Right to Know

# Hazardous Substance Fact Sheet

Common Name: **CARBON DIOXIDE**

Synonyms: Carbonic Acid; Dry Ice

Chemical Name: Carbon Dioxide

Date: May 2009 Revision: July 2016

CAS Number: 124-38-9

RTK Substance Number: 0343

DOT Number: UN 1013

**EMERGENCY RESPONDERS >>>> SEE LAST PAGE**

## Description and Use

**Carbon Dioxide** is a colorless, odorless gas. It is also commonly found as a liquid under pressure or a solid (dry ice). It is used as a refrigerant, in freezing foods, to make other chemicals, and as a fire extinguishing agent and propellant.

## Hazard Summary

| Hazard Rating | NJDHSS | NFPA |
|---|---|---|
| HEALTH | 3 | - |
| FLAMMABILITY | 0 | - |
| REACTIVITY | 0 | - |
| POISONOUS GASES ARE PRODUCED IN FIRE<br>CONTAINERS MAY EXPLODE IN FIRE | | |

*Hazard Rating Key: 0=minimal; 1=slight; 2=moderate; 3=serious; 4=severe*

## Reasons for Citation

- **Carbon Dioxide** is on the Right to Know Hazardous Substance List because it is cited by OSHA, ACGIH, DOT and NIOSH.

- **Carbon Dioxide** can affect you when inhaled.
- Contact can irritate and burn the skin and eyes. Direct contact with the *liquid* or *solid* ("dry ice") can cause frostbite.
- Exposure to **Carbon Dioxide** can cause headache, dizziness, difficulty breathing and tremors. Higher exposure can cause convulsions, coma and death.
- Severe poisoning can affect the brain causing personality changes and loss of vision.

SEE GLOSSARY ON PAGE 5.

## FIRST AID

**Eye Contact**

- Immediately flush with large amounts of water for at least 15 minutes, lifting upper and lower lids. Remove contact lenses, if worn, while flushing. Seek medical attention.

**Skin Contact**

- Quickly remove contaminated clothing. Immediately wash contaminated skin with large amounts of water.
- Immerse affected part in warm water. Seek medical attention.

**Inhalation**

- Remove the person from exposure.
- Begin rescue breathing (using universal precautions) if breathing has stopped and CPR if heart action has stopped.
- Transfer promptly to a medical facility.

## EMERGENCY NUMBERS

**Poison Control: 1-800-222-1222**

**CHEMTREC: 1-800-424-9300**

**NJDEP Hotline: 1-877-927-6337**

**National Response Center: 1-800-424-8802**

## Workplace Exposure Limits

OSHA: The legal airborne permissible exposure limit (PEL) is **5,000 ppm** averaged over an 8-hour workshift.

NIOSH: The recommended airborne exposure limit (REL) is **5,000 ppm** averaged over a 10-hour workshift and **30,000 ppm**, not to be exceeded during any 15-minute work period.

ACGIH: The threshold limit value (TLV) is **5,000 ppm** averaged over an 8-hour workshift and **30,000 ppm** as a STEL (short-term exposure limit).

- **Carbon Dioxide** decreases the amount of available *Oxygen*. Routinely measure *Oxygen* content to make sure it is at least 19.5% by volume.

## Determining Your Exposure

- Read the product manufacturer's Material Safety Data Sheet (MSDS) and the label to determine product ingredients and important safety and health information about the product mixture.
- For each individual hazardous ingredient, read the New Jersey Department of Health Hazardous Substance Fact Sheet, available on the RTK Program website (http://nj.gov/health/workplacehealthandsafety/right-to-know) or in your facility's RTK Central File or Hazard Communication Standard file.
- You have a right to this information under the New Jersey Worker and Community Right to Know Act, the Public Employees Occupational Safety and Health (PEOSH) Act if you are a public worker in New Jersey, and under the federal Occupational Safety and Health Act (OSHA) if you are a private worker.
- The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard (29 CFR 1910.1200) and the PEOSH Hazard Communication Standard (N.J.A.C. 12:100-7) require employers to provide similar information and training to their employees.

