www.oxford.gov.uk

OXFORD CITY COUNCIL

DRAFT FOR CONSULTATION

Oxford City Council

DRAFT Air Quality Action Plan 2021-2025

In fulfilment of Part IV of the
Environment Act 1995
Local Air Quality Management

September 2020

Foreword

We all have a right to breathe clean air. However, harmful levels of air pollution are harming people's health, damaging our quality of life and cutting lives short. The poorer and more disadvantaged people in our country are disproportionately affected, facing shortened lives and lifelong health problems. Air pollution is, at its heart, a social justice issue.

With our measures we have reduced the main pollutant of concern by 26% over the last seven years. We need to go further and faster to clean air.

Oxford City Council is setting a new Air Quality Action Plan (AQAP) which, for the first time, sets a target for the reduction of air pollution. We believe that it is the first time any UK local authority has set a city-wide air pollution reduction target through its AQAP. By setting a strict target through the preparation of our AQAP (that is, by discharging our statutory duty) we make the case for clean air, public health, and social justice.

37 of Britain's 43 air quality zones are exceeding the legal limits for the main harmful pollutant of concern. Our action plan moves Oxford beyond the focus upon achieving local compliance, which is an issue for so many action plans for many authorities. We are choosing to set a target which is significantly stricter than the legal target.

We have been calling on Government to meet their legal responsibilities and, instead of simply highlighting problems, we have proposed ten solutions in the development of Oxford's Charter for Cleaner Air—the first formal cooperation of its kind between a local authority and Greenpeace UK and Friends of the Earth. We have called on the Government to tighten the legal target; now we are setting our own tighter target.

By 2025 Oxford will have met legal compliance in the four air pollution hotspots that remain today. We will have achieved legal levels across the whole city and met our nitrogen oxide target of "30 by 25".

The founding document of the modern social security state made suggestions aimed at eradicating the five "giant evils". One evil identified by the report was "disease", yet today air pollution blights our neighbourhoods just as it did when Clement Attlee's government enacted the recommendations of Sir William Beveridge. We need to bring air pollution to the lowest and safest possible levels and that means even bigger interventions from the level of government nearest to our communities.

Cllr Tom Hayes

Deputy Leader and Cabinet Member for Green Transport and Zero Carbon Oxford

Executive Summary

This Air Quality Action Plan (AQAP) has been produced as part of our statutory duties required by the Local Air Quality Management framework. It outlines the actions we will take to improve air quality in Oxford City from 2021 to 2025. It also fits within and furthers our wider ambitions to improve air quality, health, and climate.

The key objective of this AQAP is to bring NO_2 emissions into legal compliance as soon as possible. However, we also want to reach beyond legal compliance for the whole city. Oxford City Council is committing to becoming the first UK Local Authority to set a local annual mean NO_2 target in a city-wide AQAP. The overall objective of this AQAP for the whole of the Oxford City area is to:

Achieve a local annual mean NO_2 target of 30 µg/m^3 by 2025

"30 by 25"

The legal annual mean limit value for NO_2 is 40 ug/m^3. Research now shows that this legal limit is not a safe limit. Several health studies show that harmful effects of air pollution are seen at levels below air quality legal standards that were previously considered to be safe. We take the health of our residents and visitors very seriously and the decision to set a new low target for NO_2 is evidence of our commitment to improve health outcomes for all.

According to the Committee on the Medical Effects of Air Pollutants (COMEAP), a 1 µg/m^3 reduction in NO_2, could lead to about 420,000 to 903,000 life years saved in the UK over the next 106 years, associated with an increase in life expectancy (at birth) of around 2 to 5 days. It is therefore expected that a 10 ug/m^3 reduction in NO_2 will lead to a significant improvement in the health outcomes for Oxford residents.

We want to achieve the lowest possible air pollution levels which means Oxford City Council will go beyond the legal limit. This commitment is consistent with Oxford's record of leading by example and the ambition of implementing innovations aimed at reducing air pollution levels in the city[i].

The 30ug/m^3 target is determined by our analysis of several air quality modelling projections. It is intended to be stretching but within the boundaries of possibility. Without the delivery of key schemes such as the Oxford Zero Emission Zone and Connecting Oxford, we are unlikely to meet the local target. While the City Council is setting this target for the whole city, in no way can we achieve it on our own. In order

i Oxford was the first city in the UK to implement Park & Ride schemes (1973), the first city in the UK (outside London) to implement a Low Emission Zone (LEZ) for buses (2014), and the first city in the UK to develop plans to implement a Zero Emission Zone (2017).

to be able to meet this target, we propose a set of 30 actions and measures to be delivered with our partners and which sit within four priority areas of intervention:

1) Developing partnerships and public education;
2) Support for the uptake of low and zero emission vehicles;
3) Reducing emissions from domestic heating, industry and services
4) Reduce the need to travel, explore opportunities for mode shift and increase the uptake of sustainable transport

A list of the 30 actions is available in Table 5. Oxford City Council's main priorities for the period 2021-2025 are focused on the delivery of two major schemes which have been developed to tackle road traffic emissions and the dominance of the car on our roads: Oxford's Zero Emission Zone (ZEZ) and Connecting Oxford. The new AQAP will principally seek to build upon these proposals and identify new measures to complement and link them together. It is felt that by supporting and building on ambitious proposals, tangible improvements in air quality can be achieved more quickly and at greater scale. The ZEZ and Connecting Oxford are being delivered in partnership with Oxfordshire County Council.

Emissions are about more than nitrogen oxides (NOx), and we are also concerned about particulate matter (PM). While the city of Oxford is exceeding legal limits for NO_2 it is currently fully compliant with legal limits, as well as WHO advisory limits for PM_{10} and $PM_{2.5}$. Historical analysis of our air quality data shows that we have seen an overall decline in air pollution, with a reduction of 26% in NO_2, 31% in Particulate Matter (PM_{10}) and 36% in Particulate Matter ($PM_{2.5}$) at sites where air quality monitoring has been in place since 2013. However, new and emerging studies are indicating that there is no safe level for air pollution. Critically, there is now clear evidence that particulate matter has an impact on human health, including premature mortality, allergic reactions, and cardiovascular diseases. Oxford City Council considers that actions outlined in this AQAP will contribute to reducing levels of particulate matter.

The case for clean air

This is the right moment to set out a new action plan. We have an opportunity to achieve cleaner air as we recover from the COVID-19 crisis. Action on air pollution has never been more important because, in addition to the annual burden of disease and deaths caused by air pollution, it looks to be making us more vulnerable to COVID-19.

Long-term exposure to air pollution is associated with increased morbidity and chronic diseases, some of which have been identified as increasing the risk of severe COVID-19 symptoms. Given this, it would not be surprising if there was a link between exposure to air pollution and the occurrence or severity of COVID-19

infection, but currently there is no clear evidence[ii] on this or on the magnitude of any effect.

Air pollution also strongly impacts global economy. Recent research[iii] clearly shows that cleaner air could annually boost the economy by £1.6 billion. Cleaner air would save 17,000 premature deaths and prevent the loss of 3 million working days for businesses, with workers currently becoming ill or having to take time off to care for sick children as a result of air pollution.

Air pollution particularly affects the most vulnerable: children and older people, and those with heart and lung conditions. Over 40,000 people die prematurely each year as a result of poor air quality in the UK. Air quality has significant impacts on health and is liked to several serious health conditions such as cancer, strokes and heart disease. The impact of early exposure to poor air quality has lifetime effects, such as high rates of obesity, asthma and low lung function. Air pollution harms our health, our economy and our quality of life.

There is an increased salience as people have realised that clean air is possible and want it to stay. During the COVID-19 lockdown, levels of NO_2 air pollution dropped by 20-30% across the UK[ii] – primarily from a significant reduction in private car use. During the first couple of months of the lockdown, Oxford saw significant reductions of air pollution in the city; up to a 60%[iv] reduction in Nitrogen Dioxide (NO_2), with levels at the lowest ever recorded in the city since monitoring began. People have noticed and appreciated the cleaner air and safer streets.

A recent survey of Oxford residents showed clear support for action to reduce motorised traffic in order to make the city more cycle and walking friendly. During lockdown millions of people have changed their routines in ways that reduced air pollution by working from home, and walking and cycling more, and many are willing to continue to do so. It is easier to maintain a habit than foster a new one, so we want to build on this unique moment to create lasting change.

There is a positive shift in priorities nationally when it comes to our environment and air quality. Across the country we are seeing a reallocation of road space to more active modes of travel, more people walking and cycling, and harmful emissions from homes and industry being tackled through schemes to improve energy efficiency. We are experiencing a significant shift towards active travel, not least in response to the

---

ii The Air Quality Expert Group (AQEG) issued a rapid review in June 2020 on the estimation of changes in air pollution emissions, concentrations and exposure during the COVID-19 outbreak in the UK. The document acknowledges that there is some evidence to suggest that nitrogen dioxide (NO_2), particulate matter (PM) and ozone (O_3) may increase susceptibility to respiratory infections or worsen disease prognosis, although it recognises that there are still insufficient studies or mixed evidence for specific combinations of endpoints, infection types, age groups or pollutants . Studies of the associations of COVID-19 disease with both past and contemporary air pollution exposure are also limited by an, as yet, incomplete understanding of the factors controlling the transmission and progression of the disease, and especially individual risk factors.

iii "Breathing Life into the UK economy" is a report from CBI Economics, commissioned by the Clean Air fund, which quantifies the economic benefit to the UK of meeting WHO Air Quality guidelines.
iv Ricardo Energy & Environment - Blog update on COVID-19 and changes in air pollution

impacts of the COVID19 pandemic which has seen more people than ever enjoying our streets with lower levels of motorised traffic – and hence air pollution.

It is expected that many of the measures in this action plan to improve local air quality will also contribute to the Council's plans to address the climate emergency that this Council formally recognised in January 2019.

The role of transport in Oxford's poor air quality

The city of Oxford, as with many urban areas throughout the United Kingdom, is subject to poor air quality, particularly in areas with high levels of road traffic. According to our latest Source Apportionment Study, the transport sector in Oxford continues to be by far the largest contributor (68%) to total NOx emissions, followed by Domestic Combustion (19%), Combustion from Industry and Services (12%) and Others: waste, agriculture, solvents, nature (<1%).

Nitrogen dioxide (NO_2) is the pollutant of most concern as we continue to experience levels above the legal limit in several areas of the city. Continuous exceedances mean that the entire city of Oxford has been a designated Air Quality Management Area (AQMA) since 2010.

An Air Quality Action Plan (AQAP) was adopted by the Council in 2013, with a set of measures targeted at improving air quality levels in the city between 2013 and 2020. Overall, with the delivery of the AQAP (2013-2020) there has been a decline of 26% in NO_2 levels in the City[v]. The majority of the reductions are the result of targeted changes in traffic emissions, such as the introduction of a Low Emission Zone for buses. Despite this success, Oxford City is still not compliant with the NO_2 annual mean limit value at all sites. At the time of writing, data from our most recent air quality monitoring campaign (2019) shows that we have exceedances of the NO_2 annual mean limit value at six of the 71 monitored locations in the city: St. Clements Street/The Plain, St Clements Street East, George Street, St Aldates, High Street and Long Wall Street.

In this AQAP we outline plans to effectively tackle air quality issues that are within our control. The AQAP recognises that the City Council can only achieve so much. We will continue to engage and work with a wide set of stakeholders, institutions, and citizens, so that everyone can play their part. The work the Council is doing is wide-ranging, and engagement with our communities and partners is key. Air pollution results from activities we all contribute to, it is a shared problem and therefore requires shared solutions.

The 30 actions proposed in this AQAP build on a number of successful and award winning programmes. This includes extending engagement programmes to raise awareness about air pollution in local schools that we have successfully partnered

v The complete list of air quality actions that have been delivered in the city to date and their impact on the reduction of air quality levels in the city, is available for review in our published Air Quality Annual Status Reports.

with Friends of the Earth to deliver. We also propose to promote active travel, as well as the electrification of the Oxford bus fleet, and the roll out of EV charging infrastructure. There are a number of air quality policy areas that sit outside of our direct influence (such as vehicle emissions standards). However, our evidence and experience are important, and so we will continue to work with central government and key partners to develop the best measures, powers, and funding needed to deliver clean air.

