Air Quality Strategy for Nottingham and Nottinghamshire

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Foreword

Why do we need an Air Quality Strategy to reduce air pollution?

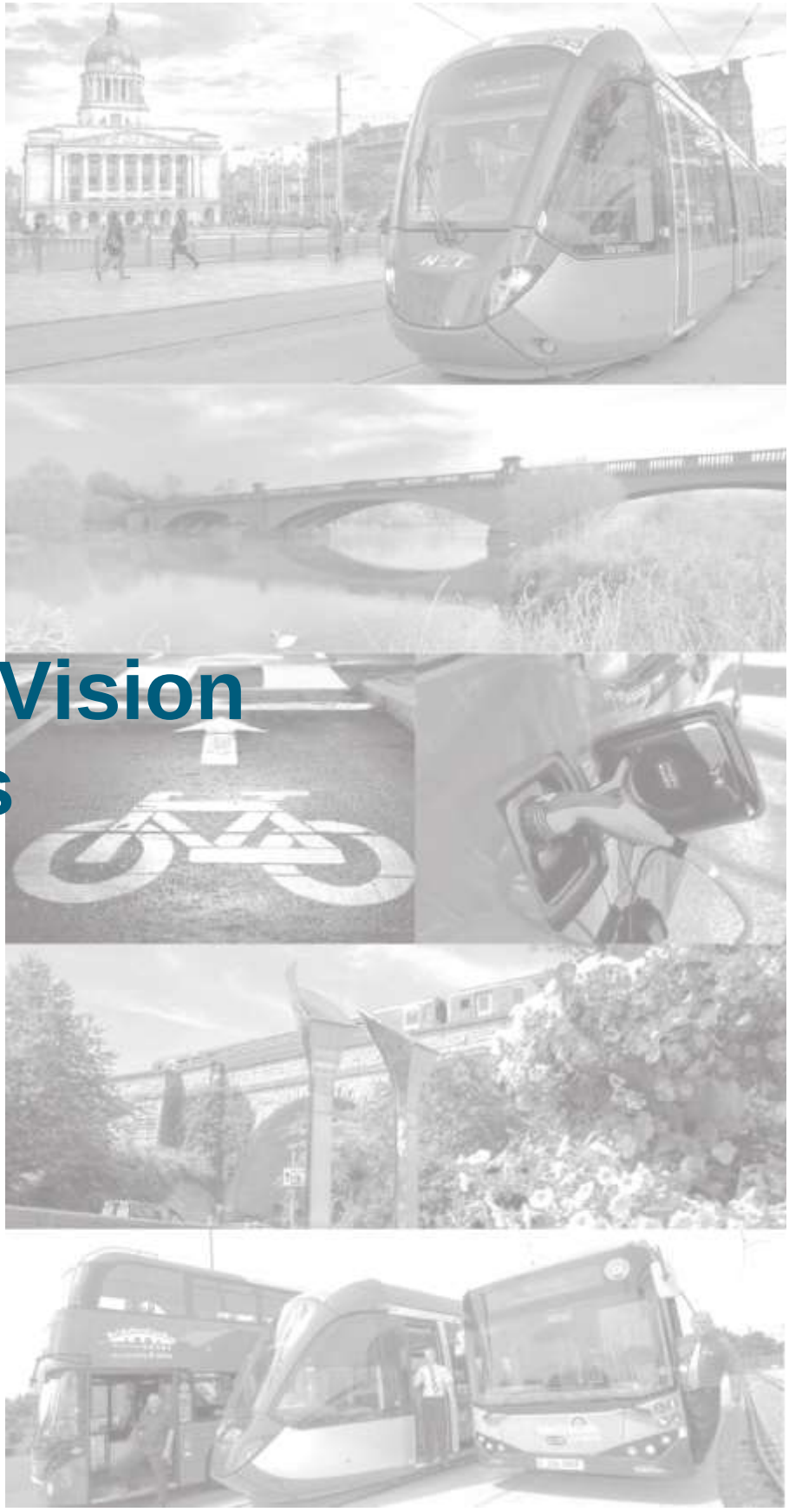
Clean air is one of the most basic requirements for us all to live and work, and is essential for our good health and wellbeing, and for the natural environment. Although there has been a reduction in air pollution since the 1970s, poor air quality is still the largest environmental risk to public health in the UK. It shortens lives and reduces quality of life, particularly amongst the most vulnerable, the young and old, and those living with health conditions. There are 1000s of cases of respiratory and other diseases and an estimated 630 deaths a year in the Nottingham City and Nottinghamshire County areas together that can be attributed to air pollutants. It is also important to recognise that air pollution also damages ecosystems and wildlife.

We aim to improve air quality further in Nottinghamshire through this strategy as there are no safe levels of air pollution and any reduction will have a positive impact on public health. In fact, our modelling shows that reducing levels of exposure to the main pollutants in the county and city would in time generate significant reductions in related morbidity and mortality and reduction in costs to the local health and care system. Importantly this would also improve the quality of life and wellbeing of 1000s of local people helping them to meet their potential and live fulfilling lives. Reducing air pollution will also contribute to protecting the climate as polluting emissions also often contain greenhouse gases. There are also other significant co-benefits such as health improvement through more active travel economic opportunities related to the development and utilisation of zero and low emission technologies.

Our vision is for all of Nottinghamshire residents and visitors to have clean air that allows them to lead healthy and fulfilling lives. We aim to reduce the average levels of the main pollutants and reduce the proportion of disease and death caused by air pollution. To order to do this it is crucial that we all contribute to tackling air pollution, and local authorities, and partner organisations provide strong leadership so that we improve the quality of the air we all breathe, every minute of every day and establish systems and places for clean air for future generations.

Councillor Tony Harper (Chair)
Nottinghamshire Health and Wellbeing Board

Councillor Eunice Campbell-Clark (Chair)
Nottingham City Health and Wellbeing Board



Strategy Vision and Aims

Our Vision

For all of Nottinghamshire residents and visitors to have clean air that allows them to lead healthy and fulfilling lives.

Modelling shows that the rate of years of life lost attributable to air pollution has decreased in the county and the city since the early 1990s, but the rate of years lost to disability attributable to air pollution remains at a similar level (Appendix 2). However, there is no known safe level of exposure below which there is no risk of health effects [1], and air pollution continues to have a significant impact on health in the city and county.

It is estimated that 5.7% of all adult deaths (equivalent to more than 410 deaths) in Nottinghamshire County (i.e. excluding the City of Nottingham), and 6.3% [2] of all adult deaths (equivalent to 146 deaths) in Nottingham City, were attributable to long term exposure to human-made particulate air pollution based on 2016 figures. When the effects of NO_2 are included the number of attributable deaths is estimated to increase to more than 450 in Nottinghamshire County and 181 in Nottingham City.

Deaths attributable to air pollution are higher than those related to alcohol consumption and road traffic accidents combined (Table 1). This demonstrates the need and importance of working towards our strategic vision.

Table 1 Comparison of deaths attributable to human-made air pollution, smoking and deaths related to alcohol consumption, Nottinghamshire County and Nottingham City.

Area	Deaths attributable to human-made air pollution	Deaths attributable to smoking	Deaths related to alcohol consumption	Deaths (deaths including serious injury) caused by road traffic accidents
Nottinghamshire County	450	3928*	405¥	28α (314)
Nottingham City	183	1408	153¥	5α (111)

*Estimate based on 1/3 of deaths attributable for 2015-2017, PHE Tobacco Control Profiles,
¥ Estimates for 2017, PHE Local Alcohol Profiles for England, 4.01 Alcohol-related mortality (persons)
α Reported casualties by severity, by local authority area, Great Britain, 2017

Our modelling shows that lowering levels of pollution would enable people to live more healthy lives. For example, if areas of the city and county where residents are exposed to higher levels of air pollution, had lower levels of pollution over the next 10 years; there would be significant health benefits and lives saved.

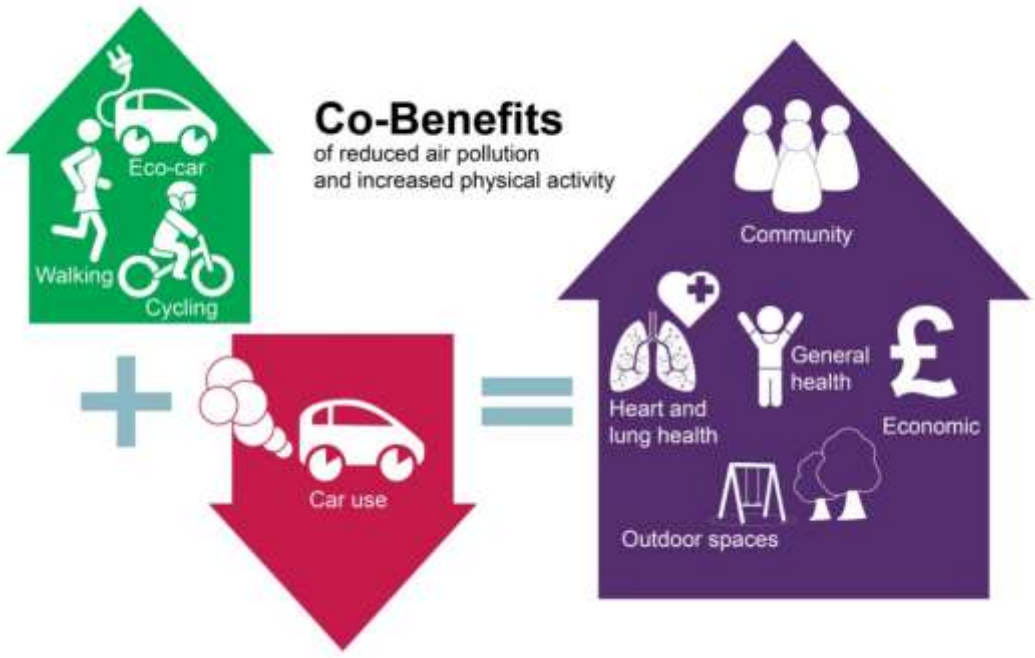
This would include 1000s of fewer cases of asthma, coronary heart disease, chronic obstructive pulmonary disease, diabetes, and lung cancer over the next 10 years and related improvements in quality of life. In addition, there would be over 1500 fewer deaths associated with these conditions, and a reduction in £160M associated with treating and caring for people with these conditions in the local health and care system (Appendix 3).

Our vision for clean air aligns with the ambition in governments national Clean Air Strategy to protect the nation's health and the government's plan [3] and forthcoming strategy for reducing vehicle emissions [4]. Other important national plans such as the NHS Long Term Plan has recognised the action needed on air quality [5].

