2016 Air Quality Annual Status Report (ASR)

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

July 2017

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Executive Summary

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.

Recently such studies have increased significantly, mainly due to improvements of monitoring technology, coupled with scientific advances in modern chemistry and modelling, which has provided a new generation of environmental researchers with the necessary tools to better interpret how various pollution elements interact with each other and the human body.

In February 2016 the Royal College of Paediatrics and Child Health published a study[1], 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.

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 considered epidemiological evidence was suggestive of an association between long term exposure to particulate pollution and chronic bronchitis. The committee's sensitivity analyses[2] estimated that over 722,000 cases of chronic phlegm in 2010 could be attributable to exposure to particulate pollution (anthropogenic PM_{10}) 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[3] that concludes that the UK had 11,940 premature deaths in 2013 from nitrogen dioxide. The number was down from 14,100 in 2012, but 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 2944 life years lost[5]. However, given the uncertainties this could, in fact, be somewhere between 0.9% and 11%.

According to Defra[4], the annual health cost to society of the impacts of particulate matter alone in the UK is estimated to be around £16 billion.

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. In the city, nitrogen dioxide (NO_2) 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. Analysis of ten years trends from our data collection and analysis show that NO_2 levels have dropped by typically 35% at roadsides in the city centre.

However, despite all the efforts committed so far to tackle air pollution, Oxford continue to breach the annual mean limit value for nitrogen dioxide (NO_2) in some areas. There is still considerable action required in order to secure our compliance with the European Directive.

The whole of the city was declared as an Air Quality Management Area (AQMA) in 2010. An Air Quality Action Plan (AQAP) was adopted by the Council in 2013. More details on the AQMA and AQAP are available here:

https://www.oxford.gov.uk/info/20216/air_quality_management/206/air_quality_management_in_oxford/2

The most recent source apportionment study, that details the individual contribution of each source to air pollution in Oxford is presented in the city's AQAP 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.

In 2016, automatic continuous monitoring of nitrogen oxides (NO and NO_2), particulate matter (PM_{10} and $PM_{2.5}$) and ozone (O_3) was carried out at three locations, referred to as Oxford Centre Roadside, Oxford High Street and Oxford St. Ebbe's. Measurements of NO_2 were also carried out at 70 locations using diffusion tubes.

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

- The annual mean Air Quality Strategy (AQS) objective for NO_2 is 40 μgm^{-3}. This objective was met at Oxford St. Ebbe's automatic monitoring site in 2016. Oxford Centre roadside and Oxford High Street registered NO_2 annual means of 49 and 47 μgm^{-3} respectively;

- The diffusion tube results show that the annual mean AQS objective of 40 μgm^{-3} for NO_2 was exceeded at 17 of the 70 monitoring locations in 2016 - a reduction of 11% when compared with the results from 2015;

- The United Kingdom Air Quality Strategy (UK AQS) hourly mean objective for NO_2 is 200 μgm^{-3}, with no more than 18 exceedances allowed each year. Oxford registered no exceedances of this value during 2016, improving the results obtained in 2015. All automatic monitoring sites met this objective for 2016;

- 4 diffusion tube locations which had previously showed exceedances are now below the NO_2 annual mean limit value of 40 μgm^{-3}. There are no new locations reporting exceedances of the annual mean limit value for NO_2 in 2016;

- The annual mean AQS target for PM_{10} is 40 μgm^{-3}. This objective was met at all the monitoring stations in 2016;

- PM_{10} may exceed the 24-hour mean limit of 50 μgm^{-3} no more than 35 times per year to meet the AQS objective. During 2016, there were 4 exceedances recorded, all of them at Oxford High Street, hence meeting the objective for hourly PM_{10};

- Oxford St. Ebbe's met the AQS objective for ozone in 2016, and the non-mandatory $PM_{2.5}$ annual mean target of 20 μgm^{-3} to be met by 2020.

Actions to Improve Air Quality

Oxford's Air Quality Action Plan (AQAP) focusses on measures the City Council has the ability to address, but includes measures that we 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 following are actions that Oxford City Council has taken to improve air quality in the city:

- 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;
- Introduced the first extensive Low Emission Zone (LEZ) outside of London. This won the prize for Local Authority Air Quality Initiative of the Year at the National Air Quality Awards 2015;
- Launched the Oxfordshire Air Quality website to make historic and real time air quality data more readily accessible to members of the public;
- Increased the number of diffusion tube monitoring locations in the city by nearly 50% from January 2015;
- Launched Oxford Park and Pedal which has seen over 100 cycle parking spaces introduced at two of our park and ride sites;
- Ran the Test Drive the Future yearly event to introduce the public to a range of electric vehicles (EVs) and the financial and environmental benefits of going electric. The event provided an opportunity to test drive vehicles, and outlined the options for driving an electric car 'pay as you go' through one of Oxford's car clubs;
- Engaged with the Oxfordshire Health Improvement Board to ensure that air quality is considered in the context of the Joint Strategic Needs Assessment;

- Commissioned a study into options for a Delivery and Servicing Plan for the Council's city centre premises. Consideration and implementation of the options is now underway;
- Continued to seek opportunities to work in partnership with neighbouring District Councils through participation in the Oxfordshire Air Quality Group.
- Presented on the OCC's experiences of implementing our Low Emission Zone to inform DEFRA's consideration of the most appropriate mechanism for establishing newly proposed Clean Air Zones (CAZ);
- Launched the School's Tackling Air pollution (STOP) Project, which provide real-time NO_2 and PM_{10} air quality monitors for installation in 6 schools together with a programme of education on air quality, raising awareness of the main sources and health effects of air pollution emissions;
- Launched a feasibility study considering the introduction of a Zero Emission Zone (ZEZ) in Oxford city centre from 2020 which would then be expanded so that the entire city is covered by around 2030/2035. This study is supported by Oxfordshire County Council and Oxford City Council;
- Launched the Go Ultra Low Oxford Project, with the aim of increasing uptake of ultra-low emission vehicles through support for individuals and provision of enabling infrastructure;
- Increased resourcing of the City Councils Air Quality Officer role, increasing the post from 0.8 FTE to 1FTE reflecting the importance the City Council places on this matter.
- Submitted a successful bid for the provision of electric vehicle charging infrastructure for the use of hackney carriages and private hire taxis in the city which will launch in 2017.

Local Priorities and Challenges

Oxford City Council's priorities for the coming year are to:

- Work in partnership with the Oxford Mobile Air Quality Measurement Group to test new monitoring technology and expand the monitoring regime, where appropriate;

- Continue working with the Local Transport Authority, Oxfordshire County Council, on the development of transport measures that can have a positive impact on Oxford's air quality;
- Complete procurement of EV charging equipment for a trial of different on-street charging technologies as part of the Go Ultra Low Oxford project. The objective for 2017/18 is to install charging equipment at 30 locations across the city, including a 12 month trial collecting data on performance and user experience from volunteer EV drivers and car club members.
- Report annually to the Health Improvement Board on the state of air quality across the county and what measures are being taken to improve it;
- Improve communication with the public on Air Quality, including exploring options for signage on monitoring stations, linking to the OCC website for live data;
- Complete the Zero Emission Zone feasibility study, consider the implications and plan next steps in partnership with Oxfordshire County Council.
- Continue the expansion of the City Councils fleet of electric vehicles;
- Expand the communications programme with schools through the newly launched STOP project.
- Develop work for the provision of electric vehicle charging infrastructure for the use of hackney carriages and private hire taxis in the city.

How to Get Involved

Everyday decisions can have an impact on the air we breathe. Do you take the car when you could have cycled? Do you drive your children to school when you could have walked? We all have a huge role to play and we can all be part of the solution. Encouraging walking and cycling in the city not only has a positive impact on air quality levels, but it also has multiple other benefits, including increasing the health of wellbeing of all those who live, work and visit Oxford.

Full details of Oxford's air quality monitoring results, including real time data on pollutant levels and reference to the city's daily Air Quality Index (AQI), a metric on the daily levels of air pollution, together with recommended actions and health advice

is available on the Oxfordshire Air Quality Group website (https://oxfordshire.air-quality.info/)

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1 Local Air Quality Management

This report provides an overview of air quality in Oxford during 2016. It fulfils the requirements of Local Air Quality Management (LAQM) as set out in Part IV of the Environment Act (1995) and the relevant Policy and Technical Guidance documents.

The LAQM process places an obligation on all local authorities to regularly review and assess air quality in their areas, and to determine whether or not 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. This Annual Status Report (ASR) is an annual requirement showing the strategies employed by Oxford City Council to improve air quality and any progress that has been made.

The statutory air quality objectives applicable to LAQM in England can be found in table E.2 in Appendix E.

2 Actions to Improve Air Quality

2.1 Air Quality Management Areas

Air Quality Management Areas (AQMAs) are declared when there is an exceedance or likely exceedance of an air quality objective. After declaration, the authority must prepare an Air Quality Action Plan (AQAP) within 12-18 months setting out measures it intends to put in place in pursuit of the objectives.

A summary of AQMAs declared by Oxford City Council can be found in Table 2.1. Further information related to declared or revoked AQMAs, including maps of AQMA boundaries are available online at http://uk-air.defra.gov.uk/aqma/local-authorities?la_id=193.

Table 2.1 – Declared Air Quality Management Areas

AQMA Name	Pollutants and Air Quality Objectives	City / Town	One Line Description	Action Plan
The City of Oxford AQMA	• NO_2 annual mean	Oxford	The whole of the administrative area of Oxford City Council	Air Quality Action Plan 2013 – 2020 http://www.oxford.gov.uk/info/20216/air_quality_management/206/air_quality_management_in_oxford/2

2.2 Progress and Impact of Measures to address Air Quality in Oxford City Council

Oxford City Council has taken forward a number of measures during the current reporting year of 2016 in pursuit of improving local air quality. Details of all measures completed, in progress or planned are set out in Table 2.2. More detail on these measures can be found in the Air Quality Action Plan.

Key completed measures in 2016 are:

- Requiring air quality assessments for all planning applications for major developments;
- Rolling out eco-driving training for our staff;
- Working closely with our County and District colleagues, through engagement with the Oxfordshire Air Quality Partnership;
- Continued engagement with the Oxfordshire Health Improvement Board;
- Completion of a feasibility study and submission of grant application to introduce EV charging infrastructure for taxis at strategic locations around the city;
- Recruited over 20 participants for the the Go Ultra Low Oxford electric charging infrastructure trials;
- Ran 'Test Drive the Future' event;
- Recruited 10 electric vehicle car clubs for participation in the GULO trail;
- Undertaken procurement exercise and engaged consultants to undertake Zero Emission Zone feasibility study.

