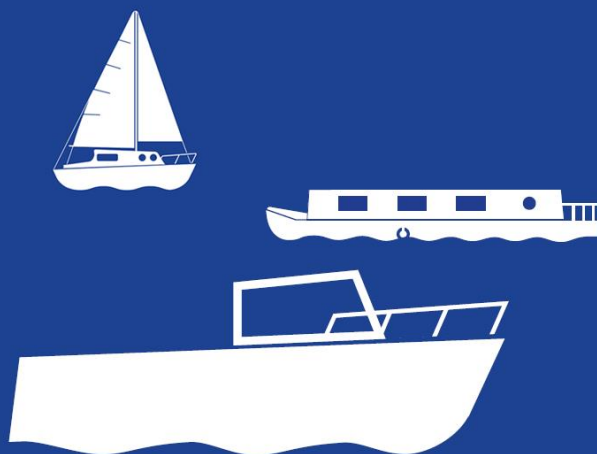


# CARBON MONOXIDE SAFETY ON BOATS



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How to protect you, your crew, your visitors and pets on  
your boat from the 'Silent Killer' - Carbon Monoxide

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**CoGDEM**

The Council of Gas Detection and  
Environmental Monitoring



# Carbon monoxide... what's the risk?

Each year boaters die or are made seriously ill from carbon monoxide (CO) poisoning.

When carbon-based appliance and engine fuels, such as gas, LPG, coal, wood, paraffin, oil, petrol and diesel don't burn completely, CO is produced.

Boats are built to keep water out, but this also makes them good containers for gases and fumes.

CO can build-up in the cabin with one or a mix of these factors:

- Faulty, badly maintained or misused appliances and flues
- Exhaust fumes from a boat's engine or generator
- Escaped flue gases from solid fuel stoves
- Blocked ventilation or short supply of air - fuel needs oxygen to burn safely

In recent years, solid fuel stoves and engine or generator exhaust gases have been responsible for most deaths of boaters from CO poisoning.



*Investigations start following the death of two people from CO poisoning*

# How the silent killer works

**CO can kill in minutes - know how to act, and act immediately if you think anyone is being poisoned!**

CO is a highly poisonous gas that weighs about the same as air.

At high concentrations, CO can kill without warning, sometimes in only minutes. **No one is immune.**

It cannot be seen, smelt, tasted, or felt, that's why it's known as the silent killer.

When you breathe in CO, it replaces the oxygen in your bloodstream, preventing essential supplies to your body tissues, heart, brain and other vital organs.

Where victims survive severe CO poisoning, they can be left with long-term brain damage such as poorer concentration, or mood swings, etc.

Even breathing-in lower levels of CO over a longer period of time, you can still suffer from headaches, poor memory and concentration, tiredness, and flu like symptoms.

**Some people may be at higher risk because of what they are doing:**

- Those who have been doing something active and are breathing more rapidly and deeply and have a greater need for oxygen
- Those who have been drinking heavily - because the symptoms may be masked

**Some people are more vulnerable to CO exposure:**

- Pregnant women and unborn babies;
- Babies and young children
- Older people
- People with respiratory problems or heart conditions

# CO poisoning can creep up on you – recognise the signs

If you are asleep, you may not notice any symptoms as they develop.

**Even if you are awake, you may not know you are being poisoned**

We have listed some of the common symptoms, but not everyone suffering CO poisoning will have all of them.

## Common symptoms include:

- Headaches
- Feeling sick and dizzy
- Feeling tired and confused
- Stomach pains and being sick

**The greater the amount of CO there is in air, or the longer you are breathing in CO, the worse your symptoms are likely to get:**

- Drowsiness, lethargy, extreme tiredness, difficulty concentrating
- A feeling of general weakness, difficulty in walking or moving
- Loss of balance
- Sight and memory problems

## ...and with very high CO levels

- Chest pains
- Increased heart rate
- Difficulty breathing or breathlessness
- Seizures
- Collapse, unconsciousness and death



HEADACHES



NAUSEA



DIZZINESS



BREATHLESSNESS

# If you think someone is suffering – Act Quickly

**Fast action saves lives. Ask yourself 'Are people showing signs of CO poisoning on the boat, but feel OK ashore?'**

If you suspect you have carbon monoxide poisoning or the CO alarm activates, you need to act fast.

