Belfast City Council
2016 Air Quality Progress Report

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

April 2016

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Executive Summary

Belfast City Council has completed this 2016 Air Quality Progress Report in accordance with the provisions of the Environment (Northern Ireland) Order 2002 and the Northern Ireland Local Air Quality Management Policy Guidance document LAQM.PGNI (16).

In undertaking this report, we have completed a review of recent ambient air quality monitoring data across the city in order to identify locations where new or existing exceedences of Air Quality Strategy objectives and European Commission limit values are occurring. The review will also identify locations where ambient air quality has improved and exceedences are no longer occurring.

Belfast City Council has declared four air quality management areas across the city for exceedences of nitrogen dioxide and particulate matter short and longer-term air quality strategy objectives. A review of the monitoring data for these air quality management areas indicates that although there have been some recent improvements in nitrogen dioxide levels across the city, the air quality management areas will need to be maintained for the time being, particularly in the case of the M1 Motorway / A12 Westlink corridor. Both automatic and passive nitrogen dioxide monitoring is undertaken throughout Belfast to continually review the situation. Sustained improvements in particulate matter within the M1 Motorway / A12 Westlink air quality management area resulted in the revocation for this pollutant in September 2015. The area remains as an air quality management area for exceedences of nitrogen dioxide.

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

There have been no monitored exceedences of Air Quality Strategy Objectives for any other ambient pollutant in recent years across the city, and no new sources have been identified which would have the potential to change this therefore no other pollutants will be considered in this report.

Several new developments have occurred throughout Belfast since the 2015 Update and Screening Assessment. 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.

In December 2015 the council along with relevant partner organisations launched a new Air Quality Action Plan (AQAP) 2015-2020 for the city that draws upon all forms of air quality and transport planning activities, including sustainable transport options as well as engineering solutions. The aim of this AQAP is to improve road vehicle operations and promote and enable a shift onto more sustainable modes of transport to achieve compliance with the NO_2 EU limit value by 2020.

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1 Introduction

1.1 Description of Local Authority Area

Belfast is the capital of Northern Ireland and as such, the city, and its wider metropolitan area, is the largest settlement in the region and the second largest city on the island of Ireland with a population of around 343,445. The city lies at the head of Belfast Lough in the lower reaches of the Lagan Valley and is flanked by the Black Mountain to the west and Castlereagh Hills to the east. The Belfast City Council district area sits at the heart of the growing population of the wider Belfast Metropolitan Urban Area, which comprises also the surrounding district council areas of Castlereagh, Lisburn, North Down, Newtownabbey and Carrickfergus.

In terms of historical air quality issues, Belfast used to experience sustained elevated levels of sulphur dioxide (SO_2) and particulate matter (PM_{10}), associated principally with the widespread use of solid fuel for domestic heating. However, through the introduction of the council's smoke control programme in the late 1960s, the Clean Air (Northern Ireland) Order 1981 and the more recent availability of natural gas to domestic, commercial and industrial sectors, levels of particulate matter and sulphur dioxide have declined substantially over recent years to the extent that we do not experience exceedences of any of the air quality strategy objectives, or indeed European Commission limit values, for either of these pollutants. Accordingly, the number of locations where we monitor these ambient pollutants has been reduced over recent years in accordance with the government's risk and exposure based approach to air quality management.

As levels of sulphur dioxide and particulate matter have declined across the city over recent years, so emissions of nitrogen dioxide, associated principally with road transport, have become more prominent. This is a similar situation to that experienced in many other major cities and conurbations across the United Kingdom. Accordingly, as a result of the first round of the review and assessment process, which was completed in 2004, Belfast City Council opted to declare four air quality management areas across the city. We published our first Air Quality Action Plan for the city in 2006 and it was completed substantially in 2010 with around 90% of planned actions delivered to schedule. A new Air Quality Action Plan has been

published for the city for the period 2015-2020 to address remaining nitrogen dioxide exceedences.

1.2 Purpose of Progress Report

This report fulfils the requirements of the Local Air Quality Management (LAQM) process as set out in the Environment (Northern Ireland) Order 2002, the Air Quality Strategy for England, Scotland, Wales and Northern Ireland 2007 and the relevant Policy and Technical Guidance documents. The LAQM process places an obligation on all local authorities to regularly review and assess air quality in their areas, and to determine whether or not the air quality objectives are likely to be achieved. Where exceedences are considered likely, the local authority must then declare an Air Quality Management Area (AQMA) and prepare an Air Quality Action Plan (AQAP) setting out the measures it intends to put in place in pursuit of the objectives.

For Local Authorities in Northern Ireland, 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 LAQM 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 µg/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 LAQM in Northern Ireland

Pollutant	Air Quality Objective		Date to be achieved by
	Concentration	Measured as	
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 mg/m^3	Running 8-hour mean	31.12.2003
Lead	0.50 µg/m^3	Annual mean	31.12.2004
	0.25 µg/m^3	Annual mean	31.12.2008
Nitrogen dioxide	200 µg/m^3 not to be exceeded more than 18 times a year	1-hour mean	31.12.2005
	40 µg/m^3	Annual mean	31.12.2005
Particulate matter (PM_{10}) (gravimetric)	50 µg/m^3, not to be exceeded more than 35 times a year	24-hour mean	31.12.2004
	40 µg/m^3	Annual mean	31.12.2004
Sulphur dioxide	350 µg/m^3, not to be exceeded more than 24 times a year	1-hour mean	31.12.2004
	125 µg/m^3, not to be exceeded more than 3 times a year	24-hour mean	31.12.2004
	266 µg/m^3, not to be exceeded more than 35 times a year	15-minute mean	31.12.2005

1.4 Summary of Previous Review and Assessments

As part of the review and assessment process, Belfast City Council completed a 2nd and 3rd stage review and assessment of air quality throughout the city in early 2004. This assessment concluded that modelled and monitored exceedences of short and longer-term objectives for both nitrogen dioxide and particulate matter were occurring in the city and would be likely to continue to do so in some locations beyond 2010. Consequently, in August 2004 the council, in consultation with other relevant authorities, declared four Air Quality Management Areas (AQMA), 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 annual and hourly-mean nitrogen dioxide concentrations would exceed the 2005 Air Quality Strategy objectives. In addition, particulate matter annual and 24-hour mean concentrations were predicted also to exceed relevant objectives in this location. The three other air quality management areas were declared on the grounds that the annual mean nitrogen dioxide objective would be exceeded in these locations during 2005 and beyond. A subsequent source apportionment study, completed for the air quality management areas, indicated that the principal cause of the exceedences was emissions emanating from road transportation.

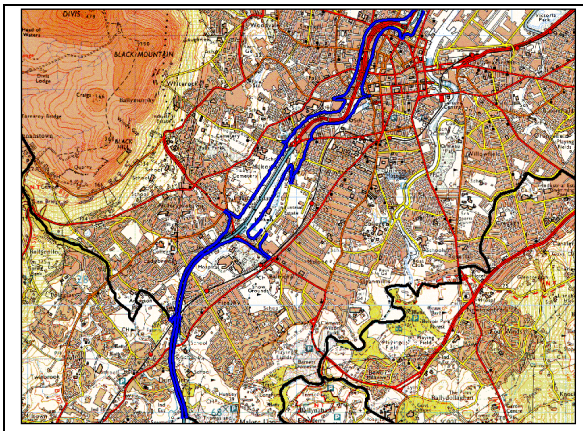
Current air quality management areas are described and depicted in more detail as follows:

1. The M1 / Westlink corridor from the Belfast City boundary at Sir Thomas and Lady Dixon Park to the end of the Westlink at the junction with Great George's Street and York Street including Stockman's Lane and Kennedy Way. This area was declared for predicted exceedences of both the nitrogen dioxide and particulate material annual mean air quality strategy objectives as well as exceedences of the particulate matter 24-hour mean objective and the nitrogen dioxide 1-hour mean objective. The boundary of the air quality management area is denoted in blue and has been set to take account of dispersion modelling uncertainties. This

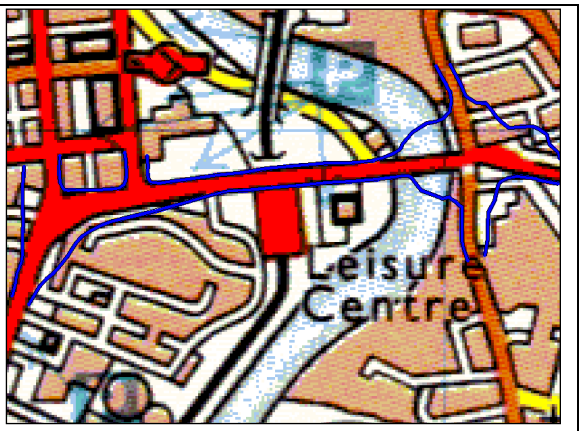
area was revoked for exceedences of particulate matter in September 2015, however continues to exceed air quality objectives for nitrogen dioxide.

2. Cromac Street to the junction with East Bridge Street and then from East Bridge Street to the junction with the Ravenhill and Albertbridge Roads and Short Strand. This area was declared for predicted exceedences of the nitrogen dioxide annual mean air quality strategy objective.
3. The Upper Newtownards Road from the North Road junction to the Belfast City boundary at the Ulster Hospital incorporating the Knock Road to the City boundary at Laburnum Playing Fields and Hawthornden Way. This area was declared for predicted exceedences of the nitrogen dioxide annual mean air quality strategy objective. The Belfast City Council boundary with Castlereagh Borough council is denoted by the solid black line.
4. The Ormeau Road from the junction with Donegall Pass to the City boundary at Galwally. This area was declared for predicted exceedences of the nitrogen dioxide annual mean air quality strategy objective.

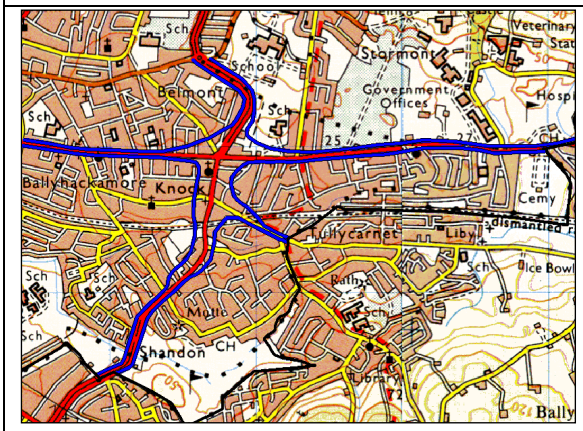
Figure 1.1 – Maps of AQMA Boundaries



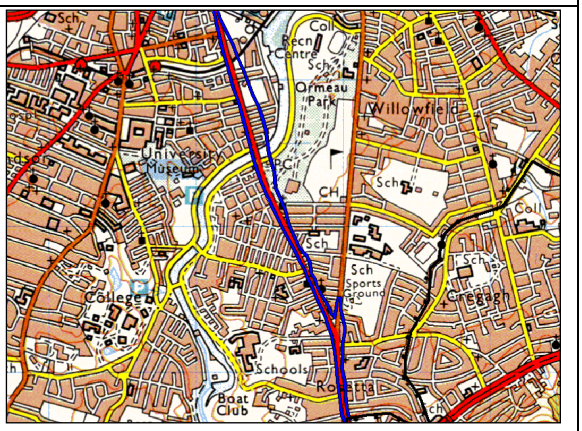
1. M1-Westlink AQMA



2. Cromac Street and Albertbridge Street AQMA



3. Upper Newtownards Road AQMA



4. Ormeau Road AQMA

A further detailed air quality assessment was completed by Belfast City Council in 2010, informed by the outcome of the 2009 Updating and Screening Assessment. Accordingly, the 2010 detailed assessment considered the potential for exceedences of the nitrogen dioxide objectives at a number of further locations across the city including the junction of the Sydenham Bypass with the Lower Newtownards Road, Shaftesbury Square, Donegall Road and Albertbridge Road, and at locations throughout the city centre. Although atmospheric dispersion modelling studies, undertaken as part of the detailed review and assessment process, did suggest exceedences of the nitrogen dioxide annual mean objective at some the of above-mentioned locations, the review and assessment identified also that there was no relevant public exposure at these locations during 2010. As a result, the 2010 Detailed Air Quality Assessment for Belfast City Council concluded that there was no need to declare further air quality management areas or to expand or revoke the existing AQMAs. This view was accepted by government.

Ambient air quality monitored results as presented in previous annual progress and update and assessment reports identified sustained improvements in particulate matter within the M1 Motorway / A12 Westlink air quality management area confirming that it has been in compliance with the objective for a number of years now. This has resulted in the Westlink / M1 AQMA being revoked for particulate matter in September 2015.

The current stage in the Review and Assessment process is to conduct a Progress Report. This report follows LAQM.TG(16) 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.

For reference and additional background information, historical Belfast City Council air quality review and assessment reports are listed in the following table, and are available to download from the Department of Environment for Northern Ireland 'Northern Ireland Air' website.

Table 1.2 Historical Belfast City Council Air Quality Reports.

Title	Publication date
2015 Updating and Screening Assessment	April 2015
2014 Progress Report	April 2014
2013 Progress Report	April 2013
2012 Updating and Screening Assessment	April 2012
2011 Progress Report	April 2011
2010 Detailed Assessment	September 2010
2010 Progress Report	April 2010
2009 Updating and Screening Assessment	April 2009
2008 Progress Report	April 2008
2007 Detailed assessment	April 2007
2007 Progress Report	April 2007

*All Historical Belfast City Council Air Quality Reports are available at: http://www.airqualityni.co.uk/laqm/district-council-reports

2 New Monitoring Data

2.1 Summary of Monitoring Undertaken

2.1.1 Automatic Monitoring Sites

Belfast City Council operate a number of automatic monitoring stations across the city in order to inform its air quality management processes and to provide real time information to the public in relation to pollution levels within our air quality management areas.

Accordingly, to ensure that the data from our sites is both accurate and representative, the monitors at each site are calibrated on a four-weekly basis by the council's Air Quality Officers in accordance with the procedures detailed in the Defra Automatic Urban and Rural Network (AURN) local site operators' manual. In addition, data management, quality assurance and quality control and service and maintenance support are all provided by appointed contractors. The data from our sites is made available to the Department of Environment for Northern Ireland and is reported on the 'Northern Ireland Air' website. For consistency, all automatic monitoring data reported in this progress report has been obtained from the 'Northern Ireland Air' website. Automatic data reported in this report relates to the calendar year (i.e. January – December) and data capture levels exceed substantially the Department's 75% data capture threshold for the calculation of annual statistics at all sites. Further information regarding our QA/QC procedures and processes can be obtained in appendix A to this report.

In relation to data correction for our automatic data, this process is generally of principal concern with regard to the treatment of particulate matter monitoring data. The Belfast Centre site uses Filter Dynamics Measurement System (FDMS) equipped Tapered Element Oscillating Microbalances (TEOMs) for particulate matter (PM_{10}) monitoring. Government equivalence tests have determined that this equipment meets the equivalence criteria and on that basis, no correction factor needs to be applied to this monitoring data.

