London Borough of Merton Air Quality Annual Status Report for 2015

Date of publication: *September 2016*

This report provides a detailed overview of air quality in the London Borough of Merton during 2015. It has been produced to meet the requirements of the London Local Air Quality Management statutory process[1].

[1] LLAQM Policy and Technical Guidance 2016 (LLAQM.TG(16)). https://www.london.gov.uk/what-we-do/environment/pollution-and-air-quality/working-boroughs

Contact details

Local Authority Officer	Mr Jason Andrews
Department	Pollution Team Environment and Regeneration
Address	Civic Centre, Morden, Surrey, SM4 5DX
Telephone	0208 545 3059
e-mail	jason.andrews@merton.gov.uk marc.dubet@merton.gov.uk
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Executive Summary

The London Borough of Merton is committed to improving air quality in the Borough. As such the Council is demonstrating its political leadership; taking action; leading by example; monitoring air quality; using the planning system; integrating air quality into the public health system; and informing the public. This 2016 Annual Status Report reviews recent air quality monitoring in the Borough in accordance with Defra LAQM guidance. In so doing it fulfils one further aspect of this ongoing commitment

The report identifies that:

For carbon monoxide, benzene, 1,3-butadiene, lead and sulphur dioxide there is not a significant risk of the objectives being exceeded in the Council's area.

In 2003 the Council declared the borough an Air Quality Management Area (AQMA) as the review and assessment process showed that air quality in the borough was not likely to meet the National Air Quality Objectives by the target dates. The findings from this report indicate that the AQMA should be maintained.

In view of the findings from the report the Council will undertake the following actions:

1. Undertake consultation with the statutory and other consultees as required.
2. Maintain the existing monitoring programme.
3. Update and implement its Air Quality Action Plan in pursuit of the AQS objectives.
4. Prepare for the submission of its next Air Quality report.

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Tables

Abbreviations

AQAP	Air Quality Action Plan
AQMA	Air Quality Management Area
AQO	Air Quality Objective
BEB	Buildings Emission Benchmark
CAB	Cleaner Air Borough
CAZ	Central Activity Zone
EV	Electric Vehicle
GLA	Greater London Authority
LAEI	London Atmospheric Emissions Inventory
LAQM	Local Air Quality Management
LLAQM	London Local Air Quality Management
NRMM	Non-Road Mobile Machinery
PM_{10}	Particulate matter less than 10 micron in diameter
$PM_{2.5}$	Particulate matter less than 2.5 micron in diameter
TEB	Transport Emissions Benchmark
TfL	Transport for London

Air Quality Objectives

The air quality objectives applicable to LAQM **in England** are set out in the Air Quality (England) Regulations 2000 (SI 928), The Air Quality (England) (Amendment) Regulations 2002 (SI 3043), and are shown in Table A. This table shows the objectives in units of microgrammes per cubic metre µg m^{-3} (milligrammes per cubic metre, mg m^{-3} for carbon monoxide) with the number of exceedances in each year that are permitted (where applicable).

Table A. Summary of National Air Quality Standards and Objectives

Pollutant	**Objective (UK)**	**Averaging Period**	**Date**[1]
Nitrogen dioxide - NO_2	200 µg m^{-3} not to be exceeded more than 18 times a year	1-hour mean	31 Dec 2005
	40 µg m^{-3}	Annual mean	31 Dec 2005
Particles - PM_{10}	50 µg m^{-3} not to be exceeded more than 35 times a year	24-hour mean	31 Dec 2004
	40 µg m^{-3}	Annual mean	31 Dec 2004
Particles - $PM_{2.5}$	25 µg m^{-3}	Annual mean	2020
	Target of 15% reduction in concentration at urban background locations	3 year mean	Between 2010 and 2020
Sulphur Dioxide (SO_2)	266 µg m^{-3} not to be exceeded more than 35 times a year	15 minute mean	31 Dec 2005
	350 µg m^{-3} not to be exceeded more than 24 times a year	1 hour mean	31 Dec 2004
	125 µg m^{-3} mot to be exceeded more than 3 times a year	24 hour mean	31 Dec 2004

Note: [1]by which to be achieved by and maintained thereafter

1. Air Quality Monitoring

The latest monitoring results for 2015 confirm that air pollution in Merton still exceeds the Government Air Quality objectives, and therefore there is still a need for Merton to be designated as an AQMA and to pursue improvements in air quality.

The Council (routinely monitors the pollutants below:

- NO_2
- PM_{10}

1.1 Locations

Automatic Monitoring Sites

The Council undertakes automatic monitoring at its two long term sites as follows:

Merton Morden (ME1) - a roadside site located at the Civic Centre in Morden; this site started operating during February 2010.The sample inlet is located at 4m from ground level (i.e. at first floor level) and 3m from the road.

