West Lindsey District Council

Annual Status Report 2018

Bureau Veritas

June 2018

Move Forward with Confidence

Document Control Sheet

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2018 Air Quality Annual Status Report (ASR)

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

June 2018

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Executive Summary: Air Quality in Our Area

Air Quality in West Lindsey 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].

Although there was an increase in the annual mean NO_2 concentration in 2017 at all sites, the concentrations of nitrogen dioxide (NO_2) recorded within the District in 2017 were well below the Air Quality Standard (AQS) objectives. There has not been a recorded exceedance of any AQS objectives within the District in the past five years. West Lindsey is mostly rural in nature and the main source of pollution is vehicle emissions from the existing road network, most notably the A15, A46 and the A631.

There are three power stations operated by EDF Energy within the neighbouring District of Bassetlaw to the west of West Lindsey; Cottam and West Burton A are both coal fired power stations, and West Burton B is a gas fired combined cycle gas turbine (CCGT) power station. Due to the close proximity of the three power stations to each other an automatic air quality monitoring station is located in Gainsborough, north to north east of the location of the power stations to continuously monitor both NO_2 and sulphur dioxide (SO_2).

There are currently no Air Quality Management Areas (AQMAs) within the District. This is due to the low concentrations that are currently, and have historically been monitored. The monitoring network is to remain in place to continually assess a number of identified areas against the AQS objectives, these locations will be reviewed in the event of a hotspot area of pollution being identified. The results show

[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

that all AQS objectives for SO_2 continue to be met at the Gainsborough Cemetery monitoring location.

Actions to Improve Air Quality

There are currently no designated AQMAs within the District and therefore an AQAP is not required. The air quality across West Lindsey is considered to be good, and as such there are no specific measures related to the control and mitigation of sources of local air pollution currently in place.

West Lindsey will continue to monitor for the coming year within the NO_2 diffusion tube network and to assess the results along with the results from the automatic monitoring station operated by EDF Energy at Gainsborough.

The adopted Central Lincolnshire Local Plan contains objectives and policies designed to minimise the impact upon local air quality from new developments.

Conclusions and Priorities

Being a rural district without any substantial urbanised areas, the pollution concentrations continue to be relatively low and monitoring will continue to ensure that any concentration trends can be identified.

West Lindsey will continue to assess new developments submitted through the planning department ensuring that any proposed developments are not detrimental to local air quality. In addition, any new industry will be permitted in line with The Environmental Permitting (England and Wales) Regulations 2010.

Local Engagement and How to get Involved

A number of initiatives can be completed by everyone to help reduce air pollution concentrations on a local scale, these include:

- Using alternative modes of transport rather than the car, walking, cycling or using public transport;
- Changes in transport modes can bring added health benefits through walking and cycling exercise; and
- Asking your employer, school or college about the possibility of developing a green travel plan.

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1 Local Air Quality Management

This report provides an overview of air quality in West Lindsey during 2017. 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 West Lindsey Council to improve air quality and any progress that has been made.

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

2 Actions to Improve Air Quality

2.1 Air Quality Management Areas

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

Currently there are no AQMAs designated within West Lindsey.

The monitoring completed within the District presented in Appendix A continues to comply with the air quality objectives, therefore no AQMA designations are proposed.

2.2 Progress and Impact of Measures to address Air Quality in West Lindsey District Council

There are several industries in the district with the potential to pollute that are controlled by Environmental Permits. These industries have their emissions controlled by a range of legally enforceable conditions. These processes are subject to regular routine inspection. The Environmental Protection team also responds to complaints regarding other air pollution issues, such as smoke nuisance from bonfires, emissions of dark smoke and offensive odours.

West Lindsey will continue to assess new developments submitted through the planning department ensuring that any proposed developments are not detrimental to local air quality. In addition, any new industry will be permitted in line with The Environmental Permitting (England and Wales) Regulations 2010.

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.

Currently there is no monitoring of $PM_{2.5}$ or PM_{10} completed within West Lindsey, therefore no concentration values can be reported or estimated using the method as described in Box 7.7 of LAQM.TG(16).

The current Defra background maps for West Lindsey (2015 based[4]) show that all background concentrations of $PM_{2.5}$ are far below the 2020 annual mean AQS objective for $PM_{2.5}$. The highest concentration is predicted to be 11.5µg/m^3 within the 1 x 1km grid square with the centroid grid reference of 481500,390500. This is an area to the northwest of Gainsborough Central.