The Stockmans Lane site is equipped with a Beta Attenuation Monitor (BAM) with unheated inlet for monitoring particulate matter. Government technical guidance

highlights that a BAM, equipped with an unheated inlet, meets the equivalence criteria for PM_{10} monitoring, provided that the results are corrected for slope. This correction involves dividing measured concentrations by a factor of 1.21. It should be noted that the data presented on the Northern Ireland Air website and in this report have already been corrected to the reference equivalent.

A location map for monitoring sites relative to the Greater Belfast area can be found below in Figure 2.1 and further site details are provided in Table 2.1.

Figure 2.1 – Location Map of Automatic Monitoring Sites

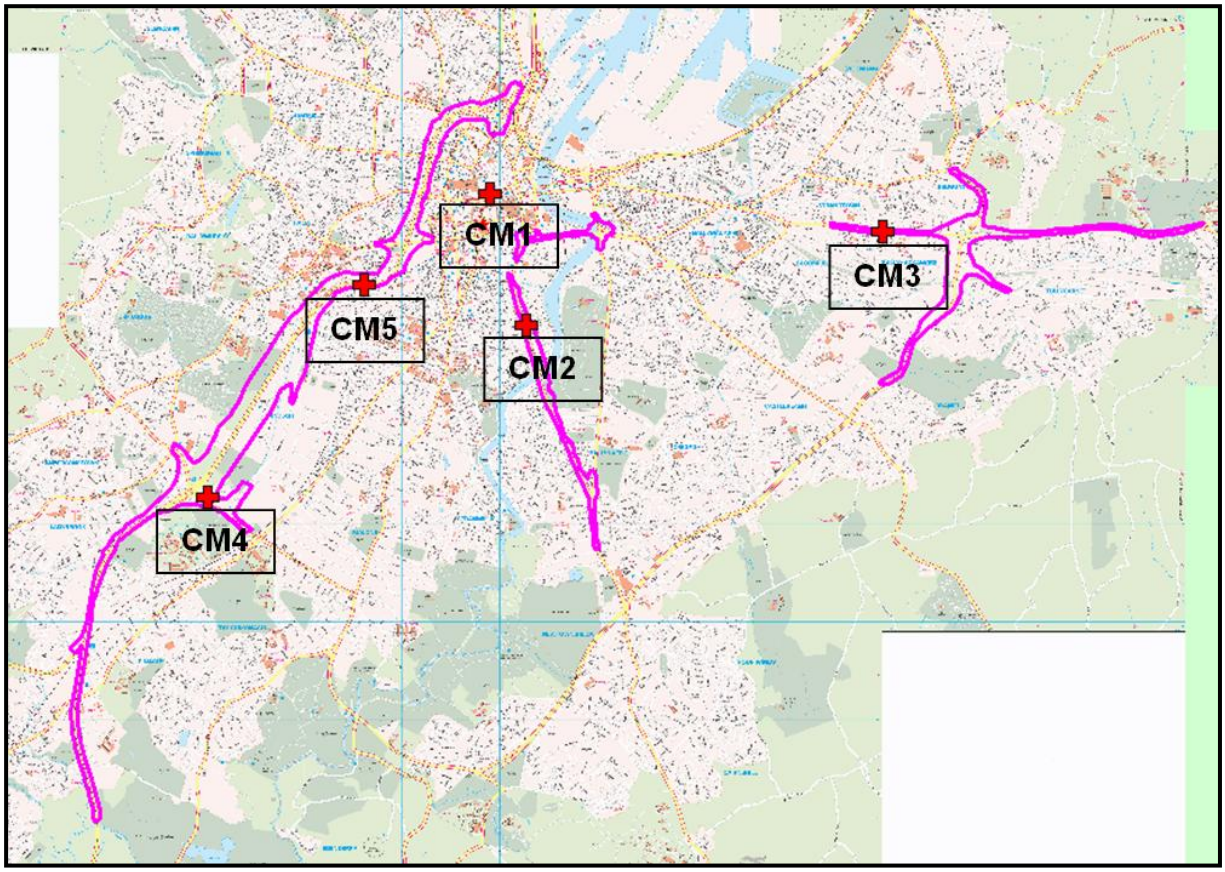


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Table 2.1 – Details of Automatic Monitoring Sites

Site ID	Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Inlet Height (m)	Pollutants Monitored	In AQMA?	Monitoring Technique	Relevant Exposure? (Y/N with distance (m) from monitoring site to relevant exposure)	Distance to Kerb of Nearest Road (m) (N/A if not applicable)	Does this Location Represent Worst-Case Exposure?
CM1	Belfast Centre AURN site Lombard Street	Urban Centre	333898	374358	4.0	Nitrogen dioxide, sulphur dioxide, carbon monoxide, ozone and particulate matter (PM_{10} and $PM_{2.5}$)	N	Chemiluminescence, UV Fluorescence, IR Absorption, UV Absorption, TEOM (Tapered Element Oscillating Microbalance) with FDMS (Filter Dynamics Measurement System) Sharp Cut Cyclone for $PM_{2.5}$	Y (monitoring site is located in a city centre pedestrian precinct)	30 m	Y
CM2	Belfast Ormeau Road	Roadside	334272	373012	1.3	Nitrogen dioxide	Y	Chemiluminescence	Y (6 m)	3 m	Y
CM3	Belfast Ballyhackamore	Roadside	337911	373972	1.3	Nitrogen dioxide	Y	Chemiluminescence	Y (7 m)	1.5 m	Y
CM4	Belfast Stockman's Lane	Roadside	331010	371252	3.5	Nitrogen dioxide and Particulate matter (PM_{10})	Y	Chemiluminescence Beta Attenuation Monitor	Y (6 m to façade of housing and 1m to gardens)	2 m	Y
CM5	Belfast Westlink Roden Street	Roadside	332617	373431	2.6	Nitrogen dioxide	Y	Chemiluminescence	Y (20 m)	5 m	Y

2.1.2 Non-Automatic Monitoring Sites

The government's risk and exposure-based approach to air quality management has meant that Belfast City Council's principal focus has been on addressing city-wide ambient nitrogen dioxide levels over recent years. Accordingly, in order to understand how nitrogen dioxide levels are varying across the city and in addition to our automatic analysers, the council uses passive diffusion tubes for monitoring nitrogen dioxide at both background and roadside locations across the city. These locations are detailed in Figure 2.2 and Table 2.2.

Diffusion tubes are comprised of a small clear plastic tube containing a chemical reagent supported on stainless steel grids that absorbs the pollutant directly from the air. In this case, triethanolamine is used to monitor levels of ambient nitrogen dioxide. Belfast City Council's diffusion tubes are exposed for successive four-week periods generally in accordance with the dates recommended by Defra and, as a result, they provide a good general indication of average nitrogen dioxide concentrations, thereby allowing a comparison with the annual mean objective.

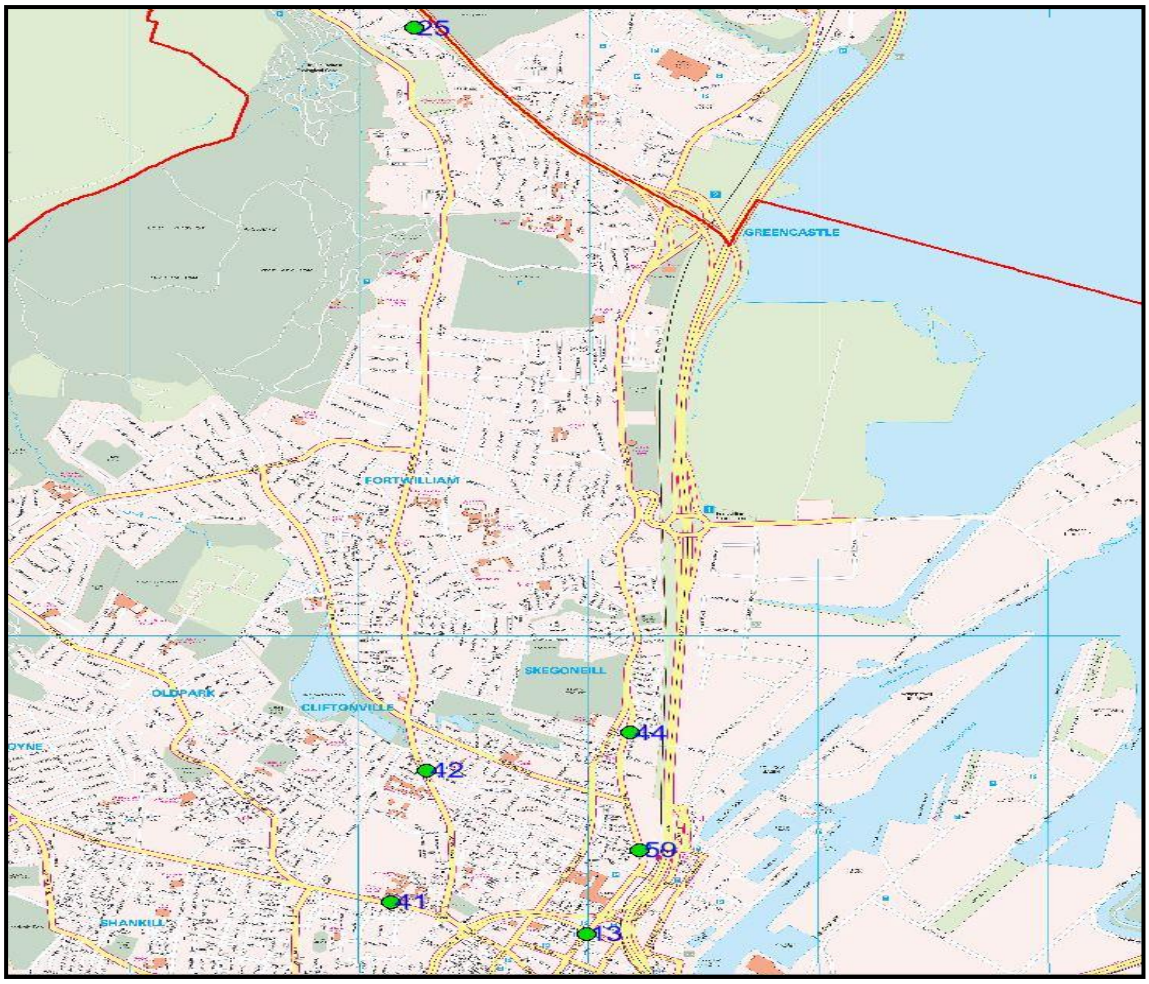
To ensure that experimental error is minimised in the preparation and analysis of its nitrogen dioxide diffusion tubes, Belfast City Council has appointed Gradko to supply, analyse and report data for its diffusion tubes. Gradko employs a 20% triethanolamine solution for monitoring ambient nitrogen dioxide and adheres to the requirements of the government's 'Diffusion Tubes for Ambient NO_2 Monitoring: Practical Guidance for Laboratories and Users' publication.

To ensure further that its diffusion tube monitoring data is as accurate as possible, the council co-locates a number of diffusion tubes with a reference method compliant chemiluminescent nitrogen dioxide analyser at the Lombard Street, Newtownards Road and Stockmans Lane monitoring sites. This process allows a bias adjustment factor (with a 95% confidence interval as an estimate of the uncertainty on the bias adjustment factor) to be calculated that can be used to correct the diffusion tube monitoring data. In the case of diffusion tube data presented in this report, the data has been corrected using a bias adjustment derived from the co-location study at the Belfast Centre Lombard Street AURN site. The bias calculation and data scaling was

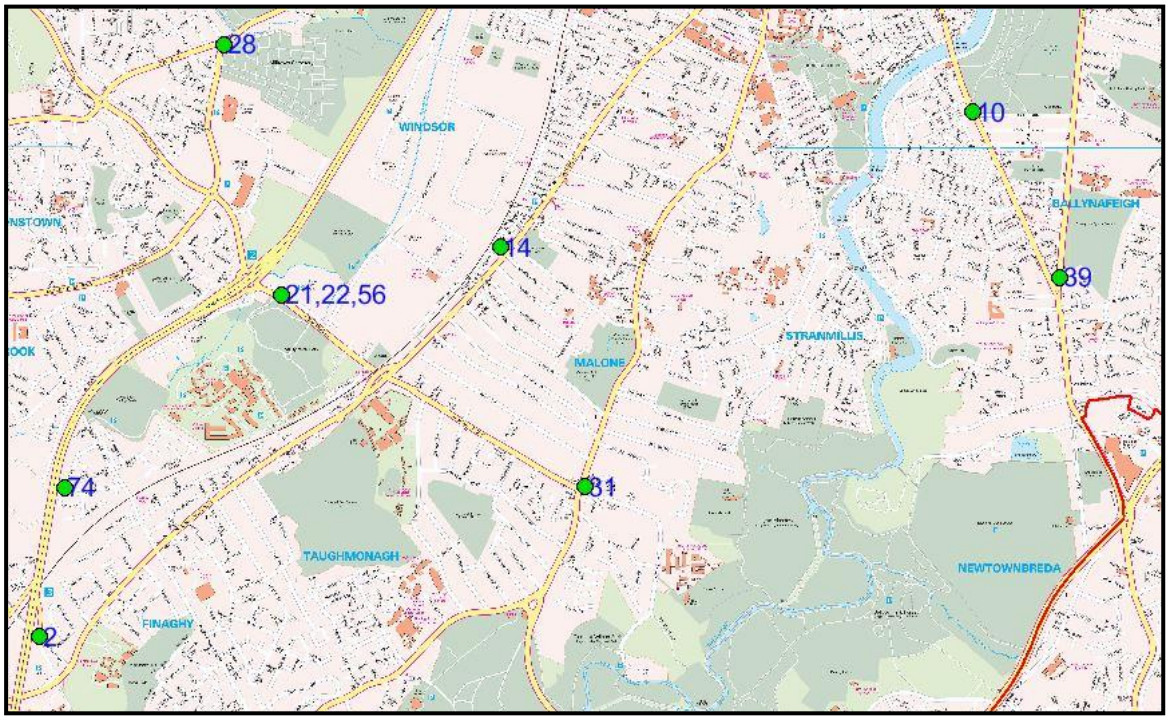
undertaken using Defra's 'Bias Adjustment Factor Calculation' Spreadsheet Version 4. Outputs from the spreadsheet for treatment of Belfast City Council's 2015 data are included in Appendix A to this report. The outputs also show monthly nitrogen dioxide monitoring data for each diffusion tube site for 2015 where available.