Merton Road (ME2) - a roadside site located in South Wimbledon; the site opened in June 2011.The sites are also representative of relevant exposure either at the site or very close by. The two Merton sites are part of the King's London Air Quality Network

All data undergo quality assurance and quality control (QA/QC) procedures to ensure that the data obtained is of a high quality. The standards of QA/QC at the LAQN sites are similar to those of the government's AURN sites. For QA/QC purposes, all the continuous analysers are manually checked and calibrated every two weeks, serviced every six months and audited by an independent auditor (the National Physical

Laboratory) every six months. Subsequent data ratification is undertaken by King's College London. Further details of the sites can be found at www.londonair.org.uk.

Table B. Details of Automatic Monitoring Sites for 2015

Site ID	Site Name	X (m)	Y (m)	Site Type	In AQMA?	Distance from monitoring site to relevant exposure	Distance to kerb of nearest road (N/A if not applicable)	Inlet height	Pollutants monitored	Monitoring technique
ME1	**Merton**	525591	168437	Roadside	Y	4m	4m	2.35m	NO2	Chemiluminescant
ME2	**Merton-Wimbledon**	525808	170122	Roadside	Y	N 3m	0.6m	1.6m	PM10	BAM

Non-Automatic Monitoring Sites

The Council also undertakes NO2 monitoring through the use of diffusion tubes and Table C includes a list of the monitored locations in the Borough for 2015.

The tubes are a relatively cheap way of monitoring, allowing more sites to be monitored to give a Borough-wide view. The results provide monthly averages and so provide an indication of NO2 pollution levels. The accuracy of the diffusion tube readings can be increased when their results are compared, and then bias adjusted, using national bias adjustment factors.

The diffusion tube survey has varied since 2010 when 11 locations were monitored. The survey was extended in 2011 to include another 23 sites; so in total 34 sites were monitored. These sites were also maintained in 2012. In 2013, 19 sites were closed and replaced by 10 new sites. In 2014, 24 sites were in operation. In 2014, the same sites than in 2013 were used except for one site, i.e. one site in Morden (site CA). In 2015 20 sites were in operation – the same as 2014 except for site AA – London Rd, Morden, TA – Town Centre, Mtcham and PA – Plough Lane, Wimbledon Park...

The sites were monitored using duplicate tubes. One site (LB) used single tube exposures only. A co-located study with the automatic monitoring station was not undertaken.

The diffusion tube site locations are illustrated in Table C below. This shows that the monitoring locations are grouped around the main centres in the Borough; including Wimbledon, Mitcham and Morden.

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Table C. Details of Non-Automatic Monitoring Sites for 2015

Site ID	Site Name	X (m)	Y (m)	Site Type	In AQMA?	Distance of tube to kerbside (m)	Distance of receptor to kerbside (m)	Inlet height (approx.) (m)	Pollutants monitored	Tube co-located with an automatic monitor? (Y/N)
BA	Burlington Road New Malden	522501	168235	suburban	Y	30	N/A	N/A	NO2	N
DA	Worple Road Raynes Park	523263	169423	roadside	Y	1	1	N/A	NO2	N
EA	Merton High St	525798	170081	kerbside	Y	0.5	2.5	N/A	NO2	N
FA	Grand Drive Raynes Park	523207	169195	roadside	Y	1	7	N/A	NO2	N
GA	Garth Road Morden	524113	166129	suburban	Y	1	N/A	N/A	NO2	N
HA	High St Colliers Wood	526955	170707	roadside	Y	1	1	N/A	NO2	N
LA	Alley Charminster Ave Morden	525449	169152	urban	Y	15	N/A	N/A	NO2	N
MA	Lavender Ave Morden	527621	169646	suburban	Y	1	3	N/A	NO2	N
RA	Pepys Road Morden	523357	169534	suburban	Y	1	5	N/A	NO2	N
WA	Woodside Wimbledon	524608	170873	suburban	Y	1	4	N/A	NO2	N

LB	Weir Road Wimbledon	525854	171643	roadside	Y	3	2	N/A	NO2	N
AC	The Ridgeway Wimbledon	524111	170883	kerbside	Y	0.5	1.5	N/A	NO2	N
BC	Haydons Road South Wimbledon	526155	170168	roadside	Y	1.5	0.5	N/A	NO2	N
CC	London Rd Tooting	527932	169502	kerbside	Y	0.5	2.5	N/A	NO2	N
DC	London Rd Tooting	527913	170518	roadside	Y	1.5	2	N/A	NO2	
EC	London Rd Mitcham	527751	168866	roadside	Y	2	2	N/A	NO2	
FC	Church Rd Mitcham	527158	168646	kerbside	Y	0.5	0.5	N/A	NO2	
GC	Western Rd Colliers Wood	526840	169694	roadside	Y	1.5	1.5	N/A	NO2	
HC	Crown Lane Morden	525401	168502	roadside	Y	0.5	0.5	N/A	NO2	
IC	London Rd Morden	525778	169624	kerbside		0.5	0.5	N/A	NO2	

1.2 Comparison of Monitoring Results with AQOs

Table D. Annual Mean NO2 Ratified and Bias-adjusted Monitoring Results (µg m-3)

