



Boating Safety Circular 86

BOATING AND CARBON MONOXIDE POISONING A DANGEROUS COMBINATION

Just because you're boating, doesn't mean you don't need to be vigilant about the dangers of carbon monoxide (CO) poisoning. Carbon monoxide is a toxic, odorless, colorless, tasteless gas produced by the burning of carbon-based fuels, such as gasoline, charcoal and propane. On boats, CO gas is emitted by engines, gas generators, cooking ranges and heaters. The build-up of CO inside boat cabins, partially enclosed cockpits, beneath swim platforms or other enclosed areas is potentially deadly. Carbon monoxide in high concentrations can be fatal in a matter of minutes. Unless the symptoms are severe, carbon monoxide poisoning is often misdiagnosed as seasickness; however, lower concentrations must not be ignored because the effects of exposure to carbon monoxide are cumulative and can be just as lethal.

Let's face it. Boating and carbon monoxide poisoning are a dangerous combination. Here are some typical accident scenarios to give you an idea as to the extent of the problem:

... about 9 a.m., water patrol officers were called to help a woman who was screaming for help. Officers found her husband unconscious on the boat. He apparently passed out because of a carbon monoxide leak aboard the boat. The boat's carbon monoxide detectors were not working.

Nowadays many boats are equipped with carbon monoxide (CO) detectors, but the CO detectors on many older boats are susceptible to false alarms and might have been disconnected; other CO detectors may appear to work when in fact they may not sound an alarm in the presence of medium to high levels of CO gases. The Coast Guard advises the owners of all inboard and sterndrive

powered boats built prior to 1998 to inspect their CO detectors. If the CO detector on your boat has been disconnected, or if the exterior cover of the device does not bear the word "marine," the Coast Guard urges immediate replacement with newer CO detection technology.

Improvements in technology and reliability of carbon monoxide gas detectors have reached the point that their installation in accommodation spaces should be considered by all safety conscious recreational boaters. American Boat and Yacht Council ABYC Standard A-24 recommends CO detectors on any boat with accommodation spaces and gasoline powered engines or generators.

Detectors are available as single and multi station systems, fully integrated systems and self-contained units with internal batteries. The major drawback to the units with internal batteries is, should the battery go dead, the detector is incapable of indicating the presence of carbon monoxide. The newer CO detectors have fault circuit checks and other features that were not available in the older models and are considered more reliable with fewer false alarms.

On older CO detector models, detector sensitivity (susceptibility to false alarms) increases with the unit's age; however, owners should learn to react to every alarm as a situation which

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requires immediate action. If your CO detector sounds an alarm, and neither your engine nor a generator are running, do not assume a false alarm. A boat next to you might be the source of the CO and the reason for the alarm. Boat owners should replace their CO detectors as recommended by the device manufacturer.

Follow this link to a list of marine type CO detectors at the Office of Boating Safety website: <http://www.uscgboating.org/articles/>

. . . three people who had been running a generator to power an air conditioner aboard a houseboat were sent to the hospital after complaining of carbon monoxide poisoning symptoms. The boat was in a canyon and the children were sleeping in the rear of the boat next to an open window, while a generator there was running to power the air conditioning. Their symptoms were headache, nausea and vomiting.

The common practice of running gasoline-powered generators to power air conditioning, entertainment centers and galley appliances while anchored or moored creates another situation in which carbon monoxide can accumulate in dangerous concentrations, particularly if an air conditioner is located near the exhaust port for a generator.

Gasoline powered **portable** generator sets also produce carbon monoxide. Some marine surveyors have reported seeing small generators on boats that have been mounted in the bilge to do nothing more than power high-wattage stereos. The generators were installed by the same businesses that sold the stereos. Currently, no portable generators meet the Coast Guard Electrical and Fuel System Standards. The fuel tank is usually on top of the generator directly above electrical components that are not ignition-protected. The exhaust system on a portable generator is usually constructed of nonmarine alloys that can rust through after brief exposure to a salt water environment. The hot exhaust is typically run to the transom by a dry (non water-cooled) rubber hose. Once the exhaust hose on a portable generator fails, it doesn't take long to fill the engine compartment and eventually the cabin with dangerous levels of carbon monoxide.

. . . a child who vomited and who appeared to be having a seizure were a family's first clue something was wrong. Before the ordeal ended, 21 people aboard the boat were treated for carbon monoxide poisoning in what one person called the largest case of carbon monoxide poisoning he had seen. It was the third such poisoning in the area in less than a week, and the cases have spurred authorities to again warn boaters about dangers posed by the colorless, odorless gas.

