



Right to Know Hazardous Substance Fact Sheet

Common Name: **CARBON MONOXIDE**

Synonyms: Carbonic Oxide; Exhaust Gas; Flue Gas

Chemical Name: Carbon Monoxide

Date: January 2010 Revision: December 2016

CAS Number: 630-08-0

RTK Substance Number: 0345

DOT Number: UN 1016

Description and Use

Carbon Monoxide is a colorless and odorless gas. It is mainly found as a product of incomplete combustion from vehicles and oil and gas burners. It is used in metallurgy and plastics, and as a chemical intermediate.

Reasons for Citation

- ▶ **Carbon Monoxide** is on the Right to Know Hazardous Substance List because it is cited by OSHA, ACGIH, DOT, NIOSH and NFPA.
- ▶ This chemical is on the Special Health Hazard Substance List.

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 rinsing.

Skin Contact

- ▶ In case of contact with *liquid Carbon Monoxide*, 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.
- ▶ Medical observation is recommended for several days after exposure or if symptoms are present, as some symptoms may be delayed.

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

EMERGENCY RESPONDERS >>>> SEE LAST PAGE

Hazard Summary

Hazard Rating	NJDHSS	NFPA
HEALTH	-	2
FLAMMABILITY	-	4
REACTIVITY	-	0
TERATOGEN FLAMMABLE POISONOUS GASES ARE PRODUCED IN FIRE CONTAINERS MAY EXPLODE IN FIRE		

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

- ▶ **Carbon Monoxide** can affect you when inhaled.
- ▶ **Carbon Monoxide** may be a TERATOGEN. HANDLE WITH EXTREME CAUTION.
- ▶ Exposure during pregnancy can cause lowered birth weight in offspring.
- ▶ Skin contact with *liquid Carbon Monoxide* can cause frostbite.
- ▶ Inhaling **Carbon Monoxide** can cause headache, dizziness, lightheadedness and fatigue.
- ▶ Higher exposure to **Carbon Monoxide** can cause sleepiness, hallucinations, convulsions, and loss of consciousness.
- ▶ **Carbon Monoxide** can cause personality and memory changes, mental confusion and loss of vision.
- ▶ Extremely high exposure to **Carbon Monoxide** can cause the formation of *Carboxyhemoglobin* and decrease the ability of the blood to carry *Oxygen*. This can cause a bright red color to the skin and mucous membranes causing trouble breathing, collapse, convulsions, coma and death.
- ▶ **Carbon Monoxide** can affect the heart and damage the nervous system.
- ▶ **Carbon Monoxide** is a FLAMMABLE GAS and a DANGEROUS FIRE HAZARD.

Workplace Exposure Limits

OSHA: The legal airborne permissible exposure limit (PEL) is **50 ppm** averaged over an 8-hour workshift.

NIOSH: The recommended airborne exposure limit (REL) is **35 ppm** averaged over a 10-hour workshift and **200 ppm**, not to be exceeded during any 15-minute work period.

ACGIH: The threshold limit value (TLV) is **25 ppm** averaged over an 8-hour workshift.

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 and the PEOSH Hazard Communication Standard (N.J.A.C. 12:100-7) 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) requires private 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 Monoxide**:

- ▶ Skin contact with *liquid Carbon Monoxide* can cause frostbite.
- ▶ Inhaling **Carbon Monoxide** can cause headache, dizziness, lightheadedness and fatigue.
- ▶ Higher exposure to **Carbon Monoxide** can cause sleepiness, hallucinations, convulsions, and loss of consciousness.
- ▶ **Carbon Monoxide** can cause personality and memory changes, mental confusion and loss of vision.
- ▶ Extremely high exposure to **Carbon Monoxide** can cause the formation of *Carboxyhemoglobin* and decrease the ability of the blood to carry *Oxygen*. This can cause a bright red color to the skin and mucous membranes causing trouble breathing, collapse, convulsions, coma and death.