There is currently one designated smoke control zone within West Lindsey, the Lincoln Fringe (the area between the boundary of the West Lindsey District and Lincoln bypass). Details on the smoke control area and the order governing the zone are available within the air quality section of the website for West Lindsey[5].

The Public Health Outcomes Framework data tool[6] compiled by Public Heath England quantifies the mortality burden of $PM_{2.5}$ within England on a county and local authority scale. The 2016 fraction of mortality attributable to $PM_{2.5}$ pollution across England is 5.3%, and in contrast the fraction within West Lindsey is slightly lower than the National average at 5.1%.

LAQM.TG(16) Table A.1 Action toolbox presents a list of measures that can be implemented to help reduce concentrations of $PM_{2.5}$.

[4] Defra Background Mapping data for local authorities (2015-based), available online at https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2015

[5] West Lindsey District Council, Air Quality, available online at https://www.west-lindsey.gov.uk/my-services/my-community/environment/air-quality-and-smoke-control/air-quality/

[6] Public Health Outcomes Framework, Public Health England. data tool available online at http://www.phoutcomes.info/public-health-outcomes-framework#page/0/gid/1000043/pat/6/par/E12000004/ati/101/are/E07000142

Where required West Lindsey will review any proposed actions to be implemented with the County Council Public Health team to consider the potential impact of the actions and whether any further action is required.

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.

West Lindsey District Council undertook automatic (continuous) monitoring at one site during 2017. Table A.1 in Appendix A shows the details of the site. The Gainsborough Cemetery site is operated by EDF Energy as part of a monitoring network to monitor emissions from the 'North Trent' group of power stations.

The results from the Gainsborough Cemetery monitoring site are not currently available online however national monitoring results are available at https://uk-air.defra.gov.uk/networks/.

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

West Lindsey District Council undertook non- automatic (passive) monitoring of NO_2 at 12 sites during 2017. Table A.2 in Appendix A shows the details of the sites.

Maps showing the location of the monitoring sites are provided in Appendix D. Further details on Quality Assurance/Quality Control (QA/QC) for the diffusion tubes, including bias adjustments and any other adjustments applied (e.g. "annualisation" and/or distance correction), are included in Appendix C.

3.2 Individual Pollutants

The air quality monitoring results presented in this section are, where relevant, adjusted for bias, "annualisation" and distance correction. Further details on adjustments are provided in Appendix C.

3.2.1 Nitrogen Dioxide (NO_2)

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

For diffusion tubes, the full 2017 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.

All monitoring locations continue to be well below the annual mean AQS objective for NO_2. The highest concentration in 2017 was 32.7µg/m^3, this was recorded at the diffusion tube monitoring location WL7 which is located on Lea Road in Gainsborough.

Annual mean concentration graphs for NO_2 are presented in Figure A.1. The annual mean concentration recorded at the Gainsborough Cemetery automatic monitor has remained at a relatively constant concentration since 2013. For the diffusion tube concentrations, when compared to 2016, all the sites experienced an increase in concentration. The maximum increase in annual mean NO_2 concentration was 6.1µg/m^3 recorded at WL7. All of the monitoring results were well below the AQS objective of 40µg/m^3, therefore, no fall-off distance correction is required to be undertaken.

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.

There have been no exceedances of NO_2 hourly mean objective in the last five years.

3.2.2 Sulphur Dioxide (SO_2)

Table A.5 in Appendix A compares the ratified continuous monitored SO_2 concentrations for 2017 with the air quality objectives for SO_2. The results show that all AQS objectives for SO_2 continue to be met at the Gainsborough Cemetery monitoring location.

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)
GC	Gainsborough Cemetery	Industrial	482021	289974	NO_2; SO_2	NO	Chemiluminescent; UVF	N/A	N/A	3

Notes:

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

(2) N/A if not applicable.

Table A.2 – Details of Non-Automatic Monitoring Sites

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube collocated with a Continuous Analyser?	Height (m)
WL1	19 Spring Gardens, Gainsborough	Roadside	481721	389935	NO2	NO	7.8	2.9	NO	2.75
WL2	58 Etherington Street, Gainsborough	Roadside	481688	389770	NO2	NO	20.1	1.6	NO	2.75
WL3/4/5	Gainsborough Cemetery, Gainsborough	Industrial	482021	389974	NO2	NO	N/A	13.8	YES	3
WL6	Cherry Tree, Gainsborough	Kerbside	481500	390400	NO2	NO	1.7	0.2	NO	2.75
WL7	3 Lea Road, Gainsborough	Roadside	481526	389077	NO2	NO	0	8.6	NO	2.75
WL8	Marshall Way, Gainsborough	Roadside	483062	389224	NO2	NO	11.2	15.9	NO	2.75
WL9	Lamas Leas Lane, Market Rasen	Roadside	510840	388610	NO2	NO	32.4	10.2	NO	2.75
WL10	Beeches Way, Market Rasen	Roadside	510851	388475	NO2	NO	1.2	6.9	NO	2.75
WL11	53 Caistor Rd/ Gallimore Lane, Market Rasen	Roadside	510681	389675	NO2	NO	15.1	1.7	NO	2.75
WL12	Walkerith	Rural	479811	392738	NO2	NO	51	2	NO	2.75
WL13	Heaton Street	Roadside	481555	389891	NO2	NO	5.9	2.22	NO	2.75

