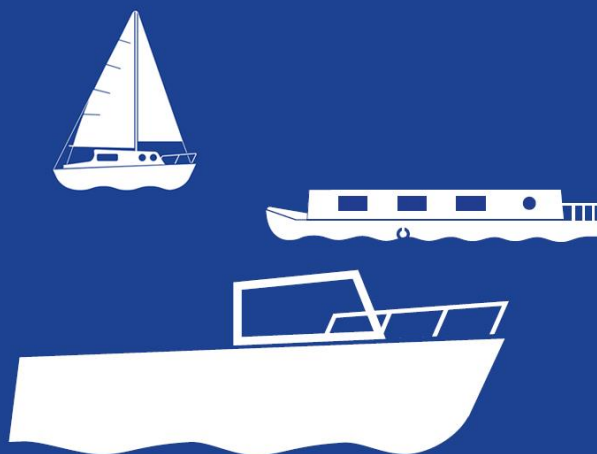


# CARBON MONOXIDE SAFETY ON BOATS



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

**CoGDEM**

The Council of Gas Detection and  
Environmental Monitoring



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

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.

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

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

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

- Faulty, badly maintained or misused appliances
- 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 - be prepared to act quickly if you think you are 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.

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.

But even breathing-in lower levels of CO over a longer period, you can still suffer serious effects such as memory problems and difficulty concentrating.

## Some people will be affected much more quickly:

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

## For other reasons, some people may be at higher risk:

- 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

If CO is in your cabin space, everyone is at risk, no one is immune!

## 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

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

### Common symptoms include:

- Headache and bad temper
- Feeling sick and dizzy
- Feeling tired and confused
- Stomach pains and being sick

For more information visit the NHS website  
<http://www.nhs.uk/conditions/carbon-monoxide-poisoning>

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

- Drowsiness, lethargy, extreme tiredness, difficulty concentrating
- A feeling of general weakness, difficulty in walking or moving
- Loss of balance and 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 you are suffering – ACT QUICKLY

Fast action could save your life. Ask yourself 'Are people ill on my 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.

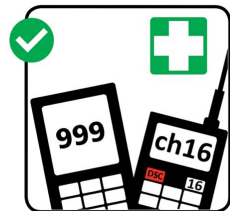
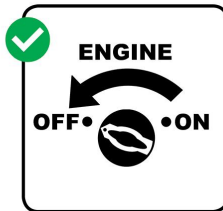
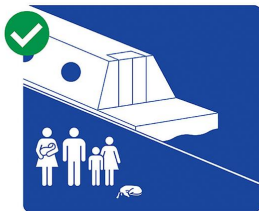
**Seek medical help and don't delay!** Tell the doctor or nurse that you may have suffered carbon monoxide poisoning.

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! Contact the emergency services straightaway.**

**Severe CO poisoning needs immediate medical treatment**

CO poisoning can only be tested shortly after exposure as its traces begin to disappear as soon as you start breathing clear air.



# Know any danger signs on your boat

Routine checking that your boat's fuel-burning appliances and engines are free from signs of problems and in good condition will help keep you safe.

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

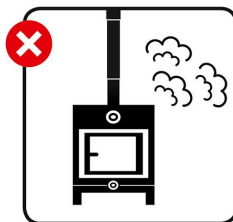
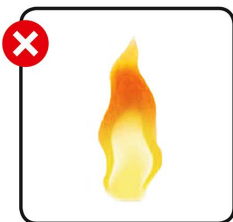
Any of the following could be signs that CO is filling your boat:

- 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 with yellow or orange or 'floppy' flames that threaten to go out

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.

If there's a CO problem on your boat - get a properly qualified person to find and fix the appliance or engine before it is used again.



# 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 serviced routinely by competent fitters.

Annual servicing of appliances is recommended where the boat is used frequently or for longer periods.

Ensure all repairs use proprietary components. Make no mistake, gash fixes or bodge jobs bring risks.

Good air supply in the cabin is vital to running appliances.

The required ventilation can be calculated by using the formula in Ch.8 of the BSS Essential Guide

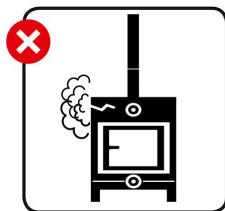
Check the cabin vents for blockages and build-ups of spiders' webs and debris.

Open windows for extra ventilation when cooking, especially when using large pans on LPG hobs.

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.

When removing hot ashes and embers, use a metal ash bucket with lid and keep it outside in the open.



# 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.

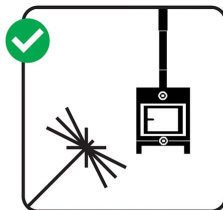
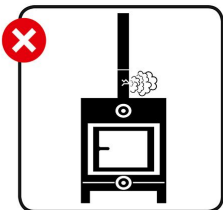
Ensure solid fuel stove chimneys are swept at least annually, or even several times a year - the more a stove is used, the more often the chimney needs cleaning.

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.

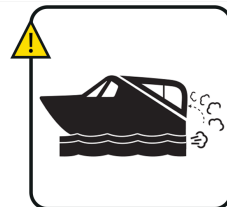
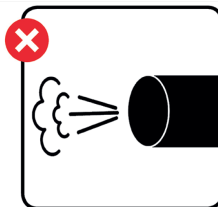
## Stay aware of the risks when running engines

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 do these things

**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 charcoal gives off dangerous amounts of CO. Charcoal is only safe when it's stone-cold.