Chronic Health Effects

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

Cancer Hazard

- ▶ There is no evidence that **Carbon Monoxide** causes cancer in animals. This is based on test results presently available to the New Jersey Department of Health from published studies.

Reproductive Hazard

- ▶ **Carbon Monoxide** may be a TERATOGEN in humans since it is a teratogen in animals.
- ▶ There is limited evidence that **Carbon Monoxide** may damage the male reproductive system (including decreasing the sperm count) in animals.

Other Effects

- ▶ **Carbon Monoxide** can affect the heart and damage the nervous system.

Medical

Medical Testing

For frequent or potentially high exposure (half the TLV or greater), the following are recommended before beginning work and at regular times after that:

- ▶ *Carboxyhemoglobin* levels (a combination of **Carbon Monoxide** and hemoglobin) should be tested for within a few hours after exposure to the gas.
- ▶ EKG
- ▶ Exam of the nervous system

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).

Mixed Exposures

- ▶ Smoking increases your exposure to **Carbon Monoxide**. Because smoking can cause heart disease, as well as lung cancer, emphysema, and other respiratory problems, it may worsen respiratory conditions caused by chemical exposure. Even if you have smoked for a long time, stopping now will reduce your risk of developing health problems. Exposure to **30 ppm of Carbon Monoxide** throughout the day is equivalent to smoking 20 cigarettes a day.

Conditions Made Worse By Exposure

- ▶ Individuals who have heart disease should not be exposed to levels of **Carbon Monoxide** above **25 ppm**.

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:

- ▶ Specific actions are required for this chemical by OSHA. Refer to the OSHA *Compressed gases* Standard (29 CFR 1910.101).
- ▶ Before entering a confined space where **Carbon Monoxide** may be present, check to make sure that an explosive concentration does not exist.
- ▶ Where possible, transfer **Carbon Monoxide** 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 Monoxide**. 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.

- ▶ Safety equipment manufacturers recommend work gloves, and Tychem® BR, Responder®, and TK, or the equivalent, as protective materials for clothing.
- ▶ 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.
- ▶ All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.
- ▶ Wear protective clothing made of material that does not generate static electricity.

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).

- ▶ DO NOT USE CHEMICAL CARTRIDGE OR CANISTER RESPIRATORS.
- ▶ Where the potential exists for exposure over **25 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 **1,200 ppm** is immediately dangerous to life and health. If the possibility of exposure above **1,200 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.

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).

- ▶ **Carbon Monoxide** is a FLAMMABLE GAS.
- ▶ Stop flow of gas and use water spray to disperse vapors.
- ▶ POISONOUS GASES ARE PRODUCED IN FIRE.
- ▶ Use water spray to keep fire-exposed containers cool.
- ▶ Vapors may travel to a source of ignition and flash back.
- ▶ **Carbon Monoxide** may form an ignitable vapor/air mixture in closed tanks or containers.

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 Monoxide** 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.
- ▶ Keep **Carbon Monoxide** out of confined spaces, such as sewers, because of the possibility of an explosion.
- ▶ Turn leaking cylinder with leak up to prevent escape of gas in liquid state.
- ▶ Purge with *inert gas* before attempting repairs.
- ▶ It may be necessary to contain and dispose of **Carbon Monoxide** 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 Monoxide** you should be trained on its proper handling and storage.

- ▶ **Carbon Monoxide** is not compatible with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE) and ALKALI METALS (such as LITHIUM, SODIUM and POTASSIUM).
- ▶ *Liquefied, cold Carbon Monoxide* may react vigorously with WATER.
- ▶ **Carbon Monoxide** is mildly corrosive to NICKEL and IRON.
- ▶ Store in tightly closed containers in a cool, well-ventilated area away from HEAT. Do not store above 125°F (52°C).
- ▶ Sources of ignition, such as smoking and open flames, are prohibited where **Carbon Monoxide** is used, handled, or stored.
- ▶ Metal containers involving the transfer of **Carbon Monoxide** should be grounded and bonded.
- ▶ Use explosion-proof electrical equipment and fittings wherever **Carbon Monoxide** is used, handled, manufactured, or stored.
- ▶ Use only non-sparking tools and equipment, especially when opening and closing containers of **Carbon Monoxide**.

