

In fulfilment of Part IV of the Environment Act 1995

Local Air Quality Management Updating and screening assessment 2015

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Executive Summary

Part IV of the Environment Act 1995 places a statutory duty on local authorities to review and assess the air quality within their area and take account of Government guidance when undertaking such work. This Updating and Screening Assessment is a requirement of the Sixth Round of Review and Assessment, and is a requirement for all local authorities. The Report has been undertaken in accordance with the Technical Guidance LAQM.TG (09) and associated tools (as updated in 2010).

This Updating and Screening Assessment considers all new monitoring data and assesses the data against the Air Quality Strategy objectives. It also considers any changes that may have an impact on air quality.

Norwich City council have carried out all past rounds of review and assessment and have consolidated all previous AQMAs into one larger city centre AQMA.

Proposed actions from this report are as follows:

- Continue with automatic and passive NO₂ monitoring within the city area
- Subject to further road changes going ahead in the city centre, as proposed in the Norwich Area Transport Strategy, consider amending the locations of monitoring positions to assess any resultant impacts
- Proceed to 2016 Annual Progress Report.

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1 Introduction

1.1 Description of Local Authority Area

Norwich covers approximately 39 square kilometres in the heart of Norfolk with a population of circa 132,000 people. The population of the Norwich 'Travel to Work Area' ie the area of Norwich in which most people both live and work is circa 376,500. Norwich is the fourth most densely populated local authority district in the eastern region with approximately 34 people per hectare.

The City is home to more than 123,000 jobs, and more than 8,000 businesses. Almost one-third of Norfolk's workforce is based within the City Council area, and 40% are employed in the urban area. Approximately 73% of the City Council's working age resident population is economically active.

Employment in Norwich is predominantly service sector based reflecting the national picture. The Business & Financial Sector accounts for 31% of employment in Norwich. Around 26% of people employed in Norwich work in public services (Government, Health and Education). A further 12% of the workforce is employed in the retail sector and 7% work in tourism. The manufacturing sector accounts for almost 8% of employment in Norwich.

The City permits 43 'Part B' authorised processes, including petrol stations, road stone coating plant, vehicle re-sprayers and a crematorium. The major pollutant source in the city is road traffic.

1.2 Purpose of Report

This report fulfils the requirements of the Local Air Quality Management process as set out in Part IV of the Environment Act (1995), the Air Quality Strategy for England, Scotland, Wales and Northern Ireland 2007 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 exceedences are considered likely, the local authority must then 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.

The objective of this Updating and Screening Assessment is to identify any matters that have changed which may lead to risk of an air quality objective being exceeded. A checklist approach and screening tools are used to identify significant new sources or changes and whether there is a need for a Detailed Assessment. The USA report should provide an update of any outstanding information requested previously in Review and Assessment reports.

1.3 Air Quality Objectives

The air quality objectives applicable to LAQM **in England** are set out in the Air Quality (England) Regulations 2000 (SI 928), The Air Quality (England) (Amendment) Regulations 2002 (SI 3043), and are shown in Table 1.1. This table shows the objectives in units of micrograms per cubic metre μ g/m³ (milligrams per cubic metre, mg/m³ for carbon monoxide) with the number of exceedences in each year that are permitted (where applicable).

Table 1.1 Air Quality Objectives included in Regulations for the purpose of LAQM in England

	Air Quality	objective	Date to be
Pollutant	Concentration	Measured as	achieved by
Bonzono	16.25 µg/m ³	Running annual mean	31.12.2003
Delizene	5.00 μg/m ³	Running annual mean	31.12.2010
1,3-Butadiene	2.25 μg/m ³	Running annual mean	31.12.2003
Carbon monoxide	10.0 mg/m ³	Running 8-hour mean	31.12.2003
	0.5 µg/m ³	Annual mean	31.12.2004
Lead	0.25 µg/m ³	Annual mean	31.12.2008
Nitrogen dioxide	200 µg/m ³ not to be exceeded more than 18 times a year	1-hour mean	31.12.2005
	40 µg/m³	Annual mean	31.12.2005
Particles (PM ₁₀) (gravimetric)	50 μg/m ³ , not to be exceeded more than 35 times a year	24-hour mean	31.12.2004
	40 µg/m³	If duality ObjectiveDate to achieveationMeasured asachieveationRunning annual mean31.12.3/m³Running annual mean31.12.3/m³Running annual mean31.12.3/m³Running 8-hour mean31.12.3/m³Annual mean31.12.3/m³Annual mean <td< td=""><td>31.12.2004</td></td<>	31.12.2004
	350 µg/m ³ , not to be exceeded more than 24 times a year	1-hour mean	31.12.2004
Sulphur dioxide	125 μg/m ³ , not to be exceeded more than 3 times a year	24-hour mean	31.12.2004
	266 µg/m ³ , not to be exceeded more than 35 times a year	15-minute mean	31.12.2005

1.4 Summary of Previous Review and Assessments

Norwich City Council (NCC) has completed the following review and assessments of air quality to date:

Review and Assessment of Air Quality (1998);

Further Assessment (1999);

Further Assessment Update (2002);

Detailed Assessment (2003);

Updating and Screening Assessment (2004);

Progress Report (2005);

Updating and Screening Assessment (2006);

Progress Report (2007);

Detailed Assessment (2008);

Updating and Screening Assessment (2009);

Progress Report (2010);

Further Assessment for Riverside Road AQMA (2010);

Progress Report (2011);

Updating and Screening Assessment (2012);

Detailed Assessment (2012);

Progress Report (2013);

Progress Report (2014).

First Round of Air Quality Review and Assessment.

The first stage of the review and assessment process concluded that within the City the Government's objectives were likely to be met for carbon monoxide, benzene, 1,3-butadiene and lead. However, there were doubts as to whether the Government's objectives would be met with respect to nitrogen dioxide (NO₂), sulphur dioxide (SO₂) and particulate matter less than 10 μ m (PM₁₀). The report recommended that Norwich City Council progress to a Further Assessment for NO₂, SO₂ and PM₁₀.

The findings are presented in greater detail in the following report: **Review and Assessment of the Air Quality, Norwich City Council (1998)** The findings of the Further Assessment are presented in greater detail in the following report:

Review and Assessment of Air Quality – Further Assessment, Norwich City Council (2001)

The Further Assessment included estimation, modelling/measurement of pollutants and indicated which national objectives would not be achieved.

The assessment for SO_2 and PM_{10} concluded that the Air Quality objectives for 2005 would be achieved.

Nitrogen dioxide was taken straight to a Stage 3 review and assessment as Stage 1 indicated Norwich was unlikely to achieve the Air Quality objectives in 2005.

The Further Assessment for NO_2 concluded that the Air Quality Objective was unlikely to be achieved in certain areas of the city by 2005. As a result the council declared three AQMAs for exceedences of the NO_2 annual objective.

An update to the Further Assessment was produced in 2002. The findings of the report are presented in greater detail in the following report: Air Quality Review and Assessment Further Assessment Update, Norwich City Council (2002)

The Further Assessment concluded that there could be an exceedence of the NO₂ objectives as a result of traffic sources. Declaration of three AQMAs was recommended. Norwich City Council considered the likelihood of receptor exposure to exceedences based on the modelling and decided the appropriate locations of AQMAs in the city. Three AQMAs were proposed, Castle, Grapes Hill and St Augustines.

