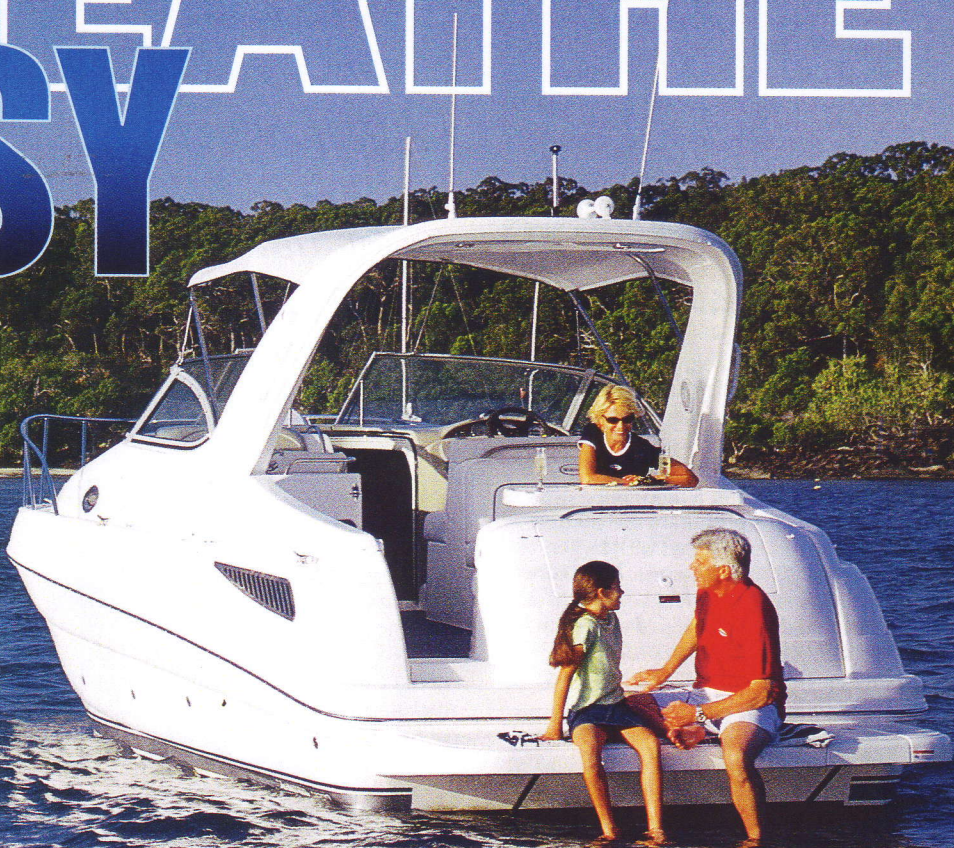


BREATHE EASY

A recent recall has highlighted the need for petrol-powered boat owners to be aware of the potential dangers of carbon monoxide poisoning.



By Chris Beattie

Everybody agrees that carbon monoxide (CO) is bad for you. In fact, in the right (wrong?) circumstances, it can be fatal. From a marine standpoint, the risks of CO contamination and poisoning are something that all motorboat owners should be aware of – provided those risks are kept in perspective. For instance, you should be aware that your chances of suffering injury or death as a result of carbon monoxide poisoning on a boat are remote and dependant to a large degree on your own actions. It mostly comes down to following a few simple, common sense guidelines. For example, if you want to avoid CO poisoning, you'd

be unlikely to seal your boat with clears and covers, fire up your generator while leaving your engine idling and then lie back for a good snooze. Then again, that's exactly how two people died recently in the US. Tragic, avoidable – but true. Common sense, as they say, ain't all that common.

In a marine context, CO is primarily a bi-product of the combustion process in petrol engines. It enters the environment via the exhaust system. Sources of CO on boats include inboard and outboard engines as well as generators and gas cooking appliances. The danger comes when concentrations of CO are drawn into the cockpit, bridge, cabin and living areas, particularly on larger vessels where the exhaust exits at the rear. This can happen due to the 'station wagon effect', in which larger boats create low

pressure zones directly behind them as they move through the water. This causes air – and sometimes exhaust gases – to be drawn forward into the cockpit and interior of the boat. Any activities that involve people being in the vicinity of the rear of the boat, such as wake surfing or trolling, can also place people at risk. Exhaust leaks are another potential source of poisoning, while the age of a boat can also have some bearing on its susceptibility to CO build-up. CO contamination can also occur in static situations when boats berth in close proximity to each other, but for now we will confine ourselves to mobile scenarios.

