Carbon Dioxide (CO_2)
Safety Information

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READ THESE INSTRUCTIONS

Warning, Caution, and Note Statements

Warnings, Cautions, and Notes appear throughout this guide. A sample of each statement appears below. Within each sample, a definition of the statement type and its purpose is given.

CARBON DIOXIDE

CAUTION:
HIGH PRESSURE LIQUID AND GAS.
CAN CAUSE RAPID SUFFOCATION.
CAN INCREASE RESPIRATION AND HEART RATE. MAY CAUSE FROSTBITE.

Avoid Breathing Gas.
Store and use with adequate ventilation.
Do not get liquid in eyes, on skin or clothing.
Cylinder temperature should not exceed 125°F (52°C).
Use equipment rated for cylinder pressure.
Use a back flow prevention device in the piping.
Close valve after each use and when empty.
Use in accordance with...(Refer to applicable safety literature).

FIRST AID
IF INHALED:
Remove to fresh air. If not breathing, give respiration.
If breathing is difficult, give oxygen. Call a physician.
IN CASE OF FROSTBITE:
Obtain Medical attention immediately.
DO NOT REMOVE THIS PRODUCT LABEL
(or equivalent wording)

Product Description

WARNING: Carbon dioxide has properties that can cause serious accidents, injuries, and even death if proper precautions are not followed. Before handling carbon dioxide or operating and maintaining carbon dioxide equipment, be sure to read and understand the safety precautions described in this document, the Safety Data Sheet (SDS) for carbon dioxide, the applicable safety standards, and other literature referred to in this document. Follow the manufacturers' operating instructions for equipment using carbon dioxide exactly.

Carbon dioxide (CO_2) consists of one carbon and two oxygen atoms. In its most common form, it is a gas, but depending on the temperature and pressure, it may exist as a gas, a liquid, or a solid. Carbon dioxide comprises approximately 0.038 percent by volume of the earth's atmosphere at sea level. It is a product of human and animal metabolism and is important to the life cycle of all types of plants.

Gaseous carbon dioxide is about 1½ times as heavy as air. It is nontoxic, soluble in water, colorless, and odorless. In concentrations above 5000 ppm, carbon dioxide can be detected by some individuals as a pungent or irritating odor as it dissolves in the moisture of the mucous membranes in the nasal passages.

Carbon dioxide gas is cooled and compressed to form a colorless liquid with approximately the same density as water. At temperatures above 87.8 F (31 C), carbon dioxide cannot be liquefied regardless of the pressure applied.

Potential Health Hazards

Working safely with carbon dioxide requires a supply system that is properly designed and installed and personnel who know and follow procedures for safe handling of any containers involved. Personnel responsible for these systems and equipment should be properly instructed on its safe use and the potential hazards associated with carbon dioxide.

Carbon dioxide presents these basic hazards:

- Carbon dioxide-enriched atmospheres: Can cause symptoms from a headache to unconsciousness.
- Oxygen-deficient atmospheres: Can cause fatigue, headaches, nausea, and, in worst cases, asphyxiation.
- Cold temperatures: Can cause frostbite

- High pressure: Can cause splashing liquid, flying debris, and potential rupture of piping or containers.
- Static electricity build-up: A static discharge can ignite combustible material. This is a concern with liquid or solid carbon dioxide but not for gaseous carbon dioxide.

FIRST AID

Frostbite

WARNING: Skin exposure to gaseous or solid carbon dioxide will result in frostbite.

Frostbite is a freezing injury resembling a burn. The objectives for basic treatment of all thermal injuries are similar—that is, to restore the affected body part to normal temperature and to protect the injured area from further damage.

Frostbite typically occurs when a person is exposed to cold weather, but it may also be caused by exposure to a cryogenic fluid. Although liquid carbon dioxide temperatures may be far colder than normal weather, the type of tissue damage and the treatment objectives are the same.

