
# 2020 Air Quality Annual Status Report (ASR)

## In fulfilment of Part IV of the Environment Act 1995

## Local Air Quality Management

Date: June, 2021

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# Executive Summary

## Health impacts of air pollution in the context of COVID-19

The year 2020 brought the most defining global health crisis of our time. Since it emerged in Asia in late 2019, the COVID pandemic has been responsible for more than 3 million[1] deaths worldwide. The coronavirus (SARS-CoV-2) is responsible for causing acute respiratory syndrome, and the symptoms can be highly variable, ranging from none to life-threateningly severe.

It is widely understood that long term exposure to air pollution is historically associated with a number of adverse health impacts and is linked with increased morbidity. Air pollution can cause health problems like cardiovascular disease, respiratory system disease, strokes, diabetes, increasing obesity and high blood pressure, all of which have been identified as the pre-existing medical conditions[2] that raise the chances of death from COVID-19 infection.

Emerging research, including a study from Harvard T.H. Chan School of Public Health[3], found that breathing more polluted air over many years may itself worsen the effects of COVID-19. These authors found an association between air pollution over many years with an 11% increase in mortality from COVID-19 infection for every 1 microgram/cubic meter increase in air pollution, and whilst the study does not show that air pollution directly affects an individual's likelihood of dying from COVID-19 (because individual-level COVID data is not yet publicly available), it does show an association between long term exposure to air pollution and higher COVID-19 mortality rates.

Here in the UK, the Air Quality Expert Group (AQEG) issued, in June 2020, a rapid review[4] on the estimation of changes in air pollution emissions, concentrations and exposure during the COVID-19 outbreak in the UK. The document also acknowledges that there is some evidence to suggest that nitrogen dioxide ($NO_2$), particulate matter (PM) and ozone

1 Data obtained from Worldometers, on the 4th June 2021

2 International Journal of Infectious diseases

3 Air pollution and COVID-19 mortality in the United States

4 Air Quality Expert Group, Rapid evidence review June 2020

($O_3$) may increase susceptibility to respiratory infections or worsen disease prognosis, although it recognises that there are still insufficient studies or mixed evidence for specific combinations of endpoints, infection types, age groups or pollutants.

The mortality burden of air pollution within the UK was equivalent to 28,000 to 36,000 deaths at typical ages[5], with a total estimated healthcare cost to the NHS and social care of £157 million in 2017[6].

Action on air pollution has therefore never been more important. In addition to the annual burden of disease and deaths caused by air pollution, it also looks to be making us more vulnerable to the impacts of COVID-19.

## Oxford's air pollution sources and the city's new AQAP

The city of Oxford, as with many urban areas throughout the United Kingdom, is subject to poor air quality, particularly in areas with high levels of road traffic. Nitrogen dioxide ($NO_2$) is still the pollutant of most concern, and the entire city of Oxford has been a designated Air Quality Management Area (AQMA) for $NO_2$ since 2010.

According to Oxford's most recent source apportionment study[7], the transport sector continues to be by far the largest contributor (68%) to total emissions of Nitrogen Oxides ($NO_x$), followed by domestic combustion (19%), combustion from industry and services (12%) and others: waste, agriculture, solvents, nature (<1%).

In January 2021, Oxford City Council's cabinet approved the adoption of a new Air Quality Action Plan (AQAP) for the city, replacing the old plan which expired in December 2020. The new AQAP, which is available at the city county's website, sets out the list of actions that the city council and its partners have committed to deliver during the period 2021-2025 in pursuit of an improvement of air quality levels in the city and, more importantly, sets out what is believed to be the UK's first localised air pollution target for $NO_2$.

The action plan, which was developed by Oxford City Council together with Oxfordshire County Council's Localities, Public Health and Innovation teams, seeks to go further than the legal annual mean limit value for $NO_2$ of 40 µg/m$^3$, by establishing a new local annual

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5 Defra. Air quality appraisal: damage cost guidance, July 2020

6 Public Health England. Estimation of costs to the NHS and social care due to the health impacts of air pollution: summary report, May 2018

7 Oxford City Council's Source Apportionment study, July 2020

mean $NO_2$ target of 30 µg/$m^3$ to be achieved by 2025 in recognition that there's no safe level for air pollution.

## Oxford's air pollution levels and lockdown impacts

This annual status report outlines the result of air quality monitoring undertaken across the city of Oxford in 2020. Data for a full year of monitoring is required in order to report on the complete set of $NO_2$ air quality objectives, and Oxford City Council annually publishes all air quality data on its website as well as on https://oxfordshire.air-quality.info/

Results from the air quality monitoring conducted during 2020 indicate significant decreases of $NO_2$, $PM_{10}$ and $PM_{2.5}$ levels in all the places where these pollutants are being monitored in the city. This is directly linked to the onset of the COVID-19 pandemic and ensuring Government lockdowns.

During the first couple of months of the first lockdown, Oxford saw reductions of up to 60%[8] in Nitrogen Dioxide ($NO_2$), primarily from a significant reduction in traffic, with levels at the lowest ever recorded in the city since 1996, the year air quality monitoring began.

During 2020, due to the lockdowns and in response to the impacts of the COVID-19 pandemic, millions of people have changed their routines in ways that reduced air pollution by working from home and walking and cycling more. The significant shift that we have all experienced towards active travel during this period has seen more people than ever enjoying our streets with lower levels of motorised traffic, which has translated into significant positive changes in air pollution levels and likely improvements in public health.

Recent surveys of Oxford residents showed clear support for action to reduce motorised traffic to make the city more cycle and walking friendly. People have indicated that they have noticed and appreciated cleaner air and safer streets.

Throughout 2020, Oxford City Council operated an air quality monitoring network that consists of a total of 71 sites using passive monitoring (diffusion tubes) and three sites using automatic (continuous) monitoring. In 2019, before the COVID-19 pandemic, we were experiencing $NO_2$ levels above the annual mean legal limit for this pollutant at six locations in the city. In 2020, we have witnessed a reduction in $NO_2$ levels at all 71 monitored locations of between 14-45% (depending on the location).

8 Ricardo Energy & Environment – Blog update on COVID-19 and changes in air pollution

The average reduction of $NO_2$ levels across the entire city was of 29% in 2020. This figure is consistent with the 20-30% reductions in $NO_2$ levels which were observed across the UK, as highlighted on the AQEG report on the estimation of changes in air pollution emissions, concentrations and exposure during the COVID-19 outbreak in the UK.

The highest $NO_2$ annual mean concentration measured in Oxford in 2020 was 36 ug/$m^3$ at our highest historic air pollution hotspot – St Clements. This figure is 10% below the current limit value of 40ug/$m^3$, and represents a reduction of 32% with regards to the measurement obtained in 2019. Overall, this means that in 2020 all monitoring sites were, for the first time since air quality monitoring began in the city, in full compliance with the UK air quality objectives for this pollutant.

But $NO_2$ was not the only pollutant experiencing significant reductions in 2020 as a consequence of the COVID-19 impacts. Analysis of the annual means obtained for Particulate Matter show an average 19% reduction of $PM_{10}$ levels, and a 22% reduction of $PM_{2.5}$ levels, in all the city locations where these pollutants are being monitored.

These reductions were less pronounced than those observed for $NO_2$ due to the closer association of these pollutants to long-range transport and to the fact that the biggest contributor to local emissions of these pollutants is not the transport sector (contrary to what is seen for $NO_2$), but domestic combustion instead. During lockdown, people have remained in their homes, and continued to use their heating systems, hence they have continued to generate PM emissions via this emission source.

Whilst the impacts of the pandemic seem to have been largely positive in reducing local levels of $NO_2$, $PM_{10}$, and $PM_{2.5}$, the same cannot be said with regards to ozone ($O_3$). Overall, the concentrations of ozone measured at AURN St Ebbes were significantly higher in 2020 when in comparison with the previous monitoring year. Nitric oxide (NO) - largely emitted from vehicles, destroys ozone and therefore acts as a local sink. For this reason, ozone levels are typically never as high in urban areas as in rural areas.

The significant reductions in traffic[9] caused by the pandemic restrictions have led to a decrease in NO levels, which in turn caused general increases of ozone levels in Oxford, and generally throughout the UK.

9 Oxfordshire County Council (the Highways authority) have estimated an average 35% reduction in traffic levels in Oxford City Centre, during the period that goes from 23rd March to the 31st December 2020.

## Actions to Improve Air Quality

Oxford's new Air Quality Action Plan 2021-2025 focusses on measures the City Council has the ability to address, but also includes measures that we can influence, or work in partnership with others to deliver. Effective action requires co-operation from all sectors including transport, construction, business and commerce, and daily choices made by every single transport user. 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 range of stakeholders.

The following are actions that Oxford City Council has taken over the last reporting year (from July 2020 to June 2021) to improve air quality in the city despite the impact of the COVID-19 pandemic in disrupting plans. The list below is presented in chronological order:

1) Agreed, in July 2020 and together with Oxfordshire County Council, for work to be accelerated, where feasible, on Connecting Oxford, the Zero Emission Zone and the wider sustainable and active travel programme.
2) Announced in September 2020, the winning primary school for the school banner competition to raise awareness of air pollution. Schools across Oxford were invited in March 2020 to take part in a competition, organised by the City Council and Oxford Friends of the Earth to create a banner raising awareness about the effects of air pollution, and to promote sustainable transport on the school run. The competition is part of the City Council's STOP (Schools Tackling Oxford's Air Pollution) project which aims to raise awareness of the main sources and health effects of air pollution emissions among the school community (link to press release);
3) Supported Oxfordshire County Council's successful delivery of the new Street Tag app in October 2020. The app forms part of County Council's active travel plans to increase exercise and improve air quality in Oxfordshire. Street Tag is aimed at children, parents' schools, leisure venues and community groups. It will also involve the use of outdoor spaces and school staff. (link to press release);
4) Organised and hosted Oxford's first youth climate summit in November 2020. The meeting has supported participating young people to learn more about climate breakdown and its impacts on the Global South, explore the topic of lobbying for change and inform the council's plans on climate action. The development of a

youth climate summit was one of Oxford City Council's commitments, made as a result of 2019's Citizens Assembly on Climate Change (link to press release);

5) Supported the delivery of the 3rd edition of Oxford's EV summit in December 2020. The 2020 panel line up was focused on UK Charging Infrastructure, International Charging Infrastructure, Original Equipment Manufacturers (OEMs), Two Wheels, Investment, Electric Buses, Sustainability and Research. The event was delivered remotely due to the COVID-19 pandemic, and was hosted by Oxford University at the Said Business School (link to website).
6) Developed and delivered a new Air Quality Action Plan for the City of Oxford, which was approved at cabinet meeting in January 2021. The new AQAP outlines the complete list of 30 actions that will be delivered by the City and its partners to improve air quality in Oxford City from 2021 to 2025. It also voluntarily sets a new lower target for $NO_2$, one which is tighter than the Government's own. (link to press release);
7) Organised and delivered, in February 2021, several online show and tell sessions to try to understand city centre businesses' needs, to help them adapt to the Zero Emission Zone Pilot which will be launched in August. These activities are part of on-going work with *Futuregov* on user research to build a qualitative understanding of businesses operations and the challenges they experience to reduce their emissions following a user-centred design process. This project forms part of the £122,500 from DEFRA Air Quality Fund that was secured specifically to work with businesses in the city centre on how to adopt zero emission delivery and servicing solutions for their business (link to press release);
8) Secured in March 2021 £162,500 from the Department for Environment, Food, and Rural Affairs (DEFRA) Air Quality Fund for the delivery of a new Air Quality community website to help raise awareness of air pollution across Oxfordshire, working in partnership with neighbouring district councils - Cherwell, West Oxfordshire, South Oxfordshire and Vale of White Horse, along with Oxfordshire County Council. (link to press release);
9) Secured in March 2021 £45,000 from the Department for Environment, Food, and Rural Affairs (DEFRA) Air Quality Fund for the delivery of a citywide behaviour change campaign that will draw attention to the importance of the domestic combustion sector and how it contributes to air pollution levels in Oxford. (link to press release);

10) Introduced in March 2021 the first purpose built, fully integrated electric refuse collection vehicle (eRCV) on the streets of Oxford, providing emission free waste collection services across the city. The vehicle is the latest in its 339-strong fleet to be converted to electric, thanks to funding from Energy Superhub Oxford. The project is helping Oxford Direct Services (ODS) to convert 25% of its fleet to electric by 2023. It is already well on its way to meeting this target, with 51 electric vehicles in operation and a further eight vehicles on order. (link to press release);
11) Saw in March 2021 the approval by City and County Council's cabinets of the final proposal for a ZEZ pilot in Oxford City centre, which will start in August 2021. The ZEZ pilot will be based on a road user charging scheme where Zero emission vehicles will be able to drive in the zone free of charge. The work was developed in partnership with the Local Transport Authority – Oxfordshire County Council. Throughout 2020/2021, both councils have also continued to develop work towards the expansion of the ZEZ to the entire city, which is expected to occur in full by 2030 (link to press release);
12) In March 2021, supported in principle Oxfordshire County Council's trial of new Low Traffic Neighbourhoods (LTNs) within the Cowley area in Oxford and worked with the transport authority to improve their implementation. A Low Traffic Neighbourhood is an area where through traffic is prevented by the use of "*traffic filters*" which can be either planters or bollards, so that residents can enjoy a quieter neighbourhood and feel safer when they walk, cycle or go by wheelchair. (link to press release);
13) Supported Oxfordshire County Council's trial in March 2021 of various experimental school streets schemes with the aim to improve road safety to help boost cycling and walking and improve air quality. The schemes made use of temporary barriers, some signs and a few volunteers, to close the road outside a school to motor vehicles for a short period of time either side of the start and end of the school day. Anyone walking or cycling can pass through the barriers, while drivers are advised of alternative routes. Emergency vehicles, blue badge holders and anyone who lives within the School Street are also allowed through. (link to press release);
14) Presented Oxford's first Action Plan for bringing about a net zero carbon city by 2040 or earlier in March 2021 — ten whole years ahead of the Government's national legal target. The Net Zero Oxford Action Plan sets out the actions the City Council will be taking directly, as well as those in which it is seeking to partner with others. It references how it will engage residents, businesses and other

organisations to eliminate Oxford's contributions to climate change, and how it will use its influence with Government. The Action Plan is accompanied by the Council's new Carbon Management Plan that sets out how it will achieve zero carbon emissions across its estate and operations by 2030 or earlier. The Plan feeds into the conclusion of a new Sustainability Strategy set to take place in 2021. (link to press release);

15) Initiated the development of Oxford's first Urban Tree Strategy in March 2021, which will be created to maximise the benefits trees have on the local environment and communities. The new strategy will also play a part in helping the city reduce air pollution levels and achieve net zero carbon by 2040. (link to press release)
16) Submitted to DEFRA, in April 2021, the final report of a DEFRA funded air quality project involving the testing of low cost innovative Air Quality sensors to map air pollution and human exposure in Oxford. This project was delivered in partnership with local group Ox-Air (link to press release);
17) Started a pilot project in June 2021 to test and demonstrate the effectiveness of e-cargo bikes for deliveries in Oxford's covered market and to support and expedite their uptake (link to press release);
18) Developed , in June 2021, a green recovery plan with measures for the city and that included the delivery of: Pedestrianisation trials at St Michaels and George Streets; Allowing for parking at Oxford's five park and rides to be free throughout August; Introducing a one way pedestrian flow system in Oxford city to help maintain social distancing; Installed 130 new bike parking at the park and rides and in the city centre; Freed up pavement space and created designated rest areas to keep pedestrians moving in the city centre's busy and narrow streets.

## Conclusions and Priorities

The results of the monitoring work carried out by Oxford City Council in 2020 show the following:

- Average reductions of Nitrogen Dioxide ($NO_2$) and Particulates ($PM_{10}$ and $PM_{2.5}$) in the city of Oxford of 29%, 19% and 22% respectively. All of these reductions can be directly attributable to the several lockdown restrictions that ended up affecting traffic levels and were imposed on the city of Oxford and its residents throughout 2020;

- Significant increases of ozone ($O_3$) levels in the city in 2020. Overall, Oxford has exceeded the AQS daily objective for ozone 152 times, during a total of 26 days during the year. This represents a significant increase in the number of exceedances (+112) and days (+16) when compared with the results from 2019 and is directly related to the significant reductions in traffic during the lockdown;
- For the first time since air quality monitoring started in Oxford, the city is fully compliant with all (short and long term) air quality objectives for $NO_2$, $PM_{10}$, and $PM_{2.5}$. Hence, no air quality hotspot was identified in 2020;
- In 2020, all the monitoring sites have experienced significant reductions of $NO_2$ levels. The biggest $NO_2$ reductions were seen at DT48 and DT47, both located at George St (45% and 40% reduction). The lowest reductions were seen at DT81 (Cowley Road/Union St) and DT28 (51 Sunderland Avenue), with 14% and 15% reduction respectively.
- The monitoring location with the highest annual mean for $NO_2$ in 2020 was DT55 - St. Clements Street/The Plain - with a value of 36 $\mu gm^{-3}$. This represents a decrease of 32% of the $NO_2$ levels at this location when compared with data from the previous year (53 $\mu gm^{-3}$).
- In 2020, the third full year of monitoring was completed since the opening of the Westgate Shopping Centre. Air quality was monitored at a total of 12 locations around the Westgate Centre. None of the previous historic monitoring at these locations has ever shown any exceedances of the annual mean $NO_2$. In 2020, all these sites showed decreases of $NO_2$ levels measured between 5-12 $ugm^{-3}$. Overall, the results of the monitoring around the Westgate indicate an average $NO_2$ annual mean reduction of 30% in 2020, which is a positive change in $NO_2$ levels when compared with the previous year;

Oxford City Council's priorities for the coming year will be to try to progress as much as possible with the complete list of actions that were agreed for delivery by Oxford City Council and its partners under the City's recently approved Air Quality Action Plan (2021-2025) and which fall under the following agreed four key areas of intervention:

- Developing partnerships and public education;
- Support for the uptake of Low and Zero emission vehicles;
- Reducing emissions from domestic heating, industry and services;

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

Specifically, the City Council is expecting:

- To deliver the ZEZ pilot scheme in August 2021 and progress plans for the introduction of the wider ZEZ in Oxford, working in partnership with the Local Transport Authority – Oxfordshire County Council;
- To fully deliver a £162,500 DEFRA Air Quality Grant funded project for a new Air Quality Website for Oxfordshire, working in partnership with all the other District Councils in Oxfordshire;
- To fully deliver a £45,000 DEFRA Air Quality Grant funded project for a city-wide raising awareness campaign, specifically addressing the use of wood burning and inappropriate fuels, and highlighting the negative health impacts caused to residents by the use of these energy sources;
- To continue the roll out of 100 EV chargers across the city, as part of the GULO project;
- To progress with the delivery of a £122,500 DEFRA Air Quality Grant funded project aimed at the development of a communication and engagement plan, to inform and work with businesses in the city centre on how to adopt zero emission delivery and servicing solutions for their businesses;
- To progress with the delivery of a £200,000 DEFRA Air Quality Grant funded project aimed at facilitating Oxford's historic Covered Market to go electric through the provision of electric charging points, electric delivery vehicles and the delivery of an e-cargo bike pilot study to facilitate sustainable deliveries;
- To continue the expansion of the City Council's fleet of electric vehicles which currently stands at 51 full electric vehicles with a further 8 electric vehicles on order;
- To continue to deliver the STOP project, in partnership with the local Friends of the Earth group, working with local primary schools and raising awareness of air pollution and promoting active travel;
- To progress with the delivery of a £40 million central Government funded project for the development of an innovative new Energy Superhub Oxford project in Redbridge park and ride site;
- To introduce a new Euro VI LEZ for buses in Oxford in December 2021;
- To fully deliver Oxford's Urban Tree Strategy;

- To progress with the development of a detailed business case for the Connecting Oxford proposals, as well as modelling, design and a comprehensive engagement programme with a wide range of stakeholders and resident groups across the city;
- To initiate, the second phase of new emission standards for hackney carriages in Oxford. In January 2021, hackney carriage taxi drivers will be required to have at least Euro 4 standard to renew their licence, and zero-emission capable vehicles to receive a new licence;
- To continue developing work for the provision of electric vehicle charging infrastructure for the use of hackney carriages and private hire taxis in the city, using £370,000 of funding awarded by the Government's Office for Low Emissions Vehicles (GOLEV)
- To finalise the delivery of £2.3 million CBTF project for the retrofitting of five of the city's open-top sightseeing buses to become fully electric, and the retrofitting of 115 local buses to euro VI standards, using Selective Catalytic Reduction (SCR) technology;

## Local engagement and how to get involved

From the 10th September 2020 to the 1st November 2020 Oxford City Council ran a consultation on the proposed new Air Quality Action plan (2021-2025). The results of this public consultation have allowed the city council to gain a better understanding of the level of interest and understanding of our local residents on air quality matters.

The results of the public consultation were positive and in general supportive of the key priority areas of intervention and air quality actions developed in the proposed AQAP. At the same time, the following statistics were gathered as a result:

- 60% of the consultees have rated "Air Quality" in Oxford to be either "Poor" or "Very poor";
- 86% of the consultees have rated "Traffic Congestion" in Oxford to be either "Poor" or "Very poor" and 63% believe that traffic has become worse in the city over the past 5 years;
- 68% of the consultees have rated "Adequate space for cycling" in Oxford as either "Poor" or "Very Poor";

- 68% of the consultees feel moderately informed about air quality issues in Oxford, and 84% said they would like to feel more informed about air quality.

The results of this public consultation were very useful in terms of making the City Council aware of how much Oxford's residents value clean air, have a good understanding of most of the issues that need to be tackled in the city, and of how much they want to be informed about air quality issues.

Everyone deserves to breathe clean air, but it is important to highlight that everyone also has a role to play in improving air quality levels, as our everyday decisions can have an impact on the air we breathe.

- Do you burn inappropriate fuels or use inappropriate appliances at home?
- 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 (OAQG) website https://oxfordshire.air-quality.info/ or alternatively on AQ England and UK-Air websites.

Relevant information with regards to Oxford city Council's air quality projects, current air quality management and other relevant air quality information can be found at the city council's website: https://www.oxford.gov.uk/info/20052/air_quality.

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## Figures

## Tables

# 1 Local Air Quality Management

This report provides an overview of air quality in Oxford during 2020. 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 are presented in Appendix E.

# 2 Actions to Improve Air Quality

## 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 should prepare an Air Quality Action Plan (AQAP) within 12 months setting out measures it intends to put in place in pursuit of compliance with the objectives.

A summary of AQMAs declared by Oxford City Council can be found in Table 2.1. The table presents a description of the only AQMA that is currently designated within Oxford City Council. Appendix D: Map(s) of Monitoring Locations and AQMAs provides a map of this AQMA and also the air quality monitoring locations in relation to the AQMA. Currently, the only air quality objective pertinent to the current AQMA designation is:

- $NO_2$ annual mean

## Table 2.1 – Declared Air Quality Management Areas

| AQMA Name | Date of Declaration | Pollutants and Air Quality Objectives | One Line Description | Is air quality in the AQMA influenced by roads controlled by Highways England? | Level of Exceedance: Declaration | Level of Exceedance: Current Year | Name and Date of AQAP Publication | Web Link to AQAP |
|---|---|---|---|---|---|---|---|---|
| The city of Oxford | Declared 2010 | NO2 annual and hourly mean | The whole of the administrative area of Oxford City Council | YES | 78µg/m$^3$ | 36µg/m$^3$ | AQAP (2021-2025)<br><br>January 2021 | Visit the AQAP for Oxford's city-wide AQMA here |

☒ **Oxford City Council confirm the information on UK-Air regarding their AQMA(s) is up to date.**

☒ **Oxford City Council confirm that all current AQAPs have been submitted to Defra.**

# Progress and Impact of Measures to address Air Quality in Oxford

Defra's appraisal of last year's ASR concluded that overall, the report was well written, structured and detailed, and provided all the information specified in the LAQM guidance. However, a few comments were made with regards to the identification of actions for improvement of future versions of the report:

- *It would be useful for the report to include a map with the AQMA extent;*
- *The city's AQAP would need to be updated for next year's ASR as the existing plan was mapped out to run from 2013 – 2020;*
- *Distance correction using the LAQM calculator should be applied in future and the corresponding calculations should be included as annex;*
- *Further details on the calculation of the local bias adjustment factors should also be included as annex.*
- *The report included excellent detail from local $PM_{2.5}$ monitoring but could supplement this information with reference to the Public Health Outcomes Framework.*
- *The feedback from DEFRA's last year appraisal was not included or commented upon. The council should look to include this in future years.*

Oxford City Council has carefully reviewed the suggestions made and have decided to incorporate the complete list of DEFRA's suggestions into this year's ASR.

Oxford City Council has taken forward a number of direct measures during the reporting year of 2020 in pursuit of improving local air quality. Details of all measures completed, in progress or planned are set out in Table 2.2. A complete list of 30 measures is included within Table 2.2, with the type of measure and the progress Oxford City Council have made during the reporting year of 2020 presented. Where there have been, or continue to be, barriers restricting the implementation of the measure, these are also presented within Table 2.2.

