West Lindsey District Council
Annual Status Report 2020

Bureau Veritas

June, 2020

Move Forward with Confidence

Document Control Sheet

Identification	
Client	West Lindsey District Council
Document Title	West Lindsey 2019 Annual Status Report
Bureau Veritas Ref No.	7726905/UK/v1.0

Contact Details		
Company Name	Bureau Veritas UK Limited	West Lindsey District Council
Contact Name	[redacted]	[redacted]
Position	[redacted]	[redacted]
Address	[redacted]	[redacted]

Configuration				
Version	**Date**	**Author**	**Reason for Issue/Summary of Changes**	**Status**
1.0	30/06/20	[redacted]	Draft for comment	Draft
1.0	30/06/20	[redacted]	Final Issue	Final

	Name	Job Title	Signature
Prepared By	[redacted]	[redacted]	[redacted]
Reviewed By	[redacted]	[redacted]	[redacted]

Disclaimer

This Report was completed by Bureau Veritas on the basis of a defined programme of work and terms and conditions agreed with the Client. Bureau Veritas confirms that in preparing this Report it has exercised all reasonable skill and care taking into account the project objectives, the agreed scope of works, prevailing site conditions and the degree of manpower and resources allocated to the project

Bureau Veritas accepts no responsibility to any parties whatsoever, following the issue of the Report, for any matters arising outside the agreed scope of the works.

This Report is issued in confidence to the Client and Bureau Veritas has no responsibility to any third parties to whom this Report may be circulated, in part or in full, and any such parties rely on the contents of the report solely at their own risk Unless specifically assigned or transferred within the terms of the agreement, the consultant asserts and retains all Copyright, and other Intellectual Property Rights, in and over the Report and its contents.

Any questions or matters arising from this Report should be addressed in the first instance to the Project Manager

Bureau Veritas UK Limited
5th Floor, 66 Prescot Street
London
E1 8HA

Telephone: +44 (0) 207 6610700
Fax: +44 (0) 207 6610741
Registered in England 1758622
www.bureauveritas.co.uk

Registered Office
Suite 206 Fort Dunlop
Fort Parkway
Birmingham B24 9FD

2020 Air Quality Annual Status Report (ASR)

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

June 2020

Local Authority Officer	[redacted]
Department	Housing and Environmental Enforcement
Address	West Lindsey District Council Guildhall Marshall's Yard Gainsborough Lincolnshire DN21 2NA
Telephone	[redacted]
E-mail	[redacted]
Report Reference number	7726905/UK/v1 0
Date	June 2020

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]

In 2019, the annual nitrogen dioxide (NO_2) concentrations recorded within West Lindsey District Council have all shown to be well below the Air Quality Strategy (AQS) objectives. A new diffusion tube location was deployed at the start of 2019, WL14 This site has been deployed as it has been identified as a typically congested junction, however the 2019 concentration reported is also well below the AQS objectives. This site did however report the highest concentration in West Lindsey. There has not been a recorded exceedance of any AQS objective 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, located north to north east of the power stations. This has been put in place in order to continuously monitor both NO_2 and sulphur dioxide (SO_2), which are produced by such industrial activities

[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

For the second year running, the automatic monitor at Gainsborough Cemetery has reported much lower NO_2 concentrations than previous years, and lower than the co-located diffusion tubes. This resulted in a low local bias adjustment factor which is not likely to be representative of the other roadside diffusion tube locations throughout West Lindsey This is largely due to the co-location site being situated in an industrial setting, whereas the majority of diffusion tubes throughout West Lindsey are situated at roadside locations. The national bias adjustment factor was applied to the 2019 monitoring data as it takes the more conservative approach by using a the higher factor.

There are currently no Air Quality Management Areas (AQMAs) within the Council's designation This is due to the continuously low concentrations that are currently, and also have been historically, 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 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 those 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. This can be accessed at: https://www west-lindsey gov uk/my-services/planning-and-building/planning policy/central lincolnshire local plan/

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 so as to ensure that any proposed developments are not detrimental to local air quality In addition, any new industrial processes will be regulated in line with The Environmental Permitting (England and Wales) Regulations 2016 (as amended).

Additionally, an investigation will be carried out in association with EDF in 2020 in order to determine the cause of the recent decrease in concentrations detected at the Gainsborough Cemetery continuous monitor relative to the co-located diffusion tubes.

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

Table of Contents

List of Tables

List of Figures

1 Local Air Quality Management

This report provides an overview of air quality in West Lindsey during 2019 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 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.

