The background of the entire page is a photograph of a wind turbine. The turbine's blades are white and extend from a central hub. The image is slightly out of focus, with the foreground blade being sharper than the background ones. The sky is a pale, overcast grey.

Air Quality Monitoring Survey – Anglia Square, Norwich

Report to Weston Homes Plc

July 2022

Title	Air quality Monitoring Survey – Anglia Square, Norwich
Customer	Weston Homes Plc
Recipient	Weston Homes, Icen
Report Reference	Anglia Square 2022
Report Status	V1
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File	Aether_AQ_Monitoring_Survey_AngliaSquare_v1

Author	Annie Thornton
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Signature	
Date	8 th July 2022

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1 Introduction

Aether was commissioned by Weston Homes Plc to undertake nitrogen dioxide (NO₂) monitoring in support of the development at Anglia Square. The proposed works consists of the comprehensive redevelopment of Anglia Square, as shown in Figure 1 below.

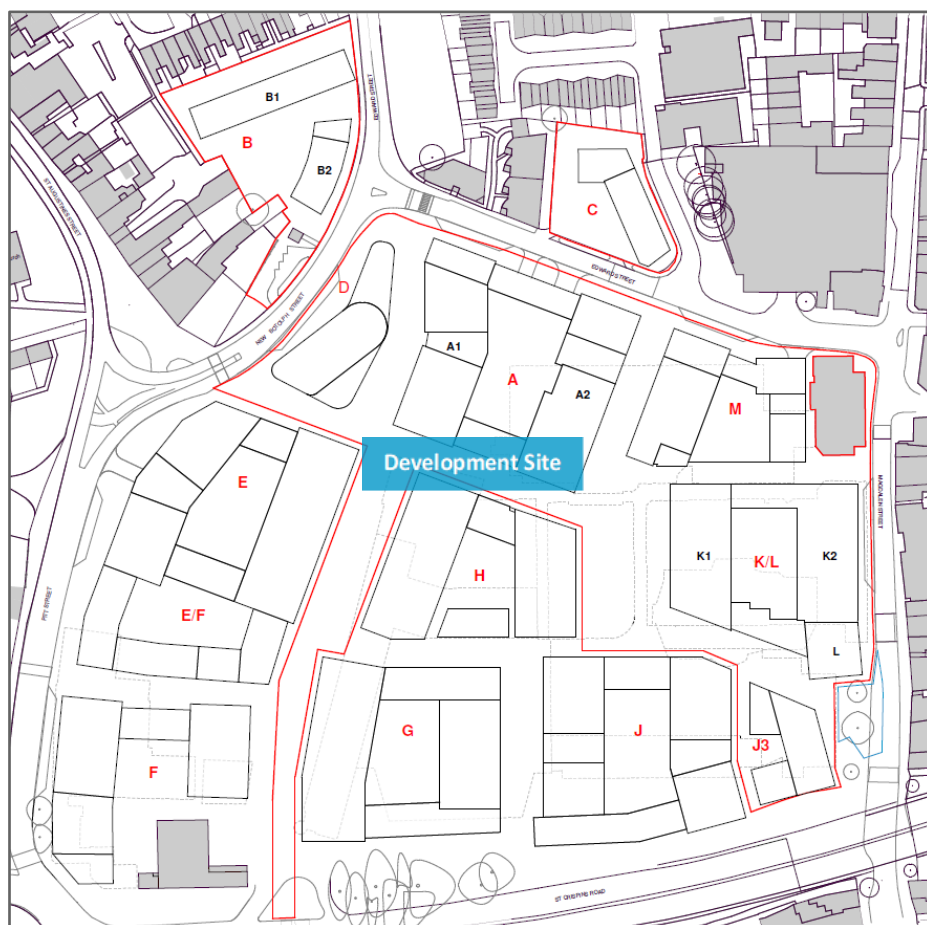
The Site is in a highly accessible position within the northern part of Norwich City Centre and comprises a significant element of the Anglia Square/Magdalen Street/St Augustines' Large District Centre. It is thus of strategic importance to the City, and accordingly has been identified for redevelopment for many years within various local planning policy documents, including the Northern City Centre Area Action Plan 2010, (NCCAAP), (now expired), the Joint Core Strategy for Broadland, Norwich and South Norfolk 2014, (JCS), and NCC's Anglia Square and Surrounding Area Policy Guidance Note 2017, (PGN). The Site forms the principal part of an allocation (GNLP 0506) in the emerging Greater Norwich Local Plan (GNLP).

This report provides the results of the NO₂ monitoring survey undertaken between November 2021 and April 2022, to establish the current concentrations at the existing site.

1.1 The Location of the Development

The Proposed Development is in the northern part of Norwich City Centre, north of St Crispin's Road (Figure 1).

Figure 1 - Location of the development site.



1.2 Assessment Criteria

A summary of the air quality objectives relevant to the proposed development, as set out in the UK Air Quality Strategy¹, is presented in **Table 1** below.

Table 1 - UK Air Quality Objectives for NO₂ and PM₁₀.

