

2011 Air Quality Progress Report for Belfast City Council

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

April 2011



Local	Arlene Jamieson
Authority	
Officer	

Department	Health and Environmental Services
Address	The Cecil Ward Building
	4-10 Linenhall Street
	Belfast
	BT2 8BP
Telephone	028 9027 0428 Ext 3315
e-mail	jamiesona@belfastcity.gov.uk

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Executive Summary

The Environment Order (NI) 2002 places a responsibility on councils to periodically review and assess air quality within their boundaries. As part of this process, Belfast City Council presents the 2011 Air Quality Progress Report.

This report has been undertaken in compliance with LAQM-TG(09) and focuses on the progress of implementing local air quality management; progress with Belfast City Council Air Quality Action Plan is also included.

It is encouraging to note the downward trend in urban background concentrations of nitrogen dioxide evident over the past 18 years of monitoring and an 11% reduction in annual means since 2005. However, despite this background reduction, monitored nitrogen dioxide results continue to show breaches of the annual mean objective within three of the four Air Quality Management Areas. Exceedences of the hourly mean nitrogen dioxide objective are also evident in the M1-Westlink AQMA. Both automatic and passive nitrogen dioxide monitoring is undertaken throughout Belfast to continually review the situation.

Again, trends at the urban background site show a sustained decrease in particulate matter (PM_{10}) over the past 18 years. PM_{10} monitoring in the M1-Westlink AQMA has also recorded concentrations below both the annual mean and 24-hour objective in 2009 and 2010.

Monitored levels of benzene and sulphur dioxide remain well below the objectives and show no reason for concern.

Previous rounds of assessment have confirmed that relevant Air Quality Objectives for carbon monoxide, benzene, 1,3-butadiene, lead and ozone are being met throughout the city. No new sources have been identified which would have the potential to change this situation therefore these pollutants will not be considered in this report.

Several new developments have occurred throughout Belfast since the 2010 Progress Report. These developments were identified during the planning application process and where necessary an air quality assessment was requested. The impact of these developments was then assessed and any necessary development specific mitigation measures were identified.

Since the Air Quality Action Plan was implemented in 2006, BCC and all partners have been pro-active in implementing the actions assigned to them. To date the total actions considered complete is 58%, with 38% still considered ongoing which is very encouraging. Of the 4% where there has been no progress to date it is unlikely some of these actions will be implemented in the foreseeable future.

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1 Introduction

1.1 Description of Local Authority Area

Air quality in Belfast today is generally considered to be of good quality although in some areas certain pollutants remain a concern. Belfast experienced significant improvements with the introduction of the Clean Air Act and Smoke Control programme in the late 1960s which targeted domestic particulate and sulphur dioxide emissions. The impact of this programme was further augmented by widespread availability of natural gas within both the commercial and domestic sectors, which has had a beneficial effect on particulate and sulphur dioxide emissions. Industrial emissions are principally controlled via Industrial Pollution Control permitting legislation. Currently the predominant sources of air pollution in Belfast are from vehicle exhausts. Our heavy reliance on road transport produces fine particulate matter (PM_{10} and $PM_{2.5}$) and nitrogen dioxide which contribute to the formation of low level ozone.

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 microgrammes per cubic metre $\mu g/m^3$ (milligrammes per cubic metre, mg^{/m³} for carbon monoxide) with the number of exceedences in each year that are permitted (where applicable).

Pollutant	Concent Measur	tration red as	Date to be achieved by
Benzene	16.25 μg/m ³	Running annual mean	31.12.2003
	3.25 μg/m ³	Running annual mean	31.12.2010
1,3-Butadiene	2.25 μg/m ³	Running annual mean	31.12.2003
Carbon monoxide	10.0 mg/m ³	Running 8-hour mean	31.12.2003
Lead	0.5 μg/m ³	Annual mean	31.12.2004
	0.25 <i>µ</i> g/m ³	Annual mean	31.12.2008
Nitrogen dioxide	200 μ g/m ³ not to be exceeded more than 18 times a year	1-hour mean	31.12.2005
	40 <i>µ</i> g/m ³	Annual mean	31.12.2005
Particles (PM ₁₀) (gravimetric)	50 μ g/m ³ , not to be exceeded more than 35 times a year	24-hour mean	31.12.2004
	40 <i>µ</i> g/m ³	Annual mean	31.12.2004
Sulphur dioxide	350 μ g/m ³ , not to be exceeded more than 24 times a year	1-hour mean	31.12.2004
	125 μ g/m ³ , not to be exceeded more than 3 times a year	24-hour mean	31.12.2004
	266 μ g/m ³ , not to be exceeded more than 35 times a year	15-minute mean	31.12.2005

Table 1.1	Air Quality Objectives included in Regulations for the purpose of
Local Air Qu	ality Management in Northern Ireland.

1.4 Summary of Previous Review and Assessments

As part of the review and assessment process Belfast City Council conducted a Second and Third Stage Review and Assessment of air quality throughout its area in 2004. This concluded that modelled exceedences of the nitrogen dioxide and particulate matter were occurring in the city and would continue to do so after 2010. Consequently, in August 2004 four Air Quality Management Areas (AQMAs) were declared, comprising the M1 Motorway and Westlink corridor, Cromac Street to the junction of Short Strand, Woodstock Link and the Albertbridge Road, the Upper Newtownards Road and the Ormeau Road. The M1-Westlink AQMA was declared on the basis that the annual mean and hourly mean nitrogen dioxide concentrations would exceed the 2005 Objective. Particulate matter (annual and 24-hour means) was also predicted to exceed the relevant objectives for this area. The three other areas were declared on the grounds that they would exceed the annual mean nitrogen dioxide objective. These areas are defined in Figures 1.1, a larger scale map showing AQMAs location is provided in Appendix B.

Figure 1.1 Map of AQMA Boundaries



In May 2006, Belfast City Council and 11 other parties published an Air Quality Action Plan setting out how air quality in these areas and across the city as a whole was to be tackled. In April 2006, Belfast City Council published their first Updating and Screening Assessment concluding that five further areas within the city required consideration. These areas underwent a detailed dispersion modelling exercise in 2007 however modelled results did not indicate it was necessary to declare any new AQMAs or extend or revoke existing AQMAs.

In April 2009 Belfast City Council published an Updating and Screening Assessment (USA). The findings of this assessment highlighted three areas throughout Belfast where LAQM-TG(09) criteria indicated it was necessary to conduct a 'Detailed Assessment' (City Centre, Ormeau Road and Westlink/M1 Corridor). Concern from Local Community Groups after completion of the USA regarding air quality in the Short Strand area resulted in this area also being considered. The Detailed Assessment was completed in September 2010 and concluded that there was no need to declare new AQMAs nor expand or revoke existing AQMAs.

The current stage in the Review and Assessment process is to conduct a Progress Report. This report follows Guidance LAQM.TG(09) issued by DEFRA and intends to identify any significant changes that have occurred since the previous stage of R&A which may have the potential to affect the localised air quality.

2 New Monitoring Data

2.1 Summary of Monitoring Undertaken

2.1.1 Automatic Monitoring Sites

Continuous nitrogen dioxide concentrations have been monitored at the Belfast Centre site since 1992. This continuous real time nitrogen dioxide monitoring equipment is part of Defra's Automatic Urban and Rural Network (AURN). In April 2002, Belfast City Council established roadside continuous monitoring locations on the Upper Newtownards Road (Belfast Roadside site) and along the Westlink Corridor. In 2006, due to the major road rebuilding scheme along the M1-Westlink corridor the Westlink site was closed and relocated to the Stockman's Lane Site. On completion of the road works scheme a new site was established in March 2010 along the Westlink Corridor to monitor nitrogen dioxide and particulate matter. This site will not be discussed for the purpose of this Progress Report as it was installed mid year and does not have sufficient data capture. In May 2006, a roadside continuous nitrogen dioxide monitoring station was established on the Ormeau Rd. A location map for monitoring sites relative to the Greater Belfast area can be found below in Figure 2.1; smaller scale location maps are provided in Appendix C and further site details are provided in table 2.1.

These council operated sites are calibrated and operated under the same principles as Defra's Automatic Urban and Rural Network, they undergo regular independent audits and the data is independently collated, scaled and verified before disseminating, further details on the QA/QC procedures can be found in appendix A.





Note: All locations are approximate and for reference purposes only.