More detail on these measures can be found in Oxford City Council's recent Air Quality Action Plan 2021-2025

Oxford City Council's key completed measures since last year's ASR include:

- Agreed, in July 2020 and together with Oxfordshire County Council, for work to be accelerated, where feasible, on Connecting Oxford, the Zero Emission Zone and the wider sustainable and active travel programme.
- Announced in September 2020, the winning primary school for the school banner competition to raise awareness of air pollution. Schools across Oxford were invited in March 2020 to take part in a competition, organised by the City Council and Oxford Friends of the Earth to create a banner raising awareness about the effects of air pollution, and to promote sustainable transport on the school run. The competition is part of the City Council's STOP (Schools Tackling Oxford's Air Pollution) project which aims to raise awareness of the main sources and health effects of air pollution emissions among the school community (link to press release);
- Supported Oxfordshire County Council's successful delivery of the new Street Tag app in October 2020. The app forms part of County Council's active travel plans to increase exercise and improve air quality in Oxfordshire. Street Tag is aimed at children, parents' schools, leisure venues and community groups. It will also involve the use of outdoor spaces and school staff. (link to press release);
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- Supported the delivery of the 3rd edition of Oxford's EV summit in December 2020. The 2020 panel line up was focused on UK Charging Infrastructure, International Charging Infrastructure, Original Equipment Manufacturers (OEMs), Two Wheels, Investment, Electric Buses, Sustainability and Research. The event was delivered remotely due to the COVID-19 pandemic, and was hosted by Oxford University at the Said Business School (link to website).
- Developed and delivered a new Air Quality Action Plan for the City of Oxford, which was approved at cabinet meeting in January 2021. The new AQAP outlines the complete list of 30 actions that will be delivered by the City and its partners to improve air quality in Oxford City from 2021 to 2025. It also voluntarily sets a new lower target for $NO_2$, one which is tighter than the Government's own. (link to press release);

- Organised and delivered, in February 2021, several online show and tell sessions to try to understand city centre businesses' needs, to help them adapt to the Zero Emission Zone Pilot which will be launched in August. These activities are part of on-going work with *Futuregov* on user research to build a qualitative understanding of businesses operations and the challenges they experience to reduce their emissions following a user-centred design process. This project forms part of the £122,500 from DEFRA Air Quality Fund that was secured specifically to work with businesses in the city centre on how to adopt zero emission delivery and servicing solutions for their business (link to press release);
- Secured in March 2021 £162,500 from the Department for Environment, Food, and Rural Affairs (DEFRA) Air Quality Fund for the delivery of a new Air Quality community website to help raise awareness of air pollution across Oxfordshire, working in partnership with neighbouring district councils - Cherwell, West Oxfordshire, South Oxfordshire and Vale of White Horse, along with Oxfordshire County Council. (link to press release);
- Secured in March 2021 £45,000 from the Department for Environment, Food, and Rural Affairs (DEFRA) Air Quality Fund for the delivery of a citywide behaviour change campaign that will draw attention to the importance of the domestic combustion sector and how it contributes to air pollution levels in Oxford. (link to press release);
- Introduced in March 2021 the first purpose built, fully integrated electric refuse collection vehicle (eRCV) on the streets of Oxford, providing emission free waste collection services across the city. The vehicle is the latest in its 339-strong fleet to be converted to electric, thanks to funding from Energy Superhub Oxford. The project is helping Oxford Direct Services (ODS) to convert 25% of its fleet to electric by 2023. It is already well on its way to meeting this target, with 51 electric vehicles in operation and a further eight vehicles on order. (link to press release);
- Saw in March 2021 the approval by City and County Council's cabinets of the final proposal for a ZEZ pilot in Oxford City centre, which will start in August 2021. The ZEZ pilot will be based on a road user charging scheme where Zero emission vehicles will be able to drive in the zone free of charge. The work was developed in partnership with the Local Transport Authority – Oxfordshire County Council. Throughout 2020/2021, both councils have also continued to develop work towards the expansion of the ZEZ to the entire city, which is expected to occur in full by 2030 (link to press release);

- In March 2021, supported in principle Oxfordshire County Council's trial of new Low Traffic Neighbourhoods (LTNs) within the Cowley area in Oxford and worked with the transport authority to improve their implementation. A Low Traffic Neighbourhood is an area where through traffic is prevented by the use of "*traffic filters*" which can be either planters or bollards, so that residents can enjoy a quieter neighbourhood and feel safer when they walk, cycle or go by wheelchair. (link to press release);
- Supported Oxfordshire County Council's trial in March 2021 of various experimental school streets schemes with the aim to improve road safety to help boost cycling and walking and improve air quality. The schemes made use of temporary barriers, some signs and a few volunteers, to close the road outside a school to motor vehicles for a short period of time either side of the start and end of the school day. Anyone walking or cycling can pass through the barriers, while drivers are advised of alternative routes. Emergency vehicles, blue badge holders and anyone who lives within the School Street are also allowed through. (link to press release);
- Presented Oxford's first Action Plan for bringing about a net zero carbon city by 2040 or earlier in March 2021 — ten whole years ahead of the Government's national legal target. The Net Zero Oxford Action Plan sets out the actions the City Council will be taking directly, as well as those in which it is seeking to partner with others. It references how it will engage residents, businesses and other organisations to eliminate Oxford's contributions to climate change, and how it will use its influence with Government. The Action Plan is accompanied by the Council's new Carbon Management Plan that sets out how it will achieve zero carbon emissions across its estate and operations by 2030 or earlier. The Plan feeds into the conclusion of a new Sustainability Strategy set to take place in 2021. (link to press release);
- Initiated the development of Oxford's first Urban Tree Strategy in March 2021, which will be created to maximise the benefits trees have on the local environment and communities. The new strategy will also play a part in helping the city reduce air pollution levels and achieve net zero carbon by 2040. (link to press release)
- Submitted to DEFRA, in April 2021, the final report of a DEFRA funded air quality project involving the testing of low cost innovative Air Quality sensors to map air pollution and human exposure in Oxford. This project was delivered in partnership with local group Ox-Air (link to press release);

- Started a pilot project in June 2021 to test and demonstrate the effectiveness of e-cargo bikes for deliveries in Oxford's covered market and to support and expedite their uptake (link to press release);
- Developed , in June 2021, a green recovery plan with measures for the city and that included the delivery of: Pedestrianisation trials at St Michaels and George Streets; Allowing for parking at Oxford's five park and rides to be free throughout August; Introducing a one way pedestrian flow system in Oxford city to help maintain social distancing; Installed 130 new bike parking at the park and rides and in the city centre; Freed up pavement space and created designated rest areas to keep pedestrians moving in the city centre's busy and narrow streets.

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

- To Launch and operate a ZEZ pilot in Oxford city centre, and to progress with the develop of work towards the expansion of the ZEZ to the entire city, which is expected to occur in full by 2030;
- Continue to run anti-idling campaigns across the city in partnership with Friends of the Earth (FoE) Oxford and continue to work with local schools via STOP Project and with Oxfordshire County Council on the subjects of air quality and sustainable travel;
- To roll out a further 100 EV chargers across the city by the end of 2021, as part of the GULO project;
- To deliver a new Air Quality community website to help raise awareness of air pollution across Oxfordshire, working in partnership with neighbouring district councils - Cherwell, West Oxfordshire, South Oxfordshire and Vale of White Horse, along with Oxfordshire County Council, and to deliver a citywide behaviour change campaign that will draw attention to the importance of the domestic combustion sector and how it contributes to air pollution levels in Oxford (both projects are being funded by DEFRA's Air Quality Grant 2021/2022);
- To finalise covered market's cargo bike pilot, evaluate performance of the scheme and agree and decide on next steps;
- To finalise delivery of Oxford's first Urban Tree Strategy
- To introduce next phase of Ultra Low Emission Standards for Hackney carriage vehicles. From January 2022 Hackney carriage taxi drivers will be required to have

at least Euro 4 standard to renew their licence, and zero-emission capable vehicles to receive a new licence;

- To continue the expansion of Oxford City Council's EV fleet and progress with the delivery of Energy Super Hub;
- For Oxford City Council to approve full adoption of Oxfordshire's EV Strategy;
- To finalise the delivery of £2.3 million CBTF project for the retrofitting of five of the city's open-top sightseeing buses to become fully electric, and the retrofitting of 115 local buses to euro VI standards, using Selective Catalytic Reduction (SCR) technology.

Oxford City Council's priorities for the coming year (2022) are:

- To fully deliver the £122,500 DEFRA Air Quality Grant funded project aimed at the development of a communication and engagement plan, to inform and work with businesses in the city centre on how to adopt zero emission delivery and servicing solutions for their business;
- To deliver a public consultation on the wider ZEZ scheme, after having learned from the experience of the ZEZ Pilot and having commissioned a new feasibility study to inform on the real air quality and economic impacts of the future scheme;
- To deliver further work on the Connecting Oxford Plans, which will also include the delivery of a new public consultation on the final versions of the scheme;
- To introduce a Euro VI LEZ for buses in Oxford

The principal challenges and barriers to implementation that Oxford City Council anticipates facing are:

- Any potential issues still arising from the COVID-19 pandemic (future lockdowns and restrictions of movement) that may still occur in 2021 and that may significantly end up impacting the delivery of several projects.

Progress on the following measures has been slower than expected:

- The official launch of the ZEZ Pilot was moved from December 2020 to August 2021, due to the impacts of the COVID-19 pandemic, and in recognition that businesses and residents across the city, including those directly impacted by the scheme, would need to focus all of their attention on managing the current and potential impacts on their trade and way of life;

- The delivery of the covered market's cargo bike pilot has suffered significant delays due to the restrictions of movements affecting the delivery of essential cargo bike parts, which were needed by the supplier to build the e-cargo bikes;
- The delivery of the communication plan to engage and support businesses with the transition to the ZEZ has suffered significant delays due to businesses being shut during the several lockdowns imposed throughout 2020;
- The delivery of the STOP Project and continuous engagement with primary schools in Oxford to raise awareness of air pollution and promote active travel was put on hold due to schools being closed for long periods of time in 2020 and due to restrictions of movements and on public gatherings;
- The introduction of a new city wide Euro VI LEZ for buses was moved from December 2020 to December 2021, also due to the impacts of the COVID-19 pandemic.

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## Table 2.2 – Progress on Measures to Improve Air Quality

| Measure No. | Measure | Category | Classification | Year Measure Introduced | Estimated / Actual Completion Year | Organisations Involved | Funding Source | Defra AQ Grant Funding | Funding Status | Estimated Cost of Measure | Measure Status | Reduction in Pollutant / Emission from Measure | Key Performance Indicator | Progress to Date | Comments / Barriers to Implementation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Work with schools, vulnerable groups and hard to reach communities to raise awareness of air pollution and promote Active Travel | Public Information/ Promoting Travel Alternatives | Student Assemblies/ Air Quality campaigns/ Promotion of Cycling and Walking | 2021 | Annually 2021-2025 | Oxford City Council + Oxfordshire County Council + Friends of the Earth | Active Travel Fund, LAs annual budget | NO | Fully Funded | < 5k (per year) | Implementation | NOx reduction not estimated, but increase of up to 23% in walking rates and reduction of up to 30% car journeys was observed with the delivery of the active travel programme WOW + communication campaigns can increase awareness of up to 12% and behaviour change of up to 6% (Clean Air Day) | Number of walking, cycling, scooting, car, and park & stride trips, Number of participating schools and deprived areas and of activities delivered | Implementation on-going | Delivery of most of schools events and activities planned throughout 2020 had to be put on hold due to the COVID Pandemic and self-isolation duties |
| 2 | Support city wide events that aim to accelerate the uptake of sustainable transport | Public Information/ Promoting Low Emission Transport/ Freight and Delivery Management | Webinars/ Summits Physical Events | 2021 | Annually 2021-2025 | Oxford City Council + Other Partners (ex:Green TV) | Sponsorship | NO | Fully Funded | Not estimated | Planning | NOx reduction not estimated, but communication campaigns can increase awareness of up to 12% and behaviour change of up to 6% (Clean Air Day) | Total amount of attendees and Businesses participating, number of business adopting sustainable delivery options, number of business compliant with the ZEZ | Implementation on-going | Next edition of Oxford's EV Summit scheduled for September 2021 Previous edition took place virtually in December 2020 due to the COVID-19 pandemic |
| 3 | Support projects that increase Oxford's Air Quality/AQ & Health evidence base | Public Information | Other | 2021 | Annually 2021-2025 | Oxford City Council + Oxfordshire County Council (Public Health Team) | Several types of funding possible (Innovate UK, DEFRA AQ Grant, UKRI) | YES | Partially funded | Not estimated (Successful bids and projects will be added on a regular basis) | Planning | Not directly applicable – NOx reduction not estimated | Total amount of partnerships created; amount of AQ/health studies delivered | Implementation on-going | OxAir + OxAria + In March 2021 Oxford Brookes have won via Transition – Discovery and Innovation Fund an air quality project, with the support of Oxford City Council and Oxfordshire County council for the development of a 3D Modelling of Pollutant Dispersion and Exposure |
| 4 | Develop partnership work with NHS, commissioners, and providers to increase awareness of air pollution amongst patients and reduce their personal exposure to air pollution | Public Information | Via the Internet/ Via other mechanisms | 2021 | 2021-2025 | Oxford City Council + Oxfordshire County Council (Public Health Team) | LAs annual budget | NO | Not funded yet | Not estimated (Successful bids and projects will be added on a regular basis) | Planning | NOx reduction not estimated, but communication campaigns can increase awareness of up to 12% and behaviour change of up to 6% (Clean Air Day) | Number of workshops /training sessions delivered, reduction in number of hospital admissions for COPD patients | Not started | |
| 5 | Improve air quality communication on our website and associated websites to assist the public in accessing reliable information about air pollution | Public Information | Via the Internet | 2021 | 2022 | Oxford City Council + all other DCs in Oxfordshire + Oxfordshire County Council | DEFRA AQ Grant | YES | Fully Funded | £162,500 | Planning | NOx reduction not estimated, but communication campaigns can increase awareness of up to 12% and behaviour change of up to 6% (Clean Air Day) | Number of website visitors, Number of website downloads, Reduction of public requests for AQ information, | Funding secured (AQ Defra Grant - March 2021) Planning phase | |
| 6 | Explore opportunities to use green infrastructure to reduce exposure to poor AQ levels | Public Information | Other | 2021 | 2021-2025 | Oxford City Council + Oxfordshire County Council + Highways England | LA annual budget + Other sources of funding (still to be identified) | NO | Partially funded | Not estimated (Successful bids and projects will be added on a regular basis) | Planning | Reduction of up to 50% in exposure to air pollution levels where green infrastructure is installed (Greater London Authority) | Air Quality data, number of species planted | Oxford City Council is currently developing its Urban Forest Strategy | It is expected that Oxford City Council's Urban Forest Strategy will go to Cabinet in July 2021 following public consultation in May. |
| 7 | Delivery of city-wide campaign on how to implement DEFRA's best practice on the use of open fires and wood burning stoves, and on how | Public Information | Via Leaflets/ Via the Internet/ Via other mechanisms | 2021 | 2022 | Oxford City Council + Friends of the Earth+ River Trust | DEFRA AQ Grant | YES | Fully Funded | £45,000 | Planning | NOx reduction not estimated, but communication campaigns can increase awareness of up to 12% and behaviour change of up to 6% (Clean Air Day) | Reduction of nuisance complaints, Reduction of NOx, $PM_{10}$ and $PM_{2.5}$ concentrations | Funding secured (AQ Defra Grant - March 2021) Planning phase | According to the city's latest Source apportionment study, combustion emissions from domestic settings accounts for 48% and 66% of the city's PM10 and PM2.5 emissions |

| Measure No. | Measure | Category | Classification | Year Measure Introduced | Estimated / Actual Completion Year | Organisations Involved | Funding Source | Defra AQ Grant Funding | Funding Status | Estimated Cost of Measure | Measure Status | Reduction in Pollutant / Emission from Measure | Key Performance Indicator | Progress to Date | Comments / Barriers to Implementation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | to reduce burning of inappropriate fuel | | | | | | | | | | | | | | |
| 8 | Work with the District and County Councils on a co-ordinated approach to public awareness and education | Public Information | Via Leaflets/<br>Via the Internet/<br>Via other mechanisms | 2021 | Annually 2021-2025 | Oxford City Council + all other DCs in Oxfordshire + Oxfordshire County Council | LAs annual budget + Other sources of funding if required | NO | Fully Funded | Not estimated | Planning | NOx reduction not estimated, but communication campaigns can increase awareness of up to 12% and behaviour change of up to 6% (Clean Air Day) | Number of comms and other campaigns run together between all the District Councils in Oxfordshire | Successful submission of a DEFRA AQ Grant, supported by all DCs, for the development of an Oxfordshire Air Quality website that will serve all residents of Oxfordshire | The Air Quality Officers of all the DCs in Oxfordshire already meet regularly to discuss air quality projects and opportunities for future partnership work |
| 9 | Introducing a Euro VI LEZ for buses in Oxford | Promoting Low Emission Transport | Low Emission Zone (LEZ) or Clean Air Zone (CAZ) | 2021 | 2022 | Oxford City Council + Oxfordshire County Council + local bus operators | LAs annual budget, CBTF | NO | Fully Funded | Staff time only | Planning | Estimated reductions of between 5% to 12.8% of total city Road NOx emissions (Ricardo's Source Apportionment Study) | LEZ Euro VI Approved bus database | Delivery planned and already in progress | Start date delayed from 1 Dec 2020 to 1 Dec 2021 due to COVID-19. Scheme currently under review in light of national bus strategy and ZEBRA funding opportunities |
| 10 | Introducing Ultra Low emission standards for Hackney Carriage Vehicles | Promoting Low Emission Transport | Taxi Licensing conditions | 2021 | 2025 | Oxford City Council | LAs annual budget | NO | Fully Funded | Staff time only | Planning | Up to 0.2% total city Road NOx emissions (Ricardo's Source Apportionment Study) | Amount of New HCV Applications, enforcement stats | Delivery planned and already in progress | The new standards will be introduced using a phased approach with future important deliverables occurring in January 2022 and 2025 |
| 11 | Delivery of Zero Emission Zone (measures to incentivise zero emission vehicles or place restrictions on other vehicles in Oxford) | Promoting Low Emission Transport/<br>Traffic Management | Low Emission Zone (LEZ) or Clean Air Zone (CAZ) /<br>Road User Charging (RUC)/ Congestion charging | 2021 | 2021-2030 | Oxford City Council + Oxfordshire County Council | LAs annual budget, DEFRA AQ Grant and other sources of funding | YES | Partially Funded | ZEZ Pilot - £267,400<br>ZEZ - £921,480 | Implementation (ZEZ Pilot)<br>Planning (ZEZ) | By 2035 (after full implementation), up to 66% reduction in city-wide transport NOx emissions and of 100% transport NOx emissions in the city centre are expected | Behavioural responses, AQ monitoring, ANPR counts | Launch of city centre ZEZ Pilot approved for August 2021, with public consultation on the wider ZEZ expected later in the year | The Councils began a final consultation on the ZEZ pilot in March 2020, but this was suspended due to the COVID-19 pandemic. An updated final consultation on the ZEZ ran from 20 November 2020 to 17 January 2021 |
| 12 | Increase the amount of EV charging infrastructure in the City | Promoting Low Emission Transport | Procuring alternative Refuelling infrastructure to promote Low Emission Vehicles, EV recharging, | 2021 | 2021-2025 | Oxford City Council + Oxfordshire County Council | Innovate UK, AQ DEFRA Grant, OLEV Grant scheme, LAs budget | YES | Fully Funded | Not estimated | Planning | NOx reduction not estimated | Number of EV Chargers Installed | Delivery in Progress<br>In July 2020 Oxford saw the installation of 38 electric vehicle chargers and the city's first 50kW rapid electric charger for ODS' electric vehicle fleet at the ODS depot<br>Preparation for "Go Ultra Low Oxford (GULO) Project Phase 2 | A map of all EV charging point locations in Oxford can be found here |
| 13 | Expansion of City Council's EV Fleet (Electrification of 25% of vehicle fleet) | Promoting Low Emission Transport | Company Vehicle Procurement -Prioritising uptake of low emission vehicles | 2021 | 2023 | Oxford City Council | Innovate UK, LAs annual budget | NO | Fully Funded | Not estimated | Planning | NOx reduction not estimated | Number of Electric vehicles purchased | Delivery in Progress<br>Oxford City Council operates at the moment a fleet of 51 electric vehicles, with further 8 vehicles on order | |
| 14 | Development of an EV Strategy for Oxfordshire | Policy Guidance and Development Control | Other Policy | 2021 | 2021 | Oxfordshire County Council + other DCs | LAs own budget | NO | Fully Funded | Not estimated | Planning | NOx reduction not estimated | Publication of EV strategy and adoption of Strategy by all District Councils | Approval of the adoption of the Oxfordshire Electric Vehicle Infrastructure Strategy and its policies was granted at County Cabinet meeting of 16th March 2021 – details here | Cherwell DC has adopted the strategy on 6th April 2021 and West Oxfordshire DC on 23rd March 2021. Other districts to follow |
| 15 | Work with bus operators on the electrification of Oxford's Bus fleet | Promoting Low Emission Transport | Company Vehicle Procurement -Prioritising uptake of low emission vehicles | 2021 | 2030 or sooner | Oxfordshire County Council + local bus operators | All-electric bus town scheme; Zero Emissions Buses Regional Area (ZEBRA) scheme | NO | Not funded yet | No specific scheme estimated. Approx £42m to fund difference between 150 electric buses and 150 diesel buses | Planning | Up to 32% of the city's total road NOx emissions (Ricardo's Source Apportionment Study) | % of bus fleet ZEV | In January 2021 Oxford and Coventry developed a proposal to become the first part of the UK to run all-electric bus services<br>Discussions are continuing with DfT re AEBT and ZEBRA schemes | Completion year 2030 or sooner (depending on successful funding) |
| 16 | Delivery of Oxford's Energy Super Hub (installation of more than 20 ultra-rapid + 30 fast vehicle EV chargers for the public use + provision of ground source heat pumps | Promoting Low Emission Transport/<br>Promoting Low Emission Plant | Procuring alternative Refuelling infrastructure to promote Low Emission Vehicles, EV recharging<br>Replacement of combustion sources | 2021 | 2021-2032 | Oxford City Council + Partners | Innovate UK | NO | Fully Funded | £41 million | Planning | 20,000 tonnes of CO2 per year saving by 2021, rising to 44,000 tonnes per year by 2032 + up to 22% reduction of NO2 emissions from transport by 2032 (Oxford City Council) | Number of EV chargers and Ground Source Heat Pumps (GSHP) installed, number of EVs purchased, AQ monitoring | Installation commenced in July 2020 of the world's largest hybrid battery. This battery is supporting a 50 plus Charge point Super hub at Redbridge Park and Ride. Contracts were awarded to three CPNO's in July 2020 | All relevant updates can be found at the ESO website here |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | for more than 300 homes) | | | | | | | | | | | | | and October 2020, providing both AC and DC chargepoints for the site in addition to transformers and a solar canopy. Planning approval for the entire Superhub was granted in February 2021. | |
| 17 | Delivery of Air Quality Benefits through Planning System (Reduce amount of car parking in the city + increase EV charging infrastructure + require more efficient/less pollutant domestic heating technologies) | Policy Guidance and Development Control | Air Quality Planning and Policy Guidance/<br><br>Other Policy | 2021 | Annually 2021-2036 | Oxford City Council | LAs own budget | NO | Fully Funded | Not estimated | Planning | NOx and PM reductions not estimated | Number of developments with EV chargers /number of EV chargers installed, number of Planning conditions discharged | Already being delivered through Oxford's Local Plan | This specific air quality actio is already being delivered since the 8th June 2020, date on which Oxford's new Local Plan (2016-2036) was formally adopted. Relevant policies within the plan that contribute to the delivery of this measure are policies RE1, RE6, M3 and M4. |
| 18 | Explore opportunities for the delivery of electric infrastructure that could accelerate the uptake of electric boats and reduce their reliance on fossil fuel use for domestic heating | Promoting Low Emission Transport/<br><br>Promoting Low Emission Plant | Procuring alternative Refuelling infrastructure to promote Low Emission Vehicles, EV recharging,<br><br>Replacement of combustion sources | 2021 | 2025 | Oxford City Council + River trust + Environment Agency | DEFRA Air Quality Grant or other | YES | Not funded yet | Not estimated | Planning | NOx and PM reductions not estimated | Number of installations delivered, number of boats relying on energy sources that are locally emissions free | Not started | Funding required |
| 19 | Upgrade Energy Efficiency of City Council's Housing stock | Promoting Low Emission Plant | Other Policy | 2021 | Annually 2021-2025 | Oxford City Council | LAs own budget | NO | Partially funded | Not estimated | Planning | NOx and PM reductions not estimated | Number of boiler upgrades, insulations and high efficiency storage heaters installed per year | Implementation on-going | |
| 20 | Provide Energy advice services: employ Energy advice Officers to visit Council homes and advise tenants, whilst also identifying energy saving improvements to the properties | Promoting Low Emission Plant | Other Policy | 2021 | Annually 2021-2025 | Oxford City Council | LAs own budget | NO | Fully Funded | Not estimated | Planning | NOx and PM reductions not estimated | Total amount of home visits and of energy savings per year | Implementation on-going | |
| 21 | Use of central government's ECO Flexible Eligibility funding to identify and designate households as eligible under the Affordable Warmth Scheme | Promoting Low Emission Plant | Other Policy | 2021 | Annually 2021-2025 | Oxford City Council | ECO Flexible Eligibility funding | NO | Partially funded | Not estimated | Planning | NOx and PM reductions not estimated | Total amount of households being granted with energy efficiency improvements | Implementation on-going | |
| 22 | Review of Smoke Controlled Zones and implementation of revised government legislation for smoke nuisance | Promoting Low Emission Plant | Other Policy | 2021 | 2021-2025 | Oxford City Council | LAs own budget | NO | Not funded yet | Not estimated | Planning | NOx and PM reductions not estimated | Implementation of new enforcement methods/ reduction of the amount of nuisance complaints | Not started | Potential delay in the implementation of Government's future Environment Bill, and which are expected to include:<br><br>a) extension of existing SCA's smoke emission standards to the whole of England<br>b) provision of new powers for local to respond to instances of nuisance smoke pollution from boats with improvement and enforcement action |
| 23 | Encourage the development of local heat networks | Promoting Low Emission Plant | Other Policy | 2021 | Annually 2021-2025 | Oxford City Council | LAs own budget | NO | Fully Funded | Not estimated | Planning | NOx and PM reductions not estimated | Number of planning applications using heat networks | Already being encouraged and delivered (when feasible) through Oxford's Local Plan | |

| Measure No. | Measure | Category | Classification | Year Measure Introduced | Estimated / Actual Completion Year | Organisations Involved | Funding Source | Defra AQ Grant Funding | Funding Status | Estimated Cost of Measure | Measure Status | Reduction in Pollutant / Emission from Measure | Key Performance Indicator | Progress to Date | Comments / Barriers to Implementation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 24 | Delivery of Connecting Oxford (explore opportunities for implementation of Workplace Paring levy + introduction of access restrictions) | Traffic Management | Workplace Parking Levy/<br>Selective vehicle priority | 2021 | 2021-2025 | Oxford City Council + Oxfordshire County Council | LAs own budgets | NO | Partially funded | £170m Capital<br>£25m revenue | Planning | NOx and PM reductions not estimated | Traffic counts, numbers of people travelling by bus, cycling, or walking, number of businesses enrolled, enforcement stats | All relevant updates can be found at the Connecting Oxford website here | The next steps for Connecting Oxford's introduction involve developing a detailed business case as well as modelling, design and a comprehensive engagement programme with a wide range of stakeholders and resident groups across the city. |
| 25 | Delivery of sustainable transport measures such as cycling improvements and bus priority lanes | Transport Planning and Infrastructure/<br>Traffic management | Cycle network/<br>Bus priority | 2021 | 2021-2025 | Oxford City Council + Oxfordshire County Council | Department for Transport (Emergency Active Travel Fund); LAs own budget | NO | Partially funded | £44m approx. for sustainable transport schemes on three Oxford radial routes and other locations | Implementation and Planning | NOx and PM reductions not estimated | Scheme delivery Transport monitoring (e.g. cycle counts) | Access to Headington largely completed<br>Major improvement works have been completed in late 2020 on the traffic-free walking and cycling path at Kennington + at Oxford unction on George Street<br>Major works on Botley Road are underway and due for completion in autumn 2021 | Further improvements expected to be rolled out within the next few months/years, following the recommendations of the recently published Oxford Local Cycling & Walking Infrastructure Plan and using part of the 2.98 million of the emergency active travel fund that was won by Oxfordshire County in late 2020 |
| 26 | Roll-out of Controlled Parking Zones (CPZ) and Low Traffic Neighbourhoods (LTN) | Traffic Management | Traffic reduction | 2021 | 2021 | Oxfordshire County Council | Department for Transport (Emergency Active Travel Fund); LAs own budget | NO | Fully Funded | £340k approx. for controlled parking zones<br>£311,000 for LTNs | Implementation and Planning | NOx and PM reductions not estimated | Implementation of the new CPZs and LTNs | Oxfordshire County Council won, in November 2020 £2.98 million to transform active travel in the County, with part of that funding being allocated for the development of LTN's in Oxford | 3 LTNs are being tested in Cowley area since March 2021, using an Experimental Traffic Regulation Order (ETRO) |
| 27 | Work with businesses to explore the inclusion of innovative sustainable travel modes into their current business models | Freight and Delivery Management | Delivery and Service plans/<br>Freight Partnerships for city centre deliveries | 2021 | Annually 2021-2025 | Oxfordshire County Council<br>+ Oxford City Council | DEFRA AQ Grant; LAs own budget | YES | Partially funded | Not estimated | Planning | NOx and PM reductions not estimated | Number of businesses adopting sustainable travel modes | Exploring opportunities (On-going)<br>Considering submitting a bid together with Oxfordshire County council via the next round of the e-cargo bike fund | Eventual COVID-19 impacts still impacting business throughout 2021, which may limit investment |
| 28 | Explore opportunities for implementation of consolidation centre to address city centre freight emissions | Freight and Delivery Management | Freight Consolidation Centre | 2021 | 2025 | Oxfordshire County Council + Oxford City Council | LAs annual budget, and other sources of funding | NO | Not funded yet | Not estimated | Planning | NOx reduction not estimated | Number of businesses enrolled | Exploring opportunities<br>(On-going) | Finding an adequate space within the city's outskirts that could be viable for this, lack of funding |
| 29 | Work with schools to reduce exposure to air pollution by reducing the need to travel during drop off/pick up times (ex: School Streets) | Alternatives to private vehicle use/<br>Promoting Travel Alternatives | Other | 2021 | 2025 | Oxfordshire County Council | Active Travel fund for LAs in England | NO | Partially funded | £60,000 approx. for School Streets | Implementation and Planning | NOx reduction not estimated | Number of streets closed, schools enrolled | An experimental order to prohibit access for motor vehicles at school drop-off and/or pick-up times was issued on the 22th March 2021 and will continue to run until a decision is made on whether it becomes permanent | 8 schools in Oxford are involved in this pilot. Exempt motorists include emergency services, residents and visitors, blue badge holders, emergency vehicles, school buses/transports, deliveries. |
| 30 | Support Bikeability (free cycling lessons provided to pupils) | Promoting Travelling alternatives | Promotion of Cycling | 2021 | 2021-2025 | Oxfordshire County Council | DfT via The Bikeability Trust charity | NO | Not funded yet | Not estimated | Planning | NOx reduction not estimated | Number of schools enrolled | Not started | On 9th April 2021, Transport Secretary has announced £18m for cycle training across the country to ensure children and their families have the confidence to choose active travel |

## $PM_{2.5}$ – 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 2.5µm 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.