Site ID	*Site Type*	*Within AQMA?*	*Valid data capture 2015 %*	*Annual mean concentration (adjusted for bias) mg m^{-3}*			
				2012	***2013***	***2014***	***2015***
ME1	Roadside	Y	49	**48 (48.1)**	**40.1**	38 (37.9)	*34*
BA	Suburban	Y	75	37.2	42	32.9	28
CA	Suburban	Y	N/A	31.6	39.1	N/A	N/A
DA	Roadside	Y	8	**44.6**	**46.7**	**42.3 (40.2)**	*37*
GA	Suburban	Y	75	37.5	39.6	32.8	32
HA	Roadside	Y	66	**50.7**	**52.2**	**49.8 (46.6)**	*31*
LA	Urban	Y	92	24	26.1	26	17
MA	Suburban	Y	83	31.4	35.2	32.2	32
RA	Suburban	Y	92	32	35.9	32.8	26
TA	Urban	Y	N/A	34.4	39.3	34.8	N/A

WA	Suburban	Y	66	33.3	33.7	**40.5** (36.1)	*25*
PA	Roadside	Y	N/A	**47**	**48.4**	**57.2 (48.8)**	N/A
AA	Roadside	Y	N/A	**45.1**	**48.2**	**51 (48.7)**	N/A
EA	Roadside	Y	75	**52.7**	**57.5**	**<u>61.1</u> (50.5)**	**<u>65</u>**
FA	Roadside	Y	92	34.7	37.7	**43.4** (36.5)	32
AB	Roadside	Y	N/A	**44.6**	N/A	N/A	N/A
BB	Roadside	Y	N/A	**44.2**	N/A	N/A	N/A
CB	Roadside	Y	N/A	**50.8**	N/A	N/A	N/A
DB	Roadside	Y	N/A	**52.2**	N/A	N/A	N/A
EB	Roadside	Y	N/A	**47**	N/A	N/A	N/A
FB	Roadside	Y	N/A	39.2	N/A	N/A	N/A
GB	Roadside	Y	N/A	37.4	N/A	N/A	N/A
HB	Roadside	Y	N/A	37.8	N/A	N/A	N/A
IB	Roadside	Y	N/A	34.5	N/A	N/A	N/A
JB	Roadside	Y	N/A	33.4	N/A	N/A	N/A

KB	Roadside	Y	N/A	37.4	N/A	N/A	N/A
LB	Roadside	Y	17	38.1	37.5	28.4	*21*
MB	Roadside	Y	N/A	37.4	N/A	N/A	N/A
NB	Roadside	Y	N/A	34.8	N/A	N/A	N/A
OB	Roadside	Y	N/A	33.9	N/A	N/A	N/A
PB	Roadside	Y	N/A	32.2	N/A	N/A	N/A
QB	Roadside	Y	N/A	35.3	N/A	N/A	N/A
RB	Roadside	Y	N/A	38.3	N/A	N/A	N/A
SB	Roadside	Y	N/A	34.8	N/A	N/A	N/A
TB	Roadside	Y	N/A	**46**	N/A	N/A	N/A
AC	Roadside	Y	58	N/A	**47.6**	**41.6** (38)	*37*
BC	Roadside	Y	75	N/A	**48.3**	**43.6 (42.6)**	**43**
CC	Roadside	Y	33	N/A	**<u>72.6</u>**	**<u>67.2 (54.5)</u>**	***<u>64</u>***
DC	Roadside	Y	92	N/A	**59.3**	**55.5 (50.2)**	**45**
EC	Roadside	Y	58	N/A	**40.4**	38	37
FC	Roadside	Y	17	N/A	**45.2**	36.2	*37*
GC	Roadside	Y	92	N/A	N/A	N/A	**53**
HC	Roadside	Y	75	N/A	N/A	N/A	**46**
IC	Roadside	Y	75	N/A	N/A	N/A	**-51**

Notes: Exceedance of the NO_2 annual mean AQO of 40 μgm^{-3} are shown in **bold**.

reduced font size indicates low data capture

NO_2 annual means in excess of 60 $\mu g\ m^{-3}$, indicating a potential exceedance of the NO^2 hourly mean AQS objective are shown in bold and underlined.

The bias adjustment factor used for all sites is 0.96 calculated using the National bias adjustment factor for Gradko 50% TEA.

Diffusion Tube Monitoring Data

Table D shows the NO2 diffusion tube monitoring results, with bias corrected values for each year from 2012 to 2015. (Note – see Table N for the unbiased monthly data for 2015). The results in bold indicate an exceedance of the annual mean objective of 40 µg m-3 and the results underlined indicate NO2 annual means in excess of 60 µg m-3 indicating a potential exceedance of the NO2 hourly mean AQS objective.

