***STANDARD OPERATING PROCEDURE – C012***

**PYROPHORICS AND SELF-HEATING MATERIALS**

1. **Objectives**

The objective of this document is to establish standard operating procedures for working with pyrophorics, 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 neoprene 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 pyrophorics, 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:

* **Explosive/ Fire Hazard:** Pyrophoric chemicals are defined as chemicals that spontaneously ignite in air at or below a temperature of 54.5 °C or chemicals with an autoignition temperature in air at or below 54.4 °C. Many pyrophorics are sold/used as solutions in flammable solvents, which may exacerbate any dangerous reactions that can occur with misuse of these reagents.
* **Health Hazard:** Pyrophoric chemicals tend to exhibit additional hazards such as target organ toxicity, reproductive toxicity, corrosivity, water reactivity, and peroxide formation. 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

* Pyrophoric reagents must be handled and stored under **an inert atmosphere** in a manner to avoid exposure to atmospheric oxygen and moisture.
* Containers of pyrophoric materials and storage locations must be clearly labeled.
* Pyrophoric chemicals must be stored away from incompatible materials including combustible materials, oxidizing acids, oxidizers, and aqueous solutions.
* Store pyrophoric chemicals in a flammable storage cabinet, refrigerator/freezer rated for flammable storage, glovebox, or a desiccator. Consult the SDS for the most appropriate storage location and ensure proper segregation.
* If pyrophoric reagents are received in a specially designed shipping, storage, or dispensing container, ensure that the integrity of that container is maintained.
* Ensure that sufficient protective solvent, oil, kerosene, or inert gas remains in the container while the material is stored
* NEVER work alone. At least one other person must be informed and present in the same room while work with pyrophoric chemicals is being conducted.
* When possible, run reactions with pyrophoric reagents in **an inert atmosphere glovebox**.
* Pyrophoric solids must be transferred under an inert atmosphere in a glovebox. Pyrophoric liquids may be transferred within a glovebox or using a proper syringe, cannula, or Schleck techniques. Cannulation should be used when transferring any amounts greater than 20 mL.
* Ensure that the work area is adequately prepared prior to the experiment (e.g. remove all combustible materials [including paper towels and Kimwipes], remove all excess or nonessential chemicals and equipment from the area).
* NEVER return excess chemical to the original container (small amounts of impurities introduced into the container may cause a fire or explosion).

1. Disposal of Pyrophorics

* Refer to the SOP titled “Disposal of hazardous chemical waste” for more details. Pretreat the pyrophoric chemicals before disposal whenever feasible.
* Quenching:
  + Do not return unused pyrophoric materials to their original container. Used pyrophoric materials should be quenched under an inert atmosphere with adequate cooling.
    - Never quench pyrophoric materials with water.
    - Refer to a published quenching procedure.
    - If a published quenching procedure is not available, consult HSEO.
* NEVER leave a container or waste bottle with residue or pyrophoric materials open to the atmosphere. These materials should always be contained to prevent fires.
* Check the waste log sheet and avoid incompatibilities.

1. **Spills, Incidents and Reporting**

* In the event of a fire, activate the fire alarm and evacuate the area. Do not activate the emergency ventilation system, as they can exacerbate combustion.
* If pyrophoric chemicals spill within a glovebox, quench the materials, absorb the spill with non-combustible materials, and dispose of the materials as hazardous solid waste. 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**

* Alnajjar, M., Quigley, D., Kuntamukkula, M., Simmons, F., Freshwater, D., & Bigger, S. (2011). Methods for the safe storage; handling; and disposal of pyrophoric liquids and solids in the laboratory. *Journal of Chemical Health and Safety*, *18*(1), 5–10. https://doi.org/10.1016/j.jchas.2010.03.001
* University of Georgia. (2022). *Standard operating procedure for pyrophoric and self-heating materials*. <https://research.uga.edu/docs/units/safety/manuals/ChemicalSafetyManual/Pyrophorics_SOP.pdf>
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