C_006 Hydrofluoric Acid Safety Training

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About this training

- ***Hydrofluoric acid (HF) and ammonium bifluoride* (ABF)*** **are primarily used at LLE to strip hard oxide coatings from optics and etch MLD gratings**

  *** Ammonium bifluoride is also known as "Ammonium hydrogen fluoride" or "Buffered Oxide Etch (BOE)**

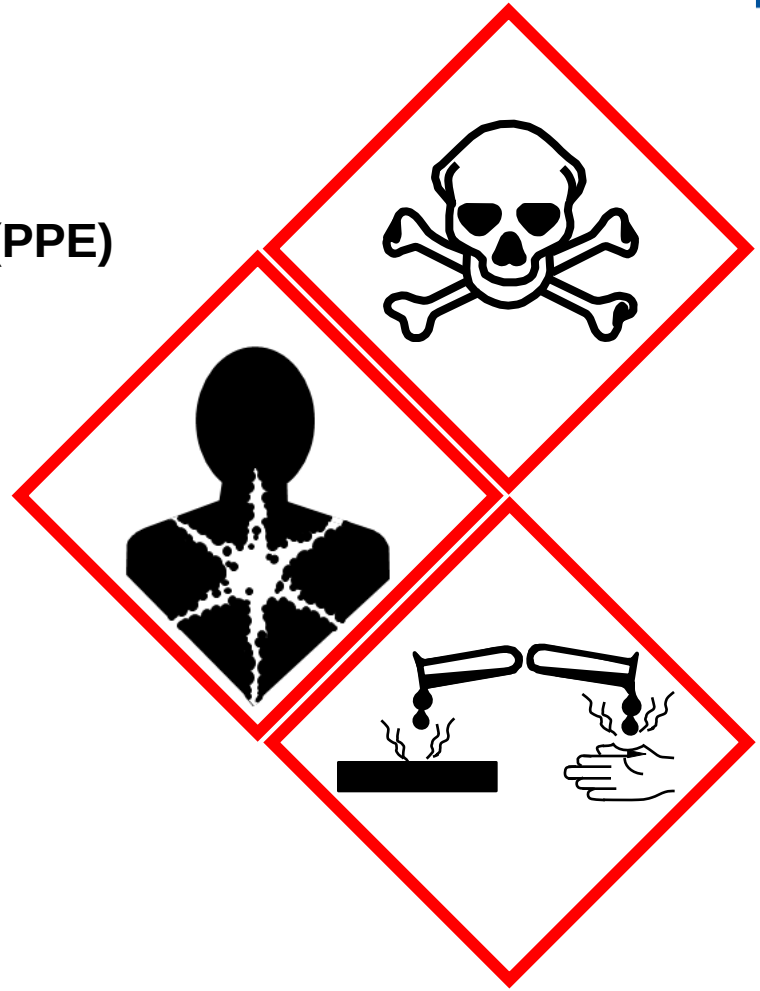
- **Employees who handle *HF and ABF must* be trained on the hazards of these chemicals, required personal protective equipment (PPE) and what to do in the event of an exposure or a spill.**

- **Emergency exposure treatment and Safety Data Sheets (SDS) for these chemicals *must* always be kept in the immediate work area and reviewed regularly before use.**

Use Buffered Oxide Etch in place of HF whenever possible

Outline

- Hazards
- Safe work practices
- Personal Protective Equipment (PPE)
- Skin exposure
- Eye exposure
- Inhalation
- Ingestion
- Spill clean-up
- Waste disposal
- Summary



Exposure can cause delayed injury and symptoms

- **HF or ABF can penetrate deeply into the skin before dissociating (initially painless), causing delayed injury and symptoms. These symptoms can include:**
  - **Destruction of tissue**
  - **Decalcification of bone**
  - **Cardiac arrhythmia**
  - **Liver or kidney damage**
  - ***Death***