In Oxford, and according to the city's latest source apportionment study, domestic combustion is the biggest contributor to the local fraction of $PM_{2.5}$ levels (66%), followed by transport (21%), with remaining contributors spread between production processes (4%) and 9% Others (nature, waste, solvents, agriculture).

Oxford also currently has 23 active smoke control areas (SCAs). In a smoke control area you can generally only burn fuel on the list of authorised fuels, unless you're using an exempt appliance. For detailed information about all SCAs in Oxford, including an interactive map showing the areas of the city currently covered by SCA legislation, and information on good practice and advice, please visit the Council's air quality page here.

The Public Health Outcomes is a framework developed by Public Health England to set out a vision for public health. The framework develops a list of indicators that provide useful insight on how well public health is being improved and protected and concentrates on two high-level outcomes (healthy life expectancy and differences in life expectancy and healthy life expectancy between communities) to be achieved across the public health system.

According to the latest version of this framework (i.e. 2019), 5.52% of deaths from all causes in those aged 30+ are attributable to $PM_{2.5}$ alone in Oxford.

Figures 1 and 2 below show the existing relationship between the level of mortality attributed to $PM_{2.5}$ and life expectancy at birth for males and females in Oxford. A comparison is also made in Figures 1 and 2, between Oxford's data and the data obtained for other District Councils in Oxfordshire and for England.

Oxford's performance is, in general, the worst when compared with the other DCs for these type of indicators, which is not a surprise, given the levels of traffic and air pollution that can be found in a city when compared with what is found in other parts of the

Oxfordshire, where rural areas tend to prevail and where population and urban density levels are often less pronounced.

**Figure 1 - Relationship between Mortality attributable to $PM_{2.5}$ and Male's life expectancy at birth.**

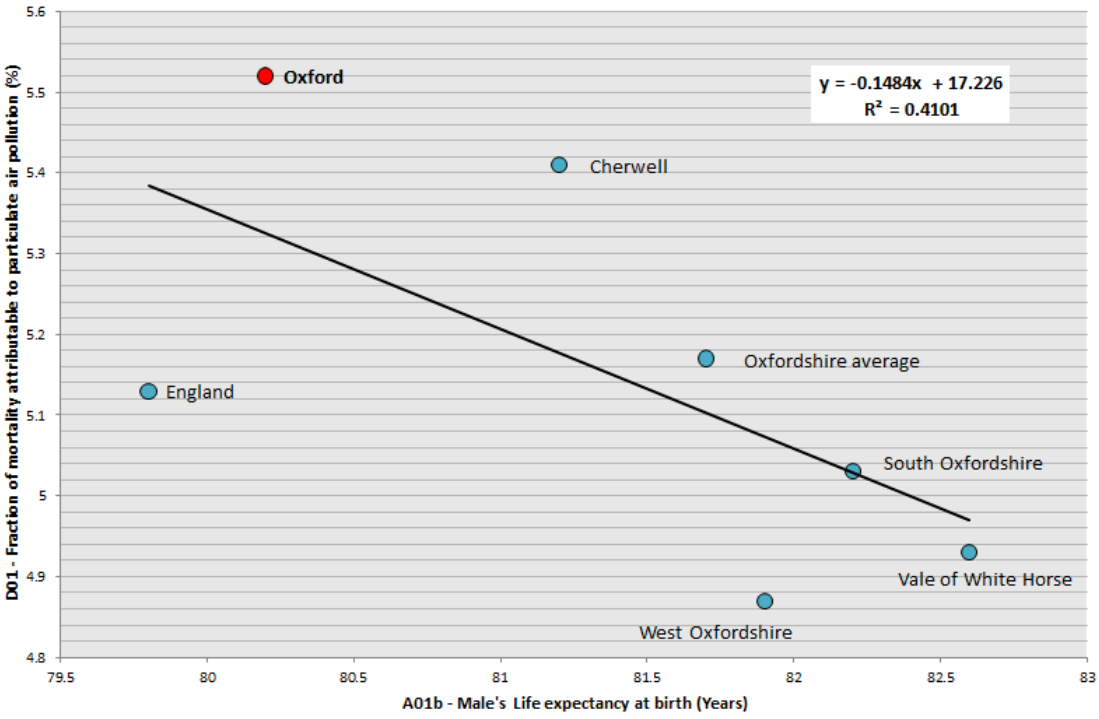
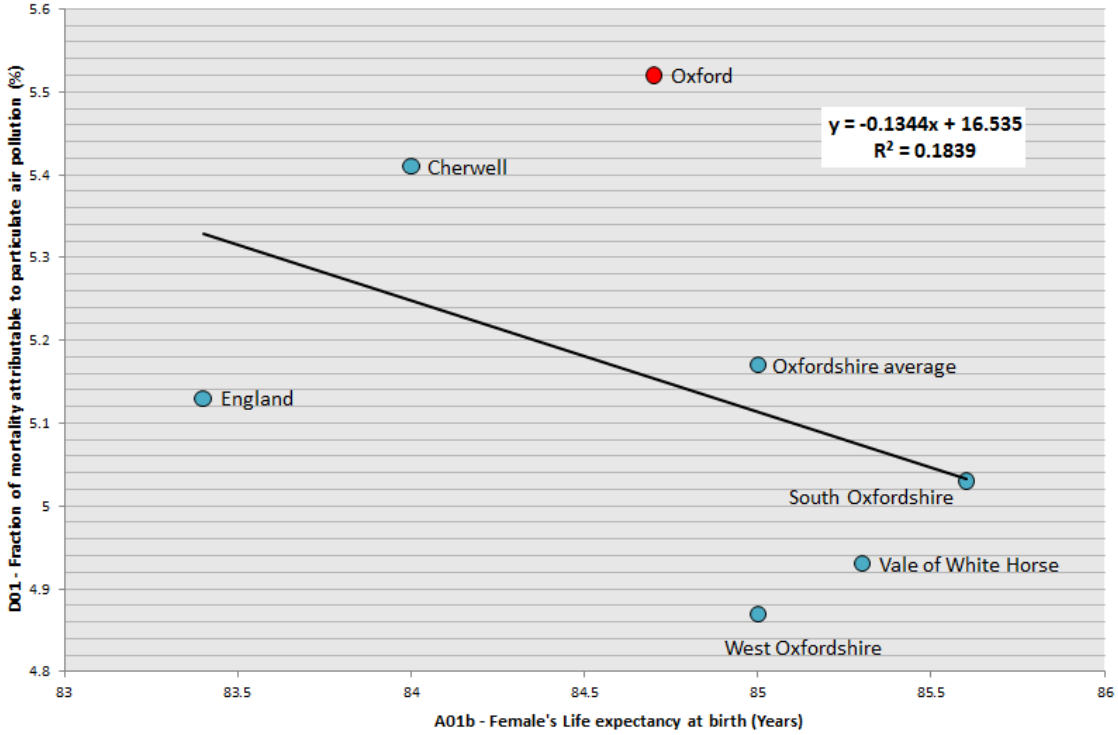



**Figure 2 - Relationship between Mortality attributable to $PM_{2.5}$ and Female's life expectancy at birth.**



Oxford City Council measures $PM_{2.5}$ at AURN St Ebbes' urban background site. In 2020 the annual mean concentration was 7 $\mu gm^{-3}$. Oxford City Council considers that many of the measures designed to reduce levels of nitrogen dioxide set out in the city's recent AQAP will also contribute to reducing levels of $PM_{2.5}$. Table 3 below shows the current list of actions set out in the action plan which we believe to also contribute positively for the reductions of $PM_{2.5}$ levels in the city.

**Table 3 - List of measures included in Oxford City Council's new Air Quality Action Plan (2021-2025) that (in)directly target $PM_{2.5}$ emissions.**

| Measure | Reduces $PM_{2.5}$ emissions |
|---|---|
| Introducing a Euro VI LEZ for buses in Oxford | ✓ |
| Introducing Ultra Low emission standards for Hackney Carriage Vehicles | ✓ |
| Delivery of city-wide campaign on how to implement DEFRA's best practice on the use of open fires and wood burning stoves, and on how to reduce burning of inappropriate fuel | ✓ |
| Increase the amount of EV charging infrastructure in the City | ✓ |
| Expansion of City Council's EV Fleet (Electrification of 25% of vehicle fleet) | ✓ |
| Development of an EV Strategy for Oxfordshire and adoption of strategy by all DCs | ✓ |
| Work with bus operators on the electrification of Oxford's Bus fleet | ✓ |
| Delivery of Oxford's Energy Super Hub (installation of more than 20 ultra-rapid + 30 fast vehicle EV chargers for the public use + provision of ground source heat pumps for more than 300 homes) | ✓ |
| Delivery of Air Quality Benefits through Planning System (Reduce amount of car parking in the city + Increase EV charging infrastructure + require more efficient/less pollutant domestic heating technologies) | ✓ |
| Upgrade Energy Efficiency of City Council's Housing stock and provision of energy advice services to city council's tenants, whilst identifying energy saving improvements to the properties | ✓ |
| Review of Smoke Controlled Zones and implementation of revised government legislation for smoke nuisance | ✓ |
| Encourage the development of local heat networks | ✓ |

| | |
|---|---|
| Delivery of sustainable transport measures such as cycling improvements and bus priority lanes | ☑ |
| Roll-out of Controlled Parking Zones (CPZ) and Low Traffic Neighbourhoods (LTN) | ☑ |
| Work with businesses to explore the inclusion of innovative sustainable travel modes into their current business models | ☑ |
| Explore opportunities for implementation of consolidation centre to address city centre freight emissions | ☑ |
| Work with schools to reduce exposure to air pollution by reducing the need to travel during drop off/ pick up times (ex: School Streets) | ☑ |
| Support Bikeability (free cycling lessons provided to pupils) | ☑ |

In addition to the list of measures above, we are working in partnership with Oxfordshire County Council on the delivery of two major transport management projects which are expected to produce the biggest impact on the reduction of air pollution levels in the city:

a) A Zero Emission Zone (ZEZ) in Oxford, to be rolled out in phases over 15 years, starting in August 2021. The overall aim of this *'journey to zero'* is to largely eliminate transport *'tailpipe'* emissions in Oxford city centre by 2035

b) Connecting Oxford, a set of proposals that will deliver a number of traffic restrictions in Oxford, such as the introduction of a Workplace Parking Levy (WPL), which is an annual charge paid by employers for each parking space they provide, on or off-site, that is used for employee (commuter) car parking, or the introduction of bus gates to reduce the number of private cars moving around the city and allowing bus priority.

Connecting Oxford aims to (amongst other things) reduce motorised traffic levels; the ZEZ aims to minimise emissions from the traffic that remains, and therefore both are expected to hugely contribute to the reduction of $PM_{2.5}$ emissions.

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

This section sets out the monitoring undertaken within 2020 by Oxford City Council and how it compares with the relevant air quality objectives. In addition, monitoring results are presented for a five-year period between 2016 and 2020 to allow monitoring trends to be identified and discussed.

Oxford City Council undertook automatic (continuous) monitoring of Nitrogen Oxides ($NO_X$) at three sites, Particulate Matter ($PM_{10}$ and $PM_{2.5}$) at two sites and Ozone ($O_3$) at one site in 2020. Non-automatic (passive) monitoring of Nitrogen Dioxide ($NO_2$) was carried out at seventy one locations in 2020.

Oxford City Council is pleased to inform that none of the two main impacts arising from the LAQM COVID 19 survey (and which are referenced in the supplementary guidance provided by Defra for Local Air Quality Management Reporting in 2021 due to COVID-19) have occurred in 2020. In Oxford, the COVID 19 pandemic didn't cause any impact on the collection of monitoring data neither in the conduction of general LAQM duties throughout 2020, mainly due to adequate level of planning, flexibility, and commitment demonstrated by the small team of Environmental Sustainability Officers who were responsible for operating the Council's Air Quality Network.

Maps showing the location of the air quality monitoring (continuous and passive) conducted in 2020 can be found in Appendix D. Maps covering current and historic locations of air quality monitoring locations are also provided in 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 factors used for the diffusion tubes are included in Appendix C.

## Summary of Monitoring Undertaken

### 3.1.1 Automatic Monitoring Sites

Oxford City Council undertook automatic (continuous) monitoring at three sites during 2020. Table A.1 in Appendix A shows the details of the sites. National monitoring results

and annual statistics of those sites are available at https://uk-air.defra.gov.uk/ and http://www.airqualityengland.co.uk/.

### 3.1.2 Non-Automatic Monitoring Sites

Oxford City Council undertook non-automatic (passive) monitoring of NO2 at 71 sites in 2020. Table A.2 in Appendix A shows the details of those sites.

For the purposes of deciding which locations to monitor, 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. Monitoring is carried out in line with DEFRA's Technical Guidance LAQM.TG (16)

Approximately half of the monitoring locations are within central Oxford at locations where the City Council believes 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.

## Individual Pollutants

The air quality monitoring results presented in this section are, where relevant, adjusted for bias, annualisation (where the annual mean data capture is below 75% and greater than 25%), and distance correction. Further details on adjustments are provided in Appendix C. Details of the UK air quality objectives for protection of human health, as well as of WHO's recommended limit values for comparison with the 2020 monitoring results can be found in Appendix E.

### 3.1.3 Nitrogen Dioxide ($NO_2$)

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

a) 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 $NO_2$.

b) $NO_2$ 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.

$NO_2$ data has been monitored in 2020 at three locations in Oxford by the use of automatic continuous monitors and at 71 locations using passive monitoring (diffusion tubes).

The annual mean AQS objective for $NO_2$ is 40 $\mu gm^{-3}$. In 2020, Oxford High Street annual mean for $NO_2$ was 26 $\mu gm^{-3}$ and AURN Oxford Centre Roadside 28 $\mu gm^{-3}$. At AURN St. Ebbes, the $NO_2$ annual mean was 11 $\mu gm^{-3}$. This objective was therefore largely met at all the automatic monitoring stations in 2020.

Table A.3 in Appendix A compares the ratified and adjusted automatic monitored $NO_2$ annual mean concentrations for the past five years with the air quality objective of 40µg/$m^3$. Note that the concentration data presented represents the concentration at the location of the monitoring site, following the application of bias adjustment and annualisation, as required (i.e. the values are exclusive of any consideration of fall-off with distance adjustment).

Figure 3 (below) shows the 16 year long term trend for levels of measured $NO_2$ at Oxford's three automatic monitoring stations. The results are expressed in $\mu gm^{-3}$.

**Figure 3 - Long term trends of Annual Mean $NO_2$ ($\mu gm^{-3}$) at Oxford's continuous monitoring stations, 2004-2020.**

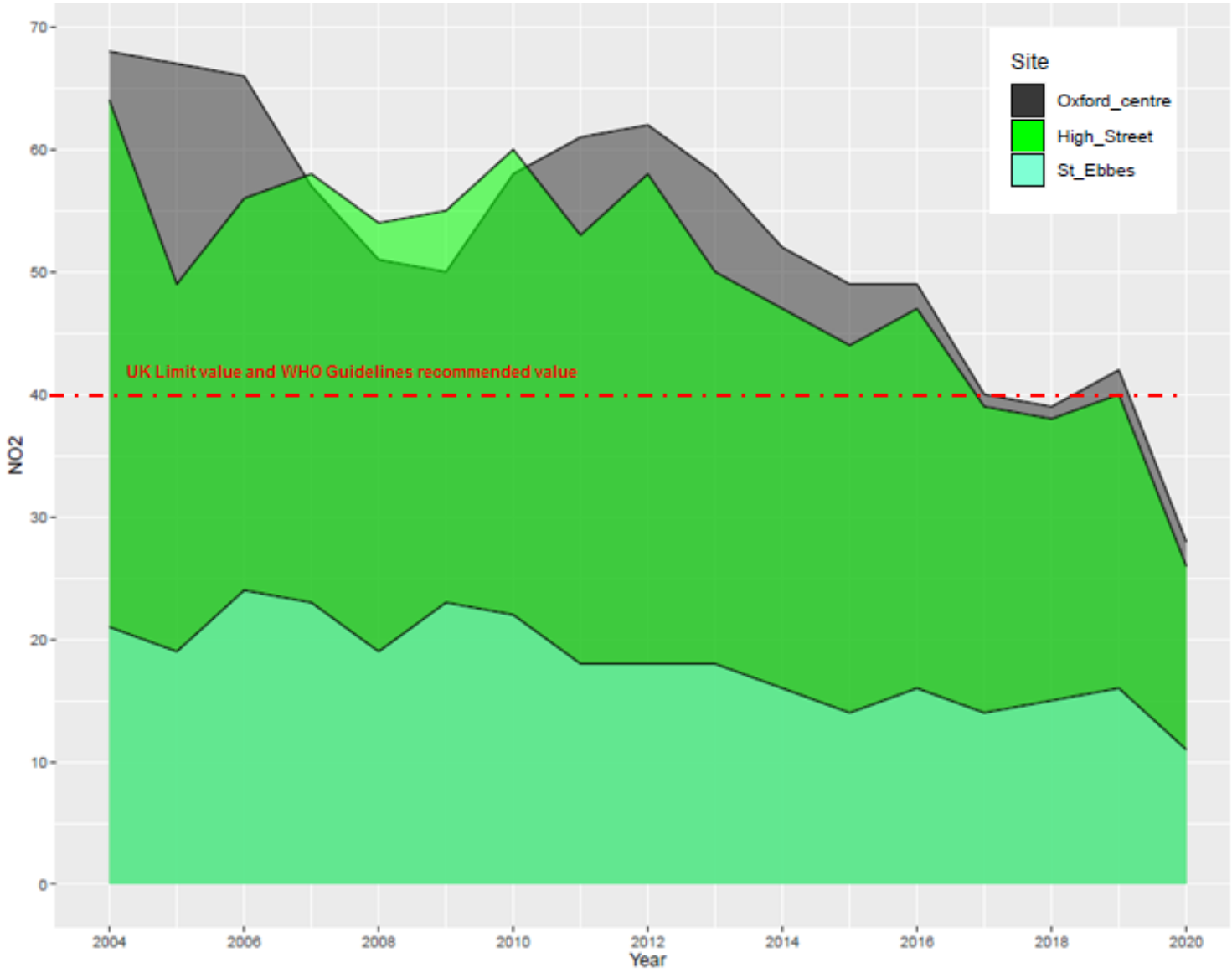


Figure 3 shows that the $NO_2$ levels measured in Oxford at the locations of our automatic monitoring sites have decreased significantly in 2020.

Whilst in previous years we saw the $NO_2$ levels at our automatic monitoring stations plateauing slightly above the current annual mean limit value of 40 $ugm^{-3}$, in 2020 we have seen a considerable reduction (33% on average) of $NO_2$ concentrations at these stations, to values way below the current annual mean objective, and even slightly below the Oxford's new local $NO_2$ annual mean target of 30$ugm^{-3}$ (a commitment laid out in the city's recently approved AQAP).

Although the reasons behind these reductions are quite well known (the successive lockdown restrictions of movements motivated by the COVID19 pandemic which had a direct effect on the reduction of traffic levels), they provide us with a sense of hope, as they show that it is possible to achieve reductions of this magnitude in the city centre and reach compliance with our new AQAP $NO_2$ local target, as long as the City and County council's major plans for the reduction of polluting traffic in the city (ZEZ and Connecting Oxford) become a reality.

For detailed information on time variations and daily means of $NO_2$ at Oxford's three automatic monitoring stations please refer to Appendix G.

The AQS objective for hourly mean $NO_2$ concentration is 200 $\mu gm^{-3}$, and may be exceeded up to 18 times per calendar year. The time series of hourly averaged concentrations of $NO_2$ for the 3 automatic monitoring sites is compared against the hourly mean objective (dashed red line) in Figure 4 below. The results are expressed in $\mu gm^{-3}$.

Table A.5 in Appendix A compares the ratified continuous monitored $NO_2$ hourly mean concentrations for the past five years with the air quality objective of 200$\mu g/m^3$, not to be exceeded more than 18 times per year.

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**Figure 4 - Time series of hourly averaged concentrations of $NO_2$ ($\mu gm^{-3}$) at automatic monitoring sites, 2020.**

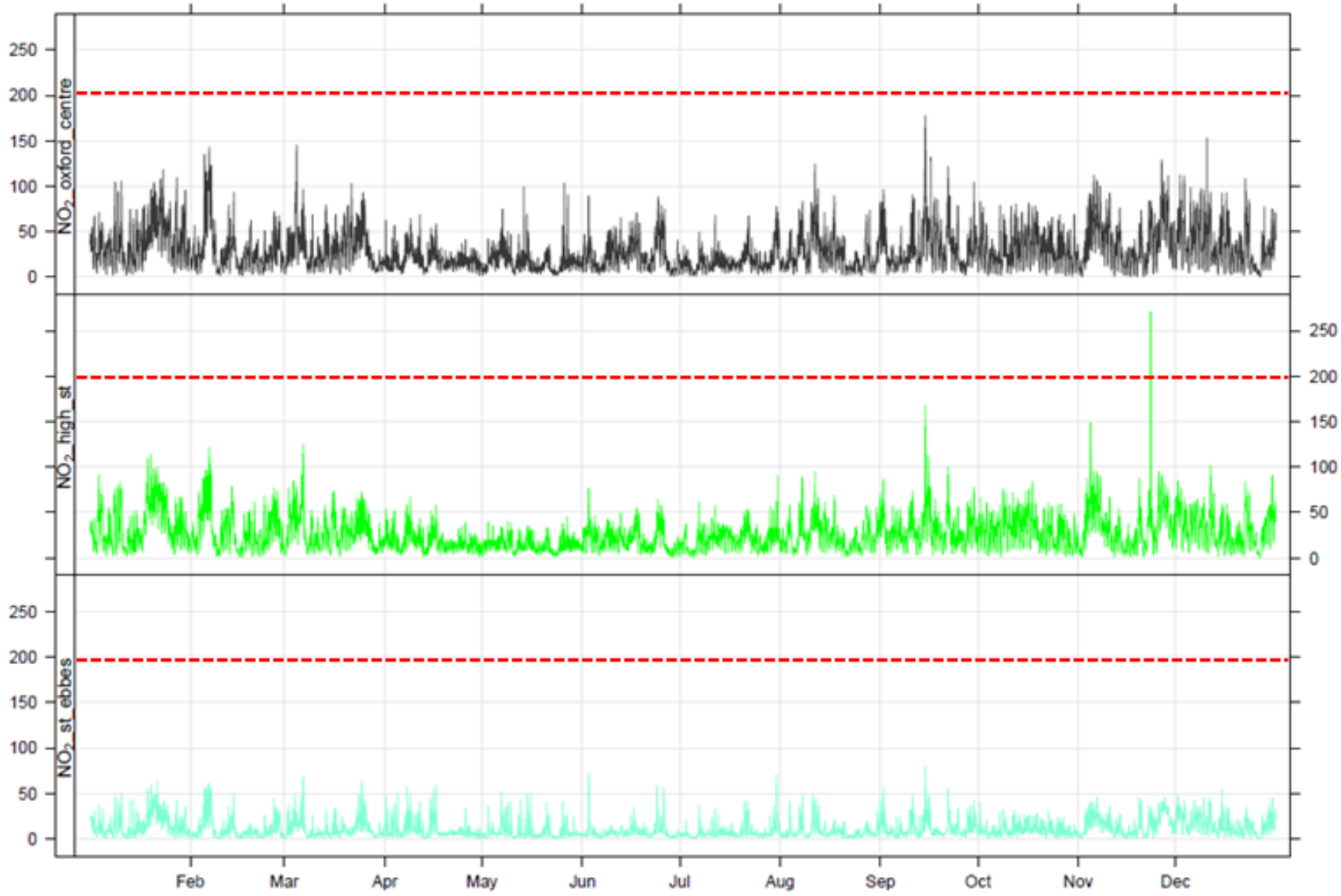


Figure 4 shows that in 2020 there was only one hourly mean $NO_2$ measurement exceeding 200 $\mu gm^{-3}$. The highest hourly mean $NO_2$ measured was of 271 $\mu gm^{-3}$ and was registered on the 23rd November 09:00 at Oxford High Street.

The threshold of the *"Moderate"* air quality band as set out by DEFRA for the $NO_2$ hourly mean ranges from 201 to 400 $\mu gm^{-3}$. $NO_2$ levels at all 3 sites were always recorded within the DEFRA *"Low"* band in 2020, with the exception of the one exceedance mentioned above. As none of the automatic monitoring sites have registered more than 18 exceedances of the AQS hourly objective for $NO_2$, this objective was therefore met in all automatic monitoring sites in 2020.

Non-automatic monitoring using diffusion tubes took place at 71 locations in 2020. Approximately half of this number was exposed within central Oxford, rotated between the locations where we believe relevant exposure is most likely. The remaining tubes were used outside of the central area, again prioritised by locations where relevant exposure is most likely. All the 2020 diffusion tube monitoring locations are within the existing AQMA. The main observations of the monitoring carried out in 2020 using non-automatic monitoring are as follow:

- 71 locations in the City of Oxford were part of the 2020 air quality diffusion tube monitoring campaign. Of those, 4 locations correspond to new monitoring sites (New Inn St, St Michaels St, Market St, Blackbird Leys), and the remaining 67 sites were sites where air quality had been monitored in the previous year;
- The diffusion tube results show that the annual mean AQS objective of 40 $\mu gm^{-3}$ for $NO_2$ specified by DEFRA was for the first time not exceeded at any of the 71 monitoring locations where $NO_2$ levels were measured in 2020;
- For the fourth consecutive year, none of the City's $NO_2$ diffusion tube monitoring sites presented an annual mean $NO_2$ equal or above 60 $ugm^{-3}$. According to LAQM (TG16), this is an indication that exceedances of the hourly mean objective for $NO_2$ are not likely to have occurred in the city in 2020;
- In 2020, $NO_2$ levels have reduced on average by 29% at all the 71 diffusion tube monitoring sites, due to the effects of the COVID19 pandemic. The biggest reductions were seen at DT48 and DT47, both located at George St (45% and 40% reduction). The lowest reductions were seen at DT81 (Cowley Road/Union St) and DT28 (51 Sunderland Avenue), with 14% and 15% reduction respectively.

