



DETECTING CARBON MONOXIDE

FORMULA: CO | CAS: 630-08-0

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Carbon Monoxide

Formula: CO | CAS: 630-08-0

Carbon monoxide (CO) is a colourless, tasteless, odourless, and non-irritating gas formed when carbon in fuel is not burned completely. It enters the bloodstream through the lungs and attaches to haemoglobin (Hb), the body's oxygen carrier, forming carboxyhaemoglobin (COHb) and thereby reducing oxygen (O₂) delivery to the body's organs and tissues. High COHb concentrations are poisonous. Central nervous system (CNS) effects in individuals suffering acute CO poisoning cover a wide range, depending on the severity of exposure: headache, dizziness, weakness, nausea, vomiting, disorientation, confusion, collapse, and coma.

At lower concentrations, CNS effects include reduction in visual perception, manual dexterity, learning, driving performance, and attention level. Earlier work is frequently cited to justify the statement that CO exposure sufficient to produce COHb levels of ca 5% would be sufficient to produce visual sensitivity reduction and various neurobehavioral performance deficits. In a recent literature re-evaluation, however, the best estimate was that (COHb) would have to rise to 15-20% before a 10% reduction in any behavioural or visual measurement could be observed.

This conclusion was based on;

- 1, critical review of the literature on behavioural and sensory effects.
- 2, review and interpretation of the physiological effects of COHb on the CNS.
- 3, extrapolation from the effects of hypoxic hypoxia to the effects of CO hypoxia.
- 4, extrapolation from rat behavioural effects of CO to humans.

- EPA (United States Environmental Protection Agency)

Utilising Carbon Monoxide In Everyday Applications

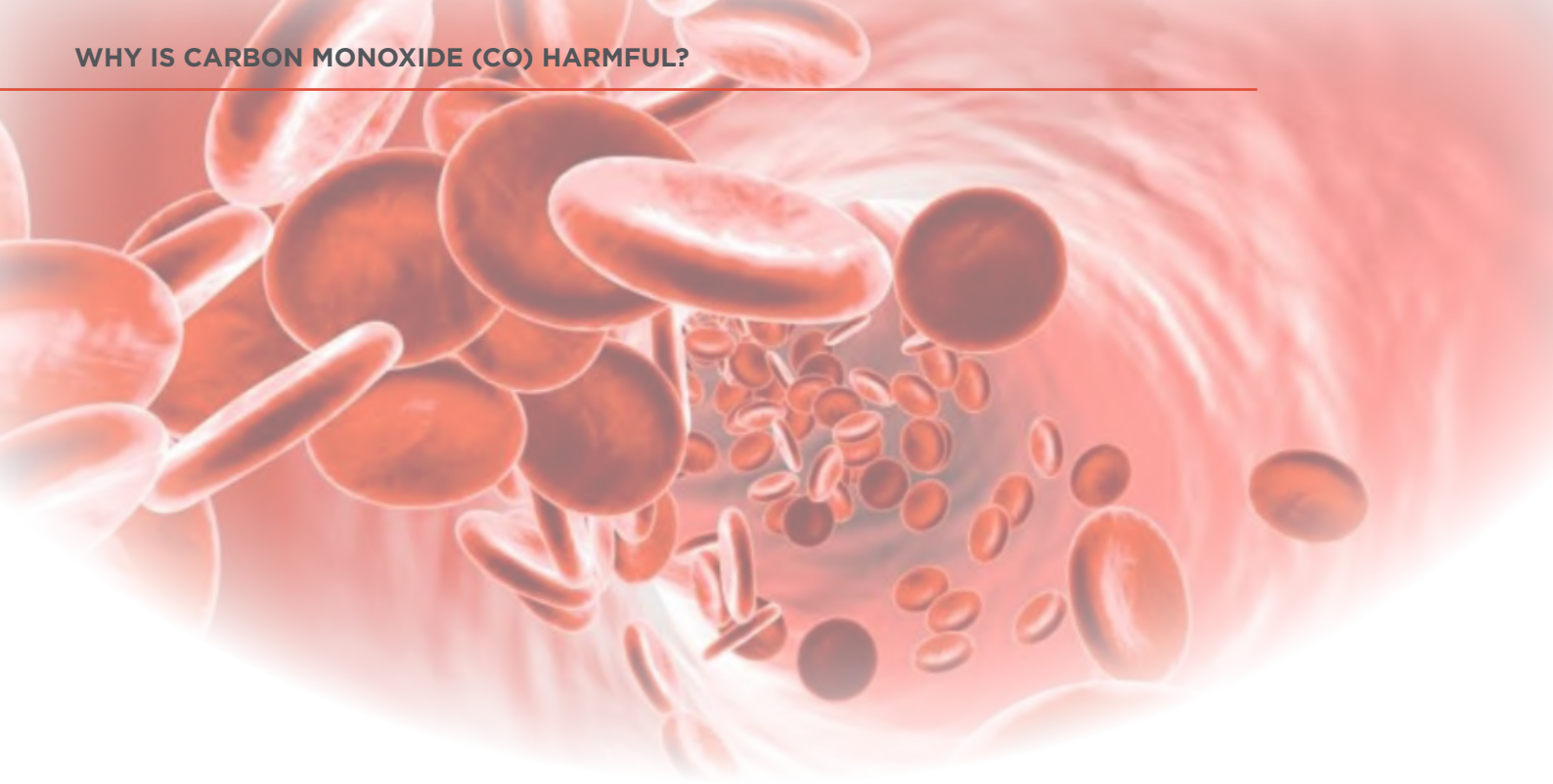
There are various applications that utilise CO gas, from chemical plants to medicine. In chemical applications, production of aldehydes is created through hydroformylation reactions of alkenes, carbon monoxide and dihydrogen. This process is part of the production of precursors placed in detergents. The gas is also found in the production of phosgene and methanol through the hydrogenation of CO gas to convert coal or biomass to diesel. Water-gas shift reactions use CO gas to produce hydrogen for its various applications.

