***STANDARD OPERATING PROCEDURE – C006***

**WORKING WITH HYDROFLUORIC ACID**

1. **Objectives**

The objective of this document is to establish standard operating procedures for working with hydrofluoric acid, ensuring the safety of laboratory personnel by mitigating potential risks associated with hazardous materials, and injuries.

1. **Personal Protective Equipment**

To ensure safety during work with hydrofluoric acid, appropriate personal protective equipment (PPE) must be worn. This includes:

* Long pants and closed-toe shoes to protect against spills and splashes.
* A long-sleeved, buttoned lab coat to minimize skin exposure.
* Safety glasses or goggles to protect against splashes or flying debris.
* Disposable **nitrile/neoprene/viton** gloves to prevent direct contact with hazardous chemicals. In case of high concentration, nitrile neoprene or viton gloves should be used instead of nitrile gloves.
	+ **NOTE:** The chemical’s SDS should always be checked prior to start of work to ensure proper glove selection.
* If the user has long hair, it should be tied back.
1. **Potential Hazards & Safety Precautions**

When working with hydrofluoric acid, safety precautions must be taken to manage and maintain a safe working environment. There are several hazards a user can come into contact with and these include:

* **Health Hazards:** Hydrofluoric acid readily penetrates skin and mucous membranes, causing deep tissue damage and systemic poisoning by binding calcium and magnesium ions. Inhalation may lead to pulmonary edema, and ingestion causes severe internal burns. Chronic exposure risks bone damage and organ failure.
	+ Concentrated HF (>50%): Exposure to a small part of the body can cause severe burns, excruciating pain, and death.
	+ 20-50% HF solutions: Burns and pain can be delayed for up to eight hours.
	+ <20% HF solutions: Pain and redness may not occur for up to 24 hours
	+ HF concentrations as low as 2%: cause burns and even if not effectively washed off.
* **Chemical Hazards:** HF dissolves glass and reacts explosively with metals, such as Aluminium, releasing flammable hydrogen gas. It is incompatible with bases, oxidizers, and organic compounds, potentially generating toxic byproducts. Prolonged contact degrades many plastics and rubbers, compromising containment.
* **It is NOT advised to handle Hydrofluoric Acid alone.**
1. **Training**

Ensure all personnel have received proper training on their hazards and safe handling techniques.

* MC03 Chemical Safety II / Hazardous Waste Management
* MC07 Chemical Safety I / Chemical Safety for Laboratory Users
1. **Procedures**
2. Storage and handling
* All workers should be familiar with the SDS of Hydrofluoric Acid prior to work.
	+ **NOTE**: Hydrofluoric acid (HF) is one of the **strongest and most corrosive acids known**.
* HF easily dissolves glass; therefore HF must always be stored in its original container/plastic bottles and placed in Nalgene/polypropylene secondary containment.
* Do not store above eye level.
* Do not store it with incompatibilities like oxides, organic chemicals, bases or metals.
* If not plainly visible, labelling must be applied to storage locations (e.g. cabinet doors & secondary containment) where these are stored, to avoid an inadvertent encounter.
* All labs working with or storing HF must include in their first-aid kit a Calcium gluconate gel for accidental spill.
* Do not heat hydrofluoric acid.
* Use a fume hood to mitigate exposure to HF.
1. Disposal of Hydrofluoric Acid
* HF waste is considered Extremely Hazardous. Note: Empty containers of HF and gloves/PPE that come in contact with HF must be disposed of as Solid with Toxic Chemicals.
* Refer to the SOP titled “Disposal of hazardous chemical waste” for more details. Pretreat the hydrofluoric acid (such as by Calcium salt) before disposal whenever feasible. It should be discarded to the designated hydrofluoric acid waste container. The final concentration of hydrofluoric acid should be less than 5% in the filled up waste content.
1. **Spills, Incidents and Reporting**
* Immediately notify others in the area of the spill, including your supervisor, departmental safety officer (DSO) and HSEO. Evacuate the location where the spill occurred.
* Regarding skin contact, immediately (within seconds) begin flushing the affected area and continue for at least 15 minutes. Remove all contaminated clothing. Wearing compatible gloves, massage calcium gluconate gel into the affected area. Re-apply every 15 minutes until medical help arrives.
* In the case of eye contact, immediately (within seconds) begin flushing the affected area and continue for at least 15 minutes. Get medical attention immediately.
* For accidental inhalation, move person into fresh air. Get medical attention immediately.
* For accidental ingestion, get medical attention immediately.
* Report any accidents that result in injuries to the PI and/or the departmental safety officer (DSO) immediately.
* For serious incidents, notify the Security Unit immediately by calling the 24-hour hotline on **2358 8999**.
1. **References**
* DCU Health and Safety Office. (2019). SOP DCU/HSO/SOP/011: *Working with hydrofluoric acid (HF)*. Dublin City University.
* Safety and Environmental Protection Manual *- Chapter 3: Disposal of Hazardous Materials and Items under Regulatory Control | Health, Safety and Environment Office - the Hong Kong University of Science and Technology*
* Safety and Environmental Protection Manual - *Chapter 3:* *Emergency Procedures* | *Health, Safety and Environment Office - The Hong Kong University of Science and Technology*. Retrieved from: https://hseo.hkust.edu.hk/sm\_03