2020 Air Quality Annual Status Report (ASR)

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

May 2021

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Please note that this report is the 2020 ASR which contains air quality monitoring data for Luton during 2019. Issued later than normal due to COVID-19 related delays, this report will be followed by the 2021 ASR (scheduled for completion by the end of June 2021). The 2021 ASR will contain the 2020 monitoring data and will include a consideration of the impact of COVID-19 on local air pollution levels.

Executive Summary: Air Quality in Our Area

Air Quality in Luton Borough Council

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 and older people, and those with heart and lung conditions. There is also often a strong correlation with equalities issues, because areas with poor air quality are also often the less affluent areas[1,2].

The annual health cost to society of the impacts of particulate matter alone in the UK is estimated to be around £16 billion[3].

Luton Borough Council (LBC) is a unitary authority in Bedfordshire with an estimated population of 213,052 (ONS mid-year figure for 2019) in an area of 4,336 hectares. The borough is dominated by the population centre of Luton town, with the M1 motorway running north/south on its western side, and London Luton Airport at the south east of the borough.

Road traffic is the main source of pollution in the borough with both the town and the motorway providing significant traffic volumes. Other sources include London Luton Airport and local industry, which is distributed in pockets around the borough. As of 2019, 43 industrial processes permitted by Luton Borough Council were operational within the borough.

At present the main pollutant of concern is nitrogen dioxide (NO_2). The council monitors this pollutant as well as particulate matter; however, no exceedance of the objective for particulate matter (PM_{10}) has been either measured or modelled to date.

Recently focus on particulate matter has shifted to the smaller $PM_{2.5}$ fraction. Responding to growing concerns about the health effects of this pollutant, Luton Borough Council started measuring $PM_{2.5}$ levels at its town centre automatic monitoring station (situated on Dunstable Road East) at the end of 2014. Over the

[1] Environmental equity, air quality, socioeconomic status and respiratory health, 2010
[2] Air quality and social deprivation in the UK: an environmental inequalities analysis, 2006
[3] Defra. Abatement cost guidance for valuing changes in air quality, May 2013

five years for which monitoring has been ongoing at this location the measured mean annual $PM_{2.5}$ concentration has remained essentially constant at ~10µg/m^3; compliant with both the EU limit and WHO guideline values of 25µg/m^3 and 10µg/m^3 respectively. These measurements are consistently different to the modelled background levels published each year by Defra, which predict that $PM_{2.5}$ levels will slightly exceed the WHO target of 10µg/m^3 across most of the borough.

With the opening of a new London Luton Airport Ltd. (LLAL) air quality monitoring station in Wigmore Park, for the first time this report includes $PM_{2.5}$ measurements from a second site within Luton. Operational for the second half of 2019, the annualised mean annual $PM_{2.5}$ concentration at this new site was 12µg/m^3. Although the first time monitoring has shown annual $PM_{2.5}$ levels within the borough to be in excess of the WHO guideline value, it should be noted that this measurement is subject to additional uncertainty due to the annual data capture at the new site being only 53%.

During 2019, LBC monitored NO_2 levels within the borough using both an automatic analyser located at its Dunstable Road East monitoring site (CRAQM 2) and a total of 44 diffusion tubes positioned at 42 different locations across the town. Changed and analysed on a monthly basis, the data from these tubes provides a measure of how NO_2 levels vary over time and is used to calculate an annual mean concentration at each monitoring location. Once corrected for measurement bias and adjusted to take into account the location of the tubes relative to any likely human exposure, these annual values should not exceed the national air quality objective level of 40µg/m^3. In the event that this level is, or is likely, to be exceeded on a consistent basis Local Authorities are under a duty to declare an Air Quality Management Area (AQMA) encompassing the relevant locations. Both nationally and locally the main source of high levels of nitrogen dioxide is road transport.

To date, LBC has identified two main areas where NO_2 concentrations either are, or are likely to, exceed the annual mean objective level:

- along the length of the M1 Motorway; and
- along the A505 (Dunstable Road) in part of Bury Park and the Town Centre.

Both areas have been declared as Air Quality Management Areas (AQMA). For further information please see the Council's website (https://tinyurl.com/y9zegeyj) or its page on the UK Air web portal (https://tinyurl.com/yd8t7ma2).

Following its most recent Air Quality Management Area Declaration (Luton Air Quality Management Area No. 3), Luton Borough Council developed and approved an Air Quality Action Plan (AQAP) to address the concentrations found. Following appraisal by Defra, in August 2019 the Council was advised to re-visit the source apportionment study that underpins the AQAP and to undertake additional work to quantify the likely impact of the proposed actions. During the remainder of the reporting period, work has been ongoing to determine both the scope of the necessary work and how it can best be resourced.

During 2019, across all LBC NO_2 passive monitoring sites that have been in the same place for more than one year, 25 recorded a higher annual mean concentration than in 2018 when rounded to the nearest integer. Of the remaining sites, levels decreased at 10 locations and remained unchanged at a further seven. Across the borough the average change in concentration at LBC diffusion tube sites was +0.8µg/m^3, with the single biggest increase (+6µg/m^3, +21%) occurring at *LN23 – Eaton Green Road 1.*

Out of the Council's 42 unique monitoring locations, following bias correction three were found to have NO_2 concentrations in excess of the annual mean objective level of 40µg/m^3:

- *LN52 – Dunstable Rd/Cardigan St Residential* (42.8µg/m^3)
- *LN61/62/LN63 – Dunstable Road East (CRAQM 2)* (40.7µg/m^3)
- *LN67 – Castle Street* (43.0 µg/m^3).

However, in the case of the CRAQM2 air quality monitoring station on Dunstable Road East, the diffusion tube derived concentration should be discounted in favour of the annual mean value obtained using the co-located reference chemiluminescent analyser (*LN60*), which for 2019 was 40µg/m^3.

In addition to the monitoring undertaken by LBC, both London Luton Airport Operations Ltd. (LLAOL) and London Luton Airport Ltd. (LLAL) also operate their own air quality monitoring programmes. During 2019 the LLAOL programme consisted of a PM_{10} automatic analyser located on the airport site and (at various

points in time) diffusion tubes at 22 unique locations both in the vicinity of the airport and along the flightpath leading to and from it. Across the 17 LLAOL diffusion tube sites in operation for more than one year, when rounded to the nearest integer and compared with 2018 levels, annual mean NO_2 concentrations decreased at 11 locations. Out of the remaining sites, the level stayed unchanged at a further seven locations, whilst the final two experienced increases:

- *LLA 1 – Outside Zone 2 (prior to Jun 19)* (+2.1µg/m^3, +4.6%)
- *LLA 7 – Drop Off Zone (prior to Dec 19)* (+2.4µg/m^3, +5.5%)

Out of all 22 sites, four had bias-corrected annual mean NO_2 concentrations in excess of 40µg/m^3:

- *LLA 1 – Outside Zone 2 (prior to Jun 19)* (47.9µg/m^3)
- *LLA 7 – Drop Off Zone (prior to Dec 19)* (45.9µg/m^3)
- *LLA 14 – Undercroft Access Road* (41.9µg/m^3)
- *LLA 16 – Exit Road Plaza* (44.1µg/m^3)

However, it should be noted that none of these exceedances constitute a breach of the air quality objective, as none of the sites are representative of relevant exposure (*i.e.* none of the measurements were made in close proximity to residential accommodation).

During 2019, in addition to instrumental monitoring in Wigmore Park, LLAL deployed a network of NO_2 diffusions tubes at 11 different locations around Luton and the surrounding area. When rounded to the nearest integer and compared with 2018, across the 10 diffusion tube sites in operation for more than one year, eight recorded increased annual mean concentrations, one remained the same and one decreased.

Out of all 11 sites, two had bias-corrected annual mean NO_2 concentrations in excess of 40µg/m^3:

- L1 – *Dunstable Road East* (40.6µg/m^3)
- L7 – *Vauxhall Way* (69.4µg/m^3)

However, similar to *LN61/62/63*, as *L1* is co-located with the LBC reference analyser at the CRAQM2 site, the instrumentally-derived value of 40µg/m^3 should be used in preference to the diffusion tube measurements for this site.

The elevated annual mean NO_2 concentration detected at *L7* is significant, as with a value in excess of 60µg/m^3 it indicates that both the annual and the 1-hour mean objective levels are exceeded at this location. However, as a remote roadside location away from residential properties and other amenities where individuals are likely to spend appreciable periods of time, this exceedance does not constitute a breach of either air quality objective due to the lack of a relevant receptor.

Finally, Defra also undertakes NO_2 monitoring in Luton with an automatic analyser (CM2 / *LUTR*) located on the A505 Dunstable Road as part of its *Automatic Urban and Rural Network* (AURN). Located at roadside, the monitor's location is not representative of relevant exposure. During 2019, the annual mean NO_2 concentration at the site was 39µg/m^3, 4µg/m^3 lower than in the previous year.

Looking at the data obtained at all sites representative of relevant exposure, overall 2019 appears to have seen a slight increase in NO_2 levels over the previous year. However, on comparison with concentration levels going back to 2015, the 2019 values are generally in the mid-to-low range of those obtained over the last five years.

As a member of the *Herts & Beds Air Quality Network*, Luton Borough Council works with colleagues in neighbouring authorities to ensure a consistent approach and raise the awareness of air quality in Luton and the surrounding area.

Where Air Quality Management Areas have been declared, appropriate actions are identified working in conjunction with partners both within the Council (Public Health, Highways, Sustainability, Licensing, Development Control) and externally (Environment Agency, Highways England, local transport providers). Regular contact with these partners will ensure that steps identified are progressed with the aim of reducing concentrations of air pollutants.

Actions to Improve Air Quality

Figure 1 - Air quality sensor being installed outside Hillborough Junior School

Working with Hillborough Junior School and the sustainable transport charity *Sustrans*, in June 2019 LBC successfully undertook a street closure pilot project which saw Hillborough Road closed for two weeks on school days between 8:15 and 9:15am and again between 3:00 and 4:00pm. Part of Sustrans' *School Streets* programme (https://tinyurl.com/yxfdjcff), the aims of the project were to:

- decrease the number of young people travelling to school by car and to increase the number of children travelling actively;
- to improve safety and air quality at the school gate;
- to demonstrate the difference that closing roads outside schools at drop off and pick up times can make; and
- to encourage more regular restrictions on school traffic outside schools to promote permanent change.

To assess the impact of the closures on air quality, a low cost air pollution sensor measuring particulate matter and NO_2 was installed outside the school one week

before the project commenced and was left in situ for a further four weeks after the closures had ended. Initial analysis by LBC Environmental Protection of the data captured before, during and after the closures showed some evidence of reduced NO_2 levels outside the school whilst traffic restrictions were in place.

Figure 2 - London Luton Airport Ltd's new air quality monitoring station in Wigmore Park

Another significant development for Luton's air quality in 2019 was the opening of London Luton Airport Ltd.'s new monitoring station in Wigmore Park (https://tinyurl.com/35d3hr49). Opened on *Clean Air Day* (20th June 2019), this new facility monitors a comprehensive range of pollutant species, many of which are outside the scope of the *Local Air Quality Management* (LAQM) regime and hence have been omitted from this report. However, to provide a comprehensive picture of air quality within the borough, data obtained at the Wigmore Park site for LAQM pollutants (*i.e.* NO_2, PM_{10}, $PM_{2.5}$ and SO_2) has been included. Additionally, the location of all LLAL passive monitoring sites as well as calculations verifying the annualisation of all monitored species for which data is available are also detailed in this report.

Full details of the data generated by LLAL's air quality monitoring programme can be found in their *Air Quality Monitoring Annual Report* for 2019 (https://tinyurl.com/ym9ra9ac).

Conclusions and Priorities

Although relative to the previous year's results, 2019 saw slight increases in annual mean NO_2 levels at many monitoring locations, when viewed over the last five years, average NO_2 levels in Luton would on the whole appear to be following a gradual downward trend.

During 2019, only one of the six exceedances of the annual mean NO_2 objective level observed outside of an AQMA occurred at a relevant receptor; *LN67 - Castle Street* (43.0µg/m^3). Addressing elevated NO_2 levels at this location remains a continued priority. To achieve this, junction improvement measures to prohibit right-turning movement from Castle Street into Windsor Street and from both Windsor Street and Hibbert Street into Castle street are scheduled for completion during 2020.

The occurrence of an exceedance of the annual mean NO_2 objective within AQMA No. 3 (at *LN52 - Dunstable Road/Cardigan St Residential* [42.8µg/m^3]) reinforces the need to address Defra's feedback on the town centre AQAP as quickly as possible. To achieve this, over the coming year LBC will need to secure resources to undertake a new source apportionment study and commission air quality modelling to better assess the likely impact of the measures included in the plan.

On a positive note, during 2019 none of the diffusion tubes in AQMA No.'s 1 or 2 exceeded 40µg/m^3. Indeed with the exception of *LN86 – Bradley Road*, which is situated on a flyover above the M1, none have exceeded 40µg/m^3 in the last five years. Furthermore (again excluding *LN86*), all 2019 annual mean concentrations at sites within the two AQMAs were lower than 36µg/m^3, *i.e.* more than 10% below the objective level. On the basis of both the duration and degree of the observed compliance, consideration should be given to whether it would be appropriate to seek to revoke the AQMAs.

Local Engagement and How to get Involved

The potential for the residents and businesses of Luton to have a positive impact on air quality is considerable. Poor air quality in the town has been shown to be as a result of busy and congested roads.

By choosing sustainable methods of travel, there will be less pollution in the local atmosphere. Recommended travel methods are:

- Walking
- Cycling
- Public Transport
- Use of Electric Vehicles

Where these are not feasible, the use of a newer vehicle that meets a higher emissions specification will produce less pollution than an older engine.

More information on journey planning, sustainable modes of travel and the local transport network can be found on the LBC *Transport and streets* webpages (https://tinyurl.com/yd8du68t).

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1 Local Air Quality Management

This report provides an overview of air quality in Luton Borough Council during 2019. 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 Luton Borough Council to improve air quality and any progress that has been made.

The statutory air quality objectives applicable to LAQM in England can be found in Table E.1 in Appendix E.

2 Actions to Improve Air Quality

2.1 Air Quality Management Areas

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

A summary of AQMAs declared by Luton Borough Council can be found in Table A. Further information related to declared or revoked AQMAs, including maps of AQMA boundaries are available online at https://uk-air.defra.gov.uk/aqma/local-authorities?la_id=150 – see full list at https://uk-air.defra.gov.uk/aqma/list.. Alternatively, see Appendix D: Maps of Monitoring Locations and AQMAs, which provides for a map of air quality monitoring locations in relation to the AQMAs.

Table A – Declared Air Quality Management Areas

AQMA Name	Date of Declaration	Pollutants and Air Quality Objectives	City / Town	One Line Description	Is air quality in the AQMA influenced by roads controlled by Highways England?	Level of Exceedance at Declaration (maximum monitored/modelled concentration at a location of relevant exposure	Level of Exceedance Now (maximum monitored/modelled concentration at a location of relevant exposure	Action Plan (inc. date of publication)
Luton AQMA No.1	Declared 03/11/2003	NO_2 Annual Mean	Luton	24 Residential properties on either side of the M1 Motorway, near Junction 11	YES	47.6µg/m^3	27.6µg/m^3 (LN82)	Within Local Transport Plan 3 2011-2026 (March 2011) [https://tinyurl.com/y9r4vhkf]
Luton AQMA No.2	Declared 31/03/2005	NO_2 Annual Mean	Luton	431 Residential properties on either side of the M1 Motorway, near Junction 11	YES	58.9µg/m^3	33.1µg/m^3 (LN17)	Within Local Transport Plan 3 2011-2026 (March 2011) [https://tinyurl.com/y9r4vhkf]
Luton AQMA No.3	Declared 01/05/2016	NO_2 Annual Mean	Luton	From Dunstable Road by Kenilworth Road through to Stuart Street and Chapel Viaduct by Latimer Road, including Castle Street to Holly Street and Telford Way	NO	54.6µg/m^3	42.8µg/m^3 (LN52)	AQAP submitted to Defra for appraisal April 2019, feedback received August 2019

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

2.2 Progress and Impact of Measures to address Air Quality in Luton Borough Council

Defra's appraisal of last year's ASR concluded:

> *"Overall the report is highly detailed, satisfies the criteria of relevant standards, and is a good source for members of the Public to find out about air quality in their area. The Council should continue their good work and submit an Annual Status Report in 2020."*

Luton Borough Council has taken forward a number of direct measures during the current reporting year of 2019 in pursuit of improving local air quality. Details of all measures completed, in progress or planned are set out in Table B.

Further information on these measures can be found in *the Luton Local Transport Plan 3* (2011 - 2026; https://tinyurl.com/y9r4vhkf) and will also be available in the town centre AQAP once work addressing feedback received from Defra has been completed.

Over the past year, key completed measures have included:

- the commencement of monitoring at London Luton Airport Ltd.'s new air quality station in Wigmore park (https://tinyurl.com/y4w3vq9g); and
- the completion of a two-week school street closure pilot project on Hillborough Road to promote active travel among pupils and evaluate the impact of such measures on air quality.

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

- the completion of a new source apportionment study for AQMA No. 3 using recent traffic data to address concerns from Defra regarding the age of the previously used information; and
- building on the output of the source apportionment, the commissioning of an air quality modelling study to evaluate the impact of potential air quality actions that could be implemented within AQMA No. 3.

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

- to address the feedback received from Defra regarding the town centre AQAP; and
- to ascertain whether the pending junction improvement measures on Castle Street resolve the NO_2 hotspot at the crossroads with Windsor and Hibbert Streets.

The principal challenge and barrier to implementation that Luton Borough Council anticipates facing will be the resourcing of the source apportionment and modelling study needed to improve the evidence base for the town centre AQAP. This is due to the fact that it is likely to require specialist support from external experts in order to access resources not available within the Council.

Whilst the measures stated above and in Table B will help to contribute towards compliance, Luton 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 No. 3. However, the absence of any exceedance of the annual mean NO_2 objective at any relevant receptor in either AQMA No. 1 or 2 in the last five years would suggest that revocation of both may be feasible in the near future.

Table B – Progress on Measures to Improve Air Quality

Measure No.	Measure	EU Category	EU Classification	Organisations involved and Funding Source	Planning Phase	Implementation Phase	Key Performance Indicator	Reduction in Pollutant / Emission from Measure	Progress to Date	Estimated / Actual Completion Date	Comments / Barriers to implementation
1	Implement a Luton Park & Ride by securing delivery at identified locations	Alternatives to private vehicle use	Bus based Park & Ride	LBC Transport	Initial scoping complete		Monitor use of Park & Ride once up and running	A Park & Ride would result in fewer cars driving into Luton Town Centre	Locations for Park & Ride sites have been identified. Next step is to secure delivery at these locations	By 2023	The emerging Luton Local Plan 2011 - 2031 provides policy support for Park & Ride schemes at M1 junction 10A and Butterfield Park Sources of funding to be identified
2	Reallocation of lanes, where possible to reduce start-stop traffic and congestion	Traffic Management	Other	LBC Transport	Complete	Summer 2017	Improved traffic flow Reduction in queuing traffic	Reducing start-stop traffic reduces acceleration and braking, resulting in reduced emissions	Dunstable Road scheme completed September 2017	September 2017	Initial report evaluating the impact of the improvements presented to the Overview and Scrutiny Board, 25 June 2019 https://tinyurl.com/yyn7eban
3	Improvement of Chapel viaduct / Castle Street roundabout	Traffic Management		LBC Transport	Ongoing	2019	Improved traffic flow	Less idling would result in reduced emissions	Various options being considered https://tinyurl.com/y52t2hr7	2020	

Measure No.	Measure	EU Category	EU Classification	Organisations involved and Funding Source	Planning Phase	Implementation Phase	Key Performance Indicator	Reduction in Pollutant / Emission from Measure	Progress to Date	Estimated / Actual Completion Date	Comments / Barriers to implementation
4	Review 20mph zones in and around AQMA #3 to encourage traffic calming and lower speeds	Traffic Management	Reduction of speed limits, 20mph zones	LBC Transport LBC Road Safety	2018		Increase number of vehicles adhering to 20mph within the zones	Vehicles travelling under 30mph generally emit less particulates and so improve air quality	20mph zones in place (Completed 2016 – 17)	2023	
5	Bedfordshire Sustainable Travel Access to Railway Stations (STARS)	Promoting Travel Alternatives	Intensive active travel campaign & infrastructure	LBC Transport in partnership with Central Bedfordshire Council and Bedford BC (£2.1 million funding secured from the DfT Access Fund for Sustainable Travel 2017 - 2020)	Ongoing	Ongoing	Increase in use of sustainable travel into Luton Town Centre	Increased use of sustainable travel will reduce car use and emissions	Ongoing	Programme funded until March 2020	https://tinyurl.com/y7jngxce
6	Connections to Luton - Dunstable cycle route to be improved and promoted	Transport Planning and Infrastructure	Cycle network	LBC Transport LBC Road Safety	2017	2017 - 2020	Increased number of people using cycle routes to access the town centre	Increase in cycling creates modal shift away from the car, resulting in reduced emissions	Ongoing Portfolio of suggested network amendments developed	2021	Work ongoing to incorporate proposed network into a wider Local Cycling & Walking Investment Plan

Measure No.	Measure	EU Category	EU Classification	Organisations involved and Funding Source	Planning Phase	Implementation Phase	Key Performance Indicator	Reduction in Pollutant / Emission from Measure	Progress to Date	Estimated / Actual Completion Date	Comments / Barriers to implementation
7	Implement variable message signs (VMS) linked to car parks in town centre, with direction varying dependent on congestion	Traffic Management	UTC, Congestion management, traffic reduction	LBC Transport Network Technology £76k Government grant awarded February 2017	2018	Installation of VMS completed Autumn 2018 https://tinyurl.com/y4bo4e8o	Improved traffic flow and information dissemination	Smoother traffic flow leading to lower emissions	Delivered	August 2018	
8	Proposed project to replace a number of small town centre surface car parks with intelligent parking system enabled multi storey on Crawley Road site	Traffic Management	Other	LBC Property & Construction	2018	2019	Improved parking information and organisation	Less engine idling and running time while drivers search for parking	Planning application permitted Options for delivery currently under review		
9	School travel planning via Modeshift STARS	Promoting Travel Alternatives	School Travel Plans	LBC Transport	Ongoing	Ongoing	Number of new and updated school travel plans	Increased uptake of lift sharing or sustainable transport methods will reduce emissions	Ongoing	Ongoing	Accredited schools have to submit their travel plans annually to maintain accreditation https://tinyurl.com/ypm32zdy

Measure No.	Measure	EU Category	EU Classification	Organisations involved and Funding Source	Planning Phase	Implementation Phase	Key Performance Indicator	Reduction in Pollutant / Emission from Measure	Progress to Date	Estimated / Actual Completion Date	Comments / Barriers to implementation
10	Development of Workplace Travel Plans for town centre employers (including LBC)	Promoting Travel Alternatives	Workplace Travel Planning	LBC Transport LBC Road Safety	2018	2019	Increase modal shift of staff using more sustainable modes	Increased uptake of lift sharing or sustainable transport methods will result in reduced emissions	Planning phase	2020	Potential measures to encourage sustainable travel include promotion of cycling and walking, discounted bus and rail travel, and car sharing Modeshift STARS to be used to manage process
11	Provide improved EV charging infrastructure	Promoting Low Emission Transport	Procuring alternative Refuelling infrastructure to promote Low Emission Vehicles, EV recharging, Gas fuel recharging	LBC Transport	2018	Ongoing	Increase number of EV charge points	Increased EV use will result in a decrease in emissions	Feb 2019 £90k of Government funding secured for ×4 rapid charging units for electric taxi use in the town centre. https://tinyurl.com/btjnvtm2	2023	Encourage greater ULEV uptake by providing charging points at Town Centre taxi ranks, car parks and on-street EV parking bays. Free / reduced parking during charging period . Encourage new developments to provide EV charging infrastructure

Measure No.	Measure	EU Category	EU Classification	Organisations involved and Funding Source	Planning Phase	Implementation Phase	Key Performance Indicator	Reduction in Pollutant / Emission from Measure	Progress to Date	Estimated / Actual Completion Date	Comments / Barriers to implementation
12	Promotion of car & lift sharing scheme via the Travel Luton website	Alternatives to private vehicle use	Car & lift sharing schemes	LBC Transport	2010 - 2011	Ongoing	Number of lift share scheme users	Lift sharing will result in fewer cars on the roads and hence reduced emissions		Ongoing	
13	Promote / encourage greater take-up of the Electric Vehicle Town Centre car club by residents and businesses	Alternatives to private vehicle use	Car Clubs	LBC Transport	2010 - 2011	Ongoing	Increase number of car club users	Use of the club's four electric cars rather than less sustainable transport will result in a reduction of emissions	49 users within LBC and 30 personal users	Ongoing	Extension to this scheme to be facilitated via planning conditions for certain developments to provide additional funding
14	Information to vulnerable groups – Air Pollution Alert service	Public Information	Via other mechanisms	LBC Environmental Health Herts & Beds Air Quality Network	2014 - 2018	2018	Service to recommence	By informing vulnerable groups of likely peaks in air pollution, they will have an opportunity to limit exposure / better manage their conditions	Completed Service launched 1st March 2019	March 2019	https://tinyurl.com/y3pb95j9
15	Raise awareness of vehicle idling through no-idling campaigns and driver education	Traffic Management	Anti-idling enforcement	LBC Transport LBC Parking Enforcement LBC Licensing	2017	Ongoing	Fewer drivers idling as a result of receiving information	Reduced idling would result in lower emissions	Ongoing	2020	Prioritise the town centre and AQMA #3. Emphasis on licensed vehicles (850 licensed vehicles around Luton) and buses.

Measure No.	Measure	EU Category	EU Classification	Organisations involved and Funding Source	Planning Phase	Implementation Phase	Key Performance Indicator	Reduction in Pollutant / Emission from Measure	Progress to Date	Estimated / Actual Completion Date	Comments / Barriers to implementation
16	School Streets Project - Pilot road closure outside Hillborough Junior School	Promoting Travel Alternatives	Promotion of cycling Promotion of walking	LBC Road Safety Sustrans	2018	Summer 2019	Decrease in number of young people travelling to school by car Increase in number of children travelling actively Improved air quality at the school gate	Modal shift away from the car, resulting in reduced emissions	Project completed and evaluated	August 2019	
17	In coordination with the Luton BID and local dealers, hold pop-up events in the town centre to showcase available EVs	Promoting Low Emission Transport	Other	LBC Environmental Health LBC Transport	2018	April 2018	Increased EV sales resulting from events	Increased EV uptake will result in reduced emissions	First event held in St. Georges Square on 27/28 April 2018	2023	
18	Work with operators to introduce hybrid/low emission buses on routes within AQMA #3	Vehicle Fleet Efficiency	Promoting Low Emission Public Transport	LBC Transport	2018 – 2021		Reduced emissions from buses	Improved Air Quality in AQMA #3		2021	Target introduction of Hybrid/low emission buses through Bury Park and on Dunstable Road DfT funding opportunities to be explored

Measure No.	Measure	EU Category	EU Classification	Organisations involved and Funding Source	Planning Phase	Implementation Phase	Key Performance Indicator	Reduction in Pollutant / Emission from Measure	Progress to Date	Estimated / Actual Completion Date	Comments / Barriers to implementation
19	Investigate implementing a Clean Air/Low Emissions Zone in the Town Centre	Promoting Low Emission Transport	Low Emission Zone (LEZ)	LBC Transport LBC Environmental Health	2018	Ongoing	Increased take up of clean energy vehicles / bikes by local businesses	Cleaner / greener transport options for staff and deliveries would reduce emissions in the town centre	Ongoing	2021	Research into possible funding options ongoing
20	Investigate expansion of pedestrianised area around Town Centre (either permanently or at peak times)	Traffic Management	Other	LBC Transport LBC Environmental Health	2019		Expansion of pedestrianised area will result in more people walking into the Town Centre	Wider pedestrianisation will reduce vehicle use in the Town Centre and hence result in improved air quality			
21	Assessment of benefit of current Town Centre green infrastructure to inform the development of new Town Centre planting schemes.			LBC Parks LBC Transport Sustainable Drainage	2018	Ongoing	Increase number of trees planted vs number of trees felled	In addition to absorbing CO_2, there is a growing body of evidence to shows that certain trees, shrubs and hedges can also help reduce levels of airborne pollutants	Dec 2019 Air quality contribution of green infrastructure considered in draft *Luton Tree Policy and Tree Management Strategy*	2020	

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

As detailed in Policy Guidance LAQM.PG16 (Chapter 7), local authorities are expected to work towards reducing emissions and/or concentrations of $PM_{2.5}$ (particulate matter with an aerodynamic diameter of 2.5µm 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.

Luton Borough Council is taking the following measures to address $PM_{2.5}$:

- Working in partnership with our Public Health Department, which has resulted from the following drivers:
    - Incorporation of the Public Health role within Unitary Authorities such as Luton Borough Council;
    - Increased evidence and awareness of harm from exposure to $PM_{2.5}$; and
    - Public Health Outcomes Framework indicator 3.01: *"Fraction of all-cause mortality attributable to anthropogenic particulate air pollution (measured as fine particulate matter, $PM_{2.5}$)"*
- Luton's Public Health Department funded the real time air quality monitoring station located on Dunstable Road East, to the south of the town centre (*LN60*). This station includes a FIDAS particulate analyser which monitors a range of particulate fractions including $PM_{2.5}$. This analyser enables the Council to monitor any changes in particulate concentrations and assists in determining the effectiveness of measures taken to improve air quality.
- Luton Borough Council has not identified any measures that will specifically tackle $PM_{2.5}$ concentrations however all measures that are aimed at reducing the numbers of road vehicles, and those that increase the uptake of sustainable transport methods, will have a positive impact on the reduction on $PM_{2.5}$ that is produced locally.

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

3.1 Summary of Monitoring Undertaken

3.1.1 Automatic Monitoring Sites

This section sets out what monitoring has taken place and how it compares with objectives.

Luton Borough Council (LBC) undertook automatic (continuous) monitoring of nitrogen dioxide, PM_{10} and $PM_{2.5}$ at one site (*LN60 - Dunstable Road East* - https://tinyurl.com/w73r7gz) during 2019. Located within AQMA No.3, this analyser is co-located with diffusion tubes *LN61*, *LN62* and *LN63*.

In addition to the monitoring undertaken by Luton Borough Council during 2019:

- London Luton Airport Operations Ltd. (LLAOL) continuously monitored PM_{10} at its site within the airport (https://tinyurl.com/y32oqq5r);
- Defra continuously monitored nitrogen dioxide at its Luton A505 Roadside AURN site (https://tinyurl.com/yauuwns7); and
- from the summer, London Luton Airport Ltd. (LLAL) commenced continuous monitoring at its new air quality monitoring station in Wigmore Park (https://tinyurl.com/y8o7oopg);

Table A.1 in Appendix A shows the details of the sites. 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

Luton Borough Council undertook non- automatic (passive) monitoring of NO_2 at 42 unique sites during 2019. In addition to this, LLAOL undertook similar monitoring at 19 sites (three of which moved during the course of the year) and LLAL deployed NO_2 diffusion tubes at a further 11 locations. Table A.2 in Appendix A shows the details of the 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.

