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| Lewisham Nitrogen Dioxide Diffusion Tube Survey 2019  London Borough of Lewisham  Project Number: 60194269  April 2020 |

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# Introduction

AECOM was commissioned by the London Borough of Lewisham to install and maintain a network of NO2 diffusion tubes to assess the spatial variation of nitrogen dioxide (NO2) concentration within the Borough. The diffusion tube network in 2017 comprised of 37 NO2 diffusion tubes at 35 locations, one of which is a triplicate tube location with all others comprising a single tube. Since the start of 2018, 16 new locations have been added, and Stanstead Road (L25) has been decommissioned, giving a total of 50 monitoring locations. The diffusion tubes were exposed for periods of between 4 and 5 weeks in accordance with the UK NO2 Survey Timetable. The results of the survey provide Lewisham Borough Council with valuable monitoring data for use in their Local Air Quality Review and Assessment (LAQM) process.

This report outlines the results of the survey for January 2019 to December 2019, inclusive. The spatial variation in NO2 concentration throughout the Borough is discussed and the annual mean values for each location are compared against the annual mean objective for NO2 to indicate locations that may be likely to exceed the objective. Monthly concentrations are examined for evidence of seasonal trends.

# Legislative Background

Limit values and air quality objectives for nitrogen dioxide and oxides of nitrogen (NOX) were set out in the First Daughter Directive (1999/30/EC) and subsequent revisions. An annual mean NO2 objective was set at 40 µg/m3 to be achieved by 1st January 2010. A 200 µg/m3 hourly mean standard not to be exceeded more than 18 hours per year was also outlined, to be achieved by the same compliance date. These objectives were reiterated in the 2008 Directive on ambient air quality and cleaner air for Europe (2008/50/EC).

The UK has published its own Air Quality Strategy[[1]](#footnote-1), which detailed the UK’s position on nitrogen dioxide. The UK air quality objectives differ from the European objectives only in their compliance dates; the UK objectives were to be achieved by the end of 2005. European and UK air quality objectives have also been set for oxides of nitrogen for the protection of vegetation and ecosystems. A summary of the principal air quality objectives for NO2 and NOX is given in Tables 1 and 2.

Table 1. UK Air Quality Objectives for NO2 and NOx

|  |  |  |  |
| --- | --- | --- | --- |
| Pollutant | UK Air Quality Objectives | | |
| **Standard/Concentration** | **Measured as** | **Date to be achieved by and maintained thereafter** |
| Nitrogen Dioxide | 200 µg/m3 not to be exceeded more than 18 times a year | 1 Hour Mean | 31st December 2005 |
| 40 µg/m3 | Annual Mean |
| Nitrogen Oxides (for the protection of vegetation) | 30 µg/m3 | Annual Mean | 31st December 2000 |
|  |  |  |  |

Table 2. EU Air Quality Objectives for NO2 and NOx

|  |  |  |  |
| --- | --- | --- | --- |
| Pollutant | EU Air Quality Objectives | | |
| **Standard/Concentration** | **Measured as** | **Date to be achieved by and maintained thereafter** |
| Nitrogen Dioxide | 200 µg/m3 not to be exceeded more than 18 times a year | 1 Hour Mean | 1st January 2010 |
| 40 µg/m3 | Annual Mean |
| Nitrogen Oxides (assuming as nitrogen dioxide) | 30 µg/m3 | Annual Mean | 19th July 2001 |
|  |  |  |  |

# Monitoring Methodology

## Description of Network

The Lewisham Diffusion Tube Network has been maintained by AECOM since January 2011. In 2011, the network consisted of 47 sites, in which one of these was a triplicate co-located site at the automatic monitoring station in New Cross Road and the remaining were single sites, using a total 49 diffusion tubes. In 2012, the network was reduced to 34 diffusion tubes at 32 sites, comprising single tubes at 31 sites and triplicates co-located at the New Cross Road continuous monitoring station. During December 2016, 2 new sites were commissioned at Kender Primary School and Deptford Park Primary School. In October 2017 a new site was also added at St James Hatcham Primary School. Finally in 2018, 16 new sites were added, and one existing site removed, bringing the total number of sites up to 50. Diffusion tubes throughout the Borough have been deployed and collected at 4 to 5 weeks intervals in accordance with the UK NO2 Diffusion Tube calendar[[2]](#footnote-2).

The locations of the diffusion tubes are shown in Appendix A.

## Procedures and Site Changes

All diffusion tubes used in the network were stored in a refrigerator prior to deployment and after collection to reduce the possibility of degradation of the chemicals involved. Tubes subject to contamination (e.g. spider webs, foreign bodies, etc.) or vandalised have also been excluded from the final dataset.

## Tube Preparation, Analysis and Laboratory QA/QC

The diffusion tubes were supplied and analysed by Gradko International Ltd, using a 50% triethanolamine (TEA) in acetone method. Gradko participates in the AIR Proficiency Testing (PT) scheme for diffusion tubes, operated by LGC Standards and supported by the Health and Safety Laboratory (HSL), which provides a Quality Assurance / Quality Control (QA/QC) framework for local authorities carrying out diffusion tube monitoring as a part of their local air quality management process. The percentage of results submitted by Gradko International Ltd that were subsequently determined to be satisfactory was 75% in AIR-PT Round AR030 (January 2019-February 2019) and 100% for all tests in AIR-PT Rounds AR031-AR034 (March 2019-November 2019)[[3]](#footnote-3).

