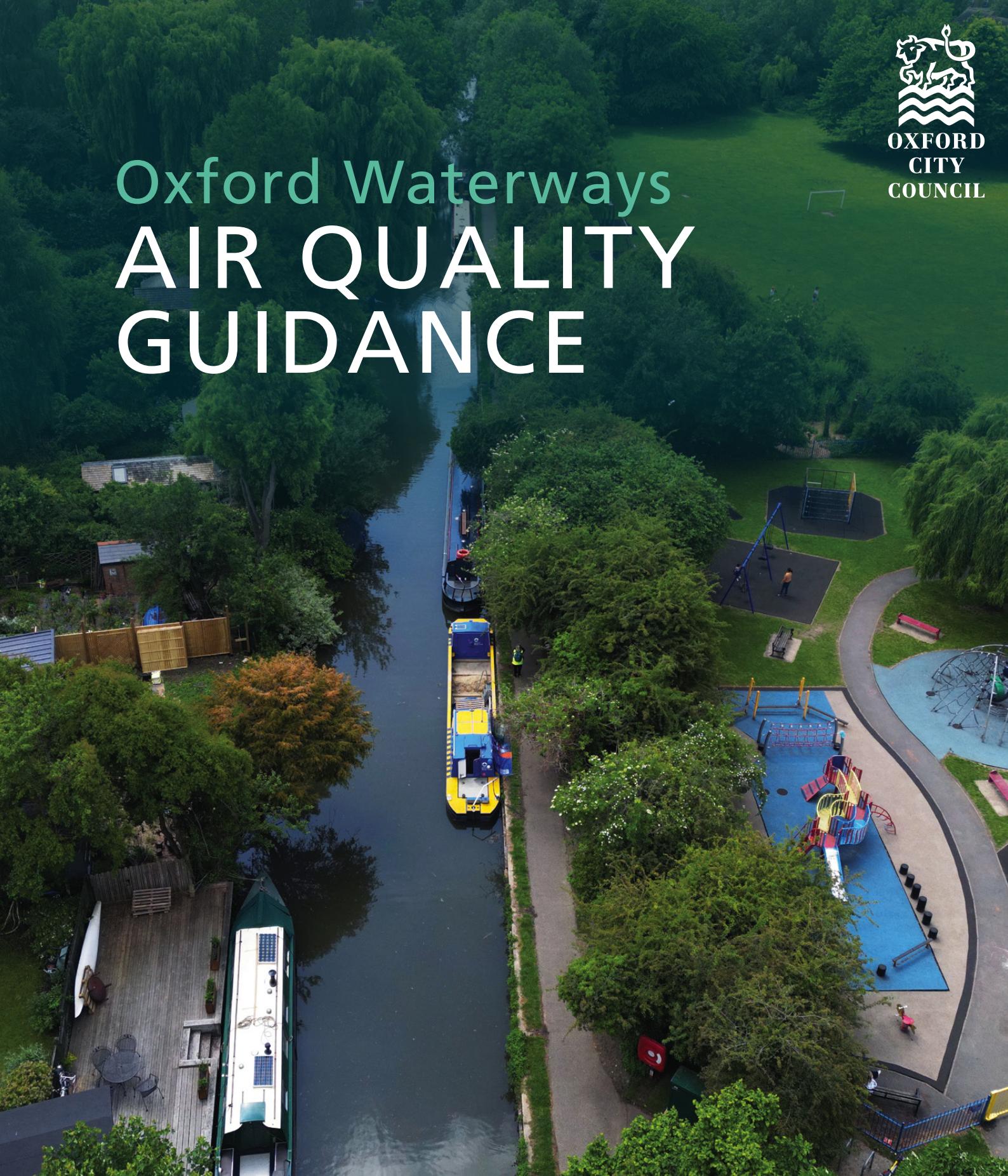


Oxford Waterways AIR QUALITY GUIDANCE



Department
for Environment,
Food & Rural Affairs



Oxford Waterways Air Quality Guidance



Purpose

This guide is designed to support the boating community in Oxford by promoting sustainable and safe practices, particularly around heating and fuel use, and to improve air quality and protect public health. It covers local air pollution sources relevant to waterways, their health impacts, best practices for domestic burning and engine use on boats, and crucial safety measures you can take. It has been co-created with input from boat dwellers in Oxford and has been supported by the Canal & River Trust and funded by the Department for Environment, Food & Rural Affairs (DEFRA).

Alongside this document is a more practical guide outlining the steps you can take to protect your health, reduce pollution and burn more efficiently which can be found on the Oxford City Council air quality website.



Contents

Glossary of Terms	4
Chapter 1: Introduction	6
Chapter 2: The Air We Breathe	10
Chapter 3: How to minimise the impacts of air pollution	18
Chapter 4: Stories from Oxford	26
Chapter 5: Boat Safety	31
Appendices	34
Further Information	36



Department
for Environment,
Food & Rural Affairs



Glossary

Air Quality Action Plan (AQAP)

A detailed plan of measures, actions, achievement dates and (AQAP) implementation methods, which must be prepared by the local authority as part of the Local Air Quality Management (LAQM) process, if an Air Quality Management Area is designated, and that shows how the local authority intends to reduce air pollution levels.

Annual Status Report

A yearly review assessing current air quality and progress toward meeting objectives.

Anthracite

A type of smokeless coal with low emissions, often used in multi-fuel stoves.

Biofuel (HVO)

Hydrotreated Vegetable Oil – a renewable diesel alternative made from waste oils

Black Carbon

Black carbon (BC) is a component of fine particulate matter ($PM_{2.5}$) and is primarily formed through the incomplete combustion of organic materials, such as fossil fuels, wood, and biomass.

Boat Safety Scheme (BSS)

A certification system for boats on UK inland waterways, covering safety and air quality-related checks.

Carbon Monoxide (CO)

A deadly, invisible gas produced by incomplete combustion. Requires alarms and proper ventilation.

Carbon Dioxide (CO₂)

A gas that plays a crucial role in Earth's atmosphere and a significant contributor to climate change.

DEFRA

Department for Environment, Food and Rural Affairs.

Eco Mooring

A mooring equipped with electric charging points to support low-emission boating.

Manufactured Solid Fuel

Engineered fuel made from compressed materials, often smokeless and cleaner than raw coal.

NO

Formed from nitrogen (N) in the atmosphere during high temperature combustion. Commonly known as Nitric Oxide.

NO₂

Formed in small amounts in the atmosphere during high temperature combustion, but the majority is formed in the atmosphere through the conversion of nitric oxide (NO) in the presence of ozone (O₃). Commonly known as Nitrogen Dioxide.

NO_x

A collective term used to refer to NO and NO₂. These are produced from the reaction of nitrogen and oxygen gases in the air during combustion, especially at high temperatures. At normal temperatures, oxygen and nitrogen gases do not react together. Nitrogen oxides are produced from fuel combustion in mobile and stationary sources. The combustion of fuel in cars emits NO_x into the atmosphere (mobile source). Stationary emissions come from coal fired power plants, electric power plants and domestic heating.

PM_{2.5}

Airborne particulate matter with an aerodynamic diameter of 2.5 μ m or less.

Ready to Burn

Certification for fuels that have been tested and meet the legislative requirements for moisture content, smoke and sulphur emissions.

Smoke Control Area (SCA)

A designated zone where burning certain fuels is restricted to reduce air pollution.

WHO

World Health Organization.

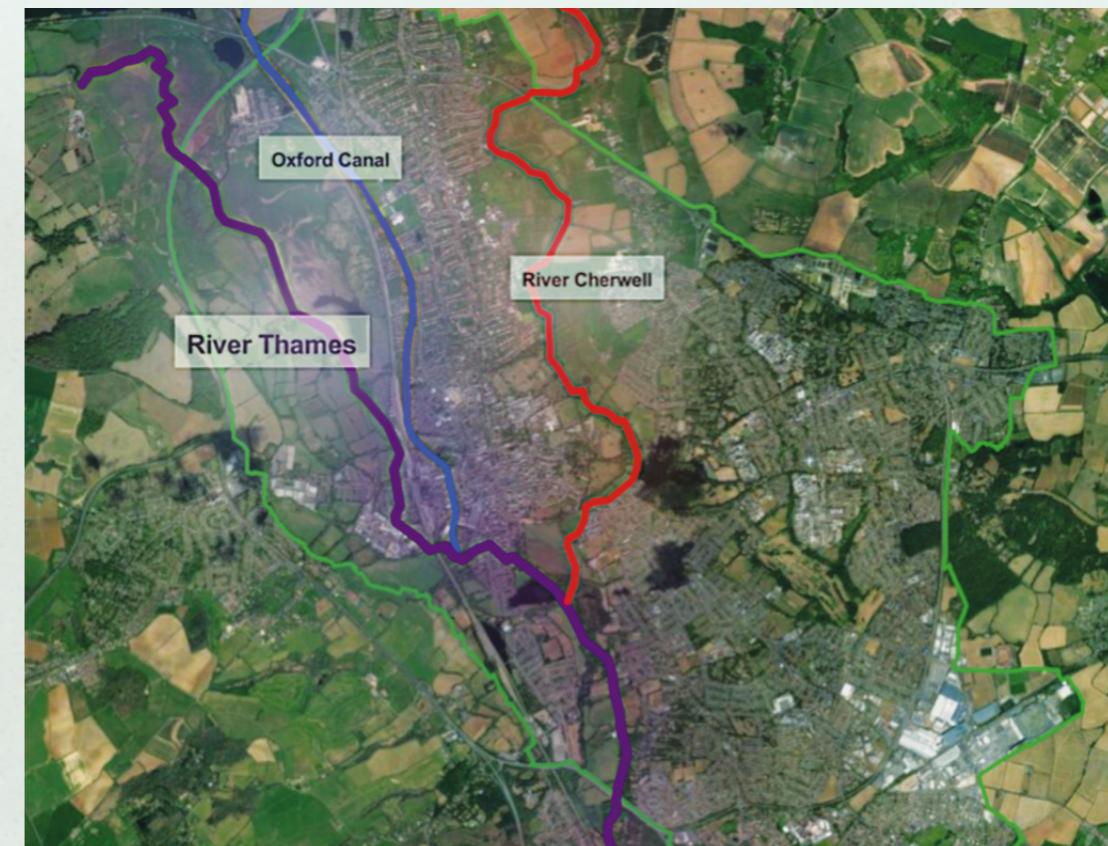
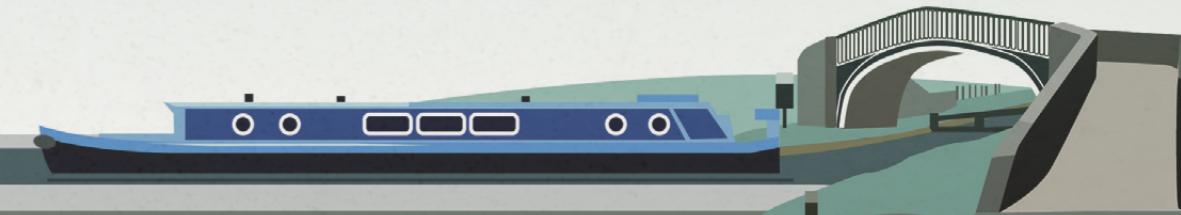


