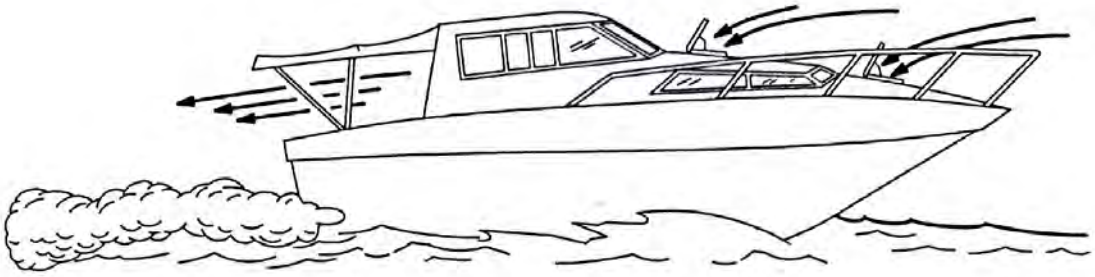
Extract from the Mercury Mercruiser Operation, Maintenance and Warranty Manual

CA766

Exhaust Emissions

CA641



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Courtesy of ABYC

CA767

Be Alert To Carbon Monoxide Poisoning

Carbon monoxide is present in the exhaust fumes of all internal combustion engines including the outboards, stern drives and inboard engines that propel boats, as well as the generators that power various boat accessories. Carbon monoxide is a deadly gas that is odorless, colorless and tasteless.

Early symptoms of carbon monoxide poisoning, which should not be confused with seasickness or intoxication, include headache, dizziness, drowsiness, and nausea.

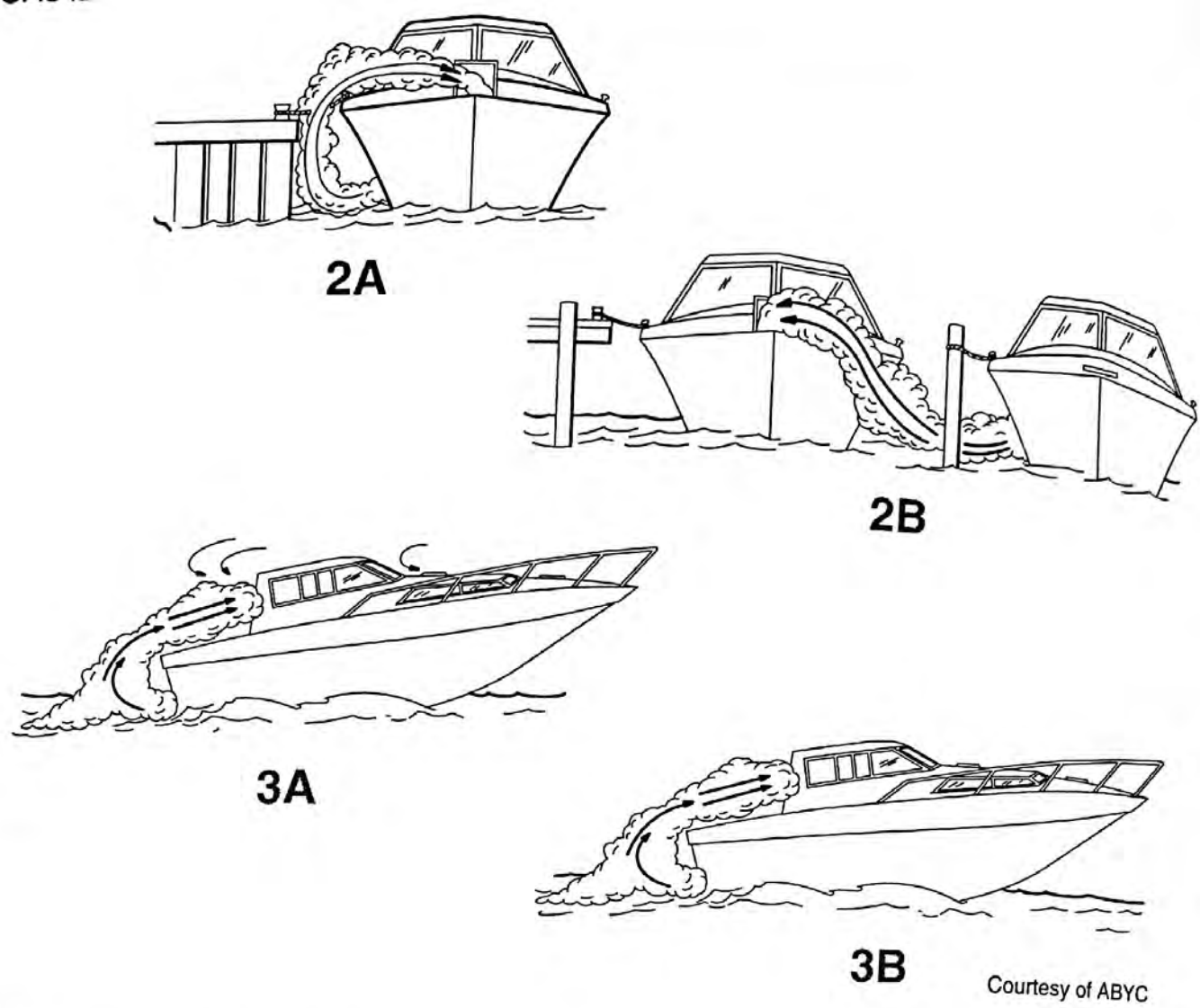
⚠ WARNING

Avoid the combination of a running engine and poor ventilation. Prolonged exposure to carbon monoxide in sufficient concentration can lead to unconsciousness, brain damage or death.

GOOD VENTILATION

Ventilate passenger area, open side curtains, or forward hatches to remove fumes.

1 Example of desired air flow through the boat.



CA643

POOR VENTILATION

Under certain running and/or wind conditions, permanently enclosed or canvas enclosed cabins or cockpits with insufficient ventilation may draw in carbon monoxide. Install one or more carbon monoxide detectors in your boat.

Although the occurrence is rare, on a very calm day, swimmers and passengers in an unclosed area of a stationary boat that contains or is near a running engine may be exposed to a hazardous level of carbon monoxide.

2 Examples of poor ventilation while boat is stationary:

A Running the engine when the boat is moored in a confined space.

B Mooring close to another boat that has its engine running.

3 Examples of poor ventilation while boat is moving:

A Running the boat with the trim angle of the bow too high.

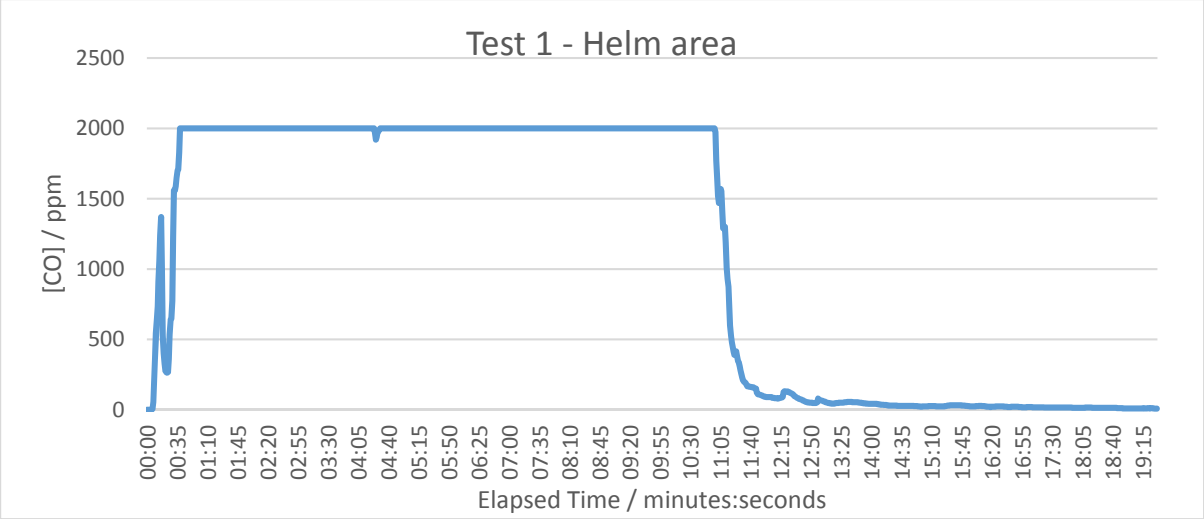
B Running the boat with no forward hatches open (station wagon effect).

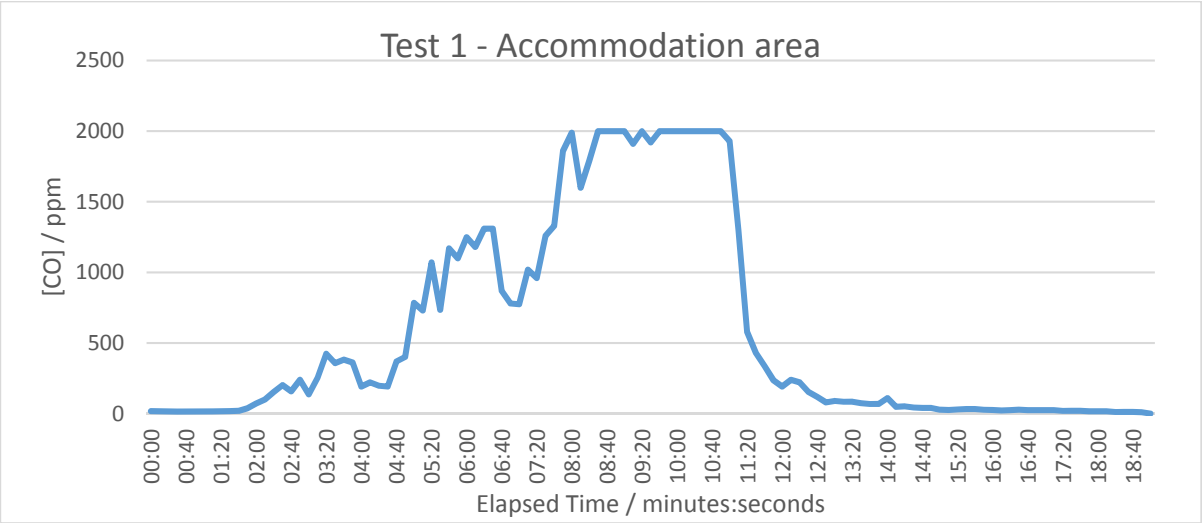
MAIB test results

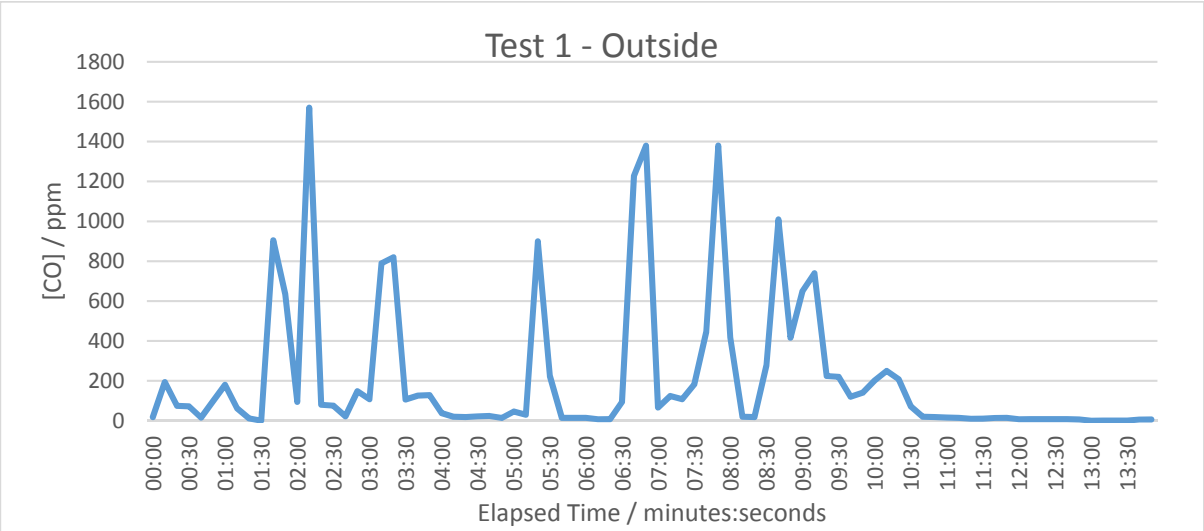
MAIB Test results - *Love for Lydia* – 12-14 September 2016

Test No	Date	Start Time	Finish time	Amb temp (int)	Amb Temp (ext)	Ventilation	Drager - 381 Accom	Drager - 363 Helm	Drager - 375 Location specified	Comments
1	13/09/2016	1132	1142	34	24	As found	Accom	Helm	On river bank	Vessel bows east. Wind 7mph SE (on starboard bow). Engine 3000rpm
2	13/09/2016	1207	1217	37	26	As found	Accom	Helm	On river bank	Vessel bows east. Wind 7mph SE (on starboard bow). Engine 3000rpm
3	13/09/2016	1346	1356	31	27	As found	Accom	Helm	On river bank	Vessel bows east. Wind 9mph SE (on starboard bow). Engine 800rpm
4	13/09/2016	1414	1424	31	26	As found	Accom	Helm	On river bank	Vessel bows east. Wind 9mph SE (on starboard bow). Engine 800rpm
5	13/09/2016	1442	1452	26	24	Fore hatch open Side vents open	Accom	Helm	On river bank	Vessel bows east. Wind 6mph SE 9 (on starboard bow). engine 800rpm
6	13/09/2016	1513	1523	26	24	Fore hatch open Side vents open	Accom	Helm	On river bank	Vessel bows east. Wind 6mph SE (on starboard bow). engine 2600rpm
7	13/09/2016	1536	1546	28	27	Fore hatch open Side vents open	Accom	Helm	On river bank	Vessel bows west. Wind 6mph SE (on stern port quarter) engine 2600rpm
8	13/09/2016	1603	1613	28	26	As found	Accom	Helm	On river bank	Vessel bows west. Wind 6mph SE (on stern port quarter) engine 2600rpm
9	14/09/2016	950	1000	24	21	As found	Accom	Helm	On river bank	Vessel bows east. Wind 5mph ENE (fine on port bow). engine 3000rpm
10	14/09/2016	1035	1945	37/21	24	As found	Accom	Helm	On the stern of neighbouring of boat	Vessel bows east. Wind 5mph ENE (fine on port bow). Small boat moored 2.4m astern. Engine 3000rpm
11	14/09/2016	1101	1111	37/23	26	Fore hatch open Side vents open	Accom	Helm	On the stern of neighbouring of boat	Vessel bows east. Wind 5mph ENE (fine on port bow). Small boat moored 2.4m astern. Engine 3000rpm
12	14/09/2016	1139	1149	40/24	27	Fore hatch and vents closed. Back canopy off	Accom	Helm	Wheelhouse of neighbouring boat	Vessel bows east. Wind 8mph ESE (fine on starboard bow). Small boat moored 2.4m astern. Engine 3000rpm
13	14/09/2016	1202	1212	40/25	28	Fore hatch open Side vents open. Back canopy off	Accom	Helm	Wheelhouse of neighbouring boat	Vessel bows east. Wind 8mph ESE (fine on starboard bow). Small boat moored 2.4m astern. Engine 3000rpm
14	14/09/2016	1225	1235	40/25	29	Fore hatch and vents closed. Canopy front and back open	Accom	Helm	Wheelhouse of neighbouring boat	Vessel bows east. Wind 10mph SE (on starboard bow). Small boat moored 2.4m astern. Engine 2400rpm
15	14/09/2016	1246	1256	40/25	29	Fore hatch open Side vents open. Canopy open back and	Accom	Helm	Wheelhouse of neighbouring boat	Vessel bows east. Wind 10mph SE (on starboard bow). Small boat moored 2.4m astern. Engine 3000rpm

