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McMaster University
Department of Biology
Standard Operating Procedures for Liquid Nitrogen

Revised: January 28, 2008
Reviewed by: EOHSS May 2008
Effective: Immediately

Applicable Legislation:

Occupational Health and Safety Act (OHSA), R.S.O. 1990, Sections 27 (2) (a), 27 (2) (c) & 28 (1) (a), 28 (1) (b), 28(1) (c).

Intent: To outline safe handling procedures of Liquid Nitrogen, including any equipment that is used in conjunction with Liquid Nitrogen, and to outline potential hazards and first aid measures should incidences occur.

Definitions:

Cryogenic fluids are liquefied gases at very low temperature (usually below -73.3°C). The most common laboratory cryogenic fluid is liquid nitrogen.

Qualified person: A person who, in respect of a specific duty, is qualified by knowledge, training and experienced to perform the duty safely and properly.

Requirements of OHSA, Section 27 (2) a, c and Section 28(1) a, b, c

- 27. (2) (a) A supervisor shall advise a worker of the existence of any potential or actual danger to the health or safety of the worker of which the supervisor is aware.
- 27. (2) (c) Take every precaution reasonable in the circumstances for the protection of a worker.

Duties of workers

- 28. (1) A worker shall,
 - (a) work in compliance with the provisions of this Act and the regulations;
 - (b) use or wear the equipment, protective devices or clothing that the worker's employer requires to be used or worn;
 - (c) report to his or her employer or supervisor the absence of or defect in any equipment or protective device of which the worker is aware and which may endanger himself, herself or another worker

Potential Hazards

Cryogenic fluids pose significant hazards due to their low temperatures and possibility of pressure buildup as the liquid warms in a closed container.

Tissue injury: There is potential for skin or eye damage due to the low temperature of the liquid. Loss of vision may result from eye contact. Contact with skin may cause frostbite and for the skin to become brittle enough to shatter.

Pressure buildup: Enclosed containers can rupture as pressure builds up in the container as the liquid converts to gas. One cubic centimetre of liquid nitrogen will expand to 700 times this volume as it converts to the gaseous state.

Asphyxiation: The buildup of inert gas in an enclosed space could generate an oxygen deficient atmosphere.

Description of Procedures

1. All persons shall consult the Risk Management Manual (RMM # 504) MSDS and SOP on Liquid Nitrogen before use. (review WHMIS materials on Cryogenics). Follow all recommendations

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2. All users will have WHMIS, Fire Safety, Gas Cylinder, Chemical handling and Spills training.
3. Appropriate personal protective equipment to prevent eye and skin injury is to be worn when transferring cryogenic liquids. A full-face shield, or safety glasses/goggles, loose fitting cryogenic handling gloves, apron, and trousers that fit over closed-toed footwear are the recommended equipment for transferring cryogenic liquids. Gloves should be loose enough to allow them to be shaken off if cryogenic material enters them.
4. All persons shall know Life Sciences Building Emergency Procedures including the location of Fire pull stations, eye wash stations and safety showers.
5. Liquid nitrogen is only to be transported in containers designed for containing cryogenic liquids such as a vacuum-jacketed Dewar flask.
6. All containers shall be designed to accommodate relief of pressure, either by the use of loose fitting stoppers or by specifically designed fittings.
7. Containers must be clearly labeled to indicate the cryogenic liquid contained therein.
8. Containers should be filled slowly to avoid splashing.
9. For transfer of cryogenic liquids, containers showing evidence of loss of vacuum in their outer jacket (i.e. ice buildup on the outside of the container) should not be used.
10. Movement of large containers (e.g. 25L containers) requires two people to perform the task and use of a cart for transport.
11. Transfer of cryogenic fluids is only to be conducted in well-ventilated areas.
12. Proceed to basement level by freight elevators (Liquid nitrogen dispensing station).
13. Open dewar and place in a safe location (floor)
14. Place hose into dewar and SLOWLY open valve.
15. Fill to desired amount, and close valve.
16. Fill out Liquid Nitrogen usage sheet providing Name, Lab Name, Date, Amount dispensed.