Get all people and pets out to fresh air as quickly as you can, and stay out in the fresh air.

If you can, on your way out, turn off appliances and engines...

...also leave doors, windows and awnings open to allow fresh air to flow through the boat.

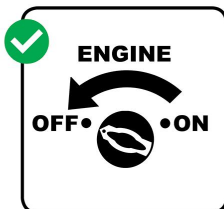
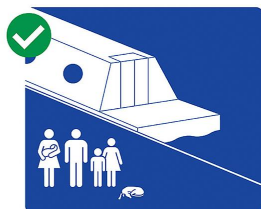
**Seek medical help and don't delay!** Tell the medic that you may have suffered carbon monoxide poisoning.

If other crew members, or pets, are feeling ill or have the symptoms, they need medical help too.

**Anyone with severe symptoms needs to get to hospital as quickly as possible! Call 999 or 'mayday' immediately.**

**Severe CO poisoning needs immediate diagnosis and medical treatment.**

Tests for CO poisoning need to be made as soon as possible after being exposed as CO starts to leave the body when breathing clean air. Test results are less clear the longer the delay.



# Know any danger signs on your boat

**Routine checking is your best safety policy.** Be sure that your boat's fuel-burning appliances and engines are free from signs of problems and in good condition.

Any of the following could be signs that CO is filling your boat:

- Staining, sooty smears, or discolouration on surfaces around an appliance or its flue
- Appliances that are difficult to light, keep lit or burn weakly
- Burners, including LPG grill ribbons, with yellow, or orange, or 'floppy' flames that threaten to go out

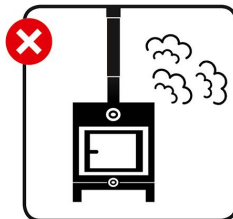
**If your boat has a CO problem, get a properly qualified person to find the cause, and fix the faulty equipment before it is used again.**

**Beware: -**

- An unfamiliar or burning smell when an LPG or oil-burning appliance is on
- Smelling or seeing smoke escaping regularly into the cabin when running your wood-burner or coal stove

**Flue gases from solid fuel stoves can have up to 100 times the concentrations of CO found in gas hob-burners with problems.**

- Smelling engine exhaust fumes regularly inside the cockpit or cabin. If those are petrol engine fumes anyone in the cabin could be in immediate danger.



# How to prevent CO on your boat

**CO can be prevented. Take a few sensible steps to reduce the risk dramatically.**

Only buy appliances that meet the latest standards and are suitable for use in boats.

Have appliances properly installed and routinely serviced by competent fitters.

Annual servicing of appliances is recommended where the boat is used constantly or regularly.

Use proprietary components for repairs and maintenance. Lash-ups and bodge-jobs are dangerous.

A good air supply in the cabin is vital to running appliances.

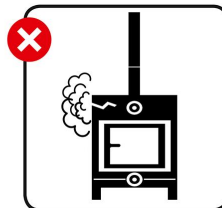
Regularly check the vents for blockages, build-ups of spider webs and debris.

When starting cooking, specifically using LPG grills and/or large pans on LPG hobs, open windows for extra ventilation.

Check solid fuel stoves for cracks, missing cover plates, warped doors and poor condition rope seals.

Follow appliance instructions - burn the right fuel for your stove, in the right way. Burning damp fuel or plastic rubbish can cause clogging of the flue.

Leftover hot ashes and embers keep releasing CO as they're cooling, so store them outside in the open in a metal ash bucket with a lid.



# Keep flue pipes and terminals in tip top condition!

Crushing your boat's chimney terminal on a bridge arch can damage more than your pocket.

Ensure all flues or exhausts vent on the outside of awnings, covered decks or cratches.

