



Environmental Disease Case Reporting and Investigation Protocol
CARBON MONOXIDE (CO) POISONING

I. IDENTIFICATION AND DEFINITION OF CASES

- A. **Clinical Description:** Carbon monoxide (CO) is a colorless, odorless, nonirritating gas that is produced through the incomplete combustion of hydrocarbons. CO 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 cause loss of consciousness and suffocation. All individuals are susceptible to CO poisoning, but persons especially at risk include young children, pregnant women, persons of advanced age, and persons with chronic cardiac or respiratory disease. The clinical presentation of acute CO poisoning varies depending on the duration and magnitude of exposure.

Typical symptoms include, but are not limited to, headache, dizziness, fatigue, weakness, nausea, vomiting, confusion, shortness of breath, chest pain, and loss of consciousness. CO poisoning can be fatal and is a leading cause of unintentional poisoning deaths in the U.S. CO is produced in combustion and is a risk in cases of fire. Other sources of CO include: gasoline or diesel-powered engines (for example, motor vehicles and generators), furnaces, gas space heaters, woodstoves, gas stoves, fireplaces, and tobacco smoke.

B. Laboratory Criteria:

- **Confirmatory:** Nonsmoker with *blood* COHb $\geq 5.0\%$
Smoker with *blood* COHb $> 12.0\%$
Unknown smoking status:
For children < 14 years, *blood* COHb $\geq 5.0\%$
For persons ≥ 14 years, *blood* COHb $> 12.0\%$
- **Presumptive:** Smoker or unknown smoking status (age ≥ 14 years) with *blood* COHb $\geq 9.0\%$ and $\leq 12.0\%$
- **Supportive:** Nonsmoker with *blood* COHb $\geq 2.5\%$ and $< 5.0\%$
Smoker with *blood* COHb $\geq 7.0\%$ and $< 9.0\%$
Unknown smoking status:
For children < 14 years, *blood* COHb $\geq 2.5\%$ and $< 5.0\%$
For persons ≥ 14 years, *blood* COHb $\geq 7.0\%$ and $< 9.0\%$

C. Clinical Criteria:

- **Presumptive:** Loss of consciousness or death
- **Supportive:** CO poisoning symptoms
Elevated *pulse* CO-oximetry reading $\geq 5.0\%$

D. Environmental Exposure Criteria:

- **Confirmatory:** Exposure to measured, elevated CO level for known duration consistent with CO poisoning.
- **Possible:** Alarm of CO detector, or CO-related symptoms associated with a CO-emitting source.

E. Wisconsin Case Definition:

Please note that cases are defined by laboratory evidence OR a combination of clinical and environmental exposure evidence.

- **Using Laboratory Evidence and Smoking Status:**
 - o Confirmed: Confirmatory laboratory evidence
 - o Probable: Presumptive laboratory evidence
 - o Suspect: Supportive laboratory evidence

* Environmental exposure is defined as patient-reported exposure to any CO-producing combustion device. See Clinical Description for examples.

** Environmental monitoring is defined as air measurements of CO. Elevated CO levels are those greater than 30 parts per million (ppm).

- **Using Clinical and Environmental Exposure Evidence:**
 - o Confirmed: Presumptive or supportive clinical evidence **and** confirmatory environmental exposure
 - o Probable: Presumptive clinical evidence **and** possible environmental exposure, **or** Presumptive or supportive clinical evidence **and** epidemiological link to confirmed case
 - o Suspect: Supportive clinical evidence **and** possible environmental exposure

II. REPORTING

- A. **Wisconsin Disease Surveillance Category II – Methods for Reporting:** This disease shall be reported to the patient's local health officer or to the local health officer's designee within 72 hours of recognition of a case or suspected case, per Wis. Admin. Code § [DHS 145.04\(3\)\(b\)](#). Report electronically through the Wisconsin Electronic Disease Surveillance System (WEDSS), or mail or fax a completed Acute and Communicable Disease Case Report ([F-44151](#)) to the address on the form.
- B. **Responsibility for Reporting:** According to Wis. Admin. Code § [DHS 145.04\(1\)](#), persons licensed under Wis. Stat. ch. [441](#) or [448](#), laboratories, health care facilities, teachers, principals, or nurses serving a school or day care center, and any person who knows or suspects that a person has a communicable disease identified in [Appendix A](#).
- C. **Clinical Criteria for Reporting:** Clinically compatible illness
- D. **Laboratory Criteria for Reporting:** Laboratory evidence of carbon monoxide poisoning, defined as a COHb level $\geq 2.5\%$ in a blood sample