Progress on the following measures has been slower than expected:

- 'Schools Tackling Oxford Air Pollution' (STOP) project rollout to schools has been delayed due to recruitment of new Air Quality Officer.

Oxford City Council expects the following measures to be completed over the course of the next reporting year:

- Full launch of 'Schools Tackling Oxford's Air Pollution' (STOP) Project. The project aims to install real time, indicative air quality sensors in six schools across the city and provides educational material to integrate into the national curriculum;
- Completion of a feasibility study investigating the introduction of a zero emission zone in Oxford city centre from 2020 which would be expanded so that the entire city is covered by around 2030/2035. This study is supported by both Oxfordshire County Council and Oxford City Council;

- Completion of Air Quality Technical Guidance for developers and planners to ensure that air quality is adequately considered in development planning and management in Oxford;
- Ensuring that Air Quality in considered fully in the upcoming Oxford Local Plan due by 2019, by creating air quality policies that are able to effectively respond to the city's air quality problems in the future;
- Working together with the Oxford Mobile Air Quality Measurement Group on the characterization of new innovative NO_2 sensors for use across a range of projects and citizen science;
- Working in partnership with local residents and groups to increase awareness of air pollution, its health implications and actions;
- Launch the trial of on-street charging equipment as part of the Go Ultra Low Oxford project.

Oxford City Council's priorities for the coming year are:

- Work in partnership with the Oxford Mobile Air Quality Measurement Group to test new monitoring technology and expand the monitoring regime, where appropriate;
- Continue working with the Local Transport Authority, Oxfordshire County Council, on the development of transport measures that can have a positive impact on Oxford's air quality;
- Complete procurement of EV charging equipment for a trial of different on-street charging technologies as part of the Go Ultra Low Oxford project. The objective for 2017/18 is to install charging equipment at 30 locations across the city, including a 12 month trial collecting data on performance and user experience from volunteer EV drivers and car club members.
- Report annually to the Health Improvement Board on the state of air quality across the county and what measures are being taken to improve it;
- Improve communication with the public on Air Quality, including exploring options for signage on monitoring stations, linking to the OCC website for live data;

- Complete the Zero Emission Zone feasibility study, consider the implications and plan next steps in partnership with Oxfordshire County Council.
- Continue the expansion of the City Councils fleet of electric vehicles;
- Expand the communications programme with schools through the newly launched STOP project.

Table 2.2 – Progress on Measures to Improve Air Quality

	Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
1	Manage bus emissions through the implementation of the Low Emission Zone	Promoting Low Emission Transport	Low Emission Zone (LEZ)	OCC	Complete	On-going	All local bus services within the streets affected must be operated exclusively by buses whose engines meet the Euro V emission standard	N/A	The Low Emission zone has been implemented	On-going	
2	Work to ensure sustainable transport measures developed in the Oxford Area Strategy of the LTP support the targets of the AQAP	Promoting Low Emission Transport	Other	OCC	Complete	Complete	Oxford Transport Strategy includes measures that support delivery of the AQAP	N/A	The Oxford Transport Strategy has been published and includes measures which support the targets of the AQAP	On-going	
3	Support walking and cycling strategies within the LTP to ensure they assist delivery of the AQAP objectives	Promoting Travel Alternatives	Promotion of Cycling	OCC/Oxfordshire County Council	Complete	Complete	Walking and Cycling strategies include measures that support delivery of the AQAP	N/A	The Active Healthy Travel Strategy has been published and includes measures to support the targets of the AQAP, various schemes around the city, new cycle assess to Headington, riverside routes, etc.	On-going	

	Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
4	Assist in development of bus and park and ride strategies within the LTP which support the AQAP. In particular we will work with the County to promote traffic management and routing measures to reduce bus emissions	Alternatives to private vehicle use	Bus based Park & Ride	OCC/Oxfordshire County Council	Complete	On-going	Bus and Park & Ride strategies include measures that support delivery of the AQAP	N/A	The Bus Strategy has been published includes measures to support the targets of the AQAP. There have also been city centre bus improvements – including Queen Street ETRO (walking, cycling, bus), improvements on the A40 -A44 strategic link road (traffic management), priority to busses at Hinksey Hill	On-going	The conclusions of the ZEZ feasibility study will have as a probable consequence the re-opening of this measure. 2 studies on-going: work place parking and access restrictions
5	Work with the County and our partners in Low Carbon Oxford to promote travel plans with organisations across the city	Promoting travel Alternatives	Workplace Travel Planning	OCC	On-going	Not Commenced	Travel Plans adopted by organisations in the city	N/A	This measure has not been progressed to date	TBC	
6	Continue to work with the County and bus operators to reduce bus emissions further, supporting the tightening of emission standards in contracted services and enforcement of the anti-idling policy following implementation of the LEZ	Vehicle Fleet Efficiency	Promoting Low Emission Transport	OCC	Complete	On-going	TBC	N/A	Continue to work with bus companies to reduce their emissions. Closely working with them around the Zero Emission Zone feasibility study which would ultimately see zero emission busses operating, Bus operators has over the last year invested significantly in Euro 6 busses,	N/A	

	Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
7	Promote the uptake of electric vehicles by working with our partners to install electric vehicle recharging infrastructure	Promoting Low Emission Transport	Procuring alternative refuelling infrastructure to promote Low Emission Vehicles, EV recharging, Gas fuel recharging	OCC	On-going	On-going	Charging infrastructure installed	N/A	Undertaken recruitment of residents to participate in EV infrastructure trial. Completed feasibility study on the introduction of EV infrastructure for Hackneys and private hire. Submitted bid to support this work.	On-going	
8	Investigate the feasibility of developing infrastructure to support emerging low or zero emission vehicle technologies, such as hydrogen cells	Promoting Low Emission Transport	Procuring alternative Refuelling infrastructure to promote Low Emission Vehicles, EV recharging, Gas fuel recharging	Oxfordshire County Council, OCC	On-going	Not commenced	TBC	N/A	Feasibility study conducted by Oxfordshire County Council looking at the cost and practicality of installing a Hydrogen refuelling station at Oxford Parkway - Park and Ride. Using £800,000 worth of grant funding won through the Go Ultra Low City Scheme to roll out EV charging solutions for properties without dedicated parking spaces and bidding to the Office for Low Emission Vehicles Taxi Scheme for funding to facilitate the installation of electric charging infrastructure to encourage the uptake of electric taxis.	Finished	Feasibility study Provided a good idea about the complexity and costs of deployment. Of hydrogen. Not many consumers available as the costs are still too high. EV charging project on-going
9	Continue to develop low emission and zero emission vehicles in our own fleet, and seek opportunities to increase the council's electric vehicle car-pool	Promoting Low Emission Transport	Company Vehicle Procurement – Prioritising uptake of low emission vehicles	OCC	Complete	On-going	Number of electric vehicles in Council's fleet	N/A	The number of electric pool vehicles in the Council's fleet continues to increase. Opportunities to replace conventionally fuelled vehicles with electric vehicles are assessed on a case by case basis	On-going	

	Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
10	Promote the development of low and zero emission car clubs schemes in the city	Alternatives to private vehicle use	Car Clubs	OCC	Complete	On-going	Number of low/zero emission car club vehicles available in the city	N/A	We have been working with car club providers to promote the provision of zero emission vehicles in the city as part of the GULO project	On-going	
11	Work with our Low Carbon Oxford Pathfinders to support the introduction of low emission vehicle into their fleets	Promoting Low Emission Transport	Company Vehicle Procurement – Prioritising uptake of low emission vehicles	OCC	Complete	On-going	Number of low/zero emission vehicles in LCO Pathfinder fleets	N/A	A number of Low Carbon Oxford Pathfinder events were held to bring together key organisations, to increase awareness of the impacts of business related travel and transport on the environment and human health	On-going	
12	Support eco-driving through inclusion of eco-driving information in the Low Carbon Hub and other travel information services, and where possible look to support eco-driving schemes with for example taxi companies	Public information	Via the internet	OCC	On-going	Not commenced	TBC	N/A	This measure has not been progressed to date	TBC	
13	Explore the impact of alternative and low emission transport on air quality in Oxford	Promoting Low Emission Transport	Company Vehicle Procurement – Prioritising uptake on low emission vehicles	OCC	On-going	Not commenced	Feasibility study report	N/A	A feasibility study for a possible zero emission zone is being undertaken by County and City Councils	Spring 2017	These will be covered by the ZEZ feasibility study

	Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
14	Exploring the options available for freight consolidation and management and other schemes to reduce the amount of freight vehicles operating in the city. We also need to consider low and zero emission vehicles in relation to the final delivery leg of any such consolidation schemes	Freight and Delivery Management	Other	OCC	Complete	On-going	TBC	N/A	Report has been completed and published https://www.oxford.gov.uk/info/20216/air_quality:management/977/reducing_freight_emissions We continue to consider how we can carry out mini consolidation across our own organisation.	On-going	Freight and consolidation study didn't show viability for major consolidation, awaiting for some possible recommendations from the ZEZ feasibility study
15	Seek to establish a freight quality partnership to promote Eco-driving and anti-idling policies with operators in the city	Freight and Delivery Management	Freight Partnerships for city centre deliveries	OCC	Not commenced	Not commenced	TBC	N/A	This measure has not been progressed to date	TBC	

	Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
16	Support the development of Delivery and Servicing Plans (DSPs) with business across the city to further reduce unnecessary freight movements. The development of such DSP's will need to consider integration with work emerging on freight consolidation	Freight and Delivery Management	Delivery and Service Plans	OCC	Not commenced	Not commenced	TBC	N/A	Internal stakeholders currently under consultation	On-going	At the moment this is being managed through the planning process
17	Ensure that transport and environmental impact assessments for new developments are adequate to determine what levels of mitigation may be required to offset potential increases in transport activity and emissions	Policy Guidance and Development Control	Low Emissions Strategy	OCC	Complete	On-going	Air Quality Assessments undertaken for all major development in the city	N/A	Air Quality Assessments are required for all new development classified as 'major'. OCC is also developing a Technical Advisory Note for developers and planners, setting out our approach to consideration of air quality in the planning process, Ensuring that air quality is considered fully during the development of the Oxford Local Plan.	On-going	

	Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
18	Explore opportunities to develop policy measures that require developers to provide investments in and contributions to the delivery of low emission transport projects and plans, including strategic monitoring and assessment activities.	Policy Guidance and Development Control	Low emissions strategy	OCC	On-going	On-going	TBC	N/A	The Oxford Local Plan is currently under review. This measure will be progressed through that process	TBC	
19	Seek to ensure that stretching targets are set within travel plans for new developments, and that all new developments are encouraged to adopt Delivery and Servicing Plans to reduce freight movements.	Policy Guidance and Development Control	Low Emissions Strategy	OCC	On-going	Not Commenced	TBC	N/A	The Oxford Local Plan is currently under review. This measure will be progressed through that process	TBC	

	Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
20	Seek to ensure that new developments make appropriate provision for walking, cycling, public transport and low emission vehicle infrastructure e.g. EV charging points	Policy Guidance and Development Control	Low Emissions Strategy	OCC	Complete	On-going	EV charging points installed at all new major developments	N/A	Currently happening through DM process. The Oxford Local Plan is currently under review and further stretching targets are being sought as part of this process. This measure will be further progressed through that process	On-going	A condition is already being imposed through the planning process requiring the installation of EV charging points for commercial and residential spaces
21	We will encourage the development of voluntary area-wide travel plans for existing developments through the Community Action Groups	Promoting Travel Alternatives	Other	OCC	On-going	Not commenced	TBC	N/A		TBC	
22	Promote the development of car clubs within new developments	Alternatives to private vehicle use	Car Clubs	OCC	On-going	On-going	Number of car clubs in new developments	N/A	Where appropriate, car clubs are considered as part of mitigation measures for air quality impacts in major developments	On-going	10 Electric Car Clubs will be launched as part of GULO project
23	Development of low emission vehicle hierarchy to guide the procurement of vehicles within our fleet	Promoting Low emission Transport	Company Vehicle Procurement – Prioritising uptake of low emission vehicles	OCC	On-going	Not commenced	Number of low emission vehicles within Council fleet	N/A	Formal hierarchy not adopted but opportunities for EV is considered when vehicles are replaced.	TBC	

	Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
24	Continue to assess our fleet operations in terms of mileage management and efficient routing of vehicle movements	Vehicle Fleet Efficiency	Driver training and ECO driving aids	OCC	Complete	On-going	N/A	N/A	Route and mileage management are integrated into business as usual for the fleet	On-going	Recent Installation of a box on every fleet vehicle that lists an assessment for alternative fuel which covers eco improvements
25	Maintain and develop our staff travel plan and complement this with Delivery and Servicing Plans (DSP) for key Council sites such as Town Hall	Freight and Delivery Management	Delivery and Service Plans	OCC	Complete	On-going	An adopted DSP is in place for the Council's city centre locations	N/A	A report outlining options for a DSP for city centre Council sites has been prepared and consideration of the options and implementation is on-going	On-going	
26	Roll out Eco-driving training for our staff	Vehicle Fleet Efficiency	Driver training and ECO driving aids	OCC	Complete	On-going	Eco-driving training in place for staff	N/A	Eco-driving training is now in place for staff	On-going	
27	Seek to develop a sub-regional approach to air quality monitoring and action planning, working closely with our County and District Colleagues, through engagement with the Oxfordshire Air Quality Partnership	Policy Guidance and Development Control	Regional Groups Co-ordinating programmes to develop Area wide Strategies to reduce emissions and improve air quality	OCC	Complete	On-going	Attendance at the Oxfordshire Air Quality Group	N/A	Engagement with neighbouring District Councils has been developed through the participation in the Oxfordshire Air Quality Group	On-going	

	Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
28	Consider the benefit of including wider stakeholders such as transport providers, public health organisations and research and consulting expertise	Policy Guidance and Development Control	Regional Groups Co-ordinating programmes to develop Area wide Strategies to reduce emissions and improve air quality	OCC	Complete	On-going	Regular updates on air quality provided to the Health improvement Board	N/A	Engagement with the Health Improvement Board is now in progress	On-going	We are also working together with the Mobile Air Quality Measurement group and members of the university on the characterization of new innovative NO2 sensors for use across a range of projects and citizen science
29	Improve communication to increase the public's understanding of the main sources and health effects of air pollution emissions	Public information	Via the internet	OCC	Complete	On-going	County wide Oxfordshire Air Quality Group website launched	N/A	The Oxfordshire Air Quality Group website (http://oxfordshire.air-quality.info/) was launched in October 2015. As well as providing real time and historic monitoring data, the website provides information on the health impacts of air quality and a 'Children's Area'	On-going	
30	Work with the district and County Councils in Oxfordshire to provide a co-ordinated approach to public awareness and education	Public Information	Other	OCC	On-going	On-going	Total amount of available sensors installed at schools, air quality stickers installed at all the monitoring sites linking with the AQ website	N/A	STOP Project (installation of air quality sensors at 6 schools in Oxford is about to start	On-going	Creation of air quality stickers to be deployed iat monitoring stations to create public awareness and linking to the AQ website is another action to support this is currently under consideration

	Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
31	Update the City Council's website to provide key air quality information, and ensure the site is accessible, up to date and user friendly	Public Information	Other	OCC	Complete	On-going	County wide Oxfordshire Air Quality Group website launched	N/A	The Oxfordshire Air Quality Group website (http://oxfordshire.air-quality.info/) was launched in October 2015. As well as providing real time and historic monitoring data, the website provides information on the health impacts of air quality and a 'Children's Area'	On-going	Site was updated in March 2017. A table was added to the air quality index section with recommended actions and health advice for every index band

2.3 $PM_{2.5}$ – Local Authority Approach to Reducing Emissions and or Concentrations

As detailed in Policy Guidance LAQM.PG16 (Chapter 7), local authorities are expected to work towards reducing emissions and/or concentrations of $PM_{2.5}$ (particulate matter with an aerodynamic diameter of 2.5 µm or less). There is clear evidence that $PM_{2.5}$ has a significant impact on human health, including premature mortality, allergic reactions, and cardiovascular diseases.

Oxford City Council measures $PM_{2.5}$ at St Ebbe's urban background site. In 2016 the annual mean concentration was 13 μgm^{-3}.

Oxford City Council considers that many of the measures designed to reduce levels of nitrogen dioxide set out in the AQAP will also contribute to reducing levels of $PM_{2.5}$.

Oxford City Council considers that the following existing measures contained in the AQAP will contribute to reducing levels of $PM_{2.5}$:

1. Manage bus emissions through the implementation of the Low Emission Zone
2. Work to ensure sustainable transport measures developed in the Oxford Area Strategy of the LTP support the targets of the AQAP.
3. Support walking and cycling strategies within the LTP to ensure they assist delivery of the AQAP objectives.
4. Assist in development of bus and park and ride strategies within the LTP which support the AQAP. In particular we will work with the County to promote traffic management and routing measures to reduce bus emissions.
5. Work with the County and our partners in Low Carbon Oxford to promote travel plans with organisations across the city.
6. Continue to work with the County and bus operators to reduce bus emissions further, supporting the tightening of emission standards in contracted services and enforcement of the anti-idling policy following implementation of the LEZ.
7. Promote the uptake of electric vehicles by working with our partners to install electric vehicle recharging infrastructure.

9. Continue to develop low emission and zero emission vehicles in our own fleet, and seek opportunities to increase the Council's electric vehicle car-pools.

10. Promote the development of low and zero emission car clubs schemes in the city.

11. Work with our Low Carbon Oxford Pathfinders to support the introduction of low emission vehicle into their fleets.

12. Support eco-driving through inclusion of eco-driving information in the Low Carbon Hub and other travel information services, and where possible look to support eco-driving schemes with for example taxi companies.

14. Exploring the options available for freight consolidation and management and other schemes to reduce the amount of freight vehicles operating in the city. We will also consider low and zero emission vehicles in relation to the final delivery leg of any such consolidation schemes.

15. Seek to establish a freight quality partnership to promote Eco-driving and anti-idling policies with operators in the city.

16. Support the development of Delivery and Servicing Plans (DSPs) with business across the city to further reduce unnecessary freight movements. The development of such DSP's will need to consider integration with work emerging on freight consolidation.

17. Ensure that transport and environmental impact assessments for new developments are adequate to determine what levels of mitigation may be required to offset potential increases in transport activity and emissions.

18. Explore opportunities to develop policy measures that require developers to provide investments in and contributions to the delivery of low emission transport projects and plans, including strategic monitoring and assessment activities.

19. Seek to ensure that stretching targets are set within travel plans for new developments, and that all new developments are encouraged to adopt Delivery and Servicing Plans to reduce freight movements.

20. Seek to ensure that new developments make appropriate provision for walking, cycling, public transport and low emission vehicle infrastructure e.g. EV charging points.

23. Develop a low emission vehicle hierarchy to guide the procurement of vehicles within our fleet.

25. Maintain and develop our staff travel plan and complement this with Delivery and Servicing Plans (DSP) for key Council sites such as Town Hall.

26. Roll out eco-driving training for our staff.

In addition we have continued to seek opportunities to engage with Public Health colleagues on air quality, presenting annual updates on air quality to the Oxfordshire Health Improvement, which links in to the Public Health Outcome Framework $PM_{2.5}$ indicator. We are working in partnership with Oxfordshire County Council on a zero emission zone feasibility study for the city. The introduction of a Zero Emission Zone is expected to help reduce $PM_{2.5}$ emissions.

3 Air Quality Monitoring Data and Comparison with Air Quality Objectives and National Compliance

3.1 Summary of Monitoring Undertaken

Oxford City Council undertook automatic (continuous) monitoring of Nitrogen Oxides (NO_x) at 3 sites, Particulate Matter (PM_{10} and $PM_{2.5}$) at 2 sites and Ozone (O_3) at one site. Non-automatic (passive) monitoring of Nitrogen Dioxide (NO_2) was carried out 70 sites during 2016.

A map showing the location of the air quality monitoring that has been conducted during 2016 can be found in appendix D. Maps covering the historic locations of air quality monitoring are provided on the Oxfordshire Air Quality Group website (https://oxfordshire.air-quality.info/). Further details on Quality Assurance/Quality Control (QA/QC), how the monitors are calibrated, how the data has been adjusted and the bias adjustment factor used for the diffusion tubes are included in Appendix C.

3.1.1 Automatic Monitoring Sites

Oxford City Council has not conducted any significant change to the automatic (continuous) monitoring plan that was in place in 2015. DEFRA's urban background site at St. Ebbe's continues to monitor PM_{10}, $PM_{2.5}$, NO_x and O_3. DEFRA's Oxford Centre Roadside site monitors NO_x, and Oxford City Councils Oxford High Street Roadside site monitors PM_{10} and NO_x. Table A.1 in Appendix A shows details of the sites. Details of low data capture obtained in 2016 at Oxford St. Ebbe's and of the procedures used, in line with the recommendations given at LAQM TG (16) for such cases can be found in Appendix C.

3.1.2 Non-Automatic Monitoring Sites

Oxford City Council undertook non-automatic (passive) monitoring of NO_2 at 70 locations during 2016. Table A.2 in Appendix A shows the details of those sites.

For the purposes of deciding which locations are significant, the City Council considers in the first instance locations where there is relevant public exposure. It is important that assessments focus on locations where members of the public are likely to be regularly present for a period of time appropriate to the averaging period

of the objective. This is carried out in line with DEFRA's Technical Guidance LAQM.TG (16)[6].

