BEDFORD
BOROUGH COUNCIL

2021 Air Quality Annual Status Report (ASR)

In fulfilment of Part IV of the Environment Act 1995

Local Air Quality Management

Date: August 2021

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Report Reference Number	BB - 2021
Date	August2021

Executive Summary: Air Quality in Our Area

Air Quality in Bedford

Air pollution is associated with a number of adverse health impacts. It is recognised as a contributing factor in the onset of heart disease and cancer. Additionally, air pollution particularly affects the most vulnerable in society: children, the elderly, and those with existing heart and lung conditions. There is also often a strong correlation with equalities issues because areas with poor air quality are also often less affluent areas[1,2].

The mortality burden of air pollution within the UK is equivalent to 28,000 to 36,000 deaths at typical ages[3], with a total estimated healthcare cost to the NHS and social care of £157 million in 2017[4].

Air quality in Bedford Borough is mostly **very good**, however, there are locations where pollutants build up and are slow to disperse due to traffic volumes and road traffic routes with unfavourable layouts/local geography.

The main pollutant of concern in Bedford Borough is Nitrogen dioxide (NO_2), the primary source of which is road traffic emissions. Bedford has several strategic transport routes including the A1, A421 and A6 which carry high levels of traffic. Traffic routes are constrained in and around the town centre by river, road and rail bridges, and one-way traffic systems have evolved in response to pinch points created by these constraints. This combined with high levels of car ownership and use results in congestion hotspots.

Bedford Borough Council is currently undertaking air quality monitoring for NO_2 at two automatic sites and at 55 passive diffusion tube sites. The 2020 monitoring results have determined that there are exceedances of the annual mean NO_2 objective at just one diffusion tube site at a location of relevant exposure within the AQMA. This is a reduction

[1] Public Health England. Air Quality: A Briefing for Directors of Public Health, 2017

[2] Defra. Air quality and social deprivation in the UK: an environmental inequalities analysis, 2006

[3] Defra. Air quality appraisal: damage cost guidance, July 2020

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

in the number of locations above the limit from 2019, when there were 4 locations above the exceedance limit. All diffusion tube results were lower than those in 2019, this can be explained in part by the Covid 19 pandemic which saw traffic levels reduced due to closure of offices, workplaces and shops. The lower results on the High street were also due to the temporary reduction to a single lane which is now to become permanent. DT27 (High Street) has historically been above 40 µg/m^3 every year since it was placed in 2004, it reduced in 2020 to 34 µg/m^3 from 42 µg/m^3 in 2019.

Bedford Borough Council has one AQMA - AQMA 5 Bedford Town Centre - https://uk-air.defra.gov.uk/aqma/details?aqma_ref=618

In the second half of 2021 the Covanta waste incinerator situated on the border of the Borough will become operational. This is an Environment Agency permitted activity with limits on emissions from the stack set as conditions within the permit for the site. The air quality in this area is very good and approximately 10K from AQMA 5. Two diffusion tubes are located in the area to monitor NO_2 and have been in place since 2018 to provide a baseline of data to be obtained prior to the site becoming operational.

As the pandemic lifts and travel begins to return to some degree of normality, it is anticipated that NO_2 levels will increase at a number of monitoring locations in general over the course of 2021 compared to results received in 2020. A number of actions in place aimed at reducing congestion and air pollution within the Borough, and potential longer term reductions to commuter travel may result in reductions from levels observed prior to the pandemic, in 2019.

Bedford Borough Council has submitted to DEFRA, for review, an updated Air Quality Action Plan for the AQMA 5 Bedford Town Centre covering the next five years. The Council is also working in close partnership with Transport, Public Health, Planning and other council departments to continue to identify pollution hotspots and key sources of pollution across the Borough, and opportunities and actions to improve local air quality.

Actions to Improve Air Quality

Whilst air quality has improved significantly in recent decades, and will continue to improve due to national policy decisions, there are some areas where local action is needed to further improve air quality.

The 2019 Clean Air Strategy[5] sets out the case for action, with goals even more ambitious than EU requirements to reduce exposure to harmful pollutants. The Road to Zero[6] sets out the approach to reduce exhaust emissions from road transport through a number of mechanisms; this is extremely important given that the majority of Air Quality Management Areas (AQMAs) are designated due to elevated concentrations heavily influenced by transport emissions.

Bedford Borough Council has recently submitted to DEFRA an updated Air Quality Action Plan for the Town Centre AQMA 5. The new AQAP covers the years 2021 to 2026. With the ultimate aim to achieve stable and compliant air quality concentrations across the Borough, and allow for the consideration of revocation of the Town Centre AQMA 5 by 2026.

A review of previously completed actions have shown that a number of key measures have contributed to an improvement in the number of diffusion tube locations above the 40 µg/m^3 limit.

The Council is also continuing to implement Transporting Bedford 2020, an 18 million investment to tackle traffic congestion across the town centre. These major works aim to reduce road traffic congestion and form a key part of the authority's actions to improve air quality and congestion within the town centre. Works to deliver this commenced in 2019 and were scheduled to be completed March 2021, however the Covid pandemic has delayed a number of these including the High street reduction to single lane which is currently underway and due for completion by the end of 2021. From May 2021, major improvement works commenced on Ampthill Road to reduce congestion and improve road safety. During these works, the road will be widened creating a second northbound lane which will be for buses and Ultra Low Emission Vehicles, enabling people to continue benefiting from the bus lane and encouraging the use of electric vehicles as they become more common. As part of this project, air quality monitoring has been installed in the form of Zephyr air quality monitors, which will give an indication of NO_2 levels as well as particulate matter (PM10 and 2.5).

[5] Defra. Clean Air Strategy, 2019

[6] DfT. The Road to Zero: Next steps towards cleaner road transport and delivering our Industrial Strategy, July 2018

Delayed work reducing the High Street to a single lane commenced early 2021. However for a large part of 2020 the High Street was reduced to a single lane to ensure social distancing in the town centre and the reduction in NO_2 levels can be partly attributed to this reduction.

Bedford Borough Council applied for a DEFRA air quality grant in 2020, to fund work on school streets project encouraging alternative travel to school and school road closures. As part of this air quality monitoring will be carried out on the school streets before and after the road closure to highlight the benefits from an air quality perspective.

Conclusions and Priorities

This Annual Status Report identifies that the annual mean objective for Nitrogen Dioxide (NO_2) exceeds at one location across the Borough and this location is within the AQMA. This is a reduction since 2019 from 4 exceedances and all diffusion tube results decreased between 2019 and 2020. One of the main reasons for these decreases is the reduction in traffic from March due to the Covid pandemic. The three diffusion tubes that fell below the 40 µg/m^3 limit were all in the AQMA and focused towards the town centre/high street.

Current priorities include publishing of the new AQAP for AQMA 5 Bedford Town Centre and the ongoing delivery of the Transporting Bedford 2020 projects.

The results published in next years ASR will still not represent ‘normal’ traffic volumes and it will take until the 2022 results to start to assess the impact of actions on air quality due to the covid pandemic. This may delay the reduction or revocation of the Bedford AQMA as guidance requires several years of consistent reductions in NO_2.

Local Engagement and How to get Involved

A dedicated link has been provided on the council website in relation to the work around Transporting Bedford 2020, which can be accessed here –

https://www.bedford.gov.uk/parking-roads-and-travel/strategies-and-projects/transporting-bedford-2020/

The air quality webpage has been updated on the Council website. Historic ASRs, Action Plans and Detailed Assessments are available from this site, and members of the public can

also report air quality issues via contact details provided on this page. The air quality webpage can be accessed here –

https://www.bedford.gov.uk/environmental-issues/noise-nuisances-and-pollution/air-quality/

How to get involved and make a positive difference:

- For shorter journeys, opt to use more sustainable travel options such as walking or cycling instead of the car.
- For longer journeys share lifts and carpool
- Where possible use buses, coaches and trains
- Switch your engine off and don't leave it running when your car is waiting stationary.
- Drive economically by accelerating smoothly, braking gently and obeying speed limits.
- Look after your vehicle with regular servicing and tyre pressure checks

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1 Local Air Quality Management

This report provides an overview of air quality in Bedford 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 Bedford Borough 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 Table E.1.

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 Bedford Borough Council can be found in Table 2.1. The table presents a description of the one AQMA that is currently designated within Bedford.

Appendix D provides maps of AQMA and also the air quality monitoring locations in relation to the AQMA. The air quality objectives pertinent to the current AQMA designation are as follows:

- 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
AQMA 5 Bedford Town Centre	06/11/2009	NO2 Annual Mean	An area encompassing the majority of properties within Bedford town centre, and incorporating the 2 previous AQMAs in the town centre	NO	59	41	AQAP for AQMA 5 sent for review August 2021	https://uk-air.defra.gov.uk/aqma/details?aqma_ref=618

☒ **Bedford Borough Council confirm the information on UK-Air regarding their AQMA is up to date**

☒ **Bedford Borough Council confirm that all current AQAPs have been submitted to Defra.**

Progress and Impact of Measures to address Air Quality in Bedford.