West Lindsey currently does not have any designated AQMAs. For reference, a map of West Lindsey's monitoring locations is available in Appendix D

The monitoring completed within the District presented in Appendix A continues to comply with the Air Quality Strategy (AQS) objectives, therefore no AQMA designations are proposed

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

Defra's appraisal of last year's ASR concluded that:

- *"The West Lindsey area enjoys very good air quality with no exceedances of the national Air Quality Strategy (AQS) objectives, for the pollutants monitored, NO_2 and SO_2;*
- *Trends are clearly presented within Figure A.1, but causality for the notable fluctuations within the data could have been more thoroughly discussed A robust comparison with air quality objectives is however provided;*
- *The discussion around the appropriate application of local vs national bias is well considered, and it is agreed that the more robust course of action was applied;*
- *The report contained some minor formatting errors, for example subscripting pollutant abbreviations; and*
- *Outcomes and the appraisal of the previous ASR could have been discussed in relation to progress, if it had been appraised, or any conclusions/outcomes which have been addressed or changed in light of the new data."*

Due to West Lindsey being a rural district without any substantial urbanised areas, the pollution concentrations are relatively low and few measures are required to control this Despite this, 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. Whilst Part A1 processes are subject to regulation by the Environment Agency, Part A2 and Part B processes are subject to regular routine inspection by the Council. 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

Monitoring of pollutants continues to ensure that any increase in concentration trends can be identified, as well as facilitating the review of areas believed to be at most risk of exceeding the AQS objectives West Lindsey continues 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

industrial processes will be regulated in line with the Environmental Permitting (England and Wales) Regulations 2016 (as amended)

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), which provides a method for estimating $PM_{2.5}$ concentrations from PM_{10} measurements

The current Defra background maps for West Lindsey (2017 reference year) show that all 2019 background concentrations of $PM_{2\,5}$ are far below the recommended 2020 annual mean AQS objective for $PM_{2.5}$ of 25µg/m^3 The highest concentration is predicted to be 9 0µg/m^3 within the 1km x 1km grid square with the centroid grid reference of 497500, 374500. This is an area to the north of Lincoln close to the A46 and A15.

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). Smoke control zones are a defined geographical region within which smoke cannot be legally emitted from a chimney, unless using authorised fuels or using exempt appliances. Further information is available via the following link: https://www.west-lindsey.gov.uk/my-services/my-community/environment/air-quality-and-smoke-control/smoke-control-zones/

The Public Health Outcomes Framework data tool[4] compiled by Public Heath England quantifies the mortality burden of $PM_{2\,5}$ within England on a county and local authority scale The 2018 fraction of mortality attributable to $PM_{2.5}$ pollution across

[4] Public Health Outcomes Framework Tool, published by Public Health England Available at: https://fingertips phe.org uk/profile/public-health-outcomes-framework

England is 5 2%, and in contrast the fraction within West Lindsey is lower than the national average, at 4 9%

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

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.

Relevant automatic (continuous) monitoring was carried out in West Lindsey at one site during 2019 Table A 1 in Appendix A shows the details of the sites The Gainsborough Cemetery site is operated by EDF Energy as part of a monitoring network to assess emissions from the 'North Trent' group of power stations. The results from the Gainsborough Cemetery monitoring site are not currently available online.

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 undertook non-automatic (passive) monitoring of NO_2 at 12 sites during 2019 Table A 2 in Appendix A shows the details of the sites An additional site was added in 2019 – WL14. This site is located on Queen Street by a busy junction, and was deployed in order to identify if the congestion in this area causes an exceedance of the annual mean NO_2 AQS objective

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 and consideration as to the selection of an appropriate bias adjustment factor) are included in Appendix C

3.2 Individual Pollutants

The air quality monitoring results presented in this section are, where relevant, adjusted for bias[5], "annualisation" (where the data capture falls below 75%), and distance correction[6] 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 Note that the concentration data presented in Table A 3 represents the concentration at the location of the monitoring site, following the application of bias adjustment and annualisation, as required (i.e. the values are exclusive of any consideration to fall-off with distance adjustment)

For diffusion tubes, the full 2019 dataset of monthly mean values is provided in Appendix B. Note that the concentration data presented in Table B.1 includes distance corrected values, only where relevant

All monitoring locations continue to record NO_2 concentrations well below the annual mean AQS objective for NO_2, inclusive of WL14 which was deployed in 2019. Following bias adjustment, the highest concentration in 2019 was 28 8µg/m^3, recorded at the diffusion tube monitoring location WL14 which is located on Queen Street in Market Rasen.