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

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

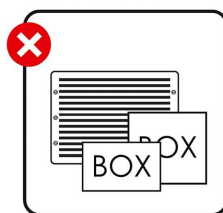
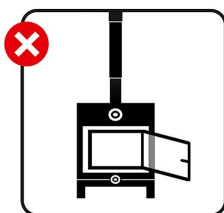
**Never** use an appliance you think is faulty or unsafe.

**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 a boat's petrol engine with the exhaust outlet restricted in any way including when the craft moored against a high-sided object such as a wall, another boat or inside a lock.

**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

Take the belt and braces approach but note this, CO alarms are not a substitute for the good installation, regular servicing and proper maintenance of fuel burning appliances and engines.

If you have any fuel burning appliances aboard, an engine or generator, fit a suitable audible carbon monoxide alarm for an added re-assurance.

'Black-spot' colour-changing indicator cards are not good enough. You won't have an instant warning of dangerous CO levels and there's no alarm to wake you up.

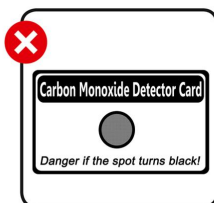
Fit alarms that meet the international standard BS EN 50291-2; these are best suited for boats. Alarms with life-long batteries are available.

Look out for the BSI Kitemark or LPCB horseshoe 'approval' symbols when buying alarms for additional assurance.

If in doubt about the choice of alarm, call the manufacturer's or supplier's support line for more advice. Also see the BSS website for the current list of CO alarm models suited for boat use.

If there is potential for CO poisoning on your boat, it is better to have an alarm, than not.

Alarms and warning devices for people with hearing loss are available.



# Where should you place your CO alarm?

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

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.

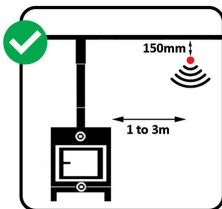
Never fit an alarm directly above a source of heat or steam.

For the best protection, follow the alarm manufacturer's installation instructions as far as the space and nature of the boat allow.

But if the placement directions are difficult to meet on your boat, these are the 'best practice' points.

Try to place the alarm:

- In living quarters between 1m and 3m (on plan view) from the appliance
- In living quarters fix alarms high up on a wall, but at least 150mm from the ceiling and where the indicator lights can be seen
- In sleeping quarters have the alarm 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 an additional alarm)



# Living with your CO alarm

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

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, cover or remove the alarm temporarily to protect the sensor. Remember to remove the cover or replace the alarm as soon as the air clears and before you use any appliance or engine.

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*

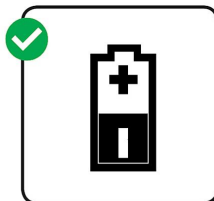
*CO alarms may not fully safeguard individuals with specific medical conditions*

*CO alarms will not detect fires, smoke or leakages of petrol or LPG fuel vapours*

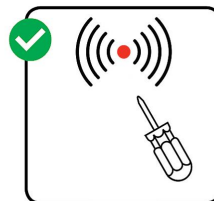
*A CO alarm can activate if it senses the explosive gas hydrogen; e.g. from the boat's batteries gassing off when under charge, perhaps indicating a charging problem*



Test it



Change it



Replace it

## If you are a tenant afloat

The law provides several additional protections for tenants including this:

If your landlord has provided LPG appliances, he/she must arrange for an annual gas safety check to be carried out by a Gas Safe registered engineer.

If you are a tenant in a rented boat with concerns about CO, raise the issues with your landlord or letting agent without delay. 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 pages on [www.gov.uk](http://www.gov.uk)

### Further information on CO and boating

For more information on CO and fire safety on boats and routine safety check items - Boat Safety Scheme:  
[www.boatsafetyscheme.org/stay-safe](http://www.boatsafetyscheme.org/stay-safe)

For alarm information - Council of Gas Detection and Environmental Monitoring (CoGDEM)  
[carbonmonoxidenewsuk.wordpress.com/56-2/](http://carbonmonoxidenewsuk.wordpress.com/56-2/)

For general CO advice Health & Safety Executive (HSE) Gas Safety Advice Line 0800 300 363 [www.hse.gov.uk/gas/domestic/co.htm](http://www.hse.gov.uk/gas/domestic/co.htm)

Gas Safe Register – to find registered gas fitters  
[www.gassaferegister.co.uk](http://www.gassaferegister.co.uk)

British Marine – to find local boatyards [www.britishmarine.co.uk](http://www.britishmarine.co.uk)

## Charities concerned about Carbon Monoxide

### The Carbon Monoxide and Gas Safety Society

[www.co-gassafety.co.uk](http://www.co-gassafety.co.uk)

CO-Awareness [www.covictim.org](http://www.covictim.org)

### Gas Safety Trust

[www.gas-safety-trust.org.uk](http://www.gas-safety-trust.org.uk)

### Gas Safe Charity

[www.gassafecharity.org.uk](http://www.gassafecharity.org.uk)

CO-Angels [www.co-angels.co.uk](http://www.co-angels.co.uk)

## Acknowledgements

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



# **CO threatens lives – stay safe, stay aware:**

**Install fuel burning appliances properly**

**Maintain appliances and engines routinely**

**Use the equipment correctly**

**Don't block cabin ventilators**

**Don't allow engine fumes into the cabin space**

**Deal with problems immediately**

**Never bring a lit or cooling BBQ into any covered area**

**Don't allow bodged repairs and maintenance**

**Install a CO alarm certified to BS EN 50291-2**

**Test the alarm routinely**

**Never remove the batteries**

**Know the signs of CO poisoning and how to react**

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