

A46 Newark Bypass

TR010065/APP/6.3

6.3 Environmental Statement

Appendix 5.3 Air Quality Monitoring Report

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A46 Newark Bypass

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ENVIRONMENTAL STATEMENT

APPENDIX 5.3 AIR QUALITY MONITORING REPORT

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1 Air Quality Monitoring Report

1.1 Introduction

- 1.1.1 A six-month Scheme-specific monitoring survey of nitrogen dioxide (NO₂) concentrations has been undertaken for 27 sites along the Scheme corridor and surrounding area between May and November 2022. The results have been used to supplement local authority monitoring data for Newark & Sherwood District Council to inform the baseline and to verify the detailed dispersion modelling assessment, which is detailed further in Appendix 5.4 (Air Quality Model Verification Report) of the Environmental Statement (ES) Appendices **(TR010065/APP/6.3)**.

1.2 Methodology

- 1.2.1 NO₂ concentrations were monitored using Palmes diffusion tubes. These are plastic tubes that work through passive diffusion of compounds from the surrounding air. They are best suited for long-term monitoring to provide sufficient time for enough NO₂ to be absorbed into the gauze within the tube for analysis.
- 1.2.2 The diffusion tubes were exposed by taking the cap off one end and securing it at a monitoring location for approximately one month at a time. The tubes include a triethanolamine (TEA) coated mesh which absorbs NO₂ and converts it to nitrite (NO₂-), which were prepared and analysed by Staffordshire Scientific Services to provide a mean NO₂ concentration for the monitoring period. This process was repeated for each month of the monitoring period.
- 1.2.3 Monitoring sites were selected based on their proximity to major roads and junctions likely to be affected by the Scheme and at locations where sensitive receptors are present. The location of each monitoring site is shown in Table 5-8 contained within Chapter 5 (Air Quality) of the ES **(TR010065/APP/6.1)** and Figure 5.6 (Air Quality Monitoring Locations) of the ES Figures **(TR010065/APP/6.2)**.
- 1.2.4 The raw data obtained from the six-month diffusion tube survey was annualised and bias adjusted to enable comparison with the annual mean NO₂ objective. The methodology behind the adjustment process is outlined in Section 1.5.

1.3 Monitoring dates

1.3.1 Monitoring was undertaken at 27 locations, between 25 May and 15 November 2022. The diffusion tubes were changed each month between these dates. The start and end dates, and length of exposure, of each of the monitoring periods are presented in Table 1-1 below. Time-weighted concentrations have been calculated for each of the monitoring periods, to account for variations in the length of exposure.

Table 1-1: Diffusion tube exposure periods

Monitoring period	Start date	End date	Length of exposure (number of days)
1	25/05/2022	24/06/2022	30
2	24/06/2022	22/07/2022	28
3	22/07/2022	19/08/2022	28
4	19/08/2022	21/09/2022	33
5	21/09/2022	19/10/2022	28
6	19/10/2022	15/11/2022	27

1.4 Bias adjustment

1.4.1 Diffusion tubes are an indicative monitoring technique and may exhibit biases relative to more accurate continuous analysers, with positive bias being more common than negative. Bias adjustment is therefore applied to the tubes. In order to correct for this, diffusion tubes are co-located with continuous monitoring stations, and a bias adjustment factor is calculated by comparing results from both techniques. Bias adjustment factors can be calculated by carrying out a specific co-location study as part of a monitoring survey or by using a combined national bias adjustment factor available from the Department for Environment, Food and Rural Affairs (Defra). National bias adjustment factors are collated in a national database (Local Air Quality Management (LAQM) National Diffusion Tube Bias Adjustment Factor Spreadsheet)¹ from a number of co-location studies, allowing the bias at a range of site locations with consistent analysis methods (laboratory and analysis technique) to be considered.