Annual mean concentration graphs for NO_2 are presented in Figure A.1. In 2018, the annual mean concentration recorded at the Gainsborough Cemetery automatic monitor showed a significant drop comparing to previous years. There was some uncertainty however with regards to the drop in NO_2 concentrations at this site due to the co-located diffusion tubes not showing a comparable substantial reduction; however the 2019 annual mean concentration is similar to that of 2018 for both the continuous and passive annual means. Similar to 2018, the concentrations recorded by the co-located diffusion tubes at this site have again not shown a notable drop in 2019, relative to the continuous monitoring dataset for which the 2019 annual mean concentration has again remained lower than previous years. There have been no external changes to the site which could be attributable for this decrease, and

[5] https://laqm defra.gov uk/bias-adjustment-factors/bias-adjustment html
[6] Fall-off with distance correction criteria is provided in paragraph 7 77, LAQM.TG(16)

therefore an investigation shall be undertaken in association with EDF during 2020 to determine the cause for this

For the diffusion tube concentrations, most have shown a decrease compared to previous years or have remained relatively consistent, with the exception of WL2 which has shown a slight increase of 0.4µg/m^3 The decreasing concentrations are likely a result of naturally improving vehicle fleets. 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 The highest 1 hour concentration measured at site GC during 2019 was 50 8µg/m^3 Further, there were no recorded exceedances of the 1 hour AQS objective in the last 5 years.

In addition to the direct measurements made at the continuous monitoring site GC, it is possible to infer the risk of the 1 hour AQS objective at the diffusion tube monitoring sites. LAQM.TG(16) provides an empirical relationship that states exceedances of the 1 hour objective are unlikely when the annual mean concentration is below 60µg/m^3 Given that the highest recorded annual mean concentration at any of the diffusion tube monitoring sites is 28 8µg/m^3, it is possible to conclude that there have been no exceedances of the NO_2 hourly mean objective in the last five years at these locations

3.2.2 Sulphur Dioxide (SO_2)

Table A.5 in Appendix A compares the ratified continuous monitored SO_2 concentrations for 2019 with the air quality objectives for SO_2. The SO_2 AQS Objectives are as follows; 15 minute mean of 266µg/m^3 not to be exceeded more than 35 times a year, 1 hour mean of 350µg/m^3 not to be exceeded more than 24 times a year, and 24 hour mean of 125µg/m^3 not to be exceeded more than 3 times a year. There were no reported exceedances of the 15 minute, 1 hour or 24 hour AQS objectives recorded at the continuous monitor site GC during 2019, with the maximum 15 minute, 1 hour and 24 hour SO_2 average concentrations being recorded as 44.2µg/m^3, 20.7µg/m^3 and 5.1µg/m^3 respectively.

Appendix A: Monitoring Results

Table A.1 - Details of Automatic Monitoring Sites

Site ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	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 (Easting)	Y OS Grid Ref (Northing)	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	3 Lea Road, Gainsborough	Roadside	481526	389077	NO_2	NO	0	8.6	NO	2.75
WL2	58 Etherington Street, Gainsborough	Roadside	481688	389770	NO_2	NO	20.1	1.6	NO	2.75
WL3	19 Spring Gardens, Gainsborough	Roadside	481721	389935	NO_2	NO	7.8	2.9	NO	2.75
WL4	Heaton Street	Roadside	481555	389891	NO_2	NO	5.9	2.22	NO	2.75
WL5/6/7	Gainsborough Cemetery, Gainsborough	Industrial	482021	389974	NO_2	NO	N/A	13.8	YES	3
WL8	Cherry Tree, Gainsborough	Kerbside	481500	390400	NO_2	NO	1.7	0.2	NO	2.75
WL9	Walkerith	Rural	479811	392738	NO_2	NO	51	2	NO	2.75
WL10	Marshall Way, Gainsborough	Roadside	483062	389224	NO_2	NO	11.2	15.9	NO	2.75
WL11	53 Caistor Rd/ Galamore Lane, Market Rasen	Roadside	510681	389675	NO_2	NO	15.1	1.7	NO	2.75
WL12	Lammas Leas Lane, Market Rasen	Roadside	510840	388610	NO_2	NO	32.4	10.2	NO	2.75
WL13	Beechers Way, Market Rasen	Roadside	510851	388475	NO_2	NO	1.2	6.9	NO	2.75
WL14	Queen Street	Roadside	510866	389106	NO_2	NO	2	2	NO	2.75

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.3 – Annual Mean NO_2 Monitoring Results