## Factors Affecting Diffusion Tube Performance

NO2 diffusion tubes are an indicative monitoring technique, as they do not offer the same accuracy as the reference method for NO2, the automatic chemiluminescent analyser. NO2 diffusion tubes are affected by several factors, which may cause them to exhibit bias relative to the reference technique.

Over-estimation may be attributed to one of the following three interfering factors:

* The shortening of the diffusive path length caused by the wind;
* The blocking of UV light resulting in reduced NO2 photolysis in the tube; and
* The interference effects of peroxyacetyl nitrate (PAN).

Under-estimation can be caused by the following factors:

* Increasing exposure period, and is thought to be due to degradation of the absorbed nitrate with time;
* Insufficient extraction of nitrite from the meshes;
* The photochemical degradation of the triethanolamine-nitrite complex by light, although this is minimised by the use of opaque end-caps; and
* The solution used. For example, 50% solution of TEA in water has been reported to lead to comparatively reduced NO2 uptake.

There are a number of additional factors that may also affect diffusion tube performance including time of the year, the exposure setting (i.e. sheltered or open sites), the proximity to roads, the preparation method and analytical laboratory used, the exposure concentration and the ratio of NO2 to NOX.

## Data Validation and Data QA / QC

Validation of diffusion tube readings is vital to ensure public confidence in the measurements produced. Validation is achieved through the following steps described in sub-sections below.

### Blanks

The laboratory reserved a set of diffusion tubes for use as laboratory blanks for each dispatch of tubes to the user. These are kept in sealed containers in a refrigerator and analysed with the exposed tubes to provide a measure of nitrite concentration on unexposed tubes.

One travelling blank was taken to site during each of the monthly changeovers. These tubes accompany the user during tubes changeover but are not themselves exposed. The purpose of using field blanks is to identify possible contamination of the tubes during transportation or in storage by the user.

Laboratory and field blanks were routinely screened by AECOM to ensure quality of data. Neither the laboratory blanks nor the travel blank results were subtracted from the results of exposed tubes, in accordance to Defra’s Local Air Quality Management Technical Guidance (LAQM.TG(16))[[4]](#footnote-4) and the Diffusion Tube Practical Guidance.

### Rejection of Diffusion Tube Results

Diffusion tube results obtained for each month were checked to meet the following criteria for inclusion in the final dataset:

* Correct calculation of exposure hours;
* Concentrations less than 3 µg/m3 were rejected as these concentrations are unlikely to occur in an urban area;
* Concentrations at the high end were not routinely rejected unless good evidence can be shown to prove they were spurious results;
* Exposure records were checked for possible explanation of any unusual results (e.g. foreign objects, bonfires, pollution episodes, construction works, tampering, etc; and
* For a triplicate site, diffusion tubes that exhibit poor precision (>20%) were excluded from the final dataset. For single sites, professional judgement was used to accept or reject the results based on observations made during site visits.

### Bias Adjustment Factor

Diffusion tube monitoring is indicative and does not offer the same accuracy as the reference method for monitoring NO2 i.e. using an automatic chemiluminescent analyser. Several factors could affect NO2 concentrations measured with diffusion tubes, which may cause them to exhibit bias (over-read or under-read readings) relative to the reference method (see Section 3.4). To correct this bias, comparison of the NO2 concentration as measured by diffusion tubes is made with continuous monitoring data to derive a bias-adjustment factor.

Bias adjustment factor can be obtained using the Nitrogen Dioxide Diffusion Tube Bias Adjustment spreadsheet[[5]](#footnote-5), which is updated periodically and collates the bias-adjustment factors obtained in co-location studies conducted nationally. It can also be derived locally through co-location of diffusion tubes with automatic analysers and comparison of results obtained from both methods of monitoring.

Further details of the monitoring sites used and the derivation of the factor can be found in Appendix B and Appendix C. The local bias factor was applied to all diffusion tube results in the period unless indicated otherwise.

## Site Designations

The designation of site types is used to compare different locations statistically. Sites were categorised as kerbside, roadside, and urban background sites according to the definitions given in LAQM.TG(16). These definitions are reproduced in Table 3 below.

Table 3. Site Designation Criteria

|  |  |  |  |
| --- | --- | --- | --- |
| Type | Definition | | |
| Urban Centre | An urban location representative of typical population exposure in towns or city centres, for example, pedestrian precincts and shopping areas. | | |
| Urban Background | An urban location distanced from sources and therefore broadly representative of city-wide background conditions, e.g. urban residential areas. For example:  > 50m from any major source of NO2, such as multi-storey car parks;  >30m from any very busy road (> 30000 vehicles per day);  > 20m from any busy road (10000 – 30000 vehicles per day);  > 10m from any main road (quiet roads e.g. within residential estates are acceptable); and  > 5m from any area where vehicles are likely to be idling. | | |
| Suburban | A location type situated in a residential area on the outskirts of a town or city | | |
| Roadside | A site sampling typically 1-5m of the kerb of a busy road (can be up to 15 m from kerb in some cases) | | |
| Kerbside | A site sampling within 1m of the kerb of a busy road | | |
| Industrial | An area where industrial sources make an important contribution to the total pollution burden | | |
| Rural | An open countryside location, in an area of low population density distanced as far as possible from roads, populated and industrial areas | | |
| Other | Any special source-orientated or location category covering monitoring undertaken in relation to specific emission sources such as power stations, car-parks, airports or tunnels | | |
|  |  |  |  |

# Results and Discussion

## Data Capture

Data capture rates for the Lewisham Diffusion Tube Survey Network during 2019 were high, achieving an overall average of 98.7% for all site types. The lowest annual data capture for any site was 83% (2 months missing out of 12), at site LWS008 / L20 (Hatcham Park Rd). As data capture was above 75% for all sites, no annualisation of data was therefore required.