Table of Contents

List of Tables

List of Figures

Introduction

This action plan outlines the actions that Oxford City Council and its partners will deliver between 2021 and 2025 in order to reduce concentrations of air pollutants and exposure to air pollution; thereby positively impacting on the health and quality of the life of residents and visitors to the city of Oxford.

It has been developed in recognition of the legal requirement on the local authority to work towards Air Quality Strategy (AQS) objectives under Part IV of the Environment Act 1995 and relevant regulations made under that part and to meet the requirements of the Local Air Quality Management (LAQM) statutory process.

Our action plan moves beyond a focus upon achievement of legal compliance. Our plan seeks to achieve the lowest levels of air pollution possible over the next five years and sets an ambitious target to drive action as quickly and effectively as possible.

Transparency is key to the delivery of this AQAP. This document will be subject to an annual review. Progress each year will be reported in the Annual Status Reports (ASRs) produced by Oxford City Council as part of our statutory Local Air Quality Management duties.

The following sections set out the scale of the air quality problem in Oxford and its causes. They outline the priority areas that we consider to be crucial to be focusing on to reduce emissions and improve air quality in the city. This action plan contains a complete list of air quality actions and measures that we aim to deliver under each one of those priority areas, in order to achieve compliance with the local annual mean air quality target for NO_2 that we commit to in this AQAP.

National Context

Part IV of the Environment Act 1995 requires the Secretary of State to publish a national Air Quality Strategy and gave Local Authorities statutory duties to implement the system of Local Air Quality Management (LAQM), which commenced in 1997.

The 2008 Ambient Air Quality Directive (ED/2008/50/EC) sets legally binding limits for concentrations in outdoor air for major air pollutants that impact public health such as particulate matter (PM_{10} and $PM_{2.5}$) and nitrogen dioxide (NO_2), to be met before 2010. The limit values were established in 2008 and are now over 10 years old. Most UK cities failed to meet the objective by 2010 as required by the Directive.

A summary of the air quality objectives for pollutants of most concern: Nitrogen Dioxide (NO_2), and Particulate Matter (PM), are shown in Table 1 below:

Table 1 – Air Quality Objectives for NO_2 and PM in England

Pollutant	Air Quality Objective	
	Concentration	Measured as
NO_2	200 µg/m^3 not to be exceeded more than 18 times a year	1-hour mean
	40 µg/m^3	Annual mean
PM_{10}	50 µg/m^3, not to be exceeded more than 35 times a year	24-hour mean
	40 µg/m^3	Annual mean
$PM_{2.5}$[ii]	25 µg/m^3	Annual Mean

The LAQM process places an obligation on all local authorities to regularly review and assess air quality in their areas, and to determine whether the air quality objectives are likely to be achieved. Where an exceedance is considered likely the local authority must declare an Air Quality Management Area (AQMA) and prepare an Air Quality Action Plan (AQAP) setting out the measures it intends to put in place in pursuit of the objectives.

The UK currently has a total of 605 AQMAs that have been declared based on failure to meet the air quality objectives for NO_2. Air quality is a significant issue in the UK, with 37 of Britain's 43 air quality zones still exceeding legal limits for nitrogen dioxide, with London being the worst European capital for the pollutant.

In response to the UK leaving the EU, the UK Government introduced a new Environmental Bill to Parliament in October 2019. Along with the commitment to set targets on air quality for the UK, the new Bill also promises the creation of a new independent Office for Environmental Protection to scrutinise environmental policy and law, investigate complaints, and take enforcement action against public authorities, if necessary, to uphold current and future environmental standards.

Air Quality and Public Health

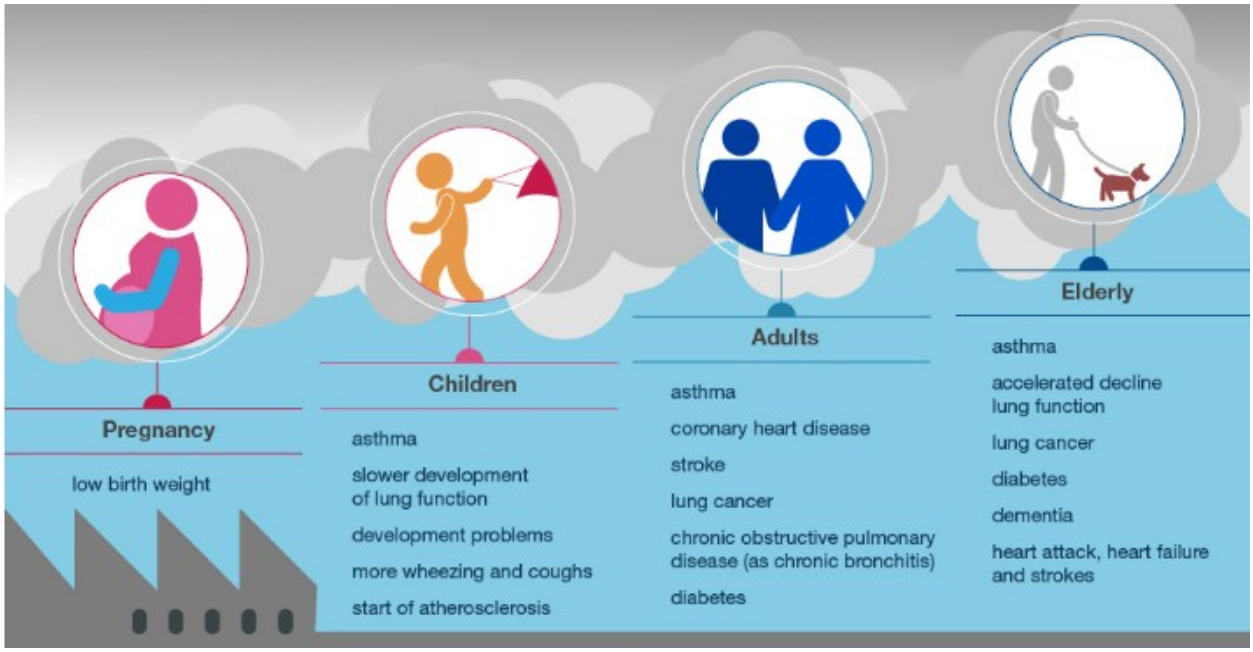
1.1 Health Impacts of air pollution

Air pollution can cause, complicate, or exacerbate many adverse health conditions. It usually manifests as respiratory or cardiac symptoms and can lead to chronic health issues. Recent studies show that poor air quality can affect every organ in the body[vi] and even cause damage to cognitive performance[vii]. Exposure to poor air quality is directly related to diseases such as cancer, asthma, stroke, heart disease, diabetes, obesity and dementia[viii].

According to the World Health Organisation (WHO), air pollution kills an estimated 8 million people worldwide every year, of which 4.2 million are attributed to exposure to outdoor air pollution and 3.8 million to indoor air pollution. Currently nine out of 10 people in the world breathe air containing health impacting levels of air pollutants.

Figure 1 shows how air pollution affects people throughout their lifetime.

Figure 1- Air pollution: Health impacts of throughout lifetime[ix]



Although air pollution affects people from all regions, ages, and social groups, it is likely to have greater impacts on those who experience heavy exposure and those who have greater susceptibility[x]. The most vulnerable are children, the elderly, or

vi Air Pollution and Non communicable Diseases (A Review by the Forum of International Respiratory Societies' Environmental Committee, Part 1: The Damaging Effects of Air Pollution).
vii The impact of exposure to air pollution on cognitive performance
viii Even low levels of air pollution linked with serious changes in the heart, according to new UK research
ix This figure forms part of the Guidance "Health Matters: air pollution", which was published by Public England on their website on 14th November 2018.
x Air Pollution linked with fetal brain development problems

those with pre-existing medical conditions. Harmful effects of air pollution are seen at levels below air quality standards previously considered to be safe.

We are now also seeing several research studies linking the severity of COVID19 to air pollution. Several of these studies suggest that air pollution worsens the health impacts of the virus, makes people more susceptible to COVID-19, and also contributes towards its transmission. This adds to the now mounting evidence of the negative impacts of air pollution on health.

The World Health Organisation (WHO) has set guideline[xi] values for key air pollutants based on evidence of their health impacts. The recommended WHO guideline values are significantly lower for PM_{10} and $PM_{2.5}$ than the current UK limit values. The WHO guideline values for NO_2 currently corresponds to the UK limit value of 40µg/m^3 (annual mean) and 200 µg/m^3 (hourly mean). However, both short and long-term studies have found adverse health impacts at concentrations that were at or below the current UK limit values. Some studies even suggest that there are in fact no 'safe' levels of air pollution, and that governments should therefore be aiming for the lowest possible air pollution levels. A revised version of the air pollution WHO Guidelines is expected to be published in 2020/2021.

Several studies are also showing a strong correlation between poor air quality and inequality issues. A 2019 research study, led by academics at the Air Quality Management Resource Centre (AQMRC) at the University of the West of England, Bristol, found that social inequalities in traffic-related pollution exposure are 'clearer and stronger' than ever before. The study, which updates a 2003 analysis of environmental justice in the UK, found that while young children, young adults, and households in poverty have the highest levels of exposure to air pollution, it is the richer households who are more responsible for it.

A Recent study from the Office for National Statistics (ONS)[xii] also shows a strong positive correlation between the proportion of population in the UK that falls into the Black, Asian and Minority Ethnicity (BAME) category and the exposure of NO_2 measured over a period of 10 years across several areas in England.

Nevertheless, and while nationally levels of air pollution are often highest in areas of deprivation, this same pattern is not seen in Oxford, mainly due to the majority of these areas being located away from high levels of traffic, such as estates. However there are high levels of air pollution on routes used by children and in areas with high levels of young people, such as the city centre which has a large student population. Despite the pattern of areas with high deprivation experiencing high levels of pollution is not seen in Oxford, this does not mean that air pollution does not impact

xi WHO sets recommended limits for health-harmful concentrations of key air pollutants both outdoors and inside buildings and homes, based on global synthesis of scientific evidence. WHO guidelines cover annual and daily concentrations of fine particulates, nitrogen dioxide, sulfur dioxide, carbon monoxide and ozone (WHO, 2005)

xii The ONS acknowledges air pollution is one of many factors that may be driving disproportionate outcomes for black, Asian and minority ethnic (BAME) people – Ethnicity is strongly correlated with pollution exposure in England, with ethnic minorities more likely to live in polluted areas.

those from minority backgrounds, the young, old and poor disproportionately in the city.

1.2 Health impacts at local level

There have been several studies produced over the years that have tried to estimate the true health impacts of air pollution in Oxford.

In April 2014, a report issued by Public Health England presented estimates of local mortality burdens associated with particulate air pollution. The report shows that long term exposure to anthropogenic particulate air pollution in Oxford could be responsible for 6% of all deaths of people aged 25 and over.

More recently, in November 2019, a scientific study conducted by Kings College London provided a series of statements about the potential risks to the public in Oxford and several other cities in the UK and Poland, from exposure to air pollutants.

Finally, in January 2020, a study from Centre for Cities showed that the estimated absolute number of attributable deaths caused by $PM_{2.5}$ alone in Oxford in 2017 was 55.

1.3 Economic Impacts of Air Pollution

Air pollution affects global economy in several ways: it costs human lives, it reduces people's ability to work, it affects vital products like food, it damages cultural and historical monuments, it reduces the ability of ecosystems to perform functions societies need and it costs money in remediation or restoration. This is of particular importance given the current situation caused by the coronavirus pandemic, which has shown the important link between human health and the health of our economy.