Figure 1 - Map of Oxford waterways



Chapter 1: Introduction



Figure 2 - Image of Oxford Canal

Oxford's Waterways

Oxford is a city intricately linked with its waterways, a rich network that has profoundly shaped its landscape, culture, and history. At the city's core lie the River Thames and the River Cherwell, along with their numerous tributaries and the Oxford Canal. These watercourses are far more than mere geographical features; they are vital ecological arteries and integral to Oxford's identity.

The Oxford Canal, completed in 1790, marks a significant chapter in the city's past. Once a bustling trade route, it connected the Midlands to London via the Thames playing a crucial role in Oxford's economic growth, particularly in the transport of essential goods at the time like coal. While the arrival of the railway in 1840 diminished its commercial prominence, the canal remains a cherished feature of the city today. The Canal flows south linking Oxford with the Coventry Canal. In Oxford it begins at Wolvercote and flows south through Summertown and Jericho to Hythe Bridge in the city centre and connects to the Castle Mill Stream.

Today, Oxford's waterways are recognised as invaluable 'blue and green spaces' that offer immense benefits to all residents and visitors.

Blue spaces encompass urban waterways, canals, rivers, and streams, while green spaces include urban parks, open natural environments, and green corridors. They provide thriving habitats for diverse flora and fauna; for instance, the stretch of canal at the Agenda 21 moorings is home to an important colony of water voles, one of the UK's most endangered mammals, where special protection measures are in place. Similarly, Port Meadow, on the banks of the Thames, supports a diverse wetland flora due to seasonal floods and is a home to a wide variety of birds. Beyond their ecological contributions, these blue and green spaces offer significant health and well-being

benefits, including protection against poor mental health, opportunities for outdoor physical activities such as walking, cycling, kayaking and rowing, and a crucial role in fostering community cohesion and enhancing the social quality of life.¹

Boat dwellers, given the very nature of their lifestyle, are inherent contributors to the health of these spaces. We recognise that they are de facto stewards of Oxford's critical blue-green infrastructure. As such, daily choices directly impact health and the health of these vital urban ecosystems, which in turn provide significant environmental and public health benefits for the entire city.

Why this Guide Matters to the Boating Community

The core purpose of this guidance is to support Oxford's boating community by promoting sustainable and safe practices, particularly concerning heating and fuel use. The overarching goals are to improve air quality and protect public health for everyone who lives on and enjoys Oxford's waterways. This guide covers local air pollution sources relevant to waterways, their health impacts, best practices for domestic burning and engine use on boats, and crucial safety measures you can take to protect your health.

This guidance also aligns with key local strategies that shape Oxford's approach to climate change, air quality, and sustainable development. As a boat dweller, exploring how these policies intersect with life on the water can be a valuable exercise, it will contribute to a broader understanding of the importance and potential of the waterways, the goals being pursued, and the role you can play in promoting sustainable practices and protecting these spaces. We hope this guidance proves genuinely helpful in shedding light on air pollution, offering practical information to support your life onboard with a particular focus on solid fuel burning.

¹ www.activetravelengland.gov.uk/planning-active-places/green-and-blue-infrastructure

The Boating Community

Oxford's waterways are home to a long-standing and deeply rooted boating community, estimated to be around 150 boats permanently moored in Oxford. To better understand the unique circumstances of this community, Oxford City Council conducted a targeted consultation in early 2025. This eight-week consultation, which ran from January 22 to March 17 2025, received 143 responses. The consultation found that most respondents (69%) are continuous cruisers, while 30% reside at permanent moorings. Occupations within the community are wide-ranging, including self-employed individuals, public sector workers, and skilled tradespeople, with a notable number of residents not currently employed such as retirees.

It showed that 59% of respondents have lived afloat for over five years. The survey also revealed that nearly half are aged 57 or older, reflecting a stable and established presence that continues to enrich the city's cultural fabric.

A key focus of the consultation was energy use and air quality. The findings highlighted that solid fuel remains the dominant heating source for boat dwellers, with 87% of respondents relying on it, primarily through multi-fuel stoves. Only 18% of boaters have access to mains electricity. A notable finding from

the consultation was the perception of air quality within the community: only 32% of respondents felt that burning solid fuels was harmful to their health, and 48% acknowledged its contribution to local air pollution. Even more striking, 63% expressed little or no concern about air quality along the canal.

This data reveals a significant difference between the scientific understanding of air pollution's impact, particularly from domestic burning, and the perception of risk within the boating community. Recent research has shown that burning solid fuels has a significant impact on human health.² This difference suggests that previous communication efforts may not have effectively conveyed the personal and immediate health risks associated with solid fuels as the primary heating methods. It also implies a potential normalisation of visible smoke or particulate matter as an unavoidable aspect of life on the water.

These consultation findings underscore the importance of developing tailored, practical solutions that genuinely respect the unique circumstances of boat dwellers while simultaneously supporting both environmental goals and the protection of public health. The information gathered directly informed the development of this waterways guidance and will help shape future infrastructure, policy, and engagement strategies for Oxford's waterways.

² www.mdpi.com/2073-4433/11/12/1326

Situating Waterways within Local Strategies

Oxford's Air Quality Action Plan³ identifies domestic heating, including solid fuel burning, as a primary source of air pollution in the city. This plan outlines actions to reduce emissions from residential and mobile sources, promote low-emission heating alternatives, and raise awareness of air pollution's health impacts. For boaters, this reinforces the importance of transitioning to cleaner fuels, maintaining stoves and flues, and exploring alternatives such as electric heating where possible. The plan also supports infrastructure improvements and commits to reviewing strategies for protecting you from air pollution.

Oxford Local Plan⁴ sets out the city's long-term vision for development, housing, and environmental sustainability. It places strong emphasis on reducing carbon emissions from buildings and transport, improving air quality through cleaner energy use, protecting and enhancing green and blue infrastructure (including waterways), and supporting inclusive communities, specifically mentioning those living in non-traditional housing such as boats. For boaters, this translates to a growing focus on reducing emissions from heating and energy use, and ensuring that waterways remain healthy, accessible, and integrated into the city's wider sustainability goals.

Oxford's Green Spaces Strategy⁵ recognises the critical role of the city's parks, meadows, and waterways in supporting biodiversity, public health, and climate resilience. The strategy highlights their function in filtering air pollutants and improving air quality, providing access to nature for physical and mental well-being, and supporting wildlife habitats and ecological connectivity. Boaters already contribute to the health of these spaces by an inherently low-impact lifestyle, and cleaner burning and reduced smoke emissions further enhance the quality of air and experience in shared public spaces along the waterways.

These local policies are not designed to restrict anyone but rather to integrate boat dwellers into the city's broader sustainability vision, offering support and opportunities to help make our air cleaner. The policies acknowledge the unique challenges facing the boating community, such as limited access to grid connections and ineligibility for major government retrofit grants and aim to support awareness campaigns to facilitate a transition to cleaner energy. This collective policy framework signals a significant shift toward cleaner, more sustainable living across Oxford. This means increased expectations around fuel use and emissions, greater support for the provision of infrastructure and cleaner fuel alternatives (such as eco-moorings)⁶ and opportunities for boaters to contribute to city-wide goals through everyday practices.

³ www.oxford.gov.uk/air-quality-management/air-quality-action-plan

⁴ www.oxford.gov.uk/local-plan

⁵ www.oxford.gov.uk/downloads/file/385/green-space-strategy-2013-2027

⁶ Eco-moorings are electric charging points installed at Aristotle Lane visitor moorings on the Oxford Canal. They consist of three electric bollards with space for six boats and were funded by DEFRA, delivered in partnership with the Canal & River Trust.



Chapter 2: The Air We Breathe

Understanding the Invisible Impacts



The air we breathe has a profound impact on health and well-being. Air pollution has long been a major public health concern, with a stark historical example being the Great London Smog of 1952.⁷ This visible, toxic smog claimed at least 4,000 lives and was even reported to have choked cows to death in nearby fields. The smog was mainly a result of coal burning during the winter.