There were no predicted exceedences of the PM_{10} objective either by traffic or industrial sources. As such, there was no need for further review and assessment of PM_{10} .

There were no sources that would result in predicted exceedences of the SO₂ objective by industrial sources.

There were no sources that would result in predicted exceedences of the lead objective by industrial sources.

Norwich City Council then proceeded to a Detailed Assessment for NO₂. The findings of the 2003 Detailed Assessment are presented in greater detail in the following report:

Detailed Assessment (stage 4), Norwich City Council (2003)

The monitoring and modelling carried out at this stage of review and assessment showed that NO₂ concentrations were expected to exceed the annual mean objective at certain locations in each of the three declared AQMAs.

The source apportionment work identified emissions of oxides of nitrogen (NOx) from traffic on roads close to the AQMAs as the main source from which emissions could be reduced. Emissions of NOx from local traffic accounted for approximately 68-79 % of the total modelled oxides of nitrogen concentration at the most affected properties within the AQMAs.

This assessment also considered a number of options in order to assess their potential to reduce the nitrogen dioxide concentration at the most sensitive receptors in the Norwich AQMAs.

Further Stages of Review and Assessment

A summary of conclusions from the second and third rounds of review and assessment reports is provided below.

2004, 2005 and 2007 Progress Reports

Each report concluded that no further action was required in respect of the pollutants: CO;

Benzene;

1,3-Butadiene; Lead; SO₂; NO₂; and PM₁₀.

2004 and 2006 Updating and Screening Assessments

These updating and screening assessment for Norwich City Council concluded that a Detailed Assessment was not required for NO_2 , PM_{10} , benzene, CO, Lead, 1,3 – butadiene or SO_2 .

2008 Detailed Assessment

As part of this Detailed Assessment air dispersion modelling was carried out for NCC covering the following locations:

Grapes Hill;

King Street;

Riverside Road;

Magdalen Street; and

Boundary Road.

The assessment concluded that on the basis of the modelled and measured results in the Grapes Hill AQMA, and also due to the fact that the NO₂ concentrations were predicted to fall in 2010, the Council could consider revoking this AQMA. However, as pollution concentrations are variable due to meteorological conditions from year to year, it was recommended that this AQMA be retained at the moment.

On the basis of the modelled and measured NO₂ results in King Street it was recommended that NCC should continue to monitor this site and review each year. Should the 2009 data exceed the objective it was recommend that this area should be declared an AQMA.

Modelling and measured results for Riverside Road suggested that the council consider implementing an improved synchronised fixed time traffic signalling system to reduce queuing effect in Riverside Road. It was recommended that NCC declare an AQMA in this area. This new area was declared in December 2009.

The concentration measured at the location of the diffusion tube in Magdalen Street marginally exceeded the objective in 2007 and was under the objective in 2008. As such, it was recommended that NCC continue to monitor the area. It was not recommended to declare this area as an AQMA.

Finally, it was recommended that the Council continue to monitor the area around Boundary Road. An AQMA was not recommended for this location.

2009 Updating and Screening Assessment

This updating and screening assessment concluded that a Detailed Assessment was not required for NO_2 , PM_{10} , benzene, CO, Lead, 1,3 – butadiene or SO_2 .

2010 Annual Progress Report

This report noted that NCC carried out diffusion tube monitoring for NO₂ at 34 locations throughout the city during 2009. The results indicated that concentrations of NO₂ exceeded the annual mean objective at several locations. These locations were: King Street; St Stephens (Mid); St Augustines Street; Cattlemarket Street; Castle Meadow; Castle Meadow 2; Bull Close Road; and Riverside Road.

Of the areas where the exceedences were found, St Augustines, Cattlemarket Street, both Castle Meadow sites and Riverside Road are within existing AQMAs. The site at St Stephens Street is not situated in a location representative of relevant exposure to the general public for the annual mean. The King Street site exceeded the objective level by 4.2μ g/m³. The Bull Close Road location exceeded the objective level by 0.5μ g/m³.

The Detailed Assessment carried out in King Street in 2008 stated that if the 2009 data confirmed an exceedence of the annual mean objective for NO₂, then this area should be declared as an AQMA. The Bull Close Road site had not been the subject of any previous detailed assessment. Therefore, in line with the recommendations of the 2008 DA, the report stated that NCC would declare an area of King Street as an AQMA and revoke the existing AQMA at Grapes Hill.

The Bull Close Road location exceeded the objective level by 0.5μ g/m³. Since this was the first, very marginal, exceedence of the annual objective level for NO₂ based on a single tube at this location, it was proposed to carry out a Detailed Assessment by increasing the monitoring in the area; to include the commencement of triplicate tubes at the existing site, and deployment of additional tubes at new nearby relevant locations. Should the monitoring results for the full 2010 calendar year show a continuing exceedence, then it was proposed to declare an AQMA in the area during 2011.

The report also concluded that, based upon the findings of previous assessments, the concentrations of 1,3-butadiene, benzene, carbon monoxide, lead, PM_{10} and SO_2 were unlikely to be in excess of the air quality objectives at any location.

Subsequent to the production of the 2010 APR, discussion took place between the city council, county council and DEFRA. It was agreed in principle that rather than declare King Street as an additional AQMA, it would be preferable to replace the existing four AQMAs with one larger area to encompass all of them plus King Street and Bull Close Road.

2010 Further Assessment for Riverside Road

This report assessed concentrations of NO_2 in and around the Riverside Road AQMA for 2009 using a combination of available monitoring data and a dispersion modelling exercise. The study took account of traffic conditions in the area and the latest meteorological data available.

The study confirmed the findings of the previous detailed assessment, namely that there are exceedences of the annual mean NO₂ objective to the south of Riverside Road.

It was estimated that ambient NOx reductions of approximately 48% are required in the AQMA to achieve compliance with the annual mean NO₂ objective.

Source apportionment indicated that the primary source of emissions is derived from local moving traffic, although queuing vehicles are also particularly important near the junction. Light vehicles are thought to be the main source type although important contributions were also noted from buses and other heavy vehicles.

The report concluded that the monitoring and dispersion modelling showed that the AQMA boundary was appropriate and that Norwich City Council should proceed with air quality action planning for the area.

2011 Annual Progress Report

The 2011 annual progress report confirmed the council's intention to declare an area of central Norwich as an AQMA to replace the existing areas and cover the potential areas at King Street and Bull Close Road. This new area came into force on 1st November 2012, and is shown in Figure 1.1.

2012 Updating and Screening Assessment

The updating and screening assessment in 2012 identified an exceedence of the short term (hourly) mean objective for NO_2 on Castle Meadow. The report recommended that the council should proceed to a detailed assessment to understand the potential for a continuation of the exceedence in this area.

2012 Detailed Assessment for Castle Meadow

The detailed assessment concluded that there may have been a short-term set of circumstances that caused the exceedence of the hourly objective for NO₂. It recommended that monitoring was to continue and reported in the 2013 annual progress report.

2013 Annual Progress Report

The 2013 annual progress report confirmed that the proposed actions from the 2012 updating and screening assessment had been achieved. It proposed to continue with automatic and passive NO_2 monitoring within the city and to develop a revised Action Plan to work towards compliance with the air quality objectives within the Norwich Central AQMA.