Defra's appraisal of last year's ASR concluded

- The Council have used an out-of-date bias adjustment factor spreadsheet used to derive their national factor for 2019. The report was submitted in October 2020, however the Council have used the 03/20 spreadsheet to obtain their factor of 0.93 (Gradko, 20% TEA in Water). Whilst this does not adhere to best practice, the factor applied is higher than the factors obtained from the 06/20 and 09/20 spreadsheets (0.92 and 0.91, respectively), and therefore there is no need for the Council to re-adjust. The Council are however advised to ensure they have utilised the most up-to-date information in all future reports prior to submission to the RSW.
  The data was analysed prior to the later factors being published, however this point is taken as noted and checked prior to publishing, although the local factor is used for this report.
- The Council have provided detailed discussion of QA//QC procedures, however have not provided supporting evidence for local factor calculation, despite stating a local factor of 0.85 has been calculated. Whilst this is not mandatory due to the application of the national factor, inclusion of calculations is encouraged for completeness, and would adhere to good practice.
  All factor calculations will be included in this report.
- The report does not draw links to the Public Health Outcomes Framework or the fraction of mortality attributable to PM2.5 emissions. The Council are encouraged to include this in future reports, in addition to a discussion of historical trends, a comparison between Bedford Borough and England as a whole, and a comparison to neighbouring authorities. For further guidance, please refer to LAQM Technical Guidance TG16.
  Noted and included in this report

Bedford Borough Council has taken forward a number of direct measures during the current 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. 11 measures are included within Table 2.2, with the type of measure and the progress Bedford Borough 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 the Bedford Borough Council Air Quality Action Plans 2021-2026 which has been sent to DEFRA for review. Key completed measures are:

• AQAP; the air quality action plan has been completed and reviewed by partners and agencies and subsequently been submitted to DEFRA.

• PM2.5 monitoring equipment; Monitoring equipment is to be installed early 2021 that will give an indication of the PM levels in some areas of the Borough. This equipment does not meet the standard for reporting, but will be used to obtain further information on indicative levels of PM2.5 and PM10 in some areas.

• Anti idling campaigns/school road closures: supporting the application for funding to educate and close school roads at peak times, including equipment for air quality monitoring/analysis.

• Transporting Bedford 2020 – some completed changes to improve traffic flow should see some improvements. Some works completed in 2020.

- Widening of Britannia Rd to ease congestion
- Junction improvements to improve traffic flow

• Planning guidance document: completed with internal review. To ensure planning applications consider air quality and provide support where mitigation is required.

- Continued electric charging point installation throughout the Borough

Bedford Borough Council expects the following measures to be completed over the course of the next reporting year:

- Air quality action plan published: with comments from DEFRA the AQAP will be published on line and the actions taken will aim to reduce the AQMA by 2026.
- Transporting Bedford 2020 – High street single lane reduction works to be completed. Ampthill Road ‘smart’ road works to begin: this will reduce traffic levels on the high street and aim to keep the pollutant levels at lower levels. Ampthill road works will encourage ULEV vehicle use and re direct traffic to less congested areas.
- School road closures and anti-idling campaigns: To educate and improve air quality at the peak times of drop off and pick up. Measuring of pollutants will be part of this

giving us an indication of levels at these times and improvement due to the closures.

- Further indications in the Borough of PM2.5 levels from equipment: Zephyr monitors will be installed in early 2021 and additional ones used as part of the school road closure project will give further indications of PM2.5 levels within the Borough and also confirm PM10 levels.

Bedford Borough Council's priorities for the coming year are:

- Progress toward publishing the air quality action plan 2021-2026 following comments/feedback from DEFRA.
- Continued provision of support towards the implementation of Transporting Bedford 2020.
- Improving air quality education of residents through project work, encouraging electric vehicle use and highlighting areas of congestion.

The principal challenges and barriers to implementation that Bedford Borough Council anticipates facing are:

- Covid pandemic: the pandemic has delayed some work beginning on transporting Bedford 2020 as well as progress on the action plan and the ongoing nature of this will cause further delays into 2021, it is anticipated that it may take some time to understand the new norm around ongoing changes to travel choices that may impact vehicle emissions at certain locations within the Borough, and also the impact of planned actions to bring about improvements to air quality such as those associated to Transporting Bedford 2020.
- Possible funding changes

Progress on the following measures has been slower than expected due to:

- Covid 19 has delayed progress on the transporting Bedford 2020 project, completing AQAP for submission, school road closure projects

Whilst the measures stated above and in Table 2.2 will help to contribute towards compliance, Bedford Borough Council anticipates that further additional measures not yet prescribed will be required in subsequent years to achieve compliance and enable the revocation of AQMA 5, although it may be possible to consider a reduction to the size of the current AQMA as evidence is gathered and reviewed over the coming years.

Table 2.2 – Progress on Measures to Improve Air Quality

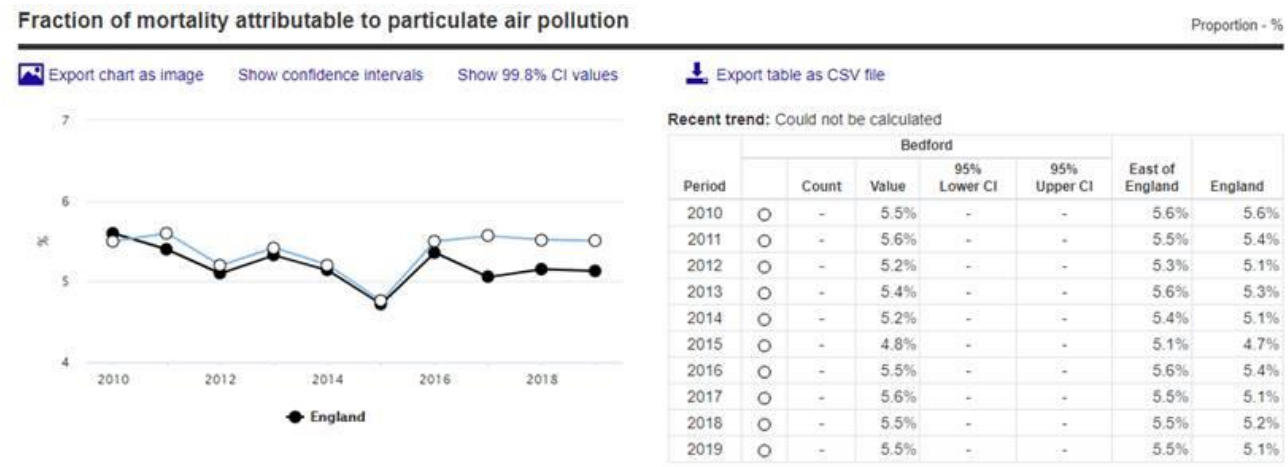
Measure No.	Measure	Category	Classification	Year Measure Introduced	Estimated / Actual Completion Year	Organisations Involved	Funding Source	Defra AQ Grant Funding	Funding Status	Estimated Cost of Measure	Measure Status	Reduction in Pollutant / Emission from Measure	Key Performance Indicator	Progress to Date	Comments / Barriers to Implementation
1	Grant application for School streets project - (pedestrian and cycling zones)	Traffic Management	Anti-idling enforcement	2020	2021	Bedford Borough Council - Public Health / Sustrans / Transport	DEFRA and LA	YES	Funded	£100k - £500k	Planning	unknown	get funding	application in progress	grant application successful works to commence
2	Purchase and installation of new chemiluminescent NO/N02 analyser	Other	Other	2020	2021	Bedford Borough Council	LA	No		£10k	Implementation	NO_2	New monitor in place	Installed May 2021	Complete
3	Reducing High street to single lane	Traffic Management	Strategic highway improvements, Re-prioritising road space away from cars, including Access management, Selective vehicle priority, bus priority, high vehicle occupancy lane	2020	2021	Bedford Borough Council - Transport	SEMLEP	No	Funded	£500k - £1 million	Implementation	NO_2 reduction in High street due to reduced vehicle emissions	High street NO2 below 40 ug/m3	works delayed due to covid, however single lane was implemented on a temporary measure from mid 2020	permanent works now underway
4	Ampthill road smart corridor including bus lanes, cycle lanes	Traffic Management	Strategic highway improvements, Re-prioritising road space away from cars, including Access management, Selective vehicle priority, bus priority, high vehicle occupancy lane	2020	2022	Bedford Borough Council - Transport		N0	Funded	£1 million - £10 million	Planning	NO_2 reduction due to improved traffic flow and encouraged use of Electric vehicles/cycling	Ampthill road NO_2 levels remaining below 40 µg/m3	works delayed due to covid however works are scheduled to start in spring 2021 and air quality monitoring to be installed early 2021 including for PM2.5	Due to covid 19 works delayed, now commencing
5	Updating urban traffic management control system upgrading signals and providing message signs highlighting congestion	Traffic Management	Strategic highway improvements, Re-prioritising road space away from cars, including Access management, Selective vehicle priority, bus priority,	2020	2021	Bedford Borough Council - Transport		No	Funded		Implementation	overall NO_2 reduction due to reduced congestion	overall reduction in NO_2	delayed due to covid but underway and due for completion late 2021	Delays due to COVID-19

