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OXFORD CITY COUNCIL

Oxford City Council Local Plan 2036

Air Quality

BACKGROUND PAPER

INTRODUCTION

The city of Oxford, in common with many urban areas throughout the United Kingdom, is subject to poor air quality. The specific layout of the city, with the majority of its streets assuming a typical mediaeval street pattern, creates the so called *"street canyon effect"*, which reduce ventilation levels and contribute to pollutants entrapment in the city. This fact, coupled with the high levels of road traffic that the city experiences, led the city of Oxford to historically register some of the highest levels of air pollution in the country. In the city, nitrogen dioxide (NO_2) is currently the pollutant of most concern.

The policies governing any new development assume therefore an important role in facilitating an improvement in air quality alongside the more traditional planning issues of special planning, the form of new development, transport and the conservation of the historic and natural environments.

The Environment Act 1995 introduced a system of local air quality management. Since then, all local authorities have had to periodically review and assess the current and likely future, air quality in their areas against national air quality objectives. Where any objective is unlikely to be met, local authorities must designate those areas as Air Quality Management Areas (AQMAs) and make Air Quality Action Plans (AQAP), liaising with the local transport authority, to work towards meeting the objectives.

The process of review and assessment of air quality in Oxford has been taking place since 1999. Since then, the air quality objectives for nitrogen dioxide, both annual mean and hourly mean have been identified as being exceeded in areas dominated by road traffic. This ultimately resulted in the declaration of a city-wide air quality management area (AQMA) for NO2 in 2010, and on the adoption in 2013 of an Air Quality Action Plan (AQAP) by the city council with a creation of a list of measures that seek to address the issue of Oxford's poor air quality.

This paper links closely to the background papers on Carbon Issues and Transport.

POLICY AND REGULATORY FRAMEWORK

National Policy

Action to manage and improve air quality is largely driven by European (EU) legislation.

2008 Ambient Air Quality Directive (2008/50/EC)[1]

This sets legally binding limits for concentrations in outdoor air of major air pollutants that impact public health such as particulate matter (PM_{10} and $PM_{2.5}$) and nitrogen dioxide

[1] https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:152:0001:0044:EN:PDF

(NO_2). For NO2 (Nitrogen Dioxide) there are two limit values for the protection of human health. These require member states to ensure that annual mean concentration levels of NO2 do not exceed 40µg/m3 and hourly mean concentration levels of NO2 do not exceed 200µg/m3 more than 18 times a calendar year. As well as having direct effects, these pollutants can combine in the atmosphere to form ozone, a harmful air pollutant (and potent greenhouse gas) which can be transported great distances by weather systems. The 2008 directive replaced nearly all the previous EU air quality legislation.

The EU Ambient Air Quality Directive sets legally binding limits for ambient concentrations of certain pollutants in the air and forms the context of the local air quality management (LAQM) regime which requires every district and unitary authority to regularly review and assess air quality in their area.

Air Quality Standards Regulations 2010[2]

The 2008 Ambient Air Quality Directive was made law in England through the 2010 Regulations which also incorporate the 4th air quality daughter directive (2004/107/EC)[3] that sets targets for levels in outdoor air of certain toxic heavy metals and polycyclic aromatic hydrocarbons. Equivalent regulations exist in Scotland, Wales and Northern Ireland.

UNECE Gothenburg Protocol[4]

The UNECE (United Nations Economic Commission for Europe and Executive Committee) Gothenburg Protocol provides separate legislation for emissions of air pollutants setting national emission limits (ceilings) for SO_2, NO_X, NH_3 and volatile organic compounds for countries to meet from 2010 onwards.

The Air Quality Strategy for England, Scotland, Wales and Northern Ireland[5]

The strategy sets out a way forward for work and planning on air quality issues. It describes, firstly, the air quality standards and objectives and, secondly, a policy framework for tackling fine particles. Through this, where it appears that air quality objectives will not be met in an area by designated target dates, local authorities must declare an Air Quality Management Area and develop an action plan. At the time of writing Government was consulting on a new Air Quality Strategy which is anticipated in late 2018.

Air quality plan for nitrogen dioxide (NO2) in UK (2017)[6]

The 2017 version provides an updated statutory air quality plan for nitrogen dioxide (NO_2), setting out how the UK will be reducing roadside nitrogen dioxide concentrations and a comprehensive approach to meeting the statutory limits for nitrogen dioxide.

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[2] http://www.legislation.gov.uk/uksi/2010/1001/contents/made
[3] http://www.epa.ie/pubs/legislation/air/quality/airquality4thdaughterdirective2004107ec.html
[4] http://www.unece.org/environmental-policy/conventions/air/guidance-documents-and-other-methodological-materials/gothenburg-protocol.html
[5] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/69336/pb12654-air-quality-strategy-vol1-070712.pdf
[6] https://www.gov.uk/government/publications/air-quality-plan-for-nitrogen-dioxide-no2-in-uk-2017

National Planning Policy Framework (Revised 2018)[7]

The Revised NPPF (published July 2018) retains an emphasis on Air Quality Management Areas (para 181) from the previous version but is strengthened by a requirement to improve air quality and mitigate the impacts of individual sites and by stating that a strategic approach is required. Importantly 2018 NPPF further strengthens the linkage between sustainable patterns of development, reduced need for travel, good air quality and health (Paragraph 103) and states in para 170 that

> "*Planning policies and decisions should contribute to and enhance the natural and local environment by:*
>
> *e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air quality;"*

Planning Practice Guidance

Sitting below NPPF is a series of Planning Practice Guidance Notes (PPG) issued by Government to inform the conduct of planning. One of the topic-based notes considers Air Quality[8].