A clean flue pipe kept in good condition will help keep a good draw and help the boat keep free from toxic flue gasses.

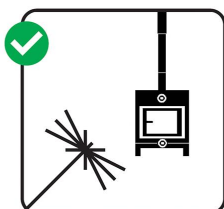
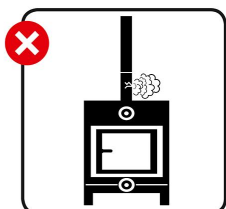
Ensure solid fuel stove chimneys are swept at least annually, or even several times a year - the more a stove is used, the more often the chimney needs cleaning.

Check all appliance flue pipes routinely for rusting, pitting, blockages, loose or missing connections.

Look for signs of leaks. A sooty smear at a flue joint is a bad sign.

Check that vents and flue terminals, especially on cabin tops, are not damaged, blocked or restricted by stowed equipment, ropes, tarpaulins or decorative objects.

**Fix all problems without delay and before the equipment is used again!**





# Exhaust gases are killers in the cabin!

**Petrol engines, portable generators & outboards produce dangerously high levels of carbon monoxide.**

Inefficient petrol engine performance can increase the concentration of CO in exhaust fumes. So, use and maintain engines as specified in the operating instructions including routine servicing and using the correct fuel.

Check exhaust systems routinely. Where accessible, inspect any manifolds, pipes, joints, hoses, clamps, silencers, and through-hull fittings for leaks or problems.

Avoid improvising portable generators for fixed use as these have led to boater deaths and injuries.

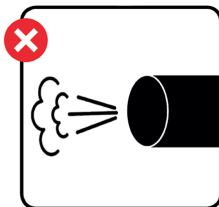
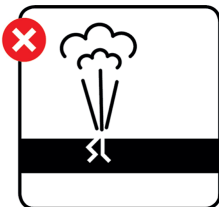
## Stay aware of the risks when running engines

Whether the boat is moving or moored, under certain running and/or wind conditions, CO at dangerous levels can be deflected or drawn in from petrol engine exhausts.

With a moving boat and even when moored, cockpit awnings can act as a funnel to draw engine fumes inside the boat.

Be a good neighbour; avoid running your engine when moored in a crowded marina, particularly when the air is still.

**Don't underestimate the risks from diesel exhausts gases, these have also been linked to illness and deaths.**



# Steer clear of danger...

**Never** block cabin ventilators.

**Never** leave LPG appliances on overnight, unless they are designed to be left on and/or are the room sealed type.

**Never** use mobile (cabinet) gas heaters - they are not suitable for use in boats and create extra fire safety hazards.

**Never** bring lit or cooling barbecues into a cabin or covered cockpit area – hot and cooling charcoal gives off dangerous amounts of CO. Charcoal is only safe when it's stone-cold.

**Never** run a solid fuel stove with its doors open, apart from when refuelling.

**Never** block an appliance's air inlet or heat outlet.

**Never** use an appliance you think is faulty or unsafe.

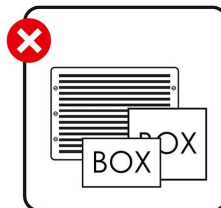
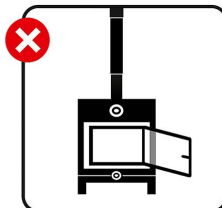
**Never** use an appliance that has a crushed flue terminal.

**Never** run portable generators in a cabin or covered cockpit area, or close to any door, opening or ventilator that opens into the boat.

**Never** run portable generators where exhaust gasses can enter a neighbouring boat.

**Never** run a boat's petrol engine with the exhaust outlet restricted in any way e.g. by inflatable tenders or large fenders / moored against a quay wall / beside another boat / inside a lock - or in similar situations when these things can deflect toxic exhaust gas back inside a boat.

**Never** swim near to boats with their engines running – many boats' exhausts are at low level and can create a toxic atmosphere at water level.



# CO alarms save lives

**Good installation, regular maintenance, competent servicing and proper use of fuel-burning appliances and engines on your boat will help stop CO from happening.**

All cabins with a fuel burning appliance should have a CO alarm fitted.