Sites recording lower than 100% data capture were as a result of tubes being stolen, clips being vandalised or data not being included in the final dataset (see Section 3.5.2).

## Bias Adjustment

### Local Bias Adjustment Factor

The co-location site annual mean NO2 concentrations measured by the diffusion tubes and the continuous monitors are displayed in Table 4.

The AEA Diffusion Tube Precision Accuracy Bias Spreadsheet[[6]](#footnote-6) tool was used to calculate the local bias adjustment factor for the co-location site. Continuous monitoring data was sourced from the London Air Quality Network (LAQN) website[[7]](#footnote-7). Further details can be found in Appendix C.

The complete diffusion tube results without the application of a bias adjustment factor can be found in Appendix B.

Table 4. Comparison of Diffusion Tube Measurement and Continuous Monitors at Co-located Site

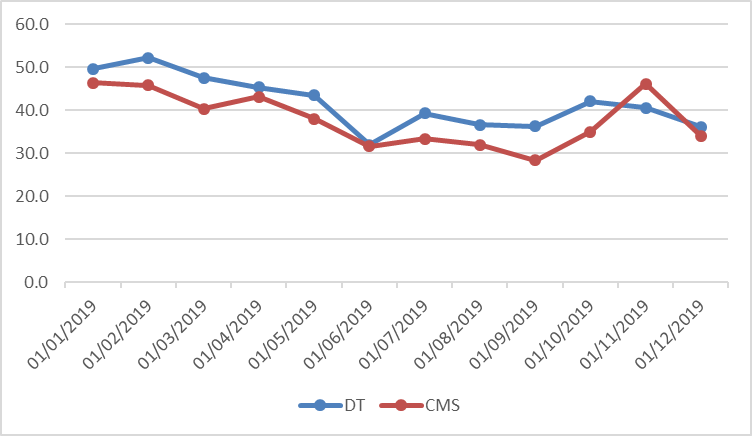
|  |  |  |  |
| --- | --- | --- | --- |
| Site Name | 2019 Annual Mean NO2 Concentration (µg/m3) | | |
| **Unadjusted Diffusion Tube** | **Continuous Monitor** | |
| Lewisham – New Cross | 41.9 | 37.8 | |
|  |  |  |  |

Monthly readings from the triplicate diffusion tubes were compared with the concentration at Lewisham New Cross (Figure 1). An average bias adjustment factor of 0.91 was obtained. It can be seen that for 11 months of the year, the monthly average diffusion tube concentration was greater than the monthly average concentration recorded by the New Cross AQMS, although during November this was reversed. In general, at locations close to sources of NOX such as roadside and kerbside sites, within-tube chemical reactions of NO and O3 have been found to result in over-reading in relation to reference method[[8]](#footnote-8).

### National Bias Adjustment Factor

The national bias adjustment factor for 2019 is 0.87 for the laboratory and preparation method, based on 8 studies (spreadsheet version 03/20). Based on the fact that the local factor was greater than the national factor, it was recommended that the local bias adjustment factor was used in 2019, to ensure a more conservative estimate was obtained of annual mean concentrations from diffusion tubes.

Figure 1. Comparison of Diffusion Tube Measurement and Continuous Monitors at Co-located Site

`

## Annual Mean NO2 Concentrations

The mean NO2 concentration over the whole network during 2019 was 29.6 µg/m3 applying the local bias adjustment factor of 0.91. The mean concentration calculated using the national bias adjustment factor was 28.3 µg/m3. Using either bias adjustment factor, the mean concentration across the whole network is below the annual mean NO2 objective of 40 µg/m3. The maximum annual mean NO2 concentration was measured at the L51 site at 290 Brownhill Road, South Circular (44.9 µg/m3). The second highest annual mean NO2 concentration was measured at LWS017 site at Baring Road (41.0 µg/m3). L51 and LWS017 are both roadside sites.

Table 5. Annual Mean NO2 Concentration (Bias Adjusted), 2019

|  |  |  |  |
| --- | --- | --- | --- |
| Site Type | Annual Mean NO2 Concentration (µg/m3) | | |
| **Raw** | **Bias Adjusted, using New Cross Co-located Tubes**  **(Factor = 0.91)** | **Bias Adjusted, using National Bias Adjustment Factor**  **(Factor = 0.87)** |
| All Sites | 32.6 | 29.6 | 28.3 |
| Roadside | 36.5 | 33.2 | 31.8 |
| Urban Background | 27.5 | 25.0 | 23.9 |
|  |  |  |  |

### Comparison with Limit Values and Objectives

The air quality objectives and limit values of relevance to NO2 in the UK are detailed in Table 1. The results in Table 5, obtained after applying the national bias adjustment factor, indicate that the annual mean NO2 objective of 40 µg/m3 was not exceeded by the mean diffusion tube network concentration during 2019. From Appendix B, it can be seen that bias-adjusted annual mean NO2 concentrations, applying the local adjustment factor of 0.91, were greater than 40 µg/m3 at 2 of the individual diffusion tube locations. Similarly, results based on the national bias adjustment factor show that 1 site exceeded the NO2 annual mean objective.