MAIB Test results - *Love for Lydia* – 12-14 September 2016







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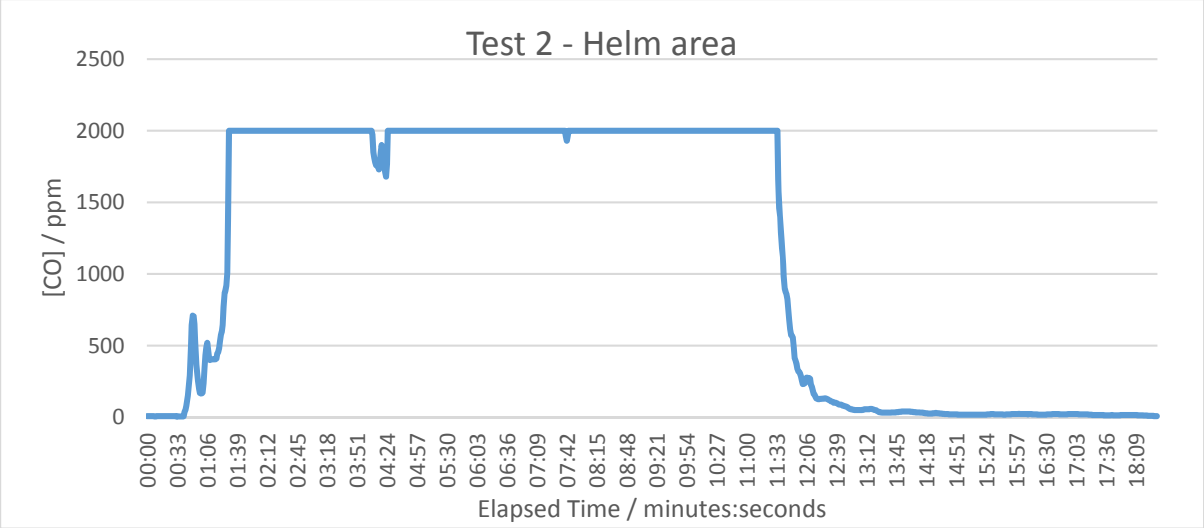

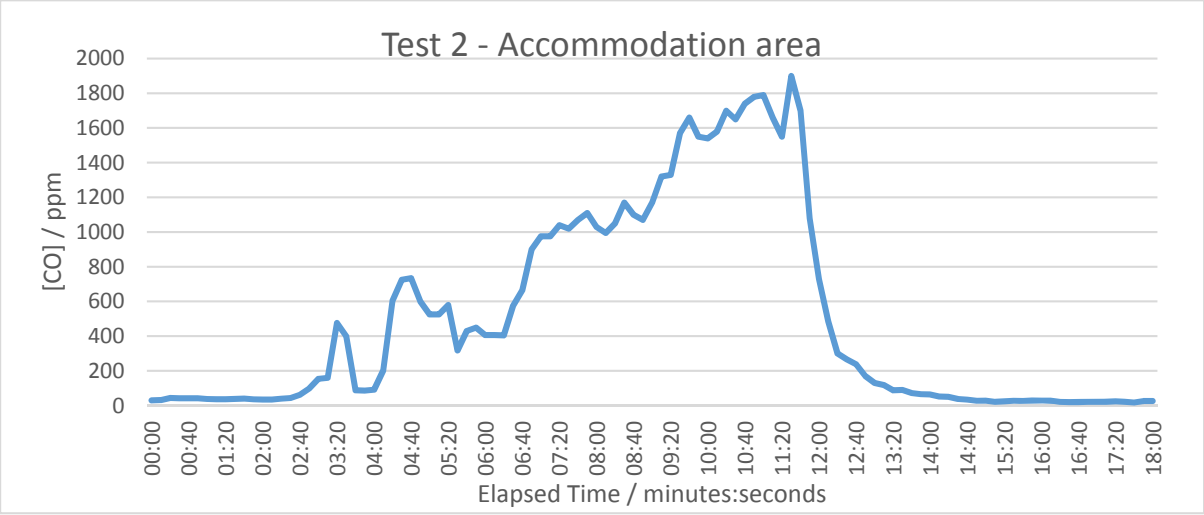

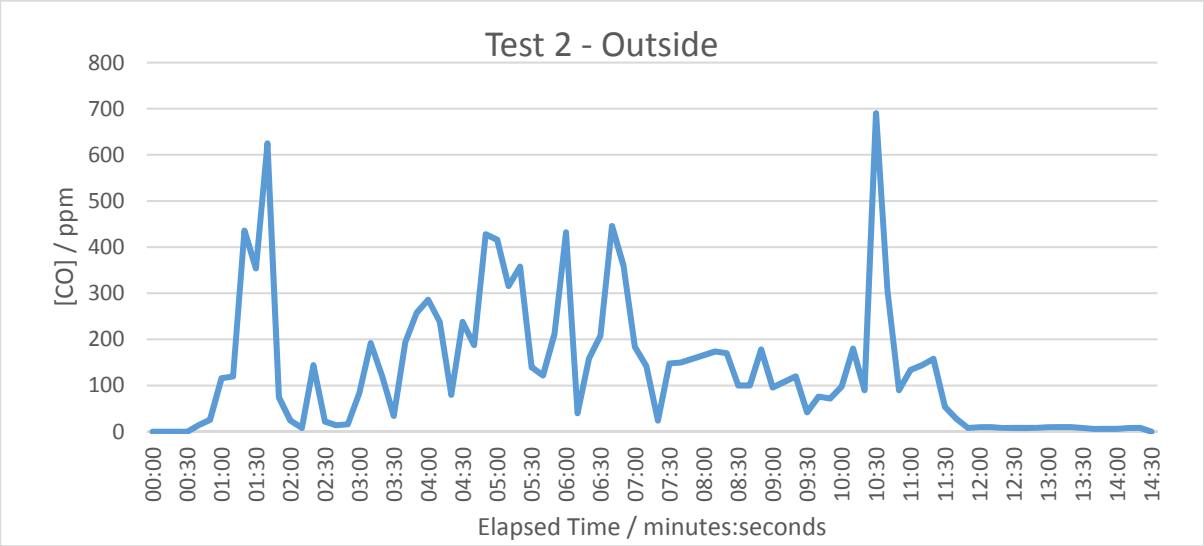

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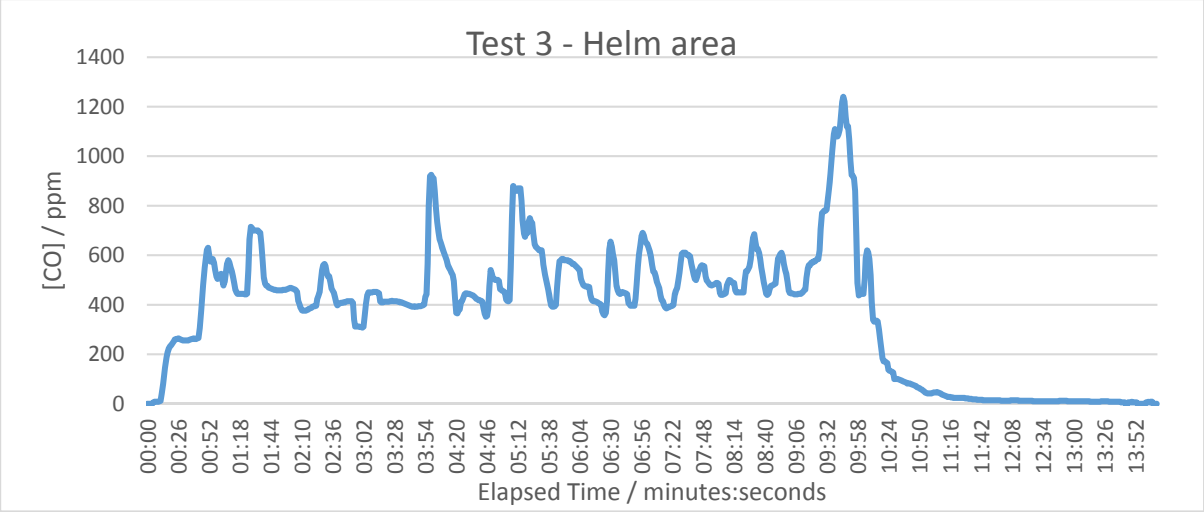

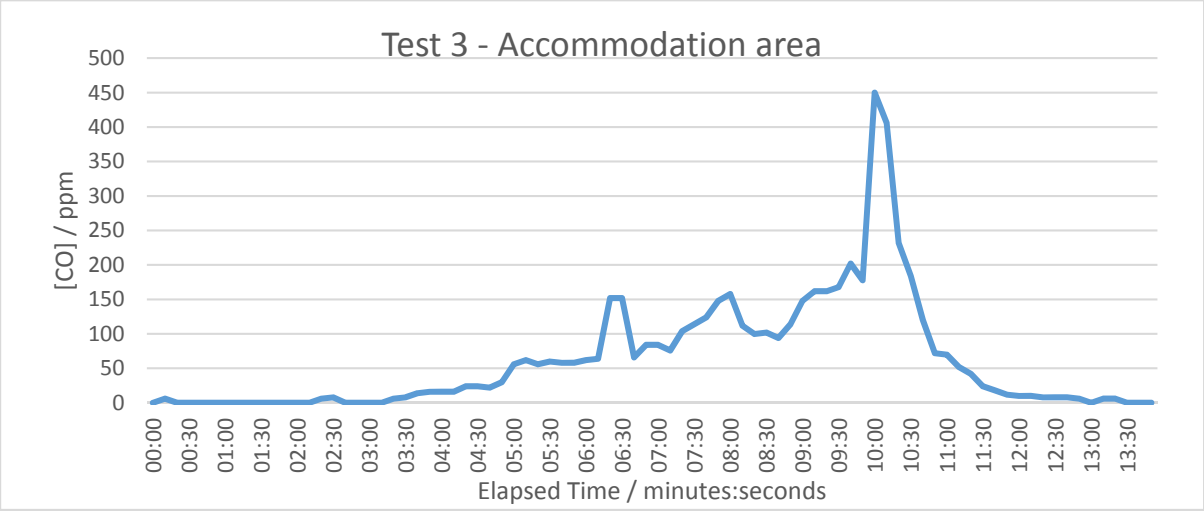

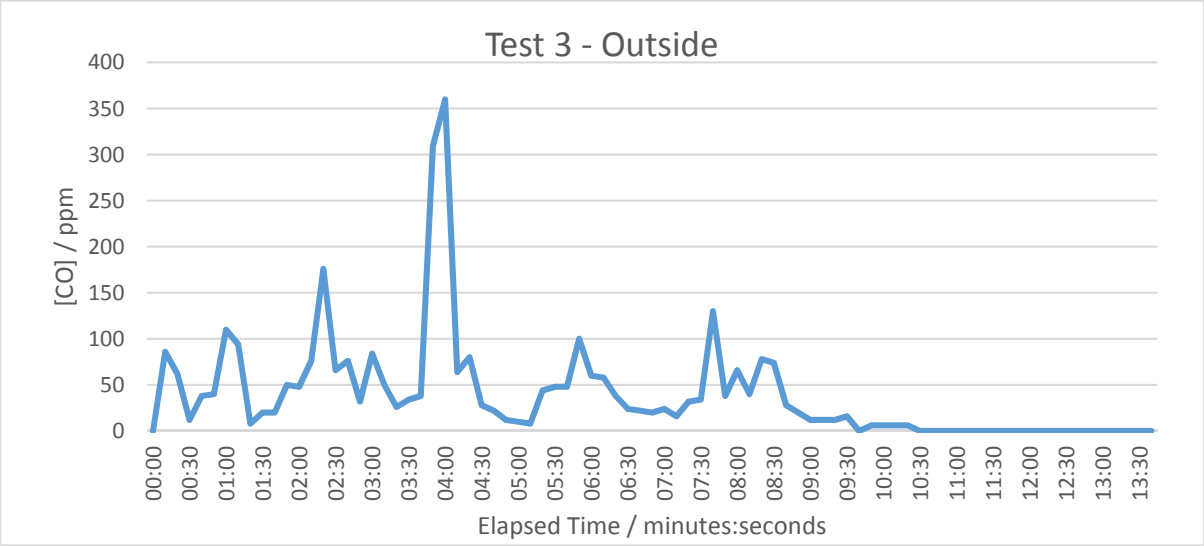

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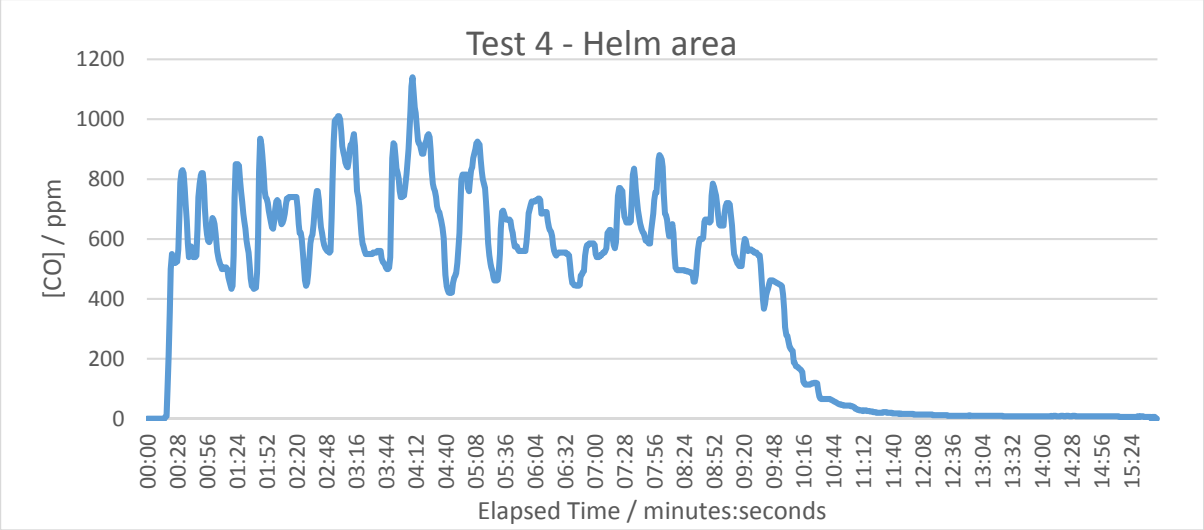