Data capture was sporadic, with missing data for November for all sites. Some sites obtained 11 months of data capture and over half, 12 sites, obtained more than 75% data capture rate. Due to technical difficulties no data was annualised. For four sites there was low intermittent data capture which did not achieve 3 consecutive months and for four sites between 4 - 8 months data capture was achieved. This data should be treated as indicative. As a result of insufficient data and problems verifying dates, the values for these sites were not annualised (DA, HA, WA, LB, AC, CC, EC and FC); data for these sites is presented on the chart in italics with smaller font. Please note – the mean for the monitoring at these sites is reported although care is clearly needed with interpretation. A review of the monitoring practices including new procedures are now in place to try and avoid this situation occurring again.

The measurement sites include areas described as roadside/ kerbside locations; these are close to both some of the busy major roads, as well as quieter roads across the Borough. The sites in the quietest residential areas measured the lowest concentrations and hence these sites are considered representative of background concentrations.

Six sites, five of which have at least 75% data capture (and adjusted with a bias correction factor of 0.96) exceeded the annual mean objective of 40 µg m-3. All of them were roadside sites. The EA site (High Street, Merton) had the highest concentration, 65 µg m-3, closely followed by CC (Merton Rd), 64 µg m-3. This indicates that the hourly objective was potentially exceeded in 2015.

Table D shows that in 2014 and in 2013 the number of sites exceeding the objective was 11 and 16 respectively. A straight comparison with 2014 however is difficult due to the intermittent data capture. This would indicate that NO2 results for 2015 show a slight improvement. It is clearly too early to say whether this is a true downward trend, so results should be treated with caution; 2016 may well show a return to slightly higher levels.

Table E. NO_2 Automatic Monitor Results: Comparison with 1-hour Mean Objective

Site ID	Valid data capture for monitoring period %	Valid data capture 2015 %	Number of Hourly Means > 200 µgm^{-3}					
			2010 [a]	2011	2012 [b] [d]	2013	2014 [d]	2015 [c]
ME1	N/A	99	4	-	0(164)	10	5(163)	2

Notes: Exceedance of the NO2 short term AQO of 200 µgm-3 over the permitted 18 days per year are shown in bold.

[a] Data capture for 2010 was 77%

[b] Data capture for 2012 was 39%

[c] Data capture for 2015 was 49%

[d] Data capture for full calendar year was less than 90%, the 99.8th percentile of hourly means is in brackets

Automatic Monitoring Site data

The NO_2 monitoring results for the LB Merton automatic site are compared directly to the annual mean and hourly mean objectives. The data for 2015 is fully ratified.

Table E provides the results of automatic monitoring for NO_2 for the 1-hour mean objective of 200 µg m^{-3}. This objective is less stringent than the annual mean but was exceeded every year except than in 2012.

Table F. Annual Mean PM_{10} Automatic Monitoring Results ($\mu g\ m^{-3}$)

Site ID	Valid data capture for monitoring period % [a]	Valid data capture 2015 %	Annual Mean Concentration (μgm^{-3})				
			2011	2012	2013	2014	2015
ME2	100	93	26 [a]	29	31	28	25

Notes: Exceedance of the PM_{10} annual mean AQO of 40 μgm^{-3} are shown in **bold**.
[a] ME2 site opened June 2011

PM_{10}

The TG16 guidance highlights that BAM instruments (as used at the Merton ME2 site (were shown to be equivalent to the PM10 reference method provided the results are corrected for slope. The results presented thus have a correction factor of 1.2 applied.

Table F provides results of automatic monitoring of PM10 and a comparison with annual mean objective. The objective of 40 µg m-3 was met at each site for every year reported with concentrations of approximately 30 µg m-3. These higher concentrations reflect the roadside nature of the monitoring location. The lowest concentration recorded was 25 µg m-3 in 2015, and the highest was 31 µg m-3 in 2013. For 2014, the annualised mean concentration was 28.2 µg m-3. 2015 saw very good data capture.

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Table G provides the comparison with 24-hour mean objective. The objective of no more than 35 days exceeding 50 µg m-3 was met at Merton ME2 site for each year reported. In 2015 the number of days that exceeded the daily mean standard of 50 µg m-3 was 21, which was slightly higher than in 2014 but lower than either 2012 or 2013. 2013 saw 31 exceedences which indicates that the objective was approached. It is not clear whether this increase in 2013 was due to inter annual meteorological conditions, which is most likely, or changes in local emissions from road transport. Further investigation, which is beyond the scope of this report, is needed to ascertain the reason.

Table G. PM_{10} Automatic Monitor Results: Comparison with 24-Hour Mean Objective

Site ID	Valid data capture for monitoring period %	Valid data capture 2015 %	Number of Daily Means > 50 μgm^{-3}				
			2011 [a]	2012	2013	2014 [b]	2015
ME2	100	93	0	26	31	17(44.4)	21

Notes: Exceedance of the PM_{10} short term AQO of 50 µg m^{-3} over the permitted 35 days per year or where the 90.4th percentile exceeds 50 µg m^{-3} are shown in **bold**. Where the period of valid data is less than 90% of a full year, the 90.4th percentile is shown in brackets after the number of exceedances.