Businesses cannot exist without the work of a healthy workforce to produce the goods and services on which we all rely, nor can they exist without a vibrant consumer market to generate the demand to fuel their firm's income. With better air quality, businesses will benefit from a healthier workforce and more productive capital assets which in turn lead to a more prosperous economy with greater resilience to economic shocks.

In September 2020, CBI Economics, commissioned by the Clean Air fund, issued *"Breathing Life into the UK Economy"*, a report that quantifies the economic benefit to the UK of meeting WHO Air Quality guidelines. The report is believed to be the first analysis of the economic benefits of reducing pollution levels such as nitrogen dioxide (NO_2) and particulate matter ($PM_{2.5}$) to below current air pollution legal limit values.

Their research found that if the UK met the World Health Organization (WHO) guidelines for air pollution, the UK's economy would have an annual benefit of £1.6bn, via the reduction in premature deaths, sickness absence and lower

productivity at work. This would be on top of savings to NHS and social care budgets from treating fewer patients with health conditions associated with pollution.

The study also found that 17,000 premature deaths of people of working age can be saved each year and it identified those people to be dying nearly 12 years earlier than expected on average. Meeting WHO guidelines would also save the loss of 3 million working days per annum for, with workers currently becoming ill or having to take time off to care for sick children as a result of air pollution.

Air Quality in Oxford

2.1 Historical Background

The process of review and assessment of air quality in Oxford has been taking place since 1999. At the time, the air quality objectives for nitrogen dioxide, both annual mean and hourly mean were exceeded in areas dominated by traffic.

The City Council declared an Air Quality Management Area (AQMA) for NO_2 in central Oxford in 2003, which was expanded in 2005. In relation to this AQMA the Council produced and published its first AQAP in 2006 seeking to address pollution in central Oxford, by focussing on emissions from buses which were identified as the main source.

Despite good progress being made with the 2006 AQAP, significant breaches of the national objectives for NO_2 still existed and additional hotspots were identified. Therefore, following further detailed assessments of air quality, a city-wide AQMA was declared in September 2010. A new Air Quality Action Plan (AQAP) was adopted by the Council in 2013, with a new set of measures targeted at improving air quality levels in the city for the period 2013-2020.

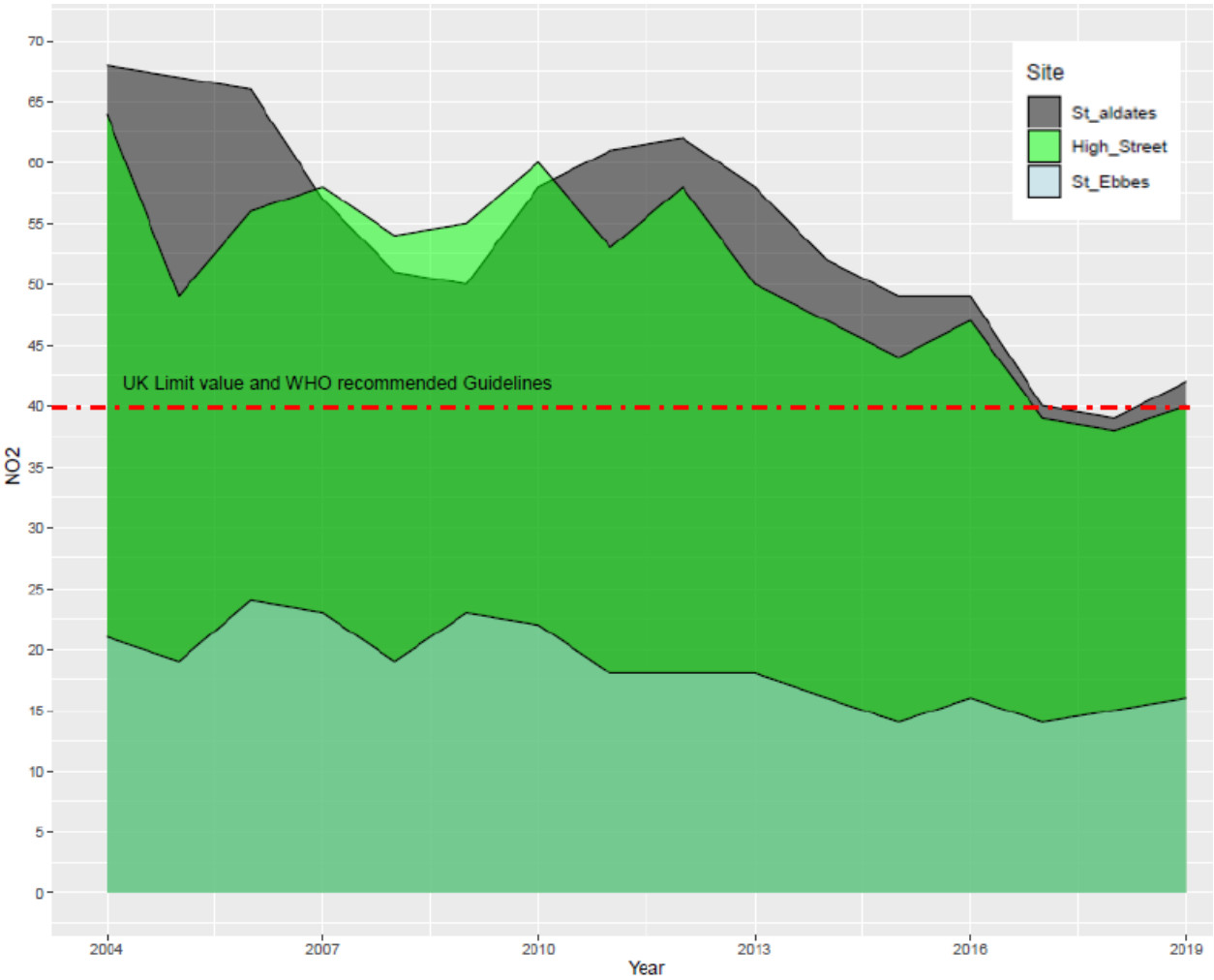
Historical analysis of air quality data (see Figure 2 below) shows that since that period, NO_2 levels have significantly improved in the city of Oxford. In 2003 we saw NO_2 of over 70 µg/m^3, while in 2019 levels were around 40 µg/m^3.

Since 2013, we have seen an overall decline of 26% in NO_2, 31% in Particulate Matter (PM_{10}) and 36% in Particulate Matter ($PM_{2.5}$) in the places where air quality is being monitored.

The majority of the reductions observed over the period are related to significant changes in traffic emissions. The introduction of a Low Emission Zone (LEZ) for buses in the city in 2014 and the retrofit of several buses to cleaner Euro VI engines (which achieve an estimated 99.5% reduction in NOx emissions compared to Euro V) have contributed to these improvements.

However, air quality monitoring results from the most recent years have shown that the rate of these reductions is now slowing down. In many cases, air quality levels seem to have plateaued in the city, suggesting that more robust action to tackle air quality in the city is now required.

Figure 2- Long term trends of Annual Mean NO_2 (µg/m^3) at Oxford's continuous monitoring stations, 2004-2019.



2.2 Current Air Quality Status

At the time of writing, data from our most recent air quality monitoring campaign (2019) shows that we still experience exceedances of the NO_2 annual mean limit value at six locations across in the city. Those locations are St. Clements Street/The Plain, St Clements Street East, George Street, St Aldates, High Street and Long Wall Street.

The 2019 monitoring results also showed positive result in that there are no exceedances of the UK limit values or the WHO recommended guidelines for particulate matter ($PM_{2.5}$ and PM_{10}) in Oxford, in all the locations where these pollutants are measured.

Air quality is monitored annually across the city. To see full details of where we monitor, why we monitor in those locations, and the latest data on air quality, you can visit our website. The current status of air quality levels in Oxford can be found in our latest official Annual Status Report which can be also downloaded from our website. All our current monitoring locations and the latest monitoring data can also be viewed using this interactive map.

Sources of Air Pollution in Oxford

The AQAP measures presented in this report are targeted towards the predominant sources of emissions within Oxford.

In December 2019 Oxford City Council commissioned Ricardo Energy & Environment to conduct a source apportionment study (SAS) to assess::

- the contribution of each activity sector to total emissions of NO_X, PM_{10} and $PM_{2.5}$ in Oxford;
- within the road transport sector, the contribution of each vehicle type to total road emissions of NO_X, $PM_{2.5}$ and PM_{10} in Oxford.

The complete source apportionment report was published by Oxford City Council on the 26th June 2020 and is available for review on Oxford City Council's website.

3.1 Emission sources by activity sector

The contribution of each activity sector to the total emissions of NO_X, PM_{10} and $PM_{2.5}$ in Oxford is shown on Figures 3 to 5 below.

Figure 3- Sources of total NO_X emissions in Oxford

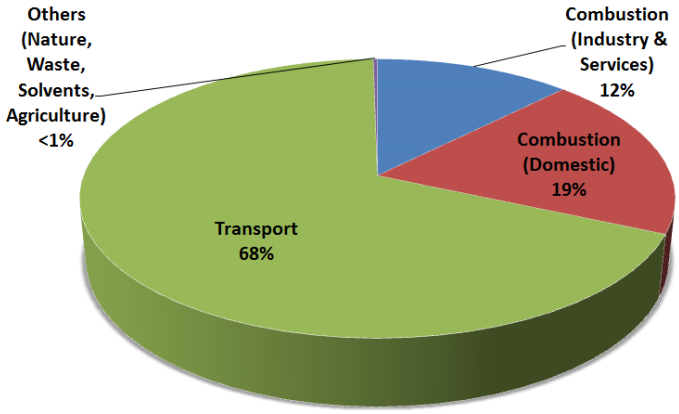


Figure 4- Sources of total PM_{10} emissions in Oxford

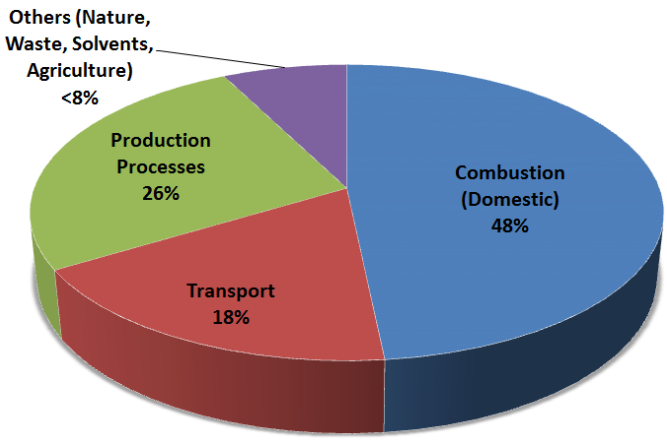
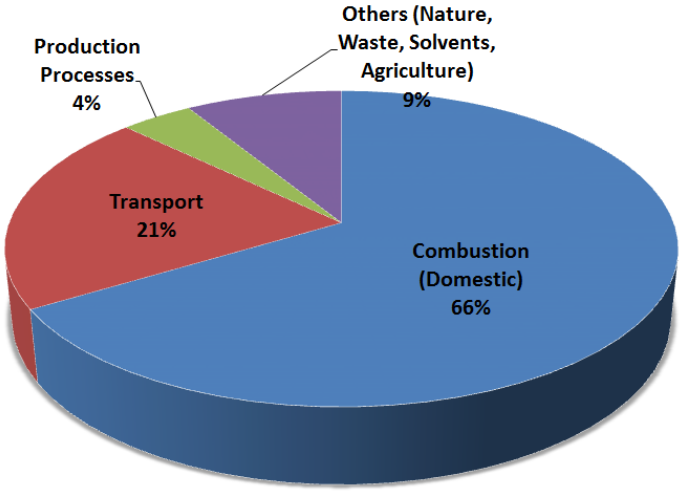


Figure 5- Sources of total $PM_{2.5}$ emissions in Oxford



Figures 3 to 5 show that in Oxford, transport comprises approximately 68% of the total emissions of NOx, in comparison to only around 18% of total PM_{10} and 21% of total $PM_{2.5}$ emissions. Domestic combustion, on the other hand, makes up just 19% of NOx emissions compared to 48% of PM_{10} emissions and 66% of $PM_{2.5}$ emissions.