WL14(3)	Sykes Lane	Rural	487742	376707	NO2	NO	0	50	NO	2.5

Notes:

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

(2) N/A if not applicable.

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 2017 (%) [2]	NO_2 Annual Mean Concentration (µg/m^3) [3]				
					2013	2014	2015	2016	2017
GC	Industrial	Automatic	100	100	15.2	13.8	13.6	13.7	14.8
WL1	Roadside	Diffusion Tube	83.3	83.3	21.7	19.5	24.7	20.8	25.3
WL2	Roadside	Diffusion Tube	83.3	83.3	15.1	14.1	19.9	18.2	20.9
WL3/4/5	Industrial	Diffusion Tube	91.7	91.7	18.8	17.7	13.4	12.3	14.6
WL6	Roadside	Diffusion Tube	91.7	91.7	29.4	26.9	16.8	15.2	17.6
WL7	Roadside	Diffusion Tube	91.7	91.7	19.4	19.0	26.8	26.6	32.7
WL8	Roadside	Diffusion Tube	91.7	91.7	18.6	17.4	18.1	14.9	19.5
WL9	Roadside	Diffusion Tube	91.7	91.7	15.8	12.8	18.1	17.2	20.0
WL10	Roadside	Diffusion Tube	83.3	83.3	19.1	18.2	13.7	12.6	15.5
WL11	Roadside	Diffusion Tube	83.3	83.3	15.1	13.7	18.8	19.8	23.0
WL12	Rural	Diffusion Tube	91.7	91.7	25.4	23.7	12.7	12.7	13.2
WL13	Roadside	Diffusion Tube	91.7	91.7	28.9	24.6	24.7	21.0	26.5
WL14	Rural	Diffusion Tube	41.7	41.7	-	-	-	-	16.4

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

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

Notes:

