



Clarendon Square

Air Quality Monitoring Report

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This document has been prepared and checked in accordance with Waterman Group's IMS (BS EN ISO 9001: 2015, BS EN ISO 14001: 2015 and BS EN ISO 45001:2018)

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Comments

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Contents

1. Introduction	1
2. Methodology	2
Diffusion Tubes	2
Diffusion Tube Co-location	2
3. Results	4
Assessment Methodology	4

Tables

Table 1: Co-location Data at Holloway Road	3
Table 2: Adjustment Process to Estimate Annual Mean NO ₂ Concentrations at the Site	4
Table 3: NO ₂ Monitoring Results at the Site	6

Figure

Figure 1: Diffusion Tube Monitoring Locations

Appendices

Appendix A Precision and Accuracy Spreadsheet

1. Introduction

- 1.1. A short-term air quality monitoring study for nitrogen dioxide (NO₂) was undertaken at and around Clarendon Square, within the London Borough of Haringey (LBH). This is hereafter referred to as the Site and the boundary is shown in **Figure A1**. The monitoring study was undertaken from March 2021 to September 2021 to establish current air quality conditions at and surrounding the Site. Six months' worth of monitoring data was obtained.
- 1.2. The Site occupies 4.9 hectares of land and is dissected by Mary Neuner Road which runs north to south through the centre of the Site. The Site is bound by commercial development and Coburg Road to the north, residential properties along Hornsey Park Road to the east, commercial development along Clarendon Road to the south, and railway tracks to the west.
- 1.3. The results obtained from this monitoring study will inform the baseline air quality assessment to be undertaken as part of the Reserved Matters Application for the proposed Development.
- 1.4. In addition, the results will be used to verify the air quality model (comparison of monitored and modelled concentrations and the use of an adjustment factor, should this be required) to predict future air pollutant concentrations at the Site, and the likely significant impacts of the proposed Development on air pollutant concentrations in the surrounding area.
- 1.5. NO₂ diffusion tubes were placed at five locations at and surrounding the Site as shown in **Figure A1**. The locations were chosen to obtain a good distribution across the Site. In addition, tubes were co-located at the automatic monitor at Holloway Road, operated by the London Borough of Islington (LBI) to allow bias-adjustment of the monitoring results (see overleaf for further details).

2. Methodology

- 2.1. In May 2016, Defra published Local Air Quality Management Technical Guidance (LAQM.TG(16))¹ an update to the LAQM. TG(09)². The methodology and results of this monitoring study accord with LAQM.TG(16).
- 2.2. The air quality monitoring study was undertaken for a six-month period from 11th March 2021 to the 13th September 2021 and consisted of deploying two NO₂ diffusion tubes at five locations as shown in **Figure A1**, and three tubes at the Holloway Road automatic monitor (Grid Reference 530698, 185735), which were changed monthly throughout the monitoring period.
- 2.3. This period is sufficient to provide a reasonable assessment of existing air quality in an area, but it does not provide data equivalent to the annual mean, which was estimated from the monitoring results.
- 2.4. The diffusion tubes were mounted on lampposts approximately two metres (m) above ground level on and around the Site.

Diffusion Tubes

- 2.5. Diffusion tube monitoring is a method for screening the air quality in an area in order to give an indication of average air pollutant concentrations. The method consists of a tube with an appropriate absorbent material at one end, mounted on to street furniture. The preparation method used is 20% TEA (triethanolamine) in water and the tubes are exposed by removing the bottom cap to allow sampling.
- 2.6. Following the relevant exposure period, the cap is replaced and the tube sent to a laboratory for analysis. For this study, the tubes were obtained from Gradko International Ltd (a UKAS Accredited laboratory) and, following exposure, were returned to Gradko for analysis.

Diffusion Tube Co-location

- 2.7. Diffusion tubes may systematically under or over-read NO₂ concentrations when compared to an automatic analyser. To improve accuracy, it is best practice to deploy duplicate / triplicate tubes specifically co-located with an automatic monitor to enable inter-comparison of monitored results and determine the 'bias' in diffusion tube results. This bias can then be corrected to improve the accuracy of the diffusion tube results, using a suitable bias-adjustment factor.
- 2.8. As part of the monitoring study, triplicate diffusion tubes were located at the LBI Holloway Road automatic monitor to derive a local bias adjustment factor. A locally derived bias adjustment factor is more appropriate than using a national factor available from Defra³ for the following reasons:
 - The survey has not been carried out over a calendar year (the national factors have been determined on a calendar year basis); and
 - NO₂ concentrations at all of the diffusion sites are significantly influenced by emissions from nearby roads. In accordance with existing diffusion tube guidance⁴, the bias adjustment factors should be determined from co-location studies at similar monitoring locations.

1 Defra, 2016, Local Air Quality Management Technical Guidance LAQM.(TG16)

2 Defra, 2009, Local Air Quality Management Technical Guidance LAQM.TG(09)

3 <http://laqm.defra.gov.uk/bias-adjustment-factors/national-bias.html>

4 Laxen and Marner for Defra, 2006. The relationship between diffusion tube bias and distance from the road.

- 2.9. The local bias spreadsheet tool, developed by Defra to help Local Authorities calculating precision, accuracy and bias adjustment factors, has been used to check the accuracy of the triplicate diffusion tubes with the Holloway Road automatic monitor.
- 2.10. The spreadsheet provides a Coefficient of Variation (CV) of the diffusion tube results, which represents their precision and is an indicator of the overall performance of the diffusion tubes. Tube precision is separated into two categories, 'good' or 'poor'. Tubes are considered to have 'good' precision where the coefficient of variation of duplicate or triplicate diffusion tubes for eight or more periods during the year is less than 20%, and the average CV of all monitoring periods is less than 10%. Tubes are considered to have 'poor' precision where the CV of four or more periods is greater than 20% and/or the average CV is greater than 10%.
- 2.11. A summary of the data from the co-location study is presented in **Table 1** and a copy of the precision and accuracy spreadsheet presented in **Appendix A**.

Table 1: Co-location Data at Holloway Road

Site	Diffusion Tubes		Automatic Monitor	Bias Adjustment
	Period Mean	Tube Mean CV (% Precision)	Period Mean	
Holloway Road	32	8	24	0.77

- 2.12. The average CV for the co-location is less than 10%, and as such shows 'good' precision, and therefore the adjustment factor of **0.77** been applied to the monitoring results.

3. Results

Assessment Methodology

- 3.1. As noted previously, the short-term sampling period is sufficient to provide a reasonable assessment of air quality in an area but cannot be compared directly to the NO₂ annual mean Air Quality Strategy objective. However, if long-term (yearly) data sets are available from nearby monitoring networks, it is possible to identify a correlation between short and long-term data sets and estimate annual means from short-term data sets using the correlation.
- 3.1. Following guidance in Defra's LAQM.TG(16) (Box 7.10), for sites with fewer than 9 months' worth of data, annual mean concentrations need to be estimated from other long-term monitoring locations, known as annualisation. The reason for annualisation is that the concentration varies throughout the year, and the diffusion tubes may have been operational for a period of above or below average concentrations.
- 3.2. To minimise the impact of local traffic, the monitoring locations used in annualisation should be distanced from sources of pollution and broadly representative of city-wide urban background conditions.
- 3.3. According to LAQM.TG(16), in order to derive an annual mean concentration for the Site; data from two to four nearby long-term monitoring sites, located at urban background locations and ideally forming part of the national network are required. It is estimated that the distance between sites should not be larger than 50 miles (80km).
- 3.4. There are several urban background automatic monitoring stations in central London, from which the following four urban background monitoring locations were selected:
 - Priory Park South – Haringey, approximately 1.2km from the Site;
 - Arsenal – Islington, approximately 3.8km from the Site;
 - Bloomsbury – Camden, approximately 7.8km from the Site; and
 - The Aldgate School – City of London, approximately 9.0km from the Site.
- 3.5. The above automatic monitors form part of the London Air Quality Network (LAQN) and monitoring data is available for all monitors for 2019.
- 3.6. The ratio of the short-term monitoring period mean for NO₂ (11th March 2021 to 13th September 2021) at the four sites to the latest NO₂ annual mean concentration (available for 2019) at the same site was obtained, as shown in **Table 2**.

Table 2: Adjustment Process to Estimate Annual Mean NO₂ Concentrations at the Site

Monitor	Annual Mean 2019 [AM] (µg/m ³)	Period Mean [PM] (µg/m ³)	Ratio (AM/PM) [R]
Priory Park South, Haringey	21.9	13.8	1.587
Arsenal, Islington	24.9	16.7	1.492
Bloomsbury, Camden	31.5	21.2	1.486
The Aldgate School, City of London	33.3	18.7	1.777
Average Ratio			1.586

- 3.7. The average of the four ratios between the sampling period and annual mean NO₂ concentrations was calculated as 1.586, as shown in **Table 2** and then applied to the short-term NO₂ diffusion tube results set out in **Table 3**. Following guidance in LAQM.TG(16), given that the calculation is carried

out using the ratio of the short-term monitoring period to the 2019 annual mean, the equivalent/estimated annual mean is for 2019.

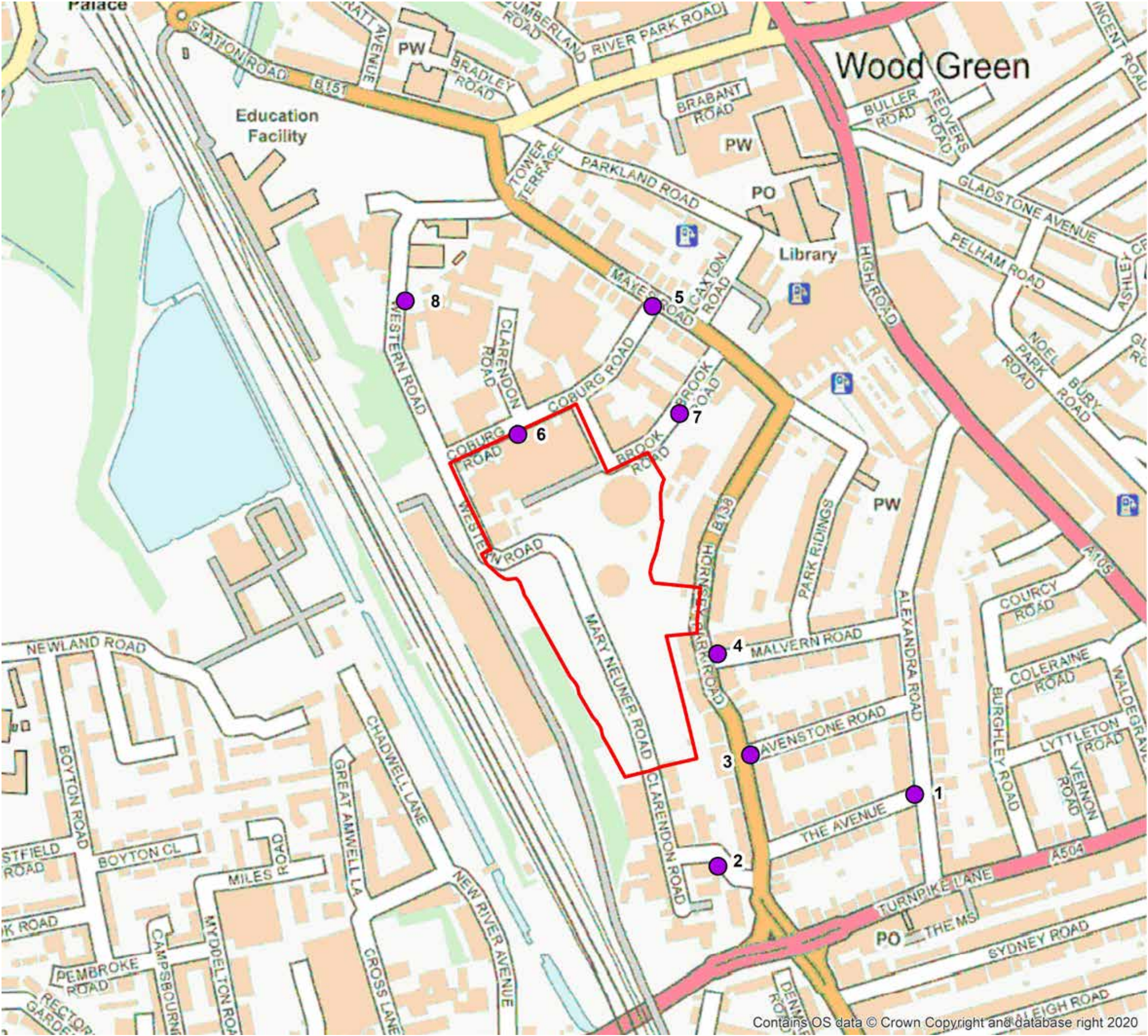
- 3.8. The results of the monitoring for NO₂ are presented in **Table 3** with the overall six-month average for each location calculated and the equivalent/estimated bias adjusted annual mean using the factor calculated above.
- 3.9. As indicated by **Table 3**, the monitored estimated annual mean NO₂ concentrations did not exceed the annual mean objective at any of the monitoring locations. These concentrations indicate the greatest source of pollution at the Site is traffic on Mayes Road with a 2019 annual mean concentration estimated to be 36.9µg/m³.

Table 3: NO₂ Monitoring Results at the Site

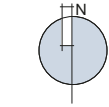
Location	NO ₂ Concentrations (µg/m ³)						Overall Average	Adjusted /Co-location Annual Mean*	Adjusted Estimated 2019 Annual Mean**	
	11 th March – 13 th April 2021	13 th April – 12 th May 2021	12 th May – 11 th June 2021	11 th June – 12 th July 2021	12 th July- 11 th August 2021	11 th August – 13 th September 2021				
1. Alexandra Road	24.6	25.1	24.8	20.5	22.8	19.6	23.0	17.7	28.1	
	25.0	25.0	24.8	20.7	22.4	20.7				
2. Clarendon Road	23.2	26.4	22.4	20.0	21.5	17.5	22.1	17.0	26.9	
	24.3	25.3	22.8	19.0	21.5	21.1				
3. Ravenstone Road	24.1	25.4	23.3	21.5	23.0	22.5	23.2	17.9	28.4	
	25.4	25.7	22.3	21.2	22.1	22.0				
4. Malvern Road	25.0	26.5	23.8	24.0	23.9	24.4	24.2	18.7	29.6	
	26.7	27.0	23.5	22.6	22.0	21.6				
5. Mayes Road	31.4	35.7	29.9	27.9	30.3	26.3	30.2	23.3	36.9	
	30.0	35.7	30.3	26.5	30.5	28.3				
6. Coburg Road	23.2	24.7	21.0	18.5	21.5	17.5	21.5	16.5	26.2	
	22.9	24.5	21.4	20.2	20.4	21.6				
7. Brook Road	23.6	22.3	20.4	17.7	19.3	16.2	20.5	15.8	25.1	
	23.8	24.0	20.6	18.0	18.9	21.6				
8. Western Road	22.1	23.9	22.3	18.8	19.0	16.2	20.9	16.1	25.5	
	22.6	27.5	21.6	19.3	17.9	19.0				
*	Multiply previous column by 0.77								Air Quality Objective	40
**	Multiply previous column by 1.586									

FIGURE

Figure A1: Diffusion Tube Monitoring Locations



- Site Boundary
- Diffusion Tube Monitoring Locations



Project Details	WIE11636-109: Clarendon Square
Figure Title	Figure A1: Diffusion Tube Monitoring Locations
Figure Ref	WIE11636-109_GR_AQ_A1A
Date	November 2021
File Location	\\s-Incs\wiel\projects\wie11636\109\graphics\aq\issued figures

APPENDICES

Appendix A Precision and Accuracy Spreadsheet

Checking Precision and Accuracy of Triplicate Tubes


AEA Energy & Environment
From the AEA group

Diffusion Tubes Measurements									
Period	Start Date dd/mm/yyyy	End Date dd/mm/yyyy	Tube 1 μgm^{-3}	Tube 2 μgm^{-3}	Tube 3 μgm^{-3}	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean
1	11/03/2021	13/04/2021	32.7	39.8	31.9	35	4.3	12	10.7
2	13/04/2021	12/05/2021	32.7	31.6	27.1	30	3.0	10	7.4
3	12/05/2021	11/06/2021	33.5	33.2	34.6	34	0.8	2	1.9
4	11/06/2021	12/07/2021	27.2	30.1	32.8	30	2.8	9	6.9
5	12/07/2021	11/08/2021	34.2	33.7	30.7	33	1.9	6	4.6
6	11/08/2021	13/09/2021	27.5	28.8	33.6	30	3.2	11	8.0
7									
8									
9									
10									
11									
12									
13									

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

Period	Mean	Data Capture (% DC)
1	32.431982	97.9
2	25.96056	97.88
3	26.994	97.78
4	20.09938	97.78
5	21	97.78
6	20	97.44
7		
8		
9		
10		
11		
12		
13		

Tubes Precision Check	Automatic Monitor Data Capture
Good	Good
Good	Good
Good	Good
Good	Good
Good	Good
Good	Good

Site Name/ ID:

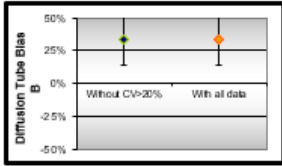
Precision 6 out of 6 periods have a CV smaller than 20%

Overall survey → **Good precision** **Good Overall DC**

(Check average CV & DC from Accuracy calculations)

Accuracy (with 95% confidence interval)	
without periods with CV larger than 20%	
Bias calculated using 6 periods of data	
Bias factor A	0.77 (0.66 - 0.91)
Bias B	31% (10% - 51%)
Diffusion Tubes Mean:	32 μgm^{-3}
Mean CV (Precision):	8
Automatic Mean:	24 μgm^{-3}
Data Capture for periods used:	98%
Adjusted Tubes Mean:	25 (21 - 29) μgm^{-3}

Accuracy (with 95% confidence interval)	
WITH ALL DATA	
Bias calculated using 6 periods of data	
Bias factor A	0.77 (0.66 - 0.91)
Bias B	31% (10% - 51%)
Diffusion Tubes Mean:	32 μgm^{-3}
Mean CV (Precision):	8
Automatic Mean:	24 μgm^{-3}
Data Capture for periods used:	98%
Adjusted Tubes Mean:	25 (21 - 29) μgm^{-3}



Jaume Targa, for AEA
Version 04 - February 2011

If you have any enquiries about this spreadsheet please contact the LAQM Helpdesk at:

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UK and Ireland Office Locations