Table 2.1Details of Automatic Monitoring Sites

Site Name	Site Type	OS G	rid Ref	Pollutants Monitored	Monitoring Technique	In AQMA?	Relevant Exposure?	Distance to kerb of nearest road	Does this location represent worst-case exposure?
Belfast Centre	Urban Centre	X 333898	Y 374358	NO ₂	Chemiluminescence	Ν	Y (6.8m)	30m	Y
Belfast Ormeau Road	Roadside	X 334272	Y 373012	NO ₂	Chemiluminescence	Y	Y(10m)	3m	Y
Belfast Ballyhackamore	Roadside	X 337911	Y 373972	NO ₂	Chemiluminescence	Y	Y(10m)	3m	Y
Belfast Stockman's Lane	Roadside	X 331004	Y 371230	NO ₂ PM ₁₀	Chemiluminescence FDMS	Y	Y(20m)	2m	Y

2.1.2 Non-Automatic Monitoring

In addition to the continuous monitoring stations, Belfast City Council utilise nitrogen dioxide diffusion tubes for monitoring throughout the city. These locations provide indicative annual mean concentrations of nitrogen dioxide throughout the city and are bias adjusted against co-located tubes at the Belfast Centre site in accordance with LAQM.TG(09). Diffusion tube QA/QC details which include the bias adjustment factor and adjusted tube data for 2010 is reported in appendix A. In 2007, Belfast City Council maintained 27 tube locations. Following a review of these locations and based on information from the Detailed Assessment (Belfast City Council, 2007), in April of 2008 the number of locations was increased to 40. These new locations focus on monitoring receptors near busy roads. They are used to evaluate any potential exceedences outside of the declared AQMAs and to highlight potential areas of concern for future investigation. This is particularly relevant in the City Centre where the potential for exceedences was highlighted in the 2009 Update and Screening Assessment. A location map for the monitoring sites can be found above in Figure 2.1 and further site details are provided in table 2.2.

Table 2.2 Details of Non- 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?
Royal Victoria Hospital	Urban Background	X332522	Y373708	NO ₂	Ν	1.93	N/A	Y
Black's Road	Roadside	X329782	Y369522	NO ₂	Y	>60	2.42	Y
61 Cromac Street	Roadside	X334220	Y373853	NO ₂	Y	13	2.7	Y
Ravenhill Road	Roadside	X335014	Y373942	NO ₂	Y	4.7	5.5	Y
Queen's Bridge	Urban Background	X334581	Y374248	NO ₂	N	13	N/A	Y
North Road	Urban Background	X337551	Y374151	NO ₂	N	On School Wall	>300	Y
Donegall Square South	Roadside	X333837	Y373950	NO ₂	N	25	5.15	Y
Milner Street	Roadside	X332476	Y373434	NO ₂	Y	>100	2.8	Y
Short Strand	Roadside	X334980	Y374254	NO ₂	N	30	1.14	Y
301 Ormeau Road	Roadside	X334503	Y372176	NO ₂	Y	0	8.63	Y
400 Ormeau Road	Roadside	X335006	Y370796	NO ₂	Y	0	10	Y
Knock Road	Roadside	X338718	Y373918	NO ₂	Y	30	1.48	Y
Great George's Street	Kerbside	X333981	Y375102	NO ₂	Y	25	0.5	Y
Lisburn Road	Kerbside	X332393	Y371766	NO ₂	N	20	0.9	Y
Shaftesbury Square	Roadside	X333594	Y373283	NO ₂	N	20	4.4	Y
Lombard Street	Urban Centre	X333898	Y374358	NO ₂	Ν	3.6	2.4	Y
Albert Clock	Roadside	X334212	Y374489	NO ₂	N	3.6	2.4	Y
Victoria Street	Roadside	X334201	Y374408	NO ₂	N	2.44	3.87	Y

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Stockman's Lane	Roadside	X331007	Y371254	NO ₂	Y	20	1.75	Y
Ballyhackamore	Roadside	X337911	Y373972	NO ₂	Y	9.4	2.91	Y
Whitewell Road	Roadside	X333563	Y380450	NO ₂	Ν	35	13	Y
Donegall Road	Kerbside	X333022	Y373122	NO ₂	Ν	1.96	0.82	Y
Grosvener Road and Falls Road	Roadside	X332252	Y373878	NO ₂	N	30	3.06	Y
Falls Road and Andersonstown	Roadside	X330716	Y372519	NO ₂	N	15	2.8	Y
Knocknagoney Road (Sydenham Bypass)	Suburban	X338299	Y376602	NO ₂	N	10	40.43	Y
Station Road	Roadside	X337252	Y375555	NO ₂	Ν	20.1	2.41	Y
House of Sport	Roadside	X332373	Y369851	NO ₂	Ν	2	1.0	Y
Great Victoria Street	Roadside	X333548	Y373772	NO ₂	Ν	1	3	Y
College Square East	Roadside	X333498	Y374241	NO ₂	Ν	1.5	2	Y
Chichester Street	Roadside	X334147	Y374123	NO ₂	Ν	1	2	Y
Cromac & Ormeau Avenue	Kerbside	X334085	Y373542	NO ₂	Y	2.5	0.75	Y
M1 end of Donegall Road	Roadside	X332190	Y373100	NO ₂	Y	2	2	Y
Creche on M1/Westlink	Suburban	X333061	Y374056	NO ₂	Y	10	20	Y
Ormeau Road (junction with Ravenhill Road)	Roadside	X334943	Y371342	NO ₂	Y	3	2	Y
Upper Newtownards Road & Hollywood Road	Roadside	X336519	Y374233	NO ₂	N	2	3	Y
Crumlin Road	Roadside	X333195	Y375279	NO ₂	Ν	2	2	Y
228 Antrim Road	Roadside	X333288	Y376143	NO ₂	N	3	2	Y
Shore Road (M2 Junction 1 end)	Kerbside	X334180	Y378100	NO ₂	N	30	0.7	Y
Shore Road (Ivan Street end)	Roadside	X334174	Y376384	NO ₂	N	2	4	Y
North Circular Road	Kerbside	X333189	Y378195	NO ₂	Ν	17	0.7	Y

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2.2 Comparison of Monitoring Results with Air Quality Objectives

2.2.1 Nitrogen Dioxide

Automatic Monitoring Data

Tables 2.3a and 2.3b provide all nitrogen dioxide continuous monitoring data collected since 2008. Data capture was below 90% at the Ormeau Road and Ballyhackamore monitoring sites, therefore the 99.8th percentile was included in Table 2.3b. Exceedences of the 40 μ g/m³ annual mean NO₂ objective and cases where there are more than the permitted 18 exceedences of the 200 μ g/m³ 1-hour mean NO₂ objective are highlighted in bold. Concentrations at Belfast Centre site have remained stable over the last three year and are not close to the objectives, therefore based on the criteria for reviewing a site outside of an AQMA it is not necessary to proceed to a Detailed Assessment in this area. Monitoring data from 2010 at Belfast Ballyhackamore site indicates there has been a slight decrease since the previous round of R&A. Concentrations continue to exceed the annual mean objective which supports the AQMA designation. This is being tackled through Belfast Air Quality Action Plan. Annual mean concentrations below the objective continue to be recorded at the Ormeau Road site. The Detailed Assessment 2010 identified potential receptors at the junction of the Ormeau and Ravenhill Road therefore it was not deemed appropriate to revoke this AQMA, diffusion tube monitoring has since been introduced in this location. Stockman's Lane site is within an AQMA declared on exceedences of both the annual and hourly NO₂ objective; based on the LAQM-TG(09) criteria it would not be considered necessary to proceed to a Detailed Assessment as Belfast Air Quality Action Plan is in place to improve air quality in this area.

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

	Location	Within	Data Capture	Annual mean concentrations (μg/m ³)		
Site ID		AQMA?	calendar year 2010 %	2008	2009	2010
	Belfast Centre	Ν	92	32	32	35
	Belfast Ormeau Road	Y	83	34	34	36
	Belfast Ballyhackamore	Y	83	44	47	45
	Belfast Stockman's Lane	Y	95	62	67	66



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

Site ID	Location	Within	Data Capture for full calendar	Number	r of Exceede hourly ean (200 μg/	ences of m³)
			year 2010 %	2008	2009	2010
	Belfast Centre	N	92	3	0	0
	Belfast Ormeau Road	Y	83	0	0(138)	0(105)
	Belfast Ballyhackamore	Y	83	0	0	1(160)
	Belfast Stockman's Lane	Y	95	21	27(218)	56

Table 2.3b Results of Automatic Monitoring for Nitrogen Dioxide: Comparison with 1-hour Mean Objective

Diffusion Tube Monitoring Data

All diffusion tube monitoring has been bias-adjusted using the co-location study and the continuous monitoring station at Belfast Centre, further details on calculations used to generate adjusted results and information on QA/QC procedures in place are provided in appendix A. A location map for the monitoring sites can be found above in Figure 2.1. As previously mentioned the diffusion tube network was increased in April 2008 to provide monitoring data in areas of concern as identified in previous rounds of R&A. These locations are numbered as 33 to 45 in Table 2.4. The diffusion tube network is continually reviewed and where it is identified that a tube is frequently missing during the monthly changeover it is moved to a more suitable location in compliance with the guidance.