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

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

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

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

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

Figure A.1 – Trends in Annual Mean NO_2 Concentrations

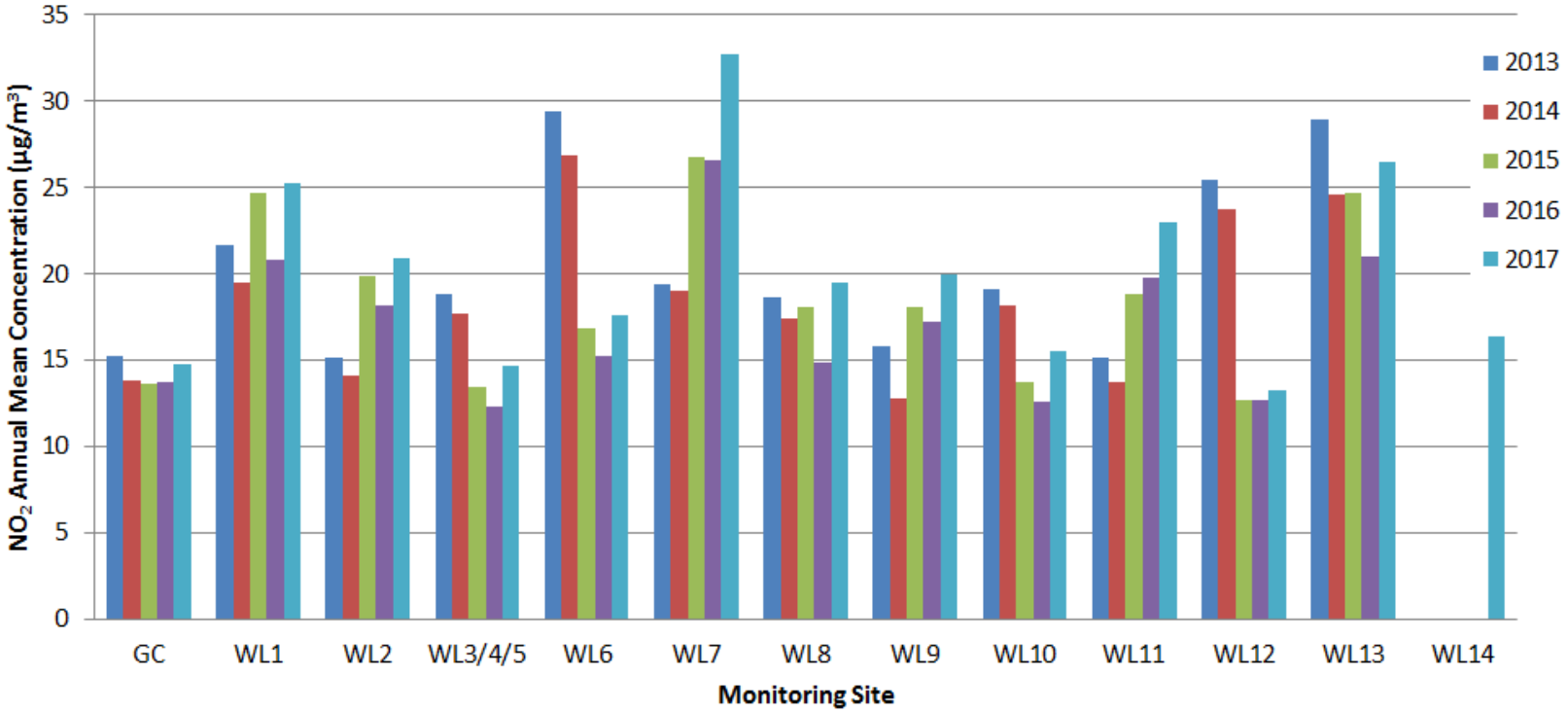


Table A.4 – 1-Hour Mean NO_2 Monitoring Results

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2017 (%) (2)	NO_2 1-Hour Means > 200µg/m^3 (3)				
					2013	2014	2015	2016	2017
GC	Industrial	Automatic	100	100	0	0	0	0 (55.4)	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 – SO_2 Monitoring Results

Site ID	Site Type	Valid Data Capture for monitoring Period (%) [1]	Valid Data Capture 2017 (%) [2]	Number of Exceedances 2017 (percentile in bracket) [3]		
				15-minute Objective (266 µg/m^3)	1-hour Objective (350 µg/m^3)	24-hour Objective (125 µg/m^3)
GC	Industrial	98	98	4	1	0

Notes:

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

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

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

(3) If the period of valid data is less than 85%, the relevant percentiles are provided in brackets.

Appendix B: Full Monthly Diffusion Tube Results for 2017

Table B.1 – NO_2 Monthly Diffusion Tube Results - 2017

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	Bias Adjusted (1.22) and Annualised (1)	Distance Corrected to Nearest Exposure (2)
WL1	12.2	24.9	22.4	20.8	-	16.9	15.8	17.0	20.3	-	29.1	27.7	20.7	25.3	-
WL2	25.8	22.1	19.2	13.4	14.6	5.2	12.8	13.3	19.3	-	25.3	-	17.1	20.9	-
WL3	19.0	16.5	11.1	8.0	8.3	8.2	7.4	7.8	10.3	-	14.6	17.6	11.7	14.3	-
WL4	24.1	15.0	10.9	8.4	8.2	7.3	8.4	6.9	10.9	-	18.6	16.2	12.3	15.0	-
WL5	19.9	14.4	13.0	11.1	8.6	7.6	7.3	7.4	10.4	-	16.6	16.2	12.0	14.7	-
WL6	19.8	19.4	15.2	11.6	9.8	9.4	9.2	8.9	11.7	-	22.0	21.8	14.4	17.6	-
WL7	37.2	28.7	26.0	25.7	21.1	19.5	22.2	28.9	21.9	-	34.7	29.0	26.8	32.7	-
WL8	24.8	19.7	14.4	13.9	11.1	10.4	10.6	10.7	14.4	-	24.6	21.5	16.0	19.5	-
WL9	26.9	20.8	14.5	13.1	13.1	11.3	11.6	12.2	13.8	-	22.6	20.5	16.4	20.0	-
WL10	21.8	14.3	10.3	10.1	8.6	9.5	8.3		10.1	-	17.5	16.6	12.7	15.5	-
WL11	24.3	20.6	18.9	17.9	-	16.2	13.9	15.7	17.4	-	26.1	17.2	18.8	23.0	-
WL12	21.0	14.3	10.4	7.9	5.9	7.5	6.5	6.5	8.5	-	15.5	15.4	10.8	13.2	-
WL13	28.2	27.6	21.0	18.0	18.4	17.6	17.0	15.7	21.4	-	27.2	26.8	21.7	26.5	-
WL14	23.0	16.4	13.4	12.4	9.6	-	-	-	-	-	-	-	15.0	16.4	-

☒ **Local bias adjustment factor used**

☐ **National bias adjustment factor used**

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

☐ **Where applicable, data has been distance corrected for relevant exposure**

Notes:

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

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

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

(2) Distance corrected to nearest relevant public exposure.