This Fact Sheet is a summary of available information regarding the health hazards that may result from exposure. Duration of exposure, concentration of the substance and other factors will affect your susceptibility to any of the potential effects described below.

## Health Hazard Information

**Acute Health Effects**
The following acute (short-term) health effects may occur immediately or shortly after exposure to **Carbon Dioxide**:

- Contact can irritate and burn the skin and eyes. Direct contact with the *liquid* or *solid* ("dry ice") can cause frostbite.
- Exposure to **Carbon Dioxide** can cause headache, dizziness, difficulty breathing, tremors, confusion and ringing in the ears. Higher exposure can cause convulsions, coma and death.

**Chronic Health Effects**
The following chronic (long-term) health effects can occur at some time after exposure to **Carbon Dioxide** and can last for months or years:

***Cancer Hazard***
- According to the information presently available to the New Jersey Department of Health, **Carbon Dioxide** has not been tested for its ability to cause cancer in animals.

***Reproductive Hazard***
- There is limited evidence that **Carbon Dioxide** causes spontaneous abortions.

***Other Effects***
- Severe poisoning can affect the brain causing personality changes and loss of vision.

## Medical

**Medical Testing**
If symptoms develop or overexposure is suspected, the following is are recommended:

- Evaluate for brain effects such as changes in memory, concentration, sleeping patterns and mood (especially irritability and social withdrawal), as well as for headaches and fatigue.
- Exam of the eyes and vision

Any evaluation should include a careful history of past and present symptoms with an exam. Medical tests that look for damage already done are not a substitute for controlling exposure.

Request copies of your medical testing. You have a legal right to this information under the OSHA Access to Employee Exposure and Medical Records Standard (29 CFR 1910.1020).

## Workplace Controls and Practices

Very toxic chemicals, or those that are reproductive hazards or sensitizers, require expert advice on control measures if a less toxic chemical cannot be substituted. Control measures include: (1) enclosing chemical processes for severely irritating and corrosive chemicals, (2) using local exhaust ventilation for chemicals that may be harmful with a single exposure, and (3) using general ventilation to control exposures to skin and eye irritants. For further information on workplace controls, consult the NIOSH document on Control Banding at www.cdc.gov/niosh/topics/ctrlbanding/.

The following work practices are also recommended:

- Label process containers.
- Provide employees with hazard information and training.
- Monitor airborne chemical concentrations.
- Use engineering controls if concentrations exceed recommended exposure levels.
- Provide eye wash fountains and emergency showers.
- Wash or shower if skin comes in contact with a hazardous material.
- Always wash at the end of the workshift.
- Change into clean clothing if clothing becomes contaminated.
- Do not take contaminated clothing home.
- Get special training to wash contaminated clothing.
- Do not eat, smoke, or drink in areas where chemicals are being handled, processed or stored.
- Wash hands carefully before eating, smoking, drinking, applying cosmetics or using the toilet.

In addition, the following may be useful or required:

- Before entering a confined space where **Carbon Dioxide** is present, check to make sure sufficient *Oxygen* (19.5%) exists.
- Where possible, transfer **Carbon Dioxide** from cylinders or other containers to process containers in an enclosed system.

## Personal Protective Equipment

The OSHA Personal Protective Equipment Standard (29 CFR 1910.132) requires employers to determine the appropriate personal protective equipment for each hazard and to train employees on how and when to use protective equipment.

The following recommendations are only guidelines and may not apply to every situation.

**Gloves and Clothing**

- Avoid skin contact with **Carbon Dioxide**. Wear personal protective equipment made from material which can not be permeated or degraded by this substance. Safety equipment suppliers and manufacturers can provide recommendations on the most protective glove and clothing material for your operation.
- All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.
- Where exposure to cold equipment, vapors, or liquid may occur, employees should be provided with *insulated* gloves and special clothing designed to prevent the freezing of body tissues.