Implementation of this strategy will also have local system-wide co-benefits (Figure 1). For example, shifting towards local and zero emission transport will enable more physical activity through active travel as part of integrated transport systems and help reduce local congestion. Other co-benefits include connecting people in their communities through better design of place, and improvements in overall environmental quality, noise reduction, greater road safety and carbon-reduction for climate change mitigation [1].

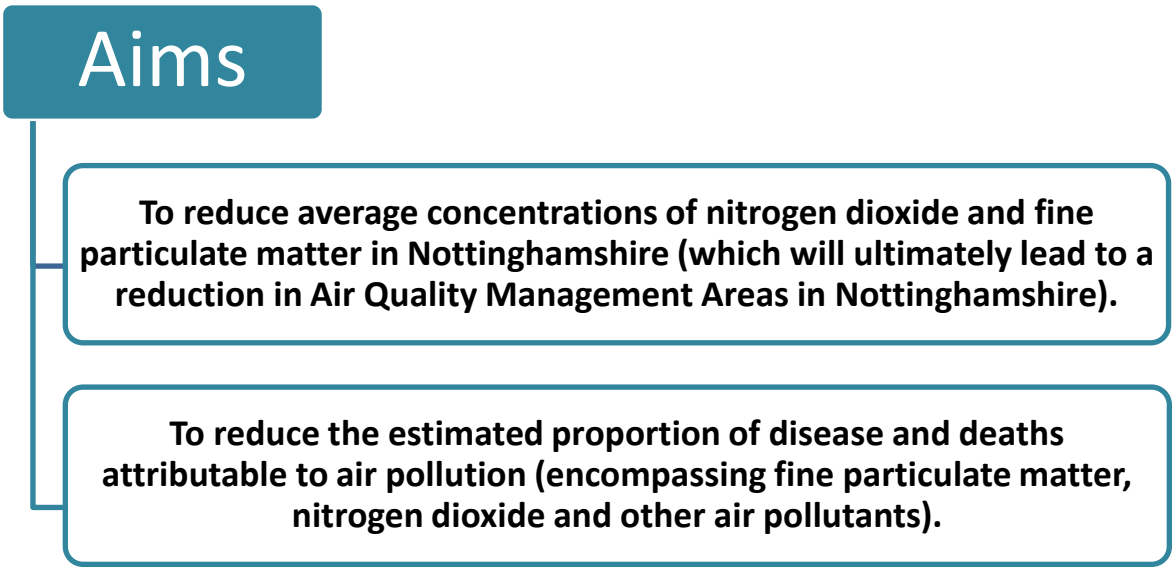
The local economy can also benefit from the action set out in this strategy. People prefer to live, and employers are likely to prefer to establish businesses, in places which are clean and support a healthy workforce. Innovation in clean energy and technologies presents opportunities for the UK economy [6].

Figure 1 Example Co-Benefits of Improving Air Quality (Public Health England)



Aims of the Strategy

This strategy aims to reduce the two key pollutants that are known to impact on human health – nitrogen dioxide and fine particulate matter. This action will also reduce the impact of these pollutants on the local environment and local ecosystems and reduce the impact of other pollutants which are emitted and produced by the same causes.



Aim 1 is in line with the 2018 legislation to reduce national emissions for fine particulate matter and nitrogen dioxide (and 3 other pollutants) [7]. It is also aligned with the national Clean Air Strategy 2019 aim to reduce $PM_{2.5}$ concentrations in all areas of the UK over the next decade [4].

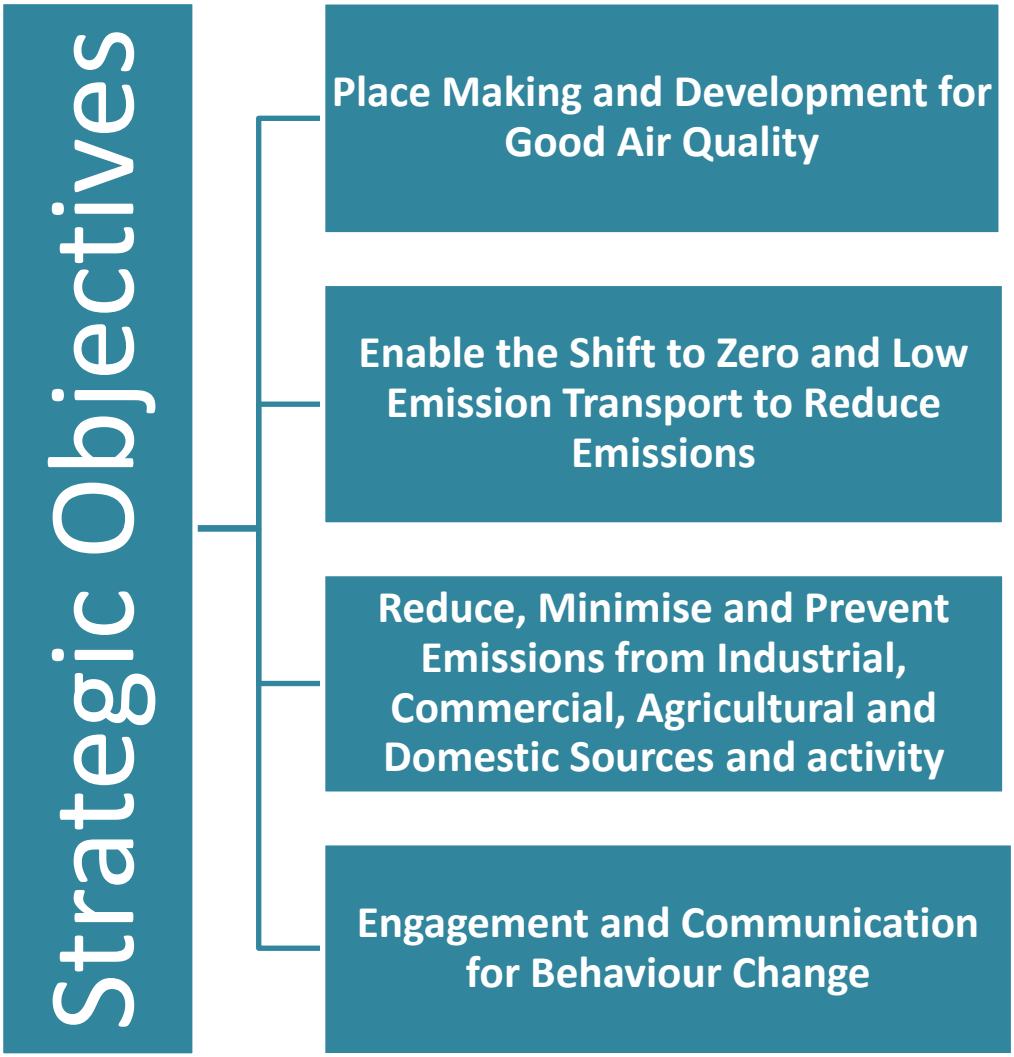
As described in Appendix 5, Air Quality Management Areas (AQMAs) are designated when levels of pollutants in local area are above the UK limits. Reducing the average concentrations of these key pollutants will subsequently lead to less areas requiring an AQMA and reduce the number of AQMA in the city and county area.

The Local Air Quality Action Plans for these AQMA in Nottingham and Nottinghamshire are therefore a key component in the delivery of this strategy in terms of reducing health risk and impact in the most polluted areas. The role of AQMA will evolve and develop as the government makes changes to modernise the local air quality management (LAQM) system as intended in the Clean Air Strategy.

Strategy Objectives and Principles

Strategic Objectives

The strategic vision and aims will be delivered through action under the following strategic objectives. These strategic objectives are aligned with the evidence base for action to improve air quality set out by the National Institute of Health and Care Excellence (NICE) [8] and the action set out in the national strategic documents:



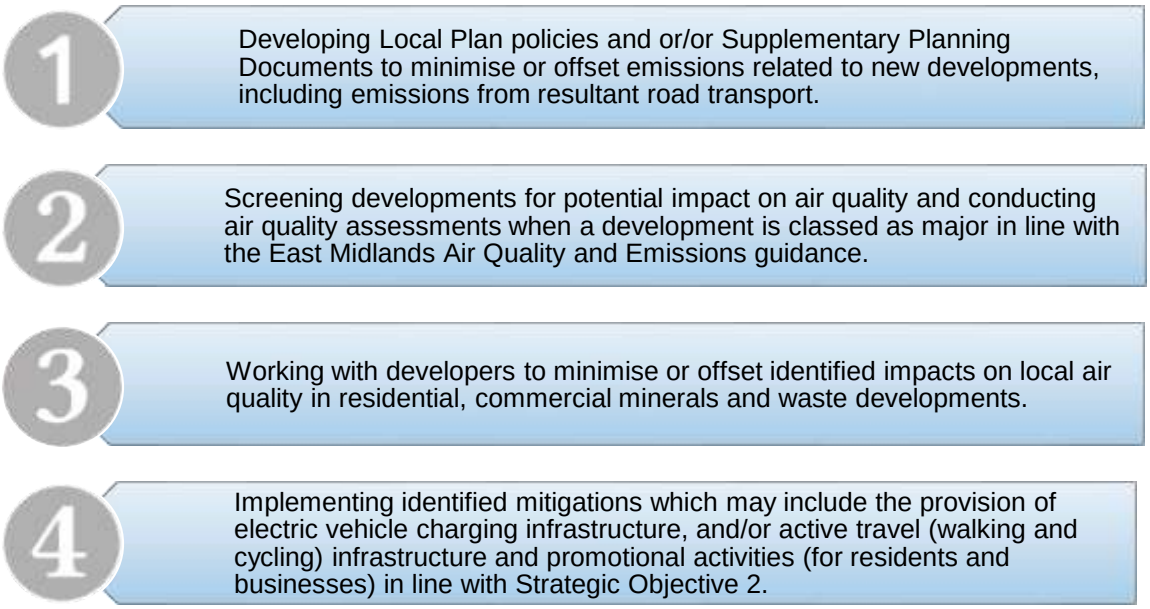
Objective 1: Place Making and Development for Good Air Quality

The local planning system has the potential to positively impact on air quality as part of its aim to contribute to sustainable development. This can be through the system's role in promoting healthy and safe communities, sustainable transport, achieving well-designed places and facilitating the sustainable use of minerals as set out in the 2018 National Planning Policy Framework (NPPF) [9].

The NPPF states that planning policies and decisions should contribute to national air quality objectives and local air quality plans. Planners should consider air quality at the plan making stage to ensure a strategic approach and limit the need for issues to be reconsidered when determining individual applications. It is envisaged that by securing reasonable emission mitigation on schemes, where appropriate, cumulative impact effects, arising from overall development can be minimised.