Pollutant	Concentration	Measured as
Nitrogen Dioxide (NO ₂)	40 µg/m ³	Annual mean
	200 µg/m ³	Hourly mean not to be exceeded more than 18 times per year (99.8th percentile)
Particulate Matter (PM ₁₀)	40 µg/m ³	Annual mean
	50 µg/m ³	24-hour mean not to be exceeded more than 35 times a year (90.4th percentile)

The oxides of nitrogen (NO_x) comprise principally of nitric oxide (NO) and nitrogen dioxide (NO₂). NO₂ is a reddish-brown gas (at sufficiently high concentrations) and occurs as a result of the oxidation of NO, which in turn originates from the combination of atmospheric nitrogen and oxygen during combustion processes. NO₂ can also form in the atmosphere due to a chemical reaction between NO and ozone (O₃). Health based standards for NO_x generally relate to NO₂, where acute and long-term exposure may adversely affect the respiratory system.

Particulate matter is a term used to describe all suspended solid matter, sometimes referred to as Total Suspended Particulate matter (TSP). Sources of particles in the air include road transport, power stations, quarrying, mining and agriculture. Chemical processes in the atmosphere can also lead to the formation of particles. Particulate matter with an aerodynamic diameter of less than 10 µm is the subject of health concerns because of its ability to penetrate deep within the lungs and is known in its abbreviated form as PM₁₀.

Further information on the health effects of air pollution can be found in the reports produced by the Committee on the Medical Effects of Air Pollutants².

As defined by the regulations, the air quality objectives for the protection of human health are applicable:

- Outside of buildings or other natural or man-made structures above or below ground
- Where members of the public are regularly present.

Using these definitions, the annual mean objectives will apply at locations where members of the public might be regularly exposed such as building façades of residential properties, schools and hospitals and will not apply at the building façades of offices or other places of work, where members of the public do not have regular access. The 24-hour objective would apply at all locations where the annual mean objective would apply, together with hotels. Therefore, in this assessment the annual mean and 24-hour mean objectives will apply at all floors of the residential development. The hourly objective will apply at all locations where members of the public could reasonably be expected to spend that amount of time. Therefore, in this assessment the hourly objective will apply to all residential, commercial and other site uses across the development site.

¹ The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (2007), Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland

² <https://www.gov.uk/government/collections/comeap-reports>

It is important to note that the monitoring survey has only covered NO₂ concentrations, as this is the primary pollutant of concern within Norwich, reflected by the designated Air Quality Management Area (AQMA) for exceedances of the annual NO₂ objective³.

1.3 Local Air Quality Management

Local authorities are required to periodically review and assess the current and future quality of air in their administrative areas. Where it is determined that an air quality objective is not likely to be met, the authority must designate an AQMA and produce an Air Quality Action Plan (AQAP).

The site lies within the administrative boundaries of Norwich City Council (NCC), which declared an AQMA in 2012, covering the centre of the city for exceedances against the annual mean NO₂ objective. The proposed development site falls within this AQMA. An AQAP³ was produced in 2021; this outlines the measures that the Council are taking to improve air quality. The 2021 Air Quality Action Plan replaces the original action plan created in 2006 and prioritises measures to deliver sustainable road transport. The AQAP identifies six key themes⁴:

- Support for development of sustainable transport measures
- Support for the uptake of low and zero emission vehicles
- Reducing freight emissions
- Planning for sustainable transport
- Managing the Council's transport emissions
- Developing partnerships and public education

2 Methodology

2.1 Tube Preparation, Analysis and Laboratory QA/QC

The diffusion tubes were supplied and analysed by Gradko International Ltd, using a 50% Triethanolamine (TEA) in acetone method. This method was chosen so that it was consistent with Norwich City Council's approach. Gradko participates in the Health and Safety Laboratory's (HSL) AIR-PT scheme (formerly WASP) for diffusion tubes, which provides a Quality Assurance / Quality Control framework for local authorities carrying out diffusion tube monitoring as part of their local air quality management process. The survey utilised 'travel blanks', which are separate diffusion tubes placed inside the package to and from the supplier and carried during site visits. The use of these blanks helps identify any contamination of diffusion tubes during transit. The travel blanks resulted in negligible NO₂ concentrations providing confidence in the results obtained from the exposed diffusion tubes.

2.2 Diffusion Tube Details and Deployment

Diffusion tubes are a simple cost-effective way of monitoring air pollution, that allow several sites to be measured over short or long-time periods. This is beneficial compared to the range of automatic monitors available, which are considerably more expensive to set up and run. A limitation, however, is that the results obtained via diffusion tubes are associated with more uncertainty.

³ AQMA details, Norwich City Council, available at:

https://www.norwich.gov.uk/downloads/file/7721/2021_air_quality_annual_status_report

⁴ The 2021 Air Quality Action Plan, available at:

https://www.norwich.gov.uk/downloads/file/7493/2021_air_quality_action_plan

At the beginning of the survey period, Aether visited the site and discussed the monitoring locations with NCC's Air Quality Officer. It was decided that the survey would be conducted at nine locations around the site with additional tubes located at the nearby automatic monitoring site for bias adjustment purposes. It is worth noting that NCC also routinely measures NO₂ concentrations using diffusion tubes at nearby locations and therefore the survey was to supplement these.