**Eye Protection**

- Wear non-vented, impact resistant goggles when working with fumes, gases, or vapors.
- If additional protection is needed for the entire face, use in combination with a face shield. A face shield should not be used without another type of eye protection.

**Respiratory Protection**

***Improper use of respirators is dangerous.*** Respirators should only be used if the employer has implemented a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing, and medical exams, as described in the OSHA Respiratory Protection Standard (29 CFR 1910.134).

- Where the potential exists for exposure over **5,000 ppm**, use a NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus or an emergency escape air cylinder.
- Exposure to **40,000 ppm** is immediately dangerous to life and health. If the possibility of exposure above **40,000 ppm** exists, use a NIOSH approved self-contained breathing apparatus with a full facepiece operated in a pressure-demand or other positive-pressure mode equipped with an emergency escape air cylinder.
- Exposure to **Carbon Dioxide** is dangerous because it can replace *Oxygen* and lead to suffocation. Only NIOSH approved self-contained breathing apparatus with a full facepiece operated in the positive pressure mode should be used in *Oxygen* deficient environments.

## Fire Hazards

If employees are expected to fight fires, they must be trained and equipped as stated in the OSHA Fire Brigades Standard (29 CFR 1910.156).

- Extinguish fire using an agent suitable for type of surrounding fire. **Carbon Dioxide** itself does not burn.
- POISONOUS GASES ARE PRODUCED IN FIRE.
- CONTAINERS MAY EXPLODE IN FIRE.
- Use water spray to keep fire-exposed containers cool.
- Flow or agitation may generate electrostatic charges and may ignite any explosive mixtures present.

## Spills and Emergencies

If employees are required to clean-up spills, they must be properly trained and equipped. The OSHA Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120) may apply.

If **Carbon Dioxide** is leaked, take the following steps:

- Evacuate personnel and secure and control entrance to the area.
- Eliminate ignition sources.
- Ventilate area of leak to disperse the gas.
- Stop flow of gas. If source of leak is a cylinder and the leak cannot be stopped in place, remove the leaking cylinder to a safe place in the open air, and repair leak or allow cylinder to empty.
- Gas is heavier than air and may accumulate in low ceiling spaces and confined spaces.
- It may be necessary to contain and dispose of **Carbon Dioxide** as a HAZARDOUS WASTE. Contact your state Department of Environmental Protection (DEP) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.

## Handling and Storage

Prior to working with **Carbon Dioxide** you should be trained on its proper handling and storage.

- *Dusts* of various METALS (such as MAGNESIUM, ZIRCONIUM, TITANIUM and CHROMIUM) can ignite or explode when suspended in **Carbon Dioxide**.
- **Carbon Dioxide** reacts with WATER to form *Carbonic Acid*.
- **Carbon Dioxide** is not compatible with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE); REDUCING AGENTS (such as LITHIUM, SODIUM, ALUMINUM and their HYDRIDES); METAL CARBIDES; METAL SALTS; and STRONG BASES (such as SODIUM HYDROXIDE and POTASSIUM HYDROXIDE).
- Store in tightly closed containers in a cool, well-ventilated area away from COMBUSTIBLE MATERIALS.
- **Carbon Dioxide** may accumulate static electricity, even when being filled into properly grounded containers.

## Occupational Health Information Resources

The New Jersey Department of Health, Occupational Health Service, offers multiple services in occupational health. These services include providing informational resources, educational materials, public presentations, and industrial hygiene and medical investigations and evaluations.

**For more information, please contact:**

New Jersey Department of Health & Senior Services
Right to Know Program
PO Box 368
Trenton, NJ 08625-0368
Phone: 609-984-2202
Fax: 609-984-7407
E-mail: rtk@doh.nj.gov
Web address:
http://nj.gov/health/workplacehealthandsafety/right-to-know

**GLOSSARY**

**ACGIH** is the American Conference of Governmental Industrial Hygienists. They publish guidelines called Threshold Limit Values (TLVs) for exposure to workplace chemicals.

