

Carbon Monoxide A Silent Killer

by Leif Albertson

Carbon monoxide (CO), a colorless, odorless gas, is responsible for the death of Alaskans every year. Anytime we burn anything (e.g., wood, fuel oil, propane, etc.) some amount of CO is produced. Carbon monoxide is produced when we burn fuels for heating and when we burn fuels inside an engine. Because we can't see, smell or taste CO, it can affect you or your family before you even know it's there. Almost all Alaska homes have sources of CO, so it is important that we understand this toxic gas and how we can protect ourselves.

Carbon monoxide can accumulate in indoor space, usually as the result of faulty combustion heating and exhaust systems. This toxic exhaust gas is absorbed by the lungs and enters the blood stream of people or pets that are exposed to it. Normally, red blood cells absorb oxygen from the lungs and distribute it to all the tissues of the body. Carbon monoxide interferes with this process because it bonds very tightly to red blood cells and prevents them from transporting oxygen throughout the body. Although the red blood cells continue to circulate throughout the body, they cannot carry oxygen as they normally would. Starved of oxygen, the body's tissues begin to suffer. This process can result in illnesses ranging from mild headaches to death.

Carbon monoxide is a leading cause of poisoning deaths in the United States, and it is a particularly important issue for Alaskans. For years, Alaska has laid claim to some of the highest rates of CO-related deaths in the nation. Because of the unusually high rates of both fatal and non-fatal CO poisonings, all Alaskans should be educated regarding this silent killer.

Why does Alaska have such high rates of carbon monoxide poisoning?

Several factors contribute to the high rate of CO poisoning in Alaska, including the cold climate. Alaskans depend heavily on combustion heating fuels (e.g., wood, fuel oil and natural gas) to provide heat during the long winter months, and combustion heat increases the risk of exposure to carbon monoxide.

In addition, many Alaskans live in communities where it is difficult to find qualified heating technicians to install and maintain furnaces and stoves. Consequently, many heating appliances are improperly installed and may receive insufficient maintenance. Properly installed and maintained heating appliances are much less likely to result in CO poisoning.

Finally, because of the cold climate Alaskans generally strive to create very "tight" homes in an effort to eliminate drafts and reduce heating costs. If there is a source of CO in a home with less ventilation, the



gas can build up to toxic levels more easily. In an old, drafty home, carbon monoxide would be more likely to dissipate before it reached dangerous levels.

Heavy dependence on combustion heating, poor access to skilled technicians and increased efforts to “tighten” homes along with the fact that Alaskans tend to spend a high percentage of their time indoors create a concerning situation.

What are the symptoms of carbon monoxide poisoning?

Carbon monoxide can cause many symptoms that range widely in severity. Because the symptoms tend to be non-specific, they can be mistaken for other illnesses, such as the flu. The most common symptoms of CO poisoning are:

- ▶ Headache
- ▶ Dizziness

- ▶ Weakness
- ▶ Nausea
- ▶ Vomiting
- ▶ Chest pain
- ▶ Confusion

It’s important to understand that most deaths occur while people are asleep. People who are sleeping or have been drinking might not notice the above symptoms before it’s too late. Additionally, the effects of CO might affect some people more than others. For this reason, it is difficult to predict how someone will respond to a given concentration of CO. The chart below is meant as a guideline to compare some of the physical effects with different CO concentrations. You can see from the chart that CO detectors do a great job of alerting us to a potential CO hazard before we even notice symptoms.