3.2 Individual Pollutants

The air quality monitoring results presented in this section are, where relevant, adjusted for bias[4], *"annualisation"* (where the data capture falls below 75%), and distance correction[5]. Further details on adjustments are provided in Appendix C.

3.2.1 Nitrogen Dioxide (NO_2)

Table A.3 in Appendix A compares the ratified and adjusted monitored NO_2 annual mean concentrations for the past 5 years with the air quality objective of 40µg/m^3. Note that the concentration data presented in Table A.3 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 2019 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.

Table A.4 in Appendix A compares the ratified continuous monitored NO_2 hourly mean concentrations for the past 5 years with the air quality objective of 200µg/m^3, not to be exceeded more than 18 times per year.

During 2018, the annual mean NO_2 level exceeded 40µg/m^3 at three of Luton Borough Council's 42 unique monitoring locations. Of these three exceedances (shown in bold on the tables in Appendix A & B and coloured red on the maps in Appendix D):

- two were located within AQMA No.3 (*LN61/62/LN63 - CRAQM 2* and *LN52 - Dunstable Rd/Cardigan St Residential*, although the former should be disregarded in favour of the co-located reference analyser); and
- one fell outside of current AQMA boundaries (*LN67 – Castle Street*).

On the basis of previous years' results the occurrence of the non-AQMA exceedance is not surprising, as 2019 is the fifth consecutive year that *LN67* has recorded an

[4] https://laqm.defra.gov.uk/bias-adjustment-factors/bias-adjustment.html
[5] Fall-off with distance correction criteria is provided in paragraph 7.77, LAQM.TG(16)

annual mean NO_2 concentrations in excess of 40µg/m^3. In order to address this apparent hotspot, junction improvement measures prohibiting right turns at this location are due to be completed during 2020.

During 2019, the annual mean NO_2 level exceeded 40µg/m^3 at four of London Luton Airport Operations Ltd.'s 22 unique monitoring locations and at a further two of London Luton Airport Ltd.'s 11 sites (although one of these was co-located with the LBC reference analyser and as such should be disregarded in favour of the more accurate technique). However, as none of these sites are in the vicinity of residential accomodation, none are representative of relevant exposure.

Out of all the sites with annual mean levels above 40µg/m^3, with a concentration of 69.4µg/m^3, a single LLAL site (*L7 - Vauxhall Way*) also exceeded 60µg/m^3. This would suggest that the 1-hour mean objective has been exceeded at this location. However, as this monitoring site is situated at the roadside away from ameneties and residential properties it is not considered to be representative of relevant exposure.

During 2019, no instances of the 1-hour mean exceeding 200µg/m^3 were observed at any of the three automatic NO_2 monitoring sites within the borough (*LN60, LA001* or *CM2*).

3.2.2 Particulate Matter (PM_{10})

Particulate matter (PM_{10}) is now monitored at three locations within Luton:

- LBC's roadside site on Dunstable Road East (*LN60*);
- LLAOL's airport site (*LA08*); and
- LLAL's new Wigmore Park site (*LA001*)

Table A.5 in Appendix A compares the ratified and adjusted monitored PM_{10} annual mean concentrations for the past 5 years with the air quality objective of 40µg/m^3.

Table A.6 in Appendix A compares the ratified continuous monitored PM_{10} daily mean concentrations for the past 5 years with the air quality objective of 50µg/m^3, not to be exceeded more than 35 times per year.

During 2019, the annual mean PM_{10} concentration measured at *LN60* was 16µg/m^3 (unchanged from 2017), at *LA08* it was 16µg/m^3 (1µg/m^3 lower than the previous year) and at *LA001* it was 14µg/m^3. Over the same period the daily mean PM_{10}

concentration exceeded 50µg/m^3 once at *LA08* and eight times at *LN60*. No such exceedances were recorded at *LA001* during the 6-months it was in operation.

3.2.3 Particulate Matter ($PM_{2.5}$)

Particulate Matter ($PM_{2.5}$) is now monitored at both Luton Borough Council's Dunstable Road East roadside site (*LN60*) and London Luton Airport Ltd.'s new Wigmore Park site (*LA001*).

Table A.7 in Appendix A presents the ratified and adjusted monitored $PM_{2.5}$ annual mean concentrations for the past 5 years.

During 2019, the annual mean $PM_{2.5}$ concentration measured at *LN60* was 10µg/m^3 (unchanged for the last four years) and at *LA001* it was 12µg/m^3 (although this is an annualised figure extrapolated from a valid annual data capture of 53%, and as such is subject to a greater degree of uncertainty). Currently the LAQM Regulations do not include a specific objective for annual mean $PM_{2.5}$, however the EU limit for $PM_{2.5}$ is 25µg/m^3 and WHO guideline value 10µg/m^3.

3.2.4 Sulphur Dioxide (SO_2)

Table A.8 in Appendix A compares the ratified continuous monitored SO_2 concentrations for 2019 with the air quality objectives for SO_2.

No exceedances of any of the relevant objectives were recorded during the first 6-months that LLAL's new Wigmore Park site has been operational.

Appendix A: Monitoring Results

Table A.1 - Details of Automatic Monitoring Sites

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Monitoring Technique	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Inlet Height (m)
LN60 *(HB007)*	Dunstable Road East	Roadside	508708	221352	NO_2; PM_{10}; PM_4; $PM_{2.5}$; PM_1	YES (AQMA No. 3)	Chemiluminescent; FIDAS	6.2	3.24	2.15
LA08 *(HB006)*	London Luton Airport	Urban Background	511871	221142	PM_{10}	NO	Beta Attenuation Monitor	N/A	N/A	1.7
LA001	London Luton Airport FutureLuToN	Other	512578	222204	NO_2; PM_{10}; $PM_{2.5}$; PM_1; SO_2; O_3; CO; Black Carbon; Benzene; Toluene; Ethylbenzene; m,p-Xylene; o-Xylene; Naphthalene	NO	GRIMM ED180	N/A	N/A	
CM2 *(LUTR; UKA00605)*	Luton A505 Roadside (AURN)	Roadside	505927	222644	NO_2	NO	Chemiluminescent	17.1	1.5	1.7

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

a) Luton Borough Council (LBC) sites

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube collocated with a Continuous Analyser?	Height (m)
LN07	Guildford Street/Bute Street	Roadside	509227	221455	NO_2	NO	1.5	3.10	NO	2.60
LN11	Upper George Street	Roadside	508910	221321	NO_2	NO	20	2.65	NO	2.9
LN15	Armitage Garden	Roadside	505557	222325	NO_2	YES (AQMA Nos. 1 & 2)	7	2.1	NO	2.8
LN16	Belper Road	Roadside	505492	222607	NO_2	YES (AQMA No. 2)	5	2.45	NO	2.68
LN17	Wyndham Road	Roadside	505324	222812	NO_2	YES (AQMA No. 2)	4	1.75	NO	2.82
LN18	Copperfields	Roadside	505014	223538	NO_2	YES (AQMA No. 2)	2	1.55	NO	2.83
LN22	1 Mistletoe Hill	Urban Background	511341	221864	NO_2	NO	0	9.3	NO	2.45
LN23	Eaton Green Road 1	Roadside	511377	221814	NO_2	NO	18	6.4	NO	2.26

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube collocated with a Continuous Analyser?	Height (m)
LN24	19 Barnston Close	Urban Background	511902	222144	NO_2	NO	0	6.95	NO	2.5
LN25	Eaton Green Road 2	Roadside	511893	222068	NO2	NO	17	1.86	NO	2.89
LN26	8 Keeble Close	Urban Background	512109	222234	NO2	NO	0	11.5	NO	2.7
LN27	Eaton Green Road 3	Roadside	512134	222198	NO2	NO	6	2.25	NO	2.71
LN28	Caddington Road	Roadside	507798	219832	NO2	NO	15	1.7	NO	2.6
LN52	Dunstable Rd/Cardigan St Residential	Roadside	508689	221379	NO2	YES (AQMA No. 3)	0	4.25	NO	2.84
LN53	3rd Floor Bagshawe Court F.F.	Suburban	507717	219923	NO2	NO	0	23	NO	9.79
LN54	M1 Corner Bagshawe Court F.F.	Suburban	507712	219915	NO2	NO	0	12	NO	1.95
LN55	M1 Corner Wyatt Court FF	Suburban	507732	219886	NO2	NO	0	13	NO	2.9
LN56	20 Wyatt Court FF	Suburban	507747	219894	NO2	NO	0	30	NO	2.9

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube collocated with a Continuous Analyser?	Height (m)
LN57†	Hitchin Rd/Cannon Lane Resi 1	Roadside	510747	224311	NO2	NO	2	9	NO	2.4
LN58†	Hitchin Rd/Cannon Lane Resi 2	Roadside	510747	224311	NO_2	NO	2	9	NO	2.4
LN59†	Hitchin Rd/Cannon Lane Resi 3	Roadside	510747	224311	NO_2	NO	2	9	NO	2.4
LN61[t]	CRAQM 2A	Roadside	508708	221352	NO_2	YES (AQMA No. 3)	6	2.5	YES	2
LN62[t]	CRAQM 2B	Roadside	508708	221352	NO_2	YES (AQMA No. 3)	6	2.5	YES	2
LN63[t]	CRAQM 2C	Roadside	508708	221352	NO_2	YES (AQMA No. 3)	6	2.5	YES	2
LN64	Park Viaduct - Park Street	Roadside	509563	220952	NO_2	NO	0.2	2.9	NO	2.65
LN65	Park Viaduct - Queens Close	Roadside	509486	220865	NO_2	NO	1.85	8.8	NO	1.85
LN66	Park Viaduct	Roadside	509288	220925	NO_2	YES (AQMA No. 3)	4.9	3.7	NO	2.65
LN67	Castle Street	Roadside	509083	220709	NO_2	NO	0	2.25	NO	2.7

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube collocated with a Continuous Analyser?	Height (m)
LN68	London Road	Roadside	508969	220487	NO_2	NO	0	8.4	NO	2.57
LN69	John Street	Roadside	509326	221357	NO_2	NO	0	1.65	NO	2.65
LN70	Crawley Green Road	Roadside	509813	221161	NO_2	NO	0	6	NO	2.62
LN71	Crescent Road	Urban Background	509549	221623	NO_2	NO	0	10.3	NO	2.4
LN72	Hucklesby Way	Urban Background	508937	221745	NO_2	NO	0	8.7	NO	2.5
LN73	Mill Street	Roadside	508959	221633	NO_2	NO	0	3.9	NO	2.9
LN74	Dunstable Road - Bury Park	Roadside	508165	222002	NO_2	NO	0	4.8	NO	2.5
LN75	New Bedford Road	Roadside	508745	222122	NO_2	NO	0	5.15	NO	2.5
LN76	Leagrave Road	Urban Background	507574	222948	NO_2	NO	0	8.8	NO	2.34
LN77	Marsh Road	Roadside	506496	224018	NO_2	NO	0	4.8	NO	2.5

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube collocated with a Continuous Analyser?	Height (m)
LN78	Hibbert Street	Roadside	509109	220676	NO_2	NO	0.2	1.35	NO	2.4
LN79	Castle Street 2	Roadside	509050	220634	NO_2	NO	-	2.05	NO	3.0
LN80	Windsor Street	Roadside	509038	220719	NO_2	NO	0.46	1.00	NO	2.33
LN81	Bank Close	Suburban	505034	223729	NO_2	YES (AQMA No. 2)	-	1.7	NO	2.55
LN82	11 Withy Close	Suburban	504828	223999	NO_2	YES (AQMA Nos. 1 & 2)	0	8.50	NO	2.50
LN83	b/h 9 Copperfields	Suburban	505116	223467	NO_2	YES (AQMA No. 2)	13	26	NO	2.50
LN84	97 Lime Avenue	Suburban	505230	223304	NO_2	YES (AQMA No. 2)	8.5	1.75	NO	2.5
LN85	26 Belper Road	Suburban	505481	222545	NO_2	YES (AQMA No. 2)	0	17	NO	2
LN86	Bradley Road (by M1 Bridge)	Roadside	505586	222235	NO_2	YES (AQMA Nos. 1 & 2)	-	2.3	NO	2.55

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.

[t] Triplicate tube (*i.e*. co-located with two other diffusion tubes).

[†] Monitoring discontinued at location prior to 2019, data provided for legacy purposes.

b) London Luton Airport Operations Ltd (LLAOL) sites

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube collocated with a Continuous Analyser?	Height (m)
LLA 1	Outside Zone 2 (prior to Jun 19)	Other	511903	221278	NO_2	NO			NO	
LLA 1*	Outside Zone 2 (from Jun 19)	Other	511920	221334	NO_2	NO			NO	
LLA 2 (LA02)	Airport Approach Road	Roadside	511579	220960	NO_2	NO	880	3	NO	1.9
LLA 3 (LA03)	Runway Threshold Western	Other	511170	220436	NO_2	NO	1000	N/A	NO	1.8
LLA 4 (LA04)	Runway Threshold Eastern	Other	513644	221207	NO_2	NO	550	N/A	NO	2
LLA 5 (LA05)	Adjacent to Stand 5	Other	511711	221337	NO_2	NO	585	N/A	NO	1
LLA 6 (LA06)	President Way Jct	Roadside	511682	221727	NO_2	NO	230	3	NO	2.3
LLA 7	Drop Off Zone (prior to Dec 19)	Roadside	512166	221226	NO_2	NO			NO	
LLA 7*	Drop Off Zone (from Dec 19)	Roadside	512105	221168	NO_2	NO			NO	
LLA 8 (LA08)	BAM Co-located	Other	511867	221148	NO_2	NO	820	N/A	NO	1.7

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube collocated with a Continuous Analyser?	Height (m)
LLA 9 (LA09)	Stagenhoe Bottom Farm	Rural	517602	222572	NO_2	NO	30	N/A	NO	1.2
LLA 10 (LA10)	Grove Farm Slip End	Rural	507667	217744	NO_2	NO	30	N/A	NO	1.2
LLA 11 (LA17)	Dane End	Roadside	513140	220669	NO_2	NO	130	1	NO	2.1
LLA 12 (LA14)	Adjacent to Stand 60	Roadside	511886	221566	NO_2	NO	420	N/A	NO	1
LLA 13 (LA15)	Eaton Green Road	Roadside	511901	222055	NO_2	NO	35	8	NO	2
LLA 14	Undercroft Access Road	Kerbside	511995	221316	NO_2	NO			NO	
LLA 15	Eaton Green Road – EasyJet CP	Kerbside	511168	221706	NO_2	NO			NO	
LLA 16	Exit Road Plaza	Roadside	512158	221087	NO_2	NO			NO	
LLA 16*	Stand 23R airside	Other	512275	221115	NO_2	NO			NO	
LLA 17	A1081 New Airport Way 1	Roadside	509489	219237	NO_2	NO			NO	

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube collocated with a Continuous Analyser?	Height (m)
LLA 18†	A1081 New Airport Way 2	Roadside	510991	220497	NO_2	NO			NO	
LLA 18ll	A1081 New Airport Way 2	Roadside	510779	220279	NO_2	NO			NO	
LLA 19	Breachwood Green Community Hall	Rural	515109	221933	NO_2	NO			NO	
LA01†	Terminal Patio	Other	511847	221336	NO_2	NO	620	N/A	NO	7
LA07†	Terminal Car Park	Other	512181	221352	NO_2	NO	780	N/A	NO	2.3
LA16†	Set Down Area	Kerbside	511954	221313	NO_2	NO	690	0.5	NO	2
LA18†	Breachwood Green	Kerbside	515053	221778	NO_2	NO			NO	
LA19†	Kensworth	Kerbside	502848	218161	NO_2	NO			NO	
LA20†	Short Term Car Park	Kerbside			NO_2	NO			NO	

Notes:

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

(2) N/A if not applicable.

* Tube moved to a new location part way through 2019.

‖ Tube moved to new location prior to the start of the year.

† Monitoring discontinued at location prior to 2019, data provided for legacy purposes.

c) London Luton Airport Ltd (LLAL) sites

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube collocated with a Continuous Analyser?	Height (m)
L1[ii]	Dunstable Road East	Roadside	508708	221352	NO_2	YES (AQMA No. 3)	6	2.4	YES	2.0
L2[ii]	Crawley Green Road		511155	222445	NO_2	NO		1.2	NO	2.1
L3[ii]	Wigmore Lane		511780	222760	NO_2	NO		1.0	NO	2.0
L4[ii]	Eaton Green Road / Darley Road		513223	222397	NO_2	NO		1.5	NO	2.0
L5[ii]	Chapel Road, Breachwood		515047	221904	NO_2	NO		2.78	NO	2.0
L6[ii]	Winch Hill		513773	221752	NO_2	NO		1.2	NO	1.9
L7[ii]	Vauxhall Way		511057	221386	NO_2	NO		2.1	NO	2.0
L8[ii]	Kimpton Road		510543	220706	NO_2	NO		2.1	NO	2.0
L9[ii]	Luton Parkway Station Exit (North)		510529	220598	NO_2	NO		-	NO	1.8

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube collocated with a Continuous Analyser?	Height (m)
L10	Luton Road, Caddington		506541	219854	NO_2	NO		1.0	NO	2.1
L11	Wigmore Valley Park		512569	222207	NO_2	NO		-	YES	1.6
V1	Crawley Green Road		511155	222445	BTEX; Napthalene; 1,3 Butadiene	NO		1.2	NO	2.1
V2	Wigmore Valley Park		512569	222207	BTEX; Napthalene; 1,3 Butadiene	NO		-	YES	2.0
V3	Chapel Road, Breachwood		515047	221904	BTEX; Napthalene; 1,3 Butadiene	NO		2.78	NO	2.0
V4	Copt Hall Road		512497	220008	BTEX; Napthalene; 1,3 Butadiene	NO		1.4	NO	1.9
V5	Luton Parkway Station Exit (North)		510529	220598	BTEX; Napthalene; 1,3 Butadiene	NO		-	NO	1.8

Notes:

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

(2) N/A if not applicable.

[ii] Duplicate site with two co-located diffusion tubes.

[iii] Triplicate site with three co-located diffusion tubes.

Table A.3 – Annual Mean NO_2 Monitoring Results

a) Luton Borough Council (LBC) sites

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2019 (%) (2)	NO_2 Annual Mean Conc. ($\mu g/m^3$) (3) (4) 2015	NO_2 Annual Mean Conc. ($\mu g/m^3$) (3) (4) 2016	NO_2 Annual Mean Conc. ($\mu g/m^3$) (3) (4) 2017	NO_2 Annual Mean Conc. ($\mu g/m^3$) (3) (4) 2018	NO_2 Annual Mean Conc. ($\mu g/m^3$) (3) (4) 2019
LN60 *(HB007)*	508708	221352	Roadside	Automatic	97	97	**43**	**47**	39	37	40
LN07	509227	221455	Roadside	Diffusion Tube	92	92	NDA	30	27	27	28
LN11	508910	221321	Roadside	Diffusion Tube	50	50	35	39	34	34	34
LN15	505557	222325	Roadside	Diffusion Tube	100	100	30	31	30	26	27
LN16	505492	222607	Roadside	Diffusion Tube	100	100	35	36	35	30	31
LN17	505324	222812	Roadside	Diffusion Tube	100	100	36	39	36	34	33
LN18	505014	223538	Roadside	Diffusion Tube	100	100	26	28	24	24	22
LN22	511341	221864	Urban Background	Diffusion Tube	100	100	21	25	23	21	23
LN23	511377	221814	Roadside	Diffusion Tube	100	100	32	36	37	29	35
LN24	511902	222144	Urban Background	Diffusion Tube	100	100	21	24	22	20	22
LN25	511893	222068	Roadside	Diffusion Tube	100	100	28	30	29	27	30

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2019 (%) (2)	NO_2 Annual Mean Conc. ($\mu g/m^3$) (3) (4) 2015	NO_2 Annual Mean Conc. ($\mu g/m^3$) (3) (4) 2016	NO_2 Annual Mean Conc. ($\mu g/m^3$) (3) (4) 2017	NO_2 Annual Mean Conc. ($\mu g/m^3$) (3) (4) 2018	NO_2 Annual Mean Conc. ($\mu g/m^3$) (3) (4) 2019
LN26	512109	222234	Urban Background	Diffusion Tube	100	100	21	21	20	20	20
LN27	512134	222198	Roadside	Diffusion Tube	100	100	28	30	30	28	28
LN28	507798	219832	Roadside	Diffusion Tube	100	100	**43**	**46**	**46**	**40**	39
LN52	508689	221379	Roadside	Diffusion Tube	100	100	**46**	**49**	**43**	40	**43**
LN53	507717	219923	Suburban	Diffusion Tube	92	92	33	34	33	28	28
LN54	507712	219915	Suburban	Diffusion Tube	75	75	32	34	34	27	28
LN55	507732	219886	Suburban	Diffusion Tube	100	100	31	34	33	29	27
LN56	507747	219894	Suburban	Diffusion Tube	100	100	32	34	31	29	28
LN57†	510747	224311	Roadside	Diffusion Tube	0	0	31	33	NDA	NDA	NDA
LN58†	510747	224311	Roadside	Diffusion Tube	0	0	31	32	NDA	NDA	NDA
LN59†	510747	224311	Roadside	Diffusion Tube	0	0	31	34	NDA	NDA	NDA
$\bar{x}$ LN61/62/63	508708	221352	Roadside	Diffusion Tube	100	100	**42**	**45**	**42**	39	**41**
LN64	509563	220952	Roadside	Diffusion Tube	100	100	32	34	31	28	31

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2019 (%) (2)	NO_2 Annual Mean Conc. ($\mu g/m^3$) (3) (4) 2015	NO_2 Annual Mean Conc. ($\mu g/m^3$) (3) (4) 2016	NO_2 Annual Mean Conc. ($\mu g/m^3$) (3) (4) 2017	NO_2 Annual Mean Conc. ($\mu g/m^3$) (3) (4) 2018	NO_2 Annual Mean Conc. ($\mu g/m^3$) (3) (4) 2019
LN65	509486	220865	Roadside	Diffusion Tube	100	100	26	27	26	23	24
LN66	509288	220925	Roadside	Diffusion Tube	100	100	37	39	39	33	37
LN67	509083	220709	Roadside	Diffusion Tube	100	100	**44**	**48**	**42**	**41**	**43**
LN68	508969	220487	Roadside	Diffusion Tube	100	100	32	35	33	31	32
LN69	509326	221357	Roadside	Diffusion Tube	100	100	29	33	31	29	31
LN70	509813	221161	Roadside	Diffusion Tube	100	100	31	34	34	31	33
LN71	509549	221623	Urban Background	Diffusion Tube	100	100	28	32	31	31	31
LN72	508937	221745	Urban Background	Diffusion Tube	100	100	27	31	30	31	30
LN73	508959	221633	Roadside	Diffusion Tube	100	100	37	**44**	**42**	37	38
LN74	508165	222002	Roadside	Diffusion Tube	100	100	39	**41**	39	35	37
LN75	508745	222122	Roadside	Diffusion Tube	100	100	38	**41**	38	36	37
LN76	507574	222948	Urban Background	Diffusion Tube	100	100	30	34	32	31	31
LN77	506496	224018	Roadside	Diffusion Tube	100	100	35	37	36	33	36

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2019 (%) (2)	NO_2 Annual Mean Conc. ($\mu g/m^3$) (3) (4) 2015	NO_2 Annual Mean Conc. ($\mu g/m^3$) (3) (4) 2016	NO_2 Annual Mean Conc. ($\mu g/m^3$) (3) (4) 2017	NO_2 Annual Mean Conc. ($\mu g/m^3$) (3) (4) 2018	NO_2 Annual Mean Conc. ($\mu g/m^3$) (3) (4) 2019
LN78	509109	220676	Roadside	Diffusion Tube	100	100	NDA	34	32	29	31
LN79	509050	220634	Roadside	Diffusion Tube	100	100	NDA	37	33	37	34
LN80	509038	220719	Roadside	Diffusion Tube	100	100	NDA	36	34	37	33
LN81	505034	223729	Suburban	Diffusion Tube	100	100	NDA	NDA	38	32	31
LN82	504828	223999	Suburban	Diffusion Tube	100	100	NDA	NDA	32	27	28
LN83	505116	223467	Suburban	Diffusion Tube	100	100	NDA	NDA	25	25	22
LN84	505230	223304	Suburban	Diffusion Tube	100	100	NDA	NDA	27	25	25
LN85	505481	222545	Suburban	Diffusion Tube	100	100	NDA	NDA	NDA	28	30
LN86	505586	222235	Roadside	Diffusion Tube	100	100	NDA	NDA	**42**	37	39

☒ **Diffusion tube data has been bias corrected**

☒ **Annualisation has been conducted where data capture is <75%**

☒ **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 adjustment**

Notes:
Exceedances of the NO_2 annual mean objective of 40µg/m^3 are shown in **bold**.
NO_2 annual means exceeding 60µg/m^3, indicating a potential exceedance of the NO_2 1-hour mean objective are shown in **bold and underlined.**

(1) Data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.
(2) Data capture for the full calendar year (*e.g.* if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).
(3) Means for diffusion tubes have been corrected for bias. All means have been *"annualised"* as per Boxes 7.9 and 7.10 in LAQM.TG16 if valid data capture for the full calendar year is less than 75%. See Appendix C for details.
(4) Concentrations are those at the location of monitoring and not those following any fall-off with distance adjustment.

† Monitoring discontinued at location prior to 2019, data provided for legacy purposes.

b) London Luton Airport Operations Ltd. (LLAOL) sites

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2019 (%) (2)	NO_2 Annual Mean Conc. ($\mu g/m^3$) (3) (4) 2015	NO_2 Annual Mean Conc. ($\mu g/m^3$) (3) (4) 2016	NO_2 Annual Mean Conc. ($\mu g/m^3$) (3) (4) 2017	NO_2 Annual Mean Conc. ($\mu g/m^3$) (3) (4) 2018	NO_2 Annual Mean Conc. ($\mu g/m^3$) (3) (4) 2019
LLA 1	511903	221278	Other	Diffusion Tube	100	42	NDA	NDA	NDA	**46**	**48**
LLA 1*	511920	221334	Other	Diffusion Tube	100	58	NDA	NDA	NDA	NDA	37
LLA 2 (LA02)	511579	220960	Roadside	Diffusion Tube	100	100	29	**40**	38	38	34
LLA 3 (LA03)	511170	220436	Other	Diffusion Tube	100	100	17	24	23	25	22
LLA 4 (LA04)	513644	221207	Other	Diffusion Tube	100	100	13	17	19	18	18
LLA 5 (LA05)	511711	221337	Other	Diffusion Tube	100	100	34	**43**	**40**	**40**	37
LLA 6 (LA06)	511682	221727	Roadside	Diffusion Tube	100	100	26	34	35	35	34
LLA 7	512166	221226	Roadside	Diffusion Tube	100	92	NDA	NDA	NDA	**44**	**46**
LLA 7* §	512105	221168	Roadside	Diffusion Tube	100	8	NDA	NDA	NDA	NDA	NDA
LLA 8 (LA08)	511867	221148	Other	Diffusion Tube	100	100	24	34	32	32	32
LLA 9 (LA09)	517602	222572	Rural	Diffusion Tube	100	100	7	10	11	11	10
LLA 10 (LA10)	507667	217744	Rural	Diffusion Tube	100	100	9	12	11	12	11

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2019 (%) (2)	NO_2 Annual Mean Conc. ($\mu g/m^3$) (3) (4) 2015	NO_2 Annual Mean Conc. ($\mu g/m^3$) (3) (4) 2016	NO_2 Annual Mean Conc. ($\mu g/m^3$) (3) (4) 2017	NO_2 Annual Mean Conc. ($\mu g/m^3$) (3) (4) 2018	NO_2 Annual Mean Conc. ($\mu g/m^3$) (3) (4) 2019
LLA 11 (LA17)	513140	220669	Roadside	Diffusion Tube	100	100	11	15	15	15	13
LLA 12 (LA14)	511886	221566	Roadside	Diffusion Tube	100	100	29	39	38	38	36
LLA 13 (LA15)	511901	222055	Roadside	Diffusion Tube	100	100	21	27	25	26	24
LLA 14	511995	221316	Kerbside	Diffusion Tube	100	100	NDA	NDA	NDA	**42**	**42**
LLA 15	511168	221706	Kerbside	Diffusion Tube	92	92	NDA	NDA	NDA	32	31
LLA 16	512158	221087	Roadside	Diffusion Tube	80	33	NDA	NDA	NDA	**44**	**44**
LLA 16*	512275	221115	Other	Diffusion Tube	71	42	NDA	NDA	NDA	NDA	32
LLA 17	509489	219237	Roadside	Diffusion Tube	92	92	NDA	NDA	NDA	**40**	32
LLA 18†	510991	220497	Roadside	Diffusion Tube	0	0	NDA	NDA	NDA	38	NDA
LLA 18‖	510779	220279	Roadside	Diffusion Tube	92	92	NDA	NDA	NDA	NDA	29
LLA 19	515109	221933		Diffusion Tube	75	25	NDA	NDA	NDA	NDA	16
LA01†	511847	221336	Other	Diffusion Tube	0	0	28	31	33	NDA	NDA
LA07†	512181	221352	Other	Diffusion Tube	0	0	23	36	**46**	NDA	NDA

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2019 (%) (2)	NO_2 Annual Mean Conc. ($\mu g/m^3$) (3) (4) 2015	NO_2 Annual Mean Conc. ($\mu g/m^3$) (3) (4) 2016	NO_2 Annual Mean Conc. ($\mu g/m^3$) (3) (4) 2017	NO_2 Annual Mean Conc. ($\mu g/m^3$) (3) (4) 2018	NO_2 Annual Mean Conc. ($\mu g/m^3$) (3) (4) 2019
LA16†	511954	221313	Kerbside	Diffusion Tube	0	0	30	**41**	40	NDA	NDA
LA18†	515053	221778	Kerbside	Diffusion Tube	0	0	NDA	14	14	NDA	NDA
LA19†	502848	218161	Kerbside	Diffusion Tube	0	0	NDA	12	NDA	NDA	NDA
LA20†			Kerbside	Diffusion Tube	0	0	NDA	NDA	**41**	NDA	NDA

☒ **Diffusion tube data has been bias corrected**

☒ **Annualisation has been conducted where data capture is <75%**

☒ **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 adjustment**

Notes:
Exceedances of the NO_2 annual mean objective of 40µg/m^3 are shown in **bold**.
NO_2 annual means exceeding 60µg/m^3, indicating a potential exceedance of the NO_2 1-hour mean objective are shown in **bold and underlined.**

(1) Data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.
(2) Data capture for the full calendar year (*e.g.* if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).
(3) Means for diffusion tubes have been corrected for bias. All means have been *"annualised"* as per Boxes 7.9 and 7.10 in LAQM.TG16 if valid data capture for the full calendar year is less than 75%. See Appendix C for details.
(4) Concentrations are those at the location of monitoring and not those following any fall-off with distance adjustment.

