

## DRY ICE SAFETY

1. Read the "[Material Safety Data Sheet](#)" for Carbon Dioxide, the Compressed Gas Association "Guidelines for Oxygen Deficient Atmospheres" (below) and the [ESTA](#) "Guide to Modern Atmospheric Effects".
2. Dry ice is extremely cold, -109 degrees F (-78 degrees C). Avoid contact with skin and eyes; use gloves and safety glasses in handling. Do not ingest. Keep away from children.
3. Dry ice expands as it changes from a solid to a gas. Do not keep in stoppered or tightly closed containers. Store in a safe place away from people. Be sure storage area has adequate ventilation.
4. Dry ice is the solid form of carbon dioxide. Carbon dioxide is 1.5 times as heavy as air and can collect in low lying areas. Carbon dioxide can cause asphyxiation due to lack of oxygen, and in sufficient concentrations is toxic. **Never lay down in dry ice fog or any other fog.** Always provide adequate ventilation to low lying areas such as basements, trap rooms, and orchestra pits. Provide adequate ventilation in automobiles during transport.
5. People walking in dry ice fog must be instructed to be aware of stairs, obstructions, openings in the stage, etc., which may be obscured by thick fog. Be careful of water vapor condensing on the stage floor.

## SAFETY BULLETIN

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### OXYGEN-DEFICIENT ATMOSPHERES (LESS THAN 19.5%)

The normal oxygen content of air is 20.9%. Depletion of oxygen content in air, either by combustion or displacement with inert gas, is a potential hazard personnel throughout industry. A general indication of what can potentially occur relative to the percentage of oxygen available is given in the table below.

Note: These indications are for a healthy average person at rest. Factors such as individual health (e.g., Smoker), degree of physical exertion, and high altitudes can affect these symptoms and the oxygen levels at which they occur.

Oxygen Content	Effects and Symptoms of acute exposure (at Atmospheric Pressure) % by Volume)
15-19%	Decreased ability to perform tasks. May impair coordination and may induce early symptoms in persons with heart, lung, or circulatory problems.
12-15%	Breathing increases, especially in exertion. Pulse up. Impaired coordination, perception, and judgment.
10-12%	Breathing further increases in rate and depth, poor coordination and judgment, lips slightly blue.
8-10%	Mental failure, fainting, unconsciousness, ashen face, blueness of lips, nausea (upset stomach), and vomiting.
6-8%	Eight minutes, may be fatal in 50 to 100% of cases; 6 minutes, may be fatal in 25 to 50% of cases; 4-5 minutes, recovery with treatment.
4-6%	Coma in 40 seconds, followed by convulsions, breathing failure, death.

**WARNING:** Exposure to atmospheres containing 8-10% or less oxygen will bring about unconsciousness without warning and so quickly that the individuals cannot help or protect themselves. Lack of sufficient oxygen may cause serious injury or death.

When personnel are subjected to, and around, oxygen-deficient atmospheres, there are certain considerations which are as follows:

1. Never enter a suspected oxygen-deficient atmosphere without proper protective breathing apparatus and attendant support.  
Analyze the atmosphere to determine if there is a deficiency of oxygen. Continue to monitor
2. during the work process. If oxygen level is less than 19.5%, ventilate to establish good air quality.
3. Train the worker on what to expect and how to handle it.
4. Blank (positively isolate) any incoming lines to a confined area and ventilate the area.
5. When it is necessary to work in any oxygen-deficient atmosphere, provide self-contained breathing apparatus or breathing airline mask for all workers.
6. An established hazardous work permit procedure should be used in all confined space activities.

This bulletin is intended to give a general overview of a potentially dangerous situation. For more detailed methods of dealing with oxygen-deficient atmospheres please see CGA Pamphlet P-14-1992, Accident Prevention in Oxygen-Enriched and Oxygen-Deficient Atmospheres.

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