In concentrations above 125 parts per million, CO, a colourless and odourless gas, can have a range of effects. It is drawn into the lungs and affects its

victims by displacing oxygen in the blood. As CO levels increase, victims can experience a range of symptoms, some of which can be mistaken for seasickness. In lower concentrations, effects such as eye irritation, headaches and difficulty in concentrating can occur, along with loss of physical coordination and tightness across the chest. Higher CO levels will cause more pronounced symptoms such as drowsiness, fatigue and nausea, and if victims are not moved out of the affected area they may lapse into unconsciousness. In extreme instances, death can result if victims are exposed for a long time to low concentrations, or for a short time to very high concentrations.

SMALLER IS BETTER

For the most part, smaller open boats, such as outboard-powered cuddy cabs, ski boats, runabouts and family-fishers are not as susceptible to CO contamination as their larger counterparts. This is mostly due to the fact that they are of a more open design that tends not to generate the 'station wagon effect' associated with larger, multi-level enclosed vessels. The more open the construction and design of the working and living areas of a boat, the less likely they are to be prone to CO build-up.

Some owners of smaller craft may risk CO contamination by trolling at low speeds for prolonged periods of time with clears and bimini up, but the nature of trolling, whereby boats regularly change direction, encourages wind-driven flushing of affected areas, such as the cockpit at the rear of the boat. Also, our much 'cleaner' modern engines produce far less toxic exhausts than their older counterparts.

In recent times, the risks of CO poisoning have been highlighted by the recall of specific Riviera models due to concerns about CO levels (see *Nautical Notes* Vol. 20 No. 4). The affected models are the M290, M370 and M430 sports cruisers. The recall affects 170 boats in Australia and 40 overseas, built between 2003 and 2005.

Announcing the recall, Riviera's CEO, Wes Moxey said the Gold Coast-based luxury boat builder had conducted intensive research into CO contamination in recent times. He said the company had spent more than \$500,000 over eight months to determine the best way to combat the problem on its petrol-powered boats.

"The problem occurs in certain circumstances when the shape of the bimini or hardtop structure and the

formation of the clears lead to an area of low pressure directly behind the boat and in the cockpit," he said.

"This area of low pressure draws in air from areas of high pressure and this air flow draws in exhaust gases from the swim platform and surrounding areas."

"Some owners of smaller craft may risk CO contamination by trolling at low speeds for prolonged periods of time with clears and bimini up"

Riviera's Director of New Product Development, Philip Candler told *Club Marine* that the research was the result of concerns the company had over some of its new models. He said that a greater focus on new model development had alerted the company to the issue of CO contamination and how it could be affected by the design of a boat's upper decks, living areas and flybridge. In particular, the company focused on aerodynamics and the way some structures affected air flow around a boat.

"Through our testing we learned a lot about air flow over and around a boat. We were able to see how the shape of targa tops and pretty much everything above deck can effect CO levels," he said.

