Air Quality Monitoring Report 2019:

Hale Bank, Halton

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Experts in air quality management & assessment

Document Control

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1 Introduction

1.1 This report provides the results of a six-month period of nitrogen dioxide monitoring carried out during January - July 2019 in the residential area of Hale Bank. This is the sixth period of independent nitrogen dioxide monitoring carried out in Hale Bank, following an initial period of monitoring in 2013/2014 and further monitoring in 2015, 2016, 2017, and 2018. This report has been prepared by Air Quality Consultants (AQC) Ltd. on behalf of Hale Bank Parish Council.

1.2 The monitoring has been carried out to determine whether there are any exceedances of the annual mean nitrogen dioxide objective in Hale Bank.

1.3 This report outlines the monitoring methodology, summarises the findings and provides recommendations for future monitoring and assessment.

2 Monitoring Methodology

Monitoring Method

2.1 Monitoring for nitrogen dioxide was undertaken using passive diffusion tubes. This method involves the use of small plastic tubes containing a media (in this case a 50:50 mixture of triethanolamine (TEA) and acetone) which reacts with nitrogen dioxide in the atmosphere and allows average atmospheric nitrogen dioxide concentrations to be determined via laboratory analysis.

2.2 The diffusion tubes are mounted on lampposts and other street furniture for a period of one month and then are sealed and returned to a laboratory for analysis.

2.3 The diffusion tubes used in this study have been prepared and analysed by SOCOTEC Didcot (formerly Environmental Scientifics Group), a UKAS accredited laboratory.

Monitoring Locations

2.4 Nitrogen dioxide monitoring was undertaken at eight locations within the Hale Bank residential area, over six periods of approximately one month each, from 27th January 2018 to 28th July 2019. A description of the diffusion tube locations is provided in Table 1 and the location of the tubes shown in Figure 1. Location 9 was discontinued for the 2018 and 2019 monitoring periods, however was used in the previous years, and so is still presented in this report.

Table 1: Description of Diffusion Tube Monitoring Locations

Site ID	Location
1	Hale Road / Lovell Terrace junction
2	Lamppost outside 368 Hale Road
3	Lamppost outside 383 Hale Road
4	Traffic light outside 413 Hale Road
5	Lamppost outside 420 Hale Road
6	Hale Bank Road (next to allotment gates)
7	Hale Bank Primary School
8	Junction of Hale Gate Road and Mersey View Road
9	Junction of Lower Road and Hale Bank Road

