JSNA Gloucestershire 2022/23
Air Quality

Health ◊ Care ◊ Wellbeing

Introduction

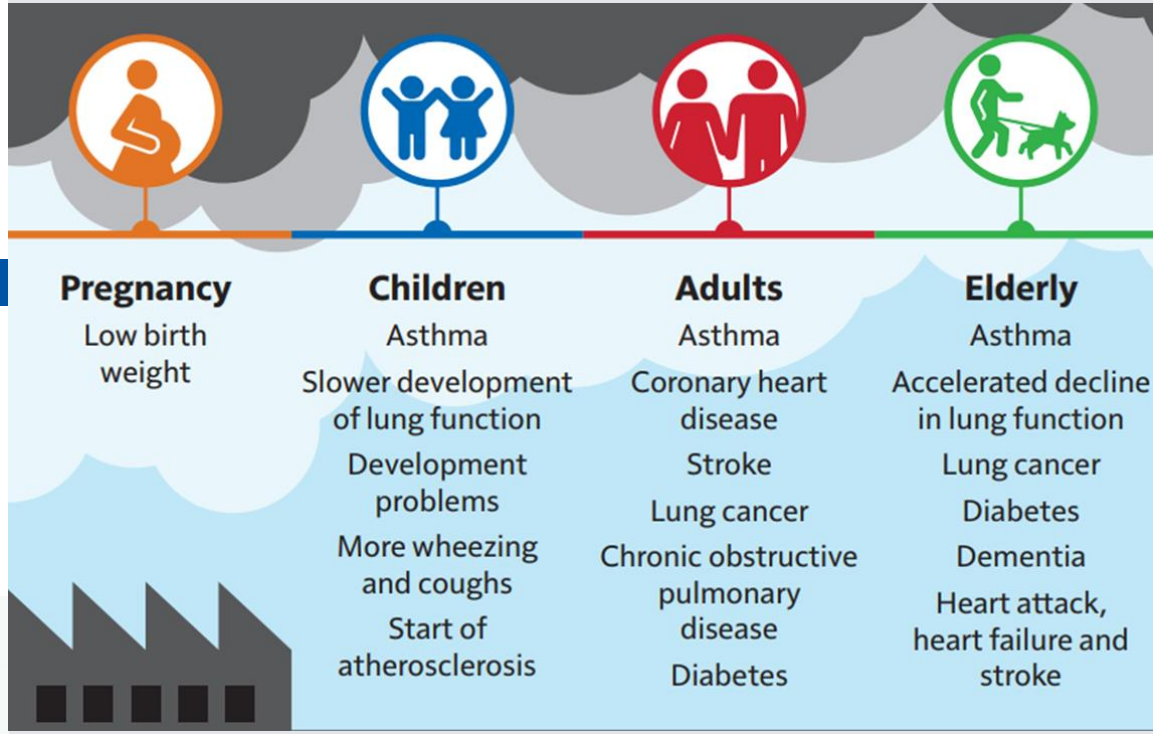
Air pollution affects us all. It can affect lung development in children and exacerbate Asthma. It can contribute towards heart disease, stroke, cancer and mortality.

We have little control as individuals over the level of pollution that we and our families breathe outside our own home – this is a societal problem to solve.

What is air pollution?

The World Health Organisation defines air pollution as **'contamination of the indoor or outdoor environment by any chemical, physical or biological agent that modifies the natural characteristics of the atmosphere'.**

Air pollution has negative effects on health throughout the life course, from pre-birth to old age, summarised below[2]:



Some individuals such as those with pre-existing respiratory or cardiovascular disease are particularly susceptible, but the effects of air pollution can be seen across the population.

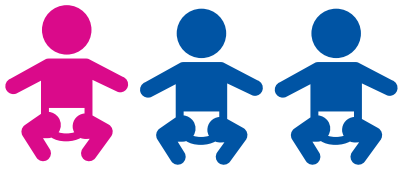
The mortality burden of air pollution in England is estimated to be between 26,000 and 38,000 a year, but in addition many people suffer avoidable chronic ill health as a result of it. Improvements in air quality have been associated with improved health outcomes – for example, reductions in air pollution in London have led to reduced childhood asthma hospital admissions. Further reductions in air pollution will lead to significant reductions in coronary heart disease, stroke and lung cancer, among others.

Children are at greater risk from air pollution[3]

- Children are still developing their organs and immune systems, and their smaller bodies and airways make them especially vulnerable to polluted air.
- There is a strong link between air pollution and the worsening of asthma symptoms and it also plays a part in causing asthma in some.
- Research is beginning to point towards the effect of high levels of air pollution on the developing brain, such as reduced memory function and mental health problems later in life, although more research is needed.
- Research has shown **that primary and nursery school children** can be exposed to **30% more pollution than adults** when walking along busy roads. This is because they are smaller and closer to the fumes from exhaust pipes.

Air Pollution and Childrens Health Report

Around



1 in 3

babies are growing up in areas of the UK with unsafe levels of particulate matter – that's nearly 270,000 babies under the age of 1 in the UK[4]

In **71%** of UK towns and cities, children are breathing unsafe levels of air pollution[5]

An estimated **1.6 million** under-fives are growing up in areas of the UK with unsafe levels of particulate matter – one third of all 0-5 year olds in the UK[6]

At least **4.5 million** children in the UK are growing up in areas with unsafe levels of particulate matter – 30% of 0-18 year olds in the UK[7]

Areas with young populations tend to have disproportionately high levels of particulate matter – 75% of local authorities with the youngest populations in the UK also have unsafe levels of particulate matter[8]

Children tend to live in more deprived communities in England, where particulate matter concentrations are often higher[9]

Outdoor Air Quality[10]

At a national level air pollution continues to decline, however pockets of poor air quality remain. This requires action in many sectors. We need to focus on areas where people live, study, work and have leisure.