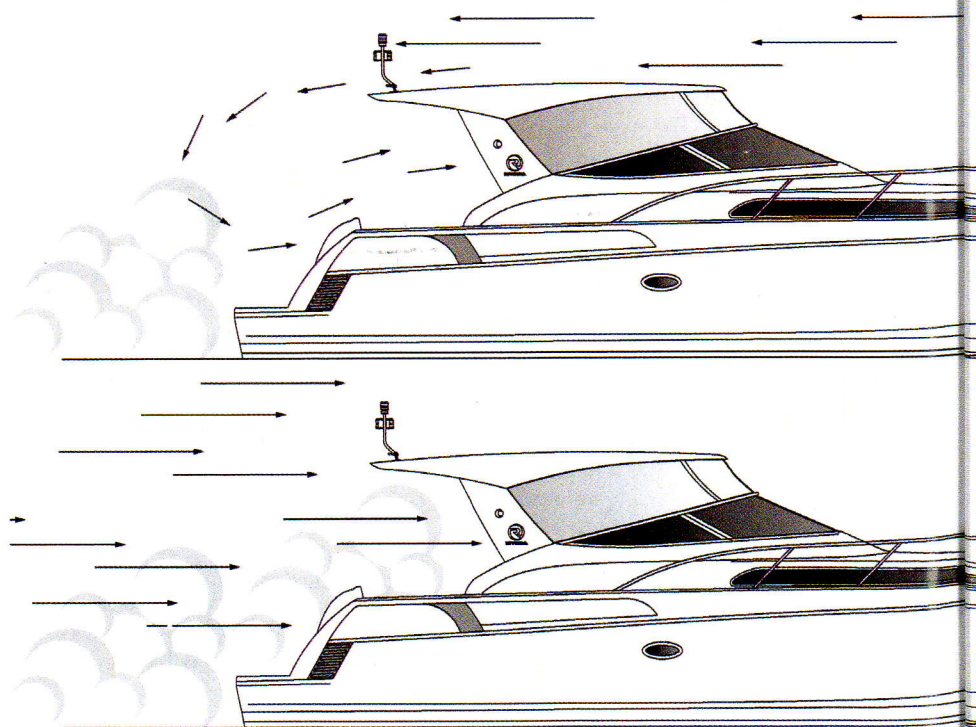
WORST SCENARIO

According to Candler, the worst possible scenario, in terms of CO contamination, is when a boat is underway at around 6-8 knots in the rain with clears up and a tailwind blowing over the stern. In this case, CO levels can increase relatively quickly, placing occupants at risk, although Candler says the CO build-up can be easily dispersed simply by opening the clears while still underway.

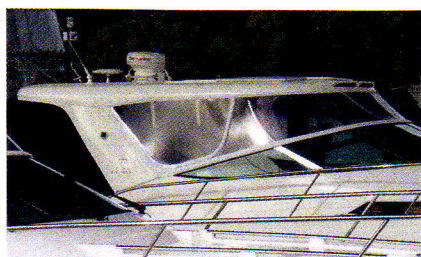
"Even at slow speeds, if you open the clears the CO will dissipate really quickly," he explained.

As part of its efforts to address the threat of CO poisoning, Riviera, working with Mercury Marine in the US, sourced a flexible bellows that fits between the transom shield and the drive unit. The bellows allows the exhaust gases to travel down the drive unit and exit below the waterline via the propeller. In the case of petrol models produced prior to 2003, Candler says the design and operation of the exhaust systems on these boats means they pose substantially less risk to owners.

Two boats, the new M360 and M400 Sports Cruisers, have been redesigned specifically to reduce the risk of CO contamination. Apart from having the bellows fitted from new, cabin roofs have been redesigned and reshaped to



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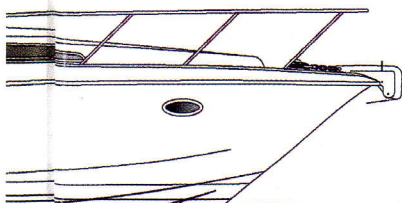
This is a general overview of the new flat hardtop and vent system, as used on the Riviera M400. The hardtop had a radar arch removed to reduce the turbulence behind the boat, thus improving the aerodynamics. The vent system was included to reduce the pressure differential between the cockpit area and the outside of the boat.

incorporate a venting system that draws air into the front of the cabin to increase interior air pressure, thus preventing the 'station wagon effect' from developing.

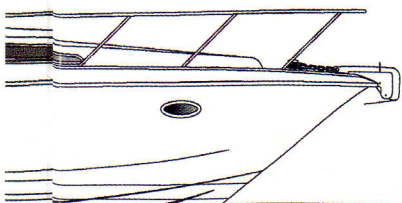
All Rivas also come fitted with a CO detection and warning system as standard. In addition, as part of its CO research programme, Riviera worked with Adelaide-based company, EVRsafe Marine Technologies (see *Building a better budgie* sidebar) to develop a highly-sensitive detector and alarm system that, apart from CO, can also detect a range of other toxic gases, including nitrogen dioxide, LPG and hydro carbons. No decision has been made at this point in time as to whether the company will adopt the new system as Original Equipment on its boats.

