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| Prepared by | Approved By | Issue Date |

## 1. OBJECTIVE

This SOP provides the procedures for safe handling of dry ice in Department of Medicine research laboratories.

## 2. SCOPE

This SOP is applicable to all staff and students in Department of Medicine research laboratories at MD1, MD6 and NUH.

## 3. RESPONSIBILITY AND ACCOUNTABILITY

3.1 The principal investigator (PI) is responsible to ensure that their staff and students are aware of the risk assessment and are trained for the safe handling of dry ice.

3.2 Lab personnel must follow the safe handling, storage and disposal of dry ice and must be trained for shipping packages containing dry ice.

## 4. PROPERTIES / USES

Dry ice is commonly purchased from a commercial manufacturer. It is used to cool reactions or ship biological specimens.

- Dry ice is carbon dioxide in solid state
- A translucent, white solid; at normal temperatures sublimes directly into a gas without passing through a liquid phase
- Non-flammable
- Temperature of dry ice is -78ºC
- Asphyxiant
- Colourless gas with slightly pungent odour and only detectable in high concentrations

## 5. HAZARDS

a. Contact: Skin contact with dry ice can lead to severe frostbite; skin cells freeze and become damaged very quickly.
b. Asphyxiation: Dry ice will sublime (change from solid to gas) at any temperature above -78$^{o}$C. This releases potentially substantial volumes of $CO_2$ which can displace oxygen quickly in the air around the dry ice, causing difficulty breathing, loss of consciousness and death. This is especially of concern in non-ventilated or confined spaces.
c. Explosion: Due to the rapid emission of large volumes of $CO_2$ gas, any dry ice that is stored in a closed container can pressurize the container. Given enough time at normal room temperature, such a container may explode if the gas is not able to escape.

## 6. PERSONAL PROTECTIVE EQUIPMENT (PPE)

Protect eyes, face and skin from contact with dry ice. Safety glasses, heavy gloves (e.g., cryogenic gloves), long sleeved lab coat and closed toe shoes should be worn. Tongs should be used to pick up items in dry ice.

## 7. HANDLING

a. Do not attempt to handle dry ice until you have read and fully understood the relevant risk assessments and instructions for use, and have been trained by a competent person in its use.
b. only experienced and properly instructed people should handle dry ice
c. Work with dry ice should be in a fume hood or well-ventilated area.
d. Wear cryogenic gloves and exercise caution when transferring dry ice from delivery bags to storage containers.
e. Beware of wearing gloves, wristbands, watch straps or rings which may trap liquid from cold traps close to the skin.
f. Do not place dry ice on a tiled or solid surface countertop as the extreme cold will cause damage.

## 8. STORAGE

a. Dry ice must be used and stored in a well-ventilated area. The sublimated $CO_2$ gas will sink to low areas and replace oxygenated air. This could cause suffocation if breathed exclusively.
b. Storage areas where oxygen displacement can occur must have an oxygen depletion alarm.
c. Store dry ice in the insulated containers such as an insulated chest, insulated coolers, or a special cooler designed for the storage of dry ice. The thicker the insulation, the slower it will sublimate.
d. Do not store dry ice in a completely airtight container. The sublimation of dry ice to $CO_2$ gas will cause any airtight container to expand or possibly explode.
e. Dry ice is never to be stored in any type of tightly sealed devices or confined area such as in walk-in coolers, refrigerators, freezers or closets.

## 9. DISPOSAL OF UNNEEDED DRY ICE

a. Let the unused dry ice sublimate in a well-ventilated area.
b. Never dispose of dry ice in a sink, toilet or other drain.
c. Never dispose of dry ice in the trash or garbage
d. Never leave surplus dry ice in the corridors.

## 10. SPILLAGE

a. The main hazard from a major spillage of dry ice is the build up of $CO_2$ gas. Areas affected should be immediately evacuated and personnel notified of the danger.
b. Access to the affected area must be restricted and sufficient time given for the gas to disperse.
c. It may be necessary to use a $CO_2$ and breathing apparatus to establish the oxygen level in a poorly ventilated area affected by a spillage. The area should be ventilated only when safe to do so.

## 11. INCIDENT REPORTING

Accidents resulting in injuries must be reported to the PI and/or laboratory safety lead immediately after first aid is applied.

Seek medical attention when necessary at the University Health Centre or proceed to the Accident & Emergency units of National University Hospital after office hours.

All incidents or accidents have to be notified to OSHE within 24 hours via the online NUS Accident and Incident Management System (AIMS) @https://inetapps.nus.edu.sg/osh/portal/eServices/ehs360_aims.html. The AIMS report can be submitted by the injured staff/student, safety leads, his or her supervisor/representative if the staff or student is unfit/unable to do the initial report.

## 12. REFERENCE

NUS Laboratory Chemical Safety Manual (NUS/OSHE/M/02)

## 13. REVISION HISTORY

| Date Revised | Version No. | Author | Summary of Revisions |
|---|---|---|---|
| 28-04-2016 | 001 | Yeo Soh Bee | |
| 01-10-2016 | 002 | Yeo Soh Bee | Section 10: Revised Accident and Incident Reporting System (AIRS) to Accident and Incident Management System (AIMS) |
| 15-04-2019 | 003 | Yeo Soh Bee | Section 4: Amended PROPERTIES/USES<br>Section 5: Added HAZARDS |