The new approach provides greater clarity and consistency for developers, which should help to speed up the planning process. Guidance has been developed through the East Midlands Air Quality Network which can aid this process [10] and several authorities are progressing Supplementary Planning Documents covering the issue. The Nottinghamshire Spatial Planning and Health Framework 2019-2022 [11] is also useful in this regard and sets out the rationale for the role of spatial planning and place making in the health of the population, and a protocol for incorporating health considerations into planning policy and development control.

Public Health England's guidance on air quality interventions states that planning should aim to improve air quality and other health outcomes through the co-implementation of a mix of various measures that provide/improve green and active travel infrastructure, prioritise road safety, provide public transport and discourage travel in private cars. This should be done together with policies focusing on reducing the emissions of vehicles that have the highest potential to be effective at reducing emissions [6]. We will achieve Strategic Objective 1 by:



Objective 2: Enable the Shift to Zero and Low Emission Transport to Reduce Emissions

As described in Appendix 1, a significant proportion of emission of nitrogen oxides and particulate matter in Nottinghamshire comes from road transport, and this has a significant impact on local air quality. Reducing emissions from these sources is a key part of the government's air quality strategy and local transport strategies [3] [4] [12] [13]. It is therefore essential that we work to reduce emissions from vehicles through local action. Transport teams within both Nottingham City Council and Nottinghamshire County Council will lead on this by ensuring air quality is a material consideration within the development of Local Transport Plans. Other parts of the public sector also have a significant role in this objective. The local Integrated Care Systems should lead on action within the NHS to reduce emissions from all related vehicles as set out in the NHS long term plan [5].

We will seek to encourage local residents, businesses and organisations (including public sector organisations) to move to zero and low emission transport options by making people more aware of their travel choices (particularly low-emission options) and providing infrastructure and training to enable people to make such journeys and reduce emissions from transport.

We will achieve strategic objective 2 by:

1. Developing and delivering coordinated integrated programmes of measures to address journey time delay including:
   - Infrastructure improvements to encourage more people to walk, cycle or use public transport more often.
   - Encouraging and enabling people to make more sustainable travel choices (e.g. through travel planning and training) as part of Strategic Objective 4.
   - Targeted capacity improvements to address journey time delay (e.g. traffic signal improvements).
2. Encouraging transfer to lower emission vehicles through the provision of electric vehicle charging infrastructure including in new developments in line with Strategic Objective 1, and promotional activities (for residents, businesses, and public transport operators).
3. Effective management of the highways networks, including planned and unplanned disruption on the highways network caused by street works, incidents and other activities.
4. Working with operators to provide appropriate public transport services.
5. Ensuring the regular exchange of information between transport planners, health and air quality colleagues relating to both air quality information and traffic information.
6. Working with freight operators and organisations, passenger transport operators (e.g. bus, rail and taxi), and public sector transport operators and fleet commissioners to hasten the transition to the operation of zero and low emission vehicles and establish appropriate routes, delivery routines and driver practices to minimise congestion and pollution.

Objective 3: Reduce, Minimise and Prevent Emissions from Industrial, Commercial, Agricultural and Domestic Sources and Activity

Industrial (including commercial) and domestic burning/combustion including commercial waste and domestic nuisance fires cause most of the particulate matter pollution and a significant amount of the emissions of nitrogen oxides as described in Appendix 1. Agricultural sources are the predominant sources of ammonia and all these sources contribute to emission of volatile organic compounds which react with other pollutants to form secondary pollutants such as ozone and particles [4].

This strategic objective will be partly delivered by the regulatory activity of the Environment Agency and local authority Environmental Health teams to reduce, minimise and prevent emissions from these sources to reduce their impact on local air quality. This work will evolve as the new local air quality framework emerges as proposed in the Clean Air Strategy [4].

We will achieve strategic objective 3 by:

1. Ensuring through regulation, inspection and enforcement action that industrial, commercial and agricultural activities comply with Environmental Permits applicable to emissions to air from their industry.
2. Enforcing existing (e.g. smoke control orders) and any new legislation that minimises emissions from commercial and domestic solid fuel combustion.
3. Encouraging and facilitating increased energy efficiency and use of renewable/sustainable energy sources and supplies across sectors.
4. Identifying and implementing strategies and measures that reduce or prevent emissions that adversely affect health and ecosystems.

Objective 4: Engagement and Communication for Behaviour Change

It is important that people have access to the correct information about local air pollution and related risks to health in their area in the short and longer term. We will seek to raise awareness amongst local residents, households, businesses and organisations of local air pollution and the ways in which they can reduce their exposure.

We will put particular emphasis on protecting those at higher risk, including children, pregnant women, the elderly, and people with long term conditions as recommended by NICE [14]. We will utilise the tools that have been proposed in Public Health England 'Improving people's health' strategy 2018 [15] and the Clean Air Strategy 2019. There is a role for local Public Health teams and the Integrated Care Systems to lead on this to ensure it is implemented locally.

Importantly we want to help people understand what they can do to improve their health and local air quality. Examples of some of the things that can be done are set out in Appendix 6.

We will achieve strategic objective 4 by:

1. Raising awareness amongst higher risk groups on how to reduce the exposure and the impact of air pollution on their health.
2. Ensuring that health and care workers that come into regular contact with high-risk groups are aware of the advice they should give and what to do when air quality is poor, and that this is actioned.
3. Providing clear coordinated messages on the risk of air pollution and what individuals and organisations can do to reduce their contribution to local air pollution.
4. Aligning air quality messaging and behaviour change with other programmes which have mutual benefits such as promoting walking and cycling for physical activity and/or to address localised congestion.
5. Promoting involvement in local, national and international awareness raising campaigns at an individual and organisational level.

Cross Cutting Principles of the Strategy

The following cross cutting principles will be followed to enable the effective delivery of the strategy.

Ensure our approaches reduce health inequalities.

People living in the most deprived, particularly urban areas of England have significantly higher air pollution levels (PM_{10} and NO_2) than those living in the least deprived neighbourhoods [16]. The related research found that the 20% most deprived areas of the East Midlands which includes parts of Nottingham City and the county districts (Appendix 4). It is therefore important that our planned actions do not exacerbate these inequalities and those related to air pollution and higher risk groups. For example, by shifting pollution from one area to another, or reducing in less polluted areas more than in areas with a greater need [17]. But our actions should in fact strive to reduce inequalities related to air pollution.

Use PHE's air pollution hierarchy in prioritizing intervention.

This approach set out in Public Health England's 2019 review of interventions set's out how a system or department/service area should first prioritise prevention to reduce or eliminate emissions, over mitigation to reduce concentrations of pollutants, over avoidance to avoid individual being exposed without addressing the cause of the pollution [6].

Take a health in all policies approach.

Health in All Policies (HiAP) is an approach to public sector policies that systematically and explicitly takes into account the health implications of the policy decisions local authorities and other organisations take. It targets the key social determinants of health; looks for synergies between health and other core objectives and the work we do with partners; and tries to avoid causing harm with the aim of improving the health of the population and reducing inequity [18].

This is therefore important in relation to air quality. For example in organisational transport or energy policy there should be a consideration of the impact on air quality and not just economic or operational efficiency.

Base our approaches on evidence and learn through evaluation.

There is a growing evidence base for modelling air pollution risk, and modelling intervention effectiveness and impact. We will use the available tools and those that are available in the future to ensure that our approaches are as effective and cost effective as possible. We will learn from approaches in other areas of the country and learn from our local interventions through undertaking effective evaluation.

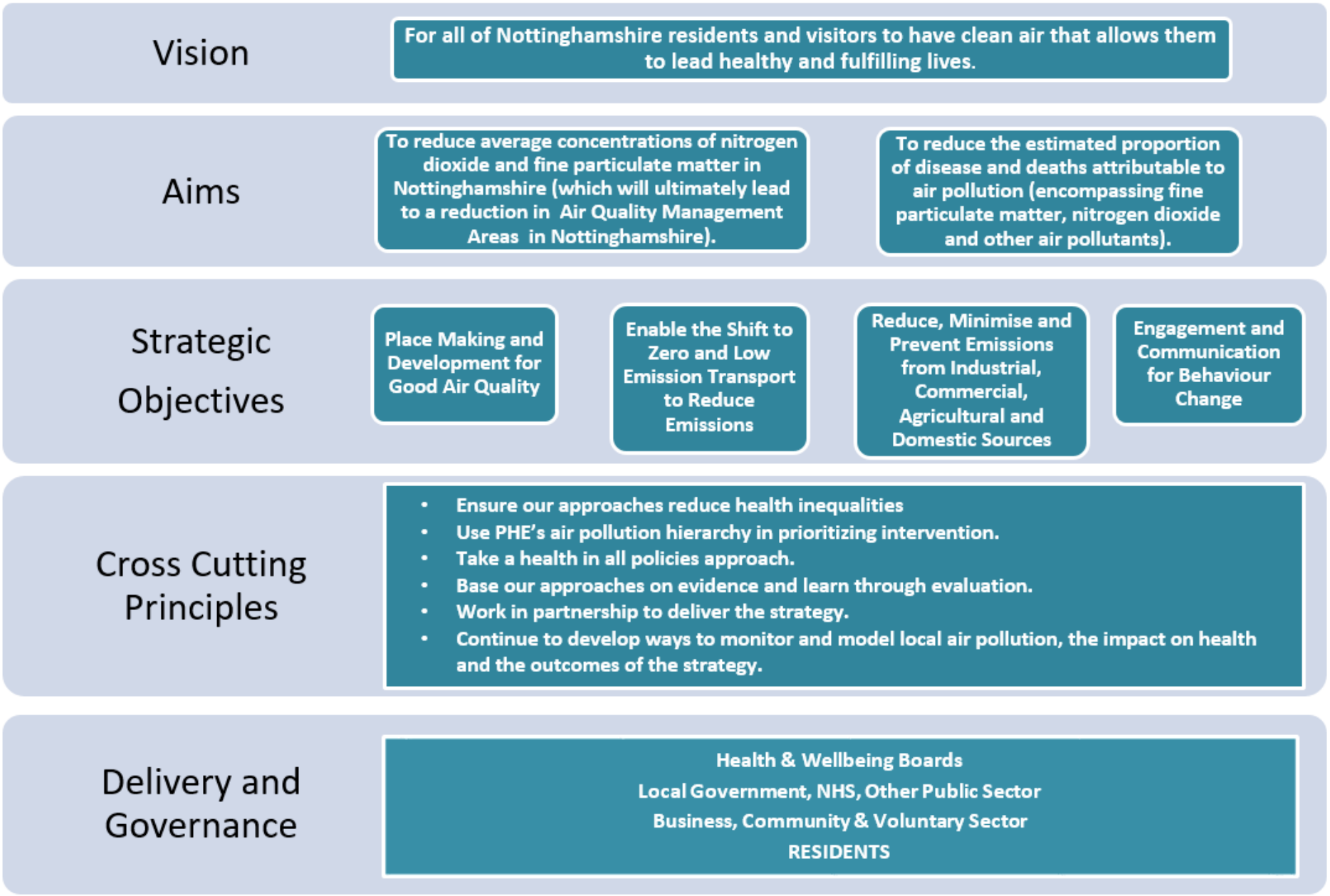
Work in partnership to deliver the strategy.