The path to better outdoor air quality is clear, as detailed in the **Chief Medical Officer's annual report 2022 on air pollution.**

Improvements in engineering for transport and industry, modifications to agricultural practice and improvements in the built environment are examples that should, once a change is made, be self-sustaining and allow us to reap health benefits for the foreseeable future. Many of the changes to improve outdoor air pollution have significant co-benefits. For example, reducing the use of fossil fuels for energy reduces both air pollution and carbon emissions; improving active travel reduces air pollution emissions from vehicles and has direct health benefits to those who are walking, wheeling or cycling.

Indoor Air Quality[11]

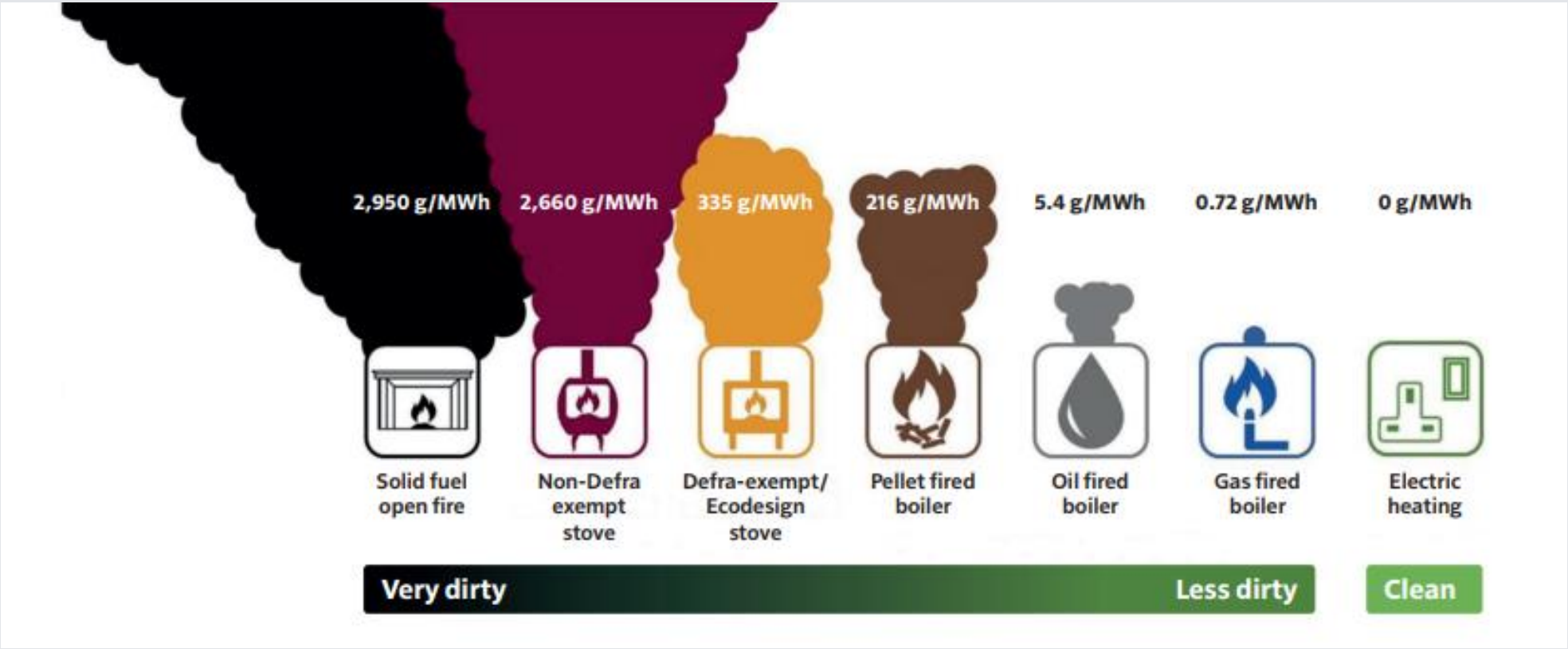
The negative health impacts from indoor air quality are becoming increasingly reported. Ventilation and reducing emissions are important. However, the path to improvement is not as clear as for outdoors, and further research is needed. Some interventions are highlighted below:

- People spend large periods of time indoors and many indoor places are public, where individuals have little control over the quality of air they breathe. These two factors should be recognised in the planning and development of public indoor spaces.
- Effective ventilation, while minimising energy use and heat loss, is a priority for reducing air pollution, respiratory infections and achieving net zero. This is a major engineering challenge which needs solving.
- While there is co-ordination across government, there currently isn't any national policy on indoor air quality.

Indoor Air Quality Report

Domestic space heating, including burning of solid fuels[12]

The heating of buildings presents an important source of indoor as well as outdoor air pollution. Some historically important forms of indoor air pollution have largely gone, such as domestic coal burning. There is a substantial difference between the least and most polluting methods of domestic heating, as shown below*:



Solid fuels are by far the most polluting method of domestic heating, and wood burning has increased in popularity over recent years. **The use of wood stoves is increasing and can impact air quality significantly** in urban areas. Air pollution emissions can be reduced, but not fully eliminated, by using modern, less polluting stoves and burning accredited wood. In smoke control areas, the rules should be adhered to.