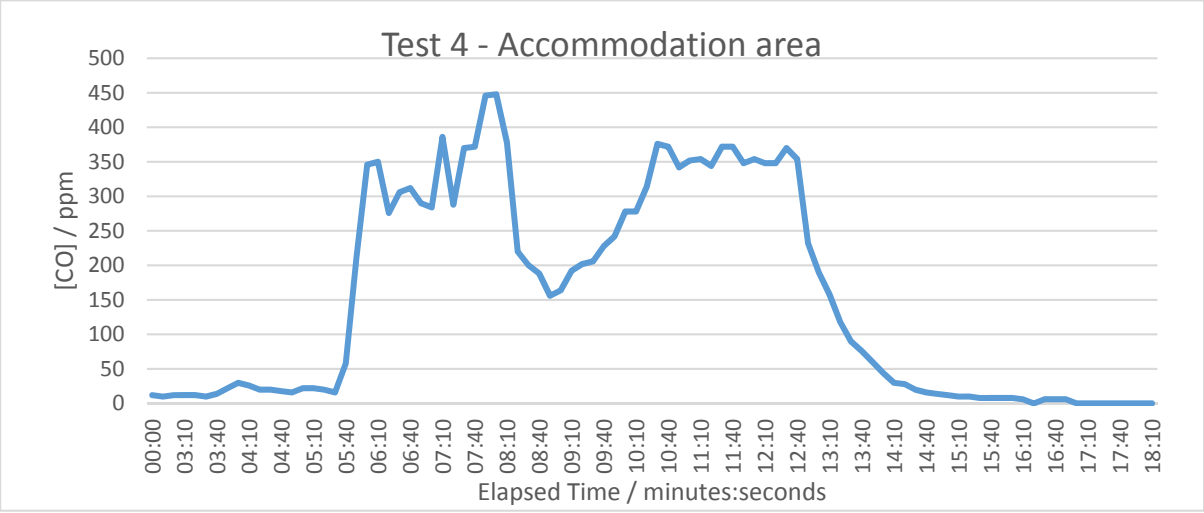

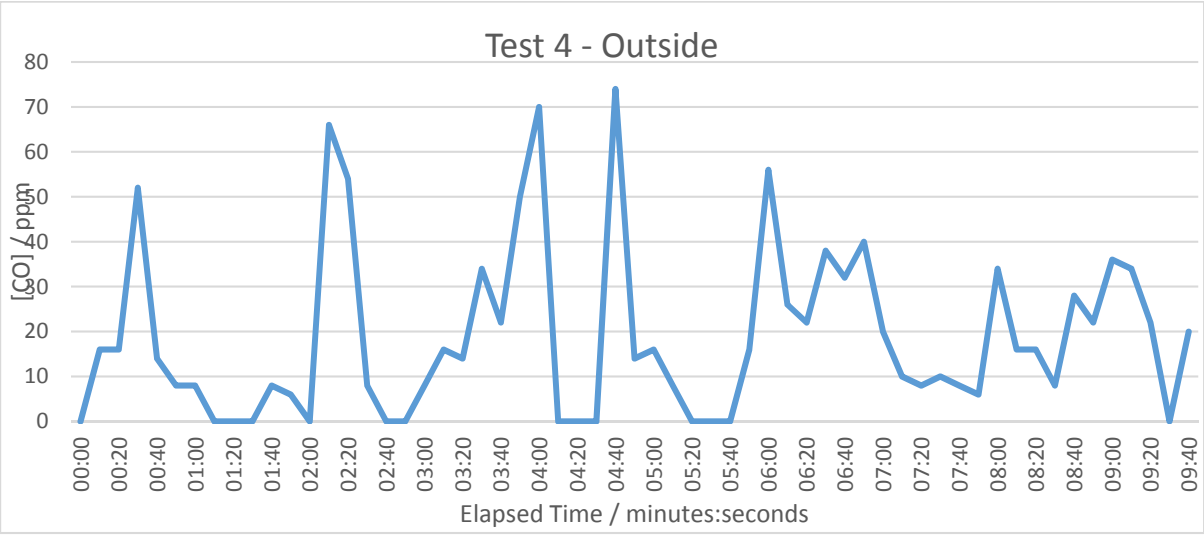

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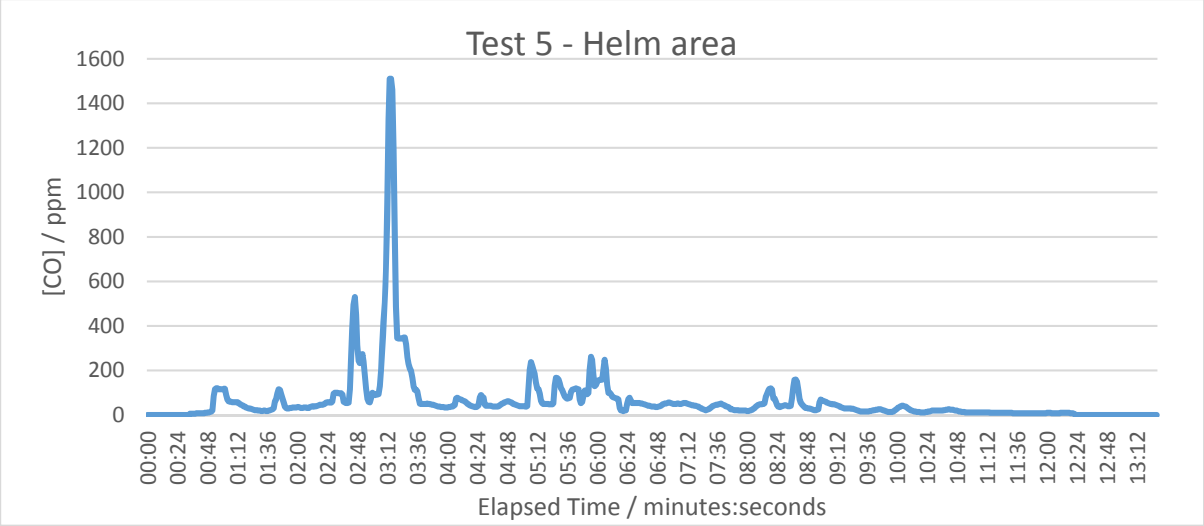

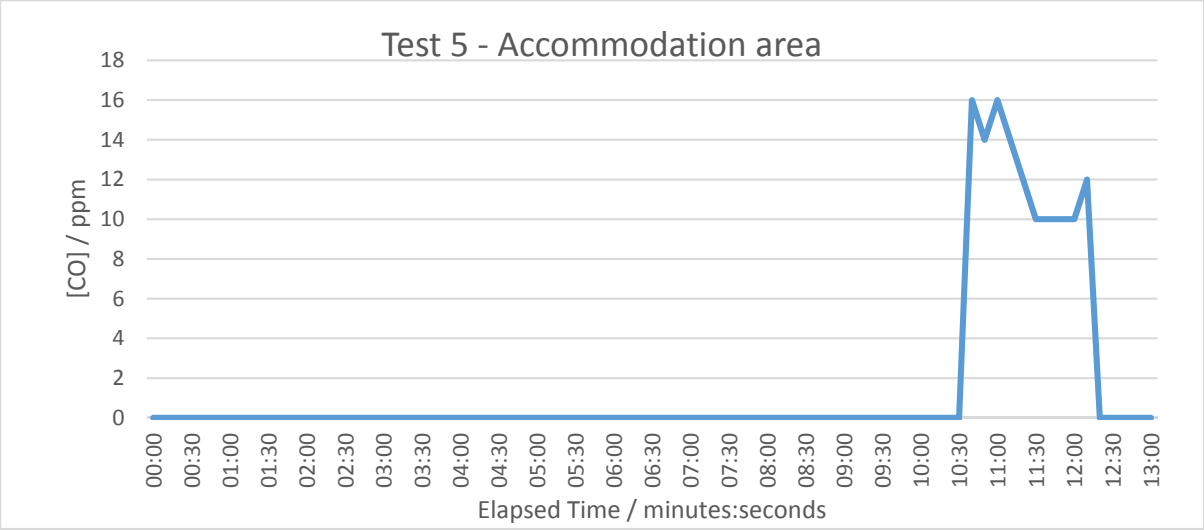

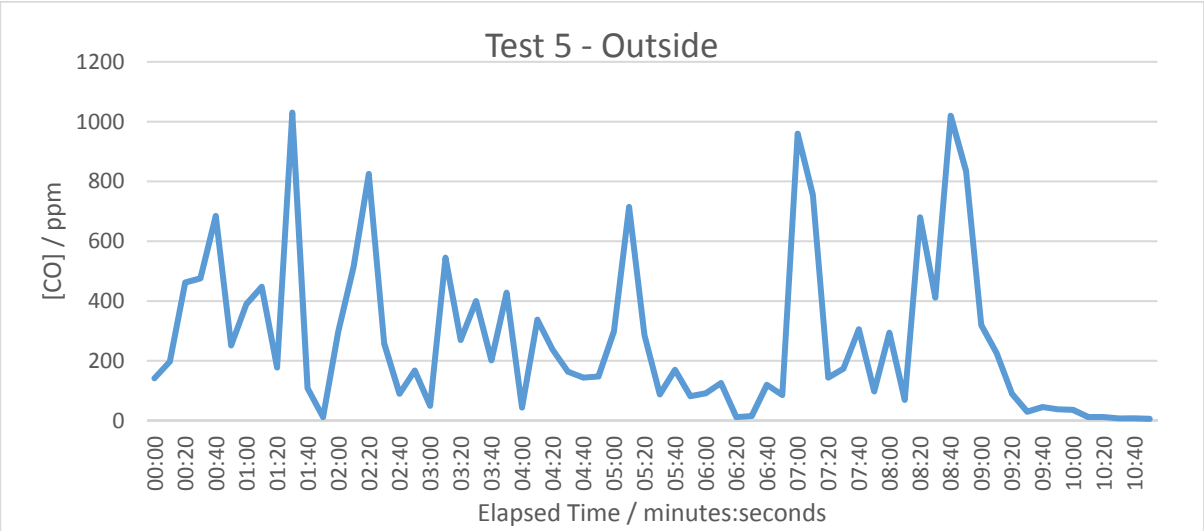

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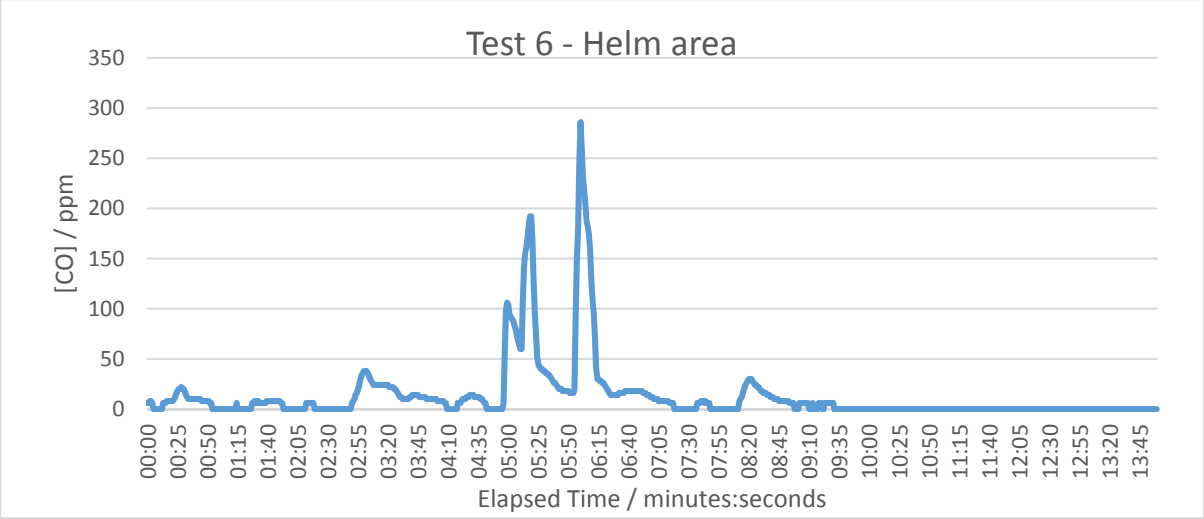