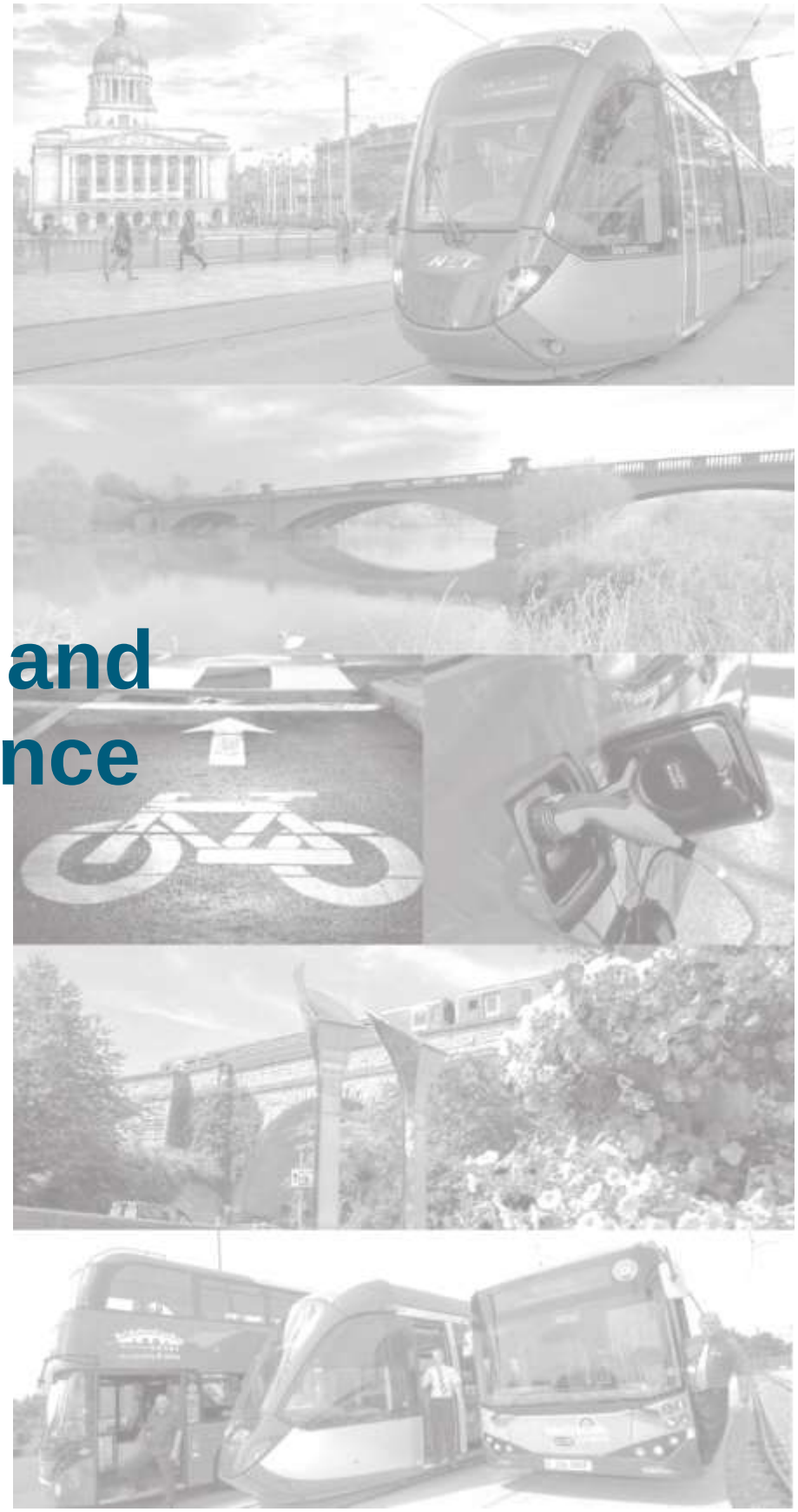
It is clear that air quality cannot be addressed by one organisation or sector alone. In order to utilise all local levers it is essential that all organisations consider their impact upon air quality. This includes the need to work across organisational boundaries to ensure that policies in one authority do not negatively transfer causes of air pollution or the pollution itself to neighbouring authorities. The need to work collaboratively has been highlighted as a policy objective in the national Clean Air Strategy.

Continue to develop ways to monitor and model local air pollution, the impact on health and the outcomes of the strategy.

The Clean Air Strategy has set out a new vision of the local air quality management system and improving national monitoring and reporting of air quality issues. We will work collectively in the longer term to adapt our local monitoring to this new regime and develop our local intelligence on air quality and health to better plan and deliver our air quality interventions.

Figure 2 Air Quality Strategy Summary





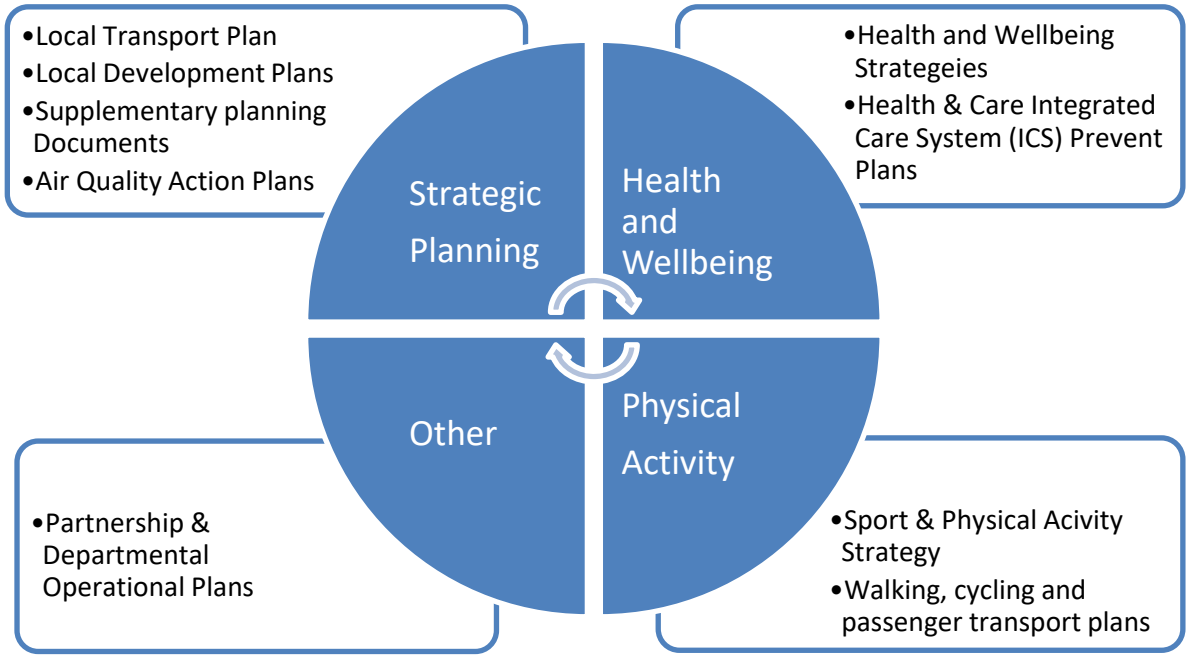
Strategy Delivery and Governance

Delivery and Governance of the Strategy

Delivery of the strategy aims and objectives requires leadership across several organisations and strategies and plans in the health & wellbeing, transport, planning, environmental health, public health and health & care sectors in the Nottinghamshire and Nottingham City areas.

It is proposed that the Health and Wellbeing Boards will provide local system leadership on the air quality agenda.

