Standard Operating Procedure

Dry Ice, Liquid Nitrogen, and Other Cryogens

Principal Investigator: _____ ***Date Approved:*** _____

Dry Ice, Liquid Nitrogen, and Other Cryogens

Cryogens are liquefied gases which boil below -180°C. The most common cryogens used in research laboratories are dry ice and liquid nitrogen. Liquid helium is used in operations that require even colder temperatures.

Tissues exposed to cryogens can freeze, causing severe frostbite. Cryogens can also embrittle plastic or rubber components of equipment, and crack glass through thermal shock. Cryogens expand dramatically upon evaporation (1:845 for dry ice; 1:694 for liquid nitrogen). This can displace oxygen if their rapid vaporization occurs in a poorly ventilated space, leading to asphyxiation. Vaporization of cryogens within a sealed vessel can cause an explosion.

Personal Protective Equipment & Personnel Monitoring

Lab Coat	Gloves	Eye Protection
		
Traditional lab coat. For operations where a significant splash hazard is present, an apron may be required.	Wear insulated, impermeable, elbow-length gloves.	ANSI Z87.1-compliant safety glasses or safety goggles **AND** a face shield when dispensing cryogens from a cylinder.

Labeling & Storage

Cryogens should be handled and stored in well-ventilated rooms. Cryogen cylinders are typically equipped with a handling ring that can protect the valves and regulators in the event of a fall. Whenever possible, store cryogen cylinders so that the venting valve points away from egress paths or regular foot traffic (e.g., towards a wall). Do not store dry ice, liquid nitrogen, or any other cryogen inside a tightly-sealed container (e.g. refrigerator, freezer, or gasketed cooler) as the pressure resulting from evaporation can cause an explosion.

Engineering Controls, Equipment, & Materials

Oxygen Sensor
Oxygen sensors may be necessary in rooms where large quantities of cryogens are stored or handled. Never enter a room if an oxygen sensor is in alarm.

Cautions & Considerations

Equipment
Regulators should be checked for cracks or defects before dispensing. Ensure a liquid phase separator is used when dispensing liquid nitrogen to prevent splashes. Fully close regulators after dispensing is finished to prevent unintended venting of liquid nitrogen, which could damage regulators and/or valves.

Transporting Cryogenic Liquids
Cryogenic liquid containers should be moved on a hand truck, cart, or other appropriate transportation method. Containers must be secured during transport and kept upright at all times. Handheld containers must be placed inside secondary containment for transport.

If inert cryogenic liquids must be transported by elevator, routes and procedures should be evaluated to ensure that the cryogens can be moved safely. In the event of a power failure, a passenger would be trapped in the confined space of an elevator with the container containing the cryogenic liquid. The evaporation of liquids could displace oxygen.

Evaluation of the routes should take into account the amount of material being transported, the vessel used, typical evaluation rates, and ventilation in all locations, including elevators. Mitigating procedures, such as sending containers alone in elevators or notifying others when cryogenic liquids are being transported, may be required based on a hazard assessment.

First Aid & Emergencies

Release
In the event of an uncontrolled release, assume that oxygen may be displaced. Notify others in the area of the release and evacuate the room until an adequate oxygen supply can be confirmed.

Skin or Eye Contact
If any tissues appear to have been frozen, seek medical attention immediately. Apply a dry, sterile bandage. Do not rub the affected area.

Inhalation
If you suspect that a person has lost consciousness due to oxygen deprivation, call 911 and **do not** enter the room. Move affected individual(s) into fresh air only if safe to do so. If symptoms persist, seek medical attention.

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By signing and dating the log below, individuals are certifying that they have been informed and understand this Standard Operating Procedure and agree to abide by its contents.

Name	Signature	Date