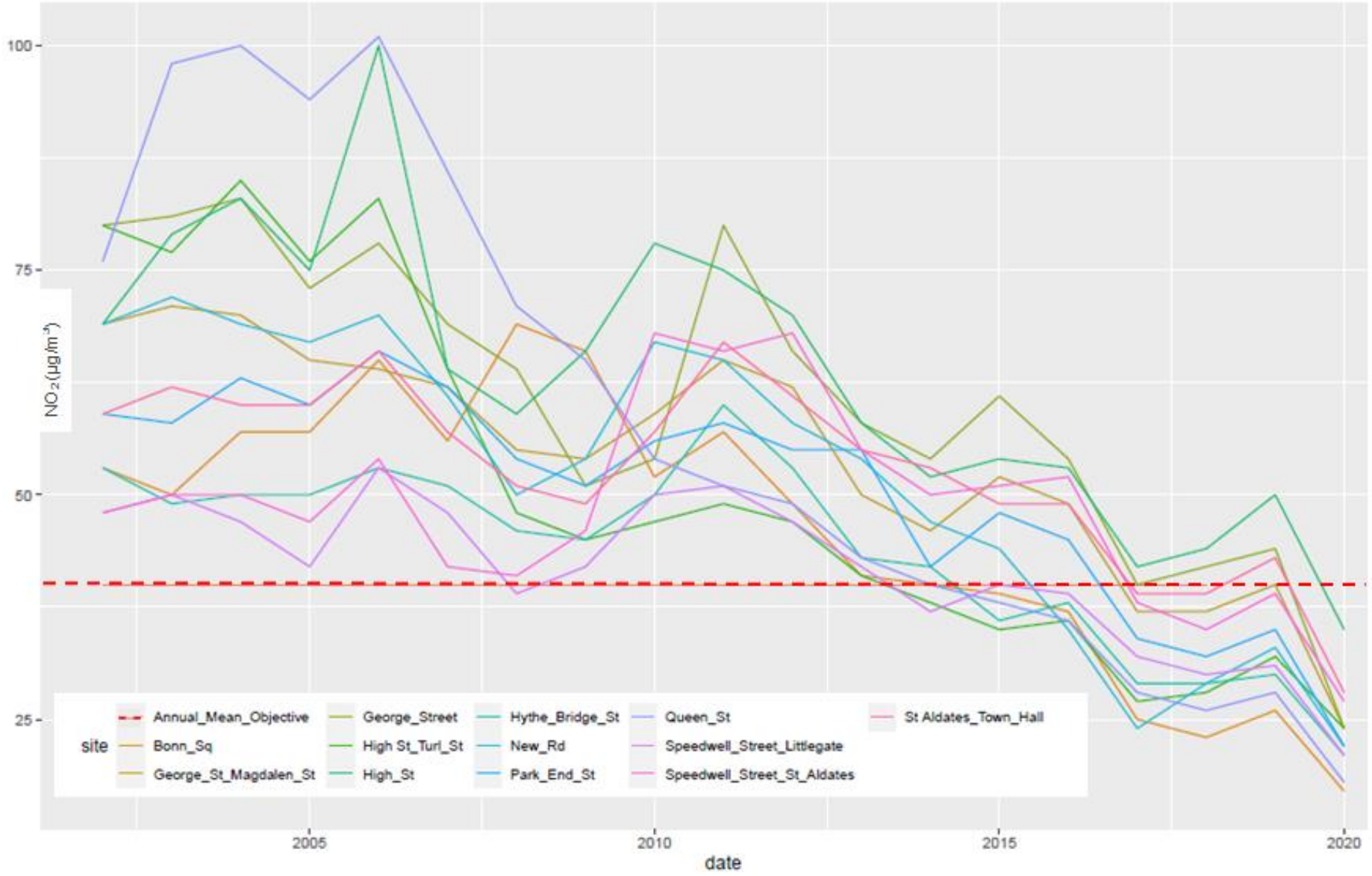
- In 2020, the third full year of monitoring was completed since the opening of the Westgate Shopping Centre. Air quality was monitored at a total of 12 locations around the Westgate Centre. None of the previous historic monitoring at these locations has ever shown any exceedances of the annual mean $NO_2$. In 2020, all these sites showed decreases of $NO_2$ levels measured between 5-12 $ugm^{-3}$. Overall, the results of the monitoring around the Westgate indicate an average $NO_2$ annual mean reduction of 30% in 2020, which is a positive change in $NO_2$ levels when compared with the previous year;
- All the 2019 city centre air quality hotspots identified in the previous ASR (George Street, St Clements (2x), High Street, Long wall St and St Aldates) are now in compliance with the annual mean objective for $NO_2$;
- The monitoring location with the highest annual mean for $NO_2$ in 2020 was DT55 - St. Clements Street/The Plain - with a value of 36 $\mu gm^{-3}$. This represents a decrease of 32% of the $NO_2$ levels at this location, when compared with data from the previous year (53 $\mu gm^{-3}$).

The full 2020 dataset of diffusion tube monthly mean values is provided in Appendix B. (Table B.1). Figure 5 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 $\mu gm^{-3}$.

It is quite clear that there has been a significant downward trend in measured levels of $NO_2$ at most of these locations since historic monitoring began in 2003. In 2020, we can all see the positive effect that the successive lockdown restrictions had on the city's air quality levels.

Overall, and on average, the annual mean objective for $NO_2$ has reduced by 29% at all the 71 diffusion tube monitoring locations in 2020.

**Figure 5 - Long Term Trends in Annual Mean $NO_2$ ($ugm^{-3}$) at Oxford's diffusion tube monitoring locations, 2003-2020.**



### 3.1.4 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.

In 2020, $PM_{10}$ data was monitored by automatic continuous monitors at Oxford St. Ebbes and Oxford High Street. $PM_{2.5}$ was monitored at Oxford St. Ebbes.

The annual mean AQS objective for $PM_{10}$ is 40 $\mu gm^{-3}$. Table A.6 in Appendix A: Monitoring Results compares the ratified and adjusted monitored $PM_{10}$ annual mean concentrations for the past five years with the air quality objective of 40µg/$m^3$.

In 2020, Oxford High Street registered a $PM_{10}$ annual mean of 16 $\mu gm^{-3}$. Oxford St. Ebbes of 11$\mu gm^{-3}$. This objective was therefore fully met in 2020.

The short term AQS objective for $PM_{10}$ is a maximum of 50 $\mu gm^{-3}$ for any 24h mean period, not to be exceeded more than 35 days a year. Table A.7 in Appendix A compares the ratified continuous monitored $PM_{10}$ daily mean concentrations for the past five years with the air quality objective of 50µg/$m^3$, not to be exceeded more than 35 times per year.

The result of $PM_{10}$ measurements in 2020 show no exceedances of the 50 $\mu gm^{-3}$ 24h mean on High Street and St Ebbes. The AQS objective for 24-hour mean $PM_{10}$ was therefore fully met at Oxford High Street and Oxford St Ebbes in 2020.

No AQS objective exists for $PM_{2.5}$; however a non-mandatory compliance target of 25 $\mu gm^{-3}$ to be met by 2020 exists. The monitored annual mean for this pollutant was 7 $\mu gm^{-3}$ at Oxford St. Ebbes. Table A.8 in Appendix A presents the ratified and adjusted monitored $PM_{2.5}$ annual mean concentrations for the past five years.

Figure 6 below show the 10 year long term trend for levels of measured $PM_{10}$ at continuous monitoring stations in Oxford, along with the current recommended WHO guideline values, which are significantly lower for $PM_{10}$ and $PM_{2.5}$ than the UK limit values. Figure 7 shows the same analysis but for $PM_{2.5}$. All the results are expressed in $\mu gm^{-3}$.

**Figure 6 - Long term trends of Annual Mean $PM_{10}$ ($\mu gm^{-3}$) at Oxford's continuous monitoring stations, 2011-2020.**

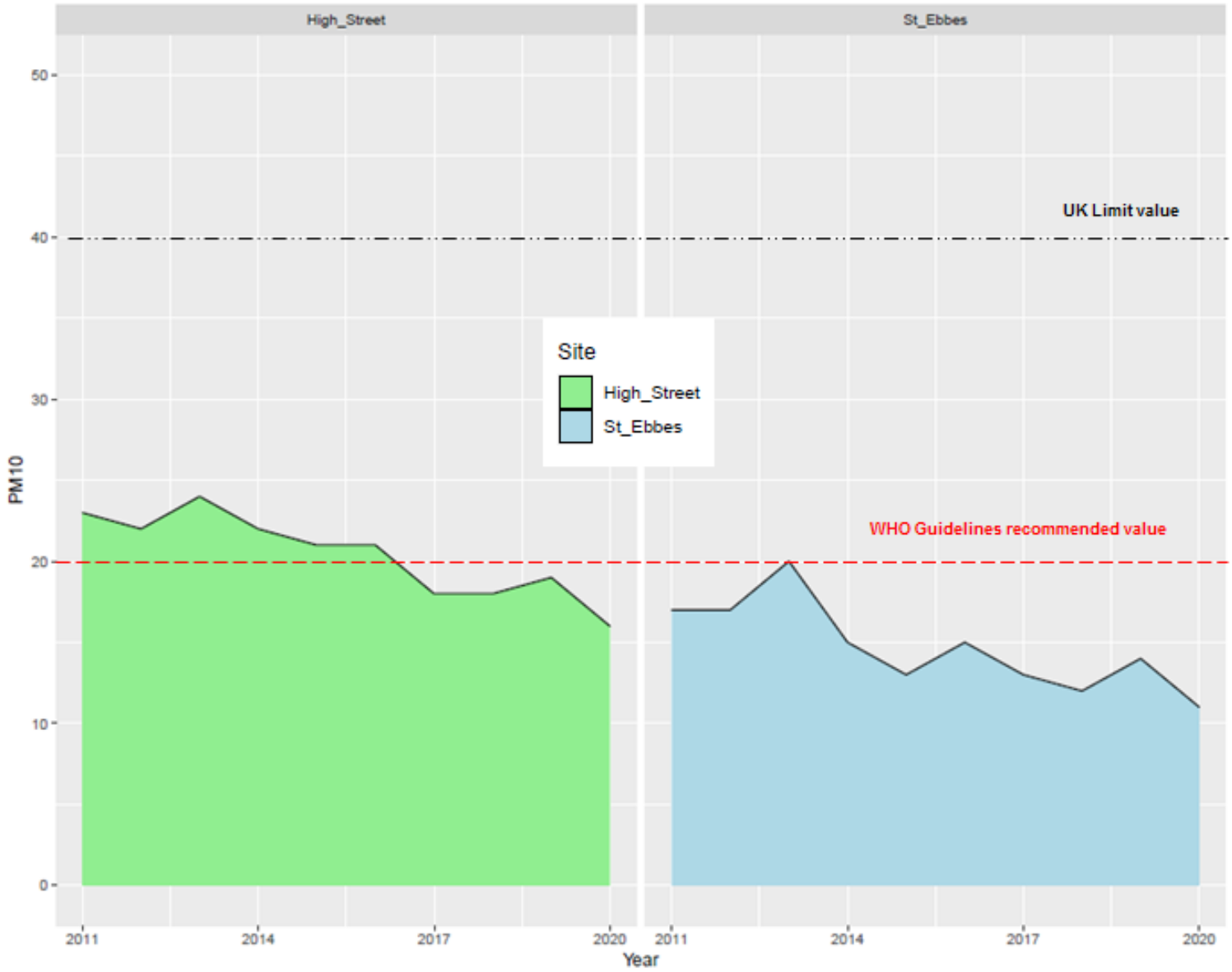


**Figure 7 - Long term trends of Annual Mean $PM_{2.5}$ ($\mu gm^{-3}$) at Oxford's continuous monitoring stations, 2011-2020.**

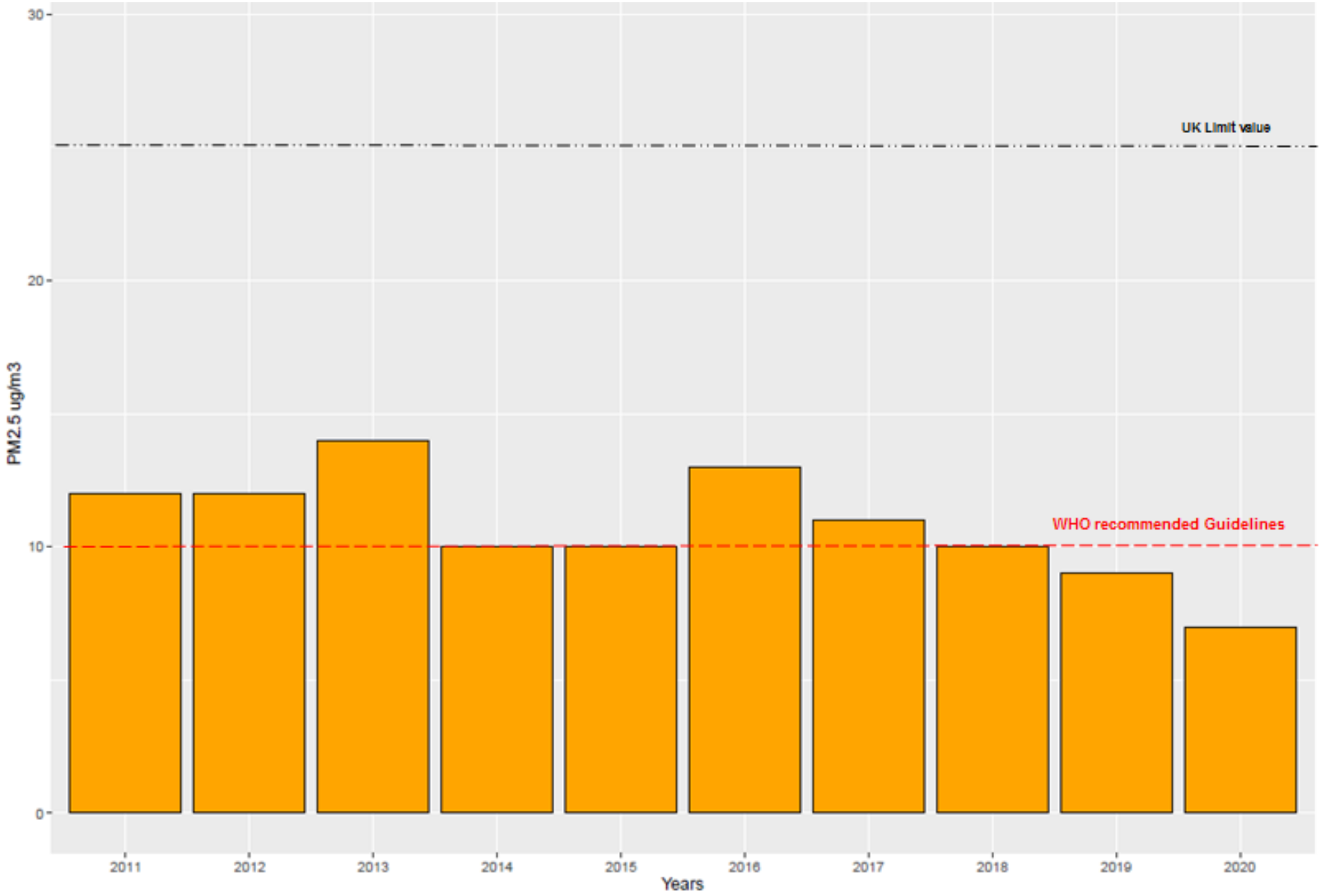


Figure 6 shows that the overall trend of $PM_{10}$ levels that were measured at our 2 automatic monitoring sites has been going downward since 2011. Figure 6 also shows that both automatic monitoring sites are well in compliance with the annual mean UK limit value and the annual mean recommended by the WHO guidelines. The more pronounced step-change in 2013 can be attributed to the Low Emission Zone, which banned high-emission buses (i.e. buses with engines older than Euro V) from the City Centre. Bus companies began converting their vehicles in the run-up to the zone's introduction in 2014. All Euro V and Euro VI bus diesels are fitted with a Diesel Particulate Filter (DPF), which reduce the amount of Particulate Matter that is released from exhaust into the atmosphere by more than 80%. On average, $PM_{10}$ levels have reduced by 19% in the city in 2020.

Figure 7 shows that in 2020 Oxford St Ebbes registered the lowest $PM_{2.5}$ annual mean since $PM_{2.5}$ monitoring began at this site in 2011. The annual mean obtained (7ug/$m^3$) is well in compliance with the annual mean UK limit value and with the annual mean recommended by the WHO guidelines for this pollutant, and corresponds to a reduction of 22% in the levels for this pollutant, when compared with the previous year.

The reductions observed on these pollutants have also occurred due to the impacts of COVID-19, although to a lesser extent than the reductions observed for $NO_2$. This can be explained by two factors:

- $PM_{10}$ and $PM_{2.5}$ have a much higher dependency from non-local emission sources than $NO_2$. The fact that these particulates are very small in size, allows them to stay in the air the longest, facilitating their movement by winds over larger areas. For example, in the UK, it is estimated that 65% of the contribution to the annual mean ambient $PM_{2.5}$ concentrations at Urban Background monitoring sites (such as AURN St Ebbes) are of non-local emission sources (45% - regional, and 20% - International ), with only 35% being directly attributed to the local Urban environment[10]. Although the consequences of the pandemic occurred nationally and globally, it is important to take into account that the severity of those impacts might have been different for each country, affecting the different sectors of activity in a different way. Some areas of the globe could have been less impacted, and hence could have contributed with their PM emissions from the most various sources and activities (via long range transport) to the levels measured in Oxford.

**10** DEFRA: Public Health – Sources and Effects of $PM_{2.5}$

- The transport sector (contrary to what happens with $NO_2$) is not the main source of local emissions for these pollutants. According to the city's latest source apportionment study, domestic combustion is the biggest contributor to local emissions of $PM_{10}$ and $PM_{2.5}$. This is important to emphasize, as during the lockdown, transport was the most impacted of these two sectors, given the need to impose restriction of movements and restrict all unnecessary travelling. During lockdown, people have remained in their homes, and continued to use their heating systems, hence generating PM emissions via this emission source.

### 3.1.5 Ozone

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 $NO_2$ 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*".

It is important to remember that ozone is an area wide pollutant, and whilst monitoring sites are relatively sparse compared to those monitoring $NO_2$, they represent the wider population exposure, so a single site may represent the ozone concentrations that hundreds of thousands of people have been exposed to.

In Oxford, $O_3$ is measured at AURN St. Ebbes. The AQS objective for daily maximum on an 8 hour running mean is 100 $\mu gm^{-3}$ not to be exceeded more than 10 days a year.

Oxford St. Ebbes data capture of $O_3$ was of 99.8 % in 2020. In 2020, this site exceeded the AQS daily objective for ozone 152 times, during a total of 26 days during the year. This represents a significant increase in the number of exceedances (+112) and days (+16), when compared with the results from 2019.

AURN St. Ebbes has not met the AQS objectives for this pollutant in 2020.

Whilst some of the exceedances correspond to typical ozone episodes that are normally already expected to occur during the summer months - according to the Imperial College

(London)[11], there were several registered moderate to high ozone episodes in June, August and September 2020 - the truth is that the overall increase in ozone levels in 2020 is more directly related with the significant reductions of traffic in urban areas (one of the main consequences of the successive lockdown restrictions). Less traffic equals less production of NO, which in turn means less consumption of $O_3$ by NO.

**11** London Air – King's college Air Quality website: LAQN Pollution episodes

# Appendix A: Monitoring Results

### Table A.1 – Details of Automatic Monitoring Sites

| Site ID | Site Name | Site Type | X OS Grid Ref (Easting) | Y OS Grid Ref (Northing) | Pollutants Monitored | In AQMA? Which AQMA? | Monitoring Technique | Distance to Relevant Exposure (m) (1) | Distance to kerb of nearest road (m) (2) | Inlet Height (m) |
|---|---|---|---|---|---|---|---|---|---|---|
| CM1 | AURN Oxford Centre | Roadside | 451359 | 206157 | NO2 | YES/Oxford city-wide AQMA | Chemiluminescence | 1 | 3 | 2.5 |
| CM2 | Oxford High Street | Roadside | 451677 | 206272 | NO2;PM10 | YES/Oxford city-wide AQMA | Chemiluminescence<br>Gravimetric analysis | 1 | 2 | 1.5 |
| CM3 | AURN St Ebbes | Urban Background | 451118 | 205353 | NO2;PM10; PM2.5;O3 | YES/Oxford city-wide AQMA | Chemiluminescence<br>Mass spectrometry<br>UV Absorption | 10 | 2 | 2.5 |

**Notes:**

(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

| Diffusion Tube ID | Site Name | Site Type | X OS Grid Ref (Easting) | Y OS Grid Ref (Northing) | Pollutants Monitored | In AQMA? Which AQMA? | Distance to Relevant Exposure (m) (1) | Distance to kerb of nearest road (m) (2) | Tube Co-located with a Continuous Analyser? | Tube Height (m) |
|---|---|---|---|---|---|---|---|---|---|---|
| DT1 | St Ebbe's | UB | 451118 | 205353 | NO2 | YES/Oxford city-wide AQMA | 10 | 2 | YES | 2.5 |
| DT2 | Weirs Lne./Abingdon Rd. LP1 | RS | 451904 | 204215 | NO2 | YES/Oxford city-wide AQMA | 2 | 2 | NO | 3 |
| DT3 | LP 52 Abingdon Rd. | RS | 451914 | 204154 | NO2 | YES/Oxford city-wide AQMA | 3 | 2 | NO | 3 |
| DT4 | Boundary Brook Rd/ Iffley Rd | RS | 452961 | 204662 | NO2 | YES/Oxford city-wide AQMA | 3 | 2 | NO | 3 |
| DT5 | Lenthall Rd Allotments | UB | 452818 | 203448 | NO2 | YES/Oxford city-wide AQMA | 5 | N/A | NO | 1.5 |
| DT7 | Oxford Rd/ Between Towns Rd | RS | 454472 | 204246 | NO2 | YES/Oxford city-wide AQMA | 3 | 2 | NO | 3 |
| DT8 | Oxford Rd(Cowley) LP13 | RS | 454355 | 204296 | NO2 | YES/Oxford city-wide AQMA | 3 | 1 | NO | 3 |
| DT14 | Windmill Rd. W | RS | 454554 | 207102 | NO2 | YES/Oxford city-wide AQMA | 0 | 2.5 | NO | 3 |
| DT15 | London Rd./BHF | RS | 454433 | 207058 | NO2 | YES/Oxford city-wide AQMA | 0 | 2.5 | NO | 3 |

| Diffusion Tube ID | Site Name | Site Type | X OS Grid Ref (Easting) | Y OS Grid Ref (Northing) | Pollutants Monitored | In AQMA? Which AQMA? | Distance to Relevant Exposure (m) (1) | Distance to kerb of nearest road (m) (2) | Tube Co-located with a Continuous Analyser? | Tube Height (m) |
|---|---|---|---|---|---|---|---|---|---|---|
| DT16 | Headley Way/London Rd. LP2 | RS | 453982 | 206817 | NO2 | YES/Oxford city-wide AQMA | 1 | 2 | NO | 3 |
| DT18 | The Roundway | RS | 455596 | 207367 | NO2 | YES/Oxford city-wide AQMA | 0 | 5 | NO | 3 |
| DT20 | Barton Lane LP2 | RS | 454999 | 207759 | NO2 | YES/Oxford city-wide AQMA | 3 | 1 | NO | 3 |
| DT25 | Cuttleslowe Rbout 3 Elsfield Rd. | RS | 450419 | 210256 | NO2 | YES/Oxford city-wide AQMA | 5 | 2 | NO | 3 |
| DT26 | Cuttleslowe Rbout 3 Summers Place | RS | 450389 | 210189 | NO2 | YES/Oxford city-wide AQMA | 1 | 2 | NO | 3 |
| DT27 | Wolvercote Rbout 78 Sunderland Ave. | RS | 449824 | 210198 | NO2 | YES/Oxford city-wide AQMA | 1 | 1 | NO | 3 |
| DT28 | Wolvercote Rbout 51 Sunderland Ave | RS | 449856 | 210162 | NO2 | YES/Oxford city-wide AQMA | 1 | 1 | NO | 3 |
| DT29 | Pear Tree P&R N Gateway | RS | 449530 | 210734 | NO2 | YES/Oxford city-wide AQMA | 10 | 4 | NO | 3 |
| DT30 | Osney Lne/Hollybush Row | RS | 450668 | 206053 | NO2 | YES/Oxford city-wide AQMA | 2 | 2 | NO | 3 |
| DT31 | Beckett St. | RS | 450566 | 206227 | NO2 | YES/Oxford city-wide AQMA | 5 | 2 | NO | 3 |

| Diffusion Tube ID | Site Name | Site Type | X OS Grid Ref (Easting) | Y OS Grid Ref (Northing) | Pollutants Monitored | In AQMA? Which AQMA? | Distance to Relevant Exposure (m) (1) | Distance to kerb of nearest road (m) (2) | Tube Co-located with a Continuous Analyser? | Tube Height (m) |
|---|---|---|---|---|---|---|---|---|---|---|
| DT32 | Royal Oxford Hotel | RS | 450674 | 206273 | NO2 | YES/Oxford city-wide AQMA | 0 | 2.5 | NO | 3 |
| DT33 | Botley RD/ Mill St | RS | 450409 | 206224 | NO2 | YES/Oxford city-wide AQMA | 1 | 1 | NO | 3 |
| DT35 | Botley Rd /Hillview Rd | RS | 450029 | 206207 | NO2 | YES/Oxford city-wide AQMA | 1 | 2 | NO | 3 |
| DT36 | Botley Rd N (Prestwich Place) | RS | 449657 | 206245 | NO2 | YES/Oxford city-wide AQMA | 1 | 2 | NO | 3 |
| DT39 | St Aldate's | RS | 451359 | 206157 | NO2 | YES/Oxford city-wide AQMA | 0 | 2 | YES | 2.5 |
| DT40 | Queen St. | RS | 451270 | 206144 | NO2 | YES/Oxford city-wide AQMA | 0 | 2 | NO | 3 |
| DT41 | Bonn Square | RS | 451216 | 206133 | NO2 | YES/Oxford city-wide AQMA | 0 | 2 | NO | 3 |
| DT42 | New Rd. | RS | 451073 | 206191 | NO2 | YES/Oxford city-wide AQMA | 2 | 3.5 | NO | 3 |
| DT43 | Park End St. | RS | 450885 | 206275 | NO2 | YES/Oxford city-wide AQMA | 2 | 1 | NO | 3 |
| DT44 | Hythe Bridge St. | RS | 450795 | 206343 | NO2 | YES/Oxford city-wide AQMA | 0 | 2 | NO | 3 |

| Diffusion Tube ID | Site Name | Site Type | X OS Grid Ref (Easting) | Y OS Grid Ref (Northing) | Pollutants Monitored | In AQMA? Which AQMA? | Distance to Relevant Exposure (m) (1) | Distance to kerb of nearest road (m) (2) | Tube Co-located with a Continuous Analyser? | Tube Height (m) |
|---|---|---|---|---|---|---|---|---|---|---|
| DT45 | Worcester St. | RS | 450942 | 206424 | NO2 | YES/Oxford city-wide AQMA | 2 | 2 | NO | 3 |
| DT46 | Beaumont St. | RS | 451167 | 206519 | NO2 | YES/Oxford city-wide AQMA | 2 | 1 | NO | 3 |
| DT47 | George St. / Magdalen St. | RS | 451222 | 206387 | NO2 | YES/Oxford city-wide AQMA | 2 | 0.5 | NO | 3 |
| DT48 | George St. | RS | 450981 | 206344 | NO2 | YES/Oxford city-wide AQMA | 1 | 0.5 | NO | 3 |
| DT49 | Cornmarket St. | RS | 451322 | 206242 | NO2 | YES/Oxford city-wide AQMA | 0 | 2 | NO | 3 |
| DT50 | High St. / Turl St. | RS | 451467 | 206222 | NO2 | YES/Oxford city-wide AQMA | 1 | 2.5 | NO | 3 |
| DT51 | 50 High St. | RS | 451900 | 206250 | NO2 | YES/Oxford city-wide AQMA | 0 | 2.5 | NO | 3 |
| DT52 | Longwall St. | RS | 451972 | 206283 | NO2 | YES/Oxford city-wide AQMA | 1 | 1 | NO | 3 |
| DT53 | Magdalen Bridge | RS | 452099 | 206117 | NO2 | YES/Oxford city-wide AQMA | 10 | 2 | NO | 3 |
| DT54 | York Place | RS | 452325 | 206015 | NO2 | YES/Oxford city-wide AQMA | 2 | 2 | NO | 3 |

| Diffusion Tube ID | Site Name | Site Type | X OS Grid Ref (Easting) | Y OS Grid Ref (Northing) | Pollutants Monitored | In AQMA? Which AQMA? | Distance to Relevant Exposure (m) (1) | Distance to kerb of nearest road (m) (2) | Tube Co-located with a Continuous Analyser? | Tube Height (m) |
|---|---|---|---|---|---|---|---|---|---|---|
| DT55 | St Clements | RS | 452326 | 205992 | NO2 | YES/Oxford city-wide AQMA | 1 | 1 | NO | 3 |
| DT56 | High St. | RS | 451576 | 206232 | NO2 | YES/Oxford city-wide AQMA | 2 | 1 | NO | 3 |
| DT57 | Speedwell St. / St. Aldate's | RS | 451407 | 205807 | NO2 | YES/Oxford city-wide AQMA | 1 | 3 | NO | 3 |
| DT58 | Folly Bridge | RS | 451437 | 205529 | NO2 | YES/Oxford city-wide AQMA | 1 | 1 | NO | 3 |
| DT59 | Thames St. | RS | 451353 | 205643 | NO2 | YES/Oxford city-wide AQMA | 1 | 3 | NO | 3 |
| DT60 | New Butterwyke Place/ Thames St. | RS | 451248 | 205710 | NO2 | YES/Oxford city-wide AQMA | 5 | 2 | NO | 3 |
| DT61 | Friars Wharf | RS | 451219 | 205707 | NO2 | YES/Oxford city-wide AQMA | 3 | 3 | NO | 3 |
| DT63 | Thames St. / Trinity St. | RS | 450926 | 205797 | NO2 | YES/Oxford city-wide AQMA | 2 | 10 | NO | 3 |
| DT64 | Thames St. / Oxpens Rd. | RS | 450887 | 205825 | NO2 | YES/Oxford city-wide AQMA | 5 | 1 | NO | 3 |
| DT65 | Speedwell St. / Littlegate | RS | 451206 | 205780 | NO2 | YES/Oxford city-wide AQMA | 1 | 2 | NO | 3 |

