Liquid Nitrogen Storage and Use

1. Liquid Nitrogen (LN2)

A. Description
Liquid nitrogen, often abbreviated as LN2, is an inert, odorless, stable cryogenic chemical. Nitrogen makes up almost 80% of the atmosphere however, it is not life supporting.

B. Physical Properties
1. Molecular weight: 28.01
2. Boiling point @ 1 atm.: -320.5°F, -195.8°C, 77K
3. Expansion ratio: 1 to 696.5
4. Liquid Density: 50.7 lb/ft³
5. Specific Gravity: 0.967
6. Color: None

C. Uses
Liquid nitrogen is mainly used to cryogenically store laboratory materials, including but not limited to cell, substrates and biological agents.

2. Handling and Storage

A. PPE required
1. Full face shield and goggles
2. Thermal insulated or leather gloves that should be loose fitting so they are able to removed quickly if necessary.
3. Long sleeved clothing and pants
4. Closed-toe shoes

B. Standard Operating Procedure for Removing Items from Liquid Nitrogen
1. Always wear appropriate PPE when using liquid nitrogen or cryogenic containers.
2. Work in an open, well-ventilated location and NEVER directly over an open vat of liquid nitrogen.
3. Boiling and splashing can occur when inserting objects into cryogenic liquids such as nitrogen. Perform these tasks slowly to minimize splashing.
4. Use tongs to withdraw objects immersed in liquid nitrogen.
5. Do not touch anything that has been immersed in liquid nitrogen until it has reached room temperature.

C. Standard Operating Procedure for transferring Liquid Nitrogen
1. Use a special separator or special filling funnel to prevent splashing and spilling when transferring liquid nitrogen into or from a dewar. The top of the funnel should be partly covered to reduce splashing.
2. Use only small, easily handled dewars for pouring liquid.
3. Use only fitted transfer tubes designed for use with dewar containers. Cracked or damaged insulation on transfer tubes should be replaced.
4. Do not pour liquid while holding secondary container. The container should be on a stable stand or hung so that the transfer tube rests securely on the neck of the secondary container.

D. Storage
1. Do not store in a confined space.
2. Never allow any unprotected part of the body to come into contact with uninsulated pipes or equipment that contains liquid nitrogen.
3. Do not drop, tip or roll containers on their sides.
4. Do not remove or interchange connections.
5. Do not use adapters.

E. Containers
Liquid nitrogen containers are insulated, vacuum-jacketed pressure vessels. They are equipped with relief valves and rupture discs to protect against pressure build up. NEVER CLOSE RELIEF VALVES. The containers operate at pressures up to 250 psig. They can hold from 80 to 450 liters of liquid. Cryogenic containers and dewars should not be filled to more than 80% of capacity.

   A. Ventilation/Engineering Controls
      1. Local exhaust should be used to prevent oxygen deficiency
      2. Mechanical or general exhaust ventilation may be used if it can maintain an adequate supply of air.
   B. Transportation
      1. Cryogenic containers should be transported in a secure position.
      2. Shipment of cryogenic containers that have been filled without the owner’s consent is a violation of federal law [49 CFR 173.301(b)].
   C. Waste/Disposal
      1. Do not attempt to dispose of residual or unused quantities.
      2. Return containers to supplier

4. Health Effects of Liquid Nitrogen
   A. Possible risks
      1. Simple asphyxiant – displaces the level of oxygen in the air required to support life
      2. Inhalation in excessive amounts can cause dizziness, nausea, vomiting, loss of consciousness and death
      3. Neither liquid nitrogen nor liquid air should be used to cool a flammable mixture in the presence of air which can lead to an explosion hazard when oxygen condenses from the air.
      4. Direct contact with cold gas or liquid can cause severe frostbite.
   B. Symptoms of exposure
      1. Dizziness
      2. Nausea
      3. Vomiting
      4. Frostbite
      5. Loss of consciousness; possible death
   C. Spill/Contamination
      1. Evacuate all personnel from spill/contaminated area.
      2. Shut off flow if you can do so without risk.
      3. Avoid contact with spilled liquid and allow to evaporate
      4. CONTACT EHSRM IMMEDIATELY

5. Regulatory Information & Emergency Contact
   A. Agencies
      1. EPA
a. CERCLA (40 CFR Parts 117 and 302)
b. SARA Sections 302/304 (40 CFR Part 55), Sections 311-312, Section 313
   (40 CFR Part 372), 40 CFR 68, TSCA
2. OSHA 29 CFR 1910.119

B. Responsible Parties
   1. Principle Investigator
   2. Supplier
   3. University of Colorado Colorado Springs

C. Emergency Contact
   1. EHSRM – (210) 458-5250