Exceedences of the 40 μ g/m³ annual mean NO₂ objective are highlighted in bold. The monitoring sites at Donegall Square South, Short Strand, Albert Clock, Victoria Street Great Victoria Sreet, College Square East, Cromac & Ormeau Avenue, Chichester Street, Antrim Road and Grosvenor Road/Falls have all experienced means in excess of the 40 μ g m⁻³ annual mean objective. These areas with the exception of the Antrim Road and Grosvenor Road/Falls were all considered in the Detailed Assessment 2010 and no relevant exposure was identified. The Antrim Road and Grosvenor Road/Falls tubes are roadside monitoring where no relevant exposure currently occurs. It is therefore not considered necessary to undertake a Detailed Assessment to address these exceedences outside of the designated AQMAs.

The monitoring sites at Black's Road, Cromac Street, Knock Road, Great George Street, Stockman's Lane, and Ballyhackamore also continue to indicate a breach of the objectives. As these locations are within existing AQMAs it is not deemed appropriate to proceed to a Detailed Assessment as an Air Quality Action Plan is in place to address these exceedences.

Table 2.4 Results of Nitrogen	Dioxide Diffusion	Tubes
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Site ID	Location	Within	Data Capture for	Annual mean concentrations (μg/m³)		
		AQIVIA ?	year 2010 %	2008	2009	2010
1	Royal Victoria Hospital	N	100	21	23	25
2	Black's Road	Y	83	36	44	46
3	61 Cromac Street	Y	92	45	42	48
4	Ravenhill Road	Y	92	33	31	36
5	Queen's Bridge	N	75	31	27	29
6	North Road	N	92	18	15	21
7	Donegall Square South	N	100	42	43	48
8	Milner Street	Y	83	35	31	38
9	Short Strand	N	100	42	48	50
10	301 Ormeau Road	Y	92	35	33	35
11	400 Ormeau Road	Y	83	27	29	30
12	Knock Road	Y	100	47	44	48
13	Great George's Street	Y	100	51	48	55
14	Lisburn Road	Ν	92	34	31	38
15	Shaftesbury Square	Ν	100	38	36	43
16,19,20	Lombard Street	Ν	100	41	34	35
17	Albert Clock	N	100	43	43	47
18	Victoria Street	N	92	42	39	48
21,22,56	Stockman's Lane	Y	100	60	67	63
23,24,32	Ballyhackamore	Y	100	47	46	44
25	Whitewell Road	N	83	21	21	25
26	Donegall Road	N	92	34	30	34
27	Grosvener Road and Falls	N	75	36	39	40
28	Falls and Andersonstown	N	100	30	31	33
29	Knocknagoney Road (Sydenham Bypass)	N	100	29	29	31
30	Station Road	N	92	24	24	25
31	House of Sport	N	100	21	23	28
33	Great Victoria Street	N	100	41	45	44
34	College Square East	N	100	37	37	44
35	Chichester Street	N	100	40	40	56

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36	Cromac & Ormeau Avenue	Y	100	39	34	41
37	M1 end of Donegall Road	Y	83	37	38	39
38	Creche on M1/Westlink	Y	83	25	20	38
39	Ormeau Road 39 (junction with Ravenhill Road)		100	25	26	33
40	Upper Newtownards Road & Hollywood Road	Ν	92	27	30	29
41	Crumlin Road	Ν	100	31	33	36
42	228 Antrim Road	Ν	67	34	34	41
43	Shore Road (M2 Junction 1 end)	Ν	92	26	29	31
44	Shore Road (Ivan Street end)	Ν	83	35	36	37
45	North Circular	Ν	67	22	21	29

2.2.2 PM₁₀

Particulate matter (size fraction 10um) concentrations have been monitored at the Belfast Centre site since 1992 and at Belfast Clara Street since 1998. These urban background monitoring sites were affiliated to Defra's Automatic Urban and Rural Network (AURN). In October 2007 the Clara Street site was dropped from this network. In April 2002, Belfast City Council established a kerbside monitoring location on the Westlink Corridor. In 2006, due to the major road rebuilding scheme along the M1-Westlink corridor the Westlink site was closed and relocated to the Stockman's Lane Site. The PM₁₀ analyser at the Stockman's Lane site was upgraded in February 2009 from a TEOM to an FDMS. These council operated sites are calibrated and operated under the same principles as Defra's Automatic Urban and Rural Network, they undergo regular independent audits and the data is independently collated, scaled and verified before disseminating

Tables 2.5a and 2.5b provide particulate matter (PM_{10}) continuous monitoring data collected since 2008. As data capture in 2010 was below 90% at the Belfast Centre monitoring site, the 90th percentile is included in brackets after the number of exceedences in Table 2.5b.

Figure 2.4 clearly demonstrates a downward trend for urban background concentrations of PM_{10} to date with a decrease of 37% since monitoring commenced in 1992. An exceedence of the annual mean objective last occurred at the Belfast Centre site in 1993.

Monitoring at Stockman's Lane site for 2010 demonstrates a slight increase in concentrations from 2009. However, compliance with both the annual mean and the 24-hour Objectives is achieved. This is very encouraging and could possibly be a result of measures implemented through the Air Quality Action Plan.

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

Site ID		Within	Data Capture	Annual mean concentrations (μg/m ³)		
	Location	AQMA?	calendar year 2010 %	2008	2009	2010
	Belfast Centre	N	72	18	20	22
	Belfast Stockman's Lane	Y	97	36	22	26

Figure 2.4 Trends in Annual Mean Particular Matter PM10 Concentration Measured at Automatic Monitoring Sites.



Table 2.5b Results of PM_{10} Automatic Monitoring: Comparison with 24-hour Mean Objective

Site ID	Site ID Location		Data Capture 2010	Numbe dail	lumber of Exceedences of daily mean objective (50 μg/m ³)		
			%	2008	2009	2010	
	Belfast Centre		72	7	3 (32)	11(109)	
Belfast Stockman's Lane		Y	97	49	9 (38)	18	

2.2.3 Sulphur Dioxide

Sulphur dioxide concentrations have been monitored at the Belfast Centre site since 1992. This continuous real time monitor is affiliated to Defra's Automatic Urban and Rural Network (AURN). The site is classed as an Urban Centre site and representative of typical population exposure in the city centre.

Previous rounds of R&A and monitored results from 2010 provided in Table 2.6 below confirm that there is no exceedence of the 15minute, the 1-hour mean and the 24-hour mean objective for sulphur Dioxide within Belfast. The last monitored exceedence was in 1998, therefore a Detailed Assessment is not considered necessary.

Table 2.6 Results of SO₂ Automatic Monitoring: Comparison with Objectives

Site		Within	Data	Number of Exceedences of: (μg/m³)			
ID	Location	AQMA?	Capture 2010 %	15-minute Objective (266 µg/m³)	1-hour Objective (350 μg/m³)	24-hour Objective (125 μg/m ³)	
	Belfast Centre	N	96	0	0	0	

2.2.4 Benzene

Benzene concentrations have been monitored at the Belfast Centre and the Belfast Roadside site since 2002. Monitoring stopped at the Belfast Roadside site in October 2007. The Belfast Centre site monitors benzene exposure for the City Centre whilst the Belfast Roadside site monitored benzene concentrations experienced at a Roadside location. No exceedence of the 2010 National Air Quality Strategy Objective (3.25 ugm⁻³ annual mean) or the 2010 EU Limit Value (5 ugm⁻³ annual mean) for benzene has been monitored in Belfast since 2002.

Previous rounds of R&A and monitored results from 2010 provided in Table 2.7 below confirm that there is no exceedence of the running annual mean of $3.25 \ \mu g \ m^{-3}$ for Benzene within Belfast. Therefore, a Detailed Assessment is not considered necessary.

