

Nottingham City Council

2012 Air Quality Updating and Screening Assessment for

Nottingham City Council

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

July 2012

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Executive Summary

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. All local authorities are required to regularly review and assess air quality in their areas, and to determine whether or not specified air quality objectives are likely to be achieved.

The air quality objectives applicable to the Local Air Quality Management process in England are set out in the Air Quality (England) Regulations 2000 (SI 928) and the Air Quality (England) (Amendment) Regulations 2002 (SI 3043).

This Updating and Screening Assessment has considered new monitoring results, and whether there have been significant changes in road traffic; other transport; industrial processes; and commercial and domestic sources of pollution since the last Progress and Further Assessment reports.

During 2011 air quality was measured, using automatic (continuous) and non-automatic monitoring, at a number of sites within the Nottingham City area.

The monitoring results showed that no exceedences of the air quality objectives for PM_{10}, sulphur dioxide, carbon monoxide and benzene were measured.

Levels in excess of the annual mean air quality objective for nitrogen dioxide is 40 $\mu g/m^3$ were measured at the 2 roadside automatic monitoring sites and at a number of diffusion tube sites, both within and outside the existing Air Quality Management Area No.2.

Monitoring within Air Quality Management Area No.3 also identified for the first time in a number of years that the nitrogen dioxide annual mean air quality objective was not exceeded.

The 1-hour objective for nitrogen dioxide (200 μg/m^3, not to be exceeded more than 18 times a year) was not exceeded at any site.

The Progress Report 2011, which was accepted by Defra, concluded that it was necessary for Nottingham City Council to undertake a Detailed Assessment (DA) in respect of the measured NO_2 exceedences outside an AQMA where there is relevant exposure of members of the public.

The monitoring data presented in this USA have shown that exceedences of the nitrogen dioxide annual mean Air Quality Objective again occurred at 2 additional sites, outside existing Air Quality Management Areas.

The Further Assessment (January 2012), also accepted by DEFRA, confirmed the decision to vary the extent of the Air Quality management Areas in 2010.

Consequently, it is proposed to broaden the scope of the DA to determine whether the extent of the City Centre AQMA is sufficiently precautionary to avoid frequent amendment in the future and; to investigate whether, as a consequence of the monitoring an AQMA that encompasses a much larger area of the inner City should be considered.

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1 Introduction

1.1 Description of Local Authority Area

The City of Nottingham covers an area of 7,470 hectares and has a population of approximately 288,700 (Key Facts, 2009). The City boundaries contain urban residential, suburban residential, commercial and industrial areas, and an area of large suburban parkland.

Geographically the Nottingham City area is made up of the River Trent valley basin which extends outside the City's southern boundary to Rushcliffe Borough Council and southwest to Broxtowe Borough Council. To the north of the river the land rises to form a ridge running from the south west near Lenton north east to Mapperley. North and north-west of this ridge the land forms a large basin through which the River Leen flows.

Throughout the 18th and early 19th Centuries the City was dominated by the textile industry which has reduced significantly. Industrial activity is now more diverse ranging from engineering through to biotechnology. Currently the Council regulates, 1 Part A2 and 70 Part B 'permitted installations' under the Pollution Prevention and Control Act 1999. There are 11 Part A1 installations permitted by the Environment Agency. The whole of the City is subject to Smoke Control Orders, the smoke control programme having been completed in 1991.

Nottingham is a major centre of commerce in the East Midlands, this together with the A453, A52, A60 and A610 road links to the M1 and A1 results in large volumes of traffic entering the City, and travelling through and onward to destinations outside the City, via the primary arterial routes. Significant numbers of people commute into the City for work, and visit for tourism, leisure and entertainment.

The City Centre is mainly retail and service sector/office use with two large shopping centres; Victoria Centre and Broadmarsh to the north and south respectively, each of which has a partially or fully enclosed bus station. The Centres are connected by busy pedestrianised areas.

The Nottingham Midland Mainline railway station is located approximately 200 metres south of the Broadmarsh bus station.

The Tram (Light Rapid Transit System) currently links the railway station with the northern suburbs and 'park and ride' sites providing an integrated transport system. Construction work on 'lines 2 and 3' which will extend the network to the west and southwest of the City has now commenced.

In Nottingham City Council's area road traffic is the principal source of the air pollutants to which the air quality objectives cited in the Air Quality (England) Regulations 2000 (SI 928) apply. Large industrial sources also contribute, but to a lesser degree.

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 since the last report and which may lead to a 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 also provides an update of any outstanding information requested by DEFRA following submission of earlier 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 $\mu g/m^3$ (milligrams per cubic metre, mg/m^3 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

Pollutant	Air Quality Objective		Date to be achieved by
	Concentration	Measured as	
Benzene	16.25 $\mu g/m^3$	Running annual mean	31.12.2003
	5.00 $\mu g/m^3$	Running annual mean	31.12.2010
1,3-Butadiene	2.25 $\mu g/m^3$	Running annual mean	31.12.2003
Carbon monoxide	10.0 mg/m^3	Running 8-hour mean	31.12.2003
Lead	0.5 $\mu g/m^3$	Annual mean	31.12.2004
	0.25 $\mu g/m^3$	Annual mean	31.12.2008
Nitrogen dioxide	200 $\mu g/m^3$ not to be exceeded more than 18 times a year	1-hour mean	31.12.2005
	40 $\mu g/m^3$	Annual mean	31.12.2005
Particles (PM_{10}) (gravimetric)	50 $\mu g/m^3$, not to be exceeded more than 35 times a year	24-hour mean	31.12.2004
	40 $\mu g/m^3$	Annual mean	31.12.2004
Sulphur dioxide	350 $\mu g/m^3$, not to be exceeded more than 24 times a year	1-hour mean	31.12.2004
	125 $\mu g/m^3$, not to be exceeded more than 3 times a year	24-hour mean	31.12.2004
	266 $\mu g/m^3$, not to be exceeded more than 35 times a year	15-minute mean	31.12.2005

1.4 Summary of Previous Review and Assessments

Table 1.2 below gives details of the previous rounds of Review and Assessment (R&A) and a brief outline of the conclusions of the reports.

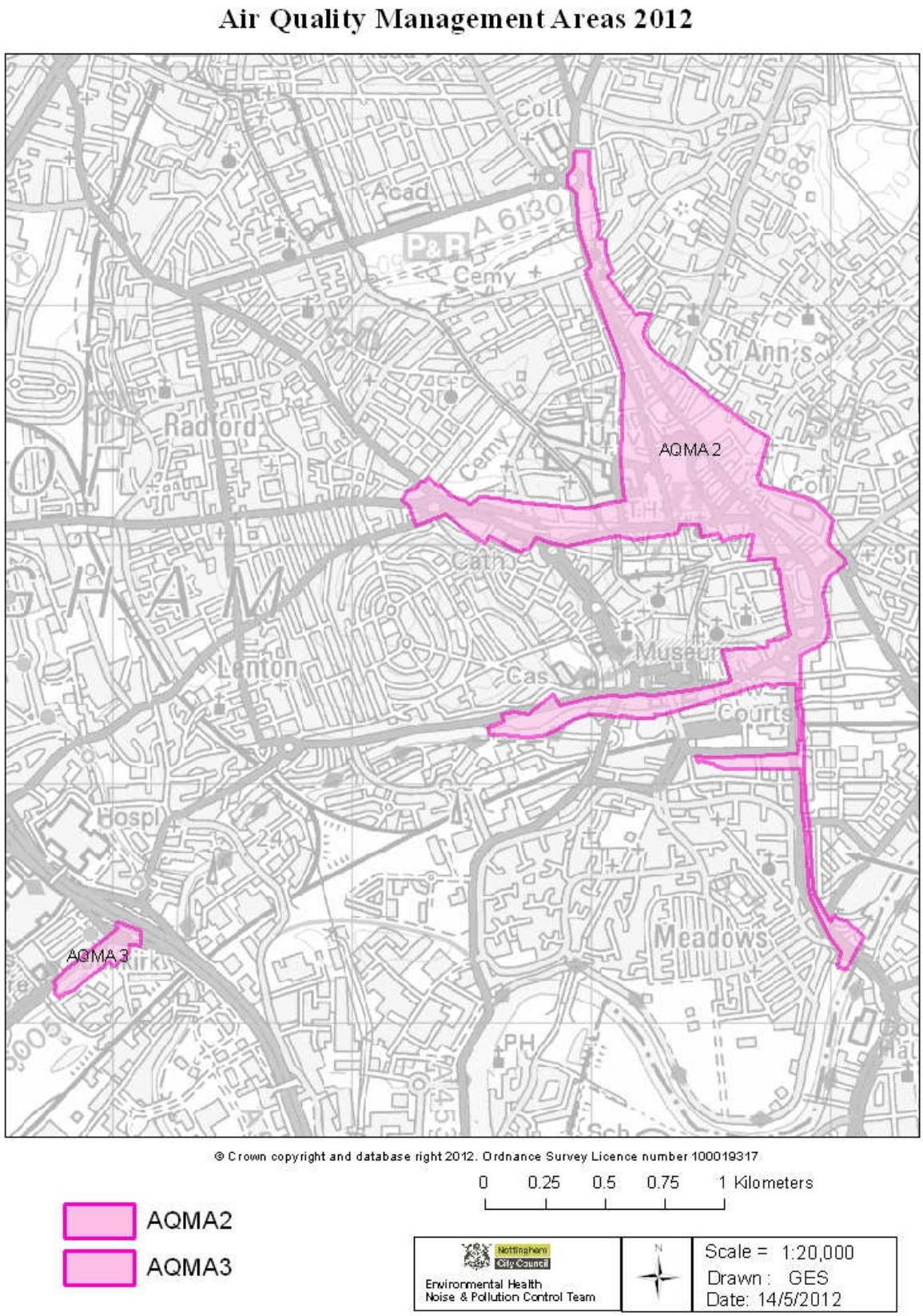
Table 1.2 Previous Review and Assessment Reports

Title	Date	Outcome	**AQMA Declared/ Revoked? (**Date of AQMA Order/s)
City of Nottingham Air Quality Review & Assessment First & Second Stage	April 2000	Concluded a third stage assessment for sulphur dioxide, nitrogen dioxide and particulates,PM_{10} was necessary. No further assessment of 1,3 Butadiene, benzene, carbon monoxide and lead required.	-
City of Nottingham Air Quality Review & Assessment Second & Third Stage Report	Sept 2001	Areas of the city where unlikely to meet air quality objectives for nitrogen dioxide or sulphur dioxide. Proposed 1 AQMA for SO_2 and 2 AQMAs for NO_2	**Declared** AQMA No:1 (Sulphur dioxide) (2002) AQMA No:2 (Nitrogen dioxide) (2002) AQMA No:3 (Nitrogen dioxide) (2002)
Stage Four Review & Assessment of Nottingham's Air Quality Management Areas	July 2003	Determined that AQOs for sulphur dioxide – hospital chimney and nitrogen dioxide – traffic sources, unlikely to be exceeded by 'due dates' therefore no Air Quality Action Plans needed	-
Updating and Screening Assessment	October 2003	Necessary to proceed to a Detailed Review and Assessment for nitrogen dioxide with respect to a number of roads and for sulphur dioxide in the vicinity of the Nottingham Main-line Station.	-
Detailed Assessment	August 2004	Sulphur dioxide 15-minute mean AQO likely to be met at locations of 'relevant exposure' at Nottingham Mainline Station. Nitrogen dioxide annual mean AQO likely to be met. Concluded insufficient	-

Title	Date	Outcome	**AQMA Declared/ Revoked? (**Date of AQMA Order/s)
		monitoring data available to allow revocation of any of the AQMAs.	
Progress Report	April 2005	Concluded that SO_2 monitoring data sufficient to propose revocation of AQMA No:1 (Sulphur dioxide). Necessary to maintain AQMAs No 2 & 3 (nitrogen dioxide)	
Updating and Screening Assessment	June 2006	Necessary to proceed to a Detailed Assessment for PM_{10} for 2 roads in the city centre and for nitrogen dioxide for a number of roads and junctions based on guidance criteria and some diffusion tube data. AQMA No:1 (Sulphur dioxide) to be revoked - agreed by Defra	**Revoked** AQMA No:1 2002 (Sulphur dioxide) (5 April 2007)
Detailed Assessment Consultation Document	May 2008	Proposed amendments to existing AQMAs No.2 & No.3 for nitrogen dioxide. Further work for nitrogen dioxide undertaken following comment and assessment by Defra (reported in Further Assessment 2010, published 2012) Conclusion that no further action required for PM_{10} accepted by Defra	
Progress Report	July 2008	Confirmed findings of Detailed Assessment 2008 and need to vary extent of the AQMAs.	
Detailed Assessment	January 2010	Confirmed findings of Detailed Assessment 2008 and need to vary extent of the AQMAs declared for nitrogen dioxide. Concluded that the Air Quality Objectives for particles PM10 would not be exceeded.	

Title	Date	Outcome	**AQMA Declared/ Revoked? (**Date of AQMA Order/s)
Nottingham No. 2 Air Quality Management, 2002 (nitrogen Dioxide) Variation Order 2010 Nottingham No. 3 Air Quality Management, 2002 (nitrogen Dioxide) Variation Order 2010			AQMAs 2 and 3 amended by orders dated June 2010
Progress Report	Oct 2010	Concluded that there was no need to undertake a Detailed Assessment for any of the regulated pollutants - accepted by Defra	
Progress Report	July 2011	Concluded that it was necessary to undertake a Detailed Assessment for annual mean nitrogen dioxide at two diffusion tube sites outside the existing AQMAs - accepted by Defra	
Further Assessment Report (2010)	Jan 2012	Confirmed the findings of the Detailed Assessment 2008 decision to revise the Air Quality Management Areas- accepted by Defra	
Updating and Screening Assessment	July 2012	Concludes that it is necessary to undertake a Detailed Assessment for annual mean nitrogen dioxide air quality objectives outside the existing AQMAs	

Figure 1.1 Map of AQMA Boundaries



2 New Monitoring Data

2.1 Summary of Monitoring Undertaken

2.1.1 Automatic Monitoring Sites

Nottingham City Council undertakes continuous monitoring at a number of locations in its area and Defra have an AURN site in the city centre. Figure 2.1 is a map of the locations of the continuous and diffusion tube monitoring sites and also shows the existing Air Quality Management Areas (AQMAs).