| Diffusion Tube ID | Site Name | Site Type | X OS Grid Ref (Easting) | Y OS Grid Ref (Northing) | Pollutants Monitored | In AQMA? Which AQMA? | Distance to Relevant Exposure (m) (1) | Distance to kerb of nearest road (m) (2) | Tube Co-located with a Continuous Analyser? | Tube Height (m) |
|---|---|---|---|---|---|---|---|---|---|---|
| DT66 | 36 Faulkner St. | UB | 451149 | 205859 | NO2 | YES/Oxford city-wide AQMA | 1 | 20 | NO | 3 |
| DT67 | Old Greyfriars St | RS | 451149 | 205947 | NO2 | YES/Oxford city-wide AQMA | 5 | 5 | NO | 3 |
| DT68 | Norfolk St. | RS | 451030 | 205962 | NO2 | YES/Oxford city-wide AQMA | 0 | 1.5 | NO | 3 |
| DT69 | Paradise Square | RS | 450982 | 205973 | NO2 | YES/Oxford city-wide AQMA | 0 | 1 | NO | 3 |
| DT70 | Castle St. | RS | 451062 | 206067 | NO2 | YES/Oxford city-wide AQMA | 0 | 1.5 | NO | 3 |
| DT71 | BP City Motors | RS | 449617 | 210216 | NO2 | YES/Oxford city-wide AQMA | 5 | 5 | NO | 3 |
| DT72 | Cowley Rd./ James Street | RS | 452761 | 205745 | NO2 | YES/Oxford city-wide AQMA | 1 | 1 | NO | 3 |
| DT73 | Walton Street LP18 | RS | 450960 | 206590 | NO2 | YES/Oxford city-wide AQMA | 1 | 1 | NO | 3 |
| DT76 | St Gilles | RS | 451226 | 206504 | NO2 | YES/Oxford city-wide AQMA | 0 | 2 | NO | 3 |
| DT77 | St Clements 2 | RS | 452451 | 205999 | NO2 | YES/Oxford city-wide AQMA | 0 | 1 | NO | 3 |

| Diffusion Tube ID | Site Name | Site Type | X OS Grid Ref (Easting) | Y OS Grid Ref (Northing) | Pollutants Monitored | In AQMA? Which AQMA? | Distance to Relevant Exposure (m) (1) | Distance to kerb of nearest road (m) (2) | Tube Co-located with a Continuous Analyser? | Tube Height (m) |
|---|---|---|---|---|---|---|---|---|---|---|
| DT78 | William Lucy Way | UB | 450378 | 207135 | NO2 | YES/Oxford city-wide AQMA | 3 | 20 | NO | 2 |
| DT79 | Old Abingdon Rd. | RS | 451908 | 203919 | NO2 | YES/Oxford city-wide AQMA | 5 | 1.5 | NO | 3 |
| DT80 | Hollow way Road | RS | 454651 | 204270 | NO2 | YES/Oxford city-wide AQMA | 4 | 1 | NO | 3 |
| DT81 | Cowley Rd/ Union Street | RS | 452805 | 205731 | NO2 | YES/Oxford city-wide AQMA | 0 | 2 | NO | 3 |
| DT82 | Summertown Parade | RS | 450806 | 208978 | NO2 | YES/Oxford city-wide AQMA | 2 | 1 | NO | 3 |
| DT83 | A44 Woodstock Rd. | RS | 449681 | 210263 | NO2 | YES/Oxford city-wide AQMA | 8 | 0.5 | NO | 2 |
| DT84 | 226 Botley Rd. | RS | 449273 | 206274 | NO2 | YES/Oxford city-wide AQMA | 10 | 1.5 | NO | 3 |
| DT85 | St Clements 3 | RS | 452625 | 206068 | NO2 | YES/Oxford city-wide AQMA | 2.5 | 1 | NO | 3 |
| DT86 | 72 Blackbird Leys | RS | 455134 | 202841 | NO2 | YES/Oxford city-wide AQMA | 6 | 1.5 | NO | 2 |
| DT87 | New Inn Hall St | RS | 451164 | 206246 | NO2 | YES/Oxford city-wide AQMA | 0 | 0.5 | NO | 2 |

| Diffusion Tube ID | Site Name | Site Type | X OS Grid Ref (Easting) | Y OS Grid Ref (Northing) | Pollutants Monitored | In AQMA? Which AQMA? | Distance to Relevant Exposure (m) (1) | Distance to kerb of nearest road (m) (2) | Tube Co-located with a Continuous Analyser? | Tube Height (m) |
|---|---|---|---|---|---|---|---|---|---|---|
| DT88 | St Michaels St | RS | 451205 | 206341 | NO2 | YES/Oxford city-wide AQMA | 0 | 0.5 | NO | 2 |
| DT89 | Turl St/Market St | RS | 451439 | 206330 | NO2 | YES/Oxford city-wide AQMA | 1 | 0.5 | NO | 2 |

**Notes:**

(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.3 – Annual Mean $NO_2$ Monitoring Results: Automatic Monitoring (µg/m$^3$)

| Site ID | X OS Grid Ref (Easting) | Y OS Grid Ref (Northing) | Site Type | Valid Data Capture for Monitoring Period (%) (1) | Valid Data Capture 2020 (%) (2) | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|---|
| CM1 | 451359 | 206157 | Roadside | 99.6 | 99.6 | **49** | 40 | 39 | **42** | 28 |
| CM2 | 451677 | 206272 | Roadside | 99.3 | 99.3 | **47** | 39 | 38 | 40 | 26 |
| CM3 | 451118 | 205353 | Urban Background | 99.5 | 99.5 | 16 | 14 | 15 | 16 | 11 |

☒ **Annualisation has been conducted where data capture is <75% and >25% in line with LAQM.TG16.**

☒ **Reported concentrations are those at the location of the monitoring site (annualised, as required), i.e. prior to any fall-off with distance correction.**

**Notes:**

The annual mean concentrations are presented as µg/m$^3$.

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

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

Concentrations are those at the location of monitoring and not those following any fall-off with distance adjustment.

(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%).

## Table A.4 – Annual Mean $NO_2$ Monitoring Results: Non-Automatic Monitoring (µg/m$^3$)

| Diffusion Tube ID | X OS Grid Ref (Easting) | Y OS Grid Ref (Northing) | Site Type | Valid Data Capture for Monitoring Period (%) (1) | Valid Data Capture 2020 (%) (2) | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|---|
| DT1 | 451118 | 205353 | UB | 100 | 100 | 18 | 14 | 15 | 16 | 11 |
| DT2 | 451904 | 204215 | RS | 100 | 100 | 34 | 28 | 27 | 29 | 23 |
| DT3 | 451914 | 204154 | RS | 100 | 100 | 38 | 31 | 29 | 34 | 26 |
| DT4 | 452961 | 204662 | RS | 83.3 | 83.3 | 34 | 28 | 27 | 28 | 23 |
| DT5 | 452818 | 203448 | UB | 100 | 100 | 14 | 10 | 14 | 14 | 10 |
| DT7 | 454472 | 204246 | RS | 100 | 100 | 36 | 31 | 28 | 32 | 27 |
| DT8 | 454355 | 204296 | RS | 100 | 100 | 34 | 29 | 27 | 31 | 24 |
| DT14 | 454554 | 207102 | RS | 100 | 100 | **43** | 33 | 32 | 35 | 28 |
| DT15 | 454433 | 207058 | RS | 100 | 100 | 34 | 26 | 25 | 27 | 21 |
| DT16 | 453982 | 206817 | RS | 100 | 100 | 35 | 27 | 25 | 27 | 19 |
| DT18 | 455596 | 207367 | RS | 100 | 100 | 33 | 23 | 26 | 28 | 22 |
| DT20 | 454999 | 207759 | RS | 100 | 100 | 29 | 25 | 27 | 28 | 22 |
| DT25 | 450419 | 210256 | RS | 100 | 100 | **48** | 35 | 35 | 35 | 26 |
| DT26 | 450389 | 210189 | RS | 100 | 100 | **40** | **41** | **41** | **40** | 31 |
| DT27 | 449824 | 210198 | RS | 100 | 100 | 34 | 29 | 29 | 29 | 22 |
| DT28 | 449856 | 210162 | RS | 100 | 100 | 32 | 26 | 27 | 26 | 22 |
| DT29 | 449530 | 210734 | RS | 100 | 100 | 36 | 28 | 25 | 26 | 20 |
| DT30 | 450668 | 206053 | RS | 83.3 | 83.3 | 33 | 27 | 28 | 27 | 19 |
| DT31 | 450566 | 206227 | RS | 100 | 100 | 39 | 29 | 31 | 32 | 21 |
| DT32 | 450674 | 206273 | RS | 75 | 75 | 38 | 32 | 31 | 32 | 24 |
| DT33 | 450409 | 206224 | RS | 100 | 100 | 29 | 23 | 26 | 24 | 19 |
| DT35 | 450029 | 206207 | RS | 100 | 100 | **40** | 34 | 32 | 34 | 23 |
| DT36 | 449657 | 206245 | RS | 100 | 100 | 35 | 27 | 27 | 25 | 17 |
| DT39 | 451359 | 206157 | RS | 100 | 100 | **49** | 39 | 39 | **43** | 28 |
| DT40 | 451270 | 206144 | RS | 100 | 100 | 36 | 28 | 26 | 28 | 18 |
| DT41 | 451216 | 206133 | RS | 100 | 100 | 37 | 25 | 23 | 26 | 17 |
| DT42 | 451073 | 206191 | RS | 83.3 | 83.3 | 35 | 24 | 29 | 33 | 22 |
| DT43 | 450885 | 206275 | RS | 100 | 100 | **45** | 34 | 32 | 35 | 22 |
| DT44 | 450795 | 206343 | RS | 100 | 100 | 38 | 29 | 29 | 30 | 21 |
| DT45 | 450942 | 206424 | RS | 91.7 | 91.7 | **51** | 38 | 37 | **40** | 26 |
| DT46 | 451167 | 206519 | RS | 100 | 100 | **45** | 31 | 31 | 31 | 20 |
| DT47 | 451222 | 206387 | RS | 91.7 | 91.7 | **49** | 37 | 37 | **40** | 24 |
| DT48 | 450981 | 206344 | RS | 100 | 100 | **54** | **40** | **42** | **44** | 24 |
| DT49 | 451322 | 206242 | RS | 100 | 100 | 30 | 23 | 24 | 26 | 18 |
| DT50 | 451467 | 206222 | RS | 100 | 100 | 36 | 27 | 28 | 32 | 24 |

| Diffusion Tube ID | X OS Grid Ref (Easting) | Y OS Grid Ref (Northing) | Site Type | Valid Data Capture for Monitoring Period (%) (1) | Valid Data Capture 2020 (%) (2) | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|---|
| DT51 | 451900 | 206250 | RS | 100 | 100 | **43** | 34 | 33 | 37 | 25 |
| DT52 | 451972 | 206283 | RS | 100 | 100 | **49** | 38 | 38 | **41** | 30 |
| DT53 | 452099 | 206117 | RS | 100 | 100 | 28 | 22 | 23 | 23 | 16 |
| DT54 | 452325 | 206015 | RS | 100 | 100 | 28 | 23 | 23 | 26 | 18 |
| DT55 | 452326 | 205992 | RS | 100 | 100 | **61** | **47** | **46** | **53** | 36 |
| DT56 | 451576 | 206232 | RS | 100 | 100 | **53** | **42** | **44** | **50** | 35 |
| DT57 | 451407 | 205807 | RS | 100 | 100 | **52** | 38 | 35 | 39 | 27 |
| DT58 | 451437 | 205529 | RS | 100 | 100 | **41** | 31 | 33 | 34 | 24 |
| DT59 | 451353 | 205643 | RS | 100 | 100 | 32 | 25 | 27 | 26 | 18 |
| DT60 | 451248 | 205710 | RS | 100 | 100 | 39 | 29 | 30 | 33 | 22 |
| DT61 | 451219 | 205707 | RS | 100 | 100 | 27 | 20 | 19 | 20 | 14 |
| DT63 | 450926 | 205797 | RS | 100 | 100 | 23 | 16 | 20 | 19 | 14 |
| DT64 | 450887 | 205825 | RS | 100 | 100 | 32 | 25 | 23 | 23 | 15 |
| DT65 | 451206 | 205780 | RS | 100 | 100 | 39 | 32 | 30 | 31 | 21 |
| DT66 | 451149 | 205859 | UB | 100 | 100 | 31 | 22 | 23 | 25 | 16 |
| DT67 | 451149 | 205947 | RS | 100 | 100 | 30 | 21 | 20 | 20 | 15 |
| DT68 | 451030 | 205962 | RS | 100 | 100 | 35 | 23 | 24 | 27 | 19 |
| DT69 | 450982 | 205973 | RS | 100 | 100 | 27 | 26 | 24 | 26 | 18 |
| DT70 | 451062 | 206067 | RS | 100 | 100 | **42** | 28 | 29 | 29 | 22 |
| DT71 | 449617 | 210216 | RS | 100 | 100 | NM | **41** | 38 | **40** | 28 |
| DT72 | 452761 | 205745 | RS | 91.7 | 91.7 | NM | 29 | 29 | 31 | 22 |
| DT73 | 450960 | 206590 | RS | 100 | 100 | NM | 27 | 26 | 24 | 15 |
| DT76 | 451226 | 206504 | RS | 100 | 100 | NM | NM | 33 | 35 | 23 |
| DT77 | 452451 | 205999 | RS | 91.7 | 91.7 | NM | NM | 36 | **42** | 28 |
| DT78 | 450378 | 207135 | UB | 100 | 100 | NM | NM | 22 | 23 | 17 |
| DT79 | 451908 | 203919 | RS | 91.7 | 91.7 | NM | NM | NM | 24 | 17 |
| DT80 | 454651 | 204270 | RS | 100 | 100 | NM | NM | NM | 37 | 31 |
| DT81 | 452805 | 205731 | RS | 75 | 75 | NM | NM | NM | 22 | 19 |
| DT82 | 450806 | 208978 | RS | 100 | 100 | NM | NM | NM | 27 | 20 |
| DT83 | 449681 | 210263 | RS | 100 | 100 | NM | NM | NM | **40** | 30 |
| DT84 | 449273 | 206274 | RS | 91.7 | 91.7 | NM | NM | NM | 27 | 18 |
| DT85 | 452625 | 206068 | RS | 91.7 | 91.7 | NM | NM | NM | 36 | 26 |
| DT86 | 455134 | 202841 | RS | 100 | 100 | NM | NM | NM | NM | 16 |
| DT87 | 451164 | 206246 | RS | 100 | 100 | NM | NM | NM | NM | 15 |
| DT88 | 451205 | 206341 | RS | 100 | 100 | NM | NM | NM | NM | 15 |
| DT89 | 451439 | 206330 | RS | 100 | 100 | NM | NM | NM | NM | 17 |

☒ **Annualisation has been conducted where data capture is <75% and >25% in line with LAQM.TG16.**

☒ **Diffusion tube data has been bias adjusted.**

☒ **Reported concentrations are those at the location of the monitoring site (bias adjusted and annualised, as required), i.e. prior to any fall-off with distance correction.**

**Notes:**

The annual mean concentrations are presented as µg/$m^3$.

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**.

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

Concentrations are those at the location of monitoring and not those following any fall-off with distance adjustment.

(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%).

### Table A.5 – 1-Hour Mean $NO_2$ Monitoring Results, Number of 1-Hour Means > 200µg/m$^3$

| Site ID | X OS Grid Ref (Easting) | Y OS Grid Ref (Northing) | Site Type | Valid Data Capture for Monitoring Period (%) (1) | Valid Data Capture 2020 (%) (2) | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|---|
| CM1 | 451359 | 206157 | Roadside | 99.6 | 99.6 | 0 | 0 | 1 | 3 | 0 |
| CM2 | 451677 | 206272 | Roadside | 99.3 | 99.3 | 0 | 0 | 0 (106) | 2 | 1 |
| CM3 | 451118 | 205353 | Urban Background | 99.5 | 99.5 | 0 (76) | 0 | 0 | 0 | 0 |

**Notes:**

Results are presented as the number of 1-hour periods where concentrations greater than 200µg/m$^3$ have been recorded.

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**.

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

(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%).

## Table A.6 – Annual Mean $PM_{10}$ Monitoring Results ($\mu g/m^3$)

| Site ID | X OS Grid Ref (Easting) | Y OS Grid Ref (Northing) | Site Type | Valid Data Capture for Monitoring Period (%) (1) | Valid Data Capture 2020 (%) (2) | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|---|
| CM2 | 451677 | 206272 | Roadside | 98.7 | 98.7 | 20 | 18 | 18 | 19 | 16 |
| CM3 | 451118 | 205353 | Urban Background | 99.9 | 99.9 | 15 | 13 | 12 | 14 | 11 |

☒ **Annualisation has been conducted where data capture is <75% and >25% in line with LAQM.TG16.**

**Notes:**

The annual mean concentrations are presented as $\mu g/m^3$.

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

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

(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%).

## Table A.7 – 24-Hour Mean $PM_{10}$ Monitoring Results, Number of $PM_{10}$ 24-Hour Means > 50µg/m$^3$

| Site ID | X OS Grid Ref (Easting) | Y OS Grid Ref (Northing) | Site Type | Valid Data Capture for Monitoring Period (%) (1) | Valid Data Capture 2020 (%) (2) | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|---|
| CM2 | 451677 | 206272 | Roadside | 98.7 | 98.7 | 4 | 2 | 0 (30) | 7 | 0 |
| CM3 | 451118 | 205353 | Urban Background | 99.9 | 99.9 | 0 (24) | 2 | 1 | 5 | 0 |

**Notes:**

Results are presented as the number of 24-hour periods where daily mean concentrations greater than 50µg/m$^3$ have been recorded.

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**.

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

(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%).

## Table A.8 – Annual Mean $PM_{2.5}$ Monitoring Results ($\mu g/m^3$)

| Site ID | X OS Grid Ref (Easting) | Y OS Grid Ref (Northing) | Site Type | Valid Data Capture for Monitoring Period (%) (1) | Valid Data Capture 2020 (%) (2) | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|---|
| CM3 | 451118 | 205353 | Urban Background | 99.9 | 99.9 | 13 | 11 | 10 | 9 | 7 |

☒ **Annualisation has been conducted where data capture is <75% and >25% in line with LAQM.TG16.**

**Notes:**

The annual mean concentrations are presented as $\mu g/m^3$.

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

(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%).

# Appendix B: Full Monthly Diffusion Tube Results for 2020

### Table B.1 – $NO_2$ 2020 Diffusion Tube Results ($\mu g/m^3$)

| DT ID | X OS Grid Ref (Easting) | Y OS Grid Ref (Easting) | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual Mean: Raw Data | Annual Mean: Annualised and Bias Adjusted (0.96) | Annual Mean: Distance Corrected to Nearest Exposure | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DT1 | 451118 | 205353 | 17 | 12 | 12 | 9 | 6 | 7 | 6 | 10 | 11 | 10 | 18 | 17 | 11.3 | 11(*) | NA | |
| DT2 | 451904 | 204215 | 33 | 24 | 22 | 19 | 18 | 23 | 17 | 25 | 27 | 23 | 33 | 29 | 24.4 | 23 | NA | |
| DT3 | 451914 | 204154 | 38 | 29 | 25 | 16 | 17 | 25 | 20 | 27 | 28 | 30 | 33 | 34 | 27 | 26 | NA | |
| DT4 | 452961 | 204662 | 33 | NR | 24 | 18 | 18 | 20 | 16 | NR | 26 | 25 | 33 | 28 | 24.1 | 23 | NA | |
| DT5 | 452818 | 203448 | 19 | 12 | 13 | 7 | 5 | 9 | 6 | 8 | 8 | 5 | 18 | 14 | 10.3 | 10(*) | NA | |
| DT7 | 454472 | 204246 | 43 | 41 | 28 | 18 | 15 | 24 | 21 | 23 | 28 | 29 | 32 | 32 | 27.9 | 27 | NA | |
| DT8 | 454355 | 204296 | 33 | 27 | 26 | 20 | 17 | 22 | 18 | 21 | 28 | 25 | 30 | 31 | 24.8 | 24 | NA | |
| DT14 | 454554 | 207102 | 41 | 36 | 30 | 17 | 19 | 25 | 23 | 27 | 31 | 34 | 37 | 34 | 29.5 | 28 | NA | |
| DT15 | 454433 | 207058 | 30 | 23 | 23 | 19 | 16 | 21 | 14 | 21 | 22 | 22 | 28 | 25 | 22 | 21 | NA | |
| DT16 | 453982 | 206817 | 27 | 20 | 21 | 18 | 15 | 14 | 12 | 18 | 22 | 18 | 25 | 22 | 19.4 | 19 | NA | |
| DT18 | 455596 | 207367 | 32 | 25 | 20 | 15 | 14 | 20 | 20 | 25 | 22 | 23 | 28 | 27 | 22.7 | 22 | NA | |
| DT20 | 454999 | 207759 | 29 | 24 | 22 | 18 | 19 | 22 | 15 | 23 | 23 | 21 | 27 | 28 | 22.6 | 22 | NA | |
| DT25 | 450419 | 210256 | 40 | 33 | 26 | 16 | 15 | 21 | 18 | 27 | 30 | 28 | 32 | 31 | 26.6 | 26 | NA | |
| DT26 | 450389 | 210189 | 41 | 31 | 32 | 27 | 26 | 37 | 26 | 33 | 37 | 29 | 37 | 36 | 32.7 | 31 | NA | |
| DT27 | 449824 | 210198 | 37 | 32 | 14 | 13 | 17 | 17 | 20 | 22 | 25 | 24 | 28 | 28 | 23.1 | 22 | NA | |
| DT28 | 449856 | 210162 | 33 | 27 | 24 | 15 | 16 | 16 | 22 | 19 | 26 | 28 | 29 | 26 | 23.4 | 22 | NA | |
| DT29 | 449530 | 210734 | 32 | 27 | 22 | 12 | 12 | 15 | 15 | 16 | 23 | 21 | 28 | 24 | 20.6 | 20 | NA | |
| DT30 | 450668 | 206053 | 29 | 22 | 21 | 15 | 14 | 15 | 13 | 21 | 23 | NR | 28 | NR | 20.2 | 19 | NA | |
| DT31 | 450566 | 206227 | 31 | 22 | 21 | 14 | 16 | 18 | 18 | 23 | 25 | 23 | 29 | 28 | 22.4 | 21 | NA | |
| DT32 | 450674 | 206273 | 34 | NR | 25 | NR | 16 | NR | 17 | 26 | 28 | 25 | 30 | 27 | 25.3 | 24 | NA | |
| DT33 | 450409 | 206224 | 26 | 17 | 25 | 21 | 16 | 16 | 11 | 20 | 19 | 18 | 25 | 25 | 19.9 | 19 | NA | |
| DT35 | 450029 | 206207 | 35 | 26 | 23 | 17 | 14 | 22 | 15 | 26 | 28 | 25 | 30 | 29 | 24.2 | 23 | NA | |
| DT36 | 449657 | 206245 | 28 | 19 | 17 | 13 | 11 | 13 | 12 | 17 | 17 | 17 | 22 | 25 | 17.5 | 17 | NA | |
| DT39 | 451359 | 206157 | 40 | 35 | 33 | 21 | 18 | 28 | 16 | 30 | 31 | 32 | 34 | 37 | 29.6 | 28 | NA | |
| DT40 | 451270 | 206144 | 31 | 24 | 24 | 13 | 11 | 14 | 11 | 16 | 22 | 10 | 22 | 22 | 18.5 | 18 | NA | |
| DT41 | 451216 | 206133 | 29 | 24 | 22 | 12 | 12 | 11 | 10 | 16 | 20 | 14 | 26 | 19 | 18 | 17 | NA | |
| DT42 | 451073 | 206191 | 34 | 25 | 27 | 16 | 13 | 18 | 14 | NR | 25 | NR | 34 | 26 | 23.2 | 22 | NA | |
| DT43 | 450885 | 206275 | 34 | 31 | 27 | 12 | 12 | 16 | 17 | 21 | 25 | 23 | 31 | 28 | 23.1 | 22 | NA | |
| DT44 | 450795 | 206343 | 36 | 26 | 23 | 14 | 14 | 15 | 13 | 21 | 26 | 15 | 28 | 25 | 21.4 | 21 | NA | |
| DT45 | 450942 | 206424 | 41 | NR | 29 | 20 | 20 | 24 | 17 | 31 | 29 | 29 | 29 | 30 | 27.2 | 26 | NA | |
| DT46 | 451167 | 206519 | 35 | 28 | 25 | 14 | 13 | 17 | 8 | 22 | 22 | 15 | 30 | 28 | 21.3 | 20 | NA | |
| DT47 | 451222 | 206387 | 41 | 33 | 29 | 18 | 14 | 17 | 15 | NR | 21 | 26 | 30 | 35 | 25.3 | 24 | NA | |
| DT48 | 450981 | 206344 | 39 | 36 | 29 | 17 | 15 | 17 | 18 | 21 | 27 | 27 | 26 | 29 | 25 | 24 | NA | |
| DT49 | 451322 | 206242 | 29 | 20 | 20 | 13 | 9 | 13 | 8 | 17 | 19 | 17 | 28 | 27 | 18.4 | 18 | NA | |
| DT50 | 451467 | 206222 | 39 | 39 | 29 | 16 | 13 | 19 | 16 | 23 | 24 | 22 | 29 | 26 | 24.5 | 24 | NA | |
| DT51 | 451900 | 206250 | 42 | 31 | 31 | 18 | 15 | 20 | 17 | 26 | 31 | 21 | 33 | 31 | 26.5 | 25 | NA | |
| DT52 | 451972 | 206283 | 50 | 41 | 32 | 20 | 19 | 23 | 24 | 24 | 32 | 32 | 38 | 38 | 30.9 | 30 | NA | |
| DT53 | 452099 | 206117 | 21 | 18 | 18 | 12 | 11 | 13 | 11 | 19 | 19 | 17 | 23 | 23 | 17.2 | 16 | NA | |
| DT54 | 452325 | 206015 | 31 | 23 | 22 | 13 | 11 | 13 | 9 | 16 | 17 | 19 | 28 | 26 | 18.9 | 18 | NA | |
| DT55 | 452326 | 205992 | 59 | 47 | 36 | 20 | 20 | 28 | 26 | 35 | 47 | 43 | 48 | 44 | 37.8 | 36 | NA | |
| DT56 | 451576 | 206232 | 56 | 47 | 41 | 22 | 18 | 32 | 23 | 36 | 35 | 37 | 46 | 42 | 36.2 | 35 | NA | |
| DT57 | 451407 | 205807 | 45 | 34 | 31 | 15 | 16 | 22 | 20 | 28 | 33 | 32 | 31 | 30 | 27.9 | 27 | NA | |
| DT58 | 451437 | 205529 | 40 | 27 | 25 | 15 | 15 | 21 | 17 | 25 | 28 | 26 | 32 | 33 | 25.4 | 24 | NA | |
| DT59 | 451353 | 205643 | 27 | 16 | 20 | 15 | 13 | 12 | 10 | 18 | 18 | 15 | 28 | 26 | 18.3 | 18 | NA | |
| DT60 | 451248 | 205710 | 35 | 23 | 24 | 15 | 14 | 14 | 14 | 22 | 26 | 25 | 27 | 30 | 22.5 | 22 | NA | |
| DT61 | 451219 | 205707 | 23 | 14 | 16 | 13 | 9 | 10 | 8 | 14 | 17 | 14 | 21 | 21 | 14.9 | 14 | NA | |
| DT63 | 450926 | 205797 | 21 | 13 | 15 | 11 | 10 | 10 | 8 | 14 | 16 | 14 | 21 | 18 | 14.2 | 14 | NA | |