3.1.1 Changes since 2013

The results of the new source apportionment study provide useful evidence demonstrating how different emission contribution sectors have changed over time.

Table 2 show a direct comparison between the two source apportionment studies that were conducted for NOx in 2013 and 2019.

Table 2 – Historic comparison of the contribution of each sector to total NOx emission in Oxford.

Activity Sectors	2013	2019	Comparison (2013 vs 2019)
Transport	75%	68%	-7%
Combustion (Domestic, Industry & Services)	25%	31%	+6%
Others (Agriculture, Solvents, Nature, Waste)	<1%	<1%	Unchanged

The results of this comparison show that the contribution of the transport sector to total NOx emissions have reduced by 7% since 2013, with the contribution from combustion sources associated with domestic combustion, industry and services increasing in the same proportion. This reduction in transport emissions is due to fleet upgrades, which are partly the result of local government interventions such as the introduction of a Low Emission Zone for buses in 2014. It was recognised that buses contributed a significant proportion of emissions and, through cooperation and

close working with bus services providers, the targeted action of local government contributed to a reduction of emissions.

Similar comparison was not possible for Particulate Matter (PM_{10} and $PM_{2.5}$), as the 2013 source apportionment study did not include Particulate Matter.

3.2 Vehicle fleet composition and emissions

The contribution of each vehicle type to the total road emissions[xiii] of NO_X, PM_{10} and $PM_{2.5}$ in Oxford is shown on Figures 6 to 8 below.

Figure 6- Total road NO_X emissions in Oxford, per vehicle type.

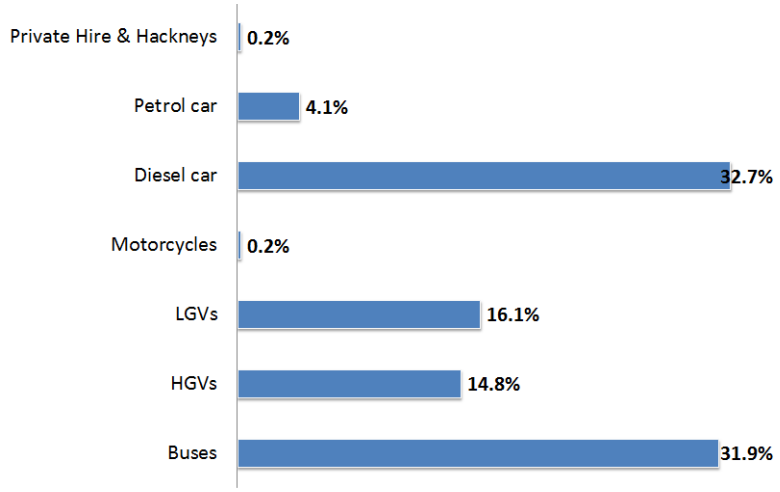
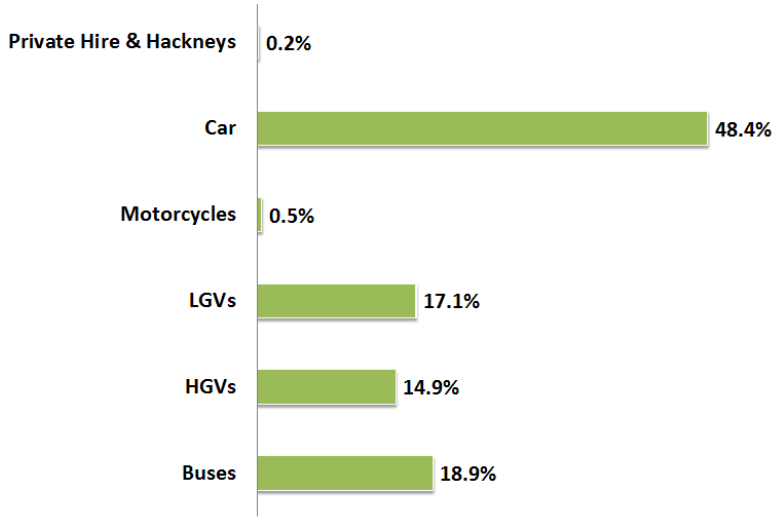
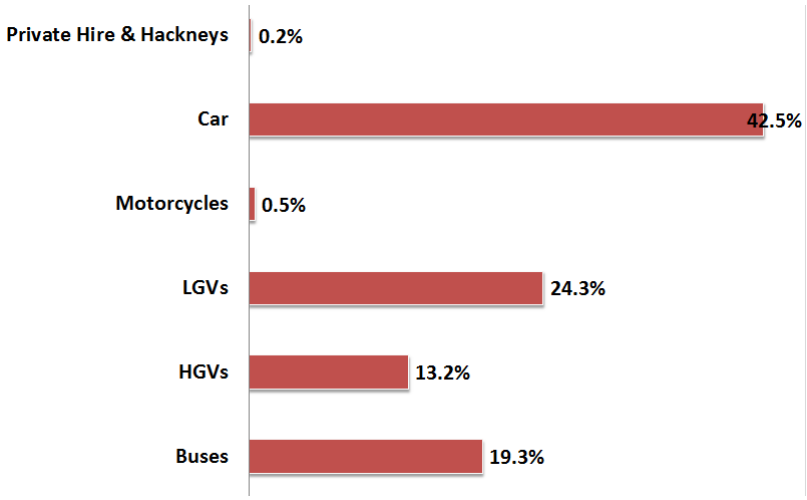


Figure 7- Total road PM_{10} emissions in Oxford, per vehicle type.



xiii the percentage of NOx, PM_{10} and $PM_{2.5}$ emissions for Hackney carriages and Private Hire was calculated on the basis of the information that was available for review. Not all the road links used in the air quality model had information related with Private Hires and Hackneys. This is an indication that the contribution of these vehicle types to total road NOx, and PM emissions in Oxford may be in fact slightly higher than that shown in Figures 6-8

Figure 8- Total road $PM_{2.5}$ emissions in Oxford, per vehicle type.



The breakdown of contributions to NOx emissions per vehicle type shows that the current biggest contributors in the city are diesel cars (32.7%) followed closely by buses (31.9%).

For PM_{10} and $PM_{2.5}$, the biggest transport contributor is the car, with 48.4% and 42.5% of all PM_{10} and $PM_{2.5}$ emissions in the city attributed to this vehicle type.

3.2.1 Changes since 2013

The results showed in Table 3 represent a big shift in the contribution of each vehicle type to total emissions of NOx in the city if we compare them with data from 2013.

Table 3 - Historic comparison of the contribution of each vehicle type to total NOx emission in Oxford.

Vehicle type	2013	2019	Comparison (2013 vs 2019)
Private Hire & Hackneys	3%	<1%	-2% ↓
Cars	15%	37%	+22% ↑
Light Goods Vehicles	6%	16%	+10% ↑
Heavy Goods Vehicles	12%	15%	+3% ↑
Buses and Coaches	64%	32%	-32% ↓

The results of table 3 show that since 2013, the contribution of buses to total road NO_X emissions have reduced by 50%. This shows how effective measures such as the introduction of the city's Euro V Low emission Zone for buses in 2014 and the

retrofitting of a significant amount of buses to Euro VI standard have been in reducing air pollution from this vehicle type.

On the other hand, the data also reveals that the contribution from cars to total road NOx emissions have increased by 22% - from 15% to 37%. This significant percentage increase can largely be explained by the reductions observed in bus emissions during the same period, as well as by the update in car emissions data (post VW scandal), which now reflect the impact of real world car emissions.

While we have seen significant improvements overall in air quality in the city, we know we have to do much more to ensure our residents and visitors can breathe clean air, particularly when it comes from emissions from fossil fuel vehicles.

3.3 Required Reduction in Emissions

Air Quality levels are known to be historically poor at 4 locations in the city: St Clement's, George Street, High Street and Cutteslowe Roundabout. Specific information about these 4 hotspots can be found in Appendix A.

On Table 4, we present the road NO_X reductions[xiv] that will be required at the four historic NO_2 hotspot locations identified above to meet:

- the National NO_2 annual mean air quality objective of 40 µg/m^3;
- Oxford's new NO_2 annual mean local target of 30 µg/m^3.

The required reduction in emissions has been calculated in line with chapter 7 of DEFRA's statutory Technical Guidance document (LAQM.TG16).

xiv Nitrogen oxides (NOx) are a collective term used to refer to nitric oxide (NO) and nitrogen dioxide (NO_2). Both are produced from the reaction of nitrogen and oxygen gases in the air during combustion processes, especially at high temperatures. Total oxides of nitrogen (NOx) are used for the required reduction in vehicle emissions. This is routinely used for vehicle emissions standards instead of NO_2. Vehicles emit nitrogen dioxide (NO_2) and nitrogen oxide (NO) which make up the total NOx. The NO reacts with ozone in sunlight to create NO_2. The relationship between NOx emitted and ambient NO_2 is not linear hence required emission reductions tend to always be presented as NOx rather than NO_2.

Table 4 – Road NO_X reductions required to achieve compliance with the NO_2 legal annual mean limit value as well as with Oxford's NO_2 annual mean local target at Oxford's 4 air pollution hotspots

Diffusion Tube Code	Location	NO_2 measured in 2018, ug/m3	NOx background, ug/m3	(A) Roadside NOx from NO_2 calculator, ug/m3	(B) Roadside NOx to achieve compliance with current limit value, ug/m3	(C) Roadside NOx to achieve compliance with local target, ug/m3	Road NOx reduction required to achieve limit value ug/m3 (A-B)	Road NOx reduction required to achieve local target ug/m3 (A-C)	Road Nox reduction required for Limit Value (%)	Road Nox reduction required for Local Target (%)
DT55	**St Clement's**	**46**	**21.1**	**66.03**	51.3	28.6	14.7	37.4	**22.3%**	**56.7%**
DT48	**George St**	**42**	**26.4**	**50.09**	45.3	22.9	4.8	27.1	**9.5%**	**54.3%**
DT56	**High St**	**44**	**24.9**	**56.65**	47.0	24.6	9.6	32.1	**17.0%**	**56.6%**
DT26	**Cutteslowe**	**41**	**17**	**58.39**	55.9	33.0	2.4	25.4	**4.2%**	**43.5%**

Table 4 shows that the required reduction in emissions for St Clement's Street / The Plain to achieve compliance with the NO_2 annual mean Limit Value is 14.7 µg/m^3 or 22.3%. For George Street, High Street and Cutteslowe the necessary road NOx reductions are of 4.8 ug/m^3, 9.6 ug/m^3, 2.4 ug/m^3 or 9.5%, 17%, and 4.2% respectively.

Calculations also show that there needs to be road NOx reductions of above 50% for most sites to achieve compliance with Oxford's new local target for NO_2.. At St Clement's, George St, High St and Cutteslowe, NOx reductions of 56.7%, 54.3%, and 56.6% are required to achieve compliance with the new target. At Cutteslowe, the level of road NOx reduction required is slightly lower at 43.5%.

Vision and aims of the AQAP

The scope of this AQAP is to set out a range of actions to reduce air pollutants from different sectors of activity in response to the declaration of an AQMA for exceedances of the annual mean objective for NO_2.

4.1 Oxford NO_2 target

The key objective of this AQAP is to bring NO_2 emissions across the city into legal compliance as soon as possible, however importantly we want to reach beyond legal compliance for the whole city. Oxford City Council is committing to becoming the first UK Local Authority to set a local annual mean NO_2 target in a city-wide AQAP.

The overall objective of this AQAP for the whole of the Oxford City area is to:

Achieve a local annual mean NO_2 target of 30 µg/m^3 by 2025

"30 by 25"

The legal annual mean limit value for NO_2 is 40 ug/m^3. Research now shows that this legal limit is not a safe limit. Several health studies show that harmful effects of air pollution are seen at levels below air quality legal standards previously considered to be safe. We take the health of our residents and visitors very seriously and the decision to set a new low target for NO_2 is evidence of our commitment to improve health outcomes for all.