UK Industrial Strategy (2017)[9]

The Industrial Strategy, published in November 2017, emphasises the need for clean growth in order to boost economic prosperity within the UK. Some of the stated aims of the Industrial Strategy relevant to air quality include:

- Decarbonising the heat supply; and
- Lowering emissions from the transport sector.

Local Policy

Oxford Strategic Partnership (OSP)

OSP was founded in 2003 to promote joined-up approaches for improving quality of life in Oxford and also provides a distinct set of priorities for the City. The OSP is made up of a range of organisations including Oxford City and Oxfordshire County Councils, the Universities, the Health Sector, Business and Voluntary Organisations. The priorities that were developed by the OSP are set out in the Oxford Strategic Partnership Visioning Document[10].

The Aims of the OSP are:

- To provide a clear and ambitious vision for the future of Oxford, developing its environmental, economic and social life in a positive and sustainable manner;

[7] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/733637/National_Planning_Policy_Framework_web_accessible_version.pdf
[8] https://www.gov.uk/guidance/air-quality--3
[9] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/611705/building-our-industrial-strategy-green-paper.pdf
[10] https://www.oxford.gov.uk/downloads/file/1757/osp_vision_aims_challenges_and_priorities_2013

- To improve the quality of life of all sections of the community, to reduce inequalities, and support the needs and aspirations of citizens in their local areas;
- To foster and promote closer working between local agencies to deliver responsive and high quality services across the city.

Oxford City Council Corporate Plan 2016-2020[11]

The City Council's ambition, which has been developed with partners among local businesses, community organisations, unions, the health and education sectors and the County Council, is to make Oxford a world-class city for all of its citizens. The Corporate Plan focuses on five interlinked priorities which address the key needs of the city. The new Local Plan 2036 will help to deliver the Council's strategic priorities which include:

- Vibrant and Sustainable Economy;
- Meeting Housing Needs;
- Strong and Active Communities
- A Clean and Green Oxford

Vision for Oxford 2050 (2018)[12]

2050 provides a consultation-based, thought-provoking Vision for Oxford 2050. It is intended to assist Councillors in their strategic thinking and decision making and considers a wide range of areas for which Oxford City Council has responsibility:

- Work and Learning;
- People and Communities;
- Built and Natural Environment;
- Transport and Connectivity;
- Culture and Leisure.

The Built and Natural environment element Vision 2050 states that Oxford will be a clean and accessible city where petrol and diesel vehicles have been superseded and air pollution substantially reduced.

Oxford City Council A Sustainability Strategy for Oxford (2011 – 2020)[13]

This brought together within one overarching document, all of the Council's existing policies relating to sustainability and set out a longer term framework to address these issues. The Sustainability Strategy focuses on a number of core themes and sets long term targets and objectives for these themes. The themes covered are:

- Climate change and sustainable energy
- Sustainable transport and air quality
- Sustainable business and procurement
- Water consumption and sustainable drainage

[11] https://www.oxford.gov.uk/download/downloads/id/1756/corporate_plan_2016-20.pdf
[12] https://oxford2050.com/build-and-natural-environment/
[13] https://www.oxford.gov.uk/download/downloads/id/1905/sustainability_strategy_2011-2020.pdf

- Waste management

The strategy was intended to enable the Council to broaden its scope in dealing with its corporate objectives relating to sustainability and to assist in the delivery of broader objectives for the City as a whole such as those set out, for example, in the Low Carbon Oxford Strategy. As such it remains an important point of reference for the Local Plan 2036.

A replacement Sustainability Strategy is under preparation with adoption by the Council anticipated in early 2019.

Air Quality Action Plan 2013-20 [14]

Oxford City Council has a duty under Part IV of the Environment Act, 1995 to periodically review and assess the air quality within the city. Where it appears that air quality objectives will not be met by designated target dates, Oxford City Council must declare an Air Quality Management Area (AQMA) and develop an action plan in pursuit of those objectives.

The whole of Oxford was declared an AQMA in 2010 via an Air Quality Management Area Order[15]. The AQMA was declared because assessments of air quality predicted that the annual mean objective for nitrogen dioxide of 40 µg/m3 would not be met in a number of areas.

The Council's current Air Quality Action Plan (AQAP) highlights measures to improve local air quality in order to meet the air quality objectives within the city. Further measures to improve air quality are considered within the Oxford Area Strategy of Oxfordshire County Council's Local Transport Plan for 2015-2030 (LTP4). (see below).

The 2013 AQAP prioritises measures to deliver sustainable road transport and improve air quality. In doing so it identifies six key themes:

- Support for development of sustainable transport measures
- Support for the uptake of low and zero emission vehicles
- Reducing freight emissions
- Planning for sustainable transport
- Managing the Council's transport emissions
- Developing partnerships and public education

Since the inception of the air quality action programme and the consequent drop in pollutants from road traffic, whilst the drive for zero emissions from traffic will continue,

[14] https://www.oxford.gov.uk/downloads/download/133/air_quality_action_plan
[15] https://www.oxford.gov.uk/downloads/file/543/air_quality_management_order_2010

the contribution to poor air quality by static sources (especially emissions from domestic central heating boilers, industrial and commercial facilities) is now coming under closer scrutiny.