The tubes were then set up in accordance with best practice guidance⁵ and with Gradko's Nitrogen Dioxide Instruction Sheet⁶. At each location between one and three diffusion tubes were placed. Initially triplicates were only placed at the Lakenfields' Monitoring site (a nearby automatic monitoring station) as the Technical Guidance recommends that this approach is taken for bias adjustment purposes⁷ and other sites had one diffusion tube each. However, from the beginning of February, triplicates were also placed at AS 5 (the junction of St Crispins and Pitt Street) due to the high readings that were being obtained, so that more confidence could be obtained in the result.

Each set of diffusion tubes were exposed for approximately four or five weeks in accordance with the Defra NO₂ diffusion tube monitoring calendar⁸. Monitoring was undertaken for a six-month period (1st November 2021 to 4th May 2022), which is deemed to be an acceptable period from which an estimate of the annual mean can be calculated. The monitoring sites are provided below with Figure 2 providing the exact locations for tubes 1 to 9.

- AS 1: South side of Edward Street
- AS 2: Dalymond Court, Edward Street
- AS 3: East end of Edward Street
- AS 4: St Crispins Rd. Cherry Lane
- AS 5: Junction of St Crispins St & Pitt St
- AS 6: South End of Pitt Street, Opp Fsg Signs
- AS 7: New Botolph Street
- AS 8: St George's Street (a background location)
- AS 9: Edward Street (North of Anglia Square)
- AS 10: Travel blank
- AS 11 to 13: co-located with Lakenfields automatic monitoring site

⁵ As outlined in Paragraph 7.193 Local Air Quality Management – Technical Guidance TG16. April 2021 update

⁶ Gradko Diffusion Tube Instruction Sheet, available at: <http://www.gradko.com/environmental/environmental-resources/technical-resources/sampling-instructions/nitrogen-dioxide-instruction-sheet.pdf>

⁷ Paragraph 7.115, Local Air Quality Management – Technical Guidance TG16. April 2021 update. <https://laqm.defra.gov.uk/documents/LAQM-TG16-April-21-v1.pdf>

⁸ NO₂ diffusion Tube Monitoring Calendar available at: <https://laqm.defra.gov.uk/air-quality/air-quality-assessment/diffusion-tube-monitoring-calendar/>

Figure 2 - Monitoring locations surrounding the site.



2.3 The impact of Covid 19

As discussed previously, the diffusion tube survey was undertaken between the 1st November 2021 and the 4th May 2022. Whilst in most parts of the country, traffic levels had returned to pre pandemic levels prior to the survey being undertaken, in Norwich there appears to be uncertainty as to whether this is the case. A traffic survey was conducted by Iceni (the Transport Consultants) in early November 2021 for one day at three locations: Pitt Street, Edward Street and St Crispin's Way and these results were then compared with data that had been collected in 2016. The results are shown in Table 2 below. The 2021 data shows a reduction in total vehicle movements in all three locations when compared against the 2016 data.

Table 2 – Traffic survey results

DAILY TWO WAY MOVEMENTS	2016 Data	2021 Data	Difference	% Difference
Pitt Street	20,271	17,602	-2,669	-13%
Edward Street	12,318	9,911	-2,407	-20%
St Crispin's Way	25,192	24,549	-643	-3%

Therefore, there is uncertainty in how representative the six-month diffusion tube survey results are of pre Covid and post Covid traffic levels. To minimise this uncertainty, the annualisation process has compared the diffusion tube survey period (1st November 2021 to 4th May 2022) with annual data for 2019 which is regarded as the last ‘normal’ year before the Covid-19 pandemic.

2.4 Bias correction of the results

Whilst diffusion tubes provide an indicative estimate of pollutant concentrations, they tend to under or over read. Annual data is corrected using a bias adjustment factor. There are two types of bias adjustment factor – local and national. The local factor is derived from co-locating diffusion tubes (usually in triplicate) with automatic monitors, whereas the national factor is obtained from the average bias from all local authorities using the same laboratory. In this case, a local bias adjustment factor has been calculated by comparing the average NO₂ concentration recorded by the Lakenfields’ continuous monitoring site between the 1st November 2021 and the 4th May 2022 with the triplicate diffusion tubes placed at this location during the same period. A factor of 0.80 has been calculated and applied to all of the diffusion tube results.

2.5 Annualisation of the results

The air quality objectives are based on concentrations measured over a calendar year and the greater the period of monitoring the more direct comparison is enabled. However, it is often necessary to use monitoring data collected over a shorter period such as in this case. Where monitoring is carried out for <75% of the year, it is appropriate to adjust results using the approach provided in Paragraph 7.200 and section Box 7.10 of LAQM TG(16) April 2021 version. This will therefore lead to uncertainty in the results and the concentrations presented should be viewed as indicative.

The annualisation method⁹ involves the identification and selection of two to four nearby, long-term, continuous monitoring sites, ideally those forming part of the national network. Ideally these should be background sites to avoid any very localised effects that may occur at roadside sites and should be located within a radius of about 50 miles. However, if no background sites are available and the site itself is an urban centre, roadside or kerbside site then it is permissible to annualise using roadside or kerbside sites rather than background sites. The sites selected as being most appropriate were the Lakenfield AURN background site, and the Castle Meadow roadside automatic monitor¹⁰. Unfortunately, apart from the Lakenfield background monitoring site, no other background sites were deemed suitable and therefore a roadside site has been used.