AURN, Clinton Street East

The AURN station is located in the city centre and classified as an 'Urban centre' site. The surrounding area comprises retail outlets and city centre business premises in an urban pedestrianised area. The nearest road, the A6008, approximately 30 metres from the site, is no longer a major through-route following completion of the City Centre Major Scheme to divert and redirect traffic around the City Centre and limit access to certain vehicles types such as buses. Relevant exposure is at residential properties approximately 40 metres to the South and approximately 23 metres to the North East.

The monitoring equipment is housed in a self-contained, air-conditioned fixed unit; the manifold inlet is approximately 3 metres high and has continuous automatic analysers that measure nitric oxide (NO), nitrogen dioxide (NO_2), oxides of nitrogen (NOx), particles (PM_{10}), particles ($PM_{2.5}$), sulphur dioxide (SO_2) and ozone (O_3). Benzene is measured using continuous pumped diffusion tubes. Black Smoke was measured on a near real time basis using a continuous aethalometer up to March 2012.

Particles PM_{10} was measured from site initiation in 1996 until December 2008 at which time Particles $PM_{2.5}$ measurement commenced and is on-going. Re-commencement of Particles PM_{10} measurement started from late 2009 and is on-going

Carbon monoxide (CO) monitoring ceased in October 2007.

CG NOx, Carter Gate, City Centre

This unit has been located at Carter Gate monitoring NOx since December 2003 and monitoring SO_2 from May 2007 until late 2009. The site is a suburban mixed commercial/residential area of the City adjacent to the A60. It is approximately 10 metres from the A60 which is a major traffic route and approximately 3 metres from a busy B road and is classed as a 'Roadside' site. There are residential properties approximately 12 metres from the unit and 8 metres away from the A60.
The sampling inlet for the self-contained, air-conditioned enclosure is approximately 2.5 metres high. NO, NO_2 and NOx are measured using a continuous automatic analyser.

LS NOx, Lace Street, Dunkirk

This is a fixed unit located at Lace Street since March 2007. The site is a suburban, mixed commercial/residential area of the City adjacent to the A6005, a busy road traffic route. It is approximately 4 metres from the A6005 and 1 metre from a minor road and is classed as a 'Roadside' site. The unit is sited on the pavement at the boundary with a residential property.
The sampling inlet for the self-contained, air-conditioned enclosure is approximately 1.5 metres high. NO, NO_2 and NOx are measured using a continuous automatic analyser.

For the automatic monitoring sites referred to above the following information is given in the appendices:

- Details of QA/QC - Appendix A.

2.1.1 / 2.1.2 Map of Monitoring Sites

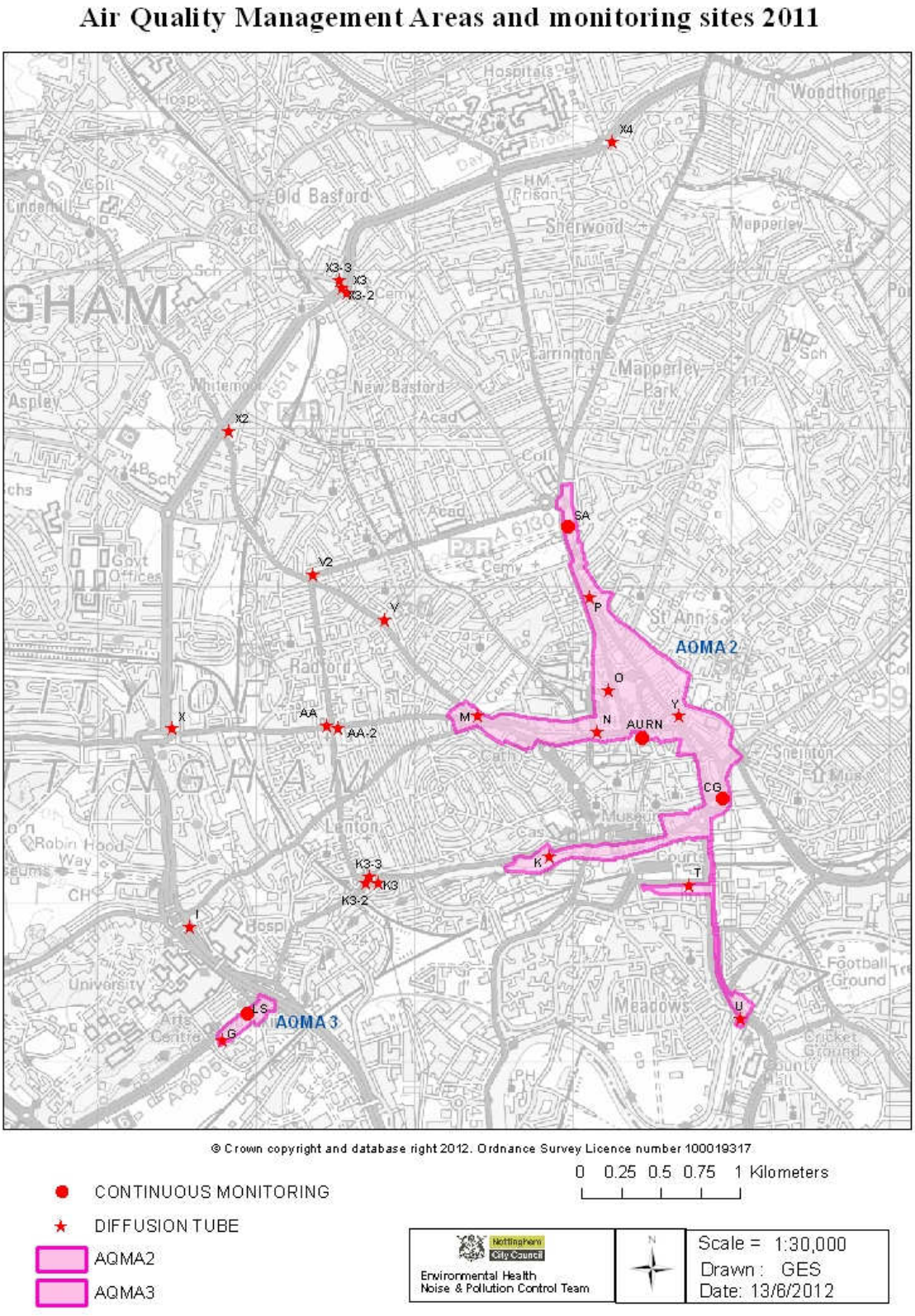


Table 2.1.1 Details of Automatic Monitoring Sites

Site Name	**Site Type**	**OS Grid Ref**	**Pollutants Monitored**	**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 Location?**
AURN Clinton St	Urban centre	X 457437 Y 340049	NO_2, NO, NOx, SO_2, O3, PM_{10}, $PM_{2.5}$,	N	Y (0m)	35m	N
CG NOx Carter Gate	Roadside	X 457946 Y 339668	NO_2, NO, NOx,	Y	Y (12m)	4m	Y
LS NOx Lace St	Roadside	X 454941 Y 338315	NO_2, NO, NOx,	Y	Y (0m)	9m (main rd 1m (minor rd)	Y
St Andrews Rd NOx	Roadside	X 456967 Y 341382	NO_2, NO, NOx,	Y	Y (0m)	13m (main rd.) 2m (minor rd.)	Y

2.1.2 Non-Automatic Monitoring Sites

Nitrogen Dioxide (NO_2) Diffusion Tube Monitoring

Nottingham City participates in the UK NO_2 diffusion tube network and has diffusion tubes sited at a number of locations including tubes co-located with continuous monitors at the CG NOx, LS NOx sites and St Andrews Road NOx site. Tubes have been exposed in and near AQMAs No.2 and 3 and in other areas where there may be 'hot spots' due to road and/or traffic changes.

All of the tubes are placed on building façades of residential properties at sites classified as 'roadside'. The tubes are typically exposed for a month (unless otherwise specified in the Annual Diffusion Tube Monitoring Calendar) before being sent for laboratory analysis.

The geographical locations of the tube sites (excluding, for clarity, those co-located at continuous sites) are shown in Figure 2.1.

See Appendix A for:

- details of the tube type and the laboratory that supplies and analyses the tubes
- details of the bias adjustment factor that has been applied to the annual mean NO_2 diffusion tube data.
- details of Nottingham City Council's diffusion tube and continuous monitoring 2011 co-location study including comparison with the reference method.

See Appendix B for:

- details of diffusion tube QA/QC

Benzene Pumped Tube Monitoring

Benzene is measured at the AURN, as part of the Non-Automatic Hydrocarbon Network, using a controlled flow pumped tube sampler. The 2 tubes are changed every two weeks and returned to AEA Technology laboratory for analysis.

The apparatus is audited twice a year by AEA. The sample flow is calibrated and adjusted as required; the system is leak checked and preventative maintenance performed. The audit calibrations are used to convert the collected amount on each tube into a concentration.

Table 2.1.2 Details of Non-Automatic Monitoring Sites

Site Name & Id		Site Type*	OS Grid Ref	Pollutants Monitored	In AQMA ?	Is monitoring collocated with a Continuous Analyser (Y/N)	Relevant Exposure? *(Y/N with distance (m) to relevant exposure)*	Distance to kerb of nearest road *(N/A if not applicable)*	Worst-case Location?
Diffusion Tube									
G	Beeston Road	R	454782 338146	NO_2	Y	N	Y (0)	9	Y
I	Derby Road	R	454577 338860	NO_2	N	N	Y (0)	25	Y
X	Western Boulevard	R	454466 340111	NO_2	N	N	Y (0)	16	Y
X2	Wilkinson Street	R	454823 341993	NO_2	N	N	Y (0)	18	Y
X3	Nottingham Road	R	455573 342860	NO_2	N	N	Y (0)	8	Y
X3-2	Nottingham Road	R	455542 342894	NO_2	N	N	Y (0)	7	Y
X3-3	Nottingham Road	R	455520 342944	NO_2	N	N	Y (0)	4	Y
X4	Danethorpe Vale	R	457250 343815	NO_2	N	N	Y (0)	15	Y
AA-2	Ilkeston Rd. R.Crt.	R	455519 340113	NO_2	N	N	Y (0)	9	Y
AA	Ilkeston Road	R	455445 340132	NO_2	Y	N	Y (0)	3	
V	Bentinck Rd	R	455808 340799	NO_2	N	N	Y (0)	6	Y
V2	Gregory Boulevard	R	455358 341086	NO_2	N	N	Y (0)	10	Y
K3	Grove Castle Boulevard	R	455769 339137	NO_2	N	N	Y (0)	4	Y
K3-2	Castle Boulevard	R	455693 339136	NO_2	N	N	Y (0)	13 (3 minor)	Y
K3-3	Sherwin Road	R	455711 339181	NO_2	N	N	Y (0)	13 (6 minor)	Y
K	Castle Boulevard	R	456852 339303	NO_2	Y	N	Y (0)	4	Y
M	Canning Terrace	R	456399 340191	NO_2	N	N	Y (0)	4	Y
N	Upper Parliam't St.	R	457154 340095	NO_2	Y	N	Y (0)	4	Y
O	Shakespeare St.	R	457221 340351	NO_2	Y	N	Y (0)	2	Y
P	Mansfield Road	R	457103 340944	NO_2	Y	N	Y (0)	4	Y
Y	Beck Street	R	457673 340194	NO_2	Y	N	Y (0)	3	Y
U	Trent Bridge	R	458060 338277	NO_2	N	N	Y (0)	3	Y
T	Queen's Road	R	457729 339122	NO_2	N	N	Y (0)	2	Y
Other									
AURN Clinton St		UC	457437 340049	benzene, black smoke	N		Y (0m)	35	N

2.2 Comparison of Monitoring Results with AQ Objectives

The 2011 results of the automatic and non-automatic monitoring undertaken by Nottingham City Council are shown in Tables 2.3a -2.7. Comparison with the Air Quality Objectives (AQO) has been made and where the relevant AQO has been exceeded the figure is highlighted in bold type.

The data shows that all exceedences relate to the nitrogen dioxide annual mean AQO and all are at sites where there are residential properties nearby (i.e. relevant public exposure).

At the AURN site the annual mean PM_{10} levels were considerably below the AQO value and the 24-hour AQO was not exceeded at either site.

Similarly there were no exceedences of the sulphur dioxide and benzene AQOs.

2.2.1 Nitrogen Dioxide

Data is shown below for both continuous and diffusion tube nitrogen dioxide monitoring results. The monitoring data shows that the 1-hour AQO was not exceeded - no automatic site recorded more than 18 1-hour means above 200$\mu g/m^3$ and no diffusion tube concentrations were greater than 60 $\mu g/m^3$.

However the annual mean at a number of sites (automatic and diffusion tube) was greater than 40$\mu g/m^3$. All but two of the sites where the annual mean AQO was exceeded are within existing AQMAs.

Automatic Monitoring Data

The nitrogen dioxide annual mean concentration was exceeded at the CG NOx and St.Andrews Road NOx roadside sites – Table 2.3a. These sites were initiated as a result of previous rounds of Review & Assessment; CG NOx is within AQMA No.2 and LS NOx is within AQMA No.3 - both stations are located close to residential properties.

Map 2.1.1 and 2.1.2 show the locations of monitoring sites in respect of the AQMAs.

Table 2.2.1a Results of Automatic Monitoring of Nitrogen Dioxide: Comparison with Annual Mean Objective

Site ID	Site Type	Within AQMA?	Valid Data Capture for period of monitoring %[a]	Valid Data Capture 2011 % [b]	Annual Mean Concentration μg/m^3				
					2007*[c]	2008* [c]	2009* [c]	2010* [c]	2011 [c]
AURN Clinton St	Urban centre	N	96.1	96.1	33.3	33.0	34.5	39.9	35.9
CG NOx Carter Gate	Roadside	Y	92.6	92.6	42.3	43.5	40.4	43.3	42.3
LS NOx Lace St	Roadside	Y	92.3	92.3	-	41.5	39.8	40.9	38.1
St Andrews Rd NOx	Roadside	Y	98.8	98.8	-	-	-	45.4*	41.4

* St.A NOx Commissioned June 2010 Short-term monitoring data annualised according to TG09

From TG09 for St.Andrews Road NOx

3.14 to 3.16 Pages 37 (3-3)– 38 (3-4)

Site Commissioned Mid June 2010

2.1.1 Trends in Annual Mean Nitrogen Dioxide Concentrations measures at Automatic Monitoring Sites – Figures 2.1.1a - 2.1.1f

The trends in annual mean nitrogen dioxide levels for those automatic sites with more than 5 years of data i.e. AURN and CG NOx are shown in Figures 2.1.1a-d, for LS NOx 2.1.1e (4 years) & for St.Andrews Road NOx 2.1.1f (2 years). The trend lines shown on each graph were drawn using the Microsoft Excel spreadsheet package.