**Acute Exposure Guideline Levels** (AEGLs) are established by the EPA. They describe the risk to humans resulting from once-in-a lifetime, or rare, exposure to airborne chemicals.

**Boiling point** is the temperature at which a substance can change its physical state from a liquid to a gas.

A **carcinogen** is a substance that causes cancer.

The **CAS number** is unique, identifying number, assigned by the Chemical Abstracts Service, to a specific chemical.

**CFR** is the Code of Federal Regulations, which are the regulations of the United States government.

A **combustible** substance is a solid, liquid or gas that will burn.

A **corrosive** substance is a gas, liquid or solid that causes destruction of human skin or severe corrosion of containers.

**DEP** is the New Jersey Department of Environmental Protection.

**DOT** is the Department of Transportation, the federal agency that regulates the transportation of chemicals.

**EPA** is the Environmental Protection Agency, the federal agency responsible for regulating environmental hazards.

**ERG** is the Emergency Response Guidebook. It is a guide for emergency responders for transportation emergencies involving hazardous substances.

**Emergency Response Planning Guideline** (ERPG) values provide estimates of concentration ranges where one reasonably might anticipate observing adverse effects.

A **fetus** is an unborn human or animal.

A **flammable** substance is a solid, liquid, vapor or gas that will ignite easily and burn rapidly.

The **flash point** is the temperature at which a liquid or solid gives off vapor that can form a flammable mixture with air.

**IARC** is the International Agency for Research on Cancer, a scientific group.

**Ionization Potential** is the amount of energy needed to remove an electron from an atom or molecule. It is measured in electron volts.

**IRIS** is the Integrated Risk Information System database on human health effects that may result from exposure to various chemicals, maintained by federal EPA.

**LEL** or **Lower Explosive Limit**, is the lowest concentration of a combustible substance (gas or vapor) in the air capable of continuing an explosion.

**mg/m$^3$** means milligrams of a chemical in a cubic meter of air. It is a measure of concentration (weight/volume).

A **mutagen** is a substance that causes mutations. A **mutation** is a change in the genetic material in a body cell. Mutations can lead to birth defects, miscarriages, or cancer.

**NFPA** is the National Fire Protection Association. It classifies substances according to their fire and explosion hazard.

**NIOSH** is the National Institute for Occupational Safety and Health. It tests equipment, evaluates and approves respirators, conducts studies of workplace hazards, and proposes standards to OSHA.

**NTP** is the National Toxicology Program which tests chemicals and reviews evidence for cancer.

**OSHA** is the federal Occupational Safety and Health Administration, which adopts and enforces health and safety standards.

**PEOSHA** is the New Jersey Public Employees Occupational Safety and Health Act, which adopts and enforces health and safety standards in public workplaces.

**Permeated** is the movement of chemicals through protective materials.

**ppm** means parts of a substance per million parts of air. It is a measure of concentration by volume in air.

**Protective Action Criteria** (PAC) are values established by the Department of Energy and are based on AEGLs and ERPGs. They are used for emergency planning of chemical release events.

A **reactive** substance is a solid, liquid or gas that releases energy under certain conditions.

**STEL** is a Short Term Exposure Limit which is usually a 15-minute exposure that should not be exceeded at any time during a work day.

A **teratogen** is a substance that causes birth defects by damaging the fetus.

**UEL** or **Upper Explosive Limit** is the highest concentration in air above which there is too much fuel (gas or vapor) to begin a reaction or explosion.

**Vapor Density** is the ratio of the weight of a given volume of one gas to the weight of another (usually *Hydrogen*), at the same temperature and pressure.

The **vapor pressure** is a force exerted by the vapor in equilibrium with the solid or liquid phase of the same substance. The higher the vapor pressure the higher concentration of the substance in air.