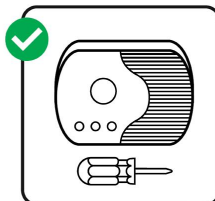
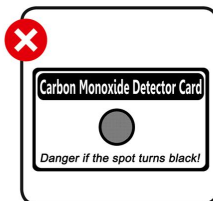
If CO from nearby boat engines or appliances is drawn into your boat, only a CO alarm can give you protection.

'Black-spot' colour-changing indicator cards do not give you an instant warning of dangerous CO levels and there's no alarm to wake you up.

When buying alarms:

- choose ones that meet the international standard BS EN 50291-2; these are best suited for boats
- look out for the BSi Kitemark, LPCB horseshoe or UL-EU 'approval' symbols indicating independent product testing.
- you may want to consider if alarms with sealed-in batteries are best for you.

Alarms and accessories with warning devices for people with hearing loss are also available meeting the latest standards.



# Where should you place your CO alarm?

All cabins with a fuel burning appliance should have a CO alarm fitted.

**Have enough CO alarms to protect those onboard from flue and exhaust gases entering the cabin from neighbouring boats.**

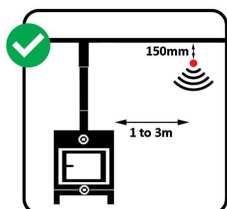
If fuel burning appliances, generators or engines are used whilst people sleep, all sleeping quarters will need their own alarms. If the boat has a single multi-use cabin, one alarm is OK.

**For best protection, follow the alarm manufacturer's installation instructions as far as the boat space and design allows.**

Installation instructions can be tricky to meet on boats. **These are CoGDEM's 'best practice' pointers.** Try placing alarms: -

- in living quarters between 1m and 3m (on plan view) from the appliance
- away from strong drafts and not above a source of heat or steam/vapour
- high up on walls, but at least 150mm from the ceiling and where the indicator lights can be seen
- or fixed on ceilings at least 300mm from the cabin sides and bulkheads
- or in sleeping quarters, in the "breathing zone", i.e. near the bed head

**Before fixing**, test that you can hear an alarm from any position in the boat (or buy more alarms).



# Living with your CO alarm

**Test the alarms when you first board the boat. Test the alarm monthly when the boat is in use.**

CO alarms certified to EN 50291-2 will make a warning sound if the battery is low or the sensor is failing.

CO alarms do not last forever and have a replacement date marked on them. Do not use the alarm beyond that date and if in any doubt, replace it earlier.

When working on the boat with paints, solvents, degreasers or strong chemicals, ventilate the boat well and cover or remove the alarm temporarily to protect the sensor. As the air clears and before you use any appliance or engine, remove any cover or refit the alarm.

Consider removing the alarm from a winterised boat because long periods of sub-zero temperatures may affect its sensor and battery.

**Always re-install any alarm after winterisation. Then test the alarm before any appliance or engine is used.**

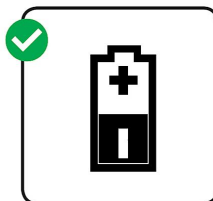
## Note these points:

- CO alarms only detect, they cannot prevent the dangerous build-up of carbon monoxide
- CO alarms may not fully safeguard individuals with specific medical conditions
- CO alarms will not detect fires, smoke or leakages of petrol or LPG fuel vapours

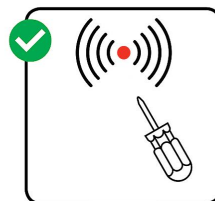
CO alarms can activate sensing highly-explosive hydrogen gas e.g. when charging batteries gas off. Do not ignore this, your batteries may need attention.



Test it



Change it



Replace it

## If you are a tenant afloat

The BSS requires boats with cabins to have suitable working CO alarms, but UK law provides further protections for tenants including: if your landlord has provided LPG appliances, they must have an annual gas safety check by a Gas Safe registered engineer.

