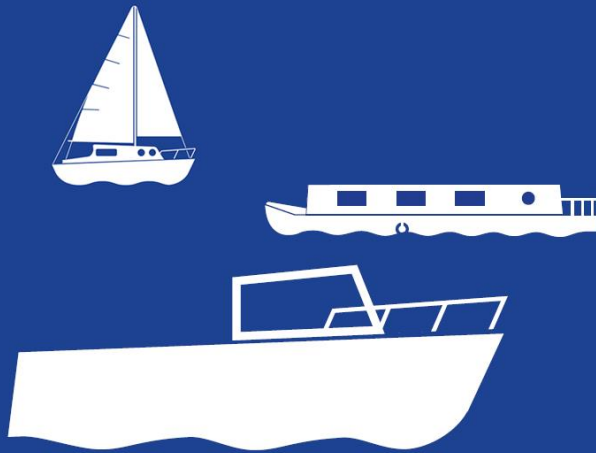


CARBON MONOXIDE SAFETY ON BOATS



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.

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

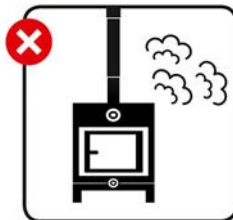
- Staining, sooty smears, or discolouration on surfaces around an appliance or its flue
- Appliances that are difficult to light, keep lit or burn weakly
- Burners with yellow or orange or 'floppy' flames that threaten to go out

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.

- 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

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.

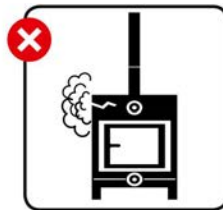
Check the vents for blockages, build-ups of spiders' webs and debris.

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.

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.

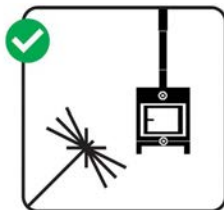
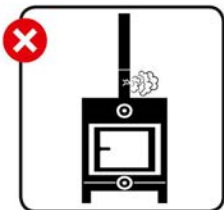
Ensure solid fuel stove chimneys are swept at least annually, or even several times a year - the more a stove is used, the more often the chimney needs cleaning.

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.

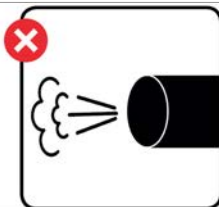
Stay aware of the risks when running engines

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.

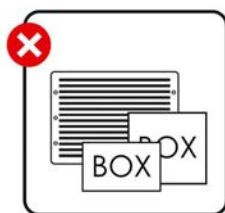
Never use an appliance you think is faulty or unsafe.

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

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.

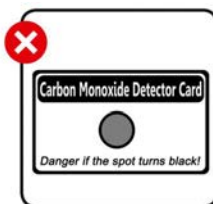
If CO from nearby boat engines or appliances is drawn into your boat, only a CO alarm can give you protection.

'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 or LPCB horseshoe 'approval' symbols indicating independent product testing.
- for the current list of CO alarm models recommended by the alarm makers, go to boatsafetyscheme.org/co
- you may want to consider if alarms with life-long 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?

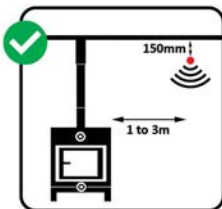
All cabins with a fuel burning appliance should have a CO alarm fitted.

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 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, CoGDEM has these 'best practice' pointers. Try to place the alarm:

- In living quarters between 1m and 3m (on plan view) from the appliance
- Keep alarms from being directly above a source of steam or heat
- If wall mounting a CO alarm, fix it high up, but at least 150mm from the ceiling and where the indicator lights can be seen
- If ceiling mounting, fix alarms at least 300mm from the cabin sides and bulkheads
- In sleeping quarters have the CO 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 further 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 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 charging batteries gassing off. It means there could be a problem, it should be investigated and not ignored.



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 for more information for tenants and the health and safety in privately rented accommodation pages on www.gov.uk

Further information on CO and boating

For boater information on CO, ventilation calculations, fire safety and basic routine safety checks - Boat Safety Scheme:
www.boatsafetyscheme.org/stay-safe

For alarm information - Council of Gas Detection and Environmental Monitoring (CoGDEM)
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

Gas Safe Register – to find registered gas fitters
www.gassaferegister.co.uk

British Marine – to find local boatyards www.britishmarine.co.uk

Acknowledgements

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www.gov.uk/firekills

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

- Ei Electronics Ltd
- Firehawk
- FireAngel Safety Technology Ltd
- First Alert
- Honeywell
- Kidde Safety Europe Ltd

If you are about to choose a CO alarm, see the BSS website for the current list of CO alarm models suited for boats.

The authors are grateful for the help of Public Health England staff with our booklet's content and acknowledge the PHE & NHS as our source of medical information.



We highly recommend reading the additional NHS information on CO: -
www.nhs.uk/Conditions/Carbon-monoxide-poisoning

Charities concerned about Carbon Monoxide

The Dominic Rodgers Trust

domicrodgerstrust.org.uk

Gas Safety Trust

gas-safety-trust.org.uk

Gas Safe Charity

gassafecharity.org.uk

Katie Haines Memorial Trust

katiehainestrust.com

The Carbon Monoxide and Gas Safety Society

co-gassafety.co.uk

CoGDEM (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 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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