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Liquid Nitrogen

Liquid nitrogen (LN2) is a clear, low viscosity liquid that is extremely cold (-196 ° C) and, thus, belongs to the cryogenic liquids. You cannot smell liquid nitrogen. The liquid is inactive (does not react chemically) and cannot burn.

The most common hazards when handling liquid nitrogen are:

- **Injury caused by frost, especially eye injury**
- **Suffocation**
- **Explosion**

Injury caused by frost, especially eye injuries

Serious injuries caused by frost may occur if liquid nitrogen comes into contact with the skin. Bare skin may freeze on surfaces that have been cooled by LN2 and may cause serious injuries. Long-term cooling of the skin may cause frostbite, and inhaling the cold gas may damage the lungs.

The eyes are particularly sensitive – even small splashes or spray of liquid nitrogen may cause immediate freezing of the tissue, causing permanent damage.

- **Avoid skin contact with LN2 or chilled surfaces, use cold-insulating gloves**
- **Wear safety goggles**
- **Be aware that due to its low viscosity, LN2 easily penetrates clothing**
- **If the accident has already occurred, rinse with plenty of *lukewarm* water and, if necessary, seek medical advice**

Suffocation

Although liquid nitrogen is not toxic in and of itself, the presence of liquid nitrogen may pose a choking hazard. When the liquid is converted to gas, the volume increases drastically, e.g. 1 liter liquid turns into 700 liters of gas, which reduces the air's oxygen content. Air normally contains 20.9 % oxygen. You should not stay in a room with an oxygen content below 19.5 %. If the oxygen content continues to decrease, it may cause dizziness, nausea, vomiting, fainting and death. Be aware that there are no warning signs, e.g. feeling suffocated.

It does not take much to lower the air's oxygen content. If the contents of a 10-liter Dewar (insulating container) evaporates in a room measuring $4\text{m} \times 3.6\text{m} \times 2.5\text{m} = 36\text{ m}^3$, the oxygen content will decrease to 16.9 %!

- **Avoid spilling LN2**
- **Be aware that the cold gas falls to the floor, so the oxygen concentration is lower near the floor than near the ceiling**
- **Only use LN2 in ventilated rooms**
- **Use a monitor to monitor the air's oxygen content in small rooms in which LN2 is being used**
- **Avoid transporting LN2 in elevators with people**
- **Avoid transporting LN2 in closed cars**

Explosion

As liquid nitrogen expands drastically when evaporating, improper storage may lead to powerful explosions. For this reason, large containers for cryogenic gases are equipped with relief valves that regulate the pressure in the container. Small containers are usually equipped with *loose* lids.

Consuming LN2, deliberately or accidentally, will most probably result in the stomach exploding.

The low viscosity of liquid nitrogen means that it easily passes through small holes and crevices. For example, if LN2 is poured into a normal thermos, there is a great risk that the nitrogen will seep between the glass container and the rubber packing. When the liquid then is converted to gas, the pressure increases and the thermos may explode.

If LN2 is stored in open containers, the vapors condense the moisture in the air in such a way that the nitrogen will contain ice crystals. Even more critical is the fact that the oxygen in the air will condense on surfaces that have the same temperature as LN2, so that you inadvertently may create a reservoir of liquid oxygen. The oxygen may react violently with certain organic material and cause fire/explosion.

- **Never drink LN2!**
- **Only store LN2 in containers approved for this purpose**
- **Avoid ice blocking valves and evaporation pipes**
- **Never close the lid of containers with LN2**
- **Be aware of the risk of collecting liquid oxygen**