Figure 2.2 – Location Maps of Non-Automatic Monitoring Sites

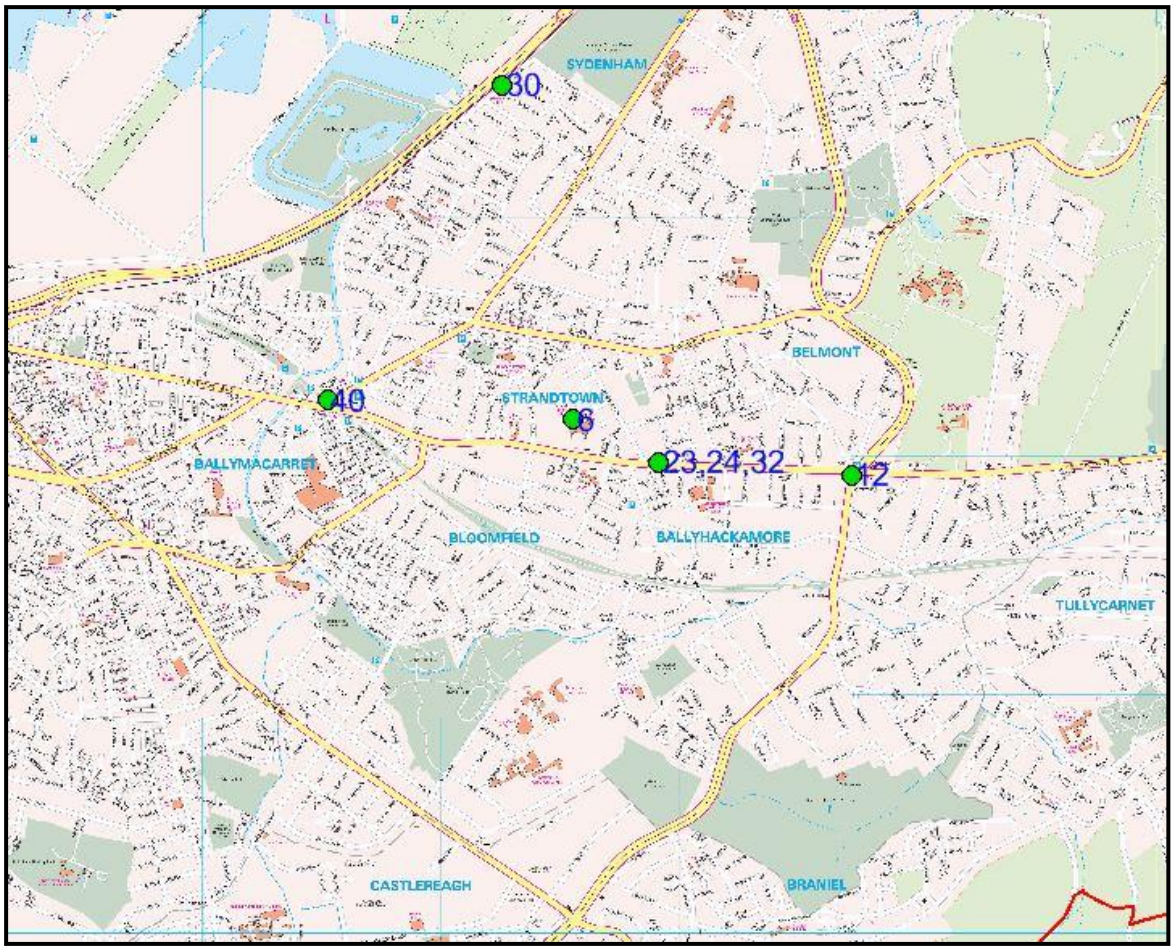
North Belfast



South Belfast



East Belfast



Belfast City Centre

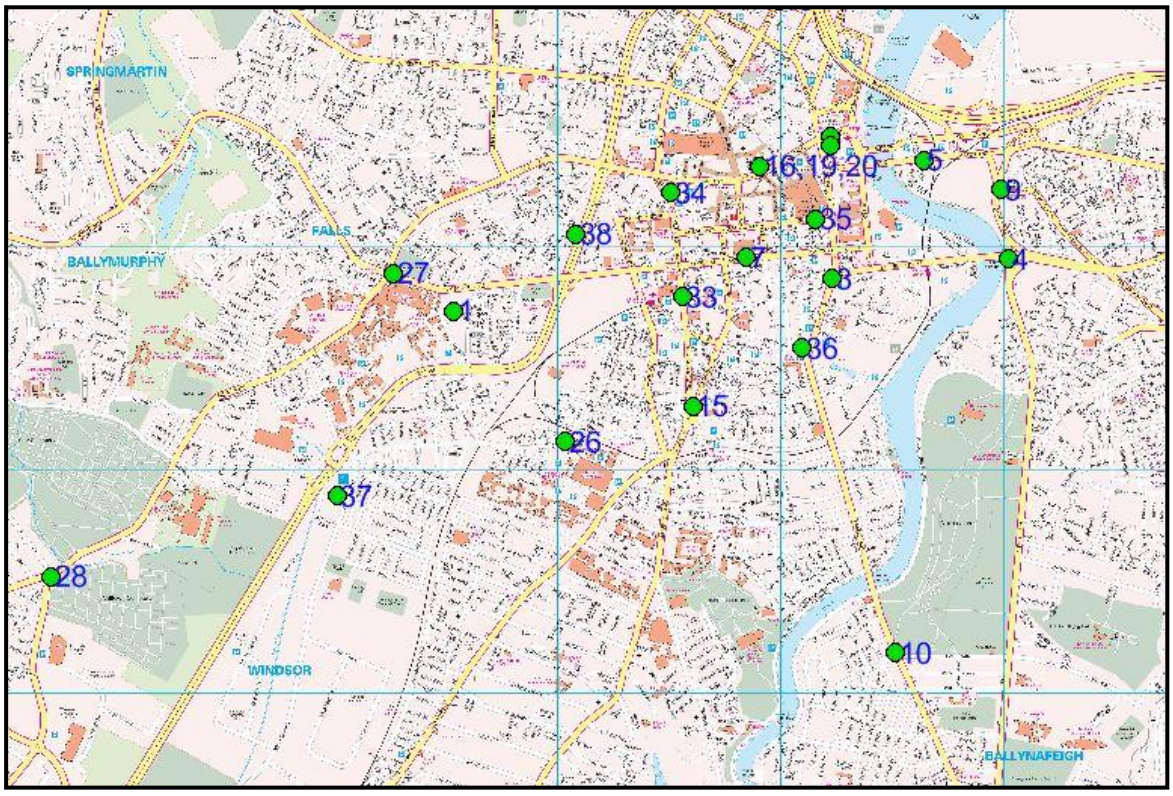


Table 2.2 – Details of Non- Automatic Monitoring Sites

Site ID	Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Site Height (m)	Pollutants Monitored	In AQMA?	Is Monitoring Co-located with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) from monitoring site to relevant exposure)	Distance to Kerb of Nearest Road (m) (N/A if not applicable)	Does this Location Represent Worst-Case Exposure?
1	Royal Victoria Hospital	Urban Background	332522	373708	3.8	NO_2	N	N	>70	>80	N/A
2	Black's Road	Roadside	329782	369522	2.7	NO_2	Y	N	30	2	Y
3	61 Cromac Street	Roadside	334220	373853	3.0	NO_2	Y	N	10	3	Y
4	Ravenhill Road	Roadside	335014	373942	3.0	NO_2	Y	N	45	5	Y
5	Queen's Bridge	Roadside	334570	374393	3.0	NO_2	N	N	13	1	Y
6	North Road	Urban Background	337551	374151	3.0	NO_2	N	N	On School Wall	135	N/A
7	Donegall Square South	Roadside	333837	373950	3.5	NO_2	N	N	N	N/A	Y
9	Short Strand	Roadside	334980	374254	3.2	NO_2	N	N	28	1	Y
10	301 Ormeau Road	Roadside	334503	372176	3.0	NO_2	Y	N	25	7	Y
12	Knock Road	Roadside	338718	373918	2.5	NO_2	Y	N	27	1.5	Y
13	Great George's Street	Kerbside	333981	375102	3.0	NO_2	Y	N	40	0.5	Y

Site ID	Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Site Height (m)	Pollutants Monitored	In AQMA?	Is Monitoring Co-located with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) from monitoring site to relevant exposure)	Distance to Kerb of Nearest Road (m) (N/A if not applicable)	Does this Location Represent Worst-Case Exposure?
14	Lisburn Road	Roadside	332114	371492	2.7	NO_2	N	N	8	1.5	Y
15	Shaftesbury Square	Kerbside	333594	373283	2.7	NO_2	N	N	N	N/A	Y
16,19,20	Lombard Street	Urban Centre	333898	374358	3.5	NO_2	N	Y	N	N/A	Y
17	Albert Clock	Roadside	334212	374489	3.1	NO_2	N	N	3.5	2.5	Y
21,22,56	Stockman's Lane	Roadside	331007	371254	3.0	NO_2	Y	Y	15	2	Y
23,24,32	Ballyhackamore	Roadside	337911	373972	3.0	NO_2	Y	Y	36	1.5	Y
25	Whitewell Road	Roadside	333563	380450	2.7	NO_2	N	N	35	13	Y
26	Donegall Road	Kerbside	333022	373122	2.7	NO_2	N	N	2	1	Y
27	Grosvener Road and Falls Road	Roadside	332252	373878	3.0	NO_2	N	N	25	2	Y
28	Falls Road and Andersonstown	Roadside	330716	372519	3.0	NO_2	N	N	35	2	Y
30	Station Road	Roadside	337252	375555	2.7	NO_2	N	N	28	2	Y
31	Malone Road	Roadside	332478	370289	3.0	NO_2	N	N	18	2	Y
33	Great Victoria Street	Roadside	333548	373772	3.2	NO_2	N	N	N	N/A	Y

Site ID	Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Site Height (m)	Pollutants Monitored	In AQMA?	Is Monitoring Co-located with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) from monitoring site to relevant exposure)	Distance to Kerb of Nearest Road (m) (N/A if not applicable)	Does this Location Represent Worst-Case Exposure?
34	College Square East	Roadside	333498	374241	3.0	NO_2	N	N	3	3	Y
35	Chichester Street	Roadside	334147	374123	3.5	NO_2	N	N	2	2	Y
36	Cromac & Ormeau Avenue	Kerbside	334085	373542	2.5	NO_2	Y	N	3	1	Y
37	Glenmachan Street	Roadside	331999	372881	3.0	NO_2	Y	N	12	2	Y
38	Creche on M1/Westlink	Roadside	333006	374061	3.0	NO_2	Y	N	10	1.5	Y
39	Ormeau Road (junction with Ravenhill Road)	Roadside	334943	371342	3.0	NO_2	Y	N	10	2	Y
40	Upper Newtownards Road & Hollywood Road	Roadside	336519	374233	3.0	NO_2	N	N	40	7	Y
41	Crumlin Road	Roadside	333195	375279	3.5	NO_2	N	N	10	2	Y
42	228 Antrim Road	Roadside	333288	376143	2.7	NO_2	N	N	18	2	Y

Site ID	Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Site Height (m)	Pollutants Monitored	In AQMA?	Is Monitoring Co-located with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) from monitoring site to relevant exposure)	Distance to Kerb of Nearest Road (m) (N/A if not applicable)	Does this Location Represent Worst-Case Exposure?
44	Shore Road (Ivan Street end)	Roadside	334174	376384	3.0	NO_2	N	N	2.5	3.5	Y
59	York Street	Roadside	334212	375614	2.7	NO_2	Y	N	5	2	Y
63	Queens Square	Kerbside	334208	374507	2.7	NO_2	N	N	Building Façade	5	Y
74	Ardmore Park	Roadside	329908	370278	2.7	NO_2	N	N	6	1.5	Y

2.2 Comparison of Monitoring Results with Air Quality Objectives

2.2.1 Nitrogen Dioxide (NO_2)

Automatic Monitoring Data

Tables 2.3 and 2.4 summarise recent monitoring data from the council's nitrogen dioxide automatic analysers for 2015 and preceding years from 2011. In all cases, exceedences of the Air Quality Strategy Objectives are highlighted in bold. In addition, trends in annual mean monitoring data for nitrogen dioxide are summarised in Figure 2.3.

Annual mean concentrations at the Belfast Centre AURN site continue to remain below the 40 μ/gm^{-3} annual mean objective for nitrogen dioxide as denoted by the solid red line on the graph.

Belfast Ormeau Road site experienced extensive problems with the air conditioning in 2012 and 2013 which prevented the monitoring equipment working to full capacity. As this had been a reoccurring problem a decision was made towards the end of 2013 to upgrade the site. Taking account of procurement requirements and liaison with NIE this upgrade took a considerable length of time to the point that data capture from this site was so low it was not considered reliable to report the data from this site for 2013 and we would question the realibility of the 2012 data as it does not appear to follow any trend. Following the site upgrade, the annual mean concentration has continued to drop to 28 μ/gm^{-3} in 2014 and 27 μ/gm^{-3} in 2015. The council will continue to monitor the Ormeau Road air quality management area until a more definitive understanding of nitrogen dioxide levels and trends emerge.

From the data in Table 2.3, it can be seen that concentrations along the Upper Newtownards Road have remained in the thirties from 2011 to the extent that the nitrogen dioxide annual mean objective has now been achieved along the Upper Newtownards Road. Nonetheless, the council will continue to monitor nitrogen dioxide concentrations along the Upper Newtownards Road in order to determine whether this improvement in ambient conditions is sustained.

Unfortunately, despite the completion of significant structural improvements to the M1 Motorway and A12 Westlink corridor, nitrogen dioxide concentrations along Stockmans Lane continue to significantly exceed the 40 µg/m^{-3} annual mean objective for nitrogen dioxide with levels averaging around 53 µg/m^{-3} in the last two years. There are a number of residential premises directly adjacent to the carriageway at Stockmans Lane necessitating continuation of the air quality management area for this location.

Concentrations monitored at Westlink Roden Street site continue to remain below the 40 µg/m^{-3}, with an average of 36µg/m^{-3} annual mean over the previous five years. The council will continue to monitor the Westlink Corridor/M1 air quality management area until a more definitive understanding of nitrogen dioxide levels and trends emerge.

Historically, modelled and monitored exceedences of the 1-hour mean objective for nitrogen dioxide were encountered only in the vicinity of the M1 Motorway / A12 Westlink corridor. As a result, this is the only air quality management area within Belfast that has been declared on the basis of exceedences of the 1-hour objective. From ambient monitoring data for Stockman's Lane, as summarised in Table 2.4, it can be seen that the number of exceedences of the hourly objective has substaintally decreased in the last two years to comply with the objective of 200 µg/m^{-3} not to be exceeded more than 18 times in a year. As there are residential properties located directly adjacent to the carriageway in Stockman's Lane and most of these properties have gardens facing onto the roadway thereby providing for short-term relevant public exposure we will continue to monitor at this location to identify trends.