CO concentration (parts per million)	Acceptable operating conditions/physiological effects	Safety standard for CO detectors (UL 2034)
0–7	Normal conditions in and outside Alaska homes	
9	Maximum allowable outdoor concentration averaged over an 8-hour period (EPA NAAQS)	
30		CO detectors must not alarm within 30 days.
50	Maximum allowable indoor air concentration averaged over an 8-hour period in an occupational setting (OSHA PEL)	
70		CO detectors must alarm between 60 and 240 minutes.
150		CO detectors must alarm between 10 and 50 minutes.
200	Mild headache following 2–3 hours of exposure; maximum concentration allowed in an occupational setting at any time (OSHA ceiling)	
400	Headache and nausea after 1–2 hours of exposure	CO detectors must alarm between 4 and 15 minutes.
800	Headache, nausea and dizziness after 45 minutes; collapse and unconsciousness after 1 hour of exposure	
1,200	Loss of consciousness after 1 hour of exposure; instantaneous exposure limit, which is immediately dangerous to life and health (NIOSH IDLH)	
1,600	Headache, nausea and dizziness after 20 minutes of exposure	
3,200	Headache, nausea and dizziness after 5–10 minutes; collapse and unconsciousness after 30 minutes of exposure	
6,400	Headache and dizziness after 1–2 minutes; unconsciousness and danger of death after 10–15 minutes of exposure	

NAAQS = National Ambient Air Quality Standards; PEL = Permissible Exposure Limits; IDLH = Immediately Dangerous to Life or Health

Sources: Environmental Protection Agency (EPA), Occupational Safety and Health Administration (OSHA), National Institute for Occupational Safety and Health (NIOSH), National Fire Protection Association (NFPA), UL standard 2034

Where does carbon monoxide come from and what can I do to protect myself and my family?

Since all combustion appliances inside the home produce some CO, the most important action you can take to prevent poisoning is to make sure that appliances are operating properly and exhausting correctly. Make sure that your fuel-burning appliances are properly installed, operated and maintained to protect yourself and your family from exhaust fumes. Have your boiler, furnace or wood stove inspected and serviced annually to ensure that it is running smoothly and exhausting correctly. When cooking with fossil fuels, use exhaust fans and range hoods.

Attached garages are also a common source of CO in the home. Combustion engines also produce CO, so warming up your car inside a garage can easily create harmful levels of CO inside a home.

Nationwide, portable generators cause a significant percentage of poisonings, including those from occupational exposure, such as on a construction site, as well as home exposure. According to the Federal Emergency Management Agency (FEMA), portable generators can produce 100 times more CO than a typical automobile engine. Many homeowners have portable generators to power their homes in the event of a prolonged power outage, such as in the event of a natural disaster. Always operate portable generators well away from the home; never operate a generator inside an attached garage, even with the garage door open. Never operate near open windows or doors.

Remember, all combustion engines produce carbon monoxide. Chainsaws, snowmachines, four-wheelers or automobiles operated in or near a home can cause elevated levels of carbon monoxide inside the home.

Carbon monoxide detectors

Carbon monoxide detectors are sensitive devices that are designed to alert you to toxic levels of CO before you experience symptoms. Carbon monoxide detectors are easy to purchase at stores or online and cost between \$15 and \$40. Because CO is

produced by combustion heating (boilers, furnaces, wood stoves, etc.) as well as combustion engines (cars, four-wheelers, chainsaws, chainsaws, etc.), almost all Alaska homes have a source of CO and should have a CO detector.

There are different kinds of CO detectors on the market. While they must all conform to the same industry standards for alarm sensitivities, some detectors have added features. Some operate on a battery, while others plug into an outlet. Plug-in detectors with a battery backup will function even during a power outage. It is also helpful to have a detector with a digital readout or a “peak level” feature. If your alarm does sound, this feature can help you, or medical personnel, get an idea of what your potential exposure to CO may have been. An “end-of-life” warning feature alerts you when it is time to replace your detector. Carbon monoxide detectors do not last forever and, depending on the model, should be replaced every five to seven years.

Follow the manufacturer’s recommendations on where to put the detector. Detectors should be placed at breathing level on every floor. Since poisoning tends to be most common while victims are asleep, detectors should be placed near sleeping areas.