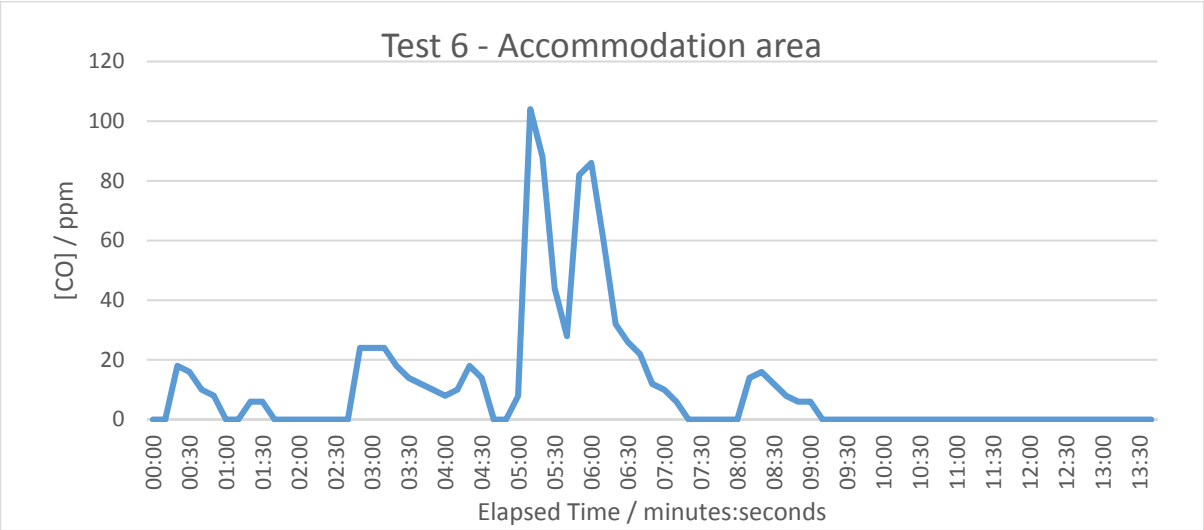

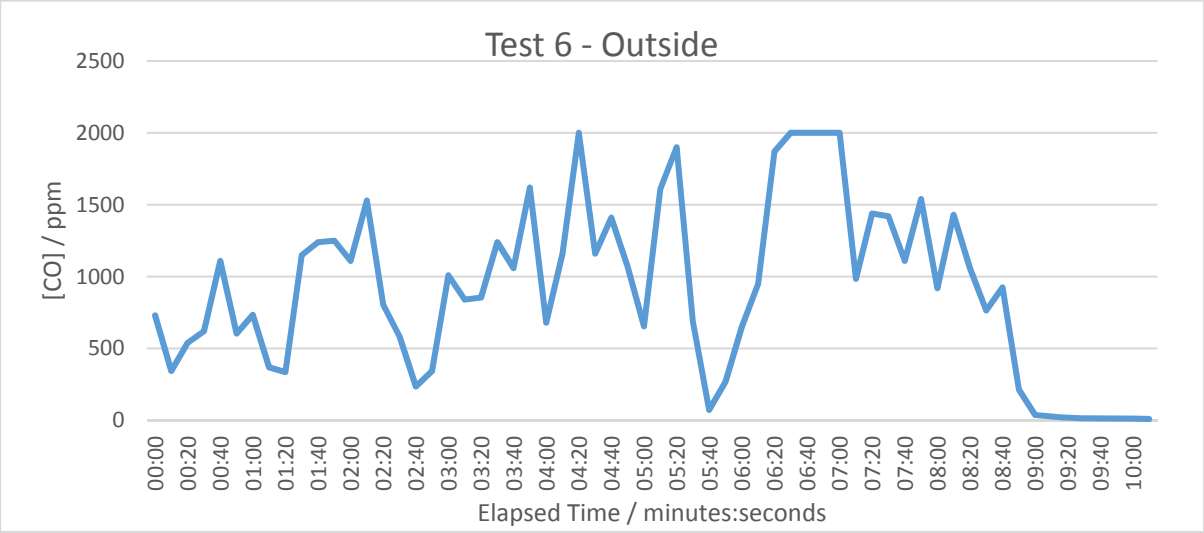

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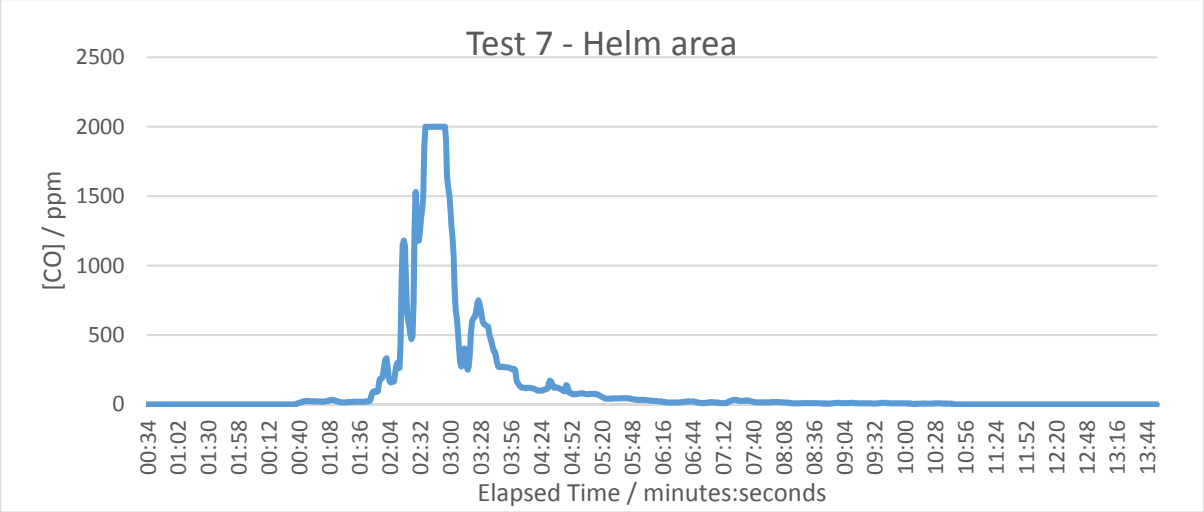

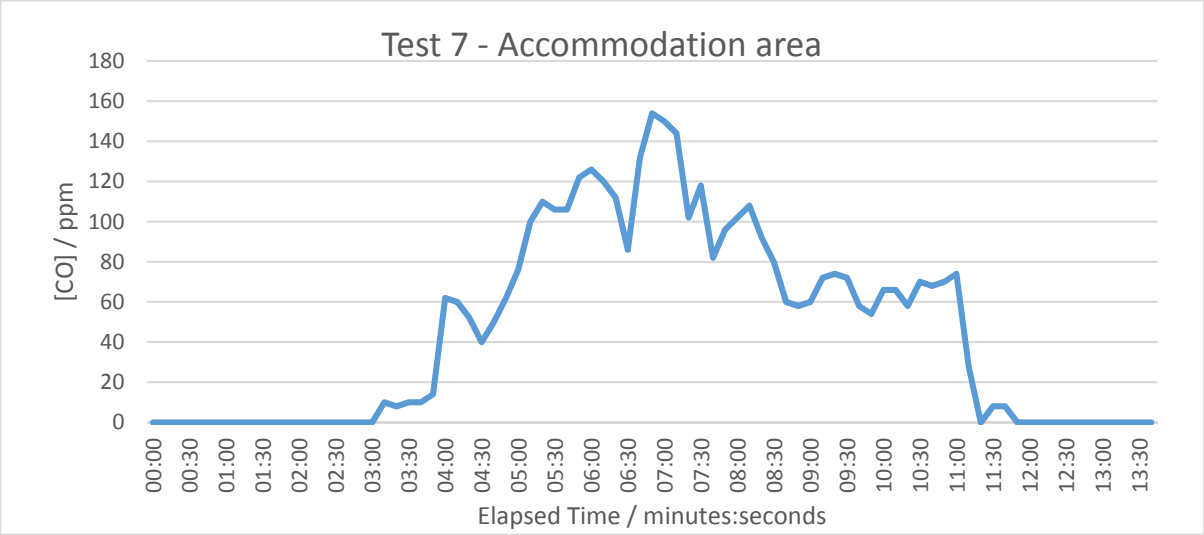

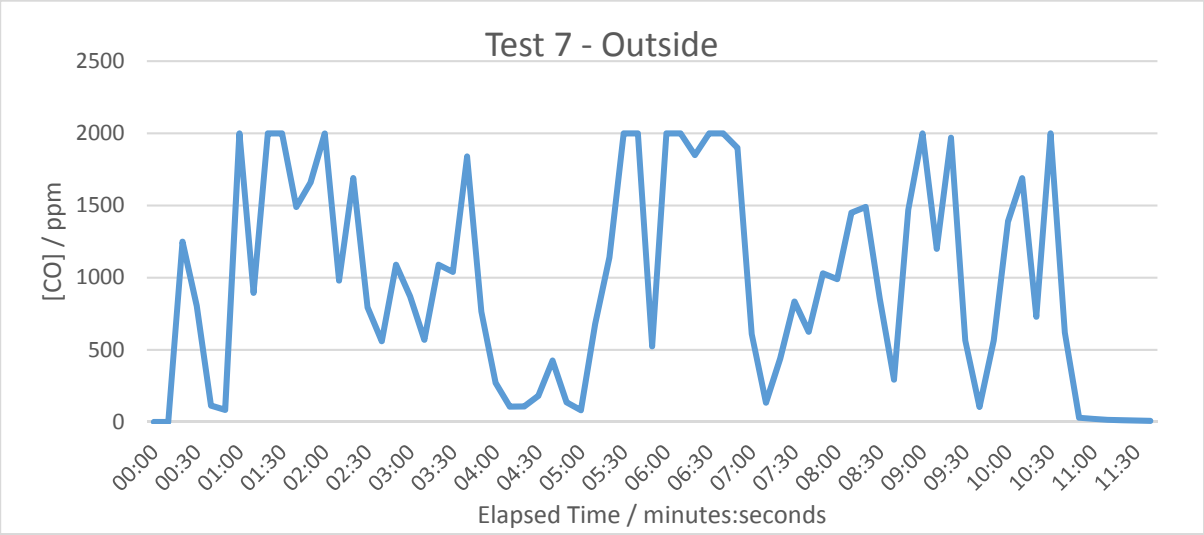

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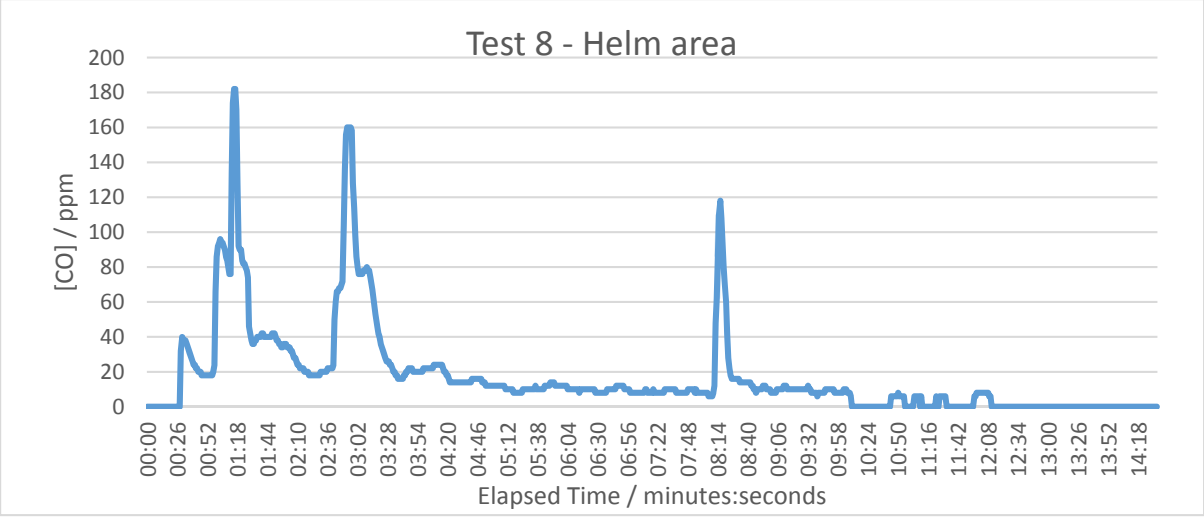

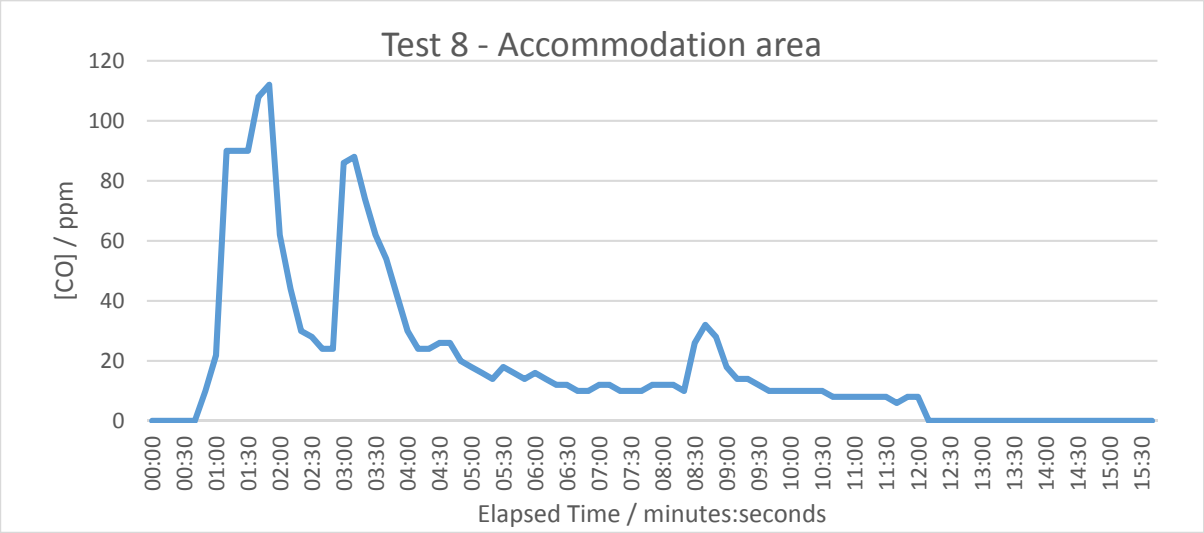

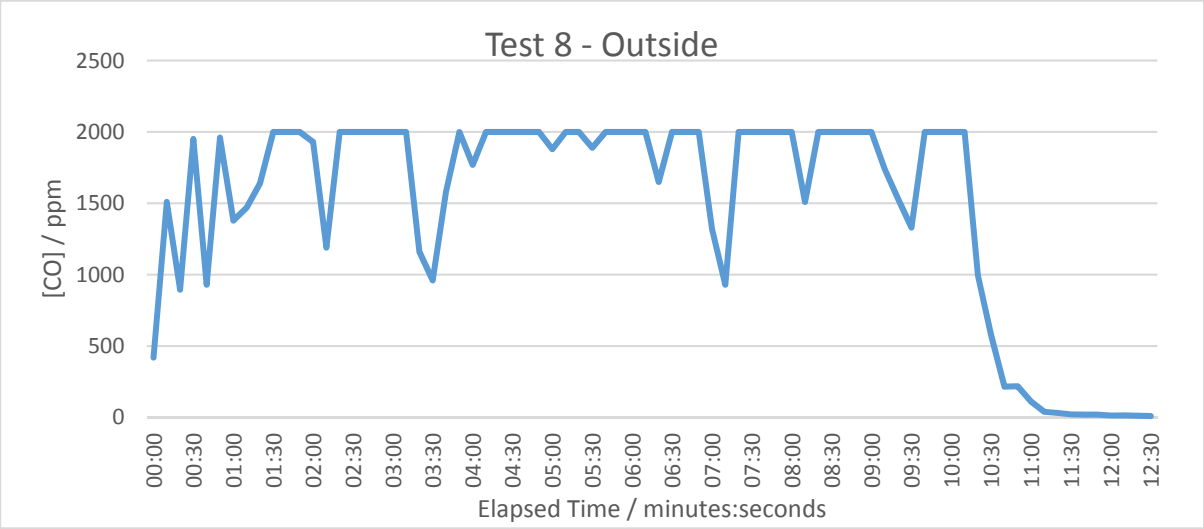

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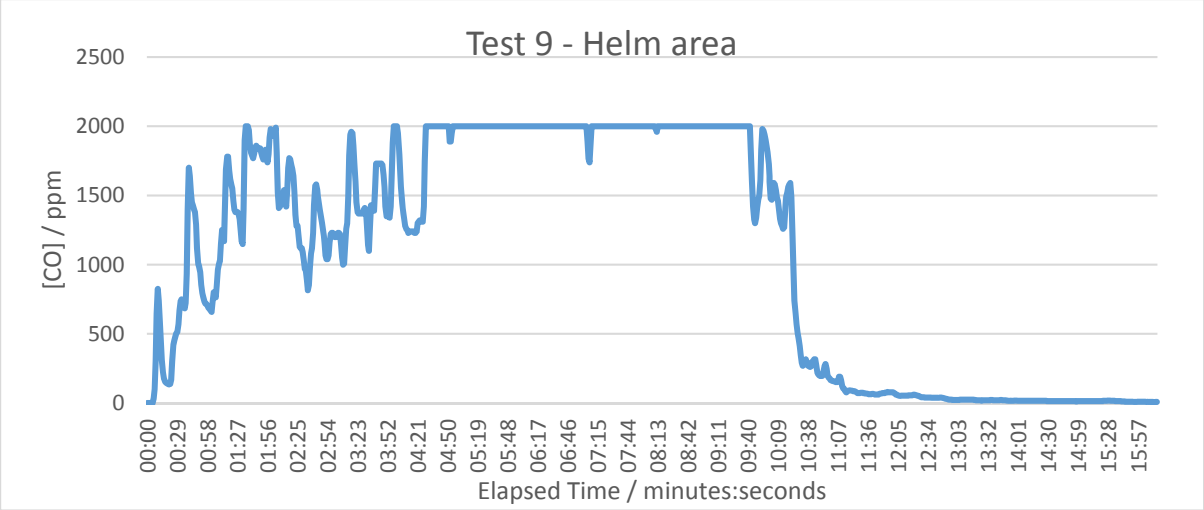