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

Diffusion Tube Local Bias Adjustment Factors

There is a set of triplicate diffusion tubes co-located with the Gainsborough Cemetery automatic monitoring station. A local bias adjustment factor of 1.22 has been calculated from the Precision and Bias Adjustment spreadsheet (v04)[7], the outputs from the spreadsheet are shown in Figure C.1 below.

Figure C.1 – Local Bias Correction Output: Gainsborough Cemetery Automatic Monitoring Station

Checking Precision and Accuracy of Triplicate Tubes

AEA Energy & Environment
From the AEA group

Diffusion Tubes Measurements										Automatic Method		Data Quality Check	
Period	Start Date dd/mm/yyyy	End Date dd/mm/yyyy	Tube 1 μgm^{-3}	Tube 2 μgm^{-3}	Tube 3 μgm^{-3}	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean	Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
1	04/01/2017	01/02/2017	19.0	24.1	19.9	21	2.8	13	6.8	25.288438	100	Good	Good
2	01/02/2017	01/03/2017	16.5	15.0	14.4	15	1.1	7	2.7	16.509759	100	Good	Good
3	01/03/2017	29/03/2017	11.1	10.9	13.0	12	1.2	10	3.0	13.053328	100	Good	Good
4	29/03/2017	26/04/2017	8.0	8.4	11.1	9	1.7	18	4.2	8.823857	95.42772861	Good	Good
5	26/04/2017	31/05/2017	8.3	8.2	8.6	8	0.2	3	0.5	10	100	Good	Good
6	31/05/2017	28/06/2017	8.2	7.3	7.6	8	0.5	6	1.1	7	100	Good	Good
7	28/06/2017	02/08/2017	7.4	8.4	7.3	8	0.6	8	1.5	10	100	Good	Good
8	02/08/2017	30/08/2017	7.8	6.9	7.4	7	0.4	6	1.1	12	100	Good	Good
9	30/08/2017	27/09/2017	10.3	10.9	10.4	11	0.3	3	0.8	14	99.84567901	Good	Good
10	27/09/2017	01/11/2017								16	100		Good
11	01/11/2017	06/12/2017	14.6	18.6	16.6	17	2.0	12	5.0	23.848253	100	Good	Good
12	06/12/2017	03/01/2018	17.6	16.2	16.2	17	0.8	5	2.0	21.123693	100	Good	Good
13													

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

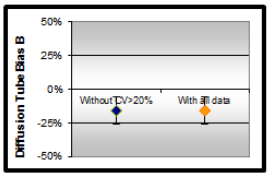
Overall survey --> Good precision | Good Overall DC

(Check average CV & DC from Accuracy calculations)

Site Name/ ID:

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

Accuracy (with 95% confidence interval) without periods with CV larger than 20%		Accuracy (with 95% confidence interval) WITH ALL DATA	
Bias calculated using 11 periods of data		Bias calculated using 11 periods of data	
Bias factor A	1.22 (1.09 - 1.39)	Bias factor A	1.22 (1.09 - 1.39)
Bias B	-18% (-28% - -8%)	Bias B	-18% (-28% - -8%)
Diffusion Tubes Mean:	12 μgm^{-3}	Diffusion Tubes Mean:	12 μgm^{-3}
Mean CV (Precision):	8	Mean CV (Precision):	8
Automatic Mean:	15 μgm^{-3}	Automatic Mean:	15 μgm^{-3}
Data Capture for periods used:	100%	Data Capture for periods used:	100%
Adjusted Tubes Mean:	15 (13 - 17) μgm^{-3}	Adjusted Tubes Mean:	15 (13 - 17) μgm^{-3}



Jaume Targa, for AEA
Version 04 - February 2011

Diffusion Tube National Bias Adjustment Factors

The diffusion tubes for the year 2017 were supplied and analysed by Gradko International Limited, the tubes were prepared using the 50% Triethanolamine (TEA) in water preparation method. The national bias adjustment factor for Gradko 50% TEA is 0.97 (based on 22 studies, version 03/18) as derived from the national bias adjustment calculator[8].