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2019 (%) (2)	NO_2 Annual Mean Concentration ($\mu g/m^3$) (3) (4)				
							2015	2016	2017	2018	2019
GC	482021	289974	Industrial	Automatic	98.3	98.3	13.6	13.7	14.8	6.9	7.5
WL1	481526	389077	Roadside	Diffusion Tube	100.00	100.0	26.8	26.6	32.7	24.6	22.8
WL2	481688	389770	Roadside	Diffusion Tube	100.0	100.0	19.9	18.2	20.9	18.6	19.0
WL3	481721	389935	Roadside	Diffusion Tube	83.3	83.3	24.7	20.8	25.3	20.6	17.3
WL4	481555	389891	Roadside	Diffusion Tube	75.0	75.0	24.7	21	26.5	21.4	20.7
WL5/6/7	482021	389974	Industrial	Diffusion Tube	100.0	100.0	13.4	12.3	14.6	11.5	11.3
WL8	481500	390400	Kerbside	Diffusion Tube	100.0	100.0	16.8	15.2	17.6	15	14.7
WL9	479811	392738	Rural	Diffusion Tube	100.0	100.0	12.7	12.7	13.2	11.7	11.5
WL10	483062	389224	Roadside	Diffusion Tube	100.0	100.0	18.1	14.9	19.5	16.8	15.0
WL11	510681	389675	Roadside	Diffusion Tube	83.3	83.3	18.8	19.8	23	17.1	16.3
WL12	510840	388610	Roadside	Diffusion Tube	100.0	100.0	18.1	17.2	20	17.2	14.8
WL13	510851	388475	Roadside	Diffusion Tube	91.7	91.7	13.7	12.6	15.5	12.8	12.3
WL14	510866	389106	Roadside	Diffusion Tube	100.0	100.0	-	-	-	-	28.8

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

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

☒ **Reported concentrations are those at the location of the monitoring site (bias adjusted and annualised, as required), i.e. prior to any fall-off with distance adjustment**

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. No annualisation was required due to data capture exceeding the minimum threshold. See Appendix C for details.

(4) Concentrations are those at the location of monitoring and not those following any fall-off with distance adjustment.