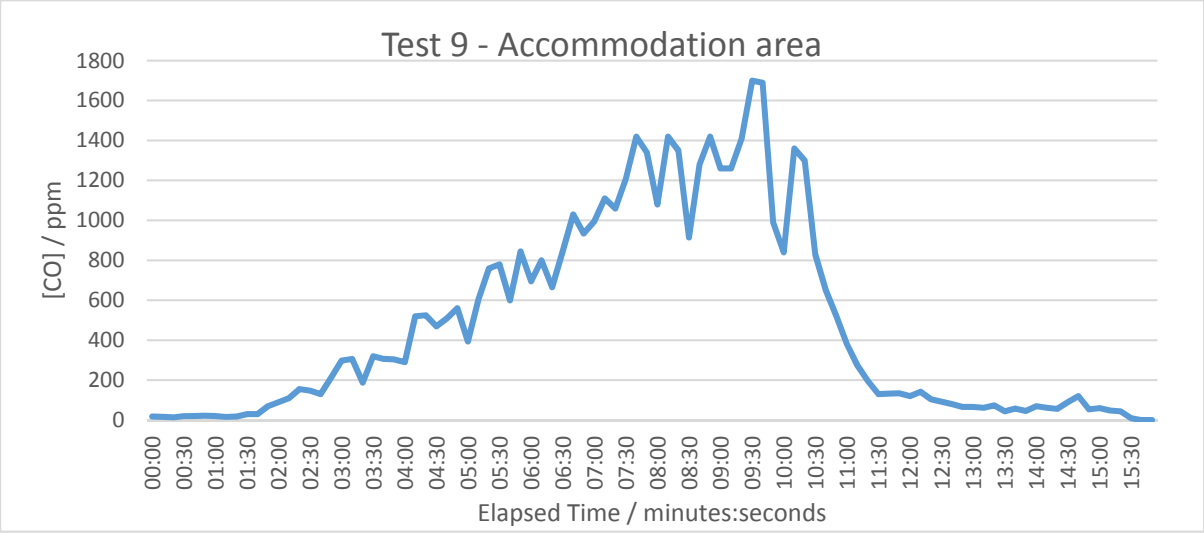

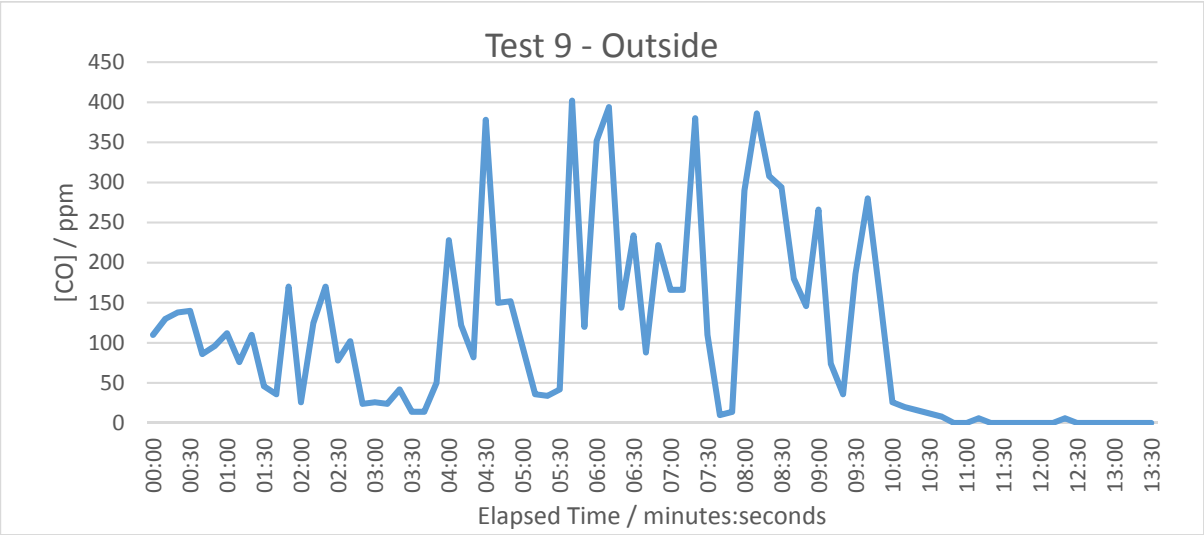

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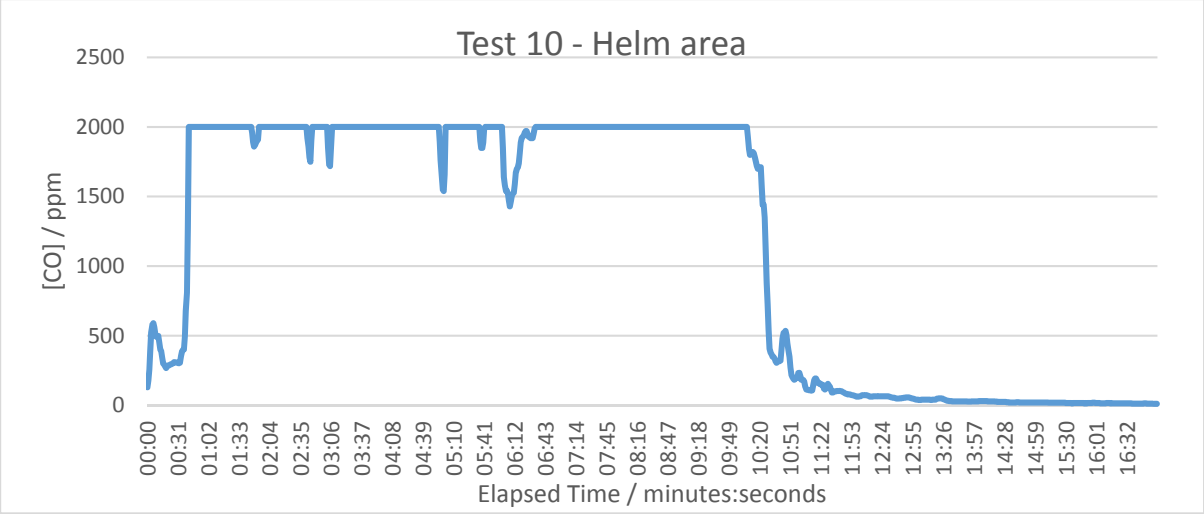

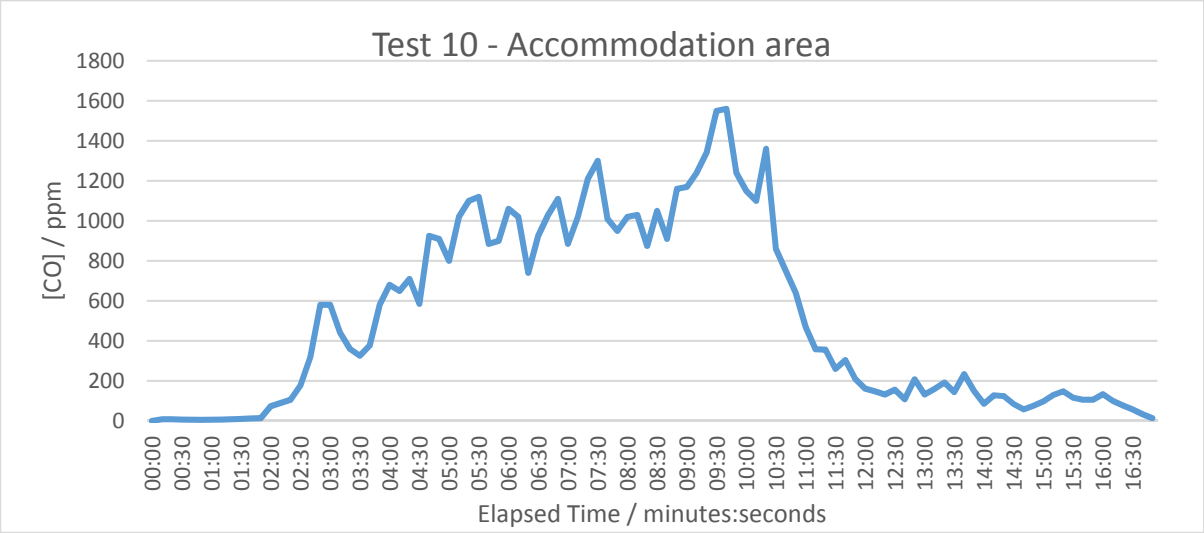

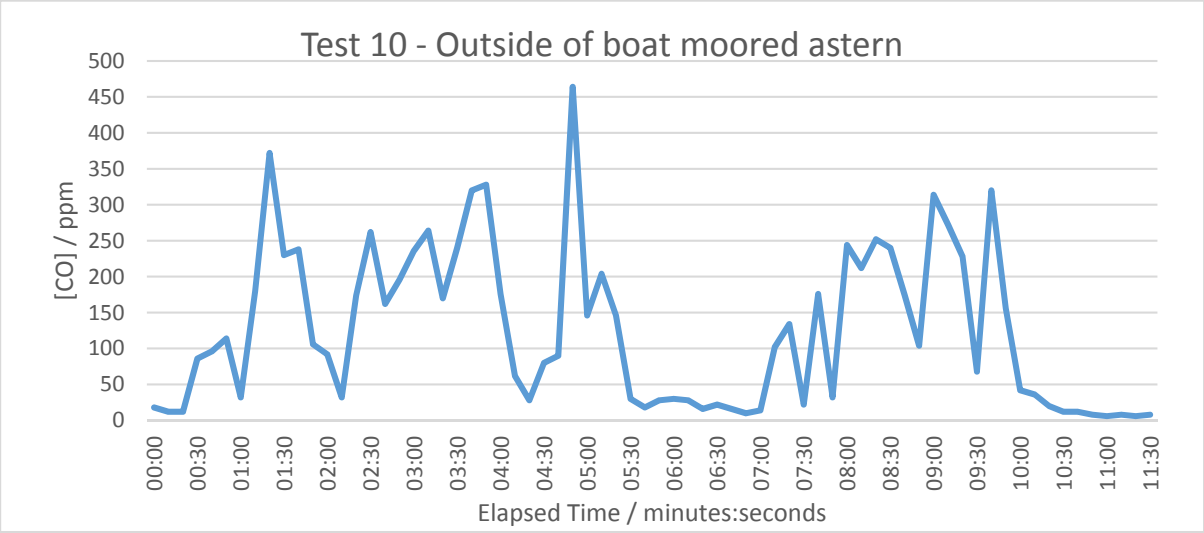

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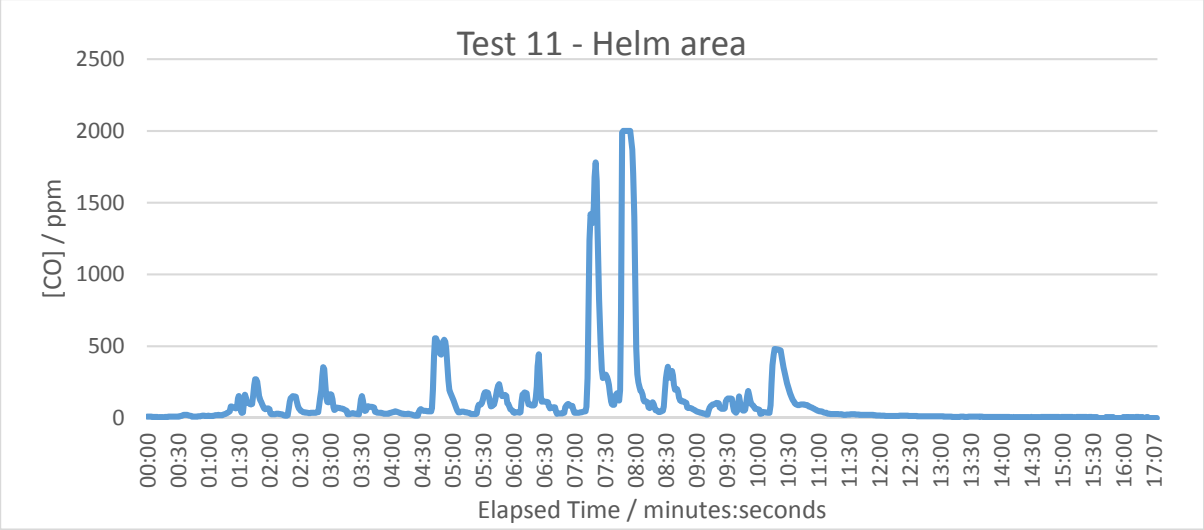