According to the Committee on the Medical Effects of Air Pollutants (COMEAP), a 1 µg/m^3 reduction in NO_2, could lead to about 420,000 to 903,000 life years saved in the UK over the next 106 years, with an increase in life expectancy (at birth) of around 2 to 5 days. It is therefore expected that a 10 ug/m^3 reduction in NO_2 will lead to a significant improvement in the health outcomes for Oxford residents.

4.1.1 Why are we proposing a new NO_2 target?

A significant amount of research has been completed since the air quality directive was established and since the WHO published guidelines on outdoor air pollution. This now suggests that there are in fact no 'safe' levels of air pollution and that governments should, therefore, be aiming for the lowest possible air pollution levels. Our setting of a lower target is a key step towards reducing air pollution to the lowest possible level, thereby protecting the largest number of people's health and lives.

Recent studies show that there is strong evidence of a relationship between long-term exposure to NO_2 and respiratory effects, particularly the development of asthma

in children. Results suggest that both short and long-term exposure to NO_2 maybe be associated with cardiovascular and related metabolic effects, as well as premature mortality. Further to that, long-term exposure may be associated with poorer birth outcomes, and cancer,

Oxford City Council has pioneered measures to reduce air pollution levels and address climate breakdown. Including:

- Oxford pioneered the first enduring UK Park and Ride bus scheme (1973) and provided a model for other cities, notably Nottingham, York, Leicester, Norwich, and Cambridge.
- Oxford was the first UK city to follow London in the implementation of a Low Emission Zone (LEZ) for buses (2014).
- Oxford launched plans (2017) for the UK's first Zero Emission Zone in Oxford City.
- Oxford became the first UK city to host a Citizens' Assembly on Climate breakdown (2019), which addressed measures to reduce air pollution.
- Supported by the City Council, Oxford is home to the £41m project Energy Superhub Oxford, which includes the world's largest hybrid battery system and supports the roll out of electric and zero emitting vehicle charging capacity and fleets.
- Supported by the City Council, Oxfordshire is trialling a £40m industry-first local energy system, called Project LEO (Local Energy Oxfordshire). This smart local energy system explores how growth in local renewables, electric vehicles, battery storage, vehicle-to-grid technology can be supported by a local, flexible, and responsive electricity grid, which will enable zero emission mobility.
- Supported by Oxford City Council, trialling '*OxPops*', the world's first residential 'pop up' on-street electric vehicle charging point to enable the shift towards zero emission mobility.

Setting a stretching target and increasing our ambition is also helping to secure additional investments in the innovative areas where the city has strengths and a strong record of success. The City Council seeks to support large investment into the city which will enable us to clean Oxford's air as much as we can, and as quickly as possible. Thereby improving public health, reducing early deaths, and addressing climate breakdown. While also supporting local businesses, jobs, and inclusive economic growth. The rapid expansion of the Green Economy is especially important as Oxford seeks to recover from the coronavirus pandemic.

4.1.2 Why are we setting a new local NO_2 target fixed at 30 µg/m^3?

The decision to choose the target of 30ug/m^3 was based on the 2018 analysis of the results of several air quality modelling projections and studies, the analysis of our city centre historic air quality monitoring data for the period 2002 - 2018, and taking into account the expected air quality impacts of the complete set of air quality measures that are being put forward in this AQAP. In short, the target-setting is evidence-led.

The air quality models and resources used for this analysis were:

- Air Quality Modelling for ZEZ Feasibility Study
- DEFRA's Roadside Projection Factors;
- JAQU's modelling work for targeted feasibility study
- Oxford City Council's historical diffusion tube data (2003-2018)
- Review of Air Quality impact of measures set out in the new AQAP

A comparative analysis across these sources showed that a target NO_2 value of 30 ug/m^3 would be both stretching, and realistically achievable, in the specified time period.

It is important to set clear and realistic targets so that we inspire the confidence of citizens and partners in our plans, and they can understand their potential role in our shared efforts. This local authority will seek out opportunities to make a greater contribution and a larger reduction than our headline target wherever possible.

4.1.3 The current annual mean limit value for NO_2

Oxford is currently in breach of the annual mean limit value for NO_2 in six locations of the city (out of the 71 locations where air quality is being monitored). It is therefore also a commitment of this Air Quality Action Plan to:

Achieve compliance with the legal annual mean limit value of 40 µg/m^3

The current annual mean limit value for NO_2 is set out in the European air quality directive (2008/EC/50) for the protection of human health, which says that NO_2 annual mean value may not exceed 40 micrograms per cubic metre (µg/m^3). This and other air pollutant limit values have been all transposed into UK law through the Air Quality Standards Regulations 2010. They are referred to as "UK Air Quality Objectives" and all came into force on 11th June 2010.

The local air quality management (LAQM) regime requires every district and unitary authority to annually review and assess air quality in their area. Air quality monitoring is utilised to identify whether the relevant limit values have been achieved at relevant locations.

4.2 Zero Emission Zone and Connecting Oxford

The new AQAP is anchored in two transport and air pollution management schemes that the City and County Councils are in the process of delivering; the Zero Emission Zone and Connecting Oxford. We believe these will be the main drivers and contributors to the reduction of air pollution levels in the city. It is felt that by supporting and building upon these existing proposals, tangible improvements in air quality can be achieved more quickly.

Oxfordshire County Council's Local Transport Plan 4, published in 2015, set out proposals to introduce a Zero Emission Zone (ZEZ) in Oxford starting in 2020. Since then, proposals have been developed by Oxford City Council, in partnership with the County Council, for a ZEZ in Oxford to be rolled out in phases starting in 2020. The overall aim of this journey to zero is to eliminate transport 'tailpipe' emissions in Oxford city centre by 2035. Transitioning businesses and residents to ultra-low and zero emission vehicles is a critical building block of this zero emission ambition. The councils consulted on initial proposals for a ZEZ in 2017. After 15 months of listening to businesses, residents, transport operators, and health experts in Oxfordshire, updated proposals were published in January 2019 for emissions requirements to be implemented in Oxford city centre in a phased approach to allow for learning from 2021 to 2035. Detailed information about the current and future ZEZ plans can be found on Oxford City Council's website.

In January 2020, Oxfordshire County Council and Oxford City Council cabinet approved the development of proposals for the delivery of Connecting Oxford. This is a traffic management scheme that is designed to increase connectivity, reduce congestion, and tackle air pollution and climate breakdown. The proposed plans include the delivery of a set of traffic restrictions and the implementation of a workplace parking levy in parts of the city. Detailed information about the Connecting Oxford proposals can be found on Oxfordshire County Council's website.

Several of the actions in the AQAP are linked to these two schemes and facilitate a significant modal shift towards active travel, as well as the transition to zero emission transport. This includes the installation of electric vehicle charging points in the city, as well as the introduction of electric car clubs to allow residents to take up zero emission vehicles.

4.3 Priorities and Actions

This AQAP provides a framework for continuing current activity in the city to reduce NO_2 emissions whilst also developing new actions to complete our journey to legal emissions, and go beyond the council's new NO_2 local target. Please see the table on the next pages for a detailed breakdown of our proposed measures, interventions, and key priorities.

Actions will be delivered by a range of partners including Oxfordshire County Council who as local transport authority are responsible for many of the actions related to

Priority 1 - Developing Partnerships and Public Education

Encouraging behavioural change to clean up the air in our cities through public education and effective communication can play a significant role in the reduction of air pollution. By raising awareness, we can see that we all have a role to play and we are all part of the solution; our everyday decisions can have an impact on the air we breathe.

The set of measures that are being presented within this priority area are aimed at delivering a solid foundation of environmental education in our community. They build upon the successful delivery of behavioural change and air quality communication programmes, such as the Award winning STOP, WOW, Anti-Idling Campaign or OxAir.

Core actions will be to:

- Continue to work with schools, children, and young people to raise awareness of air pollution, discourage idling and promote active travel;
- Support city wide events that aim to accelerate the uptake of sustainable transport;
- Support projects that increase Oxford's Air Quality/AQ & Health evidence base such as OxAir;
- Develop partnership work with the NHS, the third-sector, as well as public health commissioners and providers to increase awareness of air pollution amongst patients and reduce their personal exposure to air pollution;
- Improve air quality communication on our website and associated websites to assist the public in accessing reliable information about air pollution;
- Explore opportunities to use green infrastructure as a way to reduce exposure to poor air quality levels;
- Deliver city-wide campaign on how to implement DEFRA's best practice on the of use open fires and wood burning stoves, and on how to reduce burning of inappropriate fuel;
- Work with the District and County Councils on a co-ordinated approach to public awareness and education.

transport modal shift.

Priority 2 - Support for the uptake of Low and Zero emission vehicles

This priority area is aimed at the delivery of air quality measures that support the city's plans for the implementation of a Zero Emission Zone. It is expected that the delivery of the measures under this key priority area will substantially contribute to the reduction of transport emissions in the city. According to our source apportionment, transport is responsible for 68% of total NOx emissions in Oxford.

The main measures to be delivered include the introduction of a new Euro VI Low Emission Zone (LEZ) for buses in Oxford, a road user charge scheme for all non-zero emission vehicles in Oxford city centre, the delivery of EV charging infrastructure, plans for the electrification of the City Council's own fleet, opportunities for the complete electrification of Oxford's bus fleet, as well as the commitment to incentivize zero-emission vehicles or to place restrictions on other vehicles in Oxford.

Core actions will be to:

- Introduce a Euro VI LEZ for buses in Oxford;
- Continue to introduce tighter Ultra Low emission standards for Hackney Carriage Vehicles;
- Deliver the Zero Emission Zone to incentivise zero emission vehicles or place restrictions on other vehicles in Oxford;
- Increase the amount of EV charging infrastructure in the City;
- Expand the City Council's EV Fleet (electrification of 25% of vehicle fleet);
- Develop an EV Strategy for Oxfordshire;
- Work with bus operators on the electrification of Oxford's bus fleet;
- Deliver Oxford's Energy Super Hub including the installation of more than 20 ultra-rapid + 30 fast vehicle EV chargers for the public use + the provision of ground source heat pumps for more than 300 homes;
- Deliver Air Quality Benefits through Planning System (EV charging infrastructure + efficient/less pollutant technologies);
- Explore opportunities for the delivery of electric infrastructure that could accelerate the uptake of electric boats and reduce their reliance on fossil fuel use for domestic heating.

Priority 3 - Reducing emissions from Domestic Heating, Industry and Services

The proportion of emissions from domestic heating, industry and services has increased as transport emissions have reduced. With the decrease in air pollution emissions from transport, air pollution levels generated from these other sectors gain more importance every year. In particular, when it comes to the role they play in the generation of PM_{10} and $PM_{2.5}$ emissions. With regards to NOx, these activities also contribute to 31% of total NOx emissions of the City.

The city of Oxford is currently fully compliant with legal limits, as well as WHO advisory limits, for PM_{10} and $PM_{2.5}$. However, recent studies clearly indicate that there is no safe level of air pollution, and there is already clear evidence that particulate matter has a significant impact on human health, including premature mortality, allergic reactions, and cardiovascular diseases.

Most of the measures proposed under this priority area are related to the reduction of combustion emissions via increased energy efficiency, thereby reducing NOx and PM emissions. I.e. replacing old combustion sources such as boilers, shifting to low fuel appliances, and exploring heat networks.

Core actions will be to:

- Upgrade the Energy Efficiency of City Council's Housing stock;
- Provide Energy Advice Services, by employing Energy Advice Officers to visit Council homes and advise tenants, whilst also identifying energy saving improvements to the properties;
- Use central government's ECO Flexible Eligibility funding to identify and designate households as eligible under the Affordable Warmth Scheme;
- Review of Smoke Controlled Zones and implement revised government legislation for smoke nuisance;
- Encourage the development of local heat networks.

