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| **Liquid Nitrogen and Dry Ice**  |
| **Policy** | This policy provides information for the safe handling of Liquid Nitrogen & Dry Ice. |
| **Hazards** | * Liquid Nitrogen
	+ Liquid nitrogen (LN2) is used to snap freeze tissue for preservation and possible further studies.
	+ Hazards associated with handling LN2 include cold contact burns and freezing, asphyxiation, explosion, and material embrittlement.
	+ Locations where LN2 is used and/or stored (these areas have an oxygen monitor in place):
		- B606B Minneapolis Histology Laboratory
		- B2 060 Minneapolis Morgue
		- Room 4444 Minneapolis CVCC
		- L163 St. Paul Histology Laboratory
	+ Oxygen monitors must have a visual inspection of the display/readout performed on a schedule determined by the responsible department. This is to be documented on an appropriate maintenance checklist.
* Dry Ice
	+ Dry ice is the solid form of carbon dioxide. It is used primarily as a cooling agent.
	+ Prolonged contact with the skin will freeze cells and cause severe skin damage through frostbite.
	+ If dry ice is stored in an area without proper ventilation, it may cause people to inhale large amounts of the gas CO2, which displaces oxygen in the body. This, in turn, can lead to harmful effects, including headache, confusion, disorientation and death.
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| **Safe Work Practices** | * Liquid Nitrogen
	+ Required PPE when entering or decanting an open container of LN2:
		- Lab coat
		- Thermal protective gloves
			* LN2 is dangerously cold and skin contact with either liquid LN2 or LN2 vapors can immediately cause frostbite.
		- Full face shield
			* Eyes are extremely sensitive to freezing and LN2 or LN2 vapors can cause eye damage.
			* LN2 is at a high risk for splattering when objects at much higher temperatures are placed into LN2.
	+ LN2 should be stored and used in a well-ventilated area.
		- Do not store or use LN2 in confined areas or rooms without ventilation.

A leak in such an area could cause an oxygen-deficient atmosphere.* + - Nitrogen is nontoxic and inert, but can act as an asphyxiant by displacing oxygen in the air.
		- Inhalation of excessive nitrogen can cause dizziness, headache, confusion, blue lips or skin, labored breathing, nausea, vomiting, loss of consciousness, and death.
	+ Oxygen monitors have been mounted near LN2 containers.
		- An alarm will sound if oxygen levels are not sufficient.
		- If this occurs, immediately evacuate the area.
		- Contact Security:
			* **Minneapolis: 5-7777**
			* **St. Paul: 1-8899**
		- Contact the Lab manager/supervisor/safety officer.
	+ Move LN2 containers carefully and avoid sloshing liquid into warmer regions of the container.
		- Small changes in temperature can create large pressure increases in the container increasing the risk of an explosion.
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| **Safe Work Practices** | * Dry Ice
	+ Required PPE when handling dry ice:
		- Lab coat
		- Thermal protective gloves
		- Scoop or dry ice tongs
		- Safety goggles/glasses
	+ Dry ice should be stored and used in a well-ventilated area.
		- Do not use in confined areas or rooms without ventilation.

A leak in such an area could cause an oxygen-deficient atmosphere.This could cause suffocation if breathed exclusively.* + - Store dry ice in an insulated container. Do not store dry ice in a completely airtight container. The sublimation of dry ice to carbon dioxide gas will cause an airtight container to expand or possibly explode.
	+ Dispose of any extra dry ice from patient samples or reagents by placing into the dry ice storage container located in the Referrals section of the lab.
		- Do not leave dry ice on a countertop or dispose into a sink as the extreme cold could crack surfaces and damage plumbing.
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| **Emergency Response: Symptoms** **of anoxia** | * If an individual that is working with LN2 or Dry Ice is overcome by toxic or oxygen-displacing fumes and displays dizziness/confusion, shortness of breath, or a headache:
	+ Quickly move the affected person to fresh air.
	+ Ensure that all other personnel have evacuated the area.
	+ Initiate a response of Dr. Blue by pushing the nearest alert button or by contacting Security:
		- **Minneapolis: 5-7777**
		- **St. Paul: 1-8899**
	+ Contact the Lab manager/supervisor/safety officer.
* If an individual that is working with LN2 or Dry Ice is overcome by toxic or oxygen-displacing fumes and has lost consciousness:
	+ **Do not** attempt to rescue, especially if you are alone and uncertain of the conditions.
	+ If possible, open the nearest door in order to increase ventilation into the room.
	+ Initiate a response of Dr. Blue by pushing the nearest alert button or by contacting Security:
		- **Minneapolis: 5-7777**
		- **St. Paul: 1-8899**
	+ Contact the Lab manager/supervisor/safety officer.
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| **Spill Response** | * If a large spill occurs:
* Clear all staff from the area
* Contact Security:
	+ - **Minneapolis: 5-7777**
		- **St. Paul: 1-8899**
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| **SDS** | Access Safety Data Sheets (SDS) on Star Net for more information on Liquid Nitrogen and Dry Ice. |
| **Supporting Documents** | [SA 10.04 Personal Protective Practices](https://starnet.childrenshc.org/References/labsop/gen/safety/sa/sa10.04-personal-protective-practices.pdf)[SO 1.00 Special Collections and Send Out Manual](http://khan.childrensmn.org/manuals/lab/sop/his/soproc/191682.pdf)[SO 5.10 Shipping Specimens on Dry Ice](https://starnet.childrenshc.org/references/labsop/ss/shipcour/so-5.10-shipping-specimens-on-dry-ice.pdf) |
| **References** | 1. CLSI. Clinical Laboratory Safety; Approved Guideline – Third Edition. CLSI document

GP17-A3. Clinical and Laboratory Standards Institute, Wayne, PA; 2012.1. Centers for Disease Control and Prevention. Guidelines for Safe Work Practices in Human and Animal Medical Diagnostic Laboratories. MMWR; 2011.
2. OSHA. Quick Facts: Laboratory Safety Cryogens and Dry Ice. Occupational Safety and Health Administration Website. <https://www.osha.gov/Publications/laboratory/OSHAquickfacts-lab-safety-cryogens-dryice.pdf>. Reviewed October 2011. Accessed 05/22/2019.
3. Air Products. Liquid Nitrogen – Safetygram 7. Air Products and Chemicals, Inc.: 2019.
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| **Historical Record** | **Version** | **Written/Revised by:** | **Effective Date:** | **Summary of Revisions** |
| 1 | Kerstin Halverson | 10/26/04 | Initial  |
|  | 2 | Carol Buhl | 06/05/15 | Reformatted to CMS.Renumbered from 4.1.1.Added hazard information and expanded Safe Work Practices.Added Supporting Documents.Added References. |
|  | 3 | Carol Buhl & Lab Safety Committee | 01/31/19 | Added spill response information.Updated references. |
|  | 4 | Carol Buhl & Lab Safety Committee | 07/26/2019 | Added oxygen monitor information.Added dry ice information.Added supporting documents SA 10.04 & SO 5.10.Removed supporting document HI 1.12.  |
|  | 5 | Andrew Fangel & Lab Safety Committee | 04/10/20 | Added locations of all LN2 dewars.Added directions for periodic inspection of oxygen monitors. Added emergency response instructions for individuals who have experienced anoxia. Added reference. |