Table 2.7 Results of Benzene Monitoring: Comparison with Running AnnualMean Objectives

Site ID	Location	Within	Data Capture for full	Running Annual mean concentrations (mg/m ³)			
		AQMA?	calendar year 2010 %	2008	2009	2010	
	Belfast Centre	Ν	100	0.61	0.65	0.73	

2.2.5 Other pollutants monitored

Previous rounds of R&A have confirmed that relevant Air Quality Objectives for carbon monoxide, 1,3-butadiene, Ozone and lead are being met throughout the city. No new sources have been identified which would have the potential to change this situation therefore these pollutants will not be considered in this report.

Summary of Compliance with AQS Objectives

Belfast City Council has examined the results from monitoring throughout the city. Measured concentrations of nitrogen dioxide above the annual mean objective at a number of locations have been identified. Local knowledge and conclusions from the Detailed Assessment 2010 confirm that there is no relevant exposure currently occurring at these locations.

In summary there is no need to undertake a Detailed Assessment for exceedences of the AQS Objectives in Belfast.

3 New Local Developments

3.1 Road Traffic Sources

The following road traffic sources which may have an impact on air quality have been identified and considered:

- Narrow congested streets with residential properties close to the kerb.
- Busy streets where people may spend one hour or more close to traffic.
- Roads with a high flow of buses and/or HGVs.
- Junctions.
- New roads constructed or proposed since the last Progress Report.
- Roads with significantly changed traffic flows.
- Bus or coach stations.

Belfast City Council confirms that there has been no significant change to any of the above sources since the last Progress Report, therefore there is no need to proceed to a Detailed Assessment.

3.2 Other Transport Sources

The following additional transport sources which may have an impact on air quality have been identified and considered:

- Airports.
- Locations where diesel or steam trains are regularly stationary for periods of 15 minutes or more, with potential for relevant exposure within 15m.
- Locations with a large number of movements of diesel locomotives, and potential long-term relevant exposure within 30m.
- Ports for shipping.

Belfast City Council confirms that there has been no significant change to any of the above sources since the last Progress Report, therefore there is no need to proceed to a Detailed Assessment.

3.3 Industrial Sources

The following industrial sources which may have an impact on air quality have been identified and considered:

- **Industrial installations:** new or proposed installations for which an air quality assessment has been carried out.
- **Industrial installations:** existing installations where emissions have increased substantially or new relevant exposure has been introduced.
- **Industrial installations:** new or significantly changed installations with no previous air quality assessment.
- Major fuel storage depots storing petrol.
- Petrol stations.

• Poultry farms.

Belfast City Council confirms that there has been no significant change to any of the above sources since the last Progress Report, therefore there is no need to proceed to a Detailed Assessment.

3.4 Commercial and Domestic Sources

The following commercial and domestic sources which may have an impact on air quality have been identified and considered:

- Biomass combustion plant individual installations.
- Areas where the combined impact of several biomass combustion sources may be relevant.
- Areas where domestic solid fuel burning may be relevant.

Belfast City Council confirms that there has been no significant change to any of the above sources since the last Progress Report, therefore there is no need to proceed to a Detailed Assessment.

3.5 New Developments with Fugitive or Uncontrolled Sources

The following new developments with fugitive or uncontrolled sources which may have an impact on air quality have been identified and considered:

- Landfill sites.
- Quarries.
- Unmade haulage roads on industrial sites.
- Waste transfer stations etc.
- Other potential sources of fugitive particulate emissions.

Belfast City Council confirms that there has been no significant change to any of the above sources since the last Progress Report, therefore there is no need to proceed to a Detailed Assessment.

Belfast City 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.

4 Planning Applications

Of the planning applications received by The Environmental Protection Unit of Belfast City Council in 2010-11 eight new developments were identified as having the potential to have a negative impact on air quality. These proposed developments included large mixed use developments, residential developments, proposed extension to Police Headquarters and a stadium extension to the Ravenhill Ulster Rugby grounds.

Detailed and screening air quality assessments submitted in support of these developments concluded that their individual impact would have minimal or insignificant impacts on localised air quality or the existing AQMAs. Several developments proposed mitigation measures during the construction phase that centred on controlling fugitive emissions of particulate matter. Details of these applications are provided below in Table 4.1.

Table 4.1 New Developments that had a potential to have a negative impact on air quality in the 2010-11 period

Location	Development description	Outcomes of air quality impact assessment	Mitigation measures proposed
Percy Street Mill Development	Mixed used development comprising 362 apartments, 83V Duplex units.	Detailed dispersion model predicted no significant impact on existing local air quality. No exposure to exceedences of NO2 and PM10 Objectives	Construction mitigation measures included site roads cleaning, water spraying on surfaces and roads, wheel washes, covering of loads, checking emissions of vehicles.
Finaghy Road North (Phase 2)	Housing development: 24no. townhouses, 29no apartments	Detailed dispersion model predicted no significant negative impact on existing local air quality. No exposure to exceedences of NO2 and PM10 Objectives	Construction mitigation measures included site roads cleaning, water spraying on surfaces and roads, wheel washes, covering of loads, checking emissions of vehicles.
Knocknagoney Dale	Construction of 245 Apartments with covered parking and hard and soft landscaped amenity provision	DMRB screening assessment concluded minimal localised impact on NO2 and PM10 concentrations. No exposure to exceedences of Objectives.	None proposed as none required
Knock Road, Brooklyn	Proposed Extension to Police Headquarters (inc offices and car parking space)	Detailed dispersion model predicted no significant negative impact on existing local air quality. No exposure to exceedences of NO2 and PM10 Objectives	None proposed as none required
Barrow Square	Mixed development	DMRB screening assessment predicted	Contractors should implement a dust

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Location	Development description	Outcomes of air quality impact assessment	Mitigation measures proposed
	compromising retail, 124 apartments with 112 parking spaces.	no significant increase in traffic volumes and associated atmospheric pollutants. No exposure to exceedences of NO2 and PM10 Objectives	minimisation plan once commencing work on- site.
Ravenhill Stadium Extension	Upgrade the supporters facilities on three sides of the Ulster Rugby Grounds	Detailed dispersion model predicted no significant increases in pollutant concentrations due to the development. No exposure to exceedences of NO2 and PM10 Objectives	Employ efficient mitigation measures in the Event Management Plan to provide better traffic control in the area.
101 Corporation Street	Proposed 15- storey apartment building over 3 levels of private parking.	Detailed dispersion model predicted no significant impact on the AQ due to the development. No exposure to exceedences of Objectives	None proposed as none required
City Quay's Masterplan	Mixed Development compromising retail and residential.	Detailed AQ Impact Assessment concluded the impact on local AQ with the scheme in place is predicted to be slight adverse. No exposure to exceedences of Objectives.	Contractors should implement a dust minimisation plan once commencing work on- site.

5 Air Quality Planning Policies

It is important for all local authorities to think about how they can best bring air quality considerations into the planning process at the earliest possible stage and it is no longer satisfactory to simply demonstrate that a development is no worse than the existing or previous land use on a particular site.

Very little development bypasses the planning stage therefore it provides an opportunity to identify and prevent potential problems from arising in the first place an excellent example of where prevention is far better than trying to find a cure.

In light of this, Belfast City Council produced and in June 2009 launched 'Air quality and land use planning: A Belfast specific guidance note for developers and air quality consultants'. The document outlines what the Council, as a key consultee for the Planning Service, would look for in forming its opinion on a proposed development and its potential impact on air quality. If developers and consultants follow the procedures in this guidance, it will help ensure consistency in the approach to dealing with air quality and planning in Belfast.

The ultimate aim of the guidance is to speed up the planning process and encourage developers to submit appropriate air quality related information with the initial planning application. On the basis of this submitted information, Environmental Protection Unit will then be able to take into due consideration the proposed development's impact on air quality. The guidance document is available at <u>www.belfastcity.gov.uk/airquality</u>.

6 Implementation of Action Plans

Belfast City Council also report annually on progress relating to the Action Plan. Since it was implemented in 2006, BCC and all partners have been pro-active in implementing the actions assigned. Action Plan Progress to date brings the total actions complete to 90%, with 10% still considered ongoing which is very encouraging, of the 4% where there has been no progress it is unlikely some of these actions will be implemented in the foreseeable future. These include major highway network schemes which in the current financial climate no private sector funding has been identified to deliver these projects, also some of the actions which have had no progress to date will no longer be pursued as over the last few years alternatives have been introduced which are more sustainable and cost-effective. Table 6.1 below provides progress information over the past 12 months specifying ongoing actions. Actions which were considered complete in the 2010 Progress report have not been included and can be found in Belfast City Air Quality Action Plan 2006 available at www.airqualityni.co.uk.