* Tube moved to new location part way through 2019.
‖ Tube moved to new location prior to the start of the year.

† Monitoring discontinued at location prior to 2019, data provided for legacy purposes.

§ Insufficient data capture for the full calendar year to generate meaningful annual mean concentration for 2019 (*i.e.* data capture <25%).

c) London Luton Airport Ltd (LLAL) sites

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2019 (%) (2)	NO_2 Annual Mean Conc. ($\mu g/m^3$) (3) (4) 2015	NO_2 Annual Mean Conc. ($\mu g/m^3$) (3) (4) 2016	NO_2 Annual Mean Conc. ($\mu g/m^3$) (3) (4) 2017	NO_2 Annual Mean Conc. ($\mu g/m^3$) (3) (4) 2018	NO_2 Annual Mean Conc. ($\mu g/m^3$) (3) (4) 2019
LA001	512578	222204		Automatic	99	53	NDA	NDA	NDA	NDA	16
L1[ii]	508708	221352		Diffusion Tube	100	100	NDA	NDA	NDA	37	**41**
L2[ii]	511155	222445		Diffusion Tube	92	92	NDA	NDA	NDA	31	30
L3[ii]	511780	222760		Diffusion Tube	83	83	NDA	NDA	NDA	26	30
L4[ii]	513223	222397		Diffusion Tube	100	100	NDA	NDA	NDA	16	20
L5[ii]	515047	221904		Diffusion Tube	100	100	NDA	NDA	NDA	11	15
L6[ii]	513773	221752		Diffusion Tube	100	100	NDA	NDA	NDA	14	17
L7[ii]	511057	221386		Diffusion Tube	67	67	NDA	NDA	NDA	**69**	**69**
L8[ii]	510543	220706		Diffusion Tube	83	83	NDA	NDA	NDA	28	35
L9[ii]	510529	220598		Diffusion Tube	92	92	NDA	NDA	NDA	25	31
L10[ii]	506541	219854		Diffusion Tube	100	100	NDA	NDA	NDA	19	25
L11[iii]	512569	222207		Diffusion Tube	100	42	NDA	NDA	NDA	NDA	20

☒ **Diffusion tube data has been bias corrected**

☒ **Annualisation has been conducted where data capture is <75%**

☒ **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 adjustment**

Notes:

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

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

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

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

(3) Means for diffusion tubes have been corrected for bias. All means have been *"annualised"* as per Boxes 7.9 and 7.10 in LAQM.TG16 if valid data capture for the full calendar year is less than 75%. See Appendix C for details.

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

ii Duplicate site with two co-located diffusion tubes.

iii Triplicate site with three co-located diffusion tubes.

d) Defra AURN sites

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2019 (%) (2)	NO_2 Annual Mean Conc. ($\mu g/m^3$) (3) (4) 2015	NO_2 Annual Mean Conc. ($\mu g/m^3$) (3) (4) 2016	NO_2 Annual Mean Conc. ($\mu g/m^3$) (3) (4) 2017	NO_2 Annual Mean Conc. ($\mu g/m^3$) (3) (4) 2018	NO_2 Annual Mean Conc. ($\mu g/m^3$) (3) (4) 2019
CM2 *(LUTR; UKA00605)*	505927	222644	Roadside	Automatic	97	97	**45**	**50**	**44**	**43**	39

☒ **Annualisation has been conducted where data capture is <75%**

☒ **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 adjustment**

Notes:

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

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

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

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

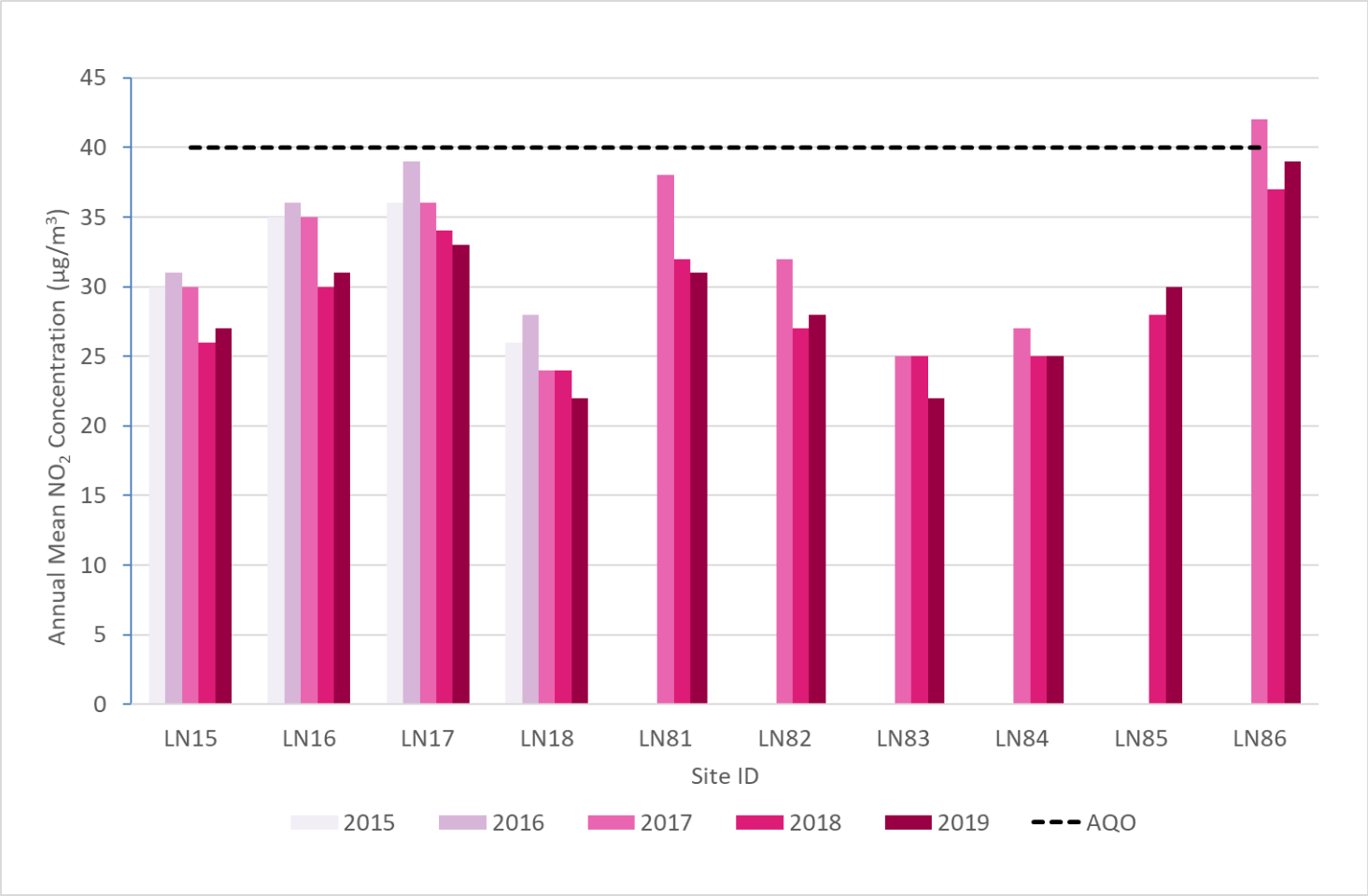
(3) Means for diffusion tubes have been corrected for bias. All means have been *"annualised"* as per Boxes 7.9 and 7.10 in LAQM.TG16 if valid data capture for the full calendar year is less than 75%. See Appendix C for details.

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

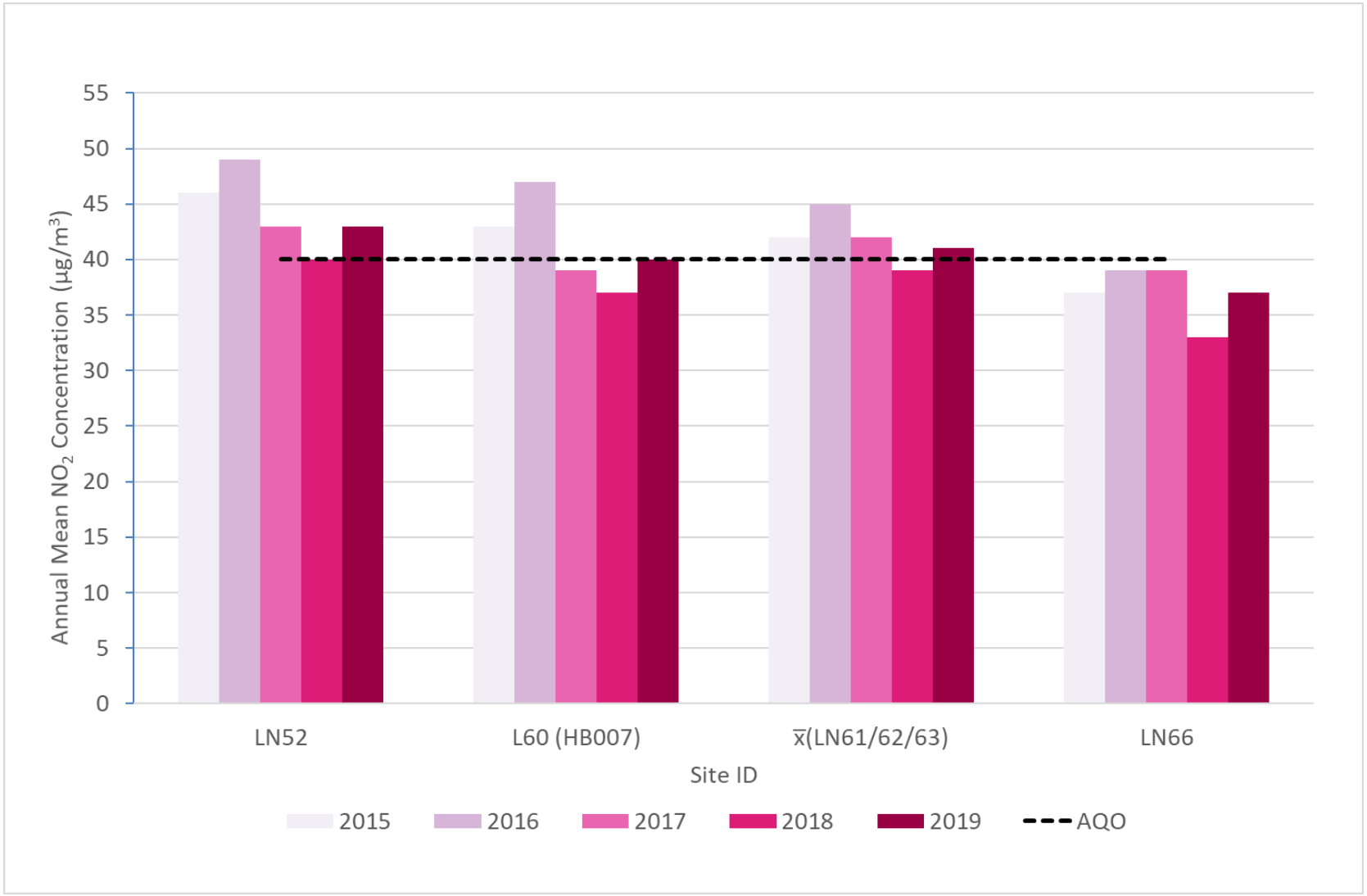
Figure A.1 – Trends in Annual Mean NO_2 Concentrations

a) Luton Borough Council (LBC) sites

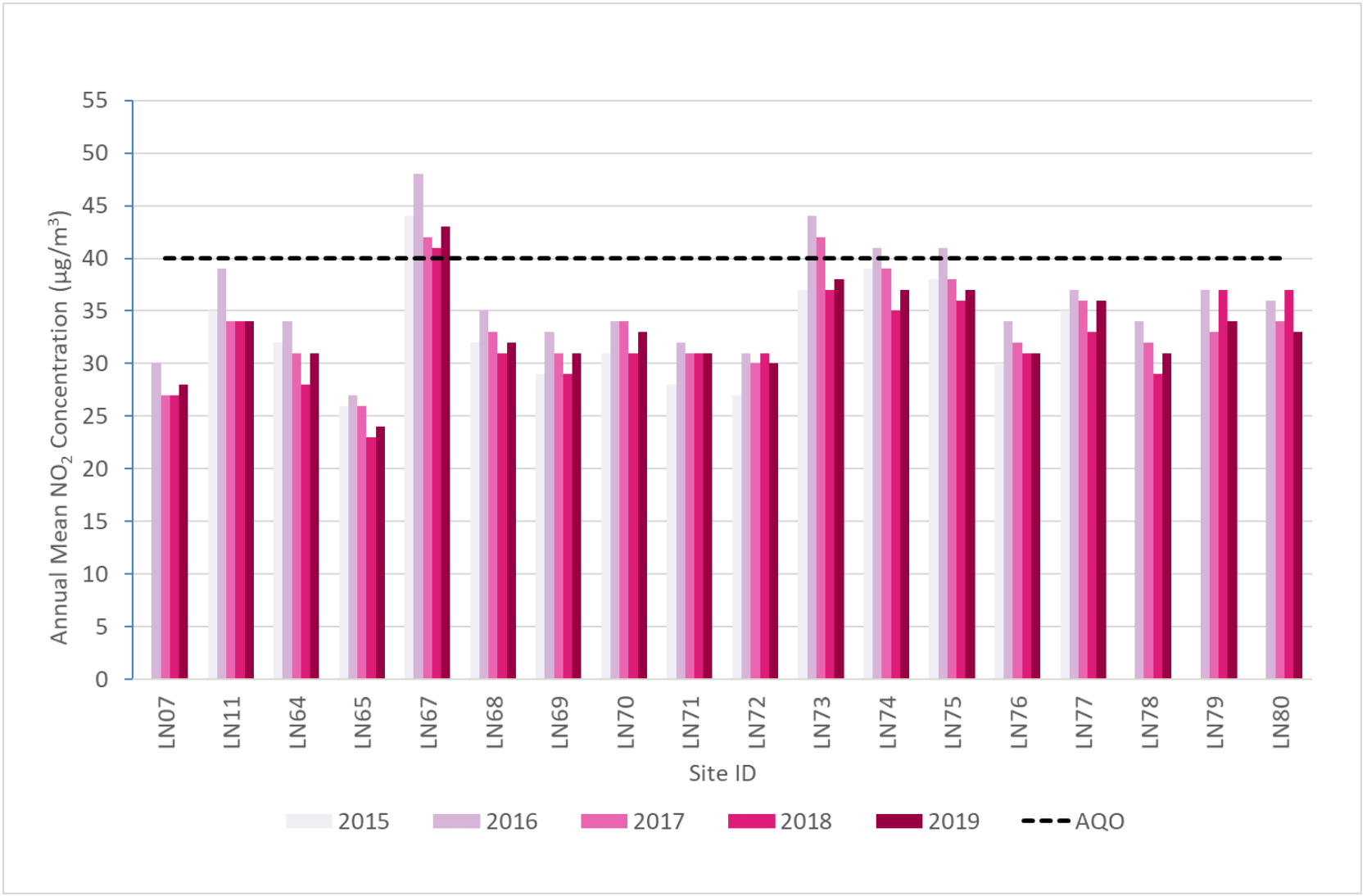
a. Within Luton AQMA Nos. 1 & 2 (Located in Challney & Leagrave Wards)



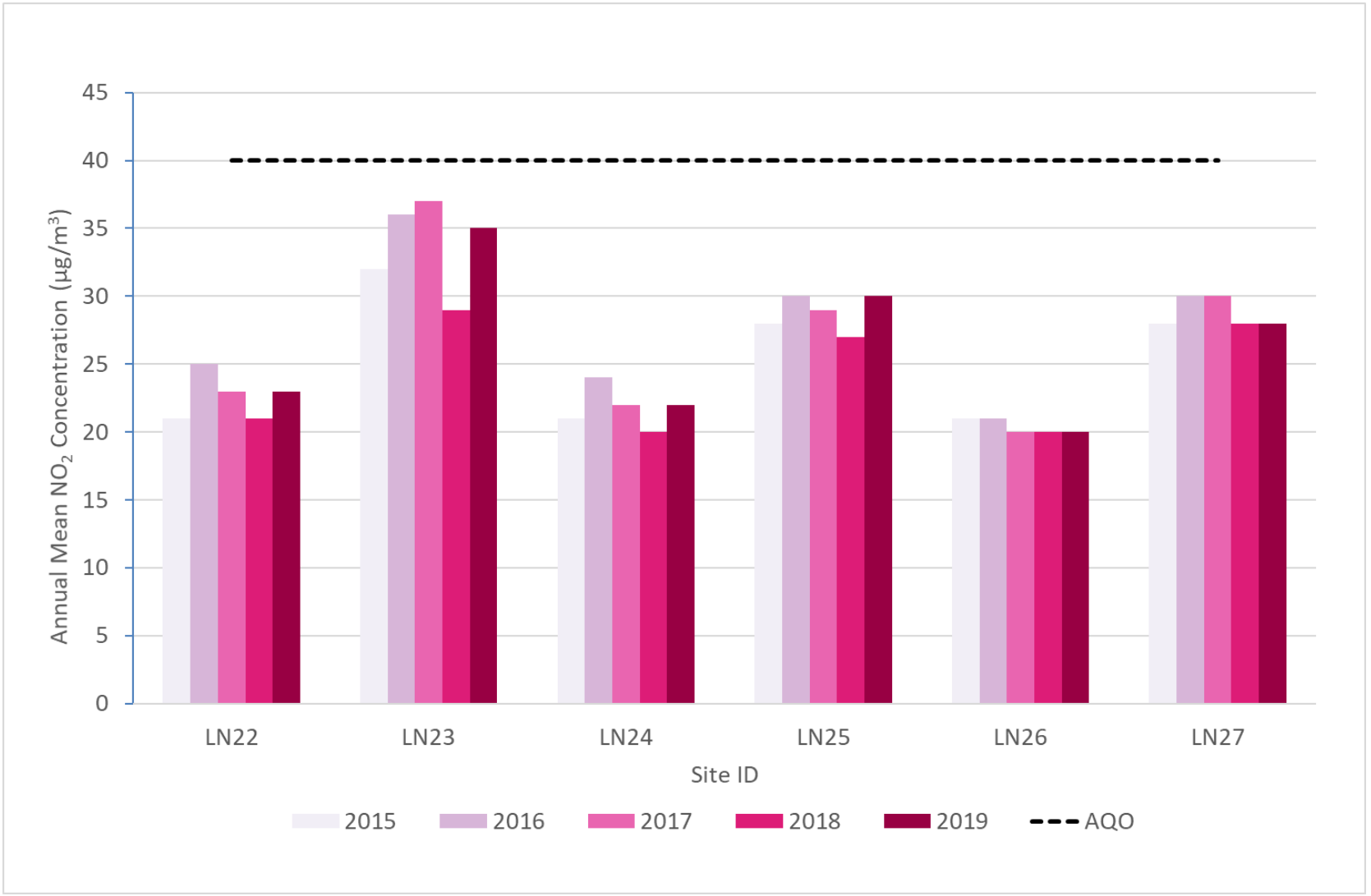
b. Within Luton AQMA No. 3 (Located in South Ward)



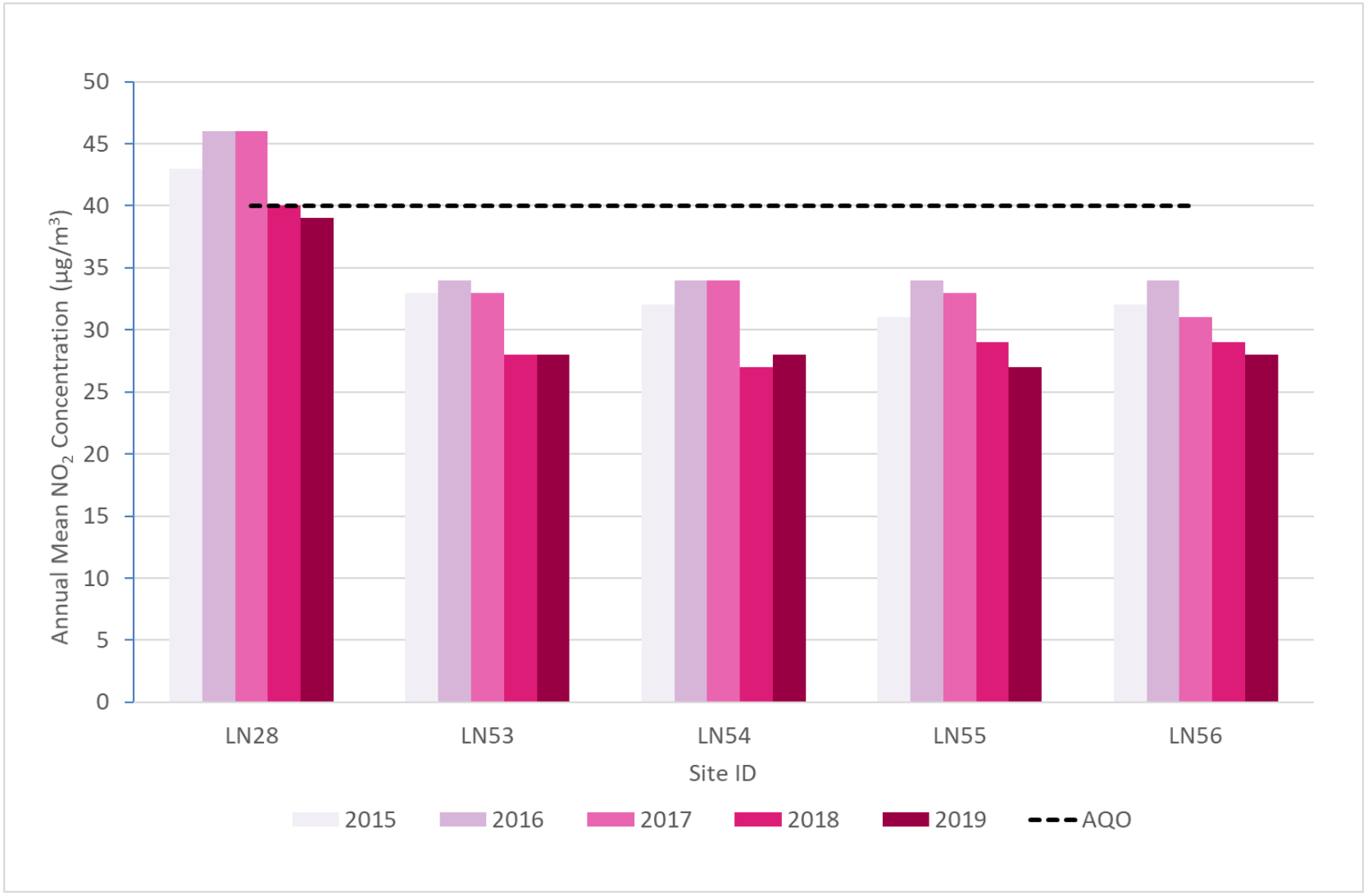
c. Non-AQMA locations in Central / North Luton (Located in South, Farley, High Town, Bury Park, Biscot, Saints and Limbury Wards)



d. Non-AQMA locations in East Luton (Located in Crawley and Wigmore Wards)

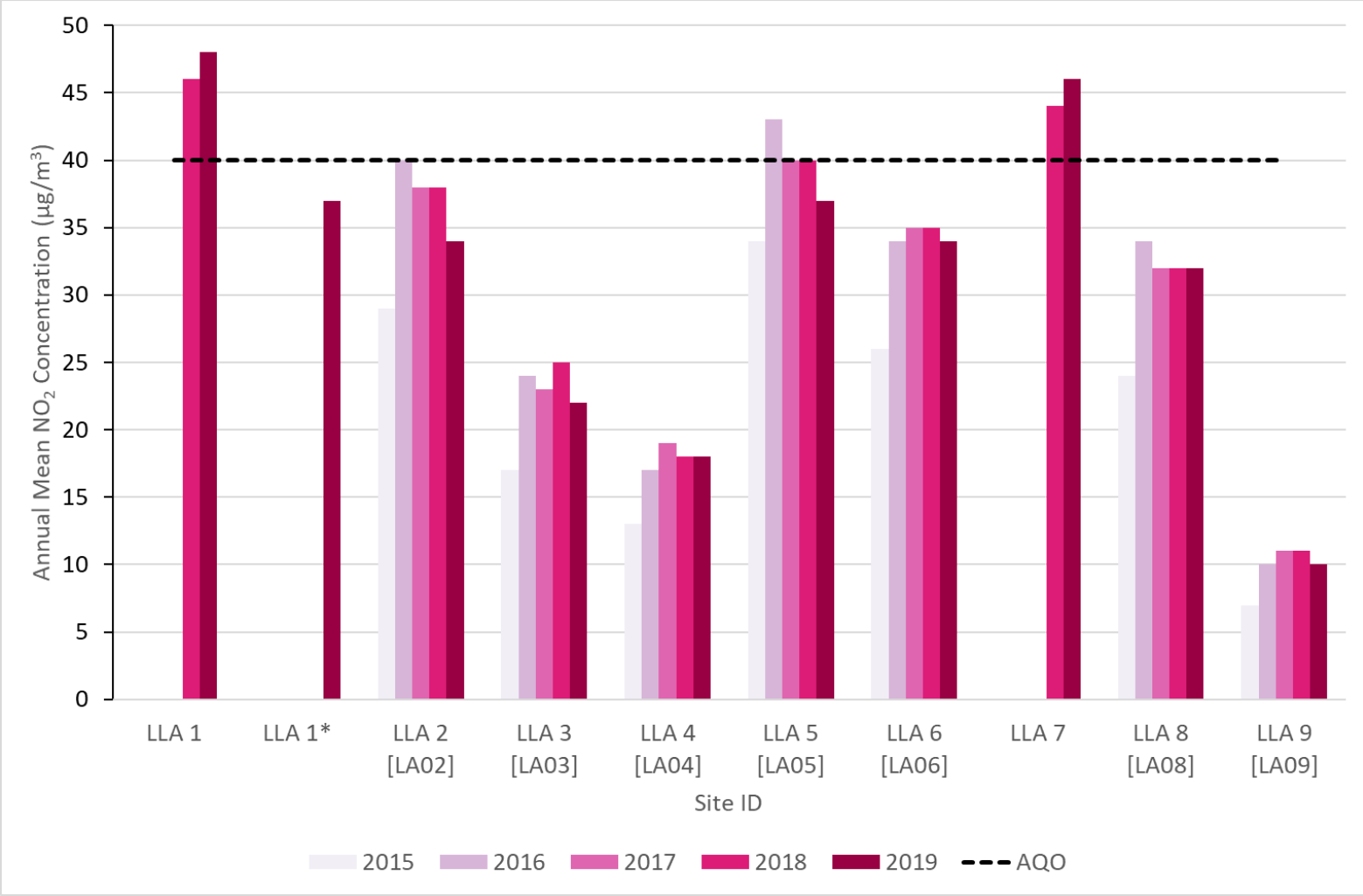


e. Non-AQMA locations in West Luton (Located in Farley Ward)