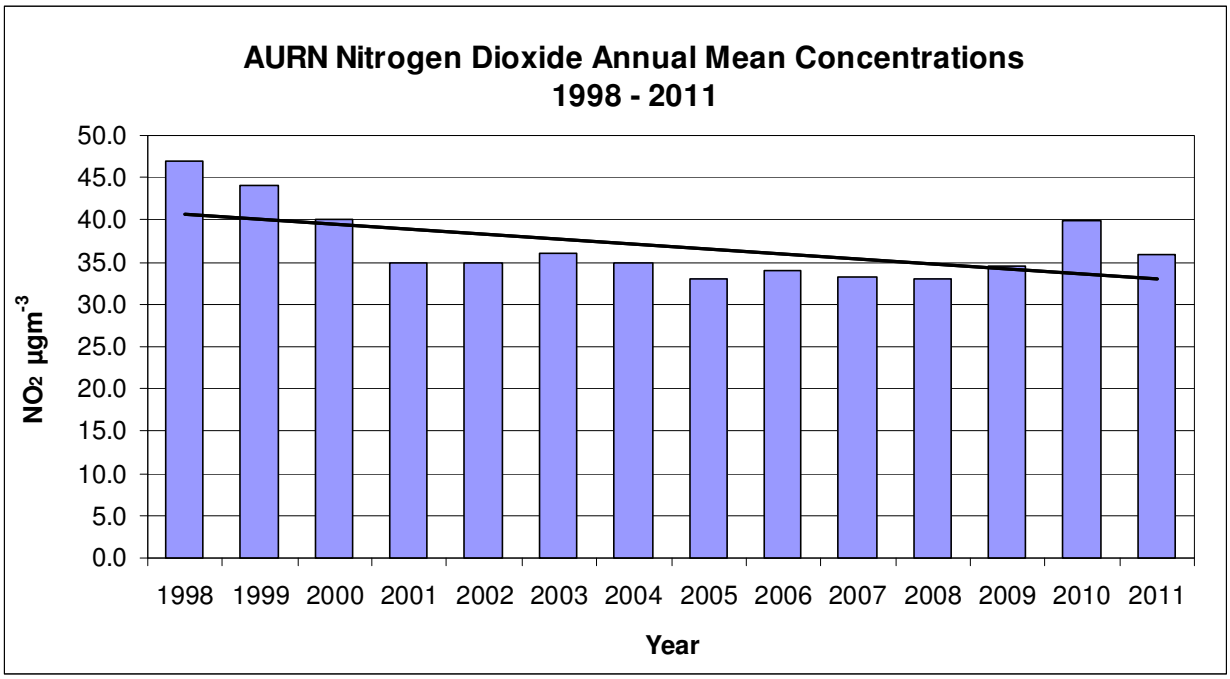
Figure 2.1.1a shows that at the AURN the overall trend has been decreasing annual mean NO_2 concentrations for the 12 years that it has been operational. However the most noticeable decrease was between 1998 and 2001.

Between 2002 and 2009 nitrogen dioxide levels have been relatively steady with minor year on year variations with concentrations no greater than 36$\mu g/m^3$. The 2010 value represents a significant increase in the annual mean concentration. It is unlikely to be due to local changes such as increased traffic or congestion but possibly can be attributed to the extreme meteorological conditions that occurred in the last few months of 2010.

The Leicester Centre, Sheffield Centre and Leeds Centre AURN stations also measured increased NO_2 concentrations compared with last year. This is demonstrated in Figure 2.1.1c which shows 2006 – 2011 annual mean NO_2 levels at Nottingham Centre and the above sites. The increase between 2009 and 2010 was largest at the Leicester Centre site.

All four of the sites are classified as ‘Urban Background’.

Figure 2.1.1a



At the CG NOx roadside site the overall trend shows increasing annual mean nitrogen dioxide concentrations that slightly exceed the annual mean NO_2 AQO (Figure 2.1.1b). This is likely to be influenced by road traffic levels on the nearby heavily trafficked A60, and may be a consequence of fleet composition changes (increased diesel fuelled vehicles) and/or the unexpected (but measured and verified) increase in NO2 emissions from Euro standard 3 and 4 vehicles during 'urban cycle' operation, and contrasts with the trend at the AURN which is an urban background site. However, the 2011 annual mean was lower than that recorded during 2010, which seems to have resulted in elevated annual mean NO2 levels at most monitoring stations during 2010.