2014 Annual Progress Report

The 2014 annual progress report confirmed that the proposed actions from the 2013 annual progress report had been achieved. It proposed to continue with automatic and passive NO_2 monitoring within the city and to submit the revised action plan by the end of 2014.



Figure 1.1 Map showing Norwich Central AQMA Boundary

2 New Monitoring Data

2.1 Summary of Monitoring Undertaken

2.1.1 Automatic Monitoring Sites

Automatic monitoring was carried out at two locations in Norwich during 2014. The locations are shown in Figures 2.1 and 2.2. The Norwich Lakenfields site is an urban background location and is part of Defra's Automatic Urban and Rural Network (AURN). The Norwich Castle Meadow site is a mobile unit that currently monitors roadside concentrations of particulates and NO₂ within the city centre.

Data for 2014 is available for both the Castle Meadow site (91.5% NO₂ and 93.4% PM_{10} data capture) and the Lakenfields site (99% NO₂ and 92% PM_{10} data capture).

The Norwich Lakenfields site incorporates an FDMS device on the PM_{10} and $PM_{2.5}$ TEOMs to correct for loss of volatile components of particulate matter that occur due to the high sampling temperatures employed by these instruments. The Castle Meadow site does not incorporate an FDMS. Therefore, PM_{10} data from this site has been corrected using the Volatile Correction Method (VCM).



Figure 2.1 Castle Meadow Automatic Monitoring station

Figure 2.2 Lakenfields Automatic Monitoring Station



Site Name & ID	Site Type	OS Grid Ref	Pollutants Monitored*	Monitoring Technique	In AQMA?	Relevant Exposure? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road (N/A if not applicable)	Worst case exposure?
Norwich Castle Meadow (CM1)	Urban Roadside	X623202 Y308615	PM ₁₀ , NO _x , NO ₂ , PM _{2.5}	Ambirak TEOM	DM Y N 1m		N/A	
Norwich Lakenfields (CM2)	Urban Background	X623637 Y306940	O ₃ , PM ₁₀ , NO _x , NO ₂ , PM _{2.5}	Thermo FDMS	N	Y (20m)	N/A	N

Table 2.1 Details of Automatic Monitoring Sites

2.1.2 Non-Automatic Monitoring Sites

Norwich City Council carried out indicative monitoring of NO₂ by diffusion tubes at 26 sites throughout the city during 2014. Triplicate tubes were located at 130 Magdalen Street, 26 Bull Close Road, 5 Riverside, 256 King Street and 4 Chapelfield North. A co-location study was also carried out using triplicate tubes at the Lakenfields AURN site.

Details of the diffusion tube monitoring locations are provided in Table 2.2, and shown in Figure 2.3. The locations include kerbside, roadside and urban background sites. Non-bias corrected diffusion tube data is presented in Appendix B.

Appendix A contains information on automatic and non-automatic monitoring QA/ QC procedures.

Figure 2.3 Map showing automatic and non-automatic monitoring locations



Site ID	Site Name	Site Type	OS Grid Ref	In AQMA?	Relevant Exposure? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road	Worst- case Location?
DT1	256 King Street	R	X 623863.04 Y 307678.60	Y	Y (1m)	3.5m	Y
DT2	Queens Rd Travelodge	R	X 622917.08 Y 307974.49	Y	Ν	N/A	N/A
DT3	St Stephens (mid)	К	X 622879.16 Y 308089.96	Y	Ν	N/A	N/A
DT4	Lakenfields	UB	X 623681.24 Y 307015.82	Ν	Y (20m)	N/A	Ν
DT5	Chalk Hill Road	R	X 623906.97 Y 308596.92	Y	Y (1m)	7m	Y
DT6	130 Magdalen Street	R	X 623160.89 Y 309550.43	Y	Y (1m)	4m	Y
DT7	Reads Flour Mill	К	X 623796.25 Y 307772.13	Y	Y (1m)	1m	Y
DT8	Deleted						
DT9	13 St Augustines St	К	X 622905.81 Y 309496.11	Y	Ν	1m	Y
DT10	32 St Augustines St	к	X 622865.96 Y 309529.93	Y	Y (1m)	2m	Y
DT11	50 St Augustines St	К	X 622825.87 Y 309573.17	Y	Y (1m)	1m	Y
DT12	65 St Augustines St	К	X 622813.72 Y 309609.96	Y	N	1m	Y
DT13	Castle Meadow	R	X 623141.06 Y 308606.69	Y	Ν	N/A	N/A
DT14	Castle Meadow 2	R	X 623250.50 Y 308590.12	Y	Ν	N/A	N/A
DT15	Deleted						
DT16	Zipfel House	R	X 623185.69 Y 309649.68	Y	Y (1m)	3m	Y
DT17	68 Bull Close Road	R	X 623305.49 Y 309543.95	Y	Y (1m)	4m	Y
DT18	Upper King Street	К	X 623337.40 Y 308632.52	Y	Ν	N/A	N/A
DT19	Cattlemarket Street	R	X 623320.58 Y 308430.88	Y	Y (1m)	2m	Y
DT20	Exchange St	К	X 623007.27 Y 308716.34	Y	N	N/A	N/A
DT21	Rotary House King Street	R	X 623879.53 Y 307658.91	Y	Y (3m)	2m	Y
DT22	Carrow Bridge House	R	X 623900.96 Y 307709.56	Y	Y (1m)	5m	Y
DT23	62 Magpie Road	R	X 622970.72 Y 309652.02	Y	Y (1m)	2m	Y
DT24	26 Bull Close Road	R	X 623228.63 Y 309625.14	Y	Y (1m)	5.5m	Y
DT25	24 Bargate Court	R	X 623422.42 Y 309388.23	Y	Y (1m)	4m	Y
DT26	5 Riverside Road	R	X 623870.26 Y 308515.77	Y	Y (1m)	3m	Y
DT27	Deleted						
DT28	71 Dukes Court	R	X 622431.35 Y 308663.05	Y	Y (1m)	4m	Y
DT29	4 Chapelfield North	К	X 622532.23 Y 308490.36	Y	Y (1m)	1m	Y

Table 2.2 Details of Non-Automatic NO₂ Monitoring Sites

2.2 Comparison of Monitoring Results with Air Quality Objectives

2.2.1 Nitrogen Dioxide (NO₂)

Automatic Monitoring Data

The annual mean concentration at the Castle Meadow automatic monitoring site was recorded as 66μ g/m³ for 2014, which exceeds the annual mean objective by 26μ g/m³. This monitoring site is within the central AQMA, although it does not represent any nearby relevant exposure. There were **57** exceedences of the 1-hour mean over 35 days during 2014.

The Norwich Lakenfields urban background automatic monitoring site measured an annual mean concentration of $14\mu g/m^3$. There were no exceedences of the 1-hour mean.