Low Emission Strategy 2013 [16]

The Low Emission Strategy provides an overarching city-wide carbon reduction plan via a framework for integrating all of the Council's activities to reduce carbon and air quality related emissions across the City. This integrated approach seeks to reduce the climate change and air quality related emissions generated from activities across the city via three main sectors:

- Domestic activity – essentially emissions from domestic or residential dwellings ;
- Non-domestic activity – emissions from commercial, industrial, business and public sector premises;
- Transport – all transport activity on the road and rail network in the City.

Through the Low Emission Strategy the Council focuses on the measures and policies the City Council can carry out or influence, rather than action from all actors in the City.
As such it concentrates on:

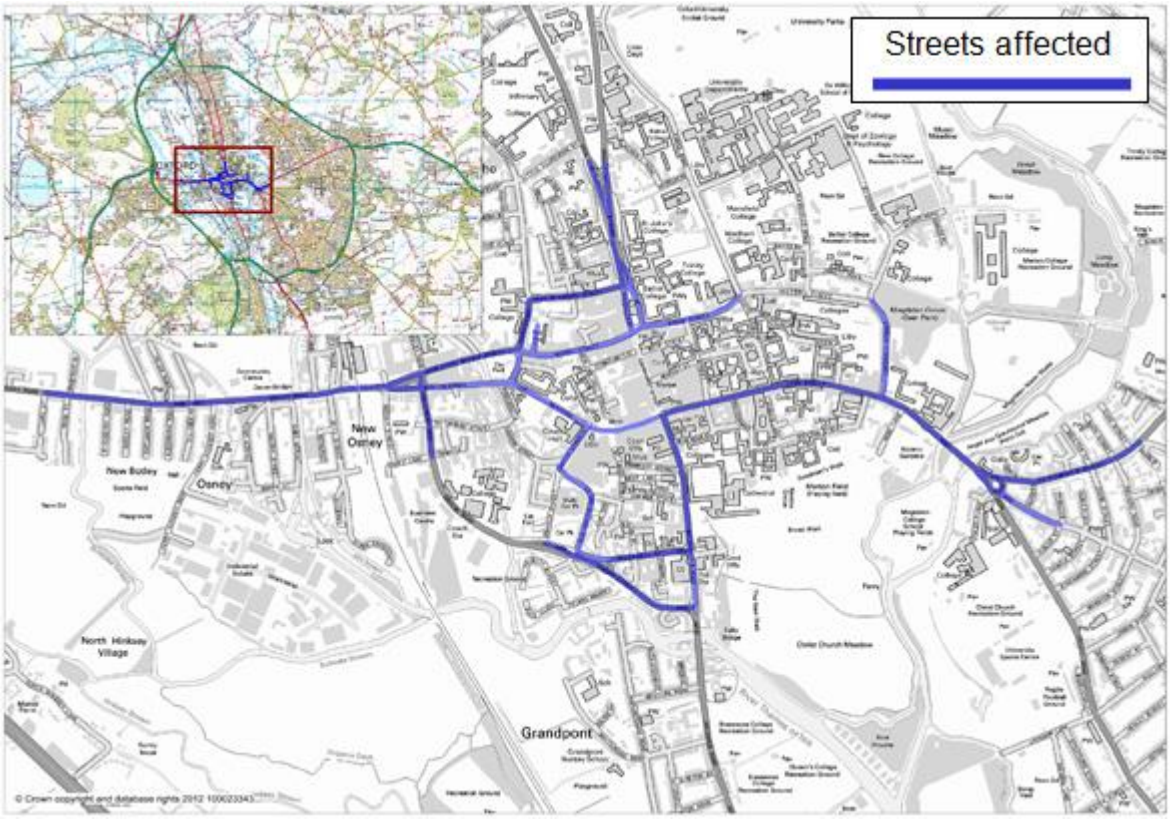
- Own estate (the council's own operational buildings, council owned housing and the Council's vehicle fleet);
- Direct influence (measures with a direct impact on the emissions of others through regulations, planning policies and procurement practices);
- Wider influence (through partnerships, advice and leadership).

Oxford City Council: Low Emission Zone[17]

The Low Emission Zone (LEZ) was introduced in 2016 to encourage the uptake of cleaner greener vehicles, leading to reductions in pollution emissions and improved air quality. Oxford City Council, together with Oxfordshire County Council, developed the LEZ over a number of years, including assessments highlighting the need to reduce the impact of vehicle generated emissions. A joint City-County feasibility study identified the process leading to the development of the LEZ, including consultation with the Bus Operators. Figure 1 shows the extent of the Oxford LEZ.

[16] https://www.oxford.gov.uk/download/downloads/id/597/low_emission_strategy_2013-20.pdf
[17] https://www.oxford.gov.uk/info/20216/air_quality_management/208/oxfords_low_emission_zone_lez

Figure 1: Streets affected by the Oxford City Low Emission Zone (2016)



Connecting Oxfordshire: The Local Transport Plan for 2015-2030 (LTP4)[18]

LTP4 sets out Oxfordshire County Council's policy and strategy for developing the transport system in Oxfordshire to 2031 and fits the highest level strategic aims, as set out in "*Oxfordshire 2030, the Sustainable Community Strategy*" (see above). "*Connecting Oxfordshire*" has been developed with three over-arching transport goals:

- To support jobs and housing growth and economic vitality;
- To reduce emissions, enhance air quality and support the transition to a low carbon economy
- To protect and enhance Oxfordshire's environment and improve quality of life (including public health, safety and individual wellbeing)