Figure 2.1.1b

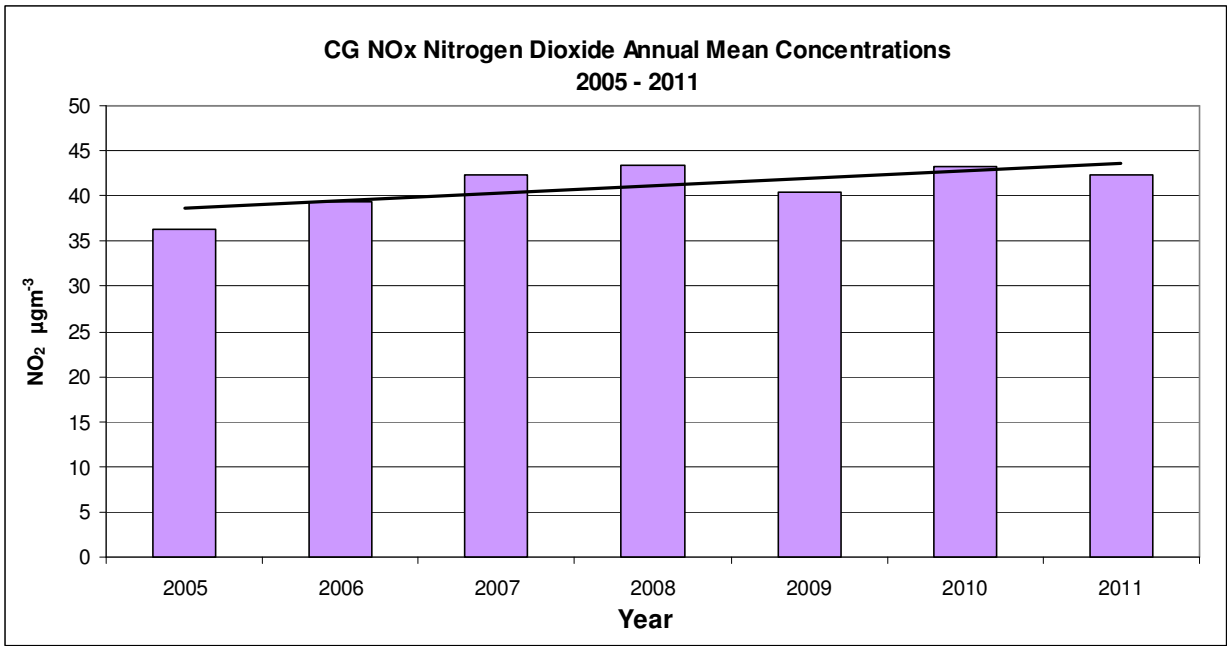


Figure 2.1.1c

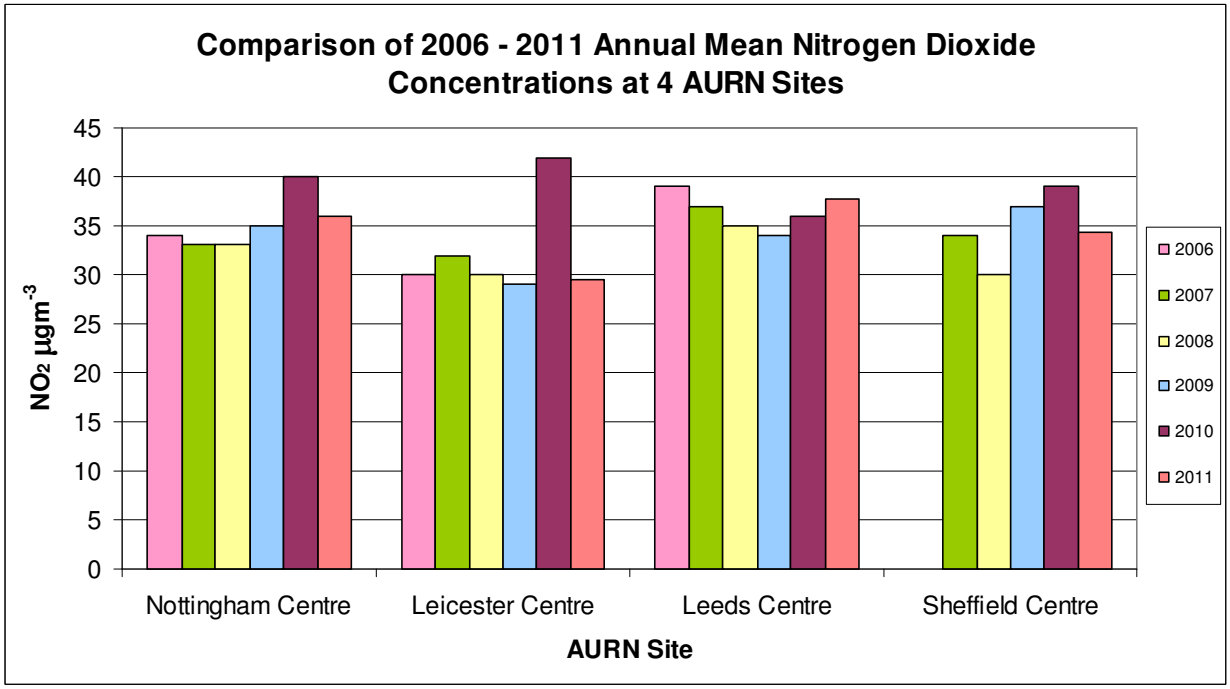


Figure 2.1.1d

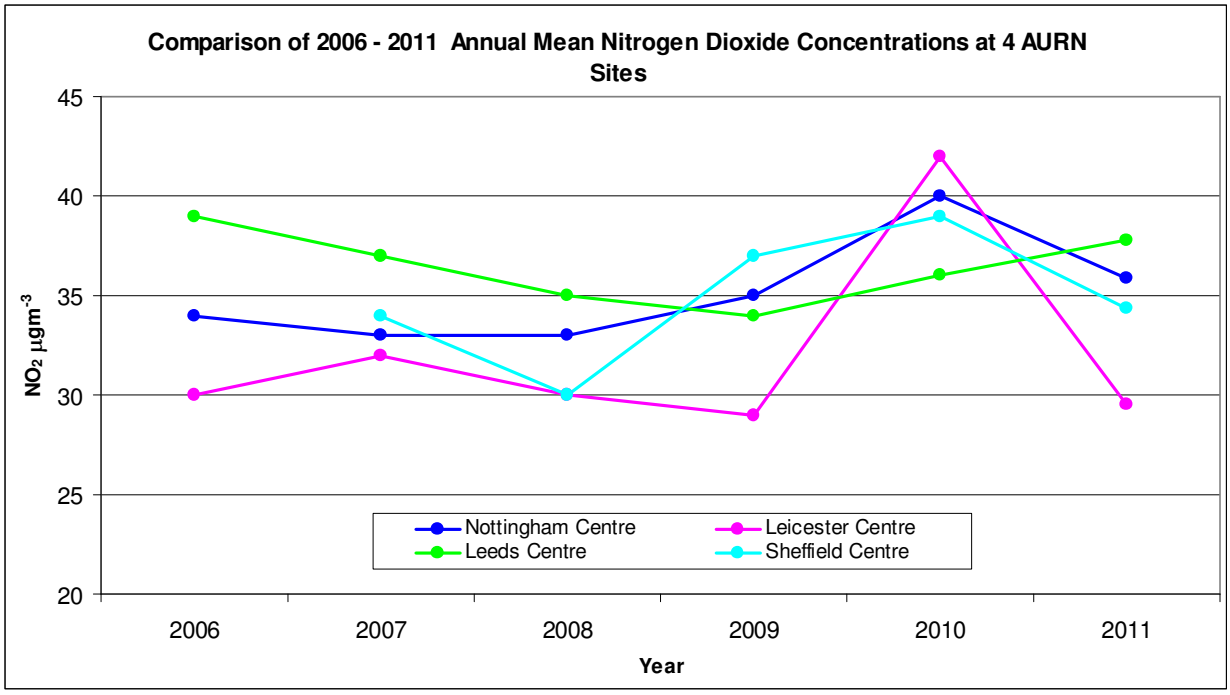


Figure 2.1.1e

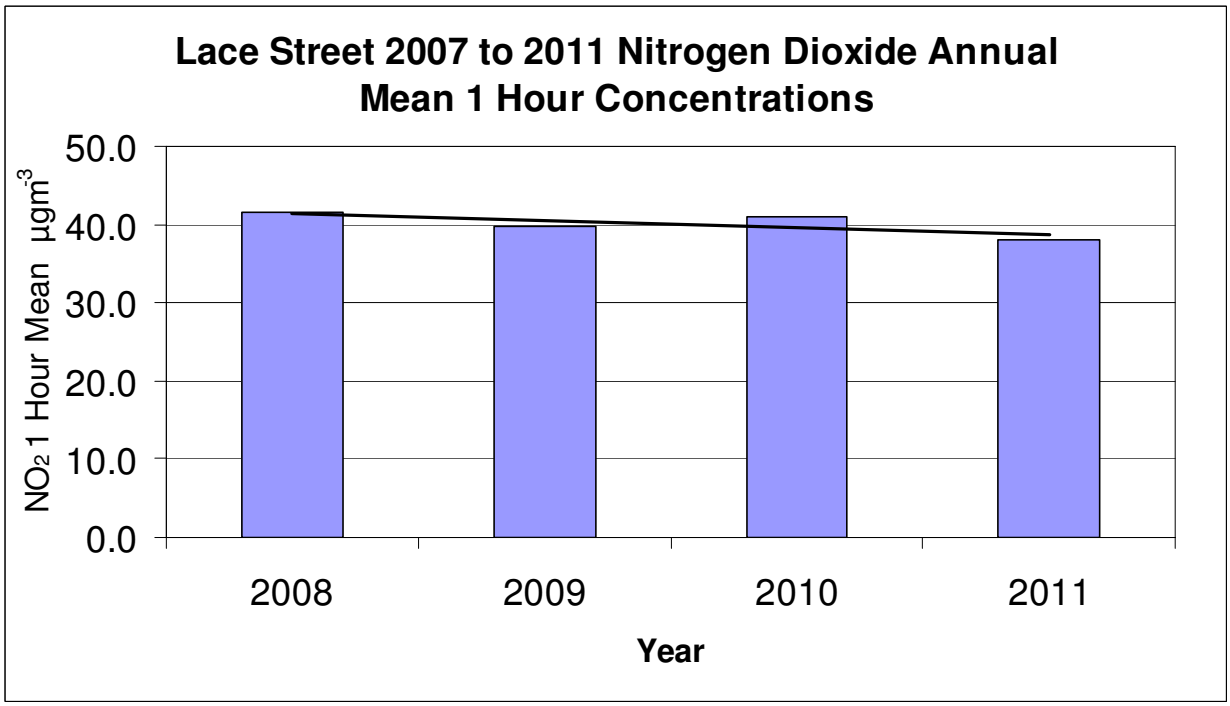


Figure 2.1.1f

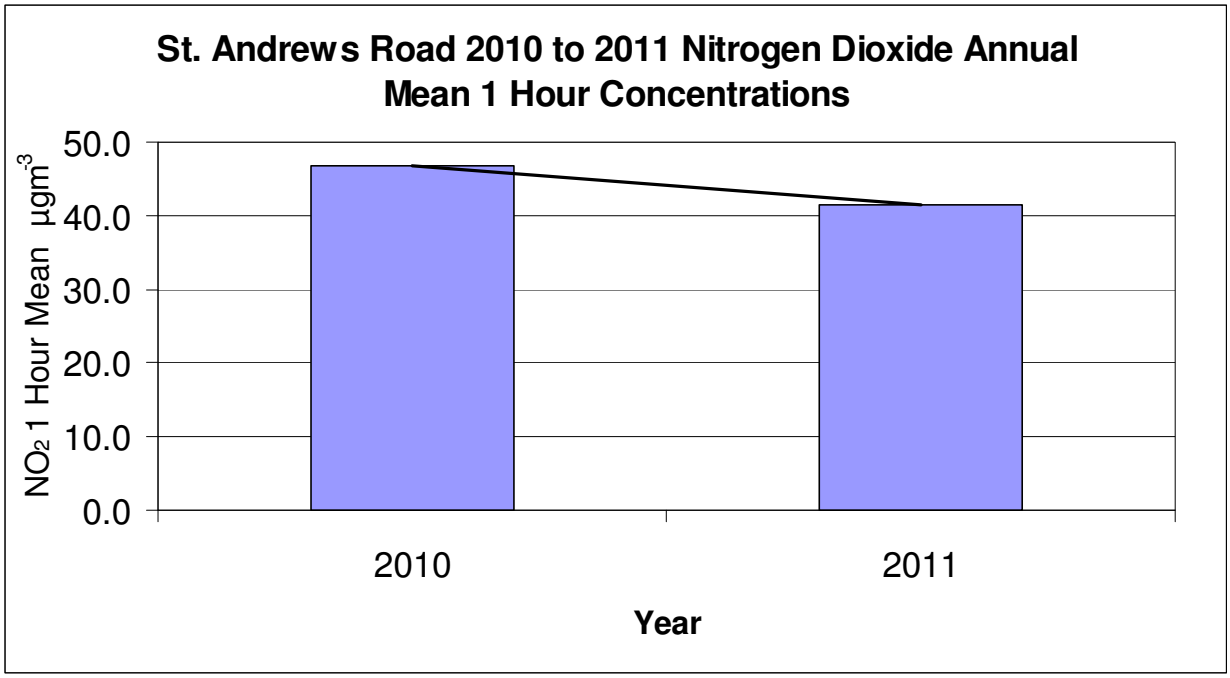

St. Andrews Road 2010 to 2011 Nitrogen Dioxide Annual Mean 1 Hour Concentrations
NO2 1 Hour Mean µgm-3
50.0
40.0
30.0
20.0
10.0
0.0
2010
2011
Year

Table 2.2.1.1 Results of Automatic Monitoring for Nitrogen Dioxide: Comparison with 1-hour mean Objective

Site ID	Site Type	Within AQMA?	Valid Data Capture for period of monitoring %[a]	Valid Data Capture 2011 % [b]	Number of Exceedences of Hourly Mean (200 μg/m^3)				
					2007*[c]	2008* [c]	2009* [c]	2010* [c]	2011 [c]
AURN Clinton St	Urban centre	N	96.1	96.1	0	6	0	2	0
CG NOx Carter Gate	Roadside	Y	92.6	92.6	10	0	0	0	0
LS NOx Lace St	Roadside	Y	92.3	92.3	-	4	0	2	0
St Andrews Rd NOx	Roadside	Y	98.8	98.8	-	-	-	0	0

From TG09 for St.Andrews Road NOx

3.14 to 3.16 Pages 37 (3-3)– 38 (3-4)

Site Commissioned Mid June 2010

Table 2.2.1.2 Results of Nitrogen Dioxide Diffusion Tubes in 2011

Site ID	Location	Site Type	Within AQMA?	Triplicate or Collocated Tube	Data Capture 2011 (Number of Months or %)	Data with less than 9 months has been annualised (Y/N)	Confirm if data has been distance corrected (Y/N)	Annual mean concentration (Bias Adjustment factor = 0.91) 2011 ($\mu g/m^3$)
G	Beeston Road	Roadside	Y	N	100	N/A	N/A	39
I	Derby Road	Roadside	N	N	100	N/A	N/A	31
X	Western Boulevard	Roadside	N	N	100	N/A	N/A	34
X2	Wilkinson Street	Roadside	N	N	100	N/A	N/A	34
X3	Nottingham Road	Roadside	N	N	91.7	N/A	N/A	**41**
X3-2	Nottingham Road	Roadside	N	N	100	N/A	N/A	38
X3-3	Nottingham Road	Roadside	N	N	91.7	N/A	N/A	33
X4	Danethorpe Vale	Roadside	N	N	100	N/A	N/A	31
V	Bentinck Road	Roadside	N	N	83.3	N/A	N/A	36
AA	Ilkeston Road	Roadside	N	N	91.7	N/A	N/A	**43**
AA-2	Ilkeston Road / Ray Crt	Roadside	N	N	91.7	N/A	N/A	31
V2	Gregory Boulevard	Roadside	N	N	100	N/A	N/A	34
K3	The Grove Castle Blvd.	Roadside	N	N	83.3	N/A	N/A	**41**
K3-2	Castle Blvd	Roadside	N	N	91.7	N/A	N/A	29

Site ID	Location	Site Type	Within AQMA?	Triplicate or Collocated Tube	Data Capture 2011 (Number of Months or %)	Data with less than 9 months has been annualised (Y/N)	Confirm if data has been distance corrected (Y/N)	Annual mean concentration (Bias Adjustment factor = 0.91) 2011 ($\mu g/m^3$)
K3-3	Sherwin Road	Roadside	N	N	100	N/A	N/A	30
K	Castle Boulevard	Roadside	Y	N	83.3	N/A	N/A	**42**
M	Canning Terrace	Roadside	Y	N	100	N/A	N/A	**51**
N	Upper Parliament St.	Roadside	Y	N	91.7	N/A	N/A	**51**
O	Shakespeare St.	Roadside	Y	N	100	N/A	N/A	**47**
P	Mansfield Road	Roadside	Y	N	100	N/A	N/A	**46**
Y	Beck Street	Roadside	Y	N	100	N/A	N/A	**45**
U	Trent Bridge	Roadside	Y	N	100	N/A	N/A	**41**
T	Queen's Road	Roadside	Y	N	100	N/A	N/A	**47**

Diffusion Tube Monitoring Data Continued

The annual mean NO_2 AQO was exceeded at 11 diffusion tube sites. The data is shown in Table 2.4 and exceedences of the AQO are highlighted in bold type. The 3 rows that are shaded highlight sites i.e. AA, X3 and K3 where exceedances of the annual mean AQO were measured and which are not within AQMAs. The extent of area covered by these 3 exceedances is confirmed to be minimal by V, K3-2, K-3, and X3-2, X3-3. Also the K3 site where exceedence outside an AQMA was measured, is close to a heavily trafficked roundabout on a residential/commercial building that is currently unoccupied.

Diffusion Tube Monitoring Data Continued

All other exceedances are within AQMA No.2

While all the sites with Site Id 'X' prefixes are located on residential properties adjacent to the outer ring road only X3 – Nottingham Road measured an exceedence of the AQO. This is located at a junction where a busy local traffic route and the outer ring road cross.

Table 2.2.1.3 Results of Nitrogen Dioxide Diffusion Tubes

Site ID	Location	Within AQMA 2011?	Data Capture 2011 %	2011 Annual mean concentrations NO_2 ($\mu g/m^3$) Bias Adjusted
G	Beeston Road	Y	100	39
I	Derby Road	N	100	31
X	Western Boulevard	N	100	34
X2	Wilkinson Street	N	100	34
X3	Nottingham Road	N	91.7	**41**
X3-2	Nottingham Road	N	100	38
X3-3	Nottingham Road	N	91.7	33
X4	Danethorpe Vale	N	100	31
V	Bentinck Road	N	83.3	36
AA	Ilkeston Road	N	91.7	**43**
AA-2	Ilkeston Road / Ray Crt	N	91.7	31
V2	Gregory Boulevard	N	100	34
K3	The Grove Castle Blvd.	N	83.3	**41**
K3-2	Castle Blvd	N	91.7	29
K3-3	Sherwin Road	N	100	30
K	Castle Boulevard	Y	83.3	**42**
M	Canning Terrace	Y	100	**51**
N	Upper Parliament St.	Y	91.7	**51**
O	Shakespeare St.	Y	100	**47**
P	Mansfield Road	Y	100	**46**
Y	Beck Street	Y	100	**45**
U	Trent Bridge	Y	100	**41**
T	Queen's Road	Y	100	**47**

Single tubes were located at the above sites.

The bias adjustment factor applied = 0.91 and the raw data for the monthly values are shown in Appendix B Table B-1.

I Hour Mean NO_2 Objective

In 2011 no diffusion tube annual mean NO_2 concentrations greater than 60$\mu g/m^3$ were measured. The advice in TG(09) is that it is reasonable to conclude that the I hour AQO has not been exceeded.

Figures 2.2.1.4 - 2.2.1.8 Trends in Annual Mean Nitrogen Dioxide Concentrations measured at Diffusion Tube Monitoring Sites

Figures 2.2.1.4 – 2.2.1.8 show trends at 4 diffusion tube sites, within AQMAs, where measurements have been made for least five years. It is apparent that trends vary at individual sites:

- Beeston Rd (G) levels have been similar for the last five years and have been either just below or slightly above the AQO concentration.

- Castle Boulevard (K) the concentrations of nitrogen dioxide have reduced compared with 2006/2007 but have levelled out since then. They continue to exceed the AQO.

- Mansfield Road (P) the trend is slightly upwards with a noticeable increase in annual mean nitrogen dioxide compared with 2009.

- Queens Road (T) shows increasing nitrogen dioxide concentrations. Other than a city centre site this location record the highest 2011 annual mean concentration. Long term ongoing works have been carried out in the vicinity which may have contributed to traffic congestion and hence to an increase in nitrogen dioxide levels.

