2013 Air Quality Progress Report for North Down Borough Council

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

May 2013

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Executive Summary

The Environment (Northern Ireland) Order 2002, requires North Down Borough Council to undertake Air Quality Reviews and Assessments in their local areas and to meet the local air quality targets and objectives set out in the UK National Air Quality Strategy (2000). The production of an annual air quality report is now a statutory duty for all local authorities. The process is set out in the Department of Environment's Local Air Quality Management Policy Guidance LAQM PGNI (03).

This report is prepared by the North Down Borough Council to meet its statutory obligations under the above regime and has been prepared using the recommended template. The report has been prepared in accordance with the policy guidance mentioned above and with the relevant technical guidance Local Air Quality Management (LAQM.TG(09)

The Borough of North Down is geographically one of the smallest Council areas in Northern Ireland, but is regarded as economically one of the wealthiest. Population has increased steadily over recent years and is now in the region of 78,900. Air Quality in North Down is generally good as there is good ventilation from sea breezes. There are few industrial processes in the area that are significantly detrimental to air quality and heavy fuel oil is not widely used for heat generation. However, there are a number of very busy trunk roads in the area the busiest being the A2 commuter route from Bangor to Belfast with average daily traffic flows of 44,000 vehicle movements per day at Holywood. The A2 has now been identified as the only area of concern with relation to Air Quality, for Nitrogen Dioxide and PM10. All monitoring sites are now located at relevant exposure along this main arterial route to Belfast., All present monitoring within the Borough indicates that the objectives in the air quality strategy are not currently being exceeded , and a detailed assessment is not required for any of the pollutants

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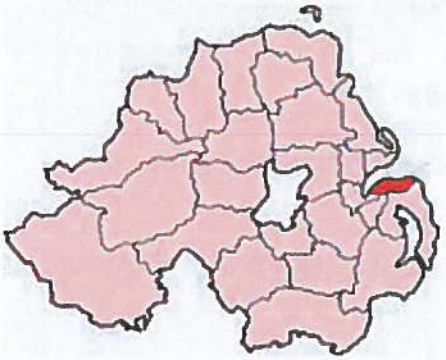
1 Introduction

1.1 Description of Local Authority Area

The Borough of North Down is geographically one of the smallest Council areas in Northern Ireland, but is regarded as economically one of the wealthiest. Population has increased steadily over recent years and is now in the region of 79,000.

Air Quality in North Down is generally good as there is good ventilation from sea breezes. There are few industrial processes in the area that are significantly detrimental to air quality and heavy fuel oil is not widely used for heat generation



There are a number of very busy trunk roads in the area as indicated on the above map. Much of the monitoring work in the area is in relation to NO_2 and PM_{10} at relevant locations particularly in relation to the A2 to Belfast between Ballyrobert and Holywood.

Studies in relation to solid fuel use were carried out in 2002 to assess the risk of exceeding the air quality objectives in relation to SO_2 and PM_{10}.

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

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

Stages Completed	*Exceedences Identified / Predicted*	*Areas Affected*	*AQMA's Declared*
Stage 1 2001	PM10, SO2, NO2	A2 Bangor to Belfast Road, Clandeboye Road Area.	No
Stage 2&3 2004	PM10, SO2, NO2	A2 Bangor to Belfast Road, Clandeboye Road Area.	No
Progress Report 2005	None	A2 Bangor to Belfast Road, Clandeboye Road Area.	No
USA 2006	None	A2 Bangor to Belfast Road, Clandeboye Road Area	No
Progress Report 2007	None	A2 Bangor to Belfast Road, Clandeboye Road Area	No
Progress Report 2008	NO2	A2 Bangor to Belfast Road,	No
USA 2009	None	A2 Bangor to Belfast Road,	No
Progress Report 2010	None	A2 Bangor to Belfast Road,	No
Progress Report 2011	None	A2 Bangor to Belfast Road,	No
USA 2012	None	A2 Bangor to Belfast Road,	No

