



ENVIRONMENTAL HEALTH AND SAFETY

### Cryogenic Liquids and Dry Ice: Handling and Storage Guidance

Cryogenic liquids are liquefied gases created by cooling a liquid to a low temperature under high pressure, which creates special health and safety hazards. Common cryogenics are: argon, helium, hydrogen, nitrogen, and oxygen. Dry ice (solid carbon dioxide) is not a cryogen, but converts directly to carbon dioxide and can be hazardous if not handled properly.

**Hazards:**

<b>Asphyxiation</b>	Cryogenics can evaporate into very large volumes of gas, which can displace oxygen and create an asphyxiation hazard.
<b>Cold Burns</b>	Cryogenics and vapors can rapidly freeze skin tissue and eye fluid, resulting in cold burns, frostbite, and permanent eye damage.
<b>Oxygen Enrichment and Fire Hazard</b>	Cryogenics in containers and piping can (at temperatures $\leq$ the boiling point of liquefied air) condense air and create a localized oxygen-enriched atmosphere, which is a fire hazard.
<b>Pressure Buildup and Explosions</b>	Without adequate venting or pressure-relief devices on containers and equipment, enormous pressures can build up and cause an explosion.

**Personal Protective Equipment**



**(PPE):**

- Face Shield + Safety Glasses
- Cryogen Apron + Gloves
- Pants + Long Sleeve Shirt
- Closed Toe Shoes

**Handling:**

- Do not use dry ice or cryogenics in confined areas (e.g., walk in refrigerators, rooms without ventilation)
- Handle cryogenic liquid slowly to minimize splashes
- Always use tongs when removing objects immersed in cryogenic liquids
- When transporting cryogenics, always use Dewars that are double walled, open-necked, free-venting, and non-pressurized
- **Emergency Procedure:** Under no circumstances is it safe to enter an oxygen-deprived environment; if suspected, restrict access to the area and call campus police immediately at **303-724-4444**.

**Storage:**

- Cryogenics and dry ice should be stored in a well-ventilated area, with a ventilation rate of 6 air changes per hour under normal operating conditions. Contact Facilities Management to confirm the condition of the storage location.
- Locations that do not meet the ventilation recommendations may be acceptable with further safety measures, such as continuous oxygen monitoring. These locations must be reviewed and the additional safety measures approved by EHS and Facilities Management.

### **Removal of Sample Tubes from Liquid Nitrogen**

- If liquid nitrogen seeps into sample tubes they may explode when removed to room temperature.
- Only use manufacturer approved cryotubes designed for storage in the liquid and/or gaseous phases.
- Before removing sample tubes to room temperature place them at the highest level (warmest) in the Dewar for at least an hour.
- Any sample tubes removed from the liquid phase should be placed in the highest level for at least 24 hours.

### **First Aid:**

- In the case of exposure to dry ice or cryogenics, remove clothing that is not frozen to skin
- Do NOT rub frozen body parts – this may cause tissue damage; obtain medical assistance ASAP
- Place the affected body part in a warm water bath (< 40°C); never use dry heat