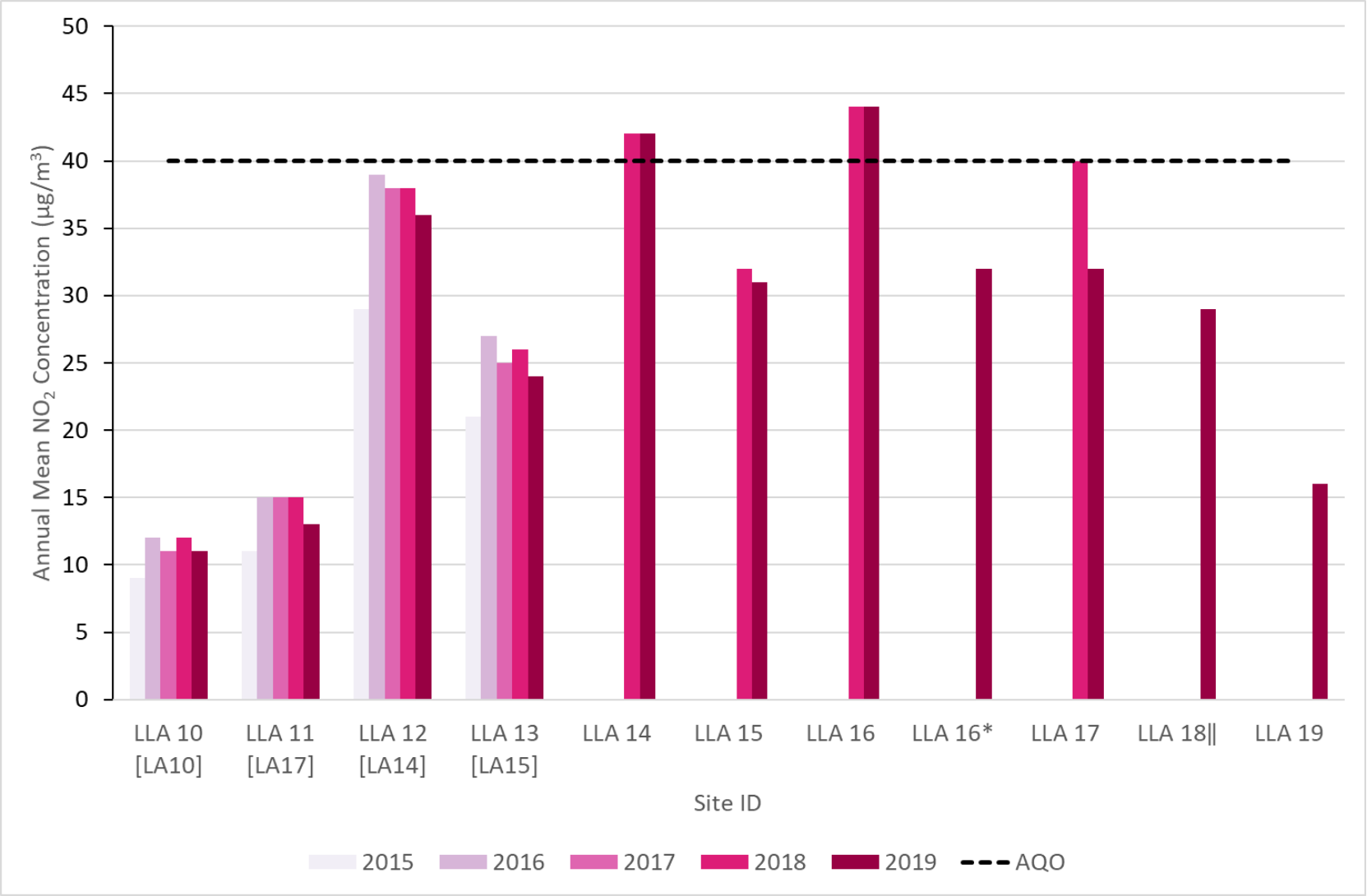


b) London Luton Airport Operations Ltd. (LLAOL) sites

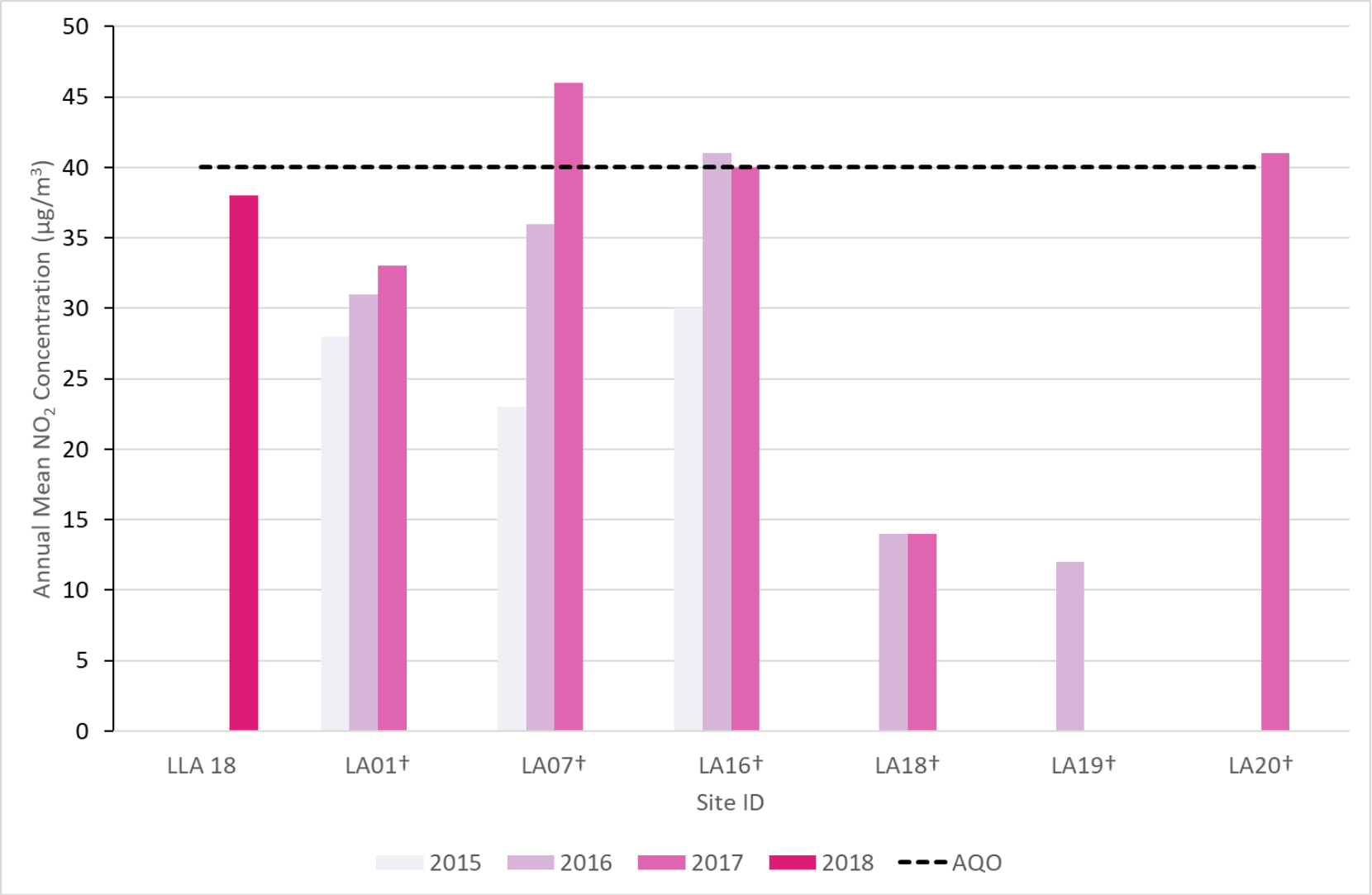
a. Locations active during 2019 (part 1)



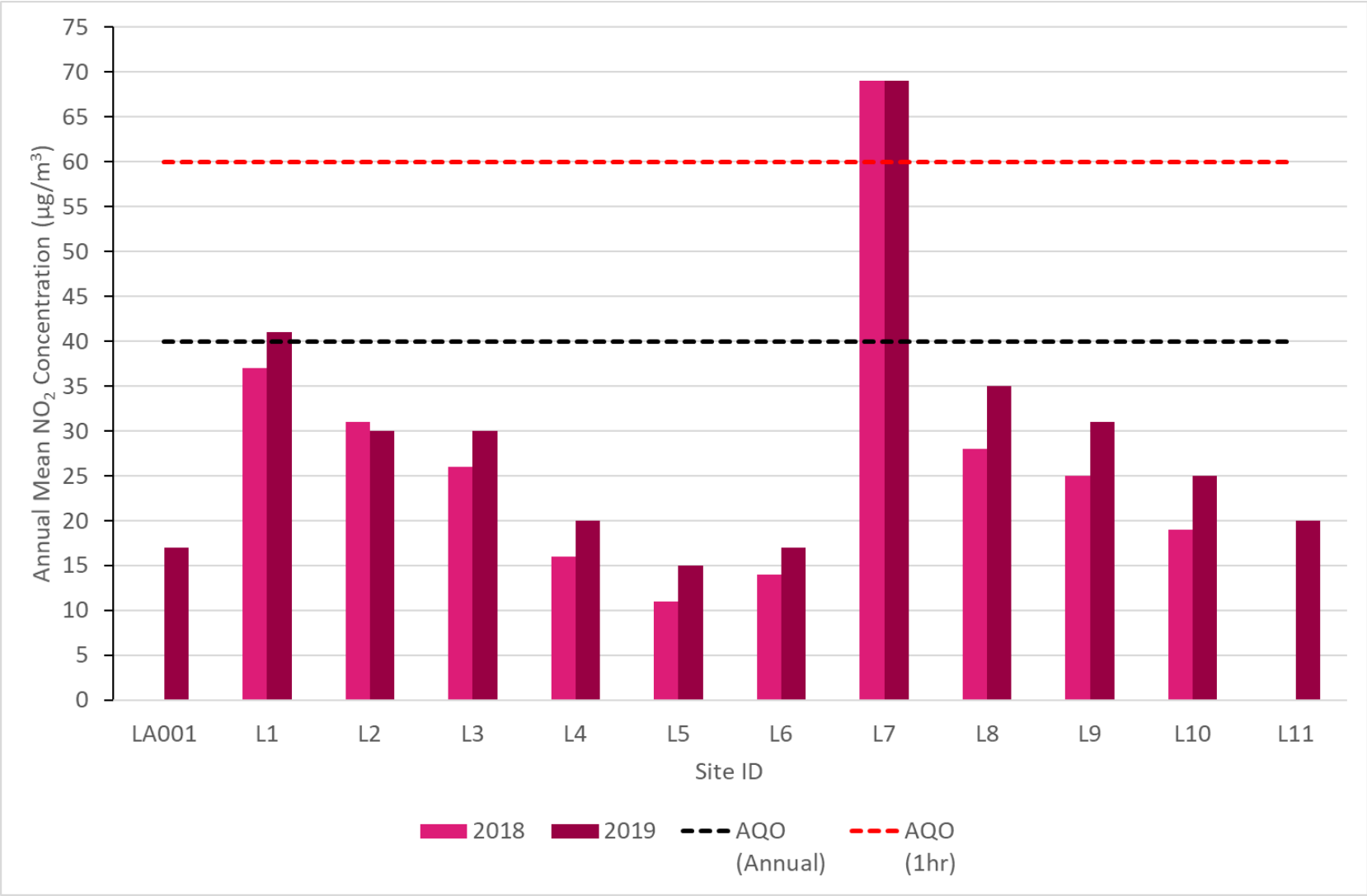
b. Locations active during 2019 (part 2)



c. Closed locations active between 2015 and 2018



c) London Luton Airport Ltd (LLAL) sites



d) Defra AURN sites

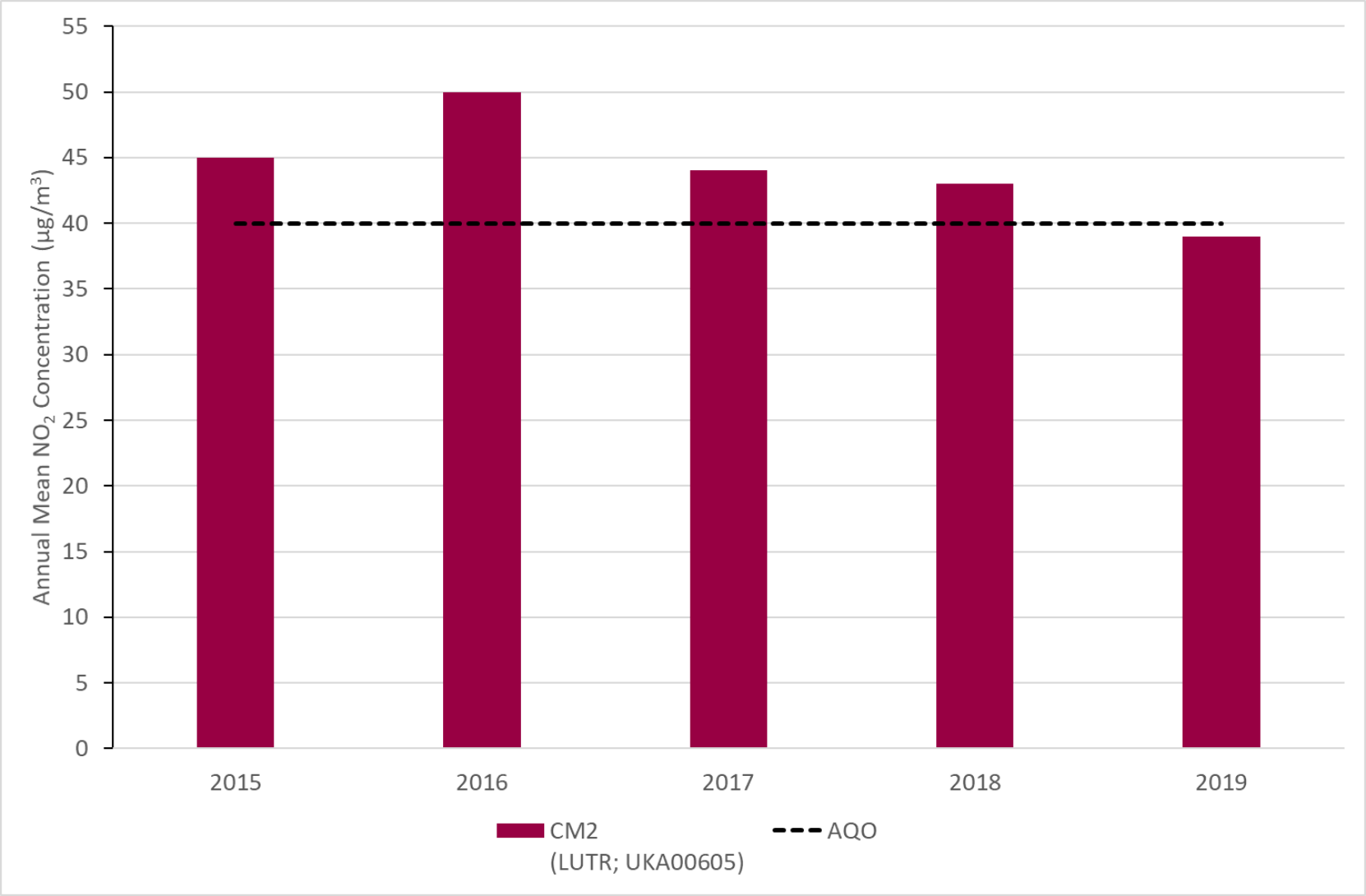


Table A.4 – 1-Hour Mean NO_2 Monitoring Results

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2019 (%) (2)	NO_2 1-Hour Means > 200µg/m^3 (3) 2015	NO_2 1-Hour Means > 200µg/m^3 (3) 2016	NO_2 1-Hour Means > 200µg/m^3 (3) 2017	NO_2 1-Hour Means > 200µg/m^3 (3) 2018	NO_2 1-Hour Means > 200µg/m^3 (3) 2019
LN60 *(HB007)*	508708	221352	Roadside	Automatic	97	97	0	2	0	0	0
LA001	512578	222204	Other	Automatic	99	53	NDA	NDA	NDA	NDA	0 (66)
CM2 *(LUTR; UKA00605)*	505927	222644	Roadside	Automatic	97	97	1	16	6	0	0

Notes:

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

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

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

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

Figure A.2 – Trends in Number of NO_2 1-Hour Means > 200µg/m^3

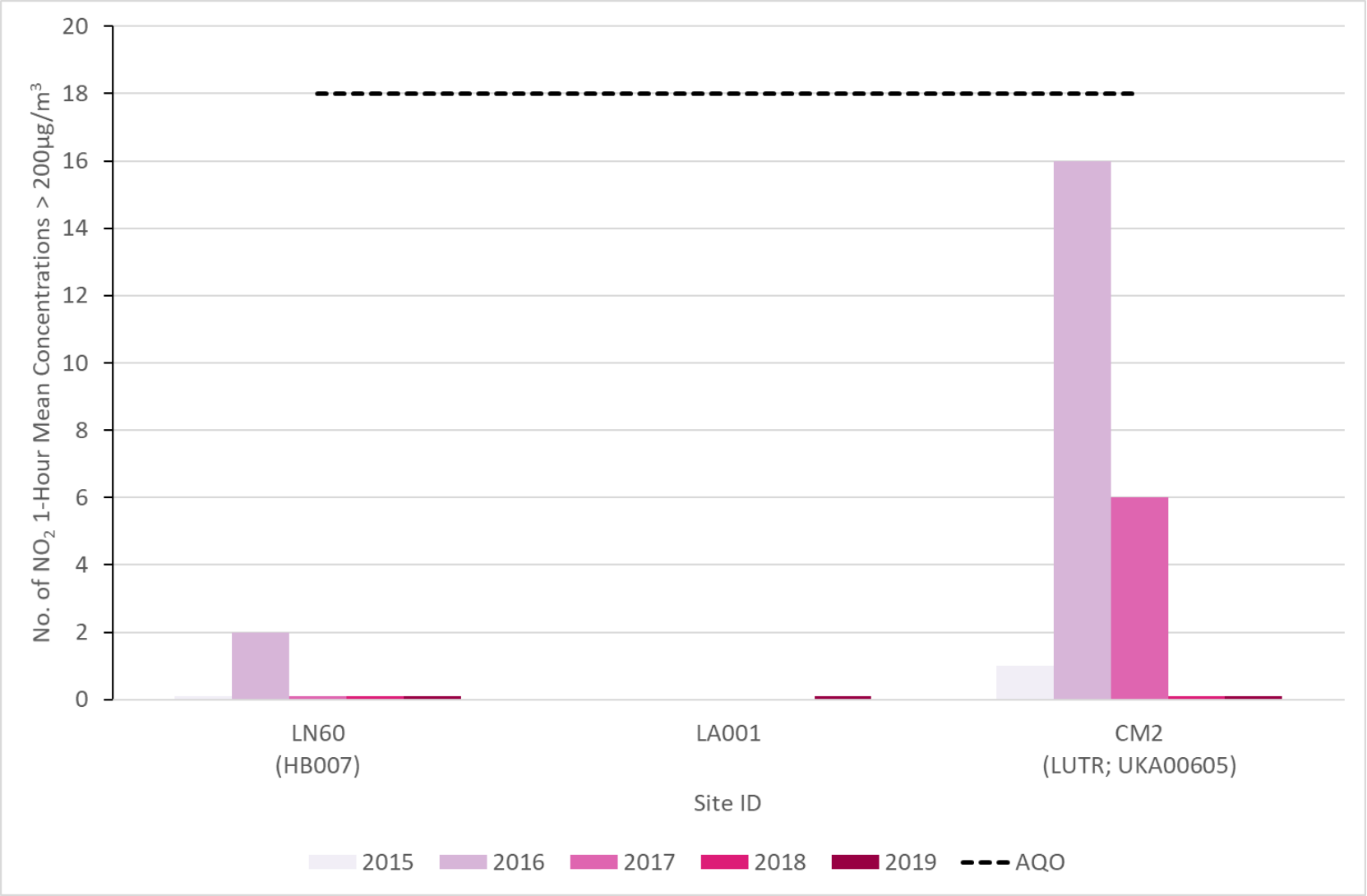


Table A.5 – Annual Mean PM_{10} Monitoring Results

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2019 (%) (2)	PM_{10} Annual Mean Conc. ($\mu g/m^3$) (3) 2015	PM_{10} Annual Mean Conc. ($\mu g/m^3$) (3) 2016	PM_{10} Annual Mean Conc. ($\mu g/m^3$) (3) 2017	PM_{10} Annual Mean Conc. ($\mu g/m^3$) (3) 2018	PM_{10} Annual Mean Conc. ($\mu g/m^3$) (3) 2019
LN60 *(HB007)*	508708	221352	Roadside	99	99	15	15	16	16	16
LA08 *(HB006)*	511871	221142	Urban Background	93	93	15	18	18	17	16
LA001	512578	222204	Other	99	53	NDA	NDA	NDA	NDA	14

☒ **Annualisation has been conducted where data capture is <75%**

Notes:

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

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

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

(3) All means have been *"annualised"* as per Boxes 7.9 and 7.10 in LAQM.TG16, valid data capture for the full calendar year is less than 75%. See Appendix C for details.

Figure A.3 – Trends in Annual Mean PM_{10} Concentrations

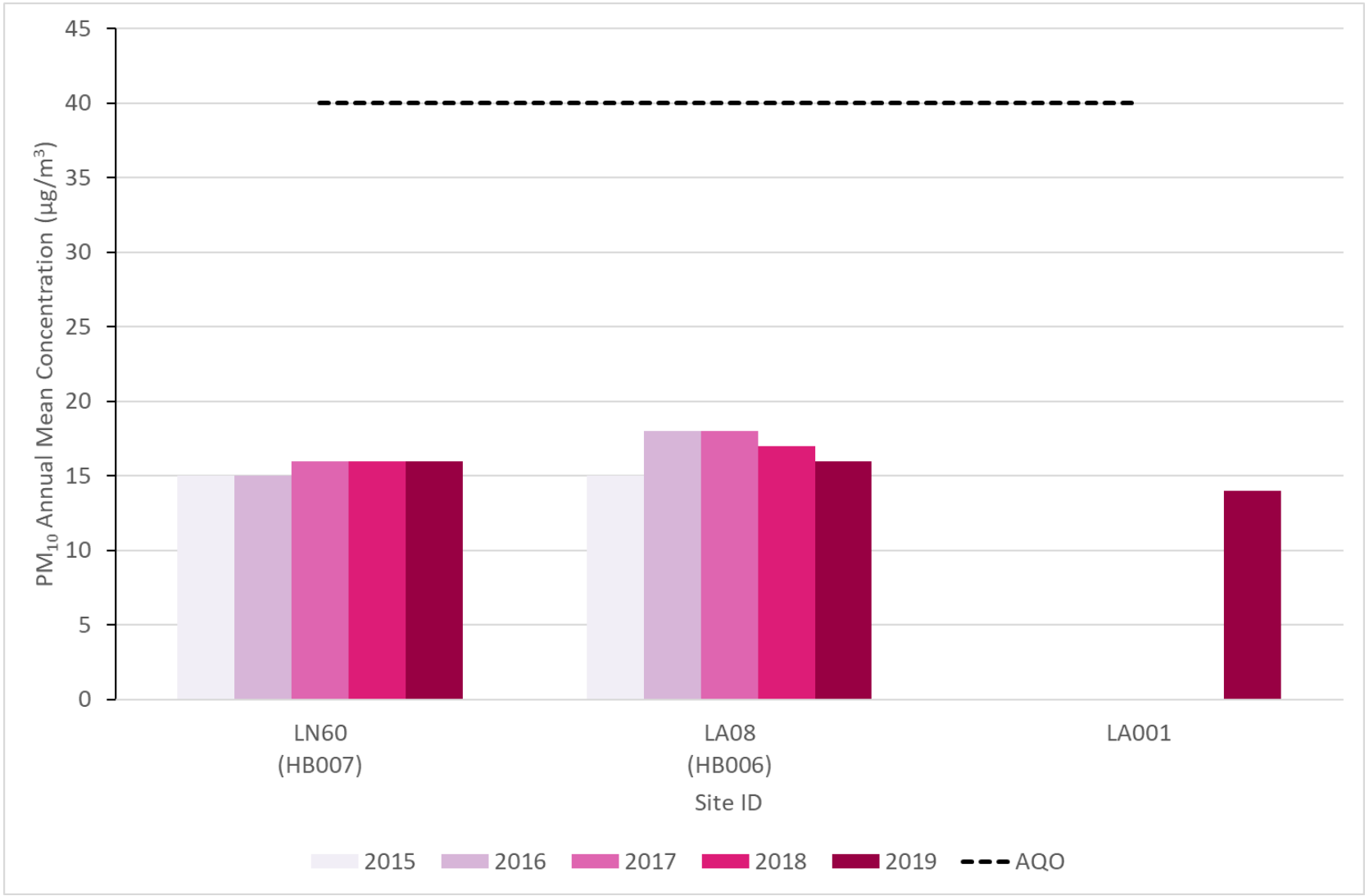


Table A.6 – 24-Hour Mean PM_{10} Monitoring Results

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2019 (%) (2)	PM_{10} 24-Hour Means > 50µg/m³ (3) 2015	PM_{10} 24-Hour Means > 50µg/m³ (3) 2016	PM_{10} 24-Hour Means > 50µg/m³ (3) 2017	PM_{10} 24-Hour Means > 50µg/m³ (3) 2018	PM_{10} 24-Hour Means > 50µg/m³ (3) 2019
LN60 *(HB007)*	508708	221352	Roadside	99	99	5	3	4	1	8
LA08 *(HB006)*	511871	221142	Urban Background	93	93	0	1	1	1	1
LA001	512578	222204	Other	99	53	NDA	NDA	NDA	NDA	0 (20)

Notes:

Exceedances of the PM_{10} 24-hour mean objective (50µg/m³ not to be exceeded more than 35 times/year) are shown in **bold.**

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

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

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

Figure A.4 – Trends in Number of 24-Hour Mean PM_{10} Results >50µg/m^3

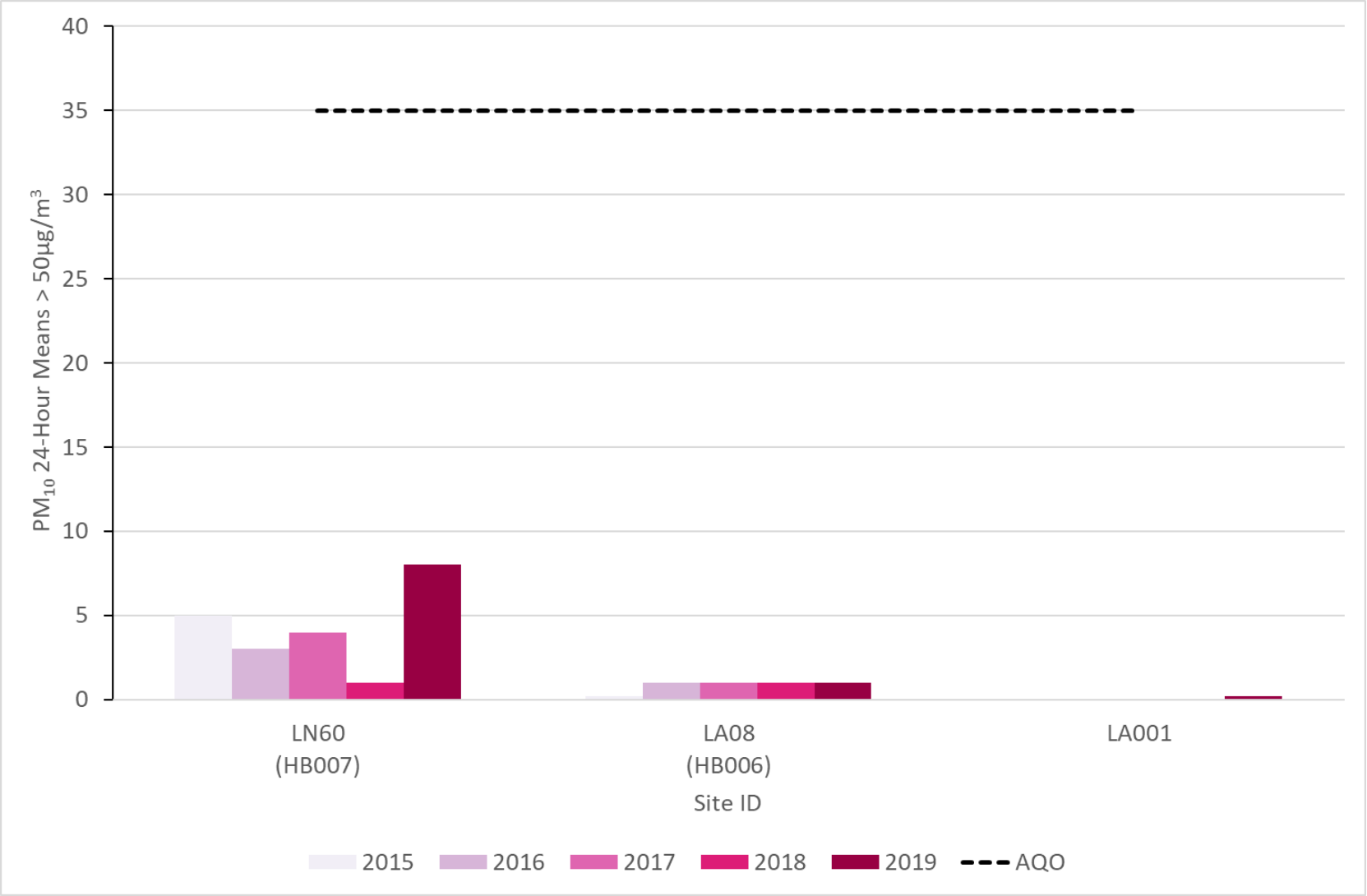


Table A.7 – $PM_{2.5}$ Monitoring Results

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2019 (%) (2)	$PM_{2.5}$ Annual Mean Concentration ($\mu g/m^3$) (3) 2015	$PM_{2.5}$ Annual Mean Concentration ($\mu g/m^3$) (3) 2016	$PM_{2.5}$ Annual Mean Concentration ($\mu g/m^3$) (3) 2017	$PM_{2.5}$ Annual Mean Concentration ($\mu g/m^3$) (3) 2018	$PM_{2.5}$ Annual Mean Concentration ($\mu g/m^3$) (3) 2019
LN60 *(HB007)*	508708	221352	Roadside	99	99	9	10	10	10	10
LA001	512578	222204	Other	99	53	NDA	NDA	NDA	NDA	12

☒ **Annualisation has been conducted where data capture is <75%**

Notes:

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

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

(3) All means have been *"annualised"* as per Boxes 7.9 and 7.10 in LAQM.TG16, valid data capture for the full calendar year is less than 75%. See Appendix C for details.

Figure A.5 – Trends in Annual Mean $PM_{2.5}$ Concentrations

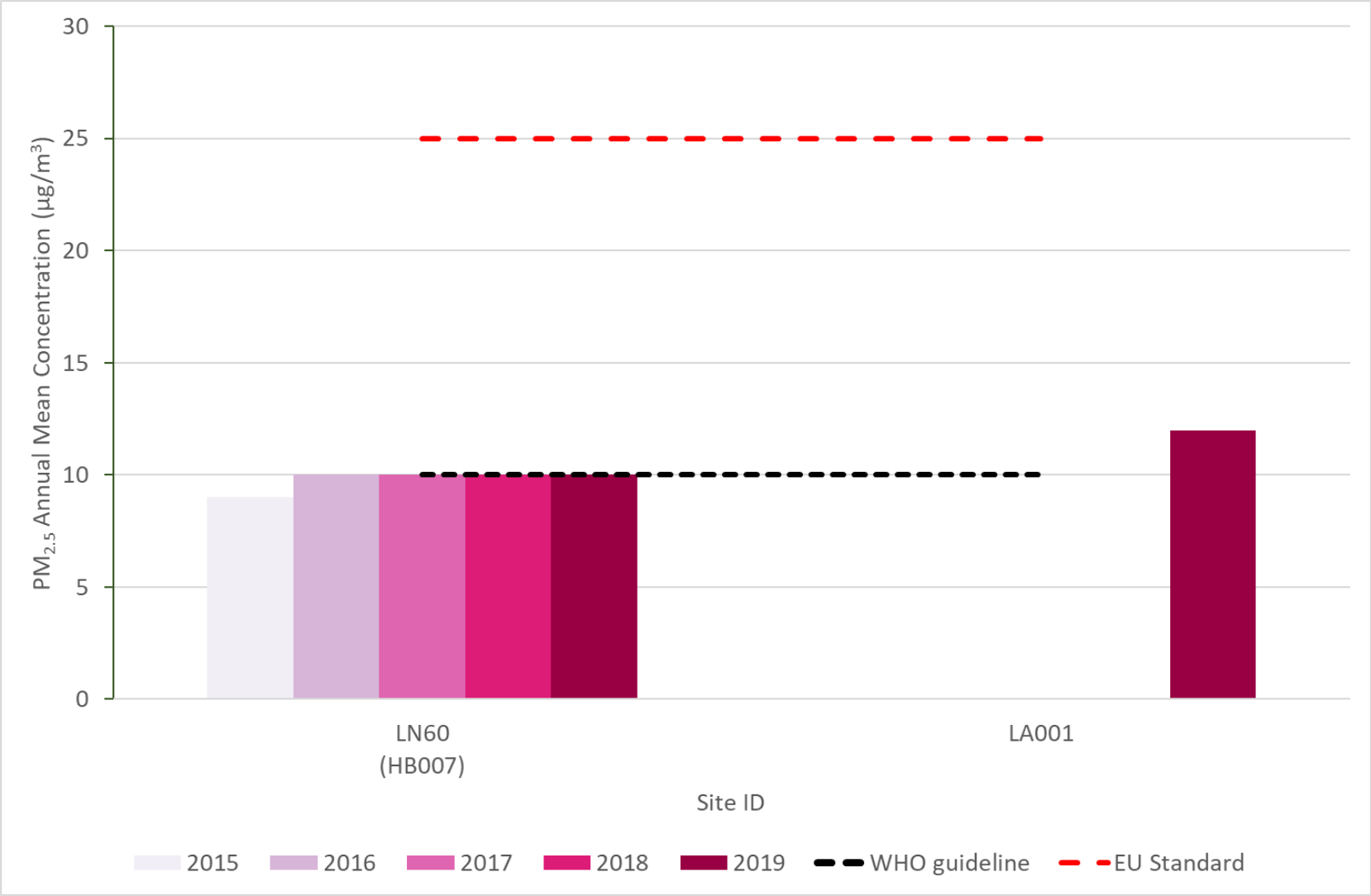


Table A.8 – SO_2 Monitoring Results

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for monitoring Period (%) (1)	Valid Data Capture 2019 (%) (2)	Number of Exceedances 2019 (percentile in bracket) (3) 15-minute Objective (266 µg/m^3)	Number of Exceedances 2019 (percentile in bracket) (3) 1-hour Objective (350 µg/m^3)	Number of Exceedances 2019 (percentile in bracket) (3) 24-hour Objective (125 µg/m^3)
LA001	512578	222204	Other	99	53	0 (5.7)	0 (3.8)	0 (2.0)

Notes:

Exceedances of the SO_2 objectives are shown in **bold** (15-min mean = 35 allowed a year, 1-hour mean = 24 allowed a year, 24-hour mean = 3 allowed a year)

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

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

(3) If the period of valid data is less than 85%, the relevant percentiles are provided in brackets (the 99.7th percentile for the 1hr objective and the 99.2nd percentile for the 24hr objective).

