



Chemical Standard Operating Procedure

All work involving materials classified as Particularly Hazardous requires the completion of Section 6.

Procedure Name		Cryogenics			
Procedure Author					
Name of Responsible Person					
Location to be Performed					
Creation Date			Review Date(s)		Revision Date(s)
1.	THIS STANDARD OPERATING PROCEDURE (SOP) IS FOR A:				
	<input type="checkbox"/> Specific laboratory procedure or experiment <ul style="list-style-type: none"> Examples: synthesis of chemiluminescent esters <input type="checkbox"/> Generic laboratory procedure that covers several chemicals <ul style="list-style-type: none"> Examples: distillation, chromatography <input checked="" type="checkbox"/> Generic use of a specific chemical or class of chemicals with similar hazards <ul style="list-style-type: none"> Examples: Organic azides, mineral acids, hydrofluoric acid 				
2.	DESCRIPTION: <i>Briefly describe how the chemical will be used.</i>				
	Liquid nitrogen used for the preservation of tissue samples.				
3.	RISK IDENTIFICATION: <i>Identify potential safety hazards – refer to Section 2 of the SDS.</i>				
	<input type="checkbox"/> Explosive <input type="checkbox"/> Pyrophoric <input type="checkbox"/> Flammable (liquid, solid, gas or aerosol) <input type="checkbox"/> Self-Reactive <input type="checkbox"/> Peroxide Forming <input type="checkbox"/> Organic Peroxide <input type="checkbox"/> Oxidizing (liquid, solid or gas) <input type="checkbox"/> Water-Reactive <input checked="" type="checkbox"/> Compressed Gases <input checked="" type="checkbox"/> Cryogen <input type="checkbox"/> Corrosion to Metals <input type="checkbox"/> Radionuclides <input type="checkbox"/> Other: Click or tap here to enter text.		<input type="checkbox"/> Carcinogen <input type="checkbox"/> Sensitizer (respiratory and/or skin) <input type="checkbox"/> Irritant (skin and/or eye) <input type="checkbox"/> Corrosive (skin and/or eye damage) <input type="checkbox"/> Acute Toxicity (oral, dermal and/or inhalation) <input type="checkbox"/> Germ Cell Mutagen <input type="checkbox"/> Reproductive Toxicity <input type="checkbox"/> Target Organ Systemic Toxicity: Single Exposure <input type="checkbox"/> Target Organ Systemic Toxicity: Repeated Exposure <input type="checkbox"/> Other: Click or tap here to enter text.		
	Notes (include chemicals that will be used, additional cautions, permissible exposure limits, etc.):				
	Asphyxiation <ul style="list-style-type: none"> Cryogenic liquids and dry ice undergo substantial volume expansion upon evaporation or sublimation. This leads to displacement of oxygen and potential asphyxiation of the user. 				



	<p>Fire</p> <ul style="list-style-type: none"> The use of cryogenic liquids may condense oxygen from the atmosphere. Exposure of combustible materials to oxygen-enriched cryogenic liquids enhances the combustibility of the material. <p>Explosion</p> <ul style="list-style-type: none"> Cryogenic liquids and dry ice undergo substantial volume expansion upon evaporation or sublimation. This can cause an explosion of a sealed container. <p>Contact/Absorption</p> <ul style="list-style-type: none"> Cryogenic liquids are extremely cold at atmospheric pressure. Contact with skin may lead to burns and/or severe frostbite.
4.	<p>WHAT ENGINEERING CONTROLS WILL BE USED TO MINIMIZE EXPOSURES TO THESE HAZARDS? <i>select all that apply</i></p> <p><input type="checkbox"/> Fume Hood <input type="checkbox"/> Snorkel <input type="checkbox"/> Glove Box <input type="checkbox"/> Clean Room <input type="checkbox"/> Explosion Shielding <input type="checkbox"/> Splash Shielding <input type="checkbox"/> Beta Shielding <input type="checkbox"/> Safety Storage Cabinet <input type="checkbox"/> Flammable Storage Refrigerator <input checked="" type="checkbox"/> Other: Proper ventilation, appropriate storage dewar</p>
5.	<p>WHAT PERSONAL PROTECTIVE EQUIPMENT IS REQUIRED TO MINIMIZE THESE HAZARDS? <i>select all that apply</i></p> <p><input checked="" type="checkbox"/> Safety Glasses <input checked="" type="checkbox"/> Lab Coat <input type="checkbox"/> Fire-Resistant Lab Coat <input checked="" type="checkbox"/> Gloves - specify type: insulated gloves <input type="checkbox"/> Acid Resistant Gloves <input type="checkbox"/> Acid Resistant Apron <input checked="" type="checkbox"/> Face shield <input type="checkbox"/> Other: Click or tap here to enter text.</p>
6.	<p>STEP-BY-STEP OPERATING PROCEDURE</p> <p><i>Provide a sequential description of work, including as much detail as possible such as designated work area(s), chemical concentrations ranges and amount used (mass, volume) and when special safety equipment is to be utilized. Include temperature, pressure, and other experimental conditions if possible. Pictures and schematics are recommended for complex setups. Highlight the steps with the highest hazards.</i></p> <p>1. Cryogenic gases are capable of causing asphyxiation by displacing breathable air and therefore should only be used and dispensed in well-ventilated areas.</p>



