

Compliance Training

Liquid Nitrogen Safety

Liquid Nitrogen Safety

Liquid nitrogen is a colorless, odorless, extremely cold liquid and gas under pressure. Nitrogen can displace oxygen in the work area, leading to asphyxiation. One volume of liquid nitrogen will expand to produce 696.5 equivalent volume of gas. Although nitrogen is considered non-toxic and non-flammable, nitrogen in liquid form poses a variety of hazards. Liquid nitrogen must be handled and stored properly to avoid injury to the user and others in the work area.

Health Effects

Inhalation of nitrogen in excessive amounts can cause dizziness, nausea, vomiting, excess salivation, loss of consciousness, and death. In such cases of massive over-exposure, death may result from errors in judgment, confusion, or loss of consciousness that prevents self-rescue. At low oxygen concentrations, unconsciousness and death may occur in seconds and without warning.

Skin contact with liquid nitrogen can cause tissue freezing due to the low temperature of the cryogenic liquid, resulting in severe burns. Eye contact with liquid nitrogen and its vapors can result in tissue freezing and severe cryogenic burns.

Container Use and Storage

Cryogenic liquid cylinders are insulated, vacuum-jacketed pressure vessels. They come equipped with safety relief valves and rupture discs to protect the cylinders from pressure build up. Product may be withdrawn as a gas by passing liquid through an internal vaporizer or as a liquid under its own vapor pressure.

Liquid nitrogen should be stored in a cool, dry, well-ventilated, low fire-risk area. Protect containers against physical damage and extremes of temperature. Liquid nitrogen storage areas should be kept clean and free from flammable materials. Make sure that containers are properly vented to prevent build-up of pressure.

Pressure Relief Valves

Cryogenic containers are equipped with pressure relief devices to control internal pressure. Under normal conditions, these containers will periodically vent product. This venting will

THIS TRAINING SESSION IS RECOMMENDED FOR:

Employees who use liquid nitrogen or dispense it for use by others.

Training Objectives

This training module will provide participants with an understanding of the following for liquid nitrogen:

- Properties;
- Health effects of exposure;
- Handling requirements;
- Personal protective equipment and other safety precautions;
- Storage and dispensing instructions; and
- Spill control and disposal.

Interactive Training Reminder

Compliance Training is an interactive training program in which you can address questions with other staff members or supervisors to obtain clarification for situations in your work setting.

Write down any questions that you have about the training topic and address them with your Safety Training Coordinator or supervisor.

be audible as a slight hissing sound. Do not plug, remove, or tamper with any pressure relief device.

Ice or frost buildup on a pressure relief valve can be removed with a damp cloth. Wear proper personal protective equipment (PPE) when removing frost. Discontinue use and contact the vendor if you experience any difficulty operating the container valve or its connections. Use the proper connection. **DO NOT USE ADAPTERS!**

Piping

Use piping and equipment designed to withstand the pressures to be encountered. On gas withdrawal systems, use a check valve or other protective apparatus in any line or piping from the container to prevent reverse flow.

To prevent cryogenic liquids or cold gas from being trapped in piping between valves, the piping should be equipped with pressure relief devices. Only transfer lines designed for use with cryogenic liquids should be used.

Some elastomers and metals such as carbon steel may become brittle at low temperatures and will easily fracture. These materials must be avoided in cryogenic service. It is recommended that all vents be piped to the exterior of the building or to a well-ventilated indoor space.

Moving Containers

- Use a suitable hand truck for container movement.
- Containers should be handled and stored in an upright position.
- Do not drop, tip, or roll containers on their sides.
- Do not remove or interchange connections.

Dewar Bottles

Small quantities of liquid nitrogen can be stored in Dewar bottles. Dewar bottles are hollow-walled containers, which provide excellent insulation. Dewar bottles will keep liquid nitrogen for a fairly long period of time.

These vessels utilize a lid, sometimes also called a “neck tube

core.” This lid is a mechanical cover for the opening and an insulating cover for the top of the dewar, but allows venting of vapors to prevent pressure buildup.

Liquid nitrogen is to be dispensed only into smaller Dewars which either (a) have carrying handles or (b) are on wheels or (c) are 500 mL or smaller, and which have pressure relief valves or pressure venting lids. A wide-base Dewar, which is stable on a wheeled cart, qualifies as “on wheels.” Persons filling must be in constant attendance of the filling operation.

If the receiving vessel is small enough, place it on an adjustable table, so that the delivery is immediately at the mouth of the receiving vessel (i.e., do not allow the liquid nitrogen to fall through a distance to reach the receiving vessel). If the vessel is too large for the table, other provisions must be made for safely raising the vessel up to the delivery tube.