What is PM2.5?

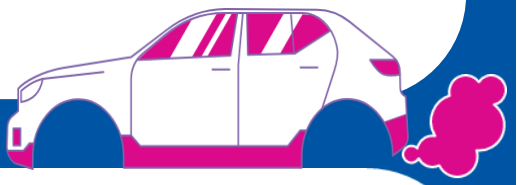
PM stands for '**particulate matter**', and 2.5 refers to the size of the particulate (2.5 micrometres or less). It is an urban pollutant which often disperses over a large area and consists of finely divided solids or liquids such as dust, fly ash, soot, smoke, aerosols, fumes, mists, and condensing vapours that can be suspended in the air.

PM2.5 is produced by combustion (including car engines), vehicle tyres and brakes, and wood burning stoves.

What is NO_2?

NO_2 stands for **nitrogen dioxide**, and millions of tons of this harmful gas are produced each year. It is a local, primary traffic pollutant.

NO_2 is introduced to the environment largely from vehicle traffic, but also from manufacturing and construction, butane and kerosene heaters, stoves and cigarette smoke.



How do they affect our health?

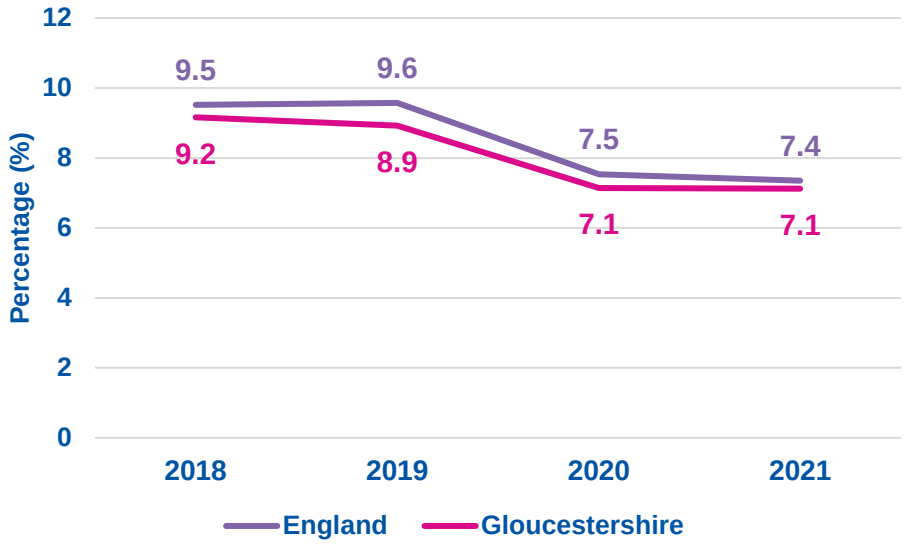
PM2.5 is particularly harmful since the small particles can easily and quickly penetrate deep into the lungs where they can cause damage to the tissue.

Exposure to PM2.5 has been linked to a range of health outcomes including asthma, respiratory disease, coronary heart disease, stroke, and lung cancer, with emerging evidence showing impacts on diabetes and low birth weight.

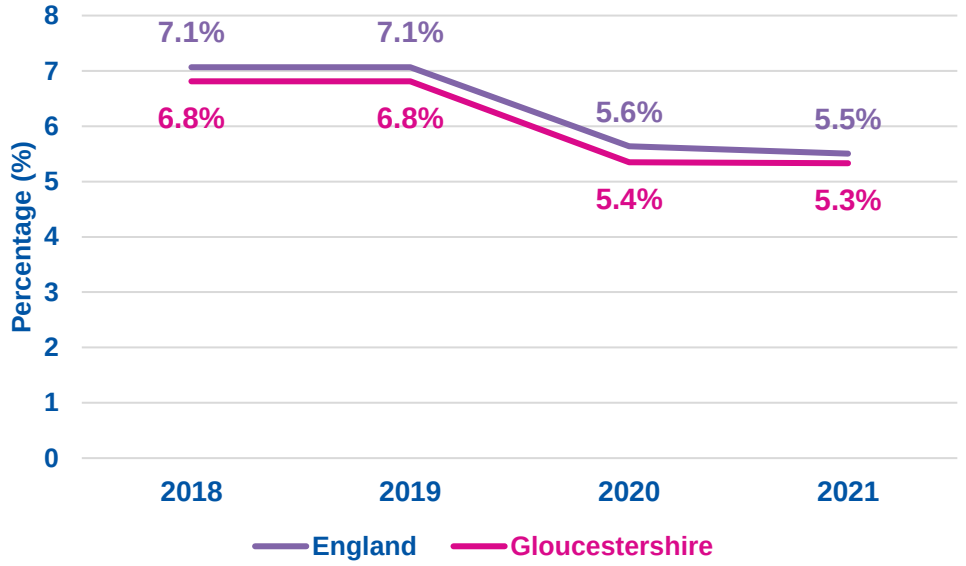
Inhalation of **NO_2** affects our health by entering the cells which line the respiratory tract and causing reactions with cells there.

These reactions cause tightening of the airways in the lungs (causing wheezing, coughing, shortness of breath), inflammation, and a reduced immune response. NO_2 has been associated with exacerbating and causing asthma, lung cancer and among other diseases.

