Clean Air Strategy

2020-2024

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South Gloucestershire Council

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Contents

List of Figures and Tables

Foreword

Approved by Councillor Benjamin Stokes (Public Health)

We are pleased to present South Gloucestershire's Clean Air Strategy. Action is being taken across the UK to tackle poor air quality, and we have committed to taking forward a local Clean Air Strategy this year to support those efforts.

We face a significant threat from air pollution. Unlike smogs of the past, it is now often an invisible killer, making the dangers of it harder to appreciate. It has been linked to strokes, heart attacks, cancer, asthma and dementia. It is estimated that approximately 217 deaths a year amongst those living in South Gloucestershire are attributable to air pollution. Poor health means people are less able to work and may need more social and medical care, resulting in higher costs to the National Health Service and other public services. Air pollution causes significant damage to the environment and there are also associated inequalities. It is the poorest and most vulnerable in our communities, such as the very young and very old, who are most affected by polluted air.

We often think of air pollution as a problem caused by road transport and industrial level burning of fossil fuels. Whilst these are two of the central sources of pollution, we now also need to tackle other sources of air pollutants that damage human health and the environment. Air pollution can be caused by intensive agricultural food production, additional freight trips from increased use of online shopping or even heating our homes. This Strategy sets out how we will tackle five of the most important air pollutants and considers all aspects of our lives under four themes: on the go, at home, at work and raising awareness.

This Strategy articulates a clear and compelling vision for all those who live, travel and work in South Gloucestershire with meaningful areas for actions, based on data and evidence and has been co-produced by our Children, Adults and Health and Environment and Community Services departments.

The principles of the Strategy will enable the action plan to be developed at a time when there have been tangible improvements in air quality as a result of the restrictions put in place to tackle the Covid outbreak. There has been a significant reduction in vehicle travel and a move to more sustainable travel options such as walking and cycling, therefore the development of actions will aim to build on the associated air quality benefits of some of the restrictions. We will try to retain some of these benefits while restrictions are relaxed and we will seek to build on the move some people have made to less polluting options and attempt to address the balance of encouraging economic recovery along with improving in air quality for the benefit of us all.

Executive Summary

Air pollution is harmful to our health, the environment and the economy, and can cause significant inequalities by affecting some groups of people more than others. It is estimated that in South Gloucestershire there are around 217 deaths per year attributable to the combined effects of exposure to nitrogen dioxide and fine particulate matter, this represents 9.3% of deaths of all people over 25 in South Gloucestershire. This is more than injuries or all infectious diseases cause, making it a very important issue, and one which is gaining recognition and momentum.

This Clean Air Strategy shows how South Gloucestershire Council will tackle key sources of air pollution, making air healthier to breathe, protecting nature and boosting our economy. It aims to make our ambitions about air quality clear to our partners, and all those who live, travel and work in South Gloucestershire.

This Strategy is guided by eight principles as well as a number of evidence reviews, stakeholder engagement and a gap analysis comparing previous and current actions with recommended actions from the evidence. It builds on our existing work towards meeting statutory duties and links to existing mechanisms including our Air Quality Action Plan and Air Quality Management Areas. It broadens the focus to consider five important air pollutants - nitrogen dioxide, particulate matter, sulphur dioxide, ammonia and non-methane volatile organic compounds - both indoors and outdoors. It raises our ambition by aiming to meet World Health Organisation target levels. It considers all aspects of our lives by being organised under four themes – on the go, at home, at work and raising awareness.

This Strategy sets out our monitoring and governance arrangements, and as the issue of air quality is closely intertwined with climate change so are the governance arrangements with a joint Clean Air and Climate Change steering group.

Purpose of this Strategy

This Clean Air Strategy shows how South Gloucestershire Council (SGC) will tackle key sources of air pollution, making our air healthier to breathe, protecting nature and boosting the economy. It aims to make our ambitions about air quality clear to our partners and all those who live, travel and work in South Gloucestershire.

Our vision

Protecting and enhancing health and wellbeing, the environment, and sustainable economic growth through improved air quality across South Gloucestershire.

Our aims

To achieve the above vision SGC will commit to the following strategic aims:

- Address air pollution hotspots to reduce inequalities by continuing to work to meet all statutory duties regarding air pollution.
- Build on the statutory duties by delivering an ongoing reduction in nitrogen dioxide (NO_2), and particulate matter to reach WHO target levels across the whole of South Gloucestershire by 2025.
- Reduce the fraction of mortality attributable to particulate air pollution so that it matches or is better than the South West region average by 2025.

Our commitments

To meet these aims we will:

- Make it preferable to travel in ways that do not contribute to poor air quality by increasing the proportion of journeys made by public or active travel methods.
- Ensure buildings and urban areas with an emphasis on new developments have a neutral or beneficial impact on local air quality.
- Work across partners including businesses, agriculture and industry, to access funding and enable them to help deliver the aims of this Strategy.
- Continue to raise awareness of the impact of poor air quality with the public and partners in order to improve air quality through changing behaviour.
- Deliver an ongoing reduction of NO_2, in all Air Quality Management Areas (AQMAs) until they can be revoked.
- Use our influence to promote low emission living and lead by example by reducing emissions of air pollutants from our fleet and buildings and through our policies and contracts.
- Continue to make data publicly available through our Air Quality Annual Status Reports (ASRs).
- Pilot innovative measures and be ambitious with our actions.
- Facilitate collaboration on air quality improvement across the West of England (WoE) through the Joint Local Transport Planning process and a regional approach to spatial planning.
- Build the Strategy into other key strategies and plans as they are renewed or developed, such as those resulting from the Climate Emergency which SGC has declared.
- Coordinate and support actions that individuals, communities and employers can take.

1. Why is this Strategy needed?

1.1 Introduction

Clean air is essential for health, the environment and the economy. Despite considerable improvements in air quality over the last 40 years, air pollution continues to be a significant problem. There are numerous harmful impacts from air pollution both to health and to the environment. Many solutions to air pollution issues have been recognised, creating a responsibility to put the research into practice. This evidence base continues to grow. (1)-(11)

Both politically and to the public air quality is becoming an increasingly high priority. In a YouGov survey in 2017, 75% of the British public believed that the government has a moral obligation to improve air quality. (8)

Local authorities are required by law to identify local air quality problems and to take action to improve them. Part IV of the Environment Act 1995 established the system of local air quality management (LAQM). (12) (13) Since then, local authorities have been required to review and assess air quality against national air quality objectives. In places where objectives are exceeded, local authorities must declare an AQMA and put a plan in place to improve the air quality in these locations. Traditionally, the focus of the air quality assessments has primarily been on the transport related pollutant, NO_2, and therefore initiatives have been largely aimed at this source. However, vehicles are not the only source of harmful emissions. Air pollution is a result of the way we currently generate power, heat our homes, produce food, manufacture consumer goods and travel. This Strategy aims to build on our previous work and broaden the approach to address the wide range of pollutants which we know affect our health and environment. This is in line with the UK Clean Air Strategy 2019 which states that new legislation will seek to shift the focus on air pollution towards prevention and will be cross sector. (14)

1.2 Background in South Gloucestershire

In South Gloucestershire the most recent survey of resident's views on air quality was in 2012, 75% of people were 'concerned' or 'very concerned' about air quality locally. (15) In 2018, SGC Cabinet gave approval for *'the development of a council-wide plan to address a wider range of air pollutants for future presentation to Cabinet for agreement and implementation'*. (16) The last local Air Quality Action Plan (AQAP) was produced in 2012, (15) and this Strategy aims to influence future revisions as well as set out broader aims.

1.3 Principles

Assessing the impacts of air quality interventions, including cost effectiveness, is challenging as pollution levels depend on many factors, including background pollutant levels, geographic location and topography, population density, height of emission sources and meteorology. Air quality also changes over space and time. Therefore, not all of the interventions which are likely to have benefit have been evaluated with traditional research study designs, and an even smaller proportion have cost effectiveness studies available. With this in mind, it is important to use overarching principles and logic as well as the evidence to drive actions.

The eight principles which guide this Strategy are:

1. **It is better to reduce air pollution at source than to mitigate the consequences**. There is a hierarchy of interventions; most effective approaches reduce emissions at source and should be the first priority, actions to reduce the concentration once it has occurred is the second priority, and individual avoidance of exposure is the third.

2. **Different air pollutants should be considered and tackled together**. Air pollutants are rarely independent of each other, either in their production or resulting exposures. Interventions to reduce individual pollutants should not be considered in isolation from other pollutants, otherwise reducing harm from one may be countered by an increase in another.
3. **Any improvement in air quality will have positive consequences but those with co-benefits should be prioritised.** Legal limits are in place to protect human health. However, it is recognised that there are no absolutely safe levels of some pollutants, and health effects can still occur well below these legal limits. (14) Actions with multiple benefits as well as reducing air pollutants, for example, a shift to active travel modes (which increases physical activity, reduces weight, improves mental health, reduces road traffic injuries, reduces congestion, increases biodiversity, and reduces carbon emissions and climate change) will be prioritised over actions, such as dust suppressants, which solely reduce pollutants.
4. **Small effects across the population are likely to bring about greater change than large effects for a few individuals**. The spectrum of health responses to air pollution in a population can be characterised as a pyramid, with the number of people affected by less severe health problems (such as minor respiratory symptoms, and increased use of medication), being much higher than those affected by the most extreme effects (premature death). (14) While actions need to be targeted on the areas we know to have poorer air quality, we will work to improve air quality across the wider area to bring wider health benefits.
5. **Actions need to be wider than just within AQMAs**. Air pollution is a global problem that does not abide boundaries. Once released, pollutants are dispersed by the weather and can travel significant distances within and between countries.
6. **Effective strategies require a coherent approach.** This should be between local authority functions (such as environmental health and public health, transport and spatial planning) and between local authorities and communities, as well as other public and private sector organisations at all levels, regionally, nationally and internationally.
7. **Everyone has a role to play**. Individuals and communities can change behaviours to reduce their exposure and contribution to air pollution. Employers, private and public sector organisations can also play their part to make it easier to make choices that do not contribute to pollution. Local authorities are at the centre of local leadership and can coordinate and lead by example.
8. **As action is taken some groups may need particular support**. Some evidence-based actions may disproportionally affect some groups of people. For example, those whose livelihoods depend on driving but who do not have access to or the resources for cleaner vehicles. Without such support, action on air quality may have the perverse impact of increasing inequalities.

1.4 What is air pollution?

Air pollution can be defined as the emission of harmful substances into the atmosphere and can impact both outdoor and indoor air quality. This broad definition includes a number of pollutants; nitrogen oxides (NO_x), particulate matter (PM), sulphur dioxide (SO_2), ammonia (NH_3), volatile organic compounds (VOCs), radon, and carbon monoxide (CO). Whilst carbon dioxide (CO_2), ozone, and other greenhouse gases are technically air pollutants they are addressed through South Gloucestershire's work on tackling the Climate Emergency, (17) as well as at national level and above. See *Section 3 Legislation and policy context* and *Section 7 Governance* for more information.