It is very difficult to quantify the emission reduction achieved through implementation and completion of the various actions within the 2006 action plan. Belfast City Council are in discussions with partner organisations with a view to producing a new Air Quality Action Plan. Actions within the new plan will focus on targeting emission reduction specifically in the AQMAs and will carefully consider how it will be possible to quantify effectiveness of the actions.

Table 6.1Belfast City Action Plan Progress

No.	Measure	Focus	Lead authority	Progress 2006 to 2010	Progress in last 12 months	Estimated completion date
1	Introduction of new orbital bus routes to complement the radial QBC network.	Introduction of new orbital bus routes to complement the radial QBC network.	Road Services	QBC's operating on 12 main radial routes in Belfast, including a 25% increased service frequency. A second phase would achieve a total of 50% with a further 25% increase in service frequency. http://www.translink.co.uk/nithctlcorpplan200 910.asp	£9 million earmarked for the introduction of Orbital Bus Routes by 2015 and several semi orbital routes in place serving new retail developments	2015
2	Rapid Transit.	The creation of a bus rapid transit network EWAY on the Upper Newtownards Road corridor.	DRD	Scheme earmarked to receive funding of £100 million in the RTS and also featured in the BMTP. A number of feasibility studies have already taken place.	Legislation required for implementation included in Transport Act (NI) 2011. Preliminary designs produced. Competitive tender process to appoint consultants to assist with preparation of Outline Business Case completed. Consultants appointed April 2011.	Ongoing programme
3	Establish a programme to enable vehicle fuel consumption efficiency to be improved.	Purchase software to enable a baseline survey to be undertaken and subsequent fuel usage logging to be introduced.	BCC	New fuel management system to be procured during 2009 that will enable good fuel performance benchmarks to be developed.	 Belfast City Council had initially elected to update only the fuel monitoring aspects of its fleet management activities at the Duncrue Complex. However, during initial scoping studies, it was determined that the fuelling infrastructure needed also to be updated. Accordingly, the council is now in the process of replacing the fuels tanks and all associated supply infrastructure including the pumps and monitoring software. Although better management of the council's vehicle fleet was included in the air quality action plan, it should be noted the actions were of low priority and therefore expected to have a low impact upon air quality levels within the declared air quality management areas. 	Ongoing programme
4	Improve procedures for recording and monitoring fuel usage.	Improve procedures for recording and monitoring fuel usage.	BCC	To be developed in 2009 in conjunction with the new fuel management system.	The development of fuel benchmarks for individual vehicles will be progressed following the installation of the new fuelling management system as per the above update.	Ongoing programme

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No.	Measure	Focus	Lead authority	Progress 2006 to 2010	Progress in last 12 months	Estimated completion date
5	Support the regeneration of Belfast's major arterial routes as part of a regional regeneration agenda.	Develop and implement integrated regeneration plans for designated Arterial Routes across the City.	BCC	Regeneration of arterial routes supported by BCC, work on development and implementation of integrated regeneration plans still on going.	Regeneration of arterial routes supported by BCC, work on development and implementation of integrated regeneration plans still on going	Ongoing programme
6	Influence policy development for the city through the development of corporate policies and responses to promote more sustainable development.	Lobby for the development of a memorandum of understanding between the Planning Service and Belfast City Council.	BCC	Belfast City Council continues to liaise with the Department of Environment Planning Service for Northern Ireland. In addition, it should be noted that various planning policy statements already make mention of air quality. By way of example, PPS 1: General Principles contains a commitment to conserve natural resources to include air quality. Similar references to air quality are contained within PPS13 on transport, etc. At present, Belfast City Council acts as a statutory consultee to the Planning Service however, the Review of Public Administration recommended that local development plan functions (including town centre and subject plans) be transferred to local authorities. The government consultation into the 'Reform Programme for the Planning System' and the draft Planning Bill closed in October 2009	In 2009, Belfast City council published 'Air quality and land use planning A Belfast specific guidance note for developers and air quality consultants' to inform developers regarding the implications of air quality in the development control regime. The guidance was endorsed by Environmental Protection UK.	Ongoing programme
7	Strategic highway network capacity enhancements.	Widening of the A2 at Greenisland on the Carrickfergus corridor	Road Service	Public consultation of scheme ran from February to May 2006. Construction due.	Finalisation of Scheme design	Ongoing programme
8	Strategic highway network capacity enhancements.	Widening of the A2 Sydenham Bypass between Tillysburn and the M3 Lagan Crossing	Road Service	Scheme proposed in the 2004 - Regional Transport Plan. Construction due between 2014 and 2018.	Scheme design progressing	Ongoing programme
9	Strategic highway network capacity enhancements.	Widening of the A55 Outer Ring Road at Knock Road.	Road Service	Publication of statutory orders issued Autumn 2009.	Pubic Inquiry held Nov 2010. Roads Service considering Inspector's recommendations. No capital funding identified in current 4 year budget period	Ongoing programme

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No	. Measure	Focus	Lead	Progress 2006 to 2010	Progress in last 12 months	Estimated completion
10	non-strategic highway network capacity enhancements.	Construction of the Holywood Arches bypass.	Road Service	No private sector funding identified to deliver scheme. This scheme may not be implemented.	No private sector funding identified to deliver scheme. This scheme may not be implemented.	This scheme may not be implemented
11	Non-strategic highway network capacity enhancements.	Construction of new road link between Quarry Corner and East Link Road	Road Service	This scheme may not be implemented. Linked to DRD's Rapid transit proposals for Eway.	Outline business case for Rapid Transit will consider the feasibility and justification for this road scheme – due to commence spring 2011	Ongoing programme
12	Non-strategic highway network capacity enhancements.	Construction of Bankmore Link	Road Service	In RS Forward Planning schedule. Preferred options study underway.	In RS Forward Planning schedule. Preferred options study underway.	2015
13	Strategic highway network capacity enhancements.	Route Management Strategies on the A55 outer ring.	Road Service	Study proposed for 2009/10.	Study delayed. Report expected by end of 2011.	Ongoing programme
14	Non-strategic highway network capacity enhancements.	Traffic management measures on local and distributor roads to improve the flow of traffic.	Road Service	Ongoing improvements to network to improve traffic flow.	These generally comprise minor local changes to roads and how traffic uses them, along with new or enhanced signage. Examples include the provision of right turn pockets (Upper Malone Road), road markings (Carlisle Circus) and direction signage to local facilities. Local consultation has been undertaken regarding potential one-way traffic systems in Dunluce Avenue and in the Sunnyside Street area. Legislation for the introduction of waiting restrictions at several locations (eg Pomona Avenue) has been processed but implementation of the Orders have been delayed due to as yet unresolved objections being received. Installation of Dynamic Traffic Control (MOVA) at Kings Rd / Knock Rd and Knock Rd / Upper N'Ards Rd to improve the efficiency of traffic flow at the junction.	Ongoing programme
15	Non-strategic highway network capacity enhancements.	Traffic management measures in Belfast City Centre comprising the	Road Service	Traffic regulation Orders being processed to facilitate DSD's Streets Ahead Project. Plans under development to reduce traffic levels in the central area and facilitate a greater degree of priority for pusses and	Streets Ahead enabling measures to commence May 2011. Traffic regulation orders for next phase of traffic management changes in city centre (Sustainable transport enabling measures) to be published in	Ongoing programme