Priority 4 - Reduce the need to travel, explore opportunities for mode shift and increase the uptake of sustainable transport

One of the key themes of Oxfordshire's current local transport plan is to support the transition to a low carbon future by minimising the need to travel and reducing the proportion of journeys made by private car by making the use of public transport, walking and cycling more attractive.

The City and County Councils and partners have been supporting a shift to more sustainable and low emission modes of travel as well as reducing the proportion of car-based travel to and around the city, as this is an important way to reduce transport emissions.

The main measures to be delivered include exploring the possibility of implementing a Work Place Parking Levy in the city, introducing new vehicle access restrictions, implementing a local cycle and walking infrastructure plan, as well as introducing bus priority measures.

Core actions will be to:

- Deliver Connecting Oxford;
- Deliver sustainable transport measures such as cycling improvements and bus priority lanes;
- Roll-out Controlled Parking Zones (CPZ) to discourage non-residential parking;
- Work with businesses to explore the inclusion of innovative sustainable travel modes into their business models;
- Explore opportunities to address city centre freight emissions by creating consolidation centre/s;
- Work with schools to reduce exposure to air pollution by reducing the need to travel during drop off/pick up times;
- Support Bikeability (free cycling lessons provided to pupils).

4.4 AQAP Measures

Table 5 shows the complete list of AQAP measures for each one of the 4 key areas of intervention identified above. It contains:

- a list of the actions that form part of the plan;
- the responsible individual and departments/organisations who will deliver this action;
- expected benefit in terms of pollutant emissions and/or concentration reduction;
- the timescale for implementation.

4.5 Policy Integration

Oxford City Council has several relevant planning and policy documents that have been developed and accounted for during the process of developing the measures in this AQAP. Some of these documents are being updated at the time of writing. If you are interested in learning more about those and the way they link with the new AQAP please click on the hyperlinks below:

- Oxford's new Local Plan 2036
- Air Quality Planning Application Guidance
- Local Transport & Connectivity Plan
- Oxford's Sustainability Strategy
- Climate breakdown: Citizen's Assembly report

Table 5 – Air Quality Action Plan Measures

Key priority area	Measure	Measure	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Associated benefits
(1) Developing Partnerships and Public Education	1	Work with schools to raise awareness of air pollution and promote Active Travel	Oxford City Council + Oxfordshire County Council + Local Friends of the Earth	Annually	2021-2025	Number of: walking,cycling, scooting, car, and park & stride trips, Number of participating schools and of activities delivered	NOx reduction not estimated, but increase of up to 23% in walking rates and reduction of up to 30% car journeys, Nox reduction difficult to estimate, but increase of awareness of up to 12% and behaviour change of up to 6% (Clean Air Day)	Delivery in progress	2025	Prevention of obesity, reduction of noise and traffic accidents, reduction of nuisance
(1) Developing Partnerships and Public Education	2	Support city wide events that aim to accelerate the uptake of sustainable transport	Oxford City Council + Other partners (e.g.,: Green TV)	Annually	2021-2025	Total amount of attendees and businesses participating, number of business adopting sustainable delivery options, number of business compliant with the ZEZ	NOx reduction not estimated, but increase of awareness of up to 12% and behaviour change of up to 6% (Clean Air Day)	Planning Phase	2025	Acceleration of EV and e-bike uptake, promotion of sustainable deliveries, promotion of behavioural change, reduction of noise and CO_2
(1) Developing Partnerships and Public Education	3	Support projects that increase Oxford's Air Quality/AQ & Health evidence base	Oxford City Council + Oxfordshire County Council (Pub. Health)	Annually	2021-2025	Total amount of partnerships created, amount of AQ/health studies delivered	Not directly applicable – NOx reduction not estimated	Already being delivered	2025	Development of future policies, promotion of behavioural change, backed by more robust evidence
(1) Developing Partnerships and Public Education	4	Develop partnership work with NHS, commissioners and providers to increase awareness of air pollution amongst patients and reduce their personal exposure to air pollution.	Oxford City + Oxfordshire County Council (Pub. Health)	On-going	2021-2025	Number of workshops/training sessions delivered, reduction in number of hospital admissions for COPD patients	NOx reduction not estimated, but communication campaigns can increase of awareness of up to 12% and behaviour change of up to 6% (Clean Air Day)	Not started	2025	Promotion of behavioural change and reduction of personal exposure to poor air quality

Key priority area	Measure	Measure	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Associated benefits
(1) Developing Partnerships and Public Education	5	Improve air quality communication on our website and associated websites to assist the public in accessing reliable information about air pollution.	Oxford City Council + All other District Councils	On-going	2021-2025	Number of website visitors, reduction of public requests for AQ information, reduction of hospital admissions	NOx reduction not estimated, but communication campaigns can increase awareness of up to 12% and behaviour change of up to 6% (Clean Air Day)	Planning Phase	2025	Air Quality education and reduction of personal exposure to poor air quality
(1) Developing Partnerships and Public Education	6	Explore opportunities to use green infrastructure as a way to reduce exposure to poor AQ levels	Oxfordshire County Council + Highways England	2020	2021-2025	Air Quality data after implementation	Reduction of up to 50% in exposure to air pollution levels where green infrastructure is installed (Greater London Authority)	Not started	2025	Reduction of noise, reduction of nuisance
(1) Developing Partnerships and Public Education	7	Delivery of city-wide campaign on how to implement DEFRA's best practice on the use of open fires and wood burning stoves, and on how to reduce burning of inappropriate fuel	Oxford City Council + Local Friends of the Earth + River Trust	2021	2021-2025	Reduction of nuisance complaints, PM10 and PM2.5 data	NOx and PM reductions not estimated, but communication campaigns can increase of awareness of up to 12% and behaviour change of up to 6% (Clean Air Day)	Not Started	2025	Promotion of behavioural change, reduction of nuisance, reduction of nuisance investigations
(1) Developing Partnerships and Public Education	8	Work with the District and County Councils on a co-ordinated approach to public awareness and education	Oxford City Council + All other District Councils	2020	2021-2025	Number of campaigns run together between all the District Councils	NOx reduction not estimated, but communication campaigns can increase of awareness of up to 12% and behaviour change of up to 6% (Clean Air Day	Planning Phase	2025	Division of resources, simplified message (integrated approach increases the power and effectiveness of the message) and reaches more people
(2) Support for the uptake for Low and Zero emission vehicles	9	Introducing a Euro VI LEZ for buses in Oxford	Oxford City Council + Oxfordshire County Council + Bus Operators	2020	2021	LEZ Approved bus database	5% to 12.8% total Road NOx emissions (Ricardo's Source Apportionment Study)	Delivery in progress	2022	Reduction of health impacts associated with air pollution

Key priority area	Measure	Measure	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Associated benefits
(2) Support for the uptake for Low and Zero emission vehicles	10	Introducing Ultra Low emission standards for Hackney Carriage Vehicles	Oxford City Council	2019	2020-2025 (phased approach)	Amount of New HCV Applications, enforcement stats	Up to 0.2% total Road NOx emissions (Ricardo's Source Apportionment Study)	Delivery in progress	2025	Reduction of health impacts associated with air pollution
(2) Support for the uptake for Low and Zero emission vehicles	11	Delivery of Zero Emission Zone (measures to incentivise zero emission vehicles or place restrictions on other vehicles in Oxford)	Oxford City Council + Oxfordshire County Council	2020	2021-2030 (phases 1 to 4)	Behavioural responses, AQ monitoring, ANPR counts	By 2035 (after full implementation), up to 66% reduction in city-wide NOx emissions and of 100% transport emissions in the city centre	Planning Phase	2021-2030 (phases 1 to 4)	Reduction of noise, traffic, CO_2 and PM emissions, better walking and cycling environment, improved townscape and historic environment
(2) Support for the uptake for Low and Zero emission vehicles	12	Increase the amount of EV charging infrastructure in the City	Oxford City Council + Oxfordshire County Council	2019	2020-2025	Number of EV chargers installed	NOx reduction not estimated	Delivery in progress	2025	Reduction of noise, CO_2
(2) Support for the uptake for Low and Zero emission vehicles	13	Expansion of City Council's EV Fleet (Electrification of 25% of vehicle fleet)	Oxford City Council	2020	2020-2023	Number of Electric vehicles purchased	NOx reduction not estimated	Already being delivered	2023	Reduction of noise, CO_2
(2) Support for the uptake for Low and Zero emission vehicles	14	Development of an EV Strategy for Oxfordshire	Oxfordshire County Council + Other District Councils	2020	2021	Publication of EV strategy and adoption of Strategy by all District Councils	NOx reduction not estimated	Planning Phase	2021	Reduction of noise, CO_2
(2) Support for the uptake for Low and Zero emission vehicles	15	Work with bus operators on the electrification of Oxford's Bus fleet	Oxfordshire County Council + Bus Operators	2020	2021-2025	% of bus fleet ZEV	Up to 32% of the city's total road NOx emissions (Ricardo's SAS)	Planning Phase	2025	Reduction of CO2 and noise, improvement of passenger experience, reduction in operating costs

Key priority area	Measure	Measure	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Associated benefits
(2) Support for the uptake for Low and Zero emission vehicles + (3) Reducing emissions from domestic heating, Industry and Services	16	Delivery of Oxford's Energy Super Hub (installation of more than 20 ultra-rapid + 30 fast vehicle EV chargers for the public use + provision of ground source heat pumps for more than 300 homes)	Oxford City Council + partners	2019	2021	Number of GSHP installed, AQ monitoring	20,000 tonnes of CO2 per year saving by 2021, rising to 44,000 tonnes per year by 2032 + up to 22% reduction of NO2 emissions from transport by 2032 (Oxford City Council)	Planning and Construction Phases	2021	Reduction of carbon and PM
(2) Support for the uptake for Low and Zero emission vehicles + (3) Reducing emissions from domestic heating, Industry and Services	17	Delivery of Air Quality Benefits through Planning System (EV charging infrastructure + efficient/less pollutant technologies)	Oxford City Council	2020	2020-2036	Number of developments with EV chargers installed/number of EV chargers installed, number of planning conditions	NOx and PM reductions not estimated	Already being delivered	2025	Reduction of noise, CO_2, requirement for minimum NOx emission standards from IAQM guidelines to be followed
(2) Support for the uptake for Low and Zero emission vehicles + (3) Reducing emissions from domestic heating, Industry and Services	18	Explore opportunities for the delivery of electric infrastructure that could accelerate the uptake of electric boats and reduce their reliance on fossil fuel use for domestic heating	Oxford City Council + River trust + Environment Agency	2021	2021-2025	Number of installations delivered, number of boats relying on energy sources that are locally emissions free	NOx and PM reductions not estimated	Exploratory Phase	2025	Promotion of behavioural change, reduction of nuisance, reduction of nuisance investigations, reduction of NOx and PM emissions, improvement in quality of life for those who use the canals
(3) Reducing emissions from domestic heating, Industry and Services	19	Upgrade Energy Efficiency of City Council's Housing stock	Oxford City Council	2020	2021-2025	Number of boiler upgrades, insulations and high efficiency storage heaters installed per year	NOx/PM reductions not estimated, but this measure is responsible for savings of at least 199 tonnes carbon dioxide (CO2) per year	Already being delivered	2025	Reduction of carbon and PM

