2013 Air Quality Progress Report for Castlereagh Borough Council

In fulfillment of the Environment (Northern Ireland) Order 2002 - Local Air Quality Management

May 2013

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Executive Summary

The Air Quality Strategy has established the framework for air quality management in the UK. Local Authorities have a duty under the Environment Act 1995, and subsequent regulations to review and assess air quality in their areas on a periodic basis, so as to identify all areas where the air quality objectives are being or are likely to be exceeded. A phased approach has been adopted for the review and assessment process so that the level of assessment undertaken is commensurate with the risk of an exceedence of an air quality objective.

An updating and screening assessment (USA) is required to be prepared every three years by all local authorities in the UK. The last updating and screening assessment of air quality was undertaken in 2009,with two interim progress reports. This report is the 2013 (Progress Report), the assessment is fully compliant with the applicable policy and technical guidance. Castlereagh Borough lies to the southeast of Belfast in Northern Ireland. The Borough is of mixed urban and rural character. It is mainly residential with no significant industrial activity. Many residents work in Belfast and this, combined with the major arterial routes passing through the Borough, makes road transport the major air pollution concern. There is currently an Air Quality Management Area within the Borough.

Following the 2009 Update and screening assessment a detailed assessment was carried out. This concluded the NO_2 air quality objective was exceeded on A20 Upper Newtownards Road and relevant exposure was identified, ie Normandy Court.

Following this detailed assessment the triplicate NO_2 diffusion tubes positioned kerb side were moved to the façade of Normandy Court at the end of 2009. Although the levels of NO_2 have decreased by approximately 40%, they have remained slightly above or close to the objective so Castlereagh Borough Council declared the six apartments to the front of Normandy Court, an Air Quality Management area on the 30th January 2011 and an Air Quality Action plan has since been produced and submitted to the Department.

There are no other air quality exceedences at relevant exposure within the Borough previous real-time monitoring was carried out for NO_2 and PM_{10} at Loughview but due to levels being continuously below the objective this site was decommissioned at the end of 2010. PM_{10} monitoring also ceased in Dundonald at this time

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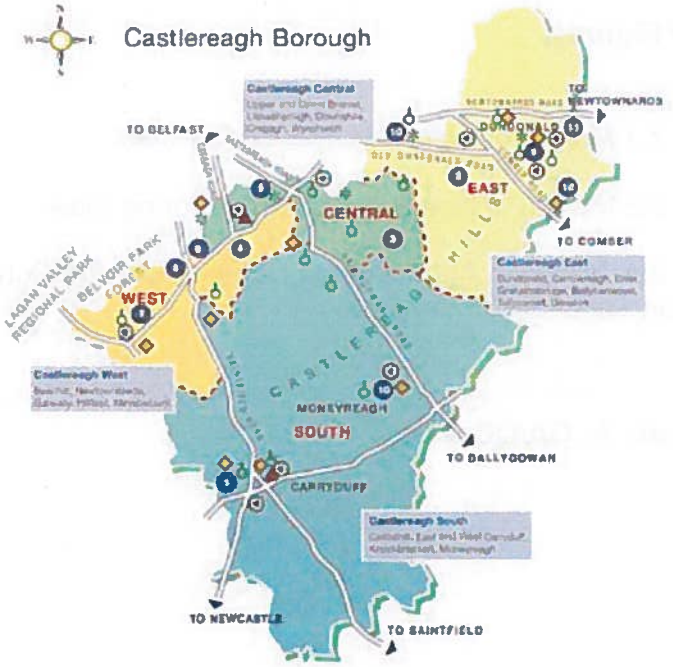
1 Introduction

1.1 Description of Local Authority Area

Castlereagh Borough Council covers an administrative area of 84Km² to the Southeast of Belfast and in 2006 was home to a population of 66,633. The Borough is of mixed and urban rural character and the predominant wind direction is from the Southwest.
The Borough is surrounded by five neighbouring councils. Its position in relation to Belfast, has made it a very popular area to live. Commuting time to the city centre from the Borough is relatively short and this combined with major arterial routes passing through the Borough into Belfast, has made road transport the major air pollution concern.



1.2 Purpose of Progress Report

Progress Reports are required in the intervening years between the three-yearly Updating and Screening Assessment reports. Their purpose is to maintain continuity in the Local Air Quality Management process.

They are not intended to be as detailed as Updating and Screening Assessment Reports, or to require as much effort. However, if the Progress Report identifies the risk of exceedence of an Air Quality Objective, the Local Authority (LA) should undertake a Detailed Assessment immediately, and not wait until the next round of Review and Assessment.

1.3 Air Quality Objectives

The air quality objectives applicable to LAQM in Northern Ireland are set out in the Air Quality Regulations (Northern Ireland) 2003, Statutory Rules of Northern Ireland 2003, no. 342, and are shown in Table 1.1. This table shows the objectives in units of micrograms per cubic metre $\mu g/m^3$ (milligrammes 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 Local Air Quality Management in Northern Ireland.

Pollutant	Concentration	Measured as	Date to be achieved by
Benzene	16.25 $\mu g/m^3$	Running annual mean	31.12.2003
	3.25 $\mu g/m^3$	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 (PM10) (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

Castlereagh Borough Council has completed the following reviews and assessments of air quality in earlier rounds of the assessment process:

