

Safety concerning handling of Liquid Nitrogen

Liquid nitrogen N₂ (l) is a clear fluid with a very low viscosity, it is extremely cold (-196° C) and therefore it belongs to the Cryogenic liquids. Liquid nitrogen is odourless, it is not flammable and it is inactive (does not react chemically).

The most common dangers while handling N₂ (l) are:

- Frost damages, especially eye injuries
- Suffocation
- Explosion

Frost damages, especially eye injuries

Serious frost damages can occur if the N₂ (l) get in contact with the skin. If bare skin freezes onto surfaces that are cooled down with N₂ (l), it will cause severe damage.

Sustained cooling of the skin can lead to frostbites.

Inhalation of the cold gas can be very harmful to the lungs.

Especially the eyes are sensitive, so even small splashes or aerosols of N₂ (l) can cause immediate freezing of eye tissue with permanent damages as a result.

- Use protective glasses
- Avoid skin contact with N₂ (l), especially on cooled surfaces
- Notice that N₂ (l), due to its low viscosity, easily penetrates fabric
- If harm is done, rinse with lukewarm water and seek medical treatment if necessary

Suffocation

N₂ (l) is not dangerous in itself, but its presence can cause suffocation, because the liquid converts into gas and the volume increases drastically.

1 Liter of N₂ (l) converts into 700 L of gas, which will reduce the amount of oxygen in the room.

Normal air contains **20.9 % oxygen** and it is prohibited to stay in a room with less than **19.5 %** oxygen. If the oxygen content decreases further, this will cause dizziness, nausea, vomit, fainting and death. Be aware! No warning is given in advance, i.e. 'feelings of suffocation'.

If the content of a 10 L Dewar (container) evaporates in a room sized 4 m x 3.6 x 2.5 m = 36 m³, the concentration of oxygen will drop to **16.9%!**

- Be careful not to spill N₂ (l)
- Only use N₂ (l) in well ventilated rooms / areas
- When working with N₂ (l) in smaller rooms, use oxygen monitor
- Never transport N₂ (l) in lifts with persons. The N₂ (l) has to be transported on its own

Explosion

Since liquid nitrogen expands dramatically when it evaporates, incorrect storage can cause vigorous explosions. Large containers for N_2 (l) are therefore equipped with overpressure valves regulating the pressure in the container. Smaller containers are provided with loose lids.

Ingestion of N_2 (l), intentionally or by mistake, will almost certainly make the stomach explode.

Due to the low viscosity of N_2 (l) it will penetrate small holes and cracks. If you pour N_2 (l) into a normal kitchen thermos, the N_2 (l) will most likely diffuse into the cavity between the glass container and the rubber sealing. When the N_2 (l) converts to gas, the pressure will rise and the thermos can explode.

If N_2 (l) is stored in open containers, the vapour condenses the moisture in the air so the nitrogen will obtain a content of ice crystals. Even more serious is, that oxygen from the air will condense onto surfaces with low temperature because of the N_2 (l), so a reservoir of liquid oxygen builds up. This oxygen can react violently with certain organic chemicals leading to a fire or explosion.

- Never drink liquid nitrogen
- Store N_2 (l) only in approved containers
- Avoid that valves and evaporation tubes freezes and get blocked
- Never tighten a lid on a N_2 (l) container
- Be aware of the risk of building up liquid oxygen because of condense

The abovementioned is a translation of the official (Department of Physics and Astronomy, Aarhus) safety instruction:

http://phys.medarbejdere.au.dk/fileadmin/site_files/arbejdsmiljoe/Sikkerhed_LN2.pdf