The area-based supplement to LTP4, "*The Oxford Transport Strategy*"[19] considers further and in more localised detail how transport within the city might become more sustainable and less polluting through the encouragement of modal shift, the reduction in need to travel and the utilisation of non-carbon fuelled forms of transport. It sets ambitious air quality objectives for the city and provides a starting point for City and County Councils' joint work for the development of a Zero emission zone in Oxford:

[18]http://mycouncil.oxfordshire.gov.uk/documents/s33704/Background%20CA_JUN2816R07%20Connecting%20Oxfordshire%20vol%201%20-%20Policy%20and%20Overall%20Strategy.pdf
[19]http://mycouncil.oxfordshire.gov.uk/documents/s33711/Background%20CA_JUN2816R12%20Connecting%20Oxfordshire%20vol%208%20part%20i%20-%20Oxford%20Transport%20Strategy.pdf

"to start a city centre zero-emission zone for all vehicles by 2020, with the zone being gradually expanded over time as the required infrastructure and technology develops. This will support objectives to improve air quality and targets to reduce emissions from vehicles."

Local Planning Guidance

In addition to the above Oxford City Council is in the process of developing its own planning guidance on air quality for developers. This document is expected to be published this year.

OTHER RELEVANT DOCUMENT(S)

Land-Use Planning and Development Control: Planning for Air Quality [20]

Published by The Institute of Air Quality Management in 2015 this document was published to ensure that air quality is adequately considered in the land-use planning and development control processes and sets out how land-use planning can play a critical role in improving local air quality. The pattern of land use determines the need for travel, which is a major influence on transport related emissions. At a strategic level, spatial planning can provide for more sustainable transport links between home, work and facilities. Development is not inherently negative for air quality; policies should promote high quality building standards that reduce energy use and use cleaner technologies.

CURRENT SITUATION

A helpful backdrop to understanding the progress being made by Oxford and continuing challenges in the matters considered by this paper is provided by the *Oxford Sustainability Index 2016*[21]. The outcome of the Oxford Sustainability Index was designed to identify environmental strengths and potential opportunities for action and improvement. It found that Oxford has taken huge strides to improve the environment but that further challenges continue to be faced in order for its environmental goals to be achieved whilst at the same time striving to increase its economic output and meet the housing needs as one of the fastest growing cities in the UK.

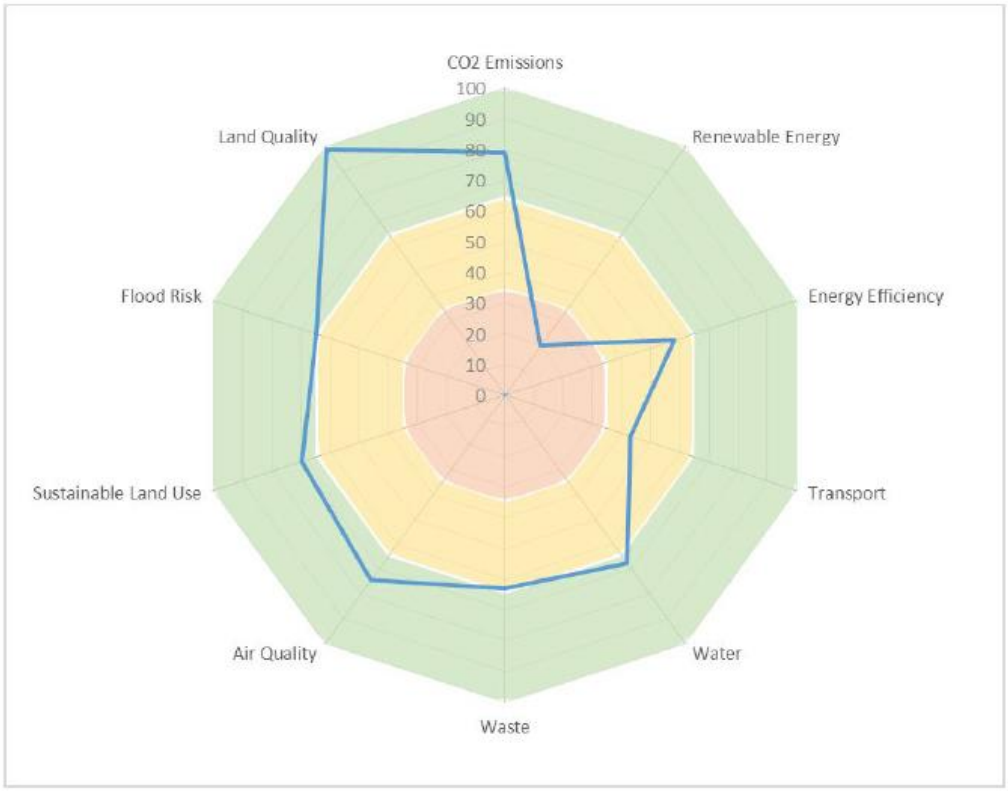
The results of the analysis (Figure 2 - below) indicate that Oxford performed better than average in most categories including Air Quality scoring particularly well in land quality. However the study also highlighted the need for significant improvement in three key areas connected to this paper – renewable energy, energy efficiency and transport.

[20] http://www.iaqm.co.uk/text/guidance/air-quality-planning-guidance.pdf
[21] https://www.oxford.gov.uk/downloads/file/2655/oxford_sustainability_index_2016

Appendix 1 to this paper summarises in rather more detail the approach adopted to the monitoring of air quality in Oxford and the improvement that the implemented policies have permitted.

