

Safe Methods of Use 18: Cryogenic Liquids

Purpose: This applies to **principal investigators (PIs), sector managers, designated laboratory person (DLPs)**, technical staff and students who use cryogenic liquids or use equipment containing cryogenic liquids within the University of Auckland.

There are two major hazards associated with cryogenic liquids such as liquid nitrogen and helium – burns and asphyxiation.

A. BURNS

Cryogenic liquids are, by definition, extremely cold. Contact between cryogenic liquids and exposed skin can produce a painful burn. A splash of cryogenic liquid to the eye can cause loss of vision.

Personal Protective Equipment

- Face shield
- Loose fitting Thermal Mittens or Gloves (that can be easily shaken off)
- Closed Shoes or boots
- If pouring cryogenic fluids ensure pants material is not tucked into boot

Emergency Treatment for Burns

- Attempt to raise the burnt area to room temperature reasonably quickly.
- Do not use warm water.
- Do not remove clothing around burn as it may lift frost bitten skin

B. ASPHYXIATION.

Cryogenic liquids will expand many times their origin volume when they convert to gas at room temperature.

If vented into a closed space, cryogenic liquids such as helium, argon and nitrogen will displace oxygen when they become gaseous and have the potential to create oxygen deficient environments in a closed room.

Because of the nature of the gases involved, the victim will have no warning that they are in or entering an oxygen-deficient environment.

For this reason, container of cryogenic liquid **must never** be stored in small enclosed rooms.

Refer to SMOU 19 - Safe Storage of Liquid Nitrogen for further guidance as to room size.

Liquid nitrogen and argon **must never** be stored or used in basement area or pits. Where gas can accumulate and develop an oxygen deficient atmosphere.

Other Hazards Associated With Cryogenic Liquids

1. Pressure buildup.

Boiling of liquefied gases within a closed system increases pressure. Users must make certain that cryogenic liquids are never contained in a closed system. Cold fingers and similar devices have exploded when either an ice dam is formed within the apparatus or when users create a closed system by shutting off all valves. Users should also tape exposed glass parts to minimize the hazard of flying glass shards in the event of an explosion.

2. Oxygen enrichment.

Liquid nitrogen and liquid helium may fractionally distill air, causing liquid oxygen to collect in the cryogenic container.

Liquid oxygen increases the combustibility of many materials, creating potentially explosive conditions. Make sure to provide adequate venting when working with cryogenic liquids in a closed system or enclosed space.

3. Embrittlement.

Do not dispose of cryogenic liquids down the drain! Ordinary materials such as metal or polyvinylchloride (PVC) piping in laboratory sinks may not be able to withstand cryogenic temperatures.

Allow cryogenic liquids to evaporate in a fume hood or other well-ventilated area. Materials exposed to cryogenic temperatures for long periods or materials that have undergone periodic warming and freezing must be examined regularly for cracks and warping.

4. Cryotube Explosions.

Cryotubes used to contain samples stored under liquid nitrogen may explode without warning when warmed. Tube explosions are caused by liquid nitrogen entering the tube through minute cracks and then expanding rapidly as the tube thaws. Cryotubes may be thawed behind shields or in fume hoods where the glass sash can provide shielding. When thawing cryotubes in the open, take the following protective steps:

- Wear a face shield, or at least safety goggles, whenever handling cryogenic liquids.
- Wear heavy gloves.

5. Transporting Liquid Nitrogen in Lifts

- Liquid nitrogen **shall** travel unaccompanied in the lift.
- If a general service lift is being used it is important that this transport of liquid nitrogen takes place at a time when the lifts are not being used (i.e. outside of peak times).
- If the lift cannot be commandeered by key control, then it is advisable that two people work together to transport liquid nitrogen via the lift. One person should be stationed on the relevant floor to receive the liquid nitrogen when the lift arrives. The second person places the approved liquid nitrogen container in the lift, places a warning sign (if not already present in the lift) immediately behind the lift door so it will bar entry to the lift, and then selects the floor/level and exits the lift. The person on the receiving floor removes the liquid nitrogen and the sign when it arrives.
- Liquid Nitrogen must not be carried up and down stairwells.