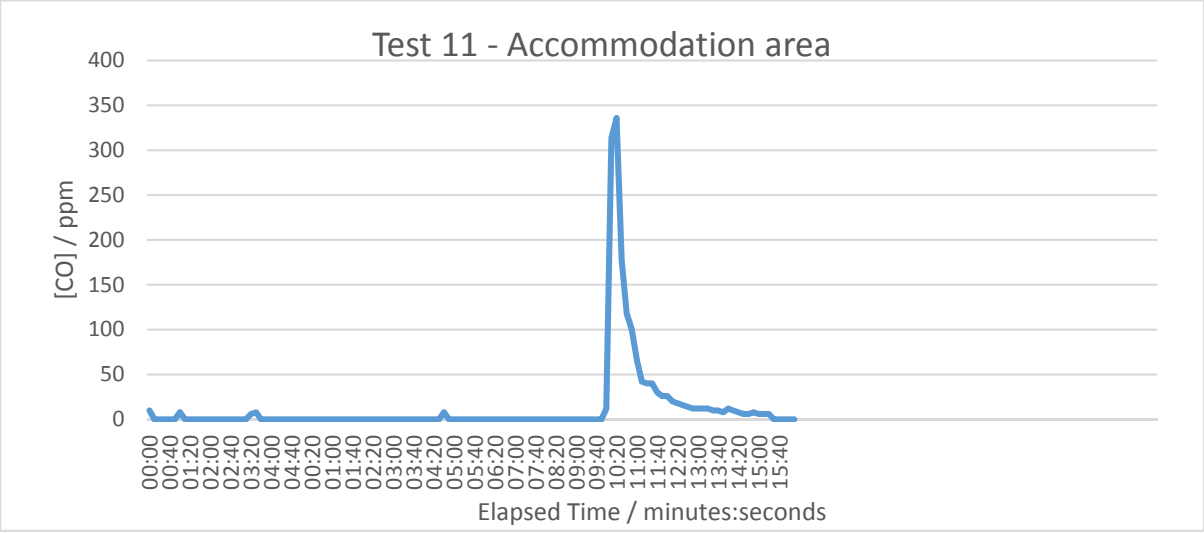

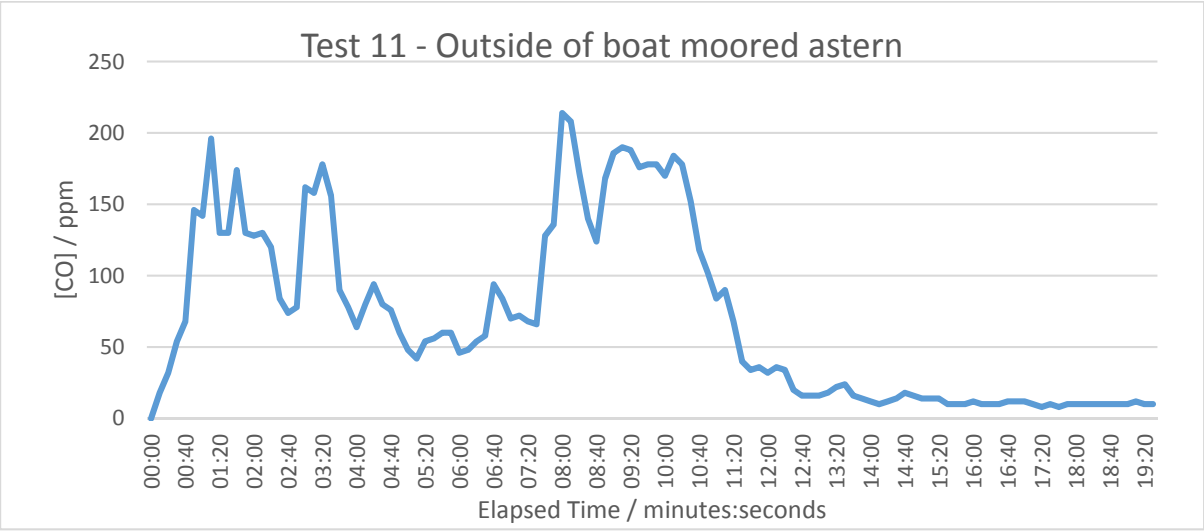

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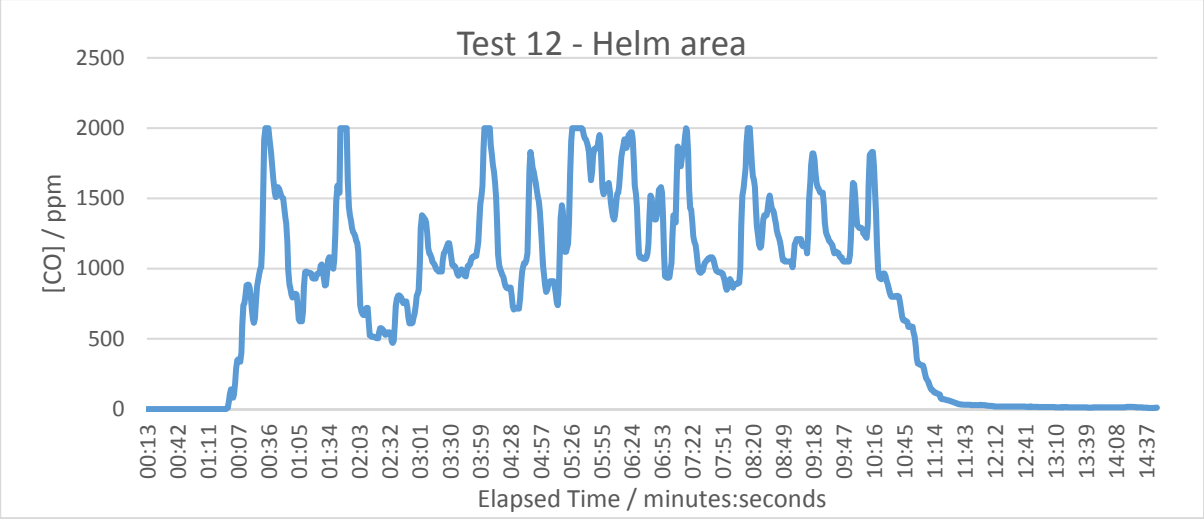

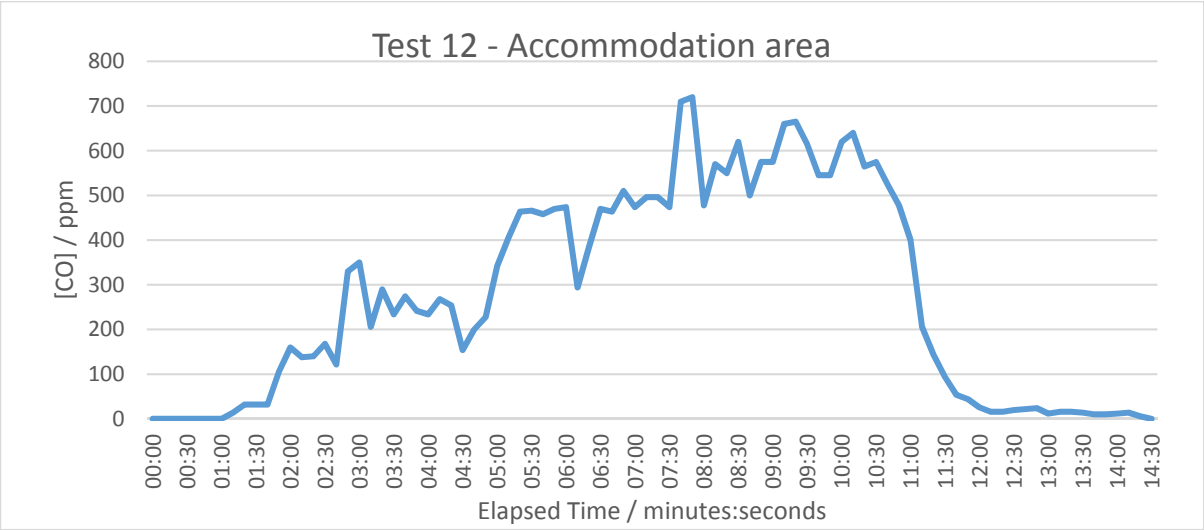

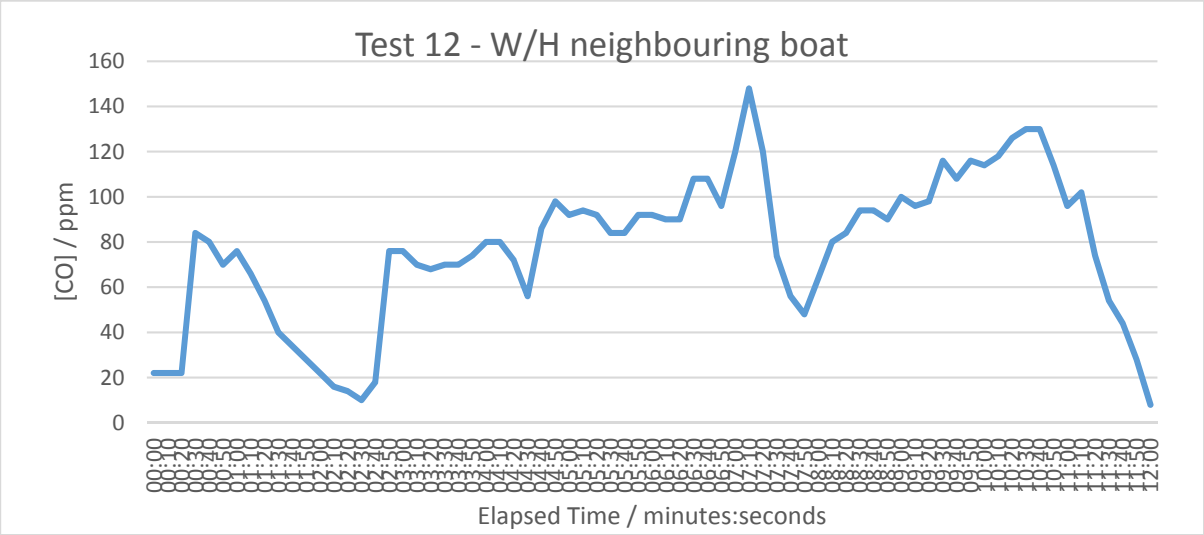

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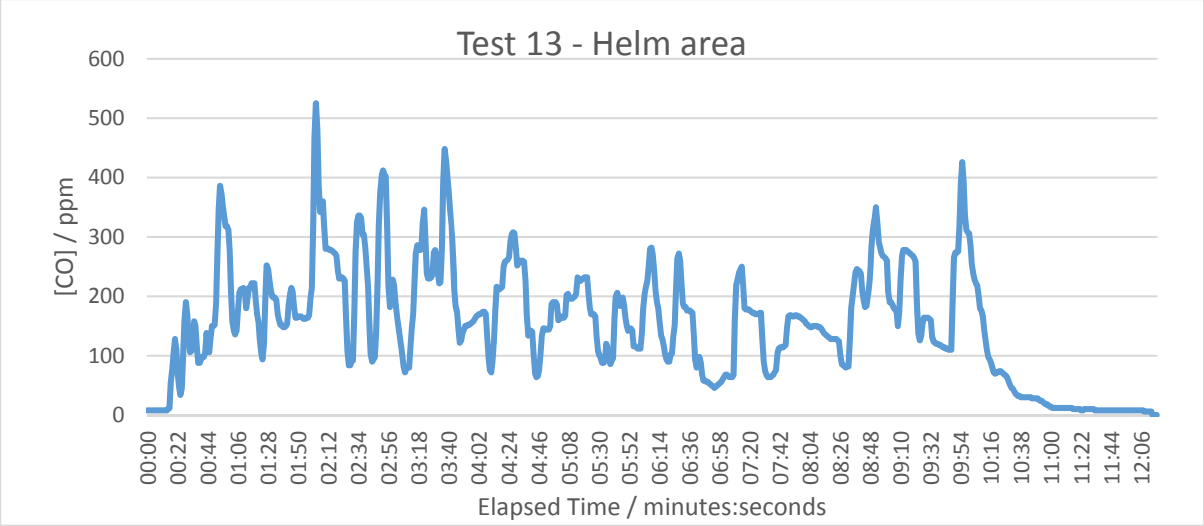

