

HYDROFLUORIC ACID

Hazard Description

Hydrogen fluoride (HF) is used at the University of Waterloo in various forms. Hydrofluoric acid comes in liquid form in various concentrations. It is clear, colourless, and resembles water.

Anhydrous hydrogen fluoride is a gas at room pressure (1 atm) and temperature (20°C). Regardless of its physical state or concentration, it is a highly toxic and corrosive substance with an irritating, pungent odour.

Prior to Working with Hydrogen Fluoride (HF)

- Complete a research-specific laboratory risk assessment.
- Ensure that a standard operating procedure (SOP) is created, posted, trained and approved by the supervisor on the process.
- Only use in a fume hood.
- Do not use HF when working alone or outside regular business hours (8 am – 4:30 pm).
- Do not work with HF until you have received practical training on all the of the specific work procedures of your laboratory (or workspace) that use HF. This should be performed by someone knowledgeable in the use and hazards of HF. This includes your supervisor, a lab technician, or senior graduate student.
- Determine if any suitable substitute can be found. If no substitute is available and HF is required for the work being undertaken, the Safety Office requires the lab purchase 2.5% calcium gluconate gel (contact ChemStores). Note this has an expiry date, and all users need to have this ready for immediate application before beginning work and while storing HF.
- Do not purchase HF in larger than 2L. Discard any HF that has not been used for the last 6 months.
- Post a sign where HF will be used in the work area and say “Hydrogen Fluoride” not “HF.”
- Ensure that all required materials are available in case of spill, emergency, and for waste collection.
- Ensure an HF-specific spill kit is available which includes everything in a basic spill kit plus:
 - HF-specific neutralizer (see table below)
 - Absorbent, appropriate for strong acids

HF Specific Neutralizers

There are a number of factors to consider when selecting a neutralizer. If you would like to purchase a neutralizer not listed below, please contact chemsafety@uwaterloo.ca for review.

- Liquid neutralizers will make less of a mess than a solid neutralizer. Due to this, the spill should already be absorbed with absorbent prior to placing the neutralizer.

- When neutralizing, some neutralizers can cause over-neutralization which leads to the spill becoming a base. If you are concerned about over-neutralization, consider a colour-changing neutralizer.
- The neutralizer should not give off a gas as a by-product.

Item	Physical State	Colour Changing	Example Supplier
LeVert HF	Liquid	No	Levitt-Safety *
Safurex	Liquid	Yes	Levitt-Safety *
Amphomag Universal Spill Neutralizer	Solid	Yes	Thomas Scientific
Ansul Spill X-A Acid Neutralizer/Solidifier	Solid	No	Fisher Scientific
Calcium hydroxide**	Solid or Liquid *We recommend storing calcium hydroxide as a solution in a spray bottle. Saturated solution is 1.85 g/L at 20°C	No	Sigma Aldrich
Calcium carbonate**	Solid	No	Sigma Aldrich
Spilfyter Kolor-Safe Kolor-Lock Hydrofluoric Dry Acid Neutralizer	Solid	Yes	FyterTech *, Fisher Scientific , Absorbents for Less

*Levitt-Safety and FyterTech may require emailing the supplier to purchase

**If using calcium hydroxide or calcium carbonate, you must have a designated bottle in your spill kit so it is always stocked and not lost on the shelf

Spill response

1. Clear the area and call the Spills Team.
2. Lay absorbents on the area to prevent vapours.
3. Using gloves, pick up the saturated absorbent, and continue until the liquid is absorbed.
4. Using tweezers, pick up any remaining plastic or equipment pieces involved in the spill.
5. Spray the area with the HF neutralizers, and briefly let it sit. Check the area with pH paper.
6. Place absorbent on the area to pick up the neutralizer.
7. Retest with pH paper to ensure the spill is no longer acidic.