Approximately half of the monitoring locations are within central Oxford at locations where we believe relevant exposure is most likely to be significant. The remaining locations are outside of the central area, again prioritised by locations where relevant exposure is most likely.

Monitoring of NO_2 cannot be undertaken at every location on a continuous basis. The City Council therefore makes the most efficient use of available resources by implementing a rotational system on a percentage of monitoring sites every year, ensuring such sites are covered on average every 2 to 3 years.

One important aspect of monitoring is to be able to demonstrate trends in air quality over long time periods. In order to do so, the City Council continues monitoring at a number of the same sites year on year, so that the results reported can provide a strong basis for showing trends that are independent of location.

3.2 Individual Pollutants

The air quality monitoring results presented in this section are ratified, and, where relevant, adjusted for "*annualisation*" and bias. Further details on adjustments are provided in Appendix C. Details of the UK air quality objectives for protection of human health for comparison with the 2016 monitoring results can be found in table E.1 in Appendix E.

3.2.1 Nitrogen Dioxide (NO_2)

Combustion processes emit a mixture of nitrogen oxides – NO and NO_2 - collectively termed NO_x.

i) NO is described as a primary pollutant (meaning it is directly emitted from source). NO is not known to have any harmful effects on human health at ambient concentrations. However, it undergoes oxidation in the atmosphere to form the secondary pollutant NO_2.

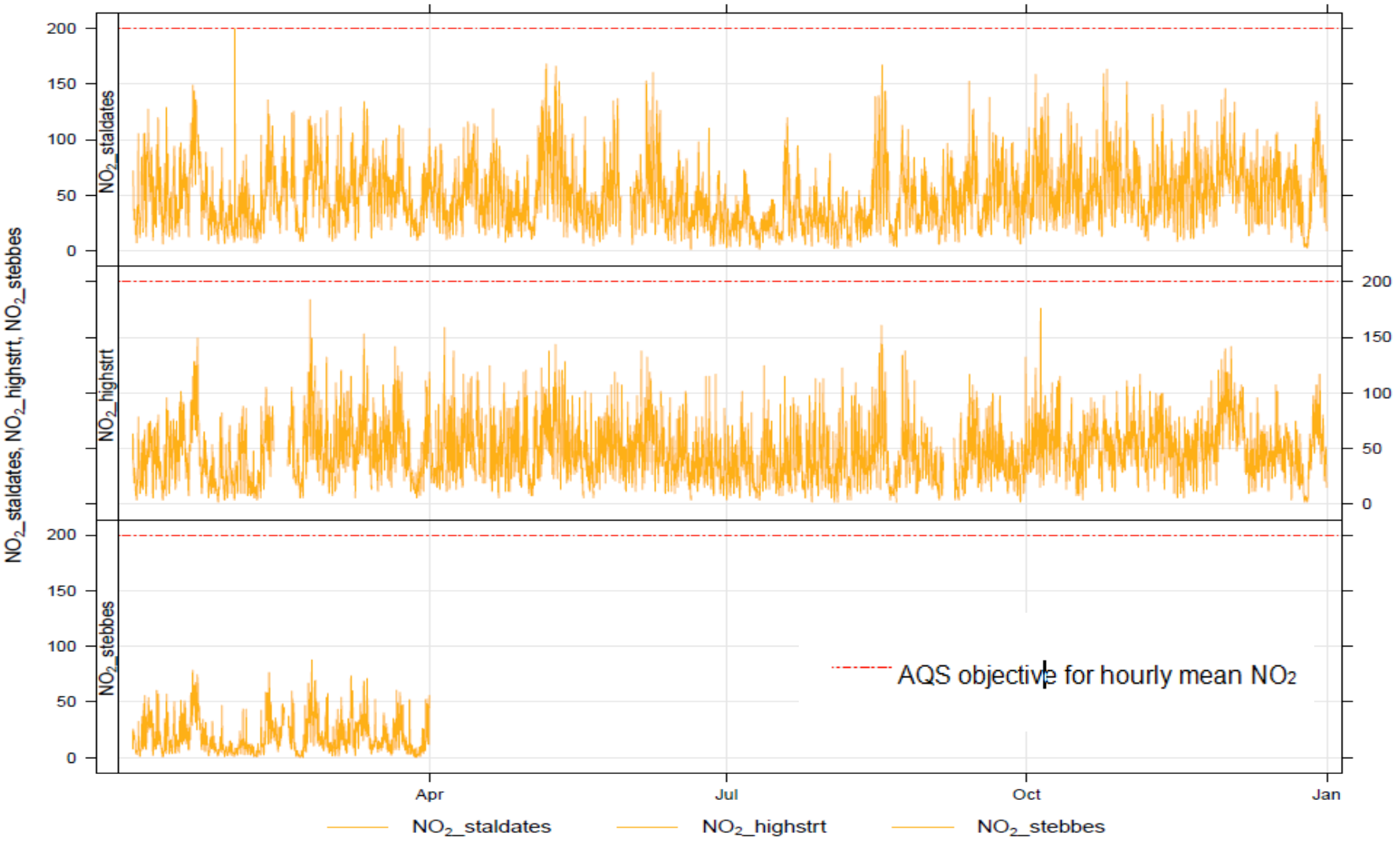
ii) ii) NO_2 has a primary (directly emitted) component and a secondary component, formed by oxidation of NO. NO_2 is a respiratory irritant and is toxic at high concentrations. It is also involved in the formation of

photochemical smog and acid rain and may cause damage to crops and vegetation.

NO_2 Automatic Monitoring

NO_2 data has been monitored by the use of automatic continuous monitors and passive monitoring (diffusion tubes) in 2016. The time series of hourly averaged concentrations of NO_2 for the 3 automatic monitoring sites is shown in Figure 1. The results are expressed in μgm^{-3}.

Figure 1 - Time series of hourly averaged concentrations of NO_2 (μgm^{-3}) at automatic monitoring sites, 2016



The Air Quality Strategy (AQS) objective for hourly mean NO_2 concentration is 200 μgm^{-3}, and may be exceeded up to 18 times per calendar year. Figure 1 shows that during 2016 there was no recorded hourly mean NO_2 measurement exceeding 200 μgm^{-3}. The highest hourly mean NO_2 measured in 2016 was of 199.7 μgm^{-3} and was registered on the 1st February (07:00am) at Oxford Centre Roadside site (St. Aldates). Table A.4 in Appendix A summarises the NO_2 hourly mean exceedances of the 200 μgm^{-3} hourly air quality objective reported in Oxford over the past 5 years.

The threshold of the "Moderate" air quality band as set out by DEFRA for the hourly mean ranges from 201 to 400 µg m^{-3}. NO_2 levels at all 3 sites were recorded within the DEFRA "Low" band for the whole year. The AQS hourly objective for NO_2 was met in 2016.

The annual mean AQS objective for NO_2 is 40 μgm^{-3}. Oxford High Street's annual mean for NO_2 was 47 μgm^{-3} and Oxford Centre Roadside 49 μgm^{-3}. At St. Ebbe's, the NO_2 annual mean was 16 μgm^{-3}. This objective was therefore not met at the two roadside automatic monitoring stations in Oxford in 2016. Table A.3 in Appendix A compares the ratified monitored NO_2 annual mean concentrations for the past 5 years with the air quality objective of 40 μgm^{-3}.

Figure 2 (below) shows the 13 year long term trend for levels of measured NO_2 at continuous monitoring stations. The results are expressed in μgm^{-3}.

Figure 2 – Long term trends of Annual Mean NO_2 (μgm^{-3}) at Oxford's Continuous Monitoring Stations, 2003-2016.

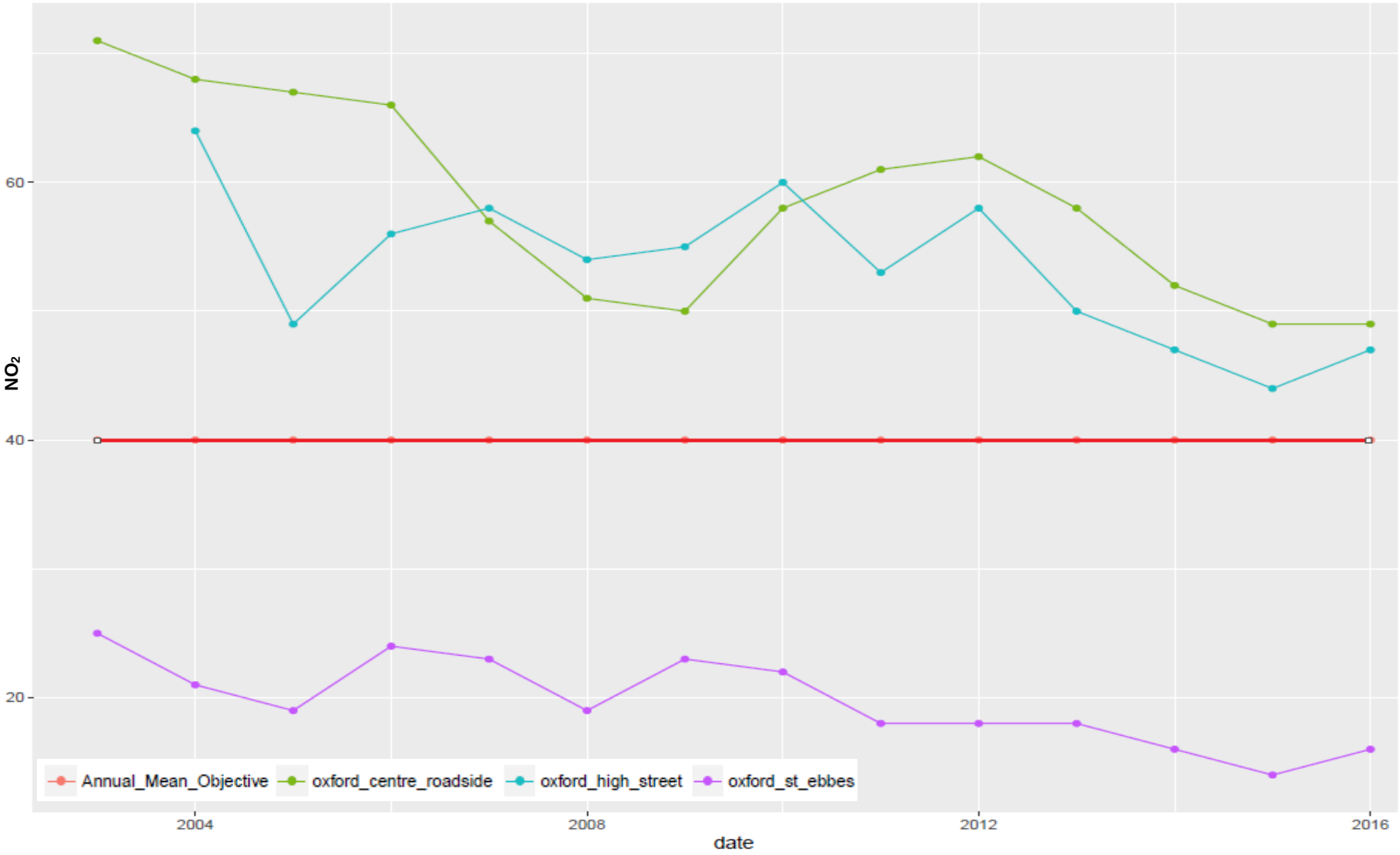


Figure 2 shows that while NO_2 levels have remained stable for Oxford Centre Roadside in 2016, they have slightly increased at Oxford St. Ebbe's and Oxford High Street, when compared with the results obtained in 2015.