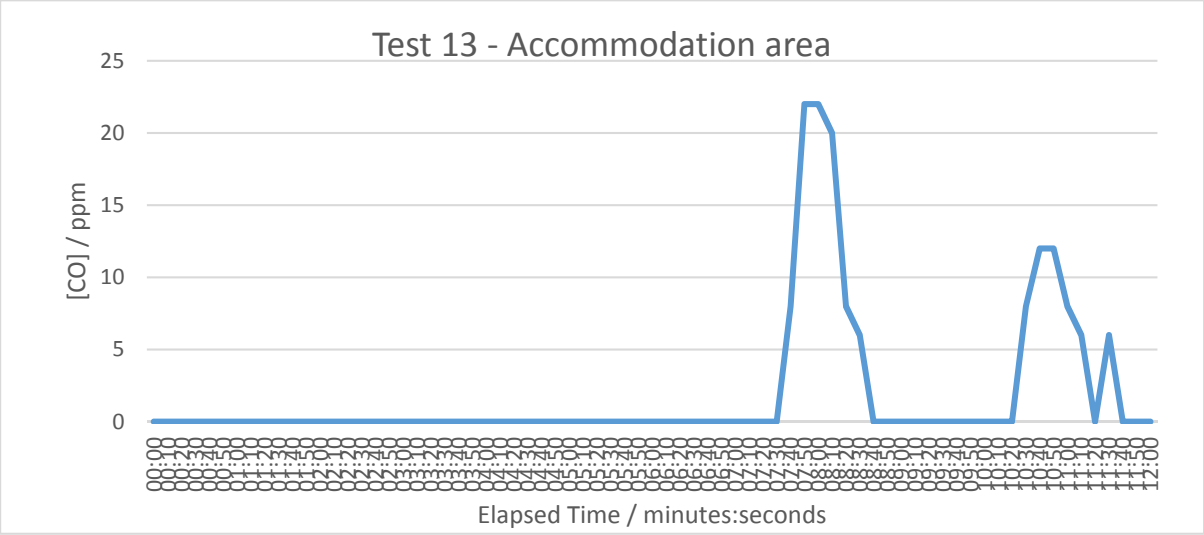

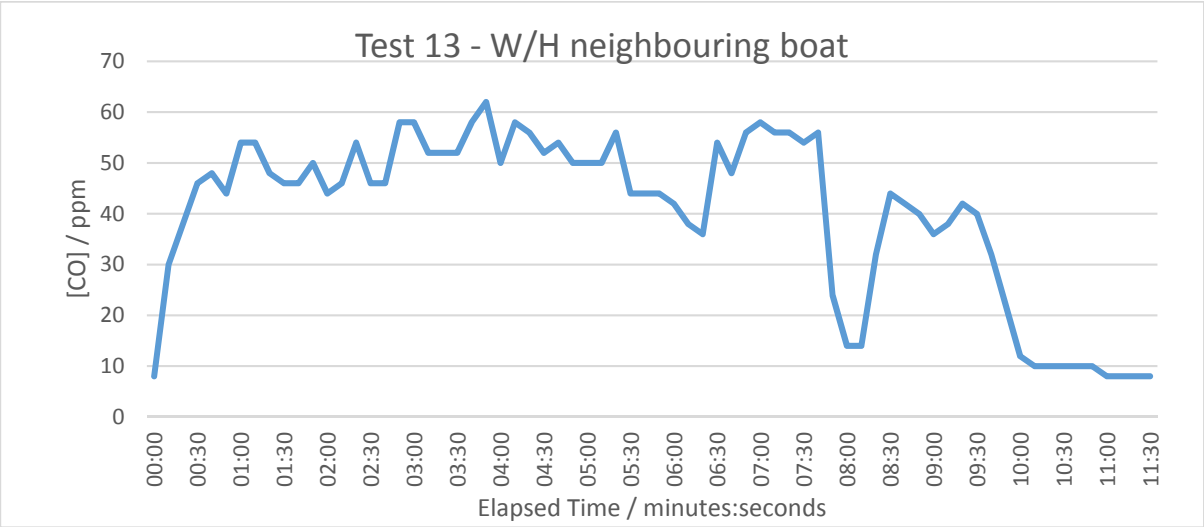

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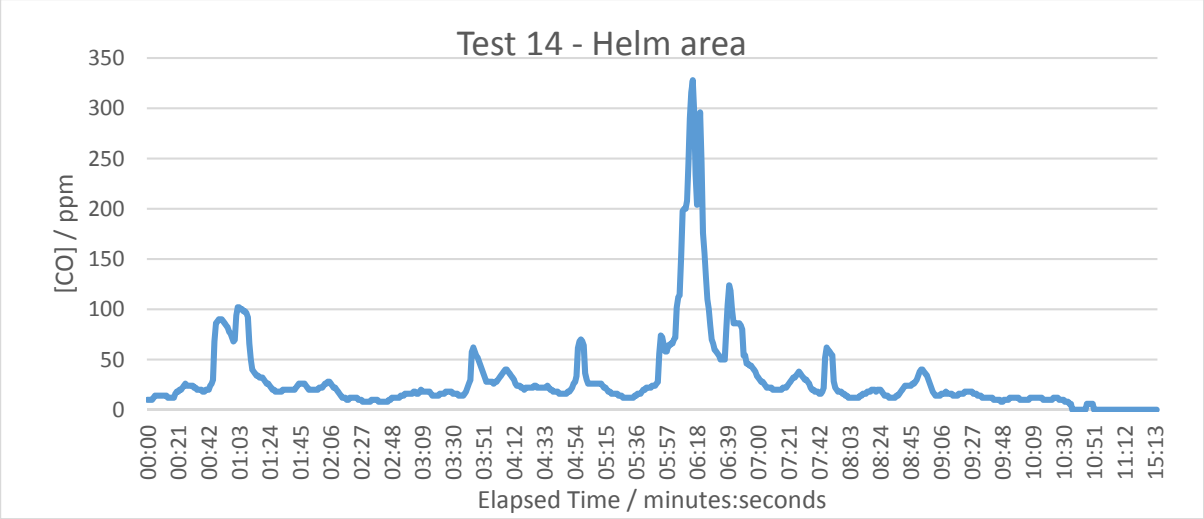

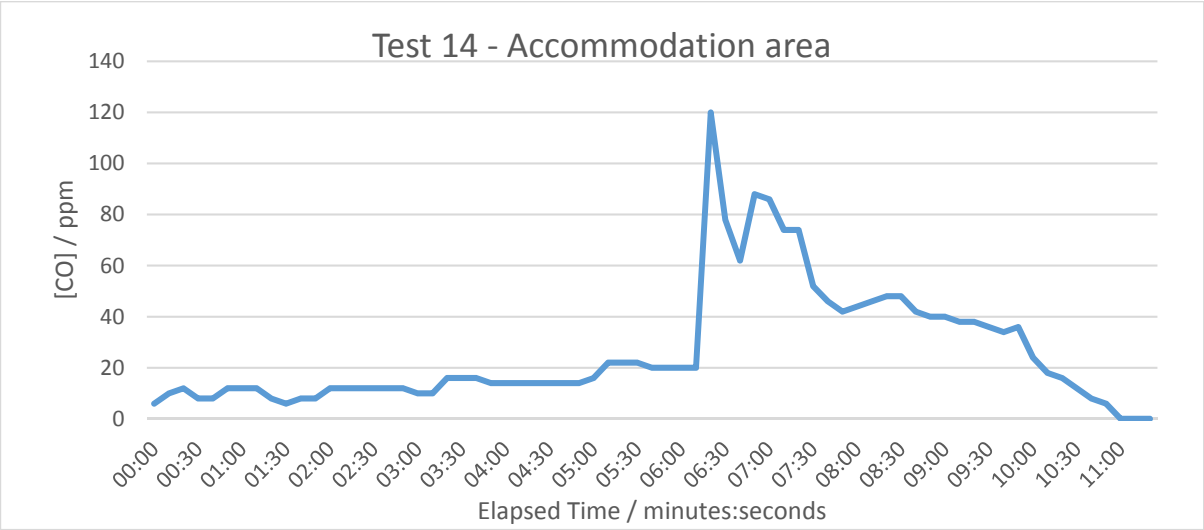

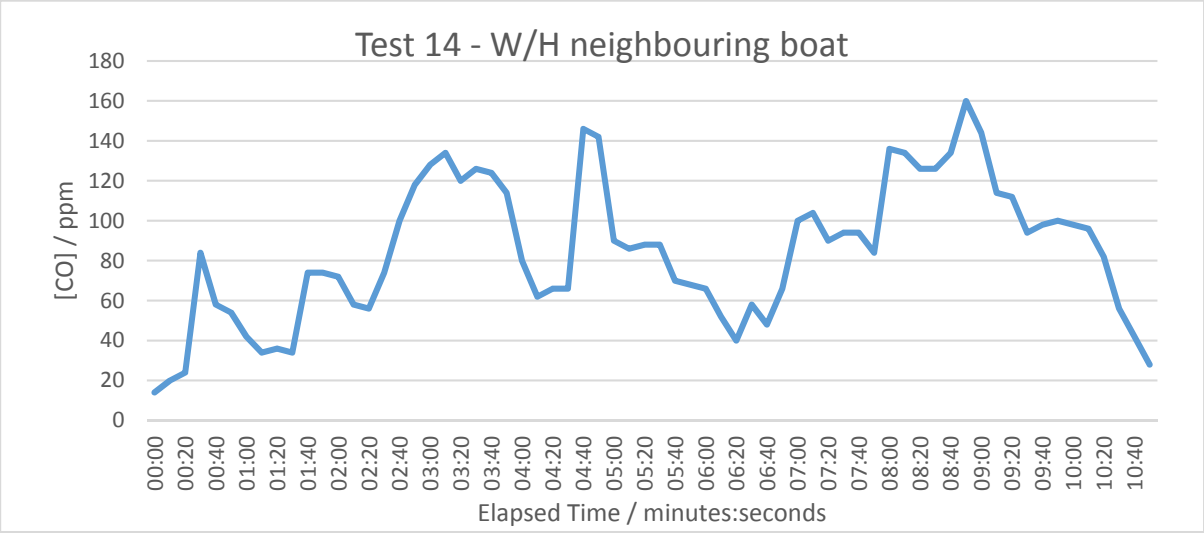

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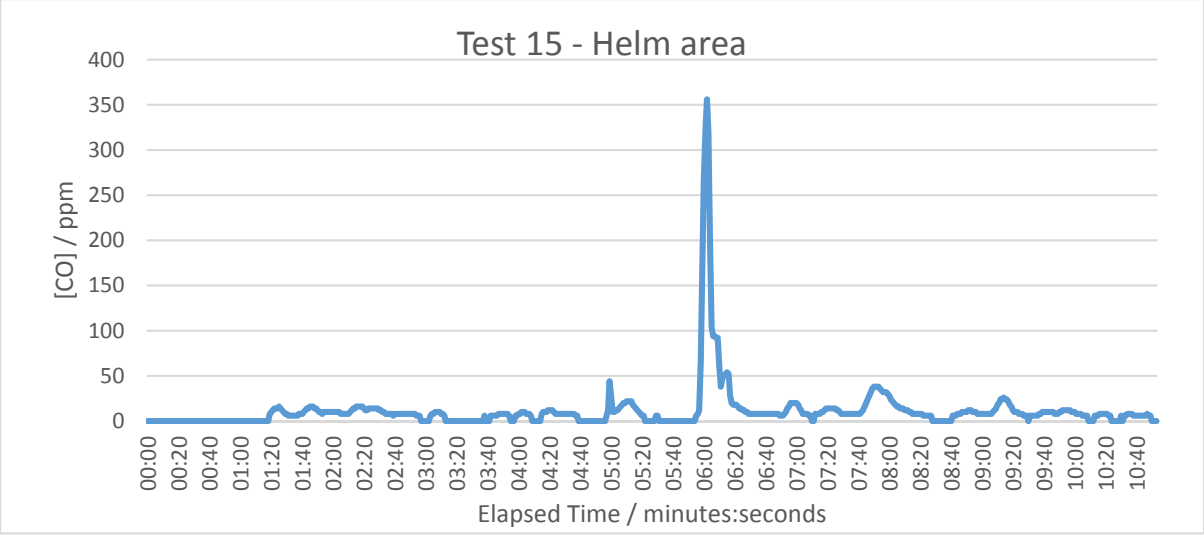
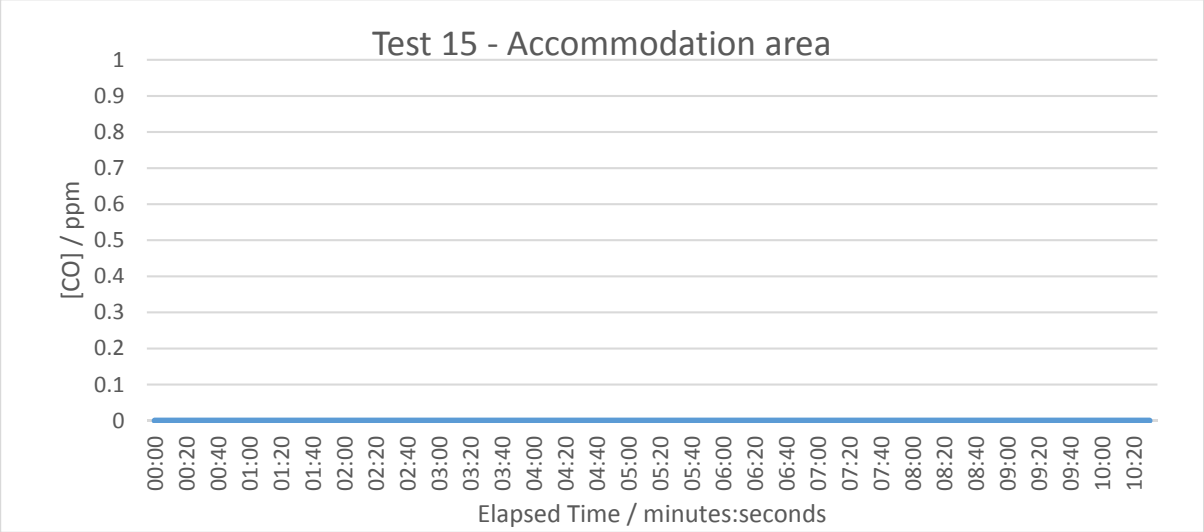
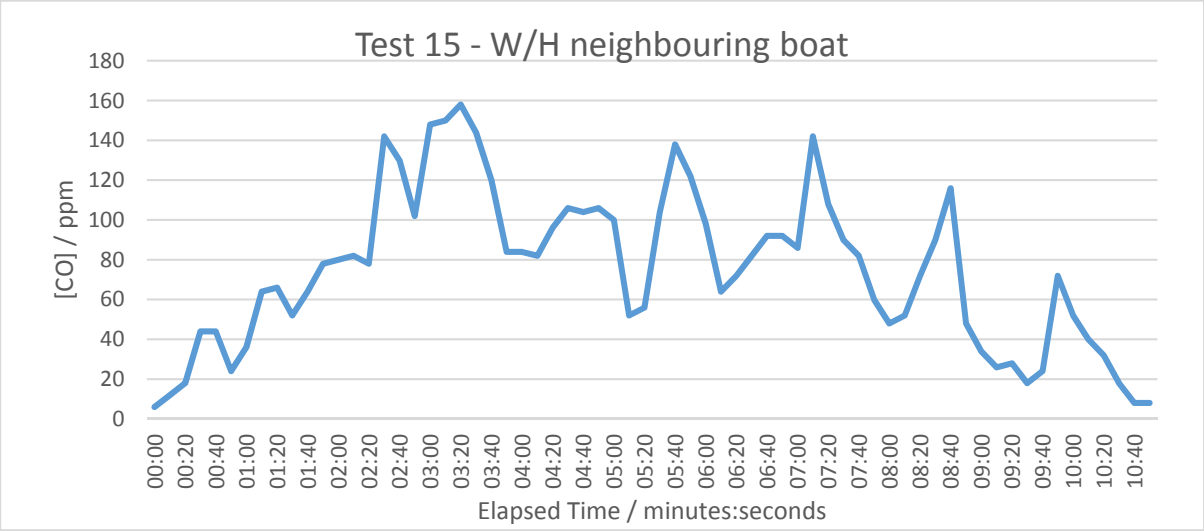






Carbon Monoxide Alarms for Boats

Carbon Monoxide Alarms For Boats

The BSS/CoGDEM leaflet 'Carbon Monoxide Safety on Boats' gives full advice on how to stay safe from carbon monoxide (CO) poisoning aboard your boat. The leaflet suggests that as well as ensuring the correct installation and servicing of heating and cooking appliances on board your boat, the permanent installation of a stand-alone self-powered CO alarm will provide early detection of rogue CO from whatever source. Other sources of CO could be the engine of your boat or neighbouring boats, nearby barbecues, generators, portable gas-bottled appliances or other fossil-fuelled combustion devices.

All of the listed alarms from the four manufacturers shown below comply with the relevant safety standard for CO alarms suitable for use on boats, BS EN 50291-2 and carry the BSI Kitemark. The Kitemark is an indication that the product and its manufacturer have been independently assessed by BSI, which is one of the UK bodies accredited to carry out third party certification and product monitoring.

If you already have an Kitemarked alarm and it was tested to BS EN 50291, or BS EN 50291-1, our advice is to keep that alarm, test it routinely and when it needs replacing, choose a unit showing it was tested to BS EN 50291-2 and suitable for boat use. It is important that the alarm manufacturer's installation and operating instructions are strictly conformed to at all times. A British and European Standard (BS EN 50292) has been produced as a guide on the selection, installation, use and maintenance of these detectors/alarms, and the BSS/CoGDEM leaflet contains guidance taken from this standard. This information is suitable for boats up to 24 metres used for leisure, hire or residential purposes. For other classes of craft, such as commercial or work boats, regulations requiring specified equipment may apply.

Remember that no safety device is completely infallible and fitting a CO alarm should never be taken as a substitute for correct initial appliance installation or for regular and effective appliance operation, service and maintenance by an appropriately competent engineer.

Further information on CoGDEM (The Council of Gas Detection & Environmental Monitoring) is available from:

CoGDEM, Unit 11 Theobald Business Centre,
Wilbury Way, Hitchin, Herts SG4 0TY
Tel: 01462 434322 Fax: 01462 434488.
CO Helpline: 0800 1694 457
Email: admin@cogdem.org.uk Web: www.cogdem.org.uk

CoGDEM
The Council of Gas Detection and Environmental Monitoring

Kidde Safety Europe Ltd Mathisen Way, Poyle Road, Colnbrook, Berkshire, SL3 0HB	Kidde	Tel No: 0800 917 0722 Web: www.kiddesafetyeurope.co.uk
7CO		
Manufacturer's Comments: Battery operated CO alarm. Easy to set-up and use. Wall-mounting or free-standing options. End-of-life warning signal after 10 years. 10 year warranty.		
7DCO		
Manufacturer's Comments: Battery operated CO alarm. Easy to set-up and use. Wall-mounting or free-standing options. End-of-life warning signal after 10 years. LCD display of concentration. 10 year warranty.		