The annualisation factor (AF) calculation is shown in Table 3 below. An AF of 1.22 was obtained.

Table 3 - Calculation of the annualisation factor using the Lakenfields and Castle Meadow automatic monitoring results.

Long term site	2019 Annual mean [Am] (µg/m ³)	Period mean [Pm] (µg/m ³)	Annualisation factor (AF) [Ratio of Am/Pm]
Lakenfields	12.8	12.3	1.04
Castle Meadow	41.2	29.4	1.40
Average			1.22

⁹ As outlined in Box 7.9 of LAQM TG16, April 2021 update

¹⁰ Data for Lakefield and Castle Meadow monitors available at: <https://www.norfolkairquality.net/>

3 Results

3.1 Measured and Annualised Results

Table 4 below presents the results for the diffusion tubes placed at each of the monitoring locations. The ‘unadjusted period mean’ refers to the average concentration of each diffusion tube across the 6-months of data prior to any bias adjustment or annualisation. The ‘estimated 2019 adjusted annualised mean’ refers to estimated values for 2019 by undertaking bias adjustment and annualisation.

Table 4 – Nitrogen dioxide results from the monitoring survey.

DT location	Unadjusted period mean ($\mu\text{g}/\text{m}^3$)	Estimated 2019 adjusted annualised mean ($\mu\text{g}/\text{m}^3$)
AS: 1	27.4	26.9
AS: 2	24.5	24.1
AS: 3	30.0	29.4
AS: 4	21.0	20.6
AS: 5	40.2	39.5
AS: 6	34.6	34.0
AS: 7	29.5	29.0
AS: 8	23.8	23.4
AS: 9	29.1	28.6

Note: Exceedances of the annual NO_2 objective are highlighted in bold

The results show that the estimated annual mean NO_2 concentrations in 2019 are below the objective of $40\mu\text{g}/\text{m}^3$ at all locations modelled. However, the estimate for AS:5 is only marginally below the objective. AS:5 represents the southwest corner of the site close to the roundabout where Pitt Street meets St Crispin’s Road and is where block F of the development will be located.

In line with guidance, to account for the inherent uncertainty associated with using diffusion tubes, values within 10% of the objective should be considered as locations that could have exceeded the objective¹¹. Therefore, it is possible that AS:5 experienced annual mean NO_2 concentrations above the

¹¹ As outlined in paragraph 3.52 of LAQM TG16, April 2021 update

objective in 2019. At all other locations, estimated annual mean NO₂ concentrations are more than 10% below the objective and are therefore not of concern.

Diffusion tubes do not provide information on hourly exceedances, but research¹² identified a relationship between the annual and 1 hour mean objective, such that exceedances of the latter were considered unlikely where the annual mean was below 60 µg/m³. The annual mean results indicate concentrations far below 60 µg/m³ at all monitoring locations. Therefore, exceedances of this objective at any of these locations are extremely unlikely.

4 Summary and Conclusions

A six-month nitrogen dioxide (NO₂) diffusion tube survey was undertaken between the 1st of November 2021 and the 4th May 2022 at nine locations around the existing Anglia Square site in Norwich. The aim of the survey was to obtain an indication of the current concentrations of NO₂ around the site, ahead of the planned residential development. For NO₂, there is an annual mean objective that applies to residential locations and an hourly objective that applies to locations where the public are expected to spend that amount of time.

A local bias adjustment factor of 0.8 has been applied to the diffusion tube results. This was calculated by comparing the concentrations recorded by the automatic monitoring site in Lakenfields with triplicate diffusion tubes exposed at the same location. The data was then annualised to 2019 using data obtained from Lakenfields and Castle Meadow automatic monitoring sites.

The results show that in 2019, NO₂ concentrations near to the junction of Pitt Street with Crispins Street (where block F will be located) were within 10% of the objective and therefore it is recommended that action is taken at this location to reduce resident's exposure to air pollution at ground floor level if pollutant concentrations remain at this level leading up to the year 2031 (the anticipated first full year of occupation). It is however anticipated that annual mean NO₂ concentrations will reduce substantially by 2031 due to improvements in vehicle emissions. At all other locations, estimated annual mean NO₂ concentrations are more than 10% below the objective and are therefore not of concern.

Diffusion tubes do not provide information on hourly exceedances, but research has identified a relationship between the annual and 1 hour mean objective. Exceedances of the hourly objective were found to be highly unlikely at all monitoring locations.