Table 1.1 Previous reports submitted by Castlereagh Borough Council

Stage 1 Report (CBC, 2000)	The first stage review and assessment found that the air quality objectives for 4 of the 7 specified parameters namely carbon monoxide, nitrogen dioxide, PM10 and sulphur dioxide were all unlikely to be achieved by 2003-2005.
Stage 2/3 Air Quality Review CBC, 2003, 2004)	The stage 2/3 review for road emissions and domestic fuel combustion concluded that an Air Quality Management Area (AMQA) should not be declared for NO2, PM10 and SO2, as there were not predicted to be exceedences of the air quality objectives
Progress report (CBC2005)	The progress reported for 2004 concluding that PM10, NO2 and SO2 were not predicted to cause exceedences of the air quality objectives at relevant receptors.
Updating and Screening Assessment (USA, 2006)	This reported data for 2005.This indicated that current objectives in relation to SO2, NO2 and PM10 would be achieved at the location of the automatic monitoring stations. The diffusion tube measurements at the A20 Upper Newtownards road in Dundonald indicated the possibility of exceedences in relation to NO2
Progress report (EG, 2007)	This reported the 2006 measurements and the decommissioning of the SO2 automatic site in Espie way and the analyser to be replaced with an NO_2. The station was relocated to Dundonald, where the NO_2 diffusion results were close to the objective .
Progress report (EG, 2008)	This reported the 2007 measurements. Although based on 76% data capture, the annual mean NO2 concentration at the Dundonald automatic monitoring site was below the objective.
Updating and Screening Assessment (USA, 2009)	This reported 2008 measurements. The A20 Dundonald NO2 diffusion tube site exceeded the the objective, and a detailed assessment was initiated.
Detailed assessment	A detailed assessment was carried out for NO2 for the A20 in the Dundonald area
Progress report (CBC 2010)	This reported the 2009 measurements and the relocation of the NO_2 diffusion tubes on the A20 to the façade of the relevant exposure ie: Normandy Court
Progress report (CBC 2011)	This reported the continued elevated levels of NO2 at Normandy Court Dundonald and details of the AQMA Castlereagh Borough Council declared in January 2011.
Updating and Screening Assessment (USA, 2012)	This reported the 2011 measurements and further details of the AQMA and Action Plan.

2 New Monitoring Data

2.1 Summary of Monitoring Undertaken

2.1.1 Automatic Monitoring Sites

Castlereagh Borough Council has one automatic site measuring NOx .using a chemiluminescence analyser.
Calibrations are carried out every two weeks, and the site is independently audited by AEA who were also employed to ratify and validate the data.
The site is located in Dundonald village 30M from the AQMA. A co-location study for the NO_2 diffusion tubes is also carried out at this site. Results from this study are used to assist in bias correction of the NO_2 diffusion tubes within the AQMA and Borough.
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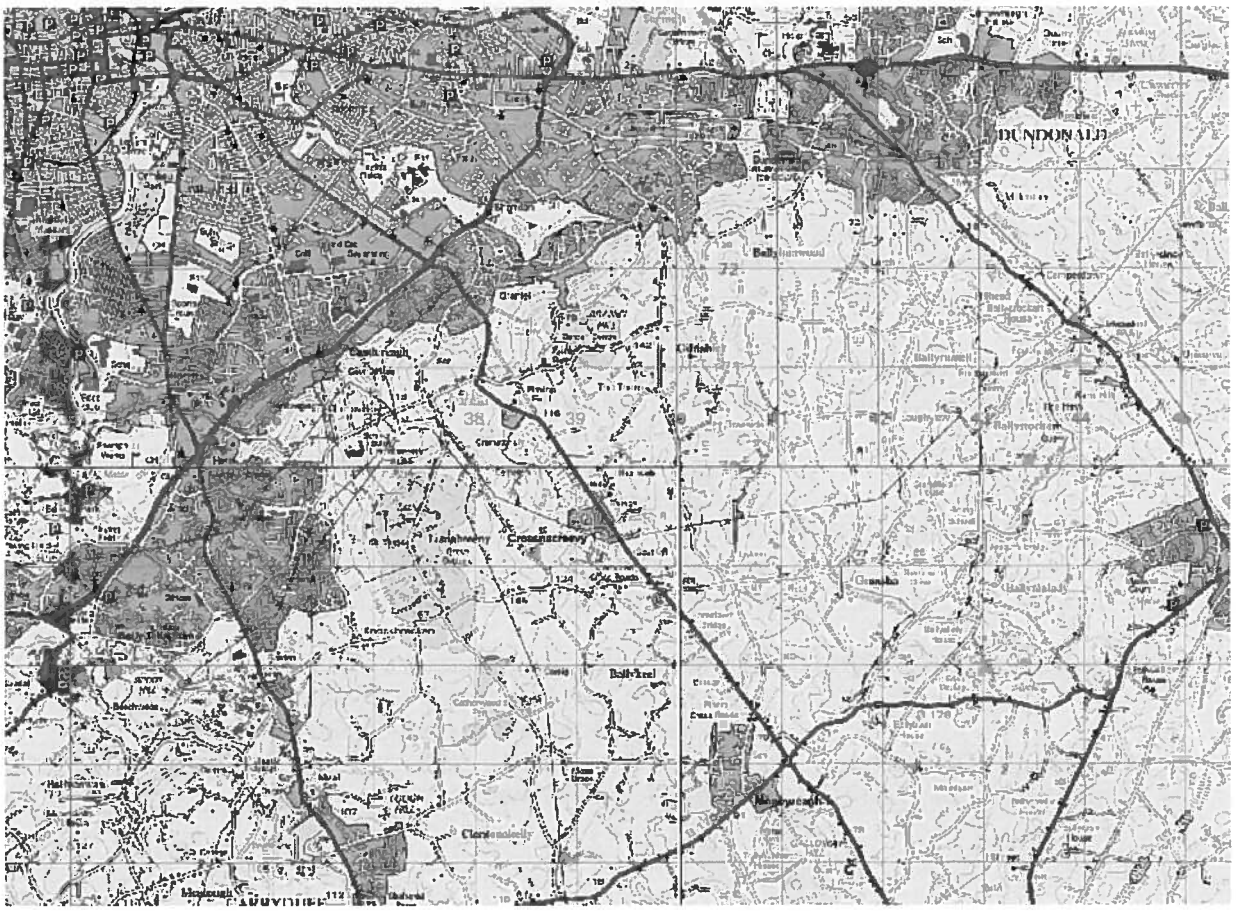
See Appendix A: Details of Quality Assurance and Quality Control