Sprue Safety Products Ltd - FireAngel Ltd
Vanguard Centre, Sir William Lyons Road,
Coventry, CV4 7EZ

Tel: 02476 323232
Fax: 02476 693610
Email: info@fireangel.co.uk
Web www.fireangel.co.uk

FireAngel CO-9B

Manufacturer's Comments: Replaceable battery powered 7 year life carbon monoxide alarm. Large test & reset button makes testing easy. Automatic self diagnostic check. Retail and trade packs available. 7 year warranty

FireAngel CO-9X

Manufacturer's Comments: 7 year sealed for life carbon monoxide alarm. Large test and reset button makes testing easy. Automatic self diagnostic check. Triple LED display shows power, fault and alarm. Retail and trade packs available. 7 year warranty.

FireAngel CO-9X-10

Manufacturer's Comments: 10 year sealed for life battery powered carbon monoxide alarm. Large test and reset button makes testing easy. Automatic self diagnostic check. Triple LED display shows power, fault and alarm. Retail and trade packs available. 10 year warranty.

FireAngel W2-CO-10XQ
Sona WCOB-SN-1

Manufacturer's Comments: 10 year sealed for life battery powered carbon monoxide alarm with wireless interconnect . Large test and reset button makes testing easy. Automatic self diagnostic check. Triple LED display shows power, fault and alarm. Retail (FireAngel) and trade packs (Sona) available. 5 year warranty.

Ei Electronics Ltd
Shannon,
Co. Clare,
Ireland.

Phone: 00 353 61 471277
Fax: 00 353 61 471053/471140
Email: eielectronics@eiltd.ie
Web: www.eielectronics.com

Ei208

Manufacturer's Comments: Battery Powered Carbon Monoxide Alarm With CO memory function. Sealed-in 10 yr life lithium battery.

Ei208W

Manufacturer's Comments: Battery Powered Carbon Monoxide Alarm With CO memory function. Sealed-in 10 yr life lithium battery and Radio LINK RF interconnect option

Ei208DW

Manufacturer's Comments: Battery Powered Carbon Monoxide Alarm With Digital Display, CO memory function. Sealed-in 10 yr life lithium battery and Radio LINK RF interconnect option

Ei208WRF

Manufacturer's Comments: Battery Powered Carbon Monoxide Alarm With CO memory function. Sealed-in 10 yr life lithium battery and supplied with Radio LINK RF interconnect module

Honeywell Analytics (Domestic Products)
4 Stinsford Road,
Nuffield Ind. Est., Poole
Dorset BH17 ORZ.

Tel: 01202 645587
Fax: 01202 665331
Email: adrian.keats@honeywell.com;
Web: www.homesafety.honeywell.com

XC70-EN

Manufacturer's Comments: Self contained (sealed for life batteries) carbon monoxide alarm. Completely tamper proof. Fully comprehensive 7 year maintenance free operational life & guarantee. Additional features include memory function, low level monitoring mode, early warning "Ventilate" function, low volume test mode and upgradeable to wireless interconnection options. Also has full data download capability (further details on request)

XC100-EN

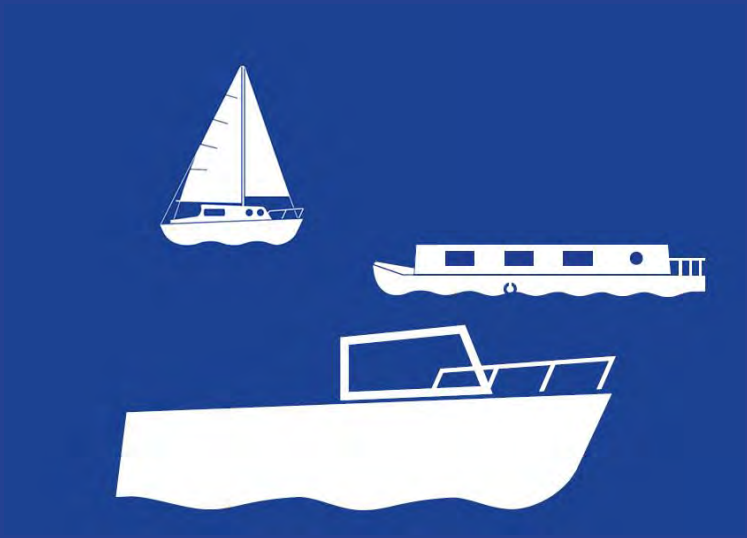
Manufacturer's Comments: All the same features and benefits of the XC70-EN model with the addition of a fully comprehensive 10 year operational life and guarantee and the unique Action Text feature which gives a clear indication to the user of what to do in the event of a full alarm..

XC100D-EN

Manufacturer's Comments: All the same features and benefits of the XC100-EN model with the addition of a multi function digital display which can provide a range of information including, CO alarm concentrations, peak level indicator/memory, other units connected wirelessly and percentage CO levels when in low level monitoring mode.

Carbon Monoxide Safety on Boats

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

BOAT SAFETY SCHEME

GO BOATING - STAY SAFE

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

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 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.

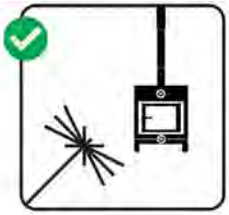
Ensure solid fuel stove chimneys are swept at least annually, or even several times a year - the more a stove is used, the more often the chimney needs cleaning.

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.

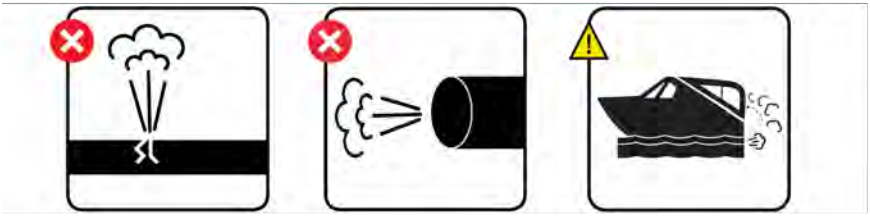
Stay aware of the risks when running engines

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 bar-becues 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.

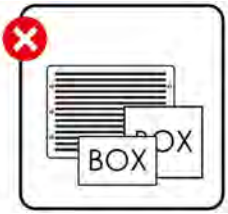
Never use an appliance you think is faulty or unsafe.

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 atmos-phere 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 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 more information on CO and fire safety on boats and routine safety check items - 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

Charities concerned about Carbon Monoxide

The Carbon Monoxide and Gas Safety Society
www.co-gassafety.co.uk

CO-Awareness www.covictim.org

Gas Safety Trust
www.gas-safety-trust.org.uk

Gas Safe Charity
www.gassafecharity.org.uk

CO-Angels www.co-angels.co.uk

Acknowledgements

CoGDEM is the UK trade body for companies and experts in the field of gas detection. CoGDEM provides its expertise to UK, European and global standards-writing bodies, and provides technical guidance and support to all CO awareness-raising projects and organisations, including the HSE.

This information is supported by the CoGDEM member companies that produce CO alarms www.cogdem.org.uk

Published with the generous support of Ei Electronics – "Kitemarked long life CO alarms manufactured in Ireland for boat use"; and Kidde Safety – "A world leading manufacturer of smoke and carbon monoxide alarms".

The authors are grateful for the help of Public Health England staff with our leaflet's content and acknowledge www.nhs.uk/Conditions/Carbon-monoxide-poisoning as a source of medical information. We highly recommend reading the additional NHS information on CO.

Design based on the Fire Safety On Boats leaflet with permission from Fire Kills 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

Printed with vegetable based inks on recycled paper by Greenshires

Carbon Monoxide Safety On Boats v3.1 December 2016

MAIB Safety Bulletin 2/2016

MAIB
MARINE ACCIDENT INVESTIGATION BRANCH

SAFETY BULLETIN

SB2/2016

August 2016

Extracts from The United Kingdom Merchant Shipping (Accident Reporting and Investigation) Regulations 2012

Regulation 5:
"The sole objective of a safety investigation into an accident under these Regulations shall be the prevention of future accidents through the ascertainment of its causes and circumstances. It shall not be the purpose of such an investigation to determine liability nor, except so far as is necessary to achieve its objective, to apportion blame."

Regulation 16(1):
"The Chief Inspector may at any time make recommendations as to how future accidents may be prevented."

Press Enquiries:
01932 440015

Out of hours:
020 7944 4292

Public Enquiries:
0300 330 3000

NOTE

This bulletin is not written with litigation in mind and, pursuant to Regulation 14(14) of the Merchant Shipping (Accident Reporting and Investigation) Regulations 2012, shall be inadmissible in any judicial proceedings whose purpose, or one of whose purposes is to attribute or apportion liability or blame.

All bulletins can be found on our website:
https://www.gov.uk/maib

For all enquiries:
Email: maib@dft.gsi.gov.uk
Tel: 023 8039 5500
Fax: 023 8023 2459

Carbon monoxide poisoning on board the Doral 250 SE motor cruiser *Love for Lydia* at Wroxham on the Norfolk Broads resulting in two fatalities between 6 and 9 June 2016

Figure 1: Boat alongside a marina following the accident (canopy as found)

MAIB SAFETY BULLETIN 2/2016

This document, containing safety lessons, has been produced for marine safety purposes only, on the basis of information available to date.

The *Merchant Shipping (Accident Reporting and Investigation) Regulations 2012* provide for the Chief Inspector of Marine Accidents to make recommendations at any time during the course of an investigation if, in his opinion, it is necessary or desirable to do so.

The Marine Accident Investigation Branch is carrying out an investigation into an accident that occurred on board a Doral 250 SE motor cruiser. Two people and their dog died when they suffered carbon monoxide poisoning.

The MAIB will publish a full report on completion of the investigation.

Steve Clinch
Chief Inspector of Marine Accidents

NOTE

This bulletin is not written with litigation in mind and, pursuant to Regulation 14(14) of the Merchant Shipping (Accident Reporting and Investigation) Regulations 2012, shall not be admissible in any judicial proceedings whose purpose, or one of whose purposes, is to apportion liability or blame.

This bulletin is also available on our website: www.gov.uk/maib

Press Enquiries: 01932 440015; Out of hours: 020 7944 4292

Public Enquiries: 0300 330 3000

BACKGROUND

A summer holiday on the Norfolk Broads on board a 15-year-old Doral 250 SE ended tragically when a couple and their dog were killed by carbon monoxide. At the time of the accident the boat was moored at a quiet river island location.

INITIAL FINDINGS

The motor cruiser's 5.7 litre petrol-driven inboard engine had been left running at 3000rpm while it was moored alongside, probably to charge the batteries. A slight wind blowing from the stern caused exhaust gas emitting from below the aft transom to enter the canopy covering the aft deck **(Figure 1)** from where it spread down into the accommodation area forward. During in-situ tests with the engine running the concentration of carbon monoxide from the wet exhaust **(Figure 2)**, reached high levels in the accommodation in less than 3 minutes. The accommodation area was not ventilated and the couple and their dog were overcome. No carbon monoxide alarms were fitted.

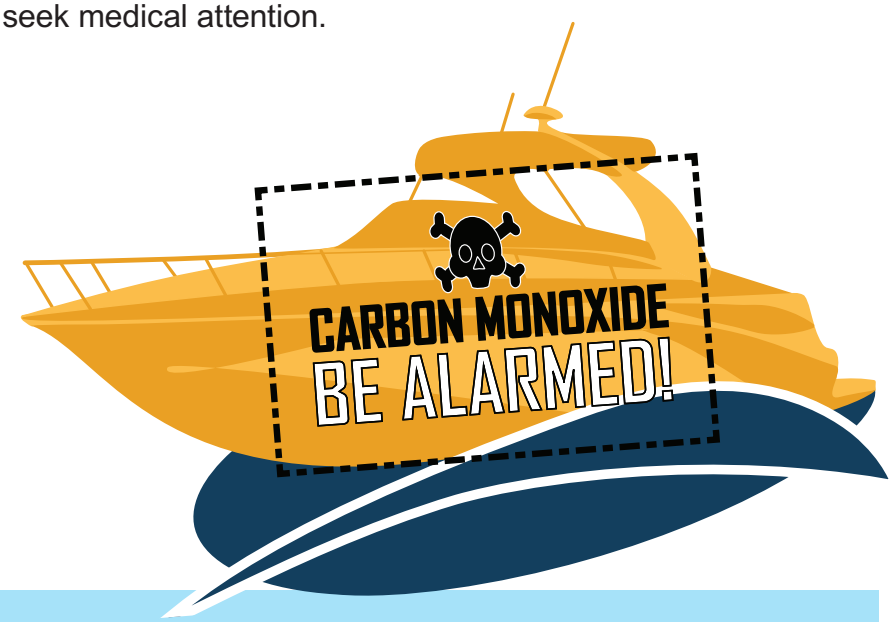
Figure 2: Wet exhaust at boat's stern

SAFETY LESSONS

1. Carbon monoxide is a by-product of combustion appliances fuelled by oils, solid fuel or gas. It has no smell, no taste, is colourless and is extremely difficult for human senses to detect. Therefore, it is essential that carbon monoxide alarms are fitted in areas where carbon monoxide could accumulate and pose a risk to health (such as the accommodation areas of motor cruisers). When selecting a carbon monoxide alarm, preference should be given to those marked as meeting safety standard EN 50291-2:2010, which are intended for use in a marine environment. It is essential to fit alarms following the manufacturer's guidance, to test them routinely using the test button and not to ignore them.

2. The use of canopies can potentially increase the risk of poisoning, even when a boat is making way. Although external engine exhaust outlets discharge exhaust fumes into the open, the wind, aerodynamic effects and the proximity of nearby structures frequently result in the fumes entering the boat. Ensure that all spaces, including those under a canopy or an awning are always well ventilated. Never ignore the smell of exhaust fumes in any enclosed space.

3. Carbon monoxide is a silent killer. Its symptoms can be similar to colds, flu or hangovers; headaches, dizziness, nausea, vomiting, tiredness, confusion, stomach pain and shortness of breath are warning signs of its presence. If carbon monoxide poisoning is suspected, stop the source, get to the open air and seek medical attention.



Further advice on how to avoid carbon monoxide poisoning on boats, and more detail about carbon monoxide alarms, produced by the Boat Safety Scheme (BSS) and the Council of Gas Detection and Environmental Monitoring (CoGDEM), can be found at:

http://www.boatsafetyscheme.org/stay-safe/carbon-monoxide-(co)

Issued August 2016