Exposure to fluoride-containing acids can have serious health consequences

- **Inhalation of fumes at low concentration can irritate the eyes, nose and respiratory tract.**
- **Inhalation at high concentration can cause death from an irregular heartbeat or from fluid buildup in the lungs.**
- **Ingestion of only a small amount of highly concentrated solutions will affect major internal organs and may be fatal**
- **Eye exposure may cause prolonged or permanent visual defects, blindness, or total destruction of the eye.**

*** For a more detailed list of signs, symptoms and health effect of exposure visit:**
https://emergency.cdc.gov/agent/hydrofluoricacid/basics/facts.asp

Only qualified and experienced personnel should handle HF or ABF

Protective Measures:

- ***Always*** **work inside a fume hood**
- ***Always*** **wear all the required Personal Protective Equipment (PPE)**
- ***Never*** **use HF or ABF when working alone or after hours**

- **All personnel working with (or near those working with) HF or ABF should be aware of the hazards of these chemicals and the emergency procedures necessary in case of an accident/exposure**

Always **wash hands thoroughly after handling HF or ABF**

Special precautions must be taken when storing hydrofluoric acid and ammonium bifluoride

Protective Measures (continued):

- **Always place HF and ABF on a low protected shelf in a secondary container or other location where it will not be accidentally spilled or knocked over**

- **HF and ABF must always be stored in heavy-walled plastic containers.**

- **Never store these chemicals in glass bottles**

Safety Data Sheets and Calgonate Gel must be located in the immediate vicinity of HF or ABF use

* Acute Toxicity (fatal or toxic)

* Corrosive

* Health Hazard

Everyone using HF or ABF must be trained on its properties, procedures for use, emergency response, and disposal

When working with hydrofluoric acid or ammonium bifluoride the following PPE is required

- **Chemical splash goggles and a face shield**
  - ***Safety glasses with side shield DO NOT provide adequate protection***
- **Long-sleeved, buttoned lab coat, full-length pants, and closed-toed shoes**
- **Neoprene or Nitrile (22 mil) or other hydrofluoric acid resistant gloves**
  - ***Do NOT wear latex gloves***
- **An apron made of natural *rubber, neoprene or Viton* is also required**

Ensure that all PPE is fully functional with no tears or holes prior to use

Skin Exposure

Any person exposed to HF or ABF must seek immediate medical assistance

For skin exposure:

- ***Immediately*** **and continuously wash all affected areas with water for 5 minutes**
- **The victim's buddy must call an LLE Receptionist to have the Medical Emergency Response Team paged and 911 called.**
- **After rinsing, use a properly gloved hand to apply Calgonate Gel by massaging it into the skin. (If Gel is not available, continue to rinse with water for at least 15 minutes)**
- **Re-apply Calgonate Gel continually every 10-15 minutes until medical treatment is given by a physician or EMT**

Users of HF or ABF must verify Calgonate has not expired before starting work

Eye Exposure

Any person exposed to HF or ABF must seek immediate medical assistance

For eye exposure:

- **Immediately flush eyes for at least 15 minutes with cool flowing water. Hold the eyelids open and away from the eye during irrigation.**

- **Victim *must* be taken to the doctor (preferably an eye specialist) while continually irrigating the eyes during transport**

Inhalation Exposure

Any person exposed to HF or ABF must seek immediate medical assistance

If a large volume of gas is inhaled:

- **Immediately move the victim to fresh air and call for medical attention**
- **Keep the victim warm, quiet, and comfortable**

If breathing has stopped, a trained responder can begin CPR after ensuring that:

- **The Medical Responder will not also be exposed to HF**
- **The mouth and throat are free of foreign material**

The victim *must* be examined by a doctor and held for observation for at least 24 hours after exposure

Ingestion

Any person exposed to HF or ABF must seek immediate medical assistance

If acid is ingested:

- **Drink large amounts of water as quickly as possible to dilute the acid**
  - ***Do NOT induce vomiting***

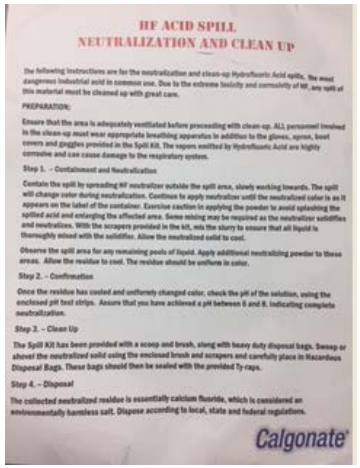
- **Drink several glasses of milk or several ounces of Milk of Magnesia, Mylanta, Maalox, or similar product; or eat up to 30 Tums (Calcium Carbonate), Caltrate or other antacid tablet.**

In the event of a spill….