Air pollution: particulate matter (concentrations of total PM2.5)[13]

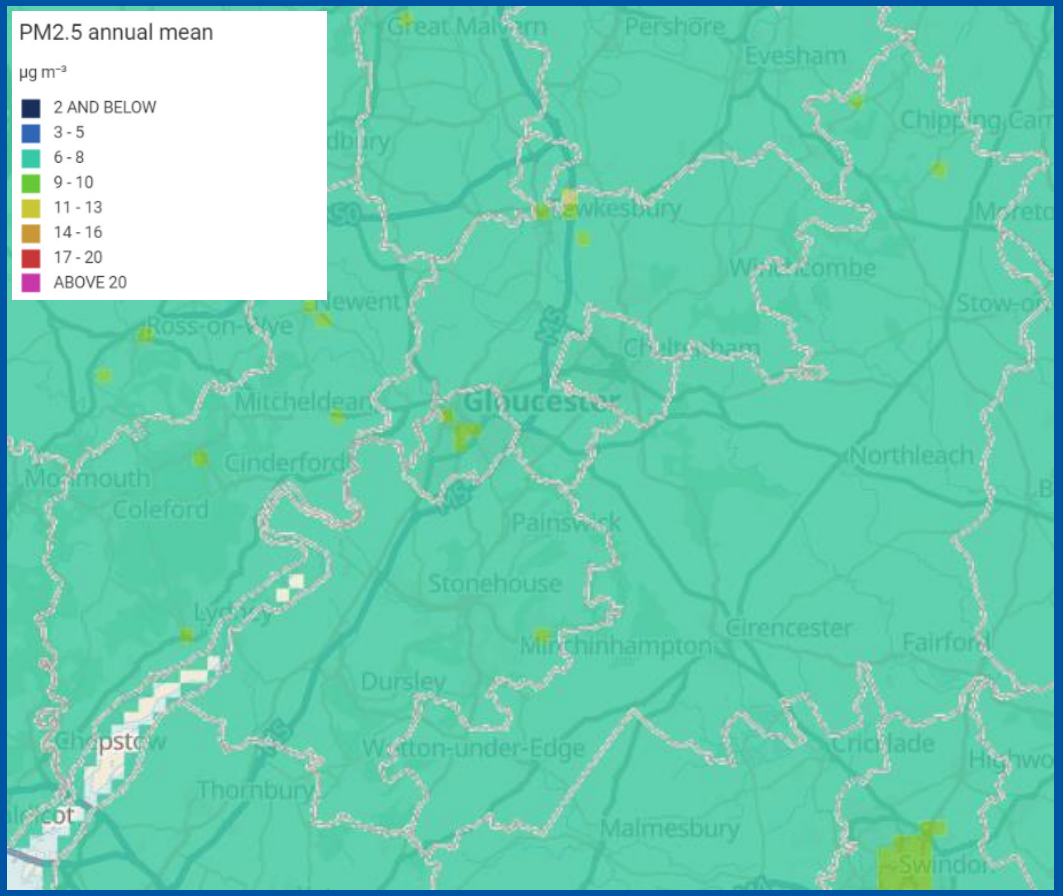


Fraction of mortality attributable to particulate air pollution (measured as fine particulate matter, PM2.5*)[14]



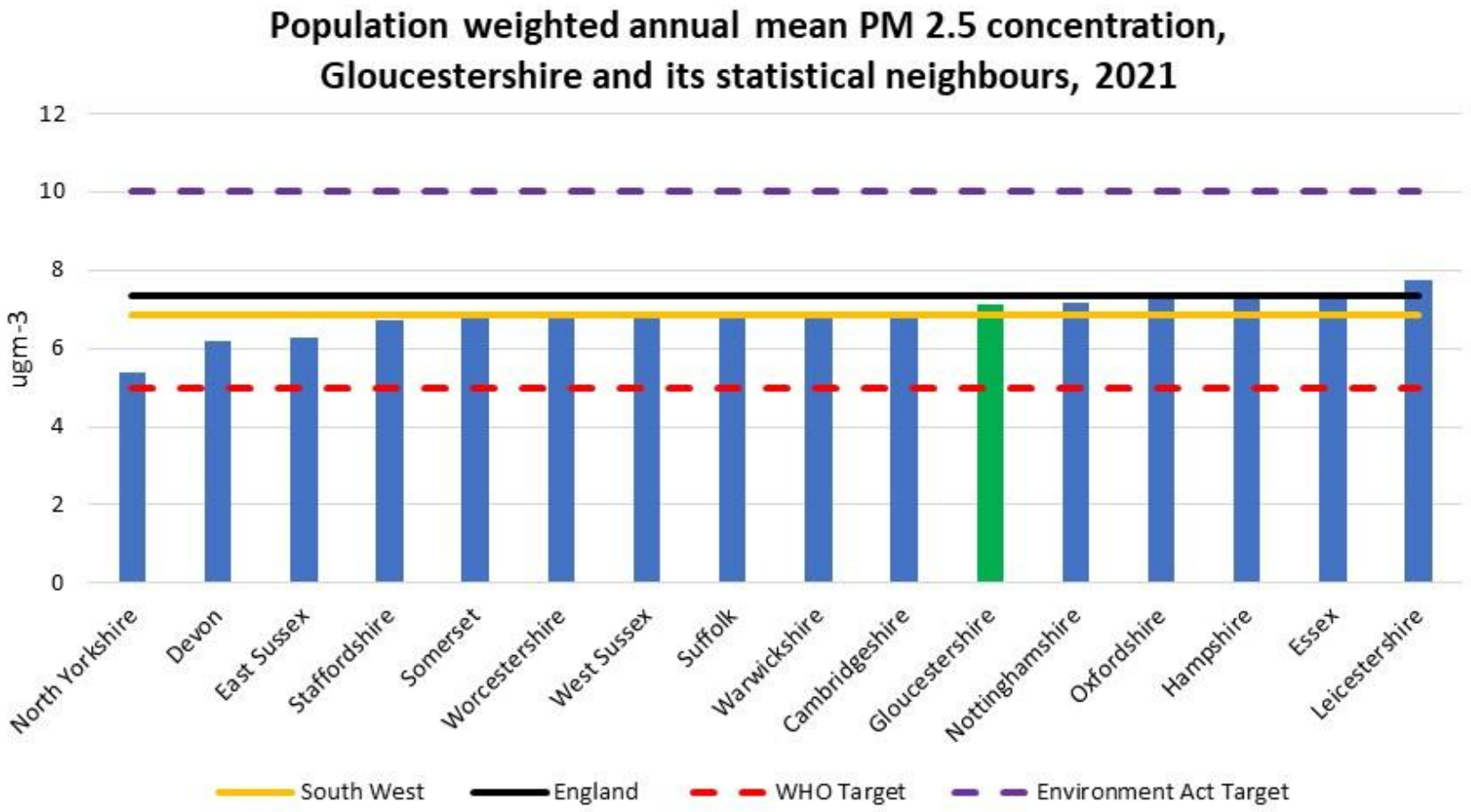
Particulate Matter 2.5 (PM 2.5) in Gloucestershire

