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## HYDROFLUORIC ACID (HF) PROGRAM - External

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### INTRODUCTION

Hydrofluoric acid has a number of unique chemical, physical and toxicological properties, which make handling this material especially hazardous. Hydrofluoric acid spill and exposure response are unique to the chemical, and standard lab response can be ineffective or create additional hazards. This document outlines the basics of safely handling hydrofluoric acid at UC Riverside, as well as the role of EH&S in the administration of hydrofluoric acid program.

### OBJECTIVES

The objectives of this program include, but are not limited to:

- Ensure that researchers working with hydrofluoric acid are aware of the hazards of the material.
- Ensure that researchers working with hydrofluoric acid are meeting the minimum safety requirements when working around and with hydrofluoric acid.
- Ensure that researchers are aware of appropriate exposure and spill response procedures when working with hydrofluoric acid.

### RESPONSIBILITIES

#### Environmental Health and Safety

EH&S is responsible for the management of the campus' chemical inventory, including hydrofluoric acid, and for the generation of reports based on the inventory data. EH&S works with laboratories to verify that all requirements of working with hydrofluoric acid, as outlined by this program, are met.

#### Principal Investigators (PIs)

The PI is responsible for maintaining safety protocols in their laboratory spaces. This involves making sure their laboratory personnel are properly trained for hazards that may be present in the laboratory, and that training is documented. The PI is also responsible for making sure that all safety precautions are being upheld in their laboratory space, including use of Standard Operating Procedures (SOPs) and adherence to the [Personal Protective Equipment \(PPE\) policy](#). The PI ensures

that the inventory in their space is regularly managed, and annually certifies that their inventory in UC Chemicals is accurate. While a PI may delegate tasks related to safety to members of their laboratory, the ultimate responsibility of safety in the space remains with the PI.

## Laboratory Personnel

Laboratory Personnel are individuals who work in the laboratory. Laboratory personnel are required to follow all safety protocols in the laboratory as outlined by the PI, including following SOPs and wearing required PPE. Any changes to established procedure or amounts should be approved by the PI before making the change.

## RECOGNIZING HYDROFLUORIC ACID AND ITS HAZARDS

Hydrofluoric acid, commonly known by the abbreviation **HF**, is a solution of hydrogen fluoride in water. Hydrofluoric acid is most commonly sold to laboratories at 48-51% concentration in water. Due to its reactivity with glass, hydrofluoric acid is one of the few acids regularly sold and stored in plastic bottles.

Though a weak acid in dilute aqueous solution, hydrofluoric acid is a strong corrosive, including attacking glass when hydrated. Hydrofluoric acid is a powerful contact poison. It easily penetrates skin, making exposure through skin or eyes, or when inhaled or swallowed a significant concern. Once it penetrates the skin, it dissociates into fluoride ions, causing destruction of deep tissue layers, including bone and the cardiovascular system. Hydrofluoric acid interferes with nerve function, so exposures or burns may not be initially painful or readily apparent at lower concentrations. Though there may be no pain associated with the initial exposure, unless rapid neutralization of the HF and binding of the fluoride ion takes place, tissue destruction can continue for days, potentially resulting in limb loss or death. Because of the delay of pain and symptoms, often hydrofluoric acid exposures are not reported or treated until onset of severe symptoms, which increases likelihood of severe outcomes including death.

## TRAINING REQUIREMENTS

All members of the lab should be trained on the contents of this document, including spill and exposure response, the laboratory SOP with specific guidance on working with HF, and have taken [Hydrofluoric Acid Training](#) in the UCR Learning Center.

## INVENTORY MANAGEMENT

Inventory updates are the responsibility of the laboratory that purchases them. Having an updated inventory allows for accurate response in hazardous situations, particularly in spaces with hydrofluoric acid. To reduce risk, it is recommended to minimize ordering and keep only a few months stock of hydrofluoric acid. Hydrofluoric acid should be stored in a corrosive cabinet, properly labeled, in secondary containment separate from other acids.

Due to the unique hazards associated with the material, if no projects are ongoing with hydrofluoric acid, or the regularly trained users of hydrofluoric acid have left the lab, it is recommended to dispose of remaining material through the [EH&S Hazardous Waste Pickup program](#) to minimize risk of exposure or spill by untrained researchers in the lab.

## HYDROFLUORIC ACID SOP

A generic SOP created by EH&S is available in Appendix A, which covers the basic safety requirements of handling hydrofluoric acid in a laboratory setting. One requirement of the SOP is defining the largest allowed quantity without PI approval, to keep reaction size and risk of exposure low. While it is understood that the requirements of a research laboratory may require varied and changing processes, it is strongly encouraged, whenever possible, to outline specific processes in detail when working with hazardous substances. SOP should be signed by the PI, along with anyone in the laboratory using or handling hydrofluoric acid in any way.