Outdoor air pollutants come from a range of sources including transport, domestic burning, industry, power generation and farming. Further details are provided in *Section 2.3 Sources.* Exposure to outdoor air pollution has a substantial impact on health, the environment, the economy and results in inequalities across the population (see *Section 2.5).*

Air pollution in indoor spaces including public buildings, schools and homes is often higher than outdoors in developed countries. (18) Sources of indoor air pollutants include: those generated outside buildings which migrate indoors (e.g. traffic emissions); those generated inside buildings from building materials, furniture and furnishings or by activities such as cooking, heating, smoking etc.; and natural radon gas that enters buildings from the ground. (19) Indoor air pollution is known to have adverse effects on human health, particularly children and those with pre-existing health conditions such as respiratory illness, and contributes to widening inequalities by disproportionately affecting people who already live in poor quality housing and poverty.

Indoor air pollution is currently beyond the scope of this strategy as the guidance available for interventions to improve indoor air quality is more limited. However, it is important to acknowledge the interconnected relationship between the two; outdoor air pollution can be an important contributor to indoor air quality and similarly, indoor air pollution sources may be important causes of outdoor air pollution. There will therefore inevitably be an impact on indoor air pollution through delivery of this strategy. The National Institute of Health and Care Excellence (NICE) produced draft guidance in June 2019, (19) and the final version will be reviewed in the interim update of the Strategy (See *Section 7 Governance*).

1.5 Which pollutants is this Strategy focussing on?

This Clean Air Strategy considers five important air pollutants, in line with the UK Strategy (14); NO_2, PM (including two sizes; PM_{10} and $PM_{2.5}$), SO_2, NH_3 and non-methane volatile organic compounds (NMVOCs). Targets vary, with some pollutants having more than one limit value, across national, European and global policies. The UK targets known as Air Quality Objectives are set out in the Air Quality (England) Regulations 2000, as amended by the Air Quality (England) (Amendment) Regulations 2002, (13) and largely mirror the EU Limit Values laid out in the Ambient Air Quality Directive (2008/50/EC) (20). The World Health Organisation (WHO) has global targets, which are the most ambitious and which this Strategy will work towards (21). There are also percentage emission reduction targets set by the European National Emission Ceilings Directive (22) (see Table 1).

Table 1: National, European and global targets for the five pollutants under consideration

Pollutant	National (*NECD % emission reduction targets from 2005 baseline*)	European	Global *(% emission reduction target)*	Critical level for environment *
NO_2	• 73% by 2030 40 µg/m^{-3} annual mean • 200 µg/m^{-3} 1-hour mean not to be exceeded >18 times a year • *(NOx emissions 73% reduction by 2030)*	• 40 µg/m^{-3} annual mean • 200 µg/m^{-3} 1-hour mean not to be exceeded >18 times a year	• 40 µg/m^{-3} annual mean • 200 µg/m^{-3} 1-hour mean	• 30 µg/m^{-3} annual mean
$PM_{2.5}$	• *(46% by 2030)*	• 25 µg/m^{-3} annual mean by 2020 • 15% reduction in concentrations at background locations between 2010 and 2020	• 10 µg/ m^{-3} annual mean • 25 µg/m^3 24-hour mean • *(69kt by 2030)*	
PM_{10}	• 40 µg/m^{-3} annual mean • 50 µg/m^3 24-hour mean not to be exceeded >35 times a year	• 40 µg/m^{-3} annual mean • 50 µg/m^3 24-hour mean not to be exceeded >35 times a year	• 20 µg/ m^{-3} annual mean • 50 µg/m^3 24-hour mean	
SO_2	• 125 µg/m^{-3} (24-hour mean not to be exceeded >3 times/ year) • 266 µg/m^3 15-min mean not to be exceeded> 35 times a year • 350 µg/m^{-3} 1-hour mean not to be exceeded >24 times a year • *(88% by 2030)*	• 125 µg/m^{-3} 24-hour mean not to be exceeded >3 times a year • 350 µg/m^{-3} 1-hour mean not to be exceeded >24 times a year	• 20 µg/m^{-3} 24-hour mean • 500 µg/m^3 10-minute mean	• 75 µg/m^{-3} 24-hour mean • 20 µg/ m^{-3} annual mean
NH_3	• *(16% by 2030)*		• *(242kt by 2030)*	
NMVOCs	• *(39% by 2030)*		• *(636kt by 2030)*	

** Ecosystem critical level taken from the EU Directive 2008* (20)

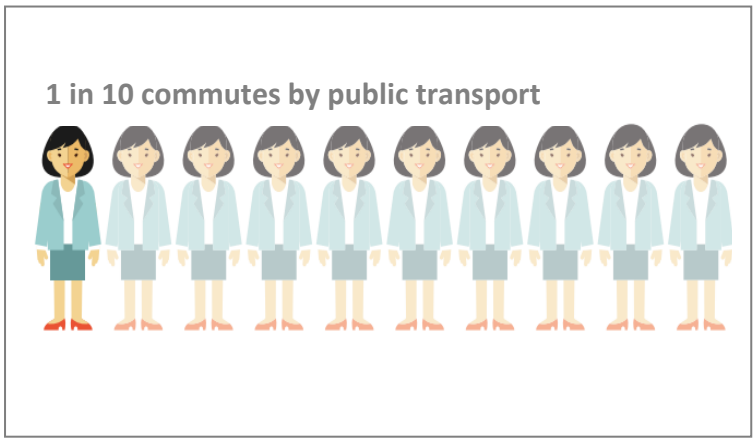
2. Understanding the extent of the problem

2.1 Setting

The 2018 mid-year population estimate for South Gloucestershire is 282,600, a 15% growth since the 2001 census. (23) The population is projected to continue to rise, and as a result, a number of large-scale new neighborhood developments are planned across South Gloucestershire in the next 10-15 years. This means that managing future development and air quality impacts is a key challenge.

Urban areas tend to have more air pollution than rural areas. South Gloucestershire lies immediately adjacent to the north and east of Bristol and also to the north of Bath. 80% of South Gloucestershire's population live in the north and east urban fringes.

There is a mix of urban and rural areas and the road network includes the major junction of the M4 and M5 motorways. Car usage is a major challenge and South Gloucestershire can experience severe traffic congestion at peak times. Since 1991 traffic on the roads of South Gloucestershire has increased by 30% (compared to the national average of 21%), but within the North Fringe of Bristol traffic has increased by 50%. More households in South Gloucestershire have access to a car than the national average (87% compared to 73%) and the proportion of households with 2 or more cars is significantly higher than the national average (42% compared to 29%). Improvements have been made to the public transport system, but traffic congestion continues to adversely affect bus journey times and reliability. (24) Many short journeys are also still made by car. Two in five commuting car journeys are less than 2km. There is a lot of potential for these to be walked or cycled and for the longer journeys to be taken by public transport or broken up with intercepts, such as Park and Rides. (25)



Potential future adverse and beneficial impacts on air quality may come from the proposed Bristol airport expansion, Bristol port expansion, a chargeable Clean Air Zone (CAZ) in Bath which has been approved for class C vehicles (excludes private cars), and a potential chargeable CAZ and other possible measures in Bristol.

2.2 Pollutant levels

In South Gloucestershire air quality data is available from three types of monitors (see Table 2). The exact locations of these monitors and more detailed data from them is captured in our Air Quality Annual Status Reports. (26) In summary, at the diffusion tube sites used to monitor nitrogen dioxide, there was one exceedance of the annual mean target (40 µg/m^3) and nine sites where concentrations were approaching the target (within 10% of the target at 36 µg/m^3 or above) in 2018. The Air Quality Mesh pods were installed in 2018 but have provided incomplete data due to sensor malfunctions and only provide indicative results. The automatic monitoring station in Yate has shown annual levels of PM_{10} and NO_2 below the national targets (PM_{10} 13µg/m^{-3}, and NO_2 20µg/m^{-3} in 2018) but as described in Principle 6 even pollutant levels under legal limits can be harmful to human health.

Table 2: Air quality data available in South Gloucestershire in 2018

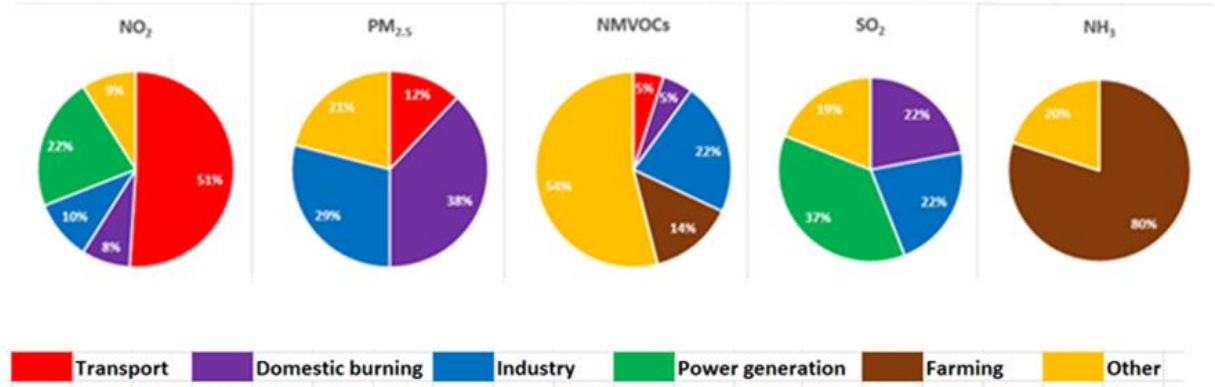
Monitor	Location(s)	Pollutant	Level in 2018 (compared to national target)	Trend since 2017
Diffusion tubes	105 across South Gloucestershire	NO_2	1 exceedance (target 40 µg/m^3) and 9 borderline exceedances (i.e. within 10% of the objective at 36 µg/m-3 or above).	Improved as 3 exceedances and 13 borderline exceedances in 2017)
Air Quality Mesh pods	3, in Warmley, Staple Hill and Hambrook	$PM_{2.5}$	Indicative data only	N/A
Automatic (continuous) monitoring station	1 in Yate	PM_{10}	13 µg/m^{-3} annual mean (target 40µg/m^{-3}) No exceedance of the 24-hour mean (target 50 µg/m^{-3} not to be exceeded > 35 times a year)	Improved Annual mean 14 µg/m^{-3} in 2017
		PM2.5	Not measured but when estimated from PM_{10} is 9.1 µg/m^{-3} annual mean (target 25 µg/m^{-3}) (27)	Improved Estimated annual mean 9.8 µg/m^{-3} in 2017
		NO_2	20 µg/m^{-3} annual mean (target 40 µg/m^{-3}) No exceedance of the 1-hour mean (target 200 µg/ m^{-3} not to be exceeded > 18 times a year)	Improved (Annual mean 23 µg/m^{-3} in 2017)

Any trend data must be interpreted with caution as pollutant concentrations can vary significantly from year to year due to a number of factors, in particular the meteorological conditions, which can affect pollutant dispersion.

2.3 Sources

Air pollutants come from a range of sources, the way we generate power, heat our homes, produce food, manufacture consumer goods and travel around. The sources of air pollution in South Gloucestershire are likely to generally mirror the national sources which can be seen in Figure 1.