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
			high vehicle occupancy lane												
6	Britannia road widening	Traffic Management	Strategic highway improvements, Re-prioritising road space away from cars, including Access management, Selective vehicle priority, bus priority, high vehicle occupancy lane	2019	2020	Bedford Borough Council - Transport		No	Funded		Completed	NO2 levels due to reduced congestion	reductions in levels in Ampthill road and Prebend street	completed 2020	
7	Bedford Borough Council agile working policy	Promoting Travel Alternatives	Encourage / Facilitate home-working	2015	2022	Bedford Borough Council	None	No	Not Funded		Implementation	NO2 levels due to reduced congestion	more staff working from home	due to Covid agile working increased massively and will encourage more staff in the future	
8	Air quality action plan for next 5 years	Policy Guidance and Development Control	Air Quality Planning and Policy Guidance	2019	2021	Bedford Borough Council	None	No	Not Funded		Completed		sent to DEFRA	submitted spring 2021	Delayed due to Covid-19
9	Air Quality planning guidance document	Policy Guidance and Development Control	Air Quality Planning and Policy Guidance	2019	2021	Bedford Borough Council	None	No	Not Funded		Implementation		guidance in place for planning	draft document completed, consultation with planning and planning policy during 2021	Delayed due to Covid-19
10	Electrifying rail line through the Borough	Alternatives to private vehicle use	Other	2020	2020	Network rail		No	Not Funded		Completed	NO_2 PM	electrifying line completed	completed 2020	
11	Installation of publicly available rapid charging points roadside/car parks	Promoting low emission transport	Procuring alternative Refuelling infrastructure to promote Low Emission Vehicles, EV recharging, Gas fuel recharging	2019	2020	Local Authority Transport		No			Ongoing	NO_2		30 new Charging points in place	

$PM_{2.5}$ – 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.

Between 2017 and 2019 an estimated 1,424 people in Bedford Borough died under the age of 75 (from all causes), and during the same period, 78 premature deaths (5.5%) were attributable to Particulate Air Pollution (this is expressed as the percentage of annual deaths from all causes in those aged 30+).



Period		Bedford Count	Bedford Value	Bedford 95% Lower CI	Bedford 95% Upper CI	East of England	England
2010	○	-	5.5%	-	-	5.6%	5.6%
2011	○	-	5.6%	-	-	5.5%	5.4%
2012	○	-	5.2%	-	-	5.3%	5.1%
2013	○	-	5.4%	-	-	5.6%	5.3%
2014	○	-	5.2%	-	-	5.4%	5.1%
2015	○	-	4.8%	-	-	5.1%	4.7%
2016	○	-	5.5%	-	-	5.6%	5.4%
2017	○	-	5.6%	-	-	5.5%	5.1%
2018	○	-	5.5%	-	-	5.5%	5.2%
2019	○	-	5.5%	-	-	5.5%	5.1%

This value is the same as the regional (East of England) and slightly above the England average.

Bedford Borough Council does not currently monitor PM2.5 concentrations (as per relevant guidelines), but has completed, in 2018, a review of estimated PM2.5 concentrations across Bedford. The results from this review suggested that annual mean PM2.5 concentrations in Bedford are between 10-12µg/m³. This compares favourably to the EU PM¬2.5 limit of 25µg/m³.

Modelled PM2.5 background data from DEFRA for 2020 (https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html) show the maximum background level was 11.15µg/m^3 at Elstow Interchange, Elstow, Kempston a roundabout on the A421, some distance from residential properties or pedestrians (the second highest of 10.56 µg/m^3 was also next to the A421). The third highest is 10.45 µg/m^3 which is located on Ampthill Road

close to the junction of Britannia Rd and the hospital. Two Zephyr monitors are to be installed in a single location on Ampthill Rd, Bedford from Feb 2021 close to the PM2.5 DEFRA background level and diffusion tube DT17. It is acknowledged that the Zephyr monitors are not the reference standards for monitoring NO_2 and PM however it will provide comparisons of NO_2 levels and indications of PM10 and 2.5 will be available. The average of all background PM2.5 throughout the Borough for 2020 was 9.20 µg/m^3.

The AQAP measures outlined in Table 2.2 are expected to help towards reducing the levels of PM2.5 within the Borough. A review of the smoke control areas is proposed in 2021, however currently a large part of Bedford and Kempston are already smoke control areas.

The Air Quality (Domestic Solid Fuels Standards) (England) Regulations 2020 came into force on 1st May 2021. Advice and guidance relating to these regulations have been sent to known solid fuel suppliers in the Borough and information made available on the web site.

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

This section sets out the monitoring undertaken within 2020 by Bedford Borough 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.

Summary of Monitoring Undertaken

3.1.1 Automatic Monitoring Sites

Bedford Borough Council undertook automatic (continuous) monitoring at 2 sites during 2020. A new continuous monitor has been bought and installed in the Prebend street location in May 2021.

Table A.1 in Appendix A shows the details of the automatic monitoring sites. The https://www.airqualityengland.co.uk/local-authority/?la_id=408

Web site presents automatic monitoring results for Bedford, with automatic monitoring results also available through the UK-Air website .

Maps showing the location of the monitoring sites are provided in Appendix D. Further details on how the monitors are calibrated and how the data has been adjusted are included in Appendix C.

3.1.2 Non-Automatic Monitoring Sites

Bedford Borough Council undertook non- automatic (i.e. passive) monitoring of NO_2 at 51 sites during 2020. Table A.2 in Appendix A presents the details of the non-automatic sites.

Maps showing the location of the monitoring sites are provided in Appendix D. Further details on Quality Assurance/Quality Control (QA/QC) for the diffusion tubes, including bias adjustments and any other adjustments applied (e.g. annualisation and/or distance correction), are included in Appendix C.

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.

3.1.3 Nitrogen Dioxide (NO_2)

Table A.3 and Table A.4 in Appendix A compare the ratified and adjusted 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 to fall-off with distance adjustment).

For diffusion tubes, the full 2020 dataset of monthly mean values is provided in Appendix B. Note that the concentration data presented in Table B.1 includes distance corrected values, only where relevant.

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

In 2020 there was one exceedance of the annual mean NO_2objective of 40µg/m^3 after bias adjustment and annualisation. This occurred at the following site located inside the Town Centre AQMA 5:

- DT20 Prebend Street – 41µg/m^3

This was a reduction from 4 exceedances in 2019 and 8 in 2018. The concentration at tube DT20 reduced from 47µg/m^3 in 2019, but as previously stated results will have been impacted by significant reductions to vehicle use associated to the pandemic, in particular April to June.

Prebend Street and Lurke Street automatic sites have demonstrated no exceedances of the annual mean or hourly mean NO_2 objectives in 2020. Additionally there are no diffusion tubes measuring annual mean concentrations greater than 60µg/m^3 in 2020, which indicates there are no exceedances of the hourly mean objectives at the diffusion tube sites either.

Overall trends demonstrate that of the 55 monitoring sites all 55 demonstrated reductions in concentrations compared to 2019.

Based on the 2020 monitoring results, it has been determined by the Council that the Bedford Town Centre AQMA should remain in place, due to the continued exceedances of the annual mean NO_2, objective at one site and due to significant reductions in vehicle use associated to the pandemic Covid these results are likely to be lower than usually seen due to decreased traffic. With work being carried out on the High street, if the High street results remain below 40 µg/m³ over the next three years we will be in a position to reduce the AQMA to just the area surrounding Prebend street.

Funding was applied for to carry out road diversion at the junction of Prebend street which was unsuccessful. However further discussions are underway to apply for funding to achieve better traffic flow at the Prebend street junction which is the location of the high NO_2 levels and this will go some way to reducing this number if successful.

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	Prebend street	Roadside	504496	249625	NO2	YES AQMA 5	Chemiluminescent	1	4.2	1.5
CM2	Lurke street	Roadside	505044	249980	NO_2	YES AQMA 5	Chemiluminescent	3.5	7.5	1.5

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)
DT5	Bromham Road, Bedford	Roadside	503819	250060	NO2	No	15.0	3.1	No	2.5
DT7	4 Bunyan Road, Kempston	Roadside	503160	247751	NO2	No	1.8	1.4	No	2.5
DT10	1 Kirkstall Close, Bedford	Other	505425	247063	NO2	No	5.0	2.0	No	2.5
DT12	8 The Lane, Wyboston	Roadside	516345	256592	NO2	No	10.0	2.7	No	3.0
DT13	Gt Nth Road, Wyboston - A1 South	Other	516420	256552	NO2	No	8.0	2.6	No	3.0
DT14	Horne Lane, Bedford	Roadside	504857	249652	NO2	Yes - AQMA 5	2.6	2.7	No	2.4
DT16	Kempston Road ,Bedford	Roadside	504585	249003	NO2	Yes - AQMA 5	6.0	3.9	No	2.2
DT17	Ampthill Road , Bedford	Roadside	504783	248711	NO2	Yes - AQMA 5	4.0	4.4	No	2.5
DT19	Kimbolton Road ,Bedford	Roadside	505551	250584	NO2	Yes - AQMA 5	9.0	1.1	No	2.5
DT20	Prebend Street ,Bedford	Roadside	504486	249616	NO2	Yes - AQMA 5	0.1	2.0	No	2.5
DT25	London Road crossroad	Roadside	505389	248858	NO2	Yes - AQMA 5	2.9	2.4	No	3.0
DT27	High St ladbrookes	Urban Centre	505057	249741	NO2	Yes - AQMA 5	0.2	2.3	No	2.5

