**Cope of Practice:**

**Storage and Handling of Liquid Nitrogen.**

**Hazards.**

Cryogenic Burns  
**Oxygen Depletion**  
Explosion and Fire  
Load Handling  
Container Failure

**Contributory Factors.**

Spillage  
Surface Contact  
Working in restricted areas  
**Working in areas without adequate ventilation**  
Liquid Nitrogen Storage Containers not appropriately vented  
Vials stored in liquid nitrogen may explode when brought to room temperature.  
Atmospheric Oxygen in contact with liquid Nitrogen can form liquid Oxygen certain conditions.  
Personal injury resulting from manual handling Damage to Containers either physical or chemical.

**Risk Control Measures.**

1) Preventing access to unauthorised people used for delivering, storing, dispensing and using liquid nitrogen. Particularly: our storage room (Sorter Lab 1) is controlled by electronic badge access.

2) Suitable training and PPE is supplied. ( see Appendix 1)

3) Avoid direct skin contact with items which recently been in proximity of liquid nitrogen, by using insulated gloves or tongs.

4) Careful handling to minimise risk of spillage. The low temperature vapour produced during a large spill can cause damage to soft tissues e.g. eyes and lungs.

5) If the nitrogen is going to be stored in a confined space the calculation will inform you whether an Oxygen depletion Monitor should be installed. (not currently the case for us)
British Compressed Gases Association (BCGA) Code of Practice prohibits transportation of liquid nitrogen in cars. Dewars must be transported in vehicles with a bulkhead that separates them from driver or passengers.

6) To avoid Dewars becoming sealed with plugs of ice, use only Dewars built in accordance to Good Manufacturing Practice (see BCGA Code of Practice p12). Always fit properly vented storage vessels designed for the purpose.

7) Use face visor suitable for liquid nitrogen when removing vials from liquid nitrogen (safety glasses are inadequate).

8) Fill liquid nitrogen storage vessels from the large Storage Vessel using the flexible hose did not lift the 25litre small tanks for that purpose. Those are only to be used for filling small Dewars.

9) Two people are required when refilling, decanting liquid nitrogen, in case of fainting

Guidelines for removing Cryovials from Liquid Nitrogen storage

1. Wear protective gloves and face shield.
2. After removing cryovial loosen the lid by half a turn.
3. Place each cryovial in an appropriate rack then place the rack in a polystyrene box with lid on.
4. Cl2 samples should be taken without delay to an appropriate hood
5. Wait a couple of minutes to check liquid N2 has dissipated.

Recommendations:–

a) Use cryovials suitable for the type of storage i.e. vapour or liquid. Not all the cryostores in the department are designed for vapour storage but if so, store the vials in vapour phase. This will remove the risk of splash injury to an exposed surfaces (including skin) and virtually eliminate the possibility of an exploding vial due to penetration by liquid nitrogen.

b) Wear appropriate PPE and handle the frozen vial for as little time as possible

Risk Assessment of Manual Handling of Liquid Nitrogen Cylinder (240 and 180L Cryogenic Vessels). Hazards: As above

Risk Factors:
1) The vessel and trolley weight is above that of the operator and therefore any starting, stopping or directional force is high. Over exertion may result in back, shoulder, chest or arm injuries.

2) Considerable risk of crushing particularly limbs and fingers between walls, door frames and other equipment exists.

3) Uneven ground may result in load tipping or a sudden stop

4) Cryogenic injury either direct from the liquid nitrogen or surfaces which have been in contact with the liquid nitrogen

5) There is a risk of asphyxiation when the vessel is in an enclosed space without ventilation for example the lift.

**Risk Control Measures:**

1) Trolleys must be maintained in good mechanical order.

2) Vessels should not be exposed to strong acidic or alkaline cleaners or other corrosive substances.

3) Inspect all vessels regularly for evidence of damage that could affect the integrity of the inner flask or its handling.

4) Because of vessel size, users must have clear vision of their route. DO NOT twist the body while changing direction of the load and use another person to assist.

5) It is important to consider individual physical strength of staff when assigning physical work of this type.