Figure 1: Sources of pollutants in the UK



Source: Adapated from Defra Clean Air Strategy 2019 (14)

- In areas where the UK is exceeding its NO_2 target 80% is due to road transport, with diesel vehicles being particularly responsible. Transport is also responsible for significant contribution of PM from brake and tyre wear.
- $PM_{2.5}$ is caused largely by domestic fuel burning. South Gloucestershire has many domestic burners (see *Appendix A*).
- NH_3 is largely caused by farming with cattle farming, particularly dairy farming. There are several large poultry farms and a large pig farm in South Gloucestershire.
- SO_2 has a range of sources with power generation being a significant one. Across the West of England Combined Authority (WECA) 87% of power is generated from fossil fuels, and 15% from clean energy sources. Whereas in South Gloucestershire 4.9% of current local energy demand is provided by renewable power.
- The largest contributor to NMVOCs is household products, such as, air fresheners, cleaning products, and solvents.

Pollutants can travel large distances and are a transboundary problem. For example, depending on wind direction and other circumstances, up to 50% of the UK $PM_{2.5}$ levels (more in South East England than other areas) are from sources outside of the UK. Boundaries in local authority carbon free and air quality plans are arbitrary since air pollution must be addressed collectively. Partnerships with the WoE Local Enterprise Partnership, Public Health England (PHE) South West and West of England Combined Authority (WECA) are therefore important.

2.4 Air pollution hotspots

Air Quality Management Areas

AQMAs are declared when there is an exceedance or likely exceedance of an air quality objective. There are currently three AQMAs declared in relation to the NO_2 annual mean in South Gloucestershire:

- Staple Hill - in the centre around the Broad Street (A4175), High Street (B4465), Victoria Street and Soundwell Road (A4017) crossroads
- Kingswood to Warmley - from the Bristol/South Gloucestershire boundary in Kingswood along the A420 main road to the junction with Goldney Avenue in Warmley

- Cribbs Causeway - adjacent to the M5 Junction 17 Roundabout (although this AQMA is soon to be formally revoked)

See *Appendix B* for the locations of the Staple Hill and Kingswood-Warmley AQMAs and for further details, see the latest SGC air quality Air Quality Annual Status Report. (26)

A4174 Hambrook Targeted Feasability Study

The Council was required by the Joint Air Quality Unit (JAQU) (Defra and Department for Transport) to carry out a Targeted Feasability study for a 1.27km section of the A4174 Ring Road between the M32 Junction 1 and Bromley Heath roundabout in March 2018 because a national assessment had identified NO_2 concentrations on this section of the A4174 was above the EU annual mean (40 µg/m^3).

The study assessed whether there were any actions that could be taken to reduce the high levels of NO_2 to meet the legal limits in the shortest time possible. It identified that the introduction of traffic management measures, in the form of restrictions on certain vehicle movements at the Hambook junction, could bring forward compliance. The study was accepted by JAQU in October 2018 and the council were legally directed to implement the measures with full funding provided by JAQU. The traffic management measures were implemented in August 2019 by way of an Experimental Traffic Order (ETO) which allows a trial of the measures for up to 18 months, during which time consideration is given whether to make the order permanent. The ETO is subject to a period of consultation which was completed in February 2020.

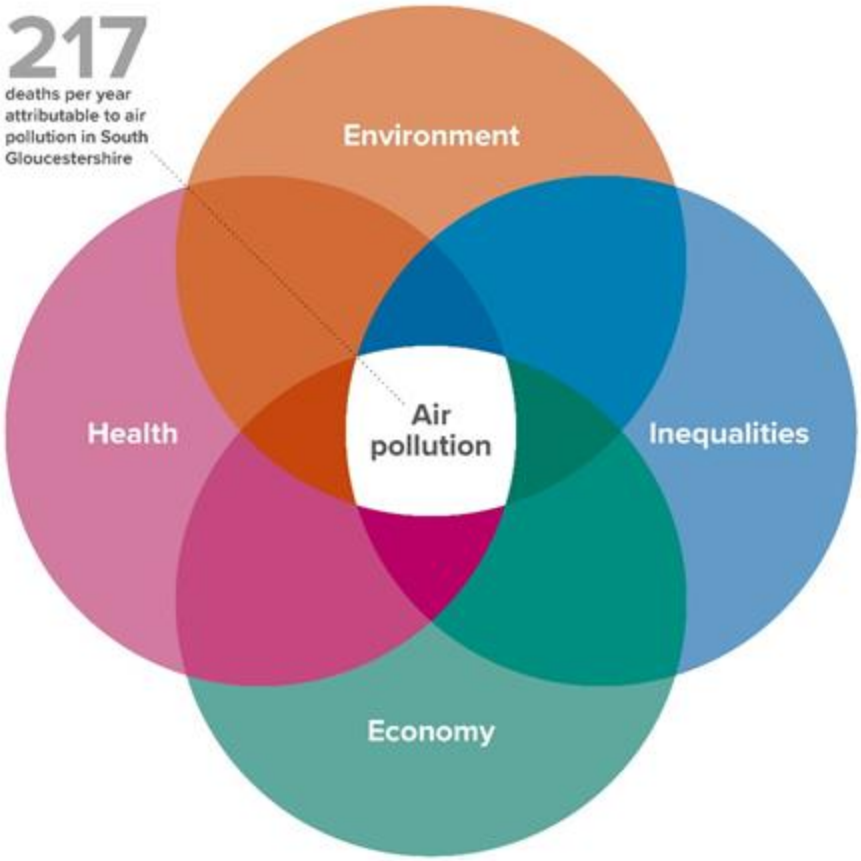
Smoke control area

Smoke control areas are where it is prohibited to emit smoke from a chimney unless burning an authorised fuel or using 'exempt appliances', for example certain burners or stoves. Currently individuals can be fined up to £1,000 for breaching these rules. (28) In South Gloucestershire, the main single Smoke Control Area (29) lies between the M4/M5 motorway junction near Patchway. This does not overlay the area with highest PM_{10} emissions, (26) (see *Appendix A*) so is not effectively protecting people as much as it could.

2.5 Impacts of air pollution

As air pollution is largely invisible, it is difficult to appreciate and communicate its impacts, but effects on the environment, health, the economy and inequalities are now well known (see Figure 2).

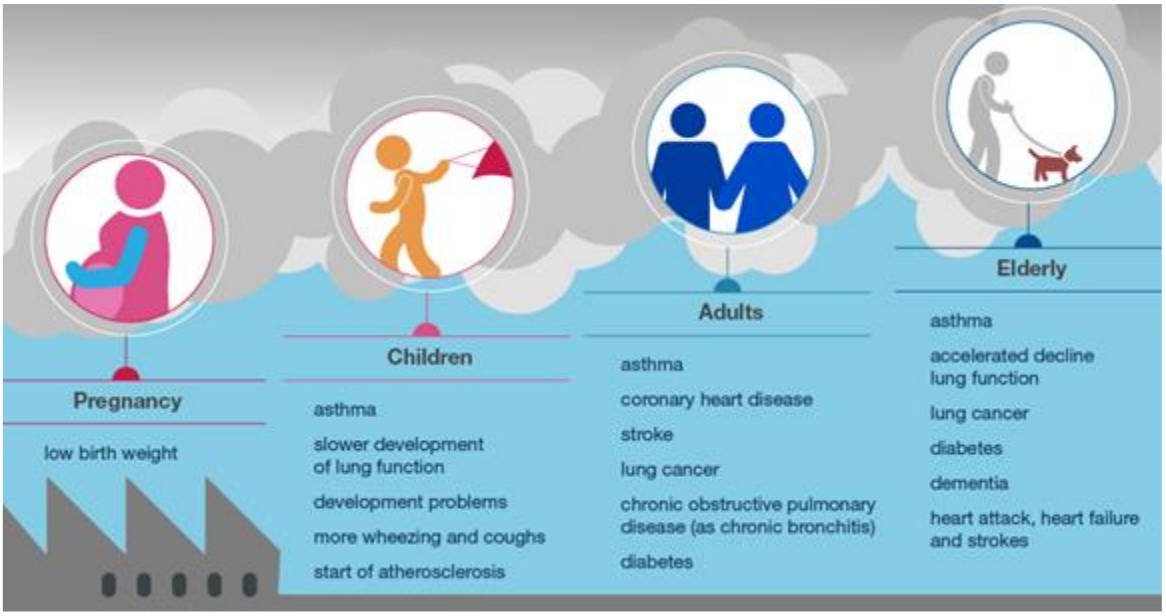
Figure 2: Harmful impacts of air pollution are interlinked



Health

Poor air quality can affect everyone at all stages of life both through short-term impacts from high-pollution episodes and through long-term exposure to lower levels of pollution that accumulate across the life course. (14) Short-term problems can include minor symptoms such as sneezing and coughing, eye irritation, headaches, and dizziness, increased use of medication such as inhalers, increased days of restricted activity, increased visits to doctors, emergency health services and hospital admissions. (3) Long term problems can start in the womb and accumulate across the life course (see Figure 3) which can all result in reduced quality of life and life expectancy. (3) (14)

Figure 3: Health effects of air pollution across the life course

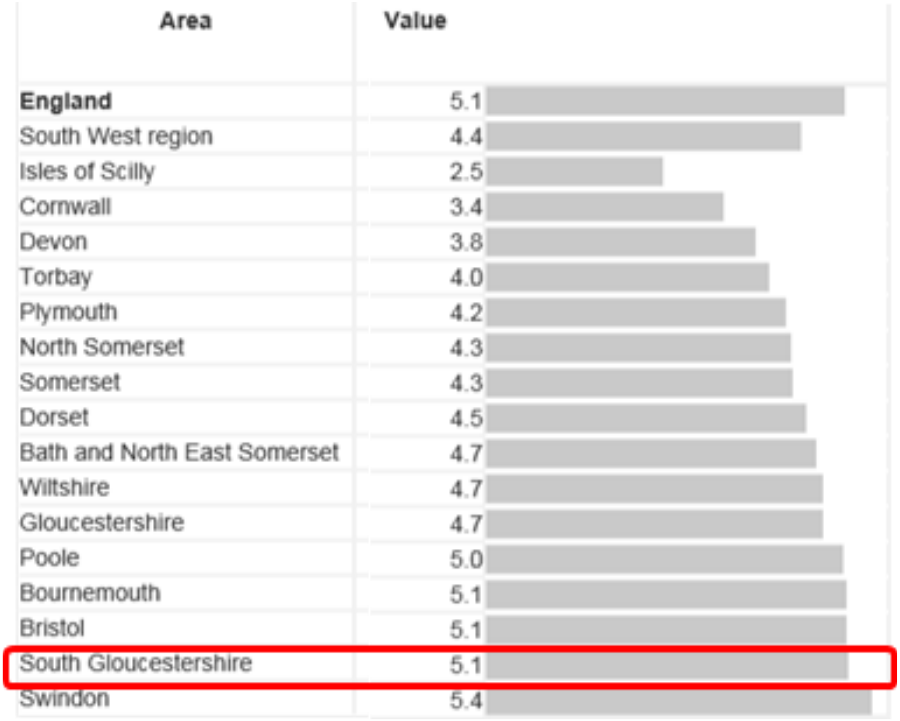


Source: Taken from PHE (3)

The Department of Health and Social Care's advisory Committee on the Medical Effects of Air Pollutants (COMEAP) estimates that 28,000 to 36,000 deaths in the UK each year can be attributed to human-made air pollution, (11) roughly equivalent to shortening each person's lifespan by 7-8 months. (1) This wider impact on health and healthcare services is significant. For example, lung cancer, asthma, coronary obstructive pulmonary disease, myocardial infarctions and stroke have all been linked to air pollution. In South Gloucestershire there were over 1,800 hospital admissions for these condition in 2016/17 (see *Appendix C*).