Although many of the pollutants which contribute to poor air quality are not carbon based they are typically generated by the burning of fossil fuels in their various forms. It is therefore important that this paper should, where appropriate, be read alongside the Carbon Issues paper.

Figure 2: Oxford Sustainability Index environmental performance by category



Health Impacts of Air Pollution

Since the introduction of the Clean Air Act in the 1950s, there has been a growing body of evidence from epidemiologic studies that correlate human exposure to air pollutants with a variety of health impacts.

In February 2016 the Royal College of Paediatrics and Child Health published a study[22], estimating the amount of deaths in the UK attributable to exposure to outdoor air pollution to be 40,000/year. In the same study, air pollution was linked to diseases such as cancer, asthma, stroke, heart disease, diabetes, obesity and dementia.

[22] https://www.gov.uk/government/publications/comeap-long-term-exposure-to-air-pollution-and-chronic-bronchitis

In April 2016, the Committee on the Medical Effects of Air Pollutants (responsible for carrying out research into the link between air quality and human health) stated that epidemiological evidence was suggestive of an association between long term exposure to particulate pollution and chronic bronchitis. The Committee's sensitivity analyses [23] estimated that over 722,000 cases of chronic phlegm in 2010 could be attributable to exposure to particulate pollution (anthropogenic PM10) in the UK, and that a reduction of 1 μgm^{-3} of this pollutant in 2010 could have led to over 65,000 fewer cases in 2010. Later in the year (November 2016), the European Environment Agency published a report[24] concluding that the UK had 11,940 premature deaths in 2013 from nitrogen dioxide. The number was down from 14,100 in 2012, but was still the second worst in Europe.

In 2014, Public Health England estimated the mortality burden attributed to long term fine particulate air pollution exposure in Oxfordshire to be 5.6% of the population, equivalent to 276 deaths (Age 25+) and equivalent to 2,944 life years lost[25]. However, given the uncertainties, this could be somewhere between 0.9% and 11%. According to Defra[26], the annual health cost to society of the impacts of particulate matter alone in the UK is estimated to be around £16 billion.

Actions to Improve Air Quality

The AQAP focusses on measures the City Council has the ability to address, but includes measures that it can influence, or work in partnership with others to deliver.
Effective measures require co-operation from all sectors including transport policy and management, the Council's priorities for new developments, freight management for business and commerce, and daily choices made by all transport users.

Oxford's AQAP recognises that the City Council cannot act in isolation in order to deliver a comprehensive package of measures without engagement and delivery from a wide set of stakeholders. The AQAP describes a wide variety of actions that Oxford City Council has taken to improve air quality in the city. As well as a wide range of initiatives to raise public awareness, develop best practice and partnership working and improve the uptake of measures designed to improve air quality (via for example the encouragement of the use of electric vehicles) and energy efficiency the Council has:

- Declared the whole of the city an Air Quality Management Area for NO_2;
- Developed an Air Quality Action Plan and Low Emission Strategy for the city;
- In 2014 introduced the first extensive Low Emission Zone (LEZ) outside of London. The aim of this is to improve air quality and reduce transport related emissions in the city centre by the introduction of buses with lower emission engines.

[23] https://www.rcplondon.ac.uk/projects/outputs/every-breath-we-take-lifelong-impact-air-pollution
[24] http://www.eea.europa.eu/publications/air-quality-in-europe-2016
[25] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/332854/PHE_CRCE_010.pdf
[26] https://www.gov.uk/guidance/air-quality-economic-analysis

Oxford Zero Emission Zone (ZEZ)

As described above Oxford city centre currently has illegally-high levels of toxic nitrogen dioxide, which contributes to diseases including cancer, asthma, stroke and heart disease contributing to around 40,000 deaths in the UK every year.

In response, and building on the wide range of work already undertaken, Oxford City Council and Oxfordshire County Council are proposing to introduce the world's first Zero Emission Zone in Oxford city centre. The proposal would see diesel and petrol vehicles banned from Oxford city centre in phases, starting with some vehicle types and a small number of streets in 2020, and - as vehicle technology develops - moving to all vehicle types across the whole city centre in 2035.

It is estimated by the Council that the ZEZ will cut the NO_2 level in Oxford city centre's most polluted street, George Street, by 74% by 2035 - bringing it well below the legal limit.
There is a YouTube video[27] of the proposed ZEZ summarising the proposals and benefits.
In late 2017 a consultation was held in which 755 individuals and businesses took part. Although there was huge support for a Zero Emission Zone in Oxford with 90% of those who responding saying tackling poor air quality in Oxford is either "very important" or "important", many concerns were raised. At the time of the preparation of this paper Oxford City Council, in partnership with the County Council, are considering the next steps for this initiative in light of the of the consultation outputs.

CONCLUSION

The recently revised NPPF has raised the profile and relevance of air quality within planning policy. This is particularly important for Oxford City primarily due to its mediaeval street pattern and historically high levels of air pollution along with the associated need for planning, in its role as a facilitator of change, to contribute to the required reduction of air pollution in the city from not only transport sources but also residential and employment sources.