| DT ID | X OS Grid Ref (Easting) | Y OS Grid Ref (Easting) | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual Mean: Raw Data | Annual Mean: Annualised and Bias Adjusted (0.96) | Annual Mean: Distance Corrected to Nearest Exposure | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DT64 | 450887 | 205825 | 23 | 15 | 16 | 13 | 10 | 12 | 11 | 17 | 17 | 15 | 21 | 19 | 15.8 | 15 | NA | |
| DT65 | 451206 | 205780 | 37 | 25 | 23 | 14 | 11 | 15 | 14 | 20 | 24 | 24 | 31 | 30 | 22.2 | 21 | NA | |
| DT66 | 451149 | 205859 | 28 | 20 | 18 | 11 | 8 | 10 | 9 | 15 | 18 | 17 | 27 | 21 | 16.9 | 16(*) | NA | |
| DT67 | 451149 | 205947 | 25 | 15 | 15 | 11 | 9 | 10 | 9 | 12 | 16 | 16 | 24 | 20 | 15.2 | 15 | NA | |
| DT68 | 451030 | 205962 | 32 | 25 | 23 | 12 | 12 | 14 | 15 | 18 | 21 | 19 | 27 | 26 | 20.3 | 19 | NA | |
| DT69 | 450982 | 205973 | 30 | 23 | 20 | 13 | 9 | 10 | 10 | 18 | 21 | 19 | 28 | 25 | 18.9 | 18 | NA | |
| DT70 | 451062 | 206067 | 34 | 24 | 23 | 15 | 13 | 17 | 14 | 20 | 25 | 24 | 34 | 27 | 22.5 | 22 | NA | |
| DT71 | 449617 | 210216 | 42 | 34 | 29 | 18 | 19 | 25 | 23 | 32 | 34 | 26 | 38 | 33 | 29.5 | 28 | NA | |
| DT72 | 452761 | 205745 | 35 | 28 | 24 | 18 | 16 | 20 | NR | 16 | 18 | 21 | 29 | 22 | 22.6 | 22 | NA | |
| DT73 | 450960 | 206590 | 26 | 17 | 18 | 11 | 8 | 10 | 8 | 14 | 14 | 12 | 23 | 21 | 15.2 | 15 | NA | |
| DT76 | 451226 | 206504 | 41 | 35 | 26 | 13 | 10 | 15 | 21 | 22 | 27 | 25 | 32 | 26 | 24.4 | 23 | NA | |
| DT77 | 452451 | 205999 | 51 | NR | 32 | 17 | 15 | 23 | 20 | 26 | 35 | 28 | 38 | 32 | 28.7 | 28 | NA | |
| DT78 | 450378 | 207135 | 28 | 26 | 18 | 11 | 12 | 13 | 14 | 15 | 18 | 18 | 21 | 20 | 17.8 | 17(*) | NA | |
| DT79 | 451908 | 203919 | 28 | NR | 18 | 13 | 11 | 14 | 9 | 19 | 20 | 17 | 24 | 24 | 17.9 | 17 | NA | |
| DT80 | 454651 | 204270 | 43 | 38 | 27 | 22 | 22 | 27 | 30 | 27 | 40 | 40 | 42 | 37 | 32.8 | 31 | NA | |
| DT81 | 452805 | 205731 | 29 | 22 | 19 | 13 | 10 | 13 | NR | 18 | 25 | NR | NR | 29 | 19.7 | 19 | NA | |
| DT82 | 450806 | 208978 | 32 | 24 | 20 | 12 | 13 | 15 | 13 | 19 | 23 | 21 | 27 | 25 | 20.4 | 20 | NA | |
| DT83 | 449681 | 210263 | 47 | 43 | 30 | 15 | 21 | 28 | 29 | 28 | 33 | 28 | 37 | 33 | 31 | 30 | NA | |
| DT84 | 449273 | 206274 | 30 | NR | 20 | 11 | 10 | 18 | 14 | 19 | 19 | 21 | 26 | 22 | 19 | 18 | NA | |
| DT85 | 452625 | 206068 | 36 | 31 | 31 | 21 | 18 | 23 | 23 | 27 | 30 | 31 | 30 | NR | 27.5 | 26 | NA | |
| DT86 | 455134 | 202841 | 27 | 20 | 18 | 14 | 13 | 12 | 6 | 15 | 17 | 15 | 24 | 21 | 16.8 | 16 | NA | |
| DT87 | 451164 | 206246 | 25 | 20 | 18 | 12 | 9 | 12 | 9 | 13 | 16 | 15 | 22 | 21 | 16 | 15 | NA | |
| DT88 | 451205 | 206341 | 24 | 18 | 18 | 11 | 10 | 9 | 10 | 13 | 15 | 16 | 20 | 22 | 15.4 | 15 | NA | |
| DT89 | 451439 | 206330 | 32 | 22 | 18 | 12 | 10 | 11 | 11 | 14 | 15 | 18 | 27 | 24 | 17.9 | 17 | NA | |

☒ **All erroneous data has been removed from the $NO_2$ diffusion tube dataset presented in Table B.1**

☒ **Annualisation has been conducted where data capture is <75% and >25% in line with LAQM.TG16**

☒ **Local bias adjustment factor used**

☐ **National bias adjustment factor used**

☒ **Where applicable, data has been distance corrected for relevant exposure in the final column**

☒ **Oxford City Council confirm that all 2020 diffusion tube data has been uploaded to the Diffusion Tube Data Entry System**

**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**.

See Appendix C for details on bias adjustment and annualisation.

(*) Tubes corrected using local bias adjustment obtained from urban background co-location study (details available in Appendix C)

(**) According to paragraph 7.78 of the LAQMTG(16), considerations should be given to distance correct all the diffusion tubes that are not representative of human exposure, and whose concentrations fall within 10% of the $NO_2$ annual mean objective (i.e. > 36 $ugm^{-3}$), to account for the inherent uncertainty in diffusion tube monitoring concentration data. As in 2020, all diffusion tube monitoring results were ≤ 36 $ugm^{-3}$, no distance corrections were made.

NA – Not Applicable

NR – Not Recovered (Lost/damaged)

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

## New or Changed Sources Identified Within Oxford during 2020

Oxford City Council has not identified any new sources relating to air quality within the reporting year of 2020.

## Additional Air Quality Works Undertaken by Oxford City Council during 2020

Oxford City Council has not completed any additional works within the reporting year of 2020.

## QA/QC of Diffusion Tube Monitoring

Oxford's diffusion tubes were supplied and analysed in 2020 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, under the independent AIR-PT scheme. The results of these inter-comparisons are publicly available for scrutiny.

All the diffusion tubes used in the 2020 monitoring campaign were replaced according to DEFRA's 2020 diffusion tube monitoring calendar and within the ± 2 days due date tolerance.

### Diffusion Tube Annualisation

In 2020, none of the diffusion tubes of the monitoring campaign have presented annual data capture rates below 75%. Hence, and according to LAQM TG.16, diffusion tube annualisation was not required.

### Diffusion Tube Bias Adjustment Factors

The diffusion tube data presented within the 2021 ASR have been corrected for bias using an adjustment factor. Bias represents the overall tendency of the diffusion tubes to under or over-read relative to the reference chemiluminescence analyser. LAQM.TG16 provides guidance with regard to the application of a bias adjustment factor to correct diffusion tube

monitoring. Triplicate co-location studies can be used to determine a local bias factor based on the comparison of diffusion tube results with data taken from $NO_x$/$NO_2$ continuous analysers. Alternatively, the national database of diffusion tube co-location surveys provides bias factors for the relevant laboratory and preparation method.

Oxford City Council carries out two co-location studies annually, and has used the results of these studies to calculate two locally derived bias adjustment factors.

In 2020, the following bias correction factors were derived from the following Oxford's AURN sites:

AURN Oxford Centre (Roadside) - **0.96**

AURN Oxford St Ebbes (Urban Background) – **0.97**

In March 2010, Local Air Quality management Helpdesk have issued a briefing note with regards to the influence of location on diffusion tube bias and whether roadside collocation studies should be used to adjust background diffusion tubes and vice versa. The document concludes the below:

***"The value of a collocation study (and the subsequent bias adjustment) will be improved if the concentrations being measured are similar to those in the wider survey*".**

***"Care should be taken to avoid applying a bias adjustment factor derived from a local collocation study carried out for concentrations that are very different to those being measured in the wider survey"***.

In other words, co-location results from a low concentration site (typically a background site) should not be used to derive a bias adjustment factor for survey results from high concentration sites (typically roadside sites) and vice versa.

In light of the above, Oxford City Council decided to apply both bias adjustment factors that were obtained locally in 2020 to correct the diffusion tube data from its air quality network, following the following approach:

- The local bias of **0.96** obtained from local AURN Oxford Centre roadside site was applied to adjust all monitoring roadside sites;
- The local bias of **0.97** obtained from local AURN St Ebbes urban background site was applied to adjust all monitoring urban background sites.

The average of the national bias correction factor for diffusion tubes that were tested using the same Acetone method (50% TEA) – considering the National Diffusion Tube Bias Adjustment Factor Spreadsheet version3/21 from March 2021 was of **0.82** in 2020.

The two locally derived bias adjustment factors were used, instead of the national bias adjustment factor due to the following:

a) The bias adjustment factors of our local studies are slightly higher than the one that was obtained nationally. Using the calculated local bias to adjust Oxford's $NO_2$ diffusion tube results represents therefore a much more conservative approach;

b) For a question of methodology and consistency with previous AQ AS reports;

c) Due to the fact that our local co-location studies have both presented *"good"* precision for the diffusion tubes in 2020, together with high quality chemiluminescence results, and an extremely high data capture rate for $NO_x$ (>99%) obtained from our AURN monitoring sites of Oxford Centre roadside and Oxford St Ebbes.

A summary of bias adjustment factors used by Oxford City Council over the past five years is presented in Table C1 below.

Table C2 shows the accuracy of the local bias adjustment factors used in 2020, and Figure C1 and C2 (below) show print screens of the DEFRA approved spread sheet used in the calculation of those factors.

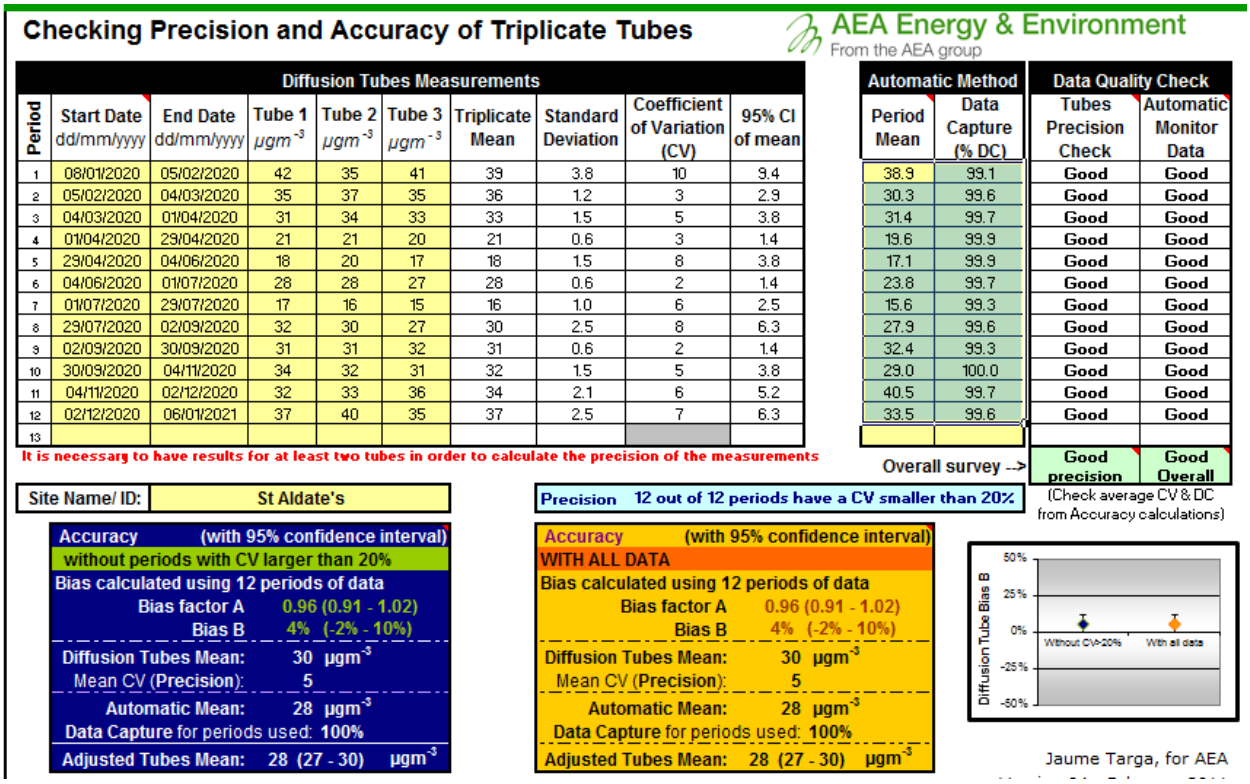
### Table C 1– Bias Adjustment Factor

| Year | Local or National | If National, Version of National Spreadsheet | Adjustment Factor |
|---|---|---|---|
| **2020** | Local | NA | 0.96/0.97 |
| **2019** | Local | NA | 0.94/1.05 |
| **2018** | Local | NA | 0.89/0.97 |
| **2017** | Local | NA | 0.83 |
| **2016** | Local | NA | 0.96 |

## Table C 2 - Accuracy of Local Bias Adjustment factors

| | Local Bias Adjustment 1 (AURN Oxford Centre Roadside) | Local Bias Adjustment 2 (AURN St Ebbes Urban Background |
|---|---|---|
| **Periods used to calculate bias** | 12 | 12 |
| **Bias Factor A** | 0.96 (0.91-1.02) | 0.97 (0.92-1.03) |
| **Bias Factor B** | 4% (-2%-10%) | 3% (-3%-9%) |
| **Diffusion Tube Mean (µg/m$^3$)** | 30 | 11 |
| **Mean CV (Precision)** | 5 | 6 |
| **Automatic Mean (µg/m$^3$)** | 28 | 11 |
| **Data Capture** | 100% | 100% |
| **Adjusted Tube Mean (µg/m$^3$)** | 28 (27-30) | 11 (10-12) |

## Figure C 1– Calculation of local bias adjustment 1 (AURN Oxford Centre Roadside)



**Checking Precision and Accuracy of Triplicate Tubes**

AEA Energy & Environment
From the AEA group

**Diffusion Tubes Measurements**

| Period | Start Date dd/mm/yyyy | End Date dd/mm/yyyy | Tube 1 µgm$^{-3}$ | Tube 2 µgm$^{-3}$ | Tube 3 µgm$^{-3}$ | Triplicate Mean | Standard Deviation | Coefficient of Variation (CV) | 95% CI of mean |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 08/01/2020 | 05/02/2020 | 42 | 35 | 41 | 39 | 3.8 | 10 | 9.4 |
| 2 | 05/02/2020 | 04/03/2020 | 35 | 37 | 35 | 36 | 1.2 | 3 | 2.9 |
| 3 | 04/03/2020 | 01/04/2020 | 31 | 34 | 33 | 33 | 1.5 | 5 | 3.8 |
| 4 | 01/04/2020 | 29/04/2020 | 21 | 21 | 20 | 21 | 0.6 | 3 | 1.4 |
| 5 | 29/04/2020 | 04/06/2020 | 18 | 20 | 17 | 18 | 1.5 | 8 | 3.8 |
| 6 | 04/06/2020 | 01/07/2020 | 28 | 28 | 27 | 28 | 0.6 | 2 | 1.4 |
| 7 | 01/07/2020 | 29/07/2020 | 17 | 16 | 15 | 16 | 1.0 | 6 | 2.5 |
| 8 | 29/07/2020 | 02/09/2020 | 32 | 30 | 27 | 30 | 2.5 | 8 | 6.3 |
| 9 | 02/09/2020 | 30/09/2020 | 31 | 31 | 32 | 31 | 0.6 | 2 | 1.4 |
| 10 | 30/09/2020 | 04/11/2020 | 34 | 32 | 31 | 32 | 1.5 | 5 | 3.8 |
| 11 | 04/11/2020 | 02/12/2020 | 32 | 33 | 36 | 34 | 2.1 | 6 | 5.2 |
| 12 | 02/12/2020 | 06/01/2021 | 37 | 40 | 35 | 37 | 2.5 | 7 | 6.3 |
| 13 | | | | | | | | | |

It is necessary to have results for at least two tubes in order to calculate the precision of the measurements

| Automatic Method | | Data Quality Check | |
|---|---|---|---|
| Period Mean | Data Capture (% DC) | Tubes Precision Check | Automatic Monitor Data |
| 38.9 | 99.1 | Good | Good |
| 30.3 | 99.6 | Good | Good |
| 31.4 | 99.7 | Good | Good |
| 19.6 | 99.9 | Good | Good |
| 17.1 | 99.9 | Good | Good |
| 23.8 | 99.7 | Good | Good |
| 15.6 | 99.3 | Good | Good |
| 27.9 | 99.6 | Good | Good |
| 32.4 | 99.3 | Good | Good |
| 29.0 | 100.0 | Good | Good |
| 40.5 | 99.7 | Good | Good |
| 33.5 | 99.6 | Good | Good |
| | | | |
| Overall survey --> | | Good precision | Good Overall |

(Check average CV & DC from Accuracy calculations)

Site Name/ ID: St Aldate's

Precision: 12 out of 12 periods have a CV smaller than 20%

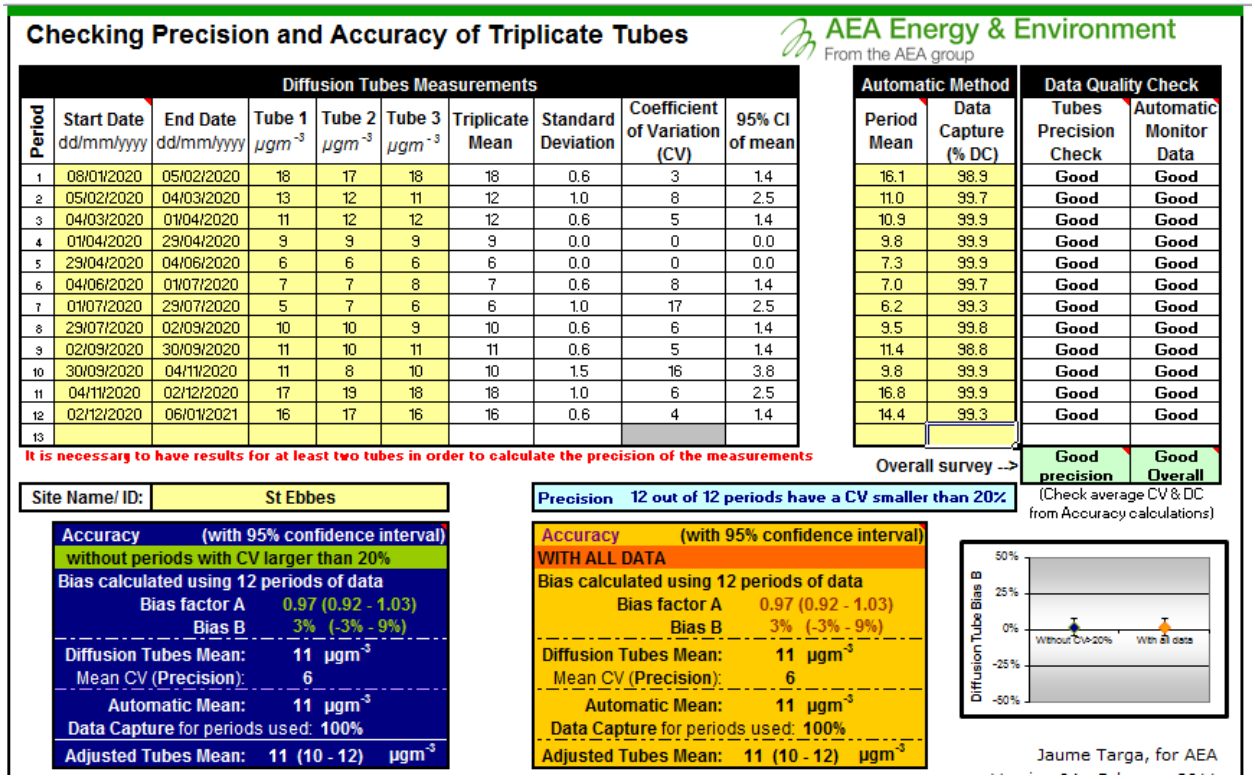
Accuracy (with 95% confidence interval) without periods with CV larger than 20%
Bias calculated using 12 periods of data
Bias factor A 0.96 (0.91 - 1.02)
Bias B 4% (-2% - 10%)
Diffusion Tubes Mean: 30 µgm$^{-3}$
Mean CV (Precision): 5
Automatic Mean: 28 µgm$^{-3}$
Data Capture for periods used: 100%
Adjusted Tubes Mean: 28 (27 - 30) µgm$^{-3}$

Accuracy (with 95% confidence interval) WITH ALL DATA
Bias calculated using 12 periods of data
Bias factor A 0.96 (0.91 - 1.02)
Bias B 4% (-2% - 10%)
Diffusion Tubes Mean: 30 µgm$^{-3}$
Mean CV (Precision): 5
Automatic Mean: 28 µgm$^{-3}$
Data Capture for periods used: 100%
Adjusted Tubes Mean: 28 (27 - 30) µgm$^{-3}$



Jaume Targa, for AEA

## Figure C 2 - Calculation of local bias adjustment 2 (AURN St Ebbes Urban B.)



**Checking Precision and Accuracy of Triplicate Tubes**

AEA Energy & Environment
From the AEA group

**Diffusion Tubes Measurements**

| Period | Start Date dd/mm/yyyy | End Date dd/mm/yyyy | Tube 1 µgm$^{-3}$ | Tube 2 µgm$^{-3}$ | Tube 3 µgm$^{-3}$ | Triplicate Mean | Standard Deviation | Coefficient of Variation (CV) | 95% CI of mean |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 08/01/2020 | 05/02/2020 | 18 | 17 | 18 | 18 | 0.6 | 3 | 1.4 |
| 2 | 05/02/2020 | 04/03/2020 | 13 | 12 | 11 | 12 | 1.0 | 8 | 2.5 |
| 3 | 04/03/2020 | 01/04/2020 | 11 | 12 | 12 | 12 | 0.6 | 5 | 1.4 |
| 4 | 01/04/2020 | 29/04/2020 | 9 | 9 | 9 | 9 | 0.0 | 0 | 0.0 |
| 5 | 29/04/2020 | 04/06/2020 | 6 | 6 | 6 | 6 | 0.0 | 0 | 0.0 |
| 6 | 04/06/2020 | 01/07/2020 | 7 | 7 | 8 | 7 | 0.6 | 8 | 1.4 |
| 7 | 01/07/2020 | 29/07/2020 | 5 | 7 | 6 | 6 | 1.0 | 17 | 2.5 |
| 8 | 29/07/2020 | 02/09/2020 | 10 | 10 | 9 | 10 | 0.6 | 6 | 1.4 |
| 9 | 02/09/2020 | 30/09/2020 | 11 | 10 | 11 | 11 | 0.6 | 5 | 1.4 |
| 10 | 30/09/2020 | 04/11/2020 | 11 | 8 | 10 | 10 | 1.5 | 16 | 3.8 |
| 11 | 04/11/2020 | 02/12/2020 | 17 | 19 | 18 | 18 | 1.0 | 6 | 2.5 |
| 12 | 02/12/2020 | 06/01/2021 | 16 | 17 | 16 | 16 | 0.6 | 4 | 1.4 |
| 13 | | | | | | | | | |

It is necessary to have results for at least two tubes in order to calculate the precision of the measurements

| Automatic Method | | Data Quality Check | |
|---|---|---|---|
| Period Mean | Data Capture (% DC) | Tubes Precision Check | Automatic Monitor Data |
| 16.1 | 98.9 | Good | Good |
| 11.0 | 99.7 | Good | Good |
| 10.9 | 99.9 | Good | Good |
| 9.8 | 99.9 | Good | Good |
| 7.3 | 99.9 | Good | Good |
| 7.0 | 99.7 | Good | Good |
| 6.2 | 99.3 | Good | Good |
| 9.5 | 99.8 | Good | Good |
| 11.4 | 98.8 | Good | Good |
| 9.8 | 99.9 | Good | Good |
| 16.8 | 99.9 | Good | Good |
| 14.4 | 99.3 | Good | Good |
| | | | |
| Overall survey --> | | Good precision | Good Overall |

(Check average CV & DC from Accuracy calculations)

Site Name/ ID: St Ebbes

Precision 12 out of 12 periods have a CV smaller than 20%

Accuracy (with 95% confidence interval)
without periods with CV larger than 20%
Bias calculated using 12 periods of data
Bias factor A 0.97 (0.92 - 1.03)
Bias B 3% (-3% - 9%)
Diffusion Tubes Mean: 11 µgm$^{-3}$
Mean CV (Precision): 6
Automatic Mean: 11 µgm$^{-3}$
Data Capture for periods used: 100%
Adjusted Tubes Mean: 11 (10 - 12) µgm$^{-3}$

Accuracy (with 95% confidence interval)
WITH ALL DATA
Bias calculated using 12 periods of data
Bias factor A 0.97 (0.92 - 1.03)
Bias B 3% (-3% - 9%)
Diffusion Tubes Mean: 11 µgm$^{-3}$
Mean CV (Precision): 6
Automatic Mean: 11 µgm$^{-3}$
Data Capture for periods used: 100%
Adjusted Tubes Mean: 11 (10 - 12) µgm$^{-3}$



Jaume Targa, for AEA

## $NO_2$ Fall-off with Distance from the Road

Wherever possible, local authorities should ensure that monitoring locations are representative of exposure. However, where this is not possible, the $NO_2$ concentration at the nearest location relevant for exposure should be estimated using the Diffusion Tube Data Processing Tool/$NO_2$ fall-off with distance calculator available on the LAQM Support website. Where appropriate, non-automatic annual mean $NO_2$ concentrations corrected for distance are presented in Table B.1.

According to paragraph 7.78 of the LAQM TG (16), distance corrections should be considered at any monitoring site where the annual mean concentration falls within 10% of the annual mean objective (i.e. greater than 36µg/m$^3$), and the monitoring site is not located at a point of relevant exposure, to account for the inherent uncertainty in diffusion tube monitoring concentration data.

In 2020, all diffusion tube monitoring results were ≤ 36 ugm$^{-3}$, so no distance corrections to relevant human exposure were made.

## QA/QC of Automatic Monitoring

Oxford City Council currently operates three continuous monitoring sites. All routine calibration and maintenance is carried out by Oxford City Council's Air Quality Officer and recorded in accordance with manufacturers' and Automated Urban Monitoring Network site operators' manual. 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 $NO_2$ reference standards;
- every six months an audit of instrument response is carried out by an external organization using independent gas calibration standards, and which guarantees that data are traceable to UK national and international 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. Before final publication of the air quality annual monitoring results, for comparison against current legislation, the air quality data needs to be ratified.

Data Ratification is a detailed manual check of the data set carried out on a quarterly basis in all our automatic monitoring stations covered by the full QA/QC process. It requires a longer-term view of the dataset incorporating the results from the independent QA/QC audits of the monitoring stations.

All the automatic monitoring data obtained in 2020 and presented within this ASR has been fully ratified by Ricardo Energy & Environment, following in full all the national AURN QA/QC procedures. Live and Historic data from our 3 automatic monitoring sites can be found on the following websites:

- UK-Air
- AQ England
- Oxfordshire AQ website

### $PM_{10}$ and $PM_{2.5}$ Monitoring Adjustment

The instrument used at AURN St Ebbes to measure $PM_{10}$ and $PM_{2.5}$ data (FIDAS), do not require the application of any correction factor. The $PM_{10}$ data measured at Oxford High Street is obtained from a TEOM, and as such requires a VCM correction. However, Ricardo Energy & Environment applies the VCM correction factor automatically during ratification, and before presenting the final corrected annual dataset to Oxford City Council. We can therefore confirm that this was also the case in 2020.

### Automatic Monitoring Annualisation

During the course of 2020, all Oxford City Council's automatic monitoring stations have registered data capture rates above 98% for all the monitored pollutants; therefore there was no need to follow LAQM TG.16 annualisation methodology to be used.