Key priority area	Measure	Measure	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Associated benefits
(3) Reducing emissions from domestic heating, Industry and Services	20	Provide Energy advice services: employ Energy advice Officers to visit Council homes and advise tenants, whilst also identifying energy saving improvements to the properties	Oxford City Council	2020	2021-2025	Total amount of home visits and of energy savings per year	NOx and PM reductions not estimated	Already being delivered	2025	Reduction of carbon and PM
(3) Reducing emissions from domestic heating, Industry and Services	21	Use of central government's ECO Flexible Eligibility funding to identify and designate households as eligible under the Affordable Warmth Scheme	Oxford City Council	2020-2025	2020-2025	Total amount of households being granted with energy efficiency improvements	NOx and PM reductions not estimated	Already being delivered	2025	Reduction of carbon and PM
(3) Reducing emissions from domestic heating, Industry and Services	22	Review of Smoke Controlled Zones and implementation of revised government legislation for smoke nuisance	Oxford City Council	2020	2021-2025	Implementation of new enforcement methods / reduction of the amount of nuisance complaints	NOx and PM reductions not estimated	Exploratory Phase	2025	Government's future AQ Plans: a) extension of existing SCA's smoke emission standards to the whole of England b) provision of new powers for local to respond to instances of nuisance smoke pollution from boats with improvement and enforcement action
(3) Reducing emissions from domestic heating, Industry and Services	23	Encourage the development of local heat networks	Oxford City Council	2021	2021-2025	Number of planning applications using heat networks	NOx and PM reductions not estimated	Exploratory Phase	2025	Reduction of carbon, maximise energy efficiency, reduction of PM

Key priority area	Measure	Measure	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Associated benefits
(4) Reduce the need to travel, explore opportunities for mode shift and increasing the uptake of sustainable transport	24	Delivery of Connecting Oxford (explore opportunities for implementation of Workplace Paring levy + introduction of access restrictions)	Oxfordshire County Council + Oxford City Council	2020	2023	Traffic counts, numbers of people travelling by bus, cycling or walking, number of businesses enrolled, enforcement stats	NOx reduction not estimated	Planning Phase	2023	Prevention of obesity, reduction of noise and traffic collisions,
(4) Reduce the need to travel, explore opportunities for mode shift and increasing the uptake of sustainable transport	25	Delivery of sustainable transport measures such as cycling improvements and bus priority lanes	Oxfordshire County Council + Oxford City Council	2020	2021-2030	Scheme delivery Transport monitoring (e.g. cycle counts)	NOx reduction not estimated	Planning Phase	2030	Reduction of CO_2, prevention of obesity, reduction of noise and traffic collisions, reduction of traffic
(4) Reduce the need to travel, explore opportunities for mode shift and increasing the uptake of sustainable transport	26	Roll-out of Controlled Parking Zones (CPZ) in order to discourage non-residential parking	Oxfordshire County Council	2020	2021	Implementation of the new CPZs	NOx reduction not estimated	Planning Phase	2021	Reduction of CO_2, reduction of noise and traffic collisions , reduction of traffic
(4) Reduce the need to travel, explore opportunities for mode shift and increasing the uptake of sustainable transport	27	Work with businesses to explore the inclusion of innovative sustainable travel modes into their current business models	Oxfordshire County Council + Oxford City Council	2020	2021-2025	Number of businesses adopting sustainable travel modes	NOx reduction not estimated	Planning Phase	2025	Reduction of traffic, acceleration of e-bike uptake, reduction of noise, promotion of sustainable transport

Key priority area	Measure	Measure	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Associated benefits
(4) Reduce the need to travel, explore opportunities for mode shift and increasing the uptake of sustainable transport	28	Explore opportunities for implementation of consolidation centre to address city centre freight emissions	Oxfordshire County Council + Oxford City Council	2020	2021-2025	Number of businesses enrolled	NOx reduction not estimated	Exploratory Phase	2025	Reduction of traffic, acceleration of e-bike and EV uptake, reduction of noise, promotion of sustainable transport
(4) Reduce the need to travel, explore opportunities for mode shift and increasing the uptake of sustainable transport	29	Work with schools to reduce exposure to air pollution by reducing the need to travel during drop off/pick up times	Oxfordshire County Council	2020	2021	Number of streets closed, schools enrolled	NOx reduction not estimated, however estimated high levels of human exposure to NO2 at local level during school pick-up/drop off times (school gates)	Planning Phase	2021	Reduction of traffic, collisions, acceleration of e-bike and EV uptake, reduction of noise, promotion of sustainable transport
(4) Reduce the need to travel, explore opportunities for mode shift and increasing the uptake of sustainable transport	30	Support Bikeability (free cycling lessons provided to pupils)	Oxfordshire County Council	2020	2021-2025	Number of schools enrolled	NOx reduction not estimated	Planning Phase	2025	Reduction of traffic, acceleration in uptake of cycling, reduction of noise, promotion of sustainable transport

Appendix A: Oxford's air pollution hotspots

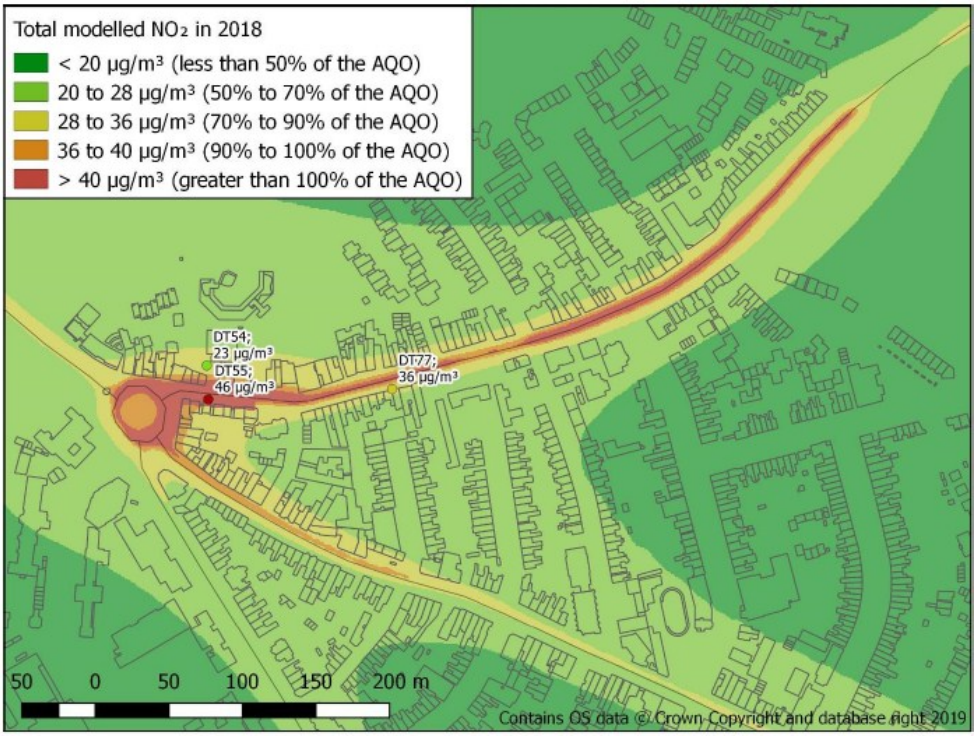
This section of the AQAP provides additional information about the City's four historic air quality hotspots.

Figures 9-12 (below) show air quality modelling and measured data from 2018. Shading shows air quality modelled data, points are diffusion tube (measured) data. Both modelled and monitored data was used to inform Oxford's most recent Source Apportionment Study.

St Clement's

St Clement's is the location that historically registers the highest levels of NO_2. This road link is in the commercial centre of the city, within Oxford City Council local authority area. The road is a key city centre route, which connects east and west Oxford through The Plain Roundabout. St Clement's St is the most direct route that connects the east with the centre of the city,

Figure 9 - Modelled and Monitored total NO_2 concentrations (2018) at St Clements



Traffic builds up from St Clement's towards The Plain roundabout, with queues regularly extending beyond 125m. Several bus stops are along the road link which accommodates local bus services. 24h Coach services to London and the airports are also on the street with stops located in both east and west directions.

There is also a significant number of delivery and service vehicles using this road, as it serves as an access point to the city centre from the east. There is a high number of businesses which receive daily deliveries.

The main causes of the relatively poor air quality at this location are the narrow street layout, and obstructions to traffic flow. The street layout creates a canyon effect, which encourages pollutant entrapment. The obstructions include 4 bus stops for local buses and national coaches; daytime on street parking (by the Alms Houses); and frequently stopping delivery and servicing vehicles that supply local retailers.

In 2017, an Air Quality steering group was created, including elected Oxford City and Oxfordshire County Council councillors for St Clement's, and officers. The objective was to develop measures that could address the problem of NO_2 exceedances at that location. Several options were brought forward as a result of the work developed by the group and air quality modelling was used to estimate the impacts of each option. The air quality modelling results indicated that upgrading the current Euro V requirement for buses to Euro VI would lead to the quickest reduction in NO_2 levels at St Clement's. This will ensure compliance with the annual mean legal limit value of 40µg/m^3 for NO_2 once the scheme is fully delivered. The introduction of a Euro VI Low Emission Zone is planned for 2021.

George Street

George Street is located in the heart of Oxford's City Centre. Its eastern end meets Broad Street at a crossroads with Cornmarket Street to the south and Magdalen Street to the north. Its western end meets Hythe Bridge Street at a crossroads with Worcester Street.

George Street is perhaps the most striking example of an air pollution problem caused by a combination of traffic and historic street planning in Oxford. It is a narrow street with tall buildings on both sides that are close to the road. This creates a canyon, which traps polluted air, leading to high levels of nitrogen dioxide from vehicle exhausts.

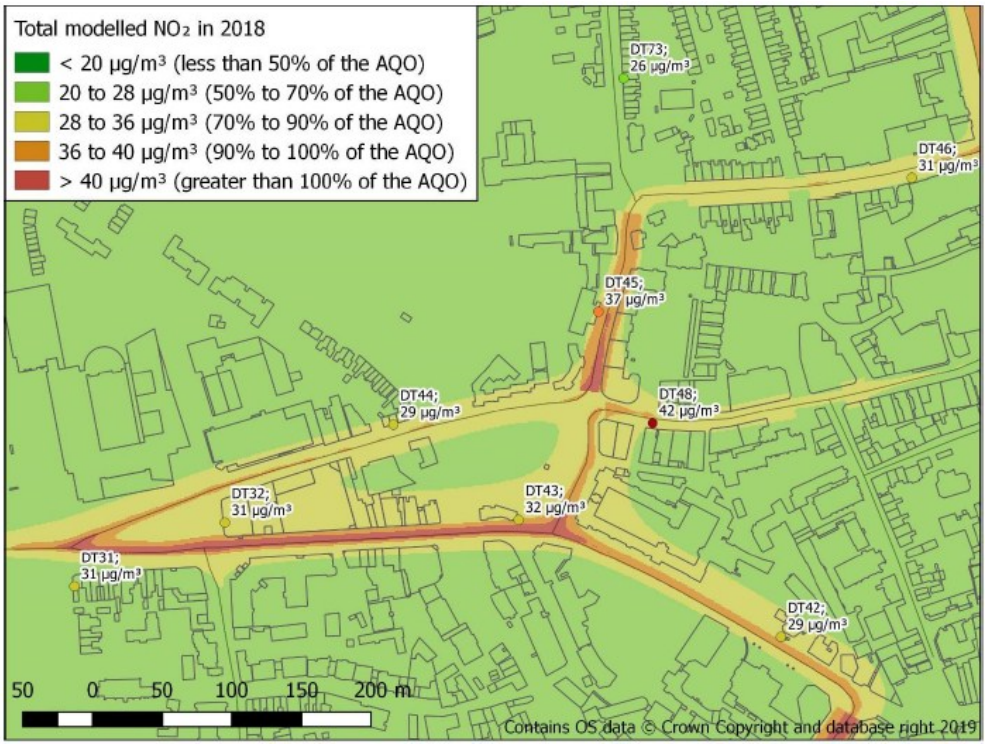
The street is covered by a bus gate which excludes several vehicles types for the majority of the day. Full details can be seen on table 6 below:

Table 6 – Vehicle restrictions on George Street

Bus gate	Time	Vehicle types allowed through the gate
George Street	10am – 6pm	Local buses, taxis/licensed private hire (not private rental) and exempt emergency vehicles only
	6pm – 10am	Access for loading allowed

The restrictions mean that the majority of traffic in the road is buses. Bus stops are located where footways are narrow and so bus tailpipe emissions are close to pedestrians, residents, and occupiers of shops and offices. Additionally, buses using these stops contribute to traffic congestion more generally by blocking flow (particularly of larger vehicles), as well as posing a risk for cyclists. Bus flows are high and tend to be at stops for a while whilst passengers board.