2 New Monitoring Data

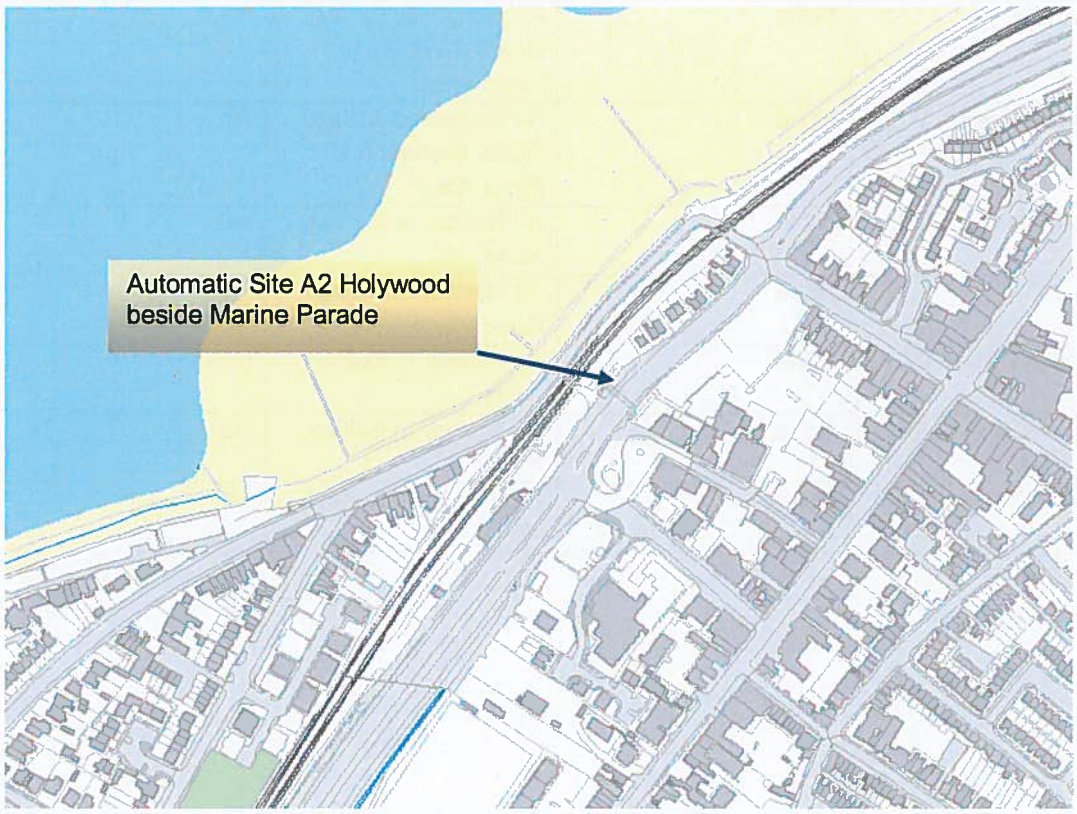
2.1 Summary of Monitoring Undertaken

2.1.1 Automatic Monitoring Sites

North Down Borough Council has one automatic site on the A2 Holywood, monitoring NO2 and PM10. AEA technology were contracted to carry out the QA/QC for the site. This includes data handling, ratification of data and 6monthly site visits. The Eastern Group Air Quality technical officer visits the site on a weekly basis and calibrates the equipment on a fortnightly programme.

See Appendix A: Details of Quality Assurance and Quality Control

Figure 2.1 Map(s) of Automatic Monitoring Sites



Ariel photograph of the Automatic Station situated on the A2 at Marine Parade Holywood

