
General Guideline on Gas Cylinders and Liquid Nitrogen – availability, use and transportation

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Definitions: Dewar – a container, usually made of stainless steel, designed to contain liquid nitrogen and withstand low temperatures. Size ranges from large – holding many litres to small, thermos flask size.

1. Health and Safety:

Mechanical Hazards

All cylinders must be secured at all times so they cannot be knocked over or fall either during transport by trolley or when in use in the laboratory. A falling cylinder can cause serious injury; at the very least the weight of a cylinder could do reasonable damage to your foot etc if it happens to fall.

Liquid nitrogen dewars and gas cylinders must be secured in a vehicle to minimise danger of them becoming a loose object in a vehicle in the event of any vehicle emergency.

Liquid nitrogen dewars and compressed gas cylinders are heavy and care must be taken when lifting and transporting them to avoid back or muscle strain.

High Pressure Vessel Hazard

Apart from being heavy, nitrogen cylinders contain gas at high pressures. If they are knocked or accidentally fall over, the regulator or the valve may be damaged causing the cylinder to take off like a rocket and fly around the room.

Health hazards – though not classified as a hazardous chemical, all forms of nitrogen must be handled with care.

Burns

Liquid nitrogen can cause severe burns or frostbite and must not be handled if spilt. This is a risk to skin and eyes.

Asphyxiant

An important hazard in the use and carriage of nitrogen (liquid or compressed gas) is escape (rapid or slow release) of the nitrogen into any confined and/or poorly ventilated space. Nitrogen is an asphyxiant as it replaces oxygen in the environment – it can reduce ambient oxygen levels from 21 – 14 % and this may induce drowsiness and affect judgement. One deep breath of almost pure (100%) nitrogen may cause immediate loss of consciousness and may be fatal.

The interior of a vehicle is a good example of a confined space in which a slow increase of nitrogen into the atmosphere will impair driving ability and lead to drowsiness.

MSDS for nitrogen is attached; also refer to Australian Standard AS 2243

Risk Assessment: The procedures outlined here present a potentially serious hazard to the user and others if controls are not in place and procedures are not followed. If proper procedures are followed the transport and use of compressed and liquid nitrogen should present minimal danger to the user and others. If there is any doubt at any time – stop and get help.

2. Gas Cylinder Storage and Use

Gas Cylinders:

This safety note assumes you know the size classification of gas cylinders and some of the terminology associated with the use of them. Consult the BOC gases handbook (lab manager's office) if you are not sure. Sizes in common use are: 'G' the largest, and 'D' which is two sizes smaller than 'G'.

Cylinders of gas are available from the store or by a direct order to BOC gases (UTS account No required).

- When not in use, gas cylinders must be secured in a proper storage facility designed to support them. This must be a well ventilated area, away from any fire (ignition) or heat risk as required in the regulations. Usually a substantial wall bracket with a chain to secure them in place is sufficient provided they are positioned so that they cannot be accidentally bumped and knocked over.
- If you need to use gas cylinders in a lab please make arrangements with the lab staff or the Building Services Officer to install a suitable bench or wall support - before you start work.
- Gases must also be stored according to the Dangerous Goods storage regulations.
- When not using the gas and before changing cylinders ensure all valves are fully turned off.
- It is good practice to make a habit of checking hoses and connections regularly and/or each time you change cylinders for any visible damage and for leaks using soapy water.

Reference: BOC handbook of gases, AS2243, safety in Laboratories.

3. Transporting Gas Cylinders

Within the building

- Always remove the regulator and ensure cylinder valve is fully off.
- Always use a gas cylinder trolley suitable for transporting gases (with a chain to support the cylinder).
- Don't attempt to trolley a cylinder on your own if you are unable to handle it - they are heavy and may injure your back or fall and injure others.

In vehicles

Wherever possible arrange for gas cylinders to be delivered by the supplier to site (ie Biology Annex) - it is safer than attempting to transport by passenger vehicle. NEVER attempt to transport cylinders larger than a D size (ie G or E) inside a passenger vehicle.

In certain limited circumstances D size cylinders of nitrogen or air are required to be transported by passenger vehicle. Though this is not recommended they may however be relatively safely transported with minimal risk, providing the procedures below are carefully followed.