[a] Data capture for 2011 was 16%

[b] Where data capture is less than 90%, the 90th percentile of 24-hour means is in brackets

2. Action to Improve Air Quality

Table J. Commitment to Cleaner Air Borough Criteria

Theme	Criteria		Achieved (Y/N)	Evidence
1. Political leadership	***1.a***	Pledged to become a Cleaner Air for London Borough (at cabinet level) by taking significant action to improve local air quality and signing up to specific delivery targets.	Y	Member sign up for LBMerton April 2013 Merton are currently pursuing a diesel levy for parking permits to encourage change to better vehicles and highlight poor air quality..
	1.b	Provided an up-to-date Air Quality Action Plan (AQAP), fully incorporated into LIP funding and core strategies.	N	In progress
2. Taking action	**2.a**	Taken decisive action to address air pollution, especially where human exposure and vulnerability (e.g. schools, older people, hospitals etc) is highest.	Y	On-going Cleanerair4schools project, funded through MAQF.

	2.b	Developed plans for business engagement (including optimising deliveries and supply chain), retrofitting public buildings using the RE:FIT framework, integrating no engine idling awareness raising into the work of civil enforcement officers, (etc. etc.)	Y	The Council has participated in a trial that involves liaising with businesses to explore the possibility of retiming deliveries to off peak periods in two of the Council's district and local centres).
	2.c	Integrated transport and air quality, including by improving traffic flows on borough roads to reduce stop/start conditions		The borough works with TfL to identify junctions where traffic signal timings can be improved to help smooth traffic flows. As part of any transport schemes, opportunities are also taken to review signal timings and junction layouts where congestion is an issue. The borough has also implemented a range of schemes to help encourage sustainable transport, which in term reduce reliance on the private car helping to ease congestion.
	2.d	Made additional resources available to improve local air quality, including by pooling its collective resources (s106 funding, LIPs, parking revenue, etc).	Y	The Council makes use of a range of funding sources to help deliver its transport schemes which in turn deliver air quality benefits. Sources include TfL LIP funding, other TfL funding streams (such as Borough Cycle Programme and Incubator funding), s106 funding, Council uplift funding, Council revenue funding and Mayor's Air Quality funding. For instance

				the Council recently ran a project in schools to raise awareness of air quality issues, which was funded through a combination of LIP and MAQF funding.
3. Leading by example	**3.a**	Invested sufficient resources to complement and drive action from others	Y	Air Quality Officer maintained as a key role in the Council Shared Service Partnership, budget for Air Quality monitoring maintained throughout the service. Funding for monitoring and action planning sought through the parking agenda and joint action around congestion sites.
	3.b	Maintained an appropriate monitoring network so that air quality impacts within the borough can be properly understood	Y	All existing AQ monitors maintained
	3.c	Reduced emissions from council operations, including from buildings, vehicles and all activities.	Y	As of 2016, Merton have installed 1.46 megawatt peak (MWp) of solar PV across the borough. Merton are also exploring the possibility of district heating systems in the borough.
	3.d	Adopted a procurement code which reduces emissions from its own and its suppliers activities, including from buildings and vehicles operated by and on their behalf (e.g. rubbish trucks).	Y	Air Quality and sustainability is a key factor in the Councils procurement policy and there is a commitment to improve the Councils fleet over the next few years.
4. Using the planning	**4.a**	Fully implemented the Mayor's policies relating to air quality neutral, combined heat and power and biomass.	Y	All approved planning applications meet the Mayor's requirements

system				relating to AQ neutral and CHPs
	4.b	Collected s106 from new developments to ensure air quality neutral development, ***where possible***	N	None has been collected. However this is being explored through the Local Plan
	4.c	Provided additional enforcement of construction and demolition guidance, with regular checks on medium and high risk building sites.	Y	Strict planning conditions for construction and demolition applied to all major sites. Complaints responded to.
5. Integrating air quality into the public health system	**5**	Included air quality in the borough's Health and Wellbeing Strategy and/or the Joint Strategic Needs Assessment	Y	Health and Wellbeing Strategy includes air quality as a key theme
6. Informing the public	**6.a**	Raised awareness about air quality locally	Y	airTEXT is promoted on the website and at local events. Lessons to local schools raise awareness for air quality. Merton has also been key in developing the Lovecleanair website across a number of boroughs.

2.1 Air Quality Action Plan Progress

Merton produced its Updating and Screening Assessment in June. Considering recent developments in the area of Air Quality and a significant change in impetus, we now feel the need to completely refresh the Air Quality Action Plan; this is currently in progress, and partnership with colleagues in Transport & Public Health.

3. Planning Update and Other New Sources of Emissions

3.1 New or significantly changed industrial or other sources

No new sources of emissions identified.

Conclusions

In 2015 NO_2 concentrations were found to exceed the objective of 40ug/m^3 at six locations monitored. This indicates the continuing need for the Borough to remain designated as a Borough-wide AQMA, for NO_2. The results further indicate that the hourly objective is potentially exceeded at some sites.