Carbon monoxide and the law

Alaska Statute 18.70.095, which deals with both smoke detectors and carbon monoxide detectors, states:

“... carbon monoxide detection devices shall be installed and maintained in all qualifying dwelling units in the state.” Any housing unit with an attached garage or installed fuel-burning appliance is covered by this law.

The law requires that CO detectors “must have an alarm, and shall be installed and maintained according to the manufacturer’s recommendations.”

In the case of rentals, the landlord must supply the detector; the tenant is obligated to maintain the detector, test it regularly and not disable it. If someone dies or is injured in a rental unit where there is not a working CO detector, it can be considered negligence and the landlord could be liable.

Quick facts about carbon monoxide

- ▶ Carbon monoxide detectors have been required by state law since 2005.
- ▶ Carbon monoxide detectors cost about \$35. Some have added features, such as a digital readout.
- ▶ If you rent a home, your landlord is required to provide a CO detector for you, but you must change the batteries.
- ▶ Carbon monoxide detectors do not last forever. Many brands recommend replacing every five years.
- ▶ Carbon monoxide can be produced by any combustion. This includes wood stoves, Toyo stoves, boilers, furnaces and propane space heaters and engines.
- ▶ Sealing drafts in homes (“weatherizing”) can create carbon monoxide problems. When sealing drafts, it’s important to consider how this could affect overall ventilation and air inside the home.
- ▶ Children, the elderly, those with respiratory/circulatory difficulties and inebriates are at particular risk from CO exposure.
- ▶ Proper installation and annual maintenance of boilers and wood stoves is critical to avoiding CO problems in your home.
- ▶ Carbon monoxide poisoning in Alaska is common in temporary shelters, such as tents. Proper ventilation for heating appliances is vital whether in a house, shack or tent.
- ▶ Running small engines (such as portable pumps or generators) too close to homes is a common cause of carbon monoxide poisoning.

To simplify information, trade names of products have been used. No endorsement of named products by the University of Alaska Fairbanks Cooperative Extension Service is intended, nor is criticism implied of similar products that are not mentioned.

References

- Sircar, Kanta et al. 2015. Carbon Monoxide Poisoning Deaths in the United States, 1999-2012. *American Journal of Emergency Medicine* 33 (9): 1140-1145. [www.ajemjournal.com/article/S0735-6757\(15\)00380-0/pdf](http://www.ajemjournal.com/article/S0735-6757(15)00380-0/pdf).
- Centers for Disease Control and Prevention, National Center for Environmental Health, Division of Environmental Hazards and Health Effects, Air Pollution and Respiratory Health Branch, Atlanta, GA 30333, USA.
- U.S. Fire Administration. Portable Generator Hazards. Last reviewed Oct., 2013. www.usfa.fema.gov/prevention/outreach/carbon_monoxide.html.
- ### Symptoms and PPMs
- Centers for Disease Control and Prevention. Carbon Monoxide Poisoning Frequently Asked Questions. www.cdc.gov/co/faqs.htm.
- Iqbal, S., J.H. Clower, M. King, J. Bell and F.Y. Yip. 2012. National Carbon Monoxide Poisoning Surveillance Framework and Recent Estimates. *Public Health Report* 127 (5): 486-96. www.ncbi.nlm.nih.gov/pubmed/22942466.
- Hospitalizations Due to Unintentional Carbon Monoxide Poisoning — Alaska, 1993–2010. *State of Alaska Epidemiology Bulletin No. 15*, July 26, 2012. www.epi.hss.state.ak.us/bulletins/docs/b2012_15.pdf.
- National Fire Protection Association. Jan. 5, 2009. Symptoms of CO Poisoning. www.nfpa.org/public-education/by-topic/fire-and-life-safety-equipment/carbon-monoxide/symptoms-of-co-poisoning.
- ### Alarm Specs
- UL 2034: *Single and Multiple Station Carbon Monoxide Alarms*. <http://ulstandards.ul.com/standard/?id=2034>.

www.uaf.edu/ces or 1-877-520-5211

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07-14/LA/03-21

Reviewed March 2021