The overall conclusion of Oxford City Council's Sustainability Index (2016) was that the city's policies and strategies perform well compared to those set by other local authorities. The latest data would support the premise that these policies aiming to improve local air quality through the Low Emission Zone, the proposed future Zero Emission Zone and the Green House Gas reduction commitments through the Covenant of Mayors continue to perform well. In achieving this improvement Oxford has demonstrated leadership in tackling air quality issues with initiatives including:

- work to deliver a hybrid bus fleet
- the implementation of the first Low Emission Zone outside London;

[27] https://www.youtube.com/watch?v=5nbEdlS4by8

- the proposal for the World's first Zero Emission Zone

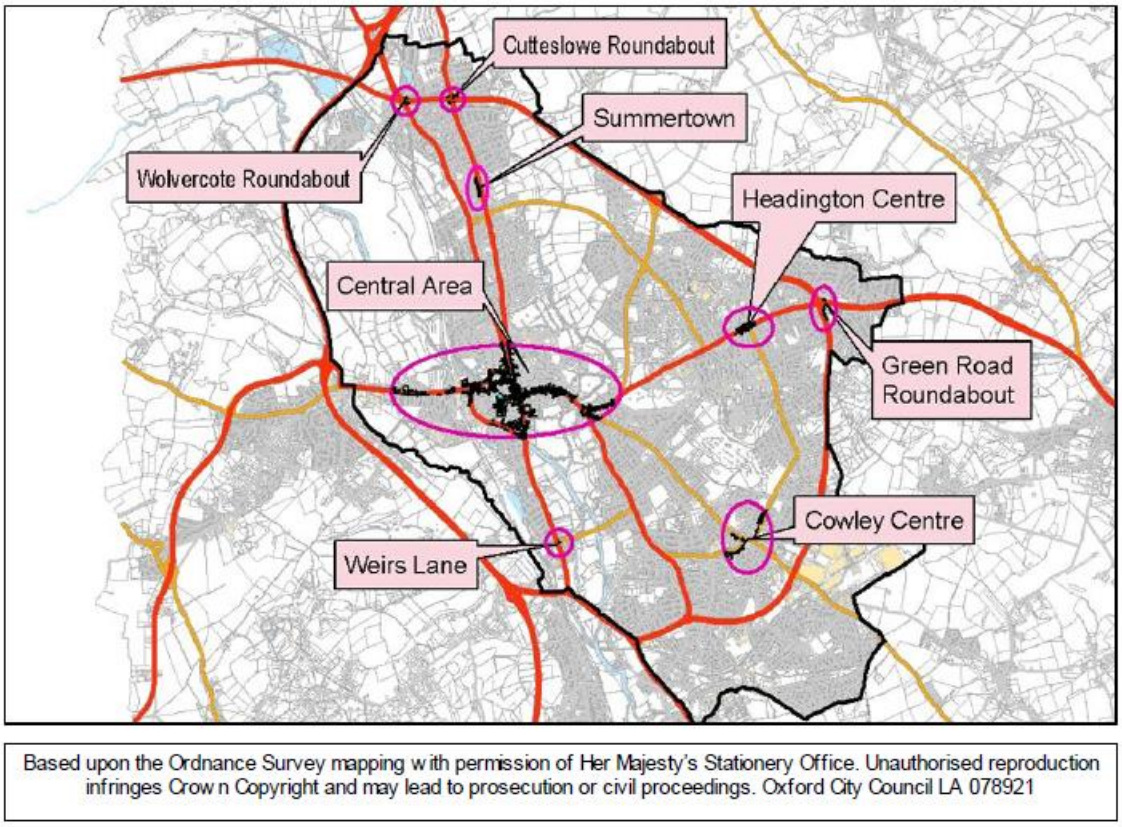
The wealth of data contained in this paper and the source documents underpinning it indicate that Oxford has made significant progress in addressing its particular air quality issues since 2010 but that there is still much progress to be made in order to ensure that, in the future, the air quality thresholds imposed by legislation are no longer breached, the health of the city improved whilst at the same time the planned growth of the city does not impact upon this improvement.

APPENDIX 1: AIR QUALITY MONITORING IN OXFORD CITY

Air pollution 'hotspots' in Oxford

Figure A1 (below) is a map extracted from the 2013 AQAP and shows the AQMA (black line) and mean air quality hot spots (pink circles) in the city at the time of the preparation of the document. This highlighted that many of the main roads in the city centre were air quality hotspots, along with key junctions on the ring road and many district centres (most notably Summertown, Headington and Cowley).

Figure A1: Air quality "hotspots" in Oxford, 2013



Based upon the Ordnance Survey mapping with permission of Her Majesty's Stationery Office. Unauthorised reproduction infringes Crown Copyright and may lead to prosecution or civil proceedings. Oxford City Council LA 078921

Source: Oxford Air Quality Action Plan, 2013.

The 2017 Air Quality Status Report (published June 2018, still subject to review by DEFRA)[28] confirms that there are now only 3 air quality hotspots (the Central area, Wolvercote Roundabout and Cutteslowe Roundabout) where exceedances of the limit value annual mean for NO2 are still observed.