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		reduction of existing road capacity within the core of the city centre.		accommodate rapid transit.	autumn 2011.	
16	Implementation of Parking Measures.	Implementation of a parking policy focused on central Belfast to include a Controlled Parking Zone, improved enforcement, regulation and planning measures.	Road Service	On 30th October 2006 parking enforcement transferred from PSNI to DRD. Newly empowered traffic attendants to concentrate on ensuring street parking restrictions are adhered to. Within the period April 2006 to March 2009, 80 on-street spaces added in the current CPZ. Current proposal to extend the CPZ to provide a further 294 spaces. The current tariff review carried out by the division proposes changing 150 spaces in Belfast from free to charge.	Proposals to further extend the central CPZ are being developed. Work has been on-going to implement residents' parking schemes in several city centre locations. Most progress has been made in the Stranmillis and Lower Malone areas where scheme layouts have been agreed with residents' groups. Further progress and full local consultation has been delayed over concerns relating to the cost of permits in these areas.	Ongoing programme
17	Education campaign for young people highlighting the health problems related to air pollution.	Develop and deliver a targeted education campaign via the Council's web site or published material.	BCC	Council website currently going through a major re-vamp. Education campaigns regarding air quality issues will form a part of this work.	Council website currently going through a major re- vamp. Education campaigns regarding air quality issues will form a part of this work.	Ongoing programme
18	Promote the use of alternative fuels and vehicle types via the Energy Saving Trust	Promote emissions testing amongst large organisations in Belfast.	BCC	Belfast City Council has commenced upon preliminary investigations regarding biodiesel however, government policy and the provisions of the Renewable Transport Fuel Obligation are unclear at this time.	The Renewable Transport Fuels Obligation (RTFO), requires suppliers of fossil fuels to ensure that a specified percentage of the road fuels that they supply in the UK is made up of renewable fuels. The target for 2010/11 is 3.5% by volume. However, to be truly sustainable, government has recognised that carbon emissions associated with changing the usage of land to biofuel crop cultivation must be considered. Belfast City Council has had preliminary discussions with potential local biofuel suppliers however, few indigenous supplies are presently commercially available. Issues around the quality of fuels, the blend percentage and the impact this may have on engine warranties have also been encountered.	Ongoing programme At present, Belfast City Council is assisting the Department for Regional Development and the Department of Environment to develop a regional application as part of the Department for Transport Office of Low Emission Vehicles Plugged in Places initiative. This will provide public infrastructure to support the deployment of zero emission vehicles for Belfast and further afield.

7 Conclusions and Proposed Actions

7.1 Conclusions from New Monitoring Data

New monitoring data for the 2010 period as presented in this report would indicate that nitrogen dioxide levels exceed the AQS Objectives at a number of locations outside existing AQMAs. Information from the 2010 Detailed Assessment and local knowledge confirm that relevant exposure as defined by LAQM.TG(09) does not currently occur at these locations. It is therefore not deemed appropriate to proceed to a Detailed Assessment based on the 2010 monitoring data.

7.2 Conclusions relating to New Local Developments

Of the planning applications received and reviewed in 2010 it was concluded they would have no significant negative impact on existing local air quality. In addition no significant changes in local circumstances were identified within Belfast which would require more detailed consideration. It is therefore not considered necessary to proceed to a 'Detailed Assessment' based on new local developments or potential sources.

7.3 Proposed Actions

Monitoring data presented in this report would indicate it is not necessary to proceed to a Detailed Assessment for any pollutant. A number of diffusion tube monitoring sites both within and outside AQMAs exceed the nitrogen dioxide (NO₂) annual mean objective of $40\mu g/m^3$, however, relevant exposure does not occur in the locations outside the existing AQMAs therefore no further action is necessary.

An extensive nitrogen dioxide monitoring network exists throughout Belfast and currently captures all areas of potential concern, therefore it is not envisaged the existing network will be increased unless a change in local circumstances is identified. Nitrogen dioxide continues to be identified as the biggest problem with road traffic as the main source.

Significant progress has been made by all partners involved in the Air Quality Action Plan, it is anticipated focus over the next year will be on achieving completed status to those actions currently considered ongoing. Belfast City Council intend to consult with partnership organisations with a view to producing a new Air Quality Action Plan.

Under the Local Air Quality Management Review and Assessment process the next course of action for Belfast City Council will be to submit a progress report in 2012.

8 References

Belfast City Council, 2010. Belfast City Detailed Assessment, September 2010. Available at: www.airqualityni.co.uk/laqm

Belfast City Council, 2010. Belfast City Progress Report, April 2010. Available at: www.airqualityni.co.uk/laqm

Belfast City Council, 2009. Belfast City Update and Screening Assessment, April 2009. Available at: www.airqualityni.co.uk/laqm

Local Air Quality Management – Technical Guidance (09). 2009. Available at: www.defra.gov.uk/environment/airquality/index

Appendices

Appendix A: QA/QC Data

Appendix B: Belfast City Council Air Quality Management Area Location Map

Appendix C: Belfast City Council Air Quality Monitoring Station Details

Appendix A: QA:QC Data

Diffusion Tube Monitoring

Belfast City Council use Gradko International for the supply and analysis of diffusion tubes. The laboratory constantly delivers high performance both in terms of results and service, it operates in accordance with LAQM-TG(09), and participates in the WASP scheme.

2010 Bias-adjusted Results and Factor from Local Co-location Study

Cł	Checking Precision and Accuracy of Triplicate Tubes													
	Diffusion Tubes Measurements										Automa	tic Method	Data Quali	ty 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	07/01/2010	04/02/2010	48.0	47.5	55.0	50	4.2	8	10.4		45	99	Good	Good
2	04/02/2010	03/03/2010	51.4	44.0	50.3	49	4.0	8	9.9		50	94	Good	Good
3	03/03/2010	01/04/2010	37.4	39.0	36.8	38	1.1	3	2.8		41	88	Good	Good
4	01/04/2010	29/04/2010	41.8	40.5	41.1	41	0.6	1	1.5		35.17	99.8	Good	Good
5	29/04/2010	02/06/2010	28.3	22.2	28.7	26	3.6	14	9.1		26	97.5	Good	Good
6	02/06/2010	30/06/2010	28.4	28.2	28.3	28	0.1	0	0.3		24	100	Good	Good
7	30/06/2010	04/08/2010	23.1	23.1	22.4	23	0.4	2	1.0		20	99.3	Good	Good
8	04/08/2010	01/09/2010	30.1	23.8	27.0	27	3.2	12	7.9		26	94	Good	Good
9	01/09/2010	29/09/2010	31.0	29.6	33.2	31	1.9	6	4.6		26	71	Good	or Data Capture
10	29/09/2010	03/11/2010	45.3	42.4	77.1	55	19.2	35	47.8		31	99	Poor Precision	Good
11	03/11/2010	01/12/2010	24.1	38.7	50.2	38	13.1	35	32.6		38.61	99	Poor Precision	Good
12	01/12/2010	11/01/2011	49.2	51.1	44.2	48	3.6	7	8.9		54.27	99	Good	Good
13														
lt is r	necessary to have	e results for at le	ast two tub	es in order	to calculate	the precision	of the measure	ments			Overa	II survey>	Good precision	Good Overall DC
Sit	e Name/ ID:	Lo	mbard (1	6,19,20)			Precision	10 out of	12 periods I	have a C	/ smaller th	an 20%	(Check average	CV & DC from
	A		050/		last a muselly		A	6	050/	()	last som an IV		Accuracy ca	iculations)
	Accuracy	(with	95% COI	maence	interval)		Accuracy	(with	95% CON	fidence	interval)			
	without per	riods with C	V larger t	nan 20%			WITH ALL					50%		
	Bias calcula	ited using 9	periods o	of data			Bias calcu	lated using 11	periods	of data		25%		
	E	Bias factor A	0.9	7 (0.9 - 1	.05)			Bias factor A	0.92	(0.8 - 1	.09)	8	I	.
		Bias B	3%	(-5% - 1	1%)			Bias B	8%	(-8% - 2	25%)	1 <u>1</u> 0%	Without CV= 209/	With all data
	Diffusion Tubes Mean: 37 µgm ⁻³				Diffusion	Tubes Mean:	38	µgm ⁻³		0 -25%	Without CV22076	with all data		
Mean CV (Precision): 6					Mean C	(Precision):	11		caution	ffus				
	Auto	matic Mean:	36	µgm ⁻³			Auto	omatic Mean:	35	µgm ⁻³		ā _{-50%}		
	Data Cap	oture for perio	ods used:	97%			Data Ca	apture for peri	ods used:	97%			J	aume Targa
	Adjusted T	ubes Mean:	36 (3	3 - 39)	µgm ⁻³		Adjusted	Tubes Mean:	35 (31	- 42)	µgm ⁻³		jaume.targa@	Daeat.co.uk