Other local manufacturers we've spoken to said that CO was not an issue with their boats, either because the design of their craft discouraged CO build-up, or because of their choice of powerplants and exhaust systems. As a

An area of low pressure can form directly behind the boat and in the cockpit. With the transfer of air from high to low pressure exhaust gases can be drawn into the boat.



The worst possible scenario is when a boat is underway at low speed with the cleats up and a tail wind blowing. CO buildup occurs relatively quickly.



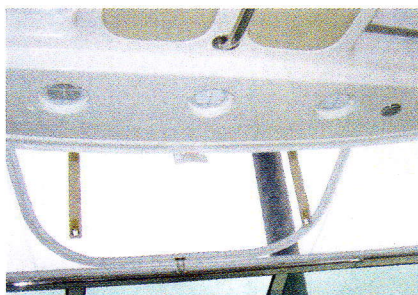
result, they did not feel that CO detectors were needed on their boats.

While CO detectors are not compulsory in Australia, in the US all new boats that have sleeping accommodations, including cuddy cabins, now have to be fitted with CO detectors as part of the National Marine Manufacturers Association certification process.

US FIGURES

According to available research and records, the US has by far the highest rate of CO-related incidents per capita of any boating country. This is in very large part due to the sheer number of petrol-powered boats, including houseboats, in the US national recreational fleet in comparison to other countries. It is also very much a function of typical US boating practices, such as 'teak surfing', in which people hang on to the rear (often teak) boarding platform of motor cruisers while the boat is underway. Apart from risking injury from churning props, practitioners are also directly in the path of exhaust fumes. In recent times, several deaths have been blamed on CO ingestion from teak surfing. As we said, common sense isn't always that common.

Houseboaters in the US are particularly prone to CO poisoning, mostly from running on-board generators without proper venting. In fact, this seems to be the most common method of CO poisoning in the US.



This is a view of the cockpit vent system and the louvers, which redirect the flow away from the passengers should they require it.

The figures put the situation into perspective. According to the US Coast Guard, which compiles data on recreational boating fatalities, there are an incredible 78 million recreational boaters in the US. Using the year 2003 as an example, a total of 20 people fell victim to CO poisoning, with seven deaths attributed directly to CO. As we said, the figures put the issue into clearer perspective, although the Coast Guard is also quick to point out that CO incidents aren't always reported and that CO poisoning may have indirectly contributed

to some of the overall total of 703 boating fatalities recorded that year.

As far as Australia goes, our research suggests CO-related incidents are relatively rare, which is undoubtedly due to the way we use our boats, especially compared to the American experience. Houseboats play a far greater role in recreational boating in the US and subsequently figure much more prominently in CO incidents.

Nevertheless, petrol-powered boat owners need to be aware of the dangers and implications of CO contamination. And the fact that Riviera has seen fit to issue a recall of its boats due to CO-related concerns highlights the need for public awareness of the issue. Also, according to NSW Maritime, at least two deaths have been attributed recently to CO poisoning. A fishing trip on Pittwater ended in tragedy with three people hospitalised and one dead due to a CO leak on their boat. In another incident on Wallace Lake in Forster, a fatality was blamed on CO poisoning that involved teak surfing. NSW Maritime is currently running a CO awareness campaign and has produced a brochure detailing the dangers of CO poisoning. The government body is also pushing to have teak surfing outlawed in that state.

NO CAUSE FOR ALARM

Overwhelmingly, industry members we talked to during the course of researching this article said they were keen to dispel any undue concerns the boating public might have about the CO issue, particularly in the wake of the Riviera recall. Many said they were worried that publishing any kind of article on CO might provoke unnecessary alarm and angst and possibly impact on petrol boat sales.

"We build our boats to the highest possible standards, including CO preventative measures, and this whole recall thing is blowing the issue out of all proportion," said one industry source, who didn't want to be identified. "Just because one manufacturer builds boats that have problems, the rest of us can get tarred with the same brush. It's a non-issue as far as our boats are concerned."

Certainly, from the research we've conducted on CO-related issues and incidents, there is absolutely no cause for alarm. Modern boats are designed to ensure that CO levels are kept to a minimum and any risks are largely due to how boat owners maintain and use their boats. Practices such as teak or wake surfing, and others outlined above, carry