Where diffusion tube locations are not representative of relevant exposure (for example, where a tube is kerbside, but residential facades are several metres back from the kerb), annual mean NO2 concentrations can be distance-corrected to take into account the fall-off in concentration away from the kerb. Appendix B presents the full set of diffusion tube results including distance-corrected concentrations. When considering the local bias-adjusted diffusion tube results, there are no locations that, when distance-corrected to the nearest relevant exposure, exceed the annual mean objective.

A report issued by Air Quality Consultants[[9]](#footnote-9) analysed the relationship between annual mean and hourly mean NO2 concentrations, concluding that locations where the annual mean concentration is greater than 60 µg/m3 may be susceptible to breaches of the hourly mean objective (hourly mean NO2 concentration of 200 µg/m3 or more not to be exceeded more than 18 occasions per year). After bias adjustment, there are no sites with measured NO2 concentrations greater than 60 µg/m3 in 2019.

### Seasonal Variation

The seasonal variation in NO2 concentrations during 2019 are shown in Table 6 and Figure 2. Due to seasonal variations in the bias adjustment that can occur at diffusion tube sites, the results that have been presented are the raw concentrations with no bias adjustment applied.

The highest mean concentrations occurred in January, February, April and November at roadside sites. For urban background sites, the highest mean concentrations were measured during January and February. Mean NO2 concentrations were lowest in June for all site types.

Table 6. Monthly Mean NO2 Concentrations in Lewisham, 2019 (µg/m3; Unadjusted)

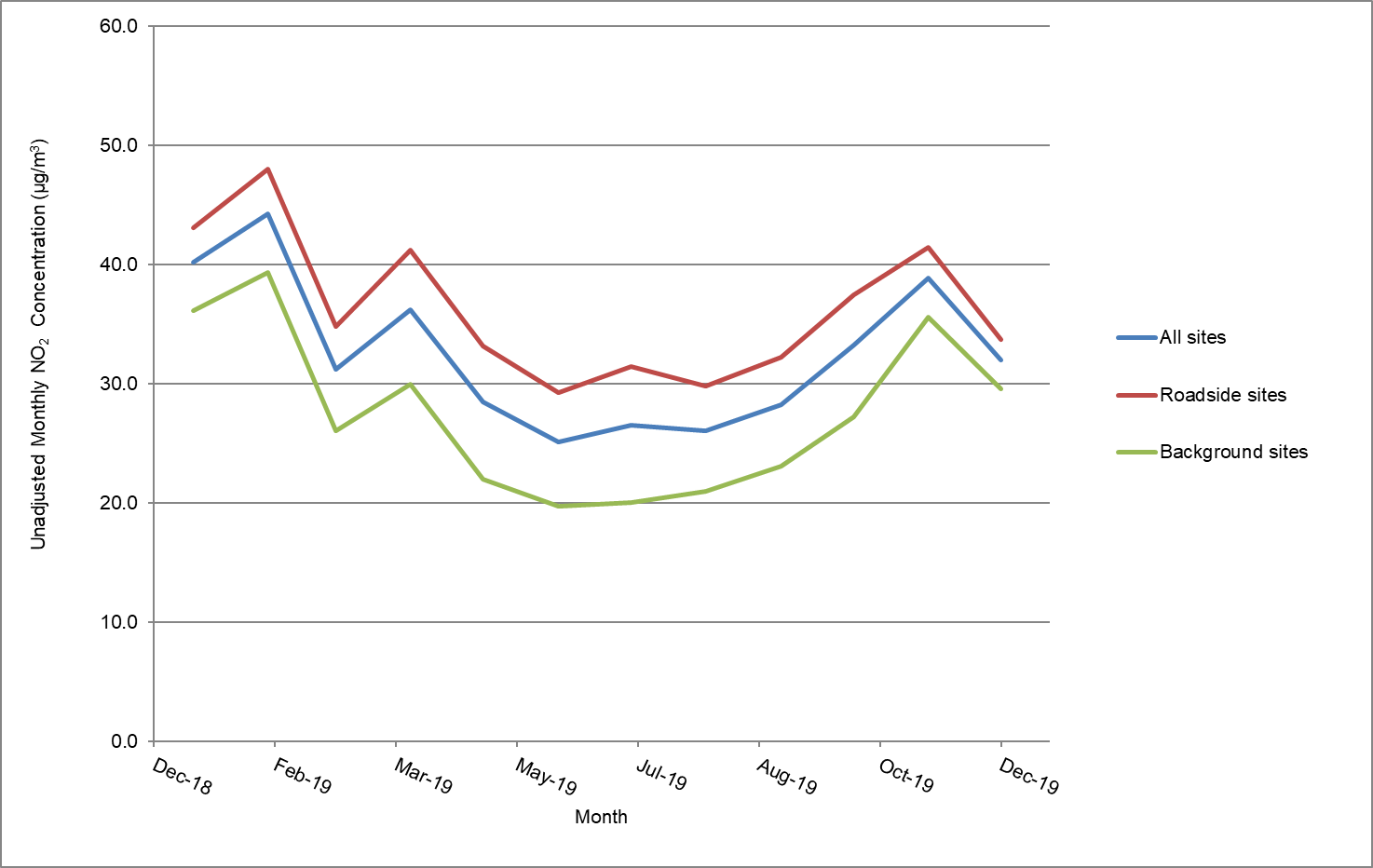
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Site Type | Jan | | Feb | Mar | Apr | | May | | Jun | | Jul | | Aug | | Sep | | Oct | | Nov | | Dec | |
| All Sites | **40.2** | | **44.2** | 31.2 | 36.2 | | 28.5 | | 25.1 | | 26.5 | | 26.1 | | 28.2 | | 33.3 | | 38.9 | | 31.9 | |
| Roadside | **43.1** | | **48.0** | 34.8 | **41.2** | | 33.2 | | 29.3 | | 31.4 | | 29.8 | | 32.2 | | 37.4 | | **41.5** | | 33.7 | |
| Urban Background | 36.1 | | 39.3 | 26.0 | 29.9 | | 22.0 | | 19.7 | | 20.0 | | 21.0 | | 23.1 | | 27.2 | | 35.6 | | 29.6 | |
|  |  |  | |  | |  | |  | |  | |  | |  | |  | |  | |  | |  |