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
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/>

The Right to Know Hazardous Substance Fact Sheets are not intended to be copied and sold for commercial purposes.

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.

The **critical temperature** is the temperature above which a gas cannot be liquefied, regardless of the pressure applied.

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/m³ 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 *Air*), 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 MONOXIDE**

Synonyms: Carbonic Oxide; Exhaust Gas; Flue Gas

CAS No: 630-08-0

Molecular Formula: CO

RTK Substance No: 0345

Description: Colorless, odorless gas

HAZARD DATA

Hazard Rating	Firefighting	Reactivity
2 - Health 4 - Fire 0 - Reactivity DOT#: UN 1016 ERG Guide #: 119 Hazard Class: 2.3 (Poisonous Gas)	Carbon Monoxide is a FLAMMABLE GAS. Stop flow of gas and use water spray to disperse vapors. POISONOUS GASES ARE PRODUCED IN FIRE. Use water spray to keep fire-exposed containers cool. Vapors may travel to a source of ignition and flash back. Carbon Monoxide may form an ignitable vapor/air mixture in closed tanks or containers.	Carbon Monoxide is not compatible with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE) and ALKALI METALS (such as LITHIUM, SODIUM and POTASSIUM). <i>Liquified, cold Carbon Monoxide</i> may react vigorously with water.

SPILL/LEAKS

Isolation Distance:

Small Spill: 30 meters (100 feet)

Large Spill: 150 meters (500 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.

Keep **Carbon Monoxide** out of confined spaces, such as sewers, because of the possibility of an explosion.

Turn leaking cylinder with leak up to prevent escape of gas in liquid state.

Purge with *inert gas* before attempting repairs.

Use only non-sparking tools and equipment, especially when opening and closing containers of **Carbon Monoxide**.

Carbon Monoxide is harmful to aquatic life at very low concentrations.

PHYSICAL PROPERTIES

Odor Threshold:	Odorless
Flash Point:	Flammable gas
LEL:	12%
UEL:	75%
Auto Ignition Temp:	1,125°F (607°C)
Vapor Density:	0.97 (air = 1)
Vapor Pressure:	>750 mm Hg at 68°F (20°C)
Specific Gravity:	0.79 (water = 1)
Water Solubility:	Very slightly soluble
Boiling Point:	-313°F (-192°C)
Melting Point:	-337°F (-205°C)
Critical Temp:	-282°F (-139°C)
Ionization Potential:	14 eV
Molecular Weight:	28

EXPOSURE LIMITS

OSHA: 50 ppm, 8-hr TWA

NIOSH: 35 ppm, 10-hr TWA; 200 ppm, 15-min Ceiling

ACGIH: 25 ppm, 8-hr TWA

IDLH: 1,200 ppm

The Protective Action Criteria values are:

PAC-1 = 75 ppm PAC-2 = 83 ppm PAC-3 = 330 ppm

PROTECTIVE EQUIPMENT

Gloves:	Insulated work gloves (double glove for spills)
Coveralls:	Tychem® BR, Responder® and TK (330-minute breakthrough) >10% LEL wear flash protection or turnout gear
Respirator:	SCBA

HEALTH EFFECTS

Eyes: No information available

Skin: Skin contact with *liquid Carbon Monoxide* can cause frostbite

Inhalation: Headache, dizziness, lightheadedness and fatigue, convulsions and loss of consciousness

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.

In case of contact with *liquid Carbon Monoxide*, 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.

Medical observation is recommended as symptoms may be delayed.