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Program Highlights

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CARBON MONOXIDE POISONING

WHAT IS IT?

Carbon monoxide -- a colorless, odorless, tasteless gas -- is one of the most common industrial hazards. Mild poisoning can cause such symptoms as nausea, dizziness or headaches while severe poisoning can result in brain or heart damage or even death. This poisonous gas is produced by the incomplete burning of any material containing carbon, such as gasoline, natural gas, oil, propane, coal or wood. Forges, blast furnaces and coke ovens all produce carbon monoxide, but one of the most common sources of exposure in the workplace is the internal combustion engine.

Be suspicious of carbon monoxide poisoning if you develop headache, flushed face, dizziness or weakness. Bear in mind that although carbon monoxide has no telltale odor, it may mix with gases which do have an odor. Thus, the smell of other gases doesn't mean an absence of carbon monoxide.

ARE YOU LIKELY TO BE POISONED?

If you have a heart condition, your condition may be aggravated by carbon monoxide. Ingestion of barbiturates and alcohol may increase the gas' health effects. Further, smokers will have higher carboxyhemoglobin than non-smokers, and therefore face higher risk from carbon monoxide exposures on the job.

Harmful levels of carbon monoxide are a potential danger to: acetylene workers, blast furnace workers, boiler room workers, brewery workers, carbon black makers, coke oven workers, customs workers, diesel engine operators, dock workers, garage mechanics, metal oxide reducers, miners, organic chemical synthesizers, petroleum refinery workers, pulp and paper workers, steel workers, toll booth and tunnel attendants, and warehouse workers.

HOW DOES CARBON MONOXIDE HARM YOU?

Large amounts of carbon monoxide can kill in minutes. The

more carbon monoxide in the air and the longer you are exposed to it, the greater the danger. Any one or more of the following symptoms can signal carbon monoxide poisoning: headaches, tightness across the chest, nausea, drowsiness, inattention or fatigue. As the amount of carbon monoxide in the air increases, more serious symptoms develop such as lack of coordination, weakness and confusion.

The poisoning can be reversed if caught in time. But even if you recover, acute poisoning may result in permanent damage to the parts of your body which require a lot of oxygen, such as the heart and brain.

There is a significant reproductive risk involved with carbon monoxide. An American Journal of Industrial Medicine article quotes two studies showing that acute carbon monoxide exposures that were non-lethal to the mother were associated with fetal loss.

WHAT CAN YOU DO ABOUT CARBON MONOXIDE?

If you suspect carbon monoxide, get out of the area and into the open fresh air. Remove anyone overcome by the gas immediately and give the person artificial respiration. Call for a doctor and continue the artificial respiration until the doctor arrives or the person recovers. Prompt action can make the difference between life and death.

HOW CAN POISONING BE PREVENTED?

Suggestions for Employers

1. Install an effective ventilation system to remove poisonous carbon monoxide from the area.
2. Maintain appliances and equipment in good order, adjusting flames, burners and drafts to reduce the formation of carbon monoxide.
3. Consider switching from fossil fuel-powered equipment to battery-powered machinery when possible.
4. Provide approved respirators for emergency use. Regular respirators (negative pressure) will not work in this atmosphere. If necessary, provide an independent air supply to workers.
5. Install carbon monoxide monitors or regularly test air in areas when carbon monoxide is generated or used.
6. Provide preplacement and periodic medical examinations for workers who may be exposed to carbon monoxide. If possible, transfer affected workers to other jobs.
7. Instruct workers in the hazards of carbon monoxide and train them in the proper use of respirators.

Suggestions for Workers

1. Report to your employer any condition which might make carbon monoxide form or accumulate.
2. Be alert to ventilation problems, especially in enclosed

areas where gases of burning fuels may be released.

3. Report complaints early. Don't overexert yourself if you suspect carbon monoxide poisoning. Physical activity increases the body's need for oxygen and thus increases the danger of poisoning.

4. If you get sick, don't forget to tell your doctor about the possibility of exposure to carbon monoxide.

5. Think carefully about your smoking habits. Tobacco, when burned, releases carbon monoxide which reduces the oxygen-carrying ability of the blood, even before any industrial exposure is added.