The annual mean for NO_2 at St. Ebbe's has been annualised in 2016, according to the procedures described in DEFRA Technical Guidance LAQM.TG (16). Details of the annualisation procedure can be found in Appendix C.

Non-Automatic Monitoring

Non-automatic monitoring using diffusion tubes took place at 70 locations in 2016. Approximately half this number is exposed within central Oxford, rotated between the most exposed locations where we believes relevant exposure is most likely. The remainders are used outside of the central area, again prioritised by locations where relevant exposure is most likely.

The Diffusion tube results show that the annual mean AQS objective of 40 μgm^{-3} for NO_2 specified by DEFRA was exceeded at 17 of the 70 monitoring locations in 2016. All of these exceedances were within the existing AQMA and were considered representative of public exposure, therefore there was no need to correct the results for distance. The main observations of the monitoring carried out in 2016 using non-automatic monitoring are as follow:

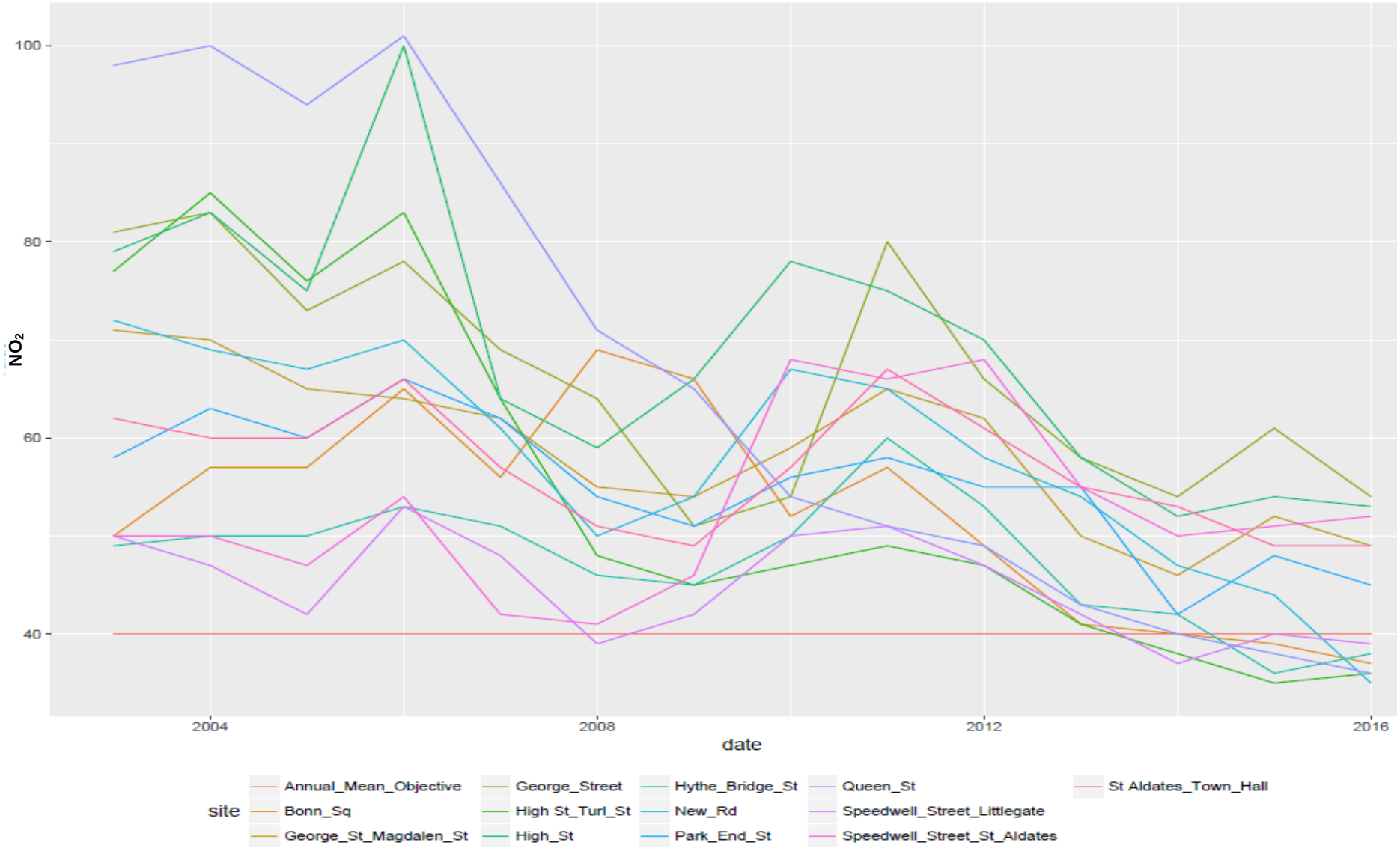
- In 2016, decreases of NO_2 levels were observed in the city centre, the largest drops being observed along George Street. However, the city centre overall continues to be the area with the most significant number of exceedances of the NO_2 annual limit value;
- The monitoring location with the highest annual mean for NO_2 was DT55 - St Clements - with a value of 61 μgm^{-3}, which indicates that exceedances of the 1-hour mean objective are also likely to have occurred at that site. The monitoring results were, however, substantially better than the one registered in 2015 (67 μgm^{-3});
- NO_2 was measured for the first time at 11 new locations in 2016. None of the new locations measured concentrations of NO_2 above the limit value;

- Air Quality has improved at 27 of the 59 historic diffusion tube locations in 2016, with 13 of those improvements occurring in places were the NO_2 annual mean was above 40 ugm^{-3};
- 4 locations ([DT3] Abingdon Road, [DT32] Royal Oxford Hotel, [DT42] New Road and [DT65] Speedwell Street/Little Gate) are now below the NO_2 annual mean limit value of 40 μgm^{-3}. There are no new locations reporting exceedances of the annual mean limit value for NO_2 in 2016;
- Increases of the annual mean NO_2 have been observed at some locations in the city in 2016. However, these are still below the annual mean limit value for NO_2 and correspond in the main with areas experiencing considerable construction work and associated road layout changes.

Figure 3 below shows the long term trend for levels of measured NO_2 at a number of historic diffusion tube monitoring stations. The results are expressed in μgm^{-3}.

It is apparent that there has been a significant downward trend in measured levels of NO_2 at most of these locations. However, as highlighted above, the annual mean objective was exceeded at 17 of the 70 monitoring locations in 2016.

Figure 3 – Long Term Trends in Annual Mean NO_2 (ugm^{-3}) at Oxford's diffusion tube monitoring locations, 2003-2016



Diffusion tube details, location and results can be found in Tables A.2 and A.3 in Appendix A. A map with the locations of the air quality monitoring that was conducted during 2016 and levels of NO_2 is shown in Appendix D.

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

Airborne particulate matter varies widely in its physical and chemical composition, source and particle size. The terms PM_{10} and $PM_{2.5}$ 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.

PM_{10} data has been monitored by automatic continuous monitors at Oxford St. Ebbe's and Oxford High Street. $PM_{2.5}$ has been monitored at Oxford St. Ebbe's.

The AQS objective for PM_{10} is a maximum of 50 μgm^{-3} for any 24h mean period, not to be exceeded more than 35 times a year.

The results of PM_{10} measurements during the course of 2016 show 4 exceedances to the 50 μgm^{-3} 24h mean periods value recorded at Oxford High Street. Because data capture was poor at Oxford St. Ebbe's in 2016, the 90.4th percentile for 24 hour PM_{10} is being reported instead. According to LAQM TG16[6], if the 90.4th percentile is greater than 50μgm^{-3} it means that if there had been 100% data capture, then there would have been more than 35 exceedences of 50μgm^{-3} in the calendar year. The 90.4th percentile of PM_{10} was 24 μgm^{-3} at St. Ebbe's and both sites are therefore well within the yearly maximum permitted number of exceedances of 35 times, all meeting the AQS objective for 24-hour mean PM_{10}.

Table A.6 in Appendix A shows the number of exceedances to the PM_{10} 24-hour mean objective in the past 5 years.

The annual mean AQS objective for PM_{10} is 40 μgm^{-3}. Table A.5 in Appendix A compares the ratified and adjusted monitored PM_{10} annual mean concentrations for the past 5 years with the air quality objective of 40μgm^{-3}. Due to poor data capture,

PM_{10} annual average has been annualised at Oxford St. Ebbe's in 2016, according to the procedure described in LAQM TG (16).

Oxford High Street registered an annual mean of 20 μgm^{-3}. Oxford St. Ebbe's of 15 μgm^{-3}. This objective was therefore met in 2016.

No AQS objective exists for $PM_{2.5}$; however a non-mandatory compliance target of 25 μgm^{-3} to be met by 2020 exists. The annual mean for this pollutant (*annualised*) was 13 μgm^{-3} at Oxford St. Ebbe's. Table A.7 in Appendix A presents the ratified and adjusted monitored $PM_{2.5}$ annual mean concentrations for the past 5 years.

3.2.3 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".

O_3 is measured at Oxford St. Ebbe's. The AQS objective for daily maximum on an 8 hour running mean is 100 μgm^{-3} not to be exceeded more than 10 days a year. Oxford St. Ebbe's met the AQS objectives for this pollutant in 2016.

