

LIQUID NITROGEN HAZARDS

Recently there have been several incidents involving liquid nitrogen. It is imperative that everyone understands the potential hazards associated with using liquid nitrogen and that proper safety procedures are followed at all times.

1. Liquid nitrogen has a boiling temperature of -196°C at atmospheric pressure. Direct contact can freeze the skin causing frostbite and cold burns. Delicate tissue, such as eyes, can be damaged by an exposure to the cold gas alone which would be too brief to affect skin. It is often stated that splashes of liquid nitrogen will run off bare skin due to a vapour layer forming between the skin and liquid – this must NEVER be relied upon.

Do not expose bare skin to liquid nitrogen or its vapours.

Do not inhale liquid nitrogen vapours.

Always wear the proper protective equipment including: a face shield (if a face shield is unavailable use goggles, not safety glasses); a lab coat; proper footwear and clothing; and cryo-gloves which are designed to protect against extreme cold.

The water repellent cryo-gloves (protects against cold) and the 100% waterproof cryo-gloves (protects against cold and splashes) are NOT designed to be immersed in liquid nitrogen. Always use tongs to remove items from liquid nitrogen.

Always label liquid nitrogen containers.

Always transport liquid nitrogen in an appropriate container (not ice buckets!) which must be properly vented. Use a cart between buildings and floors. Use the freight elevator, not the passenger elevator.



Dewars (liquid nitrogen containers)

LIQUID NITROGEN HAZARDS

2. Nitrogen gas is odorless, colourless and tasteless. When liquid nitrogen evaporates it reduces the oxygen concentration in the air and may act as an asphyxiant in confined spaces. A person can become unconscious without any warning symptoms.

Always allow excess liquid nitrogen to evaporate in a fume hood or in a well ventilated area.

NEVER use liquid nitrogen in the cold room – it is NOT ventilated.

Do not transport liquid nitrogen in the passenger elevator, use the freight elevator.

3. Liquid nitrogen can freeze and embrittle many materials, including lab plumbing, ice buckets and flooring.

Never pour liquid nitrogen down the sink.

Use the appropriate containers for liquid nitrogen transport – do not use ice buckets.

Do not place freezer box towers directly on the floor, use a Styrofoam box lid.

4. Liquid nitrogen has a liquid to gas expansion rate of 1:694. This means as it vaporizes the volume it occupies will expand close to 700 times. If liquid nitrogen gets into a vial, this expansion rate is what can cause vials to explode when removed from liquid nitrogen storage.

Liquid nitrogen can get into a vial if: the vial is defective or past its expiration date; if the vials are over or under tightened; if there is water on the vial threads; if the wrong type of vials are used.

Always wear a face shield and other PPE when removing vials from liquid nitrogen.

Immediately loosen the lid and put vials in a container or behind a shield when thawing. Do not remove PPE until they have reached room temperature.

Do not hold tubes in your hand to warm them up.

Never mix liquid nitrogen with ice or water. Ice can solidify around it, trapping gas at high pressure and the ice can become a projectile.

Select vials which are suitable for liquid nitrogen storage.

LIQUID NITROGEN HAZARDS

TYPES OF VIALS

There are various suppliers of cryogenic vials. Most manufacturers do not recommend storage in liquid nitrogen but in vapour phase only.



The two vials on the left have internal threads and a silicon sealing ring.

The two vials on the right have external threads and no o-rings.

Select tubes which are manufactured specifically for cryogenic purposes and can withstand temperatures of -196°C . Tubes with internal threads tend to have thicker threads and a sealing ring which reduces the explosion risks.

Nunc Cryotubes™ must be used within 3 years of their sterilization date. Both Nalgene cryogenic vials and Nunc Cryotubes™ must be sealed with Nunc Cryoflex™ tubing if they are to be stored in contact with liquid phase nitrogen. Cryoflex™ is a type of heat shrinkable tubing which goes around the tube and helps reduce the explosion risks.



LIQUID NITROGEN HAZARDS

First Aid

Skin/Eye Contact:

Immediately flush area thoroughly with copious quantities of tepid water (the water must not be hotter than 44C). In the case of frostbite, spray with water.

DO NOT apply any form of direct heat.

DO NOT rub affected parts either before or after warming.

Protect any frozen parts with bulky, dry, sterile dressings. Do not apply to tightly.

Seek medical attention.

Anoxia:

If a person becomes dizzy or loses consciousness while working with liquid nitrogen, move to a well-ventilated area immediately. (Attempts to rescue affected persons from confined spaces or where oxygen deficient atmospheres may be present should only be made by those with breathing apparatus).

If breathing has stopped, apply artificial respiration.

Seek immediate medical attention

Cuts/Punctures from exploding vials:

Wash area and apply sterile dressings.

Seek immediate medical attention.