Figure 10 - Modelled and Monitored total NO_2 concentrations (2018) at George Street and surrounding area.



High Street

High Street is a busy city centre street with shops located on both sides.

It has a pavement on each side of the road, as well as several bus stops along its length. The road is frequently used by cyclists and has very high numbers of pedestrians on the pavements. High Street is covered by a bus gate which excludes several vehicles types for the majority of the day. Full details can be seen on table 3 below:

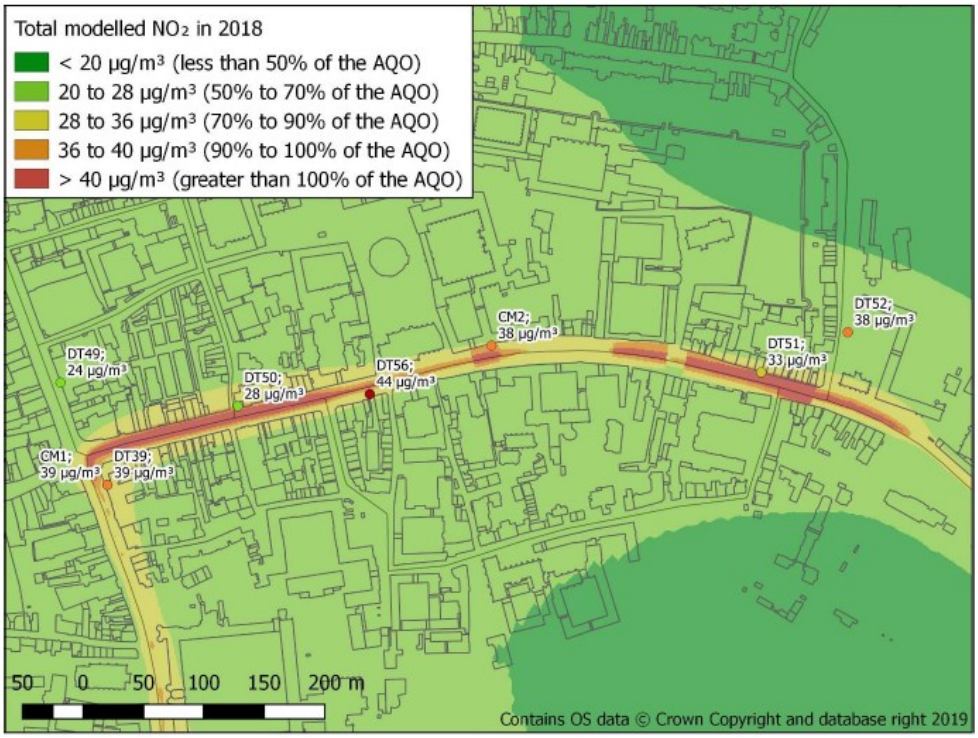
Table 7 – Vehicle restrictions on High Street

Bus gate	Time	Vehicle types allowed through the gate
High Street	7.30am – 6.30pm	Local buses, taxis/licensed private hire (not private rental) and exempt emergency vehicles only
	6.30pm – 7.30am	Any vehicle type allowed.

While vehicles are banned from going through the bus gate, they can enter the zone to make deliveries, for servicing and access purposes, but cannot use it as a through

route. Buses enter High Street eastbound from St Aldates and Queen Street, whilst westbound flow is generated from the Plain roundabout. Intensively used bus stops and high numbers of frequently stopping delivery and servicing vehicles creates congestion throughout the day, impacting flow in both directions.

Figure 11 - Modelled and Monitored total NO_2 concentrations (2018) on High Street

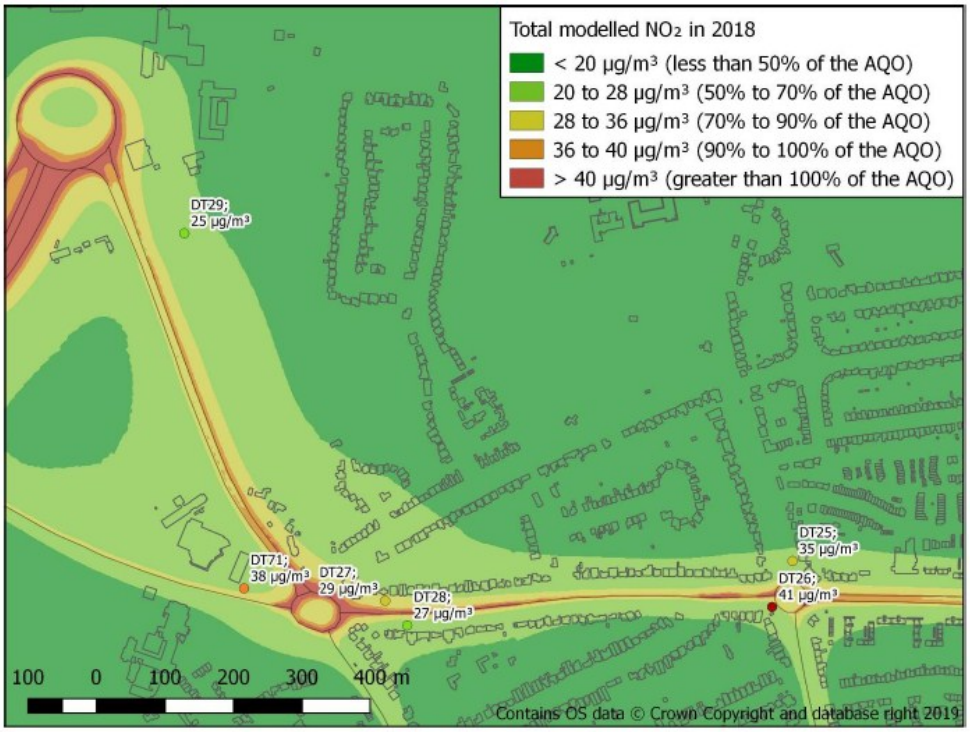


Cutteslowe Roundabout

Of the four historic NO_2 air pollution hotspots in Oxford this is the only one that is not in the city centre.

This is important to highlight, as locations outside the city centre usually have much lower footfall levels (due to the absence of shops and services in those areas). As such, human exposure to air pollution in these locations is much less pronounced, and occurs for less time, in comparison with the city centre. Cutteslowe and Wolvercote roundabouts are located on the Northern boundary of the city. Through these roundabouts, daily direct links are established to the city centre (via Banbury Road), as well as with the A40 going east (Cheltenham/Swindon) and west (serving John Radcliffe Hospital). The direct access from Oxford to the A34 going north (Bicester) and south (Abingdon) is also here, which makes it one of the biggest traffic arteries of the city.

Figure 12 - Modelled and Monitored total NO_2 concentrations (2018) at Cutteslowe



We are confident that the measures included in this AQAP, including the implementation of all Oxford's ZEZ and Connecting Oxford measures and proposals, will bring down NO_2 levels well below compliance with the current limit value at these four hotspot locations.

Glossary of Terms

Name and/or Abbreviation	Description
Air Quality Action Plan (AQAP)	A detailed plan of measures, actions, achievement dates and implementation methods, which must be prepared by the local authority as part of the Local Air Quality Management (LAQM) process, if an Air Quality Management Area is designated, and that shows how the local authority intends to reduce air pollution levels
Air Quality Management Area (AQMA)	An area where air pollutant concentrations exceed / are likely to exceed the relevant air quality objectives. AQMAs are declared for specific pollutants and objectives
Air Quality Strategy (AQS)	Document produced by UK Government and that sets out sets out all the national plans and policy options for dealing with all sources of air pollution in the UK from today into the long term.
Air Quality Objectives (AQO)	Limit values for pollutants set by UK Government, usually expressed as a maximum concentration to be achieved within a specified timescale, possibly with a permitted number of exceedances.
Annual Mean NO_2	The average NO_2 concentrations measured over a 12 month period (Calendar year). The current UK Annual Mean limit value for NO_2 is set at 40 µg/m^3.
Local Annual Mean NO_2 Target	The annual mean target set by Oxford City Council, to be achieved in Oxford City.
Annual Status Report (ASR)	Document that reviews on an annual basis current and likely future air quality and assess whether air quality objectives are currently being achieved or are likely to be achieved
CBTF	Clean Bus Technology Fund
COLTA	City of Oxford Licensed Taxi Association
Concentration	The amount of a substance in a volume (of air) typically expressed as a mass of a pollutant per unit volume of air, e.g. micrograms per cubic metre

	($\mu g/m^3$).
COPD	Chronic Obstructive Pulmonary Disease
COPERT	Computer Programme to calculate Emissions from Road Transport
Defra	Department for Environment, Food and Rural Affairs
DT	Diffusion Tube
ED/EC	European Directive/European Commission
Emission	The amount of a substance emitted in a certain time, typically expressed as a mass of a pollutant per unit of time (e.g. grams per second or tonnes per year).
ESO	Energy Super Hub Oxford
EU	European Union
Euro standards	Emission standards set by the EU which all new road vehicles sold in the EU must meet.
EVs	Electric Vehicles
EWNI	England, Wales and Northern Ireland
Exceedence	When a UK air objective or EU limit value is not achieved
GULO	Go Ultra Low Oxford
HGV	Heavy Goods Vehicle
Hourly Mean NO_2	The average concentrations measured (or predicted) for NO_2 over 1 hour.
JAQU	Joint Air Quality Unit
LAQM	Local Air Quality Management - A UK Government policy framework that requires local authorities to periodically review and assess the current and future air quality in their areas
LAQM TG16	Local Air Quality Management – Technical Guidance 16

LES	Low Emission Strategy
LEZ	Low Emission Zone - The application of emissions limit for nominated vehicles operating within a defined area
LGV	Light Goods Vehicle
Limit Value	Legally binding pollution levels that must not be exceeded. Limit values are set for individual pollutants and are made up of a concentration value, an averaging time over which it is to be measured, the number of exceedances allowed per year, if any, and a date by which it must be achieved. Some pollutants have more than one limit value covering different endpoints or averaging times.
LTP	Local Transport Plan
Microgramme (µg)	One millionth of a gram
Microgrammes per cubic metre of air ($\mu g/m^3$)	A unit for describing the concentration of air pollutants in the atmosphere, as a mass of pollutant per unit volume of clean air.
NAEI	National Atmospheric Emissions Inventory
NO	Formed from nitrogen (N) in the atmosphere during high temperature combustion. Commonly known as Nitric Oxide.
NO_2	Formed in small amounts in the atmosphere during high temperature combustion, but the majority is formed in the atmosphere through the conversion of nitric oxide (NO) in the presence of ozone (O_3). Commonly known as Nitrogen Dioxide.
NO_x	Nitrogen oxides is a collective term used to refer to nitric oxide (NO) and nitrogen dioxide (NO_2). These are produced from the reaction of nitrogen and oxygen gases in the air during combustion, especially at high temperatures. At normal temperatures, oxygen and nitrogen gases do not react together. Nitrogen oxides are produced from fuel combustion in mobile and stationary sources. The combustion of fuel in cars emits NOx into the atmosphere (mobile source). Stationary emissions come from coal fired power

	plants, electric power plants and domestic heating.
OTS	Oxford Transport Strategy
PM_{10}	Airborne particulate matter with an aerodynamic diameter of 10µm (micrometres or microns) or less
$PM_{2.5}$	Airborne particulate matter with an aerodynamic diameter of 2.5µm or less
STOP	Schools Tackling Oxford's air Pollution
UK	United Kingdom
WHO	World Health Organisation
WOW	Oxfordshire County Council's Walk to School programme
ZEZ	Zero Emission Zone