Oxford St. Ebbe's data capture rate of O_3 was at 91.9% in 2016. The site exceeded the AQS daily objective for ozone on 4 days during the year. The maximum concentrations of ozone were recorded between 05th- 09th May 2016, with a maximum of 127.7 µg m^{-3} on the 6th May 17h00. According to Kings College[8], the period 5-9th May 2016 corresponds to a period of very warm days, with hours of unbroken sunshine where 'moderate' levels of ozone were recorded at urban and rural locations across the South East. "(…) *The elevated levels of ozone were caused by a combination of strong sunshine which lasted throughout the day, high ambient temperatures, and local emissions mixed with a feed of polluted air from continental Europe which - having passed over industrialised, urban and agricultural areas - contained the precursors required for photochemical reactions".*

Appendix A: Monitoring Results

Table A.1 – Details of Automatic Monitoring Sites

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Monitoring Technique	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Inlet Height (m)
CM1	St Aldate's (Oxford Centre AURN)	Roadside	451355	206155	NO_2	Y	Chemiluminescent	1	3	2.5
CM2	High Street	Roadside	451677	206272	NO_2 PM_{10}	Y	Chemiluminescent; Conventional TEOM Gravimetric Equivalent	1	2	1.5
CM3	St Ebbe's	Urban background	451168	205382	NO_2; PM_{10}; $PM_{2.5}$; O_3	Y	Chemiluminescent; FDMS; FDMS; UV absorption	10	2	2.5

(1) 0m if the monitoring site is at a location of exposure (e.g. installed on the façade of a residential property).

(2) N/A if not applicable.

Table A.2 – Details of Non-Automatic Monitoring Sites

Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube collocated with a Continuous Analyser?	Height (m)
St. Ebbe's	Urban Background	451168	205382	NO_2	Y	10	2	Y	3
Weirs Lane/Abingdon Road Lamp Post 1	Roadside	451922	204203	NO_2	Y	2	2	N	3
Lamp Post 52 Abingdon Road	Roadside	451912	204156	NO_2	Y	3	2	N	3
Boundary Brook Road/ Iffley Road	Roadside	452962	204660	NO_2	Y	0	2	N	3
Lenthall Road Allotments	Urban Background	452741	203533	NO_2	Y	5	N/A	N	1.5

Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube collocated with a Continuous Analyser?	Height (m)
Templar square	Roadside	454335	203949	NO_2	Y	2	2	N	3
Oxford Road/ Towns Road	Roadside	454479	204247	NO_2	Y	3	2	N	3
Oxford Road (Cowley) lamp post 13	Roadside	452756	205746	NO_2	Y	0	1	N	3
Cowley Road/Divinity Road	Roadside	453150	205530	NO_2	Y	3	1	N	3
Divinity Road/Warneford Lane	Roadside	453619	206070	NO_2	Y	2	1	N	3

Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube collocated with a Continuous Analyser?	Height (m)
Gypsy Lane/Old Road	Roadside	453916	206330	NO_2	Y	3	5	N	3
Churchill Drive/Old Road	Roadside	454467	206367	NO_2	Y	1	1	N	3
Windmill Road/Old Road	Roadside	454880	206446	NO_2	Y	3	0.5	N	3
Windmill Road W	Roadside	454555	207096	NO_2	Y	0	2.5	N	3
London Road / BHF	Roadside	454420	207021	NO_2	Y	0	2.5	N	3

Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube collocated with a Continuous Analyser?	Height (m)
Headley Way/London road lamp post 2	Roadside	453970	206818	NO_2	Y	1	2	N	3
Latimer road/London road	Roadside	454134	206907	NO_2	Y	2	2	N	3
4 The Roundway	Roadside	455601	207380	NO_2	Y	0	5	N	3
North Way Lamp Post 9	Roadside	455405	207569	NO_2	Y	0	1	N	3
Barton Lane Lamp post 2	Roadside	454954	207758	NO_2	Y	3	1	N	3

Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube collocated with a Continuous Analyser?	Height (m)
North Way/ Barton Village Road Lamp Post 20	Roadside	455114	207799	NO_2	Y	0	0.5	N	3
Foxwell Drive Lamp Post 4	Roadside	453785	208376	NO_2	Y	2	1	N	3
Marsh Lane/ Dents Close Lamp Post 1	Roadside	453785	208289	NO_2	Y	3	2	N	3
Corner of South Parade/ Banbury Road	Roadside	450759	209156	NO_2	Y	0	1	N	3
3 Elsfield Way Cutteslowe Roundabout	Roadside	450378	210224	NO_2	Y	5	2	N	3

Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube collocated with a Continuous Analyser?	Height (m)
3 Summers Place Cutteslowe Roundabout	Roadside	450468	210227	NO_2	Y	1	2	N	3
Wolvercote roundabout - 78 Sunderland Avenue	Roadside	449828	210209	NO_2	Y	1	1	N	3
Wolvercote Roundabound – 51 Sunderland Avenue	Roadside	449810	210164	NO_2	Y	1	1	N	3
BP Service Station Woodstock Road	Kerbside	449592	210219	NO_2	Y	5	5	N	3
Pear Tree Park & Ride	Roadside	449515	210720	NO_2	Y	10	4	N	3

Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube collocated with a Continuous Analyser?	Height (m)
Osney Lane/ Hollybush Row	Kerbside	450671	206055	NO_2	Y	2	2	N	3
Beckett Street	Roadside	450565	206217	NO_2	Y	5	2	N	3
Royal Oxford Hotel	Roadside	450673	206265	NO_2	Y	0	2.5	N	3
Botley Road/ Mill Street	Roadside	450392	206228	NO_2	Y	1	1	N	3
Abbey Road corner	Roadside	450352	206241	NO_2	Y	0	1	N	3

Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube collocated with a Continuous Analyser?	Height (m)
Botley Road/ Hillview Road	Roadside	450016	206204	NO_2	Y	1	2	N	3
Botley Road N (Corner of prestwich place)	Roadside	449659	206241	NO_2	Y	0	2	N	3
Botley Road South (Corner of Duke Street)	Roadside	449656	206223	NO_2	Y	0	2	N	3
Duke Street	Urban Background	449653	206158	NO_2	Y	0	1	N	3
St Aldate's	Roadside	451355	206155	NO_2	Y	0	2	Y	2.5

Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube collocated with a Continuous Analyser?	Height (m)
Queen Street	Roadside	451269	206143	NO_2	Y	0	2	N	3
Bonn Square	Roadside	451202	206128	NO_2	Y	0	3	N	3
New Road	Roadside	451066	206195	NO_2	Y	2	3.5	N	3
Park End Street	Kerbside	450883	206276	NO_2	Y	2	1	N	3
Hythe Bridge Street	Roadside	450793	206343	NO_2	Y	0	2	N	3

Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube collocated with a Continuous Analyser?	Height (m)
Worcester Street	Roadside	450940	206419	NO_2	Y	2	2	N	3
Beaumont Street	Kerbside	451168	206519	NO_2	Y	2	1	N	3
George Street/ Magdalen Street	Kerbside	451232	206392	NO_2	Y	2	0.5	N	3
George Street	Kerbside	450967	206343	NO_2	Y	0	0.5	N	3
Cornmarket street	Urban centre	451325	206230	NO_2	Y	0	2	N	3

Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube collocated with a Continuous Analyser?	Height (m)
High Street/ Turl Street	Roadside	451465	206222	NO_2	Y	1	2.5	N	3
50 High Street	Roadside	451900	206251	NO_2	Y	0	2.5	N	3
Longwall Street	Kerbside	451967	206259	NO_2	Y	1	1	N	3
Magdalen Bridge	Roadside	452111	206111	NO_2	Y	0	2	N	3
York Place	Kerbside	452328	206016	NO_2	Y	0	2	N	3

Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube collocated with a Continuous Analyser?	Height (m)
St Clements	Kerbside	452322	205990	NO_2	Y	1	1	N	3
High Street	Kerbside	451574	206231	NO_2	Y	2	1	N	3
Speedwell Street/ St Aldate's	Roadside	451409	205809	NO_2	Y	1	3	N	3
Folly Bridge	Roadside	451429	205567	NO_2	Y	0	1	N	3
Thames Street	Roadside	451305	205659	NO_2	Y	1	3	N	3

Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube collocated with a Continuous Analyser?	Height (m)
New Butterwyke Place/ Thames Street	Roadside	451255	205695	NO_2	Y	5	2	N	3
Friars Wharf	Roadside	451209	205706	NO_2	Y	0	3	N	3
1 Blackfriars Road	Roadside	451072	205750	NO_2	Y	0	3	N	3
Thames Street/ Trinity Street	Roadside	450926	205797	NO_2	Y	0	10	N	3
Thames Street/ Oxpens Road	Kerbside	450887	205825	NO_2	Y	0	1	N	3

Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube collocated with a Continuous Analyser?	Height (m)
Speedwell Street/ Littlegate	Roadside	451206	205780	NO_2	Y	1	2	N	3
36 Faulkner Street	Urban Background	451149	205859	NO_2	Y	1	20	N	3
Old Greyfriars Street	Roadside	451149	205947	NO_2	Y	5	5	N	3
Norfolk Street	Roadside	451030	205962	NO_2	Y	0	1.5	N	3
Paradise Square	Roadside	450982	205973	NO_2	Y	0	1	N	3

Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube collocated with a Continuous Analyser?	Height (m)
Castle Street	Roadside	451062	206067	NO_2	Y	0	1.5	N	3

(1) 0m if the monitoring site is at a location of exposure (e.g. installed on/adjacent to the façade of a residential property).

(2) N/A if not applicable.

Table A.3 – Annual Mean NO_2 Monitoring Results

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2016 (%) (2)	NO_2 Annual Mean Concentration ($\mu g/m^3$) (3)				
					2012	2013	2014	2015	2016
CM1	St Aldate's (Oxford Centre AURN)	Automatic	98	98	**62**	**56**	**52**	**49**	**49**
CM2	High Street	Automatic	94	94	**58**	**50**	**47**	**44**	**47**
CM3	St Ebbe's	Automatic	24	24	19	18	17	14	16
DT1	St Ebbe's	Diffusion Tube	100	100	22	20	17	16	18
DT2	Weirs Lane/Abingdon Road Lamp Post 1	Diffusion Tube	100	100	NM	35	35	39	34
DT3	Lamp Post 52 Abingdon Road	Diffusion Tube	100	100	NM	**40**	37	**42**	38
DT4	Boundary Brook Road/ Iffley Road	Diffusion Tube	92	92	NM	NM	NM	NM	34
DT5	Lenthall Road Allotments	Diffusion Tube	100	100	19	20	13	15	14
DT6	Templar square	Diffusion Tube	83	83	NM	NM	NM	NM	25
DT7	Oxford Road/ Towns Road	Diffusion Tube	92	92	NM	NM	NM	NM	36
DT8	Oxford Road (Cowley) lamp post 13	Diffusion Tube	92	92	NM	NM	NM	NM	34
DT9	Cowley Road/Divinity Road	Diffusion Tube	100	100	NM	NM	NM	NM	28
DT10	Divinity	Diffusion Tube	83	83	NM	NM	NM	NM	25