While coal was the dominant fuel during the time of the Great Smog - responsible for high emissions of sulphur dioxide - its use has since declined, replaced largely by other types of solid fuels like wood and smokeless coal. These tend to be less polluting than coal due to the lower levels of volatile compounds and sulphur, leading to less smoke and fewer particulate emissions when burned. They are also more efficient as they burn at higher temperatures, producing more heat with less waste. However, this shift has not necessarily made exposure to air pollution safer. In fact, burning solid fuels of any kind still releases harmful pollutants, including fine particulate matter ($PM_{2.5}$), which pose serious health risks, especially in enclosed or poorly ventilated and confined environments such as boats.

The Royal College of Physicians states that there is no safe limit of air pollution and that negative health impacts have been found from exposure to much lower levels of air pollution than previously understood.⁸ In fact, we continue to learn more every day about where air pollution comes from and how it harms our health, hence its more important than ever to pay attention to the air we breathe and act where possible to reduce both personal emissions and exposure.

⁷ www.bbc.co.uk/weather/features/67549533

⁸ www.rcp.ac.uk/media/0ia2peh/rcp-summary-for-policymakers-a-breath-of-fresh-air-responding-to-the-health-challenges-of-modern-air-pollution.pdf

Did you know?

Exposure to $PM_{2.5}$ can lead to serious impacts to health, especially in vulnerable groups of people such as the young, elderly, and those with respiratory problems.

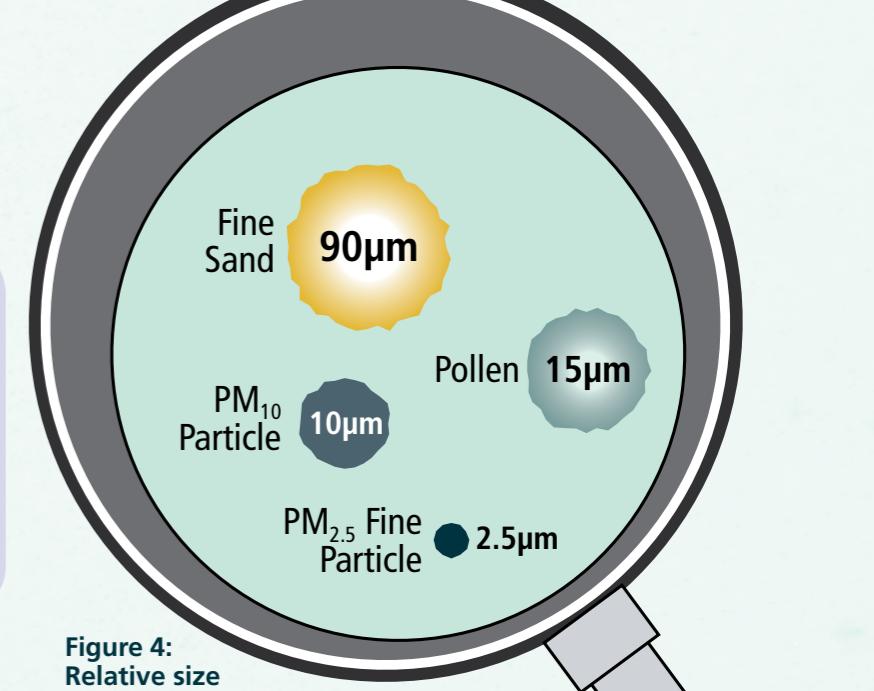


Figure 4:
Relative size
of particulate matter

What is Air Pollution?

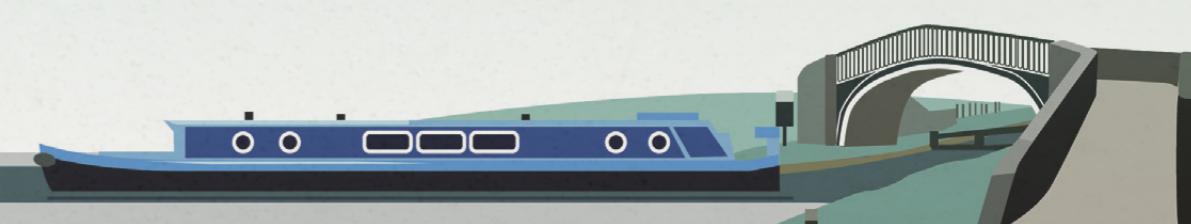
There are many forms of air pollution, but for boaters, two main pollutants are of particular concern:

- **Nitrogen dioxide (NO_2):** This is a gas released during combustion, primarily from diesel and petrol boat engines and generators to charge batteries
- **Fine particulate matter ($PM_{2.5}$):** These are microscopic particles, less than 2.5 micrometres in diameter, produced when burning solid fuels such as wood, coal, and smokeless fuels.

$PM_{2.5}$ is the main pollutant of concern due to its minuscule size (approximately 20 times thinner than the width of a human hair), which makes it particularly dangerous, and results in its ability to penetrate deep into the body and contribute to premature mortality. The focus on domestic burning as the primary source of $PM_{2.5}$ makes it the most critical area where boat dwellers' everyday practices can have the biggest impact.

Air Quality in Oxford

Oxford has demonstrated leadership in improving its air quality over the past two decades. The city has established more stringent local NO_2 targets, which set a target for lower levels of NO_2 than national legal limits. Over the past 20 years, NO_2 concentrations at key monitoring sites across the city have declined by an average of 65%. The 2024 *annual air quality status report* shows that NO_2 concentrations have halved since 2014. A large portion of this decline can be attributed to targeted changes in traffic emissions such as the introduction of low emission zone buses, the electrification of the bus fleet and development of a zero emission zone. Meanwhile, Oxford has consistently remained within the UK's legal limits for fine particulate matter ($PM_{2.5}$), observing a 40% reduction in urban background $PM_{2.5}$ concentrations at Oxford St. Ebbes over the past decade.





Despite these achievements, particulate pollution, primarily stemming from the burning of wood for domestic heating, continues to pose a significant threat to healthy lives across the city. While historical pollution was often highly visible and toxic, modern air pollution, particularly PM_{2.5} from domestic burning, is insidious because it is largely invisible, yet still profoundly harmful. This invisibility can contribute to a lower public concern, as observed in the recent boater consultation. The success in reducing NO_x demonstrates that targeted policy and investment can yield substantial improvements, but PM_{2.5} requires a different approach, one that focuses more intently on domestic sources and behaviour change.

To gain a precise understanding of air pollution sources in Oxford, the City Council published a Source Apportionment Study⁹ in February 2025. This study examines the contributions of various sources such as transport, domestic combustion, industrial point sources, and other emissions to key air pollutants like nitrogen oxides¹⁰ (NO_x) and fine particulate matter (PM_{2.5} and PM₁₀)¹¹ across the city.

The study's findings on Primary Contributors to PM_{2.5} Emissions are particularly significant:

- Domestic wood burning is unequivocally identified as the single largest contributor to fine particulate pollution (PM_{2.5}) in Oxford, responsible for 25% of total PM_{2.5} emissions across the city
- Within the broader domestic combustion sector, wood burning is overwhelmingly dominant, accounting for 70% of all PM_{2.5} emissions from this source. Other domestic sources like commercial heating contribute 15% while smokeless fuels account for 1%.

For NO_x Emissions the study revealed:

- "Other transport," a category that explicitly includes inland waterways and military aircraft, accounts for almost 9% of total NO_x emissions. Given the absence of military aircraft in the city, it is safe to assume most of these emissions relate with Oxford's inland waterways, likely from the running of boat engines and generators.

The clear identification of domestic wood burning as the leading cause of harmful PM_{2.5} emissions in Oxford represents a significant shift in the primary challenges for air quality improvement. While road transport remains a major NO_x contributor, the report shows that the most prevalent and damaging air pollutant, PM_{2.5}, is largely attributable to domestic combustion.

Figure 5 - Sources of PM_{2.5} emission in Oxford

Domestic heating	35%
Road transport	17%
Production processes	10%
Point Sources	9%
Waste	8%
Other transport inc. inland waterways & aircraft	7%
Solvents	5%
Nature	4%
Non-road machinery	3%
Other inc. industry, rail, agriculture & energy production	2%

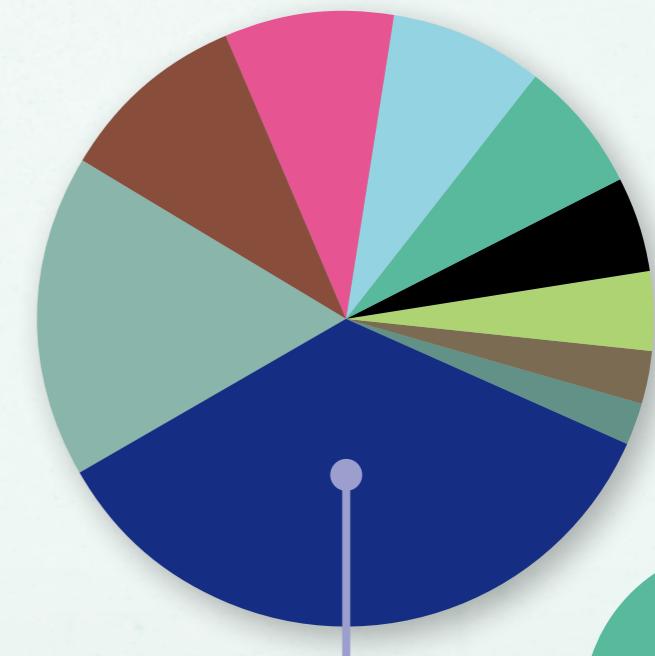
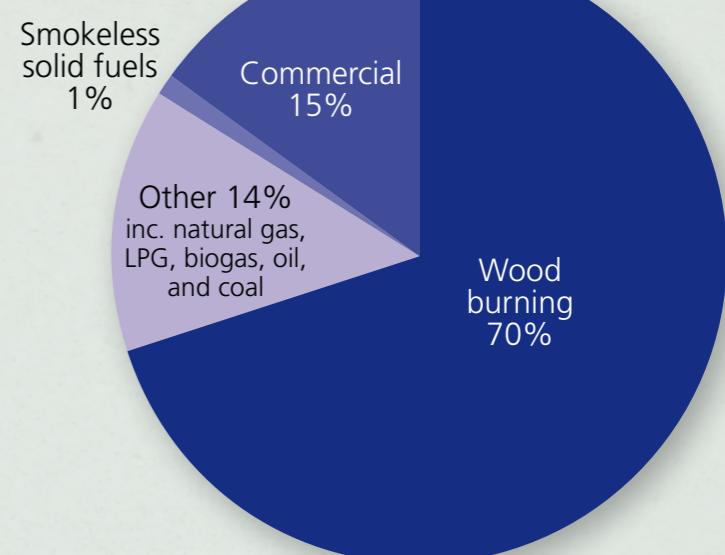