WHAT ARE THE FEDERAL STANDARDS?

The Occupational Safety and Health Administration (OSHA) standard for exposure to carbon monoxide prohibits workers' exposure to more than 35 parts of the gas per million parts of air (ppm), averaged over an 8-hour workday. There is also a ceiling limit of 200 ppm (as measured over a 15-minute period).

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This is one of a series of fact sheets highlighting U.S. Department of Labor programs. It is intended as a general description only and does not carry the force of legal opinion. This information will be made available to sensory impaired individuals upon request. Voice phone: (202)523-8151. TDD message referral phone: 1-800-326-2577.

carbon monoxide [Sax] [Prager]

CAS: 630-08-0

M Formula: CO

Definition: Discovered by Priestly in America in 1799.

Properties: Colorless gas or liquid, practically odorless. Burns with a violet flame, slightly soluble in water, soluble in alcohol and benzene. Density 0.96716 (air = 1.0), boiling point -190C, freezing point -207C, specific volume 13.8 cubic feet/lb (21.1C). autoignition temperature (liquid) 1128F (609C). Classed as an inorganic compound.

Derivation: (1) Obtained almost pure by placing a mixture of oxygen and carbon dioxide in contact with incandescent graphite, coke, or anthracite. (2) Action of steam on hot coke or coal (water gas) or on natural gas (synthesis gas). In the latter case, carbon dioxide is removed by absorption in amine solution, and the hydrogen and carbon monoxide separated in a low-temperature unit. (3) By-product in chemical reactions. (4) Combustion of organic compound with limited amount of oxygen, as in automobile cylinders. (5) Dehydration of formic acid.

Grade: Commercial (98%), CP (99.5%).

Hazard: Highly flammable, dangerous fire and explosion risk. Flammable limits in air 12-75% by volume. Toxic by inhalation. TLV: 50 ppm (industrial workrooms), the former USSR standard 35 ppm. *Note:* Carbon monoxide has an affinity for blood hemoglobin over 200 times that of oxygen. A major air pollutant.

Use: Organic synthesis (methanol, ethylene, isocyanates, aldehydes, acrylates, phosgene), fuels (gaseous), metallurgy (special steels, reducing oxides, nickel refining), zinc white pigments.

CARBON MONOXIDE [Hawley] [Prager]

DPIM: CBW750

Hazard Rating: **3**

CAS: 630-08-0

DOT Number: UN 1016/NA 9202

M Formula: CO

M Weight: 28.01

Properties:

Colorless, odorless, tasteless gas. Melting point: -213°, boiling point: -190°, lower explosive limit: 12.5%, upper explosive limit: 74.2%, density: (gas) 1.250 gram/L @ 0°, (liquid) 0.793, autoignition temperature: 1128°F. Very slightly soluble in H₂O; soluble in AcOH, MeOH, and EtOH.

Synonyms:

CARBONE (OXYDE de) (FRENCH)
 CARBONIC OXIDE
 CARBONIO (OSSIDO di) (ITALIAN)
 CARBON MONOXIDE (ACGIH, OSHA)
 CARBON MONOXIDE (UN 1016) (DOT)
 CARBON MONOXIDE, refrigerated liquid (cryogenic liquid) (NA 9202) (DOT)
 CARBON OXIDE (CO)
 EXHAUST GAS
 FLUE GAS
 KOHLENMONOXID (GERMAN)
 KOHLENOXYD (GERMAN)
 KOOLMONOXYDE (DUTCH)
 OXYDE de CARBONE (FRENCH)
 WEGLA TLENEK (POLISH)

TOXICITY DATA with REFERENCE

Inhalation-Mouse TCLO: 65 ppm/24H (female 7-18D post): Reproductive effects

TJADAB 29(2), 8B, 84 (1)

Inhalation-Mouse TCLO: 8 pph/1H (female 8D post): Teratogenic effects

FPNJAG 11, 301, 58 (2)

Inhalation-Human TCLO: 600 mg/m³/10M

GTPZAB 31(4), 34, 87 (3)

Inhalation-Man LCLo: 4000 ppm/30M

29ZWAE -, 207, 68 (4)