The Public Health Outcomes Framework (PHOF) indicator on air pollution estimates that the percentage of deaths attributable to $PM_{2.5}$ alone ranges from 2.5% in the lowest local authority to 7.1% in the highest. In 2017, the most recent year data is available, in South Gloucestershire the percentage of deaths attributable to $PM_{2.5}$ was 5.1% (over 1 in 20 deaths). This is the same as the national average and the urban area of Bristol (5.1%), but worse than the South West average (4.4%), Bath and North East Somerset (4.7%) and North Somerset (4.3%) (see Figure 4). (30)

Figure 4: Percentage of adult deaths attributable to $PM_{2.5}$ in 2017



Area	Value
England	5.1
South West region	4.4
Isles of Scilly	2.5
Cornwall	3.4
Devon	3.8
Torbay	4.0
Plymouth	4.2
North Somerset	4.3
Somerset	4.3
Dorset	4.5
Bath and North East Somerset	4.7
Wiltshire	4.7
Gloucestershire	4.7
Poole	5.0
Bournemouth	5.1
Bristol	5.1
South Gloucestershire	5.1
Swindon	5.4

Mortality burden is based on modelled annual average concentrations of $PM_{2.5}$
Source: Taken from PHOF (30)

Air pollution is a major public health risk ranking alongside cancer, heart disease and obesity. Using PHE methodology (31), this can be compared to other causes of death in South Gloucestershire. Deaths from manmade $PM_{2.5}$ alone are over twice the deaths caused by all infectious diseases combined, and greater than that of many other illnesses, such as, liver disease and injuries (see *Appendix C*).

In the last few years, epidemiological studies have provided evidence that NO_2 is having an independent effect on deaths. COMEAP and PHE have provided advice on quantifying the number of deaths attributable to NO_2 and how to combine this with deaths attributable to PM. (32) (33) (31) This methodology has been used to calculate that in South Gloucestershire in 2017, 87 additional deaths are attributable to NO_2, which when added to 130 deaths from $PM_{2.5}$ gives a total of 217 deaths per year (confidence interval 172 to 332 deaths). This represents 9.3% (confidence interval 7.4% to 14.2%) of all deaths in South Gloucestershire being attributable to the combined effect of exposure to NO_2 and $PM_{2.5}$. (34) (See *Appendix C* for full methodology)

<u>Inequalities</u>
We are all affected by the quality of the air we breathe so the whole population is at risk; but some groups, especially children, older people, pregnant women and people who already have illnesses as described above, are more vulnerable than others. Those who live in deprived areas, poor quality housing, or live, work or learn near busy roads are also more vulnerable to health effects, even though they are less likely to have caused the pollution. In the worst affected areas, life-expectancy may be reduced by as much as nine years. (1)

This happens on a local and global scale, with those who are most polluting being least likely to have harm from its effects. The AQMA system can help us target more polluted geographical areas but we are unable to selectively protect more vulnerable groups of the population from air pollution effects so must improve air quality as a whole.

Environment

Air pollutants cause significant damage to the environment. They can change or deplete nutrients in soil and water, harm forests and crops and damage buildings and cultural icons such as monuments and statues. Whilst the impact of air pollutants such as, NO_x, PM, SO_2, and NH_3, is not as significant as greenhouse gases, such as carbon dioxide, they do influence the formation of pollutants such as ozone which does act as a greenhouse gas. (14) Air pollution and climate change have bi-directional impacts. Some of the consequences of climate change, such as overheating, can lead to drought and fires, can further exacerbate localised air pollution by increasing PM. (35) By 2040 every other summer is predicted to be as extreme as the summer of 2003 where heatwaves caused an estimated 20,000 excess summer deaths across Europe. (36)

Economy

The health and environmental impacts not only significantly reduce quality of life but also mean that people are less able to work and may need more medical care, resulting in higher social costs and burdens to the National Health Service and other public services. The Department for Environment, Food and Rural Affairs (DEFRA) estimates that poor air quality causes over six million sick days per year costing the economy about £16 billion annually, likely to reach £18.6 billion by 2035. These costs are twice those caused by physical inactivity and on a par with those from smoking and obesity. (14)

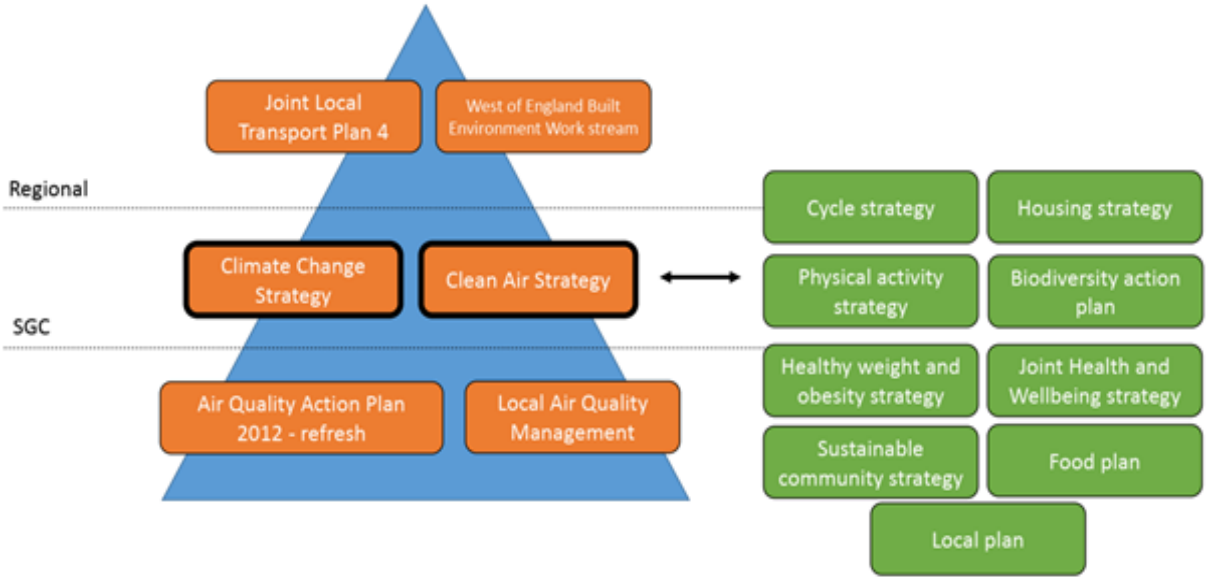
Co-benefits of Covid restrictions

The principles of the Clean Air Strategy will enable the action plan to be developed at a time when there have been tangible improvements in air quality as a result of the restrictions put in place to tackle the Covid outbreak. There has been a significant reduction in vehicle travel and a move to more sustainable travel options such as walking and cycling, therefore the development of actions will aim to build on the associated air quality benefits of some of the restrictions. We will try to retain some of these benefits while restrictions are relaxed and we will seek to build on the move some people have made to less polluting options and attempt to address the balance of encouraging economic recovery along with improving in air quality.

3. Legislation and policy context

Air quality links to numerous policies at international, national, regional and local levels. Appendix D shows the key links between this Clean Air Strategy and international, national, and regional policies. It also presents further detail about links to local policies and plans. The Strategy and subsequent action plan will also contribute to the priorities of the Council Plan 2020-2024 which is currently being developed. Figure 5 shows the links at the local level between this Clean Air Strategy and existing strategies and plans. This strategy has been informed by all of them and will aim to feed into future revisions and resulting action plans. In addition, the strategy will take account of the impact of the COVID-19 pandemic, ensuring relevant evaluation and analysis is also considered and reflected in resulting action plans.

Figure 5: Links between this Clean Air Strategy and existing strategies and plans in SGC



Link to AQAP refresh

As per Part IV of the Environment Act 1995, (37) the AQAP from 2012 focusses on NO_2, has a high level of technical detail and contains many actions to improve air quality within the AQMAs. This Strategy aims to inform the AQAP refresh as well as other relevant projects such as the master planning of Kingswood Town Centre.

Link to Climate Emergency

In July 2019 South Gloucestershire Council declared a Climate Emergency pledging to provide the leadership to enable South Gloucestershire to become carbon neutral by 2030. The declaration also signed up to the UK100 pledge to enable South Gloucestershire to be powered by 100% renewable energy by 2050.

The South Gloucestershire Climate Emergency declaration made in July 2019, (17) has been drawn out in parallel to the Clean Air Strategy as the issues are intrinsically linked in numerous ways:

- Carbon emissions and air pollutants frequently have the same sources (power generation, housing, transport, industry) and therefore require many of the same solutions. For example, the combustion of fossil fuels whilst not the only source is often a primary driver for both air pollution and climate change.
- Many interactions between air pollution and climate change exist for example, air pollutants (in addition to CO_2) can warm the atmosphere. Air pollution damages vegetation reducing its ability to act as a carbon sink. Hot and dry weather increases some air pollutants and risk of droughts and fires. NO_x and NH_3 contribute to acidification which is harmful to the environment but can also deposit nutrients which increase plant growth. (38)
- Measures to address one issue in isolation can lead to worsening of others as trade-offs exist for some interventions, such as housing insulation vs ventilation, diesel vs petrol vehicles, and biomass/ solid fuel burners vs other heating. Win-wins can be identified to reduce conflicting advice.
- Those most at risk of the adverse impacts of poor air quality are the same groups within the population – children, the elderly and those with underlying health conditions, as those most vulnerable to the impacts of climate change such as extreme heat.
- Integrating policies can be more efficient in terms of cost and time. For example, many of the same organisations and professional roles govern actions relating to air quality and climate change.

See *Section 7 Governance* for more details on how these will be addressed in a coordinated way.

4. What is already happening?

Much progress has already been made towards cleaner air in South Gloucestershire and this strategy aims to maintain momentum with the current activities as well as stimulating new and innovative actions.

The Strategy has been informed by a Gap Analysis comparing previous and current local actions to improve air quality with recommended actions relevant for South Gloucestershire, as identified from key evidence, research and specialist knowledge (see *Appendix E* for full methodology). Actions were identified under four themes: reducing air pollution on the go; reducing air pollution at home; reducing air pollution at work; and raising awareness. The previous and current local actions identified through the gap analysis can be found in *Appendix F.*

5. How will we achieve our vision?

The vision will be achieved through implementation of a broadly owned action plan to accompany this strategy. The action plan addresses five key priority areas, which are based on the themes identified in the Gap Analysis (see *Section 4)* and guided by the eight principles in this Strategy as well as the Clean Air and Climate Change steering group (see *Section 7 Governance* for more information). The action plan also incorporates and updates actions detailed in the current Air Quality Action Plan (AQAP) for 2012 which focuses on improving air quality in the Kingswood-Warmley and Staple Hill Air Quality Management Areas (AQMAs) in South Gloucestershire.