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)
DT28	Prebend St corner of commercial road	Roadside	504576	249501	NO2	Yes - AQMA 5	2.8	2.5	No	2.4
DT29	Goldington Road opp uni	Roadside	506630	250274	NO2	Yes - AQMA 5	4.0	2.5	No	2.0
DT30	High St Barovic jewellers	Urban Centre	505020	250044	NO2	Yes - AQMA 5	2.0	1.4	No	2.3
DT31	High St, luddingtons	Urban Centre	505060	249766	NO2	Yes - AQMA 5	0.1	2.0	No	3.0
DT33	Shakespeare Road/Bromham Rd Junction	Roadside	504100	250142	NO2	Yes - AQMA 5	5.0	2.6	No	3.0
DT34	St Marys St kings arms PH	Roadside	505102	249411	NO2	Yes - AQMA 5	0.5	2.4	No	3.0
DT35	Prebend St, crown quay	Roadside	504599	249432	NO2	Yes - AQMA 5	3.0	3.3	No	2.2
DT36	37 Ashburnham Road	Roadside	504289	249711	NO2	Yes - AQMA 5	2.0	2.0	No	3.0
DT40	YMCA, Tavistock St	Roadside	504808	250232	NO2	Yes - AQMA 5	6.0	2.1	No	2.5
DT42	28 St Johns St	Roadside	505143	249299	NO2	Yes - AQMA 5	9.0	3.3	No	2.5
DT43	45 Dame Alice St	Roadside	504913	250038	NO2	Yes - AQMA 5	0.6	2.3	No	3.0
DT44	Midland Road-outside No.137,139A	Roadside	504423	249647	NO2	Yes - AQMA 5	0.2	2.4	No	2.0

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)
DT46	Midland Rd-outside Beegees opp Priory St	Urban Centre	504635	249724	NO2	Yes - AQMA 5	1.4	1.2	No	3.0
DT47	On corner Harpur St – opp 51A	Urban Background	504894	250049	NO2	Yes - AQMA 5	8.0	2.7	No	2.0
DT48	Outside Sound & Vision –Tavistock St	Urban Centre	504903	250199	NO2	Yes - AQMA 5	3.0	1.9	No	2.5
DT50	Outside John Bull – St Peters St	Urban Centre	505190	250075	NO2	Yes - AQMA 5	0.3	1.9	No	3.5
DT53	Outside Longstaff Gentle & Co – 59-61 Harpur St	Roadside	504907	250084	NO2	Yes - AQMA 5	1.9	2.5	No	2.5
DT54	Outside 63 – Union St	Roadside	504505	250361	NO2	Yes - AQMA 5	1.7	2.3	No	3.0
DT55	Opp urban & Rural on corner – Bromham Rd	Roadside	504475	250123	NO2	Yes - AQMA 5	4.0	2.4	No	2.5
DT57	Outside 110 - Newnham Av	Roadside	506626	250226	NO2	Yes - AQMA 5	2.4	1.2	No	2.2
DT61	Outside 185 Goldington Rd	Kerbside	506588	250254	NO2	Yes - AQMA 5	5.0	0.9	No	2.2
DT 62	Outside 139 Goldington Rd	Kerbside	506390	250243	NO2	Yes - AQMA 5	6.0	1.0	No	2.2
DT65	Outside no.43 London Rd	Roadside	505438	248793	NO2	Yes - AQMA 5	3.0	1.5	No	2.5
DT66, DT67, DT68	Monitoring station	Roadside	504495	249622	NO2	Yes - AQMA 5	1.7	3.7	Yes	2.0

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)
DT69	River Street, opposite chinese	Urban Centre	504734	249689	NO2	Yes - AQMA 5	0.3	3.8	No	3.0
DT70	Outside bus station	Urban Centre	504706	249860	NO2	Yes - AQMA 5	5.0	2.5	No	2.0
DT71	174 Ampthill Road ,Bedford	Roadside	504625	248169	NO2	No	3.0	4.4	No	2.5
DT72	150 Ampthill Road ,Bedford	Roadside	504648	248257	NO2	No	3.0	2.3	No	2.5
DT73	112 Ampthill Road ,Bedford	Kerbside	504684	248388	NO2	No	8.0	1.0	No	2.5
DT74, DT75, DT76	LS Monitor	Roadside	505044	249980	NO2	Yes - AQMA 5	2.0	5.0	Yes	1.5
DT 77	Green lane, Stewartby	Roadside	501574	242181	NO2	No	250.0	2.3	No	3.0
DT 78	churchill close, stewartby	Suburban	501878	242176	NO2	No	5.0	1.9	No	2.5
DT 79	Turner way off Manton Lane	Roadside	504356	251146	NO2	No	10.0	1.5	No	2.2
DT 80	Shakespeare Rd/Clapham Rd junction	Roadside	503946	250765	NO2	No	5.0	1.8	No	2.5
DT 81	Brooklands avenue - Wixams	Suburban	505273	245175	NO2	No	4.0	1.7	No	3.0
DT 82	32 Fields Rd, Wootton	Roadside	500968	244911	NO2	No	5.0	1.6	No	2.5

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)
DT 83	37 Cemetery road, off Branston way	Suburban	501595	247537	NO2	No	7.0	1.7	No	2.5
DT 85	Rope Walk/Cardington Rd	Roadside	505493	249254	NO2	No	10.0	1.5	No	2.5
DT 86	Outside 33 Goldington Rd	Roadside	505464	250142	NO2	Yes - AQMA 5	2.0	1.5	No	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.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	504496	249625	Roadside	Automatic	97	33	28	29	32	26
CM2	505044	249980	Roadside	Automatic	97	**41**	28	26	30	21

☒ **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
DT5	503819	250060	Roadside	78	59.6	29.0	27.0	30.0	22.9	17.9
DT7	503160	247751	Roadside	100	75.0	27.0	26.0	25.0	25.7	23.2
DT10	505425	247063	Other	100	75.0	25.0	25.0	24.0	21.7	19.3
DT12	516345	256592	Roadside	100	75.0	23.0	20.0	21.0	18.2	14.6
DT13	516420	256552	Other	78	57.7	26.0	27.0	23.0	21.8	21.6
DT14	504857	249652	Roadside	89	67.3	37.0	31.0	31.0	32.6	22.0
DT16	504585	249003	Roadside	89	67.3	27.0	26.0	28.0	26.7	21.1
DT17	504783	248711	Roadside	89	65.4	34.0	32.0	33.0	31.0	23.8
DT19	505551	250584	Roadside	100	75.0	28.0	25.0	26.0	24.8	21.1
DT20	504486	249616	Roadside	100	75.0	**60.0**	**50.0**	**44.0**	**47.4**	**41.3**
DT25	505389	248858	Roadside	100	75.0	**41.0**	**42.0**	39.0	34.6	30.6
DT27	505057	249741	Urban Centre	100	75.0	**47.0**	**40.0**	**41.0**	**42.0**	34.0
DT28	504576	249501	Roadside	100	75.0	**40.0**	34.0	34.0	32.4	27.3

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
DT29	506630	250274	Roadside	78	59.6	37.0	37.0	38.0	35.5	26.4
DT30	505020	250044	Urban Centre	89	67.3	**44.0**	**40.0**	**41.0**	38.8	31.4
DT31	505060	249766	Urban Centre	100	75.0	**42.0**	36.0	**40.0**	38.8	28.2
DT33	504100	250142	Roadside	89	67.3	**43.0**	38.0	38.0	36.3	27.5
DT34	505102	249411	Roadside	100	75.0	**45.0**	37.0	**42.0**	38.4	30.1
DT35	504599	249432	Roadside	100	75.0	37.0	33.0	36.0	36.3	29.1
DT36	504289	249711	Roadside	100	75.0	38.0	34.0	36.0	33.5	26.8
DT40	504808	250232	Roadside	100	75.0	24.0	26.0	25.0	25.1	20.6
DT42	505143	249299	Roadside	100	75.0	**43.0**	37.0	39.0	38.8	30.1
DT43	504913	250038	Roadside	89	65.4	39.0	35.0	**40.0**	31.5	22.9
DT44	504423	249647	Roadside	100	75.0	**40.0**	38.0	**42.0**	**40.2**	33.3
DT46	504635	249724	Urban Centre	100	75.0	35.0	36.0	34.0	36.6	32.1
DT47	504894	250049	Urban Background	89	65.4	31.0	27.0	30.0	32.5	21.2
DT48	504903	250199	Urban Centre	100	75.0	36.0	35.0	37.0	36.0	29.6