Current WHO Air Quality Guideline levels introduced in 2021 suggest the target level for annual average PM2.5 should be 5 ugm-3. This is significantly lower than the previous target of 10 µg/m3. The UK's Environment Act (2021) has a target of 10 µg/m3, with a reduction in average population exposure by 35% by 2040 compared to a 2018 baseline.[15]



PM2.5 at a 1km^2 level in 2021 for Gloucestershire is visualised in the above map, showing an exceedance of the recommended PM2.5 WHO target of 5 ugm-3. Estimated levels of PM2.5 in most areas are estimated to be between 6 - 8 ugm-3, the exceptions are parts of Gloucester and areas around our market towns, which have estimated levels between 11-13 ugm-3.[16]

Population weighted data is available at a local authority level, this estimated that in 2021 the total annual mean PM2.5 concentration in Gloucestershire was 7.1 ugm-3, above WHO guidelines but below the target set in the UK's Environment Act.

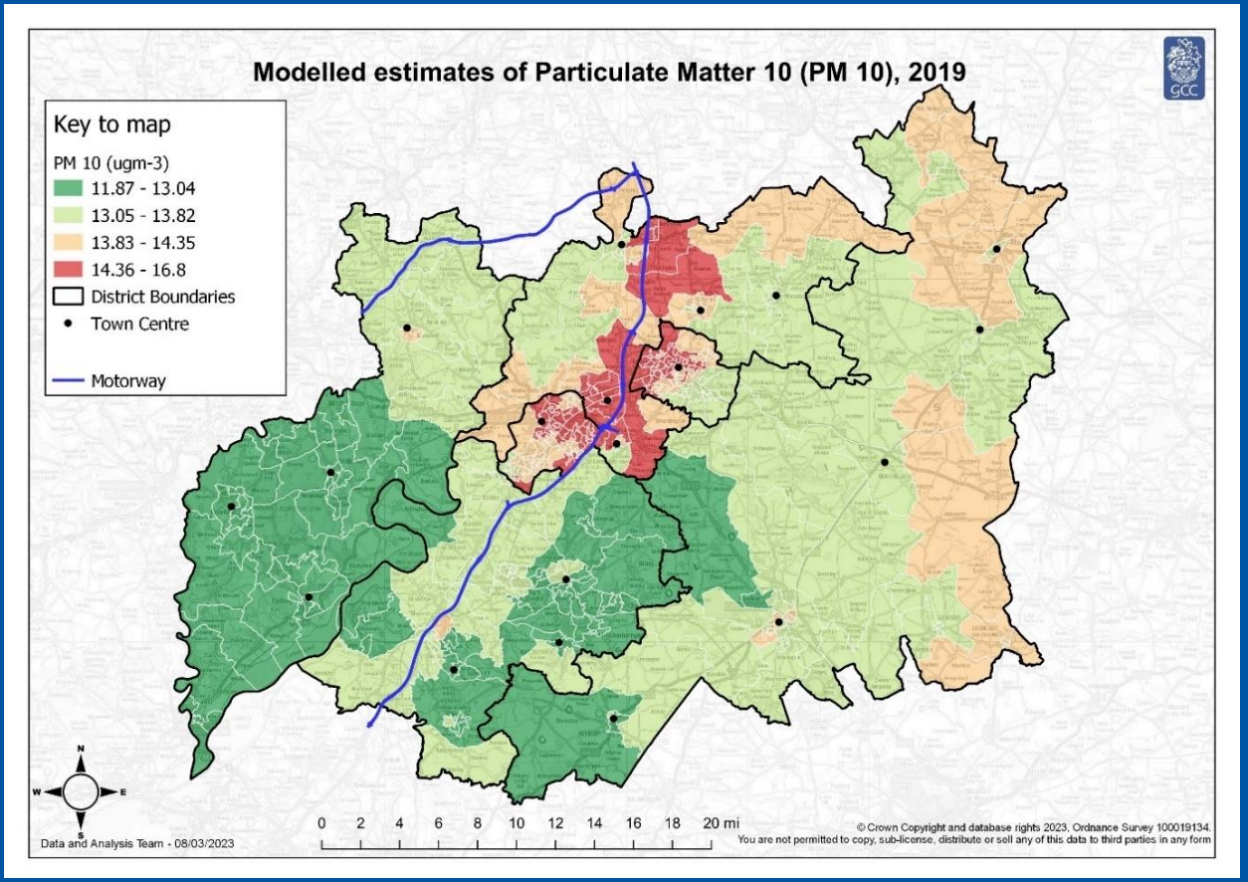


This graph shows that all of Gloucestershire's statistical neighbours also had PM2.5 levels which exceeded the WHO Guidelines. When compared to its statistical neighbours, Gloucestershire is ranked 6th out of 16 areas, putting it in the top half of similar authorities. Gloucestershire has higher PM2.5 levels than the Southwest (6.8 ugm-3) but was below the national average of 7.4 ugm-3.[17]

Particulate Matter 10 (PM10) in Gloucestershire

Particulate matter 10 (PM10) is the term used to describe condensed phase (solid or liquid) particles suspended in the atmosphere which are 10 micrometres or less in diameter.

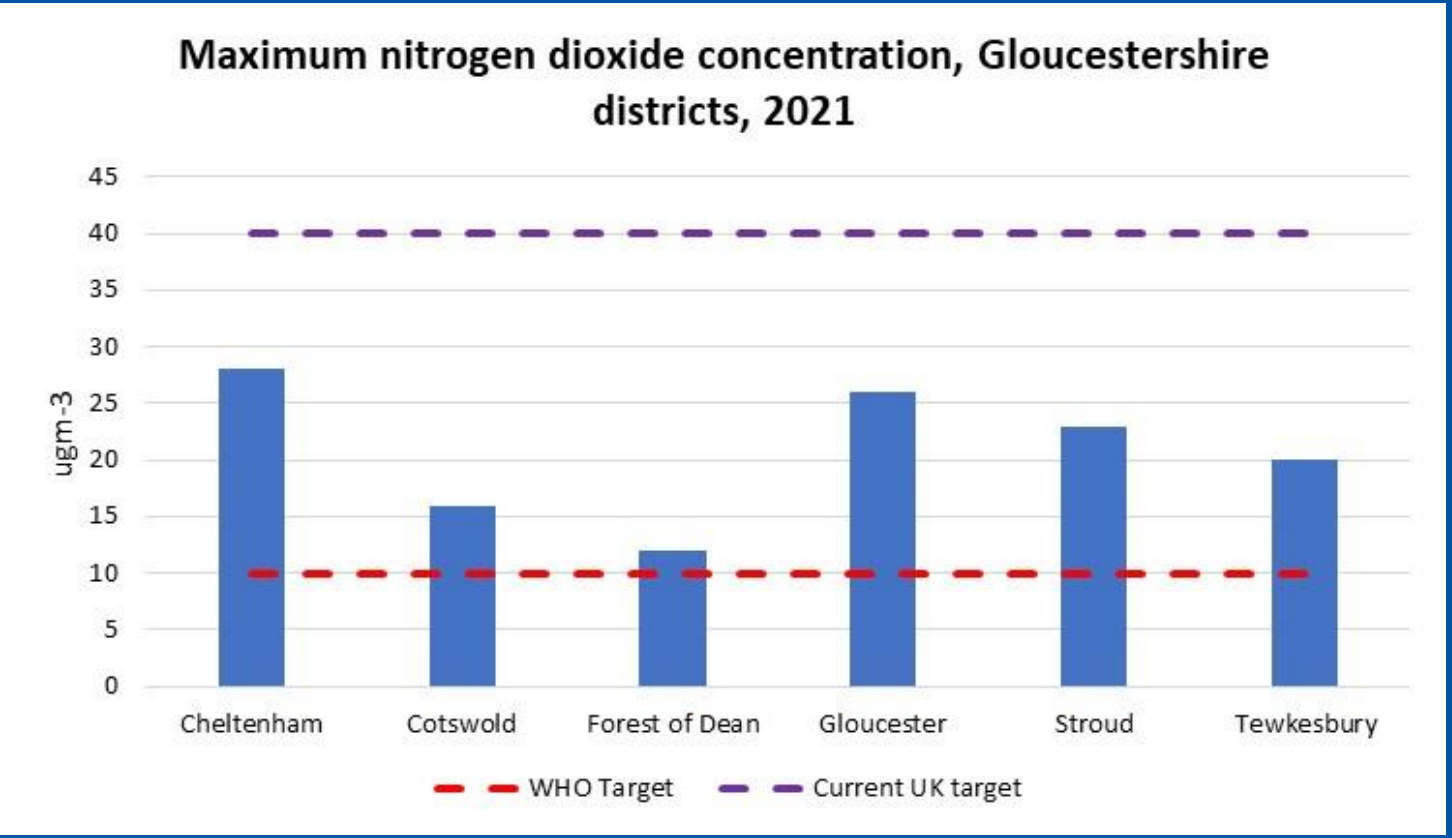
Current WHO Air Quality Guidelines levels for PM10 are set at an annual average of 10 ugm-3[18], this is significantly lower than the previous target of 20 ugm-3. Across the UK the current guidelines are set at 40 ugm-3.