Figure 2.1 Map(s) of Automatic Monitoring Sites

- Dundonald NOx Automatic monitoring site within Borough



AQMA
Automatic monitoring NOx site position in Dundonald Village

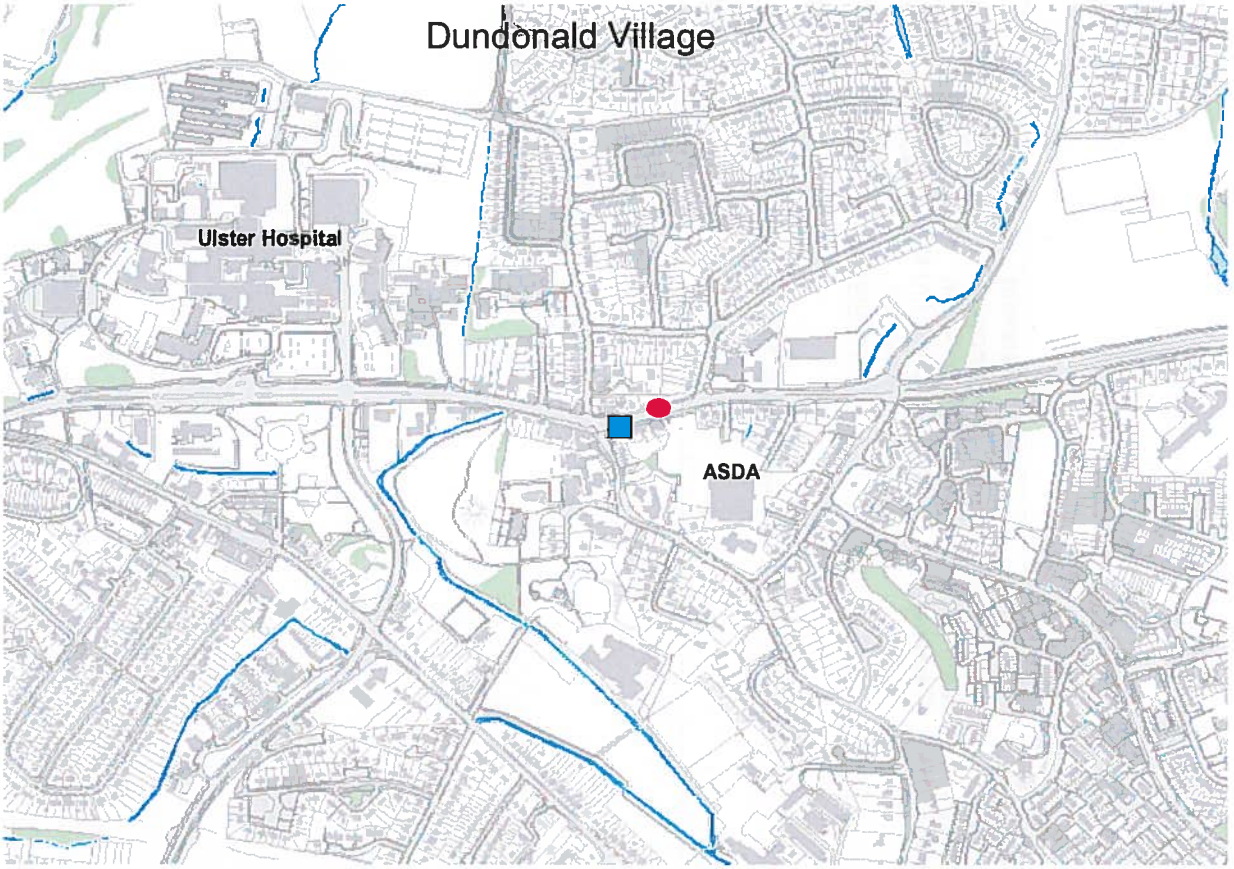


Table 2.1 Details of Automatic Monitoring Sites

Site Name	Site Type	OS Grid Ref		Pollutants Monitored	Monitoring Technique	In AQ MA ?	Relevant Exposure? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road (N/A if not applicable)	Does this location represent worst-case exposure?
Castlereagh Dundonald	Roadside	E 342016	N374041	NO_2,	Chemiluminescence	NO	YES 22M	3M	N (30M from AQMA YES

2.1.2 Non-Automatic Monitoring

Castlereagh Borough Council presently has five NO_2 diffusion tube sites positioned along the main arterial routes into Belfast, and a co-location study carried out at the Dundonald automatic site.(T7) The results from this have been submitted to the national data base.
The bias adjustment factor from this co-location study is **0.62.**
Castlereagh Borough Council lies within the Eastern Group area. There are five neighbouring councils within the group. Four of these councils carried out co-location NO2 diffusion tube studies. The average of these four studies is **0.75,** a decision was made to apply this figure rather than the local rather lower figure.
They were all calculated using the R&A support precision and accuracy spreadsheet.
All the other diffusion tube sites within the area are also roadside sites and typical of all the co-location studies within the Eastern Group
The Normandy Court site (T6) has triplicate tubes, as it is within the AQMA. This site was commenced at the end of 2009 when the results from the kerbside site (T5) on the Upper Newtownards Road, showed levels to be above the objective. The tubes are supplied and analysed by ESG (Environmental Scientifics Group), and sited in accordance with the technical guidance.
Further information on the decision to use this bias adjustment factor and details of the QA/QC of the diffusion tubes can be found in appendix A