The PM_{10} monitoring results show that the annual mean PM_{10} and daily mean PM_{10} limits were not exceeded at any site in the Borough during the last four years. However, modelling undertaken for 2015 (from the 2014 Progress Report) indicates that we should expect the objectives to be exceeded at a few vulnerable receptor sites. On that basis the AQMA designation for PM10 is retained.

The Authority as a matter of course will continue to review and evaluate its NO2 diffusion tube locations annually and move or add tubes where gaps are identified.

The Council is further reducing the emissions by encouraging developers to participate in the 'Considerate Constructor Scheme' and assessing all major developments for air quality.

At the regional level, the Borough continues to work with the Mayor of London's plan to reduce emissions in his London Air Quality Strategy.

Appendix A Details of Monitoring Site QA/QC

A.1 Automatic Monitoring Sites

All data undergoes quality assurance and quality control (QA/QC) procedures to ensure that the data obtained are of a high quality.

The NO2 continuous analyser is automatically calibrated every night and also manually checked and calibrated every two weeks by the local authority Air Quality Officer. There is a need for frequent calibration adjustments as the gradual build-up of dirt within the analyser reduces the response rate. This fall off in response needs appropriate correction, to ensure the recording of the true concentrations. The calibration process involves checking the monitoring accuracy against a known concentration of span gas. The span gas used is nitric oxide and is certified to an accuracy of 5% (the automatic overnight calibration uses the permeation tube method).

The NO2 continuous analyser is serviced every six months by Enviro Technology Services plc and also audited by NPL every six months as part of the King's LAQN QA/QC procedure, to ensure optimum data quality.

PM10 Monitoring Adjustment

The TG09 guidance highlights that BAM instruments (as used at the Merton ME2 site) were shown to be equivalent to the PM_{10} reference method, provided that the results are corrected for slope. The results presented below have the correction factor of 1.2 applied. Thus the results for the **Merton** site as reported below are **reference equivalent**. Results from 2011 to 2015 (inclusive) are reported, although data capture for 2011 was only 16%. Data capture at the Merton (ME2) roadside site in South Wimbledon was also reduced for 2014 (77%), thus the annual mean has been annualised and the 90th percentile of the one hour mean has been included. Data capture for 2015 was very good.

A.2 Diffusion Tube Quality Assurance / Quality Control

Directive 2008/50/EC of the European Parliament and of the Council on ambient air quality and cleaner air for Europe (EC, 2008) sets data quality objectives for NO_2 along with other pollutants. Under the Directive, annual mean NO_2 concentration data derived from diffusion tube measurements must demonstrate an accuracy of ±25 % to enable comparison with the NO_2 air quality objectives of the Directive.

In order to ensure that NO_2 concentrations reported are of a high quality, strict performance criteria need to be met through the execution of QA and QC procedures. A number of factors have been identified as influencing the performance of NO_2 diffusion tubes including the laboratory preparing and analysing the tubes, and the tube preparation method (AEA, 2008). QA and QC procedures are therefore an integral feature of any monitoring programme, ensuring that uncertainties in the data are minimised and allowing the best estimate of true concentrations to be determined.

Our NO_2 diffusion tubes are analysed for us by Gradko using 50% TEA in acetone method of preparation. Gradko take an active role in developing rigorous QA and QC procedures in order to maintain the highest degree of confidence in their laboratory measurements. Gradko were involved in the production of the Harmonisation Practical Guidance for NO_2 diffusion tubes (AEA, 2008) and have been following the procedures set out in the guidance since January 2009. Since April 2014 Gradko has taken part in a new scheme AIR PT, which combines two long running PT schemes: LGC Standards STACKS PT scheme and HSL WASP PT scheme.

This section contains details of Gradko International Ltd's Results of laboratory precision

- performance in AIR NO2 PT Scheme (April 2014 – February 2016

- Summary of Precision Scores for 2013 - 2015

- UKAS schedule of accreditation

Summary of Laboratory Performance in AIR NO2 Proficiency Testing Scheme (April 2014 – February 2016).

Gradko participate in the AIR PT NO_2 diffusion tube scheme which uses artificially spiked diffusion tubes to test each participating laboratory's analytical performance on a quarterly basis. The scheme is designed to help laboratories meet the European Standard. Gradko demonstrated "good" laboratory performance for every month in 2015 for 50% TEA in Acetone.

Reports are prepared by LGC for BV/NPL on behalf of Defra and the Devolved Administrations. Background AIR is an independent analytical proficiency-testing (PT) scheme, operated by LGC Standards and supported by the Health and Safety Laboratory (HSL). AIR PT is a new scheme, started in April 2014, which combines two long running PT schemes: LGC Standards STACKS PT scheme and HSL WASP PT scheme.