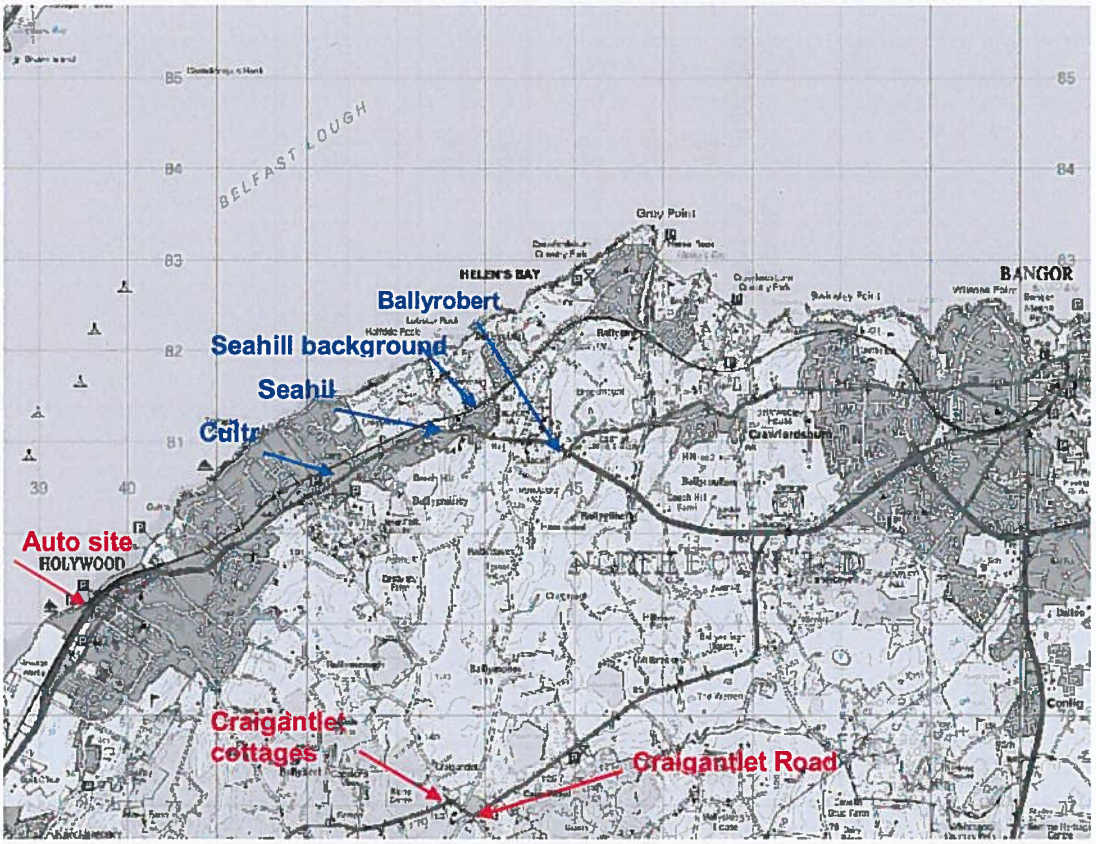
Table 2.1 Details of Automatic Monitoring Sites

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?
Marine Parade Holywood A2	Roadside	X339481	Y379328	NO_2, PM_{10}	Chemiluminescence TEOM	NO	YES 30M	4.6M	YES

2.1.2 Non-Automatic Monitoring

North Down Borough Council presently has four NO_2 diffusion tube sites positioned along the main arterial route the A2 into Belfast. There is also a co-location study carried out at the Holywood automatic site. Two new sites were commenced in March 2012 at Craigantlet crossroads, due to proposals to widen this alternative route into Belfast close to residential property.
All the diffusion tubes have been sited in accordance with the technical guidance. The bias adjustment factor from the local Holywood co-location study is **0.73**.and the results from this have been submitted to the national data base.
A decision was made to apply a bias adjustment factor of **0.75** to the diffusion tubes. This was derived from an average of the four local Eastern Group co-location studies. 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

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



Automatic site A2 Holywood	NO2 and PM10 (also co-located study)
Seahill	NO2 Diffusion Tubes
Seahill Background	NO2 Diffusion Tubes
Ballyrobert	NO2 Diffusion Tubes
Craigantlet Road	NO2 Diffusion Tubes (new site)
Craigantlet Cottages	NO2 Diffusion Tubes (new site)