Picture of triplicate diffusion tubes on façade of Normandy Court

Figure 2.2 Map(s) of Non-Automatic Monitoring Sites

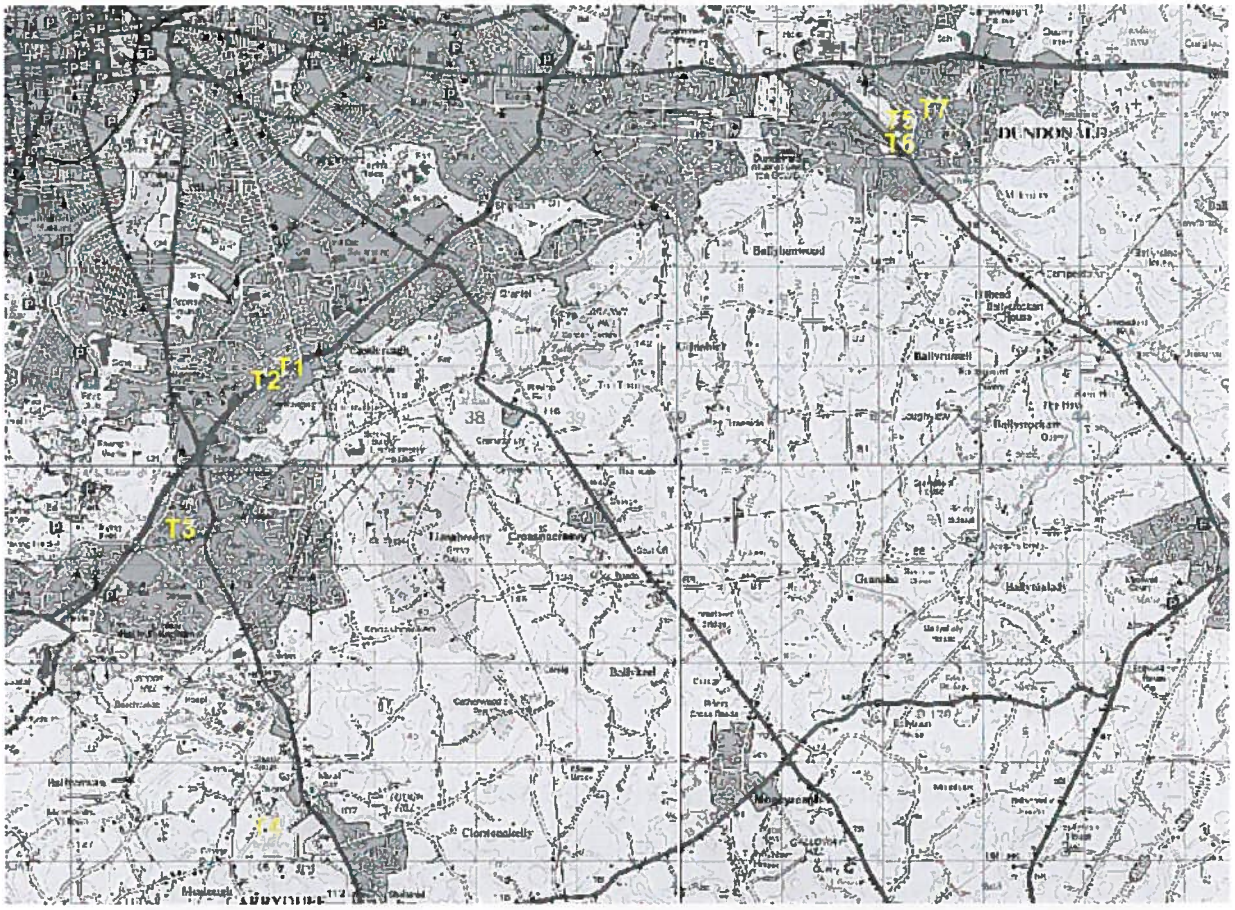


Table 2.2 Details of Non- Automatic Monitoring Sites

Site Name	Site Type	X OS Grid Ref (Irish 1964)	Y OS Grid Ref (Irish 1964)	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)*	Does this location represent worst-case exposure?
T1 Cregagh Road	Roadside	E336257	N371278	NO_2	N	Y	Y (28m)	N/A	N/A
T2 Everton Drive	Background	E336132	N371141	NO_2	N	N	Y (98m)	3m	Y
T3 Newtownbreda Road	Roadside	E335246	N370061	NO_2	N	N	Y (12m)	250m	Y
T4 Saintfield Road	Roadside	E336832	N365625	NO_2	N	N	Y (70m)	10m	Y
T7 Castlereagh Dundonald	Co-location	E342016	N274041	NO_2	N	N	Y (22m)	6.3m	Y
T5 Upper Newtownards Road (adjacent to Normandy Court)	Roadside	E341991	N374013	NO_2	N	N	Y (0m)	1.5m	Y
T6 Normandy Court Facade (AQMA)	Roadside	E341991	N374013	NO_2	Y	N	Y (0m)	0.5m	Y

2.2 Comparison of Monitoring Results with Air Quality Objectives

In the following section results are presented for NO2 at the automatic and diffusion tube sites and compared with the objective. The only site above the objective in 2012 was the single diffusion tube site situated at the junction of the Newtonbreda / Saintfield Road (T3). This is unusual as monitoring has been carried out for a number of years at this site and it has always been below the objective. This is a historical kerbside site relevant exposure is approximately 7M away. A decision has been made to try and gain permission to place the tube on the façade of the dwelling and continue monitoring in 2013. The diffusion tube site within the AQMA remains close to the objective.

2.2.1 Nitrogen Dioxide

In the following section results are presented for NO_2 at the automatic and diffusion tube sites and compared with the objective.

Automatic Monitoring results

Table 2.3a presents the annual mean concentrations of NO_2 determined at the automatic site in 2012 from the hourly measurements.

Figure 2.3 Trends in Annual Mean Nitrogen Dioxide Concentration Measured at Automatic Monitoring Sites.

The automatic station was installed in Dundonald in 2008 because of high results from NO2 tubes at Normandy Court in the village. Results from the station increased slightly each year until 2011 when there was a slight decrease. NO2 levels continued to decrease in 2012. A co-location diffusion tube study is carried out at this site and the results have been submitted to the national data base.

Table 2.3a Results of Automatic Monitoring for 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				
					2008	2009	2010	2011	2012
Castlereagh Dundonald	Roadside	N (within 30M)	99.8	99.8	32.3	36	**41**	39	30

Table 2.3b 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)				
					2008	2009	2010	2011	2012
Castlereagh Dundonald	Roadside	N (within 30M)	99.8	99.8	0	0	0	5	3

Diffusion Tube Monitoring Data

Results of the NO_2 diffusion tube sites, situated within the borough are shown below in table 2.5
They are located at relevant exposure and sited in accordance with the technical guidance.LAQM.TG(09)
A co-location study has been carried out at the Dundonald automatic site, and its results submitted to the LAQM data base. The 2012 local bias was 0.62. There are 4 co-location studies carried out within the local Eastern Group area and the average of these is 0.75, a decision was made to use this factor.
Details of the QA/QC for the diffusion tubes and the reason for the use of the bias adjustment factor **0.75** can be found in appendix A
All diffusion tube sites are below the objective except for the Newtonbreda Road / Saintfield Road junction, this was above the objective. This is not consistent with 2011 when levels had dropped considerably at this location. An automatic site was located the other side of this junction from 2002 until 2011 when it was decommissioned due to continuing low results. This is a historical roadside site and 7M from the façade of the nearest dwelling. Castlereagh Borough Council in 2013 intends in re-locating the diffusion tube to the façade of relevant exposure.
A trend for the five diffusion tube sites within the Borough is shown in figure 2.4.