Table 2.3 Results of Automatic Monitoring of Nitrogen Dioxide: Comparisonwith Annual Mean Objective

Sito			Valid Data Capture for Monitoring Period (%)	Valid Data	Annual Mean Concentration (µg/m ³)					
ID	Location	AQMA?		Capture 2014 (%)	2010	2011	2012	2013	2014	
CM 2	Norwich Lakenfields	N	99	99	13	13	14	15	14	
CM 1	Norwich Castle Meadow (mobile)	Y	91.5	91.5	53	52	53	64	66	

Table 2.4 Results of Automatic Monitoring for Nitrogen Dioxide: Comparisonwith 1-hour Mean Objective

Site ID	Location	Within AQMA?	Valid Data Capture for Monitoring Period (%)	Valid Data Capture 2014 (%)	Number of Exceedences of hourly mean (200 μg/m ³) (99.8 th percentile of hourly means in brackets)				
					2010	2011	2012	2013	2014
CM 2	Norwich Lakenfields	N	99	99	0	0	0	0	0
CM 1	Norwich Castle Meadow (mobile)	Y	91.5	91.5	15	54	4	72	57

Diffusion Tube Monitoring Data

Table 2.5 shows the diffusion tube results for 2014, corrected for bias using a national bias adjustment factor of 0.97 using Gradko Labs for analysis and the 50% TEA in Acetone method.

The national bias spreadsheet is shown in Appendix A and is available here: <u>http://laqm.defra.gov.uk/documents/Database_Diffusion_Tube_Bias_Factors-v03_15-Final.xls</u>

The precision and accuracy spreadsheet used to calculate the local bias correction is also shown in Appendix A.

Site ID	Site Name	Site Type	Triplicate or Co-located	Within AQMA?	Data Capture 2014 (%)	2014 Anr Concentra Bias Adjustme	nual Mean ation (μg/m ³) ent factor = 0.97		
			Tube?		2014 (70)	Uncorrected	Bias-adjusted		
DT1	256 King Street	R	Triplicate	Y	100	42.7	41.5		
DT2	Queens Rd Travelodge	R	N	Y	83	34.6	33.6		
DT3	St Stephens (mid)	К	N	Y	83	61.5	59.6		
DT4	Lakenfields	UB	Triplicate & co-located	N	100	12.9	12.5		
DT5	Chalk Hill Road	R	N	Y	100	33.9	32.9		
DT6	130 Magdalen Street	R	Triplicate	Y	100	31.9	30.9		
DT7	Reads Flour Mill	К	N	Y	67	24.0	23.2		
DT8	Deleted								
DT9	13 St Augustines St	К	N	Y	100	43.2	41.9		
DT10	32 St Augustines St	к	N	Y	100	40.7	39.4		
DT11	50 St Augustines St	к	N	Y	100	50.1	48.6		
DT12	65 St Augustines St	К	N	Y	100	32.9	31.9		
DT13	Castle Meadow	R	N	Y	100	58.0	56.3		
DT14	Castle Meadow 2	R	N	Y	83	52.0	50.5		
DT15	Deleted								
DT16	Zipfel House	R	N	Y	100	40.2	39.0		
DT17	68 Bull Close Road	R	N	Y	100	29.9	29.0		
DT18	Upper King Street	К	N	Y	83	34.1	33.1		
DT19	Cattlemarket Street	R	N	Y	100	47.4	46.0		
DT20	Exchange St	к	N	Y	100	32.0	31.0		
DT21	Rotary House King Street	R	N	Y	92	37.8	36.6		
DT22	Carrow Bridge House	R	N	Y	100	25.4	24.7		
DT23	62 Magpie Road	R	N	Y	100	33.1	32.1		
DT24	26 Bull Close Road	R	Triplicate	Y	100	32.5	31.5		
DT25	24 Bargate Court	R	Ν	Y	100	36.1	35.1		
DT26	5 Riverside Road	R	Triplicate	Y	100	52.8	51.2		
DT27	Deleted								
DT28	71 Dukes Court	R	N	Y	92	26.6	25.8		
DT29	4 Chapelfield North	К	Triplicate	Y	100	39.3	38.1		

Table 2.5 Results of NO₂ Diffusion Tubes 2014

Using the National bias correction, a total of eight sites exceeded the NO₂ annual mean objective of 40μ g/m³ during 2014. This is two less than 2013. These sites were:

- 256 King Street
- St Stephens (Mid);
- 13 St Augustines Street;
- 50 St Augustines Street;
- Castle Meadow;
- Castle Meadow 2;
- Cattlemarket Street; and
- 5 Riverside Road

All of these sites are within the existing Norwich Central AQMA, though the tubes at St Stephens Street, Castle Meadow and Castle Meadow 2 are not situated at locations representative of relevant exposure for the annual mean. The Castle Meadow tube indicated an annual mean of $56.3\mu g/m^3$, which is considerably lower than 2013, when a potential threat to the 1-hour objective was identified. This location has been monitored for many years using a single diffusion tube, and is located approximately 60m along the road from our mobile automatic analyser. 2013 was the first occasion that a potential threat to the hourly mean had been indicated at this location. The automatic analyser has recorded exceedences also this year, though again, fewer than 2013.

The Chapelfield North site was a new triplicate site for 2013. It recorded an indicated annual mean of 60.9μ g/m³ in that year. The road was closed to general traffic between July and November 2014 for carriageway improvements, as part of a major change of road layout/traffic flow in central Norwich. In 2014 the site indicated an annual mean of 38.1μ g/m³. Monitoring will continue to establish whether compliance with the nitrogen dioxide annual mean is maintained.

Fig 2.4 displays the bias adjusted diffusion tube monitoring results across the time series 2010 to 2014. This data is also shown in Table 2.6.

Non bias-corrected monthly diffusion tube results are shown in Appendix B.

Site ID	Site Name	Within AQMA?	Annual mean concentrations (μg/m ³) Adjusted for bias				
				Bias Ac	ljustment	Factors	
			2010	2011	2012	2013	2014
			1.03	0.93	1.02	1.01	0.97
DT1	256 King Street	Y	41.5	41.9	43.8	39.7	41.5
DT2	Queens Rd Travelodge	Y	40.3	31.8	33.9	38.8	33.6
DT3	St Stephens (mid)	Y	54.5	53.0	<u>61.6</u>	55.4	59.6
DT4	Lakenfields	N	15.1	13.1	14.1	13.2	12.5
DT5	Chalk Hill Road	Y	34.1	31.1	32.6	32.9	32.9
DT6	130 Magdalen Street	Y	39.7	29.0	32.7	32.7	30.9
DT7	Reads Flour Mill	Y	24.9	23.1	24.1	23.5	23.2
DT8	Grapes Hill (upper)	Y	26.3	24.9	24.4	N/A	N/A
DT9	13 St Augustines St	Y	N/A	37.6	41.7	45.1	41.9
DT10	32 St Augustines St	Y	N/A	36.2	40.1	42.8	39.4
DT11	50 St Augustines St	Y	55.0	47.5	52.1	51.2	48.6
DT12	65 St Augustines St	Y	N/A	29.6	35.1	33.2	31.9
DT13	Castle Meadow	Y	58.4	51.1	57.2	<u>63.5</u>	56.3
DT14	Castle Meadow 2	Y	49.6	52.5	53.4	52.4	50.5
DT15	Grapes Hill (lower)	Y	29.5	25.6	24.6	N/A	N/A
DT16	Zipfel House	Y	42.3	42.8	44.2	40.9	39.0
DT17	68 Bull Close Road	Y	34.5*	29.1	31.2	29.8	29.0
DT18	Upper King Street	Y	26.3	35.2	37.2	35.6	33.1
DT19	Cattlemarket Street	Y	48.4	45.0	47.2	46.7	46.0
DT20	Exchange St	Y	38.7	32.7	30.7	30.3	31.0
DT21	Rotary House King Street	Y	N/A	40.2	38.1	36.7	36.6
DT22	Carrow Bridge House	Y	28.8*	24.7	26.1	27.2	24.7
DT23	62 Magpie Road	Y	32.1	31.6	34.4	33.1	32.1
DT24	26 Bull Close Road	Y	37.7	35.0	34.6	32.2	31.5
DT25	24 Bargate Court	Y	39.3	35.1	36.9	37.2	35.1
DT26	5 Riverside Road	Y	52.1	49.4	51.0	52.4	51.2
DT27	Wellington Lane (lower)	Y	33.9	26.2	30.0	N/A	N/A
DT28	71 Dukes Court	Y	28.8	27.9	27.8	28.1	25.8
DT29	4 Chapelfield North	Y				<u>60.9</u>	38.1