Figure 3 Local Strategies and Plans aligned with this Air Quality Strategy

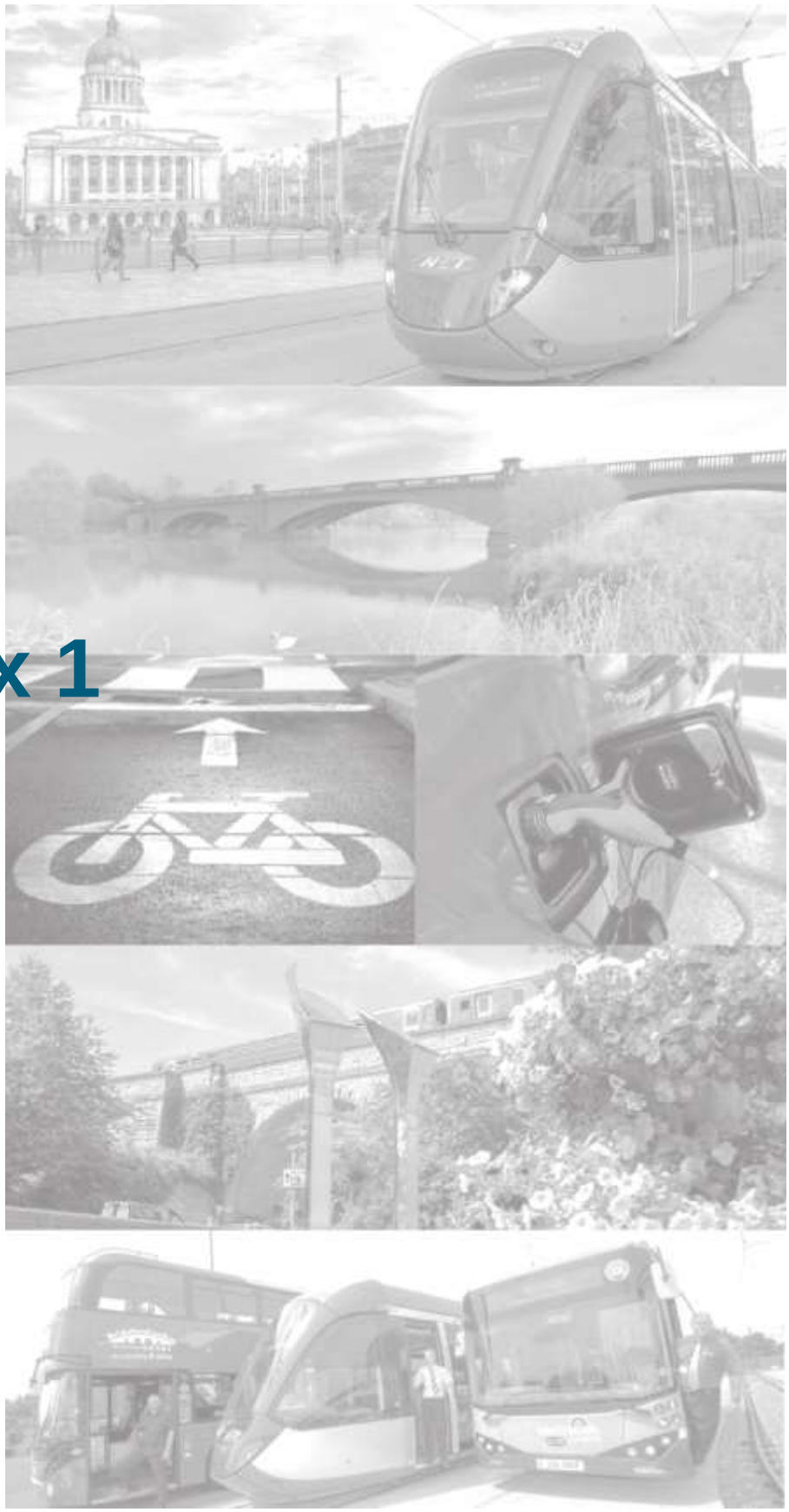


A strategy oversight group will be formed comprising a core of Environmental Health, NHS, Planning Policy, Public Health, Transport Planning representative of Nottingham City and Nottinghamshire. This group will meet once or twice a year to consider local air quality monitoring and modelling data, progress of any specific air quality delivery work streams and aligned strategy and the evidence base of effective interventions for improving air quality.

This purpose of the group will be to:

- Review progress of the delivery against the strategy aims and objectives.
- Ensure current programmes and projects are joined up in the local system for impact.
- Capitalise on new opportunities for strategic action on air quality.
- Review the partnership impact of implementation of changes to the local air quality management system.
- Coordinate and share local air quality modelling and monitoring at a strategic level.
- Identify and influence other strategic work streams with co-benefits for air quality.
- Oversee the Joint Strategic Needs Assessment for Air Quality for both areas.

Review the strategy on a 5 year cycle to take into account longer term changes in air quality and evidence for the partnership action required to continue to make improvements.



Appendix 1

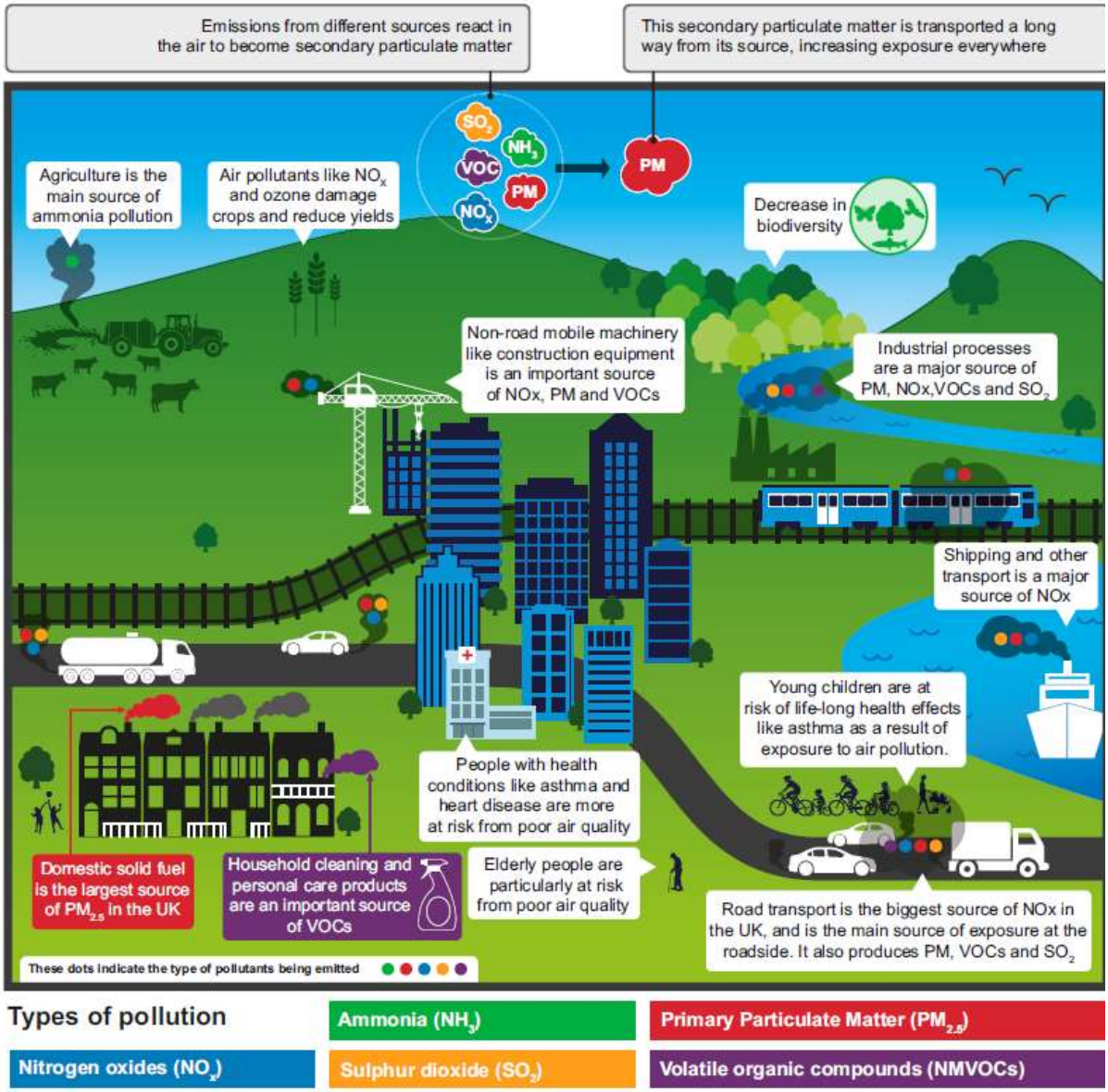
Appendix 1 - Local Air Pollution

Sources of air pollution

Air pollution is defined as a mixture of gases and particles that have been emitted into the atmosphere by natural and human-made processes.

There are a range of pollutants as shown in Figure 4. The combustion of fossil and carbon based fuels such as coal, oil, gas, petrol/diesel and wood burning are the most significant sources of the key pollutants of concern to local authorities, and also emit carbon dioxide, a key greenhouse gas.

Figure 4 the sources of air pollutants and their effects (Source: DEFRA, 2018)



The pollutants we are most concerned about locally, because of their health effects, are:

- **Nitrogen oxides (Nitrogen dioxide (NO_2) and Nitrogen oxide (NO))**
- **Particulate matter (microscopic particles - PM_{10}, $PM_{2.5}$ and smaller)**

Nitrogen Oxides

Nitrogen dioxide (NO_2) and nitrogen oxide (NO) (known together as Nitrogen Oxides or NO_x) are released into the atmosphere when fuels are burned (for example, petrol or diesel in a car engine or natural gas in a domestic central heating boiler). NO_x emissions from burning fossil fuels are mainly as NO, but some sources can release a lot of NO_2.

Road transport produces 34% of the NO_x in the air, and 80% near roadsides in the UK. Diesel vehicles are a particularly significant source of NO_2 and contribute 90% of the roadside emissions in the UK [3]. Because of this road transport and particularly diesel vehicles are the main local sources of concern for NO_x pollution locally. Other important sources of NOx emissions in the UK are power stations and refineries that use fossil fuels (22%), domestic and industrial combustion (19%), and other transport such as rail, shipping and aviation (18%) [4].

Nitrogen dioxide pollution[1] is a problem at several locations in Nottingham City and elsewhere in the county and there are currently (March 2019) five declared AQMAs resulting from nitrogen dioxide emissions due predominantly from road transport.

These AQMAs range in size from a few streets adjacent to the localised issues) to the whole of Nottingham City following amendment to the city's previous AQMA2 (although it should be noted that the air quality exceedances are only on specific roads in the City, not the whole of the City).

Each of these AQMAs has an associated Local Air Quality Action Plan and local authorities report on the status of AQMA and changes in local air quality monitoring and factors that affect local air quality in Annual Status reports. Given the breaches of air quality objectives beyond 2020 in Nottingham City predicted by DEFRA, Nottingham City was also required to conduct a detailed assessment and plan to address the air quality issues in the City [19].

[1] See appendix 1 for a description of pollutants and their impact.