Waste Management and Environmental Responsibility

These gases are released as is in the atmosphere.

Waste disposal procedures

Do not attempt to dispose of the container or of its content. Return in the shipping container properly labeled, with any valve outlet plugs or caps secured and valve protection cap in place to Air Liquide for proper disposal. For emergency disposal, contact the closest Air Liquide location. Phone at 1-888-629-0202 (option 1 Medical gases)

Handling and Storage Requirements (refer to MSDS)

Do not place containers in a closet or other enclosed space where there is no ventilation supply to the area.

Use of cryogenic fluids is only to be conducted in well-ventilated areas.

Appropriate personal protective equipment to prevent eye and skin injury is to be worn when handling cryogenic liquids. A full-face shield, loose fitting cryogenic handling gloves, and trousers that fit over closed-toed footwear are the recommended equipment for handling cryogenic liquids.

Because of the possibility of rupture of the sample container due to pressure buildup, a face shield shall be worn when removing samples (e.g. microfuge tubes) from storage dewars.

Do not pour cryogenic fluids down the drain.

Handling: Valve protection caps must remain in place unless cylinder is secured with valve outlet pipe to usage point. Do not drag, slide or roll cylinders. Use suitable hand truck for cylinder movement. Use a pressure regulator

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when connecting cylinder to lower pressure piping or systems. Do not heat cylinder by any means to increase the discharge rate of product from the cylinder. Use a check valve or trap in the discharge line to prevent hazardous back flow to the cylinder. Do not tamper with (valve) safety device. Close valve after each use and when empty.

Storage: Protect cylinders from physical damage. Store in cool, dry, well-ventilated area of non-combustible construction away from heavily trafficked areas and emergency exits. Do not allow the temperature where cylinders are stored to exceed 52°C/125°F. Cylinders must be stored upright and firmly secured to prevent falling or being knocked over. Full and empty cylinders should be segregated. Use a “first-in first-out” inventory system to prevent full cylinders being stored for excessive periods of time. Post “No Smoking or Open Flames” signs in the storage or use area. There should be no source of ignition in the storage or use area.

Contingency Plan and Reporting

All accidents and spills will require persons involved to fill out an "incident report" after the situation has been contained. **In case of emergency Dial 88.**

Accident response

EVACUATE ALL PERSONNEL FROM AFFECTED AREA.

Use appropriate protective equipment. If leak is in user's equipment, be certain to purge piping with an inert gas prior to attempting repairs. If leak is on cylinder or cylinder's valve, contact the closest Air Liquide location.

If a spill is substantial (big puddle) **call Ext 88, and EOHSS ext. 24352.**

If a spill is small, keep the area well ventilated and allow the liquid to return to the gas phase.

See Occupational Health Nurse or, if necessary, call ext 88 and request medical assistance. Stay on the line until the dispatcher has confirmed your location and the nature of the accident.

Remove any clothing that may restrict circulation in the frozen area.

Do not rub frozen parts; tissue damage will result.

If part of the feet are frozen, do not walk.

As soon as practical, re-warm by immersing the affected part in warm (not hot) water (40 to 46 C) or with body heat. Never use dry heat. Do not re-warm rapidly. Keep victim in a warm room if possible. Continue rewarming until the pale blue tint of the skin turns pink or red. Affected area should be cleaned with mild soap and water to prevent infection.

Remove victim to fresh air. Perform artificial respiration if needed.

Dial 88 and request medical assistance. Stay on the line until the dispatcher has confirmed your location and the nature of the accident.

Spill clean up (refer to MSDS)

Do not attempt to mop up the spill.

If spill is major or in case of critical injury **call Ext 88, and EOHSS ext. 24352.**

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References:

Material Safety Data Sheets: Sigma Aldrich
Risk Management Manual (RMM #504) McMaster University
Occupational Health and Safety Act (OHSA)
Cameron Lab Protocols (2008)