Figure 2.2.1.4

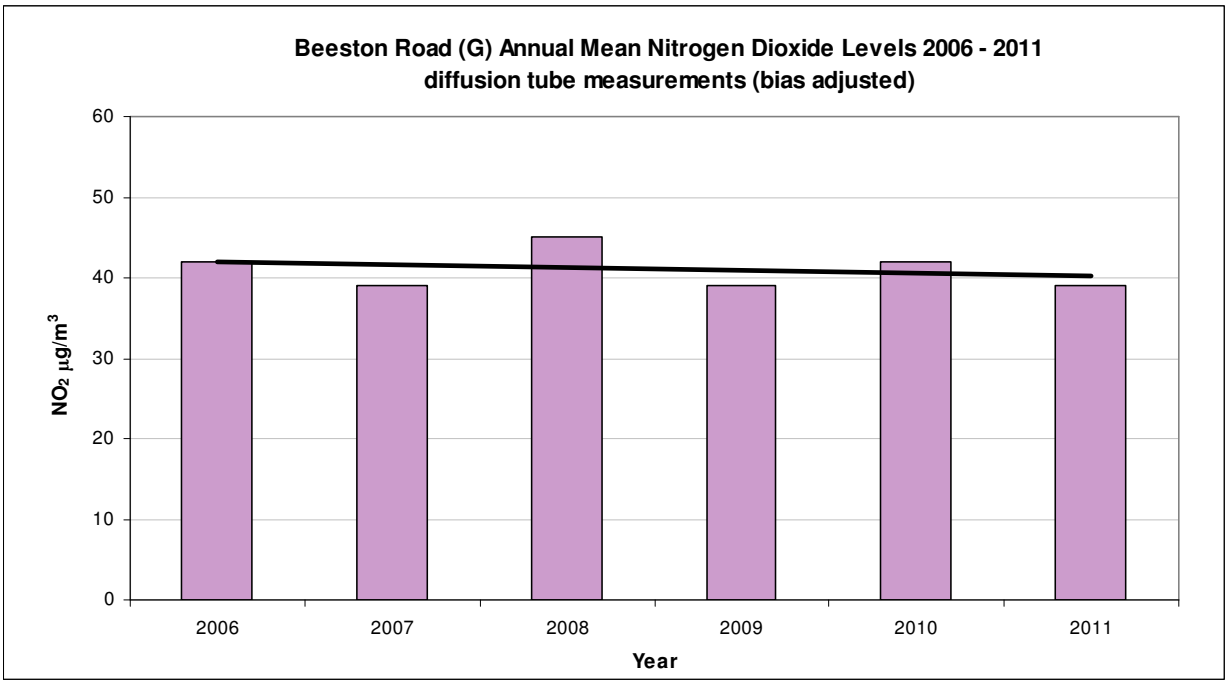


Figure 2.2.1.5

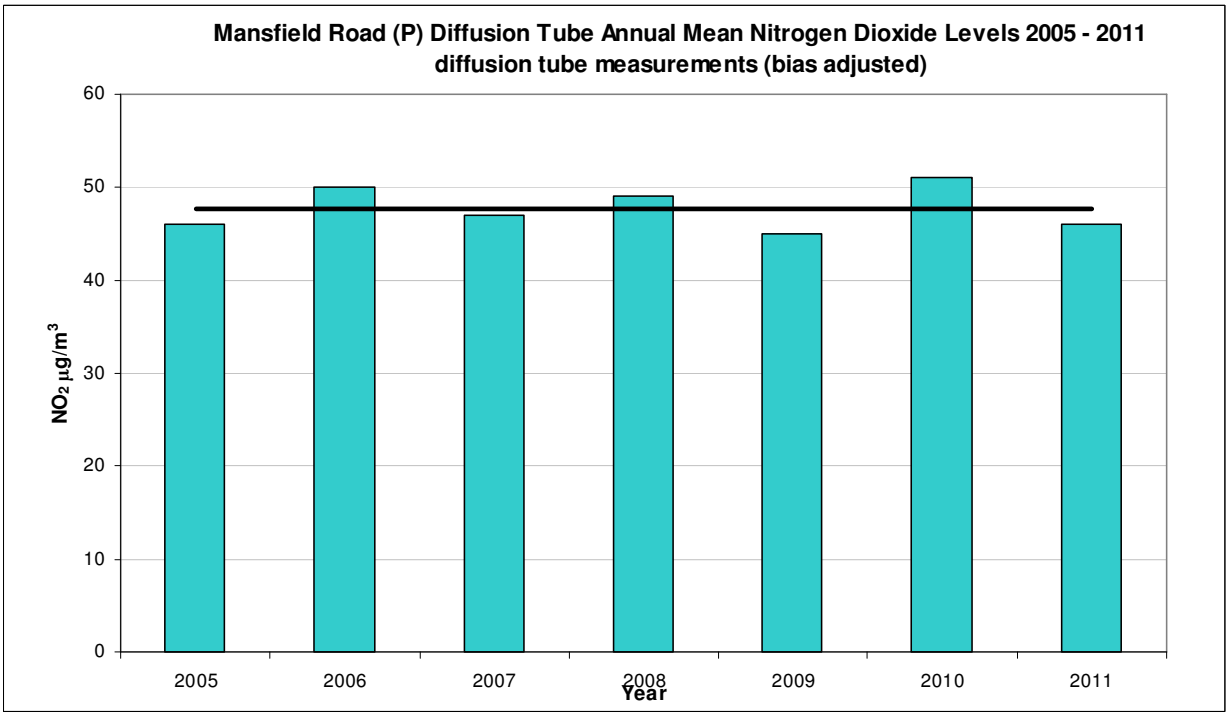


Figure 2.2.1.6

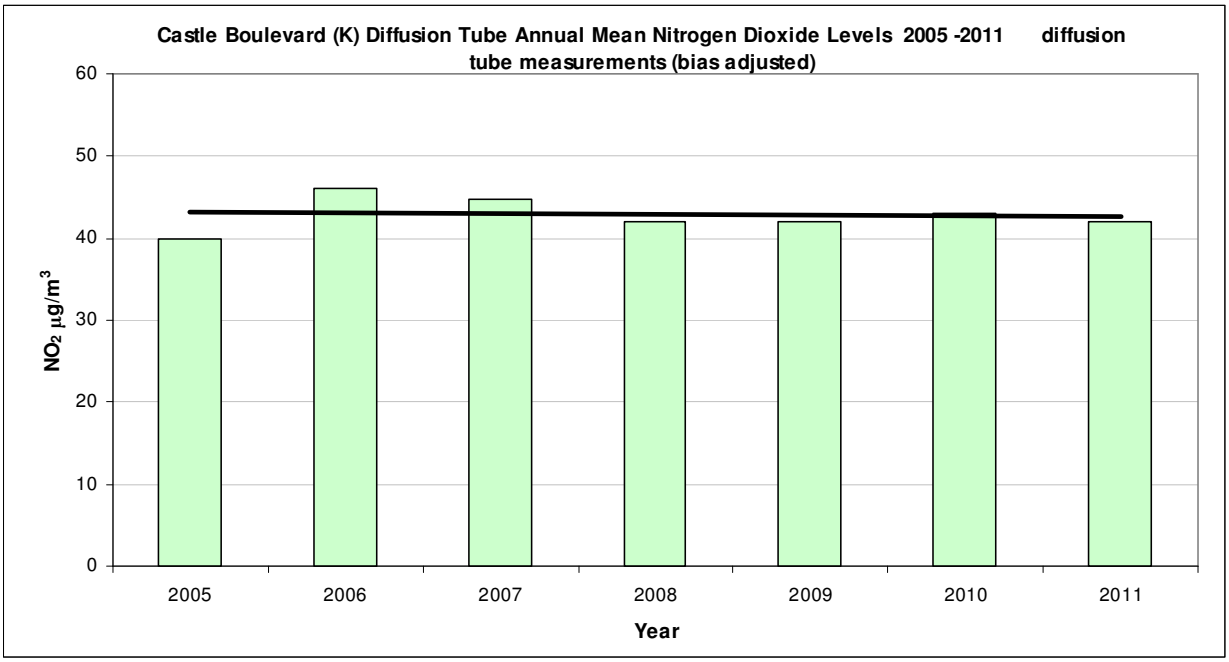


Figure 2.2.1.7

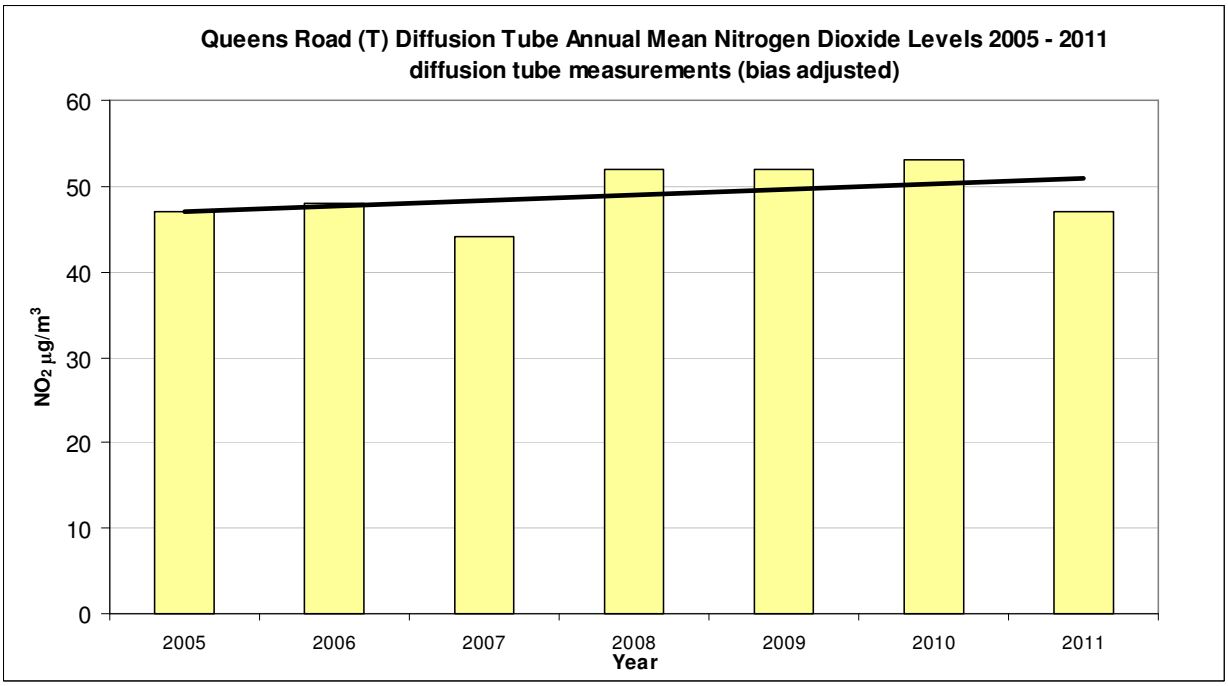
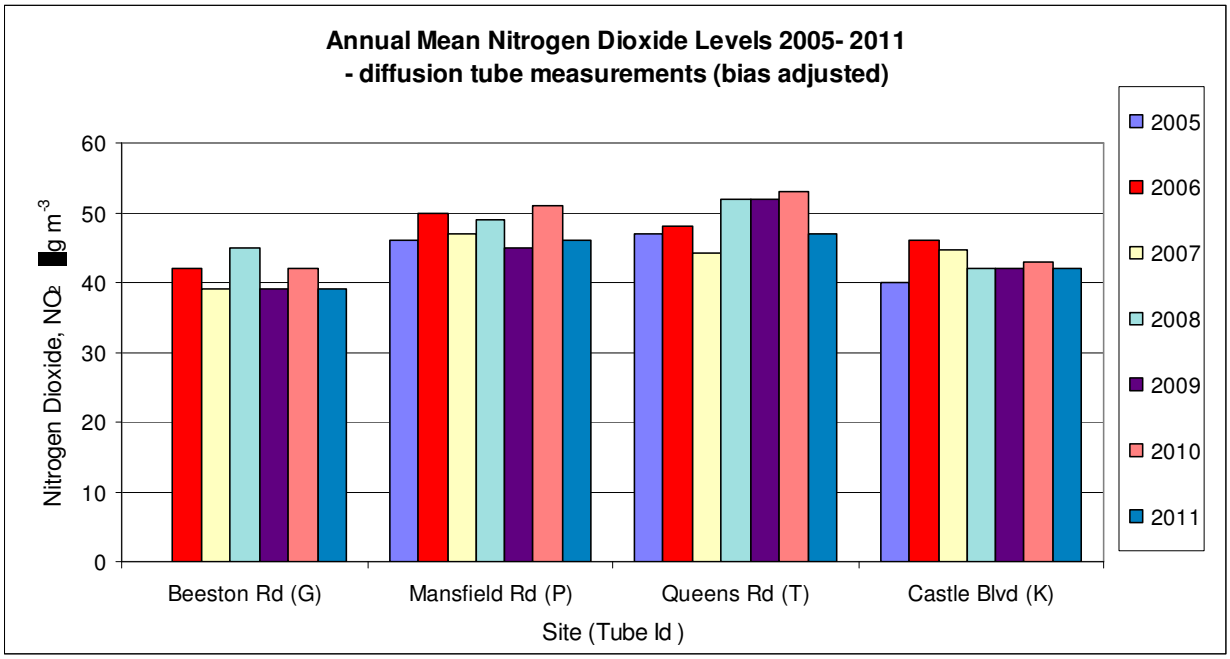


Figure 2.2.1.8



2.2.2 PM_{10}

Automatic Monitoring Data

Whilst there is relevant public exposure at the AURN site where PM_{10} is measured i.e. neither of the PM_{10} AQ objectives were exceeded.

The annual and 24-hour mean PM_{10} figures shown in Tables 2.5a & b below are provided by the network as $PM_{10\ TEOM\ FDMS}$.

Table 2.2.2a Results of PM_{10} Automatic Monitoring: Comparison with Annual Mean Objective

Site ID	Location	Within AQMA?	2011 Data Capture %	2011 Annual mean concentrations $PM_{10\ TEOM\ FDMS}$ ($\mu g/m^3$)
AURN	Clinton Street East	N	93.5	24.8

12 months ratified data – 01/01/2011 to 31/12/2011

Table 2.2.2b Results of PM_{10} Automatic Monitoring: Comparison with 24-hour Mean Objective

Site ID	Location	Within AQMA?	2011 Data Capture %	2011 Maximum 24-hour mean PM_{10} FDMS TEOM ($\mu g/m^3$)	Number of exceedences of 24-hour mean i.e. >=50 $\mu g/m^3$
AURN	Clinton Street East	N	93.5	82	23

12 months ratified data – 01/01/2011 to 31/12/2011

Table 2.2.2c Results of $PM_{2.5}$ Automatic Monitoring

Site ID	Location	Within AQMA?	Data Capture for full calendar year 2011 %	Annual mean concentrations ($\mu g/m^3$) $PM_{2.5}$ TEOM FDMS 2011	Number of times the daily mean >= 50 $\mu g/m^3$ 2011
AURN	Clinton St East	N	90.9	13.2	5

12 months ratified data 1 January 2011 – 31 December 2011

Table 2.2.2d Results of Automatic Monitoring of PM_{10}: Comparison with Annual Mean Objective

Site ID	Site Type	Within AQMA?	Valid Data Capture for monitoring Period %[a]	Valid Data Capture 2011 %[b]	Confirm Gravimetric Equivalent (Y or NA)	Annual Mean Concentration μg/m³				
						2007*[c]	2008* [c]	2009* [c]	2010* [c]	2011 [c]
AURN	Urban Centre	N	93.5	93.5	Y	21.1	18.0	N/A	18.8	24.8

TEOM (Gravimetric) upgrade to FDMS late March 2007. No PM_{10} monitoring during 2009.

Table 2.2.2e Results of Automatic Monitoring for PM_{10}: Comparison with 24-hour mean Objective

Site ID	Site Type	Within AQMA?	Valid Data Capture for monitoring Period %[a]	Valid Data Capture 2011 %[b]	Confirm Gravimetric Equivalent	Number of Exceedences of 24-Hour Mean (50 μg/m³)				
						2007*	2008*	2009*	2010*	2011
AURN	Urban Centre	N	93.5	93.5	Y	14	9	N/A	12	23

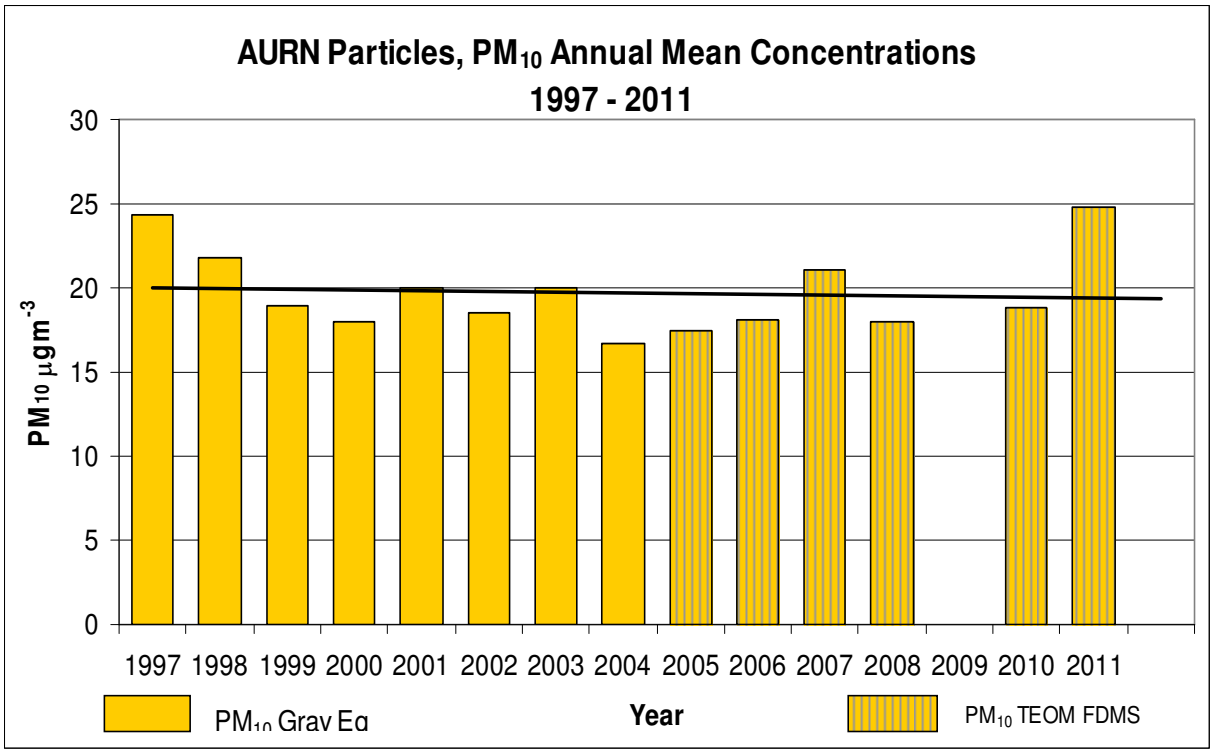
* Optional

Trends in Annual Mean PM_{10} Concentrations

Figure 2.2.2.1 shows the PM_{10} trend data for the AURN. The values show gravimetric equivalent PM_{10} annual mean concentrations with a distinction between the gravimetric adjustment used prior to 2005 and TEOM FDMS correction used since then.