1.4.2 Bias adjustment of the monitoring results has been undertaken in line with the national bias adjustment factor for 2022 of 0.87. This was due to there being no suitable

¹ Defra (2023) The Diffusion Tube Bias Adjustment Factors Spreadsheet [online] available at: National Bias Adjustment Factors | [LAQM \(defra.gov.uk\)](https://www.defra.gov.uk/laqm) (Last accessed December 2023).

automatic monitors in the vicinity of the survey area for a co-location study to conduct local bias adjustment. The national bias adjustment factor was based on the results of co-location studies that had also used diffusion tubes prepared by Staffordshire Scientific Services using the 20% TEA in water method.

1.5 Annual adjustment

- 1.5.1 Annualisation is a technique that can be used to estimate an annual average from a part year average and is applied where monitoring has been undertaken for less than 75% of the year (i.e. 9 months). The methodology, as outlined in Defra TG22,² consists of comparing the period mean for the survey to the annual mean for the desired annualisation year using continuous monitoring data from nearby Automatic Urban and Rural Network (AURN) sites.
- 1.5.2 Since the diffusion tube survey was undertaken for six months from May 2022 to November 2022, it was necessary to convert the period data to an annual mean concentration for 2022 to allow comparison with the annual mean NO₂ objective.
- 1.5.3 Automatic monitoring data was obtained from AURN stations within 50 miles of the Scheme and with a minimum data capture of 85%, in line with Defra TG22. The following AURN sites were used to undertake the annualisation:
- Nottingham Centre
 - Chesterfield Loundsley
 - Leicester University
- 1.5.4 For each AURN site and at each diffusion tube location, the AURN monitored period mean concentration was calculated. The concentration was time-weighted according to the monthly diffusion tube exposure period. The data capture at all of the diffusion tube locations was 100%, except diffusion tube locations 13 and 14, where it was 66.7% and 83.3% respectively, as they had missing data in one/two months. As such the AURN monitored period mean concentrations for diffusion tube locations 13 and 14 were adjusted so that the months with missing data were not included, which resulted in different period mean concentrations to the rest of the diffusion tubes.

² Department for Environment, Food and Rural Affairs and Devolved Administrations (August 2022). Local Air Quality Management – Technical Guidance LAQM.TG22.

- 1.5.5 The AURN monitored period mean concentration for each diffusion tube location was then compared to the annual mean concentration monitored in 2022 to obtain an annualisation factor for each location.
- 1.5.6 Table 1-2 presents the annual mean NO₂ concentration and range of period mean NO₂ concentrations for each AURN site, whilst Table 1-3 presents the annualisation factor for each location.

Table 1-2: AURN site information

Site ID	Distance from scheme (km)	Site type	Data capture (%)	Annual mean NO2 concentration (µg/m³)	Period mean NO2 concentration (µg/m³)*
Nottingham Centre AURN	23.2	Urban background	98.9	21.8	18.0-19.5
Chesterfield Loundsley AURN	42.7	Urban background	97.7	11.5	8.7-9.8
Leicester University AURN	52.1	Urban background	99.1	18.9	15.4-16.1

*Average for period 25 May 2022 to 15 November 2022. The concentration is time-weighted and takes into account the data capture at each of the monitoring sites. Survey data capture was 100% at all diffusion tube sites except sites 13 and 14 where it was 66.7% and 83.3%, respectively. The range of concentrations recorded at the diffusion tube locations are presented.

Table 1-3: Summary of annualisation factors

Site ID	Annualisation factor			Average annualisation factor
	Nottingham Centre AURN	Chesterfield Loundsley AURN	Leicester University AURN	
A46_001	1.2149	1.3097	1.2164	1.2294
A46_002	1.2149	1.3097	1.2164	1.2294
A46_003	1.2149	1.3097	1.2164	1.2294
A46_004	1.2149	1.3097	1.2164	1.2294
A46_005	1.2149	1.3097	1.2164	1.2470
A46_006	1.2149	1.3097	1.2164	1.2470
A46_007	1.2149	1.3097	1.2164	1.2470
A46_008	1.2149	1.3097	1.2164	1.2470
A46_009	1.2149	1.3097	1.2164	1.2470
A46_010	1.2149	1.3097	1.2164	1.2470
A46_011	1.2149	1.3097	1.2164	1.2470
A46_012	1.2149	1.3097	1.2164	1.2470
A46_013	1.1551	1.2285	1.1647	1.1828
A46_014	1.2192	1.3340	1.2054	1.2529
A46_015	1.2149	1.3097	1.2164	1.2470
A46_016	1.2149	1.3097	1.2164	1.2470
A46_017	1.2149	1.3097	1.2164	1.2470
A46_018	1.2149	1.3097	1.2164	1.2470
A46_020	1.2149	1.3097	1.2164	1.2470