### $NO_2$ Fall-off with Distance from the Road

Wherever possible, local authorities should ensure that monitoring locations are representative of exposure. However, where this is not possible, the $NO_2$ concentration at the nearest location relevant for exposure should be estimated using the $NO_2$ fall-off with distance calculator available on the LAQM Support website.

No automatic $NO_2$ monitoring locations within Oxford required distance correction during 2020.

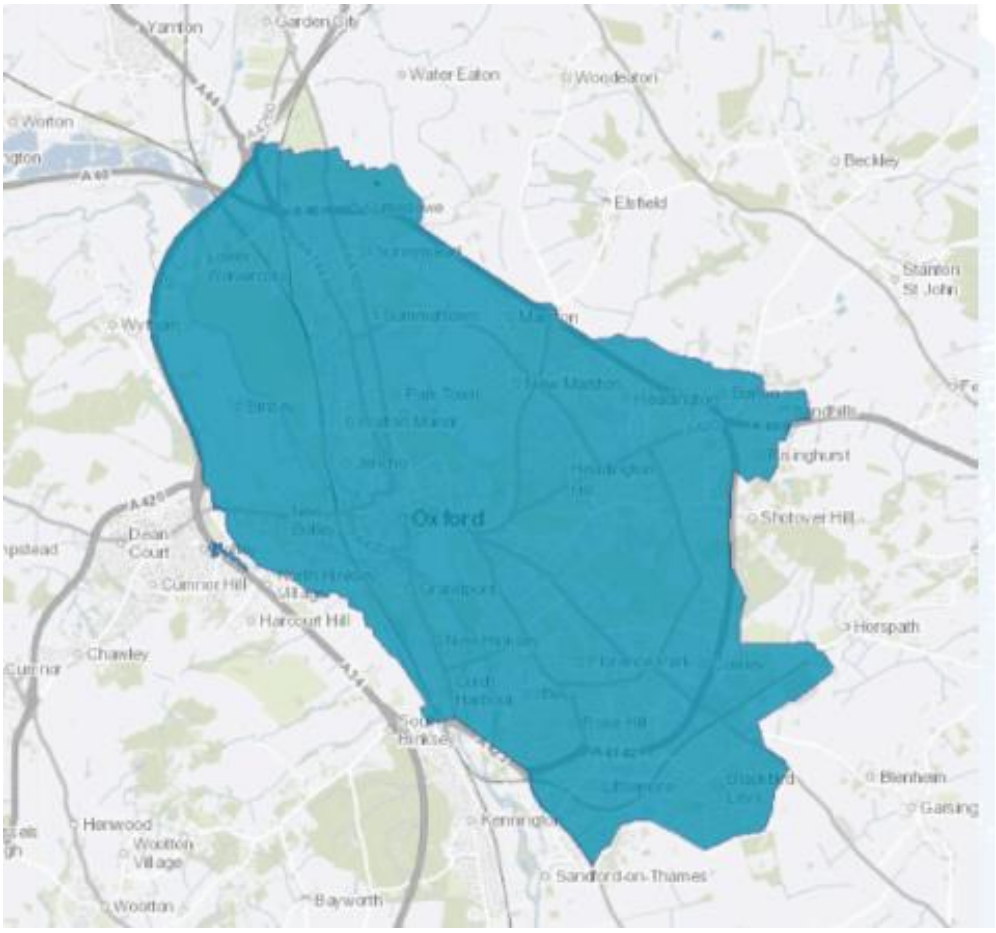
# Appendix D: Map(s) of Monitoring Locations and AQMAs

The Council previously declared Air Quality Management Areas (AQMA's) in central Oxford (2003) and at Green Road roundabout (2005), as those were the locations where the UK nitrogen dioxide objectives were not being met at the time. Following further detailed assessments (2008 and 2009); several additional areas were identified where the nitrogen dioxide objectives were being breached.

As such, in September 2010 the City Council made an Air Quality Management Order declaring the whole city an AQMA for $NO_2$. Figure D1 below shows (in blue) the area of the city covered by the current AQMA for $NO_2$ and its boundaries. Figures D2 to D10 show the maps of the locations where air quality monitoring was conducted throughout 2020.

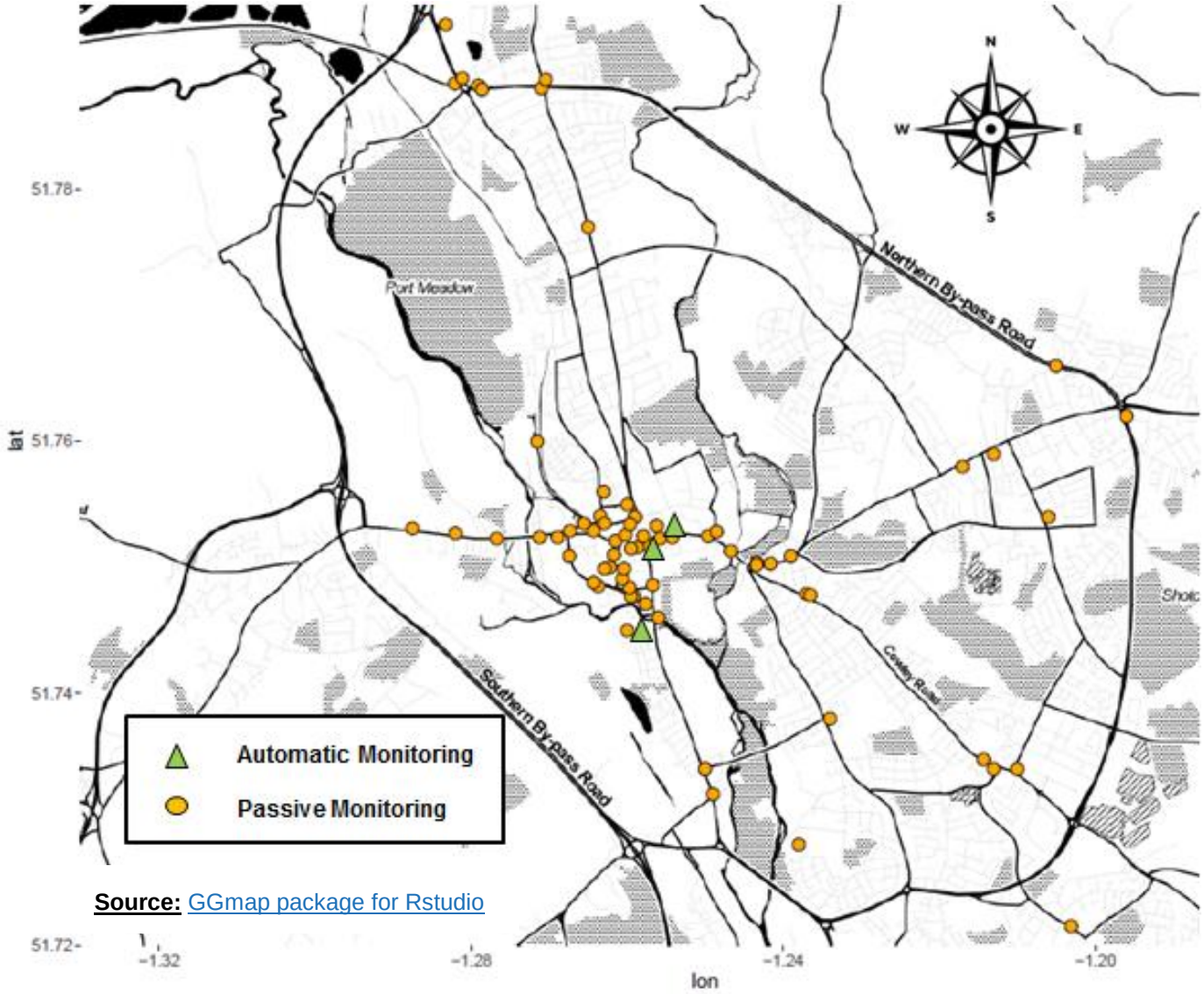
All the monitoring locations are within the current AQMA.

### Figure D 1– Oxford's current city-wide AQMA for $NO_2$



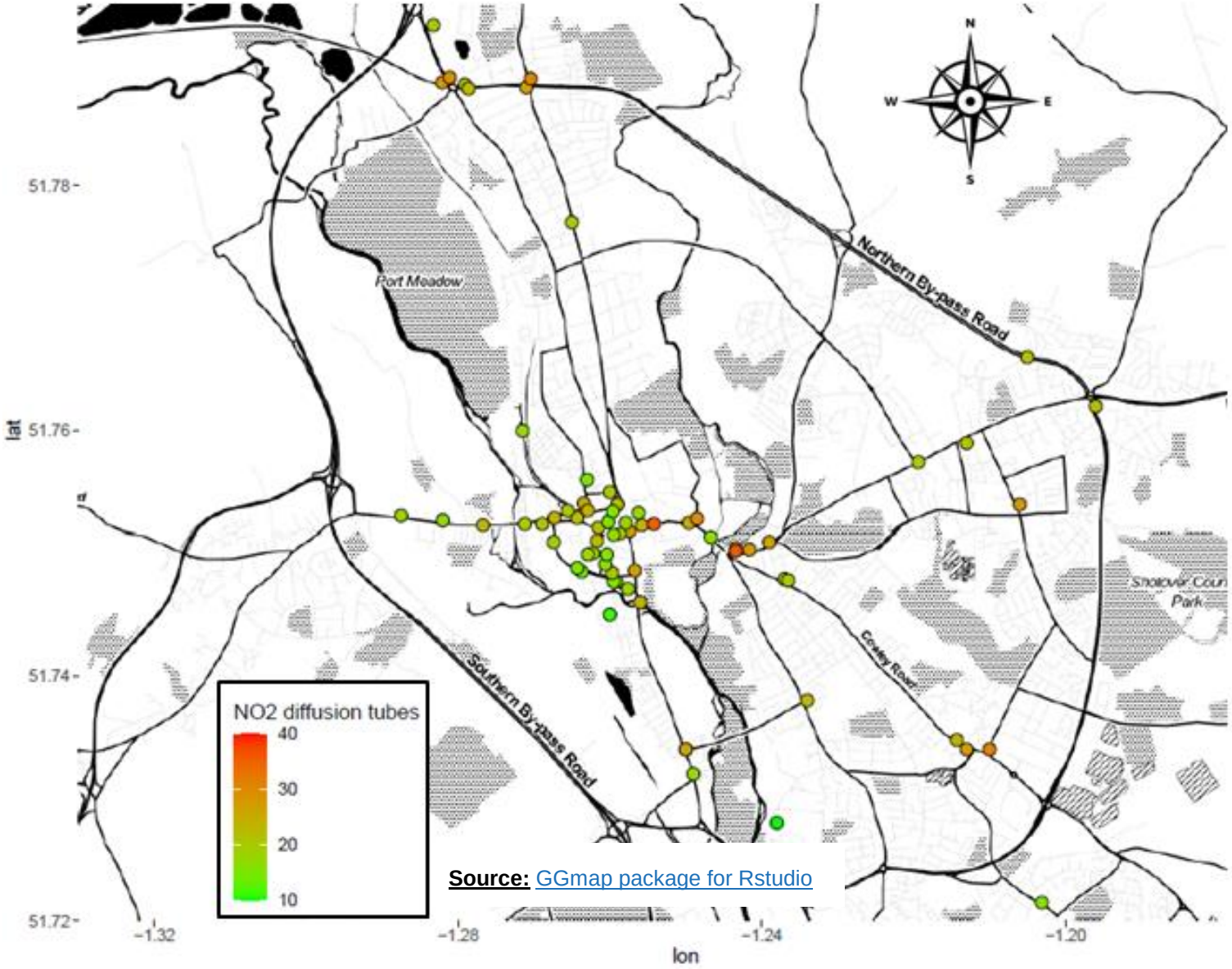

**Source**: DEFRA's national AQMA Interactive map

**Figure D 2- Oxford's automatic and passive monitoring locations, 2020**




**Source:** GGmap package for Rstudio

**Figure D 3- Oxford's diffusion tube locations by level of $NO_2$, 2020**




**Source:** GGmap package for Rstudio

**Figure D 4- Oxford city centre area: diffusion tube locations by level of $NO_2$, 2020**

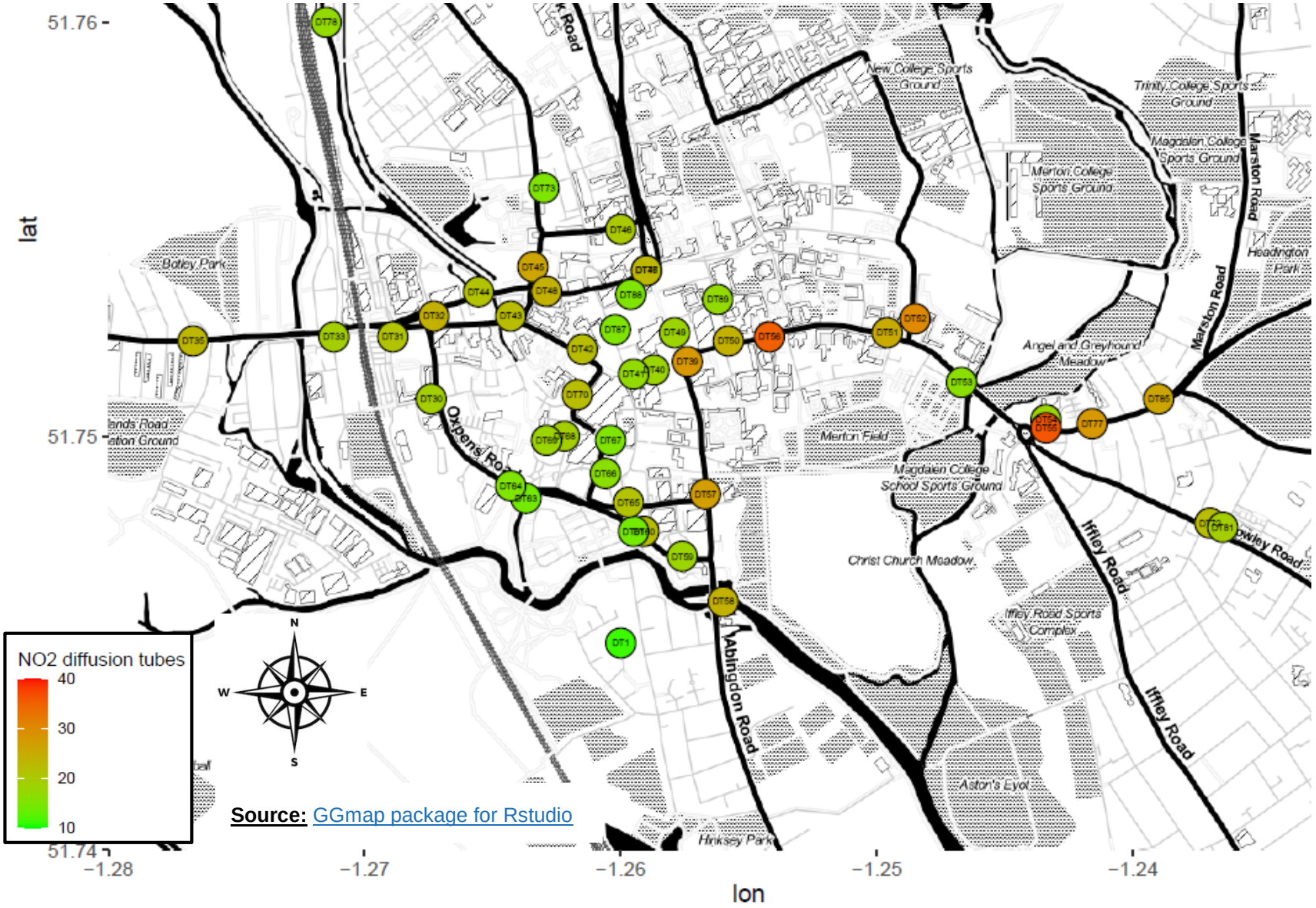


**Figure D 5- Westgate area: diffusion tube locations by level of $NO_2$, 2020**

**Figure D 6- Botley area: diffusion tube locations by level of $NO_2$, 2020**

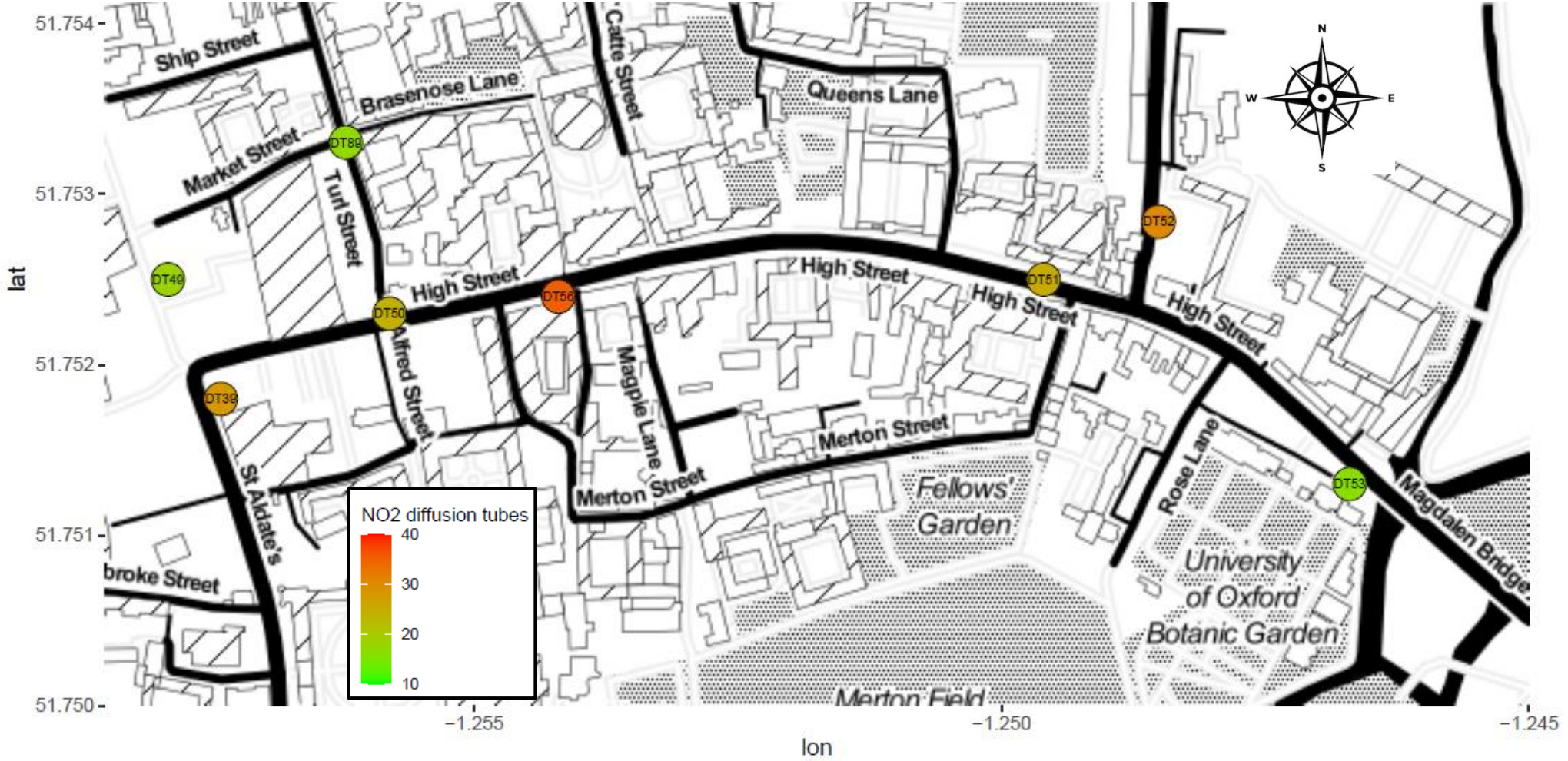

**Source:** GGmap package for Rstudio

**Figure D 7- St Clements area: diffusion tube locations by level of $NO_2$, 2020**

**Figure D 8- George Street area: diffusion tube locations by level of $NO_2$, 2020**


**Source:** GGmap package for Rstudio

**Figure D 9- High Street area: diffusion tube locations by level of $NO_2$, 2020**




**Source:** GGmap package for Rstudio

**Figure D 10- Cutteslowe/Wolvercote area: diffusion tube locations by level of $NO_2$, 2020**


**Source:** GGmap package for Rstudio

# Appendix E: Summary of Air Quality Objectives in England

## Figure E 1 – Air Quality Objectives in England[12]

| Pollutant | Air Quality Objective: Concentration | Air Quality Objective: Measured as |
|---|---|---|
| Nitrogen Dioxide ($NO_2$) | 200µg/$m^3$ not to be exceeded more than 18 times a year | 1-hour mean |
| Nitrogen Dioxide ($NO_2$) | 40µg/$m^3$ | Annual mean |
| Particulate Matter ($PM_{10}$) | 50µg/$m^3$, not to be exceeded more than 35 times a year | 24-hour mean |
| Particulate Matter ($PM_{10}$) | 40µg/$m^3$ | Annual mean |
| Particulate Matter ($PM_{2.5}$)[13] | 25 µg/$m^3$ | Annual mean |
| Ozone ($O_3$) | 100 µg/$m^3$ not to be exceeded more than 10 times a year | 8 hour mean |

## Figure E 2- World Health Organisation recommended guidelines

| Pollutant | Guidelines for each pollutant | |
|---|---|---|
| | Concentration | Measured as |
| Nitrogen Dioxide ($NO_2$) | 200 µg/m3 | 1-hour mean |
| | 40 µg/m3 | Annual mean |
| Particulate Matter ($PM_{10}$) | 50 µg/m3 | 24-hour mean |
| | 20 µg/m3 | Annual mean |
| Particulate Matter ($PM_{2.5}$) | 25 µg/m3 | 24-hour mean |
| | 10 µg/m3 | Annual Mean |
| Ozone ($O_3$) | 100 µg/m3 | 8-hour mean |

[12] The units are in microgrammes of pollutant per cubic metre of air (µg/$m^3$).

[13] Non-mandatory target value, to be achieved by 2020.

# Appendix F: Impact of COVID-19 upon LAQM

COVID-19 has had a significant impact on society. Inevitably, COVID-19 has also had an impact on the environment, with implications to air quality at local, regional and national scales.

COVID-19 has presented various challenges for Local Authorities with respect to undertaking their statutory LAQM duties in the 2021 reporting year. Recognising this, Defra provided various advice updates throughout 2020 to English authorities, particularly concerning the potential disruption to air quality monitoring programmes, implementation of Air Quality Action Plans (AQAPs) and LAQM statutory reporting requirements. Defra has also issued supplementary guidance for LAQM reporting in 2021 to assist local authorities in preparing their 2021 ASR. Where applicable, this advice has been followed.

## Impacts of COVID-19 on Air Quality within Oxford

The main impacts of COVID-19 on air quality within Oxford have already been considered and present in this report's "*Executive Summary*" section. Nevertheless, a short bulleted list summary of the main impacts is presented below:

- Ricardo Energy & Environment have presented two air quality analysis of COVID-19 lockdown on UK local air pollution throughout 2020:
    a) The first analysis was focused in the first air quality changes already in March 2020, going through the period where the first social distancing was recommended (16th March), and also including the periods going from the start of the lockdown (23rd March). This preliminary analysis was already showing that $NO_2$ levels measured at AURN Oxford Centre roadside were experiencing a reduction of 44% due to those initial restrictions;
    b) The second analysis extended the original analysis to early May, and showed that by then, $NO_2$ levels measured at AURN Oxford Centre roadside had already been reduced by 59% (when compared with a "*Business as Usual scenario*"). It's important to say that in both analysis, the impact of weather was removed from the equation, in order to allow proper quantification of COVID-19 impacts on air quality.
- A more detailed analysis on COVID-19 lockdown and its effects on air quality can also be found for Oxford High Street ($NO_x$) and AURN St Ebbes ($O_3$) on AQ England website. The analysis covers the entire 2020 period.

- Analysis of the city's entire air quality monitoring dataset have shown average reductions of $NO_2$, $PM_{10}$ and $PM_{2.5}$ of 29%, 19% and 22% respectively in 2020.
- Analysis of traffic data provided by Oxfordshire County Council show that during the period that goes from the start of the pandemic (23/03/2020) until the end of the year (31/12/2020), Oxford city centre's effective traffic reduction was of 35%.

## Opportunities Presented by COVID-19 upon LAQM within Oxford

The reduction of traffic, noise, and air quality levels were not the only positive things that were brought about by COVID-19. This pandemic has also allowed people to start thinking more about the current system we have as a society, and to question whether some significant changes should be made to the way we currently live our lives. In March 2021, the UK Government, conscious of the need to come up with a strategy that could ensure the restoration of physical infrastructure, social systems and shelter, and the revitalization of livelihoods, economies, and the environment, have produced the Build Back Better plan.

At local level, and throughout the pandemic, both City and County Councils have actively worked together towards the fast implementation of several active travel measures and opportunities to support businesses and to improve life quality in the city:

- The City Council have established an inclusive travel focus group in May 2020, which includes people with disabilities and those representing disability charities, to scrutinise changes to the city centre and make recommendations for an inclusive economic and city centre recovery post pandemic;
- Pedestrianisation trials were conducted in some streets in Oxford city centre in July and August 2020 such as St Michael's street and George Street to enable businesses to introduce outdoor dining and improve public realm;
- A two-way central cycle lane was also retained on George Street through the road closure, and bus stops were moved to nearby roads. The City Council and County Council have also made parking at Oxford's five Park and Ride sites free throughout August 2020;
- The City Council has introduced a one-way pedestrian flow system in Oxford city centre and the Cowley Road to help people maintain social distancing; installed new bike parking at Oxford's park and rides and in Oxford city centre; and created

designated rest areas to keep pedestrians moving in the city centre's busy and narrow streets;

- County Council, with the support of the City Council in principle, have introduced trials of new Low Traffic Neighbourhoods (LTNs) , school street closures and e-scooter hiring scheme, in order to support and accelerate the Green recovery;
- The County Council successfully responded to the central government's emergency active travel fund, with £2.98 million being awarded to transform active travel in Oxfordshire. The funding was announced by the Secretary of State on 23 May 2020 as part of the work to combat the COVID-19 pandemic.

**Figure F 1 – Pedestrianisation trials at George St (left) and St Michaels St (right)**


## Challenges and Constraints Imposed by COVID-19 upon LAQM within Oxford

In Oxford, the biggest challenges and/or constraints that have been experienced in relation to LAQM within 2020 that can be attributed to the pandemic, have mainly to do with delays on the implementation on a few projects that are linked with the delivery of some of the new actions to be delivered under the city's new AQAP. In particular:

- The official launch of the ZEZ Pilot which was moved from December 2020 to August 2021, due to the impacts of the COVID-19 pandemic, and in recognition that businesses and residents across the city, including those directly impacted by the scheme would need to focus all of their attention on managing the current and potential impacts on their trade and way of life – **Medium Impact**

- The launch of a new city wide LEZ for Euro VI buses was moved from December 2020 to December 2021 due to the impacts of the COVID-19 pandemic – **Medium Impact**;
- The delivery of the covered market's cargo bike pilot has suffered significant delays due to the restrictions of movements affecting not only the delivery of essential cargo bike parts, which were needed by the supplier to build the e-cargo bikes, but also covered market's capability to be open for business – **Small Impact**
- The delivery of the communication plan to engage and support businesses with the transition to the ZEZ has suffered significant delays due to businesses being shut during the several lockdowns imposed throughout 2020 – **Small Impact**
- The delivery of the STOP Project and continuous engagement with primary schools in Oxford to raise awareness of air pollution and promote active travel was put on hold due to schools being closed for long periods of time in 2020 and due to restrictions of movements and on public gatherings – **Medium Impact**

The impacts as presented above are aligned with the criteria as defined in Table F 1, with professional judgement considered as part of their application.

