

# **Standard Operating Procedure (SOP) for Liquid N<sub>2</sub> Handling**

Dr. Ragauskas group safety meeting



Purpose of the SOP is to establish guideline for the proper and safe storage, transfer, use and disposal of liquid nitrogen. Commonly liquid nitrogen is views as a compact unpressurized source of nitrogen.

Liquid nitrogen boils at 77 K ( $-196\text{ }^{\circ}\text{C}$ ) and is a cryogenic fluid with wide range of applications, such as:

- as a source of very dry nitrogen gas
- immersion freezing
- cooling a high-temperature superconductor to a temperature sufficient to achieve superconductivity
- as a coolant for vacuum pump traps and in controlled-evaporation processes in chemistry.

# Why SOP?

## Safety, Safety and Safety

The majority of the safety issues associated with liquid N<sub>2</sub> are related to its **low temperature** and that fact it readily converts from the **liquid state to a gaseous state**.

Liquid N<sub>2</sub> has a large liquid to gas expansion ratio, which in turn can generate a tremendous amount of force upon boil off.

Because of the extremely low temperature of liquid N<sub>2</sub>, careless handling may result in cold burns

As liquid N<sub>2</sub> is colorless and odorless, upon evaporation in a confined space it will reduce the oxygen concentration in the air, acting as an asphyxiant.

Vessels containing liquid N<sub>2</sub> can condense explosive oxygen from air.



### Potential Hazards:

- Explosion:** Use only equipment approved for cryogenic liquids. Always ensure that relief valves are not clogged or blocked.
- Asphyxiation:** if sufficient liquid nitrogen is vaporized so as to reduce the oxygen percentage to below 19.5%, you are at risk of oxygen deprivation. Simple asphyxiants such as nitrogen **do not have good warning properties!**

### Personal Protection Equipment:

#### •Gloves:

rubber gloves - use for incidental splash contact

However mostly use cryogenic gloves - use when direct contact with liquid nitrogen or equipment/items that have been chilled to liquid nitrogen temperature.

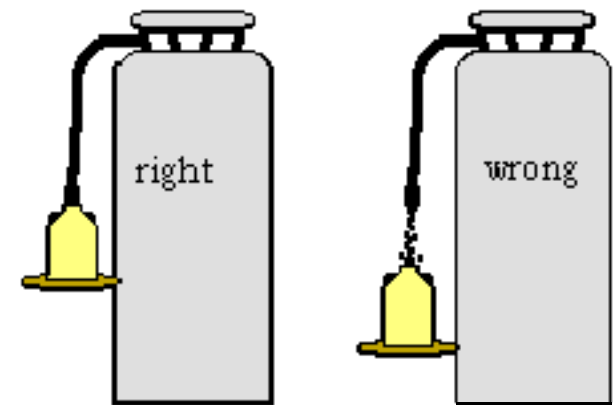
•**Eye Protection:** Safety glasses

•**Additional:** Closed toed shoes, long pants, long sleeves or lab coat.



## Guidelines for the safe and proper transfer of liquid N<sub>2</sub>:

1. Ensure all valves on dewar are closed before starting.
2. Persons filling must be in constant attendance to the filling operation.
3. Do not hold the vessel with unprotected hands while filling.
4. Persons filling dewars should wear full length non-cuffed trousers (covering tops of shoes) or full length apron, and shoes which will not admit spilled cryogen and which are easy to remove quickly. Also wear goggles and cryo-gloves.
5. Take main filler line metal hose and attach to liquid port. Make sure just finger tight.
6. Completely lower filler line into dewar.
7. Slowly turn handle to open valve on the filler line, while holding filler line into dewar until pulsing stops.
8. Filling is done when liquid N<sub>2</sub> spills from the top of the dewar, close valve on the filler line.



## Recommendations for the safe and proper use of liquid N<sub>2</sub>:

1. At all times, HAVE A PLAN of what you will do if.....
2. Do not use a funnel.
3. Remove metal jewelry/watches on hand and wrists.
4. Do not carry liquid nitrogen in a passenger elevator.
5. Purge solvent traps of air before addition of liquid N<sub>2</sub> to the dewar.
6. Glass Dewars must be taped solidly or netted around the outside.
7. When filling a liquid nitrogen dewar, the **doors must be open at all times** to prevent asphyxiation

**Exposure:** In the case of cold burns (frost bite):

***Eye:*** Flush eye with cold water for 15 minutes

***Skin:*** Flush affected area with cold water for 15 minutes

***Inhalation:*** Remove victim from area to fresh air if it is safe to do so

**Spills:** In the event of an accidental release the rapid expansion of liquefied gases will displace oxygen, posing an asphyxiation hazard.

***Minor spills*** - (a few drops) Alert others and leave immediate area.

***Major spills*** -

1. Alert others
2. Leave room immediately

**In all cases further evaluate the situation, either:**

Call emergency contact information, and/or  
Call emergency responders 404-894-2500 and 911