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?
Holywood A2	Co-location	X339481	Y379328	NO_2	N	Y	N/A	N/A	N/A
Ballyrobert A2	Roadside	X345002	Y380823	NO_2	N	N	Y (<1m)	3m	Y
Seahill Background	Urban B'Ground	X344128	Y381294	NO_2	N	N	N\A	250m	Y
Seahill A2	Roadside	X343545	Y381102	NO_2	N	N	Y (<1m)	10m	Y
Cultra A2	Roadside	X342475	Y380672	NO_2	N	N	Y (<1m)	6.3m	Y
1 Craigantlet Road	Roadside	X343929	Y376920	NO_2	N	N	Y (<1m)	1.5m	Y
Craigantlet Cottages	Roadside	X343632	Y377049	NO_2	N	N	Y(20m)	0.5m	Y

2.2 Comparison of Monitoring Results with Air Quality Objectives

No exceedences of the AQS objectives have been identified from the monitoring data collected since the last Update and Screening Assessment. All monitored pollutant concentrations have been well below their respective air quality objective limits.

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. All sites meet 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.

Results have been consistent since installation of the automatic station. In 2009 and 2010 there were a small number of exceedences of the hourly mean this was consistent of periods of unsettled weather. A high number of exceedences of the hourly mean were recorded in 2012, due to severe weather conditions a number of cars parked around the monitoring station to gain access to the train, it is believed this contributed to the high hourly means. If this problem persists in 2013 North Down Borough Council hopes to take measures to elevate the problem.

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
Marine Parade Holywood	Roadside	N	94.7	94.7	32	35	34	31	33

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
Marine Parade Holywood	Roadside	N	94.7	94.7	0	4	8	0	18

Diffusion Tube Monitoring Data

Results of the NO_2 diffusion tube sites, situated along the A2 main arterial route into Belfast Citry centre and the two new sites at Craigantlet Crossroads are shown below in table 2.5
They are located at relevant exposure and sited in accordance with the technical guidance.LAQM.TG(09)
These tubes continue to demonstrate that the objective for NO_2 is not being exceeded at these sensitive locations.

A co-location study has been carried out at the Holywood automatic site, and its results submitted to the LAQM data base. The 2012 local bias was 0.73. 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

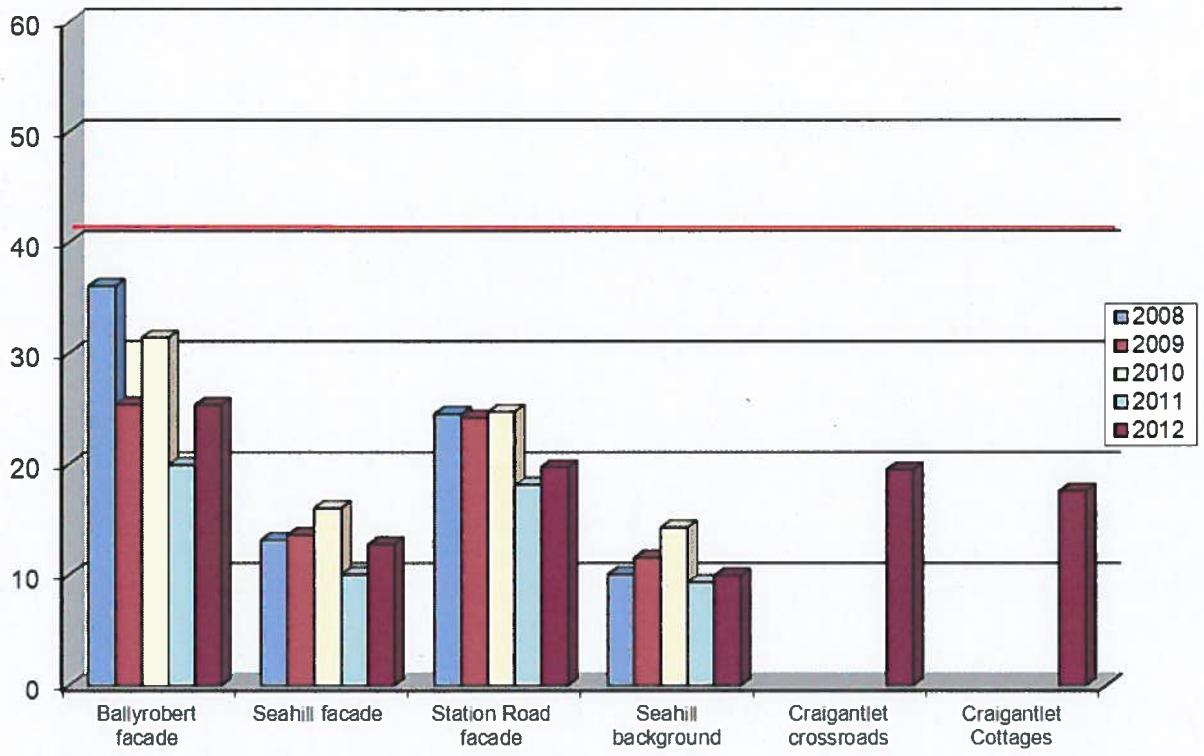
Table 2.4 Results of Nitrogen Dioxide Diffusion Tubes