Figure A.1 – Trends in Annual Mean NO_2 Concentrations

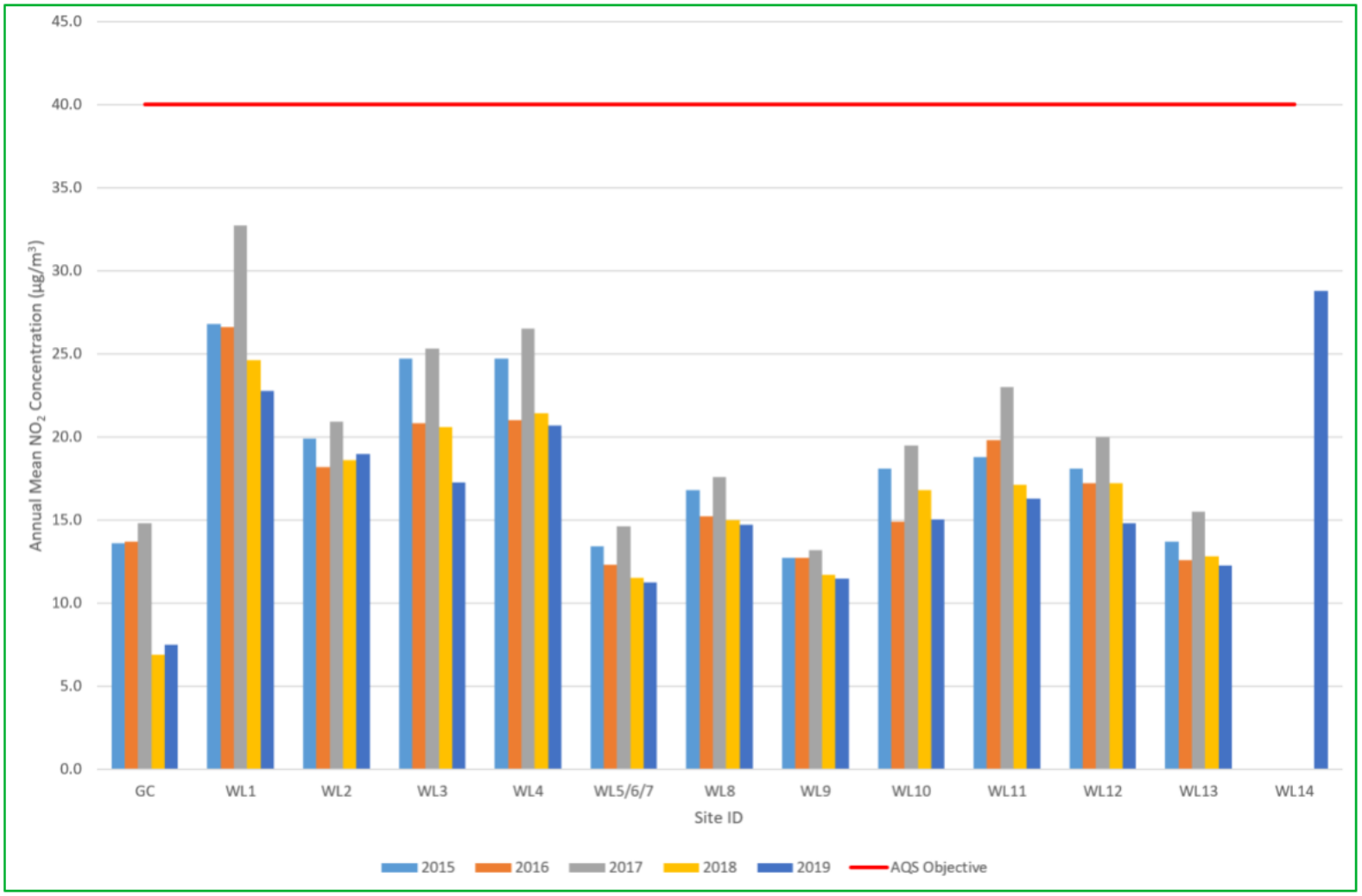


Table A.4 – 1-Hour Mean NO_2 Monitoring Results

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2019 (%) (2)	NO_2 1-Hour Means > 200µg/m^3 (3)				
							2015	2016	2017	2018	2019
GC	482021	289974	Industrial	Automatic	98.3	98.3	0	0	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 – SO_2 Monitoring Results

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for monitoring Period (%) [1]	Valid Data Capture 2019 (%) [2]	Number of Exceedances 2019 (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	482021	289974	Industrial	87.2	87.2	0	0	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 2019

Table B.1 - NO_2 Monthly Diffusion Tube Results - 2019

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	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 (0.87) and Annualised (1)	Distance Corrected to Nearest Exposure (2)
WT 1	481526	389077	36.5	28.8	27.8	24.2	25.0	23.0	22.1	19.1	24.9	27.9	31.2	23.2	26.2	22.8	-
WT 2	481688	389770	25.1	30.1	19.0	16.8	15.5	14.8	14.4	14.8	17.4	20.5	48.2	25.2	21.8	19.0	-
WT 3	481721	389935	33.6	30.8	20.6	16.2	13.4	15.0	14.0	15.5	18.5	20.8			19.8	17.3	-
WT 4	481555	389891	32.7	29.5	20.0		18.2		16.7	15.2		22.4	32.2	27.1	23.8	20.7	-
WT 5	482021	389974	20.3	19.4	12.8	8.9	9.6	7.7	8.1	9.7	11.6	12.5	18.2	16.4	12.9		
WT 6	482021	389974	24.1	22.2	12.3	10.3	8.6	7.4	9.3	9.1	12.7	13.1	20.0	15.7	13.7	11.3	-
WT 7	482021	389974	20.1	18.6	12.9	8.8	8.4	2.1	8.3	8.5	11.2	12.0	18.5	16.4	12.1		
WT 8	481500	390400	28.5	25.4	16.8	12.3	10.4	9.7	10.1	12.2	14.1	17.2	24.6	21.4	16.9	14.7	-
WT 9	479811	392738	22.4	19.6	12.0	10.6	7.5	7.4	7.3	7.3	9.1	11.4	17.3	26.3	13.2	11.5	-
WT 10	483062	389224	23.6	23.0	17.6	11.1	12.1	11.8	11.6	13.4	17.0	18.1	26.1	21.9	17.3	15.0	-
WT 11	510681	389675	23.9	29.9	19.0			16.7	14.8	12.9	12.9	16.8	22.0	18.2	18.7	16.3	-
WT 12	510840	388610	21.5	20.7	16.4	15.9	12.6	12.0	13.4	13.5	14.8	19.1	24.0	20.4	17.0	14.8	-
WT 13	510851	388475	22.5	20.0	14.1	8.4	9.5	8.3	9.5		12.4	13.7	19.8	17.0	14.1	12.3	-
WT 14	510866	389106	39.2	28.6	28.9	41.3	37.8	34.7	28.8	28.3	31.1	24.3	45.4	28.6	33.1	28.8	-

☐ **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 in the final column**

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. No annualisation was required due to data capture exceeding the minimum threshold.