Table 1: Laboratory summary performance for AIR NO_2 PT rounds AR001, 3, 4, 6, 7, 9, 10 and 12

The following table lists those UK laboratories undertaking LAQM activities that have participated in recent AIR NO_2 PT rounds and the percentage (%) of results submitted which were subsequently determined to be **satisfactory** based upon a z-score of $\leq \pm 2$ as defined above.

AIR PT Round	AR001	AR003	AR004	AR006	AR007	AR009	AR010	AR012
Round conducted in the period	April – May 2014	July – August 2014	October – November 2014	January – February 2015	April – May 2015	July – August 2015	October – November 2015	January – February 2016
Aberdeen Scientific Services	100 %	100 %	100 %	100 %	100 %	75 %	100 %	100 %
Cardiff Scientific Services	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]
Edinburgh Scientific Services	100 %	100 %	100 %	75 %	100 %	100 %	100 %	100 %
Environmental Services Group, Didcot [1]	100 %	100 %	100 %	87.5 %	100 %	100 %	100 %	100 %
Exova (formerly Clyde Analytical)	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]
Glasgow Scientific Services	100 %	100 %	100 %	100 %	100 %	100 %	100 %	75 %
Gradko International [1]	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
Kent Scientific Services	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]
Kirklees MBC	100 %	100 %	100 %	75 %	100 %	100 %	100 %	100 %
Lambeth Scientific Services	50 %	100 %	100 %	25 %	100 %	100 %	100 %	100 %
Milton Keynes Council	100 %	100 %	75 %	100 %	100 %	100 %	100 %	50 %
Northampton Borough Council	100 %	0 %	0 %	100 %	100 %	100 %	100 %	50 %
Somerset Scientific Services	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
South Yorkshire Air Quality Samplers	100 %	100 %	100 %	100 %	100 %	100 %	75 %	100 %
Staffordshire County Council	100 %	25 %	100%	100 %	100 %	75 %	75 %	75 %
Tayside Scientific Services (formerly Dundee CC)	NR [2]	100 %	100 %	100 %	NR [2]	NR [2]	NR [2]	100 %
West Yorkshire Analytical Services	75 %	100 %	75 %	100 %	75 %	75 %	75 %	75 %

[1] Participant subscribed to two sets of test samples (2 x 4 test samples) in each AIR PT round.
[2] NR No results reported
[3] Kent Scientific Services, Cardiff Scientific Services and Exova (formerly Clyde Analytical) no longer carry out NO_2 diffusion tube monitoring and therefore did not submit results.

2013 - 2015 Summary of Precision Results for Nitrogen Dioxide Diffusion Tube Collocation Studies for Gradko Laboratory 50% TEA in Acetone

Gradko, 50% TEA in Acetone	
2013	G
2013	G
2013	G
2013	G
2013	G
2013	G
2013	G
2013	G
2013	G
2013	G
2013	G
2013	G
2013	G
2013	G
2013	G
2013	G
2013	G
2013	G
2013	G
2013	P
2014	G
2014	G
2014	G
2014	G
2014	G
2014	G
2014	G
2014	G
2014	G
2014	P
2015	G
2015	G
2015	G
2015	G
2015	G
2015	G
2015	G
2015	G
2015	G
2015	G
2015	G
2015	G
2015	G
2015	G
2015	G

2013 Results of study carried out in 2013

2014 Results of study carried out in 2014

2015 Results of study carried out in 2015

Numerical results for this data are contained in the National Bias Adjustment Spreadsheet version 06/16.

P Poor Precision

G Good Precision

Gradko demonstrated “good” laboratory performance for every month in 2015 for 50% TEA in Acetone.

Gradko is accredited by UKAS for the analysis of NO_2 diffusion tubes. It undertakes the analysis of the exposed diffusion tubes by ultra violet spectrophotometry.

UKAS TESTING 2187

Accredited to ISO/IEC 17025:2005

Schedule of Accreditation
issued by
United Kingdom Accreditation Service
2 Pine Trees, Chertsey Lane, Staines-upon-Thames, TW18 3HR, UK

Gradko International Ltd
(Trading as Gradko Environmental)
Issue No: 019 **Issue date:** 04 September 2015

Testing performed at main address only

Materials/Products tested	Type of test/Properties measured/Range of measurement	Standard specifications/ Equipment/Techniques used
ATMOSPHERIC POLLUTANTS Collected on diffusion (sorbent) tubes and monitors (cont'd)	Chemical Tests (cont'd)	
Flexible Scope encompassing Volatile Organic Compounds to in-house validation criteria	Volatile Organic Compounds including: Benzene 1,3-Butadiene 1,2-Dichloro(Z)ethene, Ethylbenzene Indane Naphthalene Styrene Tetrachloroethylene Toluene Trichloroethylene 1,2,3-Trimethylbenzene 1,2,4-Trimethylbenzene 1,3,5-Trimethylbenzene p-Xylene o-Xylene **The laboratory holds a flexible scope of accreditation for these tests.** **Please contact the laboratory for details of the individual compounds they can analyse using this method.**	GLM 13 by Thermal Desorption GC-Mass Spectrometry
END		