**If you're renting a boat and have concerns about CO, tell your landlord or letting agent immediately. If your concerns are not dealt with, go to the local council for help. If you feel unwell, get medical help straightaway.**

Go to [www.hse.gov.uk/gas/domestic/faqtenant.htm](http://www.hse.gov.uk/gas/domestic/faqtenant.htm) for more information for tenants and the health and safety in privately rented accommodation.

Also look for advice on privately rented accommodation on [www.gov.uk](http://www.gov.uk) or [www.mygov.scot](http://www.mygov.scot) , or [www.gov.wales](http://www.gov.wales) , or [www.nidirect.gov.uk](http://www.nidirect.gov.uk)

### Further info on CO and other useful help

- **NHS website** for more information about CO poisoning. Go to [www.nhs.uk](http://www.nhs.uk) - search for monoxide.
- **United Against CO** website for a complete guide to CO alarms and how together we can beat CO poisoning. Go to [www.unitedagainstco.com](http://www.unitedagainstco.com)
- **CO Alarms Save Lives** [www.coalarmssavelives.com](http://www.coalarmssavelives.com) hosts 'CO Awareness Week'
- For general CO advice **Health & Safety Executive** (HSE) [www.hse.gov.uk/gas/domestic/co.htm](http://www.hse.gov.uk/gas/domestic/co.htm)
- **Gas Safe Register** – to find registered gas engineers [www.gassaferegister.co.uk](http://www.gassaferegister.co.uk)

## Acknowledgements

Design based on the BSS/Fire Kills 'Fire Safety On Boats' booklet with permission from Fire Kills [www.gov.uk/firekills](http://www.gov.uk/firekills)

This information is supported by all CoGDEM member companies that produce CO alarms:

- Ei Electronics Ltd / Aico
- Firehawk
- FireAngel Safety Technology Ltd
- Kidde Safety Europe Ltd

If you are about to choose a CO alarm, see the BSS website [www.boatsafetyScheme.org/co](http://www.boatsafetyScheme.org/co) for advice on choosing CO alarms suitable for boats and knowing where best to place them.

The authors acknowledge, and are grateful for, the substantial help with the booklet's content from:

- COMed, the All-Party Parliamentary Carbon Monoxide Group's medical sub-group, and
- UK Health Security Agency (UKHSA), responsible for England-wide public health protection

## Charities concerned about Carbon Monoxide

**CO Research Trust** - [www.coresearchtrust.org](http://www.coresearchtrust.org)

**Gas Safe Charity** - [gassafecharity.org.uk](http://gassafecharity.org.uk)

**Katie Haines Memorial Trust** - [katiehainestrust.com](http://katiehainestrust.com)

**The Carbon Monoxide and Gas Safety Society** - [co-gassafety.co.uk](http://co-gassafety.co.uk)

**CoGDEM**  
The Council of Gas Detection and Environmental Monitoring

CoGDEM ([www.cogdem.org.uk](http://www.cogdem.org.uk)) is the UK trade body for companies and experts in the field of gas detection. CoGDEM provides its expertise to UK, European & global standards-writing bodies, and provides technical guidance and support to all CO awareness-raising projects and organisations, including the HSE.

# CO threatens lives – stay in control, stay safe and stay aware:

**Control the risk and protect your family and friends** - know how the 'silent killer' works, and learn the early signs of danger - see pages 2 – 4

**Act fast - if you think someone onboard is suffering from CO poisoning** — get all people and pets out to fresh air as quickly as you can and seek medical help without delay - see page 5

**Know the danger signs, act smart and don't delay** – check appliance flues for signs of escaping gases, choose appliances wisely, maintain and service them routinely - see pages 6-9

**Learn from the fatal mistakes of others** - never do the things listed on page 10

**Treat CO alarms as your crew's last defence** – Choose well (alarms certified to BS EN 50291-2), test often, and act immediately if they sound - see pages 11-13

Go to [www.boatsafetyScheme.org/stay-safe](http://www.boatsafetyScheme.org/stay-safe) for more safety advice

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