Site ID	Location	Site Type	Within AQMA?	Triplicate or Co-located Tube	Full Calendar Year Data Capture 2012 (Number of Months)	2012 Annual Mean Concentration (µg/m^3) - Bias Adjustment factor = 0.75
	Holywood	Co-location	N	Co-location	12	45
	Ballyrobert	Roadside	N	single	12	25
	Seahill Background	Roadside	N	single	12	10
	Seahill	Background	N	triplicate	12	13
	Cultra	Roadside	N	single	12	20
	1 Craigantlet Road	Roadside	N	single	9	20
	Craigantlet Cottages	Roadside	N	single	9	18

Site ID	Site Type	Within AQMA?	Annual Mean Concentration (µg/m^3) - Adjusted for Bias [a]				
			2008 (Bias Adjustment Factor = 0.81)	2009 (Bias Adjustment Factor = 0.84)	2010 (Bias Adjustment Factor = 0.84)	2011 (Bias Adjustment Factor = 0.71)	2012 (Bias Adjustment Factor = 0.75)
Holywood (co-location)	Roadside	N	37	36	38	31	45
Ballyrobert	Roadside	N	36	25	31	20	25
Seahill Background	Background	N	10	12	14	9	10
Seahill	Roadside	N	13	14	16	10	13
Cultra	Roadside	N	25	24	25	18	20
1 CraigantletRoad	Roadside	N					20
Craigantlet Cottages	Roadside	N					18

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}

Automatic monitoring of PM10 using a TEOM carried out at the Holywood site, continued in 2012 to be below the air quality objective. AEA were employed to carry out the QA/QC and ratify the data. Summaries of this data, with regard to annual and hourly mean objectives, are presented below. The TEOM data has been corrected using Volatile Correction Model
Reports from the ratified data and the QA/QC applied can be found in appendix A.

Table 2.5 Results of Automatic Monitoring for PM_{10}: Comparison with Annual Mean Objective

Site ID	Site Type	Within AQMA?	Valid Data Capture for Monitoring Period % [a]	Valid Data Capture 2012 % [b]	Confirm Gravimetric Equivalent (Y or N/A)	Annual Mean Concentration (µg/m^3)				
						2008	2009	2010	2011	2012
Marine Parade Holywood	Roadside	N	93.4	93.4	N/A	25.1	26.2	28.7	26.3	19

Table 2.6 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 2012 % [b]	Confirm Gravimetric Equivalent (Y or N/A)	Number of Daily Means > 50µg/m^3				
						2008	2009	2010	2011	2012
Marine Parade Holywood	Roadside	N	93.4	93.4	N/A	3	4	8	6	6

Figure 2.5 Trends in Annual Mean PM_{10} Concentrations

PM10 has remained consistently low in Holywood

2.2.3 Sulphur Dioxide

North Down 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 and PM_{10} were the only pollutants monitored

2.2.6 Summary of Compliance with AQS Objectives

North Down Borough Council Council has examined the results from monitoring in the Council area. Concentrations are all below the objectives; therefore there is no need to proceed to a Detailed Assessment.

3 New Local Developments

North Down 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.