Some houseboat transom designs consist of a recessed area amidships forward of the swim platform creating a cavity for engine and generator exhaust ports. When the generator is running the carbon monoxide gas buildup in this cavity, on or near the swim platform, and near the rear deck space is so high, that there is an imminent danger of death for anyone in or near the cavity for even a very short period of time. For that reason, all owners and operators of boats equipped with swim platforms and gasoline-powered generators with exhaust ports on the transom are advised to turn off their generators when their boats are at anchor or moored and passengers are on or near the swim platform or swimmers are in the water. Keep passengers, particularly unsupervised children, off the back deck or a swim platform while gasoline engine(s) or a generator are running.

CO can accumulate anywhere in or around your boat, including on back decks, swim platforms, or on the water around generator exhausts. CO can remain in or around your boat at dangerous levels even if your engine or another boat's engine is no longer running! Don't run engine(s) or auxiliary generator(s) on boats with enclosed accommodation spaces unless the boat is equipped with a functioning marine carbon monoxide detector that complies with ABYC A-24 - Carbon Monoxide Detection Systems on Boats.

. . . authorities said one person died and three others are out of the hospital after suffering carbon monoxide poisoning while aboard a boat moored at a marina. . . . when medical officials arrived on the scene, they found all four victims unconscious. A survivor said one of the engines started to lose power, and the victim went below to open the hatch leading to the engineroom. The victim complained of not feeling well and

eventually collapsed. Authorities said they were looking at both engines and the generator as a possible cause of the carbon monoxide leak.

New propulsion engines and generator sets with catalytic converters produce reduced quantities of carbon monoxide; but what about the CO produced on the large numbers of used-boats?

What to Inspect on Your propulsion Engine or Generator Set:

* Inspect and confirm that the engine(s) and generator(s) are properly tuned, and well maintained.

* Inspect each water pump impeller and the water pump housing; consider replacement if worn.

* Inspect and confirm that cooling system(s) are in working condition.

* Inspect and confirm that all hose clamps are in good condition and securely tightened.

* Inspect and confirm that there are no leaks around the cylinder head gaskets, exhaust manifold gaskets, water inject exhaust elbows, pipe nipples between water injected elbows and exhaust manifolds, and exhaust pipes, hoses and fittings.

* Inspect and check the generator temperature sensor (if installed) to ensure that it has not been damaged by exposure to excessive exhaust temperature and that the sensor is still working properly.

* Inspect and confirm proper operation of the generator cooling water anti-siphon valve (if equipped).

What to look for includes:

- * Exhaust leaks
- * Cracks in hoses, pipes and components
- * Black streaking (this can mean loose parts are allowing exhaust to escape)
- * Corrosion in hoses, pipes and components
- * Corroded pipe nipple on exhaust elbow (move the elbow to check for looseness)
- * Change in exhaust sound
- * Change in exhaust smell in the engine room or boat interior (CO is odorless, but may be mixed with other exhaust gases)
- * Check for pitting, pinholes, and cracks or loose rust at the ends of pipe nipples and thread roots
- * Replace any component that is cracked, charred, or deteriorated.

. . . two women suffered carbon monoxide poisoning while swimming among a number of boats that were afloat in a cove at the far northern end of a lake. Boaters often gather there and leave engines and generators running, creating the potential for CO poisoning. The women were pulled from the water by off-duty firefighters. The women were breathing on their own but in an "altered stage of consciousness" because of the CO poisoning.

Large numbers of powerboaters often gather for manufacturer-sponsored regattas or as spectator boats at poker runs and other boat racing activities. Unfortunately, when large numbers of boats gather together they create significantly larger and more concentrated amounts of carbon monoxide. Individuals, particularly children, should avoid swimming near large numbers of boats adrift or at anchor with engines or generators running.

The National Institute for Occupational Safety and Health (NIOSH) conducted a series of studies of CO exposure on houseboats and express cruisers and found high levels of CO gas at or near the swim platform when the boats were either stationary or underway. When a boat is stationary and the engine(s) and/or generator set are running, the CO buildup at the transom of the boat, on the swim platform, and around the rear deck space may be so high that it creates an imminent danger for anyone who remains in these areas for even a short period of time.

The use of hand-held showers at or near the swim platform when gasoline fueled engine(s) and/or a generator set are running is hazardous to your health. As recently as a year ago, a website provided skiboat owners with instructions for installing an aftermarket hand-held hot water shower system at the swim platform. Unfortunately, instead of a hot water heater, the system required the engine to be running to heat the shower water. The Coast Guard informed the author about the lethally high levels of CO that may be found around the swim platform during engine operation, and the website promptly removed the article. The Coast Guard recommends that any owner of a gasoline powered boat who has installed a hand-held shower

connected to the engine's raw water open cooling system, to disconnect the shower immediately.

. . . officials say three people were found dead this afternoon on a cabin cruiser. Officials say they were apparently killed by carbon monoxide poisoning. Around 1:00 pm, authorities responded to reports of unconscious individuals and found two women and one man dead inside the 30-foot cabin cruiser. Carbon monoxide meters showed the level of the deadly gas at 30 parts per million; levels that high always require an evacuation of the area.