## Table F 1 – Impact Matrix

| Category | Impact Rating: None | Impact Rating: Small | Impact Rating: Medium | Impact Rating: High |
|---|---|---|---|---|
| Automatic Monitoring – Data Capture (%) | More than 75% data capture ☑ | 50 to 75% data capture | 25 to 50% data capture | Less than 25% data capture |
| Automatic Monitoring – QA/QC Regime | Adherence to requirements as defined in LAQM.TG16 ☑ | Routine calibrations taken place frequently but not to normal regime. Audits undertaken alongside service and maintenance programmes | Routine calibrations taken place infrequently and service and maintenance regimes adhered to. No audit achieved | Routine calibrations not undertaken within extended period (e.g. 3 to 4 months). Interruption to service and maintenance regime and no audit achieved |
| Passive Monitoring – Data Capture (%) | More than 75% data capture ☑ | 50 to 75% data capture | 25 to 50% data capture | Less than 25% data capture |
| Passive Monitoring – Bias Adjustment Factor | Bias adjustment undertaken as normal ☑ | <25% impact on normal number of available bias adjustment colocation studies (2020 vs 2019) | 25-50% impact on normal number of available bias adjustment studies (2020 vs 2019) | >50% impact on normal number of available bias adjustment studies (2020 vs 2019) and/or applied bias adjustment factor studies not considered representative of local regime |
| Passive Monitoring – Adherence to Changeover Dates | Defra diffusion tube exposure calendar adhered to ☑ | Tubes left out for two exposure periods | Tubes left out for three exposure periods | Tubes left out for more than three exposure periods |
| Passive Monitoring – Storage of Tubes | Tubes stored in accordance with laboratory guidance and analysed promptly. ☑ | Tubes stored for longer than normal but adhering to laboratory guidance | Tubes unable to be stored according to be laboratory guidance but analysed prior to expiry date | Tubes stored for so long that they were unable to be analysed prior to expiry date. Data unable to be used |
| AQAP – Measure Implementation | Unaffected | Short delay (<6 months) in development of AQAP measures, but is on-going ☑ | Long delay (>6 months) in development of AQAP measures, but is on-going ☑ | No progression in development of any AQAP measures |
| AQAP – New AQAP Development | Unaffected ☑ | Short delay (<6 months) in development of a new AQAP, but is on-going | Long delay (>6 months) in development of a new AQAP, but is on-going | No progression in development of a new AQAP |

# Appendix G: Time variations and calendar plots of Oxford's automatic monitoring

**Figure G 1 - $NO_2$ time variations at Oxford's 3 automatic monitoring sites along calendar year 2020**

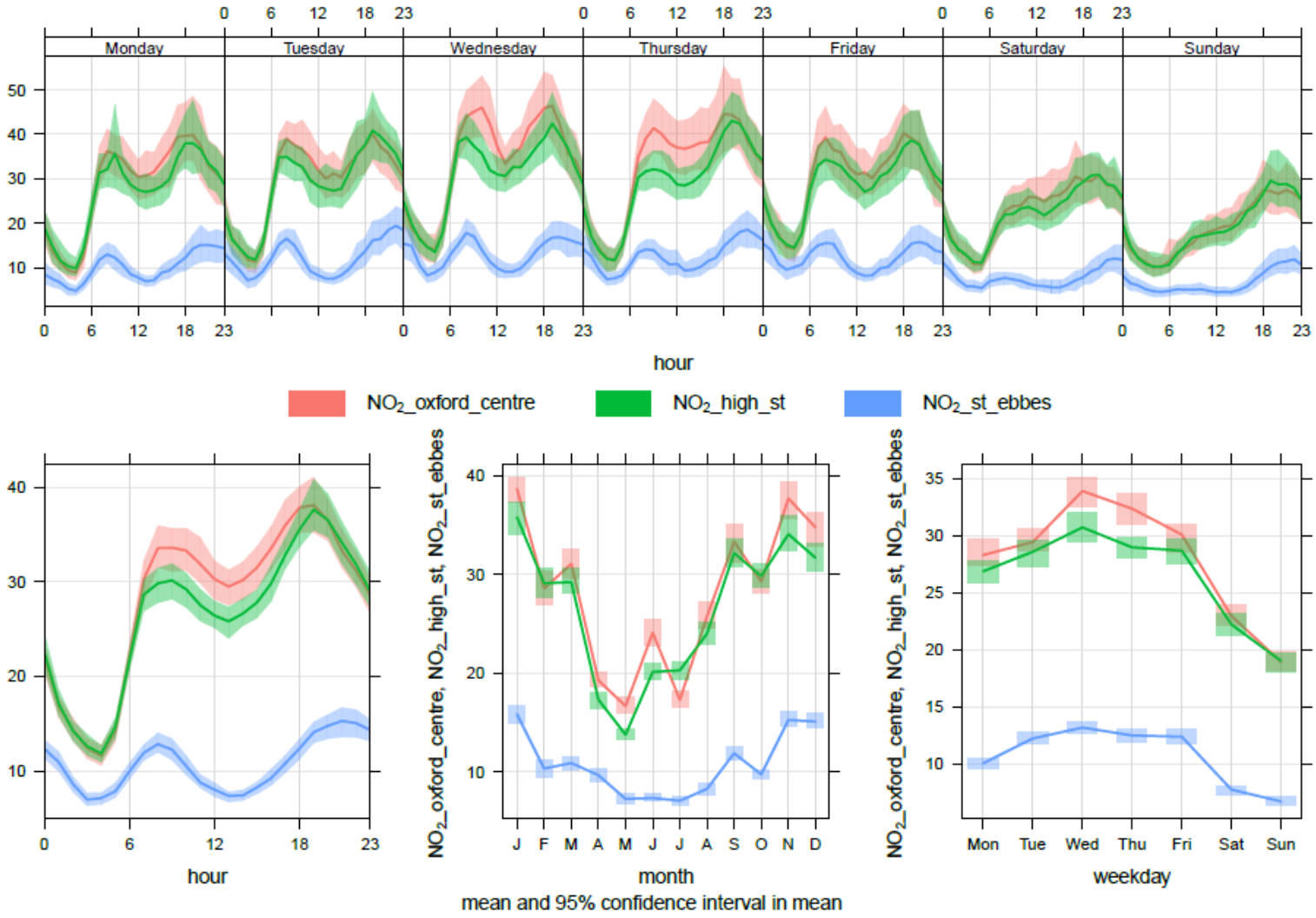


**Figure G 2 - Daily $NO_2$ averages at AURN automatic monitoring station of Oxford Centre roadside along calendar year 2020**

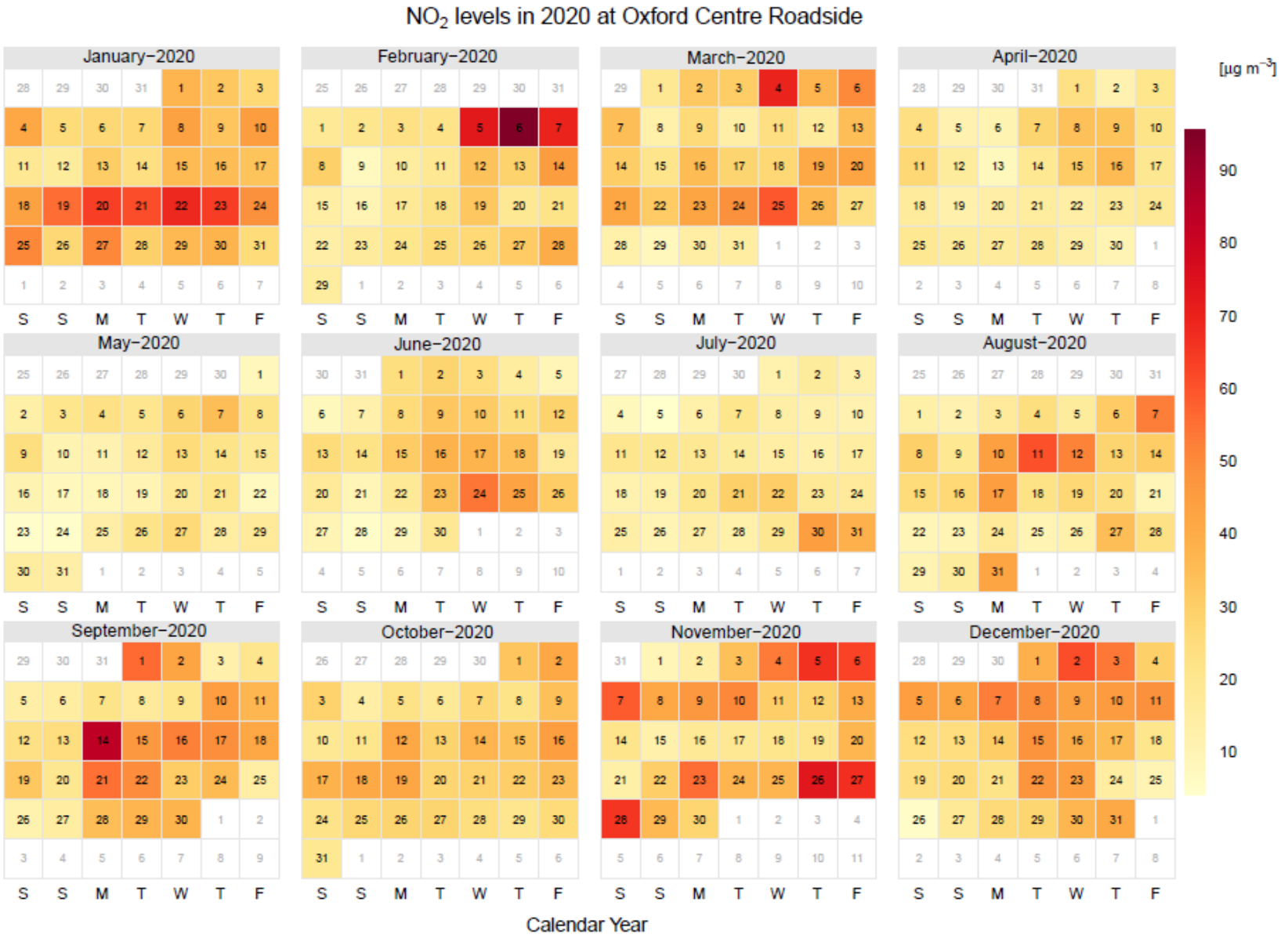


**Figure G 3 – Daily $NO_2$ averages at AURN automatic monitoring station of Oxford St Ebbes along calendar year 2020**

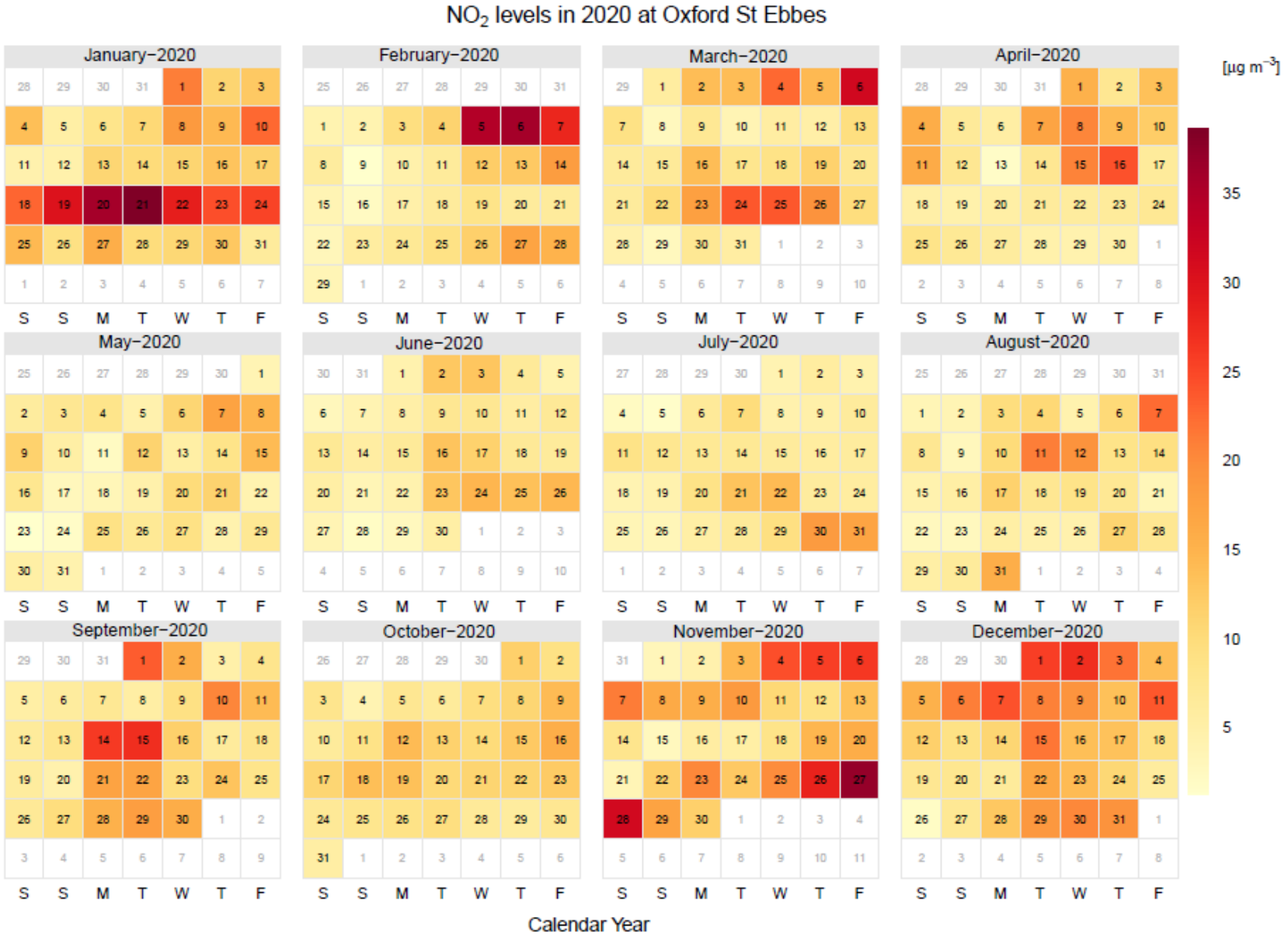
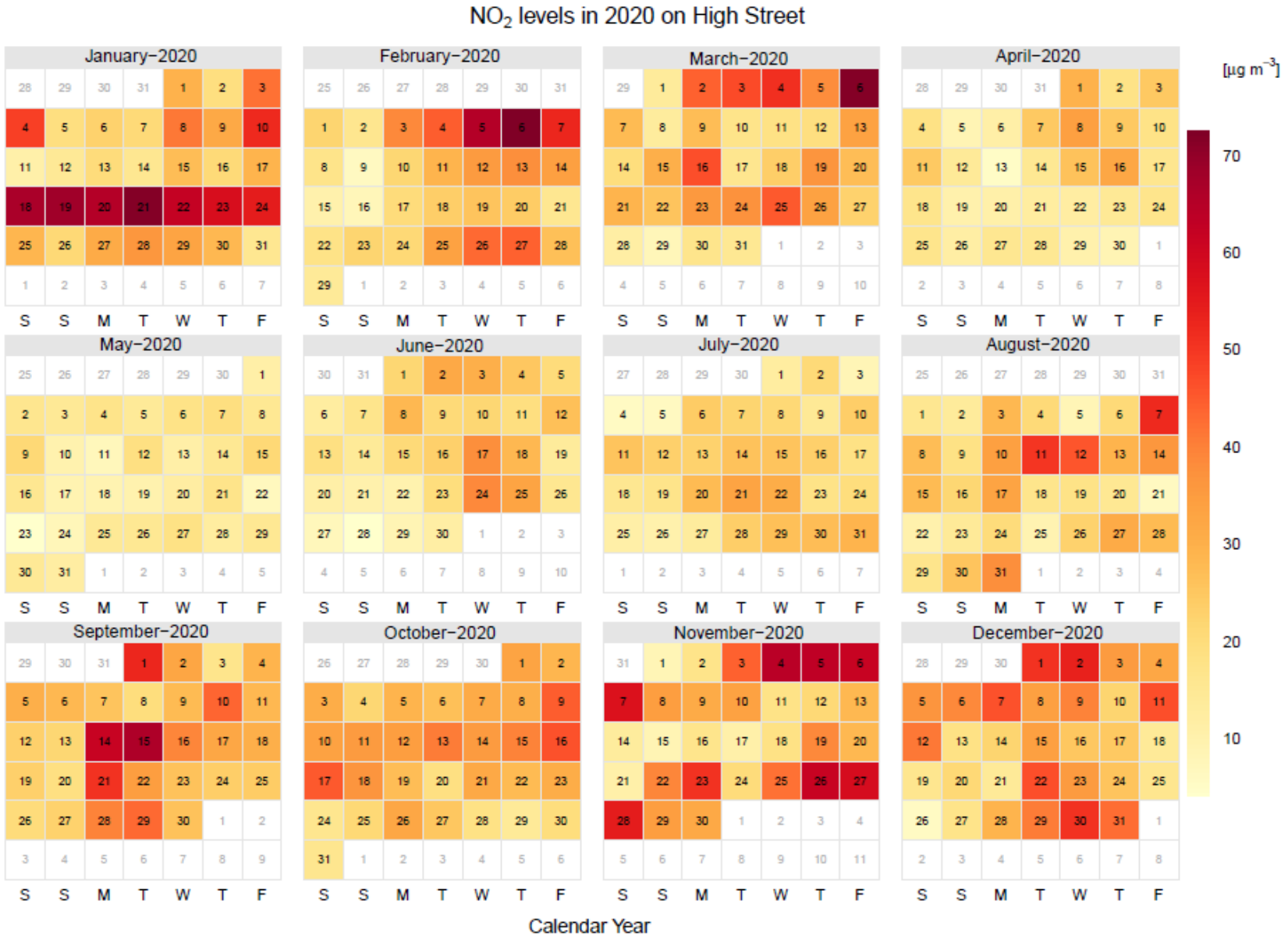


**Figure G 4 - Daily $NO_2$ averages at automatic monitoring station of Oxford High Street along calendar year 2020**



# Appendix H: DEFRA's Appraisal of the ASR 2020

*The Report sets out the Annual Status Report, which forms part of the Review & Assessment process required under the Environment Act 1995 and subsequent Regulations.*

*Oxford City Council declared a city-wide AQMA in 2010 for exceedances of the annual mean objective for $NO_2$. Concentrations have declined significantly since its declaration.*

*Oxford City Council undertook continuous (automatic) monitoring of $NO_2$ at two roadside and one urban background location during 2020. Automatic monitoring of $PM_{10}$ was undertaken at 2 locations, and $PM_{2.5}$ at one location. Ozone ($O_3$) was also monitored at one location.*

*Non-automatic (passive) monitoring of $NO_2$ was undertaken at 71 sites across the city during 2020. A maximum annual mean $NO_2$ concentration of 36 µg/$m^3$ was recorded at DT55, St Clements, a renowned hotspot location. In terms of particulate matter concentrations, a maximum annual mean $PM_{10}$ concentration of 16 µg/$m^3$ was recorded at CM2 (Oxford High Street, roadside). An annual mean $PM_{2.5}$ concentration of 7 µg/$m^3$ was also recorded, however it is noted that the $PM_{2.5}$ monitor is located in an urban background environment.*

*All monitoring sites demonstrated compliance with the annual mean objective for $NO_2$ during 2020, for the first time since monitoring across the city commenced. Whilst this achievement is to be commended, it is important to note that the significant decline in concentrations across Oxford, and the UK as a whole, is attributable to reduced traffic flows as a result of national lockdowns during the COVID-19 pandemic, and therefore the results must be interpreted with caution. Therefore, $NO_2$ concentrations recorded during 2020 should not be used in isolation to determine the success of any existing AQAP measures, nor should they solely be used as grounds for progressing amendments to existing AQMAs or justifications ceasing of interventions.*

*The Council opted to apply a local bias adjustment factor to their monitoring results for 2020. Due to the operation of a roadside and urban background co-location study, the Council calculated two local bias adjustment factors, and applied these to their roadside and urban background monitoring sites, respectively. As indicated by the Council, this approach is considered robust and avoids the application of a bias adjustment factor derived from a local collocation study carried out for concentrations that are very different to those being measured in the wider survey, as stipulated within the LAQM Helpdesk briefing note issued in March 2010. Full calculations for local factor derivation have been provided, in addition to a detailed discussion and justification of the Council's choice of factor.*

*Data capture across the monitoring network was sufficient at all sites, and therefore annualisation was not required. Additionally, all sites recorded concentrations ≤36 µg/m$^3$ and therefore distance correction was not required.*

*Oxford City Council released a new AQAP in January 2021 which contains 30 measures to improve air quality across the city from 2021 to 2025. Notable progress on AQAP measures during 2020 includes:*

- *An agreement reached in July 2020, together with Oxfordshire County Council, for work to be accelerated, where feasible, on Connecting Oxford, the Zero Emission Zone and the wider sustainable and active travel programme.*
- *Supported the successful delivery of Oxford County Council's new Street Tag app in October 2020. The app forms part of County Council's active travel plans to increase exercise and improve air quality in Oxfordshire.*
- *Schools across Oxford were invited in March 2020 to take part in a competition, organised by the City Council and Oxford Friends of the Earth to create a banner raising awareness about the effects of air pollution, and to promote sustainable transport on the school run. The competition is part of the City Council's STOP (Schools Tackling Oxford's Air Pollution) project which aims to raise awareness of the main sources and health effects of air pollution emissions among the school community.*

*The report outlines key priorities for the coming year, including:*

- *Delivery of the ZEZ pilot scheme in August 2021;*
- *Continued rollout of 100 EV chargers across the city, as part of the GULO project;*
- *Introduction of a new Euro VI LEZ for buses in Oxford in December 2021; and*
- *Full delivery of Oxford's Urban Tree Strategy.*

*On the basis of the evidence provided by the local authority the conclusions reached are* ***accepted*** *for all sources and pollutants. The next step is for Oxford City Council to submit an Annual Status Report in 2022.*

## *Commentary*

*The report is well structured, detailed, and provides the information specified in the Guidance. The following comments are designed to help inform future reports.*

1. *The Council have submitted an extremely detailed and well-written report, which contains all required content.*
2. *The report contains colour-coded maps of monitoring locations, which serve as a useful visual aid in the interpretation of monitoring results. The inclusion of such maps is encouraged in future reports. The plots provided in Appendix G ($NO_2$ time-variation and daily mean $NO_2$ concentration at the Oxford City AURN), whilst not specified per the prescribed template, are a useful addition and provide a greater insight into temporal fluctuations in $NO_2$ concentrations.*
3. *The Council opted to apply local bias adjustment factors to their monitoring data for 2020. Full calculations are provided for both a roadside and an urban background local bias adjustment factor, which is commended. It is also noted that the report contains detailed justification of the Council's choice of factor, which adheres with good practice. Moreover, the local factors calculated by the Council are higher than the appropriate national bias adjustment factor for 2020, and therefore the results presented are more conservative.*
4. *All monitoring sites recorded concentrations ≤36 µg/$m^3$ and therefore distance correction was not required. Should distance correction be required in future years, it is expected that example calculations are provided, in addition to a brief discussion on methodology.*
5. *The report provides excellent discussion of pollutant trends, in addition to a discussion on the impact of COVID-19 on the city's pollutant concentrations during 2020. This level of detail is commended, and demonstrates the Council's commitment to improving air quality across their jurisdiction.*
6. *The report draws links to the PHOF and the fraction of mortality attributable to $PM_{2.5}$ emissions. Comparisons have been made between Oxford City and neighbouring authorities, and England as a whole. This demonstrates a key understanding of the adverse effects of $PM_{2.5}$, which is fundamental in the development of actions to tackle $PM_{2.5}$ concentrations.*

# 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' |
| AQEG | Air Quality Expert Group |
| AQI | Air Quality Index – The AQI Tells you about levels of air pollution and provides recommended actions and health advice. The index is numbered 1-10 and divided into four bands, low (1) to very high (10) |
| 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 – Document produced by the UK Government that sets out all the national plans and policy options for dealing with all sources of air pollution in the UK from today into the long term |
| ASR | Annual Status Report –Document that reviews on an annual basis current and likely future air quality and assess whether air quality objectives are currently being achieved or are likely to be achieved |
| AURN | Automatic Urban & Rural Network |
| CAZ | Clean Air Zone |
| CBTF | Clean Bus Technology Fund |
| COVID-19 | Disease caused by a new strain of coronavirus. CO stands for corona, VI for virus and D for disease |
| DEFRA | Department for Environment, Food and Rural Affairs |
| DfT | Department for Transport |
| DPF | Diesel Particulate Filter – Filter that captures and stores exhaust soot in order to reduce emissions from diesel cars |
| DT | Diffusion Tube |
| Euro VI | European emission standard for Heavy-Duty Truck and Bus engines |
| EVs | Electric Vehicles |
| eRCV | Electric Refuse Collection Vehicle |
| FIDAS | Fine Dust Monitor System that uses optical light scattering to detect and measure aerosol particles |
| FoE | Friends of the Earth |
| GOLEV | UK Government's Office for Low Emission Vehicles |
| GULO | Go Ultra Low Oxford project |

| Abbreviation | Description |
|---|---|
| LAQM | Local Air Quality Management – A UK Government policy framework that requires local authorities to periodically review and assess the current and future air quality in their areas |
| LAQM PG16 | Local Air Quality Management Policy Guidance |
| LAQM TG16 | Local Air Quality Management Technical Guidance |
| LAs | Local Authorities |
| LEZ | Low Emission Zone - defined area where access by some polluting vehicles is restricted or deterred with the aim of improving air quality. This may favour vehicles such as (certain) alternative fuel vehicles, hybrid electric vehicles, plug-in hybrids, and zero-emission vehicles such as all-electric vehicles. |
| LTNs | Low Traffic Neighbourhoods –residential areas where vehicles not stopping in the area are prevented or discouraged from driving through them |
| LV | Limit Value – Legally binding pollution levels that must not be exceeded. LVs are set for individual pollutants and are made up of a concentration value, an averaging time over which it is to be measured, the number of exceedances allowed per year, if any, and a date by which it must be achieved. Some pollutants have more than one limit value covering different endpoints or averaging times. |
| NHS | National Health System |
| NO | Nitric Oxide –Formed from nitrogen (N) in the atmosphere during high temperature combustion |
| $NO_2$ | Nitrogen Dioxide – Formed in small amounts in the atmosphere during high temperature combustion, but the majority is formed in the atmosphere through conversion of nitric oxide (NO) in the presence of ozone ($O_3$) |
| $NO_x$ | Nitrogen Oxides – collective term used to refer to nitric oxide (NO) and nitrogen dioxide ($NO_2$). Nitrogen oxides are produced from fuel combustion in mobile (eg. cars) and stationary (eg power plants) sources. |
| $O_3$ | Ozone |
| OAQG | Oxfordshire Air Quality Group |
| ODS | Oxford Direct Services |
| OEMs | Original Equipment Manufacturers |
| OEVIS | Oxfordshire Electric Vehicle Infrastructure Strategy |
| PM | Particulate Matter |
| $PM_{10}$ | Airborne particulate matter with an aerodynamic diameter of 10µm or less |
| $PM_{2.5}$ | Airborne particulate matter with an aerodynamic diameter of 2.5µm or less |
| QA/QC | Quality Assurance and Quality Control |
| RUC | Road User Charging scheme |

| Abbreviation | Description |
|---|---|
| SCAs | Smoke Control Areas – legally defined area where only approved solid fuels or exempted appliances can be used within buildings |
| STOP | Schools Tackling Oxford's Air Pollution |
| TEA | Triethanolamine – Viscous organic compound that is used in diffusion tubes as an absorbent for $NO_2$ |
| TEOM | Tapered Element Oscillating Microbalance –Instrument used for real time detection of aerosol particles by measuring their mass concentration |
| µg | Microgramme – One millionth of a gram |
| µg/m$^3$ | Microgrammes per cubic metre of air – A unit for describing the concentration of air pollutants in the atmosphere, as a mass of pollutant per unit volume of clean air |
| UK | United Kingdom |
| VCM | Volatile Correction Model – Model developed by Kings College to correct TEOM concentrations to Gravimetric Equivalent |
| WHO | World Health Organisation |
| WPL | Workplace Parking Levy – Charge that a local authority can place on private business commuter parking to both manage peak time traffic congestion, improve air quality, and generate revenue for transport investment |
| ZEBRA | Zero Emission Bus Regional Areas scheme |
| ZEZ | Zero Emission Zone – area designed to reduce traffic volumes, encourage the uptake of zero emission vehicles and lead to other positive behavioural changes; all of these would reduce vehicle emissions and hence air pollution whilst maintaining access for those who need it |

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