[7]

[8] National Diffusion Tube Bias Adjustment Factor Spreadsheet version 06/17 available at https://laqm.defra.gov.uk/bias-adjustment-factors/national-bias.html

Discussion of Choice of Factor to Use

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. LAQM.TG(16) provides guidance with regard to the application of a bias adjustment factor to correct diffusion tube 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[9] recommend the use of a local bias adjustment factor where available and relevant to diffusion tube sites.

The local bias adjustment factor or 1.22 derived from the co-location study at the Gainsborough Cemetery site has been used to adjust the diffusion tube data. The automatic monitor and co-located diffusion tubes recorded a high data capture (11 months data capture) within 2017 and were deemed as having good precision, therefore, it was decided to use the local bias adjustment factor of 1.22 for the 2017 diffusion tube data set.

Short-term to Long-term Data Adjustment

Data capture at all sites which recorded less than 75% data capture during 2017 has been annualised according to the method set out in LAQM TG(16) box 7.9. The details of the annualisation have been provided in Table C.1 below.

[9] Laqm.defra.gov.uk

Table C.1 – Short-Term to Long-Term Monitoring Data Adjustment

Site	Uncorrected Diffusion Tube Mean (µg/m^3)	Barnsley Gawber AF	Sheffield AF	Nottingham AF	Average AF	Annualised Data Average µg/m^3	Annualised Bias Adjusted Concentration (µg/m^3)
WL14	15	0.848	0.939	0.909	0.899	13.0	15.9

QA/QC of Diffusion Tube Monitoring

The diffusion tubes for the year 2017 were supplied and analysed by Gradko International Ltd, the tubes were prepared using the 50% TEA in acetone preparation method. All results have been bias adjusted and annualised where required before being presented in Table A.3.

Gradko is a UKAS accredited laboratory and participates in the new AIR-PT Scheme (a continuation of the Workplace Analysis Scheme for Proficiency (WASP)) for NO_2 tube analysis and the Annual Field Inter-Comparison Exercise. These provide strict performance criteria for participating laboratories to meet, thereby ensuring NO_2 concentrations reported are of a high calibre. The lab follows the procedures set out in the Harmonisation Practical Guidance In the latest available AIR-PT results, AIR-PT AR 0018 (January to February 2017), AIR-PT AR019 (April to May 2017), AIR-PT AR021 (July to August 2017), AIR-PT AR022 (September to October 2017) and AIR-PT AR24 (January to February 2018). Gradko has scored 100% on all results. The percentage score reflects the results deemed to be satisfactory based upon the z-score of < ± 2. All local Authority co-location studies in 2017 were rated as ‘good’ (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%).

Appendix D: Map(s) of Monitoring Locations and AQMAs

Figure D.1 – Map of Automatic Monitoring Location

Legend
Automatic Monitoring Site

Contains Ordnance Survey Data Crown Copyright and Database Right [2018)

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

Location

West Lindsey District Council

Title

Automatic Monitoring Site: Gainsborough Cemetery

By	Approved
FL	HS
Scale	**Job Ref**
Not To Scal	6475348
Date	**Figure No.**
May 2018	**D.1**

Figure D.2 – Map of Non-Automatic Monitoring Sites: Gainsborough

Legend
Diffusion Tube Site

Contains Ordnance Survey Data Crown Copyright and Database Right [2018]