Table 2 Local Air Quality Management Areas in Nottinghamshire

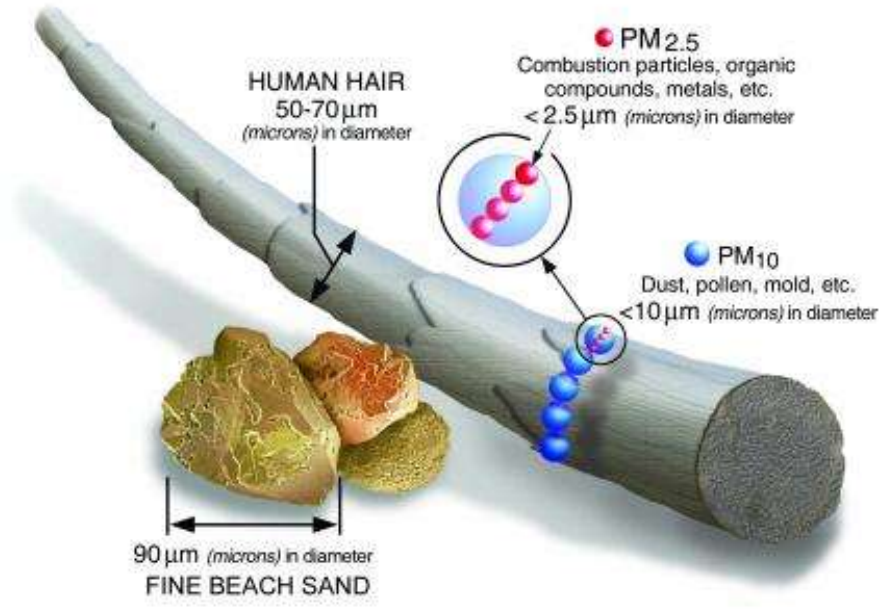
AQMA	Description	Date Declared	Pollutants of concern
Broxtowe‡	Next to the M1 motorway in Trowell.	01/02/2006	Nitrogen dioxide NO_2
Gedling	Land adjacent to a stretch of the A60 Mansfield Road	01/04/2011	Nitrogen dioxide NO_2
Nottingham City (AQMA 2)	The whole of the city's administrative area	09/01/2019	Nitrogen dioxide NO_2
Rushcliffe*	An area encompassing the vicinity between the A60/Wilford Lane junction to Lady Bay Bridge (including land south of Trent Bridge) in West Bridgford.	01/09/2005	Nitrogen dioxide NO_2
Rushcliffe*	Land adjacent to the A52 at Stragglethorpe	01/10/2011	Nitrogen dioxide NO_2

‡ Broxtowe AQMA is under review as NO_2 levels are below the threshold
* Rushcliffe AQMAs are under review as NO_2 levels are below the threshold

Fine Particulate Matter

Particulate matter is the term for a mixture of solid particles and liquid droplets found in the air. Some particles, such as dust, dirt, soot, and smoke, are large or dark enough to be seen with the naked eye. Others are so small they can only be detected using an electron microscope. They are classified by size such as PM_{10} or $PM_{2.5}$ or smaller.[2]

Figure 5 Size of Particulate Matter



(Source: US Health Protection Agency)

[2] PM_{10} (particles of ≤ 10µm (micrometres) diameter) or $PM_{2.5}$ (particles of ≤ 2.5µm diameter)

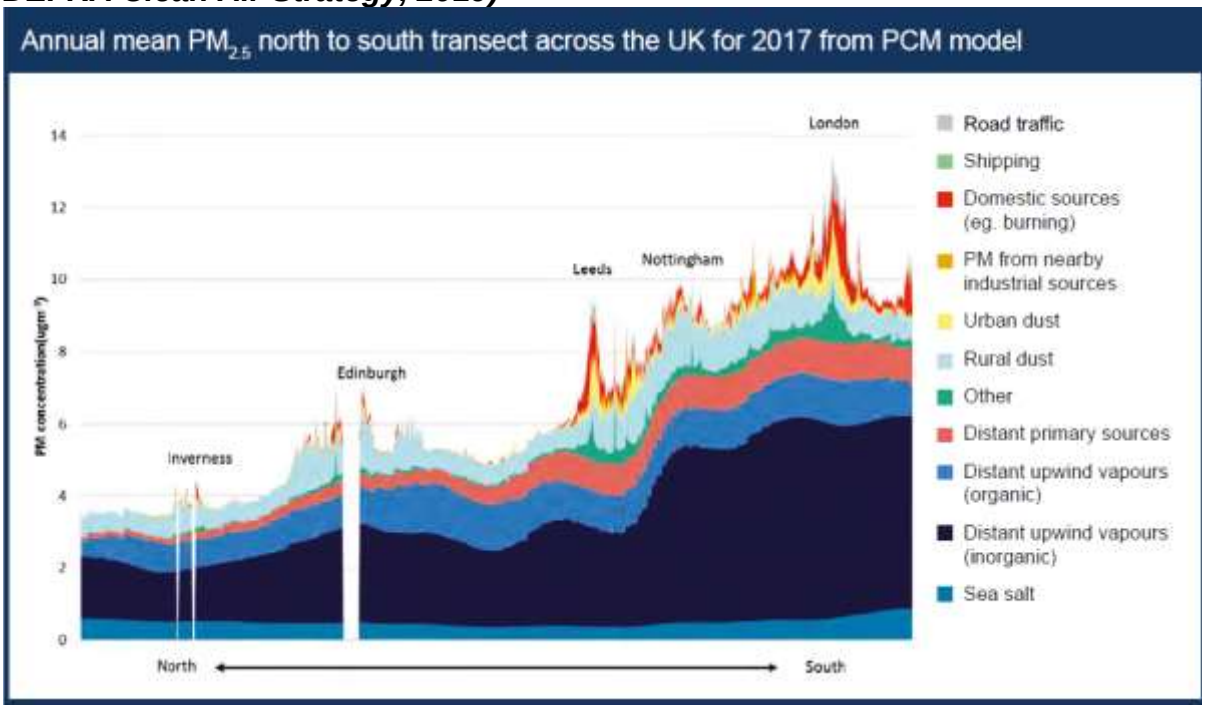
Particulate matter consists of a wide range of chemical compounds and materials from natural sources such as pollen, sea spray and desert dust; and human made sources such as from fires, engine vehicle exhausts (particularly diesel engines) soot from vehicle exhausts, dust from tyres and brakes, as well as emissions from industry. It is also formed by reactions between other pollutants and in the air e.g. ammonia from agriculture.

In the UK 38% comes from burning wood and coal in domestic open fires and stoves, 16% from industrial combustion, 12% from road transport and 13% from solvents and industrial processes, with the remainder comprising mainly 'secondary' particles. Natural and human made particulate matter can travel long distances such as from other parts of the UK and Europe [4]

Monitoring and modelling indicates there are locations in Nottingham City and Nottinghamshire where concentrations of small particulate matter^3 ($PM_{2.5}$) exceed, or potentially exceed, the WHO annual mean guideline of 10 ug/m^3 [20]. On the ground these levels are particularly clustered around urban and residential areas due to the role of domestic and industrial burning. Also around the main road networks across the county, particularly where roads are busy or congested.

As well as explicit local emissions from roads and households etc.; it should be recognised that pollution is brought into the local area by the wind from further away. This background pollution is from a variety of sources as shown in figure 4 and combines with local sources in areas with a pollution challenge [4]. This shows the important role that national policy and actions or inaction of other local authorities and agencies can influence our local air quality. It is therefore vital that there is multi-agency strategic response across Nottinghamshire.

Figure 6 Background sources of PM2.5 particulate matter pollution (Source: DEFRA Clean Air Strategy, 2019)



Other pollutants

Other pollutants such as ammonia and sulphur dioxide are also of concern in terms of their impact on the environment and human health. The main source of sulphur dioxide is the combustion of fuels containing sulphur e.g. oil and coal. There is already national regulation to control and minimise its emission. Ammonia is more problematic as it is generated by a wide range of essential agricultural activity and is a precursor to the formation of secondary particle formation, and can be significant contributor to overall particle concentrations.

Health impact and cost of air pollution

It is known that harm to human health can occur at very low levels of pollution, and that there is currently no known safe level of exposure below which there is no risk of health effects [1]. Air pollution is associated with a number of short and long-term adverse health impacts which can contribute to reduced life expectancy (see Figure 7).

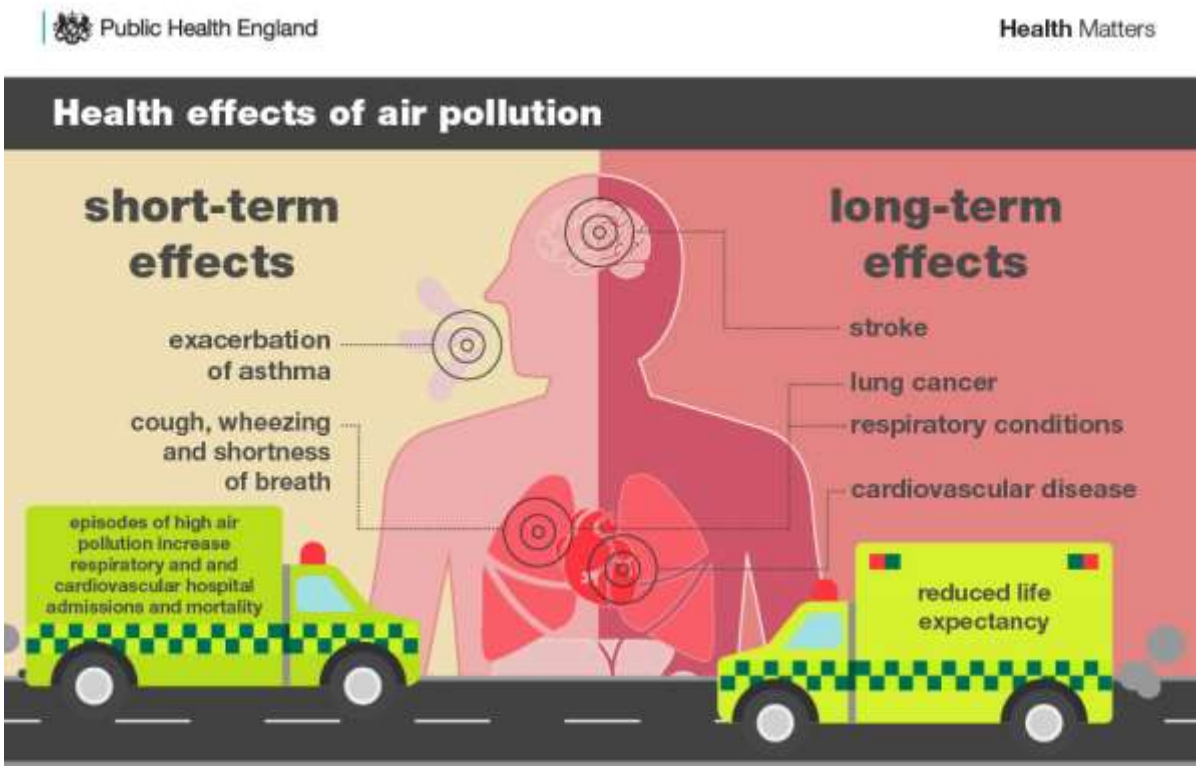
It can negatively affect the development of babies during pregnancy and normal lung function growth of children and contributes towards asthma and other breathing and lung conditions. It is recognized as a contributing factor in the onset of cardiovascular disease and lung cancer, and there is growing evidence for its associations with dementia, low birthweight and type 2 diabetes [1].

Fine ($PM_{2.5}$) and ultrafine ($PM_{0.1}$)[3] particulates can cause these problems because they are so small that they can be drawn into the lungs and can pass into the bloodstream. Once there it is transport around the body and can be deposited in body issues and interfere and affect the body's metabolic processes. As particulate matter is made up of a range of different chemical compounds and materials it can affect the body's processes in different ways.

Every year, it is estimated that long term exposure to man-made air pollution in the UK has an annual effect equivalent to 28,000 to 36,000 deaths [21].