Whilst there is an overall downward trend, PM_{10} levels have increased and decreased since 2005 but at no time have they approached 40μg/m^3 - the annual mean AQO. However 2011 does show a significant increase on recent years especially considering the moderate conditions that were present in 2011.

Figure 2.2.2.1



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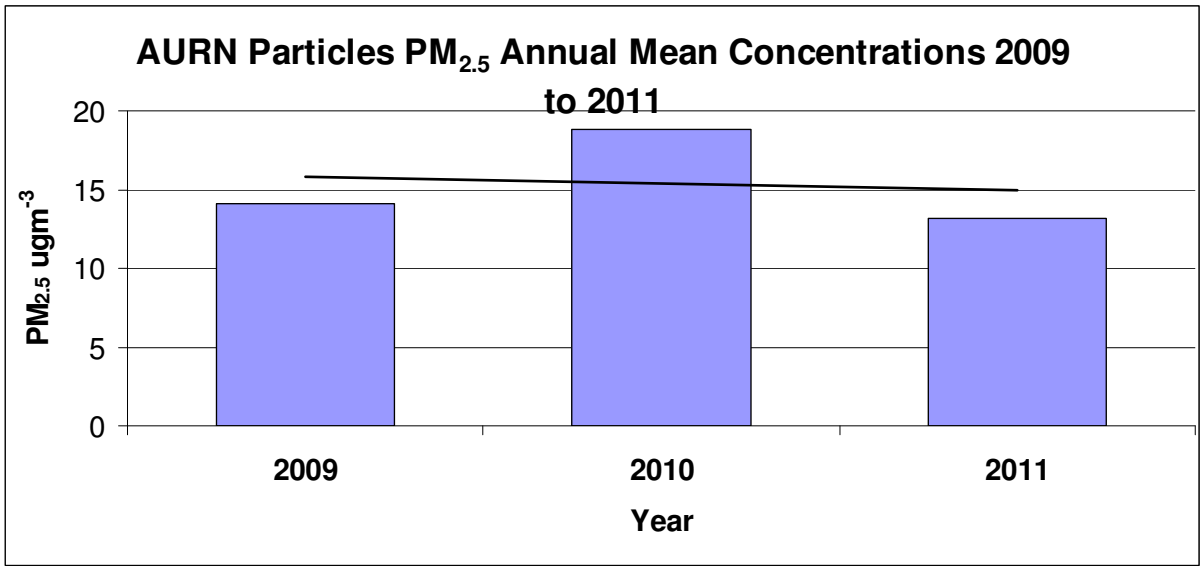
Instrument removed late 2008 to 2009.

Trends in Annual Mean $PM_{2.5}$ TEOM FDMS Concentrations

Figure 2.2.2.2 shows the $PM_{2.5}$ TEOM FDMS trend data for the AURN.

Whilst there is an overall downward trend, $PM_{2.5}$ levels have increased and decreased since 2009 – currently there is no LAQM AQO's for this pollutant. However 2011 does not show the significant increase on recent years as shown for PM_{10}.

Figure 2.2.2.2



2.2.3 Sulphur Dioxide

Sulphur dioxide levels were low at the AURN site and there were no exceedences of the SO_2 AQ objectives – Table 2.6 below.

Table 2.2.3a Results of SO_2 Automatic Monitoring: Comparison with 15-minute, 1-hour and 24-hour Mean Objectives

Site ID	Location	Within AQMA?	Data Capture 2011 %	2011 Maximum 15-minute mean SO_2 ($\mu g/m^3$)	2011 Maximum 1-hour mean SO_2 ($\mu g/m^3$)	2011 Maximum 24-hour mean SO_2 ($\mu g/m^3$)
AURN	Clinton Street Ea	N	97.7	69 0 occurrences >=266$\mu g/m^3$	32	16

12 months ratified data – 01/01/2011 to 31/12/2011

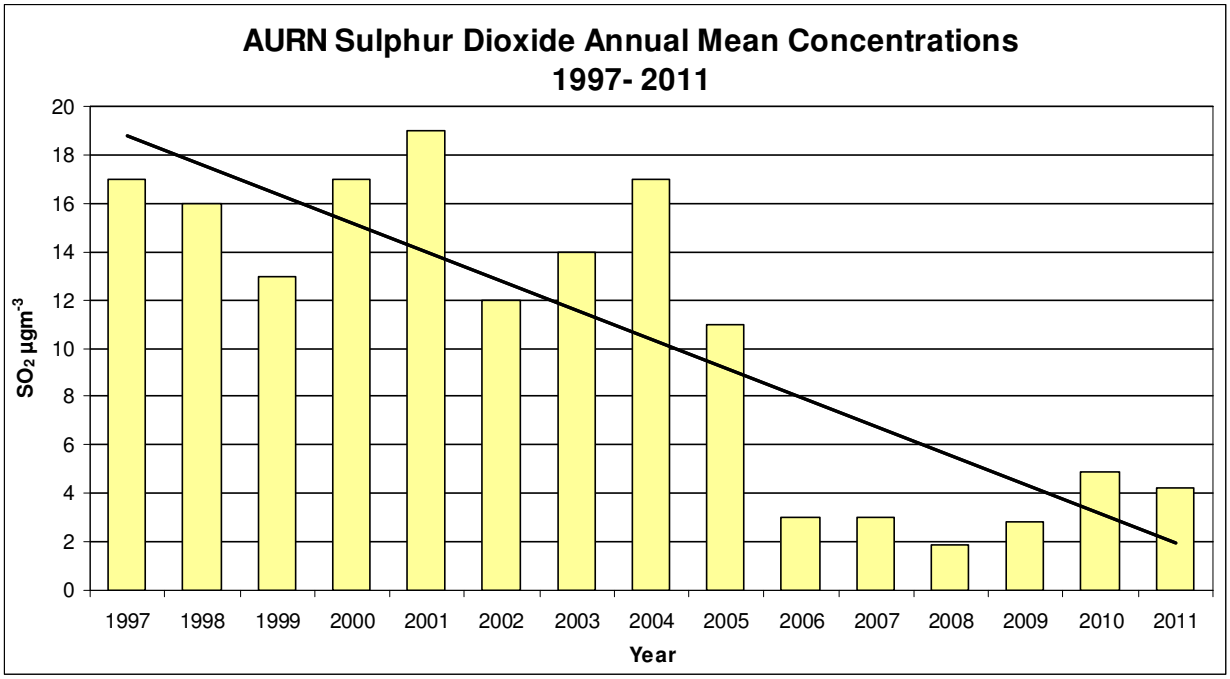
Table 2.2.3 Results of Automatic Monitoring of SO_2: Comparison with Annual Mean Objective

Site ID	Site Type	Within AQMA?	Valid Data Capture for monitoring Period %[a]	Valid Data Capture 2011 %[b]	Number of Exceedences (percentile in bracket μg/m^3)[c]		
					15-minute Objective (266 μg/m^3)	1-hour Objective (350 μg/m^3)	24-hour Objective (125 μg/m^3)
AURN	Urban Centre	N	97.7	97.7	0	0	0

Figure 2.2.3 Trends in SO_2 Concentrations

Figure 2.2.3 shows that the trend has been decreasing annual mean sulphur dioxide concentrations. As noted in the PR2010 the significant decrease in levels since 2006 is likely to be due to the completion of the Turning Point North traffic scheme. The 2011 level is a slight decrease on the 2010 level which itself is a significant increase compared with the last 4 years and may be due to the extreme weather conditions in the last few months of that year.

Figure 2.2.3



2.2.4 Benzene

Non-Automatic Monitoring Data

Benzene levels at the AURN were low and there were no exceedences of the Benzene AQ objectives.

Table 2.2.4a Results of Benzene Pumped Tube Monitoring: Comparison with Annual Mean Objectives

Site ID	Location	Within AQMA?	Data Capture 2011 %	2011 Annual mean concentration Benzene ($\mu g/m^3$)
AURN	Clinton Street Ea	N	80	0.62

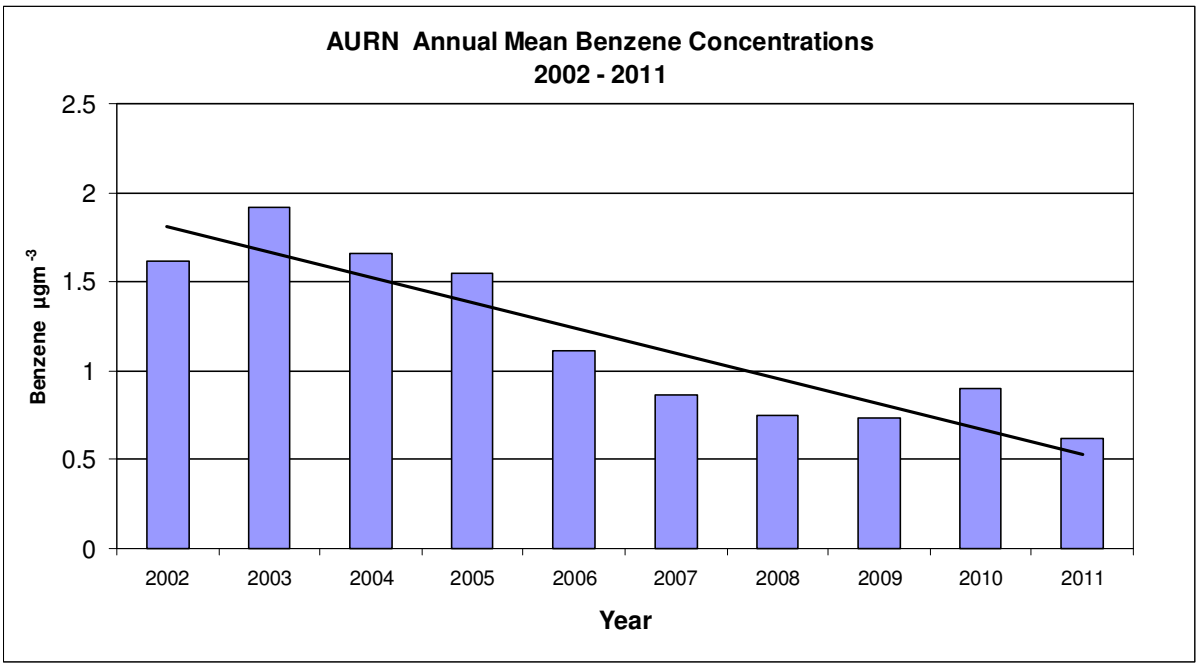
12 months ratified data – 01/01/2011 to 31/12/2011

Low data capture as a result of a mass flow controller failure.

Benzene Trend Data

Figure 2.2.4.1 shows that there is a general downward trend in measured levels of benzene at this site (apart from an increase in 2010). Whilst concentrations have been low throughout there is a noticeable reduction that is evident from 2006 onwards. This coincides with the implementation of the Turning Point North traffic management scheme.

Figure 2.2.4.1 Annual Mean Benzene Concentrations



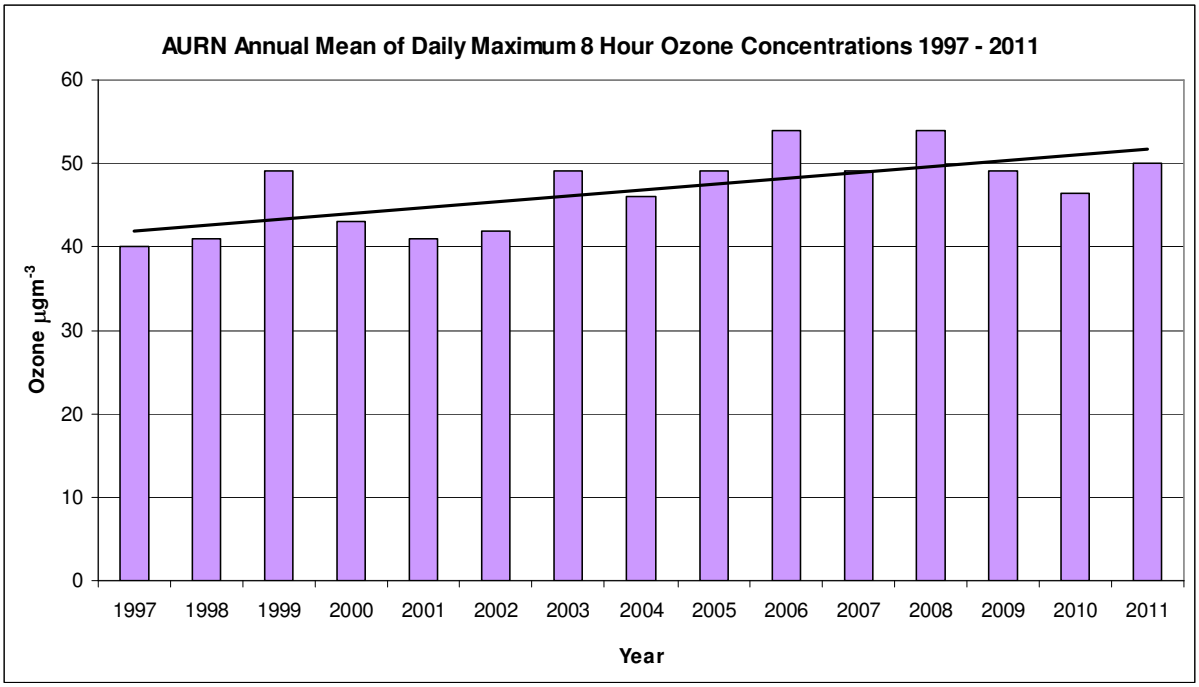
2.2.5 Other pollutants monitored

Ozone

Ozone has been monitored at the AURN since 1997. The trend for the daily maximum 8 hour yearly data at this site is shown in Figure 2.2.5.1. It can be seen that the highest value of 54µg/m^3 was measured at the AURN in 2006 and 2008.

