Chemical Standard Operating Procedure for
Liquid Nitrogen

Standard Operating Procedures are established after conducting a risk assessment to determine and minimize the hazards of the materials, equipment, and procedures used. A suggested risk assessment form is found in Appendix C. The risk assessment is to be performed by a faculty member who is familiar with the laboratory use of the chemical being used. Make sure that research has been performed to understand hazards and identify safety measures, including a review of past incidents. Consult with co-workers, vendors, or other experts.

Material and How it will be used
Chemical Name (include hazardous reaction products and by-products) or Chemical Class: **Liquid nitrogen**
Brief description of use of chemical: **Dispensing and sample storage.**

Potential Hazards
Cryogenic liquid. Extreme coldness can cause frostbite and severe tissue damage. Flesh can stick to extremely cold metal and will tear when you try to pull free. Exposure to liquid or "boil off" gases can result in extensive tissue damage. **Expansion of liquid nitrogen into nitrogen vapor can create an asphyxiation hazard. Vapor volume is 700 times the liquid volume. Confined spaces must be avoided when using liquid nitrogen.** **Liquid nitrogen in contact with cold metal surfaces can cause condensation of oxygen from the room air resulting in an oxygen enriched atmosphere, an increased fire hazard. Low temperatures may also cause materials like rubber and some metal alloys to become brittle.**

Regulatory Issues
Such as NFPA storage requirements (such as for gas cylinders), limits on storage quantities of flammable materials and use of bunker for storage where required. **Avoid confined spaces.**

Engineering Controls
Use and store only in a well-ventilated place. Always keep container is upright position. Oxygen monitors should be mounted in locations where liquid nitrogen is used on a regular basis. **Store and use liquid nitrogen only in containers and equipment recommended for cryogenic service. Ensure that all apparatus is properly vented to prevent accumulation of pressure. Be cognizant of ice blocks that could block vent lines.**

Work Practice Controls
New workers must review this SOP with PI prior to conducting work. At beginning of experiment, review properties of liquid nitrogen and any incidents. Specify whether material is to be used in fume hood. If reaction is allowed to proceed unattended, label fume hood/work area with appropriate signage. After initial experiment and when encountering changes or unexpected reactions, review this SOP with other experienced

researchers. When done with experimental work, put all experimental materials in their proper places and clean and decontaminate surfaces. Specify if working alone is permissible.

Never allow any unprotected part of your body to touch uninsulated pipes or vessels containing liquid nitrogen. It is recommended that jewelry (rings and watches, or anything that could trap cold gases next to the skin) be removed.

Specific Experimental Procedures

(Use this space for the specific procedures to be used in your laboratory)
GENERAL DISPENSING PROCEDURE (University of California SOP, 2011)

1. Check to see if pressure in tank is below 20 psi. If not, slowly open VENT valve. Make sure vent is not directed toward face) and lower pressure to 10 - 20 psi.
2. Check transfer hose for cracks and breaks.
3. With Dewar on floor, place hose to a depth of approximately one inch. Note: Hose will freeze during fill and takes 10 – 40 minutes to thaw.
4. Open LIQUID valve slowly and start fill at very slow rate to cool Dewar. At this time there will be a very high boil off of cold nitrogen gas.
5. Once Dewar is cooled, the fill speed can be increased gradually. Never fully open the valve, as it could freeze open.
6. When Dewar has been filled, close liquid valve and let dispensing hose warm.
7. Once warmed, remove hose and place cover on Dewar.
8. Check liquid and vent valves to confirm that they are closed.

ADDING AND RETRIEVING SAMPLES FROM LIQUID NITROGEN SOURCE

1. Wear a face shield and loose fitting insulated gloves when retrieving samples. Rapid changes in temperature can cause a rupture in a sample container causing containers to explode of liquid nitrogen has leaked inside.
2. Remove lid to Dewar, grasp the wire hook and maneuver the sample container to the entre of the opening.
3. Slowly lift the sample container straight up, then tilt slightly to allow excess liquid to run off before lifting the item fully out of the Dewar.
4. Gently set the sample container in a suitable location and retrieve the desired samples.
5. When returning the sample container to the Dewar, ensure the wire hook is affixed securely, then lower slowly into the Dewar to minimize splashing.
6. Replace the lid.

Personal Protective Equipment

Wear goggles and a face shield if there is a risk of contact. Gloves should be loose and insulating. Loose gloves are recommended so that they can be thrown off in the event of a spill onto the gloves. Long sleeves, lab coats or aprons, must be worn. Protective equipment is to be worn at all times.

Storage

Store in a cool dry place. If nitrogen has a blue tint, it has been contaminated with oxygen and should be replaced. The contaminated material is dangerous and potentially explosive.

Waste Disposal
No waste is anticipated. Prevent from entering sewers or any place where accumulation can be dangerous.

Spills and Releases
If a release occurs, immediately stop all work. Rapid displacement of oxygen can occur. Alert other nearby workers and supervisor to the situation. Make sure no one has received a hazardous exposure. If so, seek medical help immediately. If it can be done safely, shut off flow and ventilate area. This may not be possible in the event of a large spill. Avoid contact with liquid, and contact Providence College's Environmental Health and Safety Office and supervising faculty member for spill response assistance.

Emergency Procedures
Review the lab-specific SOP for information regarding emergency procedures and equipment. **In the event of a large spill, consider pulling the building alarm, due to the asphyxiation hazard. Evacuate the area and alert others.**

I certify that a risk assessment has been conducted by a faculty member who is familiar with the laboratory use of the chemical being used.

Name: _____ **Signature (lab supervisor):** _____ **Date:** _____

Peer-reviewed by:

Name: _____ **Signature (peer reviewer):** _____ **Date:** _____