

Dry Ice and Liquid Nitrogen Can Cause Injuries or Death

Attention: Food, beverage, and other businesses where dry ice or liquid nitrogen is used, transported, or stored.

Worker Fatalities and Injuries in Washington State

Dry ice and liquid nitrogen pose serious health risks for workers, including a loss of consciousness that can progress to death by suffocation.

For example:

- A worker died shortly after being found unconscious inside a freezer truck trailer loaded with of totes of meat packed in dry ice. Air testing demonstrated carbon dioxide gas released from the dry ice had likely caused an oxygen-deficient environment inside the trailer.
- In a separate incident, a worker entered a walk-in fridge (where 300 pounds of dry ice had been placed the day before) and collapsed due to breathing oxygen-deficient air. Fortunately, the worker survived.
- Over the past five years, seven more workers were injured, in separate incidents, after breathing low-oxygen air caused by dry ice. An additional nine workers suffered ice-burn injuries from contact with dry ice.
- Dangerously low levels of oxygen were measured in the air at and below countertop workstations in an ice cream parlor where liquid nitrogen was used to flash-freeze ice cream.

Know the Hazards

Burns: Dry ice (solid carbon dioxide) and liquid nitrogen are both cold enough to cause ice burns and permanent frostbite damage to unprotected skin and eyes.

Suffocation: Dry ice and liquid nitrogen become a gas (i.e., CO₂ and N₂, respectively) when exposed to the air (this process is called sublimation); this even happens in cold environments such as the inside of a walk-in refrigerator. Warmer temperatures accelerate this change.

As CO₂ or N₂ gas enters the air, it causes the oxygen level to drop. Over time in certain conditions (e.g., an enclosed space with little or no fresh air), the oxygen level gets so low that it can cause adverse health effects such as headache, lightheadedness, and breathing difficulties that can progress to a sudden loss of consciousness and possible death.

Explosion: Pressure can build up to an explosive level inside non-venting, airtight containers holding either dry ice or liquid nitrogen.



Use Precautions

The following precautions can help prevent inhalation injuries, ice-burns and frostbite, and pressure explosions caused by dry ice or liquid nitrogen.

- Evaluate the workplace to determine if and how dry ice or liquid nitrogen in storage, transportation, and use might harm workers (e.g., suffocate or burn them, etc.). Keep in mind that cold gases can pool at the bottom of containers, floor level, and other locations. Even a 10-pound block of dry ice that's had enough time to turn into gas can create oxygen deficiency in a room as big as 15 feet by 10 feet with an eight-foot ceiling.
- Ensure adequate ventilation by providing enough fresh air to maintain a safe oxygen level (i.e., 21% oxygen) in vehicles, rooms, and other spaces where dry ice or liquid nitrogen is used or stored.
- Install and maintain alarms that signal before the oxygen level becomes dangerously low (air with oxygen less than 19.5% is "oxygen deficient"); and/or provide workers with personal monitors for checking oxygen levels.
- Do not store dry ice in airtight or sealed containers, vehicles, or poorly ventilated spaces (e.g. walk-in coolers); instead, use Styrofoam™ or other containers designed to vent under pressure.
- Store liquid nitrogen only in insulated and vented containers (e.g., Dewar flask) and systems specially designed for cryogenic fluids. Use self-closing or metering valves to prevent excessive releases. Do not use Styrofoam™, plastic, or other materials not approved for cryogenic fluids.
- Establish written safety procedures for working with dry ice and liquid nitrogen. Be sure to cover safety in foreseeable emergencies; for example, include what to do or not do during minor to major spills and/or leaks of liquid nitrogen.
- Do not permit workers to assist or move unconscious workers unless they have proper training and equipment and follow safety procedures; this will prevent risk for multiple injuries or fatalities.
- Don't put unused dry ice in the trash, sink, toilet, or closet. Allow it to vaporize in well-ventilated areas and keep others away.
- Establish a required, written Hazard Communication Program that addresses dry ice and/or liquid nitrogen. This includes Safety Data Sheets, labeling, and worker training on the hazards of dry ice and/or liquid nitrogen, the warning signs and symptoms of hypoxia (low oxygen in blood and/or body tissues), etc.
- Provide training to workers on hazards and safety procedures. Make sure they know what to do in emergencies; for example, instruct them to not attempt to release pressure on bulging or swollen containers (they should call 911 or other emergency support).
- Instruct supervisors and others to ensure that workers who feel dizzy, have difficulty breathing, or show other signs or symptoms of hypoxia immediately seek fresh air.
- Provide protective gear to prevent cold burns and frostbite. For example, use loose-fitting leather gloves or oven mitts to protect hands; and use goggles or face shields to protect the eyes from liquid nitrogen splashes.
- Post warning signs around equipment and/or entrances to spaces where storage or use of dry ice or liquid nitrogen could present an immediate risk for death or serious injury.

Other resources you can access

To find an **electronic** copy of this Hazard Alert, go to <http://www.Lni.wa.gov/HazardAlerts>.

L&I Safety web page: www.Lni.wa.gov/safety-health.

For other related rules, contact your local L&I office or visit the safety rules webpage: www.Lni.wa.gov/SafetyRules.

To find the nearest L&I office, visit www.Lni.wa.gov/Offices.

How can I get help from Labor & Industries?

The Department of Labor & Industries provides consultations, training, and technical assistance at no cost to employers. Call today to schedule a free confidential consultation or go to www.Lni.wa.gov/SafetyConsultants for more information.

You may also call 1-800-423-7233 or visit a local L&I office and ask for the Consultation Manager.

*This alert was developed by L&I's Division of Occupational Safety and Health (DOSH) to alert employers, labor groups, and employees to potential hazards associated with work activities. **This is not a rule and creates no new legal obligations.** The information provided includes suggested guidance on how to avoid workplace hazards and describes relevant mandatory safety and health rules. DOSH recommends you also check the related rules for additional requirements.*