Table 2.3 – Results of Automatic Monitoring for NO_2: Comparison with Annual Mean Objective

Site Name	Site Type	Within AQMA?	Valid Data Capture for Monitoring Period % [a]	Valid Data Capture 2015 % [b]	Annual Mean Concentration (µg/m^3)				
					2011* [c]	2012* [c]	2013* [c]	2014* [c]	2015 [c]
Belfast Centre	Urban Centre	N	93	93	28	29	31	31	29.0
Belfast Ormeau Road	Roadside	Y	99	99	35	**53**	N/A	28	27
Belfast Ballyhackamore	Roadside	Y	92	92	37	38	37	35	33.0
Belfast Stockman's Lane	Roadside	Y	99	99	**63**	N/A	**53**	**56**	**50**
Belfast Westlink Roden Street	Roadside	Y	99	99	33	39	38	35	34

In bold, exceedence of the NO_2 annual mean AQS objective of 40µg/m^3

[a] i.e. data capture for the monitoring period, in cases where monitoring was only carried out for part of the year

[b] i.e. data capture for the full calendar year (e.g. if monitoring was carried out for six months the maximum data capture for the full calendar year would be 50%)

[c] Means should be "annualised" as in Boxes 7.9 and 7.10 of LAQM.TG16, if valid data capture is less than 75%

* Annual mean concentrations for previous years are optional

Figure 2.3 – Trends in Annual Mean NO_2 Concentrations Measured at Automatic Monitoring Sites

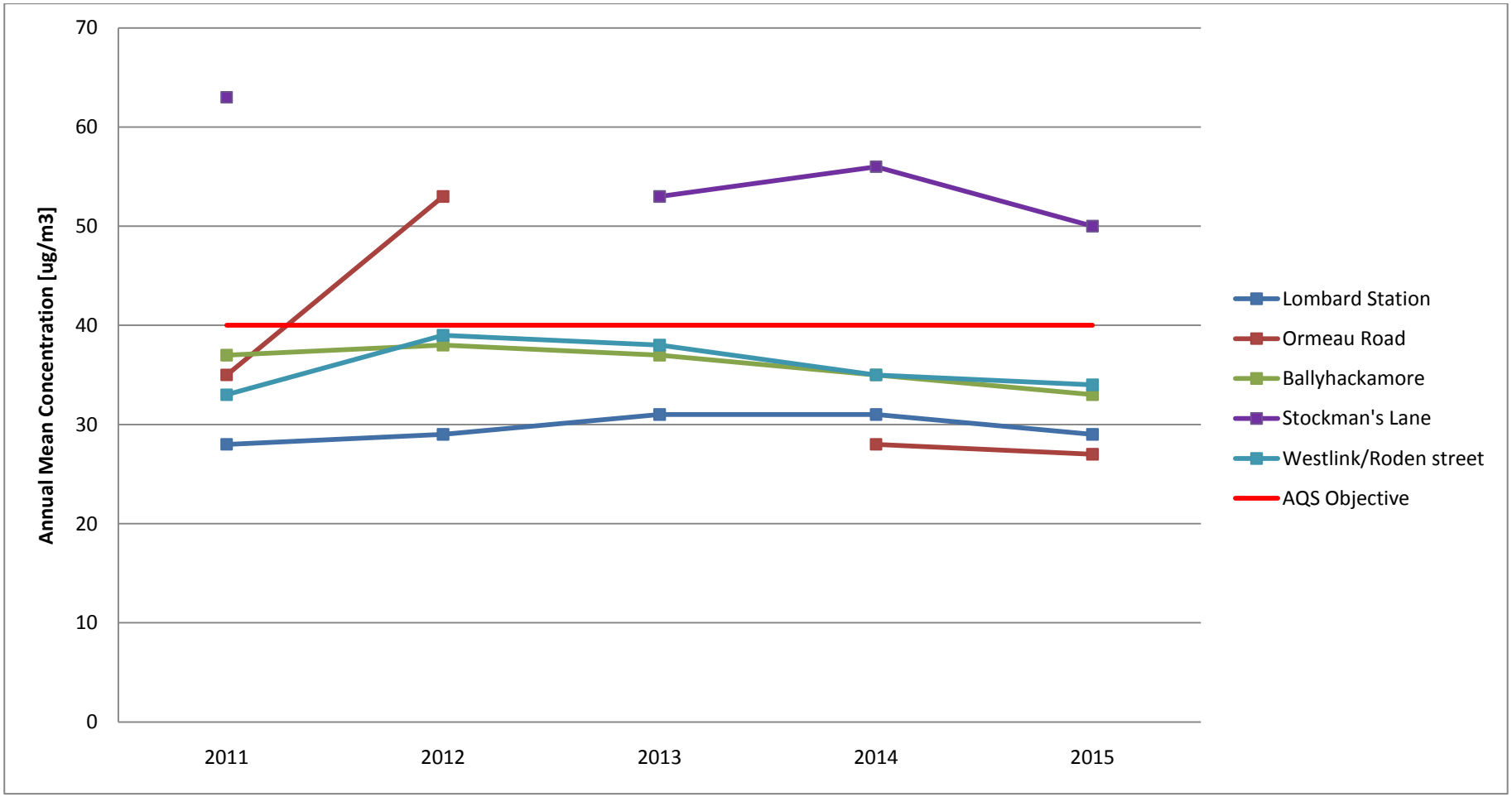


Table 2.4 – Results of Automatic Monitoring for NO_2: Comparison with 1-hour Mean Objective

Site Name	Site Type	Within AQMA?	Valid Data Capture for Monitoring Period % [a]	Valid Data Capture 2015 % [b]	Number of Hourly Means > 200µg/m^3				
					2011* [c]	2012* [c]	2013* [c]	2014* [c]	2015 [c]
Belfast Centre	Urban Centre	N	93	93	0	5	2	0	0
Belfast Ormeau Road	Roadside	Y	99	99	0	3	N/A	0(98)	0
Belfast Ballyhackamo	Roadside	Y	92	92	0	3	0	2	0
Belfast Stockman's Lane	Roadside	Y	99	99	40	**32**(227)	13	14	7
Belfast Westlink Roden Street	Roadside	Y	99	99	3	13	2	0	2

In bold, exceedence of the NO_2 hourly mean AQS objective (200µg/m^3 – not to be exceeded more than 18 times per year)

[a] i.e. data capture for the monitoring period, in cases where monitoring was only carried out for part of the year

[b] i.e. data capture for the full calendar year (e.g. if monitoring was carried out for six months the maximum data capture for the full calendar year would be 50%)

[c] If the data capture for full calendar year is less than 90%, include the 99.8th percentile of hourly means in brackets

* Number of exceedences for previous years is optional

Diffusion Tube Monitoring Data

In order to obtain a better understanding of how levels of nitrogen dioxide are varying across the city over time and to investigate those locations where previous rounds of the review and assessment process have highlighted areas of concern, Belfast City council has placed 37 diffusion tubes at relevant locations across the city. Data from these tubes for 2015 has been summarised in Table 2.5 alongside historical data where it is available in Table 2.6.

In terms of the outcome of the 2015 nitrogen dioxide diffusion tube monitoring, it is noted that the concentrations have generally decreased from last year at most locations. Annual mean exceedences during 2015 occurred at Black's Road, Knock Road, Great George's Street and Stockmans Lane all of which are located within an existing air quality management area and have been the subject of mitigation measures for some time.

Exceedences also occurred at a number of monitoring locations which are not currently declared as air quality management areas including, Short Strand, Albert Clock and Chichester Street. Further assessment using the Defra NO_2 distance calculator was undertaken to confirm if these excedeences apply to relevant receptors. The calculated results as provided in Appendix B predicted that concentrations were below the objective in relation to relevant receptors at all three locations. It is therefore not considered practical to undertake a detailed assessment on these locations.

Table 2.5 – Results of NO_2 Diffusion Tubes 2015

Site ID	Location	Site Type	Within AQMA?	Triplicate or Co-located Tube	Full Calendar Year Data Capture 2015 (Number of Months or %) [a]	2015 Annual Mean Concentration (µg/m^3) - Bias Adjustment factor = XX [b]
1	Royal Victoria Hospital	Urban Background	N	N	100%	22
2	Black's Road	Roadside	Y	N	100%	**43**
3	61 Cromac Street	Roadside	Y	N	100%	39
4	Ravenhill Road	Roadside	Y	N	100%	33
5	Queen's Bridge	Roadside	N	N	100%	31
6	North Road	Urban Background	N	N	92%	16
7	Donegall Square South	Roadside	N	N	100%	34
9	Short Strand	Roadside	N	N	100%	**45**
10	301 Ormeau Road	Roadside	Y	N	100%	34
12	Knock Road	Roadside	Y	N	100%	**42**
13	Great George's Street	Kerbside	Y	N	100%	**47**
14	Lisburn Road	Roadside	N	N	92%	27
15	Shaftesbury Square	Kerbside	N	N	100%	34

Site ID	Location	Site Type	Within AQMA?	Triplicate or Co-located Tube	Full Calendar Year Data Capture 2015 (Number of Months or %) [a]	2015 Annual Mean Concentration (µg/m^3) - Bias Adjustment factor = XX [b]
16,19,20	Lombard Street	Urban Centre	N	Y	100%	29
17	Albert Clock	Roadside	N	N	100%	**42**
21,22,56	Stockman's Lane	Roadside	Y	Y	100%	**49**
23,24,32	Ballyhackamore	Roadside	Y	Y	83%	34
25	Whitewell Road	Roadside	N	N	100%	25
26	Donegall Road	Kerbside	N	N	100%	33
27	Grosvener Road and Falls Road	Roadside	N	N	67%	38
28	Falls Road and Andersonstown	Roadside	N	N	92%	27
30	Station Road	Roadside	N	N	92%	25
31	Malone Road	Roadside	N	N	100%	39
33	Great Victoria Street	Roadside	N	N	100%	40
34	College Square East	Roadside	N	N	83%	33
35	Chichester Street	Roadside	N	N	100%	**43**
36	Cromac & Ormeau Avenue	Kerbside	Y	N	100%	34

Site ID	Location	Site Type	Within AQMA?	Triplicate or Co-located Tube	Full Calendar Year Data Capture 2015 (Number of Months or %) [a]	2015 Annual Mean Concentration (µg/m^3) - Bias Adjustment factor = XX [b]
37	Glenmachan Street	Roadside	Y	N	100%	40
38	Creche on M1/Westlink	Roadside	Y	N	100%	30
39	Ormeau Road (junction with Ravenhill Road)	Roadside	Y	N	83%	31
40	Upper Newtownards Road & Hollywood Road	Roadside	N	N	100%	28
41	Crumlin Road	Roadside	N	N	100%	30
42	228 Antrim Road	Roadside	N	N	92%	37
44	Shore Road (Ivan Street end)	Roadside	N	N	100%	30
59	York Street	Roadside	Y	N	100%	39
63	Queens Square	Kerbside	N	N	100%	38
74	Ardmore Park	Roadside	N	N	83%	35

In bold, exceedence of the NO_2 annual mean AQS objective of 40µg/m^3

Underlined, annual mean > 60µg/m^3, indicating a potential exceedence of the NO_2 hourly mean AQS objective

[a] Means should be "annualised" as in Boxes 7.9 and 7.10 of LAQM.TG16, if full calendar year data capture is less than 75%

[b] If an exceedence is measured at a monitoring site not representative of public exposure, NO_2 concentration at the nearest relevant exposure should be estimated based on the "NO_2 fall-off with distance" calculator (http://laqm.defra.gov.uk/tools-monitoring-data/no2-falloff.html), and results should be discussed in a specific section. The procedure is also explained in paragraphs 7.77 to 7.79 of LAQM.TG16.

Table 2.6 – Results of NO_2 Diffusion Tubes (2011 to 2015)

Site ID	Site Type	Within AQMA?	Annual Mean Concentration (µg/m^3) - Adjusted for Bias [a]				
			2011 (Bias Adjustment Factor = 0.81)	2012 (Bias Adjustment Factor = 0.85)	2013 (Bias Adjustment Factor = 0.94)	2014 (Bias Adjustment Factor = 0.95)	2015 (Bias Adjustment Factor = 0.96)
1	Royal Victoria Hospital	N	21	22	24	23	22
2	Black's Road	Y	40	40	**43**	**42**	**43**
3	61 Cromac Street	Y	36	36	**45**	**42**	39
4	Ravenhill Road	Y	25	29	32	30	33
5	Queen's Bridge	N	23	30	33	34	31
6	North Road	N	18	16	17	15	16
7	Donegall Square South	N	36	35	38	38	34
9	Short Strand	N	40	**43**	**47**	**47**	**45**
10	301 Ormeau Road	Y	31	31	35	35	34
12	Knock Road	Y	38	40	**46**	**47**	**42**
13	Great George's Street	Y	**45**	**48**	**52**	**50**	**47**
14	Lisburn Road	N	27	27	28	30	27
15	Shaftesbury Square	N	36	34	38	38	34
16,19,20	Lombard Street	N	29	29	31	32	29
17	Albert Clock	N	40	39	**47**	**47**	**42**

Site ID	Site Type	Within AQMA?	Annual Mean Concentration (µg/m^3) - Adjusted for Bias [a]				
			2011 (Bias Adjustment Factor = 0.81)	2012 (Bias Adjustment Factor = 0.85)	2013 (Bias Adjustment Factor = 0.94)	2014 (Bias Adjustment Factor = 0.95)	2015 (Bias Adjustment Factor = 0.96)
21,22,56	Stockman's Lane	Y	**64**	**59**	**55**	**55**	**49**
23,24,32	Ballyhackamore	Y	39	37	37	35	34
25	Whitewell Road	N	16	19	23	33	25
26	Donegall Road	N	28	35	39	36	33
27	Grosvener Road and Falls Road	N	34	30	34	34	38
28	Falls Road and Andersonstown	N	29	29	31	29	27
30	Station Road	N	22	24	23	24	25
31	Malone Road	N	21	39	**44**	**45**	39
33	Great Victoria Street	N	37	39	**42**	**42**	40
34	College Square East	N	32	33	39	40	33
35	Chichester Street	N	39	**47**	**46**	**49**	**43**
36	Cromac & Ormeau Avenue	Y	33	32	33	36	34
37	Glenmachan Street	Y	38	-	40	**43**	40
38	Creche on M1/Westlink	Y	31	31	34	35	30

Site ID	Site Type	Within AQMA?	Annual Mean Concentration (µg/m^3) - Adjusted for Bias [a]				
			2011 (Bias Adjustment Factor = 0.81)	2012 (Bias Adjustment Factor = 0.85)	2013 (Bias Adjustment Factor = 0.94)	2014 (Bias Adjustment Factor = 0.95)	2015 (Bias Adjustment Factor = 0.96)
39	Ormeau Road (junction with Ravenhill Road)	Y	25	25	29	30	31
40	Upper Newtownards Road & Hollywood Road	N	26	27	29	29	28
41	Crumlin Road	N	31	32	34	34	30
42	228 Antrim Road	N	37	34	37	**41**	37
44	Shore Road (Ivan Street end)	N	30	30	33	34	30
59	York Street	Y	40	**41**	**47**	**48**	39
63	Queens Square	N	33	37	**41**	40	38
74	Ardmore Park	N					35

