***STANDARD OPERATING PROCEDURE – C003***

**Use, storage and disposal of flammable liquids**

1. **Objectives**

The objective of this document is to establish standard operating procedures for the use, storage and disposal of flammable liquids, ensuring the safety of laboratory personnel by mitigating potential risks associated with hazardous materials, and injuries. Additionally, this SOP aims to enhance the efficiency of experimental workflows.

1. **Personal Protective Equipment**

To ensure safety for the use, storage and disposal of flammable liquids, 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 the start of work to ensure proper glove selection.
* Face shield if handling large volumes or during high-risk operations.
* If the user has long hair, it should be tied back.

1. **Potential Hazards**

The use, storage and disposal of flammable liquids poses various hazards that must be managed to maintain a safe working environment. These include:

* **Flammable and Explosive Risk:** Flammable liquids can easily ignite in the presence of oxygen, producing explosive vapors.
* **Health Hazards:** Chemical exposure can cause skin irritation, respiratory problems, or toxic effects, depending on the chemical properties.
* **Environmental Hazards:** Improper disposal can lead to environmental contamination.
* **Static Electricity:** Static discharge can ignite flammable vapors during transfer or handling.

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. Preparation

* Review the Safety Data Sheet (SDS) for each flammable substance to understand its properties, hazards, and emergency procedures.
* Eliminate any potential ignition sources, including open flames, sparks and hot surfaces. Flammable clothing consisting of synthetic fibers (e.g. polyester) **should not be worn**.
* The locations of the nearest fire extinguishers, fire blankets, and spill kits should be known, and their use should be understood during emergencies.
* The supervisor should be contacted if you are unsure about any procedures, or the control of chemical risk.
* Flammables should be used in an area that is well-ventilated and in the fume hood.
* Flammable chemicals may also have other hazardous properties including toxicity, corrosiveness, and carcinogenicity. For the storage of these chemicals, these properties should be considered.

1. Storage

* Prior to use, check for the maximum volume storage capacity of each cabinet.
* Store flammable liquids in flammable / solvent storage cabinet away from incompatible materials or in a refrigerator that is approved for flammable storage.
* Flammables should not be stored in the sump area of the cabinet.
* Ensure flammable liquids are kept away from oxygen, oxidizers, reducing agents, halogens, strong acids, strong bases, perchlorates, and trimethylaluminium.
* Store flammable substances away from heat sources, flames, sparks, extreme temperature and direct sunlight.
* Review the usage regularly and store only frequently used chemicals to minimize the infrequently used and large volumes of flammables.
* Infrequently used and large volumes of flammables should be stored in the dangerous goods stores.
* Minimize the volume of flammables stored in the working lab area. Empty or near-empty bottles should be cleaned promptly and removed from the lab and bottles should not be stored on the floor as it can become a tripping hazard.
* The lids of chemical bottles should be kept tightly closed when not in use.
* Return the flammables to the storage location immediately after use.

1. Transport and Handling

* Avoid using metal containers unless necessary, as they can create sparks.
* Keep the volume of flammable liquids in use to a minimum.
* Large glass bottles of flammable liquids should be transported using a Winchester carrier.
* Smaller bottles should be transported using a secondary container composed of polyethylene and the container should be held with both hands.
* Employ appropriate transfer methods (e.g. funnels, pumps) to limit spills.
* Ground and bond containers before transferring to avoid static electricity discharge.
* Ensure adequate ventilation during transfer operations and prohibit any ignition sources in areas where flammable vapors may accumulate.
* Always transfer flammable chemicals from glass containers to glassware or from glassware / glass to plastic.

1. Use

* Remove ignition sources (i.e. open flames, hot plates, etc.) from work areas where flammable and combustible liquids are handled.
* Conduct all operations involving flammable liquids that present a risk of explosion, splash hazard, or highly exothermic reactions within a fume hood, keeping the sash at the lowest feasible position.
* Use only the smallest amount of flammable chemical for experimentation.
* Utilize safety shielding whenever there is a risk of explosion, splash hazard, or highly exothermic reactions. Portable shields that protect all laboratory personnel are acceptable.

1. Spill Procedure and Waste Disposal

* Spill kit and PPE should be stored in the lab and all users should be informed on how to use them.
* Minor spills in the fume cupboard may be cleaned up using m-fold and / or left to evaporate overnight. Solid waste from spill cleanup should be left in the fume hood overnight to allow residual vapors to evaporate. Wastes should be placed in a plastic bag and labelled with chemical name and ‘Flammable’.
* Dispose of excess or unused flammable chemical waste in designated “flammable/solvent” waste containers, treating them as hazardous wastes. **Never dispose of flammable waste down the sink**.
* For solid waste contaminated with flammables, this should be disposed of as hazardous chemical waste.
* Review the waste log sheet and avoid mixing with incompatible substances such as oxidizers, reducing agents, halogens, strong acids, strong bases, perchlorates, and trimethylaluminum.

1. First Aid

* If need to conduct first aid after exposure to chemicals, check safety data sheet (SDS) for each specific chemical for advice on treatment.
* In case of skin or eye contact, remove contaminated clothing, jewellery, or contact lenses and rinse the affected area with water for at least 15 minutes. Wash exposed skin with soap and water. Seek medical attention immediately.
* For inhalation exposure, move the affected person to fresh air. If symptoms persist, obtain medical help.
* If ingested, rinse the mouth with water. Seek medical advice immediately.

**6) Incident 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.
* Report any incidents resulting in injuries to the Principal Investigator (PI) and/or the departmental safety officer (DSO) immediately.
* For serious incidents, contact the Security Unit immediately by calling the 24-hour hotline on 2358 8999.

**7) References**

* Phuyal, J. (2016). *SOP\_SMB013.3: Use, storage and disposal of flammable liquids*. Risk Assessment. The University of Sydney.
* Coleman, N., & Fisher, D. (2014). *SOP SMB013.2 (DF NC 0314): Use, storage and disposal of flammable liquids*. The University of Sydney.
* Health, Safety and Environment Office (HSEO). (2022). *Safe handling of flammable liquids*. In *Safety manual* (Chapter 6: Fire safety, Part F). Hong Kong University of Science and Technology.
* Health, Safety and Environment Office (HSEO). (n.d.) *Chemical storage precautions*. Available online: <https://hseo.hkust.edu.hk/sm_08_8B>
* Health, Safety and Environment Office - Hong Kong University of Science and Technology(n.d.). *Laboratory Emergency Preparedness and Response Video*, from <https://hseo.hkust.edu.hk/node/3653>