

Safe Handling, Storage, and Transport of Liquid Nitrogen

Overview

Liquid nitrogen is one of the cryogenic liquids commonly used in research labs. As “cryogenic” means related to very low temperature, it is an extremely cold material. It is liquefied under high pressure and can expand to a very large volume of gas. The major hazards of liquid nitrogen are associated with the properties of extreme cold and evaporation.

Hazards Associated with Liquid Nitrogen

Extreme Cold

The vapor of liquid nitrogen can rapidly freeze skin tissue and eye fluid, resulting in cold burns, frostbite, and permanent eye damage even by brief exposure.

Asphyxiation

Liquid nitrogen expands 695 times in volume when it vaporizes and has no warning properties such as odor or color. If sufficient liquid nitrogen is vaporized so as to reduce the oxygen percentage to below 19.5%, there is a risk of oxygen deficiency which may cause unconsciousness. Death may result if oxygen deficiency is extreme. To prevent asphyxiation hazards, handlers must ensure that the room is well ventilated when using cryogenics indoors.

Oxygen Enrichment

When transferring liquid nitrogen, oxygen in the air surrounding a cryogen containment system can dissolve and create an oxygen-enriched environment. Since the boiling point of nitrogen is lower than oxygen's, liquid oxygen evaporates slower than nitrogen and may build up to levels which can increase the flammability of materials, such as clothing near the system. Equipment containing cryogenic fluids must be kept clear of combustible materials in order to minimize the fire hazard potential. Condensed oxygen in a cold trap may combine with organic material in the trap to create an explosive mixture.

Pressure Buildup and Explosions

Without adequate venting or pressure-relief devices on the containers, enormous pressures can build upon cryogen evaporation. Users must make sure that cryogenic liquids are never contained in a closed system. Use a pressure relief vessel or a venting lid to protect against pressure build-up.



Safe Handling of Liquid Nitrogen

- Liquid nitrogen should be handled in well-ventilated areas.
- Handle the liquid slowly to minimize boiling and splashing. Use tongs to withdraw objects immersed in a cryogenic liquid, as boiling and splashing always occur when charging or filling a warm container with cryogenic liquid or when inserting objects into these liquids.
- Do not transport liquid nitrogen in wide-mouthed glass Dewars or Dewars not protected with safety tape.

Container

- Use only approved containers. Impact resistant containers that can withstand the extremely low temperatures should be used. Materials such as carbon steel, plastic and rubber become brittle at these temperatures.
- Only store liquid nitrogen in containers with loose fitting lids (Never seal liquid nitrogen in a container). A tightly sealed container will build up pressure as the liquid boils and may explode after a short time.
- Never touch non-insulated vessels containing cryogenic liquids. Flesh will stick to extremely cold materials. Even non-metallic materials are dangerous to touch at low temperatures.
- Never tamper or modify safety devices such as cylinder valve or regulator of the tank

Storage

- Liquid nitrogen should only be stored in well-ventilated areas (do not store in a confined space).
- Do not store liquid nitrogen for long periods in an uncovered container.
- Cylinders and Dewars should not be filled to more than 80% of capacity, since expansion of gases during warming may cause excessive pressure buildup.

Personal Protective Equipment

Eye/face protection

A full face shield over safety glasses/safety goggles are required during transfer and handling of cryogenic liquids to minimize injuries associated with splash or explosion.

Skin protection

Loose-fitting thermal insulated or leather gloves, long sleeve shirts, and trousers with cuffs should be worn while handling liquid nitrogen. Safety shoes are also recommended while handling containers.

Gloves should be loose-fitting so they are able to be quickly removed if cryogenic liquid is spilled on them. Insulated gloves are not made to permit the hands to be put into a cryogenic liquid. They will only provide short-term protection from accidental contact with the liquid.



Transporting Liquid Nitrogen

Liquid nitrogen must be transported in an open vehicle (an open truck or trailer) and not in a closed vehicle. Do not place these units in closed vehicles where the nitrogen gas that is continuously vented from unit can accumulate. Prevent spillage of liquids and damage to unit by securing it in the upright position so that it cannot be tipped over. Protect the unit from severe jolting and impact that could cause damage, especially to the vacuum seal.

Transportation of Dangerous Goods

Shipping Name	NITROGEN, REFRIGERATE LIQUID
Class	2.2
UN Number	UN1977

As per Section 1.15 of the Transport of Dangerous Goods Regulations, liquid nitrogen is exempt from documentation, dangerous goods safety marks, dangerous goods training, and accidental release and imminent accidental release reporting requirements if it is transported in one of more containers on a road vehicle with a gross mass of all dangerous goods transported on the road vehicle and is less than or equal to 150kg.