Table 2.6 Results of NO₂ Diffusion Tubes (2010 to 2014)

* Not based on full year's measurements



Figure 2.4 Annual mean NO₂ concentrations measured at diffusion tube monitoring sites 2010 to 2014

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2.2.2 Particulate Matter (PM₁₀)

The annual mean concentration of PM_{10} at the Castle Meadow automatic monitoring site was recorded as $21\mu g/m^3$, which is below the annual mean objective of $40\mu g/m^3$. There were 9 exceedences of the 24-hour mean of $50\mu g/m^3$ (35 allowed), and the maximum daily mean recorded was $66\mu g/m^3$ (93.4% data capture). Since the station does not incorporate an FDMS device, the data was corrected using the Volatile Correction Method (VCM). This is discussed further in Appendix A.

For the Norwich Lakenfields urban background automatic monitoring site, there were no exceedences of the 24-hour mean, and the maximum daily mean recorded was $48\mu g/m^3$. The annual mean concentration was $16\mu g/m^3$ (92% data capture).

Table 2.7 Results of Automatic Monitoring of PM₁₀:

Site ID	Location	Within AQMA ?	Valid Data Capture for Monitoring Period (%)	Valid Data	Confirm Gravimetric Equivalent (Y or N/A)	Annual mean concentrations (μg/m³)				
				2014 (%)		2010	2011	2012	2013	2014
CM 2	Norwich Lakenfields	N	92	92	Y	18	19	14	15	16
CM 1	Norwich Castle Meadow (mobile)	Y	93.4	93.4	N/A	19	25	17	25	21

Comparison with Annual Mean Objective

Table 2.8 Results of Automatic Monitoring for PM₁₀:

Comparison with 24-hour mean Objective

Site ID	Location	Within AQMA ?	Valid Data Capture for Monitoring Period (%)	Valid Data Capture 2012 (%)	Confirm Gravimetric Equivalent (Y or N/A)	Number of Exceedences of daily mean objective (50 μg/m ³) (90 th percentile of daily means in brackets)				
						2010	2011	2012	2013	2014
CM 2	Norwich Lakenfields	N	92	92	Y	4	13 (37)	1	3	0
CM 1	Norwich Castle Meadow (mobile)	Y	93.4	93.4	N/A	3	17	7	15	9

2.2.3 Sulphur Dioxide (SO₂)

There are no longer any automatic sites that monitor SO_2 in Norwich. The analysers at Lakenfields and Castle Meadow were removed as part of the rationalisation of the network. Norwich has not had any exceedences of the objectives for SO_2 , and it was therefore decided to discontinue the monitoring.

2.2.4 Benzene

Norwich City Council no longer monitors benzene as it has been determined that ambient levels in Norwich are insignificant in terms of the Air Quality Objective.

2.2.5 Other pollutants monitored

As for sulphur dioxide, the analysers for carbon monoxide and ozone were removed from the Castle Meadow station prior to the reporting year.

PM_{2.5}

Monitoring data is available for $PM_{2.5}$ from the Norwich mobile monitoring unit at Castle Meadow for the 2014 calendar year. $PM_{2.5}$ is not included in the regulations for air quality management for local authorities, though it is measured on the national network for the Govt. The recorded data shows an annual mean of $12\mu g/m^3$ and a maximum daily mean of $32\mu g/m^3$. $PM_{2.5}$ data is also available for the Lakenfields site. The recorded data shows an annual mean of $12\mu g/m^3$ and a maximum daily mean of $32\mu g/m^3$. $PM_{2.5}$ data is also available for the Lakenfields site. The recorded data shows an annual mean of $12\mu g/m^3$ and a maximum daily mean of $41\mu g/m^3$.

2.2.6 Summary of Compliance with AQS Objectives

Norwich City Council has examined the results from monitoring in the district. Concentrations within the AQMA still exceed the annual mean objective for nitrogen dioxide at eight monitoring sites (five with relevant exposure), and the AQMA should remain.

Concentrations outside of the AQMA are all below the objectives at relevant locations, therefore there is no need to proceed to a Detailed Assessment.

3 Road Traffic Sources

As mentioned in the 2014 progress report, works have been completed to implement new road layout and junction arrangements in the Chapelfield area of Norwich. This area is within the Central AQMA. Revised traffic flow and direction in the surrounding roads aims to improve bus access and reduce through-traffic in the city centre. Triplicate diffusion tube monitoring was carried out for a full year prior to the scheme commencing, and has continued since it's completion in early November 2014. There was a period between July and October during construction works when the road was closed to general traffic. However, as a result of the changes, the annual mean NO₂ concentration dropped from 60.9μ g/m³ in 2013 to 38.1μ g/m³ in 2014. Further information on the Chapelfield area changes can be found by following this link: <u>http://www.norwich.gov.uk/citychanges</u>

The Norwich Area Transport Strategy (NATS) includes additional proposals for traffic management in Norwich city centre. Details of the strategy and the proposed changes can be found by following this link:

http://www.norfolk.gov.uk/travel_and_transport/major_projects_and_improvement_pl ans/norwich/index.htm

3.1 Narrow Congested Streets with Residential Properties Close to the Kerb

Norwich City Council confirms that there are no new/newly identified congested streets with a flow above 5,000 vehicles per day and residential properties close to the kerb, that have not been adequately considered in previous rounds of Review and Assessment.

3.2 Busy Streets Where People May Spend 1-hour or More Close to Traffic

Norwich City Council confirms that there are no new/newly identified busy streets where people may spend 1 hour or more close to traffic.

3.3 Roads with a High Flow of Buses and/or HGVs.

Norwich City Council confirms that there are no new/newly identified roads with high flows of buses/HDVs.

3.4 Junctions

Norwich City Council confirms that there are no new/newly identified busy junctions/busy roads.

3.5 New Roads Constructed or Proposed Since the Last Round of Review and Assessment

Norwich City Council confirms that there are no new/proposed roads.

3.6 Roads with Significantly Changed Traffic Flows

See text above regarding the Chapelfield area changes.

Norwich City Council confirms that there are no new/newly identified roads with significantly changed traffic flows.

3.7 Bus and Coach Stations

Norwich City Council confirms that there are no relevant bus stations in the Local Authority area.