The key priority areas for the action plan are:

1. Transport, travel and infrastructure
This priority is focused on supporting people to take more sustainable travel options and to reduce the impact of transport on the environment. It aims to make it easier to travel in ways that do not contribute to poor air quality by increasing the proportion of journeys made by public transport or active travel methods. It includes making improvements to public transport and active travel infrastructure, considering the impact of changes to parking on air quality, looking at making urban areas greener and reducing the impact of pollution from freight and taxis.
2. Improving air quality at home
This priority is focused on encouraging the local population and partners to make changes in and around the home. It aims to promote low emission living. It includes supporting people to undertake boiler replacements and energy efficiency upgrades, taking action to encourage cleaner practices around solid fuel burners.
3. Supporting businesses and workplaces
This priority is focused on supporting businesses to minimise their own air pollution. It aims to work across partners including businesses, agriculture and industry, to access funding and enable them to help deliver the aims of this strategy. It includes provision of guidance, resources and information to local businesses and sharing best practice, consideration of industry practices such as anaerobic digestion for waste and agricultural practices.
4. Communication and awareness raising
This priority is focused on the communication of key messages and information to the local population and businesses to raise awareness and support them to reduce their impacts of air pollution and identify more sustainable options. It aims to raise awareness of the impact of poor air quality with the public and partners in order to improve air quality through changing behaviour. It includes campaigns (e.g. anti-idling, clean air day, 'no burn' days for wood burners, car free days), promotional messages around improving indoor air quality, ensuring air quality is a priority in regeneration projects and promotion of renewable energy and existing suppliers.
5. Council policy and measures
This priority is focused on ensuring South Gloucestershire Council are leading by example both in terms of taking a strategic role across South Gloucestershire to ensure change in this area but also in minimising air pollution from council working. It aims to ensure buildings and urban areas have a neutral or beneficial impact on local air quality and facilitate collaboration on air quality improvement across the West of England (WoE) and that this strategy is built into other key strategies and plans. It includes reducing emissions of air pollutants from our fleet and buildings and through our policies and contracts and linking with the Joint Local Transport Plan.

The action plan is a working, dynamic document, owned and monitored by the Clean Air and Climate Change steering group. It will be regularly reviewed and updated to ensure it is responsive to the current environment and local need. As part of our statutory duties required by the Local Air Quality Management framework, the council will produce an Air Quality Annual Status Report (ASR) to update on the progress made in implementing the measures detailed in the action plan.

The target for the activities listed in the action plan will be spread across the five year period of the strategy, some with a more short term focus and others with a long term focus; some will require consultation whilst others will not. The actions can be categorised into different levels of achievability:

- Keep momentum: actions already under investigation or being done.
- Quick wins: low or medium cost but may require funding to be identified and implemented.
- Leading the way: medium to high cost and would require funding.

This approach will ensure activities are achievable and relevant but does not discount the importance of the long-term horizon which is focused on *Protecting and enhancing health and wellbeing, the environment, and sustainable economic growth* as reflected in the strategy's overall vision and aims.

6. How will we know if we've been successful?

- Compliance with relevant UK and EU pollutant targets to meet our statutory duties.
- Delivered a reduction in NO_2, $PM_{2.5}$ and PM_{10} to reach WHO target levels by 2025.
- Reduced the fraction of mortality attributable to particulate air pollution to match or better the South West region average by 2025.

The above reflect the aims of the strategy as outlined on page 6.

6.1 Indicators

The indicators that will be used to monitor this Clean Air Strategy are in line with those in use by the SGC Joint Health and Wellbeing strategy (39):

Indicator	Source
Fraction of mortality attributable to particulate air pollution	PHOF (modelled, regional)
Mean annual monitored concentration of NO_2, $PM_{2.5}$ and PM_{10}	Local
Proportion of journeys by walking, cycling, public transport	Annual travel survey
New developments consider air quality	Planning applications

This strategy will also contribute to wider benefits in health and we anticipate improvements in indicators such as hospital admissions and mortality for respiratory and cardiovascular conditions.

7. Governance

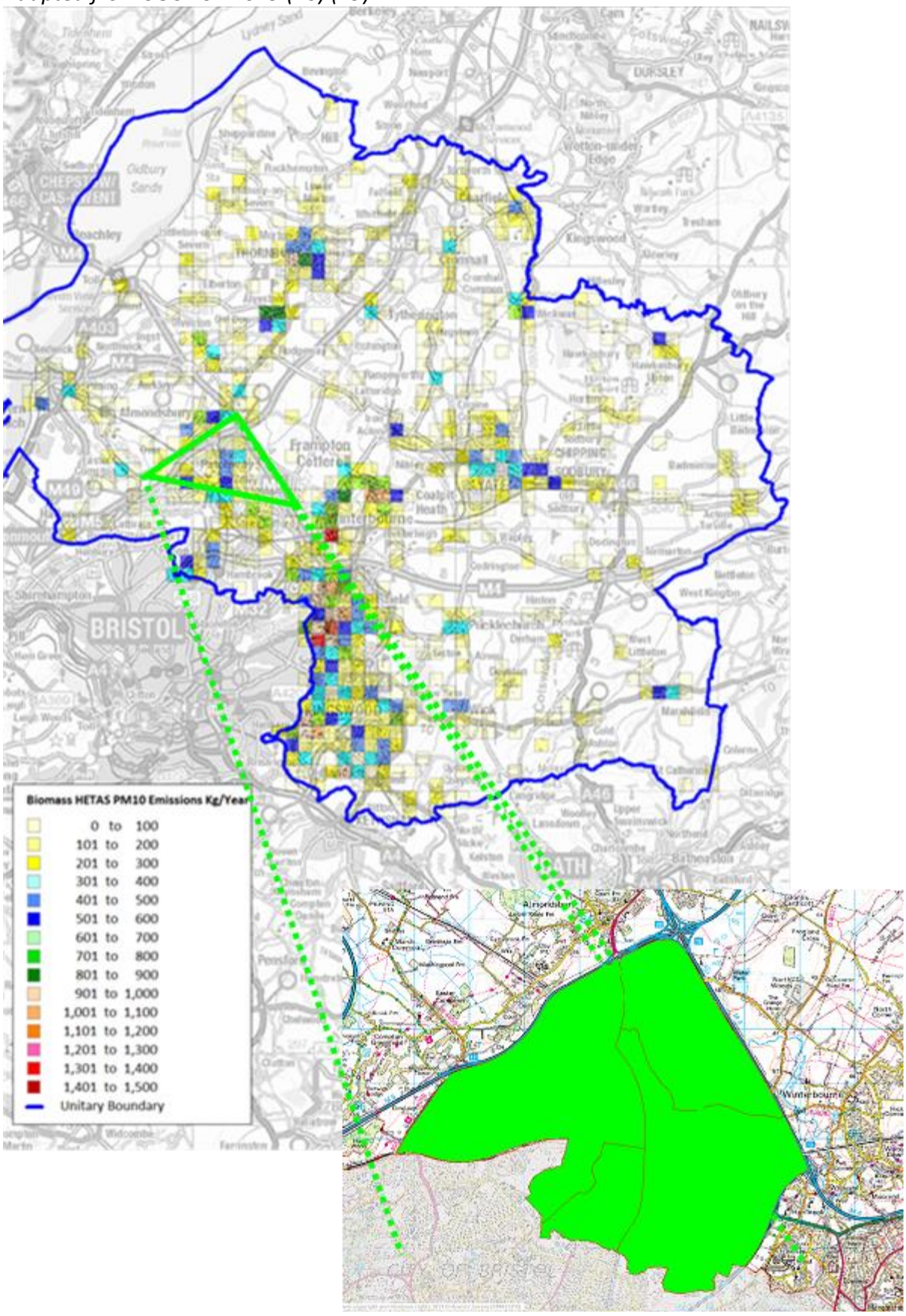
The issues of air pollution and climate change have been bought together under a Clean Air and Climate Change steering group for the reasons listed in *Section 3 Legislation and policy context*. This approach has been recommended by numerous organisations including DEFRA (40), UK Health Alliance on Climate Change, (35) 2007 UK Air Quality Strategy (41), and Environmental Protection UK. (42)

The Clean Air Strategy will be monitored and governed at various levels:

- The Strategy will be endorsed by the Senior Managers Network, Health and Wellbeing Board, Scrutiny Commission and Cabinet.
- The Clean Air and Climate Change steering group will champion and drive the vision, targets and commitments outlined in the Strategy and will be responsible for reviewing and monitoring its progress.
- A corresponding Action Plan will be developed to sit under Strategy to map out how the commitments will be delivered, assign timeframes and responsibilities. The action plan will be reviewed four times per year by the steering group and an ASR produced yearly as part of the council's statutory duties required by the Local Air Quality Management framework.
- The Strategy will also be built into other key strategies and plans as they are renewed or developed and will fall under their governing arrangements accordingly. For example, the Joint Health and Wellbeing Strategy (action area 4 - maximise the potential of our built and natural environment to enable healthy lifestyles and prevent disease). (39)
- In particular, this strategy will inform the AQAP refresh and actions taken in the AQMAs. More detail about progress monitoring is included in SGC's ASRs which are statutory and produced annually.