Treat symptoms of seasickness as possible CO poisoning, unless you can be sure it's not carbon monoxide.

Other CO Sources

Do not use any flame producing device in an unventilated area. Any heater, stove or lantern that produces an open flame uses oxygen. The argument that these devices do not produce carbon monoxide does not apply when they are used in enclosed spaces. Alcohol heaters and stoves, propane heaters and stoves, catalytic heaters, oil lamps, gasoline lanterns, even charcoal stoves consume oxygen. When the amount of oxygen in the air gets below a certain level, these devices produce carbon monoxide because of incomplete combustion of their fuel. Ventilation must be

provided whenever any device producing an open flame is used in a boat cabin.

Carbon Monoxide (CO) Checklist

The Coast Guard recommends that new owners be provided with a printed copy of the following carbon monoxide checklist to show them how to conduct appropriate system checks.

Each Time You Go On a Boat Trip

- * Educate all passengers about where exhaust outlets are located on your vessel, the symptoms of CO poisoning, and where CO may accumulate.
- * When docked, or rafted with another boat, be aware of exhaust emissions from the other boat.
- * Confirm that water flows from the exhaust outlet when the engines and generator are started.
- * Listen for any change in exhaust sound, which could indicate an exhaust component failure.
- * Test the operation of each CO alarm by pressing the test button.

Once a Month

- * Make sure all exhaust system clamps are in place and secure.
- * Look for potential sources of leakage from exhaust system components. Signs include rust and/or black streaking, water leaks, or corroded or cracked fittings.
- * Inspect rubber exhaust hoses for burned, cracked, or deteriorated sections. All rubber hoses should be pliable and free of kinks.

US Coast Guard Brochure - Carbon Monoxide Poisoning – What You Can't See...Can Harm You

A comprehensive and easy-to-understand brochure about the dangers of carbon monoxide, how it accumulates, and ways to prevent carbon monoxide poisoning can be downloaded and printed from the Office of Boating Safety website:

<http://www.uscgboating.org/command/co/tools.htm>

Copies of the brochure are available by calling (202) 372-1067 or from your local Guard Auxiliary Flotilla.

ABYC AND NMMA CARBON MONOXIDE WARNING DECALS

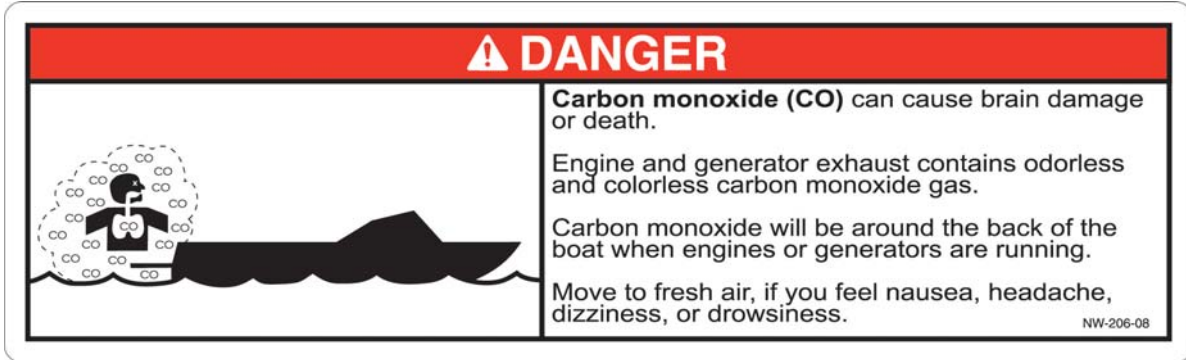
The American Boat & Yacht Council (ABYC) and the National Marine Manufacturers Association developed three standard CO decals for display on recreational boats. Order these CO decals directly from NMMA (see below) or download a printable version at the Office of Boating Safety website: www.uscgboating.org/command/co/tools.htm and print them onto paper with an adhesive backing to create your own CO decals. Since the decals are not displayed on most used boats, the Coast Guard urges all owners to obtain copies of the labels and to place them on their boats as indicated to inform others of the hazards of CO poisoning.

To order CO Decals from NMMA go to <http://www.nmma.org/certification/publications/decals.asp> or contact the NMMA Order Desk at 1-888-558-2272 or email: orderdesk@nmma.org.

CO TRANSOM LABEL

(NW 206-08) This label is required on all boats sold in the State of California in accordance with AB2222.

