



November 1, 2017

Senator Bill Ingebrigtsen, Chair  
Environment and Natural Resources Finance Committee  
3207 Minnesota Senate Building  
St. Paul, MN 55155

Representative Dan Fabian, Chair  
Environment and Natural Resources Policy and Finance Committee  
359 State Office Building  
St. Paul, MN 55155

Dear Senator Ingebrigtsen and Representative Fabian:

The Laws of 2016, Chapter 189, Article 3, Section 45 direct the commissioner of natural resources to submit a report which *must outline any issues encountered relating to implementation of Minnesota Statutes, section 86B.532, any changes to marine manufacturing industry standards relating to carbon monoxide, the availability of plug-in or battery-powered marine certified carbon monoxide detectors, and best practices in preventing carbon monoxide poisoning relating to motorboat operation, including the feasibility of requiring carbon monoxide detectors that are more sensitive in measuring carbon monoxide than required in this act* (Sophia's Law). The attached report fulfills this requirement.

If you have any questions regarding this report, please contact Assistant Commissioner Bob Meier at 651-259-5024 or [bob.meier@state.mn.us](mailto:bob.meier@state.mn.us).

Sincerely,

A handwritten signature in blue ink, appearing to read 'Tom Landwehr'.

Tom Landwehr  
Commissioner

CC: Senator Melisa Franzen  
Representative Jerry Hertaus  
Dallas Fischer, Committee Administrator  
Amy Zipko, Committee Administrator  
Legislative Reference Library

## Sophia's Law Report

November 1, 2017

The purpose of this report is to outline any issues encountered relating to the implementation of Minnesota Statute, section 86B.532, any changes to marine manufacturing industry standard relating to carbon monoxide (CO) detectors\*, and the availability of plug-in or battery-powered marine certified CO detectors, and best practices in preventing carbon monoxide poisoning relating to motorboat operation, including the feasibility of requiring CO detectors that are more sensitive in measuring CO than required in "Sophia's Law".

### Issues encountered relating to implementation

- At the time Sophia's Law was passed, only hard-wired marine standard CO detectors were available to the public. Hard-wired detectors require additional time and cost to install versus battery-powered CO detectors.
  - Implementation of the law was delayed one year to allow time for battery-powered marine CO detectors to become readily available.
- Some marine technicians/marinas were concerned about taking on added liability by installing hard-wired detectors.
  - These marinas waited to bring boats up to requirements until battery-powered marine CO detectors became available.
- Marinas were also concerned with being able to prove/test detectors were "functioning". The word "New" precedes the word functioning. This requires a new CO system before dealer sale, even if the existing CO system has years of remaining life.
  - The law could be clarified to state that the marine CO detectors must not be expired and power supply must comply with American Boat and Yacht Council (ABYC) A-24, rather than "functioning".
- General public confusion on which types of detectors were acceptable in order to comply with the law and what types of boats were required to install a detector and/or display warning stickers. Most common misconceptions were around the fuel type, size of the boat, boat features and how many detectors are required and where.
  - The Minnesota Department of Natural Resources (DNR) information campaign included the most up-to-date information on the department's website, direct mailing of informational brochures and warning stickers to 144,000 owners of motorboats, information on watercraft registration renewal reminder cards, meetings with Minnesota and Wisconsin marina associations, and fairly extensive media coverage. Efforts will continue. Boat owners were urged to adhere two of the stickers (at stern and helm), even if they had an open motorboat, to create awareness of the dangers of CO poisoning.

- Law could be clarified to state that marine CO detectors are required in the main cabin and in all sleeping accommodations (as per ABYC A-24).
  - ABYC A-24 is not readily available to the public.
    - A free 5-day trial membership is offered
- Hard-wired detectors can be wired improperly including the capability to be switched off. Older styles of CO detectors with no end-of-life warning still exist in many motorboats. Sensors in these detectors will no longer set off the alarm, even if the power light is on and the alarm sounds when pressing the test button. Boaters may be unaware of these issues. A used boat may be sold with an improperly powered, outdated or non-marine CO detector.
  - DNR will continue a substantial educational campaign.
  - The law could be amended to require that before the sale of a motorboat with an enclosed accommodation compartment, it must have the required marine CO detectors that are not expired and the power supply must comply with ABYC A-24.
- One houseboat rental company requested to use home detectors versus marine detectors in their fleet due to the time/cost of updating their fleet.
  - Home CO detectors are not tested to survive harsh marine conditions which include vibration, temperature extremes, moisture and salt exposure (rare, but Minnesota boats do travel to salt water areas). The delayed implementation date provides more time and the anticipated price competition from a second manufacturer should reduce costs.
- Privacy concerns assuming that officers would be boarding boats to check for compliance.
  - DNR and county law enforcement do not board boats for safety inspections without probable cause of a violation.
- Antique/collector boat owners had concerns with adhering stickers which would devalue the boat.
  - The law could be modified to provide alternate means to display warning stickers such as on a removable placard for antique boat owners, as is done with registration numbers.
- Penalty concerns, mostly related to the lack of availability of the battery-operated detectors.
  - Delayed implementation and a first violation being a warning to address this issue.
- Digital readout of CO parts per million not available on any current marine CO detectors. Thus advance warning is not provided.
  - Digital readouts draw more power which is an issue especially for battery-powered detectors. See innovations section for new pre-alarm warning standard.
- The law applies to all motorboats with the specified compartments on Minnesota waters. Out-of-state boaters visiting Minnesota waters must comply.
  - DNR provides this information on its website, provides brochures at bordering marinas and has thus far worked with the Wisconsin Marine Association to spread the word of this requirement.

## Current manufacturing innovation

- Sophia's law has led manufacturers to develop battery-powered marine CO detectors. Battery-powered marine CO detectors are currently being manufactured by one company, at least one and possibly two additional companies are in the process of putting a similar product on the market.