Appendix B: Full Monthly Diffusion Tube Results for 2019

Table B.1 - NO_2 Monthly Diffusion Tube Results – 2019

a) Luton Borough Council (LBC) sites

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Jan NO_2 Mean Conc. ($\mu g/m^3$)	Feb NO_2 Mean Conc. ($\mu g/m^3$)	Mar NO_2 Mean Conc. ($\mu g/m^3$)	Apr NO_2 Mean Conc. ($\mu g/m^3$)	May NO_2 Mean Conc. ($\mu g/m^3$)	Jun NO_2 Mean Conc. ($\mu g/m^3$)	Jul NO_2 Mean Conc. ($\mu g/m^3$)	Aug NO_2 Mean Conc. ($\mu g/m^3$)	Sep NO_2 Mean Conc. ($\mu g/m^3$)	Oct NO_2 Mean Conc. ($\mu g/m^3$)	Nov NO_2 Mean Conc. ($\mu g/m^3$)	Dec NO_2 Mean Conc. ($\mu g/m^3$)	Annual Mean - Raw Data	Annual Mean - Bias Adjusted (0.93) and Annualised [1]	Annual Mean- Distance Corrected to Nearest Exposure [2]
LN07	509227	221455	41.5	39.2	-	27.6	25.7	25.1	23.9	24.9	27.2	28.7	40.2	32.1	30.5	28.4	-
LN11	508910	221321	46.5	46.0	37.4	36.3	36.0	34.5	-	-	-	-	-	-	39.5	34.3	-
LN15	505557	222325	38.5	36.5	32.6	23.3	22.4	22.7	22.5	23.7	27.9	26.1	40.9	31.4	29.0	27.0	-
LN16	505492	222607	48.1	38.4	31.1	26.3	30.9	28.3	27.9	27.3	31.0	29.8	46.5	35.2	33.4	31.1	-
LN17	505324	222812	37.9	43.3	32.4	45.1	28.3	35.8	31.1	28.2	35.6	34.2	33.7	41.0	35.6	33.1	-
LN18	505014	223538	30.5	25.7	20.4	28.7	18.4	22.0	16.5	14.1	21.8	23.6	42.0	21.2	23.7	22.1	-
LN22	511341	221864	31.5	34.2	23.3	20.9	19.1	19.4	17.1	21.8	22.6	26.5	35.4	26.7	24.9	23.1	-
LN23	511377	221814	43.8	48.8	33.8	33.3	30.5	30.7	32.1	38.5	37.2	35.1	48.5	38.6	37.6	34.9	-
LN24	511902	222144	35.3	35.7	22.2	16.0	15.3	17.0	16.4	19.2	21.6	23.7	33.9	27.5	23.7	22.0	-
LN25	511893	222068	39.6	47.9	27.6	25.1	22.0	26.5	24.5	29.6	28.1	33.1	39.8	37.5	31.8	29.6	-
LN26	512109	222234	26.8	32.0	21.8	15.9	15.5	16.4	15.8	17.3	19.1	21.3	29.2	25.9	21.4	19.9	-
LN27	512134	222198	35.4	35.9	27.3	22.0	23.9	26.1	26.5	30.1	31.9	32.4	38.3	36.0	30.5	28.3	-
LN28	507798	219832	46.1	52.2	44.7	36.3	35.6	39.5	36.6	38.6	38.7	38.5	51.1	39.5	41.4	38.5	26.3
LN52	508689	221379	54.7	44.5	50.9	56.1	46.4	43.5	39.8	31.4	42.8	46.1	62.3	33.8	46.0	**42.8**	-
LN53	507717	219923	37.4	38.5	-	22.3	27.3	26.6	25.0	28.9	29.5	24.8	40.1	32.7	30.3	28.2	-
LN54	507712	219915	*2.5†*	-	*20.5‡*	22.2	27.6	25.0	31.0	28.7	29.3	31.3	43.5	34.5	30.3	28.2	-

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Jan NO_2 Mean Conc. ($\mu g/m^3$)	Feb NO_2 Mean Conc. ($\mu g/m^3$)	Mar NO_2 Mean Conc. ($\mu g/m^3$)	Apr NO_2 Mean Conc. ($\mu g/m^3$)	May NO_2 Mean Conc. ($\mu g/m^3$)	Jun NO_2 Mean Conc. ($\mu g/m^3$)	Jul NO_2 Mean Conc. ($\mu g/m^3$)	Aug NO_2 Mean Conc. ($\mu g/m^3$)	Sep NO_2 Mean Conc. ($\mu g/m^3$)	Oct NO_2 Mean Conc. ($\mu g/m^3$)	Nov NO_2 Mean Conc. ($\mu g/m^3$)	Dec NO_2 Mean Conc. ($\mu g/m^3$)	Annual Mean - Raw Data	Annual Mean - Bias Adjusted (0.93) and Annualised [1]	Annual Mean- Distance Corrected to Nearest Exposure [2]
LN55	507732	219886	38.5	29.8	30.8	22.3	27.1	26.9	25.6	28.0	29.8	25.2	40.2	28.8	29.4	27.4	-
LN56	507747	219894	41.3	39.6	30.4	21.7	26.2	24.5	25.9	27.5	26.0	27.9	39.5	36.1	30.6	28.4	-
LN61[t]	*508708*	*221352*	*51.8*	*48.3*	*43.1*	*47.4*	*39.2*	*38.2*	*44.3*	*37.8*	*42.0*	*38.9*	*59.7*	*40.0*			
LN62[t]	*508708*	*221352*	*52.7*	*52.2*	*44.2*	*38.3*	*42.5*	-	*35.9*	*35.9*	*39.3*	-	*59.0*	*45.7*			
LN63[t]	*508708*	*221352*	*52.2*	*45.3*	*43.0*	*47.3*	*41.4*	-	*36.1*	*35.8*	*39.3*	*40.3*	*58.7*	*43.6*			
$\bar{X}$ LN61/62/63	508708	221352	52.2	48.6	43.4	44.3	41.1	38.2	38.8	36.5	40.2	39.6	59.1	43.1	43.8	**40.7**	34.9
LN64	509563	220952	43.1	37.0	34.4	29.2	30.6	29.1	25.1	27.1	29.9	34.5	47.5	34.7	33.5	31.2	-
LN65	509486	220865	37.7	27.9	26.0	26.0	22.7	22.0	21.4	10.4	24.5	26.7	38.0	26.5	25.8	24.0	-
LN66	509288	220925	53.5	36.4	47.2	35.3	34.5	32.3	30.6	34.3	33.4	39.4	56.0	41.0	39.5	36.7	32.5
LN67	509083	220709	49.2	49.3	35.4	44.9	44.3	49.6	45.7	42.8	46.7	39.2	60.2	47.4	46.2	**43.0**	-
LN68	508969	220487	43.3	41.6	34.3	28.3	32.1	30.3	32.1	29.0	32.0	32.8	40.1	36.4	34.3	31.9	-
LN69	509326	221357	40.9	42.6	34.0	29.0	28.4	28.9	27.3	25.4	32.5	28.8	46.6	32.5	33.1	30.8	-
LN70	509813	221161	41.4	43.2	35.2	31.9	29.5	32.6	29.0	31.2	34.0	34.5	44.1	37.0	35.3	32.8	-
LN71	509549	221623	38.0	42.8	33.2	31.0	30.6	31.2	29.7	26.0	31.7	32.7	43.4	33.7	33.7	31.3	-
LN72	508937	221745	40.6	39.7	27.2	30.4	32.3	28.7	26.0	24.8	30.7	28.9	43.6	31.5	32.0	29.8	-
LN73	508959	221633	44.7	52.6	42.1	33.0	36.4	42.3	35.9	38.8	41.2	36.8	50.8	41.2	41.3	38.4	-
LN74	508165	222002	40.1	44.7	43.1	34.7	40.1	32.8	36.6	35.9	37.4	37.1	52.1	39.7	39.5	36.8	-
LN75	508745	222122	44.1	46.8	40.4	33.8	32.2	36.6	33.9	35.9	38.6	39.8	51.0	38.0	39.3	36.5	-
LN76	507574	222948	39.4	39.1	35.0	37.7	29.2	29.2	28.2	25.5	31.5	32.6	44.6	31.7	33.6	31.3	-
LN77	506496	224018	45.2	47.8	39.1	30.1	32.0	33.5	32.3	36.6	36.6	34.9	49.4	41.8	38.3	35.6	-
LN78	509109	220676	45.3	41.4	33.2	28.1	27.3	26.8	26.7	26.7	30.9	34.1	49.2	32.2	33.5	31.2	-

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Jan NO_2 Mean Conc. ($\mu g/m^3$)	Feb NO_2 Mean Conc. ($\mu g/m^3$)	Mar NO_2 Mean Conc. ($\mu g/m^3$)	Apr NO_2 Mean Conc. ($\mu g/m^3$)	May NO_2 Mean Conc. ($\mu g/m^3$)	Jun NO_2 Mean Conc. ($\mu g/m^3$)	Jul NO_2 Mean Conc. ($\mu g/m^3$)	Aug NO_2 Mean Conc. ($\mu g/m^3$)	Sep NO_2 Mean Conc. ($\mu g/m^3$)	Oct NO_2 Mean Conc. ($\mu g/m^3$)	Nov NO_2 Mean Conc. ($\mu g/m^3$)	Dec NO_2 Mean Conc. ($\mu g/m^3$)	Annual Mean - Raw Data	Annual Mean - Bias Adjusted (0.93) and Annualised [1]	Annual Mean- Distance Corrected to Nearest Exposure [2]
LN79	509050	220634	45.0	38.8	36.2	38.7	30.2	34.3	28.1	27.8	34.7	36.2	53.9	34.2	36.5	33.9	-
LN80	509038	220719	43.2	41.7	34.1	37.0	34.5	31.3	29.2	25.6	33.3	36.0	49.3	34.0	35.8	33.3	-
LN81	505034	223729	44.5	43.3	36.4	22.0	27.2	25.1	24.2	27.6	34.2	32.2	48.0	33.6	33.2	30.8	-
LN82	504828	223999	37.0	40.9	34.9	19.8	25.7	23.2	24.1	27.1	26.5	27.1	39.3	30.7	29.7	27.6	-
LN83	505116	223467	31.8	32.2	22.9	10.1	20.7	24.0	20.3	15.3	24.9	24.2	40.1	23.2	24.2	22.5	-
LN84	505230	223304	34.9	35.2	25.4	31.9	25.0	24.8	18.6	14.4	26.3	22.6	42.7	24.9	27.2	25.3	-
LN85	505481	222545	41.8	42.7	36.1	22.0	29.3	25.7	27.7	28.8	30.4	30.3	39.6	33.1	32.3	30.0	-
LN86	505586	222235	59.1	55.4	42.7	31.1	37.7	32.5	31.2	35.3	40.2	40.1	59.0	36.1	41.7	38.8	-

☐ **Local bias adjustment factor used**

☒ **National bias adjustment factor used**

☒ **Annualisation has been conducted where data capture is <75%**

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

Notes:

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

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

(1) See Appendix C for details on bias adjustment and annualisation.

(2) Distance corrected to nearest relevant public exposure.

† Result excluded as an outlier: tube tampered with, at time of recovery was found inverted in holder with collected rain water covered the absorbent grid.

‡ Result excluded: at time of recovery tube found smashed on the ground beneath the monitoring point.

b) London Luton Airport Operations Ltd (LLAOL) sites

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Jan NO_2 Mean Conc. ($\mu g/m^3$)	Feb NO_2 Mean Conc. ($\mu g/m^3$)	Mar NO_2 Mean Conc. ($\mu g/m^3$)	Apr NO_2 Mean Conc. ($\mu g/m^3$)	May NO_2 Mean Conc. ($\mu g/m^3$)	Jun NO_2 Mean Conc. ($\mu g/m^3$)	Jul NO_2 Mean Conc. ($\mu g/m^3$)	Aug NO_2 Mean Conc. ($\mu g/m^3$)	Sep NO_2 Mean Conc. ($\mu g/m^3$)	Oct NO_2 Mean Conc. ($\mu g/m^3$)	Nov NO_2 Mean Conc. ($\mu g/m^3$)	Dec NO_2 Mean Conc. ($\mu g/m^3$)	Annual Mean - Raw Data	Annual Mean - Bias Adjusted (0.93) and Annualised (1)	Annual Mean- Distance Corrected to Nearest Exposure (2)
LLA 1	511903	221278	73.8	71.9	57.8	53.3	54.8								62.3	**47.9**	-
LLA 1*	511920	221334						37.9	39.8	36.7	37.3	37.0	45.2	39.9	39.1	37.4	-
LLA 2 (LA02)	511579	220960	40.9	48.7	34.6	35.7	39.1	36.8	43.4	39.9	39.5	40.2	38.9	33.7	39.3	34.2	-
LLA 3 (LA03)	511170	220436	39.2	35.3	22.1	22.3	22.0	20.0	20.7	15.6	21.6	24.6	37.4	23.5	25.3	22.1	-
LLA 4 (LA04)	513644	221207	28.7	33.5	18.3	12.5	13.9	14.1	15.2	18.3	13.7	20.6	28.0	24.9	20.1	17.5	-
LLA 5 (LA05)	511711	221337	42.2	54.8	37.3	47.7	39.6	39.0	35.6	47.2	25.4	43.6	51.7	41.6	42.1	36.7	
LLA 6 (LA06)	511682	221727	44.7	56.3	34.7	35.6	32.3	31.4	33.4	35.9	36.9	37.2	49.8	38.6	38.9	33.8	-
LLA 7	512166	221226	64.9	53.0	48.2	38.2	55.9	51.2	51.5	61.2	53.0	55.4	48.3		52.8	**45.9**	-
LLA 7* §	512105	221168												47.8	-	-	-
LLA 8 (LA08)	511867	221148	42.1	48.3	30.2	35.7	33.6	31.7	30.4	33.9	36.9	34.4	42.1	35.7	36.2	31.5	-
LLA 9 (LA09)	517602	222572	18.4	21.2	8.9	9.7	4.7	7.2	6.7	6.7	8.1	8.6	18.4	16.0	11.2	9.7	-
LLA 10 (LA10)	507667	217744	18.3	17.8	10.6	14.1	8.0	7.8	7.8	6.0	9.5	13.3	22.4	15.3	12.6	10.9	-
LLA 11 (LA17)	513140	220669	26.9	24.1	14.7	14.0	12.6	10.5	10.9	9.7	13.2	14.7	24.6	9.1	15.4	13.4	-
LLA 12 (LA14)	511886	221566	47.6	58.4	33.5	41.3	35.2	40.2	34.3	40.1	38.2	39.6	41.8	43.5	41.1	35.8	-
LLA 13 (LA15)	511901	222055	34.1	40.9	23.7	23.0	19.7	22.1	23.8	21.8	25.3	30.0	35.4	29.4	27.4	23.9	-

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Jan NO_2 Mean Conc. ($\mu g/m^3$)	Feb NO_2 Mean Conc. ($\mu g/m^3$)	Mar NO_2 Mean Conc. ($\mu g/m^3$)	Apr NO_2 Mean Conc. ($\mu g/m^3$)	May NO_2 Mean Conc. ($\mu g/m^3$)	Jun NO_2 Mean Conc. ($\mu g/m^3$)	Jul NO_2 Mean Conc. ($\mu g/m^3$)	Aug NO_2 Mean Conc. ($\mu g/m^3$)	Sep NO_2 Mean Conc. ($\mu g/m^3$)	Oct NO_2 Mean Conc. ($\mu g/m^3$)	Nov NO_2 Mean Conc. ($\mu g/m^3$)	Dec NO_2 Mean Conc. ($\mu g/m^3$)	Annual Mean - Raw Data	Annual Mean - Bias Adjusted (0.93) and Annualised (1)	Annual Mean- Distance Corrected to Nearest Exposure (2)
LLA 14	511995	221316	53.2	65.1	39.2	51.8	44.2	45.2	49.7	42.8	50.9	42.8	50.7	42.6	48.2	**41.9**	-
LLA 15	511168	221706	43.9	40.2	39.5	34.7	32.6	28.8	33.7	-	35.4	31.3	38.6	35.4	35.8	31.2	-
LLA 16	512158	221087	58.1	53.9	*45.8†*	64.1	61.7								59.4	**44.1**	-
LLA 16*	512275	221115						32.8	-	*5.3‡*	35.2	37.4	44.8	38.5	37.7	32.3	-
LLA 17	509489	219237	40.5	49.6	*36.4†*	29.5	35.5	34.2	33.8	31.0	37.9	37.1	38.6	38.2	36.9	32.1	-
LLA 18[ll]	510779	220279	39.6	42.6	*27.1†*	40.5	25.1	33.4	30.9	26.6	29.9	29.7	44.7	24.7	33.4	29.1	-
LLA 19	515109	221933									*1.8‡*	16.8	24.4	20.2	20.4	15.6	-

☐ **Local bias adjustment factor used**

☒ **National bias adjustment factor used**

☒ **Annualisation has been conducted where data capture is <75%**

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

Notes:

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

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

(1) See Appendix C for details on bias adjustment and annualisation.

(2) Distance corrected to nearest relevant public exposure.

* Tube moved to new location part way through 2019.

‖ Tube moved to new location prior to the start of the year.

† Result excluded: no exposure information provided for LLA 16/17/18. Results assigned on the basis of barcode sequence cross referenced with previous results. Maximum possible exposure used in lieu of actual exposure times - hence figures represent the lowest possible ambient concentration for the period in question. Adopting a precautionary approach, data points discounted to avoid the artificial reduction of the annual mean concentrations at these locations.

‡ Result excluded as an outlier: water droplets found in tube at time of recovery - possibility that measurement has been compromised.

§ Insufficient data capture for the full calendar year to generate meaningful annual mean concentration for 2019 (*i.e.* data capture <25%).

c) London Luton Airport Ltd (LLAL) sites

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Jan NO_2 Mean Conc. ($\mu g/m^3$)	Feb NO_2 Mean Conc. ($\mu g/m^3$)	Mar NO_2 Mean Conc. ($\mu g/m^3$)	Apr NO_2 Mean Conc. ($\mu g/m^3$)	May NO_2 Mean Conc. ($\mu g/m^3$)	Jun NO_2 Mean Conc. ($\mu g/m^3$)	Jul NO_2 Mean Conc. ($\mu g/m^3$)	Aug NO_2 Mean Conc. ($\mu g/m^3$)	Sep NO_2 Mean Conc. ($\mu g/m^3$)	Oct NO_2 Mean Conc. ($\mu g/m^3$)	Nov NO_2 Mean Conc. ($\mu g/m^3$)	Dec NO_2 Mean Conc. ($\mu g/m^3$)	Annual Mean - Raw Data	Annual Mean - Bias Adjusted (0.93) and Annualised (1)	Annual Mean- Distance Corrected to Nearest Exposure (2)
L1[d]	508708	221352	*48.2*	*55.0*	*41.8*	*46.8*	*37.7*	*31.7*	*37.6*	*40.6*	*40.7*	*47.4*	*55.0*	*43.0*			
			55.4	*57.3*	*44.0*	*47.1*	*29.4*	-	*38.3*	*34.9*	*37.8*	*43.4*	*60.5*	*42.8*			
$\bar{X}_{L1}$			51.8	56.2	42.9	47.0	33.6	31.7	38.0	37.8	39.3	45.4	57.8	42.9	43.7	**40.6**	34.7
L2[d]	511155	222445	*36.3*	*43.8*	-	*33.5*	*14.8*	*23.3*	*25.4*	*23.6*	*30.3*	*33.2*	*42.9*	*43.2*			
			39.1	*49.6*	-	*30.3*	-	*21.2*	*25.6*	*24.3*	*28.9*	*34.6*	*43.2*	*37.7*			
$\bar{X}_{L2}$			37.7	46.7	-	31.9	14.8	22.3	25.5	24.0	29.6	33.9	43.1	40.5	31.8	29.6	-
L3[d]	511780	222760	*41.5*	*49.4*	-	*27.2*	*19.6*	*19.2*	*0.5†*	*21.8*	*26.7*	*35.2*	*43.7*	*39.4*			
			42.7	*48.9*	-	*25.2*	*20.1*	*17.8*	-	*21.2*	*28.4*	*35.1*	*39.6*	*35.9*			
$\bar{X}_{L3}$			42.1	49.2	-	26.2	19.9	18.5	-	21.5	27.6	35.2	41.7	37.7	31.9	29.7	-
L4[d]	513223	222397	*26.1*	*37.1*	*20.3*	*15.5*	*12.8*	*14.0*	*17.1*	*17.1*	*20.4*	*24.4*	*29.9*	*27.5*			
			22.4	*36.2*	*21.7*	*15.3*	*15.1*	*12.6*	*17.3*	*17.0*	*20.6*	*25.2*	*32.7*	*26.9*			
$\bar{X}_{L4}$			24.3	36.7	21.0	15.4	14.0	13.3	17.2	17.1	20.5	24.8	31.3	27.2	21.9	20.4	-
L5[d]	515047	221904	*21.2*	*26.1*	*12.2*	*11.3*	*9.2*	*9.6*	*10.0*	*10.4*	*13.4*	*15.0*	*25.7*	*21.7*			
			19.3	*27.1*	*13.6*	*12.0*	*10.0*	*10.1*	*8.8*	*9.7*	*14.4*	*17.0*	*25.8*	*21.6*			
$\bar{X}_{L5}$			20.3	26.6	12.9	11.7	9.6	9.9	9.4	10.1	13.9	16.0	25.8	21.7	15.6	14.5	-
L6[d]	513773	221752	*24.6*	*32.6*	*15.9*	*12.3*	*10.9*	*11.5*	*14.2*	*13.3*	*16.6*	*20.1*	*27.2*	*24.4*			
			24.9	*32.2*	*16.0*	*11.9*	*13.1*	*11.8*	*13.5*	*15.2*	*17.3*	*19.8*	*24.2*	*22.4*			
$\bar{X}_{L6}$			24.8	32.4	16.0	12.1	12.0	11.7	13.9	14.3	17.0	20.0	25.7	23.4	18.6	17.3	-

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Jan NO_2 Mean Conc. ($\mu g/m^3$)	Feb NO_2 Mean Conc. ($\mu g/m^3$)	Mar NO_2 Mean Conc. ($\mu g/m^3$)	Apr NO_2 Mean Conc. ($\mu g/m^3$)	May NO_2 Mean Conc. ($\mu g/m^3$)	Jun NO_2 Mean Conc. ($\mu g/m^3$)	Jul NO_2 Mean Conc. ($\mu g/m^3$)	Aug NO_2 Mean Conc. ($\mu g/m^3$)	Sep NO_2 Mean Conc. ($\mu g/m^3$)	Oct NO_2 Mean Conc. ($\mu g/m^3$)	Nov NO_2 Mean Conc. ($\mu g/m^3$)	Dec NO_2 Mean Conc. ($\mu g/m^3$)	Annual Mean - Raw Data	Annual Mean - Bias Adjusted (0.93) and Annualised (1)	Annual Mean- Distance Corrected to Nearest Exposure (2)
L7[d]	511057	221386	-	-	-	-	*51.6*	*47.3*	*68.9*	*58.6*	*59.7*	*74.2*	-	*69.0*			
			-	-	*78.9*	-	*53.6*	*43.9*	*58.6*	*56.0*	*62.0*	*77.9*	-	*66.3*			
$\bar{X}_{L7}$			-	-	78.9	-	52.6	45.6	63.8	57.3	60.9	76.1	-	67.7	62.8	**69.4**	-
L8[d]	510543	220706	*42.6*	*50.1*	*36.3*	*32.2*	-	*28.4*	-	*30.4*	*32.7*	*43.3*	*46.2*	*39.2*			
			42.1	*52.8*	*31.6*	*32.8*	-	*26.4*	-	*32.5*	-	*43.8*	*40.2*	*38.0*			
$\bar{X}_{L8}$			42.4	51.5	34.0	32.5	-	27.4	-	31.5	32.7	43.6	43.2	38.6	37.7	35.1	-
L9[d]	510529	220598	-	*47.1*	*29.1*	*33.7*	*24.8*	*17.6*	*30.5*	*32.0*	*16.7‡*	*35.0*	*40.3*	*28.2*			
			-	*50.1*	*34.9*	*33.0*	*24.4*	*24.8*	*31.3*	*33.5*	*33.3*	*36.7*	*42.3*	*30.9*			
$\bar{X}_{L9}$			-	48.6	32.0	33.4	24.6	21.2	30.9	32.8	33.3	35.9	41.3	29.6	33.0	30.7	-
L10[d]	506541	219854	*34.8*	*37.0*	*26.3*	*27.7*	*22.9*	*21.7*	*22.6*	*17.3*	*24.4*	*29.5*	*31.3*	*25.3*			
			32.8	*35.6*	*24.0*	*27.3*	-	*21.6*	*23.1*	*19.2*	*25.8*	*28.1*	*40.5*	*25.5*			
$\bar{X}_{L10}$			33.8	36.3	25.2	27.5	22.9	21.7	22.9	18.3	25.1	28.8	35.9	25.4	27.0	25.1	-
L11[t]	512569	222207								*15.8*	*17.2*	*21.7*	*28.7*	*23.1*			
										16.4	*16.5*	*20.2*	*28.6*	*25.6*			
										16.0	*18.3*	*20.5*	*26.5*	*24.0*			
$\bar{X}_{L11}$										16.2	17.4	20.4	27.6	24.8	21.3	20.0	-
Blank	-	-	*0.3*	*0.2*	*0.4*	*0.4*	*0.2*	*0.2*	*0.2*	*0.1*	*0.1*	*0.1*	*0.3*	*<0.1*			

☐ **Local bias adjustment factor used**

☒ **National bias adjustment factor used**

☒ **Annualisation has been conducted where data capture is <75%**

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

Notes:

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

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

(1) See Appendix C for details on bias adjustment and annualisation.

(2) Distance corrected to nearest relevant public exposure.

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

Automatic Monitoring

The nitrogen dioxide analyser on Dunstable Road East (*LN60*) is subject to fortnightly routine calibration by a Luton Borough Council Officer. The co-located FIDAS particulate analyser does not require calibration.

All automatic monitoring data collected at the Dunstable Road East, London Luton Airport (*LA08*) and Luton A505 Roadside (*CM2*) sites is managed by Ricardo Energy & Environment using the quality control procedures utilised by Defra's national air quality network stations. These procedures represent best practice and fully meet the requirements set out in LAQM.TG(16). Ricardo Energy & Environment currently provide UKAS accredited quality control audits and data management services to all Defra national network (AURN) air quality monitoring stations.

All data collected at the above sites is screened and scaled (based on site calibrations) and the final data sets presented within this report (Figures C.1, C.2 and C.3) have benefitted from a full process of data ratification, including thorough additional data quality checks and a ratification process that corrects data for instrument sensitivity drift between routine calibrations.

All automatic monitoring data collected at the London Luton Airport FutureLuToN site, operational from 19th June 2019, is validated and ratified by Air Quality Data Management (AQDM) to the standards described in LAQM.TG(16), with Enviro Technology Services undertaking routine calibration and fulfilling local site operator (LSO) duties. The site datasets published online (summarised in Figure C.4) are managed by Ricardo Energy & Environment in full compliance with the requirements of LAQM.TG(16), which includes the screening, validation and ratification of the raw data.

Due to this new site opening halfway through the year, where possible the mean concentrations detailed in Figure C.4 have been annualised in accordance with the procedure detailed in *LAQM.TG(16), Box 7.9* (Figure C.5). These annualisation adjustments were undertaken using whole year datasets obtained from the *UK Air Data Selector* for the network monitoring sites listed in Table C.1 .

Table C.1 – Network monitoring site datasets used to annualise LLAL continuous monitoring data

Monitoring Site	Distance from LA001 (miles)	Environment Type	Pollutants of interest
London Bloomsbury (*UKA00211*)	27	Urban Background	PM_{10} / $PM_{2.5}$ / O_3
London N. Kensington (*UKA00253*)	26	Urban Background	NO_2 / PM_{10} / $PM_{2.5}$ SO_2 / O_3 Black Carbon
Thurrock (*UKA00272*)	41	Urban Background	SO_2
Detling (*UKA00481*)	**57**	Rural Background	Black Carbon
Oxford St Ebbes (*UKA00518*)	40	Urban Background	NO_2 / PM_{10} / $PM_{2.5}$
London Haringey Priory Park South (*UKA00568*)	23	Urban Background	NO_2 / O_3
Chilbolton Observatory (*UKA00614*)	**69**	Rural Background	Black Carbon
Northampton Spring Park (*UKA00632*)	35	Urban Background	$PM_{2.5}$ / O_3
Borehamwood Meadow Park (*UKA00644*)	16	Urban Background	NO_2
London Honor Oak Park (*UKA00656*)	33	Urban Background	PM_{10}

All of the selected sites have calendar year data capture rates of in excess of 85% for the pollutants of interest. Additionally, with the exceptions of Detling and Chilbolton Observatory, all sites are located within a 50 mile radius of Luton. These two more distant locations have been included in the annualisation of Black Carbon due to the paucity of monitoring data available for this pollutant.

In addition to those listed in Table C.1, the London Luton Airport FutureLuToN site also monitors the following pollutants:

- Carbon monoxide;
- Benzene;
- Toluene;
- Ethylbenzene;
- m/p-Xylene and o-Xylene

Unfortunately, due to insufficient data being available at other comparator locations, it has not been possible to annualise the part-year monitoring data obtained for these pollutants.

Figure C.1 – 2019 Air Pollution Report – LN60: Luton Dunstable Road East (Site ID: HB007)

Air Pollution Report

Air Quality England

1st January to 31st December 2019

Luton Dunstable Road East (Site ID: HB007)

These data have been fully ratified

Only relevant statistics for LAQM are presented in the table. Cells with - indicate no data available or calculated.