# Right to Know Hazardous Substance Fact Sheet

Emergency Responders Quick Reference

Common Name: **CARBON DIOXIDE**

Synonyms: Carbonic Acid; Dry Ice
CAS No: 124-38-9
Molecular Formula: $CO_2$
RTK Substance No: 0343
Description: Colorless, odorless gas commonly found as a liquid under pressure or as a solid (dry ice)

## HAZARD DATA

| Hazard Rating | Firefighting | Reactivity |
|---|---|---|
| **3 - Health**<br>**0 - Fire**<br>**0 - Reactivity**<br>**DOT#:** UN 1013<br>**ERG Guide #:** 120<br>**Hazard Class:** 2.2 (Nonflammable gas) | Extinguish fire using an agent suitable for type of surrounding fire. **Carbon Dioxide** itself does not burn.<br>POISONOUS GASES ARE PRODUCED IN FIRE.<br>CONTAINERS MAY EXPLODE IN FIRE.<br>Use water spray to keep fire-exposed containers cool.<br>Flow or agitation may generate electrostatic charges and may ignite any explosive mixtures present. | *Dusts* of various METALS (such as MAGNESIUM, ZIRCONIUM, TITANIUM and CHROMIUM) can ignite or explode when suspended in **Carbon Dioxide**.<br>**Carbon Dioxide** reacts with WATER to form *Carbonic Acid*.<br>**Carbon Dioxide** is not compatible with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE); REDUCING AGENTS (such as LITHIUM, SODIUM, ALUMINUM and their HYDRIDES); METAL CARBIDES; METAL SALTS; and STRONG BASES (such as SODIUM HYDROXIDE and POTASSIUM HYDROXIDE). |

## SPILL/LEAKS

**Isolation Distance:**

Spill: 100 meters (330 feet)

Fire: 800 meters (1/2 mile)

Stop flow of gas. If source of leak is a cylinder and the leak cannot be stopped in place, remove the leaking cylinder to a safe place in the open air, and repair leak or allow cylinder to empty.

Gas is heavier than air and may accumulate in low ceiling spaces and confined spaces.

## PHYSICAL PROPERTIES

| | |
|---|---|
| **Odor Threshold:** | Odorless |
| **Flash Point:** | Nonflammable |
| **Vapor Density:** | 1.52 (air = 1) |
| **Vapor Pressure:** | 42,940 mm Hg at 68°F (20°C) |
| **Specific Gravity:** | 1.5 (water = 1) |
| **Water Solubility:** | Soluble |
| **Boiling Point:** | -109°F (-78.3°C) |
| **Freezing Point:** | -70°F (-57°C) |
| **Ionization Potential:** | 13.77 eV |
| **Molecular Weight:** | 44 |

## EXPOSURE LIMITS

**NIOSH:** 5,000 ppm, 10-hr TWA; 30,000 ppm, STEL
**IDLH:** 40,000 ppm

The Protective Action Criteria values are:
PAC-1 = 30,000 ppm
PAC-2 = 40,000 ppm
PAC-3 = 50,000 ppm

## PROTECTIVE EQUIPMENT

**Gloves:** Insulated Rubber

**Coveralls:** Insulated material

**Respirator:** >5,000 ppm - SCBA

## HEALTH EFFECTS

**Eyes:** Irritation and burns. Contact with liquid or solid ("dry ice") causes frostbite

**Skin:** Irritation and burns. Contact with liquid or solid ("dry ice") causes frostbite

**Inhalation:** Headache, dizziness, difficulty breathing, tremors, convulsions, coma and death

## FIRST AID AND DECONTAMINATION

**Remove** the person from exposure.

**Flush** eyes with large amounts of water for at least 15 minutes. Remove contact lenses if worn. Seek medical attention.

**Quickly** remove contaminated clothing and wash contaminated skin with large amounts of water.

**Immerse** affected part in warm water. Seek medical attention.

**Begin** artificial respiration if breathing has stopped and CPR if necessary.

**Transfer** promptly to a medical facility.