[3] $PM_{0.1}$; particles that are less than 0.1 µm in diameter

Figure 7 Health effects of air pollution (source: Public Health England a, 2018)



Air pollution can be harmful to all people, but some people are more affected because they live in more polluted areas or are more susceptible to the harmful effects of air pollution. Groups that are more vulnerable include children and older people, pregnant women, and those with heart and lung conditions. People living in the most deprived, particularly urban areas of England have significantly higher air pollution levels (PM_{10} and NO_2) than those living in least deprived neighbourhoods [16]. People that are from these groups and live in more polluted places such as near busy roads are particularly affected.

The care and treatment costs associated with these diseases place a significant burden on national and local health and care systems. The total NHS and social care cost due to $PM_{2.5}$ and NO_2 combined in 2017 was estimated to be £42.88 million, increasing to £157 million when diseases are included where there is currently less robust or emerging evidence for an association. Between 2017 and 2025, the total cost to the NHS and social care of air pollution for where there is more robust evidence for an association, is estimated to be £1.60 billion for $PM_{2.5}$ and NO_2 combined increasing to £5.56 billion when other diseases for which there is currently less robust evidence for an association are included [22]. The broader costs to the UK economy of death and disability associated with air pollution are estimated to be £20 billion per year [23].

In addition to care and treatment costs, air pollution impacts on productivity in people of working age. It has been estimated using 2012 pollution levels that poor air quality cost the economy £2.7 billion though its impact on productivity [24].

Air quality guidelines, objectives & management

There are international guidelines for a range of air pollutants including particulate matter and nitrogen dioxide set by the World Health Organization (WHO) which are based on scientific evidence [25]. In the UK there are air quality objectives which have been in line with EU air quality limits (Table 3). The 2019 UK Clean Air Strategy set an ambition to meet the WHO annual mean limit guideline for particulate matter of 10 µg/m^3. The Secretary of State for Environment, Food and Rural Affairs has responsibility for meeting the limit values in England and the Department for Environment, Food and Rural Affairs (Defra) co-ordinates assessment and air quality plans for the UK as a whole.

It is the responsibility of local authorities to monitor and review air quality in their areas as part of the current Local Air Quality Management framework (LAQM). This is led by local environmental health teams in the District, Borough and the City Councils. If local air quality assessments identify a location where the UK objectives are not likely to be achieved, it must declare an Air Quality Management Area (AQMA) which is managed through a plan. (For more information on the LAQM see Appendix 2).

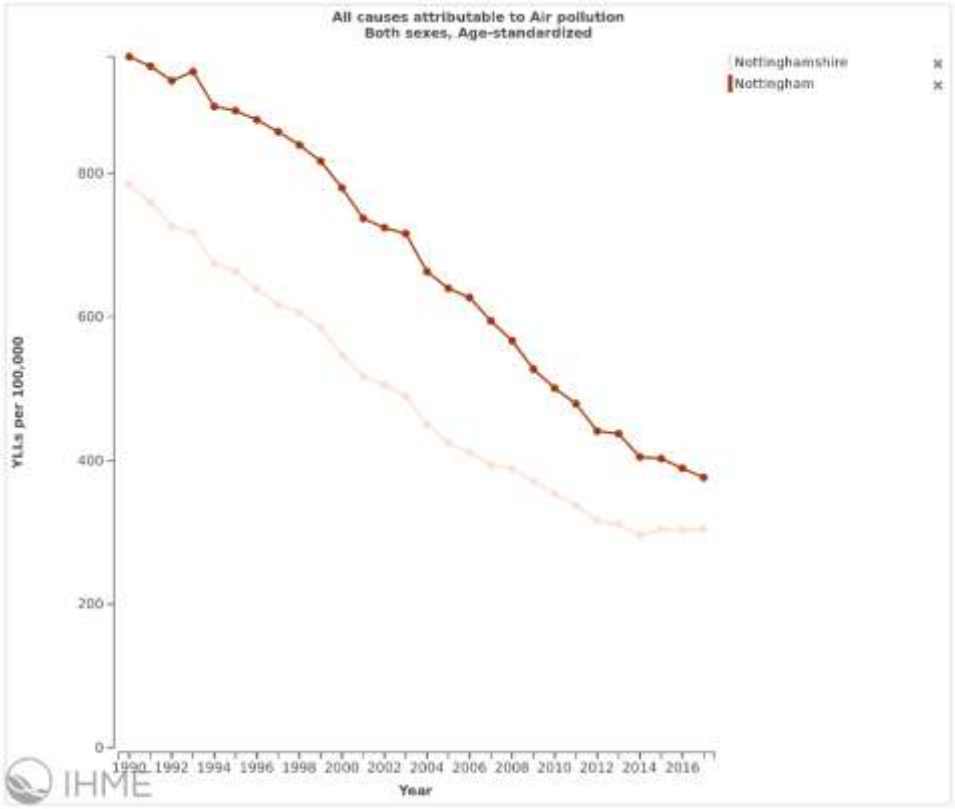
Table 3 UK Air Quality Objectives for Particulate matter and Nitrogen Dioxide

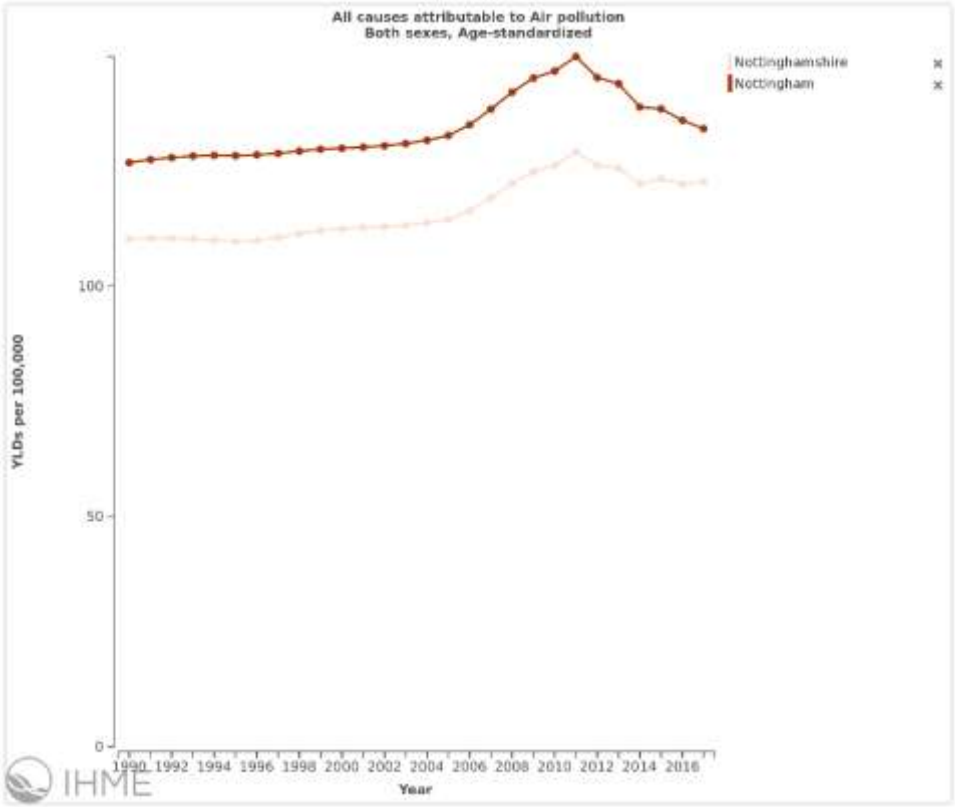
Pollutant	Region	Objective/ European Obligation
Course Particulate matter (PM_{10})	World Health Organisation Guideline	24 hour mean - 50 µg/m3 Annual mean – 25 µg/m3
	UK Objective/ EU Directive Limit	24 hour mean - 50 µg/m3 Annual mean – 40 µg/m3
Fine Particulate matter ($PM_{2.5}$)	World Health Organisation Guideline	24 hour mean – 25 µg/m^3 Annual mean – 10 µg/m^3
	UK Objective/ EU Directive Limit	Annual mean - 25 µg/m^3
	UK Clean Air Strategy 2019	Annual mean - 10 µg/m^3
Nitrogen dioxide	World Health Organisation Guideline	1 hour mean - 200 µg/m^3 Annual mean - 40 µg/m^3
	UK Objective/ EU Directive Limit	1 hour mean - 200 µg/m^3 Annual mean - 40 µg/m^3

Appendix 2

Appendix 2 - Modelled trend in Years of Life lost and Years lived with disability in Nottingham & Nottinghamshire

(source: Global burden of Disease)





Appendix 3

Appendix 3 - Modelled reductions in morbidity, mortality and health and care costs from reducing population exposure from higher to lower levels of pollution

Table 4 Estimated reduction in mortality and morbidity in Nottingham & Nottinghamshire over 10 years if residents exposed to high levels (≥12.3 µg/m^3) of particulate matter ($PM_{2.5}$) in 2017 were exposed to lower levels (<12.3 µg/m^3)$^{\Sigma}$ over the next decade (Source: Local analysis using PHE 2018 air pollution healthcare costs tool)

Local authority	Adults (aged 19 or older)						Children (age 18 or younger)	
	Coronary heart disease [α]	COPD	Stroke	Diabetes	Lung cancer	Deaths[β]	Asthma	Diabetes
Ashfield	367	211	94	374	9	115	112	4
Bassetlaw	406	222	100	437	10	125	97	4
Broxtowe	480	264	124	485	13	151	122	3
Gedling	475	260	129	433	12	144	132	4
Mansfield	309	164	82	316	7	97	78	2
Newark and Sherwood	444	246	126	401	11	123	103	3
Rushcliffe	419	228	112	426	10	113	116	3
Nottinghamshire	**2,900**	**1,595**	**768**	**2,871**	**72**	**868**	**759**	**22**
Nottingham	**1,796**	**1,049**	**480**	**1,938**	**47**	**546**	**433**	**11**

[α] For diseases, the numbers represent how many fewer residents would have the disease in 2027 if all residents lived in low PM2.5 pollution areas - as opposed to the situation in 2017.
[B] The number of deaths is the average, annual number of deaths avoided between 2017 and 2027 if all residents lived in low PM2.5 pollution areas - as opposed to the situation in 2017.
[Σ] High and low levels are set by the model.