Pollutant	NO µg/m³	NO_2 µg/m³	NO_x as NO_2 µg/m³	PM_{10} µg/m³	PM_{25} µg/m³
Number Days Low	-	357	-	355	353
Number Days Moderate	-	0	-	8	10
Number Days High	-	0	-	0	0
Number Days Very High	-	0	-	0	0
Max Daily Mean	283	114	528	63	53
Annual Max	732	175	1,297	172	82
Annual Mean	37	40	98	16	10
98th Percentile of daily mean	-	-	-	52	-
90th Percentile of daily mean	-	-	-	30	-
99.8th Percentile of hourly mean	-	136	-	-	-
98th Percentile of hourly mean	189	104	376	56	41
95th Percentile of hourly mean	123	87	272	42	30
50th Percentile of hourly mean	23	36	71	12	7
% Annual data capture	**97.05%**	**97.05%**	**97.05%**	**99.22%**	**99.21%**

Instruments:

PM_{10}: FIDAS

PM_{25}: FIDAS

All gaseous pollutant mass units are at 20°C and 1013mb. Particulate matter concentrations are reported at ambient temperature and pressure. NO_X mass units are NO_X as NO_2 µg m-3

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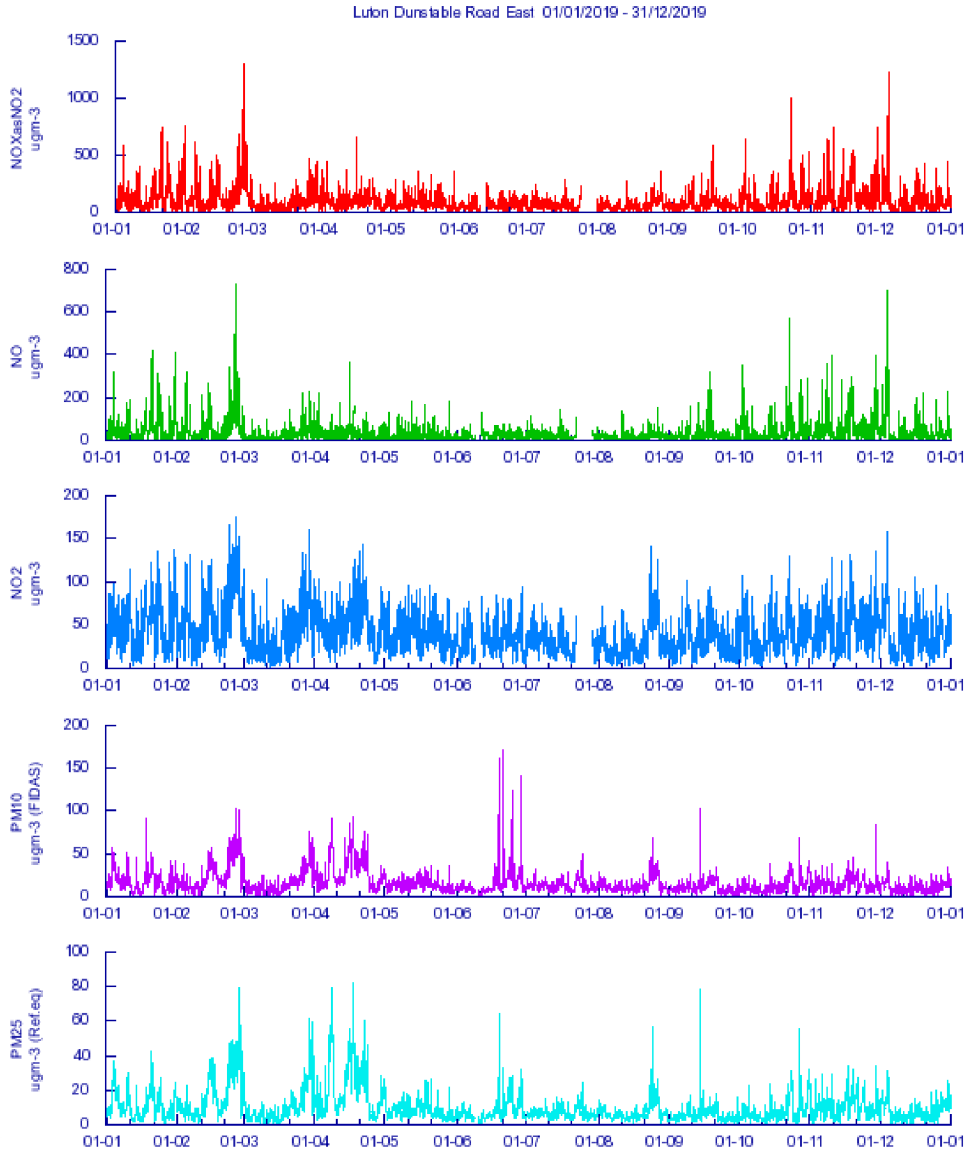
Pollutant	Air Quality Standards regulations 2010	Exceedances	Days
PM_{10} particulate matter (Hourly measured)	daily mean > 50 microgrammes per metre cubed	8	8
PM_{10} particulate matter (Hourly measured)	Annual mean > 40 microgrammes per metre cubed	0	-
Nitrogen dioxide	Hourly Mean > 200 microgrammes per metre cubed	0	0
Nitrogen dioxide	Annual Mean > 40 microgrammes per metre cubed	0	-

Annual Graph



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Report produced by Ricardo Energy & Environment

Figure C.2 – 2019 Air Pollution Report – LA08: London Luton Airport (Site ID: HB006)

Air Pollution Report

Air Quality England

1st January to 31st December 2019

London Luton Airport (Site ID: HB006)

These data have been fully ratified

Only relevant statistics for LAQM are presented in the table. Cells with - indicate no data available or calculated.

Pollutant	PM_{10} µg/m³
Number Days Low	326
Number Days Moderate	1
Number Days High	0
Number Days Very High	0
Max Daily Mean	51
Annual Max	90
Annual Mean	16
98th Percentile of daily mean	40
90th Percentile of daily mean	28
98th Percentile of hourly mean	44
95th Percentile of hourly mean	35
50th Percentile of hourly mean	14
% Annual data capture	**92.60%**

Instruments:

PM_{10}: BAM Gravimetric Equivalent (correction applied)

All gaseous pollutant mass units are at 20°C and 1013mb. Particulate matter concentrations are reported at ambient temperature and pressure. NO_X mass units are NO_X as NO_2 µg m-3

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Pollutant	Air Quality Standards regulations 2010	Exceedances	Days
PM_{10} particulate matter (Hourly measured)	daily mean > 50 microgrammes per metre cubed	1	1
PM_{10} particulate matter (Hourly measured)	Annual mean > 40 microgrammes per metre cubed	0	-

Annual Graph

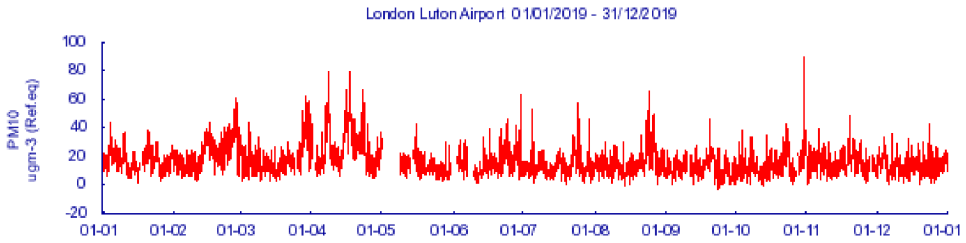


Figure C.3 – 2019 Air Pollution Report – CM2: Luton A505 Roadside (Site ID: LUTR)

Air Quality England

Air Pollution Report

1st January to 31st December 2019

(Site ID: LUTR)

These data have been fully ratified

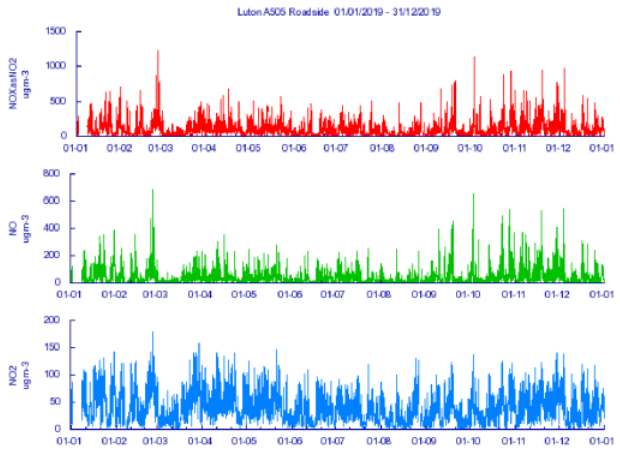
Only relevant statistics for LAQM are presented in the table. Cells with - indicate no data available or calculated.

Pollutant	NO µg/m³	NO_2 µg/m³	NO_x as NO_2 µg/m³
Number Days Low	-	360	-
Number Days Moderate	-	0	-
Number Days High	-	0	-
Number Days Very High	-	0	-
Max Daily Mean	201	97	395
Annual Max	681	179	1,224
Annual Mean	44	39	107
99.8th Percentile of hourly mean	-	135	-
98th Percentile of hourly mean	217	106	430
95th Percentile of hourly mean	154	91	321
50th Percentile of hourly mean	25	34	74
% Annual data capture	**97.39%**	**97.11%**	**97.11%**

All gaseous pollutant mass units are at 20°C and 1013mb. Particulate matter concentrations are reported at ambient temperature and pressure. NO_X mass units are NO_X as NO_2 µg m-3

Pollutant	Air quality standard	Exceedances	Days
Nitrogen dioxide	Hourly Mean > 200 microgrammes per metre cubed	0	0
Nitrogen dioxide	Annual Mean > 40 microgrammes per metre cubed	0	-

Annual Graph



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Report produced by Ricardo Energy & Environment

Figure C.4 – 2019 Air Pollution Report – LA001: London Luton Airport FutureLuToN

Air Pollution Report

Air Quality England

1st January to 31st December 2019

Luton Airport FutureLuToN (Site ID: LA001)

These data have been fully ratified

Only relevant statistics for LAQM are presented in the table. Cells with - indicate no data available or calculated.

Pollutant	O_3 µg/m³	NO µg/m³	NO_2 µg/m³	NO_x as NO_2 µg/m³	SO_2 µg/m³	CO mg/m³	PM_{10} µg/m³	$PM_{2.5}$ µg/m³	BC µg/m³	BENZENE µg/m³	TOLUENE µg/m³	ETHBENZ µg/m³	mpXYLENE µg/m³	oXYLENE µg/m³
Number Days Low	196	-	196	-	0	0	194	194	0	0	0	0	0	0
Number Days Moderate	14	-	0	-	0	0	0	0	0	0	0	0	0	0
Number Days High	2	-	0	-	0	0	0	0	0	0	0	0	0	0
Number Days Very High	0	-	0	-	0	0	0	0	0	0	0	0	0	0
Max 15 min SO2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Max 8 Hour CO	-	-	-	-	-	0	-	-	-	-	-	-	-	-
Max 8 Hour Ozone	163	-	-	-	-	-	-	-	-	-	-	-	-	-
Max Daily Mean	116	64	59	157	2	0	32	28	1	1	4	4	11	5
Annual Max	192	259	88	485	8	0	81	68	3	4	39	34	88	43
Annual Mean	48	3	15	20	1	0	11	9	1	0	1	0	1	1
98th Percentile of daily mean	-	-	-	-	-	-	27	-	-	-	-	-	-	-
90th Percentile of daily mean	-	-	-	-	-	-	20	-	-	-	-	-	-	-
99.9th Percentile of 15 minute mean	-	-	-	-	-	-	-	-	-	-	-	-	-	-
99.8th Percentile of hourly mean	-	-	66	-	-	-	-	-	-	-	-	-	-	-
99.7th Percentile of hourly mean	-	-	-	-	4	-	-	-	-	-	-	-	-	-

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Report produced by Ricardo Energy & Environment

Pollutant	O_3 µg/m³	NO µg/m³	NO_2 µg/m³	NO_x as NO_2 µg/m³	SO_2 µg/m³	CO mg/m³	PM_{10} µg/m³	PM_{25} µg/m³	BC µg/m³	BENZENE µg/m³	TOLUENE µg/m³	ETHBENZ µg/m³	mpXYLENE µg/m³	oXYLENE µg/m³
98th Percentile of hourly mean	110	25	53	89	2	0	31	28	2	1	3	4	11	4
95th Percentile of hourly mean	84	11	42	60	2	0	25	23	1	1	2	2	5	2
50th Percentile of hourly mean	48	1	11	13	1	0	9	8	0	0	0	0	0	0
% Annual data capture	**53.20%**	**53.14%**	**53.14%**	**53.14%**	**52.98%**	**12.18%**	**53.37%**	**53.37%**	**32.10%**	**40.79%**	**42.58%**	**26.19%**	**37.58%**	**34.33%**

Instruments:

PM_{10}: GRIMM EDM 180

PM_{25}: GRIMM EDM 180

All gaseous pollutant mass units are at 20°C and 1013mb. Particulate matter concentrations are reported at ambient temperature and pressure. NO_X mass units are NO_X as NO_2 µg m-3

Pollutant	Air Quality Standards regulations 2010	Exceedances	Days
Carbon monoxide	Daily maximum 8-hour running mean > 10 milligrammes per metre cubed	0	0
PM_{10} particulate matter (Hourly measured)	daily mean > 50 microgrammes per metre cubed	0	0
PM_{10} particulate matter (Hourly measured)	Annual mean > 40 microgrammes per metre cubed	0	-
Nitrogen dioxide	Hourly Mean > 200 microgrammes per metre cubed	0	0
Nitrogen dioxide	Annual Mean > 40 microgrammes per metre cubed	0	-
Ozone	8-hour running mean > 100 microgrammes per metre cubed	118	14
Sulphur dioxide	15 Minute mean > 266 microgrammes per metre cubed	0	0
Sulphur dioxide	Hourly mean > 350 microgrammes per metre cubed	0	0
Sulphur dioxide	Daily Mean > 125 microgrammes per metre cubed	0	0
Sulphur dioxide	Annual mean > 20 microgrammes per metre cubed	0	-
Sulphur dioxide	Winter Mean > 20 microgrammes per metre cubed	0	-

Annual Graph

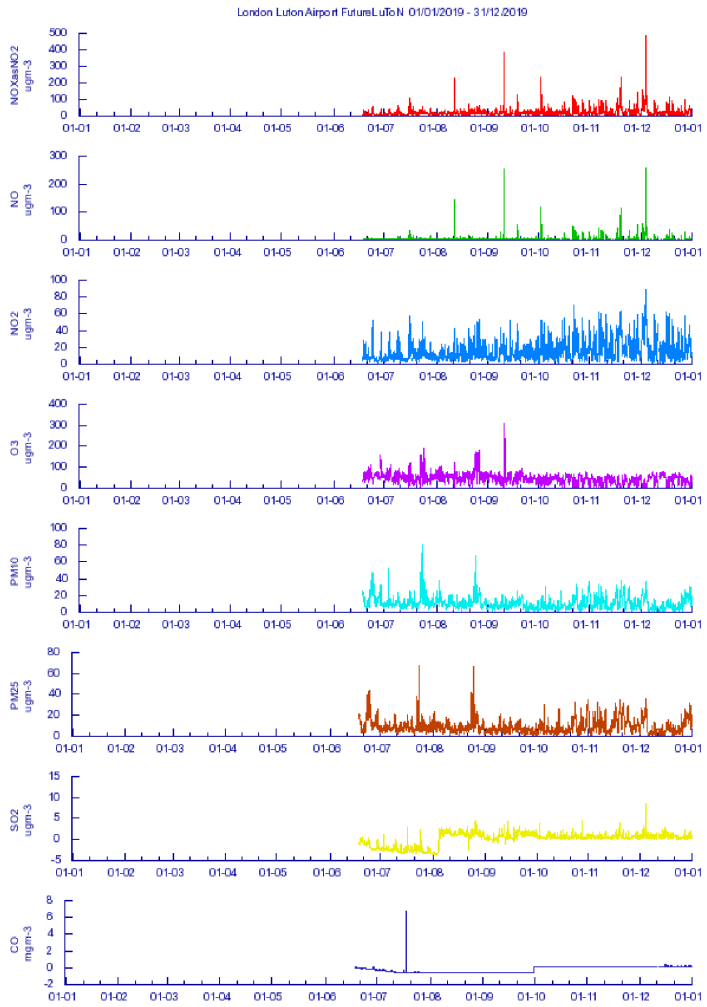


Figure C.5 – Annualisation of Continuous Monitoring Data (LA001: London Luton Airport FutureLuToN)

a) Nitrogen Dioxide (NO_2)

LA001 - NO_2 Annualisation

Variable	Value	Unit
Date measurements commenced	19/06/2019	
Annual data capture	53.1	%
*Measured period mean (**M**)*	15.2	µg/m³

Annualisation carried out in accordance with methodology set out in TG.16 Box 7.9

Background Site	Data Capture	Annual Mean 2019 (A_m)	Period Mean 2019 (P_m)	Ratio (A_m/P_m)
London N. Kensington	99%	27.3	25.2	1.082
Oxford St Ebbes	97%	15.9	13.8	1.151
London Haringey Priory Park South	99%	21.9	20.5	1.069
Borehamwood Meadow Park	97%	20.7	19.4	1.066
			Average (R_a)	**1.066**

Estimated annual mean NO_2 concentration at LA001 in 2019 = **M × R_a =** **16.2µg/m³**

b) Particulate Matter (PM_{10})

LA001 - PM_{10} Annualisation

Variable	Value	Unit
Date measurements commenced	19/06/2019	
Annual data capture	53.4	%
*Measured period mean (**M**)*	11.1	µg/m³

Annualisation carried out in accordance with methodology set out in TG.16 Box 7.9

Background Site	Data Capture	Annual Mean 2019 (A_m)	Period Mean 2019 (P_m)	Ratio (A_m/P_m)
London Bloomsbury	92%	17.6	15.0	1.174
London N. Kensington	100%	14.5	12.5	1.160
Oxford St Ebbes	97%	14.2	10.9	1.309
London Honor Oak Park	100%	14.7	12.2	1.209
			Average (R_a)	**1.213**

Estimated annual mean PM_{10} concentration at LA001 in 2019 = **M × R_a =** **13.5µg/m³**

c) Fine Particulate Matter ($PM_{2.5}$)

LA001 - $PM_{2.5}$ Annualisation

Variable	Value	Unit
Date measures commenced	19/06/2019	
Annual data capture	53.4	%
*Measured period mean (**M**)*	9.4	µg/m³

Annualisation carried out in accordance with methodology set out in TG.16 Box 7.9

Background Site	Data Capture	Annual Mean 2019 (A_m)	Period Mean 2019 (P_m) Starting 19/06/2019	Ratio (A_m/P_m)
London Bloomsbury	98%	10.8	8.6	1.251
London N. Kensington	100%	9.6	7.7	1.246
Northampton Spring Park	98%	11.5	10.7	1.079
Oxford St Ebbes	96%	8.9	6.6	1.361
			Average (R_a)	**1.234**

Estimated annual mean $PM_{2.5}$ concentration at LA001 in 2019 = **M × R_a =** **11.6µg/m³**

d) Sulphur Dioxide (SO_2)

LA001 - SO_2 Annualisation

Variable	Value	Unit
Date measurements commenced	19/06/2019	
Annual data capture	53.0	%
*Measured period mean (**M**)*	0.74	µg/m³

Annualisation carried out in accordance with methodology set out in TG.16 Box 7.9

Background Site	Data Capture	Annual Mean 2019 (A_m)	Period Mean 2019 (P_m) Starting 19/06/2019	Ratio (A_m/P_m)
London N. Kensington	93%	1.64	1.56	1.050
Thurrock	97%	0.97	1.03	0.947
			Average (R_a)	**0.999**

Estimated annual mean SO_2 concentration at LA001 in 2019 = **M × R_a =** **0.7µg/m³**

e) Ozone (O_3)

LA001 - O_3 Annualisation

Variable	Value	Unit
Date measurements commenced	19/06/2019	
Annual data capture	53.2	%
*Measured period mean (**M**)*	47.70	µg/m³

Annualisation carried out in accordance with methodology set out in TG.16 Box 7.9

Background Site	Data Capture	Annual Mean 2019 (A_m)	Period Mean 2019 (P_m) Starting 19/06/2019	Ratio (A_m/P_m)
London Bloomsbury	98%	36.4	33.6	1.081
London N. Kensington	96%	47.0	43.3	1.087
London Haringey Priory Park South	95%	44.5	39.4	1.129
Northampton Spring Park	100%	52.5	48.1	1.090
			Average (R_a)	**1.097**

Estimated annual mean O_3 concentration at LA001 in 2019 = **M × R_a =** **52.3µg/m³**

f) Black Carbon

LA001 - Black Carbon Annualisation

Variable	Value	Unit
Date measurements commenced	19/06/2019	
Annual data capture	32.1	%
*Measured period mean (**M**)*	0.50	µg/m³

Annualisation carried out in accordance with methodology set out in TG.16 Box 7.9

Background Site	Data Capture	Annual Mean 2019 (A_m)	Period Mean 2019 (P_m) Starting 19/06/2019	Ratio (A_m/P_m)
London N. Kensington	96%	0.89	0.85	1.045
Detling [1]	98%	0.44	0.41	1.068
Chilbolton Observatory [1]	96%	0.40	0.37	1.082
			Average (R_a)	**1.065**

Estimated annual mean black carbon concentration at LA001 in 2019 = **M × R_a =** **0.5µg/m³**

[1)] *Monitoring site located more than 50 miles away from the site being annualised.*

Diffusion Tube Analysis

The tubes deployed by both Luton Borough Council and LLAL are supplied by Gradko International Ltd. and use a preparation of 20% Triethanolamine (TEA) in deionised water. The exposed tubes are analysed in accordance with Gradko's documented in-house *Laboratory Method GLM7* which complies with the guidelines set out in Defra's *'Diffusion Tubes for Ambient NO_2 Monitoring: Practical Guidance'*. The analysis of diffusion tube samples to determine the amount of nitrogen dioxide present on the tubes is within the scope of their UKAS schedule. Gradko participates in the AIR NO_2 PT scheme, with the most recently published results at time of writing indicating that during 2019 93.8% of QC samples were analysed satisfactorily[6]. During the same period, reported nitrogen dioxide diffusion tube collocation studies indicate that the laboratory achieved good precision in 25 out of 27 studies where tubes prepared with 20% TEA in water were used.

The tubes deployed by LLAOL are also supplied by Gradko International Ltd. but use a preparation of 50% TEA in acetone. During 2019, the laboratory achieved good precision in all 8 reported collocation studies where 50% TEA in acetone tubes were used.

Using the *Local Bias Adjustment and Precision Calculator* (*AEA_DifTPAB_v04.xls*) to check the precision of replicate tube data, the results for the triplicate LBC tubes (LN61/62/63) co-located with the continuous analyser on Dunstable Road East were shown to demonstrate *"Good precision"* (see Figure C.6). This was also the case for the duplicate tubes co-located at the Dunstable Road East site by LLAL (see Figure C.7).

[6] Defra / LGC (November 2019) – Summary of Laboratory Performance in AIR NO_2 Proficiency Testing Scheme (January 2018 – November 2019); https://tinyurl.com/y8o5fpns

Figure C.6 – Local Bias Factor and Precision Calculation – LBC diffusion tubes (LN61/62/63) co-located with the NO_2 analyser on Dunstable Road East (LN60)

Checking Precision and Accuracy of Triplicate Tubes

AEA Energy & Environment
From the AEA group

Diffusion Tubes Measurements										Automatic Method		Data Quality Check	
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	Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
1	09/01/2019	06/02/2019	51.8	52.7	52.2	52	0.5	1	1.1	50.4	99.9	Good	Good
2	06/02/2019	06/03/2019	48.3	52.2	45.3	49	3.4	7	8.6	54.5	99.9	Good	Good
3	06/03/2019	03/04/2019	43.1	44.2	43.0	43	0.6	1	1.6	41.6	99.7	Good	Good
4	03/04/2019	01/05/2019	47.4	38.3	47.3	44	5.2	12	13.0	49.7	99.1	Good	Good
5	01/05/2019	05/06/2019	39.2	42.5	41.4	41	1.7	4	4.2	37.0	99.6	Good	Good
6	05/06/2019	03/07/2019	38.2							34.5	89.7		Good
7	03/07/2019	07/08/2019	44.3	35.9	36.1	39	4.8	12	11.8	28.8	80.0	Good	Good
8	07/08/2019	04/09/2019	37.8	35.9	35.8	36	1.1	3	2.8	29.1	99.9	Good	Good
9	04/09/2019	02/10/2019	42.0	39.3	39.3	40	1.5	4	3.8	31.9	99.9	Good	Good
10	02/10/2019	06/11/2019	38.9		40.3	40	1.0	3	9.2	38.2	99.9	Good	Good
11	06/11/2019	04/12/2019	59.7	59.0	58.7	59	0.5	1	1.4	51.5	99.4	Good	Good
12	04/12/2019	08/01/2020	40.0	45.7	43.6	43	2.9	7	7.2	34.9	99.8	Good	Good
13													
											Overall survey -->	Good precision	Good Overall DC

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

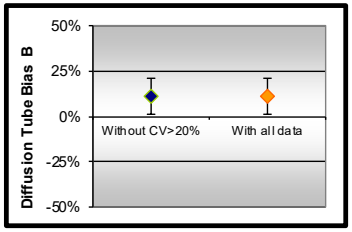
(Check average CV & DC from Accuracy calculations)

Site Name/ ID:	CRAQM 2 A;B;C (LN:61/62/63)

Precision: 11 out of 11 periods have a CV smaller than 20%

Accuracy (with 95% confidence interval) without periods with CV larger than 20%	
Bias calculated using 11 periods of data	
Bias factor A	0.92 (0.84 - 1.01)
Bias B	9% (-1% - 19%)
Diffusion Tubes Mean:	44 µgm^{-3}
Mean CV (Precision):	5
Automatic Mean:	41 µgm^{-3}
Data Capture for periods used:	98%
Adjusted Tubes Mean:	41 (37 - 45) µgm^{-3}

Accuracy (with 95% confidence interval) WITH ALL DATA	
Bias calculated using 11 periods of data	
Bias factor A	0.92 (0.84 - 1.01)
Bias B	9% (-1% - 19%)
Diffusion Tubes Mean:	44 µgm^{-3}
Mean CV (Precision):	5
Automatic Mean:	41 µgm^{-3}
Data Capture for periods used:	98%
Adjusted Tubes Mean:	41 (37 - 45) µgm^{-3}



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Version 04 - February 2011

Figure C.7 – Local Bias Factor and Precision Calculation – LLAL diffusion tubes (L1) co-located with the NO_2 analyser on Dunstable Road East (LN60)

Checking Precision and Accuracy of Triplicate Tubes

AEA Energy & Environment
From the AEA group

Diffusion Tubes Measurements										Automatic Method		Data Quality Check	
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	Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
1	09/01/2019	07/02/2019	48.2	55.4		52	5.1	10	45.7	50.3	99.9	Good	Good
2	07/02/2019	06/03/2019	55.0	57.3		56	1.6	3	14.6	54.8	99.8	Good	Good
3	06/03/2019	04/04/2019	41.8	44.0		43	1.6	4	14.0	42.0	99.7	Good	Good
4	04/04/2019	01/05/2019	46.8	47.1		47	0.2	0	1.9	49.5	99.1	Good	Good
5	01/05/2019	05/06/2019	37.7	29.4		34	5.9	17	52.7	37.0	99.6	Good	Good
6	05/06/2019	03/07/2019	31.7							34.5	89.7		Good
7	03/07/2019	05/08/2019	37.6	38.3		38	0.5	1	4.4	29.8	78.8	Good	Good
8	05/08/2019	06/09/2019	40.6	34.9		38	4.0	11	36.2	28.3	99.7	Good	Good
9	06/09/2019	04/10/2019	40.7	37.8		39	2.1	5	18.4	33.6	100.0	Good	Good
10	04/10/2019	06/11/2019	47.4	43.4		45	2.8	6	25.4	37.6	99.9	Good	Good
11	06/11/2019	04/12/2019	55.0	60.5		58	3.9	7	34.9	51.5	99.4	Good	Good
12	04/12/2019	10/01/2020	43.0	42.8		43	0.1	0	1.3	35.3	99.8	Good	Good
13													
										Overall survey -->		Good precision	Good Overall DC

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

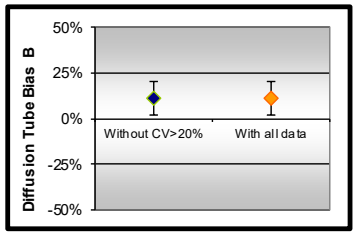
(Check average CV & DC from Accuracy calculations)

Site Name/ ID:	Dunstable Road East (L1)

Precision: 11 out of 11 periods have a CV smaller than 20%

Accuracy (with 95% confidence interval) without periods with CV larger than 20%	
Bias calculated using 11 periods of data	
Bias factor A	0.91 (0.84 - 1)
Bias B	9% (0% - 19%)
Diffusion Tubes Mean:	45 µgm^{-3}
Mean CV (Precision):	6
Automatic Mean:	41 µgm^{-3}
Data Capture for periods used:	98%
Adjusted Tubes Mean:	41 (38 - 45) µgm^{-3}

Accuracy (with 95% confidence interval) WITH ALL DATA	
Bias calculated using 11 periods of data	
Bias factor A	0.91 (0.84 - 1)
Bias B	9% (0% - 19%)
Diffusion Tubes Mean:	45 µgm^{-3}
Mean CV (Precision):	6
Automatic Mean:	41 µgm^{-3}
Data Capture for periods used:	98%
Adjusted Tubes Mean:	41 (38 - 45) µgm^{-3}



Jaume Targa, for AEA
Version 04 - February 2011

Diffusion Tube Bias Adjustment

As well as evaluating the precision of the collocated diffusion tubes, corresponding autoanalyser data was input into *Local Bias Adjustment and Precision Calculator* to calculate a local bias adjustment factor of 0.92 for the LBC diffusion tubes (Figure C.6) and 0.91 for the LLAL diffusion tubes (Figure C.7) respectively. These values were then used in the tool's single and multiple tube adjustment calculators to obtain locally adjusted annual mean values with a 95% confidence interval for all LBC and LLAL sites excluding those with valid data capture for 2019 of less than 75% (*i.e.* those requiring annualisation). Figures C.8 & C.9 show plots of this data grouped by location for the LBC and LLAL sites respectively

Consulting the *National Diffusion Tube Bias Adjustment Factor Spreadsheet Version 03/20* published on the Defra LAQM Support website, for Gradko during 2019 a national bias adjustment factor of 0.93 was obtained for the tubes used by both LBC & LLAL (20% TEA in water - based on 27 studies; Figure C.10) and 0.87 for those deployed by LLAOL (50% TEA in acetone – based on 8 studies; Figure C.11).