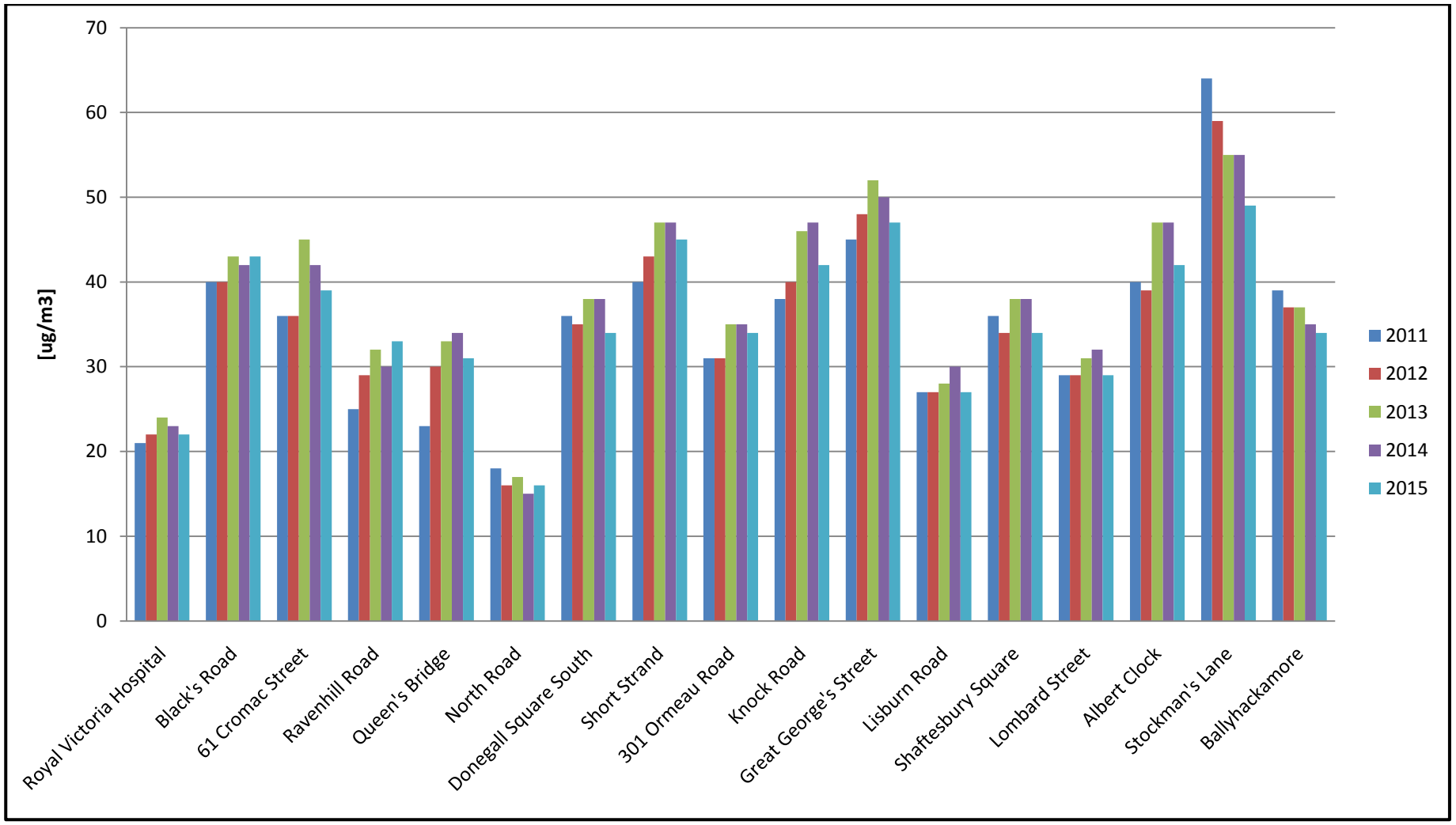
In bold, exceedence of the NO_2 annual mean AQS objective of 40µg/m^3

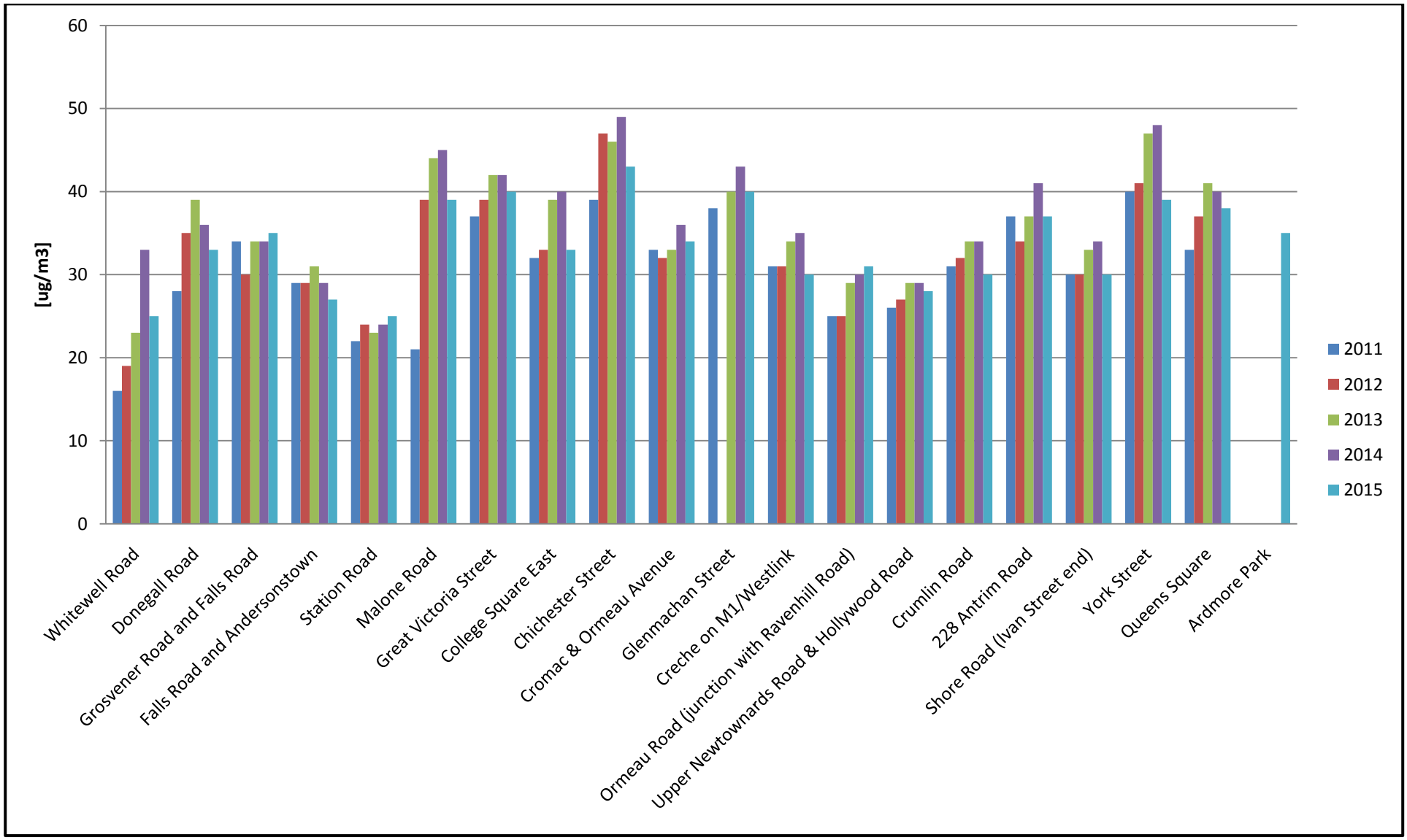
Underlined, annual mean > 60µg/m^3, indicating a potential exceedence of the NO_2 hourly mean AQS objective

[a] Means should be "annualised" as in Boxes 7.9 and 7.10 of LAQM.TG16, if full calendar year data capture is less than 75%

Figure 2.4 – Trends in Annual Mean Nitrogen Dioxide Concentrations Measured at Diffusion Tube Monitoring Sites

The following two graphs show trends in nitrogen dioxide diffusion tube data from 2011 where data exists.




60
50
40
30
20
10
0
[ug/m3]
2011
2012
2013
2014
2015
Whitewell Road
Donegall Road
Grosvener Road and Falls Road
Falls Road and Andersonstown
Station Road
Malone Road
Great Victoria Street
College Square East
Chichester Street
Cromac & Ormeau Avenue
Glenmachan Street
Creche on M1/Westlink
Ormeau Road (junction with Ravenhill Road)
Upper Newtownards Road & Hollywood Road
Crumlin Road
228 Antrim Road
Shore Road (Ivan Street end)
York Street
Queens Square
Ardmore Park

2.2.2 Particulate Matter (PM_{10})

As a result of a historic reliance upon solid fuel for domestic heating, Belfast used to experience frequent exceedences of the 24-hour and annual mean objectives for particulate matter (PM_{10}) across the city. However, with completion of the city's smoke control programme and the widespread availability of natural gas to all sectors, domestic and industrial emissions of particulate matter have decreased significantly since around 2000. As a result, the council was able to decommission its Belfast East Clara Street particulate matter monitoring site in 2007.

However, as domestic and industrial emissions have been addressed, emissions of particulate matter from road transport along the M1 Motorway and A12 Westlink corridor gained in prominence. Upon completion of the council's first review and assessment of air quality in 2004, it was concluded that the M1 Motorway and A12 Westlink corridor should be declared as an air quality management area on the basis of modelled and monitored exceedences of the 24-hour and annual mean objectives for particulate matter.

As embodied in the subsequent 2006 Air Quality Action Plan for Belfast, a range of structural improvements, designed to relieve traffic congestion, have been completed for the M1 Motorway and A12 Westlink. As a result, monitored levels of particulate matter have declined over recent years within this air quality management area. This monitoring data is summarised and reviewed in Tables 2.5a, 2.5b and in Figure 2.4.

In terms of exceedences of the 40 $\mu g/m^{-3}$ particulate matter annual mean objective, historical data (not included in this report) for the Stockman's Lane monitoring site shows an exceedence in 2007 but a rapid decline thereafter, meaning that since 2008, there have been no further exceedences of the annual mean objective at this location. Monitoring data from the Belfast Westlink site at Roden Street, which was established in 2010 and is located also within the M1 Motorway / A12 Westlink air quality management area, indicates no exceedences in recent years. PM_{10} monitoring stopped at this site in 2014 and continues at the Stockmans Lane site.

Reflecting upon the particulate matter 24-hour mean objective data, as summarised in Table 2.8, the data has remained comfortably below the objective at all sites during recent years.

On the basis of previous data which demonstrates sustained improvements in particulate matter, the council revoked the M1 Motorway / A12 Westlink air quality management area for exceedences of the particulate matter annual and 24-hour mean objectives in September 2015.

Table 2.7 – Results of Automatic Monitoring for PM_{10}: Comparison with Annual Mean Objective

Site Name	Site Type	Within AQMA?	Valid Data Capture for Monitoring Period % [a]	Valid Data Capture 2015 % [b]	Confirm Gravimetric Equivalent (Y or N/A)	Annual Mean Concentration (µg/m^3)				
						2011* [c]	2012* [c]	2013* [c]	2014* [c]	2015 [c]
Belfast Centre Lombard Street	Urban Centre	N	84	84	Y	-	15	-	16	16
Belfast Stockman's Lane	Roadside	Y	98	98	N/A	24	-	24	21	21
Belfast Westlink Roden Street	Roadside	Y	-	-	N/A	23	26	23	-	-

In bold, exceedence of the PM_{10} annual mean AQS objective of 40µg/m^3

[a] i.e. data capture for the monitoring period, in cases where monitoring was only carried out for part of the year

[b] i.e. data capture for the full calendar year (e.g. if monitoring was carried out for six months the maximum data capture for the full calendar year would be 50%)

[c] Means should be "annualised" as in Boxes 7.9 and 7.10 of LAQM.TG16, if valid data capture is less than 75%

* Annual mean concentrations for previous years are optional

Figure 2.5 – Trends in Annual Mean PM_{10} Concentrations at Belfast monitoring sites

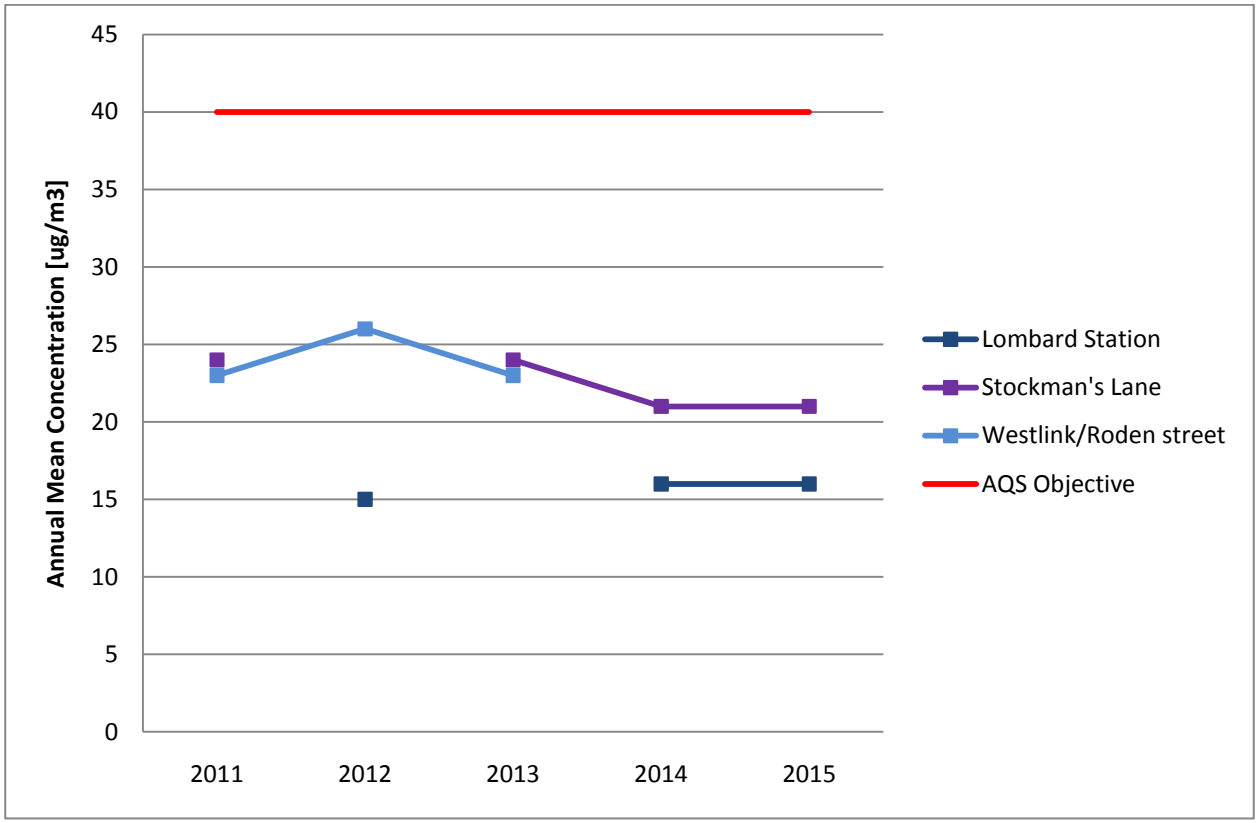


Table 2.8 – Results of Automatic Monitoring for PM_{10}: Comparison with 24-hour Mean Objective

Site Name	Site Type	Within AQMA?	Valid Data Capture for Monitoring Period % [a]	Valid Data Capture 2015 % [b]	Confirm Gravimetric Equivalent (Y or N/A)	Number of Daily Means > 50µg/m^3				
						2011* [c]	2012* [c]	2013* [c]	2014* [c]	2015 [c]
Belfast Centre Lombard Street	Urban Centre	N	84	84	Y	-	7	-	5	3
Belfast Stockman's Lane	Roadside	Y	98	98	N/A	6(41)	-	11	4	4
Belfast Westlink Roden Street	Roadside	Y	-	-	N/A	11	11	13(43)	-	-

In bold, exceedence of the PM_{10} daily mean AQS objective (50µg/m^3 – not to be exceeded more than 35 times per year)

[a] i.e. data capture for the monitoring period, in cases where monitoring was only carried out for part of the year

[b] i.e. data capture for the full calendar year (e.g. if monitoring was carried out for six months the maximum data capture for the full calendar year would be 50%)

[c] if data capture for full calendar year is less than 90%, include the 90.4th percentile of 24-hour means in brackets

* Number of exceedences for previous years is optional

2.2.3 Sulphur Dioxide (SO_2)

As a result of a historic reliance upon solid fuel for domestic heating, Belfast City used to experience frequent and widespread exceedences of the 15-minute, 1-hour and 24-hour mean objectives for sulphur dioxide. However, with completion of the city's smoke control programme and the widespread availability of natural gas to all sectors, levels of sulphur dioxide have decreased dramatically since 2000. However, there have been no exceedences of any sulphur dioxide objective in the city since 2002. Indeed, sustained low levels of sulphur dioxide have meant that the council has been able to terminate ambient monitoring at all locations with the exception of the Belfast Centre AURN site at Lombard Street. No air quality management areas have been declared for sulphur dioxide across Belfast.

