

# Cryogenic Compressed Gases

Cryogenic liquids are liquefied gases kept in their liquid state at very low temperatures. They have boiling points below -150°F. When released, they are extremely cold and can expand into very large volumes of gas condensing into moisture in the air into a highly visible fog.

Hazards include the physical and chemical hazards of the gas, frostbite, and asphyxiation if breathable oxygen in the air is displaced.

## Safety Precautions

- Consult with EHS before purchasing cryogenic gases.
- Develop and make available Standard Operating Procedures (SOPs) for cryogenic gases. These SOPs shall include emergency response and training for all involved employees
- Provide, train, and practice an emergency response procedure for everyone working in the area.
- Train employees to work with cryogenic gases and allow only those trained to work with them.
- Training must include the correct use of regulators and the detection of leaks.
- Document training on all lab personnel who will be working with cryogenic gases.
- Hold periodic cryogenic gas emergency drills. These are required and must include

all of those working in the area, whether in direct contact with toxic gases or not.

- Wear appropriate PPE when working with or around cryogenic gases!
  - Wear thermal gloves!
  - Remove watches, rings, bracelets, and other jewelry before working with or around cryogenic gas. These can freeze to exposed skin and crack when exposed to liquid gases. Use extreme caution.
  - Constantly check for frostbite.
- Cracks or breaks may occur when common materials such as carbon steel, plastics, and rubber when exposed to liquid gas.
- Do not store containers where they may come in contact with moisture. Malfunction may occur in the moving parts due to external ice formations.
- Keep ignition sources and combustible materials far away from liquefied oxygen, and ensure that the cylinders are insulated from any sources of heat. (This includes areas outside where they may be exposed to the sun's heat!)



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- Avoid storing liquid oxygen cylinders on wood, asphalt, or oil-soaked gravel. These materials may explode after an impact as light as a footstep after becoming saturated with liquid oxygen.
- Store all cryogenic compressed gas cylinders in an upright position in well-ventilated areas.
- Review the Safety Data Sheets (SDS) often to remember and observe all safety use guidelines.

## You should NEVER

- Overfill containers or carry more than one container.
- Use gloves with gauntlets.
- Wear pants with cuffs that could pool and channel spills.
- Make bare skin contact with cryogenic liquids, uninsulated pipes, or equipment.
- Work on charged cryogenic equipment without protective equipment.

## You should ALWAYS

- Use tongs or cryogenic gloves to handle charged liquid containers or other objects that might be cold.
- Stay out of the path of boil off-gases.
- Pour cryogenics slowly to minimize boiling and splashing.
- Use a phase separator or special filling funnel when transferring cryogenics.
- Ensure that all pressure relief valves and rupture disk vent paths are directed away from personnel.
- Perform routine inspections of all safety equipment and cryogenic systems.



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## Liquid Nitrogen

Liquid nitrogen is the most commonly used cryogenic liquid on campus. The best safety rule for liquid nitrogen gas and their cylinders is to know and practice using the proper handling procedures.

There are three types of containers:

1. Dewar,
2. Cryogenic Liquid Cylinder, and
3. Cryogenic Storage Tank

### Container requirements for Liquid Nitrogen

- Open, un-insulated, or glass containers should never be used with liquid nitrogen. Use only approved containers
- Use vessels approved to contain liquid nitrogen.
- Use vessels with carrying handles or on wheels.
- Use closed containers with a loose fitting top or pressure relief devices that allow venting
  - If the container is completely covered, the pressure could increase to dangerous levels, so venting is required.

- If left completely uncovered, the liquid nitrogen will evaporate much faster.

### Areas Using Liquid Nitrogen

Areas/rooms/labs that are planning to use or using liquid nitrogen should be well-ventilated! This helps exhaust any nitrogen gas off-gassing from the container. A non-ventilated room could very quickly become oxygen deficient.

### Emergencies

#### Slight Skin Contact or Frostbite

If your skin comes into contact with liquid nitrogen or develops frostbite:

- Thaw the area slowly with warm water.
- Seek medical attention through 911.

#### *Release of Gas or Severe Burns/Frostbite*

If the liquid nitrogen gas is leaking into the room or if a person has severe frostbite or a burn from exposure or contact:

- Call 911 from a UAB landline or UAB Police from a cell phone at 205-934-3535.
- Call 911 in case of fire. This is due to the possible asphyxiation hazard.

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## **Save time and lives! Know your numbers!**

Dialing 911 from a cell phone will call the Birmingham Police Department who will then call UAB Police.

911 – from a UAB landline

934-3535 – from a cell phone

## **Areas with Substantial Amounts of Liquid**

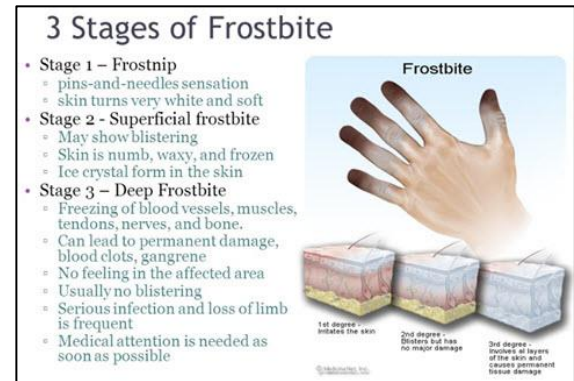
### **Nitrogen**

There are some areas where substantial amounts of cryogenic fluids are used. Because of the large quantities available, their inadvertent and uncontrolled release could produce an oxygen-deficient environment.

These areas need special operational safety requirements and systems.

Below are three requirements when working in areas where substantial amounts of cryogenic fluids are used:

- Contact EHS before purchasing.
- Develop an SOP and get it approved by EHS.
- Require a minimum of two people in the lab when cryogenic gases (large quantities) are being used.
- Commit to never working alone in these areas, and ensure that co-workers are with



another trained co-worker while working with these fluids/gases.

For these areas, EHS requires:

- Use of natural or local exhausts for ventilation
- Pressure relief devices where cryogenic liquids are enclosed, including all delivery lines and cutoff valves
- Inspection of all pressure-relief devices at regular intervals for leakage, frosting, and dirt accumulation
- Oxygen-monitoring equipment and associated visual and audible alarms in the area
- Mark evacuation routes away from the release area
- Immediate evacuation in the event of an alarm.
  - In case of a lack of oxygen, move immediately to a well-ventilated area, or outside and acquire a respirator.

## **Cryogenic Compressed Gases**

- No entry into areas/rooms in areas with active alarms.
  - Reentry may only occur by trained personnel with air-supplying respirators.