With the difference between the local and national bias correction factors for both the LBC and the LLAL sites being no greater than 2.2%, the choice of which factor to apply has relatively little impact on the 2019 diffusion tube results – as can be seen in the comparisons in Table C.2 below.

With the bias correction factor selection not changing the observed number of exceedances in either case, having given due consideration to the guidance in Box 7.11 of LAQM.TG16, a decision was made to take a precautionary approach and apply the marginally higher national coefficient. This decision is consistent with the more conservative approach of selecting the higher of the two coefficients that has been adopted in recent years.

Table C.2 – Comparison of diffusion tube output obtained using local and national bias correction factors

a) Luton Borough Council (LBC) sites

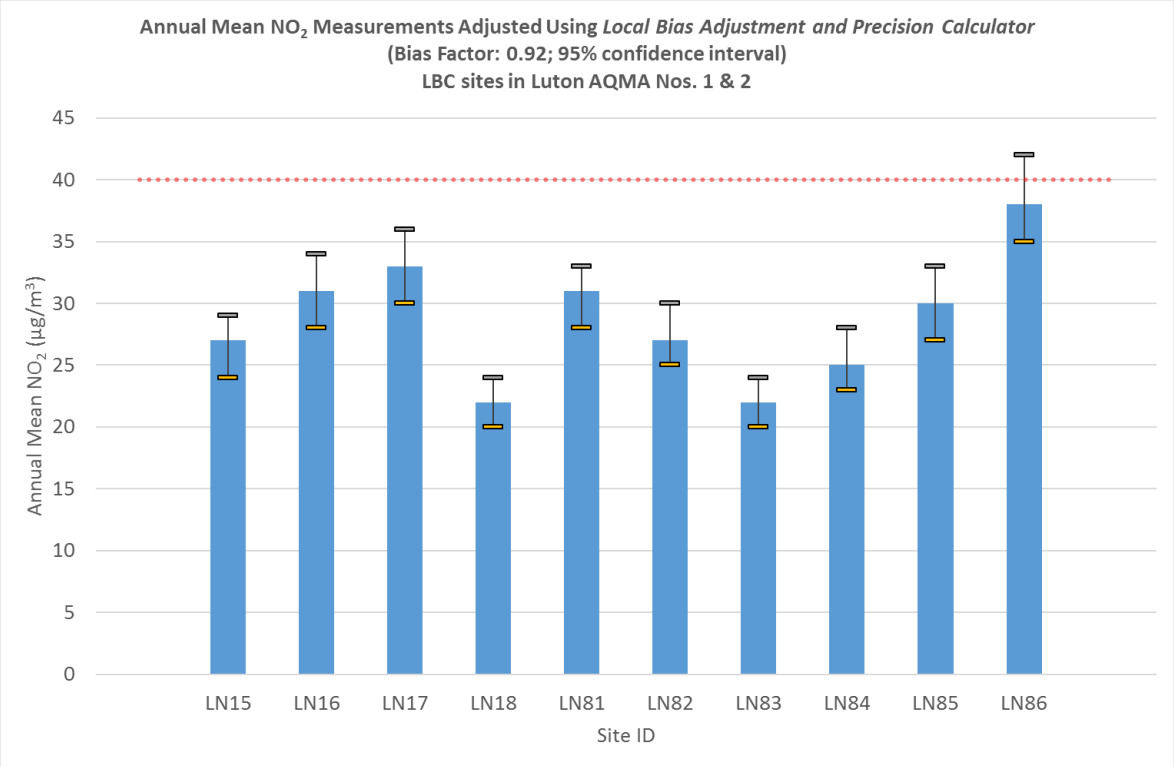
	Local	National
Bias Correction Factor	0.92	0.93
Percentage Difference	1.1%	1.1%
Number of exceedances (excluding the Dunstable Road East co-location study)	2	2
Max	42.5µg/m³	43.0µg/m³
Min	19.7µg/m³	19.9µg/m³
Range	22.8µg/m³	23.1µg/m³
Average	30.9µg/m³	31.2µg/m³
Higher than previous year (when rounded to the nearest integer)	23 (55%)	25 (60%)
Lower than previous year (when rounded to the nearest integer)	10 (24%)	10 (24%)
Unchanged (cf. 2018) (when rounded to the nearest integer)	9 (21%)	7 (17%)
Max increase (cf. 2018)	6µg/m³ (LN23, +21%)	6µg/m³ (LN23, +21%)
Max decrease (cf. 2018)	-4µg/m³ (LN80, -11%)	-4µg/m³ (LN80, -11%)
Average difference (cf. 2018)	0.5µg/m³ (1.7%)	0.8µg/m³ (2.6%)

b) London Luton Airport Ltd (LLAL) sites

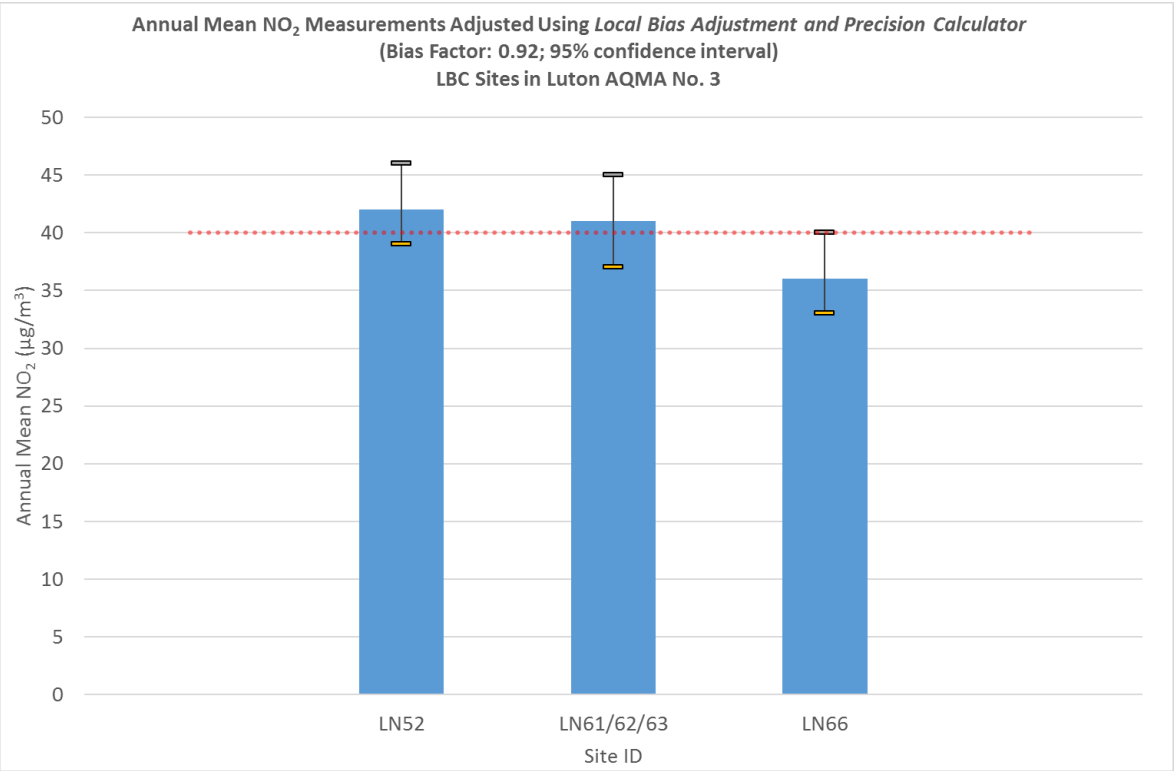
	Local	National
Bias Correction Factor	0.91	0.93
Percentage Difference	2.2%	2.2%
Number of exceedances (excluding the Dunstable Road East co-location study)	1	1
Max	67.9µg/m³	69.4µg/m³
Min	14.2µg/m³	14.5µg/m³
Range	53.7µg/m³	54.8µg/m³
Average	29.6µg/m³	30.2µg/m³
Higher than previous year (when rounded to the nearest integer)	8 (80%)	8 (80%)
Lower than previous year (when rounded to the nearest integer)	2 (20%)	1 (10%)
Unchanged (cf. 2018) (when rounded to the nearest integer)	0	1 (10%)
Max increase (cf. 2018)	6µg/m³ (L10, +32%)	7µg/m³ (L8, +25%)
Max decrease (cf. 2018)	-2µg/m³ (L2, -7%)	-1µg/m³ (L2, -3%)
Average difference (cf. 2018)	3.0µg/m³ (15.8%)	3.7µg/m³ (18.6%)

Figure C.8 – Locally Adjusted Mean NO_2 Measurements (95% confidence interval) – LBC Diffusion Tube Sites

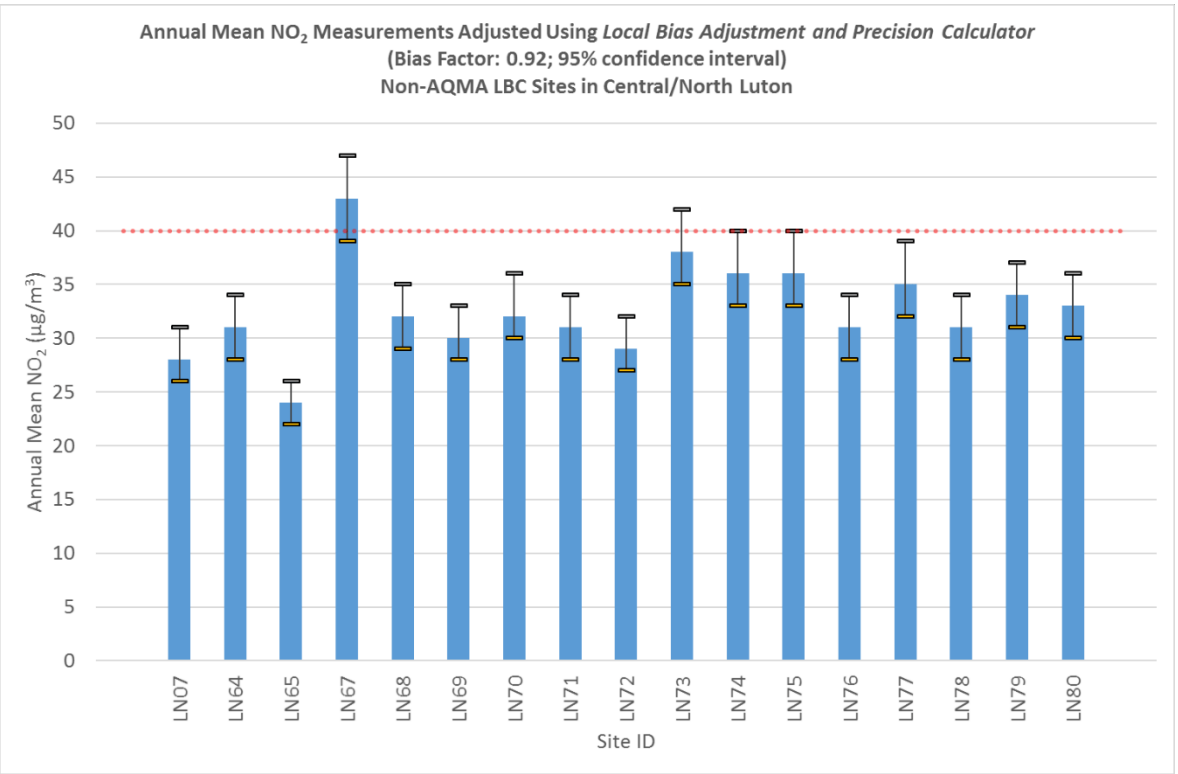
a) Sites within Luton AQMA Nos. 1 & 2



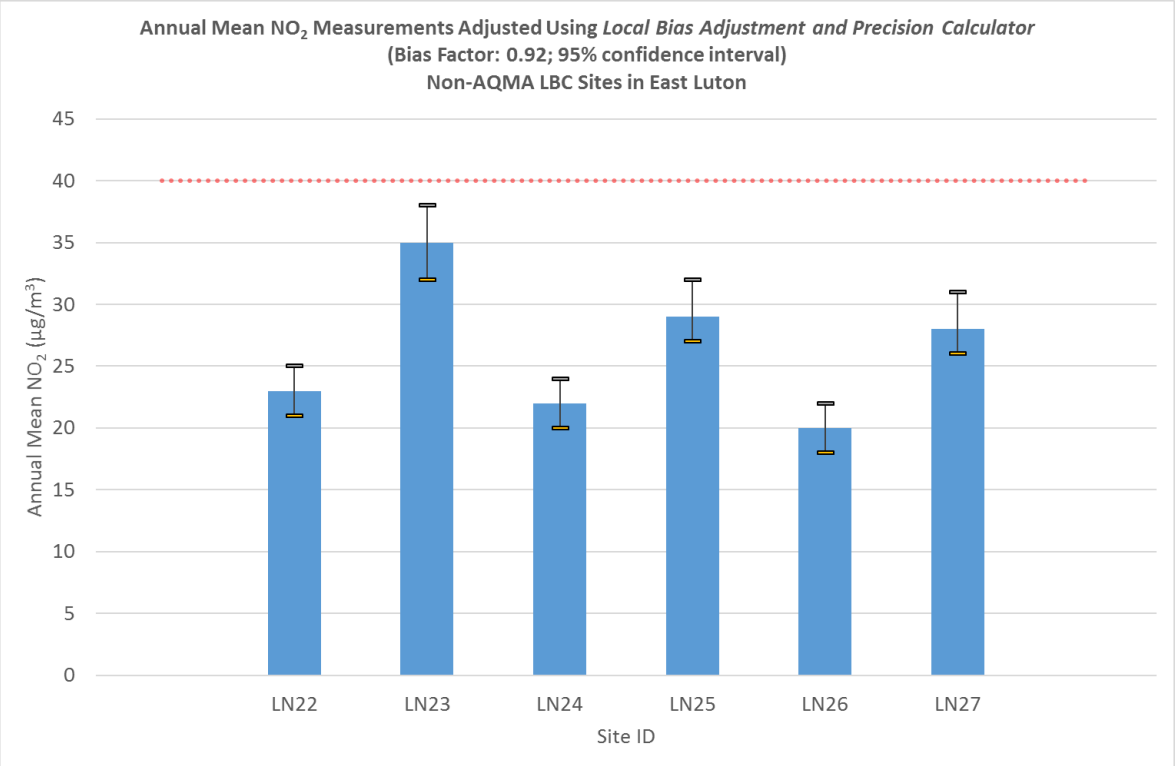
b) Sites within Luton AQMA No. 3



c) Non-AQMA sites in Central/North Luton



d) Non-AQMA sites in East Luton



e) Non-AQMA sites in West Luton

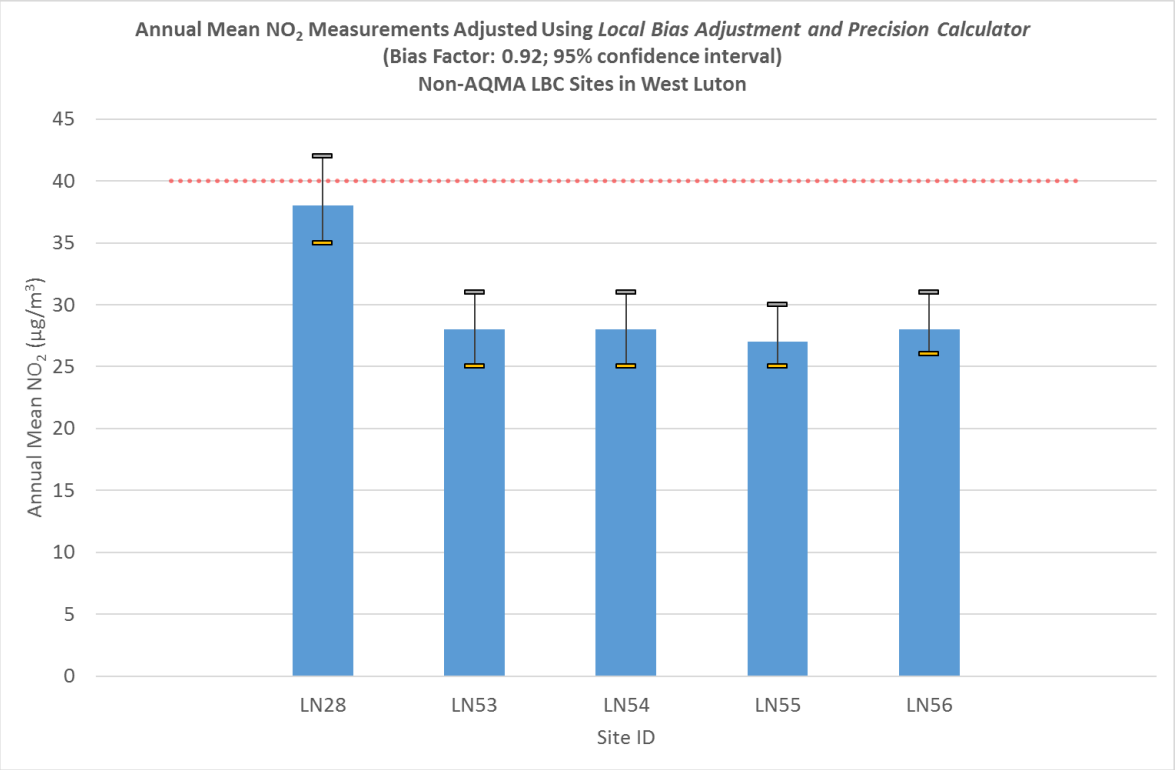


Figure C.9 – Locally Adjusted Mean NO_2 Measurements (95% confidence interval) – LLAL Diffusion Tube Sites

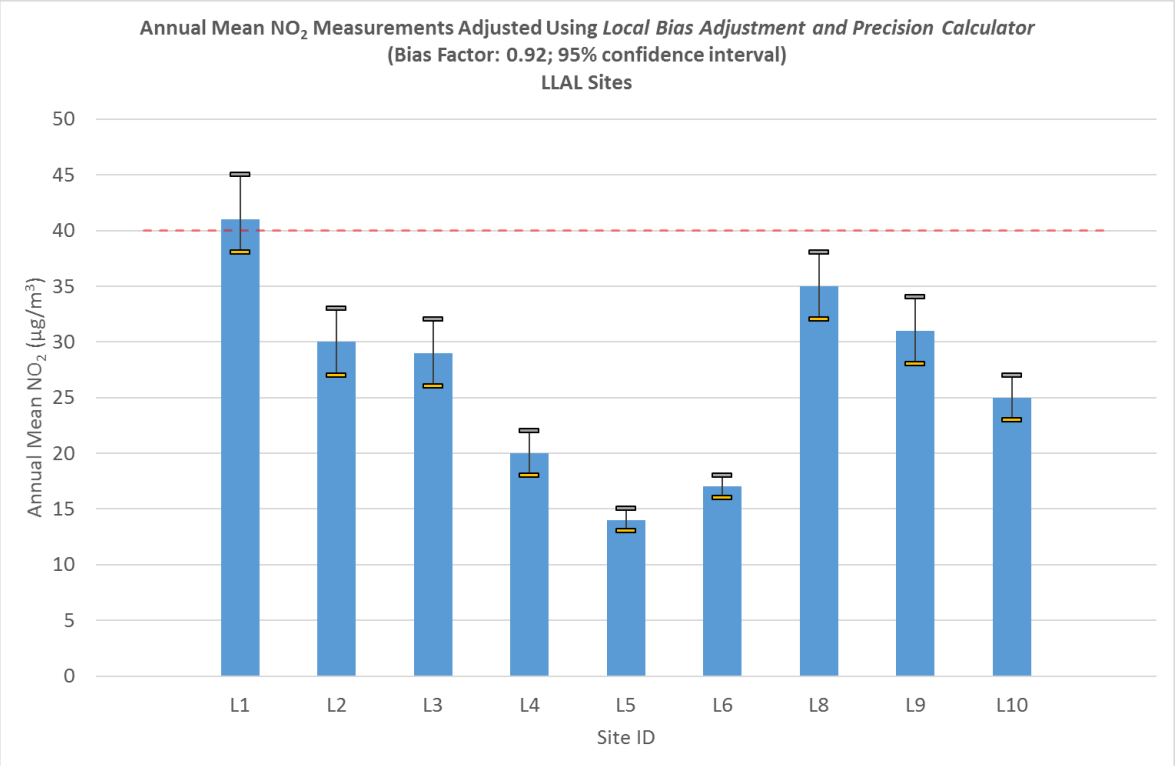


Figure C.10 – National Bias Adjustment Factor – LBC & LLAL (20% TEA in water)

National Diffusion Tube Bias Adjustment Factor Spreadsheet

Spreadsheet Version Number: 03/20

Follow the steps below **in the correct order** to show the results of **relevant** co-location studies

Data only apply to tubes exposed monthly and are not suitable for correcting individual short-term monitoring periods

Whenever presenting adjusted data, you should state the adjustment factor used and the version of the spreadsheet

This spreadhseet will be updated every few months: the factors may therefore be subject to change. This should not discourage their immediate use.

This spreadsheet will be updated at the end of June 2020

LAQM Helpdesk Website

The LAQM Helpdesk is operated on behalf of Defra and the Devolved Administrations by Bureau Veritas, in conjunction with contract partners AECOM and the National Physical Laboratory.

Spreadsheet maintained by the National Physical Laboratory. Original compiled by Air Quality Consultants Ltd.

Step 1: Select the Laboratory that Analyses Your Tubes from the Drop-Down List

If a laboratory is not shown, we have no data for this laboratory.

Step 2: Select a Preparation Method from the Drop-Down List

If a preparation method is not shown, we have no data for this method at this laboratory.

Step 3: Select a Year from the Drop-Down List

If a year is not shown, we have no data[2]

Step 4:

Where there is only one study for a chosen combination, you should use the adjustment factor shown with caution. Where there is more than one study, use the overall factor[3] shown in blue at the foot of the final column.

If you have your own co-location study then see footnote[4]. If uncertain what to do then contact the Local Air Quality Management Helpdesk at LAQMHelpdesk@uk.bureauveritas.com or 0800 0327953

Analysed By[1]	Method (To undo your selection, choose (All) from the pop-up list)	Year[5] (To undo your selection, choose (All))	Site Type	Local Authority	Length of Study (months)	Diffusion Tube Mean Conc. (Dm) (µg/m^3)	Automatic Monitor Mean Conc. (Cm) (µg/m^3)	Bias (B)	Tube Precision[6]	Bias Adjustment Factor (A) (Cm/Dm)
Gradko	20% TEA in water	2019	R	Blackburn with darwen Borough Council	10	29	21	36.9%	G	**0.73**
Gradko	20% TEA in water	2019	R	Cheshire West and Chester	12	39	38	2.0%	G	**0.98**
Gradko	20% TEA in water	2019	R	Cheshire West and Chester	11	34	34	-2.1%	G	**1.02**
Gradko	20% TEA in water	2019	R	Gedling Borough Council	12	32	30	7.3%	G	**0.93**
Gradko	20% TEA in water	2019	R	NOTTINGHAM CITY COUNCIL	10	37	40	-7.0%	G	**1.07**
Gradko	20% TEA in water	2019	R	Bedford Borough Council	11	29	29	-1.0%	G	**1.01**
Gradko	20% TEA in water	2019	R	Bedford Borough Council	12	37	32	13.0%	G	**0.89**
Gradko	20% TEA in water	2019	R	Gateshead Council	12	30	25	18.1%	G	**0.85**
Gradko	20% TEA in water	2019	R	Gateshead Council	10	32	34	-7.2%	G	**1.08**
Gradko	20% TEA in water	2019	R	Gateshead Council	12	34	27	23.7%	P	**0.81**
Gradko	20% TEA in water	2019	R	Gateshead Council	11	40	44	-10.5%	G	**1.12**
Gradko	20% TEA in water	2019	KS	Marylebone Road Intercomparison	12	85	65	30.1%	G	**0.77**
Gradko	20% TEA in water	2019	R	Borough Council of King's Lynn and West Norfolk	9	27	21	28.4%	G	**0.78**
Gradko	20% TEA in water	2019	R	Lancaster City Council	13	40	34	16.4%	G	**0.86**
Gradko	20% TEA in water	2019	R	Lancaster City Council	12	31	31	1.6%	G	**0.98**
Gradko	20% TEA in Water	2019	R	Monmouthshire County Council	12	39	39	1.3%	G	**0.99**
Gradko	20% TEA in water	2019	UC	Belfast City Council	10	29	24	21.8%	G	**0.82**
Gradko	20% TEA in water	2019	R	Dudley MBC	12	33	32	4.5%	G	**0.96**
Gradko	20% TEA in water	2019	R	Dudley MBC	12	44	42	3.9%	G	**0.96**
Gradko	20% TEA in water	2019	UB	Dudley MBC	12	23	19	19.8%	G	**0.83**
Gradko	20% TEA in water	2019	UB	Eastleigh Borough Council	12	24	26	-7.1%	G	**1.08**
Gradko	20% TEA in water	2019	R	Gateshead Council	12	34	27	23.7%	P	**0.81**
Gradko	20% TEA in water	2019	R	Gateshead Council	11	40	44	-10.5%	G	**1.12**
Gradko	20% TEA in water	2019	R	Gateshead Council	10	32	34	-7.2%	G	**1.08**
Gradko	20% TEA in water	2019	R	Gateshead Council	12	30	25	18.1%	G	**0.85**
Gradko	20% TEA in water	2019	R	Thurrock Borough Council	12	29	24	21.6%	G	**0.82**
Gradko	20% TEA in water	2019	R	Brighton & Hove City Council	11	45	50	-9.3%	G	**1.10**
Gradko	20% TEA in water	2019		**Overall Factor[3] (27 studies)**				**Use**		**0.93**

[1] For Casella Stanger/Bureau Veritas (NOT Bureau Veritas Labs) use Gradko 50% TEA in Acetone.
For Casella Seal/GMSS/Casella CRE/Bureau Veritas Labs/Eurofins/ use Environmental Scientific Groups.
From 2011 for Environmental Scientific Groups use ESG Glasgow.
From 2011 for Harwell Scientific Services use ESG Didcot.
For 2017 for SOCOTEC use ESG Didcot, as name changed mid year.
For 2018 SOCOTEC entered as Didcot and Glasgow. Glasgow analysis lab moved to Didcot mid 2018.
For Staffordshire CC SS/Staffordshire County Analyst use Staffordshire Scientific Services.
For Bodycote Health Sciences and Clyde Analytical Laboratories use Exova.
For Rotherham MBC use South Yorkshire Labs.
For Dundee CC use Tayside SS.
For Leicester Scientific Services use Staffordshire Scientific Services.
For South Yorkshire Air Quality Samplers use South Yorkshire Labs. As of January 2010 sampler body changed. As of April 2010 sampler cap changed.
Lancashire County Analysts withdrew from the Field intercomparison at the end of 2010. No submissions were supplied in 2011.
Walsall MBC closed in March 2011.
Bristol Scientific Services closed at the end of 2011.
Somerset County Council did not start the Marylebone road intercomparison until June 2012.
Exova stopped providing diffusion tubes at the end of 2013.
Kent Scientific Services stopped providing diffusion tubes at the end of 2013.
Kirklees Council stopped providing diffusion tubes in the middle of 2016.
Northampton BC stopped providing diffusion tubes in 2017.

[2] In this situation it would be reasonable to use data from the nearest year.

[3] Overall factors have been calculated using orthogonal regression to allow for uncertainty in both the automatic monitor and diffusion tube. The uncertainty of the diffusion tube has been assumed to be double that of the automatic monitor.

[4] If you have your own co-location study, please send your data to us, so that it can be included here. If this is not possible, but you wish to combine these factors with your own, select and copy the relevant data from this spreadsheet and paste them into a new one (otherwise your calculations will include hidden data). Then add your own data and calculate the bias. To obtain a new correction factor that includes your data, average the bias (B) values, expressed as a factor, i.e. -16% is -0.16. Next add 1 to this value, e.g. -0.16 + 1.00 = 0.84 in this example, then take the inverse to give the bias adjustment factor 1/0.84 = 1.19. (This will not be exactly the same as the correction factor calculated using orthogonal regression as used in this spreadsheet, but will be reasonably close).

To add data download a questionnaire

[5] Where an annual data set falls into two years it has been ascribed to the year in which most of the data has fallen.

[6] Tube precision is determined as follows: G = Good precision - coefficient of variation (CV) of diffusion tube replicates is considered G when the CV of eight or more periods is less than 20%, and the average CV of all monitoring periods is less than 10%; P = Poor precision - CV of four or more periods >20% and/or average CV >10%; S = Single tube, therefore not applicable; na = not available.

Figure C.11 – National Bias Adjustment Factor – LLAOL (50% TEA in acetone)

National Diffusion Tube Bias Adjustment Factor Spreadsheet — Spreadsheet Version Number: 03/20

Follow the steps below **in the correct order** to show the results of **relevant** co-location studies
Data only apply to tubes exposed monthly and are not suitable for correcting individual short-term monitoring periods
Whenever presenting adjusted data, you should state the adjustment factor used and the version of the spreadsheet
This spreadhseet will be updated every few months: the factors may therefore be subject to change. This should not discourage their immediate use.

This spreadsheet will be updated at the end of June 2020

LAQM Helpdesk Website

The LAQM Helpdesk is operated on behalf of Defra and the Devolved Administrations by Bureau Veritas, in conjunction with contract partners AECOM and the National Physical Laboratory.

Spreadsheet maintained by the National Physical Laboratory. Original compiled by Air Quality Consultants Ltd.

Step 1: Select the Laboratory that Analyses Your Tubes from the Drop-Down List

If a laboratory is not shown, we have no data for this laboratory.

Step 2: Select a Preparation Method from the Drop-Down List

If a preparation method is not shown, we have no data for this method at this laboratory.

Step 3: Select a Year from the Drop-Down List

If a year is not shown, we have no data[2]

Step 4:

Where there is only one study for a chosen combination, you should use the adjustment factor shown with caution. Where there is more than one study, use the overall factor[3] shown in blue at the foot of the final column.