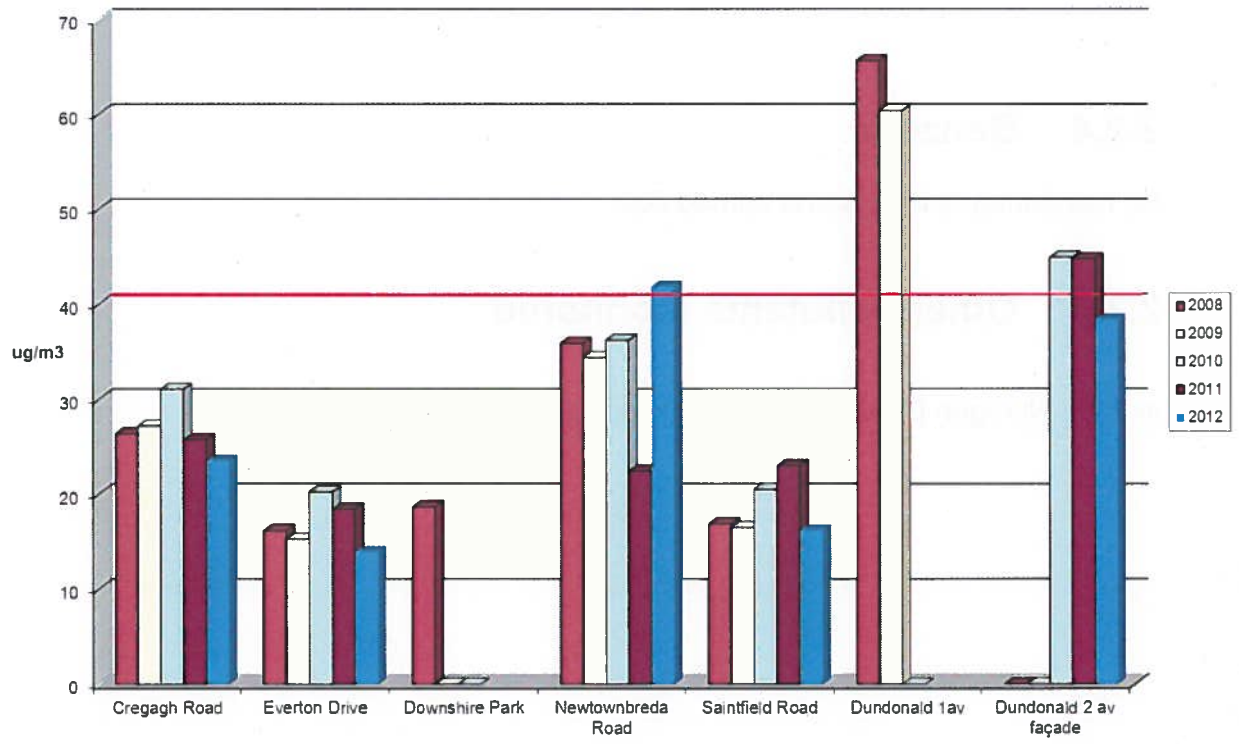
Table 2.4 Results of Nitrogen Dioxide Diffusion Tubes

Site ID	Location	Site Type	Within AQMA?	Triplicate or Co-located Tube	Full Calendar Year Data Capture 2012 (Number of Months [a]	2012 Annual Mean Concentration (µg/m^3) - Bias Adjustment factor = 0.75 [b]
T1	Cregagh Road	Roadside	N	N	12	24
T2	Everton Drive	Roadside	N	N	9	14
T3	Newtonbreda Road	Roadside	N	N	10	**42**
T4	Saintfield Road	Roadside	N	N	9	16
T6	Normandy Court Facade	Roadside	Y	Y	12	38

Site ID	Site Type	Within AQMA?	Annual Mean Concentration (µg/m^3) - Adjusted for Bias [a]				
			2008* (Bias Adjustment Factor =0.83)	2009* (Bias Adjustment Factor = 0.81)	2010* (Bias Adjustment Factor = 0.84)	2011 (Bias Adjustment Factor = 0.83)	2012 (Bias Adjustment Factor = 0.75)
T1 Cregagh Road	Roadside	N	25.8	26.9	31	26	24
T2 Everton Drive	Background	N	15.1	15.1	20	18	14
T3 Newtonbreda Road	Roadside	N	35.9	33.9	36	22	**42**
T4 Saintfield Road	Roadside	N	16.9	16.3	21	23	16
T5 Upper Newtownards Road (adjacent to Normandy Court)	Roadside	N	65.6	57.4	n/a	n/a	n/a
T6 Normandy Court Façade (AQMA)	Roadside	Y	n/a	n/a	n/a	**45**	38

Figure 2.4 Trends in Annual Mean Nitrogen Dioxide Concentration Measured at Diffusion Tube Monitoring Sites.

NO_2 diffusion tube results have remained consistent any annual variation is more likely to be as a result of climatic conditions rather than changes in emissions.



2.2.2 PM_{10}

Castlereagh Borough Council did not carry out any monitoring for PM10 in 2012

2.2.3 Sulphur Dioxide

Castlereagh borough Council did not carry out any monitoring of SO_2 in 2012

2.2.4 Benzene

No monitoring of Benzene is carried out.

2.2.5 Other pollutants monitored

In 2012 Nitrogen Dioxide was the only pollutant monitored

2.2.6 Summary of Compliance with AQS Objectives

Castlereagh Borough Council has examined the results from monitoring in the borough.

Concentrations within the AQMA are still close to objective for NO_2 at Normandy Court Dundonald 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. Castlereagh Borough Council intends relocating the Newtonbreda diffusion tube site to relevant exposure.

3 New Local Developments

Castlereagh Borough Council confirms that there are no new or newly identified local developments which may have an impact on air quality within the Local Authority area.

Castlereagh Down Borough confirms that all the following have been considered:

- **Road traffic sources**
- **Other transport sources**
- **Industrial sources**
- **Commercial and domestic sources**
- **New developments with fugitive or uncontrolled sources.**

4 Planning Applications

A planning application has been approved for a Sainsbury's supermarket in Dundonald Village west of the AQMA. A detailed air quality assessment was not recommended for this application as a Park & Ride scheme is being proposed in conjunction with the development and should assist in the reduction in traffic. This supermarket will be serving the majority of the local residents in Dundonald.

