***STANDARD OPERATING PROCEDURE – R001***

**Working with Phosphorus-32 Radioactive Isotope**

1. **Objectives**

The objective of this document is to establish standard operating procedures for working with Phosphorus-32 radioactive isotopes, 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 when working with Phosphorus-32 radioactive isotope, 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.
* Double nitrile gloves to prevent direct contact with radioactive materials. Change immediately if contaminated.
* If the user has long hair, it should be tied back.
* A personal dosimeter must be worn by personnel working with radioactive materials.
* 1 cm-thick Perspex shield for beta radiation protection.
* Geiger counter for monitoring. It must be calibrated annually.
  + NOTE: It cannot accurately measure radioactivity in liquids.

1. **Potential Hazards**

When working with Phosphorus-32 radioactive isotope presents various hazards that must be managed to maintain a safe working environment. This includes:

* **Radiation Exposure:** Exposure to radioactive materials such as 32P may pose significant health risks. All personnel working with radioactive substances must undergo medical surveillance prior to starting work. A personal dosimeter must be worn when working in the radioactive workroom
* **Environmental Contamination:** Spills can spread radioactive material. Work must be conducted in designated radiation work areas with spill trays.
* **Fire/Explosion Risk:** Some phosphorus compounds are flammable. Avoid open flames and ensure proper ventilation.
* **Health risks** associated with ingestion, inhalation, or skin contact with Phosphorus-32, which can lead to internal radiation exposure and associated health complications.

1. **Training / Licenses**

Ensure all personnel have received proper training on their hazards and safe handling techniques. All users that will use radioactive isotopes must complete the relevant training and undergo medical surveillance and register as a radiation worker prior to the start of work.

* MC01 Radiation Safety with Unsealed Radioactive Materials
* MC03 Chemical Safety II / Hazardous Waste Management
* MC07 Chemical Safety I / Chemical Safety for Laboratory Users

Ensure the licenses for the apparatus, users and workers remain valid.

1. **Procedures**
2. Preparation

* Check the workspace and PPE for any radioactivity prior to starting work with a Geiger counter.
* Record the user's name and the amount of radioactivity used before starting work.
* Practice with a dry run to rehearse the experiment.
* Arrange the workplace and minimize the amount of unnecessary equipment.
* Use absorbent material (bench coat) and trays that help to confine spills and reduce the spread of potential contamination.

1. Operation

* Ensure that the radioactivity is shielded at all times with a Perspex shield or container (thickness: at least 1 cm).
* Check the gloves and surfaces regularly for contamination throughout the experiment.
* Keep as much distance between yourself and the radiation source(s) as possible.
* If contamination is detected, promptly change the gloves and dispose of them in designated radioactive waste bins to prevent cross-contamination. Clean contaminated surfaces by wiping them down with detergent (e.g., DECON 90).

1. Post-Operation

* Check and decontaminate the shelf and surfaces.
* Take off gloves and wash hands thoroughly and do a final check of self and work area, including chairs/stools, floor, door handles, etc..

1. Disposal

* Label all radioactive waste bags with lab name, date of disposal and amount of radioactivity it contains.
* Shield all radioactive waste with Perspex (recommended thickness: 1 cm).
* All 32P radioactive waste must be allowed to decay for at least 6 months before being considered safe for disposal.
* Use a Geiger counter to assess residual radiation levels. If positive, the storage period should be extended.

1. **Spills or Incident Reporting**

* If a spill occurs, ensure proper shielding before commencing cleaning.
* Tissue pad held by long tweezers soaked in Decon 90 should be used to decontaminate radioactive spills. Refer to “SOP for cleanup of radioactive spills”. Geiger counter may be used to monitor the progress of cleanup to ensure surfaces are free from contamination.
* Any accidents that result in injuries must be reported to the PI and/or the departmental safety officer (DSO) immediately.
* In the case of serious incidents, immediately inform the Security Unit by calling the 24-hour hotline on **2358 8999**.

1. **References**

* Hofer, M. (2016). *SOP\_SMB035: Working with Phosphorus-32/33 radioactive isotope.* Risk Assessment. The University of Sydney.
* Hofer, M. & Lim, S. (2014). *SOP SMB035.2 (SLL MH 0314): Working with Phosphorus-32/33 radioactive isotope.* The University of Sydney*.*
* Safety and Environmental Protection Manual *- Chapter 10: Radiation Safety | Health, Safety and Environment Office - the Hong Kong University of Science and Technology*