AEA Energy & Environment

Adjustment of SINGLE Tubes

confidence interval) with all the data 11 periods used in this calcuations **Diffusion Tube Measurements** Bias Factor A 0.92 (0.8 - 1.09) Periods Raw Valid Site Name/ID Bias B 8% (-8% - 25%) Mean periods Tube Precision: 11 Automatic DC: 97 1 3 4 5 6 7 8 9 10 11 12 13 2 1. RVH 25 (22-30) 46 (40-55) 38.7 34.0 28.0 11.6 19.5 27.4 12 Adjusted with 95% CI 17.9 16.2 27. 39.0 Adjusted with 95% CI 2. Blacks Rd 59.2 52.8 50.6 56.0 45.5 42.3 33.5 46.9 48.6 68.2 50.4 10 3. 61 Cromac Str 48 (42 - 57) Adjusted with 95% CI 52.2 59.2 42.7 43.0 41.7 49.2 45.9 61.7 69.3 77.8 30.6 52.1 11 39.0 44.6 4. Ravenhill Rd 11 Adjusted with 95% CI 36 (32 - 43) 49.5 46.9 20.9 32.4 32.4 40.4 43.8 54.6 39.6 31.1 5. Queens Bridge 43.4 34.9 23.2 20.7 26.9 30.9 45.6 31.3 9 Adjusted with 95% CI 29 (25-34) 23.8 6. North Road Adjusted with 95% CI 21 (18 - 25) 32.3 28.4 40.3 14.1 11.4 11.0 14.3 17.5 22.5 21.9 36.0 22.7 11 7. Donegal Sq. South Adjusted with 95% CI 48 (42 - 57) 59.2 59.8 39.7 36.3 33.8 44.3 48.9 55.2 62.6 12 69.2 65.7 56.2 52.6 8. Milner Str 53.1 46.5 Adjusted with 95% CI 46.3 31.2 41.7 10 38 (33 - 45) 49.3 28.3 30.4 33.5 43.3 9. Short Strand 72.4 63.0 69.1 61.3 43.7 42.9 39.1 44.2 46.6 57.0 50.6 64.0 54.5 12 Adjusted with 95% CI 50 (44 - 59) 10. 301 Ormeau Rd 50.6 43.3 26.7 33.6 28.3 30.3 38.5 39.3 34.0 48.8 37.8 11 Adjusted with 95% CI 35 (30 - 41) 42. 11. 400 Ormeau Rd 30 (26 - 36) Adjusted with 95% CI 40.5 39.1 28.4 25.2 20.1 26.9 45.6 32.7 35.0 32.8 32.6 10 12. Knock Rd 65.2 35.6 60.9 44.0 41.9 30.2 43.1 46.8 57.1 55.3 67.9 52.5 12 Adjusted with 95% CI 48 (42 - 57) 81. 13. Gr Georges Str 73.8 76. 63.6 71.8 50.8 54.8 34.5 47.6 55.7 48.2 59.5 76.7 59.5 12 Adjusted with 95% CI 55 (48-65) 38 (33-45) 43 (38-51) 14. Lisburn Rd 52 7 43.1 39.5 31.7 30.7 32.4 29.8 41.0 42 : 58.5 41.1 11 Adjusted with 95% CI 50 15. Shaftesbury Sq Adjusted with 95% CI 47.0 64.5 49.9 54.5 36.1 39.5 31.7 34.9 40.8 53.9 41.3 62.0 12 54 17. Albert Clock 44.1 57.3 44.2 41.0 39.1 41.1 50.8 48.6 44. 67.1 50.8 Adjusted with 95% CI 47 (41 - 55) 69.3 12 62. 18. Victoria Str 69.2 49.8 44.7 11 Adjusted with 95% CI 48 (42 - 57) 57.0 62.8 45.3 33.8 37.4 50.0 55. 52.2 25. Whitewell Rd 33.2 28.1 31.8 28.1 27.5 15.6 19.2 25.9 23. 27.0 10 Adjusted with 95% CI 25 (22 - 29) 37. Adjusted with 95% CI 34 (30 - 41) 26. Donegal Rd 54.4 41.7 43.9 32.8 28.4 21.7 30.1 33.3 32.2 38.1 53.6 37.3 11 27. Grovesner Rd Adjusted with 95% CI 40 (34 - 47) 53.3 47.4 45.5 44.1 25.1 29.3 30.0 44.3 68.4 43.0 9 32.9 40.8 28. Falls and Andytown 26.7 36.4 36.1 12 Adjusted with 95% CI 33 (29-39) 45.1 44.1 37.3 28 . 22.1 25.0 51. 29. Sydenham Bypass 39.0 40 38.6 37.6 24.7 23.3 25.6 36.2 27.9 31.6 25.5 48.5 33.2 12 Adjusted with 95% CI 31 (27 - 36) 30. Station Rd 38.2 32.5 24.4 19.0 21.4 17.8 21.5 22.9 30.7 24.5 44.9 27.1 11 Adjusted with 95% CI 25 (22 - 30) 31 House of Sport Adjusted with 95% CI 28 (24 - 33) 12 32.9 30.6 43.7 30.1 37.4 45. 22.7 23.9 16.2 20.3 23.1 32.1 33.1 The bias adjust nt factor used in th inclu g of data due to poor ision has been applied. all the data and no s ' pre

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	07/01/2010	04/02/2010	48.0	47.5	55.0	50	4.2	8	10.4		45	99	Good	Good
2	04/02/2010	03/03/2010	51.4	44.0	50.3	49	4.0	8	9.9		50	94	Good	Good
3	03/03/2010	01/04/2010	37.4	39.0	36.8	38	1.1	3	2.8		41	88	Good	Good
4	01/04/2010	29/04/2010	41.8	40.5	41.1	41	0.7	2	1.6		35.17	99.8	Good	Good
5	29/04/2010	02/06/2010	28.3	22.2	28.7	26	3.6	14	9.0		26	97.5	Good	Good
6	02/06/2010	30/06/2010	28.4	28.2	28.3	28	0.1	0	0.2		24	100	Good	Good
7	30/06/2010	04/08/2010	23.1	23.1	22.4	23	0.4	2	1.0		20	99.3	Good	Good
8	04/08/2010	01/09/2010	30.1	23.8	27.0	27	3.2	12	7.8		26	94	Good	Good
9	01/09/2010	29/09/2010	31.0	29.6	33.2	31	1.8	6	4.5		26	71	Good	or Data Capture
10	29/09/2010	03/11/2010	45.3	42.4	77.1	55	19.2	35	47.8		31	99	Poor Precision	Good
11	03/11/2010	01/12/2010	24.1	38.7	50.2	38	13.1	35	32.5		38.61	99	Poor Precision	Good
12	01/12/2010	11/01/2011	49.2	51.1	44.2	48	3.6	7	8.9		54.27	99	Good	Good
13														
lt is n	ecessary to have	e results for at lea	ast two tube	es in order f	to calculate	the precision	of the measure	ments			Overa	II survey>	Good precision	Good Overall DC
Sit	e Name/ ID:	Lo	mbard (1	6,19,20)			Precision	10 out of	12 periods I	nave a C\	/ smaller th	an 20%	(Check average Accuracy ca	CV & DC from Iculations)
	Accuracy	(with	95% cor	nfidence	interval)		Accuracy	(with	95% con	fidence	interval)			
	without per	riods with C	/ larger t	han 20%	1		WITH ALL	DATA				50%		
	Bias calcula	ted using 9 p	periods c	of data			Bias calcu	lated using 11	periods	of data		S 25%		-
	E	Bias factor A	0.9	7 (0.9 - 1	.06)			Bias factor A	0.92	(0.8 - 1	.09)	10 2070 10	т	4
		Bias B	3%	(-5% - 1	1%)			Bias B	8%	(-9% - 2	25%)	<u></u> 9%	<u> </u>	
	Diffusion T	ubes Mean:	37	µgm ⁻³			Diffusion	Tubes Mean:	38	µgm ⁻³		ษ	Without CV>20%	With all data
	Mean CV	(Precision):	6				Mean C	(Precision):	11		caution	isnj25%		
	Automatic Mean: 36 µgm ⁻³					Auto	omatic Mean:	36	µgm ⁻³		ā. _{50%}			
	Data Cap	ture for peric	ods used:	97%			Data Capture for periods used: 97%]	aume Targa		
	Adjusted T	ubes Mean:	36 (3	3 - 39)	µgm ⁻³		Adjusted	Tubes Mean:	35 (31	- 42)	µgm ⁻³		jaume.targa	Daeat.co.uk