Table 5 Costs avoided in $PM_{2.5}$ scenario- 2017 alone

Local Authority	2027 costs avoided
Ashfield	£ 1,817,085
Bassetlaw	£ 1,966,194
Broxtowe	£ 2,288,375
Gedling	£ 2,241,058
Mansfield	£ 1,477,093
Newark and Sherwood	£ 2,111,683
Rushcliffe	£ 2,043,450
Nottinghamshire	**£ 13,944,938**
Nottingham	**£ 8,850,224**

Table 6 Cumulative costs avoided in $PM_{2.5}$ scenario- total over all years, 2017 to 2027

Local Authority	Cumulative costs avoided, 2017- 2027
Ashfield	£ 11,359,017
Bassetlaw	£ 12,028,504
Broxtowe	£ 13,986,104
Gedling	£ 13,949,322
Mansfield	£ 9,249,141
Newark and Sherwood	£ 12,299,652
Rushcliffe	£ 12,743,424
Nottinghamshire	**£ 85,615,165**
Nottingham	**£ 54,638,311**

Table 7 Estimated reduction in mortality[β] and morbidity in Nottingham & Nottinghamshire over 10 years if residents exposed to high levels (≥20.5 µg/m³)[Σ] of nitrogen dioxide (NO_2) in 2017 were exposed to lower levels (<20.5 µg/m³)[Σ] over the next decade (Source: Local analysis using PHE 2018 air pollution healthcare costs tool)

Local authority	Adults (age 19 or older)		Children (aged 18 or younger)	
	Diabetes[α]	Lung cancer	Asthma	Diabetes
Ashfield	158	2	19	
Bassetlaw	114	0	0	
Broxtowe	201	2	15	
Gedling	221	2	0	
Mansfield	137	3	16	
Newark and Sherwood	51	1	17	
Rushcliffe	115	1	16	
Nottinghamshire	**998**	**11**	**83**	**7**
Nottingham	**1168**	**12**	**55**	**6**

[α] The numbers represent how many fewer residents would have the disease in 2027 if all residents lived in low NO_2 pollution areas - as opposed to the situation in 2017.

[B] The modelling suggested no quantifiable effect on deaths or other disease groups cause by NO_2 pollution

[Σ] High and low levels are set by the model.

Table 8 Costs avoided in NO_2 scenario- 2017 alone

Local Authority	2027 costs avoided
Ashfield	£265,245
Bassetlaw	£182,338
Broxtowe	£327,405
Gedling	£ 376,529
Mansfield	£226,568
Newark and Sherwood	£88,828
Rushcliffe	£193,351
Nottinghamshire	**£1,660,264**
Nottingham	**£1,983,298**

Table 9 Cumulative costs avoided in NO_2 scenario- total over all years, 2017 to 2027

Local Authority	Cumulative costs avoided, 2017- 2027
Ashfield	£1,619,635
Bassetlaw	£739,368
Broxtowe	£1,914,146
Gedling	£ 1,787,357
Mansfield	£1,350,475
Newark and Sherwood	£470,483
Rushcliffe	£1,154,999
Nottinghamshire	**£ 9,036,464**
Nottingham	**£11,160,602**

Appendix 4

Appendix 4 - Most deprived electoral wards in Nottingham and Nottingham with estimated higher levels of Pollution

Research by Fecht et al published in 2015 found that the most deprived fifth of areas[4] in the East Midlands had significantly higher mean PM_{10} and NO_2 air pollution concentrations ($\mu g/m^3$) than the most affluent fifth. These are the wards in Nottingham and Nottingham that contain areas which fall within this definition.

Ward Name	Local Authority
Abbey Hill, Carsic, Central & New Cross, Hucknall North, Hucknall South, Hucknall West, Huthwaite & Brierley, Leamington, Skegby, Stanton Hill & Teversal, Summit	Ashfield
Carlton, East Retford East, East Retford North, Harworth, Worksop East, Worksop North East, Worksop North West	Bassetlaw
Chilwell West, Eastwood Hilltop, Eastwood St Mary's, Stapleford North	Broxtowe
Bestwood St Albans, Calverton, Cavendish, Coppice, Ernehale, Netherfield	Gedling
Brick Kiln, Broomhill, Bull Farm and Pleasley Hill, Carr Bank, Ladybrook, Market Warsop, Newgate, Oak Tree, Penniment, Portland, Racecourse, Ransom Wood, Warsop Carrs, Woodhouse, Woodlands, Yeoman Hill	Mansfield
Castle, Devon, Edwinstowe & Clipstone, Ollerton, Rainworth South & Blidworth	Newark and Sherwood
Aspley, Basford, Berridge, Bestwood, Bilborough, Bridge, Bulwell, Bulwell Forest, Clifton North, Clifton South, Dales, Leen Valley, Mapperley, Radford and Park, Sherwood, St Ann's, Wollaton East and Lenton Abbey, Wollaton West	Nottingham

[4] For the deprivation the research used LSOA level income domain from the Index of Multiple Deprivation 2004 as the area-level socioeconomic indicator". The wards listed in the table have one or more LSOA in the top 2 deciles of scores for this domain in the East Midlands.

Appendix 5

Appendix 5 - Local Air Quality Management Process

Since December 1997 each local authority with responsibility for environmental protection in the UK has had a duty to carry out a review and assessment of air quality within their area. This process involves measuring several key air pollutants and trying to predict if they will change in the next few years.

The aim of this process is to ensure that the national air quality objectives are achieved throughout the UK and by doing so protect of people's health and the environment.

If a local authority determines that the objectives are not likely to be achieved, it must declare an Air Quality Management Area (AQMA).

The decision to declare an AQMA considers:

- the exposure of human populations and/or ecosystems to pollutants through measurement and modelling
- the relative contributions to these exposures from source sectors
- the impact that air pollution will have on human health and the environment

Throughout the UK many local authorities have declared AQMAs, however, many more have not found this necessary. In local authority areas with lower levels of road transportation, industrial emissions and domestic heating emissions and the objective pollutant concentrations have not been breached the local authority need not declare an AQMA. In these local authority areas, the work to monitor and review air quality, as well as improve it, continues. In all areas intervention and monitoring is intended to ensure the air quality levels either remain below the objective values or improve. If the pollutant concentrations start to rise for any reason, then the local authority has a duty to reconsider its position and give proper consideration to the declaration of an AQMA.

Local authorities ensure that air quality remains safe by engaging with local industry; regulating potentially polluting industries; ensuring air quality is a material consideration through the planning process; and by encouraging active travel options, which include walking, cycling and the use of low emission vehicles amongst others.

As there are different air quality issues in Nottingham City and each Nottinghamshire District and Borough, below you will find a link to each council website where you can search for air quality assessments and related plans and policies to reduce air pollution.

Ashfield District Council

Bassetlaw District Council

Broxtowe Borough Council

Gedling Borough Council

Mansfield District Council

Newark and Sherwood District Council

Nottingham City Council

Rushcliffe Borough Council

Appendix 6

Appendix 6 - How to get involved

Residents and businesses living or working in Nottinghamshire can improve the air quality in the area by taking simple measures. One of the most effective changes that can be made is to use more sustainable forms of transport and reduce dependency on the private car.

Below are some of the actions that we could all take.

- Use Public Transport – To use all means of public transport whenever possible e.g. buses, trams and trains. You can find your best journey options at:

  - Rail journeys can be arranged via National Rail Enquires
  - Bus and rail journeys can be also be planned via Traveline
    The Nottingham Tram timetable can be accessed via Nottingham Express Transport.

- Within Nottinghamshire, further information to help people and businesses with journey planning and advice can be found at Nottinghamshire Travel Choice and within the Nottingham conurbation further information can be found at the Big Wheel.

- Use Park and Ride – There are a number of Park and Ride sites within Nottinghamshire, which serve the tram and bus services.

- Reduce the use of your car – Car sharing schemes – The County and City councils fund a car share scheme. The website helps people find others who are undertaking similar journeys so that they can car share. Businesses are also able to produce their own car share database including through the Nottinghamshire website.

- Go electric – The County and City Councils are currently developing a local network of electric vehicle charging infrastructure. Grants are also available to businesses in Nottinghamshire (including the City) for vehicle charging infrastructure. The GoUltra Low website has more information.

- Make sure your car is as efficient as possible by having regular maintenance checks on your vehicle and ensuring that the tyres are properly inflated and aligned. The way you drive your car also has an impact on fuel efficiency and emissions, driving tips to reduce fuel consumption can be at the Energy Savings Trust.

- Cycle more – Use the extensive cycle routes that are available throughout the Nottinghamshire and Nottingham City. The national cycling charity Sustrans also provides cycling information.

- Walk more - Walk short distances rather than drive, this also has the benefit of improving your health. Walking information for Nottinghamshire County and Nottingham City.

- Forget the garden bonfire – do not have bonfires at all. Compost all garden waste and recycle rubbish rather than burn it. Many councils offer a waste collection services (some free of charge).

- Burn smokeless fuel – Large parts of Nottinghamshire are 'smoke control areas', therefore you cannot emit smoke from a chimney unless you are burning an authorised fuel or using an exempt appliance. Further information on suitable fuels and exempt appliances. Appliances should be kept in good working order to ensure that they are working efficiently and it is advised that you contact your local council to determine whether or not you are in a smoke control area.

- Maintain boilers - Ensure that boilers are serviced regularly and kept in good working order. If a boiler needs replacing then purchase one that has a low NOx emission rating. Make your house more energy efficient so that you need to use your boiler less to heat your home.

Further information on garden bonfires, smokeless fuel and boilers is available from your local district, borough, or the city council.

Reducing emissions

Business success depends on many things; including the cost of energy to heat and light buildings and power ICT, manufacturing of goods and provision of services, haulage/fuel to transport and the distribution of goods and services. The health and wellbeing of staff is arguably a business's most valuable asset.

To remain competitive it is vitally important to minimise costs and maximise productivity. To run and grow a successful business at economically challenging times isn't simply a case of cutting back, it's about efficiency and productivity; using less energy to heat and light buildings; power processes; getting more miles per pound; minimising the depreciation costs of assets; and promoting health and well-being in the work force to maximise productivity and minimise absence.

Air pollution affects both workers' own health and that of their family, and time off work from illness or caring for family can have a major impact on productivity, business resilience and the ability to respond to opportunities and risks [24].

Therefore, considering the air pollution impact of your business activities and investing in technology that reduces energy/fuel use and increases efficiency and productivity is obviously good for your business.

Making a business case for sustainability

‘Mounting evidence shows that sustainable companies deliver significant positive financial performance, and investors are beginning to value them more highly.’ [26]

A good example of a business’s approach to sustainability, and the benefits it brings, can be found at the Energy Savings Trust webpages on Corporate and Social Responsibility and more generally how the Energy Savings Trust could help your business.

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