Site ID	Annualisation factor			Average annualisation factor
	Nottingham Centre AURN	Chesterfield Loundsley AURN	Leicester University AURN	
A46_021	1.2149	1.3097	1.2164	1.2470
A46_022	1.2149	1.3097	1.2164	1.2470
A46_023	1.2149	1.3097	1.2164	1.2470
A46_024	1.2149	1.3097	1.2164	1.2470
A46_025	1.2149	1.3097	1.2164	1.2470
A46_026	1.2149	1.3097	1.2164	1.2470
A46_027	1.2149	1.3097	1.2164	1.2470
A46_028	1.2149	1.3097	1.2164	1.2470

1.6 Monitoring results

- 1.6.1 The annualisation factor for each location was then applied to the bias adjusted diffusion tube results to convert them to an annual mean value for 2022. The raw NO₂ concentrations and bias adjusted and annualised NO₂ are presented in Table 1-4.

Table 1-4: Scheme-specific monitoring data

Site ID	British National Grid Co-ordinates		Site Type	Survey Period Data Capture	Raw NO ₂ concentrations	2022 bias adjusted and annualised NO ₂ concentration (µg/m ³) ^(a)
	X	Y				
A46_001	481086	355814	Roadside	100.0	20.9	22.7
A46_002	481091	356285	Kerbside	100.0	24.2	26.0
A46_003	481396	356245	Urban background	100.0	13.4	14.5
A46_004	481775	356679	Urban background	100.0	14.2	15.3
A46_005	482495	356736	Roadside	100.0	18.0	19.5
A46_006	482247	356867	Roadside	100.0	30.6	33.0
A46_007	483292	357913	Roadside	100.0	11.7	12.6
A46_008	481111	355550	Roadside	100.0	27.2	29.6
A46_009	480619	355992	Urban background	100.0	14.9	16.2
A46_010	480392	355222	Roadside	100.0	16.1	17.4
A46_011	480731	355556	Roadside	100.0	14.1	15.2
A46_012	480893	355321	Roadside	100.0	19.6	21.2
A46_013	480565	355533	Roadside	66.7	15.0	15.4
A46_014	480670	354846	Kerbside	83.3	15.1	16.5
A46_015	480350	354727	Kerbside	100.0	22.6	24.5
A46_016	479781	354525	Urban background	100.0	13.2	14.3
A46_017	479321	354501	Roadside	100.0	15.1	16.5
A46_018	479177	354336	Urban background	100.0	11.7	12.7
A46_020	480069	354230	Roadside	100.0	22.8	24.7
A46_021	479553	353828	Roadside	100.0	22.0	23.9
A46_022	479214	353376	Roadside	100.0	15.6	16.9
A46_023	478240	352829	Urban background	100.0	13.5	14.6
A46_024	478287	352639	Roadside	100.0	21.2	22.9
A46_025	477807	352216	Roadside	100.0	15.5	16.7
A46_026	477295	351780	Urban background	100.0	10.5	11.3
A46_027	477014	351649	Urban background	100.0	9.6	10.4
A46_028	476463	354507	Kerbside	100.0	9.3	10.1

Note: ^(a) A national bias adjustment factor of 0.87 has been applied to the results to correct the diffusion tube measurements.

1.7 References

¹ Defra (2023) The Diffusion Tube Bias Adjustment Factors Spreadsheet [online] available at: National Bias Adjustment Factors | LAQM (defra.gov.uk) (Last accessed December 2023).

² Department for Environment, Food and Rural Affairs and Devolved Administrations (August 2022). Local Air Quality Management – Technical Guidance LAQM.TG22.