

DEPARTMENT OF VETERANS AFFAIRS  
SOUTH TEXAS VETERANS HEALTH CARE SYSTEM  
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RESEARCH SERVICE  
MEMORANDUM NO. 05-30

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### SAFE HANDLING OF LIQUID NITROGEN

1. **PURPOSE:** To provide procedures for the safe handling of liquid nitrogen, Dewars, and supplies.
2. **POLICY:** The safe handling and use of liquid nitrogen in liquid nitrogen dewars or flasks is possible only by knowing the potential hazards and using common-sense procedures based on that knowledge. There are two important properties of liquid nitrogen that present potential hazards: (1) it is extremely cold. At atmospheric pressure, liquid nitrogen boils at  $-320^{\circ}\text{F}/-96^{\circ}\text{C}$  and (2) very small amounts of liquid vaporize into large amounts of gas. One liter of liquid nitrogen becomes  $24.6\text{ ft}^3/0.7\text{ m}^3$  of gas. The safety precautions as outlined must be followed to avoid potential injury or damage which could result from these two characteristics. Personnel should not attempt to handle liquid nitrogen until you read and fully understand the potential hazards, their consequences, and the related safety precautions.

### 3. PROCEDURES

A. Warning: Use only liquid nitrogen (or liquid argon) in liquid nitrogen dewars. Do not ever use liquid air or liquid oxygen in these dewars because either of which could present a combustion hazard with some materials used in the construction of these dewars or materials stored in them.

B. Maintenance: Keep the unit clean and dry at all times. Do not use strong alkaline or acid cleaners that could damage the finish and corrode the metal shell.

Note: Because argon is an inert gas whose physical properties are very similar to those of nitrogen, the precautions and safe practices for the handling and use of liquid argon are the same as those for liquid nitrogen.

#### C. Handling Liquid Nitrogen

(1) Contact of liquid nitrogen or any very cold gas with the skin or eyes may cause serious freezing (frostbite) injury. Handle liquid nitrogen carefully. The extremely low temperature can freeze human flesh very rapidly. When spilled on a surface the liquid tends to cover it completely and intimately, cooling a large area. The gas issuing from the liquid is also extremely cold. Delicate tissue, such as that of the eyes, can be damaged by an exposure to the cold gas which would be too brief to affect the skin of the hands or face. Never allow any unprotected part of your body to touch objects cooled by liquid nitrogen. Such objects may stick fast to the skin and tear the flesh when you attempt to free yourself. Use tongs, preferably with insulated handles, to withdraw objects immersed in the liquid, and handle the object carefully.

(2) Wear protective clothing.

(a) Protect your eyes with a face shield or safety goggles (safety glasses without side shields do not give adequate protection).

(b) Always wear cryo gloves when handling anything that is, or may have been, in immediate contact with liquid nitrogen. The gloves should fit loosely, so that they can be thrown off quickly if liquid should splash into them.

(c) When handling liquid in open containers, it is advisable to wear high-top shoes. Trousers (which should be cuffless if possible) should be worn outside the shoes. Any kind of canvas shoes should be avoided because a liquid nitrogen spill can be taken up by the canvas resulting in a far more severe burn.

(3) Use only containers designed for low-temperature liquids.

(a) Cryogenic containers are specifically designed and made of materials that can withstand the rapid changes and extreme temperature differences encountered in working with liquid nitrogen. The special containers should be filled *slowly* to minimize the internal stresses that occur when any material is cooled. Excessive internal stresses can damage the container.

(b) Do not ever cover or plug the entrance opening of any liquid nitrogen dewar.

(c) Do not use any stopper or other device that would interfere with venting of gas. Inadequate venting can result in excessive gas pressure which could damage or burst the container.

(d) Use only the loose-fitting necktube core supplied or one of the approved accessories for closing the necktube.

(e) Check the unit periodically to be sure that venting is not restricted by accumulated ice or frost.

(4) Use proper transfer equipment.

(a) Use a phase separator or special filling funnel to prevent splashing and spilling when transferring liquid nitrogen into or from a dewar.

(b) The top of the funnel should be partly covered to reduce splashing.

(c) Use only small, easily handled dewars for pouring liquid.

(d) For the larger, heavier containers, use a cryogenic liquid withdrawal device to transfer liquid from one container to another. Be sure to follow instructions supplied with the withdrawal device.

(5) Do not overfill containers: Filling above the bottom of the necktube (or specified maximum level) can result in overflow and spillage of liquid when the necktube core or cover is placed in the opening.

(6) Never use hollow rods or tubes as dipsticks.

(a) Wooden or solid metal dipsticks are recommended.

(b) Avoid using plastics that may become very brittle at cryogenic temperatures which then become prone to shatter like a fragile piece of glass.

(7) Nitrogen Gas can cause suffocation without warning. Store and use liquid nitrogen only in a well ventilated place.

(a) In closed areas, excessive amounts of nitrogen gas reduce the concentration of oxygen and can result in asphyxiation. Because nitrogen gas is colorless, odorless and tasteless, it cannot be detected by the human senses and will be breathed as if it were air. Breathing an atmosphere that contains less than 18% oxygen can cause dizziness and quickly result in unconsciousness and death.

Note: The cloudy vapor that appears when liquid nitrogen is exposed to the air is condensed moisture, not the gas itself. The gas actually causing the condensation and freezing is completely invisible.

(b) Never dispose of liquid nitrogen in confined areas or places where others may enter.

(c) Disposal of liquid nitrogen should be done outdoors in a safe place. Pour the liquid slowly on gravel or bare earth where it can evaporate without causing damage. Do not pour the liquid on the pavement.

(8) First Aid Notice: If a person seems to become dizzy or loses consciousness while working with liquid nitrogen, move to a well-ventilated area immediately. Call extension 15555 for immediate help.

(9) Handling Liquid Nitrogen Dewars

(a) Keep unit upright at all times except when pouring liquid from dewars specifically designed for that purpose.

(b) Tipping the container or laying it on its side can cause spillage of liquid nitrogen. It may also damage the container and any materials stored in it. If tipping is anticipated, be sure to purchase a dewar that can be outfitted with a tipping stand.

(10) Rough handling can cause serious damage to dewars and refrigerators.

(a) Do not "walk", roll, or drag these units across a floor.

(b) Use a dolly or handcart when moving containers

(11) Keep the unit clean and dry.

(a) Do not store it in wet, dirty areas.

(b) Use water or mild detergent for cleaning and dry the surface thoroughly.

(c) Do not use strong alkaline or acid cleaners that could damage the finish and corrode the metal shell.

D. Additional local procedures.

(1) Transfer equipment and PPE: Located in the Research Office, Q202.1.

(2) Spills: Contact Safety Office, X14039.



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DISTRIBUTION: Research Laboratories