Inhalation-Man TCLO: 650 ppm/45M: Central nervous system effects, Blood effects

AIHAAP 34, 212, 73 (5)

Inhalation-Human LCLo: 5000 ppm/5M

TABIA2 3, 231, 33 (6)

Inhalation-Rat LC50: 1807 ppm/4H

TXAPA9 17, 752, 70 (7)

Inhalation-Mouse LC50: 2444 ppm/4H

TXAPA9 17, 752, 70 (8)

Inhalation-Dog, adult LCLo: 4000 ppm/46M

HBAMAK 4, 1360, 35 (9)

Inhalation-Rabbit, adult LCLo: 4000 ppm

HBAMAK 4, 1360, 35 (10)

Inhalation-Guinea Pig, adult LC50: 5718 ppm/4H

TXAPA9 17, 752, 70 (11)

Inhalation-Mammal LCLo: 5000 ppm/5M

AEPPAE 138, 65, 28 (12)

Inhalation-Bird-wild species LD50:1334 ppm

AECTCV 12,355,83 (13)

Consensus Reports:

Reported in EPA TSCA Inventory.

Standards and Recommendations

OSHA PEL: TWA 35; CL 200 ppm

ACGIH TLV: 25 ppm; BEI: less than 8% carboxyhemoglobin in blood at end of shift; less than 40 ppm CO in end-exhaled air at end of shift. (Proposed: less than 3.5% carboxyhemoglobin in blood at end of shift; less than 20 ppm CO in end-exhaled air at end of shift.)

DFG MAK: 30 ppm (33 mg/m³); BAT: 5% carboxyhemoglobin in blood at end of shift

NIOSH REL: (Carbon Monoxide) TWA 35 ppm; CL 200 ppm

DOT Classification: 2.3; Label: Poison Gas, Flammable Gas

SAFETY PROFILE:

Mildly toxic by inhalation in humans but has caused many fatalities. Experimental teratogenic and reproductive effects. Human systemic effects by inhalation: changes in psychophysiological tests and methemoglobinemia-carboxhemoglobinemia. Can cause asphyxiation by preventing hemoglobin from binding oxygen. After removal from exposure, the half-life of elimination from the blood is one hour. Chronic exposure effects can occur at lower concentrations. A common air contaminant. Acute cases of poisoning resulting from brief exposures to high concentrations seldom result in any permanent disability if recovery takes place. Chronic effects as the result of repeated exposure to lower concentrations have been described, particularly in the Scandinavian literature. Auditory disturbances and contraction of the visual fields have been demonstrated. Glycosuria does occur, and heart irregularities have been reported. Other workers have found that where the poisoning has been relatively long and severe, cerebral congestion and edema may occur, resulting in long-lasting mental or nervous damage. Repeated exposure to low concentration of the gas, up to 100 ppm in air, is generally believed to cause no signs of poisoning or permanent damage. Industrially, sequelae are rare, as exposure, though often severe, is usually brief. It is a common air contaminant.

A dangerous fire hazard when exposed to flame. Severe explosion hazard when exposed to heat or flame. Violent or explosive reaction on contact with bromine trifluoride, bromine pentafluoride, chlorine dioxide, or peroxodisulfuryl difluoride. Mixture of liquid CO with liquid O₂ is explosive. Reacts with sodium or potassium to form explosive products sensitive to shock, heat, or contact with water. Mixture with copper powder + copper(II) perchlorate + water forms an explosive complex. Mixture of liquid CO with liquid dinitrogen oxide is a rocket propellant combination. Ignites on warming with iodine heptafluoride. Ignites on contact with cesium oxide + water. Potentially explosive reaction with iron(III) oxide between 0° and 150°C. Exothermic reaction with ClF₃, (Li + H₂O), NF₃, OF₂, (K + O₂), Ag₂O, (Na + NH₃). To fight fire, stop flow of gas.

Analytical Methods: For occupational chemical analysis use NIOSH: Carbon Monoxide

SAX'S Dangerous Properties of Industrial Materials, Ninth Edition

S340.

Class: Mutagen; Reproductively Active; Standards or Recommendations

Endnotes

1 (Popup)

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