Liquid Nitrogen Safety

Overview
Liquid Nitrogen (abbreviated LN2) is a cryogenic material, which means it’s maintained at a very low temperature. Since it’s a cryogenic, it has to be stored in a Dewar, which holds the liquid nitrogen in a vacuum as it boils at or below -196°C/-321°F. Dewars are specific to the contained material, so confirm the right type of Dewar is used for liquid nitrogen before purchase and use.

Safety Hazards Associated with Handling Liquid Nitrogen:

1. The extremely low temperatures of the liquid can cause severe frostbite or eye damage upon contact. Items in contact with liquid nitrogen become extremely cold, so touching these items may result in damaged flesh. OSHA recommends to not rub any affected skin from contact because it can further tissue damage; instead, place the body part in a warm water bath not above 40°C/140°F, and never use dry heat. Also, many objects become brittle upon contact with liquid nitrogen and may shatter when cold, such as common glass and large solid plastics, and can send pieces of the material flying.

2. On vaporization, liquid nitrogen expands by a factor of 700; one liter of liquid nitrogen becomes 24.6 cubic feet of nitrogen gas. This expansion factor can cause explosion of a sealed container. This release of nitrogen can also displace oxygen in the room and cause asphyxiation (lack of oxygen) without warning. It’s important to note that nitrogen is not poisonous to humans since it makes up 78% of the atmosphere (21% oxygen, 1% other), but oxygen levels below 19.5% is a concern.

3. Because the boiling point of oxygen is about half that of nitrogen, oxygen can condense from the air into liquid nitrogen. If Dewars and insulated flasks containing liquid nitrogen are left uncovered for an extended period of time, liquid oxygen can build up, which may cause violent reactions and a fire could result.

Personal Protective Equipment (PPE) Required When Handling Liquid Nitrogen:

1. Safety goggles, unvented (not safety glasses) – Required at all times,

2. Face shield – Required when pouring or filling.

3. Insulated gloves should be loose-fitting or with an elastic cuff so they can be thrown off if liquid pours inside – Required when pouring or filling.

4. A lab coat or long sleeves is required to minimize skin contact. Also, trousers should be worn on the outside of boots or work shoes filling in the event of a spillage – Required when pouring or filling.

Rules and Precautions for Handling Liquid Nitrogen:

1. You must have department approval prior to handling liquid nitrogen.
2. Always wear PPE when handling liquid nitrogen.

3. Use liquid nitrogen only in well ventilated places. Nitrogen is colorless and odorless – the cloud it forms when you pour liquid nitrogen is condensed water vapor from the air, not nitrogen gas.

4. Do not allow any liquid nitrogen to touch any part of your body or become trapped in clothing near the skin.

5. Do not touch any item that has been immersed in liquid nitrogen until it has warmed to room temperature.

6. Do not store liquid nitrogen in any container with a tight-fitting lid. A tightly sealed container will build up pressure as the liquid boils and may explode after a short time. Use only approved unsealed containers. Do not store liquid nitrogen for long periods in an uncovered container. Use only fittings that have been designed specifically for the use with cryogenic liquids, as non-specialized equipment may crack or fail. Do not transport liquid nitrogen in wide-mouthed glass Dewars not protected with safety tape.

7. Never dip a hollow tube or funnel into liquid nitrogen; it may spurt liquid.

8. Never ride in an elevator with liquid nitrogen. When using passenger elevators, use an elevator key to prevent the door from being opened by unauthorized people. If a key is not available, then station a person at each floor to ensure no one enters.

9. Always make sure that containers of liquid nitrogen are suitably vented and unlikely to be blocked due to ice formation.

10. Proper disposal does not include dumping on the floor, which can instigate asphyxiation, or dumping down the drain. Any time liquid nitrogen is mixed with a hazardous material, both together must be disposed of as hazardous material. Confer with the Hazardous Waste Manager for disposal procedures.

11. Do not fill cylinders or Dewars to more than 80% of capacity, since expansion of gases during warming may cause excessive pressure build-up.

For those authorized to fill Dewars:

12. Always fill warm Dewars slowly to reduce temperature shock effects and to minimize splashing.

13. Note that outside of normal working hours (M-F 8:00a.m.-5:00p.m.) no one is allowed to transfer liquid nitrogen from the Dow loading dock area without a second trained person present. Failure of a container or a large spillage could result in asphyxiation at a time when you are unlikely to be found or able to get assistance.