¹² As described in paragraph 7.91 of LAQM Technical Guidance (TG16), April 2021 update

Appendix A – Raw results received from the laboratory

Figure A 1 – Raw results for November 2021



(A division of Gradko International Ltd.)
St. Martins House, 77 Wales Street Winchester, Hampshire SO23 0RH
tel.: 01962 860331 fax: 01962 841339 e-mail: diffusion@gradko.co.uk



2187

LABORATORY ANALYSIS REPORT

NITROGEN DIOXIDE IN DIFFUSION TUBES BY U.V.SPECTROPHOTOMETRY

REPORT NUMBER P08783R
BOOKING IN REFERENCE P08783
DESPATCH NOTE 89509
CUSTOMER Aether UK Attn: Melanie Hobson
Oxford Centre for Innovation
New Road
Oxford
OX1 1BY
DATE SAMPLES RECEIVED 06/12/2021

Location	Sample Number	Exposure Data			$\mu\text{g}/\text{m}^3$ *	ppb *	$\mu\text{g NO}_2$ on tube
		Date On*	Date Off*	Time* (hr.)			
Edward St. Near to junction with New Botolph St 23009 09494	1868416	01/11/2021	01/12/2021	721.75	28.69	14.97	1.51
Dollymount Ct. 23032 09491	1868417	01/11/2021	01/12/2021	721.87	28.61	14.93	1.50
Edward St. 23139 09955	1868418	01/11/2021	01/12/2021	721.72	32.87	17.15	1.72
St Crispins Rd. Cherry Lane 23056 09315	1868419	01/11/2021	01/12/2021	721.57	23.40	12.21	1.23
Junction of St Crispins St & Pitt St 22893 09300	1868420	01/11/2021	01/12/2021	721.55	42.28	22.06	2.22
South End Of Pitt Stt, Opp Fsg Signs 22888 09337	1868421	01/11/2021	01/12/2021	721.48	35.62	18.59	1.87
New Botolph St. 22946 09430	1868422	01/11/2021	01/12/2021	721.37	32.92	17.18	1.73
St Georges St 22991 09377	1868423	01/11/2021	01/12/2021	721.30	27.53	14.37	1.44
Travel Blank	1868424			721.87	0.42	0.22	0.02
Edward St. North of Anglia Sq 23003 09534	1868425	01/11/2021	01/12/2021	721.28	33.33	17.39	1.75
Co-location 1 Lakenfields	1868426	01/11/2021	01/12/2021	721.25	20.97	10.94	1.10
Co-location 2 Lakenfields	1868427	01/11/2021	01/12/2021	721.25	22.17	11.57	1.16
Co-location 3 Lakenfields	1868428	01/11/2021	01/12/2021	721.25	21.00	10.96	1.10
Laboratory Blank				721.87	0.15	0.08	0.008

Samples have been tested within the scope of Gradko International Ltd. Laboratory Quality Procedures. Results within this report relate only to samples as received. Data provided by the client and any subsequent calculations shall be indicated by an asterisk (*), these calculations and results are not within the scope of our UKAS accreditation. Any queries concerning data in this report should be directed to the Laboratory Manager Gradko International Ltd. This report is not to be reproduced, except in full, without the written permission of Gradko International Ltd.

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Report Number P08783R

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REPORT OFFICIALLY CHECKED


Gradko International Ltd
This signature confirms the authenticity of these results
Signed 
L. Gates, Laboratory Manager

Figure A 2 - Raw results for December 2021



(A division of Gradko International Ltd.)

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2187

LABORATORY ANALYSIS REPORT

NITROGEN DIOXIDE IN DIFFUSION TUBES BY U.V.SPECTROPHOTOMETRY

REPORT NUMBER Q00581R
BOOKING IN REFERENCE Q00581
DESPATCH NOTE 89518
CUSTOMER Aether UK Attn: Melanie Hobson
Oxford Centre for Innovation
New Road,
Oxford OX1 1BY
10/01/2022

DATE SAMPLES RECEIVED

DATE SAMPLES RECEIVED		18/01/2022		Exposure Data			µg NO ₂	
Location	Sample Number	Date On*	Date Off*	Time* (hr.)	µg/m ³ *	ppb *	on tube	
Edward St Near to Jct with New Botolph. 623009, 309494	1888449	01/12/2021	05/01/2022	839.27	28.92	15.09	1.76	
Dalymond Ct. 623032, 309491	1888450	01/12/2021	05/01/2022	839.25	24.26	12.66	1.48	
Edward St. 623139 309455	1888451	01/12/2021	05/01/2022	839.25	31.72	16.56	1.94	
Chevy Lane Beside St. Crispins Road. 623056, 309315	1888452	01/12/2021	05/01/2022	839.28	21.07	10.99	1.29	
Jct of St Crispins Road with Pitt St. 622893, 3092300	1888453	01/12/2021	05/01/2022	839.23	38.35	20.01	2.34	
South end of Pitt St, opposite FSG signs. 622888 309337	1888454	01/12/2021	05/01/2022	839.25	32.15	16.78	1.96	
New Botolph St. 622946, 309430	1888455	01/12/2021	05/01/2022	839.28	28.02	14.62	1.71	
St Georges St. 622991, 309377	1888442	01/12/2021	05/01/2022	839.25	26.20	13.67	1.60	
Travel Blank	1888443			839.28	0.41	0.21	0.03	
Edward St. North of Anglia Square. 623003, 309534	1888444	01/12/2021	05/01/2022	839.07	28.79	15.03	1.76	
Co-Location 1 Lakenfields. 623637, 306940	1888445	01/12/2021	05/01/2022	839.13	16.41	8.57	1.00	
Co-Location 2 Lakenfields. 623637, 306940	1888446	01/12/2021	05/01/2022	839.13	16.61	8.67	1.01	
Co-Location 3 Lakenfields. 623637, 306940	1888447	01/12/2021	05/01/2022	839.13	16.12	8.41	0.98	
Laboratory Blank				839.28	0.11	0.06	0.007	

Samples have been tested within the scope of Gradko International Ltd. Laboratory Quality Procedures. Results within this report relate only to samples as received. Data provided by the client and any subsequent calculations shall be indicated by an asterisk (*), these calculations and results are not within the scope of our UKAS accreditation. Any queries concerning data in this report should be directed to the Laboratory Manager Gradko International Ltd. This report is not to be reproduced, except in full, without the written permission of Gradko International Ltd.