In the food and beverage industry, carbon monoxide is used in controlled environments of packaging systems for fresh meats to maintain their fresh look. The combination of CO gas with myoglobin to form a bright red pigment known as carboxymyoglobin, which slowly turns brown when oxidised. This method is certified by the **U.S. Food and Drug Administration (FDA)** as the primary meat packaging method due to carbon monoxide gas not masking the odour when a product becomes spoiled.

Carbon monoxide is naturally produced through heme oxygenase 1 and 2, a reaction from haemoglobin breaking down, to produce a limited amount of carboxyhaemoglobin in the average person and classified as a neurotransmitter. After verification of its neurotransmission abilities, the medical field dove deep into its abilities as a biological regulator to assist in anti-inflammatories, vasodilators and encouragement of neovascular growth (when beneficial for the patient). Studies regarding CO gas in the medical field have shown the benefits of the gas improving anti-inflammatory and cytoprotective aspects in a patient, leading to prevention of pathological conditions, transplant rejections, and more.

Known as the **“Silent Killer”**, CO gas is common in mining operations. Due to the low temperatures while mining for coal, or the use of internal combustion and explosions, increases the oxidation in its solid state therefore increasing its potential hazard effects.





Why Is Carbon Monoxide (CO) Harmful?

Carbon monoxide is harmful when breathed because it displaces oxygen in the blood and deprives the heart, brain, and other vital organs of oxygen. Large amounts of CO can overcome you in minutes without warning — causing you to lose consciousness and suffocate.

Acute toxicity includes headache, nausea, dizziness, weakness, confusion, hallucinations and more. While experiencing these symptoms, the reaction to your blood will cause the blood flow to decrease resulting in lower pulse and respiratory rates. Moderate symptoms progress acute symptoms, leading to collapsing and unconsciousness. In severe cases, after a certain amount of exposure over time, moderate symptoms turn into death.

Exposure and concentrations also depend on the type of side effect you initially experience. Prolonged exposure to a concentration of 50 parts per million (ppm) results in acute symptoms. But several hours of exposure at a concentration level of 100ppm leads to moderate effects, and a short time exposure to 5000ppm is lethal.

CO gas is also highly flammable, presenting as dangerous fire and explosion risk. Storage of carbon monoxide gas should be far from areas where fire or ignition sources are present. Vapours from liquified CO gas are heavier than air and travel along the ground to ignition sources, increasing the risk of a fire or explosion. Explosive environments occur when it mixes with air in a volume range of 12.5-74%.

Storage Of Carbon Monoxide (CO)

Carbon monoxide cylinders should be stored in continuously ventilated gas cabinets or fume hoods. For example, in universities with chemical laboratory buildings it is required for all students and staff performing reactions that could or do result in CO gas to do so under a fume hood. This ensures no leak of the gas affects the health of individuals in the room. The fume hood then transports the gas through a pressurised process to a container later disposed by trained individuals.

Carbon Monoxide In Workplaces, Who Is At Risk?

CO is a common industrial hazard resulting from the incomplete burning of material containing carbon such as natural gas, gasoline, kerosene, oil, propane, coal, or wood. Forges, blast furnaces and coke ovens produce CO, but one of the most common sources of exposure in the workplace is the internal combustion engine. You may be exposed to harmful levels of CO in boiler rooms, warehouses, petroleum refineries, pulp and paper production, and steel production; around docks, blast furnaces; or in one of the following occupations:

- Welder
- Garage mechanic
- Fire fighter
- Carbon-black maker
- Organic chemical synthesizer
- Metal oxide reducer
- Longshore worker
- Diesel engine operator
- Forklift operator
- Marine terminal worker
- Tollbooth or tunnel attendant
- Customs inspector
- Police officer
- Taxi driver



How Can Employers Help Prevent CO Poisoning?

To reduce the chances of CO poisoning in the workplace, employers should take the following actions:

- Install an effective ventilation system that will remove CO from work areas.
- Maintain equipment and appliances (e.g., water heaters, space heaters, cooking ranges) that can produce CO in good working order to promote their safe operation and to reduce CO formation.
- Consider switching from gasoline-powered equipment to equipment powered by electricity, batteries, or compressed air if it can be used safely.
- Prohibit the use of gasoline-powered engines or tools in poorly ventilated areas.
- Provide personal CO monitors with audible alarms if potential exposure to CO exists.
- Educate workers about the sources and conditions that may result in CO poisoning as well as the symptoms and control of CO exposure.

Detection Of Carbon Monoxide (CO) Gas

CO gas detectors such as ION Science ARA CO detector should be considered as they alert the personnel of dangerous levels of gas exposure. Devices with a fast response time and sturdy construction are important for use in harsh environments where CO may occur. ARA CO detectors help to protect yourself/your employers from this potentially lethal gas with a personal CO alarm.

The ARA CO single gas detector is a cost-effective personal detector with 24 months or 36 months of continuous operation depending on whether the standard or hibernation model is chosen. This wearable gas detector has only one button to make use simple and alerts workers when concentration levels exceed set safety levels. The product is available from ION Science.

Visit www.ionscience.com/products/ara-co-single-gas-detector/ for more information.



Standard Model



Hibernation Model



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