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

Location

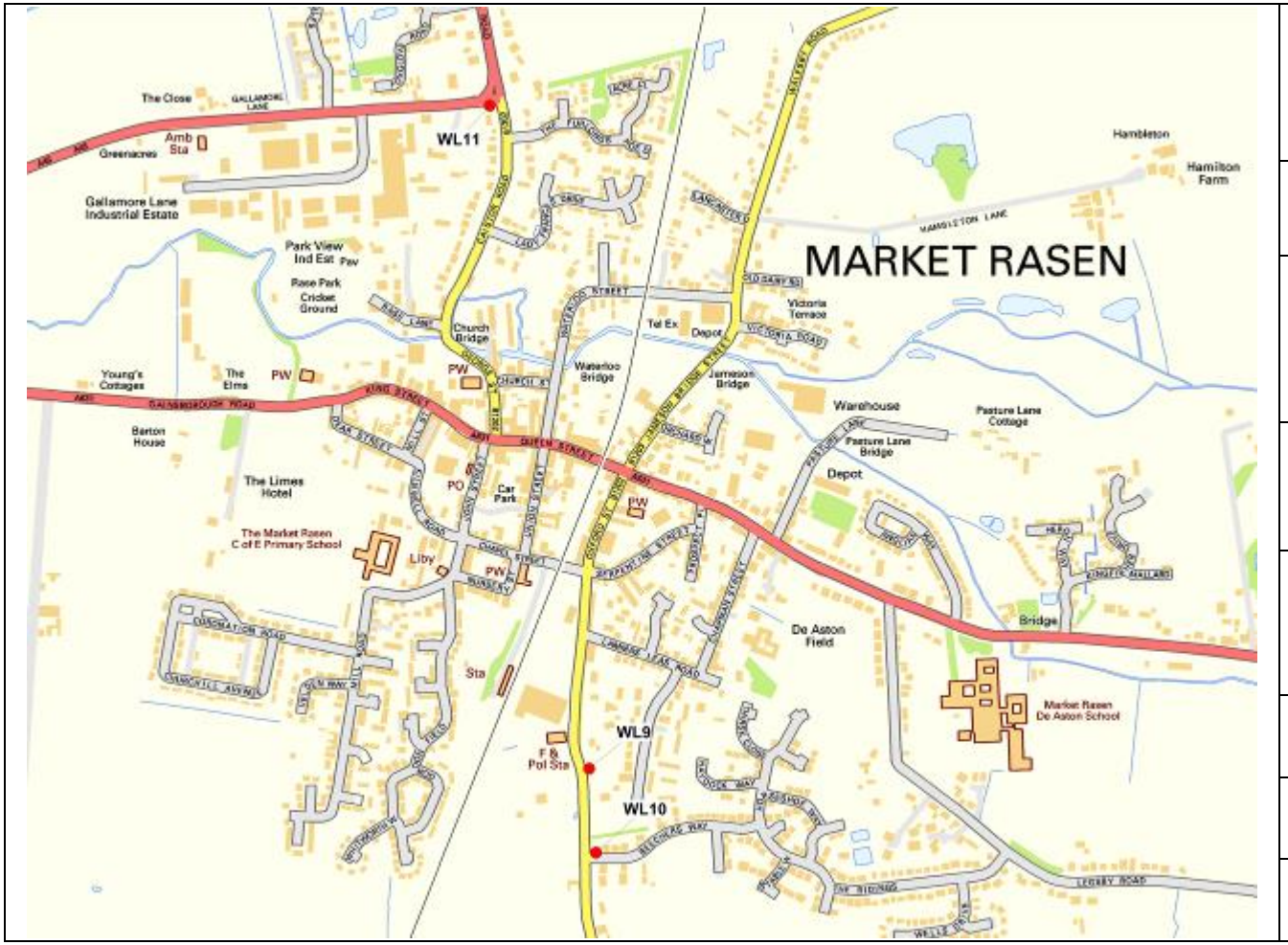
West Lindsey District Council

Title

Non-Automatic Monitoring Sites: Gainsborough

By	Approved
FL	HS
Scale	**Job Ref**
Not To Scale	6475348
Date	**Figure No.**
May 2018	**D.2**