1. Alert personnel in the immediate area, supervisor, and the Chemical Hygiene Safety Officer.
2. Obtain the Calgonate Spill Kit
3. Don the appropriate PPE
4. Contain spill by spreading Kolor-lock neutralizing powder outside spill area, working inwards
5. Isolate spill area by delineating with caution tape and posting signage (ex. Danger: HF spill)
6. Allow sufficient contact time as recommended by the manufacturer
7. Verify that neutralization is complete by using PH strips included in the spill kit
8. Collect all clean-up waste in a sealed plastic container. Label “HF clean-up waste” with a Chematix Waste Tag and place in the Hazardous Waste Collection Area
9. Rinse off all PPE used during clean up with copious amounts of water

Calgonate Spill Kit Contents

Instructions


HF ACID SPILL
NEUTRALIZATION AND CLEAN UP

The following instructions are for the neutralization and clean-up Hydrofluoric Acid spills, the most dangerous industrial acid in common use. Due to the extreme toxicity and corrosivity of HF, any spill of this material must be cleaned up with great care.

PREPARATION:

Ensure that the area is adequately ventilated before proceeding with clean-up. ALL personnel involved in the clean-up must wear appropriate breathing apparatus in addition to the gloves, apron, boot covers and goggles provided in the Spill Kit. The vapors emitted by Hydrofluoric Acid are highly corrosive and can cause damage to the respiratory system.

Step 1. – Containment and Neutralization

Contain the spill by spreading HF neutralizer outside the spill area, slowly working towards. The spill will change color during neutralization. Continue to apply neutralizer until the neutralized color is as it appears on the label of the container. Exercise caution in applying the powder to avoid splashing the spilled acid and enlarging the affected area. Some mixing may be required as the neutralizer solidifies and neutralizes. With the scrapers provided in the kit, mix the slurry to ensure that all liquid is thoroughly mixed with the solidifier. Allow the neutralized solid to cool.

Observe the spill area for any remaining pools of liquid. Apply additional neutralizing powder to these areas. Allow the residue to cool. The residue should be uniform in color.

Step 2. – Confirmation

Once the residue has cooled and uniformly changed color, check the pH of the solution, using the enclosed pH test strips. Assure that you have achieved a pH between 6 and 8, indicating complete neutralization.

Step 3. – Clean Up

The Spill Kit has been provided with a scoop and brush, along with heavy duty disposal bags. Sweep or shovel the neutralized solid using the enclosed brush and scrapers and carefully place in Hazardous Disposal Bags. These bags should then be sealed with the provided Ty-raps.

Step 4. – Disposal

The collected neutralized residue is essentially calcium fluoride, which is considered an environmentally harmless salt. Dispose according to local, state and federal regulations.

Calgonate

PPE

Treatment

Neutralizer and Clean-up

HF and ABF can only be used in approved locations and where Calgonate and spill kits are present

- **Familiarize yourself with the location and contents of the HF spill response supplies**

- **In labs where HF or ABF is utilized, use Kolor-Safe Kolor-Lock to clean up any unidentifiable spilled liquid as if it were HF or ABF**

Users must obtain approval from the Chemical Safety Officer for any new locations where these materials will be used

Spill response supplies are located near each HF or ABF work area

Rm 1210 – under the disposable glove dispensers, attached to the hood where all HF/ABF work should be handled