Recent sulphur dioxide monitoring data from the Belfast Centre site is summarised in Table 2.9. As indicated, no exceedence of any objective was observed during 2015.

Table 2.9 – Results of Automatic Monitoring for SO_2: Comparison with Objectives

Site ID	Site Type	Within AQMA?	Valid Data Capture 2015 %	Number of: [c]		
				15-minute Means > 266µg/m^3	1-hour Means > 350µg/m^3	24-hour Means > 125µg/m^3
Belfast Centre Lombard Street	Urban Centre	N	98	0	0	0

In bold, exceedence of the relevant AQS objective (15-min mean = 35 allowed/year; 1-hour mean = 24 allowed/year; 24-hour mean = 3 allowed/year)

[a] i.e. data capture for the monitoring period, in cases where monitoring was only carried out for part of the year

[b] i.e. data capture for the full calendar year (e.g. if monitoring was carried out for six months the maximum data capture for the full calendar year would be 50%)

[c] if data capture for full calendar year is less than 90%, include the relevant percentile in bracket (in µg/m^3): 15-min mean = 99.9th ; 1-hour mean = 99.7th ; 24-hour mean = 99.2th percentile

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 µg/m^{-3} annual mean) or the 2010 EU Limit Value (5 µg/m^{-3} annual mean) for benzene has been monitored in Belfast since 2002.

Previous rounds of R&A and monitored results going back to 2011 provided in Table 3.0 below confirm that there is no exceedence of the running annual mean of 3.25 µg m^{-3} for Benzene within Belfast. Therefore, a Detailed Assessment is not considered necessary.

Table 3.0: Results of monitoring for benzene: Annual mean levels for the Belfast Centre Lombard Street site 2011 – 2015.

Site ID	Site type	Within AQMA?	Valid Data Capture 2015 %	Running annual mean concentrations (µg/m^3)				
				2011	2012	2013	2014	2015
Belfast Centre Lombard Street	Urban Centre	N	100	0.57	0.55	0.60	0.64	0.51

2.2.5 Summary of Compliance with AQS Objectives

Belfast City Council has examined the results from monitoring in the district. Concentrations of ambient pollutants, as prescribed in the Air Quality Strategy for England, Scotland, Wales and Northern Ireland, outside of existing Air Quality Management Areas are all below the objectives at relevant locations, therefore it is the council's view that there is no need to proceed to a Detailed Assessment.

However, the council will continue to monitor ambient conditions across the city in order to confirm that recent improvements in air quality are sustained and that those locations where poor air quality persists are addressed.

3 New Local Developments

3.1 Road Traffic Sources

The following road traffic sources which may have an impact on air quality have been considered since the last Updating and Screening Assessment:

- 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 Updating and Screening Assessment.
- 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 Update and Screening Assessment, 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 considered since the last Updating and Screening Assessment:

- 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 Update and Screening Assessment, 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 considered since the last Updating and Screening Assessment:

- **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 Update and Screening Assessment, 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 considered since the last Updating and Screening Assessment:

- 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.
- Combined Heat and Power (CHP) plant.

Belfast City Council confirms that one biomass combustion plant individual installation was approved through the planning process in 2015. This approved installation was supported with an Air Quality Impact Assessment. The assessment demonstrated that the proposal would not have an impact on localised air quality or relevant receptors. Therefore there is no need to proceed to a Detailed Assessment. Further information on this installation is provided in Section 4 of this report under Planning Applications.

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 considered since the last Updating and Screening Assessment:

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

Belfast City Council confirms that there has been no significant change to any of the Above sources since the last Update and Screening Assessment, 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.

Belfast City Council confirms that all the following have been considered:

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

4 Planning Applications

Of the planning applications received by this Service in 2015, seventeen new developments were identified as having the potential to have a negative impact on air quality.

Detailed air quality assessments submitted in support of these developments concluded that their individual impact would not have an impact on localised air quality or the existing AQMAs. 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 2015 period.

Location	Development description	Outcomes of air quality impact assessment
SITE AT 28-30 GREAT PATRICK STREET, BELFAST, BT1 2LT	Proposal: erection of 11 storey building (34.5m high) comprising a retail unit and coffee shop at ground floor level, 529 managed student accommodation (with communal living room a and kitchens). The proposal also includes an associated reception/office facility, other ancillary accommodation, landscaped courtyard, plant and storage areas, car parking abd cycle provision.	The assessment has demonstrated that the proposed development will have a negligible impact on local air quality as a result of traffic-derived pollutants and future users will not be exposed to pollutant concentrations in excess of the relevant air quality objectives**.**
7 MOUNT POTTINGER ROAD, BELFAST	Residential development for 31 apartments with associated car parking**.**	The assessment has demonstrated that the proposed development will have a negligible impact on local air quality as a result of traffic-derived pollutants and future users will not be exposed to pollutant concentrations in excess of the relevant air quality objectives.
ANSON HOUSE, 240-242 UPPER NEWTOWNARDS ROAD, BELFAST	Alterations and 3 storey rear extension to existing building to facilitate change of use from offices to residential development of 8 no apartments and associated car parking and landscaping.	The Assessment has demonstrated that the increase in pollution concentrations as a result of the development is insignificant and future users will not be exposed to pollutant concentrations in excess of the relevant ambient air quality objectives.

Location	Development description	Outcomes of air quality impact assessment
SITE G, 45-49 HAWTORNDEN ROAD, BELFAST	Residential development of 14 units comprising of 6 no detached houses and 8 no semi-detached houses including car parking and landscaping	The assessment has demonstrated that the proposed development will have a negligible impact on local air quality as a result of traffic-derived pollutants and future users will not be exposed to pollutant concentrations in excess of the relevant air quality objectives
123-137 YORK STREET, BELFAST	Demolition of the existing building and erection of mixed use building with a ground floor retail unit, 407 managed student accommodation rooms (with communal living rooms, kitchens), associated reception office facility, gym, other ancillary accommodation above. The development also includes a landscaped courtyard, plant and storage areas, car parking, cycle provision and solar pv array	The Assessment has demonstrated that the increase in pollution concentrations as a result of the development is insignificant and future users will not be exposed to pollutant concentrations in excess of the relevant ambient air quality objectives by the occupational year of 2017
97A STOCKMANS LANE, BELFAST	Construction of 2 semi-detached dwelling houses	The consultant has assessed the predicted impact of the proposed development on human health in terms of nitrogen dioxide and particulate matter. Modelling of future scenarios for 2015 and 2016 both with / without development demonstrated that annual mean N02 concentrations are likely to slightly exceed the UK Air Quality Objective of 40ug/m3. However, the results of modelled scenarios for 2015 and 2016 incorporating mechanical ventilation from 8m draft height as a means of mitigation, demonstrated that from 2015 onwards the exposure to annual mean $N0_2$ concentrations will be less than the UK Air Quality Objectives, thus permitting development and exposure. Modelled scenarios for 2017 onward demonstrated that UK Air Quality Objectives would be met at the proposed development site, with or without mitigation.
LANDS SOUTH AND WESTOF THE DAIRY FARM COMPLEX, STEWARTSTOWN ROAD	Proposed new town centre comprising of multipurpose community building, transport hub, health centre, leisure centre, post primary school, residential, retail, business uses, town square, sports pitches, play area, park, bridge, footpaths, car parking and park & ride	The assessment has demonstrated that the proposed development will have a negligible impact on local air quality as a result of traffic-derived pollutants and future users will not be exposed to pollutant concentrations in excess of the relevant air quality objectives

Location	Development description	Outcomes of air quality impact assessment
LANDS BOUNDED BY STOCKMANS CRESCENT AND KENNEDY WAY, BT11	Proposed residential development comprising of 8 two storey semi detached dwellings, 1 detached dwelling and six apartments in one three storey block along with associated site works and sewer diversion	The assessment has concluded that the proposed development will not have an adverse impact on local air quality in the vicinity of the site and future users will not be exposed to pollutant concentrations in excess of the relevant air quality objectives
LAND BOUNDED BY LIBRARY STREET, STEPHEN STREET AND KENT STREET, BELFAST BT1 2JJ	Demolition of existing warehouse and construction of managed purpose built student accommodation comprising 78 apartments containing 408 en suite bedrooms with shared living rooms and kitchens and 10 studio apartments etc.	The assessment has concluded that the proposed development will not have an adverse impact on local air quality in the vicinity of the site and future users will not be exposed to pollutant concentrations in excess of the relevant air quality objectives
26-44 LITTLE PATRICK STREET, BELFAST, BT15	Erection of an 11 storey building for managed 380 student accommodation studios with shared communal areas; external courtyard; other ancillary accommodation including a reception / management suite and communal areas; plants and storage areas; cycle provision	The Assessment has demonstrated that the increase in pollution concentrations as a result of the development is insignificant and future users will not be exposed to pollutant concentrations in excess of the relevant ambient air quality objectives by the operational year of 2018
MOUNT EDEN COURT, 129-131 WOODVALE ROAD, BELFAST, BT13 3EB	Installation of a 3.2x11.5m wood pellet boiler cabin to serve new heating system (amended plans)	An assessment of the potential air quality impacts of this installation has been carried out using the Biomass and Air Quality Guidance for Local Authorities issued by EPUK and LACORS. The following **conditions** were attached to any planning permission granted. 1. The height of the flue serving the Biomass boiler shall not be less than that the height specified on drawing no B3053/B202 revision A. 2. The fuel to be used shall comply with standards specified in CEN/TS:2005 or a similar recognised fuel quality standard. 3. The biomass boiler shall be effectively maintained and managed and shall include the removal of ash, inspection and maintenance of particulate arrestment equipment, boiler servicing and stack cleaning.

Location	Development description	Outcomes of air quality impact assessment
LANDS AT 43-47 CHICHESTER STREET, BELFAST, BT1 4JD	Proposed apartment complex, basement car park, reception area, swimming pool gym and courtyard	The assessment has demonstrated that the proposed development will not have adverse impact on air quality in the vicinity of the site and there will be no significant air quality impact on future residents
SITE AT ROSEPARK, UPPER NEWTOWNARDS ROAD, BELFAST	Residential development with associated road works and landscaping. 8 no. Detached, 24 no. 3 bed semi detached, 8 no. 2 bed apartments, 8 no 3. Bed townhouses (additional information)	The consultant has assessed the predicted impact of the proposed development on human health in terms of nitrogen dioxide and particulate matter. The assessment model verification has not been undertaken in accordance with the correct procedure as published in the government's Local Air Quality Management Technical Guidance LAQM.TG(09). However, based on local knowledge, coupled with the assessment this Service is satisfied that the proposed development will have a negligible impact on local air quality and future users will not be exposed to pollutant concentrations in excess of the relevant air quality objectives.
18B NEWFORGE LANE, BELFAST	New clubhouse and tiered seating area, new 3g surface to pitch, all new items to include floodlights, dugouts, fencing, security tower, turnstiles, stands, toilet blocks and associated ground works	The assessment has concluded that the proposed development will have a negligible effect on local air quality in the vicinity of the site and relevant receptors will not be exposed to pollutant concentrations in excess of the relevant air quality objectives
LANDS AT 78-86 DUBLIN ROAD, BELFAST, BT2 7BY	Demolition of existing building and construction of a purpose built managed student accommodation (9 storey block) consisting of 160 studio rooms, reception/management suite, common room space, bike and general storage area	The assessment has demonstrated that the proposed development will not have adverse impact on air quality in the vicinity of the site and there will be no significant air quality impact on future residents. As a result, this Service has no concerns regarding the air quality impacts of the development proposal.
41-49 QUEEN STREET, 24-30 COLLEGE STREET AND 29 WELLINGTON PLACE, BELFAST BT6 6EB	Erection of purpose built managed student accommodation comprising 93 studios and 247 cluster rooms, retail unit(class a1) bar restaurant on ground floor of queen street and wellington place.	The assessment has demonstrated that the proposed development will not have adverse impact on air quality in the vicinity of the site and there will be no significant air quality impact on future residents.
140 DONEGALL STREET, BELFAST, BT1	Purpose built managed student accommodation comprising 710 no units with associated amenity and ancillary support accommodation with 54 no lower ground floor parking spaces	The assessment has demonstrated that the proposed development will have a negligible impact on air quality in the vicinity of the site and there will be no significant air quality impact on future residents

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, the council will then be able to take into due consideration the proposed development's impact on air quality.

6 Implementation of Action Plans

In 2006, the council, along with relevant partner organisations launched an Air Quality Action Plan (AQAP) for the city designed to address areas of air quality concern, safeguard good air quality and to achieve national air quality strategy objectives and EU limit values by 2010. Around 90 per cent of the action plan was complete by the 2010 deadline but, although the air quality limit values for particulate matter have now been achieved, limit values for nitrogen dioxide continue to be exceeded and give cause for concern in some locations.