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
DT50	505190	250075	Urban Centre	100	75.0	**44.0**	**46.0**	**43.0**	**43.6**	36.1
DT53	504907	250084	Roadside	100	75.0	36.0	32.0	33.0	31.0	25.7
DT54	504505	250361	Roadside	100	75.0	38.0	32.0	31.0	30.0	24.2
DT55	504475	250123	Roadside	89	65.4	36.0	33.0	33.0	29.9	22.5
DT57	506626	250226	Roadside	100	75.0	34.0	34.0	33.0	31.5	25.2
DT61	506588	250254	Kerbside	100	75.0	37.0	37.0	34.0	33.3	27.9
DT 62	506390	250243	Kerbside	100	75.0	30.0	27.0	27.0	26.6	21.7
DT65	505438	248793	Roadside	89	65.4	31.0	31.0	31.0	34.3	26.3
DT66, DT67, DT68	504495	249622	Roadside	100	75.0	35.7	32.0	30.3	33.8	28.0
DT69	504734	249689	Urban Centre	78	57.7	34.0	31.0	30.0	32.3	24.0
DT70	504706	249860	Urban Centre	78	57.7	36.0	33.0	32.0	33.6	24.6
DT71	504625	248169	Roadside	100	75.0	37.0	31.0	32.0	30.6	26.7
DT72	504648	248257	Roadside	100	75.0	**41.0**	36.0	36.0	32.2	28.6
DT73	504684	248388	Kerbside	100	75.0	36.0	34.0	33.0	33.9	27.3

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
DT74, DT75, DT76	505044	249980	Roadside	100	75.0	38.0	30.3	28.3	27.5	21.5
DT 77	501574	242181	Roadside	89	67.3			19.0	18.5	12.6
DT 78	501878	242176	Suburban	89	67.3			15.0	15.1	10.4
DT 79	504356	251146	Roadside	100	75.0				22.7	19.7
DT 80	503946	250765	Roadside	100	75.0				33.9	27.1
DT 81	505273	245175	Suburban	100	75.0				16.6	15.2
DT 82	500968	244911	Roadside	100	75.0				17.8	14.6
DT 83	501595	247537	Suburban	100	75.0				22.1	18.4
DT 85	505493	249254	Roadside	100	75.0					23.7
DT 86	505464	250142	Roadside	89	67.3					23.4

☒ **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**.

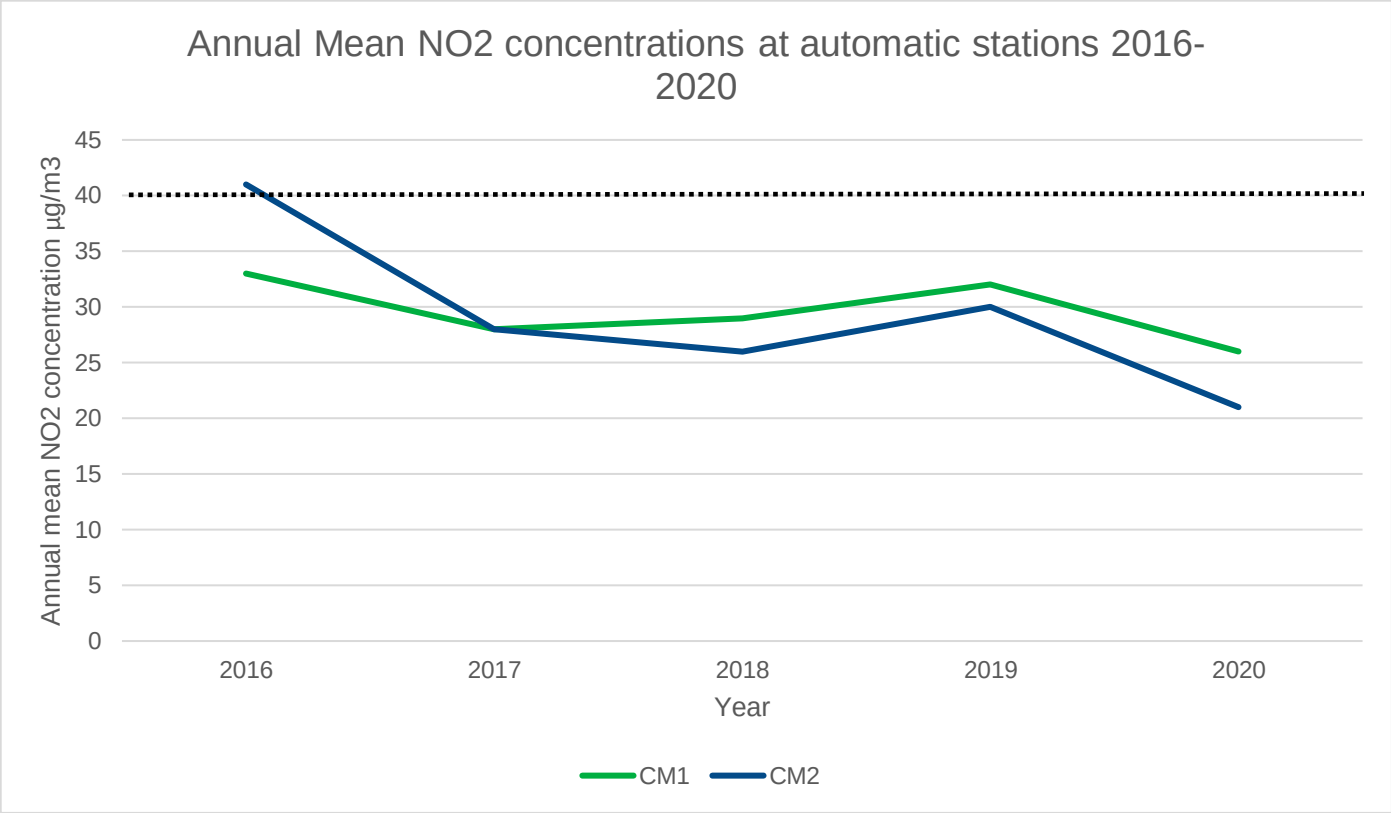
Means for diffusion tubes have been corrected for bias. All means have been "annualised" as per LAQM.TG16 if valid data capture for the full calendar year is less than 75%. See Appendix C for details.

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%).

Figure A.1 – Trends in Annual Mean NO_2 Concentrations



Annual mean NO_2 concentrations at diffusion tubes located inside the AQMA from 2016 to 2020

Annual mean NO_2 concentrations at diffusion tubes located outside the AQMA from 2016 to 2020

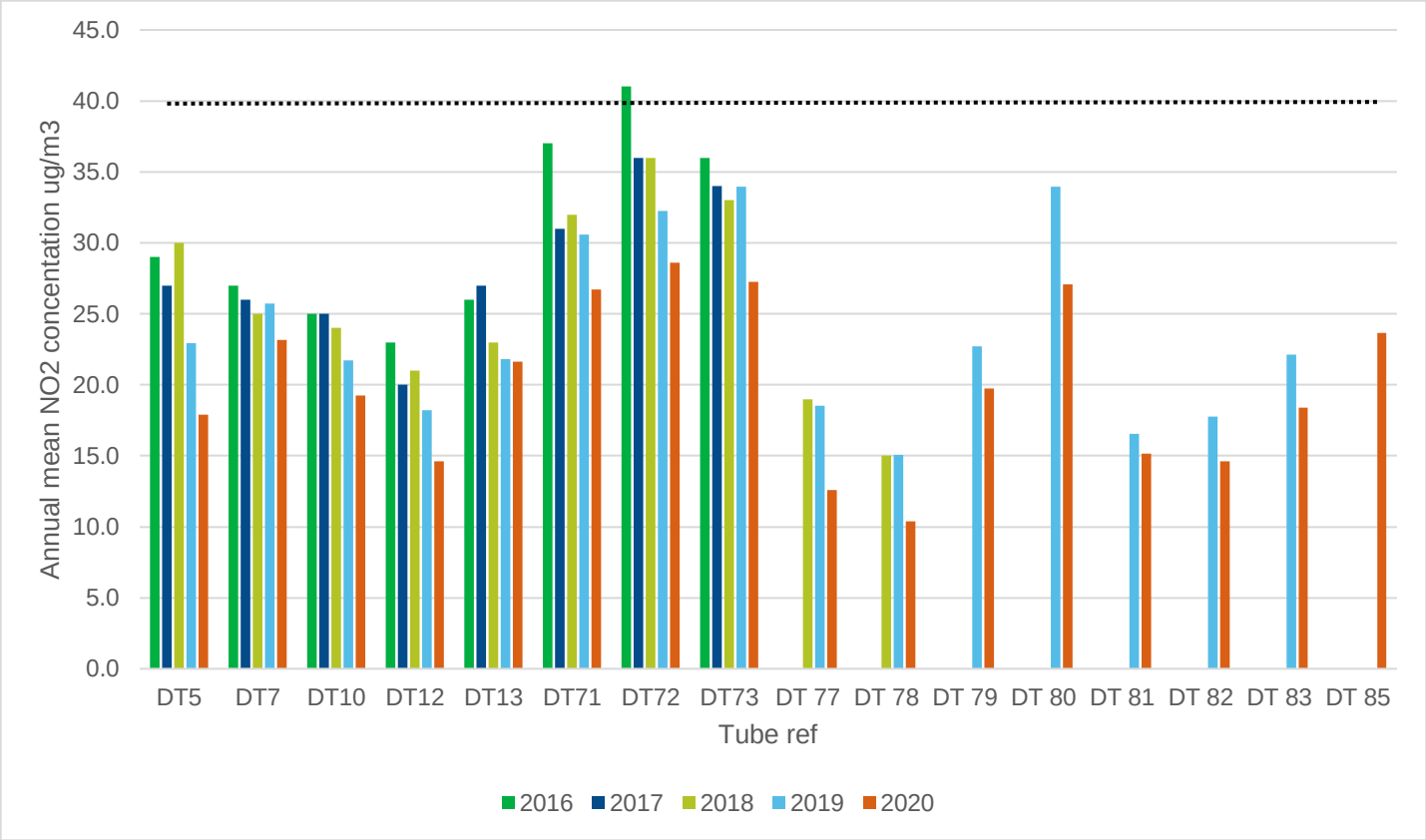


Table A.5 – 1-Hour Mean NO2 Monitoring Results, Number of 1-Hour Means > 200µg/m3

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	504496	249625	Roadside	Automatic	97	0	0	0	0	0
CM2	505044	249980	Roadside	Automatic	97	0	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%).

