



November 2011 Safety Topic of the Month

Liquid Nitrogen

Liquid nitrogen (LN_2) is an extremely cold liquid and gas under pressure. At atmospheric pressure, liquid nitrogen boils at 77K (-196°C; -321°F). It can cause severe frostbite, burns and rapid suffocation due to displacement of oxygen in the atmosphere. Pressure buildup can occur either slowly or due to rapid conversion of the liquid to the gaseous state.

Safe Handling Procedures

Avoid wearing clothing capable of trapping or holding liquid nitrogen next to the skin. Wear full length non-cuffed pants that cover tops of shoes or a full length apron, and shoes which will not admit spilled liquid and are easy to remove quickly if necessary. Remove watches, rings, bracelets and other jewelry that could freeze to the skin.

Because the liquid is prone to splashing as a consequence of the large volume expansion ratio when the liquid warms up, chemical splash goggles and a face shield should be worn when handling liquid nitrogen. Many substances become brittle and may shatter when cold, sending pieces of the material flying. Avoid common glass and large, solid plastics.

Wear insulating gloves to protect the hands when the potential exists for injury from exposure to cryogenic liquids, cold gases, or surfaces cooled to low temperatures. Gloves should be loose fitting and easy to remove in the event that liquid is spilled into the glove.

Liquid nitrogen must be stored, shipped and handled in containers that are designed for the pressures and temperatures to which they may be subjected. Use Dewars that are rated for liquid nitrogen and have venting lids. Never use a container with a tight fitting lid. It will build up pressure as the liquid boils and could explode after a short time.

Ensure that the withdrawal hose is equipped with a phase separator and transfer slowly to minimize the risk of splashing. Delivery should be immediately at the mouth of the receiving vessel.

Periodic venting from liquid nitrogen containers is normal. This may result in an audible hissing sound. Do not tamper with or block the relief valves.

Transport Dewars carefully. Carts or hand trucks should be used to move liquid nitrogen containers if they are not already equipped with wheels. Keep containers vertical at all times so that pressure relief valves can function properly. Do not drop or tip containers or roll them on their sides. Do not travel with a liquid nitrogen container on an elevator.

Do not store liquid nitrogen containers in small, poorly ventilated spaces such as a cold room. If the tank fails and the nitrogen gas is released it can deplete the oxygen and asphyxiation can occur without warning.

Discussion Topics

- 1) Review liquid nitrogen handling and transfer procedures. Look for ways to minimize risk of exposure. For example, eliminate transfers from vessels overhead.
- 2) Verify that the liquid nitrogen container is equipped with a phase separator.
- 3) Is PPE available and is it being used? Are there any barriers to safe use of PPE?
- 4) Are liquid containers and Dewars being transported in a safe manner?
- 5) Do you know the first aid procedures for frostbite?
- 6) Does the lab have a standard operating procedure for handling liquid nitrogen?
- 7) What's wrong with this picture?



References

Prudent Practices - http://www.nap.edu/catalog.php?record_id=12654

American Chemical Society *Safety in Academic Laboratories – Volume 2* -
http://portal.acs.org/portal/PublicWebSite/about/governance/committees/chemicalsafety/publications/WPCP_012293

University of Wisconsin – Madison *Liquid N2 Safety Training* - <https://fpm-www3.fpm.wisc.edu/safety/occupationalhealth/LinkClick.aspx?link=LiquidNitrogenSafetyTraining.pdf&tabid=63&mid=442>

Cryogenic Gloves - <http://www.tempshield.com/gloves.html>