North 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 Conclusions and Proposed Actions

4.1 Conclusions from New Monitoring Data

The 2012 monitored data for NO_2 and PM_{10} has been assessed and has indicated no exceedences of the national air quality objectives. It is therefore not necessary to proceed to a detailed assessment, however monitoring will continue at key locations in 2013 to allow for comparison in future rounds of review and assessment.

4.2 Conclusions relating to New Local Developments

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

4.3 Proposed Actions

This 2013 progress report for North Down Borough Council has identified there is no need to proceed to a detailed assessment for any of the pollutants.
Monitoring sites are sited in accordance with the guidance and at relevant exposure, no new significant sites have been identified.
North Down Borough Council intends to continue monitoring NO_2 and PM_{10} in 2013 and submit a progress report in 2014.

5 References

TG (2003) Part IV of the Environment Act 1995. Local Air Quality Management: Technical Guidance LAQM.TG(03). Guidance prepared by the Department for Environment, Food and Rural Affairs and the Devolved Administrations, January 2003.

TG (2009) Part IV of the Environment Act 1995. Local Air Quality Management: Technical
Guidance LAQM.TG(09). Guidance prepared by the Department for Environment, Food and Rural Affairs and the Devolved Administrations, February 2009

Appendices

Appendix A: QA/QC Data

Appendix A: QA/QC Data of automatic sites

North Down Borough Council commissioned AEA Technology to provide the QA/QC of the automatic measurements of NO_2 and PM_{10} from their Holywood A2 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 analysers.

Produced by Ricardo-AEA on behalf of Eastern Group

NORTH DOWN HOLYWOOD A2
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	-	7	-
Number Low	-	8315	-
Maximum 15-minute mean	735 µg m^{-3}	667 µg m^{-3}	1553 µg m^{-3}
Maximum hourly mean	598 µg m^{-3}	487 µg m^{-3}	1285 µg m^{-3}
Maximum running 8-hour mean	403 µg m^{-3}	273 µg m^{-3}	884 µg m^{-3}
Maximum running 24-hour mean	274 µg m^{-3}	194 µg m^{-3}	612 µg m^{-3}
Maximum daily mean	246 µg m^{-3}	183 µg m^{-3}	559 µg m^{-3}
Average	26 µg m^{-3}	33 µg m^{-3}	73 µg m^{-3}
Data capture	94.7 %	94.7 %	94.7 %

All gaseous pollutant mass units are at 20'C and 1013mb.
NO_X mass units are NO_X as NO_2 µg m-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}	18	6

Note: For a strict comparison against the objectives there must be a data capture of >90% throughout the calendar year

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

North Down 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.

North Down Borough Council 2012

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	28/12/2011	31/01/2012	54.0	52.0	55.0	54	1.5	3	3.8	33	99	Good	Good
2	31/01/2012	28/02/2012	59.0	58.0	43.0	53	9.0	17	22.3	35	99	Good	Good
3	28/02/2012	27/03/2012	56.0	44.0	59.0	53	7.9	15	19.7	36	99	Good	Good
4	27/03/2012	25/04/2012	35.0	37.0	32.0	35	2.5	7	6.3	25	99	Good	Good
5	25/04/2012	28/05/2012	37.0	39.0	36.0	37	1.5	4	3.8	30	99	Good	Good
6	28/05/2012	26/06/2012	38.0	35.0	36.0	36	1.5	4	3.8	29	99	Good	Good
7	26/06/2012	31/07/2012	38.0	35.0	36.0	36	1.5	4	3.8	25	99	Good	Good
8	31/07/2012	28/08/2012	31.0	33.0	33.0	32	1.2	4	2.9	22	99	Good	Good
9	28/08/2012	25/09/2012	35.0	34.0	31.0	33	2.1	6	5.2	24	99	Good	Good
10	25/09/2012	30/10/2012	48.0	47.0	49.0	48	1.0	2	2.5	42	99	Good	Good
11	30/10/2012	27/11/2012	59.0	63.0	64.0	62	2.6	4	6.6	45	99	Good	Good
12	27/11/2012	03/01/2013	58.0	61.0	61.0	59	2.9	5	7.2	49	99	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