- When carrying nitrogen at least one window in the vehicle must be fully open at all times - whatever the weather.
- No more than 2 (if absolutely necessary, 3) D size cylinders of *non toxic* and *non flammable* gases to be transported (ie only nitrogen or air).
- Cylinders must be secured behind the cargo barrier.
- Cylinders must be individually strapped, with suitable straps, to the cargo barrier in an upright position in the centre of the vehicle. Straps are available from the lab staff or can be purchased (details available).
- Ensure that cylinder valve is fully off and the regulators removed for transport.
- Never leave the car parked in the sun or where it can heat up. This avoids putting pressure on the cylinder valve. If the car has become hot, open the door and allow it to ventilate before entering in case there has been a leak of nitrogen.

4. Liquid Nitrogen

Health and Safety Note - also consult the MSDS

Liquid nitrogen is a cryogenic liquid at a temperature of -195°C . As it warms it releases large volumes of nitrogen gas.

It can cause serious burns and frostbite.

It may splatter if material at room temperature is added to the liquid or when liquid nitrogen is poured into some containers.

Nitrogen displaces oxygen from the atmosphere and is therefore an asphyxiant

Availability and Use

Dunbar

Liquid nitrogen is available from Cell and Molecular Biology Research Labs on the first floor. To use this service you must first make arrangements with James Phillips (ext 4121 Room 4.7b) through your supervisor or the Environmental Sciences lab staff. The correct procedure is important because they maintain the supply and they need to know approx how much will be needed for regular top-ups of the bulk supply. Cost is \$1 per litre. You will be required to enter the amount you take in the book beside the cylinder and abide by any local safety and administrative procedures.

Annex

The Annex dewar is located in the Annex prep room G14. This is filled via a standing order with BOC Gases - see Gemma for assistance.

General

- When decanting liquid nitrogen you must use a suitable container - usually a 1 L stainless steel flask or a larger dewar expressly designed for liquid nitrogen. An unsuitable container (plastic, glass or china) may fracture or shatter in contact with cryogenic liquid.
- When decanting liquid nitrogen you must wear safety glasses; ordinary glasses are not suitable unless they have side protection. It may be necessary to use gloves where they are provided for specific purposes. Wear a lab coat. You must be wearing closed in shoes.
- A full face shield is available beside the dewars on the 1st floor - this must be used when decanting in this area.
- Decanting and use of liquid nitrogen must be done in a well ventilated area.
- When pouring - always pour with the opening held away from you - and others.
- Liquid nitrogen can damage floor and bench surfaces - always pour on the timber surface provided in lab 2.8 and protect bench surfaces from direct contact.
- Do not place any liquid nitrogen in the freezer or cold room (they are confined spaces with limited air flow). Liquid nitrogen boils off and becomes a gas at cold room (4°C) & freezer room (-20°C) temps.

5. Transport of Liquid Nitrogen

Liquid nitrogen must always be transported - even a short distance - in a container that is designed to contain and transport liquid nitrogen safely. This container must be correctly labelled.

Within a building

- Larger liquid nitrogen dewars are heavy and must be transported on a trolley - suitably strapped and secured.

To the Annex

It is recommended that the liquid nitrogen dry shipper is used to transport samples between the Annex and Dunbar as it is designed for use in vehicles - available through Gemma or Narelle.

Larger quantities of liquid nitrogen may be carried in one of the university vehicles - provided the rules below are followed (also see health and safety note at beginning of document):

- it is carried in a proper liquid nitrogen container (dewar) which carries correct hazard labelling
- a staff member of the department or a trained postgraduate is present. This person must be aware of safety procedures should an incident occur
- the container is securely strapped behind the cargo barrier
- one window of the car is open at all times
- the container is never left in an unattended closed car, especially in hot weather.

If no car is available an alternative means of transport by trolley has been set up by the lab staff.

To the field in vehicles

It is recommended that the liquid nitrogen dry shipper is used to transport samples from the field as it is designed for use in vehicles - available through Gemma or Narelle.

Larger quantities may be carried in one of the university vehicles - provided:

- it is carried in a proper liquid nitrogen container which has correct hazard labelling
- a staff member of the department or a trained postgraduate is present. This person must be aware of safety procedures should an incident occur
- the container is securely strapped behind the cargo barrier
- one window of the car is open at all times
- the container is never left in an unattended closed car, especially in hot weather.

6. Care and use of the dry shipper

The dry shipper does not rely on free liquid nitrogen for cooling. In a dry shipper the liquid nitrogen is absorbed into the special absorbent material surrounding the central core in the flask producing a dry but cold (-190°C) environment for transport of samples. Even if tipped over the liquid nitrogen does not spill. These temperatures are easily maintained for long periods.

Ensure the stopper is correctly inserted to avoid damage by making unnecessary grooves which might allow cold atmosphere to escape.

Further info supplied from manufacturer's notes.