(2) Distance correction is not required due to annual mean concentrations being below the threshold as stated in TG16 for required distance correction, i.e. 36µg/m^3 or above.

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. The local bias adjustment factor is calculated from the Precision and Bias Adjustment spreadsheet (v04) and the output of the calculation is shown in Figure C 1 below The estimated value is 0.58, with one period having poor precision.

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

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	09/01/2019	06/02/2019	20.3	24.1	20.1	22	2.3	11	5.6
2	06/02/2019	05/03/2019	19.4	22.2	18.6	20	1.9	9	4.7
3	05/03/2019	03/04/2019	12.8	12.3	12.9	13	0.3	2	0.7
4	03/04/2019	01/05/2019	8.9	10.3	8.8	9	0.8	9	2.1
5	01/05/2019	13/06/2019	9.6	8.6	8.4	9	0.6	7	1.6
6	13/06/2019	05/07/2019	7.7	7.4	2.1	6	3.2	56	7.9
7	05/07/2019	09/08/2019	8.1	9.3	8.3	9	0.7	8	1.6
8	09/08/2019	04/09/2019	9.7	9.1	8.5	9	0.6	6	1.5
9	04/09/2019	02/10/2019	11.6	12.7	11.2	12	0.8	7	2.0
10	02/10/2019	06/11/2019	12.5	13.1	12.0	13	0.6	5	1.5
11	06/11/2019	04/12/2019	18.2	20.0	18.5	19	1.0	5	2.4
12	04/12/2019	09/01/2020	16.4	15.7	16.4	16	0.4	3	1.1
13									

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

Automatic Method		Data Quality Check	
Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
14.3	98	Good	Good
10.9	99	Good	Good
7.1	100	Good	Good
5.6	100	Good	Good
4.6	97	Good	Good
3.4	96	Poor Precision	Good
6.0	100	Good	Good
6.1	100	Good	Good
7.4	100	Good	Good
7.9	100	Good	Good
9.1	100	Good	Good
7.0	91	Good	Good
Overall survey -->		Good precision	Good Overall DC

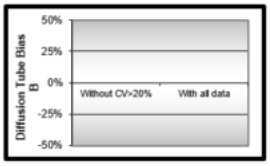
(Check average CV & DC from Accuracy calculations)

Site Name/ ID:

Precision: 11 out of 12 periods have a CV smaller than 20%

Accuracy (with 95% confidence interval) without periods with CV larger than 20%	
Bias calculated using 11 periods of data	
Bias factor A	0.58 (0.52 - 0.64)
Bias B	74% (55% - 92%)
Diffusion Tubes Mean:	14 µgm^{-3}
Mean CV (Precision):	7
Automatic Mean:	8 µgm^{-3}
Data Capture for periods used:	99%
Adjusted Tubes Mean:	8 (7 - 9) µgm^{-3}

Accuracy (with 95% confidence interval) WITH ALL DATA	
Bias calculated using 12 periods of data	
Bias factor A	0.58 (0.52 - 0.64)
Bias B	74% (56% - 91%)
Diffusion Tubes Mean:	13 µgm^{-3}
Mean CV (Precision):	11 caution
Automatic Mean:	7 µgm^{-3}
Data Capture for periods used:	98%
Adjusted Tubes Mean:	8 (7 - 8) µgm^{-3}



Jaume Targa, for AEA
Version 04 - February 2011

Diffusion Tube National Bias Adjustment Factors

The diffusion tubes for the year 2019 were supplied and analysed by Gradko International Limited, with the tubes prepared using the 50% Triethanolamine (TEA) in water preparation method The national bias adjustment factor for Gradko 50% TEA is 0 87 as derived from the national bias adjustment calculator[7], based upon 8 studies

Discussion of Choice of Factor to Use

[7] National Diffusion Tube Bias Adjustment Factor Spreadsheet version 03/20 available at https://laqm.defra.gov.uk/bias-adjustment-factors/national-bias.html

The diffusion tube data has been corrected using a bias adjustment factor, which is an estimate of the difference between concentrations measured by diffusion tube relative to continuous monitoring, the latter typically 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[8] recommend the use of a local bias adjustment factor where available and relevant to diffusion tube sites. This is however dependent on numerous caveats, including for example the data capture for the local co-location study, the precision of the factor, and whether the diffusion tubes are exposed under different settings than the co-location site