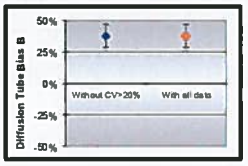
(Check average CV & DC from Accuracy calculations)

Site Name/ ID:

Precision 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										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	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

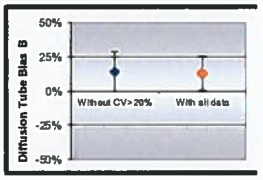
(Check average CV & DC from Accuracy calculations)

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%	
Bias calculated using 8 periods of data	
Bias factor A	0.87 (0.78 - 1)
Bias B	14% (0% - 29%)
Diffusion Tubes Mean:	29 µgm^{-3}
Mean CV (Precision):	7
Automatic Mean:	26 µgm^{-3}
Data Capture for periods used:	100%
Adjusted Tubes Mean:	25 (23 - 29) µgm^{-3}

Accuracy (with 95% confidence interval) WITH ALL DATA	
Bias calculated using 9 periods of data	
Bias factor A	0.88 (0.79 - 0.99)
Bias B	13% (1% - 26%)
Diffusion Tubes Mean:	28 µgm^{-3}
Mean CV (Precision):	11 caution
Automatic Mean:	25 µgm^{-3}
Data Capture for periods used:	100%
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
1	30/12/2011	02/02/2012	45.0	44.0	58.0	49	7.8	16	19.4
2	01/03/2012	01/03/2012	52.0	51.0	44.0	49	4.4	9	10.8
3	29/03/2012	29/03/2012	60.0	60.0	59.0	60	0.6	1	1.4
4	29/03/2012	26/04/2012	49.0	48.0	49.0	49	0.6	1	1.4
5	26/04/2012	29/05/2012	55.0	54.0	55.0	55	0.6	1	1.4
6	29/05/2012	26/06/2012	54.0	47.0	49.0	50	3.6	7	9.0
7	02/08/2012	02/08/2012	35.0	54.0	43.0	44	9.5	22	23.7
8	02/08/2012	31/08/2012	46.0	47.0	45.0	46	1.0	2	2.5
9	31/08/2012	27/09/2012	40.0	40.0	41.0	40	0.6	1	1.4
10	27/09/2012	01/11/2012	51.0	50.0	47.0	49	2.1	4	5.2
11	01/11/2012	30/11/2012	57.0	59.0	59.0	58	1.2	2	2.9
12	30/11/2012	04/01/2013	58.0	47.0	57.0	54	6.1	11	15.1
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
37	100	Good	Good
35	100	Good	Good
41	100	Good	Good
41	100	Good	Good
49	70	Good	or Data Capture
42	100	Good	Good
28	100	Poor Precision	Good
33	100	Good	Good
31	100	Good	Good
43	100	Good	Good
43	100	Good	Good
41	100	Good	Good
Overall survey -->		Good precision	Good Overall DC

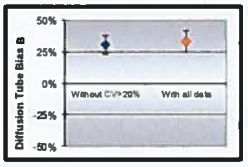
(Check average CV & DC from Accuracy calculations)

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%	
Bias calculated using 10 periods of data	
Bias factor A	0.77 (0.73 - 0.81)
Bias B	30% (23% - 38%)
Diffusion Tubes Mean:	50 µgm^{-3}
Mean CV (Precision):	6
Automatic Mean:	39 µgm^{-3}
Data Capture for periods used:	100%
Adjusted Tubes Mean:	39 (37 - 41) µgm^{-3}

Accuracy (with 95% confidence interval) WITH ALL DATA	
Bias calculated using 11 periods of data	
Bias factor A	0.76 (0.71 - 0.81)
Bias B	32% (24% - 41%)
Diffusion Tubes Mean:	50 µgm^{-3}
Mean CV (Precision):	7
Automatic Mean:	38 µgm^{-3}
Data Capture for periods used:	100%
Adjusted Tubes Mean:	38 (35 - 40) µgm^{-3}



Jaume Targa, for AEA
Version 04 - February 2011

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	56.0	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