Description

Frozen tissues are painless and appear waxy and pale yellow. After the tissues have thawed, the pain becomes intense. With more superficial injuries, the injured tissues become bright red and warm. After thawing, more severely injured tissues remain cool. These tissues appear deep red to purple, and may form small, reddish blisters. The severity of the injury is not necessarily related to movement of the affected part. Accurately determining the extent of permanent damage may not be possible for days or weeks after the injury.

First Aid Procedures

Local rescue squads and hospital emergency rooms often have preferred first aid procedures for frostbite. As their procedures may vary slightly, these organizations should be contacted and alerted that cryogenic products are handled on-site.

A common protocol for treating frostbite is:

1. Remove any clothing that may constrict circulation in the frozen area.
2. **Immediately** place the frozen area in a **circulating warm water bath**: temperature between 100°F (38°C) and 110°F (43°C).
    a. **Temperature should not exceed 115°F (46.1°C)**. This will cause a heat burn to the already damaged tissue.
    b. **Never use dry heat.** This will cause a heat burn, further injuring the already damaged tissue.
3. At the same time, **arrange for transportation to a hospital** or the nearest treatment center.
4. Continue thawing the frozen tissue, keeping the affected part immersed until the skin turns from pale blue to pink or red. Thawing may take 15 to 60 minutes. When thawed, the tissue becomes painful, swollen, and prone to infection.
5. If the frozen tissue thaws before medical personnel arrive, cover it with dry sterile dressings and a large, bulky protective covering.
6. **Ensure that the victim avoids alcoholic beverages and smoking**—they decrease blood flow to the frozen tissue.

Follow-up medical care may be required. Further instructions will be given by personnel at the treatment facility.

Inhalation Exposure

1. Move the victim to fresh air if without risk.
2. If breathing has stopped, give artificial respiration.
3. Obtain medical attention immediately.
4. If breathing is difficult, qualified personnel may give oxygen.

EMERGENCY RESPONSE

Active safety programs and safety-conscious personnel greatly reduce the likelihood of liquid and gaseous carbon dioxide accidents. To minimize injury and property damage, personnel should be prepared for prompt emergency response.

Other safety precautions include:

- Regularly conduct emergency response drills.

- Review emergency response resources and ensure that they are accessible.
- Consult SDS for more details on any hazardous product.
- Check the labels on any containers.
- Refer to your state, federal, and local guidelines for handling emergencies and hazardous products.

This document is intended to provide assistance in formulating an emergency response plan for carbon-dioxide-related emergencies. It is not intended as a complete, all-inclusive source.

Carbon Dioxide Releases

Carbon dioxide is a non-flammable gas that is heavier than air. When a carbon dioxide release occurs, it is important to determine the type of leak (liquid or gaseous) as well as the origin and the extent of the release. The only evidence that a leak has occurred may come in the form of noise (pressurized gas escaping into the atmosphere) and/or the appearance of dry ice snow, frost, or fog.

When liquid carbon dioxide is exposed to atmospheric pressures, it expands rapidly, creating large volumes of gas and dry ice.

Approximately 8.5 ft^3 (0.24 m^3) of gas is created for each pound of liquid. This means that a full SodaSense CO2 cylinder will release about 7.7 ft^3 of gas. If a full cylinder releases inside the average home (1500 sq ft) and disperses, it would result in a concentration of 0.064%. This concentration is well below all recognized safety limits, so there would normally be no need to evacuate unless other hazards were present, or the release occurred inside a confined space.

Carbon dioxide vapors released into the atmosphere will accumulate in the area adjacent to the release. The highest concentration of carbon dioxide vapor will be found at the lowest point in the release area.

Carbon dioxide releases almost always form a visible fog. The size of the cloud is determined by ambient humidity and the rate of the release. The actual carbon dioxide release may be larger than the visible cloud and may vary in shape with wind speed and direction.

The sudden change of temperature and pressure associated with the release of carbon dioxide into the atmosphere may also cause dry ice snow to form in the release area.