## Best practices in preventing CO poisoning related to motorboat operation

- A multi-faceted communications effort designed to reach key audiences with key messages.
  - DNR to create an awareness campaign through print and video public service announcements.
- Boat owners are urged to install a marine CO detector for any motorboat with an enclosed occupancy space, or even just a partial enclosure.
- Increase educational effort around the dangers of CO poisoning in an open boat. Encourage owners to install warning stickers on these motorboats.
- Keep in regular communication with boating safety partners, standards organizations and topic experts. Provide input on any proposed changes to the standards. Encourage partners to increase efforts to inform and educate the public.
- Guide local boating safety partners in efforts to educate boaters at events, boat ramps and marinas, and when they inspect motorboats.
- Share our experiences and expertise with other states and national organizations.
- Require information to be shared with slip holders in state-owned marinas.

## Feasibility of requiring CO detectors that are more sensitive in measuring carbon monoxide

What is the concern?

- UL2034 CO standards were developed to balance the need to prevent injuries and protect lives in determining CO alarm time and concentration trigger levels with the dangers to people that come with having false alarms due to a CO alarm trigger set at a lower level. False alarm issues include removing or disabling the detector, ignoring or misinterpreting the alarm, or improperly replacing batteries in the detector. The resulting standard does not provide adequate protection to high-risk groups which would include the elderly, children and those with preexisting medical conditions. Note that ABYC standards in Sophia's Law incorporate the UL2034 standard.

Who raised the concern and why?

- A retired civil engineer, avid boater and advocate for low-level monitors, has raised concerns over the UL2034 standard not being sensitive enough to protect the above noted populations and possibly others who are naturally more sensitive to CO. This citizen has developed considerable expertise in the subject in the years following an incident where his wife was poisoned and made ill by levels of CO below what would set off a marine CO detector alarm. He recommended during initial legislative hearings that low-level monitors (by definition not UL2034 compliant) be allowed as an alternative to marine-rated CO detectors. He continues that recommendation, but now also supports allowing a low-level monitor that is tested to UL2034 and then to UL2075, if such a monitor is developed. He interprets a medical study "Myth busting in carbon monoxide poisoning" by Neil B. Hampson, MD, as showing that approximately one-third of CO poisoning victims will lose consciousness before UL2034 marine CO alarms would sound their alarm.

## DNR research

- A representative of ABYC notes, “The concern with having more sensitive/low-level detectors is false alarms that end up in the user ignoring or removing the detector. Additionally, I am not aware of anyone making marine- rated detectors that have lower level detection. Low-level detectors do not comply with UL2034 as this standard has low-level false alarm requirements.”
- Current low-level CO monitors are not tested to survive harsh marine conditions including vibration, temperature extremes, moisture and salt exposure (rare, but Minnesota boats do travel to salt water areas).
- One manufacturer’s representative stated he would not recommend that their non-marine rated low-level monitors be the primary CO detectors on a motorboat, but does recommend them as a supplement.
- The Director of the Hennepin County Medical Center Hyperbaric Chamber notes, “I am not a big fan of the UL2034 with the time weighted averages necessary for these certified CO alarms to activate. It can allow low level exposures to occur for significant amounts of time before alarming and it can cost precious minutes of potential ability to respond to a threat if the CO level is climbing rapidly in abrupt, high level exposures,” when asked to comment on the medical study “Myth Busting in Carbon Monoxide Poisoning” by Neil B. Hampson, MD.

“However, it is difficult to interpret the data from the article. The table demonstrates the reported symptoms of patients in comparison to “presenting CO Hgb level”. This was the CO level measured once the patient reached the hospital, had their blood drawn and sent to the lab. It is quite possible that the patients level had declined to that value (i.e., there was significant time between exposure and measuring the value) and the patient’s level was much higher when they suffered LOC.

That being said, there are special patient populations that may not be able to tolerate CO Hgb levels of 10% very well and could lose consciousness. These populations include small children, the elderly and those with underlying medical conditions that put them at risk.”

## Industry innovation

- The fourth edition of UL2034 now allows for an optional early detection alarm to sound.
  - This is a great step forward in providing an early warning for sensitive populations if manufacturers respond and build in this feature. However, the alternate alert signal could be confusing to some boaters.
- There is a possibility of creating detectors which would be tested to meet the UL2034 standard for marine CO detectors and then have the alarming standards reduced to meet UL2075 low-level detector standards.

## DNR recommendations:

### Standards

- DNR does not recommend using low-level, non-marine grade CO detectors as replacements of marine CO detectors since they are not tested to a national standard for marine use. The state could be taking on liability by creating its own standards allowing non-marine rated CO detectors to be used in place of marine CO detectors.

- DNR continues to promote the idea of having a low-level detector on board to supplement the required marine CO detectors, especially for at risk populations.
- DNR is open to allowing a low-level CO monitor that has been tested and approved to marine environmental standards. Final approval of this detector should wait until the results and recommendations of the national standards and testing organizations.
- DNR does not recommend that a marine-grade low-level CO monitor become the only acceptable option without input from national standards and testing organizations and marine manufacturers.

#### Communications

- Continue a substantial communications effort including information in the Minnesota Boating Guide, registration renewals, a widely-available brochure and warning stickers, educational boating courses, media interviews, public service announcements and supporting the efforts of boating safety partners in educating boaters.

#### National Efforts

- DNR recommends providing information to other states and national interests who wish to implement CO regulations.
- DNR supports development of model acts for CO regulation by the National Association of State Boating Law Administrators.

\*Sophia's Law uses the term "detectors". Testing companies may use both "alarm" and "detector" interchangeably. Manufacturers may use "Carbon Monoxide Alarm" on their packaging.