Table 7. Unadjusted Winter and Summer Period Mean Concentrations in Lewisham, 2019

|  |  |  |  |
| --- | --- | --- | --- |
| Site Type | Winter Mean Concentration  (October – March) (µg/m3) | Summer Mean Concentration  (April – September) (µg/m3) | Ratio Winter : Summer |
| All Sites | 36.6 | 28.4 | 1.3 |
| Roadside | 39.7 | 32.9 | 1.2 |
| Urban Background | 32.3 | 22.6 | 1.4 |
|  |  |  |  |

Table 7 shows that the ratio of winter to summer mean NO2 concentration was 1.2 for roadside sites, indicating mean concentrations were higher in the winter than the summer period. The urban background sites display a greater winter: summer ratio compared to roadside sites with a value of 1.4 in 2019. For all sites, collectively, the ratio of winter to summer mean NO2 concentration was 1.3.

Figure 2. Seasonal Trend of NO2 Concentrations in Lewisham, 2019



## Historical Trends

Table 8 summarises the results of the Lewisham Tube Network by site type from 2014 to 2019; results for each site in 2019 are detailed in Appendix B. These results have been bias adjusted and the factors can be found in Appendix C Table 9.

Measurements from the past year showed a decrease in annual mean NO2 concentration across the network between 2018 and 2019.

Table 8. Annual Mean NO2 Concentration (bias-adjusted) by Site Type, 2014 – 2019

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Site Type** | **Bias Adjusted Annual Mean NO2 Concentration (µg/m3)** | | | | | | |
| **2014** | | | **2015** | | **2016** | |
| Bias Adjusted using New Cross Co-located tubes  (Factor = 0.82) | | Bias Adjusted using National Bias Adjustment factor  (Factor =0.97) | Bias Adjusted using New Cross Co-located tubes  (Factor = 1.02) | Bias Adjusted using National Bias Adjustment factor  (Factor = 0.95 | Bias Adjusted using New Cross Co-located tubes  (Factor = 0.92) | Bias Adjusted using National Bias Adjustment factor  (Factor = 1.03) |
| **All Sites** | 33.1 | | 38.8 | 37.7 | 35.1 | 34.5 | 38.7 |
| **Roadside** | 37.6 | | **44.2** | **43.5** | **40.5** | 39.4 | **44.1** |
| **Urban Background** | 26.5 | | 31.3 | 29.3 | 27.3 | 27.4 | 30.7 |
| **Site Type** | **Bias Adjusted Annual Mean NO2 Concentration (µg/m3)** | | | | | | |
| **2017** | | | **2018** | | **2019** | |
| Bias Adjusted using New Cross Co-located tubes  (Factor = 1.00) | Bias Adjusted using National Bias Adjustment factor  (Factor = 0.97) | | Bias Adjusted using New Cross Co-located tubes  (Factor = 0.91) | Bias Adjusted using National Bias Adjustment factor  (Factor = 0.92) | Bias Adjusted using New Cross Co-located tubes  (Factor = 0.91) | Bias Adjusted using National Bias Adjustment factor  (Factor = 0.87) |
| **All Sites** | 35.5 | 34.4 | | 31.5 | 31.9 | 29.6 | 28.3 |
| **Roadside** | **40.1** | 38.9 | | 35.7 | 36.1 | 33.2 | 31.8 |
| **Urban Background** | 29.9 | 29.0 | | 26.2 | 26.5 | 25.0 | 23.9 |

# 

# Conclusions

The main conclusions of the 2019 Lewisham Diffusion Tube Network study are:

* The raw mean NO2 concentration for the whole network was 32.6 µg/m3. Adjusted using a local adjustment factor, this was 29.6 µg/m3;
* NO2 concentrations were greatest at roadside monitoring locations, and lowest at urban background sites, as would be expected;
* The maximum annual mean NO2 concentration was measured at the L51 site at 290 Brownhill Road, South Circular (44.9 µg/m3). The second highest annual mean NO2 concentration was measured at LWS017/L28 site at Baring Road (41.0 µg/m3). L51 and LWS017/L28 are both roadside sites;
* The mean roadside NO2 concentration across the network was 33.2 µg/m3 based on the local bias adjustment factor and the mean urban background concentration was 25 µg/m3;
* Results obtained after applying the local bias adjustment factor show that 2 sites exceeded the annual mean NO2 objective of 40 µg/m3. Results based on the national adjustment factor show that 1 diffusion tube location recorded annual mean NO2 concentrations exceeding the annual mean NO2 objective;
* When correcting for distance between the monitoring location and the nearest receptor, no locations of relevant exposure exceed the objective, using either bias adjustment factor; and
* None of the locations recorded an annual mean above 60 µg/m3, indicating that it is unlikely that the short-term objective was exceeded in 2019.