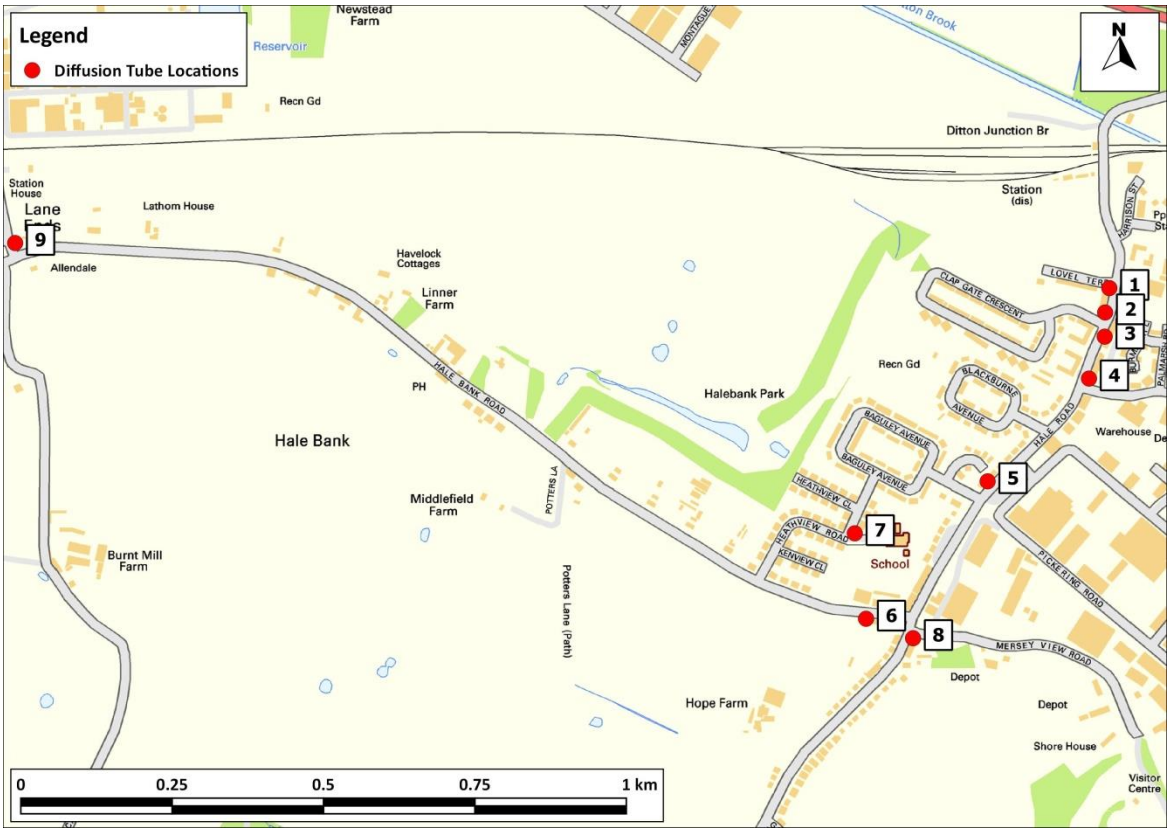

Figure 1: Diffusion Tube Monitoring Locations

Results Processing

2.5 The nitrogen dioxide diffusion tube monitoring has been undertaken for a period of six months; however, the key air quality objective with respect to nitrogen dioxide is an annual mean objective. Nitrogen dioxide concentrations vary seasonally and are typically higher in winter months than summer months. It is therefore necessary to undertake a correction known as 'annualisation' in order to adjust the 6-months of monitoring results into an equivalent annual mean.

2.6 The diffusion tube methodology also has a systematic uncertainty (or bias) associated with it, and it is therefore necessary to carry out a correction known as 'bias adjustment'. Further details on the annualisation and bias adjustment are provided below.

Time Weighting

2.7 The concentration of nitrogen dioxide absorbed by each diffusion tube will be dependent on the time period the diffusion tube was exposed to the air. The raw data for each diffusion tube have therefore been weighted according to the number of days in the specific period of time during

which each tube was exposed. This allows accurate analysis of period mean results from tubes which were exposed for varying time periods.

Annualisation

2.8 The six-month measured nitrogen dioxide concentrations have been adjusted to represent an annual mean following the approach recommended by Defra in its LAQM.TG(16) guidance (Defra, 2018).

2.9 The Defra method involves the use of a number of nearby automatic[1] background nitrogen dioxide monitoring stations to calculate a ratio between the annual mean nitrogen dioxide concentration and the period mean nitrogen dioxide concentration, where the annual mean is the 2018 annual average, and the period mean is the period of 27th January – 28th July 2019[2]. This ratio has then been applied to the raw, six-month period mean diffusion tube monitoring results for 2019 from Hale Bank in order to represent an equivalent 2018 annual mean concentration at each monitoring site.

2.10 Although the monitoring was undertaken in 2019, the annualisation method results in the calculation of 2018-equivalent annual mean nitrogen dioxide concentrations. For simplicity though, the monitoring results are described throughout this report as '2019' results. Where comparisons to the last period of monitoring are made, the last period of monitoring is described as '2018', '2017', '2016', '2015', and '2014', where these in fact represent 2017, 2016, 2015, 2014 and 2013-equivalent annual mean concentrations.