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Report Number Q00581R

Page 1 of 1

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
Gradko International Ltd
This signature confirms the authenticity of these results
Signed: 
L. Gates, Laboratory Manager

Figure A 3 - Raw results for January 2022



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2187

LABORATORY ANALYSIS REPORT

NITROGEN DIOXIDE IN DIFFUSION TUBES BY U.V.SPECTROPHOTOMETRY

REPORT NUMBER Q01477R
BOOKING IN REFERENCE Q01477
DESPATCH NOTE 89519
CUSTOMER Aether UK Attn: Melanie Hobson
Oxford Centre for Innovation
New Road
Oxford
OX1 1BY
DATE SAMPLES RECEIVED 09/02/2022

Location	Sample Number	Exposure Data			µg/m³ *		µg NO ₂ on tube
		Date On*	Date Off*	Time* (hr.)	µg/m³ *	ppb *	
Edward St. Near to junction with New Botoiph St 623009 309494	1901432	05/01/2022	02/02/2022	672.13	33.16	17.31	1.62
Dalymond Ct. 623032, 309491	1901433	05/01/2022	02/02/2022	672.13	27.14	14.17	1.33
Edward St. 623139 309455	1901434	05/01/2022	02/02/2022	672.13	31.98	16.69	1.56
Cherry Lane Beside St. Crispins Road. 623056 309315	1901435	05/01/2022	02/02/2022	672.15	22.37	11.68	1.09
Jct of St Crispins Road with Pitt St. 622893 309230	1901436	05/01/2022	02/02/2022	672.13	45.01	23.49	2.20
South end of Pitt St, Opposite FSG signs. 622888 309337	1901437	05/01/2022	02/02/2022	672.15	37.81	19.73	1.85
New Botoiph St. 622946 309430	1901438	05/01/2022	02/02/2022	672.15	35.47	18.52	1.73
St georges St 622991 309377	1901439	05/01/2022	02/02/2022	672.20	27.45	14.33	1.34
Edward St. North of Anglia Square 623003 309534	1901440	05/01/2022	02/02/2022	672.20	37.70	19.68	1.84
Travel Blank	1901441	05/01/2022	02/02/2022	672.00	0.51	0.27	0.03
Co-location 1 Lakenfields 623637 306940	1901442	05/01/2022	02/02/2022	672.28	16.37	8.55	0.80
Co-location 2 Lakenfields	1901443	05/01/2022	02/02/2022	672.28	18.28	9.54	0.89
Co-location 3 Lakenfields	1901444	05/01/2022	02/02/2022	672.28	16.90	8.82	0.83
Laboratory Blank				672.28	0.47	0.25	0.023

Comment: Results are not blank subtracted

Results have been corrected to a temperature of 293 K (20°)

Overall M.U. ±9.7%

Limit of Detection 0.040µgNO₂

The reported expanded uncertainty is based on a standard uncertainty multiplied by a factor of $k=2$, providing a level of confidence of approximately 95%. Uncertainty of measurement has not been applied to the reported results.

Tube Preparation : 50% TEA /Acetone

Analysed on UV CARY2

Samples have been tested within the scope of Gradko International Ltd. Laboratory Quality Procedures. Results within this report relate only to samples as received. Data provided by the client and any subsequent calculations shall be indicated by an asterisk (*), these calculations and results are not within the scope of our UKAS accreditation. Any queries concerning data in this report should be directed to the Laboratory Manager Gradko International Ltd. This report is not to be reproduced, except in full, without the written permission of Gradko International Ltd.

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Report Number Q01477R

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
Gradko International Ltd
This signature confirms the authenticity of these results
Signed: 
L. Gates, Laboratory Manager

Figure A 4 - Raw results for February 2022



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LABORATORY ANALYSIS REPORT

NITROGEN DIOXIDE IN DIFFUSION TUBES BY U.V.SPECTROPHOTOMETRY

REPORT NUMBER Q02042R
BOOKING IN REFERENCE Q02042
DESPATCH NOTE 89520
CUSTOMER Aether UK Attn: Melanie Hobson
Oxford Centre for Innovation
New Road
Oxford
OX1 1BY
DATE SAMPLES RECEIVED 07/03/2022