Given the fact that the local bias adjustment factor calculated from the Precision and Bias Adjustment spreadsheet (v04) (0.58) is much lower than the national bias adjustment factor (0 87), alongside the co-location site being located in an industrial setting whereas the majority of diffusion tubes in West Lindsey are situated at roadside locations, the conservative approach of applying the national factor to the 2019 monitoring data has been taken forwards Furthermore, the automatic monitoring station at Gainsborough Cemetery has reported much lower concentrations than what was expected for the second year in a row, relative to previous years and the concentrations reported from the co-located diffusion tubes. Therefore there is some uncertainty with regards to the accuracy of the 2019 automatic monitoring results

QA/QC of Diffusion Tube Monitoring

The diffusion tubes for the year 2019 were supplied and analysed by Gradko International Ltd, with tubes prepared using the 50% TEA in acetone preparation method All results have been bias adjusted before being presented in Table A 3

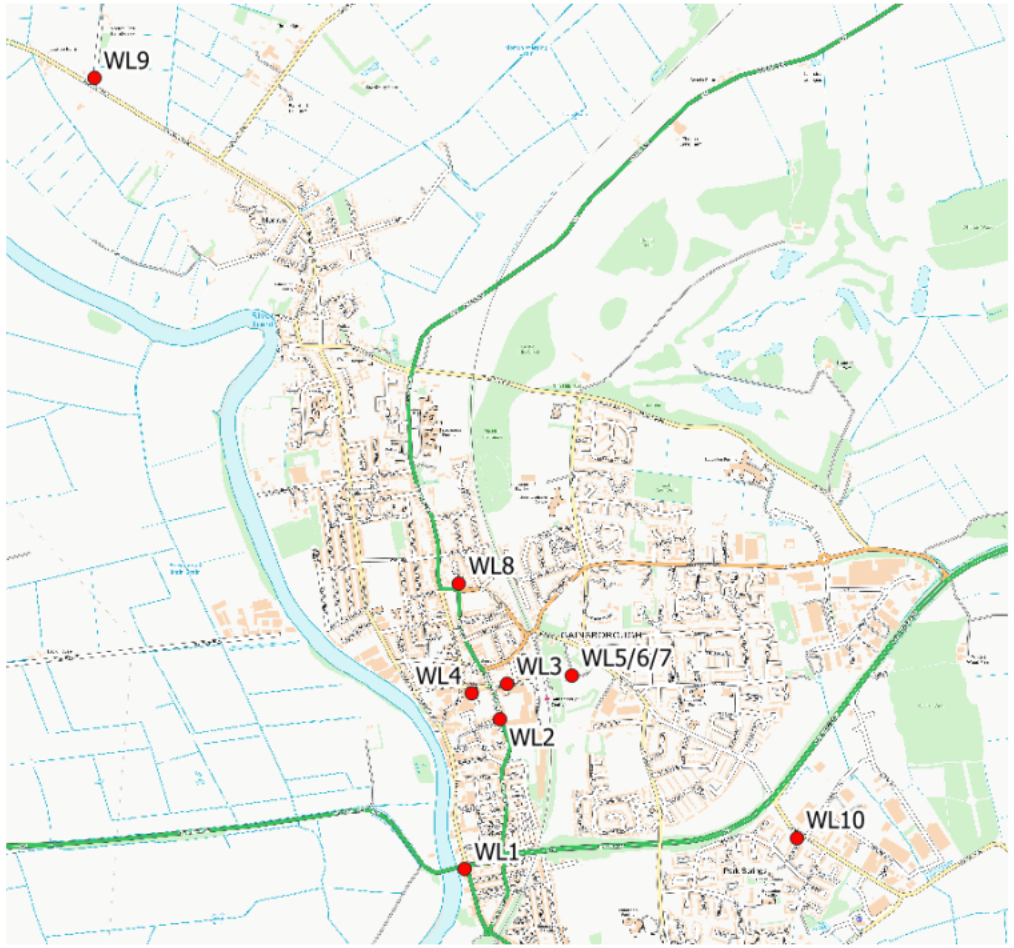
[8] Laqm.defra.gov.uk

Gradko International Ltd is a UKAS accredited laboratory and participates in the AIR-PT Scheme (a continuation of the former 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 2018 AIR-PT results, AIR-PT AR030 (January – February 2019) Gradko scored 75%, however for the AIR-PT AR031 (April – May 2019), AR033 (July – August 2019) and AR034 (September – November 2019) Gradko scored 100%. The percentage score reflects the results deemed to be satisfactory based upon the z-score of < ±2.

