

Principal Investigator: _____

Date Approved: _____

This document covers basic chemical safety protocols (CSP) for dry ice, liquid nitrogen, and other cryogenics and supplements the laboratory Chemical Hygiene Plan as appropriate. Additional lab-specific safety operating procedures for dry ice, liquid nitrogen, and other cryogenics may also be required. The use of dry ice, liquid nitrogen, and other cryogenics is subject to pre-approval by the Principal Investigator (PI) and/or the designated Laboratory Responsible Safety Person. **DO NOT USE DRY ICE, LIQUID NITROGEN, OR ANY OTHER CRYOGEN UNTIL YOU HAVE OBTAINED THE NECESSARY PRE-APPROVAL AND TRAINING.**

Dry Ice, Liquid Nitrogen, and Other Cryogenics

Cryogenics are liquefied gases which boil below $-180\text{ }^{\circ}\text{C}$. The most common cryogenics used in research laboratories are dry ice and liquid nitrogen. Liquid helium is used in operations which require even colder temperatures.

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



Personal Protective Equipment & Personnel Monitoring

**Lab Coat**

Traditional lab coat. For operations where a significant splash hazard is present, an apron may be required.

**Gloves**

Wear insulated, impermeable, elbow-length gloves.

**Eye Protection**

ANSI Z87.1-compliant safety glasses or safety goggles **and** a face shield when dispensing cryogenics from a cylinder.

**Face Shield**

Labeling & Storage

Cryogenics should be handled and stored in well-ventilated rooms. Cryogen cylinders are typically equipped with a handling ring which can protect the valves and regulators in the event of a fall. Whenever possible, store cryogen cylinders such that the venting valve is pointed away from paths of egress or regular foot traffic (e.g., towards a wall). Do not store dry ice, liquid nitrogen, or any other cryogen inside of 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 cryogenics are stored or handled. Never enter a room if an oxygen sensor is in alarm.

First Aid & Emergencies

Release

Immediately notify others in the area of the release and evacuate the location where the release occurred. Notify your PI/Responsible Safety Person and call Vanderbilt University Public Safety (VUPS) at 615-421-1911 or use the VandySafe app on your smart phone. Report any exposure through Risk and Insurance Management's Origami portal and mark that it occurred in research when prompted. Both VUPS and the Origami system will notify EHSS of the incident. Remain on site at a safe distance to provide detailed information to first responders.

Skin or Eye Contact

If any tissues appear to have frozen, get 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 VUPS at 615-421-1911 or use the VandySafe app on your smart phone.

Do not enter the room. Move person into fresh air only if safe to do so. If symptoms persist, get medical attention.

Waste Disposal

Refer to the laboratory *Chemical Hygiene Plan* (Section 6.7) for information on proper chemical waste disposal procedures.