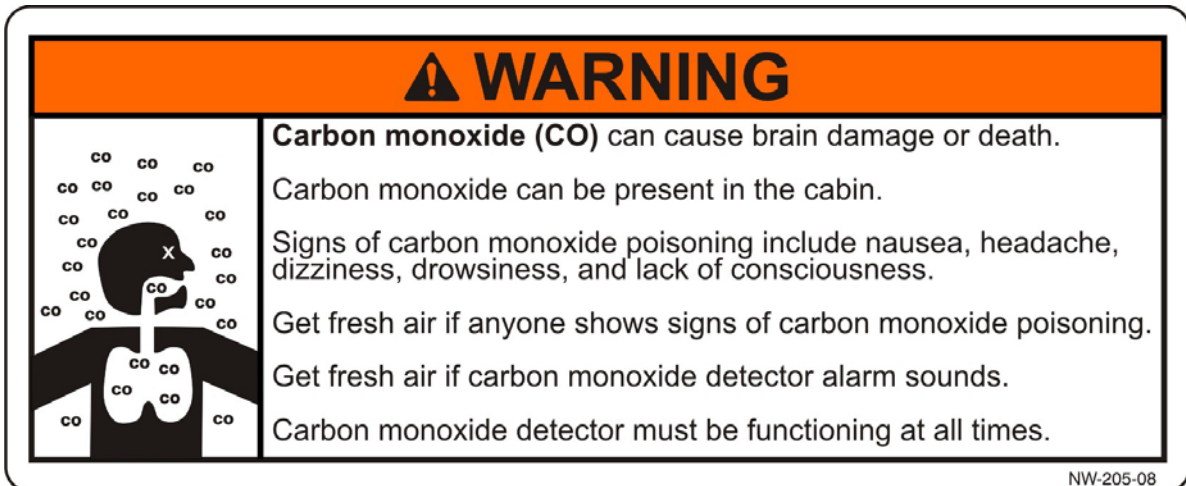
[Order from NMMA \$75.00/250 plus S&H]



CO CABIN LABEL

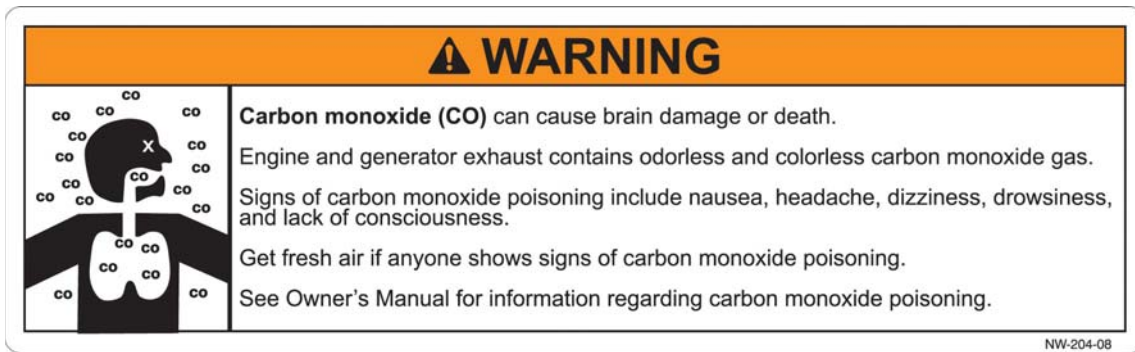
(NW 205-08)

[Order from NMMA \$62.50/250 plus S&H]



CO HELM LABEL

(NW 204-08) This label is required on all boats sold in the State of California in accordance with AB2222. [Order from NMMA \$75.00/250 plus S&H]



KNOW MORE ABOUT IT BROCHURES

The National Marine Manufacturers Association has published a series of “Know More About It” brochures. The brochures are a great addition to owners manuals and information packages for the boat owner. They have been developed by marine professionals and are widely used throughout the industry. Each of the brochures offers important contact information and where to go to get additional information about each of the topics:

Propeller Safety

This brochure explains the dangers of propeller strikes and lists safety checks and measures to ensure propeller safety while boating. \$15.00/100 plus S&H.

Carbon Monoxide Poisoning

This brochure outlines the dangers of carbon monoxide gases that are emitted from gasoline engines. It advises how to avoid CO poisoning and identifies measures a boat owner can take to avoid the effects of CO. \$15.00/100 plus S&H.

Electrical Shock

This brochure outlines problems associated with dockside power on a boat. It explains proper handling of electrical cable and practices in and around the dock electrical hookup. \$15.00/100 plus S&H.

Marine Fuel Systems Safety

This brochure offers information on the inspection and maintenance of gasoline fuel systems onboard boats. Also included are tips on hazard avoidance, a checklist for each time the boat is operated and annual inspection guidelines. \$15.00/100 plus S&H.

Water Skiing Safety

This brochure outlines proper water skiing etiquette, proper signals, and safe boat handling while towing water skiers. \$15.00/100 plus S&H.

To order any of the brochures, download an order form from <http://www.nmma.org/certification/publications/order.asp> or contact the NMMA order desk at 1-888-588-2272 or email orderdesk@nmma.org.