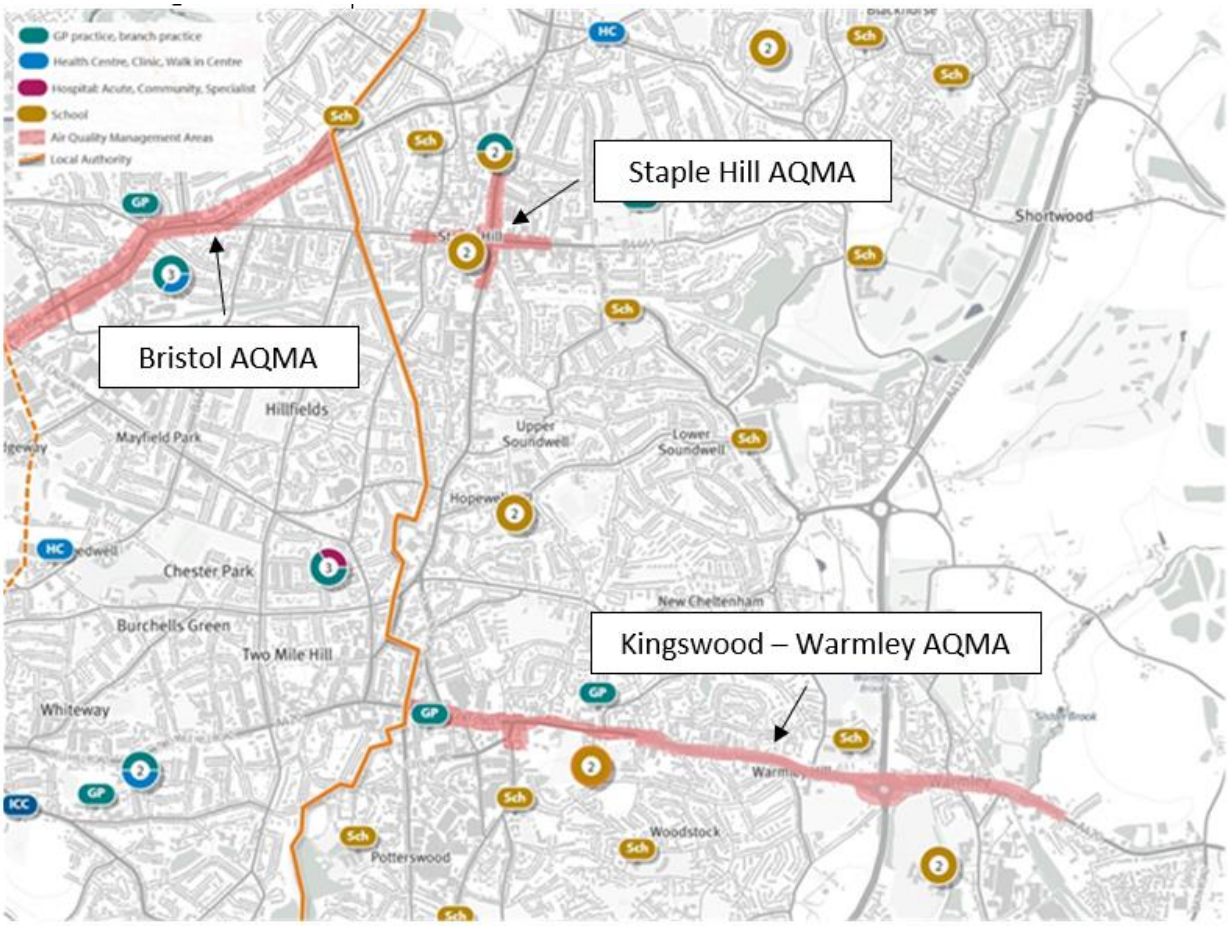
Appendix A: Map of individual solid fuel installations and PM10 emissions per 500m grid square compared to existing Smoke Control Area in South Gloucestershire

Adapted from SGC ASR 2019 (26) (29)



Appendix B: Map displaying AQMAs in relation to places with vulnerable people – schools, GP practices, health centres and community hospital

Created using SHAPE Atlas



NB: There are two AQMAs in South Gloucestershire; Kingswood – Warmley AQMA, and Staple Hill AQMA. The Kingswood -Warmley AQMA extends from the South Gloucestershire/Bristol boundary in Kingswood eastwards for approximately 2.9 km along the A420 to the junction with Goldney Avenue in Warmley. The Staple Hill Air Quality Management Area is in the centre of Staple Hill and includes the two main crossroad junctions of Broad Street/High Street/Victoria Street/Soundwell Road and High Street/Pendennis Road/Acacia Road. Part of the Bristol AQMA in Bristol City Council's local authority area which extends up the A432 to the Bristol/South Gloucestershire boundary is also showing to the left of the image.

Appendix C: Health data associated with air pollution

Quantification of deaths attributable to air pollution in South Gloucestershire

The proportion of deaths in South Gloucestershire that can be attributed to exposure to fine particulate matter ($PM_{2.5}$) has been available from the Public Health Outcomes Framework since 2010. There has been growing evidence that further deaths in South Gloucestershire could be attributable to air pollution, through exposure to the gas nitrogen dioxide (NO_2).

Rate of deaths from $PM_{2.5}$ compared to the rate of deaths from other causes

PHE methodology advises that, to compare the rate of air pollution deaths to the rate of deaths from other causes, (31) the percentage of adult deaths attributable to $PM_{2.5}$ is converted to an age standardised (<75 years old) premature mortality rate. In South Gloucestershire the rate of deaths from air pollution (manmade $PM_{2.5}$ alone) is 14.1 per 100,000 population. That is over twice the deaths caused by all infectious diseases combined, and greater than that of many other illnesses, such as, liver disease and injuries.

Ranking of PHOF mortality indicators for South Gloucestershire (2015-17 data)

Indicator in PHOF	Mortality rate, per 100,000
Preventable mortality	149.5
Preventable cancer (<75 year olds)	66.5
Preventable CVD (<75 year olds)	37.8
Mortality attributable to $PM_{2.5}$ (<75 year olds)	**14.1**
Preventable liver disease (<75 year olds)	12.7
Preventable respiratory disease (<75 year olds)	10.8
Injuries	8.2
Suicide rate	7.5
Communicable diseases	6.9

Methodology for the quantification of deaths attributable to air pollution in South Gloucestershire ($PM_{2.5}$ and NO_2 combined)

The Committee on the Medical Effects of Air Pollution (COMEAP) has quantified the effects of long-term exposure, derived by collating the results of several large epidemiological studies (using a meta-analysis of the results of the different studies). (43) A report in 2010 quantified the overall number of deaths in the UK arising from exposure to $PM_{2.5.}$ (44) A recent PHE report describes how to estimate local mortality burdens associated with $PM_{2.5}$. (31) COMEAP have then updated this guidance. (33) The latest COMEAP methodology has been applied to this assessment.

In the last few years epidemiological studies have provided evidence that NO_2 is having an independent effect on deaths. COMEAP has been, and still is, reviewing the evidence to provide its best advice on quantifying the number of deaths attributable to nitrogen dioxide. It has produced an interim advice note on this quantification and also how to combine the deaths attributable to $PM_{2.5}$ with those due to NO_2. (32)

The Greater London Authority has also addressed the combined impact of NO_2 and $PM_{2.5}$ in a report produced in July 2015. (45) The authors used a different, higher, risk coefficient than that recommended by COMEAP. The assessment presented here uses the more conservative COMEAP risk coefficient, as used by the Government.

Lastly, the methodology was cross checked with Bristol City Council's 'Health Impacts of Air Pollution in Bristol' report. (46)

Parameters used

The epidemiological studies have been used to provide risk coefficients for deaths attributable to particulate matter and nitrogen dioxide. The values used in this study are presented in the Table below. They are the officially recognised risk coefficients used by the UK Government to quantify deaths due to $PM_{2.5}$ and NO_2.

Quantified Risk Coefficients for Exposure to Different Pollutants

Pollutant	**Exposure**	**Health Endpoint** [a]	**Risk Coefficient per 10µg/m^3** [b]	
			Value to use	Range
$PM_{2.5}$	Annual	Deaths (all cause)	6%	4% to 8%
NO_2	Annual	Deaths (all cause)	2.5%	1% to 4%

[a] Based on deaths for those over the age of 25 years

[b] Risk coefficients taken from (33) and (32)

The calculations that follow use what is termed as the Relative Risk (RR). The Relative Risk is normally defined for a 10 µg/m^3 concentration increment (RR(10)) is given as 1 + the risk coefficient per 10 µg/m^3, with the risk coefficient expressed as an absolute value rather than a percentage.

In other words, for $PM_{2.5}$ the equation is:

RR(10) PM2.5 is 1 + 0.06 = **1.06** (range 1.04 to 1.08)

While for nitrogen dioxide the equation is:

RR(10) NO_2 for NO_2 is 1 + 0.025 = **1.025** (range 1.01 to 1.04)

The quantification carried out is based on a well-established methodology set out in the PHE document 'Estimating Local Mortality Burdens Associated with Particulate Air Pollution'. (31)

The calculations are based on applying the fractions of deaths attributable to air pollution (the Attributable Fraction (AF)) to the total all-cause deaths for people over 25 years of age in South Glos):

Deaths attributable to pollutant P = AFP x All-cause deaths

The all-cause deaths for South Glos have been provided by the Public Health Intelligence Unit of SGC. **There were 2,337 deaths for the year 2017**. (47)

The Attributable Fraction (AF) values have been derived from the South Glos specific Relative Risk ($RR_{(B)}$) values for the two pollutants; $RR_{(B)}NO_2$ and $RR_{(B)}PM_{2.5}$ together with the annual mean concentrations of the pollutants from the Yate monitoring station. The most recent data available was used which was for the year 2017. Only PM_{10} is measured at the Yate station so the annual mean concentration of the pollutant $PM_{2.5}$ has been estimated based on the PM_{10} concentration as per Defra LAQM Technical Guidance (TG16) (51):
AF = (RRB - 1)/RRB

9.8µg/m³ annual mean $PM_{2.5}$ from Yate monitoring station (estimated from PM_{10} concentration (2017))
23µg/m³ annual mean NO_2 from Yate monitoring station (2017)

Deaths Attributable to $PM_{2.5}$
The calculation of the deaths related to $PM_{2.5}$ in 2017 is based on the following steps:
The RR(10) value for $PM_{2.5}$ is 1.06 (see Table 1).

The annual mean concentration ($C^{(B)}$) of $PM_{2.5}$ for South Glos in 2017 is 9.8 µg/m³

The $RR(B)PM_{2.5}$ value for South Glos is thus:
$RR_{(B)}PM_{2.5} = RR(10)\ (C^{(B)\ /\ 10}) = 1.06^{\ (9.8\ /\ 10)} = 1.05876542$

The AF for $PM_{2.5}$ is thus:
$AF = (RR_{(B)}\ PM_{2.5} - 1) / RR_{(B)}PM_{2.5} = (1.05876542 - 1) / 1.05876542 = 0.0555037206$

The deaths attributable to $PM_{2.5}$ are thus:
Deaths attributable to $PM_{2.5}$ = AF x All-cause deaths = 0.0555037206x 2337 = **130**.

Deaths Attributable to Nitrogen Dioxide
The calculation of the deaths related to NO_2 in 2017 is based on the following steps:
The RR(10) value for NO_2 is 1.025 (see Table 1)

The annual mean concentration ($C^{(B)}$) of NO_2 for South Glos is 23 µg/m³

The $RR(B)NO_2$ value for South Glos is thus:
$RR(B)\ NO_2 = RR(10)\ (C^{(B)\ /\ 10}) = 1.025^{(23/10)} = 1.0584367008$

The AF for NO_2 is thus:
$AF = (RR\ (B)NO_2 - 1) / RR\ (B)\ NO_2 = (1.0584367008 - 1) / 1.0584367008 = 0.05521038788$

The deaths attributable to NO are thus:
Deaths attributable to NO_2 = AF x All-cause deaths = 0.05521038788 x 2337 = **129**.

Combined Deaths Attributable to NO_2 and $PM_{2.5}$
COMEAP recognises that there is a potential for double counting if the individual values for $PM_{2.5}$ and NO_2 are simply added together. It advises that the risk coefficient for NO_2 is reduced by 33%, i.e. RR(10) becomes 1.0167.

Deaths Attributable to NO_2 (Revised to account for duplicates)

The $RR_{(B)}NO_2$ value for South Glos is thus:

$RR_{(B)}NO_2 = RR(10)\ (C^{(B)\ /\ 10}) = 1.0167^{(23/10)} = 1.03882763482$

The AF for NO_2 is thus:

$AF = (RR_{(B)}NO_2 - 1) / RR_{(B)}\ NO_2 = (1.03882763482 - 1) / 1.03882763482 = 0.03737639769$

The deaths attributable to nitrogen dioxide are thus:

Deaths attributable to NO_2 = AF x All-cause deaths = 0.03737639769 x 2337 = **87**.