2.11 Details of the diffusion tube annualisation are presented in Appendix A2.

Bias Adjustment

2.12 The annualised Hale Bank nitrogen dioxide concentrations have been bias-adjusted using a factor of 0.76, obtained from Defra's national bias-adjustment spreadsheet (Defra, 2019). This factor suggests that monitoring using diffusion tubes prepared and analysed by SOCOTEC Didcot, using the 50% TEA in acetone method, typically overestimates nitrogen dioxide concentrations by 31.2% (1 / 0.76).

2.13 The bias adjustment factor was calculated based on 21 national studies of SOCOTEC Didcot 50% TEA in acetone diffusion tubes co-located with an automatic nitrogen dioxide analyser. The average bias adjustment factor from these 21 studies has been used (0.76), however, the range in bias between individual co-location studies is 0.63 – 0.92.

[1] Automatic nitrogen dioxide monitoring is a more accurate monitoring method than diffusion tube monitoring. It utilises automatic analysers that are capable of recording average nitrogen dioxide concentrations over much shorter time periods (typically 15-minutes to 1-hour).

[2] 2019 data for local automatic monitors are not fully ratified and therefore the period mean has been calculated using 2018 monitoring data (i.e. 27th January – 28th July 2018).

3 Results

3.1 The final annualised and bias-adjusted annual mean nitrogen dioxide concentrations for the nine monitoring locations in Hale Bank are shown in Table 2. The latest results are presented in shaded cells and the monitoring results for the previous years' of monitoring are also presented for comparison.

3.2 The results can be compared to the annual mean objective for nitrogen dioxide of 40 µg/m^3 (i.e. 40 micrograms of nitrogen dioxide per cubic metre of air).

Table 2: Diffusion Tube Monitoring Results – Nitrogen Dioxide Concentrations

Site ID	Location	Final Annual Mean NO_2 Concentrations (µg/m^3) [a]					
		2019 [b]	2018	2017	2016	2015	2014
1	Hale Road / Lovell Terrace junction	23.0	27.9	28.1	30.0	25.3	34.7
2	Lamppost outside 368 Hale Road	29.5	38.9	35.4	34.0	35.2	37.8
3	Lamppost outside 383 Hale Road	29.8	39.8	36.9	36.5	32.6	**40.1**
4	Traffic light outside 413 Hale Road	28.4	39.8	34.2	36.3	35.5	39.0
5	Lamppost outside 420 Hale Road	22.1	31.6	29.3	28.9	26.6	34.7
6	Hale Bank Road (next to allotment gates)	15.3	21.7	20.6	18.9	23.7	22.6
7	Hale Bank Primary School	15.2	19.0	18.5	19.5	20.9	19.7
8	Junction of Hale Gate Road and Mersey View Road	16.2	21.8	20.4	19.7	21.0	n/a
9	Junction of Lower Road and Hale Bank Road	n/a	n/a	19.5	n/a	n/a	n/a

[a] Results shown have been annualised and adjusted for bias.

[b] Green shaded cells indicate a reduction in concentration compared to 2018.

3.3 The final annualised and bias adjusted nitrogen dioxide concentrations for 2019 are below the annual mean objective at all monitoring sites. Measured concentrations were also all below the objective in 2018, 2017, 2016, 2015 and 2014, with the exception of Site 3 (383 Hale Road) in 2014, where the objective was slightly exceeded.

3.4 The nitrogen dioxide concentrations over the past 6 years have varied a little year-to-year, which is not uncommon. The emerging trend in the monitoring results at the Hale Bank sites is one of

neither a clear increase nor decrease in concentrations over time, but a gentle fluctuation. The results for 2019 are clearly lower than the 2018 concentrations. This may be evidence of an emerging downward trend in concentrations, or it may be that 2019 is a low pollution year for nitrogen dioxide. Future monitoring will allow the continuing trend to be determined.