At the AURN the general trend shows increasing ozone levels between 1997 and 2006 however from 2008 to 2011 there have been noticeable year on year decreases - this is consistent with national data for urban background sites. 2011 has shown a minimal increase in this recent downward trend.

Figure 2.2.5.1AURN Annual Mean of Daily Maximum 8 hour Ozone



2.2.6 Summary of Compliance with AQS Objectives

Nottingham City Council has measured concentrations of nitrogen dioxide above the annual mean objective at relevant locations outside of the AQMAs, and **will need to proceed to a Detailed Assessment that includes**:

- around the junction of the Outer Ring Road (A6514) with Nottingham Road (B682) which is in a residential/commercial area approximately 3.5km to the north west of the City centre

  and

- in the vicinity of the roundabout where Castle Boulevard (A6005) meets Abbey Bridge (A6005) - a mainly residential area approximately 1.7km west of the City centre.

3 Road Traffic Sources

3.1 Narrow Congested Streets with Residential Properties Close to the Kerb

No streets were identified that meet the specified criteria; which are outside traffic related AQMAs and that have not been previously assessed.

Nottingham 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

In the Second and Third Stage Review and Assessment busy street locations where people may regularly be for an hour or more were considered in detail. No new exposure in existing areas or exposure in new areas has been identified.

Nottingham 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.

Roads with high flows of buses/HGVs have been considered in previous rounds of review and assessment.

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

3.4 Junctions

Junctions meeting the criteria specified in the guidance LAQM.TG(09) have been previously assessed and contained within the amended AQMA 2 2010 Nitrogen Dioxide – City Centre.

Nottingham 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

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

3.6 Roads with Significantly Changed Traffic Flows

No roads with significantly changed traffic flows have been identified since the last Progress and Further Assessment reports.

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

3.7 Bus and Coach Stations

Bus and coach stations were assessed in previous rounds of Review and Assessment

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

4 Other Transport Sources

4.1 Airports

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

4.2 Railways (Diesel and Steam Trains)

4.2.1 Stationary Trains

Nottingham 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

Nottingham 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)

Nottingham 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

Nottingham 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

Nottingham 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

Nottingham 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

Nottingham City Council confirms that there are no major fuel (petrol) storage depots within the Local Authority area.

5.3 Petrol Stations

Petrol stations were assessed in previous rounds of Review and Assessment (First & Second Stage Report) and there are no new petrol stations that have an annual throughput greater than 2000m^3.

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

5.4 Poultry Farms

Nottingham City Council confirms that there are no poultry farms meeting the specified criteria within the Local Authority area.

6 Commercial and Domestic Sources

6.1 Biomass Combustion – Individual Installations

Currently the use of biomass in the Nottingham City area is minimal. Several planning applications have been received for individual installations. These are for biomass burners in public sector buildings; none are in the 50kW to 20 MW category and they will not need to be regulated under the Pollution Prevention and Control Act 1999. The air quality assessments provided so far for these boilers suggest they will not have a significant impact on air quality in the areas in which they are to be located.

Nottingham City Council has assessed the biomass combustion plant, and concluded that it will not be necessary to proceed to a Detailed Assessment.

6.2 Biomass Combustion – Combined Impacts

Very limited information is available on small combustion installations including domestic use of wood burners and solid fuel. Nottingham City Council is of the opinion that the current level of biomass combustion is so low that it can be considered that there is no significant impact on air quality. This aspect will be kept under review.

Nottingham City Council has assessed the biomass combustion plant, and concluded that it will not be necessary to proceed to a Detailed Assessment.

6.3 Domestic Solid-Fuel Burning

Domestic solid fuel use was considered in the Review and Assessment Second and Third Stage Report and no areas where significant coal/smokeless fuel burning takes place were identified.

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

7 Fugitive or Uncontrolled Sources

No locations where there are or are potential significant fugitive/uncontrolled dust sources have been identified.

Nottingham 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

The 2011 monitoring data confirms findings reported in the Progress and Further Assessment reports.

There were no exceedences of the air quality objectives for PM_{10}, sulphur dioxide, carbon monoxide and benzene.

Exceedences of the nitrogen dioxide annual mean air quality objective were measured at two roadside automatic monitoring sites and a number of diffusion tubes sites; both within and outside existing Air Quality Management Areas.

The 1-hour objective was not exceeded at any of the continuous monitoring sites and no annual mean diffusion tube nitrogen dioxide concentration was greater than 60 $\mu g/m^3$ which also indicates this objective was unlikely to be exceeded.

This report has considered 2011 monitoring data (together with some site specific historical data). Unusual and unseasonal levels of rainfall and a reduction in traffic flow (probably due to the continuing recession) appear to have had an impact: year on year indications showed a 7% reduction in continuous monitoring results and 5% reduction in diffusion tube results.

The 2011 diffusion tube monitoring measured nitrogen dioxide levels of 41, 41 and 43$\mu g/m^3$ at 3 residential sites that are not within current AQMA's. These factors suggest that the geographical extent of the AQMA may need to be reconsidered, and / or additional AQMA declared for 2 new locations.

8.2 Conclusions from Assessment of Sources

The work undertaken taken for this report has not identified any likely adverse air quality impacts from local developments, air and rail transport, industrial installations, commercial/domestic combustion, fugitive emissions, residential and commercial sources or road transport outside the existing (proposed amended) AQMAs.

No new or significantly changed sources since the last report have been identified.

8.3 Proposed Actions

The monitoring data presented in this USA have shown that exceedences of the nitrogen dioxide annual mean Air Quality Objective occurred at 2 additional sites and as such new sites of potential exceedences of the Air Quality Objectives have been identified.

Our 2011 Progress Report, which was accepted by Defra, concluded that it was necessary for Nottingham City Council to undertake a Detailed Assessment (DA) in respect of the measured NO_2 exceedences outside an AQMA where there is relevant exposure of members of the public.

The Further Assessment (January 2012), also accepted by DEFRA, confirmed the decision to vary the extent of the Air Quality management Areas in 2010.

Consequently, it is proposed to broaden the scope of the DA to determine whether the extent of the City Centre AQMA is sufficiently precautionary to avoid amending it in the future and; to investigate whether, as a consequence of the monitoring and new development findings outlined in this report, an AQMA that encompasses a much larger area of the inner City should be considered.

9 References

AEA Energy & Environment (Feb 2008) **Diffusion Tubes for Ambient NO_2 Monitoring: Practical Guidance for Laboratories and Users Issue 1a**

AEA Technology (2005)
Local Site Operators' Manual

Air Quality (England) Regulations 2000 (SI 928),

Department for the Environment, Food and Rural Affairs (February 2009) **Local Air Quality Management Technical Guidance LAQM.TG (09))**

Department for the Environment, Food and Rural Affairs (2007) **The Air Quality Strategy for England, Scotland, Wales and Northern Ireland 2007**

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Enview 2000 Software Manager Version 5

Harrison D., (June 2006) **UK Equivalence Programme for Monitoring of Particulate Matter Bureau Veritas Report No. Bureau Veritas/AQ/AD202209/DH/2396,**

Nottingham City Council (April 2009) **Key Facts for Nottingham and Greater Nottingham - Last updated: 6th April 2009**

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City of Nottingham
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City of Nottingham
Air Quality Review & Assessment Second & Third Stage Report 2001

City of Nottingham
Local Air Quality Management: Stage Four Review & Assessment of Nottingham's Air Quality Management Areas July 2003

City of Nottingham
Local Air Quality Management: Updating and Screening Assessment October 2003

City of Nottingham
Local Air Quality Management: Detailed Assessment August 2004

City of Nottingham
Local Air Quality Management: Progress Report April 2005

Nottingham City Council
Local Air Quality Management: Updating and Screening Assessment June 2006

Nottingham City Council
Local Air Quality Management: Detailed Assessment Consultation Document May 2008

Nottingham City Council
Local Air Quality Management: Progress Report July 2008

Nottingham City Council
Local Air Quality Management: Progress Report July 2008

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Local Air Quality Management: Updating and Screening Assessment Report April 2009

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Local Air Quality Management: Detailed Assessment Report January 2010

Nottingham City Council
Local Air Quality Management: Air Quality Progress Report October 2010

Nottingham City Council
Local Air Quality Management: Progress Report July 2011

Nottingham City Council
Local Air Quality Management: Further Assessment Report January 2012

Nottingham City Council Website **http://www.nottinghamcity.gov.uk**

The Air Quality (England) (Amendment) Regulations 2002 (SI 3043)

The Pollution Prevention and Control Act 1999

Appendices

Appendices

Appendix A: Nitrogen Dioxide Diffusion Tube

Appendix B: QA/QC Data for Automatic and Non-Automatic Sites

Appendix A: Diffusion Tube Data Adjustment and QA/QC Information

Diffusion Tube Bias Adjustment Factors

B-1 NO_2 Diffusion Tube Bias Adjustment

Nottingham City Council's diffusion tubes are supplied and analysed by Gradko International, Hampshire. The tubes are prepared using a 20% solution of triethanolamine (TEA) in de-ionised water and are exposed on site for approximately one month before being returned for laboratory analysis.

The R&A Helpdesk Database 2011 bias adjustment factor for Gradko 20% TEA in water tubes = 0.89. This figure is the average of 26 studies using kerbside, roadside, urban centre, urban background and other sites and was taken from Spreadsheet Version Number: 04/11.

Diffusion tube precision was good for 31 of the 39 studies used to derive the national bias adjustment factor. Tube precision is categorised as 'good' "where the coefficient of variation (CV) of triplicate diffusion tubes for eight or more periods during the year is less than 20%, and the average CV of all monitoring periods is less than10%". (LAQM.TG(09))

Factor from Local Co-location Studies

Throughout 2011 triplicate diffusion tubes were co-located at 3 roadside continuous analyser sites.

Table A-1 gives the bias adjustment factors for our co-location study for the 2 road sites; the figures in the table have been calculated from 12 months' ratified data (January to December 2011). The averaged bias adjustment factor = 0.91.

Table A -1 Nottingham City Council's Bias Adjustment Factor

Site	Site Type	Cm NO_2 $\mu g/m^3$	Dm NO_2 $\mu g/m^3$	Bias Adjustment Factor, A (Cm/Dm)	Data Capture % Cm	Data Capture % Dm	Precision (CoV) %
CG NOx, Carter Gate	Roadside	42	44	0.95	99.6	91.7	9
LS NOx, Lace Street	Roadside	38	45	0.86	92.3	100	6
SA NOx	Roadside	41	45	0.91	98.8	100	5
Averaged bias adjustment factor				**0.91** - 3 roadside sites			

12 months data January to December 2011

Cm = chemiluminescence (continuous) analyser measurement
Dm = diffusion tube measurement (average of 3 tubes)
CoV = Coefficient of variation
Nottingham City Council's co-location data has now been entered in the R & A Database site.

Discussion of Choice of Factor to Use

The 2011 national bias adjustment factor (of all sites) is 0.89 however there are a number of aspects that militate against using the factor for the Nottingham City Council data:

- for the 18 of 26 national sites that are roadside the average adjustment factor = 0.89

- for the 4 of 26 national sites that are Urban Centre, Urban Background or Background the average adjustment factor = 0.93.

Use of national factor for all sites 0.89 or just roadside sites i.e.0.89 to adjust values would lead to slightly lower nitrogen dioxide concentrations values but may lead to underestimation.

Therefore the decision was taken to use the averaged local adjustment factor for the 3 Nottingham roadside sites as being the most representative and a compromise between the various factors that could have been used.

The local factor was used to adjust the diffusion tube values because Nottingham City Council's co-located tubes were exposed at sites that are representative of the majority of the single tube locations and; the local data had good 'precision', good overall data capture and the co-efficient of variation was low at each of the sites. This choice is consistent with advice given in LAQM.TG(09).

The 2011 diffusion tube unbiased monthly nitrogen dioxide concentrations are given in Table A-2.

Nottingham City Council - England

Table A-2 2011 Diffusion Tube Unbiased Monthly Nitrogen Dioxide Concentrations (μg/m^3)

Site Id	Location	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Raw Mean μg/m^3
G	Beeston Road	56.5	46.2	52.7	35.0	37.1	39.6	25.1	37.8	42.3	48.8	50.2	41.8	42.8
I	Derby Road	51.8	23.8	44.1	26.6	28.0	33.6	30.8	33.0	32.3	32.2	38.8	31.5	33.9
X	Western Boulevard	52.3	36.3	42.8	28.6	32.6	34.7	30.8	33.9	37.1	42.7	40.4	38.8	37.6
X2	Wilkinson Street	55.4	44.4	39.9	28.6	33.2	35.3	31.6	34.1	37.0	38.1	28.4	36.4	36.9
X3	Nottingham Road	50.4	40.7	52.2	37.5	38.6	46.1	43.3	41.6	43.2	49.7	50.4		44.9
X3-2	Nottingham Road	63.6	44.7	47.4	30.0	31.5	38.4	32.3	34.3	42.0	47.8	47.8	36.5	41.3
X3-3	Nottingham Road	50.9	40.2	40.7	25.0		31.1	27.6	30.7	32.4	38.1	44.5	32.7	35.8
X4	Danethorpe Vale	45.4	33.2	40.2	23.0	30.1	34.8	27.1	30.1	36.8	36.1	38.4	34.4	34.1
V	Bentinck Road	52.1		44.1	33.0	33.3	39.5	34.3	37.0	41.2		43.2	33.5	39.1
AA	Ilkeston Road	53.8	48.9	62.2	35.8	29.7	46.8		40.4	45.6	58.3	57.5	37.0	46.9
AA-2	Ilkeston Rd / R.Crt.	49.0	38.7	40.0	35.5	24.4	30.4	23.4	30.3	32.5		40.9	29.1	34.0
V2	Gregory Boulevard	80.9	35.5	35.2	23.2	29.9	34.7	28.0	33.7	32.9	39.1	41.3	29.0	36.9
K3	The Grove Castle Blvd.	54.3	55.6	61.6		33.5		23.6	38.0	41.3	48.3	48.6	43.8	44.9
K3-2	309 Castle Boulevard	45.5	35.9	39.2	24.4	24.8	26.6	25.2	26.9		37.2	38.4	25.4	31.8
K3-3	Sherwin Road	42.8	39.0	38.6	25.8	24.9	27.6	21.4	26.9	31.5	40.7	42.2	27.9	32.4
K	Castle Boulevard	58.7	48.9	NA		35.6	42.2	39.2	41.5	38.9	63.0	54.5	38.9	46.1
M	Canning Terrace	61.8	61.3	76.1	45.3	44.4	58.2	61.2	50.6	48.4	61.9	64.2	38.8	56.0
N	Upper Parliam't St.	75.1	69.4	63.6	44.3	48.4	53.9	44.4	46.8	55.6		67.7	42.4	55.6
O	Shakespeare St.	58.0	47.7	63.3	45.0	39.7	50.4	44.0	47.9	51.7	65.7	61.5	46.9	51.8
P	Mansfield Road	63.1	56.3	63.1	40.9	38.5	47.6	45.1	43.7	44.6	61.3	64.7	38.8	50.6
Y	Beck Street	63.3	50.1	56.7	38.5	39.3	50.7	46.6	46.1	46.0	58.0	57.9	45.4	49.9
U	Trent Bridge	40.7	59.8	61.8	47.9	46.1	52.4	39.9	50.1	54.4	70.0	70.8	32.1	52.2
T	Queen's Road	36.5	52.2	51.9	35.3	37.1	47.7	45.9	45.5	44.9	55.9	61.2	30.9	45.4

Appendix B: QA/QC Information for Automatic and Diffusion Tube Monitoring

QA/QC for Automatic Monitoring

Quality Control, Maintenance, Calibration

AURN Site

The analysers at the AURN site are subject to a four weekly calibration regime. The calibrations are undertaken by a trained local site operator (LSO) and conducted in accordance with the Local Site Operators' Manual. Nottingham City has 3 trained LSOs who are audited as to their performance on an on-going basis.