4 Other Transport Sources

4.1 Airports

Norwich City Council confirms that there are no new airports in the Local Authority area.

4.2 Railways (Diesel and Steam Trains)

4.2.1 Stationary Trains

Norwich City Council confirms that there are no locations where diesel or steam trains are regularly stationary for periods of 15 minutes or more, with potential for relevant exposure within 15m.

4.2.2 Moving Trains

Norwich City Council confirms that there are no locations with a large number of movements of diesel locomotives, and potential long-term relevant exposure within 30m.

4.3 **Ports (Shipping)**

Norwich City Council confirms that there are no ports or shipping that meet the specified criteria within the Local Authority area.

5 Industrial Sources

- 5.1 Industrial Installations
- 5.1.1 New or Proposed Installations for which an Air Quality Assessment has been Carried Out

Norwich City Council confirms that there are no new or proposed industrial installations for which planning approval has been granted within its area or nearby in a neighbouring authority.

5.1.2 Existing Installations where Emissions have Increased Substantially or New Relevant Exposure has been introduced

Norwich City Council confirms that there are no industrial installations with substantially increased emissions or new relevant exposure in their vicinity within its area or nearby in a neighbouring authority.

5.1.3 New or Significantly Changed Installations with No Previous Air Quality Assessment

Norwich City Council confirms that there are no new or proposed industrial installations for which planning approval has been granted within its area or nearby in a neighbouring authority.

5.2 Major Fuel (Petrol) Storage Depots

There are no major fuel (petrol) storage depots within the Local Authority area.

5.3 Petrol Stations

Norwich City Council confirms that there are no petrol stations meeting the specified criteria.

5.4 Poultry Farms

Norwich City Council confirms that there are no poultry farms meeting the specified criteria.

6 **Commercial and Domestic Sources**

6.1 Biomass Combustion – Individual Installations

Norwich City Council confirms that there are no new biomass combustion plants in the Local Authority area.

6.2 Biomass Combustion – Combined Impacts

Norwich City Council confirms that there are no new biomass combustion plants in the Local Authority area.

6.3 Domestic Solid-Fuel Burning

Norwich City Council confirms that there are no areas of significant domestic fuel use in the Local Authority area.

7 Fugitive or Uncontrolled Sources

Norwich City Council confirms that there are no potential sources of fugitive particulate matter emissions in the Local Authority area.

8 Conclusions and Proposed Actions

8.1 Conclusions from New Monitoring Data

Norwich City Council undertakes both continuous and diffusion tube nitrogen dioxide monitoring in their administrative area. Continuous monitoring carried out at Castle Meadow in 2014 showed that the NO₂ concentration exceeded the annual mean objective of 40 μ g/m³. The monitoring also showed that the 1-hour mean objective for NO₂ was exceeded 57 times during the year (18 allowed). Automatic monitoring carried out at Norwich Lakenfields did not indicate any exceedence of the annual mean or the 1-hour mean objectives.

A detailed assessment has previously been carried out for Castle Meadow following exceedences of the hourly objective in 2011. The detailed assessment concluded that there were likely to have been a short-term set of circumstances that caused the exceedence. It recommended that monitoring was to continue and be reported in the 2013 annual progress report. In the following year there were only 4 exceedences. During 2014 the majority of exceedences occurred in April and September and between 15:00 and 17:00 hrs. It is considered that a further detailed assessment will not shed any additional information upon the likely causes of the exceedence. It is therefore proposed to continue monitoring with the automatic analyser at this location, and to consider the longer term situation in the light of further traffic changes that are likely to impact on Castle Meadow. These changes are proposed for adjacent roads in the Norwich Area Transport Strategy, as referenced in section 3.

Norwich City Council also carried out diffusion tube monitoring for NO_2 at 26 locations throughout the city. The 2014 national bias-adjusted results indicated that concentrations of NO_2 exceeded the annual mean objective at eight locations (five with relevant exposure). This is two less than 2013. These locations were:

- 256 King Street
- St Stephens (Mid);
- 13 St Augustines Street;
- 50 St Augustines Street;
- Castle Meadow;
- Castle Meadow 2;
- Cattlemarket Street; and
- 5 Riverside Road

All of these locations are within the Norwich Central AQMA.

8.2 Conclusions from Assessment of Sources

The Chapelfield North monitoring site was introduced ahead of proposed carriageway works which were part of a major change of road layout & traffic flow in central Norwich. This work was scheduled to be completed towards the end of 2014. In 2013 the site recorded an annual mean of 60.9μ g/m³. The road was closed to general traffic between July and the start of November 2014 for the works to be carried out, though monitoring continued during that time. In 2014 the site indicated an annual mean of 38.1μ g/m³, which was a very significant improvement. Monitoring continues to establish whether compliance with the nitrogen dioxide annual mean is maintained.

8.3 **Proposed Actions**

Norwich City Council has examined the results from monitoring in its administrative area. Concentrations within the AQMA still exceed the annual mean objective for nitrogen dioxide at eight monitoring sites (five with relevant exposure), and the AQMA should remain. This Updating & Screening Assessment concludes that the council is not required to carry out a detailed assessment for nitrogen dioxide, carbon monoxide, benzene, 1,3-butadiene, lead, sulphur dioxide or PM₁₀.

Proposed actions from this report are as follows:

- Continue with automatic and passive NO₂ monitoring within the city area
- Subject to further road changes going ahead in the city centre, as proposed in the Norwich Area Transport Strategy, consider amending the locations of monitoring positions to assess any resultant impacts
- Proceed to 2016 Annual Progress Report.

9 References

DEFRA (2007) *The Air Quality Strategy for England, Scotland, Wales and Northern Ireland,* Department of the Environment, Food and Rural Affairs, Cm 7169, NIA 61/06-07

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Norfolk County Council website – major projects and improvement plans - Norwich <u>http://www.norfolk.gov.uk/travel_and_transport/major_projects_and_improvement_plans/nor</u> <u>wich/index.htm</u> Accessed in 2015

DEFRA LAQM website – Air Quality Information Resource <u>http://uk-air.defra.gov.uk</u> Accessed in 2015

Appendices

Appendix A: QA/QC Data

Appendix B: 2014 Monthly Uncorrected NO₂ Concentrations (µg/m³)

Appendix A: QA/QC Data

National Diffusion Tube Bias Adjustment Factors

Supplier/ Analyst: Gradko Preparation Method: 50% TEA in Acetone National Bias Adjustment Factor (from spreadsheet v03/15): **0.97**

Factor from Local Co-location Studies (Local Bias Adjustment Factor)

Norwich Lakenfields urban background AURN site (based on 12 periods of data) Bias Factor A: **1.07** (0.98 – 1.19) Bias B: -7% (-16% - 2%) Diffusion Tubes Mean: 13µg/m³ Automatic Mean: 14µg/m³ Data Capture for periods used: 99% Adjusted Tubes Mean: 14 (13-15) µg/m³

A copy of the precision and accuracy spreadsheet used to calculate the local bias correction is shown below:

