

Cryogenics

Mindfulness Minute: Incorporate safety into your workflow by considering the hazards associated with your equipment and materials each time you use them.

Cryogenic materials are those that are -153°C (-243°F) or below. Cryogenics can cause frostbite and eye damage upon contact. Touching metal or other materials that have been stored under cryogenic conditions can even cause the skin to adhere and tear. Work with dry ice and material from -80°C or -140°C freezers can also be managed using many of the same practices as work with cryogenics.



Cryogenic gloves must be loose-fitting so that they can be quickly removed if liquid nitrogen splashes into them or a piece of dry ice falls into them. Face shields provide protection from splashes and explosions.

A common cryogen in the laboratory setting is liquid nitrogen (sometimes abbreviated LN_2). In addition to being -195.8°C , liquid nitrogen presents an asphyxiation hazard, as it can expand to almost 700 times its original volume upon vaporization and displace the oxygen in a room. This ability to expand greatly upon vaporization can also lead to explosions if storage devices are kept airtight and are not equipped with pressure relief valves. Material that has come in contact with liquid nitrogen may become brittle and can break, which could send pieces and liquid nitrogen flying. In addition to displacing oxygen, the extremely low temperatures can cause oxygen from the air to condense into the liquid nitrogen. If left uncovered for long periods of time, the oxygen can build up to levels which may start fires with organic materials like solvents, organic compounds, or even clothing.



Wear PPE and use dispensing hoses made for use with cryogenics.

Follow this list of dos and don'ts for safe handling and use of cryogenics:

- **Do** wear PPE designed for work with cryogenics. Face masks, goggles/safety glasses, and cryogenic gloves should be worn when pouring or transferring liquid nitrogen, and cryogenic gloves should be worn when handling dry ice and material from -80°C or -140°C freezers. Wear pants over boots or shoes to prevent cryogenics or dry ice from falling inside. Cryogenic aprons and other PPE are also available.
- **Do** use dispensing hoses designed for liquid nitrogen transfer. Wear PPE any time you handle or inspect the dispensing apparatus even if you don't intend to retrieve liquid nitrogen.
- **Do** use proper carrying and storage devices for liquid nitrogen. Inspect your dewar flask for cracks on the mirrored surface or damage before each use. **Don't** use damaged dewar flasks as they can shatter and eject glass and liquid nitrogen.
- **Do** work with liquid nitrogen in a large, well-ventilated area. Consider installing an oxygen meter if proper ventilation cannot be verified. Remember that nitrogen gas is colorless and odorless, so its presence and the absence of oxygen can be undetectable.
- **Don't** ride in an elevator with a container of liquid nitrogen. Instead, place the container in the elevator, press the intended floor button, and have other lab members wait on each floor to retrieve the dewar and warn others not to enter until the container is retrieved.
- **Don't** store a cryogen in a sealed, airtight container above the boiling point of the cryogen, as the conversion into gas can cause an explosion.
- **Don't** wear gloves made for heat protection in place of cryogenic gloves.



Injury and facility damage can occur from liquid nitrogen spills or from using inappropriate storage containers, like Styrofoam coolers, which are too porous to hold liquid nitrogen.