The LSO changes the filters for the TEOMs and FDMS and cleans the TEOM heads approximately every 12 weeks, in accordance with the Local Site Operators Manual, when requested by the Central Management and Co-ordination Unit (CMCU).

The equipment is fully serviced every six months. In 2011 this was undertaken by Casella Measurement, Bedford.

The site is audited by AEA Technology on a six monthly basis.

CG NOx, LS NOx and SA NOx Sites

At Nottingham City Council's CG NOx, LS NOx and SA NOx sites calibrations are carried out fortnightly. The calibrations, using zero air and span gases, are undertaken by the same LSOs as those for the AURN site and are conducted using the same principles and procedures as given in the AURN LSO Manual.
The equipment is fully serviced every six months by Casella Measurement, Bedford.

Calibration Gas Traceability

AURN Site

Calibration gases used in the AURN are supplied by AIR Liquide who have demonstrated compliance with relevant quality control procedures in the preparation of gas mixtures. The gas mixtures are certified by AEA Technology.

CG NOx, LS NOx and SA NOx Sites

Calibration gases used in the CG NOx, LS NOx and SA NOx monitoring sites are supplied by AIR Liquide who have demonstrated compliance with relevant quality control procedures in the preparation of gas mixtures. The gases are supplied with a certificate of analysis and further certified by AEA Technology.

Nottingham City Council - England

Data Collection and Processing

AURN Site

The AURN station's data logger is continuously interrogated by Bureau Veritas the Central Management and Co-ordination Unit (CMCU). The data obtained is validated by CMCU and passed to the Data Dissemination Unit (DDU).
Information about the AURN station and available data can be found on the internet at http://uk-air.defra.gov.uk.

CG NOx, LS NOx and SA NOx Sites

For Nottingham City Council's sites all data collection, validation and ratification is carried out by the Council's Noise & Pollution Control team.

Throughout 2011, data from the CG NOx, LS NOx and SA NOx sites was polled remotely directly from the analysers and collected as 15 minute averages using Envista ARM data collection software. The data have been scaled and converted into hourly or other values using the Envista ARM data management system

The software allows users to remotely view, analyse, report and distribute environmental quality data. Manipulation of raw data to verified data can be conducted in a structured approach.

Data validation is carried out and involves screening the scaled values to identify unusual measurements, errors due to equipment failure etc. and flagging them for further investigation.

Data ratification is carried at approximately 2 monthly intervals. This involves looking at the data more closely and includes:

- examination of calibration records to ensure correct application of calibration factors;
- examination of data for other pollutants and monitoring sites to highlight any anomalies;
- deletion of data shown from chart or other records to be spurious, for example, spikes generated by the analyser;
- correction of any baseline drift as indicated by examination of daily automatic calibration records.

Once this process has been carried out and data has been verified, amended or rejected as appropriate the data is ratified. This final data set is used for the R & A process.

Nottingham City Council - England

QA/QC of Diffusion Tube Monitoring

Gradko International (diffusion tube supplier and analyst) is UKAS accredited; is assessed annually for compliance to ISO 17025 and participates in other proficiency schemes.

Gradko confirmed that:

- their procedures have been amended to follow the guidance issued on behalf of Defra (AEA Energy & Environment, Feb 2008) relating to the preparation, extraction, analysis and calculation procedures for passive NO_2 diffusion tubes

also

- that most of these procedures were in force before the guidance was introduced and any amendments necessary in achieving compliance were minimal.

Gradko also participate in a number of QA/QC monitoring systems to demonstrate satisfactory performance:

- The Workplace Analysis Scheme for Proficiency **(WASP)** programme to ensure uniformity in data throughout the year. Only laboratories that are in the WASP scheme are used for analysing tubes from the National Nitrogen Dioxide Diffusion Tube Network.

- The monthly field inter-comparison exercise with other laboratories to enable assessment of bias and precision undertaken by AEA Energy & Environment.

- An external QC scheme to check solutions run by AEA Energy & Environment.

WASP

This involves monthly analysis of doped tubes, allowing assessment of overall uniformity of data throughout the year. Performance scores i.e. Z-score are assigned to the reported analysis results, on the basis of their difference from the known concentration of the analyte and the actual standard deviations.

Z-score Results are classified as follows:

Satisfactory	< +/- 2
Questionable (warning)	> +/-2 – < +/- 3
Unsatisfactory	> +/-3

Each participating laboratory's results are analysed by AEA Energy & Environment and combined to give an annual relative standard deviation. If this value is greater than + 15% of the Performance Target then the laboratory's performance for the year in the WASP scheme will be deemed unsatisfactory. Only laboratories that remain in the WASP scheme are used for analysing tubes from the National NO_2 diffusion tube non-automatic network.

Table B-1 below shows latest satisfactorily 2011 (up-to Aug 2011) WASP performance results.

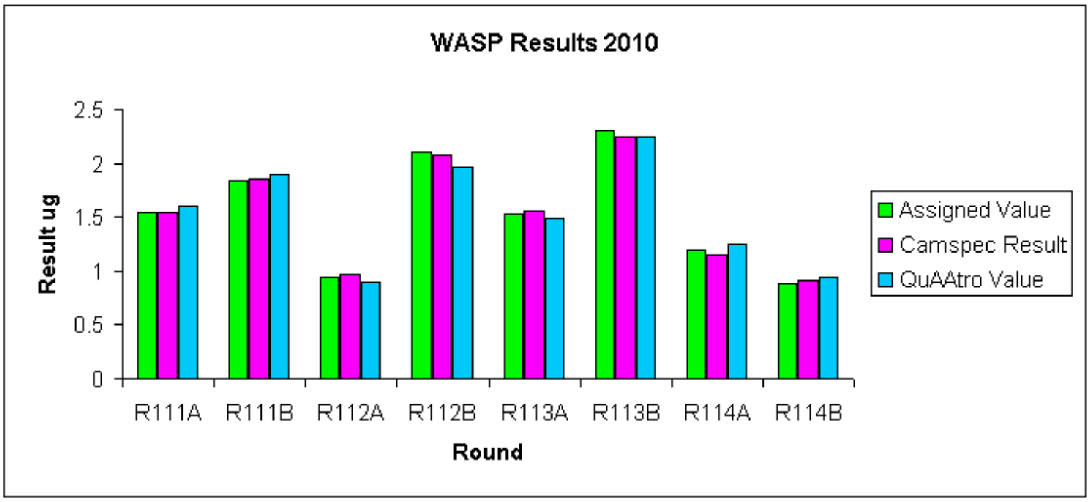
Table B-1 Gradko 2011 WASP NO_2 Diffusion Tube Performance Results

All data supplied by Gradko International April 2012.

gradko environmental
St. Martins House, 77 Wales Street Winchester, Hampshire SO23 0RH
tel.: 01962 860331 fax: 01962 841339 e-mail:diffusion@gradko.co.uk

Nitrogen Dioxide WASP Results Rounds 111 to 114

Camspec M550 & QuAAtro								
WASP Round No:-	R111A Nov-10	R111B Nov-10	R112A Feb-11	R112B Feb-11	R113A May-11	R113B May-11	R114A Aug-11	R114B Aug-11
Assigned Value	**1.54**	**1.84**	**0.94**	**2.10**	**1.532**	**2.304**	**1.20**	**0.89**
Camspec Value	1.57	1.851	0.977	2.100	1.525	2.196	1.113	0.917
Camspec Value	1.532	1.864	0.969	2.049	1.586	2.288	1.202	0.918
Average	**1.551**	**1.858**	**0.973**	**2.075**	**1.556**	**2.242**	**1.158**	**0.918**
Average Z Score	0.1	0.1	0.5	-0.2	0.2	-0.3	0.4	-0.5
Classification	Satisfactory	Satisfactory	Satisfactory	Satisfactory	Satisfactory	Satisfactory	Satisfactory	Satisfactory
QuAAtro Value	1 .590	1.896	0.901	1.926	1.503	2.229	1.247	0.939
QuAAtro Value	1.599	1.9	0.890	2.018	1.471	2.277	1.244	0.937
Average	**1.599**	**1.898**	**0.896**	**1.972**	**1.487**	**2.253**	**1.246**	**0.938**
Average Z Score	0.5	0.4	-0.6	-0.8	-0.4	-0.3	0.7	0.5
Classification	Satisfactory	Satisfactory	Satisfactory	Satisfactory	Satisfactory	Satisfactory	Satisfactory	Satisfactory
Analyst	A. Ratcliffe A. Le Ber	A. Ratcliffe A. Le Ber	A Le Ber B Le Ber	A Le Ber B Le Ber	J. Samuel P. Hunter	J. Samuel P. Hunter	J. Samuel A. Jones	J. Samuel A. Jones



Annual Field Intercomparison

Each participating laboratory is asked to provide a number (typically 3) diffusion tubes for exposure, plus one travel blank. The tubes are exposed at a suitable location for a period of around one month, before being returned to the laboratories for analysis. The exposure site will be co-located with a chemiluminescent analyser. Laboratories are expected to perform within 20% of the reference concentration (usually that obtained by the chemiluminescent analyser).

The 2011 Gradko results of AEA Energy & Environment Intercomparison NO_2 diffusion tube network exercise are given in Table B-2 below. The results show that both precision and accuracy were good for this laboratory.

Table B-2 2011 Gradko / AEA Energy & Environment Intercomparison NO2 diffusion tube network

All data supplied by Gradko International

Checking Precision and Accuracy of Triplicate Tubes

AEA Energy & Environment
From the AEA group

Diffusion Tubes Measurements										Automatic Method		Data Quality Check	
Period	Start Date dd/mm/yyyy	End Date dd/mm/yyyy	Tube 1 μgm^{-3}	Tube 2 μgm^{-3}	Tube 3 μgm^{-3}	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean	Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
1	05/01/2011	02/02/2011	99.7	113.7	114.4	109	8.3	8	20.6	91.2	93.3	Good	Good
2	02/02/2011	02/03/2011	106.0	90.5	106.5	101	9.1	9	22.5	111.7	93.3	Good	Good
3	02/03/2011	30/03/2011	106.0	90.5	106.5	101	9.1	9	22.5	95.7	96.8	Good	Good [1]
4	30/03/2011	27/04/2011	141.5	180.9	105.3	143	37.8	27	94.0	106.4	97.5	Poor Precision	Good
5	27/04/2011	01/06/2011	118.5	126.1	95.8	113	15.8	14	39.2	99.9	97.4	Good	Good
6	01/06/2011	29/06/2011	109.3	121.8	118.7	117	6.5	6	16.2	93.1	90.8	Good	Good
7	29/06/2011	03/08/2011	86.0	85.6	86.2	86	0.3	0	0.8	86.1	91.1	Good	Good
8	03/08/2011	31/08/2011	104.3	111.8	111.7	109	4.3	4	10.6	82.2	97.7	Good	Good
9	31/08/2011	28/09/2011	121.5	103.9	110.3	112	8.9	8	22.2	108.5	96.1	Good	Good
10	28/09/2011	31/10/2011	110.3	91.9	82.6	95	14.1	15	35.1	108.2	96.5	Good	Good
11	18/11/2011	14/12/2011	138.4	130.7	156.7	142	13.4	9	33.2	110.2	97.4	Good	Good
12	30/11/2011	04/01/2012	99.4	123.6	99.6	108	13.9	13	34.6	105.4	96.6	Good	Good
13													
											Overall survey -->	Good precision	Good Overall DC

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

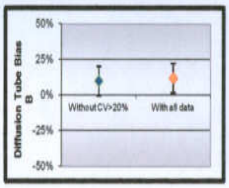
Site Name/ ID:

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

(Check average CV & DC from Accuracy calculations)

Accuracy (with 95% confidence interval) without periods with CV larger than 20%
Bias calculated using 11 periods of data
Bias factor A 0.92 (0.84 - 1.01)
Bias B 9% (-1% - 20%)
Diffusion Tubes Mean: 108 μgm^{-3}
Mean CV (Precision) 9
Automatic Mean: 99 μgm^{-3}
Data Capture for periods used: 95%
Adjusted Tubes Mean: 100 (91 - 110) μgm^{-3}

Accuracy (with 95% confidence interval) WITH ALL DATA
Bias calculated using 12 periods of data
Bias factor A 0.9 (0.82 - 0.99)
Bias B 11% (1% - 22%)
Diffusion Tubes Mean: 111 μgm^{-3}
Mean CV (Precision): 10 caution
Automatic Mean: 100 μgm^{-3}
Data Capture for periods used: 95%
Adjusted Tubes Mean: 100 (91 -,110) μgm^{-3}



Jaume Targa, for AEA
Version 04 - February 2011

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