



# TEXAS TECH UNIVERSITY HEALTH SCIENCES CENTER EL PASO

## Operating Policy and Procedure

**HSCEP OP:** 75.29, **Clinical Procedure for Safe Handling of Liquid Nitrogen (LN2)**

**PURPOSE:** The purpose of this Texas Tech University Health Sciences Center El Paso (TTUHSC El Paso) Operating Policy and Procedure (HSCEP OP) is to provide an approved method to dispense and transport liquid nitrogen (LN2) in order to protect TTUHSC El Paso employees from injury. This HSCEP OP is intended to serve as the minimum guideline for how LN2 will be handled in the clinical divisions. This is based on risk mitigation and best practices. Divisions can implement a more stringent procedure; however, they should not be more lax than this procedure.

**REVIEW:** This HSCEP OP will be reviewed and updated every two years by the senior director of safety services (DSS), with recommendations and revisions forwarded through the managing director of physical plant and support services to the chief operating officer.

### PROCEDURE:

#### I. Introduction

Always follow all of the procedures prescribed by the manufacturer for operating and maintaining the manufacture's equipment. Everyone working with cryogenic liquids shall be properly trained for the job and be supervised by experienced personnel. Any suspicion of faulty equipment should be recorded and the use of the equipment discontinued.

Liquid Nitrogen is a colorless, odorless, non-toxic, inert, and non-flammable liquid. It has an extremely low boiling point of  $-196^{\circ}\text{C}$ , at atmosphere pressure.

- The most important safety concern when handling LN2 is that it creates an **asphyxiation hazard**. Nitrogen expands by a factor of almost 700 when changing from liquid to gaseous state; this in turn displaces ambient breathable oxygen. To avoid asphyxiation hazard, liquid nitrogen should only be handled in areas with good ventilation.
- When vaporized LN2 is not allowed to vent, it can build pressure within the storage vessel, which may cause it to explode violently. When dispensing or using LN2 in a small enclosed room, the door to the room must remain propped open.
- Inhalation of LN2 in excessive amounts can cause dizziness, nausea, vomiting, loss of consciousness, and death.
- Frostbite can occur on skin when in contact with LN2 causing a change in skin color to greyish yellow and torn flesh.
- The cold temperature of LN2 can cause oxygen to condense from ambient air into liquid oxygen. This creates a potential fire hazard when it contacts organic materials that include - but are not limited to - paper, clothing, and cardboard.
- Many contents become brittle upon contact with LN2 and may shatter like glass, sending shards of material flying. Using proper cryo-containers is crucial.
- Contact the DSS (215-4820) to evaluate work space requirements for ventilation or other safety concerns.

#### II. Personal Protective Equipment

Protective clothing serves mainly to avoid frost burns.

- A. Insulating gauntlet-style gloves must be worn at all times when handling LN2 to avoid cold burns. The gloves must be loose-fitting in order to remove easily at the time of need. **Gloves must not be made of materials that will absorb liquids.**
- B. To protect face and eyes from a LN2 splatter or a shattered container, a face shield over safety glasses must be worn during the time of dispensing of LN2. Safety glasses must be worn during the time LN2 is being used during a procedure.
- C. Closed-toed, non-fabric shoes must be worn while handling LN2 for protection from accidental spills.
- D. A cryogen apron over a lab coat or lab coat must be worn to eliminate skin contact.



Cryogenic Gauntlet Gloves



Cryogenic Apron

### III. Storage and Transfer

Use only containers specially designed to hold cryogenic liquids. Although these containers (Dewar's flasks) are made from materials that can withstand very large and rapid changes in temperature, it is important that they be filled slowly in order to minimize the thermal shock, which occurs when any material is cooled. This also reduces splashing and avoids a rapid build-up of pressure. Follow these recommendations:

- A. Use LN2 with double walled evacuated container called Dewar's flask.
- B. Dewar's flask are non-pressurized, vacuum-jacketed vessels, having a loose-fitting plug or cap to prevent air and moisture from entering while allowing excess pressure to vent.
- C. The use of LN2 will only be in the clinic where the Dewar flask is located.
- D. In the event of a minor spill of LN2, follow the "Hazardous Material Spill Response Procedure." If possible, use spill kit absorbents to contain the spill. Notify your Department unit safety officer (USO) and the DSS.
- E. In the event of a major spill, evacuate the area to allow the liquid to evaporate. Since there may be oxygen deficiency in the area of the spill, DO NOT attempt to remediate the spill. Follow the "Hazardous Spill Response Procedure" and notify your Department USO and the DSS.

### IV. First Aid and Emergency Procedure

- A. If any liquid LN2 comes into contact with skin, immediately place that body part in a water bath of cool water -- never hot -- and protect the area with sterile loose dressings. DO NOT rub the affected body part. Seek immediate medical attention.

- B. In case of damage to the eye or skin blisters, go immediately to the emergency department for medical treatment.
- C. All employees are to report all incidents to their supervisor. Immediately contact your department USO or DSS.

**V. Dispensing Transferring of LN2**

Normal operations require staff to dispense LN2 from a Dewar flask into a cryogenic liquid container. If an employee has been trained to dispense LN2, he/she will follow these procedures at a minimum. LN2 can either be dispensed using a dipper (Figure A) or an automatic spigot/pump (Figure B).

- A. Prior to dispensing LN2, the receiving container must be inspected for cracks or damage and the overall integrity of the casing should be verified. If the integrity of the receiving vessel is questionable, DO NOT use. Instead place it "Out of Service" and dispose of it according to state, federal regulations. Call DSS for disposal.
- B. DO NOT utilize containers that were not engineered for use with LN2.
- C. Prior to installing the dispensing spigot/pump, check for damages. If there is damage, place the unit "Out of Service".
- D. Use approved personal protective equipment; cryogenic gauntlet gloves, goggles, face shield, cryogenic apron, and lab coat while dispensing.
- E. Follow the dispensing directions as instructed in the dispensing spigot/pump user manual.



Figure A



Figure B