COLA Clinical Laboratory Accreditation

COLA Primers Accreditation

COLA PRIMER 78

Safe Handling and Management of Dry Ice

• Dry Ice •

Dry ice is the solid form of carbon dioxide (CO_2). The solid form can exist at temperatures below -78°C (-109°F). It is commercially available in flakes, pellets or block form. There are many uses for dry ice; in the laboratory, it is primarily used to maintain and/or transport specimens in a frozen state. The main advantage of using dry ice instead of water ice is that it keeps products cold without creating water as it melts. Dry ice undergoes a process known as sublimation, where it transitions from a solid state directly to a gas. When dry ice sublimates, the gas produced is carbon dioxide.

Dry ice poses several hazards. The dry ice itself is so cold, it can "burn" skin—a form of frostbite—when handled without protection. When dry ice is used in shipping, improperly vented packages may rupture or explode due to the buildup of gases from sublimation. In addition, an excess of carbon dioxide in an enclosed space, such as a vehicle, storage room, shipping container or airline cargo hold, can create an environment depleted of oxygen. Someone entering such an area is at risk of asphyxiation.

• Transporting Dry Ice: Regulations •

Dry ice is shipped under the proper shipping name "Carbon Dioxide, Solid," and the code UN1845. It is referred to this way in the dangerous goods lists of all relevant state, federal and international transportation regulations.

While dry ice is NOT considered a Hazardous Substance by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200), it is classified as a Dangerous Good for transport purposes under the U.S. Department of Transportation (USDOT).

The International Air Transport Association (IATA) also regulates shipments containing dry ice. Specific procedures must be followed when packaging and shipping materials are refrigerated with dry ice. IATA classifies dry ice as a "class 9 dangerous good," and packages containing dry ice may only be shipped by appropriately trained individuals.

When shipping dry ice by air, the following requirements apply per IATA regulations:

- Dry ice must be packaged in accordance with packing instruction 904
- Packages must be vented to prevent pressure build-up of carbon dioxide gas to prevent rupture or explosion
- Arrangements must be made to ensure ventilation safety procedures are followed
- IATA/DOT training is required for shipping dry ice
- Compliance with Packing Instructions 954 of the IATA regulations and carrier requirements is necessary for international shipments

• Responsibilities •

The Laboratory Director is responsible for the overall operation and administration of the laboratory, and for ensuring compliance with all applicable regulations, including those related to the use and transportation of dry ice. Please reference the COLA Laboratory Accreditation Manual for the full description of the Laboratory Director's responsibilities.

As designated in your facility or laboratory policy, personnel responsible for training will provide appropriate training for any employee who works with or around dry ice. employees responsible for shipping packages containing dry ice must be properly trained and certified in USDOT shipping requirements and authorized by the company to pack and ship packages containing dry ice.

Employees must follow all procedures for safe handling, utilization, storage and disposal of dry ice.

Periodic inspections should be conducted to ensure all handling, use, storage and disposal requirements are met. In addition, proper atmospheric testing should be conducted periodically to ensure carbon dioxide levels remain below permissible exposure levels.

• Information and Training •

Laboratory workers, including couriers who use dry ice for transporting patient specimens, must be provided with information and training relevant to the hazards of handling dry ice. Training must include proper handling and disposal of dry ice, use of personal protective equipment, Safety Data Sheet information and emergency procedures.

Federal rules require that anyone who ships packages with dry ice must first complete shipping training. If your laboratory is going to package dry ice for shipment and/or sign any type of shipping documentation for a dry ice shipment, you must follow the training certification requirements. Following initial training, certification must be renewed every two years. Records and documentation of training must be retained.

• Hazard Identification •

Dry ice is classified by USDOT and IATA as a "miscellaneous" hazard, class 9. Dry ice is considered hazardous during transportation for three reasons:

1. **Explosion hazard**: Due to the rapid emission of large volumes of CO2 gas, any dry ice that is stored in a closed container can pressurize the container. Given enough time at normal room temperature, such a container may violently rupture if the gas is not able to escape and it may explode, causing personal injury or property damage. Packaging must allow for venting.

2. **Suffocation hazard**: Dry ice will sublime at any temperature above -109 °F. This releases potentially substantial volumes of CO2 (1 pound solid = 250 liters gas). When this gas is emitted in a confined space it may create an oxygen-deficient atmosphere causing dizziness, headaches, difficulty breathing, loss of consciousness and death. Personnel handling and retrieving dry ice should NEVER lean over into a storage container that contains dry ice.

3. **Contact hazard**: At -109 °F (-79 °C), skin contact with dry ice can lead to severe frostbite; skin cells freeze and become damaged very quickly.

Containers and packages must be labeled clearly and properly to communicate the hazards.

● Storage and Disposal ●

1. Dry ice must be stored and placed in well-ventilated areas, insulated chests, insulated coolers or special coolers designed for the storage of dry ice. Appropriate signage should be posted in storage areas.

2. Because of the thermal expansion of dry ice, sufficient gaseous carbon dioxide can be released in a sealed container to cause a pressure explosion. Placement of dry ice in rooms with inadequate or no ventilation can result in increased build-up of carbon dioxide in the area.

   Dry ice must **NEVER** be stored in any type of tightly sealed device such as an ultra-low freezer or plastic/glass container nor stored in any confined areas such as walk-in coolers, refrigerators, freezers, closets or vehicles of any type.

3. Dry ice will sublimate about five to ten pounds every 24 hours (blocks last longer) in a typical storage cooler. When disposing of dry ice, dry ice should be placed outdoors in an area away from walkways and doors. Dry ice should never be placed in sinks or down the drain.

4. Normal air is composed of 78% nitrogen, 21% oxygen and only 0.04% carbon dioxide. Concentrations greater than 0.5% (5000 ppm) can become dangerous. Storage and operation locations must be periodically surveyed to ensure carbon dioxide levels remain below 5000 ppm.

● Safety ●

Personal protective equipment must be provided and available to all personnel who handle dry ice.

- Eye protection – goggles and/or face shield
- Hand protection - cryogenic gloves

- Lab coat – ensure all skin surfaces are covered
- Scoop and/or tongs to retrieve dry ice from storage containers

Appropriate signage must be posted communicating the hazards of dry ice:

- Safety Data Sheet (SDS)
- No food or drink
- Emergency procedures and contacts
- Personal protective equipment (PPE) to be used when handling dry ice

● References ●

For additional information on dry ice, consult the following sources:

OSHA Laboratory Safety Guidance
https://www.osha.gov/sites/default/files/publications/OSHA3404laboratory-safety-guidance.pdf

OSHA Quick Facts – Cryogens and Dry Ice
https://www.osha.gov/sites/default/files/publications/OSHAquickfacts-lab-safety-cryogens-dryice.pdf

IATA – International Air Transport Association
https://www.iata.org
IATA - What You Need To Know About The Transport Of Dangerous Goods By Air