5 Conclusions and Proposed Actions

5.1 Conclusions from New Monitoring Data

The 2012 monitored data has been assessed and has indicated no exceedences of the national air quality objectives at relevant exposure. The NO_2 levels within the AQMA have reduced in 2012 but still close to the objective.
It is therefore not necessary to proceed to a detailed assessment, however monitoring will continue at key locations outside and within the AQMA to allow for comparison in future rounds of review and assessment.
Castlereagh Borough Council submitted their final action plan to the department in January 2013. The action plan is still waiting approval from the department.

5.2 Conclusions relating to New Local Developments

Castlereagh Borough Council has found no new or significant new developments to have likely impacts on air quality.

5.3 Proposed Actions

Castlereagh Borough Council will continue to monitor at key locations and submit a progress report in 2014.
The final action plan was submitted in 2013 this will be assessed in 2013 when approval is received. The historical diffusion tube site at Newtonbreda Road will be relocated in 2013 to the façade of the nearest dwelling. At present there is no need to proceed to a detailed assessment for any pollutants outside of the AQMA.

6 References

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Appendices

Appendix A: QA/QC Data

Appendix A: QA/QC Data of automatic sites

Castlereagh Borough Council commissioned AEA Technology to provide the QA/QC of the automatic measurements of NO_2 for the Dundonald A20 site. Local authority staff act as the local site operator and visit the sites on a weekly basis carrying out any manual calibration or filter changes required. Audits of the site were carried out by AEA Technology on a six monthly basis.
Environmental Monitoring Services were employed to service and maintain the analyser.

Produced by Ricardo-AEA on behalf of the Eastern Group

CASTLEREAGH DUNDONALD
01 January to 31 December 2012

These data have been fully ratified

POLLUTANT	NO	NO_2	NO_X
Number Very High	-	0	-
Number High	-	0	-
Number Moderate	-	0	-
Number Low	-	8769	-
Maximum 15-minute mean	1074 µg m^{-3}	308 µg m^{-3}	1925 µg m^{-3}
Maximum hourly mean	913 µg m^{-3}	258 µg m^{-3}	1635 µg m^{-3}
Maximum running 8-hour mean	572 µg m^{-3}	180 µg m^{-3}	1053 µg m^{-3}
Maximum running 24-hour mean	361 µg m^{-3}	120 µg m^{-3}	671 µg m^{-3}
Maximum daily mean	351 µg m^{-3}	119 µg m^{-3}	655 µg m^{-3}
Average	34 µg m^{-3}	30 µg m^{-3}	82 µg m^{-3}
Data capture	99.8 %	99.8 %	99.8 %

All gaseous pollutant mass units are at 20'C and 1013mb.
NO_X mass units are NO_X as NO_2 µgm^{-3}

Pollutant	Air Quality Regulations (Northern Ireland) 2003	Exceedences	Days
Nitrogen Dioxide	Annual mean > 40 µg m^{-3}	0	-
Nitrogen Dioxide	Hourly mean > 200 µg m^{-3}	3	1

QA/QC of Diffusion Tube Monitoring
The NO_2 tubes are supplied by ESG (Environmental Scientific Group) in Didcot Oxfordshire. Their preparation method is listed below.

Nitrogen Dioxide Diffusion Tube Analysis Report

The samples have been analysed in accordance with ESG's standard operating procedure HS/WI/1015 issue 15. This method meets the guidelines set out in DEFRA's 'Diffusion Tubes for Ambient NO_2 Monitoring: Practical Guidance.'

The tubes were prepared by spiking acetone:triethanolamine (50:50) onto the grids prior to the tubes being assembled. The tubes were desorbed with distilled water and the extract analysed using a segmented flow autoanalyser with ultraviolet detection. In the WASP intercomparison scheme for comparing spiked Nitrogen Dioxide diffusion tubes, Scientifics is currently ranked as a Category Good laboratory.This result can be found on the LAQM Support Web site
http://laqm.defra.gov.uk/diffusion-tubes/precision.html

Diffusion Tube Bias Adjustment Factors

Castlereagh Borough Council lies within the Eastern Group area. There are five neighbouring councils within the group. Ards Borough Council does not carry out automatic monitoring of NO_2 but the remaining four have carried out co-location studies.
The bias adjustment factor calculation of these is shown below.
The average of these four studies is **0.75.**
They were all calculated using the R&A support precision and accuracy spreadsheet.

http://laqm.defra.gov.uk/bias-adjustment-factors/co-location-data.html

and in accordance to current guidance summarized in the

Technical Guidance LAQM.TG(09).

These results have been submitted for inclusion in the national bias adjustment factor database.

Castlereagh Borough Council 2012

Checking Precision and Accuracy of Triplicate Tubes

AEA Energy & Environment
From the AEA group

Diffusion Tubes Measurements

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
1	29/12/2011	02/02/2012	55.0	49.0	61.0	55	6.0	11	14.9
2	02/02/2012	01/03/2012	63.0	60.0	64.0	62	2.1	3	5.2
3	01/03/2012	29/03/2012	58.0	60.0	56.0	57	2.3	4	5.7
4	29/03/2012	23/04/2012	45.0	48.0	46.0	46	1.5	3	3.8
5	23/04/2012	28/05/2012	43.0	50.0	42.0	45	4.4	10	10.8
6	28/05/2012	02/07/2012	41.0	39.0	43.0	41	2.0	5	5.0
7	02/07/2012	30/07/2012	30.0	32.0	34.0	32	2.0	6	5.0
8	30/07/2012	31/08/2012	32.0	30.0	31.0	31	1.0	3	2.5
9	31/08/2012	24/09/2013	39.0	38.0	43.0	40	2.6	7	6.6
10	24/09/202	29/10/2012	47.0	48.0	43.0	46	2.6	6	6.6
11	29/10/2012	26/11/2012	59.0	59.0	59.0	59	0.0	0	0.0
12	26/11/2012	03/01/2013	57.0	61.0	61.0	60	2.3	4	5.7
13									