The revised calculation of additional deaths attributable to NO_2 therefore becomes 87, which is added to 130 deaths from $PM_{2.5}$ to give **total combined deaths of 217** (based on unrounded numbers). This **represents 9.3%** (range 7.4% to 14.2%) **of all deaths in South Glos being attributable to the combined effect of exposure to NO_2 and $PM_{2.5}$. This compares to just 2 people killed in 2017 in road traffic in South Glos**. (47)

Uncertainties

There are various uncertainties that affect the calculated deaths, which are summarised below.

Uncertainties in the Concentrations

The concentrations used for $PM_{2.5}$ and NO_2 are based on an annual mean in a single location (Yate) and have not been population weighted. Yate is an urban area within South Glos and possibly mean levels of pollutants will be slightly higher here than in more rural areas of South Glos. Therefore, the calculation may marginally over-estimate the number of deaths.

However, population weighted concentrations of $PM_{2.5}$ are available for local authorities from 2013, based on national modelling. In 2013 the population weighted concentration of anthropogenic $PM_{2.5}$ for South Glos was 9.333 $\mu g/m^3$, so a very similar value. Using national modelling can give rise to uncertainty when applied at a local level. The modelled concentrations used are background values for a 1x1km grid square. These background values will reflect the contributions from traffic and other sources within the grid square, but do not take account of the fact that concentrations will be higher for people living close to busy road. This may have led to an underestimate of the population weighted concentrations and hence the calculated number of deaths, as well as being out-of-date data.

Uncertainty in Deaths

The main uncertainty relates to risk coefficients. Wide confidence intervals are cited for both pollutants; in the case of $PM_{2.5}$: 6% with a range of 4 to 8%; (33) in the case of NO_2: 2.5% with a range of 1% to 4%. (32) Applying these ranges gives the following results for attributable deaths in 2017 in South Glos:

$PM_{2.5}$ alone: 130 (88 to 170) deaths
NO_2 alone: 124 (84 to 162) deaths
Combined $PM_{2.5}$ and NO_2: 217 (172 to 332) deaths

There are additional uncertainties in any assessment of $PM_{2.5}$ effects at concentrations below around 5-10 µg/m^3, as the epidemiological studies generally do not include concentrations below these levels. The assumption made is that impacts are linearly related to concentrations down to zero, i.e. with no threshold.

There is uncertainty around the appropriate risk coefficients for nitrogen dioxide, and in particular whether it is appropriate to assume no threshold, i.e. effects continue down to zero. The study carried out by the GLA for London (45) included a sensitivity test with a cut-off of 20 µg/m^3, below which no effects were assumed. However, the same study used a higher risk coefficient of 5.5%, as compared with the value used in this study. The calculations for South Glos have been based on the more recent interim advice from COMEAP, (32) which recommends no cut-off should be used, but with a lower risk coefficient of 2.5%.

Number of emergency hospital admissions for South Gloucestershire residents, 2007 -18 data (48)

Year	Lung cancer	Myocardial infarction	COPD	Asthma*	Stroke*	Viral induced wheeze (0-4 year olds)*
2007/08	221	348	353			
2008/09	287	252	416			
2009/10	315	185	384	171		
2010/11	236	194	437	171		88
2011/12	258	244	422	194	288	123
2012/13	301	357	439	184	351	168
2013/14	254	381	426	208	334	145
2014/15	245	366	617	241	323	211
2015/16	225	318	562	250	335	260
2016/17	240	319	626	305	320	369
2017/18	231	381	716			

Lung cancer, myocardial infarction and COPD all from Healthcare Data Interrogation Service by financial year.

**Secondary Uses Service (SUS) data for calendar rather than financial years, so 2011/12 is 2011 data and 2016/17 is 2016 data, etc. SUS data is 'uncleaned' hospital activity data, so may differ from cleaned Hospital Episode Statistics data by a small degree.*

Appendix D: Links between this Clean Air Strategy and international, national, regional and local policies

Level	Initiative	Implications and link to air quality
International	Sustainable Development Goals	Links to 7 Sustainable Development Goals. E.g. 3.9: By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination, 7.2: By 2030, increase substantially the share of renewable energy in the global energy mix, 11.6: By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality…
National (UK)	National Clean Air Strategy 2019 (14)	The new Environment Bill will make smoke control legislation easier to enforce, powers to increase upgrades of inefficient heating appliances, new EU Eco-design regulations meaning all new stoves will need to meet agreed emissions standards by 2022, legislation to prohibit the sale of the most polluting fuels and new petrol/diesel vehicles by 2040, limits ammonia emissions from farming, voluntary labelling scheme for NMVOC-containing products, consultation on changes to Part F building regulations on ventilation. May require local authorities to create short term action plans to reduce population exposure during Acute Pollution Episodes.
	National Planning Policy Framework (NPPF) 2019 (49)	103. Limiting the need to travel and offering a genuine choice of transport modes. This can help to reduce congestion and emissions, and improve air quality and public health. 170. Enhance the natural and local environment by: e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution 181. Opportunities to improve air quality or mitigate impacts should be identified…. Planning decisions should ensure that any new development in AQMAs and CAZ is consistent with the local air quality action plan.
	National Planning Practice Guidance (PPG) 2019 (50)	This guidance supports the NPPF and includes guiding principles on how planning can take account of the impacts of new development on air quality.
	UK Air Quality Plan (NO_2) 2017	Focuses on tackling roadside nitrogen dioxide levels from vehicles to bring forward compliance with legal limits e.g. Clean Air Zones, retrofitting technologies and/or new low emission buses, changing road layouts at congestion and air pollution points, encouraging use of public transport and encouraging public and private uptake of Ultra Low Emission Vehicles (ULEV).
	National Air Quality strategy 2007 (41)	While somewhat superseded by the 2019 UK Clean Air Strategy, this provides a framework for air quality management, standards, reinforces AQMAs. Promotes benefits of joining with climate change strategies.
	Part IV of the Environment Act 1995 (13)	Jurisdiction for UK air quality strategy and established the system of local air quality management (LAQM) and for designation of air quality management areas (AQMAs) which commenced in 1997.
	Defra Local Air Quality Management Guidance (2016) (51)	Consisting of statutory Policy Guidance (PG16) and Technical Guidance (TG16) to support local authorities in their LAQM duties to review and assess air quality and take appropriate action to improve air quality where necessary.

Level	Initiative	Implications and link to air quality
Regional (West of England)	Joint Local Transport Plan 4 (25)	JLTP4 may have major (incidental) implications for AQ. Will include Local Cycling and Walking Infrastructure Plan (LCWHIP).
	West of England Built Environment Work stream	Supporting the work of Local Authority Public Health teams in addressing air quality as a significant health determinant.
	BNSSG CCG STP Climate Adaptation Plan	Unknown implications.
	Joint waste core Strategy, adopted 2011	Information supporting a planning application must include, as appropriate to the development proposal, assessment of the following matters… adverse effects on residential amenity including… fumes… dust… odour… traffic… health impacts
Local (SGC)	Targeted Feasibility Study A4174 – JAQU	Study complete, recommendations accepted. Measures implemented in August 2019 via Experimental Traffic Order for 18 month trial during which consideration will be given whether to make the order permanent.
	Climate change strategy 2018-23 (17)	Targets contribute to **'**Reductions in local air pollutants': • To reduce our carbon emissions by: At least 80% by 2050 • We aim to reach 25% locally produced renewable energy as a percentage of local energy demand by 2036
	Sustainable community strategy 2016	• Ensure resources are used wisely, become carbon neutral, prevent pollution and waste • Encouraging active travel (cycling, walking) to improve health and reduce dependency on the car • Everyone has high quality homes suitable to their needs
	Biodiversity action plan 2016-2026	Links to Green infrastructure but not air quality directly.
	Housing Strategy 2013-2018	No mention of air quality. Group meets quarterly.
	Council Plan 2020-2024	The Strategy and subsequent action plan will contribute to the priorities of the Council Plan 2020-2024 which is currently being developed.
	Core Strategy 2006-2027	Explains burden of traffic in South Gloucestershire and links between air pollution and traffic. 'Poor air quality also has a direct effect on health, and traffic related pollution is an issue in parts of South Gloucestershire'.
	Policy, Sites and Places Plan	PSP21 - Environmental Pollution and Impacts 'Development that, on its own or cumulatively, has the potential for significant emissions to the detriment of air quality, particularly in or adjacent to air quality management areas, will be acceptable where potential adverse effects are mitigated to an acceptable level, by an appropriate scheme of mitigation'. Relevant objectives: • 'Reducing congestion and air pollution by improving accessibility by means other than the private car' • 'Protecting land, air, aqueous environments, buildings and people from pollution'
	Local Plan 2018-2036	In draft form.
	Air Quality Action Plan: Kingswood and Staple Hill, 2012 (15)	New AQAP required to incorporate extension to Warmley, and refresh and broaden actions. This work is intended to be encompassed in the Action Plan developed under this Strategy.

Level	Initiative	Implications and link to air quality
	Cycle Strategy 2016	• Cycling will account for 20% of commuter trips by 2026 • 30% reduction in all Cyclist casualties by 2020 • To continue and increase current levels of Bikeability training within schools • To maintain or improve current high levels of public satisfaction with Walking and Cycling.
	Joint Strategic Needs Assessment	Air quality is included as a topic within section on 'Healthy built environment and transport' (p 82)
	Joint health and wellbeing Strategy 2017-21 (39)	'We want the health impacts from poor air quality to be reduced through lower emissions and reduced exposure to pollutants' Health and Wellbeing board members will 'Raise awareness of the impacts of air pollution and poor air quality on health, and work with partners in South Gloucestershire and more widely to promote a consistent and unified approach to improve air quality and reduce health impacts associated with air pollution.'
	Healthy weight and obesity Strategy 2014-2020	Crosscutting theme of built environment. promote sustainable / active travel for local journeys 4.1.10 Encouraging people to actively travel, such as to and within the workplace, developing personalised travel plans and reducing short car trips.
	Physical activity Strategy 2015-20	Active Places theme 'work with our planning, transport, street care, highways maintenance and housing colleagues to create favourable environments inclusive of physical activity, supporting walking, cycling and public transit'.

Appendix E: Gap Analysis methodology
(Completed June 2019)

Method
This gap analysis compared previous and current local actions (see *Appendix F)* to improve air quality with recommended actions drawn from an extensive existing stock of peer reviewed evidence and augmented by online searches for English language papers since 1998 addressing air quality interventions using a range of search terms. Recent review papers and their references were scanned as a means of capturing evidence that might otherwise have been missed. The specialist knowledge of the main researcher and wider team (see Acknowledgements section) was also drawn on to ensure that key evidence was considered.