6) Operators must ensure that all stock cocks are off.

7) Cryogenic vessel must travel in the lift unaccompanied. Our yellow warning notice should be in front of the vessel to discourage other lift users. There must be someone on level 6 to receive the vessel.

8) Under no circumstances should the cryogenic vessel be left unsupervised anywhere that is accessible to the general public.

9) In the event of a failure of the trolley or any other incident, the operator must not try to intercept the vessels travel. The incident area should be cordoned off, windows should be opened in adjacent areas to improve ventilation and allow any spilt liquid nitrogen to disperse as gas. Check the area with an oxygen monitor before entering the cordon and attempting to right the vessel.

**Note:**
The above information equally applies to 180L cryogenic vessels which has additional risks due to that is on castors. Particular care should be exercised with this vessel when moving out of lifts where the lift and landing floors are not aligned. This also applies to floor ridges.

**Persons at Special Risk.**

None
**Health Surveillance.**

None

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**Appendix 1.**

**Personal protective equipment when using liquid nitrogen.**

Liquid nitrogen is extremely cold and boils at –196 degrees C. The purpose of appropriate clothing and personal protective equipment when using liquid nitrogen is to:

- Prevent cryogenic burns to skin
- Prevent eye injuries caused by cryogenic burns and explosions

A local risk assessment should be undertaken to determine the PPE appropriate to the amount of liquid nitrogen used.

- Metal jewellery on hands and wrists can cause severe cryogenic burns if in contact with liquid nitrogen. Jewellery should always be removed prior to working with the material.
- Dry insulated gloves should be used when handling equipment that has been in contact with liquid nitrogen. There is doubt as to the advisability of wearing gloves when handling liquid nitrogen itself, as there is the possibility of the liquid filling the glove and making burns more severe.
- Lab coats or overalls should be worn to minimise skin contact. Splash resistant aprons are appropriate if Dewars are carried at chest height over uneven ground or on stairs. Trousers should be worn and not shorts/skirts, to prevent spillages into footwear.
- Wear eye protection (visors or goggles suitable for use with liquid nitrogen) when removing vials from liquid nitrogen and when transferring the liquid between containers.

**Appendix 2.**

**First Aid.** See also BOC Safety data sheet. Appendix 7 pages 14 & 15
1) **Asphyxia**

- Normal Oxygen levels are around 21%
- At 11-14% physical and intellectual performance is impaired.
- At 8-11% fainting is likely
- At 6-8% fainting occurs within minutes, but resuscitation is possible if carried out immediately
- Below 6% Death is likely.

**Seek immediate medical attention.**

Ensure that the area is safe and well ventilated.

If any of the following symptoms are present in a situation where asphyxia is possible, immediately remove the affected person to the open air, and follow up with artificial respiration if necessary.

**Do not enter an area where someone may have fainted from asphyxia without first ensuring adequate ventilation.**

- Rapid and gasping breath
- Rapid fatigue
- Nausea
- Vomiting
- Collapse or incapacity to move
- Unusual behaviour. The victim may not be aware of what is happening.

2. **Cryogenic burns**

Immediately flush the affected area with tepid water at a temperature of not greater than 40 C until the skin changes from pale yellow to pink.

**Seek medical attention**

Loosen clothing to affected area

**Nitrogen gas increase during filling**

Assume 10% of total spill in the above calculation (multiply the max nitrogen volume above by 0.1)

**Nitrogen gas increase during storage**

Consult Dewar supplier for expected loss per day. The BGCA calculation assumes a loss of 0.2 litres per day per litre Dewar, and assumes 0.4 changes per hour for the average room. The increase in nitrogen per day is thus I loss x 0.7/ (room volume X 0.4 X 24)

All areas where liquid nitrogen is stored, dispensed, transported or used must be well ventilated. However where the above calculation on nitrogen increase is greater than 5% (0.05) the following extra safety precautions must be considered.
- Ensuring failsafe passive ventilation
- Installing forced ventilation to an internal room
- Using an oxygen concentration alarm.