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2016 (%) (2)	NO_2 Annual Mean Concentration ($\mu g/m^3$) (3)				
					2012	2013	2014	2015	2016
	Road/Warneford Lane								
DT11	Gypsy Lane/Old Road	Diffusion Tube	100	100	NM	NM	NM	NM	24
DT12	Churchill Drive/Old Road	Diffusion Tube	75	75	NM	NM	NM	NM	33
DT13	Windmill Road/Old Road	Diffusion Tube	100	100	NM	NM	NM	NM	29
DT14	Windmill Road W	Diffusion Tube	100	100	NM	NM	**40**	**44**	**43**
DT15	London Road / BHF	Diffusion Tube	100	100	NM	NM	36	34	34
DT16	Headley Way/London road lamp post 2	Diffusion Tube	100	100	NM	NM	NM	NM	35
DT17	Latimer road/London road	Diffusion Tube	100	100	NM	NM	NM	NM	37
DT18	4 The Roundway	Diffusion Tube	100	100	**43**	37	32	32	33
DT19	North Way Lamp Post 9	Diffusion Tube	100	100	NM	NM	NM	30	30
DT20	Barton Lane Lamp post 2	Diffusion Tube	100	100	NM	NM	NM	31	29
DT21	North Way/ Barton Village Road Lamp Post 20	Diffusion Tube	100	100	NM	NM	NM	30	30
DT22	Foxwell Drive Lamp Post 4	Diffusion Tube	83	83	NM	NM	NM	22	21

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2016 (%) (2)	NO_2 Annual Mean Concentration ($\mu g/m^3$) (3)				
					2012	2013	2014	2015	2016
DT23	Marsh Lane/ Dents Close Lamp Post 1	Diffusion Tube	100	100	NM	NM	NM	20	20
DT24	Corner of South Parade/ Banbury Road	Diffusion Tube	100	100	NM	NM	NM	25	20
DT25	3 Elsfield Way Cutteslowe Roundabout	Diffusion Tube	75	75	39	NM	NM	**40**	**48**
DT26	3 Summers Place Cutteslowe Roundabout	Diffusion Tube	92	92	38	NM	NM	**42**	**40**
DT27	Wolvercote roundabout - 78 Sunderland Avenue	Diffusion Tube	92	92	33	NM	NM	39	34
DT28	Wolvercote Roundabound – 51 Sunderland Avenue	Diffusion Tube	92	92	**43**	NM	NM	34	32
DT29	Pear Tree Park & Ride	Diffusion Tube	92	92	NM	NM	NM	38	36
DT30	Osney Lane/ Hollybush Row	Diffusion Tube	100	100	35	33	28	32	33
DT31	Beckett Street	Diffusion Tube	92	92	36	36	30	33	39
DT32	Royal Oxford Hotel	Diffusion Tube	92	92	**50**	**47**	**41**	**40**	38
DT33	Botley Road/ Mill	Diffusion Tube	100	100	NM	NM	NM	28	29

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) [1]	Valid Data Capture 2016 (%) [2]	NO_2 Annual Mean Concentration ($\mu g/m^3$) [3]				
					2012	2013	2014	2015	2016
	Street								
DT34	Abbey Road corner	Diffusion Tube	100	100	36	NM	NM	28	30
DT35	Botley Road/ Hillview Road	Diffusion Tube	100	100	34	NM	NM	**40**	**40**
DT36	Botley Road N (Corner of prestwich place)	Diffusion Tube	100	100	36	NM	NM	29	35
DT37	Botley Road South (Corner of Duke Street)	Diffusion Tube	100	100	39	NM	NM	34	22
DT38	Duke Street	Diffusion Tube	100	100	NM	NM	NM	20	26
DT39	St Aldate's	Diffusion Tube	100	100	**61**	**55**	**53**	**49**	**49**
DT40	Queen Street	Diffusion Tube	100	100	**49**	**43**	**40**	38	36
DT41	Bonn Square	Diffusion Tube	100	100	**49**	**41**	**40**	39	37
DT42	New Road	Diffusion Tube	100	100	**58**	**54**	**47**	**44**	35
DT43	Park End Street	Diffusion Tube	100	100	**55**	**55**	**42**	**48**	**45**
DT44	Hythe Bridge Street	Diffusion Tube	100	100	**53**	**43**	**42**	36	38
DT45	Worcester Street	Diffusion Tube	83	83	**64**	**54**	**52**	**50**	**51**
DT46	Beaumont Street	Diffusion Tube	92	92	**49**	**42**	**43**	**44**	**45**
DT47	George Street/ Magdalen Street	Diffusion Tube	100	100	**62**	**50**	**46**	**52**	**49**
DT48	George Street	Diffusion Tube	92	92	**66**	**58**	**54**	**61**	**54**
DT49	Cornmarket street	Diffusion Tube	100	100	34	29	29	31	30
DT50	High Street/ Turl Street	Diffusion Tube	100	100	**47**	**41**	38	35	36

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) [1]	Valid Data Capture 2016 (%) [2]	NO_2 Annual Mean Concentration ($\mu g/m^3$) [3]				
					2012	2013	2014	2015	2016
DT51	50 High Street	Diffusion Tube	100	100	**65**	**56**	**47**	**45**	**43**
DT52	Longwall Street	Diffusion Tube	100	100	**63**	**53**	**50**	**50**	**49**
DT53	Magdalen Bridge	Diffusion Tube	100	100	NM	NM	NM	27	28
DT54	York Place	Diffusion Tube	100	100	39	31	32	30	28
DT55	St Clements	Diffusion Tube	100	100	**85**	**70**	**65**	**67**	**61**
DT56	High Street	Diffusion Tube	100	100	**70**	**58**	**52**	**54**	**53**
DT57	Speedwell Street/ St Aldate's	Diffusion Tube	92	92	**68**	**55**	**50**	**51**	**52**
DT58	Folly Bridge	Diffusion Tube	100	100	NM	NM	NM	**40**	**41**
DT59	Thames Street	Diffusion Tube	100	100	**43**	**44**	28	30	32
DT60	New Butterwyke Place/ Thames Street	Diffusion Tube	100	100	37	35	**44**	38	39
DT61	Friars Wharf	Diffusion Tube	100	100	NM	NM	25	25	27
DT62	1 Blackfriars Road	Diffusion Tube	100	100	NM	NM	NM	26	27
DT63	Thames Street/ Trinity Street	Diffusion Tube	100	100	23	22	19	20	23
DT64	Thames Street/ Oxpens Road	Diffusion Tube	100	100	32	31	27	27	32
DT65	Speedwell Street/ Littlegate	Diffusion Tube	92	92	**47**	**42**	37	**40**	39
DT66	36 Faulkner Street	Diffusion Tube	100	100	39	32	34	30	31
DT67	Old Greyfriars Street	Diffusion Tube	67	67	NM	NM	NM	26	30
DT68	Norfolk Street	Diffusion Tube	67	67	NM	NM	23	30	35

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2016 (%) (2)	NO_2 Annual Mean Concentration ($\mu g/m^3$) (3)				
					2012	2013	2014	2015	2016
DT69	Paradise Square	Diffusion Tube	100	100	NM	NM	29	24	27
DT70	Castle Street	Diffusion Tube	83	83	NM	NM	**42**	**47**	**42**

Notes: Exceedances of the NO_2 annual mean objective of 40µg/m^3 are shown in **bold**.

NO_2 annual means exceeding 60µg/m^3, indicating a potential exceedance of the NO_2 1-hour mean objective are shown in **bold and underlined.**

(1) data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

(2) data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

(3) Means for diffusion tubes have been corrected for bias. All means have been "annualised" as per Technical Guidance LAQM.TG16 if valid data capture for the full calendar year is less than 75%. See Appendix C for details.

* The lamp post were the tube was placed was removed for a period of 6 months

Table A.4 – 1-Hour Mean NO_2 Monitoring Results

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2016 (%) (2)	NO_2 1-Hour Means > 200µg/m^3 (3)				
					2012	2013	2014	2015	2016
CM1	Roadside	Automatic	98.1	98.1	**55**	11	0	2	0
CM2	Roadside	Automatic	93.5	93.5	3	1	0	0	0
CM3	Urban Background	Automatic	24.4	24.4	3	0	0	0	0 (76)

Notes: Exceedances of the NO_2 1-hour mean objective (200µg/m^3 not to be exceeded more than 18 times/year) are shown in **bold.**

(1) data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

(2) data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

(3) If the period of valid data is less than 85%, the 99.8th percentile of 1-hour means is provided in brackets.

Table A.5 – Annual Mean PM_{10} Monitoring Results

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2016 (%) (2)	PM_{10} Annual Mean Concentration ($\mu g/m^3$) (3)				
				2012	2013	2014	2015	2016
CM2	Roadside	98.9	98.9	22	24	22	21	20
CM3	Urban Background	20.5	20.5	17	20	15	13	15

Notes: Exceedances of the PM_{10} annual mean objective of 40$\mu g/m^3$ are shown in **bold.**

(1) data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

(2) data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

(3) All means have been "annualised" as per Technical Guidance LAQM.TG16, if valid data capture for the full calendar year is less than 75%. See Appendix C for details.

Table A.6 – 24-Hour Mean PM_{10} Monitoring Results

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2016 (%) (2)	PM_{10} 24-Hour Means > 50µg/m^3 (3)				
				2012	2013	2014	2015	2016
CM2	Roadside	98.9	98.9	3	0	0	1	4
CM3	Urban Background	20.5	20.5	5	5	0	6	0(24)

Notes: Exceedances of the PM_{10} 24-hour mean objective (50µg/m^3 not to be exceeded more than 35 times/year) are shown in **bold.**

(1) data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

(2) data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

(3) If the period of valid data is less than 85%, the 90.4th percentile of 24-hour means is provided in brackets.

Table A.7 – $PM_{2.5}$ Monitoring Results

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2016 (%) (2)	$PM_{2.5}$ Annual Mean Concentration (µg/m^3) (3)				
				2012	2013	2014	2015	2016
CM3	Urban Background	12.4	12.4	12	14	10	10	13

(1) Data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

(2) Data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

(3) All means have been "annualised" as per Technical Guidance LAQM.TG16. See Appendix C for details.

Appendix C: Supporting Technical Information / Air Quality Monitoring Data QA/QC

Automatic Monitoring Sites

Oxford City Council currently operates three continuous monitoring sites. All routine calibration and maintenance is carried out and recorded in accordance with manufacturers' and Automated Urban Monitoring Network site operators' manual [9].
Instrument drift is routinely checked by:

- a daily internal instrument calibration which is carried out automatically using an electronic calibration check;

- every two weeks a manual external instrument calibration is carried out by Oxford City Council using gas cylinders that can be traced back to reference standards for each pollutant;

- every six months an audit of instrument response is carried out by an external organization using independent gas calibration standards.