	<p>2. Non-insulated metal pipes containing cryogenic fluids must be kept clear of combustible materials in order to minimize the fire potential caused by oxygen enrichment of condensed air.</p> <p>Dispensing Liquid</p> <p>3. Ensure the transfer line is attached to the appropriate liquid dispensing valve (blue).</p> <p>4. Check that the pressure is approximately 22 psi.</p> <p>5. Position the Dewar on the floor at the base of the cylinder</p> <p>6. Slowly open the liquid valve to begin cooling down the transfer line.</p> <p>7. Once the line has cooled, open the liquid valve further to dispense cryogenic liquid. Avoid fully opening the valve since it may freeze in that position causing a spill.</p> <p>8. Listen for the change in sound as the Dewar fills – a higher pitch indicates the Dewar is getting full.</p> <p>9. Once full, close the valve and remove the transfer line carefully to avoid dropping or hitting a solid object, which can cause the phase separator to break.</p> <p>10. Loosely cap the Dewar to prevent over pressurization.</p> <p>Submerging Objects</p> <p>11. Boiling and splashing occur when inserting objects into a cryogenic liquid.</p> <p>12. Always submerge objects slowly to prevent excessive splashing.</p> <p>13. Vessels submerged in a cryogenic liquid may rupture when removed.</p> <p>14. Store cryovials in the gas phase of a liquid cryogen container or move submerged cryovials to the gas phase 24 hours prior to removal to prevent explosions.</p> <p>15. Never reach into a liquid cryogen container to remove objects.</p>				
7.	<p>TRANSPORT, RECEIVING AND STORAGE REQUIREMENTS <i>Describe transport, receiving and storage requirements. Include secondary containment, transport devices (carts, carriers, etc.), segregation requirements, any special temperature or atmospheric requirements, and container compatibility requirements. Information may be included in Section 6.</i></p> <ul style="list-style-type: none"> • Store full cryogenic containers in a dry, ventilated area - never store or handle cryogens in cold rooms or confined spaces. • Do not permit oxygen-enriched air to come in contact with organic materials. • Frost around the top of a venting container is indicative that the cold vapors are condensing the moisture in the air. Frost at the bottom or on the sides of the cylinder indicate that the container is faulty and damaged. CALL THE VENDOR and ask them to pick up and exchange the container ASAP. • If the container is dented or otherwise physically damaged, it should not be accepted from the vendor. • Follow all substance-specific storage guidance provided in SDS documentation. <table border="1" data-bbox="324 1738 1380 1843"> <thead> <tr> <th>Chemical name</th> <th>Storage location/requirement</th> </tr> </thead> <tbody> <tr> <td>Liquid Nitrogen</td> <td>Room 305</td> </tr> </tbody> </table>	Chemical name	Storage location/requirement	Liquid Nitrogen	Room 305
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Liquid Nitrogen	Room 305				
8.	WASTE DISPOSAL				



Type of waste generated by this procedure/process (*check all that apply*):
 Solid Liquid

Waste hazard determination (*check all that apply*):

Type of Waste	Hazard Determination
Solid	<input type="checkbox"/> Flammable <input type="checkbox"/> Oxidizer <input type="checkbox"/> Corrossive <input type="checkbox"/> Reactive <input type="checkbox"/> Toxic
Liquid	<input type="checkbox"/> Flammable <input type="checkbox"/> Oxidizer <input type="checkbox"/> Corrossive <input type="checkbox"/> Reactive <input type="checkbox"/> Toxic

Expected waste generation per experiemntal run (mass/volume): [Click or tap here to enter text.](#)

Disposal procedure and location of Satellite Accumulation Area:
 Not applicable to cryogenes – let evaporate and ensure proper ventilation.

9. **EMERGENCY PROCEDURES**
Indicate how spills, personnel exposure/injury, and other accidents should be handled and by whom.

- Symptoms of decreased oxygen content include headache, drowsiness, dizziness, excess salivation, vomiting and unconsciousness. Unconsciousness can happen quickly, in as low as 1 to 2 breaths, if breathing pure inert gas such nitrogen.
- Many asphyxiation fatalities in the work place have resulted from rescue efforts when workers unknowingly enter an oxygen depleted space while trying to rescue an unconscious person.

For a large spill:

- Evacuate the space immediately in the event of a cryogen leak or spill or if you are suffering from oxygen depletion symptoms. **ACTIVATE THE BUILDING’S FIRE ALARM SYSTEM IF THE SPILL REPRESENTS A THREAT TO HUMAN LIFE OR MAY CAUSE A FIRE OR EXPLOSION.**
- Do not attempt to clean up a cryogen spill. Immediately leave the area and call EHS for assistance (352-392-1591).
- Call 911 if a colleague lies unconscious. Rescue efforts should only be conducted by trained personnel.

For a small spill:

- In the event of a small spill, evacuation may not be necessary if the area is well-ventilated. Stand back and let the spill evaporate.

For contact exposure:

- Call 911 in the event of an emergency.
- Run the affected area under cool or warm water for fifteen minutes until help arrives. Do not use hot or cold water.



	Emergency contact numbers:	
	Lab manager	xxx-xxx-xxxx
	Building Manager	xxx-xxx-xxxx
	Principal Investigator	xxx-xxx-xxxx
	Poison Control Center	800-222-1222
	Emergency	911
	EHS	352-392-1591