Laboratory Standard Operating Procedure: Hydrofluoric Acid

I.	THIS STANDARD OPERATING PROCEDURE (SOP) IS FOR A:

☐ **Specific laboratory procedure or experiment**
Examples: synthesis of chemiluminescent esters, folate functionalization of polymeric micelles, etc.

☐ **Generic laboratory procedure that covers several chemicals**
Examples: distillation, chromatography, etc.

☒ **Generic use of specific chemical or class of chemicals with similar hazards**
Examples: organic azides, mineral acids, etc.

This standard operating procedure (SOP) is intended to provide general guidance on how to safely work with Hydrofluoric Acids. This general use SOP only addresses safety issues specific to this corrosive chemical. The Principal Investigator will have detailed SOPs for laboratory efforts. If you have questions concerning the applicability of any item listed in this procedure contact the Principal Investigator/Laboratory Supervisor of your laboratory or the Chemical Environmental Health and Safety Coordinator [CEHSC] at (813) 842-3528.

II.	CLASS OF HAZARDOUS CHEMICALS

Hydrofluoric acid, a solution of hydrogen fluoride gas (HF) in water, is one of the most corrosive and dangerous chemicals encountered in the laboratory. Exposure to HF can cause severe tissue damage and even death. Deaths have been reported from concentrated acid burns (i.e., 50% or stronger solutions) to as little as 2.5% Body Surface Area. In lower concentrations, symptoms may be delayed. Special safety precautions are necessary when using this chemical, regardless if using dilute or concentrated HF.

III.	GENERAL HAZARD CONTROL

Handling processes should be designed to minimize the potential for splash, splatter, or other likely scenarios for accidental contact. Employ these safe handling practices:

1) Purchase and use smallest quantities necessary.
2) Do not work alone; others present in the laboratory must be familiar with the operation's hazards and emergency procedures.
3) Plan the operation to eliminate risk of HF splash or spray.

4) Perform a “dry run” of procedure to identify and correct potential hazards.
5) Do not pour water into acid. Slowly add the acid to the water and stir.
6) Use a mechanical aid or a pipette bulb for pipetting.
7) Do not use glass, ceramic, or other incompatible containers with HF.
8) Open bottles slowly and carefully and wear protective equipment to guard hands, face, and body from splashes, vapors, gases and fumes.
9) Wipe drips from containers and bench tops. Skin contact with dry residue will result in burns.

IV. ENGINEERING & VENTILATION CONTROLS

Use a properly functioning lab fume hood when handling strong acids/bases, or other chemicals that can form mists/vapors upon contact with air [ex. “fuming”]. If the process does not permit the handing of such materials in a fume hood, contact the CEHSC at (813) 842-3528 for reviewing the adequacy of room ventilation standards.

Follow Safe Fume Hood Practices:

1. Ensure the fume hood’s certification date is within a one-year period. Verify sufficient inward airflow before using a hood by checking the hood’s airflow indicator. Report any problems to PI/Lab Supervisor and the CEHSC.
2. Maintain hood sash at or below the maximum height indicated by an arrow on the side of the fume hood.
3. Close the hood sash when not working in the hood.
4. Avoid rapid movements at the face of the hood to avoid creating competing air currents that reduce the ability of the hood to contain air contaminants.
5. Equipment used in hoods should be placed securely on blocks to allow air to flow under and around the equipment.
6. Keep chemical sources and equipment at least six inches away from the face or rear of the hood.
7. Minimize equipment and chemical storage placed in the hood to avoid dead air spaces or eddies and to prevent blocking back baffles.

V. PERSONAL PROTECTIVE EQUIPMENT

☒ Lab Coat ☒Long pants ☒Close-toed shoes

☒Safety goggles w/ face shield ☒Butyl Rubber or neoprene gloves

☒ Neoprene Apron

The above listed personal protective equipment should be worn when handling highly hydrofluoric substances. Additional protection may be required based upon additional experimental chemical agent(s) in use. Check all personal protective equipment [PPE] prior to use to ensure good undamaged condition. At a minimum:

1. Butyl Rubber or neoprene protective gloves are to be worn. For proper selection of glove material, review chemical SDS and glove selection guidance.
2. A safety goggle with face shield is also recommended.
3. A neoprene long sleeved apron over lab coat
4. Additional protective clothing includes long pants and closed toed shoes are to be worn when entering laboratory.

VI.	SPECIAL HANDLING PROCEDURES AND STORAGE REQUIREMENTS

Ensure secondary containment and segregation of incompatible chemicals per guidance within the **UT Chemical Hygiene Plan**. Also, follow any substance-specific storage guidance provided in Safety Data Sheet [SDS] documentation.

Corrosives should never be stored above eye level.

Ensure the nearest emergency safety shower /eyewash is accessible and has been tested in the last month.

VII.	DESIGNATED AREA

For use of particularly hazardous corrosives, a designated area shall be established where limited access, special procedures, knowledge, and work skills are required. A designated area can be the entire laboratory, a specific laboratory workbench, or a laboratory hood. Designated areas must be clearly marked with signs that identify the chemical hazard and include an appropriate warning; for example: **WARNING! HYDROFLUORIC ACID WORK AREA.**

1. Upon leaving the designated area, remove any personal protective equipment worn and wash

hands, forearms, face, and neck.

2. After each use (or day), wipe down the immediate work area and equipment to prevent accumulation of chemical residue.
3. At the end of each project, thoroughly decontaminate the designated area before resuming normal laboratory work in the area.