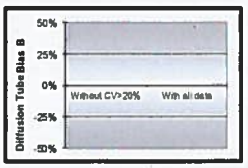
(Check average CV & DC from Accuracy calculations)

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}



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Version 04 - February 2011

Factor from Local Co-location Studies (if available)

The local bias adjustment factor from the co-location study carried out at the A2 Holywood site in North Down Borough Council is **0.73**, 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
Ballyrobert	36	25	31	20	25
Seahill	13	14	16	10	13
Cultra	25	24	25	18	20
Seahill Background	10	12	14	9	10
1 Craigantlet Road					20
Craigantlet Cottages					18

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 Holywood site in the Borough and the calculated bias adjustment factor is **0.73**

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 North Down 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 national study or local study as it was the most realistic figure.

The table below shows the results from the three studies. Using the national higher figure would not have shown any exceedences of the objective, but the local average factor was a more realistic bias adjustment..

Site	Raw Data	Local Bias 0.73	Eastern Group Average 0.75	National Average 0.79
Ballyrobert A2	34	25	**25**	27
Seahill Background	13	9	**10**	10
Seahill A2	17	12	**13**	13
Cultra A2	26	19	**20**	21
1 Craigantlet Road	26	19	**20**	21
Craiantlet Cottages	23	17	**18**	18

PM Monitoring Adjustment

Produced by Ricardo-AEA on behalf of the Eastern Group

NORTH DOWN HOLYWOOD A2
01 January to 31 December 2012

These data have been fully ratified

POLLUTANT	PM_{10}+	PM_{10} VCM*	PM_{10} GR10
Number Very High	-	-	0
Number High	-	-	0
Number Moderate	-	-	0
Number Low	-	-	8372
Maximum 15-minute mean	207 μgm^{-3}	-	269 μgm^{-3}
Maximum hourly mean	100 μgm^{-3}	-	130 μgm^{-3}
Maximum running 8-hour mean	66 μgm^{-3}	-	86 μgm^{-3}
Maximum running 24-hour mean	45 μgm^{-3}	-	59 μgm^{-3}
Maximum daily mean	44 μgm^{-3}	65 μgm^{-3}	57 μgm^{-3}
90th percentile of daily means	23 μgm^{-3}	27 μgm^{-3}	30 μgm^{-3}
Average	16 μgm^{-3}	19 μgm^{-3}	21 μgm^{-3}
Data capture	95.8 %	93.4 %	95.8 %

+ PM_{10} as measured by a TEOM
*PM_{10} VCM – TEOM data corrected using Volatile Correction Model
PM_{10} GR10 - indicative gravimetric corrected, i.e. 'raw' TEOM PM_{10} data with a 1.3 factor applied
Particulate matter concentrations are reported at ambient temperature and pressure.

Pollutant	Air Quality Regulations (Northern Ireland) 2003	Exceedences	Days
PM_{10} Particulate Matter (VCM Corrected)	Daily mean > 50 μgm^{-3}	6	6
PM_{10} Particulate Matter (VCM Corrected)	Annual mean > 40 μgm^{-3}	0	-

Note: For a strict comparison against the objectives there must be a data capture of >90% throughout the calendar year

The PM_{10} TEOM data has been corrected using the Volatile Correction Model (www.volatile-correction-model.info) as detailed on Page 3-10 of LAQM.TG (09).

Please be advised the VCM has been calculated using Belfast AURN (ratified data sourced by Ricardo-AEA) and locally source ratified FDMS data (Lisburn Dunmurry High School and Lisburn Seymour Hill) plus temperature and pressure as selected by the VCM Model

For information – PM_{10} TEOM data as indicative corrected, i.e. 'raw' TEOM PM_{10} data with a 1.3 factor applied

Pollutant	Air Quality Regulations (Northern Ireland) 2003	Exceedences	Days
PM_{10} Particulate Matter (Gravimetric)	Daily mean > 50 μgm^{-3}	4	4
PM_{10} Particulate Matter (Gravimetric)	Annual mean > 40 μgm^{-3}	0	-