3.5 Overall, the adjusted results, accounting for seasonal nitrogen dioxide variations and laboratory bias, are all below the objective in each of the past 6 years. Although concentrations at all locations are much lower in 2019 than recorded in 2018, there is no clear long-term trend in nitrogen dioxide concentrations. This suggests that while air quality along Hale Road continues to be within acceptable limits for residential exposure, changes in traffic volumes and congestion may be having a substantial impact on overall air quality.

4 Summary

4.1 The nitrogen dioxide monitoring study in Hale Bank for 2019 has demonstrated that nitrogen dioxide concentrations in the village remain within acceptable limits for residential exposure, but analysis of monitoring over the last 6 years shows no significant trend for improvement in Hale Bank.

4.2 The highest measured nitrogen dioxide concentrations were recorded at Hale Road, where high volumes of road traffic provide a significant source of nitrogen dioxide emissions.

4.3 It should be noted that the monitoring method has uncertainty associated with it and therefore the final adjusted nitrogen dioxide concentrations may be slightly under or over estimated.

5 References

Defra (2018) *Review & Assessment: Technical Guidance LAQM.TG16*, Defra.

Defra (2019) *Air Quality Web Pages*.

6 Appendices

A1 Raw Diffusion Tube Results

A1.1 Raw monthly diffusion tube data and the monitoring periods are presented in Table A1.1.

Table A1.1: Raw Monthly Diffusion Tube Data for January to July 2019 (µg/m^3)

Site ID	27/01/19 to 28/02/19	28/02/19 to 31/03/19	31/03/19 to 28/04/19	28/04/19 to 29/05/19	29/05/19 to 30/06/19	30/06/19 to 28/07/18	Weighted Mean	Data Capture (No. of Periods)
1	43.3	27.2	31.8	25.6	25.0	21.2	29.2	6
2	47.5	38.6	32.3	36.0	34.7	34.5	37.4	6
3	51.9	34.0	40.2	33.3	38.2	27.8	37.8	6
4	41.1	31.9	45.2	36.2	35.5	26.5	36.1	6
5	34.3	22.6	34.2	28.1	27.2	21.9	28.1	6
6	26.9	15.7	22.9	18.5	17.4	14.6	19.4	6
7	29.2	17.6	24.7	16.3	15.3	12.7	19.4	6
8	29.4	16.7	24.0	19.7	18.2	14.8	20.5	6

A2 Adjustment of Short-Term Data to Annual Mean

A2.1 This report describes the results of nitrogen dioxide monitoring that was carried out for less than a full calendar year. Therefore, in accordance with the guidance set out in Box 7.9 of LAQM.TG(16), the data have been adjusted to an annual mean, based on the ratio of concentrations during the short-term monitoring period (27th January to 28th July 2019) to those over the 2018 calendar year at six background sites operated as part of the Automatic Urban and Rural Network (AURN) where long-term data are available. The January to July 2018 period was used, as ratified automatic monitoring data were not available for the January to July 2019 period. This is consistent with the guidance set out in Box 7.9 of LAQM.TG(16).

A2.1 The annual mean nitrogen dioxide concentrations and the period means for each of the six monitoring sites from which adjustment factors have been calculated are presented in Table A2.1, along with the Annualisation Factors which were applied to the data.

Table A2.1: Data used to Adjust Short-term 2019 Monitoring Data to a 2018 Annual Mean Equivalent

AURN Background Site	Annual Data Capture	Period Mean Conc. (Jan-July) (µg/m^3)	Annual Mean Conc. (µg/m^3)	Annualisation Factor (Jan-July)
Manchester Piccadilly	99.1%	33.8	34.6	1.025
Preston	99.1%	19.8	21.1	1.066
Salford Eccles	98.7%	24.8	24.7	0.999
Wigan Centre	97.7%	15.8	17.3	1.099
Wirral Tranmere	99.1%	17.6	17.5	0.994
			Average Factor [a]	**1.037**

[a] The bias adjusted period-mean measured concentrations are multiplied by the average annualisation factor to give total annual mean concentrations.