In order to fulfil our statutory obligations under the provisions of the Environment (Northern Ireland) Order 2002, the council and relevant partner organisations committed to the development of a revised AQAP for the city to tackle the outstanding nitrogen dioxide (NO_2) pollution issues.

In December 2015 we launched a new AQAP 2015-2020 that draws upon all forms of air quality and transport planning activities, including sustainable transport options as well as engineering solutions. The aim of this AQAP is to improve road vehicle operations and promote and enable a shift onto more sustainable modes of transport to achieve compliance with the NO_2 EU limit value by 2020.

Progress on measures within the new AQAP will be reported on in the Progress Report April 2016.

7 Conclusions and Proposed Actions

7.1 Conclusions from New Monitoring Data

Belfast City Council has presented a range of monitoring data within this Progress Report that addresses a number of the pollutants prescribed within the United Kingdom Air Quality Strategy. Although these pollutants are routinely measured across the city, the council's focus remains principally upon addressing existing air quality management areas and upon those areas of the city centre where traffic congestion might lead to further exceedences of the nitrogen dioxide annual mean and hourly objectives. There were no monitored exceedences for any of the air quality strategy objectives for sulphur dioxide, benzene and particulate matter during 2015.

Nevertheless, 2015 monitoring data for nitrogen dioxide confirms continuing exceedences of the annual mean for nitrogen dioxide in the vicinity of Stockmans Lane, which is located within the M1 Motorway / A12 Westlink air quality management area. Similar exceedences of the annual mean objective were recorded at Great George's Street near to the end of the A12 Westlink where it joins with the M2 and M3 motorways. However, automatic monitoring site at Westlink / Roden Street indicates compliance with both annual and hourly mean objectives for nitrogen dioxide along this section of the A12 Westlink, suggesting that the recent structural improvements have reduced the number of exceedences locations along the M1 Motorway / A12 Westlink to a series of nitrogen dioxide 'hot spots'.

Historical monitoring data for the Upper Newtownards Road air quality management area revealed sustained exceedences of the nitrogen dioxide annual mean objective. For example, between 2007 and 2010 annual mean concentrations were typically around 45 $\mu g/m^{-3}$. However, the last five years have demonstrated a sharp decrease in nitrogen dioxide levels to the extent that the annual mean objective has been achieved at Ballyhackamore since 2011. The magnitude of the decrease in nitrogen dioxide levels along the Upper Newtownards Road was beyond the year-on-year reductions that might have been predicted using Defra's forward projection factors. Accordingly, the reductions in ambient nitrogen dioxide levels within this air quality

management area are welcomed, however, the council will continue to maintain its monitors in this location in order to determine whether the decrease is sustained over coming years.

Therefore, in conclusion, it is considered that our 2015 monitoring data supports the continuing need for all our existing air quality management areas for the time being, and we will continue to monitor closely ambient nitrogen dioxide levels within all the air quality management area. Furthermore, our monitoring data confirms that no further air quality management areas need to be declared for the city at this time.

7.2 Conclusions relating to New Local Developments

Of the planning applications received and reviewed in 2015 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

In conclusion, the 2016 Progress Report has not identified the need to proceed to a Detailed Assessment for any pollutant under consideration.

Furthermore, Belfast City Council has already highlighted that it operates an expansive air quality monitoring network across the city for nitrogen dioxide and other ambient pollutants. On this basis, the council is content that existing monitoring locations provide a detailed representation of pollution levels the city and, as a consequence, does not need to be expanded at this time.

With regard to our four existing air quality management areas, it is considered that although there has been decline in ambient nitrogen dioxide levels in recent years, the air quality management areas will need to be maintained to identify further trends before we could consider the possibility of revocation. Exception to this is the Weslink/M1 AQMA which was revoked for exceedences of particulate matter in September 2015.

In terms of forward actions, the council along with relevant partners have developed a comprehensive Air Quality Action Plan that draws upon all forms of air quality and transport planning activities, including sustainable transport options as well as engineering solutions. The action plan was finalised and launched in December 2015 It is considered that successful implementation of the measures will improve road vehicle operations and promote and enable a shift onto more sustainable modes of transport to achieve compliance with the nitrogen dioxide UK Objectives and EU Limit Value by 2020.

8 References

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http://laqm.defra.gov.uk/diffusion-tubes/qa-qc-framework.html

Directive 2008/50/EC in respect of ambient air quality and cleaner air for Europe
Environment (Northern Ireland) Order 2002.
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Environment (Northern Ireland) Order 2002.
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Northern Ireland Air – Air Quality in Northern Ireland website
http://www.airqualityni.co.uk/

Appendices

Appendix A: Quality Assurance / Quality Assurance and Quality Control (QA / QC) Data

Appendix B: Defra NO_2 Distance Calculator Results

Appendix A: QA/QC Data

Diffusion Tube Bias Adjustment Factors.

As in previous years, we have employed a triplicate collocation study at the Belfast Centre Lombard Street AURN monitoring site in order to obtain a local diffusion tube bias adjustment factor for 'correcting' our diffusion tubes monitoring data. The bias adjustment factor was calculated and our data 'corrected' using the Defra Bias Adjustment Factor Calculation spreadsheet (with a 95% confidence interval as an estimate of the uncertainty on the bias adjustment factor). Outputs from the spreadsheet are presented as follows:

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	07/01/2015	04/02/2015	29.1	33.9	26.9	30	3.6	12	8.9	34.7	99	Good	Good
2	04/02/2015	05/03/2015	33.7	32.6	31.3	33	1.2	4	2.9	31.3	92	Good	Good
3	05/03/2015	03/04/2015	30.8	31.9	33.1	32	1.2	4	2.9	30.0	97	Good	Good
4	03/04/2015	29/04/2015	30.3	31.0	29.5	30	0.8	3	1.9	32.9	99	Good	Good
5	29/04/2015	27/05/2015	24.1	26.3	23.6	25	1.4	6	3.6	20.8	92	Good	Good
6	27/05/2015	03/07/2015	25.2	25.3	24.0	25	0.7	3	1.9	20.7	99	Good	Good
7	03/07/2015	29/07/2015	21.5	22.7	22.8	22	0.7	3	1.8	18.2	99	Good	Good
8	29/07/2015	27/08/2015	26.0	28.3	25.5	27	1.5	6	3.8	22.2	99	Good	Good
9	27/08/2015	29/09/2015	29.6	28.7	28.9	29	0.5	2	1.2	29.3	93	Good	Good
10	29/09/2015	28/10/2015	42.0	36.6	41.1	40	2.9	7	7.3	43.4	99	Good	Good
11	28/10/2015	02/12/2015	36.8	35.4	34.2	35	1.3	4	3.2	33.8	100	Good	Good
12	02/12/2015	06/01/2016	40.0	38.6	40.0	40	0.8	2	2.1	33.2	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

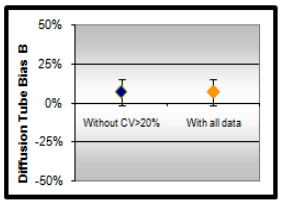
(Check average CV & DC from Accuracy calculations)

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	0.96 (0.89 - 1.04)
Bias B	5% (-4% - 13%)
Diffusion Tubes Mean:	31 μgm^{-3}
Mean CV (Precision):	5
Automatic Mean:	29 μgm^{-3}
Data Capture for periods used:	97%
Adjusted Tubes Mean:	29 (27 - 32) μgm^{-3}

Accuracy (with 95% confidence interval) WITH ALL DATA	
Bias calculated using 12 periods of data	
Bias factor A	0.96 (0.89 - 1.04)
Bias B	5% (-4% - 13%)
Diffusion Tubes Mean:	31 μgm^{-3}
Mean CV (Precision):	5
Automatic Mean:	29 μgm^{-3}
Data Capture for periods used:	97%
Adjusted Tubes Mean:	29 (27 - 32) μgm^{-3}



Jaume Targa, for AEA
Version 04 - February 2011

Adjustment of SINGLE Tubes

AEA Energy & Environment
From the AEA group

Diffusion Tube Measurements

Site Name/ID	Periods													Raw Mean	Valid periods
	1	2	3	4	5	6	7	8	9	10	11	12	13		
1. RVH	23.9	22.5	22.9	25.4	15.9	17.9	16.4	21.9	20.8	32.6	27.4	31.0		23.2	12
2. Blacks Rd	48.4	49.4	44.4	39.4	39.3	44.9	34.6	43.1	44.1	52.7	41.4	51.1		44.4	12
3. 61 Cromac Str	42.6	43.3	41.9	41.8	31.4	36.2	29.3	33.9	39.9	50.2	51.4	46.1		40.7	12
4. Ravenhill Rd	38.9	37.1	30.3	35.6	25.9	28.0	24.9	27.3	36.3	44.2	38.4	39.3		33.9	12
5. Queens Bridge	37.6	34.6	34.3	36.8	28.1	26.9	25.0	23.1	32.0	37.8	36.8	29.2		31.8	12
6. North Road	21.5	22.9	19.1	14.4	12.3	10.9	10.4	12.5	17.2		19.1	19.2		16.3	11
7. Donegal Sq. South	37.8	37.7	38.4	33.3	24.7	31.1	28.9	33.3	38.2	48.7	39.1	39.9		35.9	12
9. Short Strand	43.5	50.4	44.8	45.3	41.0	40.6	37.0	41.2	46.9	56.5	56.1	54.7		46.5	12
10. 301 Ormeau Rd	41.0	47.7	35.1	31.2	25.7	30.4	28.6	32.0	32.6	43.1	35.9	37.7		35.1	12
12. Knock Rd	46.4	46.6	38.9	42.6	36.4	38.9	34.2	37.9	42.3	58.3	52.5	46.8		43.5	12
13. Gr Georges Str	46.5	43.2	49.0	54.1	42.0	45.7	42.2	45.7	48.4	62.2	54.8	57.3		49.2	12
14. Lisburn Rd	35.9	34.0	29.5	25.6	22.8	24.9	21.9		26.9	32.2	23.9	35.4		28.4	11
15. Shaftesbury Sq	33.7	38.1	37.8	27.5	30.6	31.0	28.1	34.0	35.3	52.7	39.5	42.2		35.9	12
17. Albert Clock	45.9	39.7	37.9	40.2	34.2	36.9	33.7	45.1	41.6	55.4	66.5	47.5		43.7	12
25. Whitewell Rd	25.8	26.4	30.4	28.4	21.7	21.1	23.2	24.8	29.5	35.9	22.0	28.9		26.5	12
26. Donegal Rd	42.4	34.3	34.8	33.3	28.0	25.9	28.0	28.7	38.6	48.0	35.6	33.5		34.3	12
27. Grovesner Rd	39.9	45.8	33.3		31.5		28.3	35.2	39.0			46.4		37.4	8
28. Falls and Andytown	27.5	33.0	33.4		22.2	21.8	22.1	28.5	26.2	39.4	26.8	31.0		28.3	11
30. Station Rd	31.7	32.4	28.9	25.5	19.7	19.4		20.2	26.0	30.2	25.0	22.8		25.6	11
31 Newforge Lane	46.5	46.9	53.7	37.1	33.8	34.2	30.0	33.6	44.1	58.4	31.2	42.0		40.9	12
33 Great Victoria Street	49.9	46.4	40.3	42.0	35.0	32.9	34.7	37.1	40.3	51.0	41.9	44.1		41.3	12
34 College Square East		30.5		33.4	28.5	27.5	28.7	34.8	35.9	50.0	34.9	41.0		34.5	10
35 Chichester Street	46.1	46.1	46.8	49.3	43.1	40.8	37.2	40.3	43.9	58.6	45.6	45.4		45.3	12
36 Cromac/Ormeau Avenue	38.9	39.3	38.5	33.3	27.4	28.8	27.2	34.2	33.2	48.6	42.1	37.8		35.8	12
37 Westlink/Glenmachan Str	47.3	49.9	40.8	37.7	31.4	34.3	33.2	37.1	42.1	48.7	41.8	50.2		41.2	12

Adjusted measurement (95% confidence interval) with all the data 12 periods used in this calcuations

Bias Factor A 0.96 (0.89 - 1.04)
Bias B 5% (-4% - 13%)

Tube Precision: 5	Automatic DC: 97%
Adjusted with 95% CI	22 (21 - 24)
Adjusted with 95% CI	43 (40 - 46)
Adjusted with 95% CI	39 (36 - 42)
Adjusted with 95% CI	33 (30 - 35)
Adjusted with 95% CI	31 (28 - 33)
Adjusted with 95% CI	16 (15 - 17)
Adjusted with 95% CI	34 (32 - 37)
Adjusted with 95% CI	45 (41 - 48)
Adjusted with 95% CI	34 (31 - 37)
Adjusted with 95% CI	42 (39 - 45)
Adjusted with 95% CI	47 (44 - 51)
Adjusted with 95% CI	27 (25 - 30)
Adjusted with 95% CI	34 (32 - 37)
Adjusted with 95% CI	42 (39 - 45)
Adjusted with 95% CI	25 (24 - 28)
Adjusted with 95% CI	33 (30 - 36)
Adjusted with 95% CI	36 (33 - 39)
Adjusted with 95% CI	27 (25 - 29)
Adjusted with 95% CI	25 (23 - 27)
Adjusted with 95% CI	39 (36 - 43)
Adjusted with 95% CI	40 (37 - 43)
Adjusted with 95% CI	33 (31 - 36)
Adjusted with 95% CI	43 (40 - 47)
Adjusted with 95% CI	34 (32 - 37)
Adjusted with 95% CI	40 (37 - 43)

The bias adjustment factor used in these calculations include all the data and no screening of data due to poor precision has been applied.

Adjustment of SINGLE Tubes

AEA Energy & Environment
From the AEA group

Diffusion Tube Measurements

Site Name/ID	Periods													Raw Mean	Valid periods
	1	2	3	4	5	6	7	8	9	10	11	12	13		
38 Creche on M1/Westlink	25.6	29.2	31.8	34.2	25.9	23.6	28.1	30.2	32.9	46.9	29.3	40.0		31.5	12
39 Ormeau Rd/Ravenhill Rd		30.6	30.7	32.8	28.2	25.5	27.5	27.8	39.4	44.7	33.9			32.1	10
40 Hollywood Rd Arches	35.8	34.2	29.9	25.6	21.6	20.8	22.2	28.0	30.9	37.7	32.6	31.5		29.2	12
41 Crumlin Rd	32.7	30.9	32.9	38.4	24.9	25.6	23.0	27.2	32.6	40.9	29.1	35.8		31.2	12
42 228 AntrimRd	39.1	38.4	34.5	36.3	31.1	33.8	36.1	38.1		52.7	37.6	44.8		38.4	11
44 Shore Rd (Ivan St. End)	30.1	31.0	30.0	34.1	23.4	23.6	27.6	32.3	34.0	42.3	30.5	34.6		31.1	12
59 York Street	42.6	41.6	42.6	40.0	32.6	34.0	38.1	37.6	37.9	58.5	38.8	48.9		41.1	12
63 Queen's Sq	36.3	40.6	44.2	41.1	33.1	31.8	32.6	36.1	40.2	51.7	35.5	46.5		39.1	12
74 Ardmore Park			44.5	30.0	34.0	27.7	31.7	33.5	36.7	42.4	42.3	41.4		36.4	10

Adjusted measurement (95% confidence interval) with all the data 12 periods used in this calcuations

Bias Factor A 0.96 (0.89 - 1.04)
Bias B 5% (-4% - 13%)

Tube Precision: 5	Automatic DC: 97%
Adjusted with 95% CI	30 (28 - 33)
Adjusted with 95% CI	31 (29 - 33)
Adjusted with 95% CI	28 (26 - 30)
Adjusted with 95% CI	30 (28 - 32)
Adjusted with 95% CI	37 (34 - 40)
Adjusted with 95% CI	30 (28 - 32)
Adjusted with 95% CI	39 (37 - 43)
Adjusted with 95% CI	38 (35 - 41)
Adjusted with 95% CI	35 (32 - 38)

The bias adjustment factor used in these calculations include all the data and no screening of data due to poor precision has been applied.

