Carbon Monoxide—The Silent Killer

Because you can't smell it, see it, or taste it, carbon monoxide (CO) is an insidious poison that is the leading cause of accidental poisoning deaths in the United States. It's difficult to gain accurate statistics because the symptoms of minor poisoning are so similar to the flu and other common ailments **(Table 6).** Because CO is the product of the incomplete combustion of carbon-based fuels, nursery workers exposed to gasoline motors, gas heaters, and defective stoves and furnaces are at risk.

During normal aerobic combustion, each atom of carbon in the fuel joins with two atoms of oxygen to form a harmless gas called carbon dioxide. When there is insufficient oxygen, however, each carbon atom links with only one of oxygen and forms carbon dioxide.

Poisoning occurs when the CO replaces the oxygen (02) in the blood. When CO is inhaled, the molecules pass quickly into the bloodstream and attach themselves to the hemoglobin in the blood to form carboxyhemoglobin. Hemoglobin is the red oxygen-carrying pigment in the blood, and its affinity for CO is 210 times greater than for 0_2 **(Figure 10).** This means that CO will begin

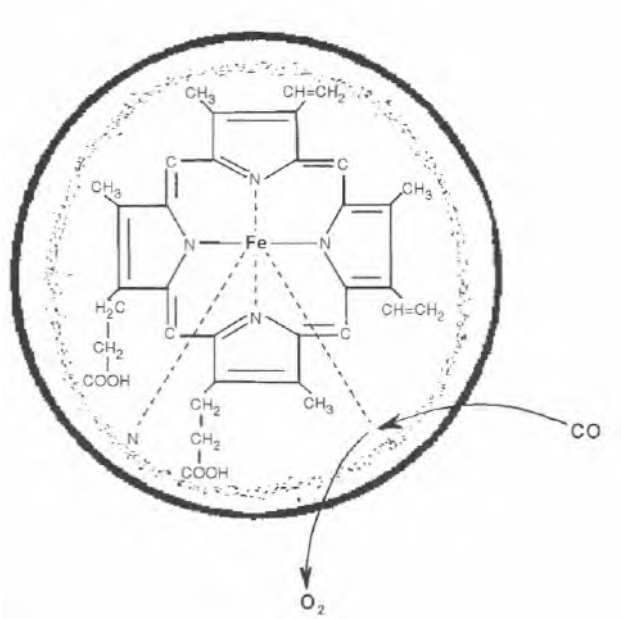

Figure 10. Even low levels of carbon monoxide (CO) in a closed environment will replace the oxygen (O_2) on the hemoglobin molecule in blood (modified from Ganong 1969)

Table 6. Health effects of human exposure to carbon monoxide (CO)

CO Level (ppm)	Exposure Time	Signs and Symptoms
200	2 to 3 hours	Mild headache
400	1 hour	Headache, muscle weakness, and nausea
800	45 minutes	Headache, dizziness, and nausea
1,300	45 minutes	Cherry-red colored skin, violent headache
1,600	30 minutes 2 hours	Headache, dizziness, and nausea Irreversible damage - death
2,000	1 hour	Irreversible damage - death
3,200	5 to 10 minutes 30 minutes	Immediate headache and dizziness Irreversible damage - death
6,400	10 minutes	Irreversible damage - death
> 10,000 (1%)	3 minutes	Irreversible damage - death

replacing 0_2 even if the ambient concentration is extremely low - 200 to 400 ppm. Workers complaining of multiple flu-like symptoms is a common indication that chronic CO poisoning is a problem. Under high CO concentrations, the blood quickly becomes oxygen deficient, leading to dizziness, nausea, and eventual death by suffocation **(Table 6).** A distinctive sign of carbon monoxide poisoning is a cherry-red coloring of the mucous membranes; people of light complexion may show a similar coloring of the skin. Although more is known about the acute symptoms, chronic CO poisoning is a more of a real hazard in the workplace.

First aid for CO poisoning is immediate exposure to fresh air followed by notification of emergency personnel to administer pure oxygen. Recovery from CO poisoning takes a long time because the hemoglobin slowly exchanges the CO for 0_2. As with most hazards, the best treatment is prevention so be sure and periodically check the exhaust system of all heaters, motors, and engines for leaks and never operate gas-powered equipment in a closed facility like the packing shed. You can usually get the fire department or other municipal safety officials to come and check for high CO levels if a problem is suspected. New digital monitoring equipment which costs less than $50 and plugs right into electrical wall sockets should be installed in all closed work areas.

Sources:

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Ganong, W.F. 1969. Review of medical physiology. Los Altos, CA: Lange Medical Publications. 628 p.