Do not hold the vessel with unprotected hands while filling.

Do NOT move/bend the copper fill tube. It causes wear that will eventually cause the tube to break.

Wear appropriate personal protective equipment as described in the PPE section below.

Handling Precautions

- Treat liquid nitrogen, and any object cooled with liquid nitrogen with caution.
- Do not allow liquid nitrogen to be trapped in clothing next to skin.
- Use only approved unsealed containers. Never pour into a coffee thermos. Never seal it in any container, as it will explode.
- Never dip a hollow tube into liquid nitrogen, as it may spurt liquid.
- Use in a well-ventilated area. Do not store in a confined space.
- Do not dispose of liquid nitrogen by pouring it on the floor, as it could displace enough oxygen to cause suffocation.

- Do not store for long periods in an uncovered container, because oxygen can condense from the air into the liquid nitrogen. If the air over the nitrogen circulates, this liquid oxygen can build up to levels that may cause violent reactions with organic materials (even materials that are ordinarily nonflammable). For example, a severe clothing fire could result from ignition in the presence of liquid nitrogen.
- Do not allow any unprotected part of the body to come into contact with uninsulated pipes or equipment that contains cryogenic product. The extremely cold metal will cause the flesh to stick fast and tear when attempting to withdraw from it.

Personal Protective Equipment

Recommended personal protective equipment for handling liquid nitrogen includes:

- A full face shield over safety glasses;
- Loose-fitting thermal insulated or leather gloves. Gloves should be loose fitting so they can be quickly removed if cryogenic liquid is spilled on/in them. Insulated gloves are not made to permit the hands to be submerged into a cryogenic liquid. They will only provide short term protection from accidental contact with the liquid.
- Long sleeve shirts, and trousers without cuffs (do NOT tuck pants into shoes or boots);
- Safety shoes are recommended for people involved in the handling of containers; and,
- In emergency situations, self-contained breathing apparatus (SCBA) may be required.
- Persons filling Dewars must wear full-length non-cuffed trousers (covering tops of shoes) or a full-length apron, and shoes that will not admit spilled cryogen, and which are easy to remove quickly. In addition, goggles and cryogloves should be worn.

Spill Clean-Up and Disposal

When liquid nitrogen is spilled, it can release a rapidly vaporizing cloud that could create an oxygen-deficient atmosphere. In the case of a spill/leak, you should evacuate while the spilled liquid is allowed to evaporate. Ventilation to the spill area should be increased, if possible, and the oxygen level monitored before re-entry is allowed. Personnel that must re-enter the area (either for rescue or clean-up operations) must wear a self-contained breathing apparatus. Insulating gloves, safety goggles and protective clothing should be worn as necessary to prevent any skin or eye contact with liquid nitrogen.

To dispose of liquid nitrogen, return the container and any unused product to the supplier. Do not attempt to dispose of unused product. Do not attempt to reclaim the product. Check with your supervisor or safety coordinator regarding liquid nitrogen disposal procedures specific to your practice. ●

Compliance Training Test

Liquid Nitrogen Safety

NAME: _____

DATE: _____

SIGNATURE: _____

STAFF POSITION: _____

There are 10 questions to the test for Liquid Nitrogen Safety. There is no pass or fail grade to the test. Review the training information to find the correct answers to any questions that may have been missed.

1 A regular thermos (such as used for coffee) may be used to store small amounts of liquid nitrogen.

Select One T F

2 Liquid nitrogen should be stored in a cool, dry, well-ventilated, low fire-risk area.

Select One T F

3 When liquid nitrogen is spilled, it can release a rapidly vaporizing cloud that could create an oxygen-deficient atmosphere.

Select One T F

4 Under normal conditions, cryogenic containers do NOT periodically vent product.

Select One T F

5 Inhalation of nitrogen in excessive amounts can cause dizziness, nausea, vomiting, excess salivation, loss of consciousness, and death.

Select One T F

6 Regular exam gloves may be worn when working with liquid nitrogen.

Select One T F

7 Liquid nitrogen should not be disposed of by pouring it on the floor, as it could displace enough oxygen to cause suffocation.

Select One T F

8 Persons filling Dewars must wear full-length non-cuffed trousers (covering tops of shoes) or a full-length apron, and shoes that will not admit spilled cryogen, and which are easy to remove quickly. In addition, goggles and cryo-gloves should be worn.

Select One T F

9 When working with liquid nitrogen, pants should be tucked into boots to help prevent skin exposure.

Select One T F

10 Do not allow any unprotected part of the body to come into contact with uninsulated pipes or equipment that contains cryogenic product, because the extremely cold metal will cause the flesh to stick fast and tear when attempting to withdraw from it.

Select One T F