8. Dispose of as Hydrofluoric Acid contaminated waste.
9. If it caused damage to the floor, contact custodial to have the issues addressed.
10. You can damp paper towels to remove any sticky residue or neutralizer and the water can be disposed of in the drain.

Handling

- Before using any HF, inspect the container to ensure it is not defective or damaged.
- All work materials, including syringes, should be made of compatible material for HF. HF dissolves most metals, natural rubber, concrete, glass, fiberglass, ceramics and glazes. HF does not attack metallic lead and platinum, polyethylene, polypropylene, Teflon, Plexiglas (i.e., acrylic), and wax.
- Additional PPE is required when working with HF:
 - Gloves: either double gloved Nitrile gloves, PVC, or neoprene gloves, or a combination of the two (one layer of nitrile gloves is not sufficient for working with HF)
 - Long pants, long sleeves, lab coat and closed-toe shoes
 - Goggles
 - Face shield
 - Acid -resistant apron

Emergency Procedures

Always review SDS of purchased product for manufacture specific recommendations. Look at SDS for other modes of exposure.

Depending on the concentration of exposure, the effect of HF can be delayed for up to 24 hours so medical attention should always be received after HF exposure.

Concentration	Time to Onset of Symptoms	Description of Surface Reaction	System Toxicity
> 50 %	Immediate	Immediate burns, rapid destruction of tissue, severe pain.	Free fluoride ions aggressively bind to cations such as calcium, magnesium, and potassium causing: <ul style="list-style-type: none"> ▪ Interference with nerve impulses, muscle contraction and relaxation ▪ Electrolyte imbalance leading to an irregular heartbeat or heart attack ▪ Lowering of blood pH (metabolic acidosis)
20 % - 50 %	1 to 8 hour delay	Burns and destruction of tissue with pain	
< 20 %	Up to 24 hour delay	Redness, mild to severe pain, or potentially no surface reaction.	

When exposed to hydrogen fluoride gas, immediate effects include:

- Upper respiratory tract irritation (coughing, choking)
- Difficulty breathing, chest tightness

Contact by acid solution potential immediate effects:

- Burns to the eyes, opacity of cornea
- Burns to the skin

In many cases, exposure to HF solutions with low concentrations can lead to delayed reactions.

No concentration is safe to handle without appropriate precautions.

Contacts	
Emergency: 911	
UW Special Constables: 519-888-4911 or ext. 22222 Poison Control: 1-800-268-9017	
Whenever 911 is called, if possible, UW Special Constables should also be informed to make them aware of the emergency on campus and allow them to support as needed. Ask them to meet the paramedics and direct them to the incident location.	
Inhalation	<ul style="list-style-type: none">• Remove individual from contaminated area• Call 911 for transport to hospital• Corrosive substances may cause severe lung damage if inhaled• Perform CPR and artificial respiration if necessary• Provide responder with SDS
Skin Contact	<ul style="list-style-type: none">• Call 911 for transport to hospital and inform them of HF exposure• Remove contaminated clothing and quickly but gently wipe material off skin• Flush with water and apply calcium gluconate (can be applied during shower)• Apply calcium gluconate every 15 minutes and can continue while people transported to the hospital• Provide responder with SDS
Eye Contact	<ul style="list-style-type: none">• Call 911 for transport to hospital• Flush eyes using eyewash station for a minimum of 15 minutes• Do not apply calcium gluconate to the eyes• Provide responder with SDS

Storage

Storage Group F – Inorganic Acids (with further segregation from other inorganic acids)

Hazardous Waste

- Must be disposed of as per the [University's Hazardous Waste Standard](#).
- Inorganic acids should not be mixed prior to being sent to the waste facility. Individually segregate.
- **Label** and make a waste Hydrofluoric Acid container that will **only be used for hydrofluoric acid**. The waste hydrofluoric acid container should only be made of polyethylene or Teflon.
- If bottles are degraded, contact esf@uwaterloo.ca for disposal instructions.