The key guidance documents that inform this gap analysis are:

- House of Commons. Air quality, 2010 (1)
- Royal College of Physicians. Every breath we take, 2016 (3)
- PHE. Working together to promote active travel, 2016 (4)
- Air Quality A briefing for Directors of Public Health, 2017 (5)
- WHO. REVIHAAP technical report, 2017 (6)
- NICE. Air pollution: outdoor air quality and health, 2017 (7)
- RCPCH. Every breath we take. Progress report, 2018 (8)
- WHO. 25 air pollution interventions, 2018 (9)
- Cochrane. Interventions to reduce ambient particulate matter air pollution, 2019 (2)
- NICE. Air pollution: outdoor air quality and health. Quality standard [QS181], 2019 (10)
- PHE. Review of interventions to improve outdoor air quality and public health, 2019 (11)

In addition, the gap analysis has been informed by in-house reviews and case studies:

- Previous SGC air quality annual status reports (ASRs) (26), 2012 AQAP (15) and AQAP refresh workshop action list
- SGC stock take report (*unpublished*)
- SGC NICE air quality baseline assessment tool (*unpublished*)
- Other local authority case studies

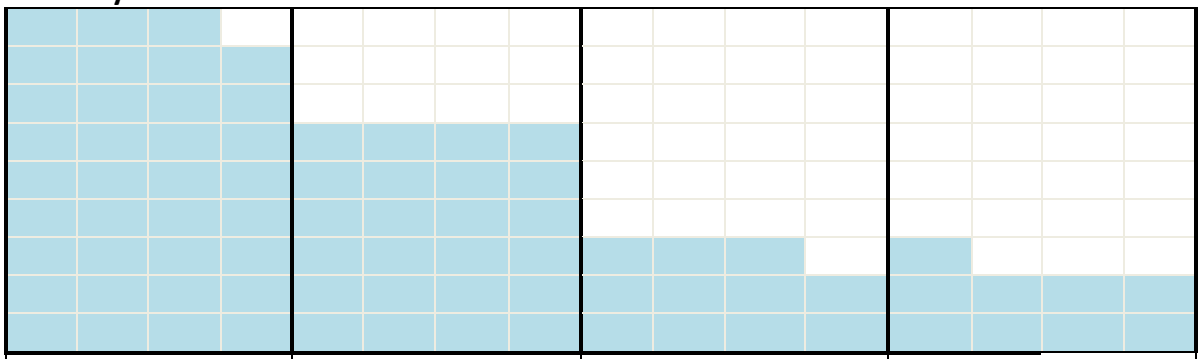
Numerous tools to estimate cost effectiveness of interventions have been reviewed:

- Par Hill. Cost Effective Actions to Cut Air Pollution in Central London, 2012 (51)
- Eunomia. Air Pollution: Economic Analysis, 2016 (52)
- PHE. Air pollution: a tool to estimate healthcare costs, 2018. (53)
- DEFRA. Emissions factor toolkit v8.0.1. (54)
- NICE. Physical activity return on investment tool, 2016. (55)
- DEFRA. Air quality damage cost appraisal toolkit, 2019. (56)

Appendix F: Previous or current actions taken in South Gloucestershire to improve air quality

(In October 2019)

Summary table



Each square represents one action.

Reducing air pollution on the go

Schools • Active travel training by Road Safety Education team (Access fund) in 16 out of 83 primary schools and 4 out of 16 secondary schools. Bikeability training reaching ~2000 children. • All schools registered to ModeShift stars (electronic version of school travel plan) last year. • Air Quality on the School Journey' project with Kings Oak. • School buses available.	**Active travel network** • Adopted Sustrans guidance for new and large existing developments. • Adopted government walking route audit tool, requirement 28/40. • Auditing (Department for Transport methodology) travel routes. • Bromley Heath Walking and Cycling Bridge. Cycle path lighting. • Cycle forum.	**Businesses** • Travel West annual big commuter challenge (June 2019). • Travel awards. • Annual travel to work survey. • 55 Active Travel Champions. • Wheels to Work (aimed at NEET sector), Travel training, Bus tickets, bike voucher scheme. • Cycle to work schemes.
Road network • Improvements to the M5 motorway junctions 16 and 17. • Signing review of delivery bays. • Parking management review in some AQMAs.	**Promote least polluting vehicles** • National online vehicle checker available.	**In-house (council)** • Entire fleet of Council pool cars switched to electric. • 16 fleet vehicles electric with funding secured to switch 8 of the other fleet vehicles by 2021 (Go Ultra Low project). • Fuel efficient driving techniques taught.

Public transport network	Smooth traffic flow	Communities
• Travel card scheme. • Bus Tracker App and continued Metrobus extensions. • MetroWest alterations. • Electrification of part of the Great Western Main Line and intercity lines. • Low emission bus scheme (gas powered) and buses upgraded to Euro VI standard as minimum.	• Vehicle activated speed reminder signs. • 20mph speed limits around schools. • Scheme to roll out speed tables. • Upgraded traffic signals in Staple Hill. • Smart motorway developed.	• Travel west website. • Travel plans program with schools, businesses and communities. • Smarter Choices roadshows. • Access WEST community's scheme with five new developments to target behaviour change.

Reducing air pollution at home

Clean Air Zones	Smoking	Green infrastructure
• Small smoke control area. • AQMAs and targeted feasibility study. • Proposed chargeable CAZ in Bath. • Proposed chargeable CAZ and other possible measures in Bristol.	• Smoking cessation program established.	• Council used funds to plant trees in 2013. • Await DEFRA Net Gain consultation result. • Partner in West of England Nature Partnership. • Five ecology projects running in the AQMA areas.
New developments	**Existing homes**	**Damp and mould**
• Significant developments assessed through planning system to ensure impacts on air quality are quantified and understood. • Public Health contribute to Local Plan. • Car club scheme in place.	• National consultation on building regulations to change Part F ventilation requirements. • 4% loans for homes work in privately rented sector. • Await national VOC voluntary labelling.	• Advice leaflet available and sent to privately rented sector.
Solid fuel burners	**Energy efficiency**	**Urban areas**
• SGC leaflet on solid fuel burners available to residents. • Chimney height approval system. • Awaiting national legislation on smoky coal and wet wood ban. • Adopted national EU eco-design controls on stoves, fireplaces (2022) and boilers (2020) for new sales.	• National Minimum Energy Efficiency Standard for privately rented sector, all dwellings required to be EPC E or above. • Warm and Well scheme, including first time central heating provision for homes which may currently have solid fuel open fires.	• Air quality data to inform urban living area bids for Yate and Kingswood. • Street washing and sweeping – in urban areas with a relatively high population density when there is low rainfall.

Reducing air pollution at work

Businesses engagement	Construction	Permits
• Sustainability month. • Existing networks. • Business West (18,000 members), North Bristol SusCom (68,000 employees and students) and others.	• Dust Management Plans are routinely conditioned on major development planning permissions.	• 13 EA Part A1, 3 Part A2, and over 80 Part B (largely petrol stations and quarries in South Gloucestershire) environmental permits in place. • Trading Standards. • Animal welfare recommendations for safe gas levels.
Power generation	**Waste management**	**Industrial processes**
• South Gloucestershire locally generated renewables are at 4.9% of local energy demand. • Two solar farms on council properties.	• Viridor waste management already uses anaerobic waste digestion.	• National advice available on pollutant capture and flue gas desulphurisation.
Farms		
• National advice on levels of protein in livestock diets, store digestate in covered stores, low emissions techniques for spreading slurries and digestate on land.		

Raising awareness

Forecasts	Schools	Advice
• Link to MET office air pollution forecast on SGC website.	• Added air quality mitigation to Health in School project award system.	• Reduce, reuse, recycle message for food waste in SGC Food Plan. • Created advice for individuals on how to reduce their air pollution available on the SGC website.
Most vulnerable	**Acute pollution episodes**	**Communications**
• NICE to work with Royal College of GP's so that clinical advice about managing relevant health conditions routinely includes information on the effect of exposure to high levels of air pollution.	• Health Protection Assurance Group has air quality as an intermittent agenda item.	• Annual participation in Clear Air Day. • Ran a communication campaign on council social media. • Links to SGC Food Plan and TravelWest.

Glossary

APE	Acute Pollution Episode
ASR	Air Quality Annual Status Repot
AQAP	Air Quality Action Plan
AQMA	Air Quality Management Area
AURN	Automatic Urban and Rural Network – a national automatic monitoring network
BAM	Beta Attenuation Monitor (for PM10 measurement)
BNSSG	Barth, North Somerset, and South Gloucestershire Council
CAZ	Clean Air Zone
CCG	Clinical Commissioning Group
DEFRA	Department of Environment, Food and Rural Affairs
EA	Environment Agency
EPC	Energy Performance Certificate
HDVs	Heavy Duty Vehicles (Buses and HGVs greater than 3.5 tonnes)
HGVs	Heavy Goods Vehicles
JAQU	Joint Air Quality Unit (Joint Air Quality Team set up by Government Departments for Food, Environment and Rural affairs (DEFRA) and Department for Transport (DfT)
JLTP	Joint Local Transport Plan (West of England Authorities)
LAQM	Local Air Quality Management (Regulatory system under the Environment Act 1995)
LDVs	Light Duty Vehicles (cars and LGVs less than 3.5 tonnes)
LGVs	Light Goods Vehicles
NH_3	Ammonia
NMVOCs	Non-methane volatile organic compounds
NO_2	Nitrogen dioxide
PHE	Public Health England
PM	A collective term for a complex heterogeneous mixture of particulate matter with different sizes and chemical compositions
$PM_{2.5}$	Fine Particulate Matter (particle size not greater than 2.5µm)
PM_5	Particulate Matter (particle size not greater than 5µm)
PM_{10}	Particulate Matter (particle size not greater than 10µm)
Dust	Particulate Matter (particle size not greater than 75µm)
SGC	South Gloucestershire Council
SiA	Stove industry Alliance
SO_2	Sulphur dioxide
STP	Sustainability and Transformation Plan
WECA	West of England Combined Authority (Bath & North East Somerset, Bristol City Council and South Gloucestershire Council)
WoE	West of England Authorities (Bath & North East Somerset, Bristol City Council, North Somerset and South Gloucestershire Council)
µm	Micrometre
µg	Microgram (a millionth of a gram)
$\mu g/m^{-3}$	Micrograms per cubic metre (the unit for describing the concentration of air pollutants in the atmosphere)

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Environment and Community Services Nigel Riglar – Director ECS Rob Walsh - Head of Safe and Stronger Communities Gerard Madden – Environmental Health Manager Sally Radwell – Air Quality Officer Shaun Fudge - Team Leader Environmental Protection Chris Gillett - Team Leader Private Sector Housing Esther Collis - Planning Officer Ecology Emma Blackham - Head of Transport & Strategic Projects Mark King - Head of Streetcare & Transport Services Alice Jennings - Transport & Environmental Policy Manager Lee Lodder - Transport Planning Officer Sally Pattison - Biodiversity Officer Pamela Williams - Senior Road Safety Officer Verity Britton - Business Engagement Account Manager, Access West Brian Glasson - Head of Strategic Planning and Housing David Villis - Principal Officer - Ecology Carl McClure – Principal Planning Officer James Cooke - Strategic Planning & Partnership Manager Ian Steele - Economic Development Project Manager Lucy Rees – Senior Environment and Climate Change officer Andy Whitehead – Acting Transport and Environment Policy Manager	VCSE organisations Sustrans Academia Air Quality Management Resource Centre Businesses North Bristol SusCom Trust Residents Priority neighbourhood group leads Neighbouring authorities West of England Built Environment work stream West of England Nature Partnership Bristol City Council Public Health Division

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