The above checks enable data to be examined subsequently for instrument drift, which is expected, or for faulty data which is usually not expected. Instrument drift is routinely adjusted by means of the 2 weekly external gas calibrations. Scaled data is calculated using the gas calibrations for each analyser.
Data from the continuous monitoring sites is collected and independently validated by Ricardo Energy & Environment following robust QA/QC procedures[10].
A dedicated supporting unit is also employed for each site, responding to equipment breakdowns and scheduled maintenance and servicing.

Data capture

During the course of 2016, the urban background monitoring station of Oxford St Ebbe's suffered from a couple of incidents that has affected the performance of both NO_x and PM analysers.

The Q2 and Q3 reports from Ricardo Energy & Environment made detailed reference to site operational issues surrounding a failed air conditioning unit, with associated

enclosure temperature issues. Additionally, there was detailed commentary on the power down of both PM systems, health and safety issues and concerns over the enclosure surrounding tree overhang. The proximity of vegetation around the sample inlet made Ricardo Energy & Environment null a considerable amount of data during QA/QC procedures as the measurements were considered not to be representative of real air pollution.

Prior to the new air conditioning unit installation going ahead, on-going health and safety issues had to be resolved to allow safe access to the analyser inlets. Gate modifications associated with the surrounding fencing along with the installation of new ladder hooks were completed in early December. Final data capture for PM_{10}, $PM_{2.5}$ and NO_x at St. Ebbe's was therefore reduced to 20.5%, 12.4% and 24.4% respectively.

Methodology used to report low data capture

a) Hourly Mean NO_2

LAQM.TG (16) was utilised to report NO_2 Hourly Mean for St. Ebbe's.

b) 24 Hour mean PM_{10}

LAQM.TG (16) was utilised to report PM_{10} Hourly Mean for St. Ebbe's.

c) Annual Mean NO_2, PM_{10} and $PM_{2.5}$ (*annualisation*)

The procedures that were used to annualise NO_2, PM_{10} and $PM_{2.5}$ data at St. Ebbe's are described within LAQM TG (16) guidance, Box 7.9 (page 49), and involved the identification of 2 to 4 nearby long term continuous monitoring sites lying within a radius of about 50 miles from St. Ebb's. The data capture of the selected sites needed to be ideally of at least 85%, and the sites to be chosen needed to be background (Urban background, Suburban or Rural), to avoid any type of interference of local pollution effects that may have occurred at Urban Centre, Roadside or Kerbside locations. Annual (A_m) and Period means (for the period of interest P_m) were obtained from the selected sites. A ratio (R) of A_m to P_m was then calculated for each site, and the average of these ratios (R_a) has resulted in the annualisation factor to be used for the estimation of the annual mean. Finally, P_m of

St. Ebbe's was multiplied by R_a to give the best possible estimate of the annual mean for 2016. The procedure was repeated accordingly for every pollutant.

Non-Automatic Monitoring Sites

Diffusion tubes are supplied and analysed by an accredited laboratory (South Yorkshire Air Quality Samplers), using the 50% TEA in Acetone method.

The laboratory is subject to quality assurance testing as part of their accreditation. This involves an independent comparison to other laboratories. The results of inter-comparisons are available for scrutiny.

As diffusion tubes are not the reference method due to is low accuracy when compared with automatic monitoring, it is necessary to bias correct them.

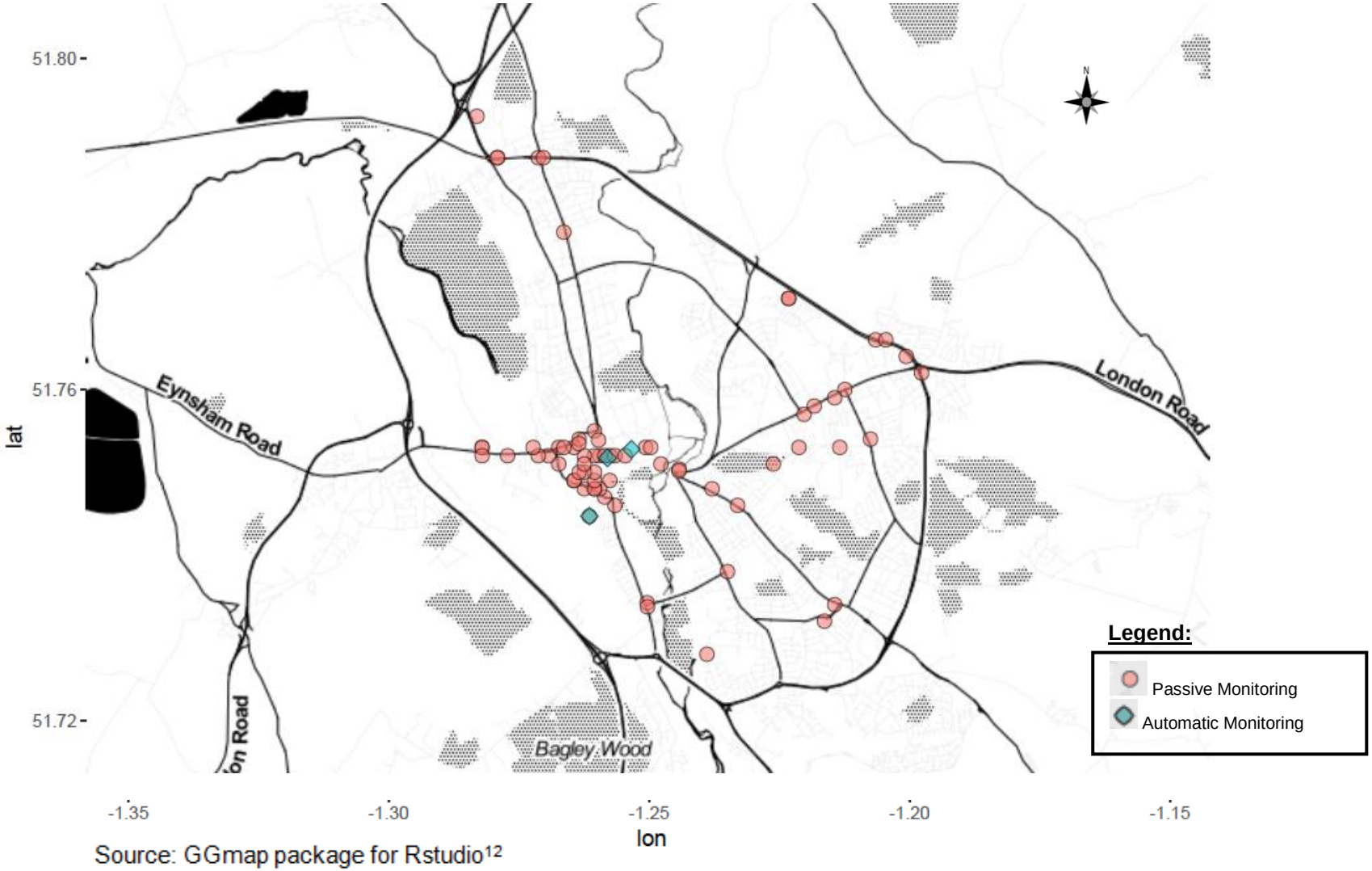
A bias correction factor is applied to diffusion tube results to account for laboratory bias and to correct to continuous monitoring results. Oxford City Council carries out a co-location study annually, and has used the results to calculate a locally derived bias adjustment factor for each separate year studied.

In 2016 the bias correction factor derived from the local co-location study was **0.96**. The national bias correction factor was **0.85**. It was considered most appropriate to use the locally derived factor as the local co-location study has presented "good" precision for the diffusion tubes, together with high quality chemiluminescence results. This was considered to be the more conservative approach and is considered to be more representative of the local situation.

The annual mean NO_2 from the diffusion tubes have been also annualised, following the procedure described above, for all the cases where annual data capture was below 75%, as per LAQM TG (16) guidelines

Appendix D: Maps of Monitoring Locations

Table D.1 – Oxford's air quality monitoring locations, 2016.



Source: GGmap package for Rstudio[12]

Table D.2 – Oxford's diffusion tube locations by level of NO_2, 2016.

Source: GGmap package for Rstudio[12]

Appendix E: Summary of Air Quality Objectives in England

Table E.2 – Air Quality Objectives in England

Pollutant	Air Quality Objective[1]	
	Concentration	Measured as
Nitrogen Dioxide (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
Particulate Matter (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
Particulate Matter ($PM_{2.5}$)[2]	25 µg/m^3	Annual Mean
Sulphur Dioxide (SO_2)	350 µg/m^3, not to be exceeded more than 24 times a year	1-hour mean
	125 µg/m^3, not to be exceeded more than 3 times a year	24-hour mean
	266 µg/m^3, not to be exceeded more than 35 times a year	15-minute mean
Ozone (O_3)	100 µg/m^3 not to be exceeded over 10 days a year	8-hour mean

[1] The units are in micrograms of pollutant per cubic metre of air (µg/m^3).
[2] Non-mandatory target value, to be achieved by 2020.

Glossary of Terms

Abbreviation	Description
AQAP	Air Quality Action Plan - A detailed description of measures, outcomes, achievement dates and implementation methods, showing how the local authority intends to achieve air quality limit values'
AQI	Air Quality Index - is a number used by government agencies to communicate to the public how polluted the air currently is or how polluted it is forecast to become.
AQMA	Air Quality Management Area – An area where air pollutant concentrations exceed / are likely to exceed the relevant air quality objectives. AQMAs are declared for specific pollutants and objectives
AQS	Air Quality Strategy
ASR	Air Quality Annual Status Report
AURN	Automatic Urban and Rural Network
CAZ	Clean Air Zones – An area where targeted action is taken to improve air quality to improve people's health and support economic growth
DEFRA	Department for Environment, Food and Rural Affairs
DSPs	Delivery and Servicing Plans
EVs	Electric Vehicles
FDMS	Filter Dynamics Measurement System
GULO	Go Ultra Low Oxford
JSNA	Joint Strategic Needs Assessment - looks at the current and future health and care needs of local populations to inform and guide the planning and commissioning (buying) of health, well-being and social care services within a local authority area.
LAQM	Local Air Quality Management
LAQMTG16	Local Air Quality Management Technical Guidance (2016)
LEZ	Low Emission Zone
LTP	Local Transport Plan

NO_x	Nitrogen Oxides
NO_2	Nitrogen Dioxide
O_3	Ozone
OCC	Oxford City Council
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
QA/QC	Quality Assurance and Quality Control
STOP	Schools Tackling Oxford's Air Pollution
TEOM	Tapered Element Oscillating Microbalance
UK AQS	United Kingdom's Air Quality Strategy
UV	Ultra Violet radiation
WHO	World Health Organization
ZEZ	Zero Emission Zone

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