Checking Precision and Accuracy of Triplicate Tubes AEA Energy & Environment																	
			Diffu		ity Check												
Period	Start Date dd/mm/yyy v	End Date dd/mm/yyy v v		Tube 3 μgm ⁻³	Triplicat Stands e Mean Deviat		Coefficient of Variation	95% CI of mean		Period Mean	Data Capture (% DC)	Tubes Precision Check	Automati c Monitor Data				
1	11/01/2014	/2014 10/02/2014 13.23 13.38 14.68				14	0.8	6	2.0	1	16.97	97	Good	Good			
2	10/02/2014 10/03/2014 20.27 21.37 21.06					21	0.6	3	1.4	1	16.66	93	Good	Good			
3	10/03/2014	12.65	13.13	13	0.4	3	1.1		16.35	100	Good	Good					
4	18/04/2014	20/05/2014	10.78	9.45	9.03	10	0.9	9	2.3		11.12	100	Good	Good			
5	20/05/2014	21/06/2014	8.37	9.95	8.52	9	0.9	10	2.2		9.36	100	Good	Good			
6	21/06/2014	22/07/2014	9.88	9.12	9.3	9	0.4	4	1.0		8.44	100	Good	Good			
7	22/07/2014	16/08/2014	7.79	7	7.56	7	0.4	5	1.0		7.75	92	Good	Good			
8	16/08/2014	16/09/2014	9.83	10.47	9.8	10	0.4	4	0.9		10.9	100	Good	Good			
9	16/09/2014	08/10/2014	13.34	12.07	13.28	13	0.7	6	1.8		14.95	100	Good	Good			
10	08/10/2014	08/10/2014 08/11/2014 13.47 15.24 15.87					1.2	8	3.1		13.7	100	Good	Good			
11	08/11/2014	06/12/2014	17.57	17.87	19.07	18	0.8	4	2.0		22.37	100	Good	Good			
12	06/12/2014	08/01/2015	15.46	15.97	15.34	16	0.3	2	0.8		17.67	100	Good	Good			
13																	
lt is	necessary to	have results	for at lea	st two tul	oes in ord	er to calcul	late the prec	ision of the m	easureme	nts	Overal	l survey>	Good precision	Good Overall DC			
Sit	e Name/ ID:	Norv	wich Lal	kenfield	S		Precision	12 out of 12	periods l	have a C	e a CV smaller than 20% (Check average CV & DC from Accuracy calculations)						
	Accuracy	(with 9	5% confi	idence i	nterval)		Accuracy	(with 9	5% confi	dence	interval		ITOIII Accuracy	calculations)			
	without pe	eriods with	CV larg	er than (20%		WITH ALL	DATA			í í	50%	·				
	Bias calcul	ated using	12 perio	ds of da	ta		Bias calcu	lated using	12 perio	ds of d	of data						
Bias factor $\Delta = 1.07 (0.98 \pm 1.19)$							E	Bias factor A	1.07	(0.98 -	1.19)	86 25%		a Quality Check bes Automati c Monitor eck Data ood Good ood Good			
		Bias B	-7%	(-16% -	2%)			Bias B		6 I .	Data Quality Check Tubes Automati Precision c Monitor Check Data Good Good Wmout I >>20% Win 1 data						
	Diffusion Tu	ubes Mean [.]	13	uam ⁻³			Diffusion T	ubes Mean [.]	13		F S	Without V>20%	With and data				
Mean CV (Precision): 5							Mean CV	(Precision):	.es -25%								
Automatic Mean: 14 µgm ⁻³							Auto	matic Mean:	14	uam		50%					
	Data Capt	ure for perio	ds used:	99%			Data Ca	oture for perio	ds used:	99%							
	Adjusted Tu	ubes Mean:	14 (1	3 - 15)	µgm ⁻³		Adjusted T	ubes Mean:	14 (13	- 15)	µgm ⁻³		Jaume Tar	ga, for AEA			
												Vor	cion 04 Eob	uppy 2011			

If you have any enquiries about this spreadsheet please contact the LAQM Helpdesk at: LAQMHelpdesk@uk.bureauveritas.com

Discussion of Choice of Factor to Use

With regard to the selection of a bias adjustment factor for diffusion tubes, Technical Guidance LAQM.TG(09) and the LAQM Support website recommend the use of a local bias adjustment factor where available and relevant to diffusion tube sites. The co-location site at Lakenfields was therefore used to derive a local bias correction factor to be considered and applied if appropriate.

However, the technical guidance also states that where the survey consists of tubes exposed over a range of settings, which differ from the co-location site (eg the colocation site is in a very exposed setting and the tubes being assessed are on a building façade in a canyon-like street), then this indicates that the national adjustment factor may be more representative.

Therefore, to be as accurate as is reasonably possible using diffusion tubes, it has been decided to use a correction derived from many surveys (including that from Norwich), and apply the nationally derived bias adjustment factor of 0.97 The Spreadsheet of National Bias Adjustment Factors (v.03/15) is shown below.

National Diffusion Tub	Spreadshe	ber: 03/15											
Follow the steps below <u>in the correct ord</u> Data only apply to tubes exposed monthly a Whenever presenting adjusted data, you sh This spreadhseet will be updated every few	This spreadsheet will be updated at the end of Jur 2015 LAOM Helpdesk Websit												
The LAQM Helpdesk is operated on behalf of D contract partners AECOM and the National Ph	Physical Laboratory. Original												
Step 1:	Step 2:	Step 3:			5	Step 4:							
Select the Laboratory that Analyses Your. Tubes from the Drop-Down List	Select a Preparation Method from the Drop-Down List	<u>Select a</u> Year from the Drop-Down Lize	Whe with	re there is only one study for a cho caution. Where there is more thar	pination, you ly, use the ov nal column.	n, you should use the adjustment factor sh the overall factor [®] shown in blue at the foc umn.							
lf a labaratary ir natzhaun, uo havo na data far thir labaratary.	If a proparation mothed ir notzhoun, wo havo ne data for thir mothed at thir laboratory.	lf a year ir not rhown, we have no data ²	lf	you have your own co-location study ther Management Helpdesk at L	n what to do then contact the Local Air Quality uveritas.com or 0800 0327953								
Analysed By ¹	Method Tranda yan olodia, daar 1941 food to provide	Year ⁵	Site Typ e	Local Authority	Length of Study (months)	Diffusion Tube Mean Conc. (Dm) (µg/m³)	Automatic Monitor Mean Conc. (Cm) (μg/m ³)	Bias (B)	Tube Precisio n ⁶	Bias Adjustme nt Factor (A) (Cm/Dm)			
Gradko	50% TEA in acetone	2014	R	East Hampshire District Council	12	25	23	10.9%	G	0.90			
Gradko	50% TEA in acetone	2014	R	London Borough of Croydon	11	48	46	4.5%	Р	0.96			
Gradko	50% TEA in acetone	2014	R	London Borough of Richmond upon Thame	10	39	36	6.2%	G	0.94			
Gradko	50% TEA in acetone	2014	R	London Borough of Richmond upon Thame	12	48	42	15.2%	G	0.87			
Gradko	50% TEA in acetone	2014	В	London Borough of Richmond upon Thame	11	24	25	-4.0%	G	1.04			
Gradko	50% TEA in acetone	2014	KS	Marylebone Road Intercomparison	12	92	80	14.8%	G	0.87			
Gradko	50% TEA in acetone	2014	UB	Norwich City Council	12	13	14	-6.2%	G	1.07			
Gradko	50% TEA in acetone 2014		R	Reading Borough Council	11	42	41	3.6%	G	0.97			
Gradko	50% TEA in acetone	2014	R	Worthing Borough Council	12	43	51	-15.2% G		1.18			
Gradko	50% TEA in acetone	2014		Overall Factor ^a (9 studies)		Jse	se 0.97						

PM Monitoring Adjustment

The Volatile Correction Method (VCM) allows corrections to be made to TEOM measurements for the loss of volatile components of particulate matter that occur due to the high sampling temperatures employed by these instruments. The resulting corrected measurements have been demonstrated as equivalent to the gravimetric reference equivalent.

