

BEST PRACTICES FOR A SAFE HANDLING OF LIQUID NITROGEN

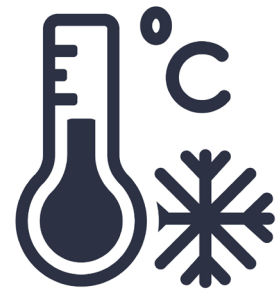


The safe handling and use of liquid nitrogen is possible only by knowing the **potential hazards** and using **common-sense procedures** based on that knowledge.

There are two important properties of liquid nitrogen that present potential hazards:

1. It is extremely cold. At atmospheric pressure, liquid nitrogen boils at -196°C / -320°F .
2. Very small amounts of liquid vaporize into large amounts of gas. One liter of liquid nitrogen becomes 0.7 m^3 of gas.

The safety precautions as outlined **must be followed to avoid potential injury or damage** which could result from these two characteristics. Do not attempt to handle liquid nitrogen until you read and fully understand the potential hazards, their consequences, and the related safety precautions.



FREEZING

Handle liquid nitrogen carefully

Contact of liquid nitrogen or any very cold gas with the skin or eyes may cause serious freezing (frostbite) injury. **Protect hands at all times** when working with liquid nitrogen with cryo-gloves. You must use all **appropriated PPEs**. The extremely low temperature can freeze human flesh very rapidly.

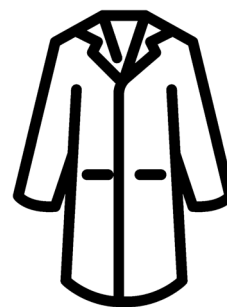
When spilled on a surface the liquid tends to cover it completely, cooling therefore a large area. The gas issuing from the liquid is also extremely cold. Delicate tissue, such as that of the eyes, can be damaged by an exposure to the cold gas which would be too brief to affect the skin of the hands or face.

Never allow any unprotected part of your body to touch objects cooled by liquid nitrogen.

Such objects may stick fast to the skin and tear the flesh when you attempt to free yourself. **Use tongs**, preferably with insulated handles, to withdraw objects immersed in the liquid, and handle the object carefully.

Wear protective clothing

Protect your eyes with a **face shield** or **safety goggles** (safety glasses without side shields do not give adequate protection). Always wear **cryo-gloves** when handling anything that is, or may have been, in immediate contact with liquid nitrogen. The gloves should fit loosely, so that they can be thrown off quickly if liquid should splash into them.



Use proper transfer equipment

Use a phase separator or special filling funnel to prevent splashing and spilling when transferring liquid nitrogen into or from a dewar. The top of the funnel should be partly covered to reduce splashing. Use only small, **easily handled dewars for pouring liquid**. For the larger, heavier containers, use a cryogenic liquid withdrawal device to transfer liquid from one container to another. Be sure to follow instructions supplied with the withdrawal device.



Store and use liquid nitrogen only in a well-ventilated place

Nitrogen gas can cause suffocation without warning. As the liquid evaporates, the resulting gas tends to displace the normal air from the area. In closed areas, excessive amounts of nitrogen gas reduce the concentration of oxygen and can result in asphyxiation. Because **nitrogen gas is colorless, odorless and tasteless**, it cannot be detected by the human senses and will be breathed as if it were air. Breathing an atmosphere that contains less than 19 percent oxygen can cause dizziness and quickly result in unconsciousness and death.

Note:

The cloudy vapor that appears when liquid nitrogen is exposed to the air is condensed moisture, not the gas itself. The gas actually causing the condensation and freezing is completely invisible.

Never dispose of liquid nitrogen in confined areas or places where others may enter.

Disposal of liquid nitrogen should be done outdoors in a safe place. Pour the liquid slowly on gravel or bare earth where it can evaporate without causing damage. Do not pour the liquid on the pavement.

First Aid Notice

If a person seems to become dizzy or loses consciousness while working with liquid nitrogen, move to a well-ventilated area immediately. If breathing has stopped, apply artificial respiration. If breathing is difficult, give oxygen. Call a physician. Keep warm and at rest.



If exposed to liquid or cold gas, restore tissue to normal body temperature 37°C (98.6°F) as rapidly as possible, followed by protection of the injured tissue from further damage and infection. Remove or loosen clothing that may constrict blood circulation to the frozen area. Call a physician. Rapid warming of the affected part is best achieved by using water at 42°C (108°F). Under no circumstances should the water be over 44°C (112°F), nor should the frozen part be rubbed either before or after rewarming. The patient should neither smoke, nor drink alcohol.

Regarding the liquid nitrogen burns, in most cases they are really bad cases of frostbite. Without belittling the harm that can come from this kind of injury, liquid nitrogen burns could be treated as frostbite. However, **if you follow the here listed precautions, you will be able to handle liquid nitrogen in total safety without risking any damage.**