## HYDROFLUORIC ACID PERSONAL PROTECTIVE EQUIPMENT (PPE)

The minimum PPE when walking into any laboratory space is long pants closed-toe/heel shoes. When in a space with hazardous materials, a lab coat and eye protection are required. Any handling of hazardous materials requires gloves. Specific to hydrofluoric acid:

- Body Protection
  - Lab Coat – protects against incidental splashes. Lab coats are not barrier protection, and should be removed in the case of a spill of hazardous materials on to the coat.
  - Acid resistant apron (recommended) – Provides additional protection from splashes, and stops a spill from absorbing through a lab coat and onto the body.
- Eye/Face Protection
  - Chemical Splash Goggles – impact glasses are not sufficient to protect from hydrofluoric acid exposure
  - Face Shield– provides additional protection to the face area and eyes. Chemical splash goggles must be worn underneath the face shield, a face shield is not sufficient protection on its own.
- Gloves
  - Thin disposable nitrile gloves (such as 4, 6, or 8 mil blue gloves) used in laboratory operations provide a contact barrier only and should be disposed of immediately when contamination is suspected.
  - Thicker (10-20 mil) PVC or neoprene gloves provide good resistance to HF but do not provide the necessary dexterity for most lab procedures.
  - Thinner PVC or poly (“food” handling) gloves can provide some resistance to HF, but should also be changed immediately at the first sign of contamination.
  - Disposable gloves should never be worn without double gloving while handling hydrofluoric acid because of the potential for pinholes and exposure. A combination of double gloves, Nitrile and poly, can be used to provide greater protection from a broader range of materials.

## WORKING WITH HYDROFLUORIC ACID IN THE LABORATORY

Before commencing work with hydrofluoric acid, researchers should:

- Understand contents of HF document
- Obtain explicit permission from their PI or supervisor
- Review and sign the lab specific standard operating procedures
- Review and be comfortable with the contents of the UC Riverside EH&S Hydrofluoric Acid (HF) Spill and Splash Quick Response Guide
- Know where the laboratory’s hydrofluoric acid spill and exposure kit are located, and how to use them
- Verify that the lab’s calcium gluconate is not expired.
- Know where to receive emergency treatment in case of an exposure.

Work with hydrofluoric acid should be done in a working fume hood, in a laboratory with an emergency shower and eyewash combination. All PPE as outlined in the “Hydrofluoric Acid Personal Protective Equipment (PPE)” section must be worn whenever handling hydrofluoric acid. **Never work alone** with hydrofluoric acid, and another member of the lab should be trained on response to hydrofluoric acid spills and exposures.

## EH&S PROVIDED EMERGENCY RESPONSE MATERIALS

EH&S will provide a kit for safely responding to HF exposures, which includes:

- UC Riverside EH&S Hydrofluoric Acid (HF) Spill and Splash Quick Response Guide
  - Provides guidance on how to safely work with HF, and how to responds to different emergencies, including spills and different types of exposures.
- Calcium Gluconate

- Use in response to skin exposures. Must be disposed of and replaced when expired. Expiration Date is noted on a label on outside of kit, contact EH&S for a replacement *before* it expires.
- Honeywell “Recommended Medical Treatment for Hydrofluoric Acid Exposure” brochure
  - To be provided to medical treatment providers to assist in appropriate response to an HF exposure

## HYDROFLUORIC ACID SPILL RESPONSE

The UC Riverside EH&S Exposure Response Kit provides directions on how to respond to a spill. In general, only clean up a spill if you are trained to do so, feel confident in doing so, and have the appropriate PPE and materials.

1. Alert others in the area.
2. If spill is small, in a fume hood, and it is safe to do so, applying HF Neutralizing Absorbent can reduce spread and risk of exposure. **Do not** use vermiculite or other silica based absorbents, like clay, kitty litter, or sand. This will create a toxic gas.
3. Cordon off the area.
4. Leave the laboratory and contact 911 or EH&S and specify that you have a hydrofluoric acid spill. Stay by the laboratory (if safe to do so) to provide information and support.
5. EH&S is responsible for the clean-up of all hydrofluoric acid spills.

## HYDROFLUORIC ACID EXPOSURE RESPONSE

The exposure response and first aid for HF exposure are unique from other chemicals, including other acids. Because HF requires a neutralizing step provided by calcium gluconate, the time in a shower is reduced to 5 minutes, from a standard 15 minutes used for all other chemical exposures. After the initial 5 minute rinse to remove any residual surface contamination, application of calcium gluconate gel begins the neutralization process while waiting for emergency personnel.

Due to these differences in first aid response, specific training for HF exposure according to this program is essential. While only those working with or having potential exposures to hydrofluoric acid need to be fully trained on its use, it is a best practice to have all members of the lab understand the basic hazards and be trained in response to a hydrofluoric acid exposure. At very least, anyone working with HF in the lab should have someone in the lab as a buddy that is fully trained on exposure response. This includes awareness of the contents of the Hydrofluoric Acid (HF) Spill and Splash Quick Response Guide, and how to safely execute the procedures included if a lab member needs assistance after a spill or exposure. **HF should never be worked with alone, and should be used during normal work hours (Monday-Friday 8-5) to ensure the fastest response to an emergency situation.** Every hydrofluoric acid exposure should be treated with initial first aid and then provided with a medical response. If the exposure is severe, UCPD should be contacted at 9-1-1 from a campus phone or (951)-827-5528 to coordinate emergency services. In the case of a small exposure, after first aid is rendered proceed to an emergency medical provider. Because pain can be delayed and damage is happening under the surface of the skin, do not rely on feeling or seeing effects of the exposure to guide response! Provide initial treatment based on the type of exposure as outlined in the Hydrofluoric Acid (HF) Spill and Splash Quick Response Guide, and receive qualified medical care.

Included in the Hydrofluoric Acid Exposure Response Kit is a Honeywell “Recommended Medical Treatment for Hydrofluoric Acid Exposure” brochure. Because of the unique hazards and symptoms of Hydrofluoric acid exposure, medical providers may not be immediately aware of the proper protocols to treat HF exposure and how they differ from other acid exposures. When being taken for medical treatment, take the copy of the brochure and provide it to the person treating you so they have a reference document for best treatment practices.