Air Quality in Oxford

The city of Oxford, in common with many urban areas throughout the United Kingdom, is subject to poor air quality, particularly in areas with high levels of road traffic. This is

[28] **https://www.oxford.gov.uk/downloads/file/4755/air_quality_annual_status_report_2017**

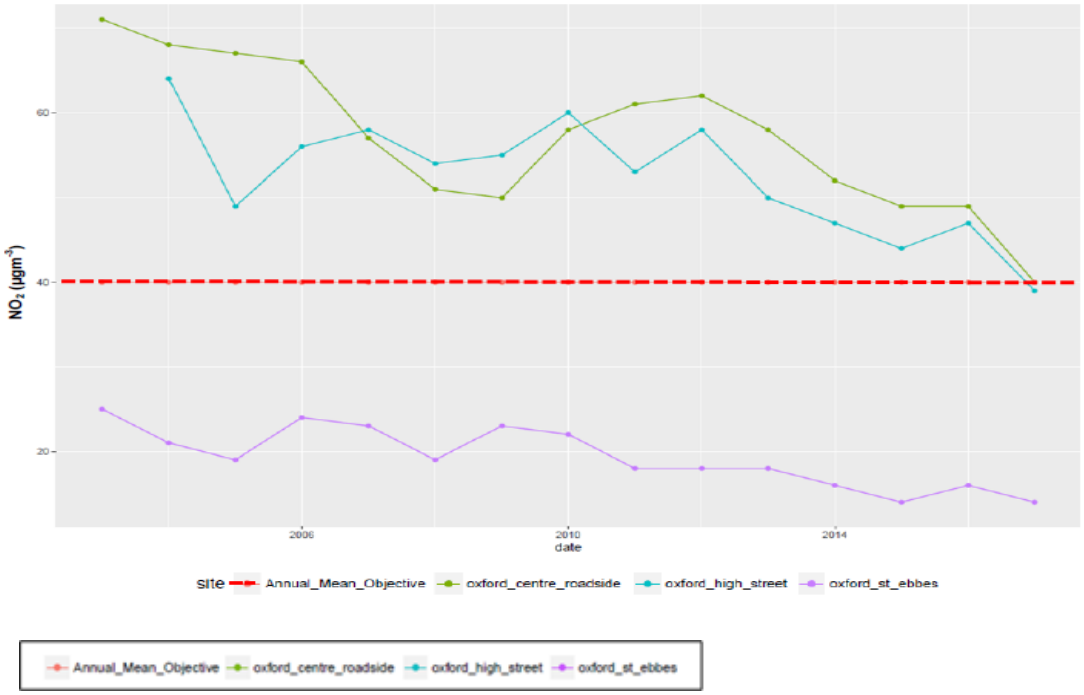
monitored via the Air Quality Annual Status Report series, the latest, for 2017, being published in June 2018.

In 2017, automatic continuous monitoring of nitrogen oxides (NO and NO_2), particulate matter (PM10 and PM2.5) and ozone (O_3) was carried out at three locations, referred to as Oxford Centre Roadside, Oxford High Street and Oxford St. Ebbe's. Further measurements of NO_2were carried out at 70 locations using diffusion tubes.

Nitrogen Oxides

In the city nitrogen dioxide (NO_2), a toxic gas emitted by internal combustion engines, is the pollutant of most concern. The process of review and assessment of air quality in Oxford has been taking place since 1999 and over this period pollution levels in Oxford have reduced significantly.

Figure A2: Long term trends of Annual Mean NO_2 (μgm^{-3}) at Oxford's Continuous Monitoring Stations, 2003-2017.



In response to this situation the entire city was declared as an Air Quality Management Area (AQMA) in 2010 and an Air Quality Action Plan (AQAP) [29] adopted by the Council in 2013. For many years the annual mean level of NO_2 in central Oxford, as measured at St Aldate's and High Street (Figure A2)[30] was consistently over the 40 micrograms lever required by the European Directive although the latest data, 2017, shows a significant reduction when compared to the 2016 with the greatest reduction (-18%) at the roadside

[29] https://www.oxford.gov.uk/downloads/file/539/air_quality_action_plan_2013
[30] https://www.oxford.gov.uk/download/downloads/id/3832/air_quality_annual_status_report_2016.pdf

monitoring stations of Oxford High St and Oxford Centre roadside such that the average NO2 level at these two stations approximated to the level permitted by the Directive.

The most recent source apportionment study described by the 2013 Air Quality Action Plan[31] details the individual contribution of each source to air pollution in Oxford which is shown by Figure A3 below and indicates that transport is by far the most significant source of emissions of oxides of nitrogen in the city, accounting for 75% of emissions (ie "*road* transport" plus "*other* transport") with Figure A4 providing a further breakdown by vehicle type.

Figure A3:Nitrogen Dioxide emissions by source in Oxford (2010)