VIII.	EMERGENCY SPILL AND ACCIDENT PROCEDURES

Hydrofluoric acid (HF) exposure is very toxic and can be fatal if not treated immediately. HF is absorbed quickly; however, damage/symptoms can occur hours to days later. Any person exposed to HF must have immediate first aid, followed by immediate medical treatment from a physician. When seeking medical attention bring a copy of the HF Material Safety Data Sheet to the Hospital Emergency Room

Pre-Planning	1. **Post HF First Aid Instruction in lab** 2. **Ensure 2.5% calcium gluconate gel intended for dermal exposures is available in the laboratory and that its shelf-life is < 1year old** 3. **Track supplies of gel and maintain fresh batch at all times.**
Health-Threatening Emergencies Skin Exposure.	1. **Call 911** 2. Immediately flush affected area with water for 15 minutes under emergency eyewash/shower station or other water source. 3. Remove all contaminated clothing while flushing with water. 4. After flushing, apply calcium gluconate to burn site with clean, gloved hand. 5. Continue massaging gel into the burned area of skin for up to 20 minutes. 6. Call Campus Security at 813-257-7777 or xtn. 7777 7. Remain nearby to provide arriving emergency responders information about chemicals. 8. Once personal safety is established, call the CEHSC at (813) 842-3528
Health-Threatening Emergencies Eye Exposure.	1. **Call 911** 2. Flush contamination from eyes using the nearest emergency eyewash/shower for a minimum of 15 minutes. 3. Be careful to not flush contaminated water into non-affected eye. 4. Call Campus Security at 813-257-7777 or xtn. 7777 5. Give medical responders copies of SDSs for all chemicals the victim was exposed to. 6. Report the exposure to the CESHC
Health-Threatening Emergencies	1. **Call 911** 2. Call Campus Security at 813-257-7777 or xtn. 7777 3. Give medical responders copies of SDSs for all chemicals the victim was exposed to.

Inhalation Exposure.	**4.** Report the exposure to the CESHC
Health-Threatening Emergencies Ingestion Exposure.	1. Call 911 2. Do NOT induce vomiting. 3. Rinse mouth with cold water. 4. Have victim drink lots of water to dilute the acid [if conscious only]. 5. Call Campus Security at 813-257-7777 or xtn. 7777 6. Give medical responders copies of SDSs for all chemicals the victim was exposed to. 7. Report the exposure to the CESHC
Small Spill Clean-Up	**Note: Only minor spills or releases can be cleaned up by knowledgeable personnel using readily available equipment:** 1. Notify personnel in the area and restrict access. Eliminate all sources of ignition. 2. Review the SDS for the spilled material, or use your knowledge of the hazards of the material to determine the appropriate level of protection. 3. Wear gloves and protective eyewear as previously recommended. Clean up using specialized neutralizing absorbent. Put the contaminated absorbent in a labeled hazardous waste container. 4. If greater than 30 ml, or if it will take longer than 15 minutes for you to clean-up, immediately call Security (813) 257-7777 or xtn. 7777 to report the spill, and notify your supervisor. 5. Submit waste pickup request to the CEHSC.
Incident Reporting	1. Report all occupational injuries or illness to laboratory supervisor as soon as practical. 2. Laboratory personnel are encouraged to report "near misses" as they are considered a precursor to actual incidents. 3. Laboratory supervisor is to conduct (or coordinate) an investigation of all incidents and "near misses." The goal of the investigation is to identify and address any deficiencies that may have contributed to the incident.
Medical Consultation	Laboratory personnel who work with hazardous chemicals are to be provided the opportunity to receive medical attention/consultation when: 1. A spill, leak, explosion or other occurrence results in a hazardous exposure (potential overexposure). 2. Symptoms or signs of exposure to a hazardous chemical develop.
IX.	**WASTE DISPOSAL**
Many corrosive liquids intended for disposal may be considered hazardous waste. Please call the CEHSC at (813) 842-3528 to describe the quantities of waste you anticipate generating	

and appropriate waste disposal procedures. Include any special handling or storage requirements for your waste.	
X.	**DECONTAMINATION PROCEDURES**
Personnel	If immediate medical attention is required, call 911. Remove any contaminated clothing, and IMMEDIATELY flush contaminated skin with water for at least 15 minutes following any skin contact. For eye exposures, IMMEDIATELY flush eyes with water for at least 15 minutes. Consult SDS for guidance on appropriate first aid. Where medical attention is required, ensure to bring along SDS(s) of chemical(s) to aid medical staff in proper diagnosis and treatment. All incidents involving exposure to hydrofluoric acid, phenol, or other severe skin contact hazards require immediate medical attention. Additionally seek medical attention if pain, numbness, redness, irritation or other health symptoms are apparent. Check the SDS to see if any delayed effects should be expected.
Area	1. Decontamination procedures vary depending on the material being handled; consult the SDS. 2. The corrosivity of some materials can be neutralized with other reagents. 3. All surfaces should be wiped with the appropriate cleaning agent following dispensing or handling. 4. Waste materials generated should be treated as a hazardous waste.
Equipment	Decontaminate laboratory apparatus or other contaminated equipment (glassware) before removing them from the designated area.
XI.	**TRAINING REQUIREMENTS**
General Training *(check all that apply):* ☑ General Safety & Emergency Preparedness – Annual Orientation Training ☑ Review of SDS for other chemicals involved in process/experiment ☑ Review of this SOP ☑ HF Emergency Procedures	

☑ Other: _____
Additional safety training is required by the University.