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

Automatic Method		Data Quality Check	
Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
35	99	Good	Good
34	99	Good	Good
39	99	Good	Good
28	99	Good	Good
30	99	Good	Good
23	99	Good	Good
15	99	Good	Good
18	99	Good	Good
23	99	Good	Good
30	99	Good	Good
36	99	Good	Good
44	99	Good	Good
Overall survey -->		Good precision	Good Overall DC

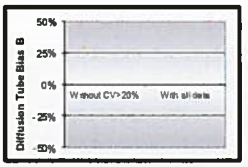
(Check average CV & DC from Accuracy calculations)

Site Name/ ID:

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

Accuracy (with 95% confidence interval) without periods with CV larger than 20%	
Bias calculated using 12 periods of data	
Bias factor A	0.62 (0.57 - 0.67)
Bias B	62% (49% - 75%)
Diffusion Tubes Mean:	48 µgm^{-3}
Mean CV (Precision):	5
Automatic Mean:	30 µgm^{-3}
Data Capture for periods used:	99%
Adjusted Tubes Mean:	30 (27 - 32) µgm^{-3}

Accuracy (with 95% confidence interval) WITH ALL DATA	
Bias calculated using 12 periods of data	
Bias factor A	0.62 (0.57 - 0.67)
Bias B	62% (49% - 75%)
Diffusion Tubes Mean:	48 µgm^{-3}
Mean CV (Precision):	5
Automatic Mean:	30 µgm^{-3}
Data Capture for periods used:	99%
Adjusted Tubes Mean:	30 (27 - 32) µgm^{-3}



Jaume Targa, for AEA
Version 04 - February 2011

North Down Borough Council 2012

Checking Precision and Accuracy of Triplicate Tubes

AEA Energy & Environment
From the AEA group

Diffusion Tubes Measurements

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
1	28/12/2011	31/01/2012	54.0	52.0	55.0	54	1.5	3	3.8
2	31/01/2012	28/02/2012	59.0	58.0	43.0	53	9.0	17	22.3
3	28/02/2012	27/03/2012	56.0	44.0	59.0	53	7.9	15	19.7
4	27/03/2012	25/04/2012	35.0	37.0	32.0	35	2.5	7	6.3
5	25/04/2012	28/05/2012	37.0	39.0	36.0	37	1.5	4	3.8
6	28/05/2012	26/06/2012	38.0	35.0	36.0	36	1.5	4	3.8
7	26/06/2012	31/07/2012	38.0	35.0	36.0	36	1.5	4	3.8
8	31/07/2012	28/08/2012	31.0	33.0	33.0	32	1.2	4	2.9
9	28/08/2012	25/09/2012	35.0	34.0	31.0	33	2.1	6	5.2
10	25/09/2012	30/10/2012	48.0	47.0	49.0	48	1.0	2	2.5
11	30/10/2012	27/11/2012	59.0	63.0	64.0	62	2.6	4	6.6
12	27/11/2012	03/01/2013	56.0	61.0	61.0	59	2.9	5	7.2
13									

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

Automatic Method		Data Quality Check	
Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
33	99	Good	Good
35	99	Good	Good
36	99	Good	Good
25	99	Good	Good
30	99	Good	Good
29	99	Good	Good
25	99	Good	Good
22	99	Good	Good
24	99	Good	Good
42	99	Good	Good
45	99	Good	Good
49	99	Good	Good
Overall survey -->		Good precision	Good Overall DC

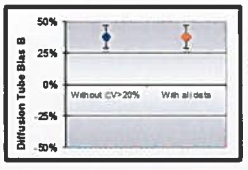
(Check average CV & DC from Accuracy calculations)

Site Name/ ID:

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

Accuracy (with 95% confidence interval) without periods with CV larger than 20%	
Bias calculated using 12 periods of data	
Bias factor A	0.73 (0.69 - 0.78)
Bias B	37% (27% - 46%)
Diffusion Tubes Mean:	45 µgm^{-3}
Mean CV (Precision):	6
Automatic Mean:	33 µgm^{-3}
Data Capture for periods used:	99%
Adjusted Tubes Mean:	33 (31 - 35) µgm^{-3}

Accuracy (with 95% confidence interval) WITH ALL DATA	
Bias calculated using 12 periods of data	
Bias factor A	0.73 (0.69 - 0.78)
Bias B	37% (27% - 46%)
Diffusion Tubes Mean:	45 µgm^{-3}
Mean CV (Precision):	6
Automatic Mean:	33 µgm^{-3}
Data Capture for periods used:	99%
Adjusted Tubes Mean:	33 (31 - 35) µgm^{-3}



Jaume Targa, for AEA
Version 04 - February 2011

Lisburn City Council 2012

Checking Precision and Accuracy of Triplicate Tubes

AEA Energy & Environment
From the AEA group

Diffusion Tubes Measurements

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	Automatic Method: Period Mean	Automatic Method: Data Capture (% DC)	Data Quality Check: Tubes Precision Check	Data Quality Check: Automatic Monitor Data
1	28/12/2011	01/02/2012	32.0	33.0	34.0	33	1.0	3	2.5	27	100	Good	Good
2	01/02/2012	29/02/2012	40.0	38.0	35.0	38	2.5	7	6.3	30	100	Good	Good
3	29/02/2012	28/03/2012	34.0	35.0	27.0	32	4.4	14	10.8	28	100	Good	Good
4	28/03/2012	25/04/2012	22.0	26.0	23.0	24	2.1	9	5.2	28	100	Good	Good
5	25/04/2012	28/05/2012	20.0	20.0	19.0	20	0.6	3	1.4	22	100	Good	Good
6	28/05/2012	27/06/2012	23.0	25.0	28.0	25	2.5	10	6.3	20	100	Good	Good
7	27/06/2012	01/08/2012	10.0	24.0	21.0	18	7.4	40	18.3	18	100	Poor Precision	Good
8	01/08/2012	29/08/2012	21.0	23.0	20.0	21	1.5	7	3.8	17	100	Good	Good
9	28/11/2012	02/01/2013	42.0	40.0	40.0	41	1.2	3	2.9	32	100	Good	Good
10													
11													
12													
13													
										Overall survey -->		Good precision	Good Overall DC

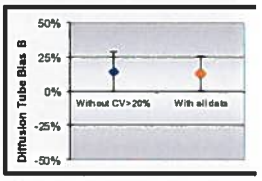
It is necessary to have results for at least two tubes in order to calculate the precision of the measurements