III. CASE INVESTIGATION

- A. **Responsibility for case investigation:** It is the responsibility of the local health department (LHD) to investigate or arrange for investigation of suspected or confirmed cases as soon as is reasonably possible. A case investigation may include information collected by phone, in-person, in writing, or through review of medical records or disease report forms, as necessary and appropriate.
- B. **Required Documentation:**
 1. Complete the WEDSS disease incident investigation report, including appropriate, disease-specific tabs.
 2. Upon completion of investigation, set WEDSS disease incident process status to "Sent to State."
- C. **Additional Investigation Responsibilities**
Determine whether the case is linked to mass exposure (>10 cases) and, if so, notify the Division of Public Health (DPH), Bureau of Environmental and Occupational Health (BEOH).

IV. PUBLIC HEALTH INTERVENTIONS AND PREVENTION MEASURES

- A. Local public health should provide routine education to the public on ways to prevent CO exposure, including the following:
 - Install CO alarms approved by Underwriters Laboratories in your home if you have fuel-burning appliances, fireplaces, or attached garages. According to Wis. Admin. Code § [SPS 328.04\(3\)](#), CO alarms must be installed and maintained in homes, apartment buildings, and any establishments that are used for sleeping or lodging purposes. [Alarms should be installed on every floor level](#), including the basement, and outside each sleeping area.
 - Maintain fireplace, ventilation systems, and gas-powered furnaces, including chimneys, flues, and vents, and have them serviced annually.
 - Do not burn charcoal inside a house, garage, vehicle, tent, or fireplace.
 - Never leave an automobile running in a closed garage or in a garage attached to the house—even with the garage door open.
 - While driving, keep the rear window or tailgate of a vehicle closed, as carbon monoxide from the exhaust can be pulled inside.
 - Do not use unvented combustion heaters in enclosed spaces, especially sleeping areas.
 - Never operate barbecue grills indoors or use stove tops or ovens that operate on flammable fuels to heat a residence.

- Never run a generator, pressure washer, or any gasoline-powered engine inside a basement, garage, or other enclosed structure, even if the doors or windows are open, unless the equipment is professionally installed and vented.
- If you operate a boat, especially a houseboat:
 - o CO from engine exhaust builds up inside and outside the boat in areas near exhaust vents. Stay away from these areas while propulsion engines or generator are running.
 - o Schedule regular engine and exhaust inspections by trained technicians.
 - o Consider installing a marine CO detector on boats with enclosed spaces.
 - o Engineering controls to prevent CO poisoning on boats are being developed by manufacturers. Visit the Centers for Disease Control and Prevention [Carbon Monoxide Dangers in Boating](#) webpage for additional information.
 - o Be aware that dangerous concentrations of CO can accumulate within seconds.
- If you suspect you are experiencing any symptoms of CO poisoning, open doors and windows, turn off gas appliances, and go outside. In cases of severe CO poisoning, call 911 emergency services or call the Wisconsin Poison Center at 1-800-222-1222.

V. CONTACTS FOR CONSULTATION

- A. Local health departments and tribal health agencies: <https://www.dhs.wisconsin.gov/lh-depts/index.htm>
- B. Medical management of CO poisoning: Wisconsin Poison Center: 1-800-222-1222
- C. Wisconsin Bureau of Environmental and Occupational Health: 608-266-1120

VI. RELATED REFERENCES

- A. Council of State and Territorial Epidemiologists. Public Health Reporting and National Notification for Carbon Monoxide Poisoning. <http://c.ymcdn.com/sites/www.cste.org/resource/resmgr/PS/13-EH-01.pdf>.
- B. Hampson N.B., Piantadosi C.A., Thom S.R., Weaver L.K. Practice recommendations in the diagnosis, management, and prevention of carbon monoxide poisoning. *Am J Respir Crit Care Med*. 2012 Dec 1; 186(11):1095-101.
- C. Centers for Disease Control and Prevention (CDC). Nonfatal, unintentional, non--fire-related carbon monoxide exposures--United States, 2004-2006. *MMWR Morb Mortal Wkly Rep*. 2008 Aug 22; 57(33):896-9. <https://www.cdc.gov/mmwr/preview/mmwrhtml/mm5733a2.htm>.
- D. Centers for Disease Control and Prevention (CDC). Carbon monoxide--related deaths--United States, 1999-2004. *MMWR Morb Mortal Wkly Rep*. 2007 Dec 21; 56(50):1309-12. <https://www.cdc.gov/mmwr/preview/mmwrhtml/mm5650a1.htm>.