***STANDARD OPERATING PROCEDURE – C013***

**WORKING WITH WATER REACTIVES**

1. **Objectives**

The objective of this document is to establish standard operating procedures for working with water reactives, ensuring the safety of laboratory personnel by minimizing the dangers posed by fire hazards. Additionally, this SOP seeks to optimize the effectiveness of experimental processes.

1. **Personal Protective Equipment**

To ensure safety during work with pyrophoric materials, 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 gloves to prevent direct contact with hazardous chemicals.
  + **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**

When working with water reactives, 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:

* **Fire Hazard:** Chemicals in this band react with water to release gases that are either flammable or present a health hazard. The production of flammable gases and heat can lead to spontaneous ignition or an explosion. Some gases that are commonly produced by water reactive chemicals include: H2, CH4, H2S, NH3, PH3, HCN, HF, HCl, HF, HI, SO2, and SO3. Some may have pyrophoric properties and may spontaneously ignite in the air.
* **Health Hazard:** Water reactive materials may also present additional hazardous including corrosivity and/or toxicity. Therefore, Users must familiarize themselves with the specific hazards and toxicity of the compounds they are working with, which can be found on the chemical’s Safety Data Sheet (SDS).

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

* Never allow water reactive materials to come into contact with water (this includes water vapor in the atmosphere).
* Keep containers tightly closed in a cool, dry, and well-ventilated place that is free of moisture/humidity. If possible, store water reactive chemicals in a desiccator or glovebox.
* Over time, pressure may increase causing containers to burst; improper storage increases the probability of this happening.
* Store and handle under an inert gas (e.g. nitrogen, argon).
* Protect storage locations from sunlight, store away from heat sources, and in a flame proof area.
* Do not leave the container on the bench top or near a source of water (e.g. lab sink, emergency eyewash, and emergency safety shower) even momentarily.
* Store in secondary containment away from acids, oxidizers, and other incompatible materials.
* Label the containers and storage locations identifying the materials as “Water Reactive”
* Ensure that sufficient protective solvent, oil, kerosene, or inert gas remains in the container while the material is stored.
* Avoid inhalation and contact with skin, eyes, and clothing. Avoid heat, flames, sparks, and other sources of ignition. Avoid shock or friction. Protect containers from physical damage.
* Unless it is known, assume the material is pyrophoric (water reactive materials often react with water in the atmosphere).
* Handle water reactive materials under an inert atmosphere (e.g. glovebox, Schlenk line).
* Design your experiment to use the least amount of material possible.
* Use fresh, dry solvent. Avoid the formation of dusts and aerosols.
* Keep water reactive materials away from sources of ignition (e.g. open flames, heat) and avoid the build-up of electrostatic charge.

1. Disposal

* Refer to the SOP titled “Disposal of hazardous chemical waste” for more details. Pretreat the water reactive chemicals before disposal whenever feasible.
* Quenching: Water reactive materials are often quenched before disposal
  + Used water reactive materials should be quenched under an inert atmosphere with adequate cooling. Never use water to quench water reactive materials. Refer to the SDS or a published quenching procedure to design a quenching scheme for residual materials. If a published quenching procedure is not available, consult HSEO.
* Check the waste log sheet and avoid incompatibility.

1. **Spills, Incidents and Reporting**

* In the event of a fire, activate the fire alarm and evacuate the area. Do not use water or carbon dioxide extinguishers and do not activate the emergency ventilation system, as they can exacerbate combustion.
* If water reactive chemicals spill within a glovebox, quench the materials, absorb the spill with non-combustible materials, and dispose of the materials as hazardous solid waste. Powdered lime, soda ash (sodium carbonate), or dry sand can be used to cover and contain a small spill outside of a glovebox. Notify your supervisor, departmental safety officer (DSO) and HSEO immediately.
* Skin or Eye Contact: Remove contaminated clothing or contact lenses and flush the affected area with water for at least 15 minutes. Obtain medical attention immediately. Inhalation: Move to fresh air. Obtain medical attention immediately.
* Ingestion: Obtain 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**

* Wake Forest University. (2022). *Standard operating procedure: Water reactive chemicals*. https://prod.wp.cdn.aws.wfu.edu/sites/208/2017/07/WATER-REACTIVE-CH EMICALS-WFU-SOP-2022.pdf
* Texas Woman's University. (n.d.). *Standard operating procedure: Water reactive chemicals*. https://twu.edu/media/documents/risk-management/Water-Reactive-Chemicals-SOP.pdf
* University of North Carolina at Charlotte. (2022). *Standard operating procedure: Water reactives*. <https://safety.charlotte.edu/wp-content/uploads/sites/783/2023/09/SOP_WaterReactives_Reviewed.pdf>
* Health, Safety and Environment Office, The Hong Kong University of Science and Technology (n.d.). *Compatibility Concerns in Chemical Storage*. Retrieved on June 30, 2025, from <https://hseo.hkust.edu.hk/various-subjects/chemical>.
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