Appendix B: Full Monthly Diffusion Tube Results for 2020

Table B.1 – NO_2 2020 Diffusion Tube Results (µg/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 (0.86)	Annual Mean: Distance Corrected to Nearest Exposure	Comment
DT5	503819	250060		20.0				17.0	14.0	20.0	23.0	23.0		26.0	20.4	17.9	-	
DT7	503160	247751	36.0	29.0				21.0	18.0	23.0	26.0	26.0	33.0	31.0	27.0	23.2	-	
DT10	505425	247063	31.0	24.0				17.0	14.0	18.0	21.0	22.0	31.0	24.0	22.4	19.3	-	
DT12	516345	256592	22.0	18.0				15.0	10.0	15.0	18.0	16.0	19.0	20.0	17.0	14.6	-	
DT13	516420	256552	39.0					18.0	22.0	21.0	25.0	28.0	31.0		26.3	21.6	-	
DT14	504857	249652	33.0					23.0	16.0	27.0	26.0	28.0	38.0	30.0	27.6	22.0	-	
DT16	504585	249003	34.0					23.0	17.0	21.0	27.0	26.0	36.0	28.0	26.5	21.1	-	
DT17	504783	248711	39.0	27.0				26.0	21.0	26.0	29.0	29.0	39.0		29.5	23.8	-	
DT19	505551	250584	36.0	29.0				17.0	15.0	18.0	23.0	25.0	32.0	26.0	24.6	21.1	-	
DT20	504486	249616	**41.0**	**61.0**				**40.0**	**41.0**	**46.0**	**44.0**	**51.0**	**61.0**	**48.0**	**48.1**	**41.3**	**41.0**	
DT25	505389	248858	36.0	31.0				29.0	31.0	38.0	35.0	37.0	**45.0**	39.0	35.7	30.6	-	
DT27	505057	249741	**55.0**	**49.0**				34.0	31.0	35.0	36.0	39.0	**40.0**	37.0	39.6	34.0	-	
DT28	504576	249501	35.0	31.0				28.0	23.0	32.0	33.0	32.0	39.0	33.0	31.8	27.3	-	
DT29	506630	250274	**47.0**	33.0						29.0	34.0	34.0	**42.0**	37.0	36.6	26.4	-	
DT30	505020	250044	**59.0**	**53.0**					34.0	30.0	35.0	39.0	**45.0**	36.0	**41.4**	31.4	-	
DT31	505060	249766	**44.0**	39.0				30.0	23.0	29.0	30.0	32.0	38.0	31.0	32.9	28.2	-	
DT33	504100	250142	**41.0**	38.0					26.0	36.0	32.0	35.0	**45.0**	37.0	36.3	27.5	-	
DT34	505102	249411	**43.0**	34.0				32.0	23.0	37.0	35.0	33.0	**42.0**	37.0	35.1	30.1	-	

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 (0.86)	Annual Mean: Distance Corrected to Nearest Exposure	Comment
DT35	504599	249432	**40.0**	**42.0**				24.0	27.0	30.0	32.0	36.0	**40.0**	34.0	33.9	29.1	-	
DT36	504289	249711	**40.0**	34.0				23.0	21.0	29.0	31.0	33.0	37.0	33.0	31.2	26.8	-	
DT40	504808	250232	33.0	25.0				17.0	15.0	19.0	22.0	26.0	30.0	29.0	24.0	20.6	-	
DT42	505143	249299	38.0	30.0				32.0	32.0	37.0	35.0	35.0	**40.0**	37.0	35.1	30.1	-	
DT43	504913	250038	35.0	32.0				24.0	23.0		31.0	29.0	33.0	31.0	29.8	22.9	-	
DT44	504423	249647	**46.0**	**43.0**				29.0	29.0	38.0	**40.0**	**41.0**	**45.0**	38.0	38.8	33.3	-	
DT46	504635	249724	**47.0**	**43.0**				31.0	28.0	35.0	33.0	33.0	**50.0**	37.0	37.4	32.1	-	
DT47	504894	250049	37.0	27.0				20.0	15.0	24.0	24.0	26.0	37.0		26.3	21.2	-	
DT48	504903	250199	**45.0**	35.0				30.0	23.0	33.0	33.0	35.0	**40.0**	36.0	34.4	29.6	-	
DT50	505190	250075	**55.0**	**45.0**				36.0	32.0	39.0	39.0	**43.0**	**51.0**	38.0	**42.0**	36.1	35.3	
DT53	504907	250084	32.0	26.0				27.0	19.0	31.0	31.0	30.0	39.0	34.0	29.9	25.7	-	
DT54	504505	250361	34.0	26.0				25.0	20.0	28.0	28.0	30.0	36.0	27.0	28.2	24.2	-	
DT55	504475	250123	36.0	27.0				20.0	21.0	27.0	27.0	29.0	36.0		27.9	22.5	-	
DT57	506626	250226	**42.0**	34.0				19.0	21.0	22.0	29.0	32.0	37.0	28.0	29.3	25.2	-	
DT61	506588	250254	**43.0**	38.0				28.0	20.0	28.0	31.0	31.0	**42.0**	32.0	32.6	27.9	-	
DT 62	506390	250243	36.0	28.0				18.0	15.0	19.0	25.0	24.0	34.0	29.0	25.3	21.7	-	
DT65	505438	248793	**58.0**	**58.0**				19.0	21.0	22.0	24.0	25.0	33.0		32.5	26.3	-	
DT66	504495	249622	**40.0**	33.0				28.0	24.0	33.0	29.0	30.0	**40.0**	34.0	-	**-**	-	Triplicate Site with DT66, DT67 and DT68 - Annual data provided for DT68 only
DT67	504495	249622	37.0	36.0				28.0	25.0	32.0	30.0	33.0	**40.0**	33.0	-	**-**	-	Triplicate Site with DT66, DT67 and DT68 - Annual data provided for DT68 only
DT68	504495	249622	**42.0**	32.0				28.0	25.0	33.0	31.0	33.0	39.0	33.0	32.6	28.0	-	Triplicate Site with DT66, DT67 and DT68 - Annual data provided for DT68 only
DT69	504734	249689	**40.0**	34.0				24.0	23.0	29.0			35.0	32.0	31.0	24.0	-	

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 (0.86)	Annual Mean: Distance Corrected to Nearest Exposure	Comment
DT70	504706	249860	**40.0**					26.0	22.0	28.0	29.0		39.0	35.0	31.3	24.6	-	
DT71	504625	248169	33.0	28.0				26.0	23.0	29.0	33.0	34.0	34.0	**40.0**	31.1	26.7	-	
DT72	504648	248257	37.0	34.0				32.0	26.0	33.0	34.0	31.0	43.0	30.0	33.3	28.6	-	
DT73	504684	248388	**40.0**	36.0				26.0	25.0	28.0	31.0	25.0	38.0	37.0	31.8	27.3	-	
DT74	505044	249980	36.0	29.0				19.0	18.0	20.0	22.0	26.0	31.0	26.0	-	-	-	Triplicate Site with DT74, DT75 and DT76 - Annual data provided for DT76 only
DT75	505044	249980	37.0	28.0				19.0	18.0	21.0	23.0	25.0	29.0	26.0	-	-	-	Triplicate Site with DT74, DT75 and DT76 - Annual data provided for DT76 only
DT76	505044	249980	39.0	28.0				18.0	18.0	19.0	22.0	24.0	30.0	26.0	25.1	21.5	-	Triplicate Site with DT74, DT75 and DT76 - Annual data provided for DT76 only
DT 77	501574	242181	25.0					12.0	13.0	13.0	13.0	15.0	18.0	17.0	15.8	12.6	-	
DT 78	501878	242176	19.0					8.0	8.0	9.0	11.0	13.0	21.0	15.0	13.0	10.4	-	
DT 79	504356	251146	33.0	27.0				15.0	15.0	17.0	23.0	23.0	28.0	26.0	23.0	19.7	-	
DT 80	503946	250765	38.0	34.0				23.0	20.0	30.0	32.0	33.0	38.0	36.0	31.6	27.1	-	
DT 81	505273	245175	27.0	17.0				11.0	13.0	14.0	17.0	18.0	21.0	21.0	17.7	15.2	-	
DT 82	500968	244911	25.0	17.0				12.0	10.0	13.0	17.0	17.0	21.0	21.0	17.0	14.6	-	
DT 83	501595	247537	28.0	20.0				17.0	15.0	20.0	22.0	19.0	27.0	25.0	21.4	18.4	-	
DT 85	505493	249254	38.0	23.0				25.0	16.0	26.0	27.0	25.0	38.0	30.0	27.6	23.7	-	
DT 86	505464	250142		34.0				20.0	19.0	23.0	27.0	31.0	40.0	32.0	28.3	23.4	-	

☒ **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.**

☒ **Bedford Borough 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.