This map shows in 2019 all Lower Super Output Areas in the county had average values which exceed the current WHO guidelines of 10 ugm-3 but are lower than the current UK targets. Levels of PM10 are estimated to be at their highest around Northway and Churchdown in Tewkesbury, the east of Cheltenham and north of Gloucester, many of which border the M5 corridor.[19]

Nitrogen dioxide in Gloucestershire

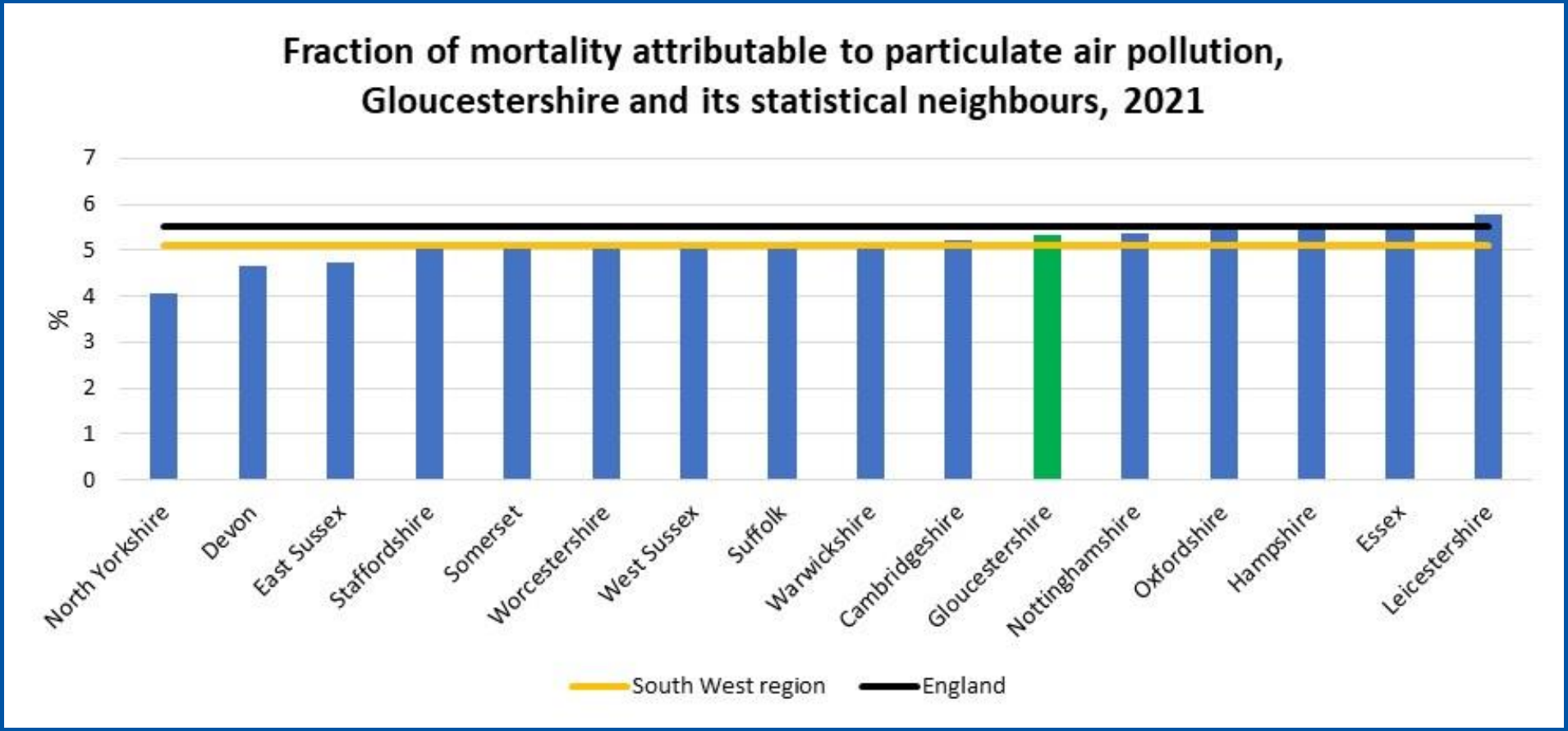
Nitrogen dioxide, or NO_2, is a gaseous air pollutant composed of nitrogen and oxygen. Current WHO Air Quality Guidelines levels for nitrogen dioxide are set at 10 ugm-3[20], this is significantly lower than the previous target of 40 ugm-3. The current UK target is 40 ugm-3.



All districts within Gloucestershire had maximum nitrogen dioxide concentration levels which exceeded WHO guidelines in 2021 but were considerably lower than the current UK targets. Maximum levels of nitrogen dioxide were highest in Cheltenham where they were estimated at 28 ugm-3.[21]

Mortality attributable to particulate air pollution

To quantify the impact of PM2.5 exposure OHID provide estimates of the fraction of mortality attributable to particulate air pollution[22], these estimates are based on the research evidence of mortality risk, combined with modelled levels of the background air pollution to which populations are exposed at local authority level.**



In Gloucestershire around 5.3% of deaths of people aged 30+ are thought to be attributable to air pollution. This graph shows this was lower than the national average (5.5%) but higher than the regional average (5.1%). When compared to its statistical neighbours, Gloucestershire is ranked 6th out of 16 areas, putting it in the top half of similar local authorities, reflecting its position in terms of overall levels of PM 2.5.[23]