Rm 112D – adjacent to the first aid kit & safety shower

Spill response supplies are located near each HF or ABF work area

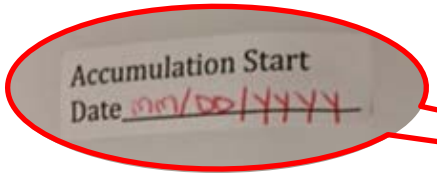
Rm 1430 – near safety shower, directly across from hood where all HF/ABF should be handled

Rm 2234 – center of room, on top of lab bench, central to all areas of lab

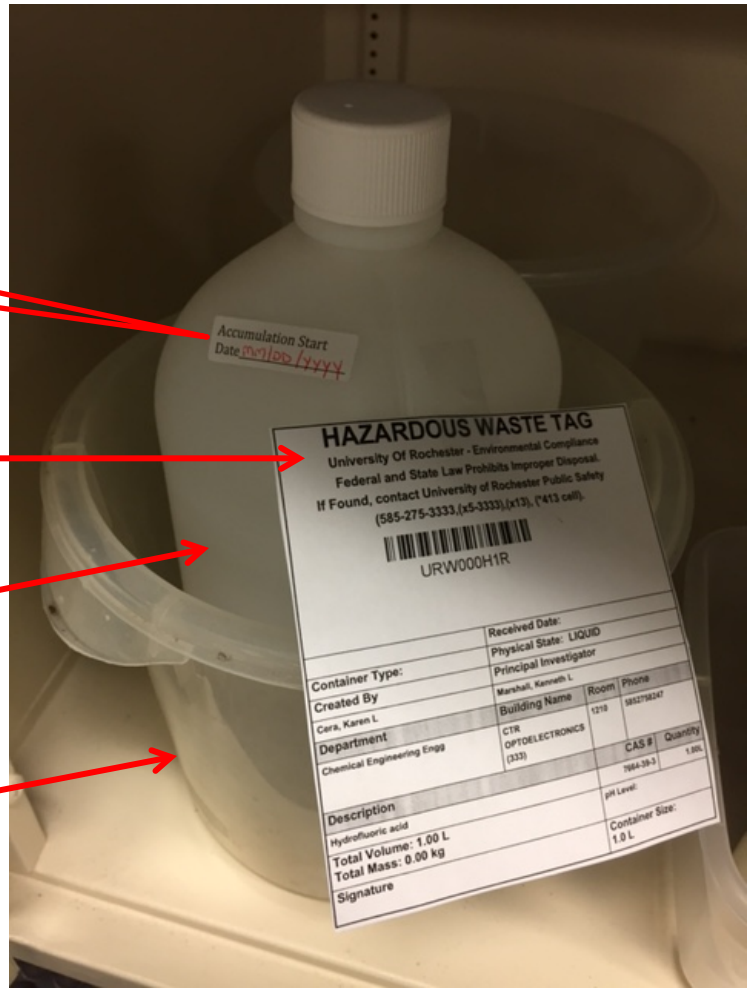
Hazardous waste containers must be properly stored and labeled

All HF and ABF waste *must*:

- **have an accumulation start date label affixed to the container**



- **be labeled with a Chematix Waste Tag**
- ***be stored in heavy-walled plastic containers***
- **be stored in secondary containment**



Summary

Accidental exposure to HF or ABF can have serious consequences, including death

- Achieving and maintaining a safe working environment is *everyone's responsibility*
- Know the Standard Operating Procedures (SOP) for the chemicals you are working with
- Only experienced, qualified personnel should handle these chemicals
- *Always* work with a buddy and *never* after-hours
- Use *all* required, properly-fitting PPE for *every* experiment *every* time
- Know what to do and who to call when something goes wrong

When uncertain about proper procedure or operational safety: STOP and ASK!

Before starting work…

- Complete the on-line C_006 Quiz:
  - Sign (handwritten, not typed) the results page that will be emailed to you
  - Deliver signed form to the “Safety” Mailbox in the LLE East lobby, or email to safety_training@lle.rochester.edu
- Submit LLE Safety Suggestions any time

Use any web browser to access these links on the LLE Safety Zone, “Training” tab

You must complete the C_006 quiz to satisfy your training requirement

New employees must obtain signature of Chemical Safety Officer after completing quiz