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

New or Changed Sources Identified Within Bedford During 2020

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

Additional Air Quality Works Undertaken by Bedford Borough Council During 2020

Bedford Borough Council has not completed any additional works within the reporting year of 2020.

QA/QC of Diffusion Tube Monitoring

The diffusion tubes used by Bedford Borough Council were analysed by Gradko International ltd using a preparation method of 20% TEA in water. The laboratory is UKAS accredited; ensuring conformance with the requirements of ISO/IEC 17025.

The monitoring was undertaken in adherence to the 2020 diffusion tube monitoring calendar, except for the March – May which were not monitored due to covid restrictions.

Diffusion Tube Annualisation

Three months of diffusion tube data were not available due to covid and the laboratory analysis not carried out and restriction of travel in the Borough. Therefore any additional missing data decreased the data capture to below 75% and this was the case for 17 diffusion tubes in 2020. Annualisation was carried out as detailed in TG16 using continuous monitoring data from the two sources available in the Borough.

The Annual Mean/Period Mean ratios are calculated (Am/Pm) and averaged to provide an annualisation factor for each site requiring annualisation. These and the final annualised

average NO_2 concentrations for each of the diffusion tube sites are presented in table C2 below.

Diffusion Tube Bias Adjustment Factors

The diffusion tube data presented within the 2020 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.

Bedford Borough Council have applied a local bias adjustment factor of 0.86 to the 2020 monitoring data. A summary of bias adjustment factors used by Bedford Borough Council over the past five years is presented in Table C.1.

The national bias adjustment factor was 0.81 using version 03/21 using 18 studies which is significantly less number of studies than in previous years. The local bias adjustment gave good overall precision and good overall data capture for both monitoring stations with data capture at 97% - for this reason and in addition due to the fact it was more conservative the local bias adjustment factor was used. This was the mean of the two local bias adjustment results 0.84 and 0.88 giving a mean of 0.86.

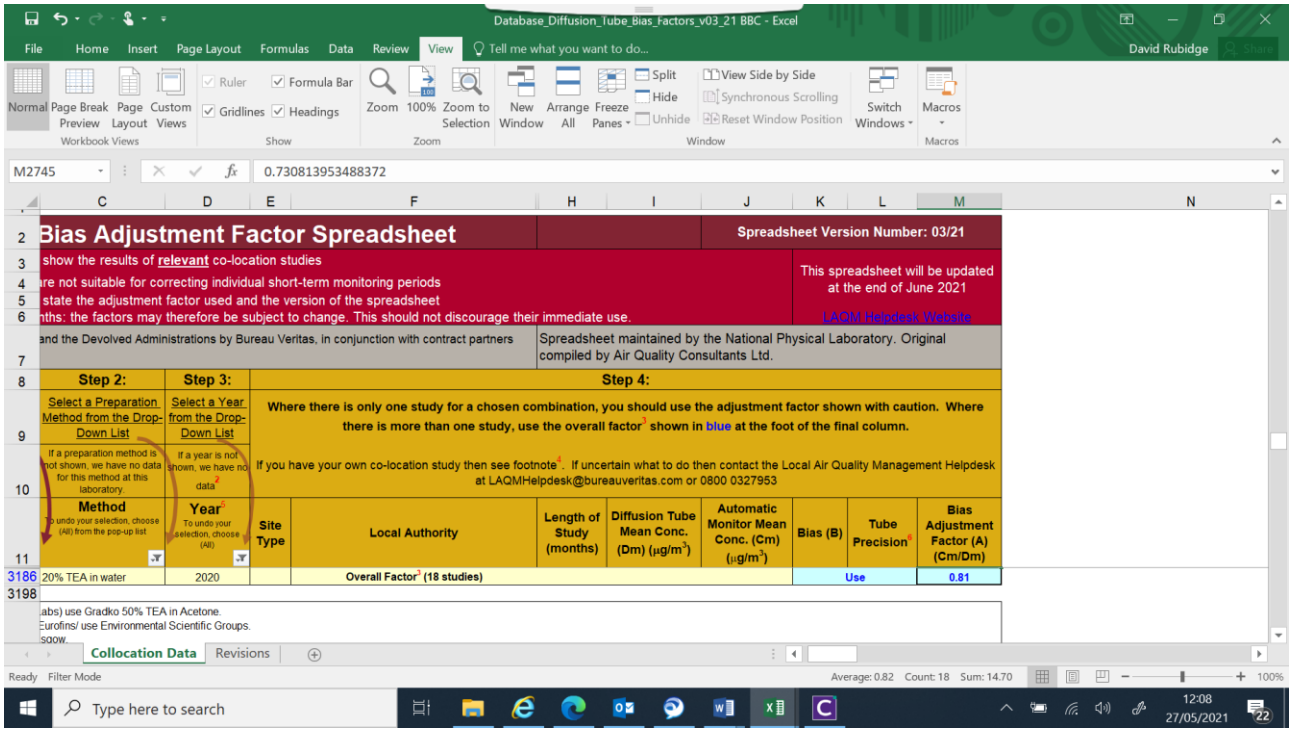


Table C.1 – Bias Adjustment Factor

Year	Local or National	If National, Version of National Spreadsheet	Adjustment Factor
2020	Local	-	0.86
2019	National	03/20	0.93
2018	National	03/19	0.93
2017	National	06/18	0.87
2016	National	03/17	0.94

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.

Two sites were calculated for distance correction DT20 and DT50.

QA/QC of Automatic Monitoring

In 2020 Bedford Borough Council have a service and maintenance contract for both monitoring stations with ESU1, which includes 2 scheduled on-site services per annum. We also have a 48hour call out for any problems that may occur.

Fortnightly calibrations are carried out by the local authority and results sent to Ricardo

Air quality measurements from automatic instruments were validated and ratified to the standards described in the Local Air Quality Management – Technical Guidance LAQM TG (16) by Ricardo. Current readings and historic data is available at: https://www.airqualityengland.co.uk/local-authority/?la_id=408

Automatic Monitoring Annualisation

All automatic monitoring locations within Bedford recorded data capture of greater than 75% therefore it was not required to annualise any monitoring data. In addition, any sites with a data capture below 25% do not require annualisation.

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. Where appropriate, non-automatic annual mean NO_2 concentrations corrected for distance are presented in Table B.1.

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

Table C.2 – Annualisation Summary (concentrations presented in µg/m^3)

Site ID	Annualisation Factor Lurke Street	Annualisation Factor Prebend Street	Average Annualisation Factor	Raw Data Annual Mean	Annualised Annual Mean	Comments
DT5	1.0339	1.0092	1.0215	20.4	20.9	
DT13	0.9580	0.9582	0.9581	26.3	25.2	
DT14	0.9268	0.9328	0.9298	27.6	25.7	
DT16	0.9268	0.9328	0.9298	26.5	24.6	
DT17	0.9366	0.9455	0.9411	29.5	27.8	
DT29	0.8201	0.8619	0.8410	36.6	30.8	
DT30	0.8693	0.9005	0.8849	41.4	36.6	
DT33	0.8693	0.9005	0.8849	36.3	32.1	
DT43	0.8785	0.9139	0.8962	29.8	26.7	
DT47	0.9366	0.9455	0.9411	26.3	24.7	
DT55	0.9366	0.9455	0.9411	27.9	26.2	
DT65	0.9366	0.9455	0.9411	32.5	30.6	
DT69	0.9094	0.8930	0.9012	31.0	27.9	
DT70	0.9268	0.9033	0.9151	31.3	28.6	

Site ID	Annualisation Factor Lurke Street	Annualisation Factor Prebend Street	Average Annualisation Factor	Raw Data Annual Mean	Annualised Annual Mean	Comments
DT 77	0.9268	0.9328	0.9298	15.8	14.6	
DT 78	0.9268	0.9328	0.9298	13.0	12.1	
DT 86	0.9701	0.9634	0.9668	28.3	27.3	

Table C.3 – Local Bias Adjustment Calculation

	Local Bias Adjustment Input 1	Local Bias Adjustment Input 2
Periods used to calculate bias	9	8
Bias Adjustment Factor A	0.84 (0.77 - 0.93)	0.88 (0.8 - 0.97)
Diffusion Tube Bias B	19% (8% - 30%)	14% (3% - 25%)
Diffusion Tube Mean (µg/m^3)	32.6	25.4
Mean CV (Precision)	3.2%	2.7%
Automatic Mean (µg/m^3)	27.4	22.3
Data Capture	97%	97%
Adjusted Tube Mean (µg/m^3)	27 (25 - 30)	22 (20 - 25)

