



**Federal Aviation
Administration**

Dry Ice - CO₂

Fact Sheet for Cargo Handlers

WHAT IS DRY ICE AND IS IT HAZARDOUS?

- Dry ice is:
 - Solid, frozen carbon dioxide (CO₂) pressed into dry blocks or pellets
 - Used as a refrigerant to package items that must remain cold or frozen during transport such as biological samples, vaccines, or foodstuffs
- When dry ice melts, it does not pool on the ground or form a puddle, it sublimates or changes directly from a solid to a gas
- Dry ice can be hazardous in enclosed spaces that are not well-ventilated due to CO₂ gas inhalation/overexposure; skin contact with dry ice can result in frostbite

WHAT IS CO₂ GAS AND IS IT HAZARDOUS?

- CO₂ gas is:
 - Naturally occurring component (0.04%) of the atmosphere
 - A physiological respiratory gas
 - Colorless, odorless, and nonflammable
 - 1.5 times heavier than air; tends to accumulate near the ground
- Increased levels of CO₂ cause drowsiness; higher concentrations increase the rate and depth of breathing, increase heart rate, and can cause irregular heartbeats (arrhythmias)
- CO₂ causes suffocation by displacing and diluting the amount of oxygen (O₂) in the air, leading to hypoxia (lack of oxygen)

SYMPTOMS OF CO₂ OVEREXPOSURE AND HEALTH EFFECTS

0.04% CO₂ (400 ppm*): typical outside air CO₂ levels; no physiological symptoms

0.5% CO₂ (5,000 ppm): OSHA occupational exposure limit; subtle to no physiological symptoms

CO₂ detector/alarm set at 0.5% (5,000 ppm); don O₂ mask and breathe 100% emergency O₂

1% CO₂ (10,000 ppm): drowsiness

2% CO₂ (20,000 ppm): headache and difficulty breathing during exertion

3% CO₂ (30,000 ppm): mild sleepiness, reduced hearing, sweating, increased heart rate, difficulty breathing at rest

Hazardous, should already be wearing O₂ mask

5% CO₂ (50,000 ppm): lethargy, dizziness, confusion, rapid breathing/shortness of breath (noticeable inability to breathe fast and deep enough)

8% CO₂ (80,000 ppm): dimmed vision, muscle tremor/twitching, unconsciousness

> 10% CO₂ (100,000 ppm): immediate unconsciousness, seizures and death

* parts per million

CO₂ GAS DETECTORS/SENSORS

- Cargo handlers should have and use CO₂ detectors/sensors while loading/unloading dry ice cargo hold
- CO₂ detectors/sensors should be worn as low on the body as possible (e.g., attached to a belt)
- If CO₂ detectors/sensors are not worn by cargo handlers, consider strapping CO₂ detectors/sensors to cargo pallets
- Routinely check CO₂ detectors/sensors
- Pulse oximeters are not recommended; pulse oximeters are ineffective for detecting CO₂ gas (by the time a pulse oximeter detects a decreased blood oxygen saturation level, CO₂ gas build-up is already at a hazardous level)



FOR CARGO HANDERS WHO ARE

- Unloading dry ice cargo at the completion of a flight and/or
- Entering airplane cargo hold shortly after airplane arrival to perform duties

Recommend these personnel don supplemental oxygen PRIOR TO AND WHILE performing these duties

IF YOU DEVELOP SYMPTOMS* OR CO₂ GAS DETECTOR/SENSOR ALARMS

! Exit the space immediately

! Seek medical attention

* Drowsiness, reduced hearing, sweating, increased heart rate, lethargy, dizziness, confusion, difficulty breathing, rapid breathing/shortness of breath

FIRST AID/MEDICAL TREATMENT

- Exit the space immediately (if able)
- Ensure the **scene is safe** (e.g., space has been adequately ventilated) before entering to rescue someone else
- Don portable/walk-around oxygen system mask **BEFORE** entering affected space
- Remove affected individuals from the space as quickly as possible
- Call 911
- Administer supplemental oxygen if available, until rescue personnel arrive

OTHER MITIGATION STRATEGIES TO CONSIDER

- Ensure workspaces (warehouse and airplane cargo hold) are well-ventilated (e.g., open bay doors, increased air circulation)
- Airplane must remain well-ventilated during loading/unloading of dry ice (e.g., leave airplane cargo doors open as much as possible, both air packs and APU should remain running)
- Consider having emergency oxygen readily available