(Check average CV & DC from Accuracy calculations)

Site Name/ ID:

Precision: 8 out of 9 periods have a CV smaller than 20%

Accuracy (with 95% confidence interval) without periods with CV larger than 20%		Accuracy (with 95% confidence interval) WITH ALL DATA	
Bias calculated using 8 periods of data		Bias calculated using 9 periods of data	
Bias factor A	0.87 (0.78 - 1)	Bias factor A	0.88 (0.79 - 0.99)
Bias B	14% (0% - 29%)	Bias B	13% (1% - 26%)
Diffusion Tubes Mean:	29 µgm^{-3}	Diffusion Tubes Mean:	28 µgm^{-3}
Mean CV (Precision):	7	Mean CV (Precision):	11 caution
Automatic Mean:	26 µgm^{-3}	Automatic Mean:	25 µgm^{-3}
Data Capture for periods used:	100%	Data Capture for periods used:	100%
Adjusted Tubes Mean:	25 (23 - 29) µgm^{-3}	Adjusted Tubes Mean:	25 (22 - 28) µgm^{-3}



Jaume Targa, for AEA
Version 04 - February 2011

Down District Council 2012

Checking Precision and Accuracy of Triplicate Tubes

AEA Energy & Environment
From the AEA group

Diffusion Tubes Measurements

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	Automatic Method: Period Mean	Automatic Method: Data Capture (% DC)	Data Quality Check: Tubes Precision Check	Data Quality Check: Automatic Monitor Data
1	30/12/2011	02/02/2012	45.0	44.0	58.0	49	7.8	16	19.4	37	100	Good	Good
2	01/03/2012	01/03/2012	52.0	51.0	44.0	49	4.4	9	10.8	35	100	Good	Good
3	29/03/2012	29/03/2012	60.0	60.0	59.0	60	0.6	1	1.4	41	100	Good	Good
4	29/03/2012	26/04/2012	49.0	48.0	49.0	49	0.6	1	1.4	41	100	Good	Good
5	26/04/2012	29/05/2012	55.0	54.0	55.0	55	0.6	1	1.4	49	70	Good	or Data Capture
6	29/05/2012	26/06/2012	54.0	47.0	49.0	50	3.6	7	9.0	42	100	Good	Good
7	02/08/2012	02/08/2012	35.0	54.0	43.0	44	9.5	22	23.7	28	100	Poor Precision	Good
8	02/08/2012	31/08/2012	46.0	47.0	45.0	46	1.0	2	2.5	33	100	Good	Good
9	31/08/2012	27/09/2012	40.0	40.0	41.0	40	0.6	1	1.4	31	100	Good	Good
10	27/09/2012	01/11/2012	51.0	50.0	47.0	49	2.1	4	5.2	43	100	Good	Good
11	01/11/2012	30/11/2012	57.0	59.0	59.0	58	1.2	2	2.9	43	100	Good	Good
12	30/11/2012	04/01/2013	58.0	47.0	57.0	54	6.1	11	15.1	41	100	Good	Good
13													
										Overall survey -->		Good precision	Good Overall DC

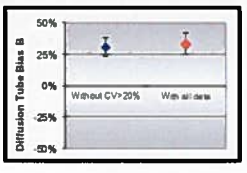
It is necessary to have results for at least two tubes in order to calculate the precision of the measurements

(Check average CV & DC from Accuracy calculations)

Site Name/ ID:

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

Accuracy (with 95% confidence interval) without periods with CV larger than 20%		Accuracy (with 95% confidence interval) WITH ALL DATA	
Bias calculated using 10 periods of data		Bias calculated using 11 periods of data	
Bias factor A	0.77 (0.73 - 0.81)	Bias factor A	0.76 (0.71 - 0.81)
Bias B	30% (23% - 38%)	Bias B	32% (24% - 41%)
Diffusion Tubes Mean:	50 µgm^{-3}	Diffusion Tubes Mean:	50 µgm^{-3}
Mean CV (Precision):	6	Mean CV (Precision):	7
Automatic Mean:	39 µgm^{-3}	Automatic Mean:	38 µgm^{-3}
Data Capture for periods used:	100%	Data Capture for periods used:	100%
Adjusted Tubes Mean:	39 (37 - 41) µgm^{-3}	Adjusted Tubes Mean:	38 (35 - 40) µgm^{-3}



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Factor from Local Co-location Studies (if available)

The local bias adjustment factor from the co-location study carried out at the A20 Dundonald site in Castlereagh Borough Council is **0.62**, however a decision was made to use an average of the 4 local studies within the Eastern group area of **0.75**

NO_2 diffusion tube results, bias applied **0.75**

	2008	2009	2010	2011	2012
T1 Cregagh Road	26	27	31	26	24
T2 Everton Drive	16	15	20	18	14
T3 Newtonbreda	36	34	36	22	42
T4 Saintfield Road	17	16	21	23	16
T5 Upper Newtownards Rd	66	60	0	0	
T6 Normandy Court façade	0	0	45	45	38

Discussion of Choice of Factor to Use

The national bias adjustment factor for Environmental Scientific Group.is **0.79**

There is a co location study carried out at the Dundonald site in the Borough and the calculated bias adjustment factor is **0.62.**
The local bias adjustment factor in 2012 was very low in 2011 the local bias adjustment was 0.84.

There are 4 co-location studies carried out within the local Eastern Group area all analysed by Environmental Scientific Group, the average of these is **0.75**.

As Castlereagh Borough Council has confidence in the QA/QC of all the four local studies (all using ratified data),also all the sites are situated in similar location in major provincial towns and climatic conditions, a decision was made to use the average of these 4 local studies rather than the local one used in 2011. The national bias factor in 2012 is **0.79**

The table below shows the results from the three studies. Using the national higher figure would not have changed the overall outcome, the local average factor was a more realistic bias adjustment.

Site	Raw Data	Local Bias 0.62	Eastern Group Average 0.75	National Average 0.79
T1 Cregagh Road	31	19	24	25
T2 Everton Drive	19	12	14	15
T3 Newtonbreda	56	12	42	44
T4 Saintfield Road	22	19	16	17
T5 Upper Newtownards Rd	N/A			
T6 Normandy Court façade	51	17	38	40