Additionally, the precision of the NO_2 diffusion tubes supplied by Gradko International Ltd has been classified as 'good' for all observations during 2019 This precision reflects the laboratory's performance and consistency in preparing and analysing the tubes, as well as the subsequent handling of the tubes in the field. Precision summary results are available from the LAQM website, at: https://laqm.defra.gov.uk/diffusion-tubes/precision.html.

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

Figure D.1 – Monitoring Locations: Gainsborough



Legend
Diffusion Tube Site

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

Location

West Lindsey District Council

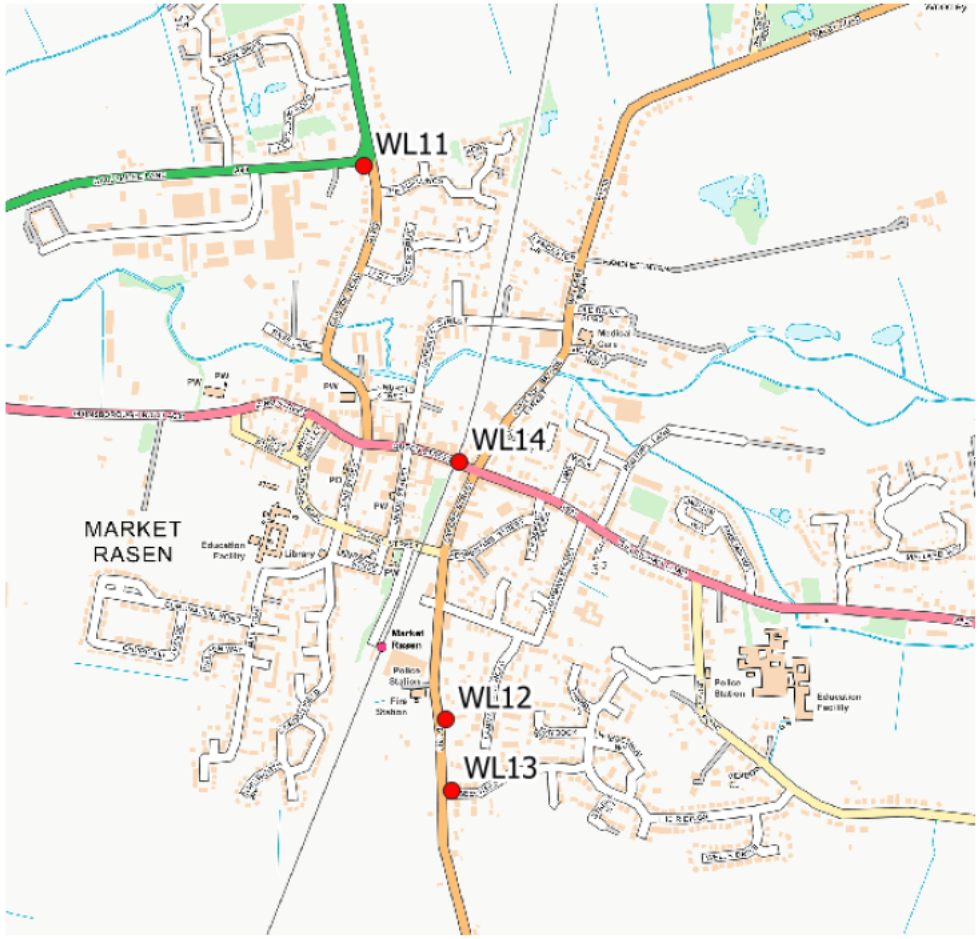
Title

Monitoring Locations: Gainsborough

By	Approved
AS	AW
Scale	**Job Ref**
Not To Scale	7726905
Date	**Figure No.**
June 2020	D.1

Note: Continuous monitor GC is co-located at Diffusion Tube Site WL5/6/7

Figure D.2 – Monitoring Locations: Market Rasen



Legend
Diffusion Tube Site

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

Location	West Lindsey District Council
Title	Monitoring Locations: Market Rasen
By AS	**Approved** AW
Scale Not To Scale	**Job Ref** 7726905
Date June 2020	**Figure No.** D.2

Appendix E: Summary of Air Quality Objectives in England

Table E.1 – Air Quality Objectives in England

Pollutant	Air Quality Objective[9]	
	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

[9] 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
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

References

- Local Air Quality Management Technical Guidance LAQM.TG(16). February 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, 2019 Annual Status Report.
- West Lindsey District Council, 2018 Annual Status Report
- Central Lincolnshire Local Plan, Adopted April 2017.
- National Diffusion Tube Bias Adjustment Factor Spreadsheet, version 03/20 published in March 2020.