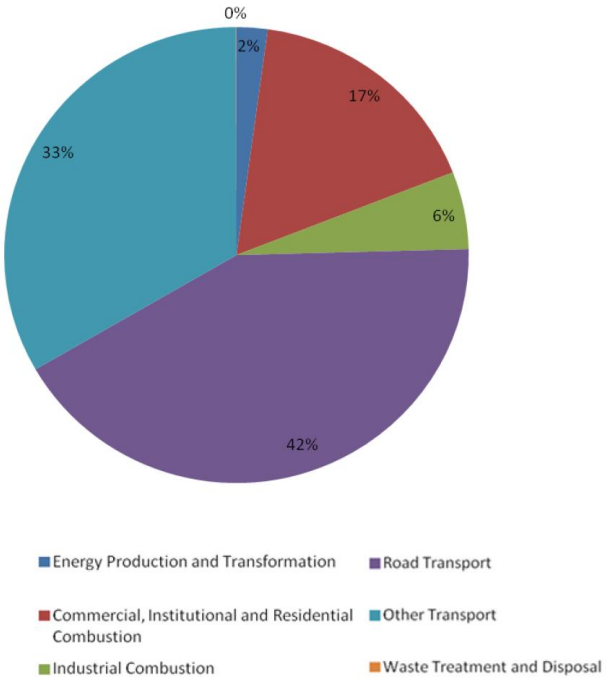
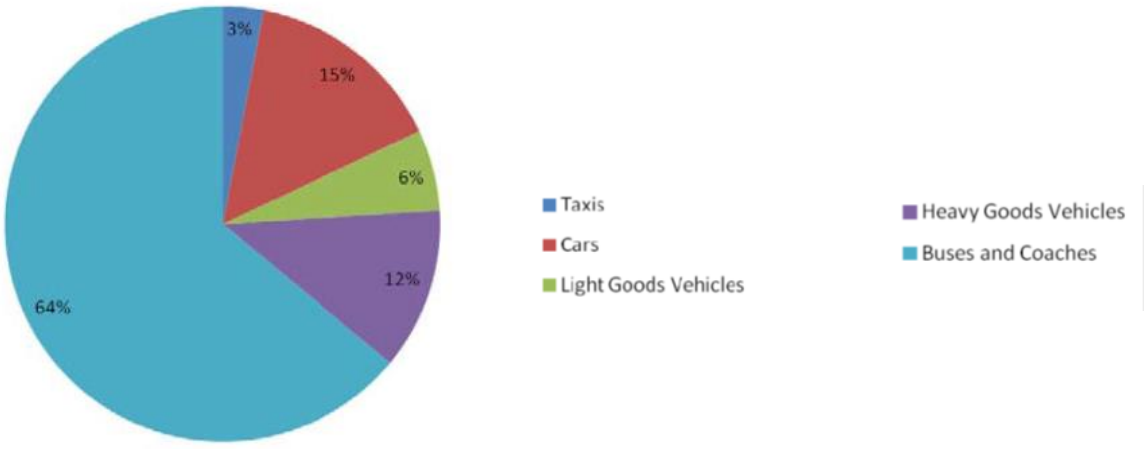


Figure A4: Nitrogen Dioxide emissions by vehicle type in Oxford (2010)



[31] https://www.oxford.gov.uk/downloads/download/133/air_quality_action_plan

The results of the monitoring work carried out by Oxford City Council for 2016 showed the following:

- Significant decreases in NO2 levels were observed in the city centre with an overall reduction 23% across the centre;
- The diffusion tube results show that the annual mean AQS objective of 40 μgm^{-3} for NO_2 was exceeded at 4 of the 70 monitoring locations in 2017 – down from 17 in 2016.

These very encouraging results are likely to be explained by two key factors:

1) During 2017 new Euro VI buses were purchased and introduced by Stagecoach and Oxford Bus Company who at the same time started to withdraw the Euro V buses;
2) Several road works leading to prolonged road closures relieving traffic levels in certain parts of the city.

Therefore these latest data will need to be treated with some caution.

Two further types of products having a significant impact on air quality are monitored:

- Particulates (PM2.5 and PM10); and
- Ozone (O_3).

These are also closely monitored and have been major additional considerations in the approach being taken by Oxford and its policy development.

Particulate Matter (PM_{10} and $PM_{2.5}$)

Airborne particulate matter varies widely in its physical and chemical composition, source and particle size and is derived mainly from combustion by diesel engines and incineration. The terms PM10 and PM2.5 are used to describe particles with an effective size less than 10 and 2.5 µm respectively. These are of concern with regard to human health, as they are small enough to penetrate deep into the lungs. They can cause inflammation and a worsening of the condition of people with heart and lung diseases. In addition, they may carry surface absorbed carcinogenic compounds into the lungs. Larger particles, meanwhile, are not readily inhaled, and are removed relatively efficiently from the air by sedimentation.

PM10 data has been monitored by automatic continuous monitors at Oxford St. Ebbe's and Oxford High Street. PM2.5 has been monitored at Oxford St. Ebbe's. The Air Quality Strategy (2013) objective for PM10 is a maximum of 50 μgm^{-3} for any 24h mean period, not to be exceeded more than 35 times a year. In 2017 there were 2 exceedances to the 50 μgm^{-3} 24h mean periods value recorded at Oxford High Street compared to 4 in 2016 thereby fully meeting the AQS requirements. Further, it has been suggested by Kings College that these were as the result of a trans-boundary pollution episode consequent to the weather conditions on Sunday 22 and Monday 23 January 2017.

Within the AQS there is no objective for PM2.5; however there is a non-mandatory compliance target of 25 µgm^{-3} to be met by 2020. The 2017 annual mean for PM2.5 (*annualised*) was 11 µgm^{-3} at Oxford St. Ebbe's, down from 13 µgm^{-3} in 2016.

Ozone (O_3)

Ozone (O_3) is not emitted directly into the atmosphere in significant quantities, but is a secondary pollutant produced by reaction between nitrogen dioxide (NO_2) and hydrocarbons, in the presence of sunlight. Whereas nitrogen dioxide (NO_2) contributes to ozone formation, nitrogen oxide (NO) destroys ozone and therefore acts as a local sink. For this reason, ozone levels are not as high in urban areas (where NO is emitted from vehicles) as in rural areas. Ozone levels are usually highest in rural areas, particularly in hot, still, sunny weather conditions giving rise to "summer smog".

Ozone is measured at Oxford St. Ebbe's with an AQS objective for daily maximum on an 8 hour running mean of 100 µgm^{-3} not to be exceeded more than 10 days a year. The site exceeded the AQS daily objective for ozone on 5 days during a hot spell in June 2017 meeting the AQS objectives for this pollutant.