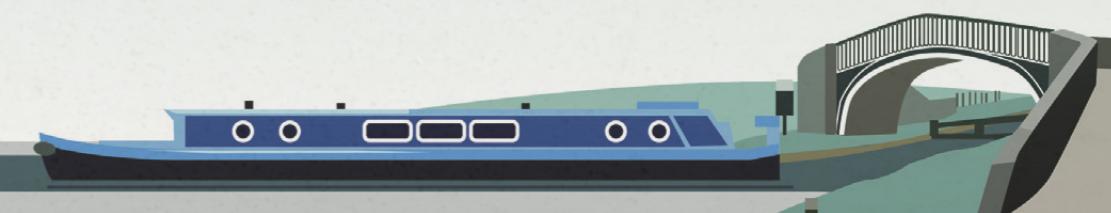
Figure 6 - Domestic wood burning, domestic smokeless solid fuels, other domestic fuels, and commercial



⁹ www.oxford.gov.uk/downloads/download/202/download-the-oxford-source-apportionment-study

¹⁰ NO_x refers to a group of nitrogen oxides, primarily nitric oxide (NO) and nitrogen dioxide (NO₂). While NO is less harmful on its own, it quickly reacts in the atmosphere to form NO₂, which is the more toxic pollutant commonly measured and regulated.

¹¹ PM₁₀ refers to particulate matter with a diameter of 10µm or less



Sources of Air Pollution on Boats

For boat dwellers who frequently burn solid fuels for heating, burning practices are directly linked to individual health and form part of the city's air quality concerns. The following table summarises the key pollutants, their primary sources relevant to boaters, and their health impacts:

Pollutant	Primary emission source in boats	Health Impacts
PM _{2.5} (fine particulate matter)	Burning solid fuels in stoves for heating and cooking	These particles can enter bloodstreams and lodge in brain, heart, lungs, liver and can result in asthma attacks, bronchitis, reduced lung function, increased risk of heart attack and stroke, COPD, lung cancer, diabetes complications. The most vulnerable groups are children, the elderly and those with existing conditions but can impact anyone at any stage of life.
NO _x (Nitrogen Oxides)	Running diesel engines and generators for propulsion or electricity generation	Contributes to death and serious respiratory illnesses such as asthma and chronic bronchitis.
CO (Carbon Monoxide)	Incomplete combustion of any carbon-based fuels onboard	CO reduces the rate at which oxygen is delivered to the tissues, thereby causing hypoxia. Common symptoms following acute exposure are headaches, nausea and vomiting, vertigo, alteration in consciousness and subjective weakness. Severe symptoms include confusion, myocardial infarction, respiratory failure, loss of consciousness and death.

A recent study published by Imperial College London¹², which specifically investigated particulate pollution on houseboats found that generally opening the door of a stove to light a fire or add fuel resulted in particulate

emissions from the stove entering the indoor environment. It also found that many of the highest PM_{2.5} measurements were recorded during periods when the engine was in use either charging batteries or moving

¹² www.islington.gov.uk/-/media/sharepoint-lists/public-records/environmentalprotection/information/adviceandinformation/20222023/indoor-pollution-on-canal-and-river-boats.pdf. Please note this study only investigated particulate pollution, not nitrogen oxides.

CLEAN ENERGY SOURCES



Figure 3 - Image depicting emissions from houseboats

the boat, resulting in emissions from a boat's diesel engine entering the indoor living area. Finally, the study found that cooking and use of the oven were significant sources of indoor pollution.¹³

A recent study¹⁴ done by the University of Surrey found how important ventilation is in reducing the number of pollutants within the indoor environment. Homes with closed windows during burning times had up to three times more pollution than those who left windows open periodically. You can take the following steps to reduce your exposure to pollution:

- Open the boat door and windows when cooking
- Slowly open the stove when refuelling
- Maintain your stove and chimney properly
- When running your outside engine or generator, close all windows and

doors to prevent pollution entering your living space.

Due to living in close proximity to the boat's emission sources (stoves, engines and generators) and often in areas with varied air circulation, boat dwellers are more likely to experience a greater exposure pattern to air pollution. This heightened exposure is a key factor to higher susceptibility to air pollution effects.

The health risks faced by boaters from air pollution are not solely a consequence of individual choices but are significantly exacerbated by systemic factors. Boat dwellers tend to rely more on solid fuels, particularly during colder months, because these are commonly the only accessible forms of heating on narrowboats where connection to the electricity and gas grid is not readily available.

¹³ Meaningful comparisons of air pollutant exposure between brick-and-mortar homes and houseboats are challenging due to numerous confounding factors, such as differences in layout/living space, ventilation systems, and occupant ventilation habits. Nevertheless, in principle, pollutant concentrations tend to accumulate more in smaller, enclosed environments. Since boats generally offer less space and may have poorer ventilation than conventional houses, it is reasonable to assume that boat residents could experience higher exposure levels to indoor air pollutants.

¹⁴ www.surrey.ac.uk/news/hidden-health-risks-wood-burning-and-eco-stoves-homes

Health Impacts of Air Pollution

Exposure to polluted air has profound health consequences throughout life, from before birth into old age. It has been shown to reduce life expectancy and is clearly linked to the development of respiratory and cardiovascular diseases, as well as lung cancer.



The impact of inhaling these microscopic particles is particularly serious for vulnerable groups, including children, the elderly, and those with pre-existing conditions such as asthma and emphysema. These particles are so small that they can enter the bloodstream, where

Air pollution can harm your health in many ways

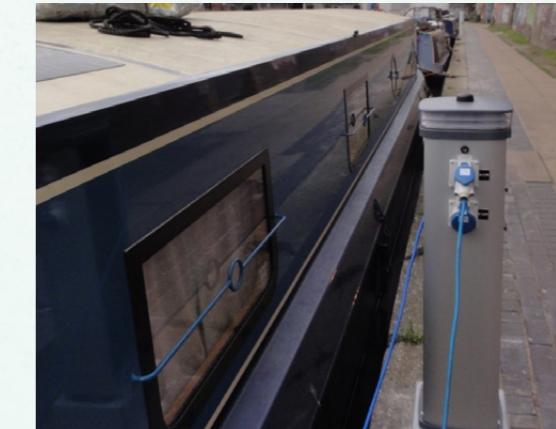
Figure 4 - Mapping the Health Effects of Air Pollution Across the Body

- Stroke
- Brain development
- Mental health
- Dementia
- Skin aging
- Lung diseases (asthma, cancer, lung development, pneumonia)
- Blood clots
- Heart disease pressure
- Insulin resistance and diabetes
- Premature birth
- Low birthweight
- Illness during pregnancy
- Decreased sperm quality

they can be transported to every organ in the body, lodging themselves in the brain, heart, lungs, and liver. When wood and other solid fuels are burned, tiny particles are released and have been shown to treble the effect of harmful pollution inside a home.

The brain is vulnerable too, with growing evidence linking air pollution to *stroke*, *dementia*, and mental health disorders. Exposure during pregnancy can lead to *premature birth* and low birthweight, while long-term exposure is associated with insulin resistance and type 2 *diabetes*. From skin aging to impaired reproductive health, the effects of polluted air are widespread and serious - making clean air essential for a healthy life.

According to a recent report¹⁵ from the Royal College of Physicians, air pollution is responsible for an estimated 30,000 deaths annually in the UK and contributes to a wide range of chronic and acute health conditions, including cardiovascular disease, respiratory illness, dementia, and mental health disorders. These national statistics are acutely felt at a local level. The accompanying image illustrates how pollution levels across the city correlate with increased risks of respiratory illness, cardiovascular disease and mortality.



The following chapter offers advice on how boaters can reduce their exposure to pollution.

