqueous HFA is inhaled as a mist, or HF gas is inhaled. HFA will release significant quantities of hydrogen fluoride gas (HF) even at room temperature.
	Skin contact, inhalation and ingestion can also cause systemic electrolyte imbalances including hypocalcemia and hypomagnesemia. At higher doses, electrolyte imbalances can lead to irregular heartbeat and eventual death. Risk of these effects increases with higher concentrations, higher temperatures, larger contact areas, and longer contact times.

Extremely hazardous and may be fatal if inhaled, absorbed through the skin, or swallowed. Both liquid and vapor can cause severe burns to all parts of the body. Medical treatment is required for any exposure to HFA.

PRECAUTIONS

Before starting work:

- Determine if you can use a less hazardous substance in place of HFA.
- Review manufacturer's Safety Data Sheet and additional chemical information at <http://www.ehs.harvard.edu/safety-data-sheets-sds>.
- Ensure that a copy of this HFA Laboratory Safety Guideline, a copy of the manufacturer's Safety Data Sheet and a written experimental protocol including safety information is immediately available.
- Make sure you are familiar with general University emergency procedures in the [EHS Emergency Response Guide](#).
- Order the most dilute solutions available that will meet experimental needs. Order only what you need.
- Identify the location of the nearest eyewash and shower and verify that they are accessible.
- Post a sign in the work area "Danger: Hydrofluoric Acid used in this Area".
- Locate and verify that a full tube of unexpired 2.5 % calcium gluconate (e.g., Calgonate) is immediately available for the treatment of skin exposures.
- Locate and verify that appropriate HFA spill cleanup materials are available (*Use only those reagents indicated for HFA cleanup, reagents that are not suitable for HFA cleanup and may result in increased HFA exposure*). A dedicated HFA spill kit containing one of the following neutralizers is required (or a dilute solution of calcium or magnesium hydroxide):
 - [Spilfyter Solidifying Neutralizer for HF Acids](#); #472101 (solid)
 - [Amphomag Universal Spill Neutralizer](#) (solid)
 - [Ansul Spill-X-A Acid Neutralizer/Solidifier](#) (solid)
 - [PIG Hydrofluoric Acid Neutralizer](#); #GEN864 (liquid)
- Ensure another person who knows HFA emergency procedures is in the area.

During work:

- AVOID INHALATION! Perform all operations in a certified chemical fume hood, wet bench or other approved ventilated enclosure. Work must be performed with the sash in the down position, between your chest and what you are handling in the hood. Always work at least 6 inches into the fume hood and behind the sash.
- AVOID CONTACT! Wear appropriate PPE including:
 - Lab coat worn over long pants covering to the ankles and closed-toed non-woven footwear (leather recommended). On top of the lab coat, wear an acid-resistant apron.
 - Chemical protective goggles and face shield (Absolutely no contact lenses).
 - Work behind a sash.
 - Wear appropriate chemically protective gloves at least 12 inches long and with a sufficient breakthrough time (BT).
 - *For splash protection/intermittent contact of HFA <52%:*
 - Minimum of 11mil Nitrile
 - Change gloves whenever you know or suspect they have become contaminated.
 - *For more than intermittent contact or use of HFA >52% (these may also be used for splash protection, but are much thicker and bulkier than the gloves listed above):*
 - MAPA Chem-Ply N 740 (BT >480/30mil) (Neoprene)
 - MAPA StanZoil NL-34/334 (BT>480/30mil)(Neoprene)
 - Whenever possible, wear a single nitrile glove underneath the glove types described above.
 - Gloves must be thoroughly inspected prior to each use. Do not use damaged gloves.
 - Gloves must be changed out as recommended based on manufacturer breakthrough time.
 - Use proper glove removal technique (without touching the outer glove surface) to avoid skin contact.
 - Wash hands and forearms thoroughly with soap and water each time gloves are removed.
- Use materials and containers appropriate for HFA use and remain aware of potential incompatibilities; Do not store in glass or metal containers. Plastic containers (e.g. polyethylene) must be used.
- Keep all containers tightly closed when not in use and during transport.

After completing the work

- Dispose of HFA waste following Harvard University [Hazardous Waste Procedures](#)
 - Hazardous Waste Classification: Corrosive/Toxic
 - Do not store waste in glass or metal containers! Primary and secondary containers must be plastic (e.g., polyethylene) and must remain sealed.
 - Return container to storage area following Harvard University [Laboratory Chemical Storage Guide](#) Storage Group IA [Inorganic Acids];
 - Store in corrosive/acid storage cabinet or standard wooden cabinet (vented if feasible)
 - Store in original primary containers or other appropriate plastic containers. Do not store in glass or metal containers.
 - Store primary containers in designated plastic (polyethylene) secondary containment bin.
 - Wash hands and forearms thoroughly with soap and water before leaving the lab.

EMERGENCY PROCEDURES

First Aid

****Call 911 during the following medical procedures to get medical attention immediately, even if you do not feel pain. Anyone who assists in first aid response must first don appropriate PPE to prevent being exposed to HFA****

SKIN CONTACT

- Flush skin with tepid water for 5 minutes using the closest available sink, portable drench hose or safety shower. While continuing to flush, remove any exposed clothing as well as any jewelry that may be trapping HFA.

- Apply 2.5% calcium gluconate gel by massaging into the exposed area using a clean pair of gloves. Affected areas do not need to be dried prior to application of calcium gluconate. Reapply calcium gluconate every 10-15 minutes until emergency medical help arrive.
- If calcium gluconate is not available, continue flushing with water until emergency medical personnel arrive.
- Call 911 on a landline phone for medical assistance (or provide location if calling on a mobile phone).

EYE CONTACT

- Using eyewash, flush eyes for 5 minutes while holding eyelid open and away from exposed eye.
- Continue flushing with water until emergency medical personnel arrive.
- Call 911 on a landline phone for medical assistance (or provide location if calling on a mobile phone).

INHALATION

- If HFA mist or vapors are inhaled, immediately move to get fresh air.
- Call 911 on a landline phone for medical assistance (or provide location if calling on a mobile phone).

INGESTION

- Do not induce vomiting.
- Provide victim with water or milk as quickly as possible.
- Provide Milk of Magnesia or TUMS, if available.
- Call 911 on a landline phone for medical assistance (or provide location if calling on a mobile phone).

Spill Response

OUTSIDE FUME HOOD OR VENTILATED ENCLOSURE

- Alert others and evacuate to a safe distance and prevent entry.
- Contact the University Operations Center at (617) 495-5560 [HMS/HSDM (617) 432-1901].
- Remain in a safe location until EH&S or other response personnel arrive.

INSIDE FUME HOOD OR VENTILATED ENCLOSURE (< 500 ml)

- Do Not Work Alone! A team of two or more individuals that are trained and confident is required to cleanup HFA spills < 500mL. Otherwise close fume hood and await support.
- Apply HFA neutralizer wearing PPE described above including face shield.
- Absorb with appropriate absorbent only after neutralization.
- Contact the University Operations Center at (617) 495-5560 [HMS/HSDM (617) 432-1901] if you need support or technical assistance.