AEA Energy & Environment Adjustment of SINGLE Tubes confidence interval) with all the data **Diffusion Tube Measurements** 11 periods used in this calcuations Bias Factor A 0.92 (0.8 - 1.09) Raw hileV Periods Site Name/ID Bias B 8% (-9% - 25%) Mean periods Tube Precision: 11 Automatic DC: 9 3 4 5 6 7 8 9 10 11 12 13 1 2 33 Great Victoria Street 47.7 Adjusted with 95% CI 44 (38 - 52) 49.0 51.2 46.0 12 Adjusted with 95% CI 44 (38 - 52) 34 College Square East 47.5 64.3 52.3 57.4 43.7 35.4 23.7 33.5 38.4 54.0 56.2 61.1 47.3 12 Adjusted with 95% CI 35 Chichester Street 56 (49-67) 70.1 77.1 67.1 81.6 58.2 46.8 60.2 57.3 39.6 53.0 53.5 69.9 61.2 12 41 (36 - 49) 36 Cromac/Ormeau Avenu 48.5 33.: 35.7 36.2 34.3 35.3 49. 44.9 Adjusted with 95% CI 55.0 53.3 38.8 62.5 12 Adjusted with 95% CI 37 M1 End Donegall Road 42.0 10 39 (34 - 46) 51.4 34.7 28.6 38.5 54.6 40.8 38 Creche on M1/Westlink 38 (33 - 44) 54.7 40.7 47.2 31.0 28.4 25.3 34.6 41.4 56.8 47.6 40.8 10 Adjusted with 95% CI 39 Ormeau Rd/Ravenhill Rd 37.7 39.8 33.1 21.4 35.5 31.2 47.9 Adjusted with 95% CI 33 (29 - 39) 37.8 42.0 32.9 29.2 41.1 35.8 12 Adjusted with 95% CI 29 (25 - 34) 40 Upper Newtownards Rd/Hollywo 45.4 40.3 33.8 32.8 25.2 20.5 20.2 26.4 29.8 30.3 42.1 31.5 11 41 Crumlin Rd 56.1 48.8 45.3 41.7 34.1 33.0 24.2 31.8 32.7 36.8 32.9 48.3 38.8 12 Adjusted with 95% CI 36 (31 - 42) 42 228 AntrimRd 39.4 38.0 43.1 65.2 45.1 Adjusted with 95% CI 41 (36-49) 53.7 51 8 31.4 38.1 8 Adjusted with 95% CI 43 Shore Rd (M2 End) 24.5 19.8 31 (27 - 37) 55.0 46.6 40.6 37.2 34.1 34. 21.7 24.3 31.3 33.6 11 44 Shore Rd (Ivan St. End) 57.0 43.4 31.2 34.9 38.7 40.5 54.4 40.7 10 Adjusted with 95% CI 37 (33-44) 55.6 24.2 27.0 45 North Circular Rd 36.5 37.4 28.8 27.8 30.1 29.4 42.8 31.9 8 Adjusted with 95% CI 29 (26-35) 57 398 Woodstock Road 20.9 26.4 337 Adjusted with 95% CL 31 (27 - 37) 28.9 38.0 36.0 52.1 6 58 61 Beersbridge Road Adjusted with 95% CI 28 (24 - 33) 31.6 39.2 28.0 30.5 5 29.8 59 York Street 62. Adjusted with 95% CI 40 (35 - 47) 43.4 38.4 46.3 26.3 ision has been applied

Discussion of Choice of Factor to Use

In deciding the appropriate bias-adjustment factor to use Belfast City Council considered a number of factors and came to the conclusion co-location biasadjustment was the preferred choice. This decision was based on the most suitable approach as outlined in LAQM-TG(09) Box 3.3 on the grounds that the co-location site used generally has "good" precision for the diffusion tubes with high quality results. In addition, this method was also chosen for constancy reasons as the site has been used for co-location bias-adjustment in previous rounds of R&A.

PM Monitoring Adjustment

Both the Belfast Centre and Stockman's Lane site use an FDMS for particulate matter monitoring. Belfast City Council do not make any adjustments to the PM_{10} data as AEA Energy & Environment have been appointed to undertake all data management. AEA have confirmed no correction factor was applied to the 2009 data as FDMS monitoring generates a nominal "gravimetric-equivalent result".

QA/QC of Automatic Monitoring

Belfast City Council staff carry-out regular calibrations of all the automatic monitoring stations, and aim to carry-out a calibration every two weeks, however this is not always possible due to staff constraints.

In addition to the routine in-house calibrations BCC have appointed AEA Energy & Environment to undertake quality control audits to all monitoring stations. The quality control programme employed by this independent organisation is based on that outlined within LAQM.TG(09).

The audits provide valuable information on equipment performance and also a sixmonthly assessment of all station calibration cylinder concentrations, ensuring that the concentrations remain stable and are thus suitable for data scaling purposes.

To ensure high quality data and uninterrupted data dissemination BCC appointed AEA Energy & Environment to undertake data management services to all monitoring stations.

This service provides:

- Daily data collection
- Screening, scaling and data ratification
- Fault notification to facilitate engineering support call out
- Data reporting (via the Northern Ireland Air Quality Archive)

QA/QC of Diffusion Tube Monitoring

GRADKO Environmental Laboratory; Nitrogen Dioxide (NO₂) WASP Results.



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 2010

WASP Round No:-R108A R108B R109A R109B R110A R110B R111A R111B 1.47 1.54 Assigned Value 1.92 1.03 1.27 0.99 2.37 1.84 GLM7 1.074 1.022 1.862 1.443 0.891 2.245 1.57 1.851 GLM7 1.065 1.872 1.462 1.236 0.930 2,240 1.864 1.532 0.911 Average 1.155 1.044 2.243 1.858 1.867 1.453 1.551 Z Score -0.3 -0.2 0.2 -1.2 -0.9 -0.7 0.1 0.1 1.896 GLM9 1.978 1.521 1.299 1.076 0.901 2.264 1.590 GLM9 2.028 1.536 1.252 1.075 0.934 2.243 1.599 1.9 Average 2.003 1.529 1.276 1.076 0.918 2.254 1.599 .898 Z Score 0.6 0.5 0.6 0.1 -0.8 -0.6 0.5 0.4

Analysis by UV/Vis spectrophotometry (GLM7) and continuous flow analysis (GLM9)

 Analyst
 E. Bancerz
 S. Facey
 S. Facey
 L. Dafter
 L. Dafter
 A. Ratcliffe
 A. Ratcliffe

 B. Le Ber
 A. Le Ber
 A. Le Ber



Appendix B: Belfast City Council Air Quality Management Area Location Map



Appendix C: Belfast City Council Air Quality Monitoring Station Details

Belfast Centre

Site Name: Belfast Centre Site Type: Urban Centre Site Comments: Lombard St. Irish Grid Coords: J333898 374358

Monitoring Network: Non-Automatic Hydrocarbon Network

Parameter	Date Started	Date Ended
Benzene	07/05/2002	Ongoing

Parameter	Date Started	Date Ended
Carbon monoxide	08/03/1992	Ongoing
Nitric oxide	08/03/1992	Ongoing
Nitrogen dioxide	08/03/1992	Ongoing
Ozone	08/03/1992	Ongoing
PM10 particulate matter (hourly	08/03/1992	Ongoing
Measured)		
Sulphur dioxide	08/03/1992	Ongoing
Nitrogen oxides as nitrogen dioxide	08/03/1992	Ongoing
Enclosure Temperature	08/03/1992	Ongoing



Stockman's Lane

Site Name: Belfast Stockman's Lane Site Type: Roadside Site Comments: Irish Grid Coords: J331004 371230

Parameter	Date Started	Date Ended
Nitric oxide	13/04/2006	Ongoing
Nitrogen dioxide	13/04/2006	Ongoing
Nitrogen oxides as nitrogen dioxide	13/04/2006	Ongoing
PM10 particulate matter (hourly	13/04/2006	Ongoing
Measured)		



Upper Newtownards Road

Site Name: Ballyhackamore Site Type: Roadside Site Comments: Irish Grid Coords: J337911 373972

Monitoring Network: Non-Automatic Hydrocarbon Network

Parameter	Date Started	Date Ended
Benzene	07/05/2002	09/10/2007

Parameter	Date Started	Date Ended
Nitric oxide	01/04/2002	Ongoing
Nitrogen dioxide	01/04/2002	Ongoing
Nitrogen oxides as nitrogen dioxide	01/04/2002	Ongoing



Ormeau Road

Site Name: Belfast Ormeau Road Site Type: Roadside Site Comments: Irish Grid Coords: J334272 373012

Parameter	Date Started	Date Ended
Nitric oxide	24/05/2006	Ongoing
Nitrogen dioxide	24/05/2006	Ongoing
Nitrogen oxides as nitrogen dioxide	24/05/2006	Ongoing



Belfast Westlink

Site Name: Belfast Westlink Site Type: Roadside Site Comments: Irish Grid Coords: J332546 373427

Parameter	Date Started	Date Ended
Nitric oxide	03/03/2010	Ongoing
Nitrogen dioxide	03/03/2010	Ongoing
Nitrogen oxides as nitrogen dioxide	03/03/2010	Ongoing
PM10 particulate matter (hourly	03/03/2010	Ongoing
Measured)		