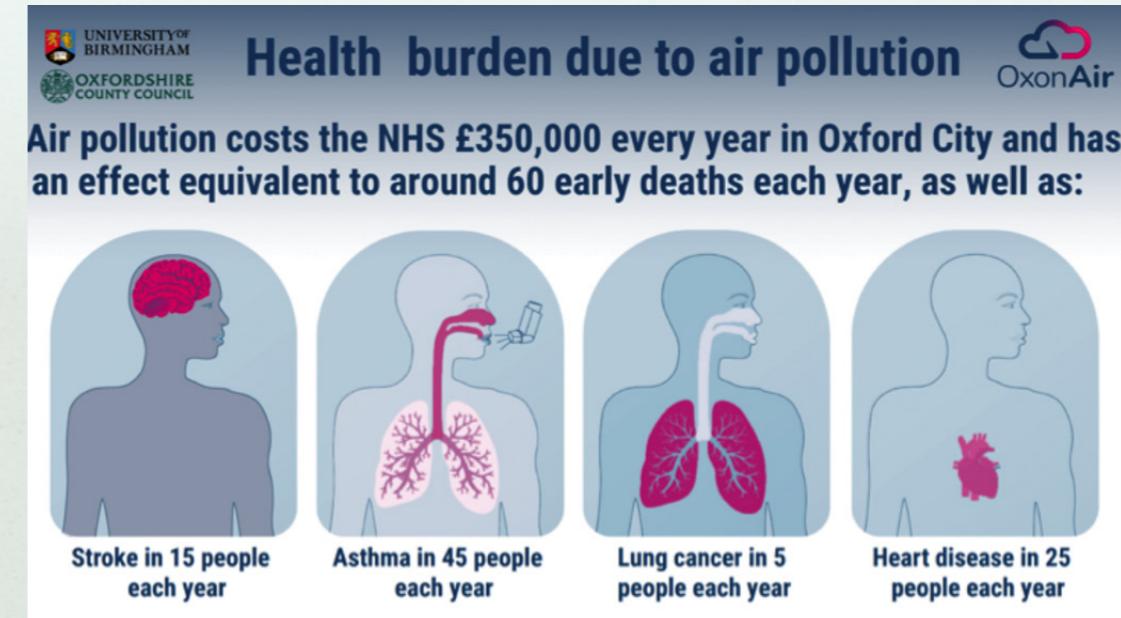
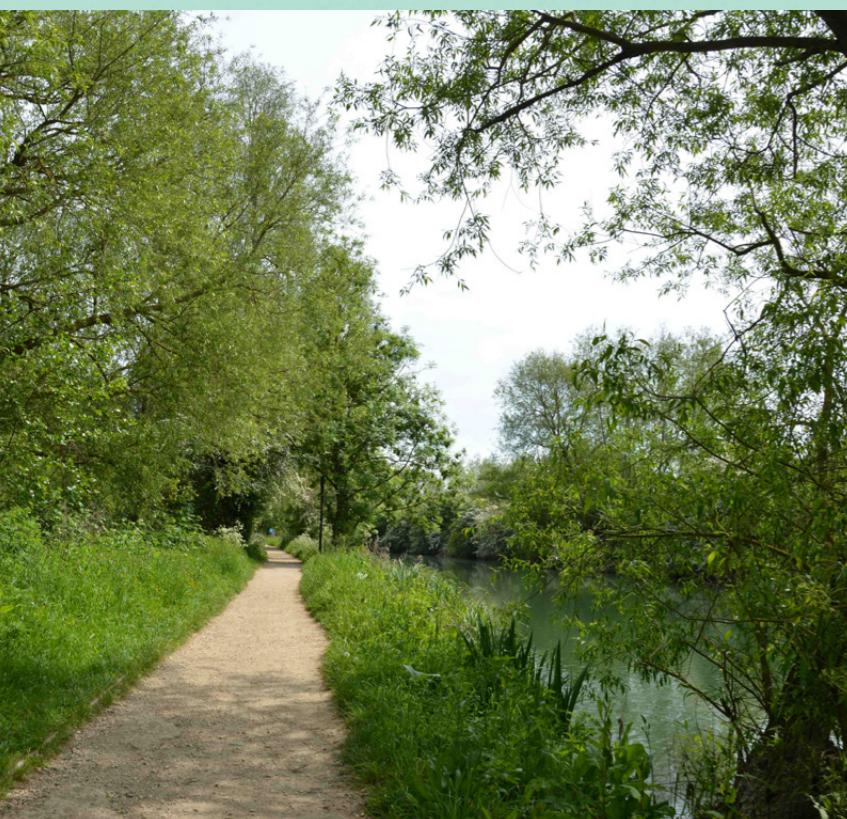


Figure 5 - Health Burden due to air pollution¹⁶

¹⁵ www.rcp.ac.uk/policy-and-campaigns/policy-documents/a-breath-of-fresh-air-responding-to-the-health-challenges-of-modern-air-pollution/

¹⁶ Oxfordshire County Council has acquired the Air Quality Life Course Assessment Tool (AQLAT), developed by the University of Birmingham. This initiative was jointly funded by Oxford City Council, the four district councils

Chapter 3: Minimising your exposure



For the vast majority of Oxford boat dwellers, multi-fuel stoves are the primary source of space heat, accounting for almost 82% of primary heating.¹⁷ Solid fuels are often the cheapest, most accessible, and likely only forms of heating on narrowboats, particularly where connection to the electricity and gas grid is not readily available.

However, this reliance presents a significant dilemma. Solid fuels are, by far, the most polluting means of domestic heating due to the release of PM_{2.5} which are proven to be harmful to human health. This is not a simple choice, but a complex trade-off driven by infrastructure limitations and cost. This forced reliance on polluting fuels has a significant health impact on yourself as a boat dweller and results in an air pollution inequality, i.e. housing type and infrastructure limitations makes boaters inherently more vulnerable to air pollution.

¹⁷ This data was obtained from the private boaters' consultation



SMOKE CONTROL AREA: What It Means for Boaters

From December 1, 2024, the entire city of Oxford was designated as a Smoke Control Area (SCA), expanding previous smaller areas into a single, city-wide zone. This legislation is designed to reduce chimney smoke from burning wood and other solid fuels in homes and businesses, as this is a major source of particulate pollution.

Oxford's first Smoke Control Area was introduced in 1958 - six years after the Great Smog of London.

Crucially, while other local authorities across the UK have extended their SCA to include boats, moored vessels such as house boats remain for the time being exempt from smoke control rules in Oxford. Despite this, it is strongly **recommended that boat dwellers voluntarily adopt these rules as best practices for burning**. This is not just about environmental responsibility; it directly protects boaters from harmful pollutants, keeps stoves running smoothly and efficiently and ultimately saves money. Adopting best practices also helps protect the wider community and shared public spaces.

In a smoke control area, you can only burn Defra authorised fuel, unless you use an appliance approved by Defra (also known as an 'exempt appliance' or 'Defra approved appliance').

Choosing your fuel

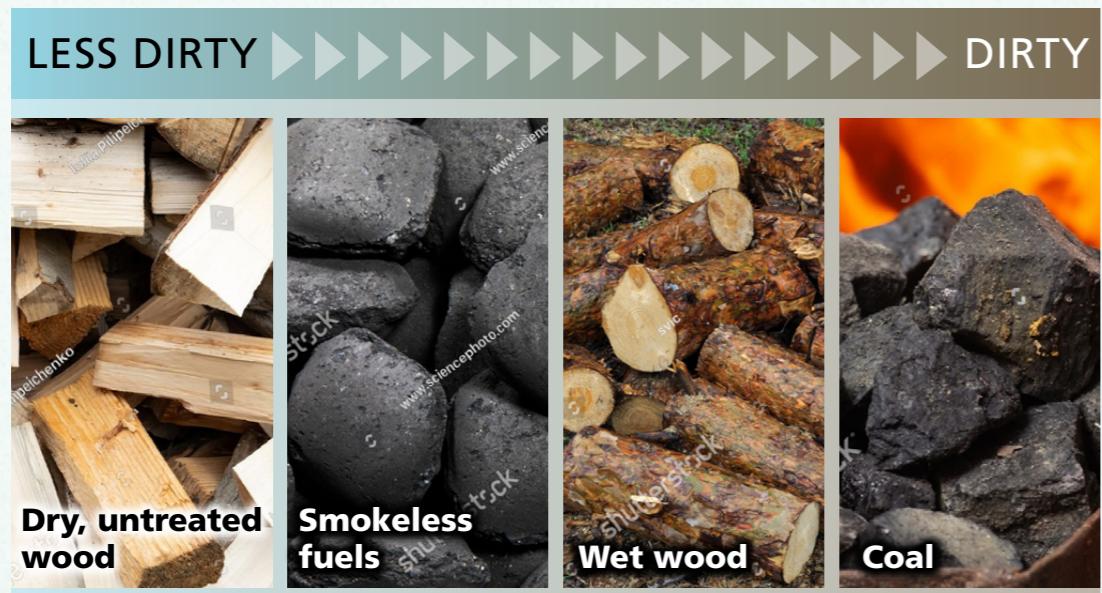


Figure 6 - Image showing pollution associated with each fuel



Smokeless fuels

Smokeless fuels, including anthracite and low volatile steam coal, are a type of fuel that emit only a small amount of smoke. This tends to be fuel used on boats as they burn for longer and reduce the need for more kindling and therefore emit less smoke. It also makes it more cost effective in the long term.

When purchasing these fuels, the 'Ready to Burn' logo indicates shows that the fuel has been tested to show it doesn't exceed the required sulphur and smoke limits. These fuels have been tested to



ensure that they have an average smoke emission of less than 5 grams per hour and contain less than 2% sulphur. HETAS certifies smokeless fuels.

The sale of traditional house coal is already banned in England under The Air Quality (Domestic Solid Fuels Standards) (England) Regulations 2020.¹⁸ **If a stove is not a DEFRA 'exempt stove' (approved for woodburning in Smoke Control Areas), it is recommended to exclusively use authorised smokeless fuels.** A comprehensive list of authorised fuels can be found on the DEFRA website.¹⁹

¹⁸ www.legislation.gov.uk/uksi/2020/1095/part/5/made

¹⁹ <https://smokecontrol.defra.gov.uk/fuels-php/england/>



Wood

Wood is often viewed as an environmentally friendly fuel source. Indeed, wood is not a fossil fuel, and trees are regenerative and store carbon from the atmosphere as they grow and develop. However, wood burning is still environmentally harmful due to the pollution it emits. Wood burning is the single biggest source of fine particulate pollution (PM_{2.5}) in Oxford, accounting for 25% of all PM_{2.5} pollution across the administrative area. While pollution travels outside the boat through the flue, it is also significantly released indoors, particularly when the stove door is opened to refuel.