# Appendix A: Diffusion Tube Locations

Figure 3. LB Lewisham Diffusion Tube Network (South) in 2019

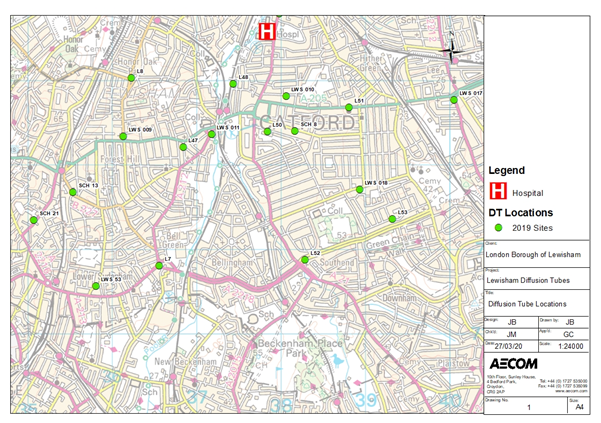
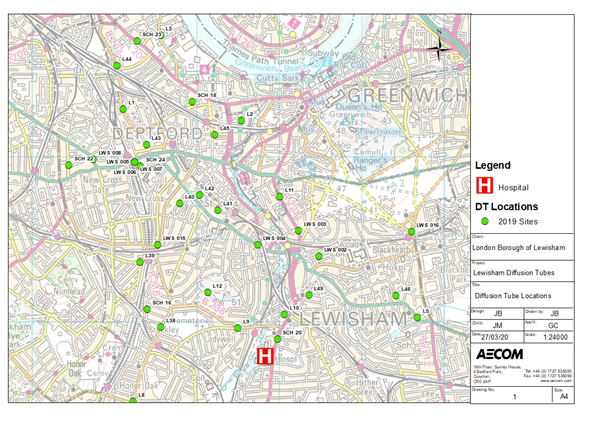