Within Gloucestershire there are **6 monitoring sites that exceeded the UK's current recommended levels for nitrogen dioxide** in 2019[A], of these **3 are in the most deprived 20% of the country** in terms of Multiple Deprivation.[24]

There are currently 7 Air Quality Management Areas (AQMA) across Gloucestershire, they have all been declared because monitoring shows the sites do not meet the EU air quality objective for nitrogen dioxide.[25]

The same communities that experience the highest pollution, tend to be those who emit the least pollution. These communities are also among the poorest areas in Britain. In many places, poor housing stock is located close to busy road networks and occupied by more deprived households.[26]

Active Travel - a local initiative…

"I ride because it's good for me and good for the environment"

- *Love to Ride Gloucestershire participant*

Switching journeys from cars to walking, cycling and public transport not only has a large beneficial impact on an individual's health, but a wider benefit to the population health as there are corresponding decreases in overall air pollution levels.

Love to Ride Gloucestershire are on a mission to get the world on bikes! With Love to Ride, you can track your bike miles, see your carbon savings, set goals, and find help and support to ride more often.

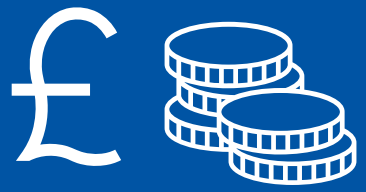
"I ride because it gets me fit, helps the environment and I really enjoy cycling ...."

- *Love to Ride Gloucestershire participant*

Love to Ride[27] Gloucestershire has so far benefitted

GLOUCESTERSHIRE ALL TIME STATS

- 142 WORKPLACES
- 1,896 PEOPLE
- 435 NEW RIDERS
- 2,152,562 MILES
- 131,989 RIDES
- 231,433 LB CO2



The total NHS and social care cost of PM2.5 and NO_2 combined in 2017 was estimated to be £42.88 million (based on data where there is more robust evidence for an association), increasing to £157 million when diseases are included where there is currently less robust or emerging evidence for an association.[28]

What are we doing locally?

- **NO_2 monitoring** by district councils at key sites
- **E-cargo bike project** in partnership with Gloucestershire Hospitals
- **Air quality monitoring webpage in development** to allow Gloucestershire residents to see air quality levels in their area
- **Grant scheme** to support district councils with air quality monitoring equipment
- **Linking local strategies:** Gloucestershire's Climate Change Strategy, Gloucestershire Energy Strategy and Gloucestershire Air Quality and Health Strategy
- **ThinkTravel projects** including engagement with schools around anti-idling and local monitoring
- Recently appointed **Air Quality Education Projects Officer** for Cheltenham Borough Council who is **working with schools** to implement measures to help **reduce air quality impacts**
- **Love to Ride Gloucestershire**

Areas of best practice

- Cheltenham Borough Council **monitoring particulate matter** in some locations
- **Ultra Low Emission Vehicle charging points** being installed around the county

Click here for the JSNA Infographic on Respiratory

Key evidence

- Gloucestershire Air Quality and Health Strategy
- Gloucestershire Energy Strategy
- Chief Medical Officer's Annual Report 2022: Air pollution
- Gloucestershire's Climate Change Strategy
- Air Quality in Gloucestershire Report (Inform)

DATA SOURCES: 1. WHO Air pollution. 2. Chief Medical Officer's annual report 2022: air pollution. 3. Air Pollution and Childrens Health Report. 4. A breath of toxic air: UK children in danger - UNICEF UK. 5. A breath of toxic air: UK children in danger - UNICEF UK. 6. A breath of toxic air: UK children in danger - UNICEF UK. 7. A breath of toxic air: UK children in danger - UNICEF UK. 8. A breath of toxic air: UK children in danger - UNICEF UK. 9. A breath of toxic air: UK children in danger - UNICEF UK. 10. Chief Medical Officer's annual report 2022 on air pollution. 11. Indoor Air Quality Report. 12. Chief Medical Officer's Annual Report 2022. **Note: The air pollution emissions will also depend on the age of the appliance, how it is maintained and used and the fuel burned (for example, dry or wet wood). The following definitions were used: Solid fuel open fire: wood burned in an open fire. Non-Defra-exempt stove: wood in a conventional stove. Defra-exempt/Ecodesign stove: wood in an advanced/ecolabelled stove. Pellet fired boiler: wood in pellet stoves and boilers. Oil fired boiler: fuel oil in a medium (≤50kWth) boiler.* 13. Public health profiles. 14. Public health profiles. 15. WHO global air quality guidelines. 16. Air Quality in Gloucestershire Report (Inform). 17. Air Quality in Gloucestershire Report (Inform) 18. WHO global air quality guidelines. 19. Air Quality in Gloucestershire Report (Inform). 20. WHO global air quality guidelines. 21. Air Quality in Gloucestershire Report (Inform). 22. Air Quality in Gloucestershire Report (Inform) **Attributable Deaths are not individually attributed to air pollution, but rather it can be thought of as a contributory factor in many deaths from other causes such as respiratory disease and Cardiovascular disease. 23. Air Quality in Gloucestershire Report (Inform). 24. Air Quality in Gloucestershire Report (Inform).[A] Data for 2020 was not used as this is likely to be skewed by the impact of the COVID19 pandemic. 25. Air Quality in Gloucestershire Report (Inform). 26. Air Quality in Gloucestershire Report (Inform). 27. Love to Ride Gloucestershire. 28. Estimation of costs to the NHS and social care due to the health impacts of air pollution: summary report.