Location	Sample Number	Exposure Date On*	Date Off*	Time* (hr.)	µg/m³ *	ppb *	µg NO ₂ on tube
Edward St Near to Jct with New Botolph St 623009, 509494	1926283	02/02/2022	02/03/2022	671.23	19.58	10.22	0.96
Dalymond Ct 623032 309455	1926284	02/02/2022	02/03/2022	671.28	19.29	10.07	0.94
Edward St 623139 309455	1926285	02/02/2022	02/03/2022	671.28	26.05	13.60	1.27
Cherry Lane Beside St. Crispins Road 623056 309315	1926286	02/02/2022	02/03/2022	671.25	17.38	9.07	0.85
Jct of St Crispins Road with Pitt St. 622893 309230	1926287	02/02/2022	02/03/2022	671.27	34.70	18.11	1.69
Jct of St Crispins Road with Pitt St. 622893 309230	1926288	02/02/2022	02/03/2022	671.28	30.17	15.75	1.47
Jct of St Crispins Road with Pitt St. 622893 309230	1926289	02/02/2022	02/03/2022	671.27	36.65	19.13	1.79
South end of Pitt St opposite FSG signs 622888 309337	1926290	02/02/2022	02/03/2022	671.27	31.63	16.51	1.54
New Botolph St. 622946 309430	1926291	02/02/2022	02/03/2022	671.25	22.63	11.81	1.10
St Georges St 622991 309377	1926292	02/02/2022	02/03/2022	671.23	17.36	9.06	0.85
Edward St North of Anglia Square 623003 309534	1926293	02/02/2022	02/03/2022	671.23	23.49	12.26	1.15
Travel Blank	1926297			671.28	0.49	0.26	0.02
Co-Location 1 Lakenfields 623637 306940	1926294	02/02/2022	02/03/2022	671.23	10.93	5.70	0.53
Co-Location 2 Lakenfields 623637 306940	1926295	02/02/2022	02/03/2022	671.23	8.73	4.56	0.43
Co-Location 3 Lakenfields 623637 306940	1926296	02/02/2022	02/03/2022	671.23	11.93	6.23	0.58
Laboratory Blank				671.28	0.18	0.10	0.009

Comment: Results are not blank subtracted

Results have been corrected to a temperature of 293 K (20°)

Overall M.U. ±9.7%

Limit of Detection 0.037 µgNO₂

The reported expanded uncertainty is based on a standard uncertainty multiplied by a factor of $k=2$, providing a level of confidence of approximately 95%. Uncertainty of measurement has not been applied to the reported results.

Tube Preparation: 50% TEA /Acetone

Analysed on UV CARY3

Samples have been tested within the scope of Gradko International Ltd. Laboratory Quality Procedures. Results within this report relate only to samples as received. Data provided by the client and any subsequent calculations shall be indicated by an asterisk (*), these calculations and results are not within the scope of our UKAS accreditation. Any queries concerning data in this report should be directed to the Laboratory Manager Gradko International Ltd. This report is not to be reproduced, except in full, without the written permission of Gradko International Ltd.

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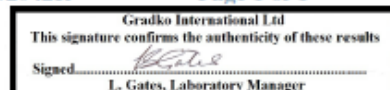




Figure A 5 – Raw results from March 2022



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LABORATORY ANALYSIS REPORT
NITROGEN DIOXIDE IN DIFFUSION TUBES BY U.V.SPECTROPHOTOMETRY

REPORT NUMBER Q02796R
BOOKING IN REFERENCE Q02796
DESPATCH NOTE 89521
CUSTOMER Aether UK Attn: Melanie Hobson
 Oxford Centre for Innovation
 New Road
 Oxford
 OX1 1BY

DATE SAMPLES RECEIVED 01/04/2022

Location	Sample Number	Exposure Data			$\mu\text{g}/\text{m}^3$ *	ppb *	$\mu\text{g NO}_2$ on tube
		Date On*	Date Off*	Time* (hr.)			
Edward St Near to Jct with New Botolph St 623009, 509494	1944515	02/03/2022	30/03/2022	672.42	32.53	16.98	1.59
Dalymond Ct 623032 309455	1944516	02/03/2022	30/03/2022	672.38	30.65	16.00	1.50
Edward St 623139 309455	1944517	02/03/2022	30/03/2022	672.40	31.29	16.33	1.53
Cherry Lane Beside St. Crispins Road 623056 309315	1944501	02/03/2022	30/03/2022	672.38	24.43	12.75	1.19
Jct of St Crispins Road with Pitt St. 622893 309230	1944502	02/03/2022	30/03/2022	672.35	47.95	25.02	2.34
Jct of St Crispins Road with Pitt St. 622893 309230	1944503	02/03/2022	30/03/2022	672.35	45.78	23.89	2.24
Jct of St Crispins Road with Pitt St. 622893 309230	1944504	02/03/2022	30/03/2022	672.33	50.75	26.49	2.48
South end of Pitt St opposite FSG signs 622888 309337	1944505	02/03/2022	30/03/2022	672.35	39.41	20.57	1.93
New Botolph St. 622946 309430	1944506	02/03/2022	30/03/2022	672.35	33.32	17.39	1.63
St Georges St. 622991, 309377	1944507	02/03/2022	30/03/2022	672.32	28.00	14.61	1.37
Edward St North of Anglia Square 623003 309534	1944508	02/03/2022	30/03/2022	672.33	31.49	16.44	1.54
Travel Blank	1944509			672.42	0.23	0.12	0.01
Co-Location 1 Lakenfields 623637 306940	1944510	02/03/2022	30/03/2022	672.28	16.72	8.73	0.82
Co-Location 2 Lakenfields 623637 306940	1944511	02/03/2022	30/03/2022	672.28	16.27	8.49	0.80
Co-Location 3 Lakenfields 623637 306940	1944512	02/03/2022	30/03/2022	672.28	16.54	8.63	0.81
Laboratory Blank				672.42	0.23	0.12	0.011