Figure D.3 – Map of Non-Automatic Monitoring Sites: Market Rasen



Legend

Diffusion Tube Site

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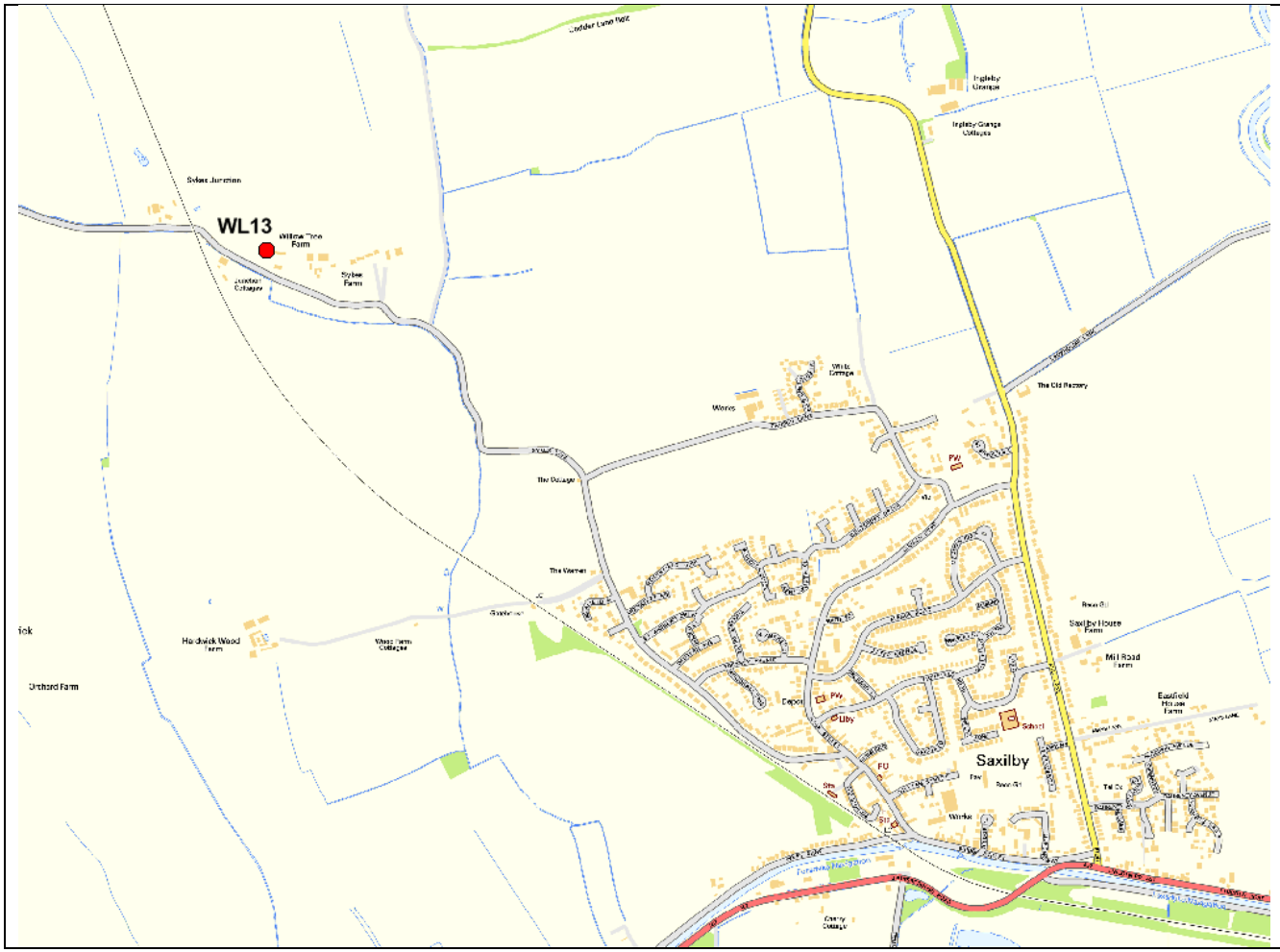
Air Quality
Bureau Veritas
5th Floor
66 Prescott Street
London, E1 8HG

Location	**West Lindsey District Council**
Title	**Non-Automatic Monitoring Sites: Market Rasen**
By FL	**Approved** HS
Scale Not To Scale	**Job Ref** 6475348
Date May 2018	**Figure No.** **D.3**

Figure D.4 – Map of Non-Automatic Monitoring Sites: Sykes Lane



Legend

Diffusion Tube Site

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

Location

West Lindsey District Council

Title

Non-Automatic Monitoring Sites: Sykes Lane

By	Approved
FL	HS
Scale	**Job Ref**
Not To Scale	6475348
Date	**Figure No.**
May 2018	**D.4**

Appendix E: Summary of Air Quality Objectives in England

Table E.1 – Air Quality Objectives in England

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

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

Glossary of Terms

Abbreviation	Description
AQAP	Air Quality Action Plan - A detailed description of measures, outcomes, achievement dates and implementation methods, showing how the local authority intends to achieve air quality limit values'
AQMA	Air Quality Management Area – An area where air pollutant concentrations exceed / are likely to exceed the relevant air quality objectives. AQMAs are declared for specific pollutants and objectives
ASR	Air quality Annual Status Report
Defra	Department for Environment, Food and Rural Affairs
DMRB	Design Manual for Roads and Bridges – Air quality screening tool produced by Highways England
EU	European Union
FDMS	Filter Dynamics Measurement System
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

References

- Local Air Quality Management Technical Guidance LAQM.TG(16). Feburary 2018. Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland.
- Local Air Quality Management Policy Guidance LAQM.PG(16). May 2016. Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland.
- West Lindsey District Council, 2017 Annual Status Report.
- Central Lincolnshire Local Plan, Adopted April 2017.
- National Diffusion Tube Bias Adjustment Factor Spreadsheet, version 03/18 published in March 2018.