NO_2 diffusion tube analysis method

NO_2 diffusion tubes are passive monitoring devices. They are made up of a Perspex cylinder, with 2 stainless steel mesh discs, coated with TEA absorbent held inside a polythene cap, which is sealed onto one end of the tube. Diffusion tubes operate on the principle of molecular diffusion, with molecules of a gas diffusing from a region of high concentration (open end of the tube) to a region of low concentration (absorbent end of the tube) (AEA, 2008). NO_2 diffuses up the tube because of a concentration gradient and is absorbed by the TEA, which is present on the coated discs in the sealed end of the tube. All Richmond NO_2 diffusion tubes are prepared by Gradko using 50% v/v TEA with Acetone as the absorbent.

Prior to and after sampling, an opaque polythene cap is placed over the end of the diffusion tube opposite the TEA coated discs to prevent further adsorption. The NO_2 diffusion tubes are labelled and kept refrigerated in plastic bags prior to and after exposure.

Discussion of Choice of Factor to Use

Merton Borough does not undertake co-location studies, so the Gradko Laboratories 50% TEA national correction factor was used to bias adjust all NO2 diffusion tubes.

Appendix B Full Monthly Diffusion Tube Results for 2015

Table N. NO_2 Diffusion Tube Results

Site ID	*Valid data capture for monitoring period %* [a]	*Valid data capture 2015 %* [b]	*Annual Mean NO_2*													
			Jan	*Feb*	*March*	*Apr*	*May*	*June*	*Jul*	*Aug*	*Sept*	*Oct*	*Nov*	*Dec*	*Annual mean – raw data*	*Annual mean – bias adjusted* [c]
BA	*100*	*75*	29.4	26.4	25.5	27.6	31.7	36.2	31.4	32.4	33.6	NA	NA	NA	30	28
DA	*100*	*8*	38.7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	39	37
GA	*100*	*75*	32.4	47.9	46.8	25.6	NA	NA	26.6	27.5	28.5	32.7	NA	33.6	34	32
HA	*100*	*66*	52.1	37.7	36.6	51.5	54.7	58.8	NA	NA	NA	47.3	NA	49.9	32	31
LA	*100*	*92*	17.3	13.2	12.6	15.2	18.7	20.1	16.1	16.5	17.1	21.9	NA	22.2	17	17
MA	*100*	*83*	NA	52.3	50.4	24.4	28	31.5	25.4	26.1	27	31.9	NA	31.6	33	32
RA	*100*	*92*	28.8	21.2	20.4	24.4	26.7	29.7	26.2	26.9	27.9	31.3	NA	32.3	27	26
TA	*100*	*N/A*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0
WA	*100*	*66*	25.8	21.7	21	25.1	25.3	27	NA	NA	NA	34.3	NA	32.2	27	25
PA	*100*	*N/A*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0
EA	*100*	*75*	73	NA	NA	60.6	75	80.4	61	63.2	65.4	65.7	NA	67.8	68	65
FA	*100*	*92*	34.6	31	30	31.3	35.8	38.3	30.3	31.3	32.4	36.7	NA	37.7	34	32

LB	*100*	*92*	NA	22.6	21.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	22	21
AC	*100*	*58*	NA	46.1	44.9	NA	NA	NA	26.7	27.5	30.9	45.4	NA	46.8	38	37
BC	*100*	*75*	54.4	36.6	35.4	41.7	50.5	56.1	39.9	41.8	42.6	NA	NA	NA	44	43
CC	*100*	*33*	NA	NA	83.7	60.5	NA	NA	NA	NA	NA	61.6	NA	61.4	67	64
DC	*100*	*92*	52.6	36.1	34.8	41.9	50.5	54	51.3	53.7	54.9	44.4	NA	45.7	47	45
EC	*100*	*58*	42.4	33.8	32.7	NA	37.3	41.4	NA	NA	NA	41.3	NA	42.6	39	37
FC	*100*	*17*	NA	NA	NA	NA	NA	NA	NA	NA	NA	37.7	NA	38.7	38	37
GC	*100*	*92*	52.1	43.5	42	55.1	50.9	54	60.6	62	64.2	61.4	NA	65.3	56	53
HC	*100*	*75*	62.4	44.5	44.4	52.7	NA	NA	49	50.7	52.5	47.4	NA	48.8	50	46
IC	*100*	*75*	40.9	37.5	36.6	35.4	70.2	78	57.8	59.7	61.8	NA	NA	NA	53	51

Exceedance of the NO_2 annual mean AQO of 40 µgm^{-3} are shown in **bold**.
[a] data capture for the monitoring period, in cases where monitoring was only carried out for part of the year
[b] data capture for the full calendar year (e.g. if monitoring was carried out for six months the maximum data capture for the full calendar year would be 50%)
[c d c] The bias adjustment factor used for all roadside/kerbside sites is 0.96 which is calculated using the National Gradko correction factor.