Figure 4. LB Lewisham Diffusion Tube Network (North) in 2019



# Appendix B: Diffusion Tube Results

Table 9. Lewisham Diffusion Tube Network 2019 – Raw and Bias Adjusted Results

| **Original Site Name** | **New Site Name** | **Address** | **X** | **Y** | **Site Type** | **Raw** | **Locally Adjusted** | **Nationally Adjusted** | **Distance Corrected** | **Comment** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| L1 | L1 | Chubworthy Street | 536109 | 177580 | Roadside | 31.0 | 28.2 | 27.0 | 27.2 | - |
| L2 | L2 | Bronze Street | 537540 | 177439 | Urban Background | 28.2 | 25.7 | 24.5 | 25.7 | - |
| L3 | L3 | Grove Street | 536561 | 178471 | Urban Background | 30.1 | 27.4 | 26.2 | 27.4 | - |
| L4 | L4 | Plough Way | 536534 | 178926 | Urban Background | 30.5 | 27.7 | 26.5 | 27.7 | - |
| L5 | L5 | Lee High Road | 539678 | 175050 | Roadside | 30.4 | 27.7 | 26.5 | 27.7 | - |
| L6 | L6 | Le May Avenue | 540615 | 172337 | Urban Background | 29.9 | 27.2 | 26.0 | 27.2 | - |
| L7 | L7 | Bell Green | 536556 | 171810 | Roadside | **43.5** | 39.6 | 37.9 | 39.6 | - |
| L8 | L8 | Stondon Park | 536229 | 174032 | Roadside | 34.6 | 31.5 | 30.1 | 31.5 | - |
| L9 | L9 | Ladywell Road | 537500 | 174925 | Roadside | 35.0 | 31.9 | 30.5 | 31.9 | - |
| L10 | L10 | Whitburn Road | 538062 | 175085 | Roadside | 34.5 | 31.4 | 30.0 | 30.5 | - |
| L11 | L11 | Sparta St, opp Morden Mount School | 538007 | 176517 | Roadside | 34.3 | 31.2 | 29.8 | 29.8 | - |
| L12 | L12 | Hilly Fields | 537132 | 175353 | Urban Background | 26.1 | 23.7 | 22.7 | 23.7 | - |
| SCH 8 | L29 | Holy Cross School | 538165 | 173406 | Roadside | 26.8 | 24.4 | 23.4 | 24.4 | - |
| SCH 13 | L30 | St George's CofE School | 535535 | 172679 | Roadside | 28.9 | 26.3 | 25.1 | 26.0 | - |
| SCH 16 | L31 | St Mary Magdalen's School | 536399 | 175150 | Urban Background | 23.3 | 21.2 | 20.2 | N/A | Measured concentration is above background concentration |
| SCH 18 | L32 | Grinling Gibbons School | 536944 | 177665 | Urban Background | 28.1 | 25.6 | 24.5 | 25.6 | - |
| SCH 20 | L33 | St Mary's Lewisham School | 537979 | 174792 | Roadside | 36.5 | 33.2 | 31.7 | 33.2 | - |
| SCH 21 | L34 | Sydenham School | 535071 | 172346 | Urban Background | 26.5 | 24.2 | 23.1 | 24.2 | - |
| SCH 22 | L35 | Kender Primary School | 535447 | 176897 | Roadside | 28.5 | 25.9 | 24.8 | 25.9 | - |
| SCH 23 | L36 | Deptford Park School | 536275 | 178405 | Roadside | **40.7** | 37.0 | 35.4 | 37.0 | - |
| SCH 24 | L37 | St James Hatcham School | 536317 | 176883 | Urban Background | 27.8 | 25.3 | 24.1 | 25.3 | - |
| LWS 53 | L13 | Mayow Road | 535804 | 171567 | Urban Background | 26.9 | 24.4 | 23.4 | 24.4 | - |
| LWS 002 | L14 | Boyne Road | 538482 | 175792 | Urban Background | 28.3 | 25.8 | 24.6 | 25.5 | - |
| LWS 003 | L15 | Lewisham Road | 538237 | 176101 | Roadside | 37.4 | 34.0 | 32.5 | 34.0 | - |
| LWS 004 | L16 | Loampit Vale | 537740 | 175930 | Roadside | **40.7** | 37.0 | 35.4 | 37.0 | - |
| LWS 005 | L17 | New Cross AQMS | 536246 | 176934 | Roadside | **42.5** | 38.6 | 36.9 | 38.6 | - |
| LWS 006 | L18 | New Cross AQMS | 536246 | 176934 | Roadside | **41.5** | 37.7 | 36.1 | 37.7 | - |
| LWS 007 | L19 | New Cross AQMS | 536246 | 176934 | Roadside | **41.8** | 38.1 | 36.4 | 38.1 | - |
| LWS 008 | L20 | Hatcham Park Road | 535746 | 176969 | Roadside | 37.7 | 34.3 | 32.8 | 33.8 | - |
| LWS 009 | L21 | Brockley Rise | 536133 | 173341 | Roadside | **43.7** | 39.8 | 38.0 | 39.8 | - |
| LWS 010 | L22 | Ringstead Road | 538060 | 173816 | Urban Background | 28.0 | 25.5 | 24.3 | 24.0 | - |
| LWS 011 | L23 | Catford Hill | 537178 | 173365 | Roadside | **42.6** | 38.7 | 37.0 | 31.8 | - |
| LWS 015 | L26 | Shardeloes Road | 536527 | 175935 | Roadside | 39.5 | 36.0 | 34.4 | 34.6 | - |
| LWS 016 | L27 | Montpelier Vale | 539605 | 176090 | Roadside | **43.4** | 39.5 | 37.7 | 34.8 | - |
| LWS 017 | L28 | Baring Road | 540051 | 173769 | Roadside | **45.1** | **41.0** | 39.2 | 32.2 | - |
| LWS 018 | L24 | Torridon School Hazelbank Road | 538930 | 172713 | Urban Background | 32.8 | 29.9 | 28.5 | 27.1 | - |
| L38 | L38 | Beecroft Primary School | 536564 | 174937 | Roadside | 33.7 | 30.6 | 29.3 | 27.5 | - |
| L39 | L39 | John Stainer Primary School | 536308 | 175721 | Roadside | 31.9 | 29.0 | 27.7 | 26.4 | - |
| L40 | L40 | Myatt Garden Primary School | 536792 | 176432 | Urban Background | 24.9 | 22.7 | 21.7 | N/A | Measured concentration is above background concentration |
| L41 | L41 | Ashmead Primary School | 537256 | 176353 | Urban Background | 25.5 | 23.2 | 22.2 | N/A | Measured concentration is above background concentration |
| L42 | L42 | Lucas Vale Primary School | 537032 | 176534 | Urban Background | 29.4 | 26.7 | 25.6 | 26.6 | - |
| L43 | L43 | Childeric Primary School | 536389 | 177144 | Urban Background | 30.2 | 27.5 | 26.3 | 26.7 | - |
| L44 | L44 | Sir Francis Drake Primary School | 536028 | 178107 | Roadside | 36.0 | 32.8 | 31.3 | 32.1 | - |
| L45 | L45 | Tidemill Academy | 537219 | 177264 | Roadside | 31.3 | 28.5 | 27.3 | 28.3 | - |
| L46 | L46 | St Margaret Lee Primary School | 539416 | 175315 | Urban Background | 27.1 | 24.7 | 23.6 | 24.5 | - |
| L47 | L47 | Rathfern Primary School | 536839 | 173211 | Roadside | 27.2 | 24.8 | 23.7 | 24.3 | - |
| L48 | L48 | Holbeach Primary School | 537433 | 173965 | Urban Background | 28.4 | 25.8 | 24.7 | 24.3 | - |
| L49 | L49 | St Saviours RC Primary School | 538358 | 175324 | Urban Background | 26.4 | 24.0 | 23.0 | N/A | Measured concentration is above background concentration |
| L50 | L50 | Rushey Green Primary School | 537836 | 173400 | Urban Background | 24.0 | 21.8 | 20.9 | N/A | Measured concentration is above background concentration |
| L51 | L51 | 290 Brownhill Road S Circular | 538803 | 173683 | Roadside | **49.3** | **44.9** | **42.9** | 35.2 | - |
| L52 | L52 | St John CofE School | 538285 | 171877 | Roadside | 36.6 | 33.3 | 31.8 | 31.1 | - |
| L53 | L53 | Greenvale School | 539319 | 172362 | Urban Background | 22.9 | 20.9 | 19.9 | 20.7 | - |

# Appendix C: Diffusion Tube Bias Adjustment

Table 10. Summary of Local and National Bias Adjustment Factors for Lewisham NO2 Diffusion Tube Surveys, 2009 to 2019

|  |  |  |
| --- | --- | --- |
| Site Type | Mean Local  Factor | National  Factora |
| **2009** | 0.84 | 0.97 |
| **2010** | 0.69 | 1.03 |
| **2011** | 0.59 | 0.95 |
| **2012** | 0.79 | 1.01 |
| **2013** | 0.93 | 1.00 |
| **2014** | 0.82 | 0.97 |
| **2015** | 1.02 | 0.95 |
| **2016** | 0.92 | 1.03 |
| **2017** | 1.00 | 0.97 |
| **2018** | 0.91 | 0.92 |
| **2019** | 0.91 | 0.87 |