Comment: Results are not blank subtracted
Tube 1944517 contained a spider. Result may be compromised.
Results have been corrected to a temperature of 293 K (20°)
Overall M.U. $\pm 9.7\%$ **Limit of Detection** $0.040\mu\text{gNO}_2$
 The reported expanded uncertainty is based on a standard uncertainty multiplied by a factor of $k=2$, providing a level of confidence of approximately 95%. Uncertainty of measurement has not been applied to the reported results.
Tube Preparation: 50% TEA /Acetone **Analysed on UV CARY2**

Samples have been tested within the scope of Gradko International Ltd. Laboratory Quality Procedures. Results within this report relate only to samples as received. Data provided by the client and any subsequent calculations shall be indicated by an asterisk (*), these calculations and results are not within the scope of our UKAS accreditation. Any queries concerning data in this report should be directed to the Laboratory Manager Gradko International Ltd. This report is not to be reproduced, except in full, without the written permission of Gradko International Ltd.

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
Gradko International Ltd
 This signature confirms the authenticity of these results
 Signed: 
 L. Gates, Laboratory Manager

Figure A 6 – Raw results from April 2022



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LABORATORY ANALYSIS REPORT

NITROGEN DIOXIDE IN DIFFUSION TUBES BY U.V.SPECTROPHOTOMETRY

REPORT NUMBER Q03758R
BOOKING IN REFERENCE Q03758
DESPATCH NOTE 89522
CUSTOMER Aether UK, Attn: Melanie Hobson
Oxford Centre for Innovation
New Road
Oxford
OX1 1BY
DATE SAMPLES RECEIVED 06/05/2022

Location	Sample Number	Exposure Date	Time* (hr.)	$\mu\text{g}/\text{m}^3$ *	ppb *	$\mu\text{g NO}_2$ on tube
Edward St near to Jct with New Botolph St 623009 509494	1962409	30/03/2022	04/05/2022	839.22	21.23	11.08
Dalymond Ct 623032 309455	1962410	30/03/2022	04/05/2022	839.20	17.22	8.98
Edward St 623139 309455	1962411	30/03/2022	04/05/2022	839.17	25.91	13.52
Cherry Lane beside St. Crispins Rd 623056 309315	1962412	30/03/2022	04/05/2022	839.15	17.23	8.99
Jct of St Crispins Road with Pitt St. 622893 309230	1962413	30/03/2022	04/05/2022	839.12	32.60	17.01
Jct of St Crispins Road with Pitt St. 622893 309230	1962414	30/03/2022	04/05/2022	839.12	35.19	18.37
Jct of St Crispins Road with Pitt St. 622893 309230	1962415	30/03/2022	04/05/2022	839.12	33.04	17.24
South end of Pitt St opposite FSG signs 622888 309337	1962416	30/03/2022	04/05/2022	839.10	31.07	16.22
New Botolph St 622946 309430	1962417	30/03/2022	04/05/2022	839.07	24.47	12.77
St Georges St 622991 309377	1962418	30/03/2022	04/05/2022	839.05	16.09	8.40
Edward St North of Anglia Square 623003 309534	1962419	30/03/2022	04/05/2022	839.02	19.94	10.41
Travel Blank	1962420			839.22	0.34	0.18
Co-Location 1 Lakenfields 623637 306940	1962421	30/03/2022	04/05/2022	838.87	8.84	4.61
Co-Location 2 Lakenfields 623637 306940	1962422	30/03/2022	04/05/2022	839.03	9.79	5.11
Co-Location 3 Lakenfields 623637 306940	1962423	30/03/2022	04/05/2022	838.87	9.05	4.73
Laboratory Blank				839.22	0.39	0.21

Comment: Results are not blank subtracted

Results have been corrected to a temperature of 293 K (20°)

Overall M.U. $\pm 9.7\%$

Limit of Detection 0.040 $\mu\text{g NO}_2$

The reported expanded uncertainty is based on a standard uncertainty multiplied by a factor of $k=2$, providing a level of confidence of approximately 95%. Uncertainty of measurement has not been applied to the reported results.

Tube Preparation: 50% TEA /Acetone

Analyst Name

Alison Wright

Analysed on UV CARY2

Report Checked By Adam Robinson

Date of Analysis

10/05/2022

Date of Report

10/05/2022

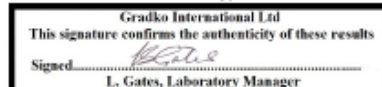
Analysis carried out in accordance with documented in-house Laboratory Method GLM7

Samples have been tested within the scope of Gradko International Ltd. Laboratory Quality Procedures. Results within this report relate only to samples as received. Data provided by the client and any subsequent calculations shall be indicated by an asterisk (*), these calculations and results are not within the scope of our UKAS accreditation. Any queries concerning data in this report should be directed to the Laboratory Manager Gradko International Ltd. This report is not to be reproduced, except in full, without the written permission of Gradko International Ltd.

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