***STANDARD OPERATING PROCEDURE – C004***

**Handling, storage and use of gas cylinders**

1. **Objectives**

The objective of this document is to establish standard operating procedures for handling, storage and use of gas cylinders, 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 handling, storage and use of gas cylinders, appropriate personal protective equipment (PPE) must be worn. This includes:

* Long pants and closed-toe shoes to protect against spills, impacts, and falling objects.
* 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 materials.
* If the user has long hair, it should be tied back.

1. **Potential Hazards**

Handling, storage and use of gas cylinders poses various hazards that must be managed to maintain a safe working environment. These include:

* **Explosion Risk:** Gas cylinders can explode if exposed to heat, physical damage, or improper handling.
* **Suffocation:** Leaks of inert gases (e.g., nitrogen, argon) in confined spaces can displace oxygen, leading to asphyxiation.
* **Chemical Exposure:** Inhalation of hazardous gases (e.g., carbon monoxide, chlorine) can cause severe health effects.
* **Fire Hazard:** Flammable gases (e.g., hydrogen, acetylene) can ignite easily, posing a significant fire risk.
* **Physical Injury:** Improperly secured cylinders can tip over, causing injuries or damage to equipment.
* **Chemical Reactivity:** Some gases (e.g., oxygen, chlorine) are highly reactive and can cause violent reactions with incompatible materials.

1. **Training**

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

* MC03 Chemical Safety II / Hazardous Waste Management
* MC05 Pressure Safety
* MC07 Chemical Safety I / Chemical Safety for Laboratory Users

1. **Procedures**
2. Storage

* Gas cylinders should always be assumed **FULL**.
  + **NOTE:** Tag may be placed on the neck of gas cylinders indicating whether it is **empty**, **in use**, or **full**.
* Secure gas cylinders upright using chains or straps and cylinder brackets to prevent them from tipping.
* The cylinder should be placed on a slip-resistant mat.
* Clearly label cylinders with their contents and any associated hazards.
* Ensure that storage areas are accessible and free from obstruction.
* Keep all gas cylinders away from combustible materials, heat sources, electrical switches / devices, or flammable liquids.
* Keep cylinders away from wet floors.
* Cylinder storage area entry should be restricted to users with an authorised entry.
* Cylinder storage areas should have clear signage with regard to local regulations.
* Areas where there is a lot of foot traffic should not have cylinder storage.
* Cylinders should not be stored for extended periods or expired the hydraulic test dates.
* Labels on all cylinders should not be obscured.
* Regularly check for cylinder leaks and for any faults.
* Cylinders containing toxic, corrosive and flammable gases, such as ammonia and hydrogen, should be stored in ventilated gas cabinets.
* Flash back arrestor should be installed for Oxygen and flammable gases, such as hydrogen and Acetylene.
* Two-stage regulator should be installed directly onto the cylinder to minimize components exposed to high pressure.
* High pressure flexible hose should be avoided.

1. Handling

* Always ask for assistance when moving large cylinders.
* **Secure the gas cylinder to a cart** or other suitable device when transporting to the bench or wall to be used.
* Handle cylinders with care to prevent them from being knocked over or falling.
* Ensure the cylinder valve is closed when not in use, and detach all equipment before moving the cylinder, no matter the distance.
* Never knock over, drag or roll cylinders, always lift **vertically**.

1. Use

* The safety data sheet (SDS) of all gases used should be consulted. Gases that are flammable, corrosive or toxic should be noted and these gases pose special risks.
* Inspect the cylinder for damage or leaks before use; do not use any damaged cylinders.
* Utilize appropriate regulators and hoses specific to the gas being used. Make sure the regulator works in the correct pressure range.
* Open valves slowly and always stand to the side of the cylinder while doing so.
* Keep a fire extinguisher readily available when handling flammable gases.

1. Refill and Disposal

* Return empty or unused gas cylinders to Center of Laboratory Supplies.
* **DO NOT** attempt to refill or dispose of gas cylinders.
* Make sure all cylinders are correctly labeled as empty when finished use.

1. **Leaks and Incident Reporting**

* In the event of a gas leak, evacuate the area immediately and inform the supervisor immediately.
* If a fire occurs, follow the laboratory’s fire emergency procedures.
* Report any injuries to the Principal Investigator (PI) and / or departmental safety officer (DSO) immediately.
* For serious incidents, contact the Security Unit immediately by calling the 24-hour hotline on **2358 8999**.

1. **References**

* Phuyal (2016). *SOP\_SMB017.3: Handling, storage and use of gas cylinders.* Risk Assessment. The University of Sydney.
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