The VCM works by using the volatile particulate matter measurements provided by nearby FDMS instruments (within 130 km) to assess the loss of PM_{10} from the TEOM; this value is then added back onto the TEOM measurements.

The VCM model was applied to the Castle Meadow TEOM data to calculate the Indicative Gravimetric Equivalent PM_{10} for the annual mean and 24-hour mean readings.

The Norwich Lakenfields site incorporates an FDMS device on the PM_{10} and $PM_{2.5}$ TEOMs.

QA/QC of Automatic Monitoring

In order to satisfy the requirements outlined in LAQM TG (09), the following QA/QC procedures were implemented:

- 2-weekly calibrations of the analysers;
- Annual audits;
- 6-monthly servicing of the monitoring site; and
- Data ratification.

Calibration of the analysers was carried out using certified compressed gas standards (ISO17025). This ensured that the calibration gas was traceable to national and international standards. In addition to the calibration, sample filters were changed for both gaseous and TEOM analysers and any faults were identified, thus minimising data loss.

Audits of the monitoring site were carried out by Ricardo-AEA and consisted of a number of performance checks to identify any faults with the equipment. The calibration cylinders were also checked against another gas standard in order to

confirm the gas concentration. Any identified faults were forwarded on to the service unit for repair.

The final stage of the QA/QC process was to ratify the data. During ratification, all calibration, audit and service data are collated and the data is appropriately scaled. Any suspect data identified are deleted, thereby ensuring that the data sets are of a high quality. The data was ratified by Air Quality Data Management (AQDM).

QA/QC of Diffusion Tube Monitoring

The diffusion tubes are supplied and analysed by Gradko International utilising a 50% Triethanolamine (TEA) in Acetone preparation method. Gradko participate in the Workplace Analysis Scheme for Proficiency (WASP) for NO₂ diffusion tube analysis (scoring 100% in each of the last 23 rounds of testing), and also the Annual Field Inter-Comparison Exercise. The lab follows the procedures set out by the Harmonisation Practical Guidance.

More information and results of the WASP testing is available on the following link: <u>http://laqm.defra.gov.uk/diffusion-tubes/qa-qc-framework.html</u>

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Appendix B: 2014 Monthly Uncorrected NO₂ Concentrations ($\mu g/m^3$)

	2014 Bias Corrected	0.97	41.5	33.6	59.6	30.9	31.0	48.6	39.4	41.9	31.9	33.1	46.0	56.3	50.5	12.5	32.1	31.5	35.1	51.2	38.1	25.8	32.9	23.2	24.7	39.0	29.0	36.6
	Annual	Average	42.7	34.6	61.5	31.9	32.0	50.1	40.7	43.2	32.9	34.1	47.4	58.0	52.0	12.9	33.1	32.5	36.1	52.8	39.3	26.6	33.9	24.0	25.4	40.2	29.9	37.8
		Dec	41.1			34.3	26.4	41.7	37.7	33.2	32.1		34.3	45.0	51.1	15.6	30.7	35.6	33.6	41.8	35.3	21.7	27.4	21.1	26.7	43.7	29.7	36.5
		Nov	45.5			31.8	42.5	51.4	38.2	48.6	33.8		46.8	59.7	48.1	18.2	38.7	30.7	32.0	52.4	52.1	33.8	35.3	30.8	27.7	40.1	29.8	33.8
µg/m³)		Oct	49.9	27.9	79.6	34.7	40.9	53.6	45.6	42.7	38.5	37.5	54.8	53.8	64.1	14.9	42.6	40.8	39.0	60.1	23.3	30.4	51.1	28.0	28.1	51.3	35.3	42.4
ations (Sep	43.7	37.4	66.0	35.2	30.5	54.5	41.1	45.8	36.5	40.1	47.0	60.0	51.4	12.9	33.9	34.0	42.6	51.0	21.5	26.2	33.2	26.3	27.6	43.6	31.9	
oncentr		Aug	36.4	44.0	60.9	30.3	31.7	49.8	37.3	47.6	27.2	36.8	44.4	65.5	47.6	10.0	26.0	26.6	41.5	47.5	18.5	22.0	38.5	20.8	26.2	35.2	26.6	32.9
		Jul	32.6	30.5	53.2	25.8	23.3	44.6	37.7	35.9	31.3	27.1	37.6	55.2	45.7	7.5	25.4	25.9	26.8	45.1	16.0	20.2	26.1	17.0	19.4	16.8	21.4	31.9
rrected		Jun	40.7	45.8	65.9	34.3	32.0	53.3	44.5	59.7	31.9	34.6	50.2	68.2		9.4	29.2	27.8	40.1	53.7	38.7	22.4	31.9	22.7	24.8	37.2	24.5	35.8
y Unco		May	43.4	38.7	66.4	31.1	30.3	50.1	43.2	53.0	30.3	32.4	50.3	66.69		9.0	29.7	29.6	37.1	60.2	68.4	24.3	32.6		24.9	37.7	30.5	36.5
Month		Apr	41.9	33.0	49.0	26.4	27.4	45.0	41.2	41.2	26.5	29.0	45.6	60.2	45.9	9.8	28.7	28.3	32.7	54.1	58.4	25.2	32.6		26.2	35.9	27.5	40.3
2014		Mar	38.9	38.3	54.9	32.6	35.9	55.4	33.3	42.4	32.7	35.4	50.5	55.4	55.2	13.1	32.1	35.3	37.5	48.6	48.9	29.7	29.1	25.2	25.9	40.8	32.3	39.9
		Feb	51.5	27.5	58.5	36.3	31.7	52.9	50.1	36.1	40.4	40.6	57.3	58.5	60.2	21.0	41.9	39.9	38.6	59.5	49.6	36.6	37.1		28.2	54.6	37.6	43.7
		Jan	47.4	23.3	60.6	29.8	31.5	49.3	37.9	32.4	33.4	28.0	50.2	44.7	51.1	13.8	38.4	35.3	32.3	59.8	40.4		31.7		19.6	46.1	31.9	41.9
		Location	256 King Street (x3)	Queens Rd Travelodge	St Stephens (mid)	130 Magdalen Street (x3)	Exchange St	50 St Augustines	32 St Augustines	13 St Augustines	65 St Augustines	Upper King Street	Cattlemarket Street	Castle Meadow	Castle Meadow 2	Lakenfields (x3)	62 Magpie Road	26 Bull Close Road (x3)	24 Bargate Court	5 Riverside Road (x3)	4 Chapelfield North (x3)	71 Dukes Court	Chalk Hill Road	Reads Flour Mill	Carrow Bridge House	Zipfel House	68 Bull Close Road	Rotary House King Street

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If you would like this information in another language or format such as large print, CD or audio cassette or Braille please contact:

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