Notes: a National factor obtained from Bias Adjustment Factor spreadsheet3 version 03/20 based on Gradko as the analysing laboratory using the 50% TEA in acetone method

Figure 4. Local Bias Adjustment Factor Calculation, Lewisham – New Cross (LW2)

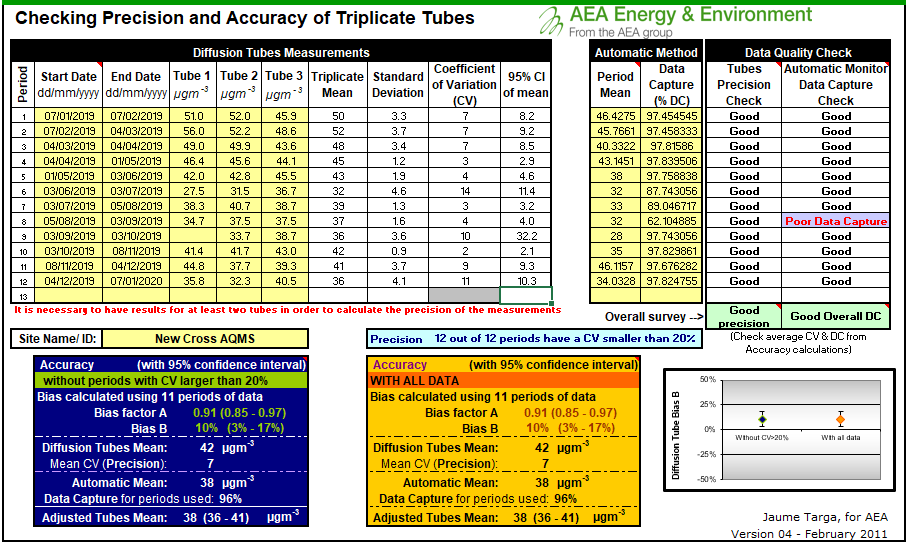
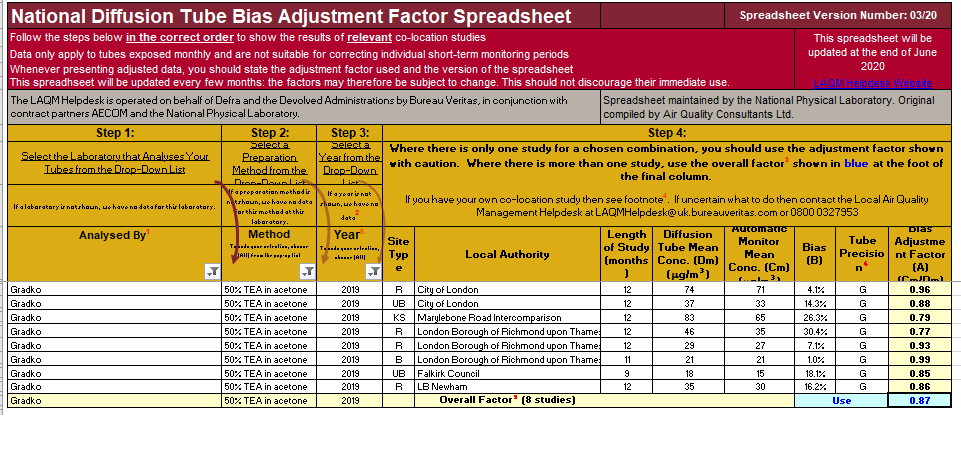


Figure 5. National Bias Adjustment Factor Calculator



|  |  |
| --- | --- |
| aecom.com |  |
|  |  |

1. Defra, The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, 2007. [↑](#footnote-ref-1)
2. Defra, Local Air Quality Management, Diffusion Tubes, Nitrogen Dioxide Diffusion Tube Monitoring, Calendar of Suggested Exposure Periods. Available at <http://laqm.defra.gov.uk/diffusion-tubes/data-entry.html> [↑](#footnote-ref-2)
3. Summary of Laboratory Performance in AIR NO2 Proficiency Testing Scheme. Available at: <https://laqm.defra.gov.uk/assets/laqmno2performancedatauptonovember2019v1.pdf> [↑](#footnote-ref-3)
4. Defra, Local Air Quality Management Technical Guidance LAQM.TG(16). [↑](#footnote-ref-4)
5. Defra, National Diffusion Tube Bias Adjustment Factor Spreadsheet (Version 03/20). Available at <http://laqm.defra.gov.uk/bias-adjustment-factors/national-bias.html> [↑](#footnote-ref-5)
6. AEA Diffusion Tube Precision Accuracy Bias Spreadsheet. Downloaded from <http://laqm.defra.gov.uk/bias-adjustment-factors/local-bias.html> [↑](#footnote-ref-6)
7. London Air Quality Network Website. Available at <http://www.londonair.org.uk>. [↑](#footnote-ref-7)
8. Cape, J.N., Review of the Use of Passive Diffusion Tubes for Measuring Concentrations of Nitrogen Dioxide in Air, 2005. Available at <http://uk-air.defra.gov.uk/reports/cat05/0810141025_NO2_review.pdf> [↑](#footnote-ref-8)
9. Air Quality Consultants (2007). Deriving NO2 from NOX for Air Quality Assessments of Roads. [↑](#footnote-ref-9)