Notes:

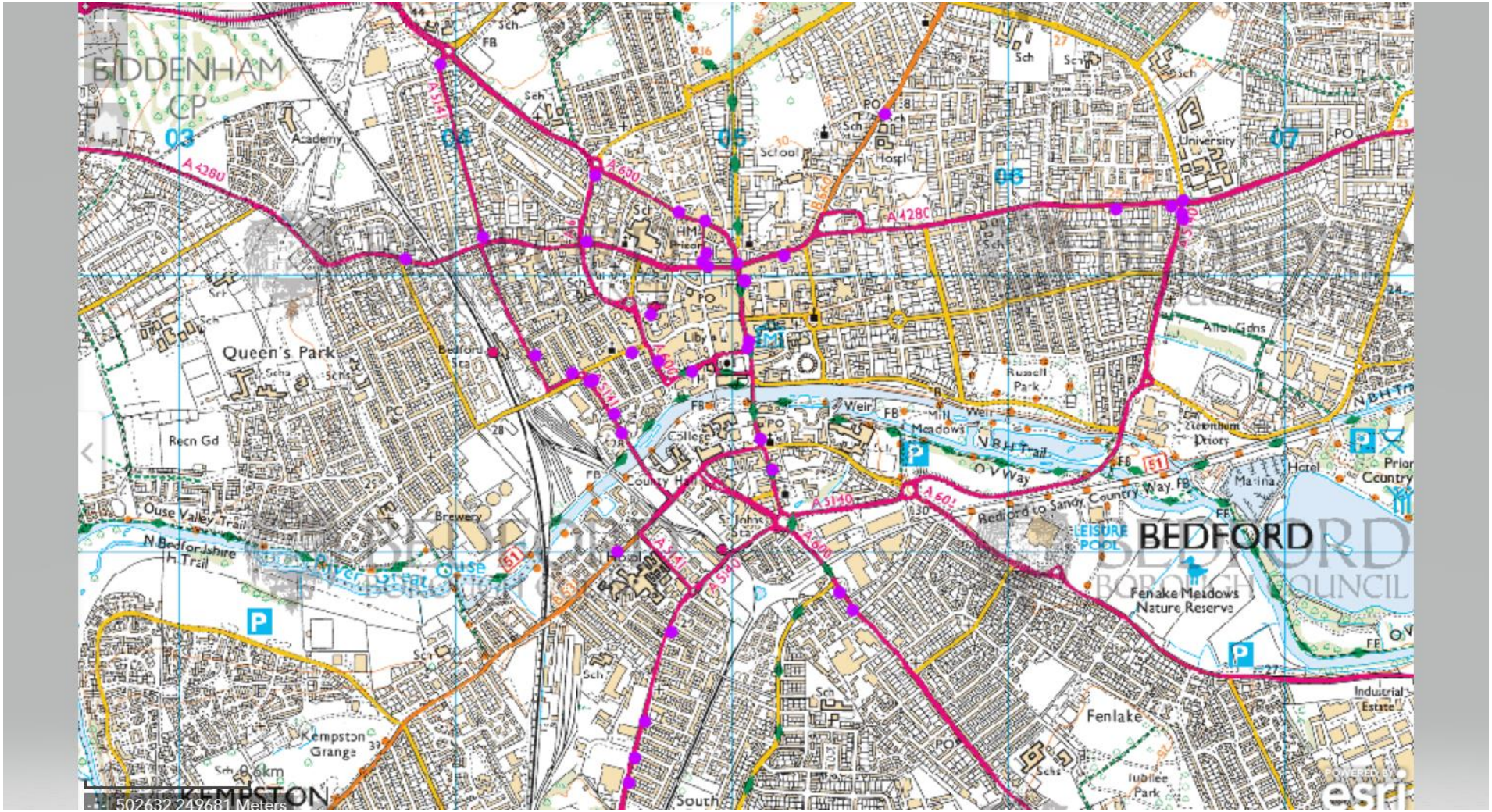
A combined local bias adjustment factor of 0.86 has been used to bias adjust the 2020 diffusion tube results.

Table C.4 – NO_2 Fall off With Distance Calculations (concentrations presented in µg/m^3)

Site ID	Distance (m): Monitoring Site to Kerb	Distance (m): Receptor to Kerb	Monitored Concentration (Annualised and Bias Adjusted	Background Concentration	Concentration Predicted at Receptor	Comments
DT20	2.0	2.1	41.3	14.2	**41.0**	*Predicted concentration at Receptor above AQS objective.*
DT50	1.9	2.2	36.1	13.2	35.3	

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

Figure D.1 – Map of Non-Automatic Monitoring Site



Appendix E: Summary of Air Quality Objectives in England

Table E.1 – Air Quality Objectives in England[7]

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
Sulphur Dioxide (SO_2)	350µg/m^3, not to be exceeded more than 24 times a year	1-hour mean
Sulphur Dioxide (SO_2)	125µg/m^3, not to be exceeded more than 3 times a year	24-hour mean
Sulphur Dioxide (SO_2)	266µg/m^3, not to be exceeded more than 35 times a year	15-minute mean

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

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.

Despite the challenges that the pandemic has given rise to, the events of 2020 have also provided Local Authorities with an opportunity to quantify the air quality impacts associated with wide-scale and extreme intervention, most notably in relation to emissions of air pollutants arising from road traffic. The vast majority (>95%) of AQMAs declared within the UK are related to road traffic emissions, where attainment of the annual mean objective for nitrogen dioxide (NO_2) is considered unlikely. On 23rd March 2020, the UK Government released official guidance advising all members of public to stay at home, with work-related travel only permitted when absolutely necessary. During this initial national lockdown (and to a lesser extent other national and regional lockdowns that followed), marked reductions in vehicle traffic were observed; Department for Transport (DfT) data[8] suggests reductions in vehicle traffic of up to 70% were experienced across the UK by mid-April, relative to pre COVID-19 levels.

This reduction in travel in turn gave rise to a change of air pollutant emissions associated with road traffic, i.e. nitrous oxides (NO_x), and exhaust and non-exhaust particulates (PM). The Air Quality Expert Group (AQEG)[9] has estimated that during the initial lockdown period in 2020, within urbanised areas of the UK reductions in NO_2 annual mean concentrations were between 20 and 30% relative to pre-pandemic levels, which

[8] Prime Minister's Office, COVID-19 briefing on the 31st of May 2020

[9] Air Quality Expert Group, Estimation of changes in air pollution emissions, concentrations and exposure during the COVID-19 outbreak in the UK, June 2020

represents an absolute reduction of between 10 to 20µg/m^3 if expressed relative to annual mean averages. During this period, changes in $PM_{2.5}$ concentrations were less marked than those of NO_2. $PM_{2.5}$ concentrations are affected by both local sources and the transport of pollution from wider regions, often from well beyond the UK. Through analysis of AURN monitoring data for 2018-2020, AQEG have detailed that $PM_{2.5}$ concentrations during the initial lockdown period are of the order 2 to 5µg/m^3 lower relative to those that would be expected under business-as-usual conditions.

As restrictions are gradually lifted, the challenge is to understand how these air quality improvements can benefit the long-term health of the population.

Impacts of COVID-19 on Air Quality within Bedford Borough Council

Diffusion tubes results were not available for three months between March and May and so the results were annualised. Direct comparisons with results in these months are therefore not available and will not have an impact on the results for 2020. However there were noticeable decreases in traffic in the Borough over periods of 2020 even during times of monitoring and this contributed towards the overall lower pollutant concentrations seen in this report. Reduction of NO_2 in the High street during 2020 are due partly due to the introduction of single lane traffic and is an indication of the reduced concentrations we will hope to see after the permanent introduction of the single lane on the high street.

Opportunities Presented by COVID-19 upon LAQM within Bedford Borough Council

No LAQM related opportunities have arisen as a consequence of COVID-19 within Bedford Borough Council.

Challenges and Constraints Imposed by COVID-19 upon LAQM within Bedford Borough Council

Automatic Monitoring – QA/QC Regime – Small impact

The calibration of the monitoring stations was decreased from fortnightly to monthly for 9 months, there was no effect on servicing and maintenance.

Passive Monitoring – Data Capture (%) - Small impact

The data capture was reduced to 75% as diffusion tubes were not collected in March or placed in April or May 2000 due to non-essential travel and tubes not being sent from the supplier.

AQAP – New AQAP Development – Medium impact

The AQAP drafted was delayed on consultation for over 9 months during 2000 – it has been progressed and submitted to DEFRA in 2021.

Table F 1 – Impact Matrix

Category	Impact Rating: None	Impact Rating: Small	Impact Rating: Medium	Impact Rating: Large
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 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
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

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'
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
ASR	Annual Status Report
Defra	Department for Environment, Food and Rural Affairs
DMRB	Design Manual for Roads and Bridges – Air quality screening tool produced by Highways England
EU	European Union
FDMS	Filter Dynamics Measurement System
LAQM	Local Air Quality Management
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxides
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
SO_2	Sulphur Dioxide

References

- Local Air Quality Management Technical Guidance LAQM.TG16. April 2021. Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland.
- Local Air Quality Management Policy Guidance LAQM.PG16. May 2016. Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland.