South Holland District Council

Annual Status Report 2016

Bureau Veritas

January 2017

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2016 Air Quality Annual Status Report (ASR)

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

January 2017

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Executive Summary: Air Quality in Our Area

South Holland District Council comprises the principal town of Spalding surrounded by the smaller towns of Holbeach, Long Sutton, Sutton Bridge and Crowland. The rest of the district is rural in character, and as such, air quality within South Holland District Council is significantly below the air quality objectives. Regardless, we are committed to improving air quality.

The South East Lincolnshire Local Plan is currently at the final consultation stage and should be published early 2017. Once the new Local Plan is in place we will be able to require air quality mitigation measures as part of new developments that have an impact on air quality.

Air Quality in South Holland District 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].

The main source of air pollution in the district is road traffic emissions from major roads, notably the A16, A17 and A151 which connect South Holland with North Lincolnshire and the Humber estuary, and south west Lincolnshire. There are currently no Air Quality Management Areas (AQMAs) declared in South Holland.

Once the new Local Plan is in place, we will, in conjunction with Lincolnshire County Council, take action to reduce emissions from transport.

[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

How to Get Involved

A variety of things can be done by everyone to help keep air pollution low, and protect their health when levels rise:

- Don't light a bonfire when pollution levels are high.
- Try to use your car less often - walk, cycle or use public transport.
- Cycling or walking is healthier for both the environment, and for you.
- Ask your employer, school or college about developing a green travel plan.
- Do not drive your car when there are warnings of high air pollution. You will normally receive pollution warnings on your local regional news and weather forecast.

The South Holland air quality webpages can be found at http://shollandair.aeat.com/.

The website allows users to find out what the latest pollution levels in South Holland area are, find out more about air pollution, and view data for individual automatic monitoring stations in the local authority area.

Figure 1 The Air Quality Monitoring Station at Westmere School

Table of Contents

1 Local Air Quality Management

This report provides an overview of air quality in South Holland District Council during 2015. 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 South Holland District 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. In addition, the national objectives for Ozone are given, though ozone monitoring is not required as a part of the LAQM regime.

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 the objectives.

South Holland District Council currently does not have any AQMAs.

2.2 Progress and Impact of Measures to address Air Quality in South Holland District Council

Air Quality within South Holland District Council is significantly below the air quality objective. Regardless, the Council is committed to improving air quality. The South East Lincolnshire Local Plan) is currently at the final consultation stage and should be published early 2017. Once the new Local Plan is in place air quality mitigation measures will be required as part of new developments that have an impact on air quality.

Across South East Lincolnshire, the focus of the Air Quality action will centre on the understanding that:

- With there now being a strong base of scientific evidence that particulates from traffic pollution are a contributor to premature death (29,000 in the UK in 2008, 25,000 of these in England), with Nitrogen Dioxide also strongly linked, there is a strong need to also avoid increasing traffic pollution at other locations that fall below the threshold for a declared AQMA, but which could potentially reach this threshold in the future if unchecked;
- Councils have a duty to ensure that the national air quality objectives are met in their area;
- National air quality objectives will evolve over time to further reduce negative impacts on human health and the environment.

With this in mind it is important that the Council is able to require further assessment by developers and apply conditioning of applications / permissions, with air quality as a material consideration. It may be necessary to agree a threshold for the number of properties being developed, or the scale of non-housing developments, at which point further assessment of air quality impacts by the developer will take effect and the areas where such further assessment will be relevant. This might be one large scale development, or potentially a number of smaller developments where there is the potential for a negative impact on air quality in a defined location. This might be where there could be impact on a particular street, or combination of streets, where the air quality objective for a particular pollutant either isn't being met, or could fail to be met in the future. Such considerations may vary to reflect changes in the levels of pollutants and the pollutants themselves, as published from time to time as national air quality objectives.

South East Lincolnshire are at a point where a large scale housing development would require an air quality assessment and proposed mitigation to be offered by the developer such as the installation of electric vehicle charge points, provision of cycle / safe pedestrian routes, bus interchanges, contributions to road improvement schemes, or combinations of these, to ensure the Council can keep control of air quality in the future.

We understand that a policy needs to exist under the local plan before such measures can be required.

Transport measures would be addressed County-wide by Lincolnshire County Council, and may include:

- Company Vehicle Procurement -Prioritising uptake of low emission vehicles;
- Priority parking for LEV's;
- Procuring alternative Refuelling infrastructure to promote Low Emission Vehicles, EV recharging, Gas fuel recharging;
- Public Vehicle Procurement -Prioritising uptake of low emission vehicles;
- Taxi emission incentives;
- Taxi Licensing conditions.

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.

There is currently no ongoing monitoring of $PM_{2.5}$ within the District, and no specific measures in place to address $PM_{2.5}$ concentrations, as the air quality across the District is considered good. Traffic emissions are the main cause of particulate emissions within the District, and as such, the implementation of the transport measures given in Section 2.2 will contribute to reduction of $PM_{2.5}$ concentrations experienced across the District.

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.

South Holland District Council undertook automatic (continuous) monitoring at 2 sites during 2015. 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

South Holland District Council undertook non- automatic (passive) monitoring of NO_2 at 15 sites during 2015. 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) and bias adjustment for the diffusion tubes are included in Appendix C.

3.2 Individual Pollutants

3.2.1 Nitrogen Dioxide (NO_2)

Table A.3 and Figure A.1 in Appendix A compare the ratified and adjusted monitored NO_2 annual mean concentrations for the past 5 years with the air quality objective of 40 µg/m^3.

For diffusion tubes, the full 2015 dataset of monthly mean values is provided in Appendix B.

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.

At both sites, there have been no exceedances of the hourly mean objective, and the annual mean has consistently fallen in recent years.

A summary of the diffusion tube results is given in Appendix B and details of the bias correction and QAQC procedures are given in Appendix C. There were at least 11 month's worth of data for all 18 tubes, and as such there was no need to anualise any of the results. In each case, the annual average of all 18 tubes was significantly lower than the permitted of 40µg/m^3.

3.2.2 Particulate Matter (PM_{10})

Table A.5 and Figure A.2 in in Appendix A compare 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.

At both sites, there has been just one exceedance of the daily mean objective (which is considerably lower than the permitted 35), and the annual mean has consistently fallen in recent years.

3.2.3 Other Pollutants

In addition to monitoring NO_2 and PM_{10}, the automatic analyser located at Westmere School also monitors Ozone (O_3) concentrations. There is no requirement to report these data for LAQM purposes; however, the results are discussed herein for completeness.

O_3 is a trans-boundary pollutant; its sources can be frequently spatially distant from the measured site of the concentration. This pollutant is not a prescribed air quality objective for the purposes or LAQM and therefore the results presented are for information only.

The AQS objective for ground level O_3 (to be met by 2005) states that the maximum daily concentration (measured as an 8-hour running mean) of 100 µg/m^3 should not be exceeded more than 10 times per year.

Table A.7 in Appendix A summarises the number of exceedances over the last 4 years. The results from 2015 show that the AQS objective was equalled with a total of 10 exceedances.

4 Conclusions

Results for 2015 indicate that both the annual mean objective and the 1-hour objective for NO_2 were met at both the continuous monitoring locations. The annual mean and the 24-hour mean air quality objectives for PM_{10} also continue to be met at both monitoring locations. NO_2 and PM_{10} concentrations are declining at both sites. NO_2 diffusion tube concentrations continue to be below the annual objective at all sites.

The South East Lincolnshire Local Plan is currently at the final consultation stage and should be published early 2017. Once the new Local Plan is in place we will be able to require air quality mitigation measures as part of new developments that have an impact on air quality.

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)
CM1	Spalding Monkhouse School	R	523168	322454	NO_2, PM_{10}	N	Chemiluminescence, TEOM corrected by VCM	1	25	3.0
CM2	Westmere School	UB	547264	321709	NO_2, O_3, PM_{10}	N	Chemiluminescence, UV Absorption,TEOM corrected by VCM	14	190	3.0

* UB – Urban Background, R – Rural

(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

Site ID	Site Name	Site Type (1)	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) (2)	Distance to kerb of nearest road (m) (3)	Tube collocated with a Continuous Analyser?	Height (m)
SH 1	21 Millfield Gardens	UB	524388	310520	NO_2	N	6.8	2.9	N	2.2
SH 2	Nutten Stoven	UB	535595	325453	NO_2	N	5.6	21.8	N	2.2
SH 3	Priory Road	UB	524734	322403	NO_2	N	38.4	80	N	2.2
SH 4	46 The Hollies	UB	536523	325078	NO_2	N	8.4	0.2	N	2.2
SH 5	Station Road	R	526585	328726	NO_2	N	24.9	1.5	N	2.2
SH 6	103 Boston Road	NR	535525	325589	NO_2	N	25.7	9.5	N	2.2
SH 7	Field End	R	541013	324393	NO_2	N	5.9	<2	N	2.2
SH8/9/10	Westmere (Triplicate)	UB	547264	321709	NO_2	N	69.4	61.2	Y	3.0
SH 11	Metalair Site	R	547957	321013	NO_2	N	N/A	<2	N	2.2
SH 13	Pinchbeck Road	K	524595	323793	NO_2	N	20.7	0.7	N	2.2
SH 14	Springfields Roundabout	K	526309	323820	NO_2	N	54.2	0.5	N	2.2
SH 15	Church Street, Pinchbeck	R	524182	325804	NO_2	N	0	1.5	N	2.2
SH 16	Bicker Road, Donington	NR	520917	336064	NO_2	N	7.5	16.5	N	-
SH 17	High Road, Spalding	R	524892	322571	NO_2	N	0	1.5	N	-
SH 18	Hawthorn Bank, Spalding	R	524191	321328	NO_2	N	1.5	3	N	-

(1) K – Kerbside, NR – Near-Road, R – Roadside, UB – Urban Background

(2) 0m if the monitoring site is at a location of exposure (e.g. installed on/adjacent to the façade of a residential property).

(3) N/A if not applicable.

Table A.3 – Annual Mean NO_2 Monitoring Results

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2015 (%) (2)	NO_2 Annual Mean Concentration ($\mu g/m^3$) (3)				
					2011	2012	2013	2014	2015
CM1	Roadside	Automatic	95.9	95.9	11.9	15.3	11.3	10.4	10.5
CM2	Urban Background	Automatic	99.3	99.3	16.2	13.9	12.7	12.1	9.0
SH 1	Urban Background	Diffusion Tube	100	100	17	13.8	14.9	13.13	10.5
SH 2	Urban Background	Diffusion Tube	100	100	16.7	13.9	15	12.19	10.5
SH 3	Urban Background	Diffusion Tube	100	100	22.8	17.6	19.4	18.86	16.5
SH 4	Urban Background	Diffusion Tube	100	100	16.2	13.9	13.9	12.22	10.7
SH 5	Roadside	Diffusion Tube	100	100	22.6	17.4	17.9	16.2	14.6
SH 6	Near-Road	Diffusion Tube	100	100	28.5	22.5	25.4	22.77	19.7
SH 7	Roadside	Diffusion Tube	100	100	27.4	19.4	21	19.12	17.8
SH8/9/10	Urban Background	Diffusion Tube	97.2	97.2	16	12.6	13.5	12.11	10.1
SH 11	Roadside	Diffusion Tube	100	100	27.1	21.5	21.9	20.77	17.7
SH 13	Kerbside	Diffusion Tube	100	100	36.4	26.9	32.3	30.13	29.8
SH 14	Kerbside	Diffusion Tube	100	100	31.3	24.1	27.3	25.42	21.3
SH 15	Roadside	Diffusion Tube	100	100	36.4	27.2	31.6	28.32	23.6
SH 16	Near-Road	Diffusion Tube	100	100	21.5	14.7	16.1	14.32	12.5
SH 17	Roadside	Diffusion Tube	100	100	33.9	25	28.3	28.21	24.3
SH 18	Roadside	Diffusion Tube	91.7	91.7	32.3	25.4	25.4	24.12	22.5

Notes: Exceedances of the NO_2 annual mean objective of $40\mu g/m^3$ are shown in **bold**.

NO_2 annual means exceeding $60\mu g/m^3$, 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 Technical Guidance LAQM.TG16 if valid data capture for the full calendar year is less than 75%. See Appendix C for details.

Figure A.1 – Trends in Annual Mean Nitrogen Dioxide Concentrations measures at Automatic Monitoring Sites

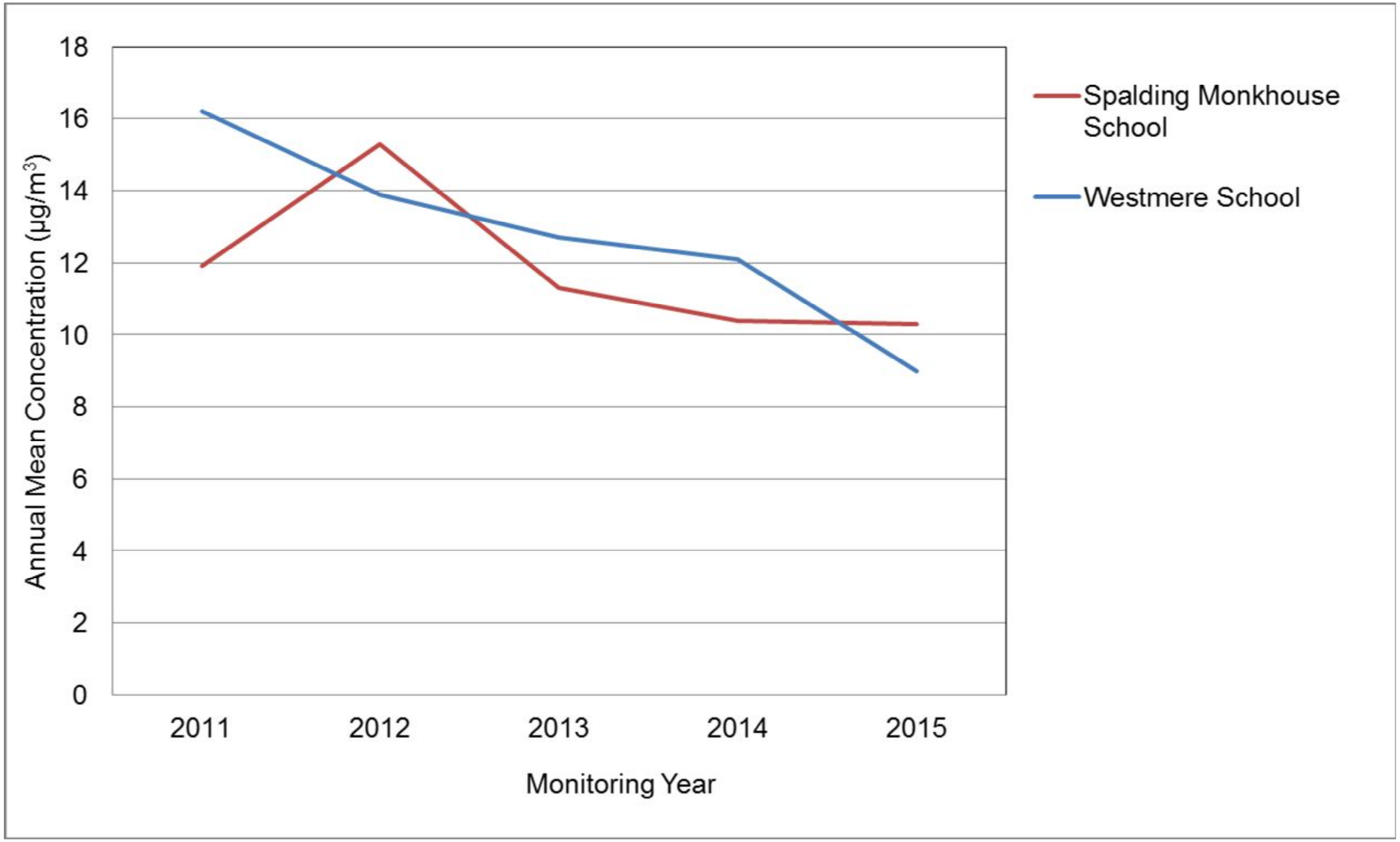


Table A.4 – 1-Hour Mean NO_2 Monitoring Results

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) [1]	Valid Data Capture 2015 (%) [2]	NO_2 1-Hour Means > 200µg/m^3 [3]				
					2011	2012	2013	2014	2015
CM1	Roadside	Automatic	95.9	95.9	0	0 (84)	0 (55)	0	0
CM2	Urban Background	Automatic	99.3	99.3	0	0 (67)	0	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.

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

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2015 (%) (2)	PM_{10} Annual Mean Concentration (µg/m^3) (3)				
				2011	2012	2013	2014	2015
CM1	Roadside	99.7	99.7	20.5	17.3	18.9	17.9	15.4
CM2	Urban Background	98.1	98.1	19.7	16.0	17.9	17.2	14.8

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 Technical Guidance LAQM.TG16, valid data capture for the full calendar year is less than 75%. See Appendix C for details.

Figure A.2 – Trends in Annual Mean PM_{10} Concentrations measures at Automatic Monitoring Sites

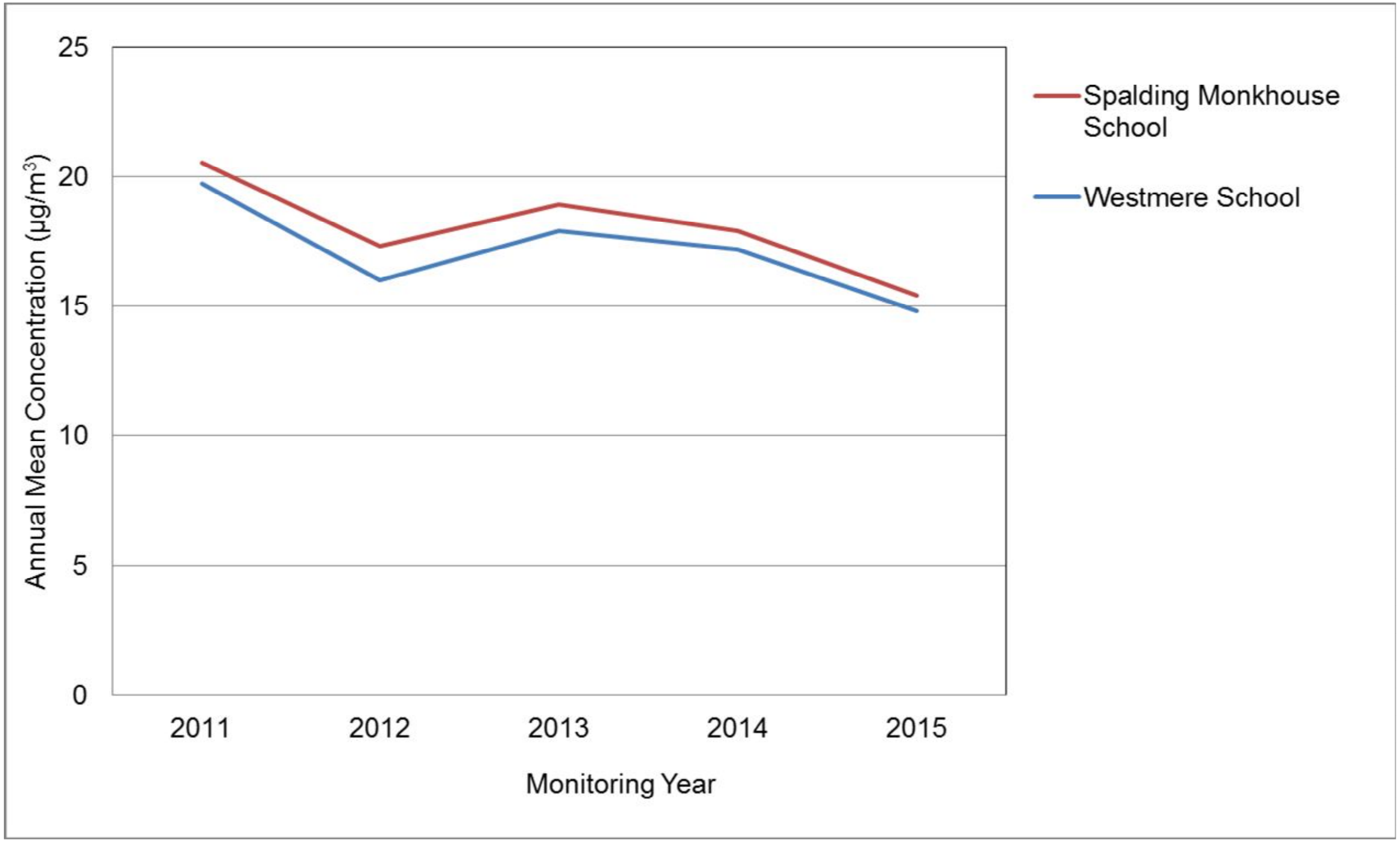


Table A.6 – 24-Hour Mean PM_{10} Monitoring Results

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2015 (%) (2)	PM_{10} 24-Hour Means > 50µg/m^3 (3)				
				2011	2012	2013	2014	2015
CM1	Roadside	99.7	99.7	7	2	5	4	1
CM2	Urban Background	98.1	98.1	8	2	4 (27.6)	4	1

Notes: Exceedances of the PM_{10} 24-hour mean objective (50µg/m^3 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.

Table A.7 – Results of Westmere School Automatic Ozone Monitoring

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2015 (%) (2)	Number of Exceedances of Maximum Daily Concentration (8-hour running mean)			
				2012	2013	2014	2015
CM2	Roadside	99.9	99.9	5	55	8	10

Notes: Exceedance of the O_3 objective: 8-hour mean of 100 µg/m^3, 10 exceedances allowed per 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%).

Appendix B: Full Monthly Diffusion Tube Results for 2015

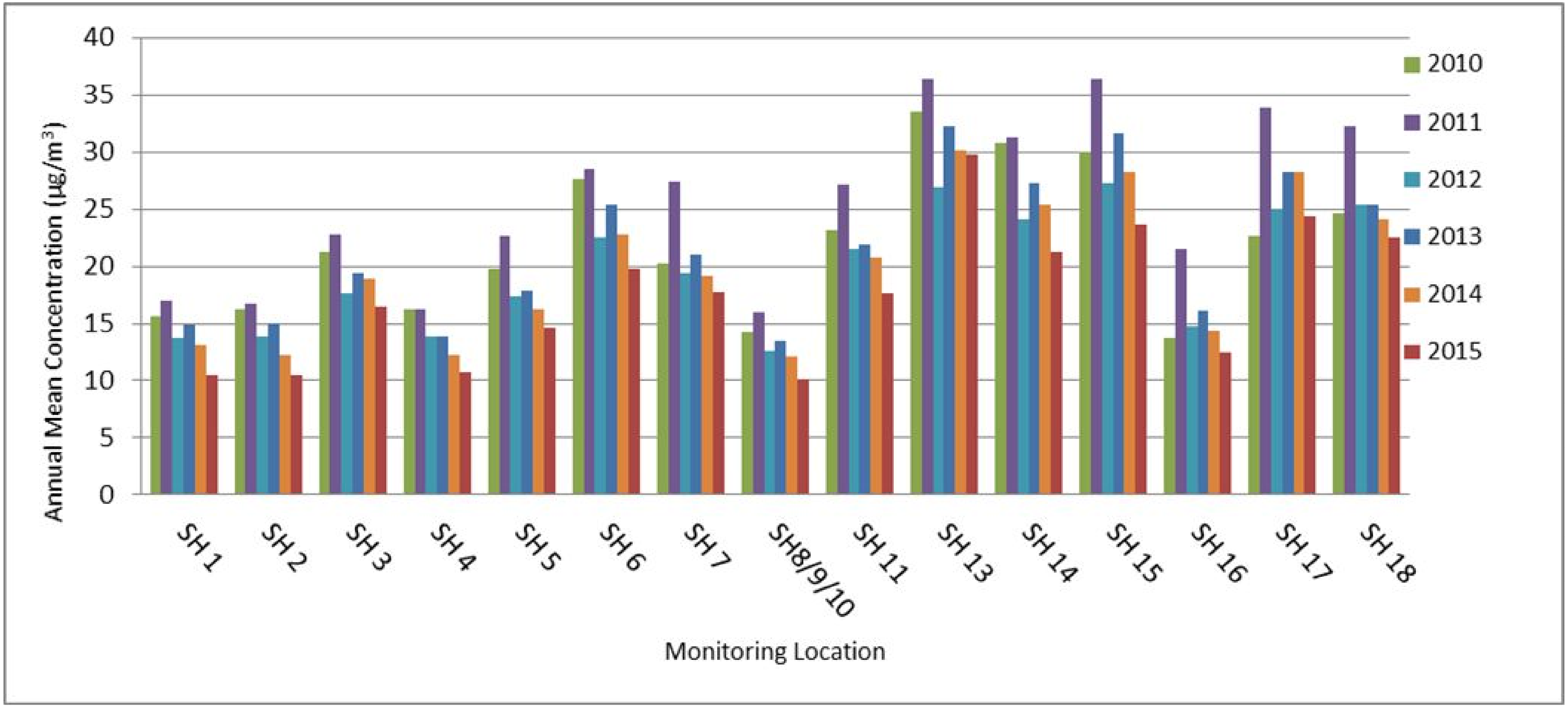
Table B.1 – NO_2 Monthly Diffusion Tube Results - 2015

Site ID	NO_2 Mean Concentrations ($\mu g/m^3$)														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean		
													Raw Data	Locally Bias Adjusted (1)	Nationally Bias Adjusted (2)
SH 1	14.4	16.0	11.1	8.5	7.2	7.5	7.6	8.8	9.5	11.7	15.8	13.5	11.0	9.4	10.5
SH 2	13.7	15.7	12.5	11.4	7.5	7.4	8.1	9.0	11.0	12.6	12.7	9.5	10.9	9.4	10.5
SH 3	24.4	23.3	16.4	17.6	13.0	13.6	13.1	12.6	16.3	19.2	20.3	15.8	17.1	14.7	16.5
SH 4	16.1	16.5	12.1	11.2	6.6	7.9	7.6	7.7	9.9	11.5	14.9	12.3	11.2	9.6	10.7
SH 5	18.6	20.6	14.5	16.1	12.7	12.8	14.0	12.8	15.8	17.9	16.8	10.5	15.2	13.1	14.6
SH 6	21.8	24.4	24.1	20.7	18.3	16.5	17.5	17.9	24.2	28.8	19.2	12.8	20.5	17.6	19.7
SH 7	23.9	22.4	17.6	15.5	16.7	15.3	17.0	16.9	14.7	17.1	24.4	21.0	18.5	15.9	17.8
SH8	14.2	15.5	9.2	9.0	7.5	6.9	7.2	8.2	7.8	11.7	14.4	12.8	10.4	8.9	9.9
SH9	15.2	14.5	11.0	9.7	6.1	6.7	6.6	-	8.7	12.1	15.7	14.7	11.0	9.4	10.5
SH10	13.9	13.6	10.1	8.7	7.4	6.8	6.9	7.6	7.9	11.2	13.1	15.3	10.2	8.8	9.8
SH 11	19.7	19.4	18.4	16.6	15.0	15.1	13.6	19.0	20.0	25.1	18.2	21.0	18.4	15.8	17.7
SH 13	34.6	36.3	27.6	27.3	32.0	26.4	27.4	32.4	30.7	33.0	35.2	29.4	31.0	26.7	29.8
SH 14	25.3	29.1	21.9	24.2	17.4	7.9	18.8	22.3	25.1	29.5	24.4	20.7	22.2	19.1	21.3
SH 15	27.6	29.7	22.1	22.2	20.3	21.5	21.6	23.6	27.7	28.6	26.6	23.7	24.6	21.2	23.6
SH 16	15.5	17.7	11.9	14.1	10.6	8.6	9.7	12.3	11.2	12.8	16.8	15.2	13.0	11.2	12.5
SH 17	26.0	31.3	20.4	26.3	19.6	20.2	20.4	25.5	21.7	28.0	31.2	33.4	25.3	21.8	24.3
SH 18	29.4	29.0	22.6	21.0	25.2	21.4	20.3	16.9	23.7	26.1	-	22.6	23.5	20.2	22.5

(1) Using a locally calculated bias correction factor of 0.86. See Appendix C for details on bias adjustment.

(2) Using a nationally calculated bias correction factor of 0.96. See Appendix C for details on bias adjustment.

Figure C.3 – Trends in Annual Mean Nitrogen Dioxide Concentrations measured at Diffusion Tube Monitoring Sites



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

New and Future Local Developments

There have been no new developments that have not been covered in previous reports.

Industrial Processes

There have been no new of substantially increased industrial processes that have not been covered in previous reports.

Biomass

There have been no new biomass burners that have not been covered in previous reports.

There are 20 operating biomass boilers within the area. South Holland District Council are sending out a questionnaire to all of the operators so that they can provide us with the information that we need ready for next year's ASR.

Landfill Sites, Poultry Farms, and Fugitive Emissions Sources

There have been no new landfill sites, poultry farms, or fugitive emission sources that have not been covered in previous reports.

QA/QC of Automatic Monitoring

South Holland District Council contracts data management for their continuous analysers to Ricardo-AEA. The Quality Assurance/Quality Control (AQ/QC) procedures employed by Ricardo-AEA are equivalent to the UK Automatic Urban and Rural Network (AURN) procedures. The PM_{10} results have been gravimetrically corrected by Ricardo-AEA who undertake the data management for the two automatic continuous monitoring sites. All monitoring locations recorded data capture of >75%, therefore it was not required to annualise any monitoring data.

Diffusion Tube Monitoring Data

The diffusion tube data has been corrected using a bias adjustment factor, which is an estimate of the difference between diffusion tube concentration and continuous monitoring, the latter assumed to be a more accurate method of monitoring. Triplicate co-location studies can be used to determine a local bias factor based on the comparison of diffusion tube results with data taken from NO_x/NO_2 continuous analysers. Alternatively, the national database of diffusion tube co-location surveys provides bias factors for the relevant laboratory and preparation method. With regard to the application of a bias adjustment factor for diffusion tubes, the Defra Technical Guidance LAQM.TG(16) and the LAQM Helpdesk recommend the use of a local bias adjustment factor where available and relevant to diffusion tube sites.

The National Correction Factor is given as 0.96 by the spreadsheet Database_Diffusion_Tube_Bias_Factors_v06_16-Final.xls as 0.96 (Table C.2)

There is a co-located triplicate diffusion tube monitoring site (SH 8/9/10) installed at the urban background Westmere School automatic monitoring site. The local bias correction factor is calculated to be 0.86 using the Diffusion Tube Bias Adjustment Factor Spreadsheet (AEA_DifTPAB_v04.xlsx (Table C.1)). This is significantly lower than the nationally derived factor of 0.96 (Table C.2). This discrepency could be due to the low average concentrations at Westmere School, which would suggest that the nationally derived factor is used (The annual average of the continuous monitoring station was 9 $\mu g/m^3$ and that of the collocated tubes was 10 $\mu g/m^3$). In the 2015 USA, a locally derived factor of 1.00 was used, which would suggest that a locally derived factor should be used for 2015 data.

As there is no clear evidence for the use of either factor, the results have been bias corrected by the locally derived factor of 0.86 and independently by the nationally derived factor of 0.96 (Appendix B).

We propose that the Nationally derived factor of 0.96 is used, as it is closer to 1 and correlates more closely with the factors used in previous years' reports.The results for the period 2010 to 2015 are presented in Figure B.1. This graph is plotted using the data corrected by the nationally derived factor – which results in the higher of the two datasets. It is evident that concentrations have dropped across all of the difusion tube monitoring sites within the District.

QA/QC of Diffusion Tube Monitoring

The diffusion tubes are supplied and analysed by Gradko International Limited utilising the 50% Triethanolamine (TEA) in acetone preparation method.

Gradko International Ltd is a UKAS accredited laboratory and participates in laboratory performance and proficiency testing schemes. These provide strict performance criteria for participating laboratories to meet, thereby ensuring NO_2 concentrations reported are of a high calibre. The laboratory follows the procedures set out in the Harmonisation Practical Guidance and participates in the AIR proficiency-testing (AIR-PT) scheme. Previously to the Air-PT scheme, Gradko participated in the Workplace Analysis Scheme for Proficiency (WASP) for NO_2 diffusion tube analysis.

Defra and the Devolved Administrations advise that diffusion tubes used for LAQM should be obtained from laboratories that have demonstrated satisfactory performance in the AIR-PT scheme. Laboratory performance in the AIR-PT is also assessed by the National Physical Laboratory (NPL), alongside laboratory data from the monthly NPL Field Inter-Comparison Exercise carried out at for Gradko at Marylebone Road, central London. A laboratory is assessed and given a 'z' score, a score of ± 2 or less indicates satisfactory laboratory performance.

Gradko International Ltd's performance for 2015 is covered by rounds AR006, AR007, AR009 and AR010 of the AIR-PT scheme, for each round 100% of the laboratories results were deemed to be satisfactory based upon a z score of ≤ ± 2. In 2015, the tube precision for NO_2 Annual Field Inter-Comparison for Gradko

International using the 50% TEA in acetone method was ‘good’ for the results of all 14 participating local authorities.

Table C.1 – Local Diffusion Tube Correction Factor Calculation

Checking Precision and Accuracy of Triplicate Tubes

AEA Energy & Environment
From the AEA group

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	Automatic Method: Period Mean	Automatic Method: Data Capture (% DC)	Data Quality Check: Tubes Precision Check	Data Quality Check: Automatic Monitor Data
1	09/01/2015	06/02/2015	14.2	15.2	13.9	14	0.7	5	1.7	12.09	99.7	Good	Good
2	06/02/2015	06/03/2015	15.5	14.5	13.6	15	1.0	7	2.5	12.81	99.1	Good	Good
3	06/03/2015	30/03/2015	9.2	11.0	10.1	10	0.9	9	2.2	11.74	99.8	Good	Good
4	30/03/2015	01/05/2015	9.0	9.7	8.7	9	0.5	6	1.3	8.75	99.7	Good	Good
5	01/05/2015	27/05/2015	7.5	6.1	7.4	7	0.8	11	1.9	6.29	99.2	Good	Good
6	27/05/2015	03/07/2015	6.9	6.7	6.8	7	0.1	2	0.3	5.01	98.6	Good	Good
7	03/07/2015	30/07/2015	7.2	6.6	6.9	7	0.3	5	0.8	4.80	99.1	Good	Good
8	30/07/2015	26/08/2015	8.2		7.6	8	0.4	5	3.7	5.57	99.5	Good	Good
9	26/08/2015	02/10/2015	7.8	8.7	7.9	8	0.5	6	1.2	7.83	99.2	Good	Good
10	02/10/2015	29/10/2015	11.7	12.1	11.2	12	0.4	4	1.1	8.00	99.1	Good	Good
11	29/10/2015	04/12/2015	14.4	15.7	13.1	14	1.3	9	3.2	11.96	99.4	Good	Good
12	04/12/2015	08/01/2016	12.8	14.7	15.3	14	1.3	9	3.2	13.01	99.0	Good	Good
13													

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

Overall survey --> Good precision | Good Overall DC

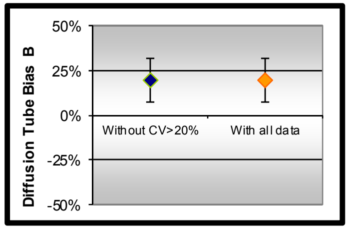
Site Name/ ID: Westmere School

Precision 12 out of 12 periods have a CV smaller than 20%

(Check average CV & DC from Accuracy calculations)

Accuracy (with 95% confidence interval)
without periods with CV larger than 20%
Bias calculated using 12 periods of data
Bias factor A 0.86 (0.78 - 0.96)
Bias B 16% (4% - 28%)
Diffusion Tubes Mean: 10 µgm⁻³
Mean CV (Precision): 6
Automatic Mean: 9 µgm⁻³
Data Capture for periods used: 99%
Adjusted Tubes Mean: 9 (8 - 10) µgm⁻³

Accuracy (with 95% confidence interval)
WITH ALL DATA
Bias calculated using 12 periods of data
Bias factor A 0.86 (0.78 - 0.96)
Bias B 16% (4% - 28%)
Diffusion Tubes Mean: 10 µgm⁻³
Mean CV (Precision): 6
Automatic Mean: 9 µgm⁻³
Data Capture for periods used: 99%
Adjusted Tubes Mean: 9 (8 - 10) µgm⁻³



Jaume Targa, for AEA
Version 04 - February 2011

If you have any enquiries about this spreadsheet please contact the LAQM Helpdesk at: LAQMHelpdesk@uk.bureauveritas.com

Table C.2 – National Diffusion Tube Correction Factor Calculation

National Diffusion Tube Bias Adjustment Factor Spreadsheet

Spreadsheet Version Number: 06/16

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 September 2016

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/m³)	Automatic Monitor Mean Conc. (Cm) (μg/m³)	Bias (B)	Tube Precision[6]	Bias Adjustment Factor (A) (Cm/Dm)
Gradko	50% TEA in acetone	2015	R	Bedford Borough Council	12	35	33	6.4%	G	**0.94**
Gradko	50% TEA in acetone	2015	UB	Norwich City Council	9	12	12	-3.3%	G	**1.03**
Gradko	50% TEA in acetone	2015	R	West Berkshire Council	11	38	35	10.7%	G	**0.90**
Gradko	50% TEA in acetone	2015	R	East Hampshire District Council	11	22	20	9.5%	G	**0.91**
Gradko	50% TEA in acetone	2015	KS	London Borough of Croydon	12	54	52	4.7%	G	**0.96**
Gradko	50% TEA in acetone	2015	B	London Borough of Richmond upon Thames	12	21	21	-0.2%	G	**1.00**
Gradko	50% TEA in acetone	2015	R	London Borough of Richmond upon Thames	12	36	33	8.9%	G	**0.92**
Gradko	50% TEA in acetone	2015	KS	Marylebone Road Intercomparison	12	86	81	6.4%	G	**0.94**
Gradko	50% TEA in acetone	2015	UI	Middlesbrough	11	16	15	5.9%	G	**0.94**
Gradko	50% TEA in acetone	2015	SI	Redcar & Cleveland	12	12	12	0.1%	G	**1.00**
Gradko	50% TEA in acetone	2015	R	West Dorset District Council	12	12	11	15.5%	G	**0.87**
Gradko	50% TEA in acetone	2015	R	Worthing Borough Council	11	42	37	14.5%	G	**0.87**
Gradko	50% TEA in acetone	2015	R	Royal Borough of Windsor and Maidenhead	12	34	37	-8.4%	G	**1.09**
Gradko	50% TEA in acetone	2015	R	Royal Borough of Windsor and Maidenhead	12	40	38	4.2%	G	**0.96**
Gradko	50% TEA in acetone	2015	R	LB Newham	11	35	38	-9.9%	G	**1.11**
Gradko	50% TEA in acetone	2015		**Overall Factor[3] (15 studies)**					**Use**	**0.96**

Appendix D: Maps of Monitoring Locations

Figure D.4 – Map of Automatic Monitoring Site: Spalding

Figure D.5 – Map of Automatic Monitoring Site: Sutton Bridge

Legend
● Automatic Monitoring Site

Contains Ordnance Survey Data Crown Copyright and Database Right [2015]

Air Quality
Bureau Veritas
5th Floor
66 Prescott Street
London, E1 8HG

Location	
South Holland District Council	
Title	
Automatic Monitoring Site: Sutton Bridge	
By	**Approved**
VY	
Scale	**Job Ref**
Not To Scale	6371463
Date	**Figure No.**
June 2016	**D.2**

Figure D.6 – Map of Non-Automatic Monitoring Site: Crowland

Legend

Diffusion Tube Location

Contains Ordnance Survey Data Crown Copyright and Database Right [2015]

BUREAU VERITAS

Air Quality
Bureau Veritas
5th Floor
66 Prescott Street
London, E1 8HG

Location	
South Holland District Council	
Title	
Non-Automatic Monitoring Site: Crowland	
By	**Approved**
VY	
Scale	**Job Ref**
Not To Scale	6371463
Date	**Figure No.**
June 2016	**D.3**

Figure D.7 – Map of Non-Automatic Monitoring Sites: Holbeach and Gedney

Legend

● Diffusion Tube Location

Air Quality
Bureau Veritas
5th Floor
66 Prescott Street
London, E1 8HG

Location

South Holland District Council

Title

Non-Automatic Monitoring Sites: Holbeach and Gedney

By	**Approved**
VY	
Scale	**Job Ref**
Not To Scale	6371463
Date	**Figure No.**
June 2016	**D.4**

Figure D.8 – Map of Non-Automatic Monitoring Sites: Spalding and Pinchbeck

Legend

Diffusion Tube Location

Air Quality
Bureau Veritas
5th Floor
66 Prescott Street
London, E1 8HG

Location

South Holland District Council

Title

Non-Automatic Monitoring Sites: Spalding and Pinchbeck

By	**Approved**
VY	
Scale	**Job Ref**
Not To Scale	6371463
Date	**Figure No.**
June 2016	**D.5**

Figure D.9 – Map of Non-Automatic Monitoring Sites: Donington and Surfleet

Legend
Diffusion Tube Location

Air Quality
Bureau Veritas
5th Floor
66 Prescott Street
London, E1 8HG

Location

South Holland District Council

Title

Non-Automatic Monitoring Sites: Donington and Surfleet

By	**Approved**
VY	
Scale	**Job Ref**
Not To Scale	6371463
Date	**Figure No.**
June 2016	**D.6**

Figure D.10 – Map of Non-Automatic Monitoring Sites: Sutton Bridge

Legend
● Diffusion Tube Location

Contains Ordnance Survey Data Crown Copyright and Database Right [2015]

BUREAU VERITAS

Air Quality
Bureau Veritas
5th Floor
66 Prescott Street
London, E1 8HG

Location

South Holland District Council

Title

Non-Automatic Monitoring Sites: Sutton Bridge

By	**Approved**
VY	
Scale	**Job Ref**
Not To Scale	6371463
Date	**Figure No.**
June 2016	**D.7**

Appendix E: Summary of Air Quality Objectives in England

Table E.1 – Air Quality Objectives in England

Pollutant	Air Quality Objective[4]	
	Concentration	Measured as
Nitrogen Dioxide (NO_2)	200 µg/m³ not to be exceeded more than 18 times a year	1-hour mean
	40 µg/m³	Annual mean
Particulate Matter (PM_{10})	50 µg/m³, not to be exceeded more than 35 times a year	24-hour mean
	40 µg/m³	Annual mean
Sulphur Dioxide (SO_2)	350 µg/m³, not to be exceeded more than 24 times a year	1-hour mean
	125 µg/m³, not to be exceeded more than 3 times a year	24-hour mean
	266 µg/m³, not to be exceeded more than 35 times a year	15-minute mean
Ozone (O_3)	100 µg/m³, not to be exceeded more than 10 days a year.	Maximum rolling 8 hour average in any given day.

[4] The units are in microgrammes of pollutant per cubic metre of air (µg/m³).

Glossary of Terms

Abbreviation	Description
AQAP	Air Quality Action Plan - A detailed description of measures, outcomes, achievement dates and implementation methods, showing how the local authority intends to achieve air quality limit values’
AQMA	Air Quality Management Area – An area where air pollutant concentrations exceed / are likely to exceed the relevant air quality objectives. AQMAs are declared for specific pollutants and objectives
ASR	Air quality Annual Status Report
Defra	Department for Environment, Food and Rural Affairs
EU	European Union
LAQM	Local Air Quality Management
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxides
PM_{10}	Airborne particulate matter with an aerodynamic diameter of 10µm (micrometres or microns) or less
$PM_{2.5}$	Airborne particulate matter with an aerodynamic diameter of 2.5µm or less
QA/QC	Quality Assurance and Quality Control
SO_2	Sulphur Dioxide
TEOM	Tapered Element Oscillating Microbalance
VCM	Volatile Correction Method

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