If you have your own co-location study then see footnote[4]. If uncertain what to do then contact the Local Air Quality Management Helpdesk at LAQMHelpdesk@uk.bureauveritas.com or 0800 0327953

Analysed By[1]	Method (To undo your selection, choose (All) from the pop-up list)	Year[5] (To undo your selection, choose (All))	Site Type	Local Authority	Length of Study (months)	Diffusion Tube Mean Conc. (Dm) (µg/m^3)	Automatic Monitor Mean Conc. (Cm) (µg/m^3)	Bias (B)	Tube Precision[6]	Bias Adjustment Factor (A) (Cm/Dm)
Gradko	50% TEA in acetone	2019	R	City of London	12	74	71	4.1%	G	**0.96**
Gradko	50% TEA in acetone	2019	UB	City of London	12	37	33	14.3%	G	**0.88**
Gradko	50% TEA in acetone	2019	KS	Marylebone Road Intercomparison	12	83	65	26.3%	G	**0.79**
Gradko	50% TEA in acetone	2019	R	London Borough of Richmond upon Thames	12	46	35	30.4%	G	**0.77**
Gradko	50% TEA in acetone	2019	R	London Borough of Richmond upon Thames	12	29	27	7.1%	G	**0.93**
Gradko	50% TEA in acetone	2019	B	London Borough of Richmond upon Thames	11	21	21	1.0%	G	**0.99**
Gradko	50% TEA in acetone	2019	UB	Falkirk Council	9	18	15	18.1%	G	**0.85**
Gradko	50% TEA in acetone	2019	R	LB Newham	12	35	30	16.2%	G	**0.86**
Gradko	50% TEA in acetone	2019		**Overall Factor[3] (8 studies)**				**Use**		**0.87**

[1] For Casella Stanger/Bureau Veritas (NOT Bureau Veritas Labs) use Gradko 50% TEA in Acetone.
For Casella Seal/GMSS/Casella CRE/Bureau Veritas Labs/Eurofins/ use Environmental Scientific Groups.
From 2011 for Environmental Scientific Groups use ESG Glasgow.
From 2011 for Harwell Scientific Services use ESG Didcot.
For 2017 for SOCOTEC use ESG Didcot, as name changed mid year.
For 2018 SOCOTEC entered as Didcot and Glasgow. Glasgow analysis lab moved to Didcot mid 2018.
For Staffordshire CC SS/Staffordshire County Analyst use Staffordshire Scientific Services.
For Bodycote Health Sciences and Clyde Analytical Laboratories use Exova.
For Rotherham MBC use South Yorkshire Labs.
For Dundee CC use Tayside SS.
For Leicester Scientific Services use Staffordshire Scientific Services.
For South Yorkshire Air Quality Samplers use South Yorkshire Labs. As of January 2010 sampler body changed. As of April 2010 sampler cap changed.
Lancashire County Analysts withdrew from the Field intercomparison at the end of 2010. No submissions were supplied in 2011.
Walsall MBC closed in March 2011.
Bristol Scientific Services closed at the end of 2011.
Somerset County Council did not start the Marylebone road intercomparison until June 2012.
Exova stopped providing diffusion tubes at the end of 2013.
Kent Scientific Services stopped providing diffusion tubes at the end of 2013.
Kirklees Council stopped providing diffusion tubes in the middle of 2016.
Northampton BC stopped providing diffusion tubes in 2017.

[2] In this situation it would be reasonable to use data from the nearest year.

[3] Overall factors have been calculated using orthogonal regression to allow for uncertainty in both the automatic monitor and diffusion tube. The uncertainty of the diffusion tube has been assumed to be double that of the automatic monitor.

[4] If you have your own co-location study, please send your data to us, so that it can be included here. If this is not possible, but you wish to combine these factors with your own, select and copy the relevant data from this spreadsheet and paste them into a new one (otherwise your calculations will include hidden data). Then add your own data and calculate the bias. To obtain a new correction factor that includes your data, average the bias (B) values, expressed as a factor, i.e. -16% is -0.16. Next add 1 to this value, e.g. -0.16 + 1.00 = 0.84 in this example, then take the inverse to give the bias adjustment factor 1/0.84 = 1.19. (This will not be exactly the same as the correction factor calculated using orthogonal regression as used in this spreadsheet, but will be reasonably close).

To add data download a questionnaire

[5] Where an annual data set falls into two years it has been ascribed to the year in which most of the data has fallen.

[6] Tube precision is determined as follows: G = Good precision - coefficient of variation (CV) of diffusion tube replicates is considered G when the CV of eight or more periods is less than 20%, and the average CV of all monitoring periods is less than 10%; P = Poor precision - CV of four or more periods >20% and/or average CV >10%; S = Single tube, therefore not applicable; na = not available.

New Diffusion Tubes, Location Changes & Annualisation

In September 2019, monitoring commenced at a new LLAOL site:

- *LLA 19 – Breachwood Green Community Hall*

In addition to this, during the course of the year LLAOL moved three of its NO_2 diffusion tubes sites to new locations:

- *LLA 1 - Outside Zone 2* moved from 511903, 221278 to (*LLA 1**) 511920, 221334 (a distance of 58.5 metres) in June 2019;
- *LLA 7 – Drop Off Zone* moved from 512166, 221226 to (*LLA 7**) 512105, 221168 (a distance of 84.2 metres) in December 2019; and
- *LLA 16 – Exit Road Plaza* moved from 512158, 221087 to (*LLA 16**) 512275, 221115 (a distance of 120.3 metres) in June 2019 and reassigned as *LLA 16 – Stand 23R airside*.

Furthermore, it should also be noted that prior to the start of the year *LLA 18 – A1081 New Airport Way 2* was moved from 510991, 220497 to (*LLA 18*[II]) 510779, 220279 (a distance of 304.1 metres).

In August 2019, monitoring commenced at a new LLAL site:

- *L11 – Wigmore Valley Park*

In addition to L11, <75% calendar year data capture was achieved at a second LLAL site; *L7 – Vauxhall Way.*

Finally, as a result of ongoing renovation works on Clemitson House, the LBC site *LN11 – Upper George Street* was inaccessible from July 2019.

With the exception of LLA 7 and LLA 18, less than 9 months' worth of data was captured at each location detailed above. Consequently, the mean NO_2 concentrations derived from the partial dataset obtained at these locations have been annualised in accordance with the procedure detailed in *LAQM.TG(16) para 7.124* and *Box 7.10* using the newly published *Annualisation Tool Version 1* (Figures C.9 to C.11)

Note: annualisation is not necessary for LLA 7 (calendar year data capture >75%) and is not possible for LLA 7* (calendar year data capture <25%)

The annualisation adjustment was undertaken using whole year datasets obtained from the *UK Air Data Selector* for the following AURN monitoring sites (all within a 50 mile radius of Luton and with data capture rates of in excess of 85% for the calendar year):

- London N. Kensington (*UKA00253*) – Type: Urban Background
- Oxford St Ebbes (*UKA00518*) – Type: Urban Background
- London Haringey Priory Park South (*UKA00568*) – Type: Urban Background
- Borehamwood Meadow Park (*UKA00644*) – Type: Urban Background

Figure C.12 – Annualisation Summary (*Annualisation Tool V1.0*) – LBC

Annualisation Summary

Diffusion Tube ID	Annualisation Factor London N. Kensington	Annualisation Factor Oxford St Ebbes	Annualisation Factor London Haringey Priory Park South	Annualisation Factor Borehamwood Meadow Park	Average Annualisation Factor	Raw Data Simple Annual Mean (µg/m3)	Annualised Data Simple Annual Mean (µg/m3)
LN11	0.9503	0.8716	0.9544	0.9680	0.9361	39.5	36.9

Figure C.13 – Annualisation Summary (*Annualisation Tool V1.0*) – LLAOL

Annualisation Summary

Diffusion Tube ID	Annualisation Factor London N. Kensington	Annualisation Factor Oxford St Ebbes	Annualisation Factor London Haringey Priory Park South	Annualisation Factor Borehamwood Meadow Park	Average Annualisation Factor	Raw Data Simple Annual Mean (µg/m3)	Annualised Data Simple Annual Mean (µg/m3)
LLA 1	0.8804	0.8622	0.8898	0.9005	0.8832	62.3	55.0
LLA 1*	1.0984	1.1227	1.0917	1.0787	1.0979	39.1	42.9
LLA 16	0.8539	0.8277	0.8650	0.8628	0.8523	59.4	50.7
LLA 16*	0.9910	1.0090	0.9723	0.9675	0.9849	37.7	37.2
LLA 19	0.8572	0.9819	0.8364	0.8327	0.8770	20.4	17.9

Figure C.14 – Annualisation Summary (*Annualisation Tool V1.0*) – LLAL

Annualisation Summary

Diffusion Tube ID	Annualisation Factor London N. Kensington	Annualisation Factor Oxford St Ebbes	Annualisation Factor London Haringey Priory Park South	Annualisation Factor Borehamwood Meadow Park	Average Annualisation Factor	Raw Data Simple Annual Mean (µg/m3)	Annualised Data Simple Annual Mean (µg/m3)	Comments
L7a	1.1968	1.1528	1.2080	1.1911	1.1872	-	-	Duplicate/Triplicate site - Annual data provided for other tube
L7b	1.1968	1.1528	1.2080	1.1911	1.1872	62.8	74.6	
L11a	0.9774	1.1274	0.9793	0.9639	1.0120	-	-	Duplicate/Triplicate site - Annual data provided for other tube
L11b	0.9774	1.1274	0.9793	0.9639	1.0120	-	-	Duplicate/Triplicate site - Annual data provided for other tube
L11c	0.9774	1.1274	0.9793	0.9639	1.0120	21.3	21.5	

Diffusion Tube Distance Correction

Wherever possible diffusion tube monitoring locations are selected to be representative of exposure. However, where this is not practicable measurements should be adjusted to estimate the nitrogen dioxide concentration at the nearest location relevant for exposure.

Where necessary, this correction has been undertaken using the *NO_2 Fall-Off with Distance Calculator Version 4.2* available on the Defra LAQM Support website along with mean background NO_2 concentrations obtained from the 2017-based background NO_2 map for 2018.

Appendix D: Maps of Monitoring Locations and AQMAs

Figure D.1 – Overview of Luton

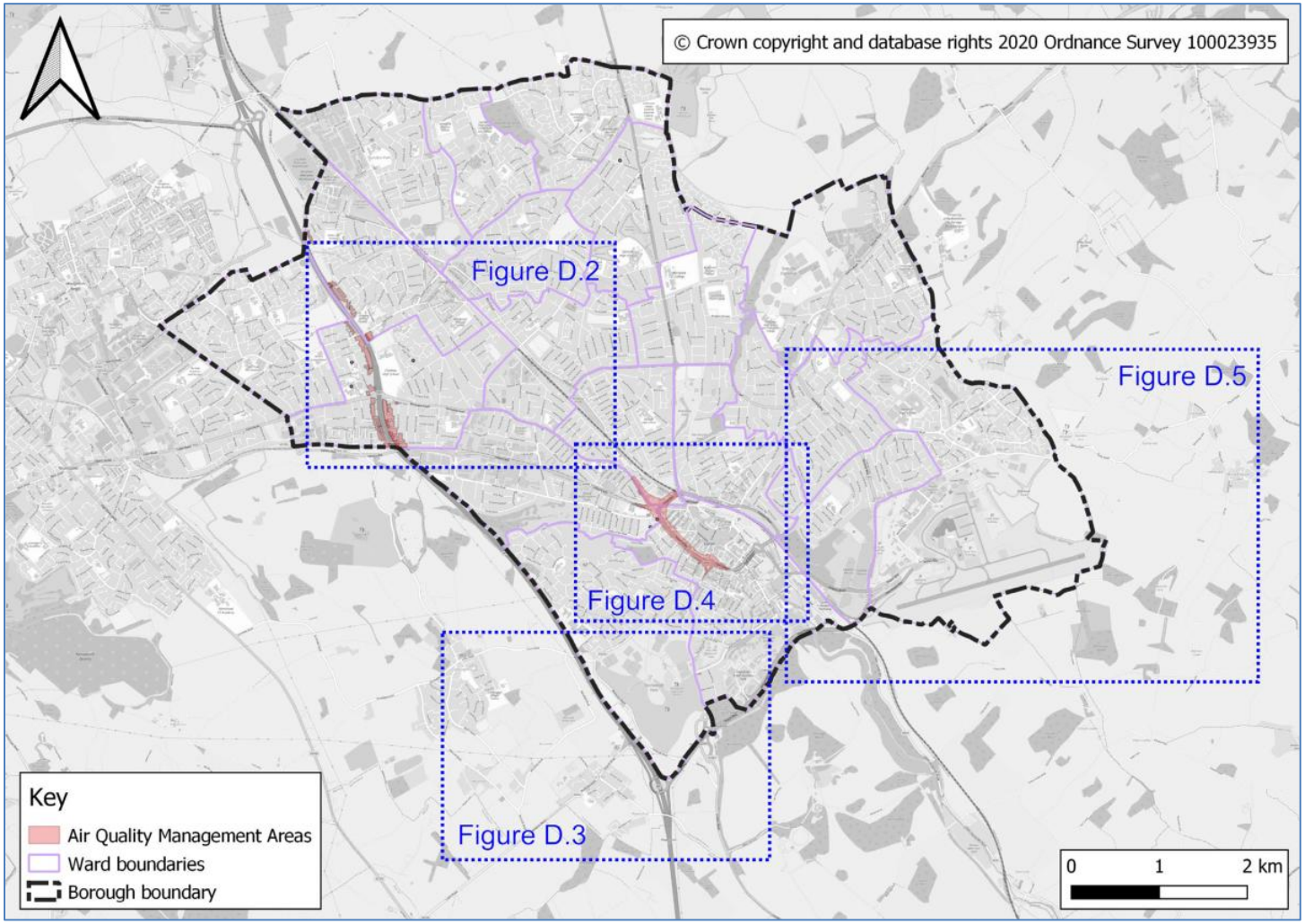


Figure D.2 – NO_2 monitoring locations in the vicinity of Luton AQMA Nºs. 1 & 2 along the route of the M1 *(Monitoring locations in Challney, Leagrave, Limbury & Saints wards)*

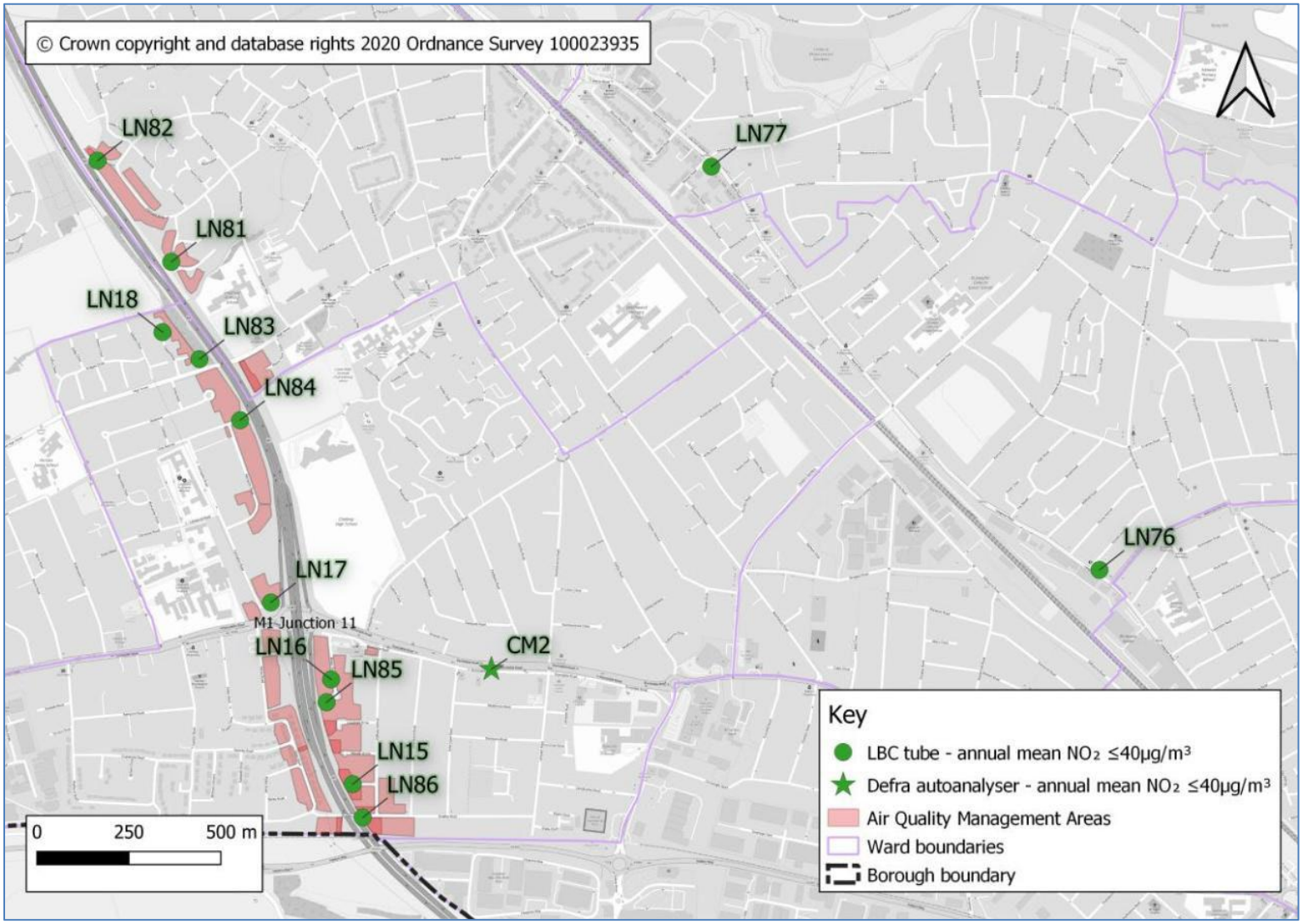


Figure D.3 – NO_2 monitoring locations in South Luton in the vicinity of the M1 *(Monitoring locations in Farley ward)*

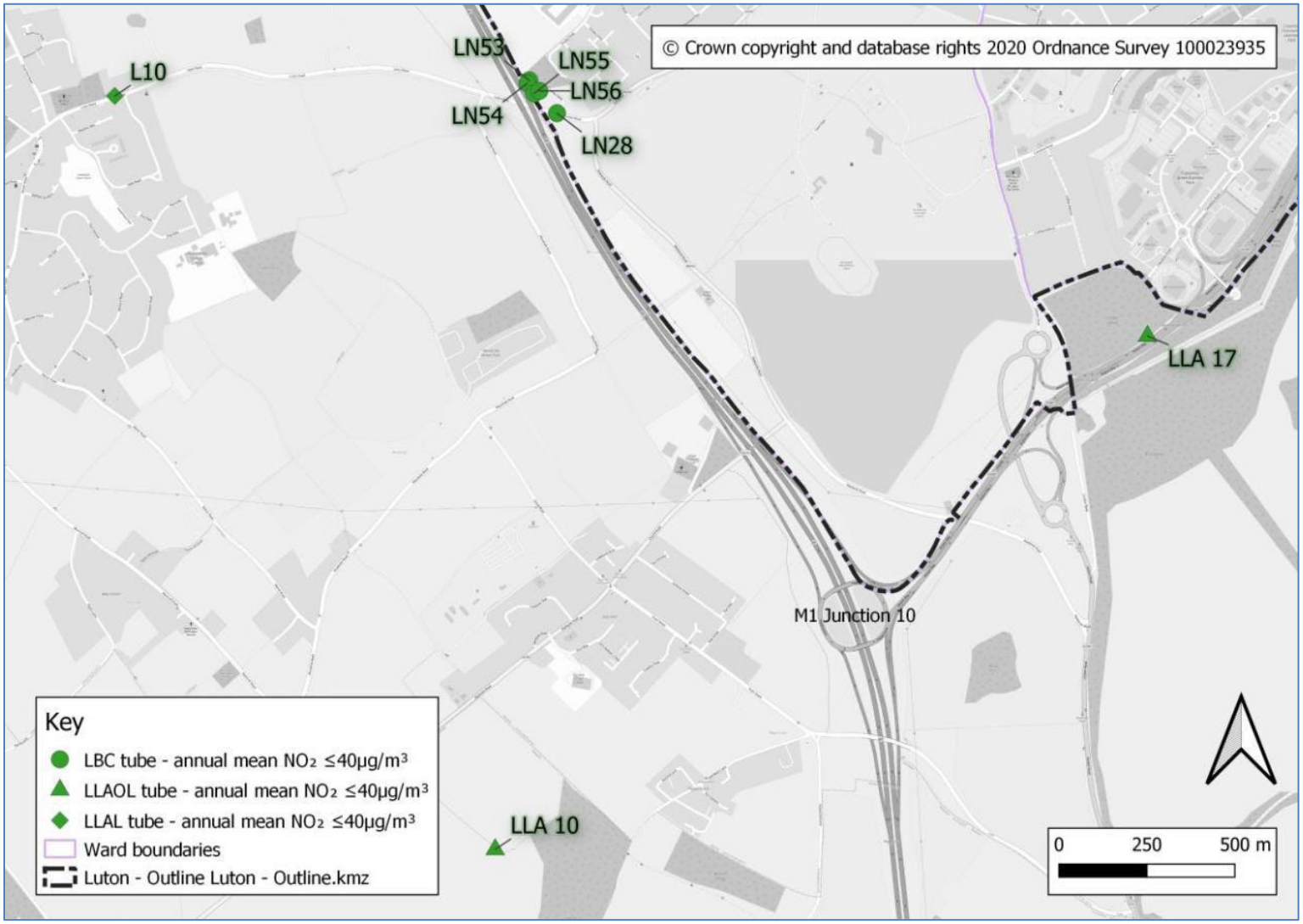


Figure D.4 –Town centre NO_2 monitoring locations in the vicinity of Luton AQMA Nº 3 *(Monitoring locations in Biscot, Dallow, Farley, High Town & South wards)*

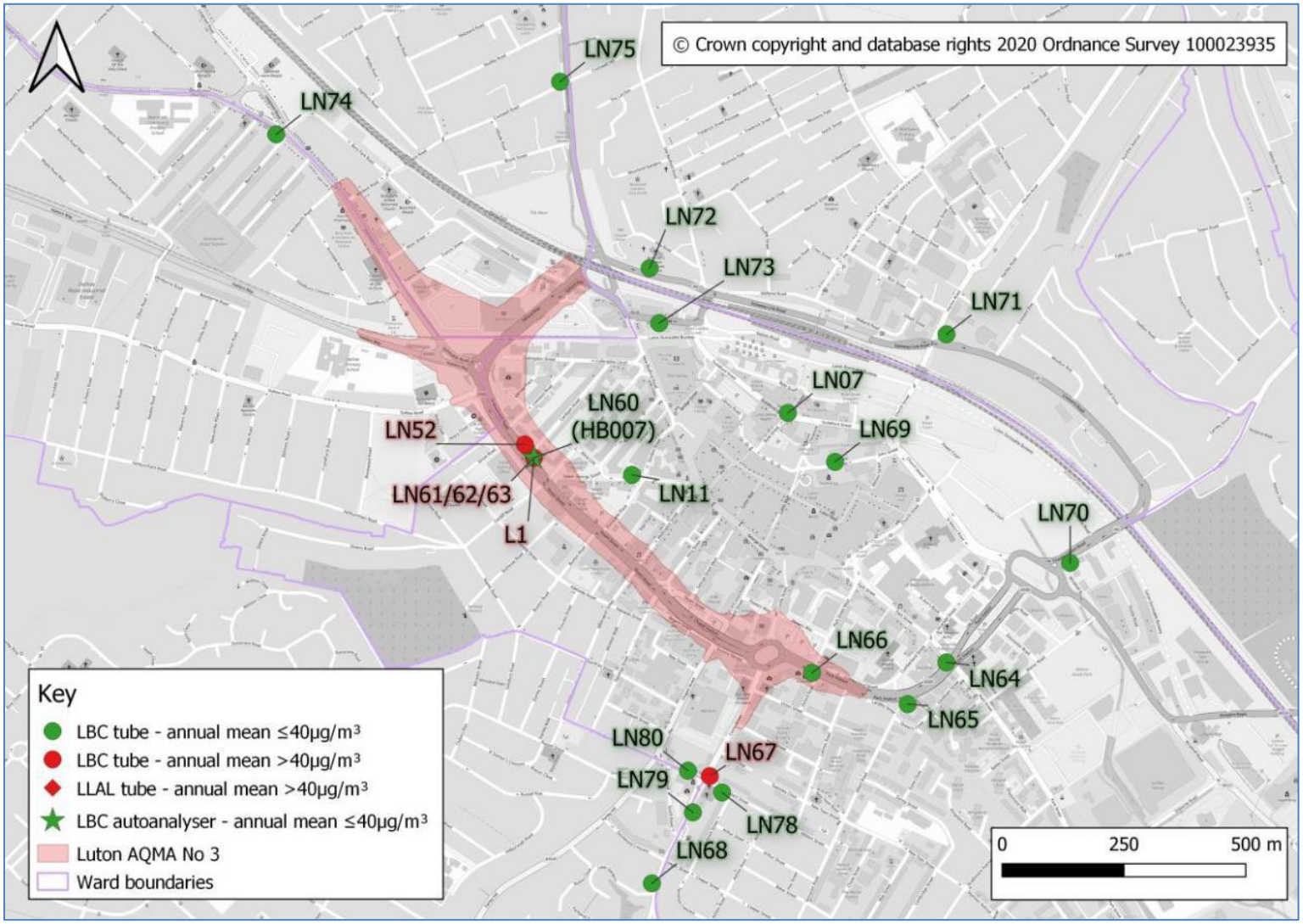
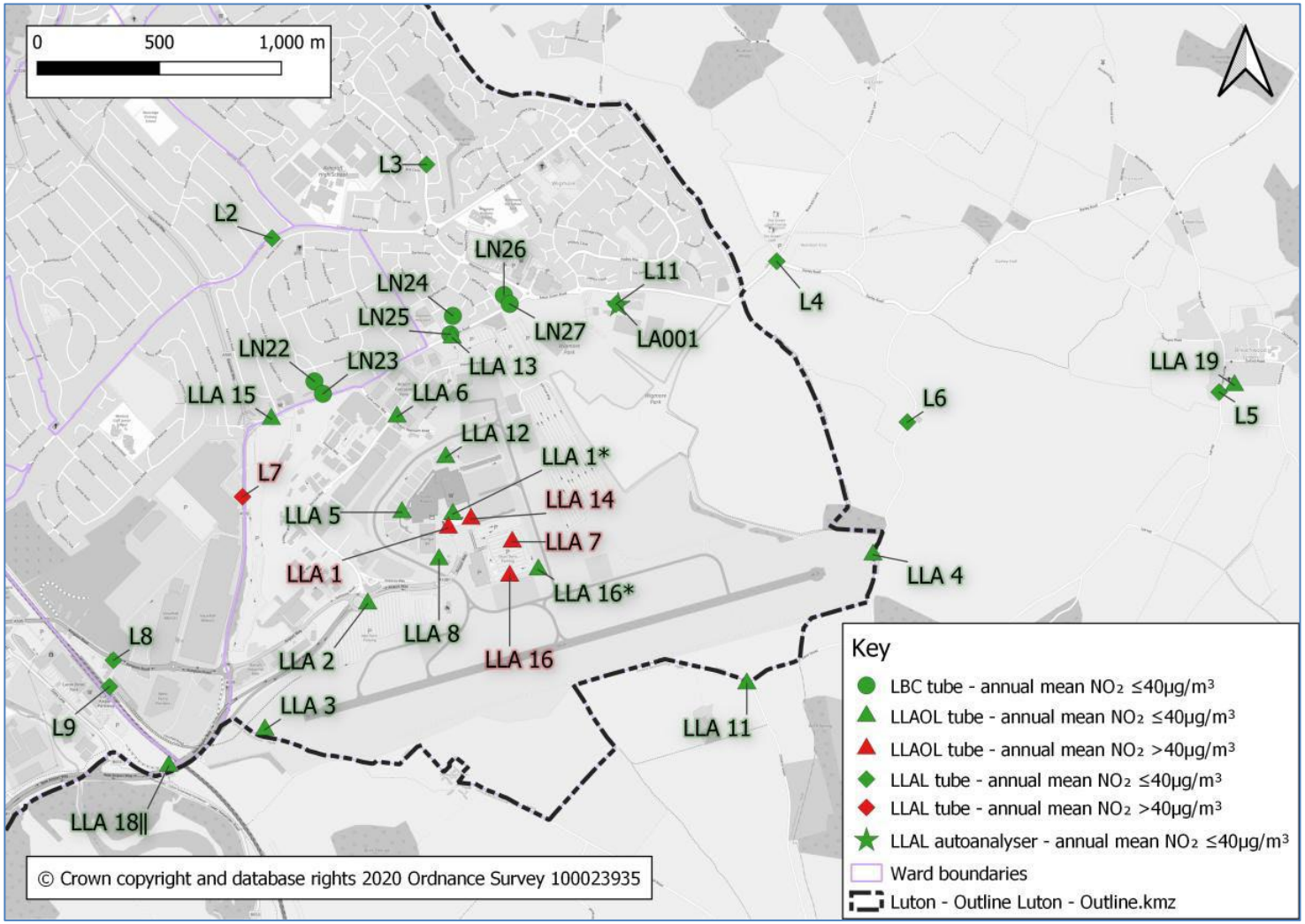


Figure D.5 – NO_2 monitoring locations in the vicinity of London Luton Airport *(Monitoring locations in Crawley & Wigmore wards)*



Appendix E: Summary of Air Quality Objectives in England

Table E.1 – Air Quality Objectives in England

Pollutant	Air Quality Objective[7]	
	Concentration	Measured as
Nitrogen Dioxide (NO_2)	200 µg/m^3 not to be exceeded more than 18 times a year	1-hour mean
	40 µg/m^3	Annual mean
Particulate Matter (PM_{10})	50 µg/m^3, not to be exceeded more than 35 times a year	24-hour mean
	40 µg/m^3	Annual mean
Sulphur Dioxide (SO_2)	350 µg/m^3, not to be exceeded more than 24 times a year	1-hour mean
	125 µg/m^3, not to be exceeded more than 3 times a year	24-hour mean
	266 µg/m^3, not to be exceeded more than 35 times a year	15-minute mean

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

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
BID	Business Improvement District
ASR	Air quality 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
EV	Electric Vehicle
FDMS	Filter Dynamics Measurement System
LAQM	Local Air Quality Management
LBC	Luton Borough Council
LLAL	London Luton Airport Ltd. – the company that owns London Luton Airport. Luton Borough Council is the sole shareholder for this company
LLAOL	London Luton Airport Operations Ltd. – the company for the day to day running of the airport.
LSO	Local Site Operator
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxides
PM_{10}	Airborne particulate matter with an aerodynamic diameter of 10µm (micrometres or microns) or less

Abbreviation	Description
$PM_{2.5}$	Airborne particulate matter with an aerodynamic diameter of 2.5µm or less
QA/QC	Quality Assurance and Quality Control
SO_2	Sulphur Dioxide
TEA	Triethanolamine
ULEV	Ultra-Low Emission Vehicle
UTMC	Urban Traffic Management and Control
VMS	Variable-message sign

References

- DEFRA, (2018). Local Air Quality Management: Technical Guidance (TG16) London [https://tinyurl.com/yaegeqpm]
- London Luton Airport Ltd, (2019). Air Quality Monitoring 2019 Annual Report [https://tinyurl.com/ym9ra9ac]
- Luton Borough Council, (2011). Luton Local Transport Plan 3. Luton [https://tinyurl.com/y9r4vhkf]
- Luton Borough Council, (2017). Luton Local Plan 2011 – 2031. Luton [https://tinyurl.com/y9339fc8]