If you use wood as your fuel, always ensure it is properly seasoned and dry, with a moisture content of less than

20%. Look for the 'Ready to Burn' certification when purchasing wood. This means that the wood meets the moisture content requirement.

For larger quantities of wood (2 cubic metres or more), suppliers are required to provide advice on how to properly season and check the fuel's dryness. Wood is certified by Woodsure.

It is critically important to never burn wet, treated, or painted wood. These are the most toxic forms of heating, highly inefficient, and counterproductive. They not only create more smoke and harmful pollution but also drastically reduce heat output and can cause significant damage to the stove and chimney.

You can better protect your health by burning only Defra-authorised fuels in Defra-exempt stoves.

Best Practice: Lighting a fire

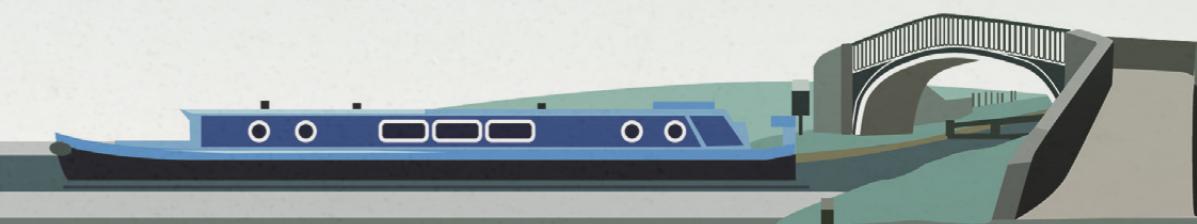
- 1) Lay scrunched up paper or firelighters in the centre of the grate
- 2) Arrange kindling in teepee shape on top and light the paper
- 3) Once the kindling is burning, gradually increase the size of the log until the fire is established.

Controlling the stove

Ventilation is the key! To start, have vents fully open. Once fully established, use the controls to manage the burn rate.

Refuelling

Let the fire burn down to embers before refuelling with new logs. Always open the stove door slowly!



Best Practice: Using your stove

For cleaner and more efficient burning, several practical steps can be taken:

Defra-exempt Stove:

Using a Defra-exempt appliance ensures that the stove passes strict emissions tests and aims to reduce the amount of pollution you are exposed to. Please see *Exempt Appliances – Clean Air Act Data Entry System* to access the list of approved stoves.

Moisture Check:

Always ensure wood has a moisture content of less than 20%. An inexpensive moisture meter, available for around £20 online or at DIY stores, can be used to determine the content.

Manufacturer Guidelines:

Always operate the stove in line with the manufacturers and installer's guidance, including using only suitable fuels.

Professional Installation:

Ensure the stove was installed by a registered and certified installer, such as those registered with HETAS, APHC, BESCA, Certsure, NAPIT, or OFTEC.

Regular Servicing:

Service the stove and sweep the chimney or stove pipe at least once a year. This prevents the buildup of soot and tar, ensures efficiency, and reduces the risk of chimney fires.

Stove Maintenance:

Regularly clean out ash, clean the stove glass, and check the seal around the stove door. The exterior of the stove should also be cleaned regularly.

Ventilation:

Ensure the ventilation system of the stove is clean and free of blockages to prevent carbon monoxide buildup. All heating appliances need proper ventilation; ensure all ventilation grills and mushrooms are clean and never blocked.

Stove Thermometer:

Use a stove thermometer to understand how the stove is performing.

Fuelling Technique:

Load up the stove and open all vents to get more air circulation until the stove reaches the desired temperature and then close vents to extend burning.

Prohibited Materials:

Never burn rubbish, plastics, treated, painted or wet wood, or chipboard.

Best Practice: Engines, Generators, and Greener Options

While domestic burning is the largest contributor to PM_{2.5}, boat engines and generators also contribute to NO_x emissions, as identified in Chapter 2. Minimising these emissions can help protect your health. For diesel engines, regular maintenance, including ensuring appropriate propellers and clean hulls, will maximise fuel efficiency and reduce emissions. Unnecessary idling of engines and generators should be avoided.

When moving

Most boats on inland waterways have diesel engines, which is not ideal from both an air pollution perspective as well as an environmental one. There is evidence that an increased risk of cancer is attributable to exposure to the particulates found in diesel engine exhaust emissions.²⁰ Meanwhile, burning diesel also produces greenhouse gases which contribute to climate change.²¹ Whilst newer diesel engines are cleaner than their predecessors (particularly from an air pollution perspective), they are often less fuel efficient and produce more CO₂.²²



Two techniques can minimise particulate emissions, cost and fuel consumption:

- Stopping engine and use ropes when operating the lock
- Reduce cruising speed by 10%.

Meanwhile, exploring alternative power sources offers significant benefits for both air quality and convenience:

Shore Power:

This is the cleanest option at the source. Recharging batteries from shore power whenever possible is the most environmentally friendly and least polluting option.

Onboard Generation:

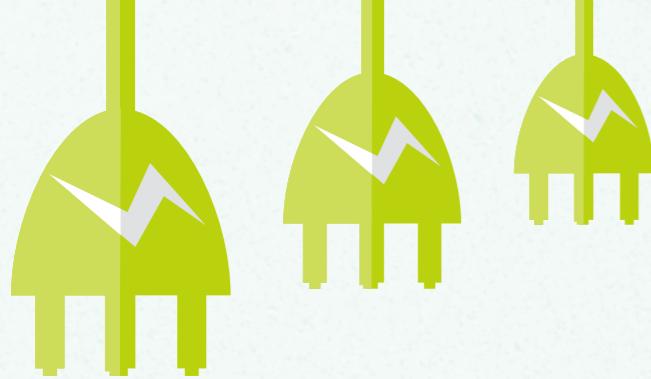
For times when shore power is unavailable, investing in solar panels can provide reliable electricity generation, particularly during the summer months. Solar panels have a long lifespan in the marine environment and are increasingly economic and easily managed. Rigid framed solar panels are sturdy and cost-effective, while semi-flexible panels are thin and ideal for curved surfaces. Wind generators are another proven and sustainable option, although their output is generally less than that of solar PV and not as easily manageable.



²⁰ www.hse.gov.uk/foi/internalops/ocs/200-299/oc292_2.htm

²¹ <https://friendsoftheearth.uk/climate/diesel-and-air-pollution-10-facts-about-invisible-killer>

²² <https://waterways.org.uk/about-us/library/briefing-note-environmental-guidance-for-boaters>



Biofuels:

To reduce the pollution and carbon footprint of your engine, a sustainable fuel called Hydrogenated Vegetable Oil (HVO) has emerged in recent years as a substitute to diesel fuel that can be used in the existing engine.

Hybrid and Electric Propulsion²³:

While converting existing diesel engines can be difficult and expensive, new boats are increasingly offering electric motors.²⁴

- An electric drive has the propeller driven by an electric motor that is powered from a battery. The battery may be charged from a variety of sources including a small diesel generator or a fuel cell.
- A hybrid drive has an electric motor, powered from a battery and an internal combustion engine that are both able to drive the propeller. The motor, driven by the engine, can also be used as a generator to charge the battery, which can also be charged from shore power or solar panels.

The Inland Waterways Association have published **guidance on electric narrow boating**.

Renewable HVO is a new generation renewable fuel produced from waste oils and stabilized using hydrogen. It has been certified by the UK Government as sustainable and can reduce carbon emissions by up to 90%.²⁵ Regrettably, HVO is a more expensive fuel option than mineral diesel and subject to volatility in pricing, meaning fewer suppliers are likely to stock it.

The Inland Waterways Association (IWA) has conducted extensive trials using HVO and has concluded the following:

- HVO is cleaner than mineral diesel with lower particle emissions
- Tried and tested in a range of modern and traditional canal boat engines
- Approved by the leading marine diesel engine manufacturers
- More resistant to 'diesel bug' than mineral diesel.

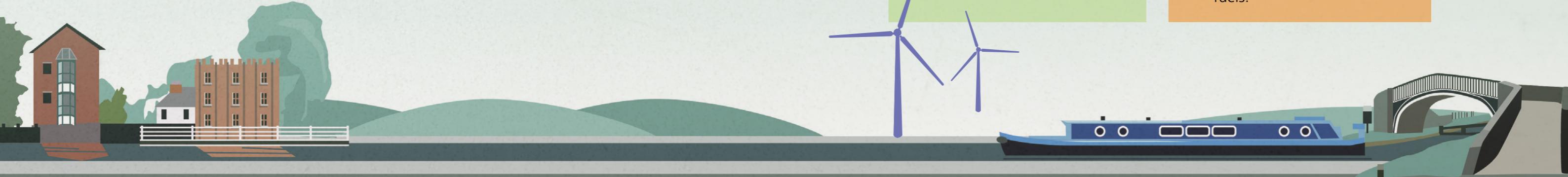


Do

- ✓ Bring the stove to temperature quickly and maintain the temperature
- ✓ Use dry wood (20% moisture or less) or smokeless fuels with the 'Ready to Burn' logo
- ✓ Follow the manufacturer's guidelines and sweep your chimney regularly
- ✓ Use a thermometer, moisture meter and stove fan to improve efficiency, save money and reduce pollution
- ✓ Fit a carbon monoxide alarm – it could save your life
- ✓ Store your wood securely in a dry space, to make sure it stays dry.

Don't

- ✗ Don't close off the air to slumber for long periods or overnight
- ✗ Don't burn wet, treated or painted wood – they are very polluting and incredibly inefficient
- ✗ Don't mix smokeless fuel and wood because they burn at different rates and temperatures, require different airflow, and mixing them can cause inefficient combustion, excessive heat, and harmful tar buildup in the flue
- ✗ Don't use logs that are too big as they burn inefficiently, leading to more smoke and lower heat output
- ✗ If you don't have space to store wood, use smokeless fuels.



Chapter 4: Stories from Oxford

Aristotle Lane Eco-Moorings

In Oxford, only an estimated 20% of boaters have access to mains electricity at their mooring, leaving others, particularly continuous cruisers, without alternative energy means. To begin addressing this disparity and support the city's net-zero targets, Oxford City Council and the Canal & River Trust have installed three 'eco-moorings' at Aristotle Lane along the Oxford Canal.

These eco-moorings consist of three electric charging bollards, each with two sockets, capable of providing electricity for up to six visiting vessels. Five of the sockets are 16-amp, while one is 32-amp, specifically installed to trial electric propulsion boats (e-boats) and cater to expected future demand. All other sockets have been installed

with adequate ducting and the capability to be easily upgraded to 32-amp in the future as demand allows.

These charging points offer continuous cruisers the opportunity to use an alternative source of clean energy, thereby reducing exposure to harmful pollution. The location is adjacent to a play park where school children spend time and can be exposed to pollution, particularly in winter. While there are no official restrictions on using engines, generators, or solid fuels at this mooring, the area has been designated a quiet zone due to its proximity to residential areas and a recreational ground. **Therefore, boats are strongly encouraged to avoid the use of generators or engines and the burning of anything but smokeless fuels, as these all constitute important sources of air and noise pollution.**

The mooring regulations at Aristotle Lane remain unchanged, meaning no pre-booking is required. Boaters will need a Meter-Macs account with credit to connect to the electricity, which provides a unique PIN for access. Whilst not mandatory to use the electricity, all boats capable of plugging in are **strongly** encouraged to make use of the electric power supply. The Canal & River Trust is responsible for the management and regular maintenance of these eco-moorings.

As of September 2025²⁶, the cost of electricity is:

- 43.1799 p/day Standing Charge
- 20.3971 p/kwh for electricity

²⁶ Please note this is the cost of electricity at time of writing and can be subject to change



Figure 6 - Eco-moorings at Aristotle Lane

How to create an account and top up for Aristotle Lane Eco-Moorings

Step 1:

Create your MeterMacs account

1. Go to: <https://portal.meter-macs.com/sign-in>
2. Click **Sign up**
3. Provider: Select **Canal & River Trust**
4. Site: Select **Visitors**
5. Email: Insert your email and create a password
6. Click **next**
7. Address: Please enter your permanent address, for example a marina

Step 2:

Top up your account

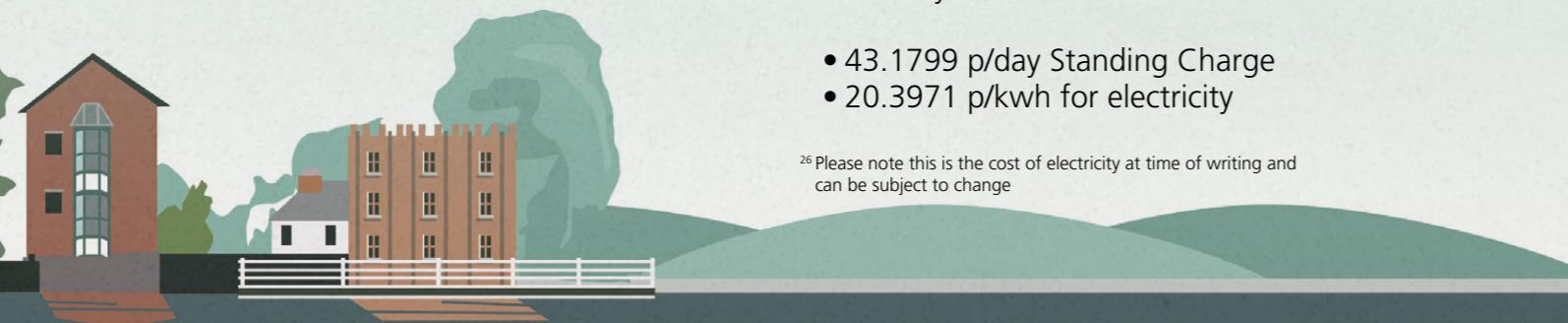
1. Log in to your new account
2. Add funds with a credit or debit card
3. When prompted to select the location, choose **Aristotle Lane**
4. Once your account is topped up, you can start using the charging points

Need Help?

If you have any questions specific to the eco-moorings including how to set up a Meter-Macs account, please see the *Aristotle Lane Eco-Moorings FAQs*.²⁷

For more help on signing up to the MeterMacs portal, topping up or powering up, you can visit the MeterMacs Youtube page: www.youtube.com/@metermacs/videos or the MeterMacs FAQs: <https://portal.meter-macs.com/help>

²⁷ Aristotle visitor moorings | Canal & River Trust



Case Study: The 'Katoomba' Sustainable Retrofit

For many boaters, the idea of a fully sustainable, electric-powered boat can seem out of reach. The Green Narrowboats²⁸ project, based in Oxford, set out to tackle this challenge head-on by converting a standard narrowboat, *Katoomba*, to run on clean energy and to find practical, affordable solutions that other boaters could follow. This real-world test aimed to answer the key questions: can we reduce the environmental impact of our boats, and can we do it without breaking the bank?

A major part of the conversion involved replacing the old diesel engine. Most narrowboat engines are old and, because they run at low revs on the canal, are often only about 10% efficient in practice. The project replaced this with a modern electric motor that is 85-90% efficient, meaning much less energy is wasted. To keep costs down, a modified motor and inverter from a Renault Twizy electric car was chosen, costing around £1,800. This new system provided quiet, emission-free cruising, using only about 1kW of power for normal travel.

To get rid of fossil fuels for heating, the project installed a water-source heat pump which uses the canal water itself as a heat source. This system provides background heat and hot water but works best alongside a good wood stove for extra comfort on the coldest days. For this kind of system to work well, excellent insulation is absolutely

essential. A well-insulated boat can stay warm for up to 12 hours, while a poorly insulated one can cool down in just two. This meant carefully adding insulation and a vapour barrier to stop damp and condensation on the inside of the boat's metal skin.

All this electric power had to come from somewhere, so the roof of *Katoomba* was fitted with 28 flexible, walk-on solar panels. The energy is stored in a modern Lithium-Ion battery bank, which is safer and lasts much longer than traditional batteries. From April to September, the solar setup generated enough power to cruise for 8 hours a day while running all the boat's systems. The project is also realistic about winter, when solar power is much lower. In the darker months, a boater would need a backup, either by plugging into shore power or by running a small, purpose-built diesel generator for about an hour a day.

Of course, a major question is the cost. The total price for this full retrofit was about £30,000. However, by eliminating the need for diesel and reducing maintenance, a live-aboard boater could save an estimated £3,000 per year. This gives the project a payback period of about 10 years for a refit, or just four years if these systems are included in a new-build boat, making it a viable long-term investment for a cleaner, quieter life on the water.

A rough breakdown²⁹ for each component can be found below:

Motor and inverter	£2,000
Reduction box	£1,200
Heat pump	£5,000
Forced air ventilation	£2,500
Batteries (used)	£3,600
Solar panels	£6,000
Electronics	£1,700
Fitting	£8,000
Total	£30,000

For a deep-dive into the Green Narrowboats project, check out these slides: www.lowcarbonhub.org/wp-content/uploads/2023/11/Green-Narrowboats-Presentation-Steve-Drummond.pdf.



The problem

Britain's inland waterways are heaven! But...

- The 38,000 narrowboats on Britain's inland waterways emit >100,000 tonnes of CO₂ per annum
- They also have a range of negative environmental impacts

The Government intends to legislate but most boat owners don't have much money.

Green narrowboats is seeking real answers to two questions

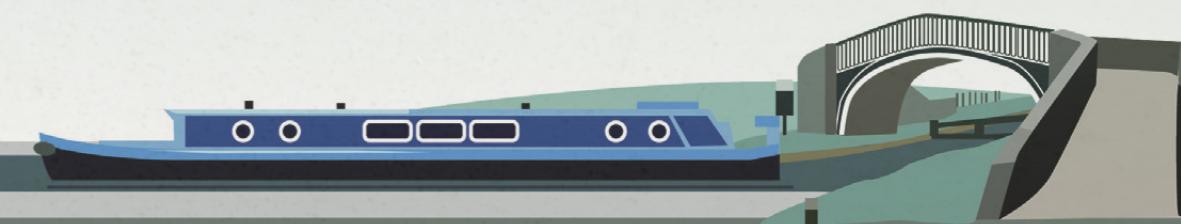
- How can we address the environmental impact of narrowboats?
- How can we do it at a reasonable cost?



Figure 7 - Green Narrowboats Sustainable Boat³⁰

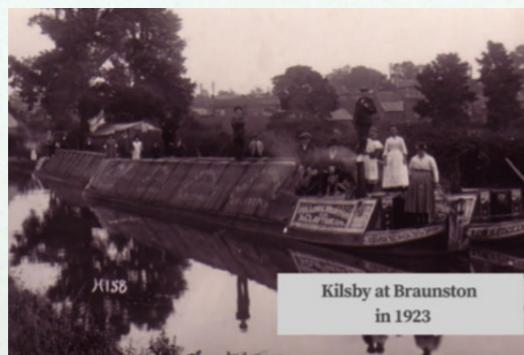
²⁸ www.lowcarbonhub.org/p/projects/green-narrowboats/

²⁹ Please note: the costs for this project may not reflect current costs. For example, a used battery was purchased, keeping the costs down.
³⁰ www.lowcarbonhub.org/wp-content/uploads/2023/11/Green-Narrowboats-Presentation-Steve-Drummond.pdf accessed 28/10/2025



Kilsby Boat Project

The Kilsby Boat Project³¹ is an initiative aimed at restoring and repurposing a 108-year-old former Fellows, Morton and Clayton narrowboat into a vibrant community theatre space. The boat is envisioned as a unique performance and exhibition venue, hoping to bring the rich stories of the Oxford Canal directly to the towpath.



