## Standard Operating Procedure

# **Cryogens**

## Overview

Cryogens are gases that have been liquefied or solidified by extreme cooling. The three common laboratory cryogens are: dry ice (-78.5 °C), liquid nitrogen (-195.79 °C) and liquid helium (-269 °C). Tissues exposed to cryogens can freeze, causing severe frostbite. They expand greatly upon evaporation which creates two hazards: oxygen displacement (asphyxiation risk) and pressurization of sealed or poorly vented containers (explosion risk). Cryogens can embrittle plastic or rubber, and crack glass due to their extremely low temperatures. Liquid nitrogen and helium can condense liquid oxygen out of the air. This powerful oxidizer can cause powerful explosions upon contact with organic materials. For carbon dioxide, the Cal/OSHA Permissible Exposure Limit (PEL: 8 hour time weighted average) = 5,000 ppm, and the Short Term Exposure Limit (STEL: 15 minute time weighted average) = 30,000 ppm.

## Special Handling and Storage Concerns

**Personal Protective Equipment**

* Traditional white lab coat.
* Insulated, impermeable elbow-length cryogenic gloves
* ANSI Z87.1-compliant safety glasses. Safety goggles and face shield if a large splash hazard is present.

**Special Storage Requirements**

Cryogens should be stored in well-ventilated rooms. Due to their low pressure and protective rings around the valves and regulators, cryogen dewars do not need to be affixed to a permanent structure. Inspect pressure release devices regularly, as ice buildup can plug or otherwise disable them. Never store cryogens in tightly sealed containers, including refrigerators and freezers.

**Engineering Controls**

*Oxygen sensors*: May be necessary in rooms where large quantities of cryogens are stored or handled, or in areas with limited ventilation (closets, cold rooms).

**Special Handling Considerations**

Be cautious when handling cryogens in poorly ventilated areas such as cold rooms.

Avoid condensing liquid oxygen when using liquid nitrogen or helium. Check vacuum systems and other equipment for leaks, and be vigilant in checking for the presence of liquid oxygen, a blueish liquid.

When transporting cryogens on elevators, use service or freight elevators when available. In addition, when transporting cryogens by elevator:

* Post a sign reading “DO NOT ENTER – GAS TRANSPORT” to exclude passengers. Send the elevator to the desired floor, but do not enter the elevator yourself.
* When possible, have someone send the elevator up while another person waits on the receiving floor to take the cylinder out of the elevator. If this is not possible, another plan should be devised to ensure that the cylinder is taken out of the elevator once it reaches the desired floor.

## First Aid and Emergencies

**Uncontrolled Release**

In the event of an uncontrolled release, assume that an oxygen deficient atmosphere is present. Notify others in the area and evacuate the room until adequate oxygen levels can be confirmed.

**Personnel Exposure**

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

If any tissues appear to have frozen, get medical attention immediately. Apply a dry, sterile bandage. Do not rub the affected area.

## Laboratory Specific Information

**Prior Approval Required**

[ ]  **NO**

[ ]  **YES (describe):**

**Designated Area**

[ ]  **Entire Laboratory Area**

[ ]  **Other (describe):**

**Experimental Conditions of Use**

**Temperature Range:**

**Pressure Range:**

**Scale Range:**

**Other Relevant Details:**