An artist's impression of the Kilsby's future, with the traditional design and livery restored.
By Rosie Taylor @taylor_rose101

The boat was generously donated to the Jericho Living Heritage Trust in 2019 and is currently undergoing extensive renovations at Tooley's boatyard in Banbury. Once completed, the boat will return to its home in the Jericho area of the Oxford Canal, serving as a floating stage that will entertain, educate, and inspire the community to engage with and enjoy the canal.

Importantly, the project is aiming to use electric propulsion, reducing carbon emissions and thereby reducing the amount of pollution coming from the boat!

³¹ <https://kilsbyboatproject.com/>

Chapter 5: Boat Safety

Boat Safety Scheme (BSS)

Boat safety extends beyond preventing accidents; it is closely tied to the health and well-being of those living aboard, especially concerning air quality. Many of the risks identified by the Boat Safety Scheme (BSS)³² arise not just from equipment, but from how fuels, appliances, and systems are used and maintained. Good safety practices help protect boaters from fire, explosion, and toxic exposure while also contributing to cleaner air inside boats and across mooring areas.



³² <https://canalrivertrust.org.uk/boating/go-boating/a-guide-to-boating/boaters-handbook>

The Boat Safety Scheme (BSS) is a public safety initiative supported by navigation authorities. It sets out a series of minimum legal safety requirements for boats on inland waterways. Much like an MOT for cars, most boats must pass a BSS examination every four years to be licensed or moored on many UK waterways. The BSS covers a wide range of safety checks, including fuel systems, electrical systems, ventilation, fire protection, carbon monoxide (CO) alarms, and appliance installation and condition. There are different sets of requirements depending on the type of boat (e.g., private, hire, or non-private), and the relevant navigation authority determines which applies. To receive a BSS certificate, a boat must pass an inspection carried out by an authorised examiner, following the BSS Examination Checking Procedures, which include both mandatory requirements and advisory checks.



Many BSS requirements directly impact air quality and respiratory health:

Carbon Monoxide (CO):

This is one of the most serious air quality concerns on boats. CO is a colourless, odourless gas that can be fatal and is produced when fuels like wood, coal, petrol, or gas do not burn completely. Poor ventilation, faulty appliances, or blocked flues can cause CO to build up inside the boat. The BSS mandates CO alarms and recommends regular maintenance of stoves and engines to prevent this risk.

Solid Fuel Stoves:

Commonly used for heating, these are another area where safety and air quality overlap. The BSS notes that two-thirds of fire and CO risks stem from how appliances and fuels are used, not just how they are installed. Improper burning techniques or using unsuitable fuels can lead to excessive smoke, both inside and outside the boat. This not only affects the boater's health but also contributes to local air pollution. Safe stove use is a key part of both fire prevention and clean air.

Ultimately, good boat safety practices support cleaner air and a healthier environment for everyone on the waterways. By maintaining equipment, ensuring proper ventilation, and remaining aware of the risks, boat dwellers can protect themselves and contribute to a safer, more sustainable community.

Generators and Petrol Engines:

These pose dual risks. In addition to fire and explosion hazards, they emit pollutants that can degrade air quality within your boat and in confined mooring areas. The BSS provides specific advice on safe generator use, including proper placement, ventilation, and avoiding enclosed spaces — all of which help reduce both safety risks and harmful emissions.

Electrical Systems, including Lithium-ion Batteries:

These offer cleaner alternatives to fossil fuels but must be installed and used safely to avoid overheating, fire, or toxic fumes. The BSS offers guidance on safe charging practices and recognising warning signs of battery failure.

CO

NO_x

NO

PM_{2.5}

PM_{2.5}

CO

PM_{2.5}

CO

³³ <https://canalrivertrust.org.uk/boating/go-boating/a-guide-to-boating/boaters-handbook>

NO₂

PM_{2.5}

CO

NO_x

CO

PM_{2.5}

PM_{2.5}



Appendix 1: Oxford boatyards, marinas and moorings³⁴

Aynho Wharf	Station Rd Banbury OX17 3BP	Diesel & Gas, Logs & Coal, Elsan & Pumpout, Chandlery, Engineering Services,	01869 338483
Bossoms Boatyard	Binsey Village Oxford OX2 0NL	Moorings, electric charging, water, waste disposal, boatyard services, boat & engine repairs	01865 247780 info@bossoms.co.uk
College Cruisers	Combe Rd Oxford OX2 6BL	Pumpout, red diesel, gas, coal, spares & sundries, narrowboat "babysitting", marine engineer, stove installation, engine servicing, painting, maintenance	01865554343 info@collegecruisers.com
Enslow Marina	Station Road Enslow Kidlington OX5 3AX	Coal, logs, calor gas, diesel, pumpout, elsan & water points, hull blacking, maintenance, re-fits, re-paints, repairs, surveys, welding	07785 734 367 richard@kingsground.co.uk
Oxford Cruisers Ltd	The Boat Centre Oxford Road Eynsham OX29 4DA	Boat Carpentry, Marine Electrical, Boat Safety, Engineering, Engine Service, Welding, Red Diesel, Refuse, Chandlery, Gas Replacement, Pumpout & Elsan	01865881698 oxfordcruisers@aol.com
Sovereign Wharf Limited	Compton Road, Banbury OX16 2PP	Chandlery, Docking, Elsan, Gas, Maintenance, Mooring, Pumpouts, Mains Electric, Online Moorings, Security, Water, WiFi	01295 275657 office@sovereignwharf.co.uk
Tooleys Boatyard	Spiceball Park Rd, Banbury OX16 2PQ	Chandlery, Docking, Dry Dock, Maintenance, Repairs, Working Boatyard, Offline Moorings	01295 272917 info@tooleysboatyard.co.uk

Appendix 2: Myth busting questions and answers

Myth	Truth
✗ Wood burning is environmentally friendly	✓ Wood burning is not always environmentally friendly as it results in the emission of particulate matter. However, there are steps you can take to minimise the amount of pollution emitted by wood burning.
✗ Eco-design stoves are safe to use	✓ Even homes with 'ecodesign' wood burners are three times more polluted than homes without. ³⁵
✗ Running a diesel engine to charge batteries isn't polluting	✓ Diesel engines emit NO ₂ and PM _{2.5} when used. Diesel exhaust has been classified as carcinogenic to humans by the International Agency for Research on Cancer (IARC). ³⁶
✗ Burning rubbish or treated wood is a good way to dispose of waste	✓ This releases toxic chemicals and fine particles that are dangerous to inhale.
✗ Wet wood is not that polluting	✓ A 1kg freshly cut log can contain around a pint of water. Burning off all that water takes a lot of energy from the fire and creates a lot of smoke and pollution.
✗ If you can't see smoke, there is no pollution	✓ Harmful pollutants like PM _{2.5} and NO ₂ are invisible. Just because the air looks clear doesn't mean it's safe to breathe.

Appendix 3

To find a supplier of 'Ready to Burn' fuels visit:
www.readytoburn.org/consumers/find-a-supplier/.

³⁴ www.canaljunction.com/boat/yard/south.htm

³⁵ www.mdpi.com/2073-4433/11/12/1326

³⁶ www.iarc.who.int/wp-content/uploads/2018/07/pr213_E.pdf

Further Information

For boat dwellers in Oxford, a network of organisations and resources exist to provide support and advocacy.

Support and Advocacy: The *National Bargee Travellers Association*³⁷ (NBTA) is a volunteer organisation that helps itinerant boaters with various issues, including GP registration, welfare benefits, and school enrolment. For general support and a listening ear, the *Boaters Chaplaincy*³⁸ provides volunteers who can assist boaters in need. The Inland Waterways Association (IWA) advocates for waterway maintenance and environmental preservation. *Better Housing Better Health*³⁹ offers free and confidential advice to support residents in Oxford, including boaters, who are at risk of fuel poverty.

Waterway Authorities and Contacts: The *Canal & River Trust* is the charity that manages the Oxford Canal. You can find boating information on their website or by calling 0303 0404040. To report an incident, you can use their contact form or email them. In an emergency, call their 24-hour line at 0800 4799947.

The Environment Agency manages the River Thames. You can get boating information by calling 03708 506506. To report an incident, call their 24-hour line at 0800 807060. To check river conditions, call 0345 9881188.

Air Quality and Stoves: For information on using a stove and burning fuel responsibly, you can consult resources from burnright.co.uk and the *Canal & River Trust* website. To learn more about air pollution and its health effects, including the *Do you Fuel Good* campaign, you can visit the Oxford City Council website.

To make an official smoke nuisance complaint, you can visit:
www.oxford.gov.uk/report-air-quality-problem/report-air-pollution-problem

If you are curious about air quality inside your boat, you can borrow an air quality sensor from a range of libraries in Oxfordshire. For more information you can visit: <https://news.oxfordshire.gov.uk/how-to-monitor-air-quality/>

There is a popular fuel delivery service on the Oxford Canal:
www.julesfuels.co.uk/

³⁷ <https://bargee-traveller.org.uk/about/>

³⁸ <https://canalrivertrust.org.uk/boating/boating-accessibility/do-you-know-a-vulnerable-boater/waterways-chaplains-help-on-the-waterways-for-boaters-in-need>

³⁹ www.bnbh.org.uk/about/