Diffusion Tube Bias Adjustment Factors

Using the spreadsheet, we have determined that diffusion tube agreement with the automatic nitrogen dioxide analyser at the Belfast Centre AURN site for our Gradko supplied and analysed diffusion tubes was deemed ‘good’ for all available sampling periods in 2015. In addition, the precision checks were also deemed ‘good’ for all sampling periods. The overall bias factor was calculated as 0.96.

Discussion of Choice of Factor to Use

For those local authorities that do not wish, or are unable to undertake a triplicate diffusion tube collocation study, government publishes a database of bias adjustment factors derived from other local authority co-location studies throughout the United Kingdom. These factors are used subsequently to calculate a combined bias adjustment factor for a range of nitrogen dioxide diffusion tube laboratories. The latest factors were published in March 2016 and cover sampling periods up until 2015. In 2015, the government derived bias adjustment factor for Gradko Laboratories for a 20% solution of triethanolamine was 0.91. This factor compares well with the council’s 2015 locally derived bias adjustment factor of 0.96. Historially, we have always used our own bias adjustment factors and for consistency in results we will continue with the same methodology.

Short-term to Long-term Data Adjustment

Guidance for the treatment of diffusion tube monitoring data, as provided in Table 2.5, requires that where annual mean results are based upon monitoring data of less than 9 months sampling, these means should be “annualised” in accordance with the procedures outlined in Box 7.9 and 7.10 of the government’s local air quality management technical guidance LAQM.TG16.

In order to complete the annualisation process, councils are required to identify up to four nearby long-term background continuous monitoring sites for nitrogen dioxide. As there are only two such sites in Northern Ireland, we have elected to use data from both the Belfast Centre AURN (urban centre) and Derry City Council Brooke Park (urban background) sites.

Individual adjustment factors have been calculated for one diffusion tube monitoring site, commensurate with the diffusion tube exposure periods. The adjustment ratios for our site with less than 9 months of data is summarised in the following table:

Table A.1 – Short-Term to Long-Term Monitoring Data Adjustment

Site	Site Type	2015Annual Mean	Diffusion tube site	2015 Annual Mean for diffusion tube sampling period*	Ratio*	Average Ratio*
Belfast Centre AURN Site	Urban Centre	29	Grosvenor Road	27.5	1.05	1.06
Derry City Council Brooke Street Site	Urban Background	15.9		14.7	1.08	

QA/QC of Automatic Monitoring Data

As highlighted in the body of this report, Belfast City Council operates a number of automatic monitoring sites across the city. In order to ensure that our data is accurate and precise, we calibrate our sites on a four-weekly basis, in accordance with the requirements of Defra.

For our automatic nitrogen dioxide analysers, we complete a two-point calibration using zero air and a nitric oxide span gas of certified concentration. We obtain our calibration gases under contract from Air Liquide who also provide similar gases to government owned AURN monitoring stations. By considering instrument operating parameters and the results of successive calibrations, we can make a determination regarding the ongoing performance of our analysers.

Where an instrument is found not be operating within normal operating parameters, we refer the matter promptly to We Care 4 Air who are retained by the council to provide service and maintenance support for our equipment.

Finally the council is a member of AEA's Calibration Club which promotes and supports best practice in the application of quality control to automatic air-monitoring data in line with the government's local air quality management technical guidance

LAQM.TG16). AEA staff visit our sites on a six-monthly basis and compare the performance of our analysers against a range of laboratory grade standards. AEA subsequently provides a series of calibration and scaling factors that are used to correct our automatic monitoring data. These scaling procedures enable the council to robustly compare our air quality data with Air Quality Strategy Objectives and European Union Limit Values.

QA/QC of Diffusion Tube Monitoring

Workplace Analysis Scheme for Proficiency (WASP) nitrogen dioxide proficiency testing.

Government provides an additional layer of surety for local authorities operating nitrogen dioxide diffusion tubes through the independent analytical proficiency-testing scheme. Through the Workplace Analysis Scheme for Proficiency, laboratories are provided with a number of test samples that are designed to test their proficiency in undertaking chemical analysis of diffusion tubes. The WASP scheme is operated independently by the Health and Safety Laboratory.

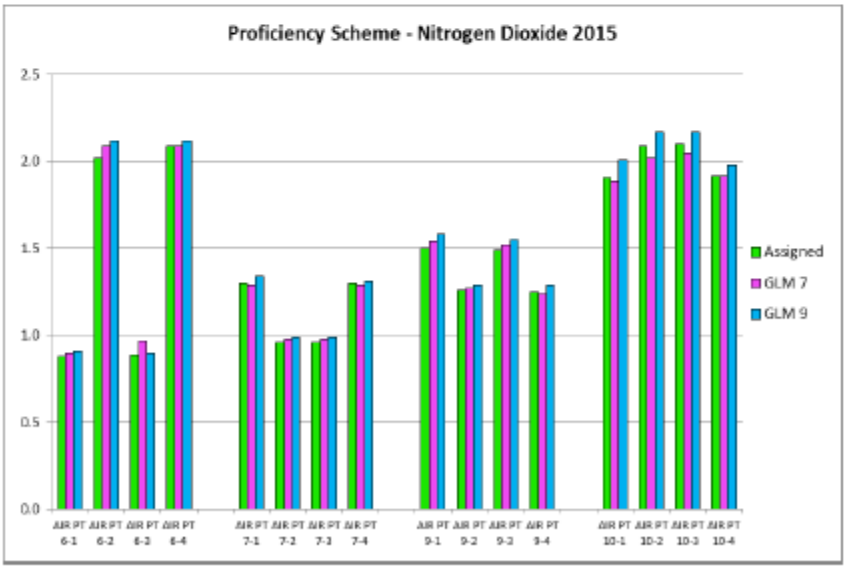
For the 2015 sampling period, Gradko's performance was assessed as follows:

gradko environmental
(A division of Gradko International Ltd.)
St. Martins House, 77 Wales Street Winchester, Hampshire SO23 0RH
tel.: 01962 860331 fax: 01962 841339 email:diffusion@gradko.com

AIR PT Nitrogen Dioxide Proficiency Scheme Results 2015

Methods: GLM 7 – Camspec M550 Spectrophotometer, GLM 9 – QuAAtro Continuous Flow analyser

Date	Round	Assigned value	Camspec M550 - GLM 7			QuAAtro - GLM 9		
			Measured concentration	z-Score	% Bias	Measured concentration	z-Score	% Bias
Feb-15	AIR PT 6-1	0.88	0.90	0.28	2.3%	0.91	0.41	3.4%
Feb-15	AIR PT 6-2	2.02	2.09	0.46	3.5%	2.12	0.66	5.0%
Feb-15	AIR PT 6-3	0.89	0.97	-0.30	-2.2%	0.90	0.15	1.1%
Feb-15	AIR PT 6-4	2.09	2.09	0.00	0.0%	2.12	0.19	1.4%
May-15	AIR PT 7-1	1.30	1.29	-0.10	-0.8%	1.34	0.41	3.1%
May-15	AIR PT 7-2	0.96	0.98	0.28	2.1%	0.99	0.42	3.1%
May-15	AIR PT 7-3	0.96	0.98	0.28	2.1%	0.99	0.42	3.1%
May-15	AIR PT 7-4	1.30	1.29	-0.10	-0.8%	1.31	0.10	0.8%
Aug-15	AIR PT 9-1	1.50	1.54	0.4	2.7%	1.58	0.71	5.3%
Aug-15	AIR PT 9-2	1.26	1.27	0.1	0.8%	1.29	0.32	2.4%
Aug-15	AIR PT 9-3	1.49	1.52	0.27	2.0%	1.55	0.54	4.0%
Aug-15	AIR PT 9-4	1.25	1.24	-0.11	-0.8%	1.29	0.43	3.2%
Nov-15	AIR PT 10-1	1.91	1.89	-0.14	-1.0%	2.01	0.7	5.2%
Nov-15	AIR PT 10-2	2.09	2.02	-0.45	-3.3%	2.17	0.51	3.8%
Nov-15	AIR PT 10-3	2.10	2.05	-0.32	-2.4%	2.17	0.44	3.3%
Nov-15	AIR PT 10-4	1.92	1.92	0.0	0.0%	1.98	0.42	3.1%



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Appendix B: Defra NO_2 Distance Calculator

Short Strand Monitoring Locations

This calculator allows you to predict the annual mean NO_2 concentration for a location ("receptor") that is close to a monitoring site, but nearer or further the kerb than the monitor. The next sheet shows your results on a graph.

Air Quality CONSULTANTS

Enter data into the yellow cells

Step 1	How far from the KERB was your measurement made (in metres)?	(Note 1)	1	metres
Step 2	How far from the KERB is your receptor (in metres)?	(Note 1)	16	metres
Step 3	What is the local annual mean background NO_2 concentration (in $\mu g/m^3$)?	(Note 2)	27.5	$\mu g/m^3$
Step 4	What is your measured annual mean NO_2 concentration (in $\mu g/m^3$)?	(Note 2)	45	$\mu g/m^3$
Result	The predicted annual mean NO_2 concentration (in $\mu g/m^3$) at your receptor	(Note 3)	35.2	$\mu g/m^3$

Note 1: In some cases the term "kerb" may be taken to be the edge of the trafficked road - see the FAQ at http://laqm2.defra.gov.uk/FAQs/Monitoring/Location/index.htm for further details. Distances should be measured horizontally from the kerb and assumes that the monitor and receptor have similar elevations. Each distance should be greater than 0.1m and less than 50m (In practice, using a value of 0.1m when the monitor is closer to the kerb than this is likely to be reasonable). The receptor is the location for which you wish to make your prediction. The monitor can either be closer to the kerb than the receptor, or further from the kerb than the receptor. The closer the monitor and the receptor are to each other, the more reliable the prediction will be. When your receptor is further from the kerb than your monitor, it is recommended that the receptor and monitor should be within 20m of each other. When your receptor is closer to the kerb than your monitor, it is recommended that the receptor and monitor should be within 10m of each other.

Note 2: The measurement and the background must be for the same year. The background concentration could come from the national maps published at www.airquality.co.uk, or alternatively from a nearby monitor in a background location.

Note 3: The calculator follows the procedure set out in Box 2.3 of LAQM TG(09). The results will have a greater uncertainty than the measured data. More confidence can be placed in results where the distance between the monitor and the receptor is small than where it is large.

Issue 4: 25/01/11. Created by Dr Ben Marner; Approved by Prof Duncan Laxen. Contact: benmarner@aqconsultants.co.uk

Albert Clock Monitoring Locations

This calculator allows you to predict the annual mean NO_2 concentration for a location ("receptor") that is close to a monitoring site, but nearer or further the kerb than the monitor. The next sheet shows your results on a graph.

Air Quality CONSULTANTS

Enter data into the yellow cells

Step 1	How far from the KERB was your measurement made (in metres)?	(Note 1)	2.5	metres
Step 2	How far from the KERB is your receptor (in metres)?	(Note 1)	6	metres
Step 3	What is the local annual mean background NO_2 concentration (in $\mu g/m^3$)?	(Note 2)	27.5	$\mu g/m^3$
Step 4	What is your measured annual mean NO_2 concentration (in $\mu g/m^3$)?	(Note 2)	42	$\mu g/m^3$
Result	The predicted annual mean NO_2 concentration (in $\mu g/m^3$) at your receptor	(Note 3)	38.9	$\mu g/m^3$

Note 1: In some cases the term "kerb" may be taken to be the edge of the trafficked road - see the FAQ at http://laqm2.defra.gov.uk/FAQs/Monitoring/Location/index.htm for further details. Distances should be measured horizontally from the kerb and assumes that the monitor and receptor have similar elevations. Each distance should be greater than 0.1m and less than 50m (In practice, using a value of 0.1m when the monitor is closer to the kerb than this is likely to be reasonable). The receptor is the location for which you wish to make your prediction. The monitor can either be closer to the kerb than the receptor, or further from the kerb than the receptor. The closer the monitor and the receptor are to each other, the more reliable the prediction will be. When your receptor is further from the kerb than your monitor, it is recommended that the receptor and monitor should be within 20m of each other. When your receptor is closer to the kerb than your monitor, it is recommended that the receptor and monitor should be within 10m of each other.

Note 2: The measurement and the background must be for the same year. The background concentration could come from the national maps published at www.airquality.co.uk, or alternatively from a nearby monitor in a background location.

Note 3: The calculator follows the procedure set out in Box 2.3 of LAQM TG(09). The results will have a greater uncertainty than the measured data. More confidence can be placed in results where the distance between the monitor and the receptor is small than where it is large.

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Chichester Street Monitoring Locations

This calculator allows you to predict the annual mean NO_2 concentration for a location ("receptor") that is close to a monitoring site, but nearer or further the kerb than the monitor. The next sheet shows your results on a graph.

Air Quality CONSULTANTS

Enter data into the yellow cells

Step 1	How far from the KERB was your measurement made (in metres)?	(Note 1)	2	metres
Step 2	How far from the KERB is your receptor (in metres)?	(Note 1)	5	metres
Step 3	What is the local annual mean background NO_2 concentration (in $\mu g/m^3$)?	(Note 2)	27.5	$\mu g/m^3$
Step 4	What is your measured annual mean NO_2 concentration (in $\mu g/m^3$)?	(Note 2)	43	$\mu g/m^3$
Result	The predicted annual mean NO_2 concentration (in $\mu g/m^3$) at your receptor	(Note 3)	39.7	$\mu g/m^3$

Note 1: In some cases the term "kerb" may be taken to be the edge of the trafficked road - see the FAQ at http://laqm2.defra.gov.uk/FAQs/Monitoring/Location/index.htm for further details. Distances should be measured horizontally from the kerb and assumes that the monitor and receptor have similar elevations. Each distance should be greater than 0.1m and less than 50m (In practice, using a value of 0.1m when the monitor is closer to the kerb than this is likely to be reasonable). The receptor is the location for which you wish to make your prediction. The monitor can either be closer to the kerb than the receptor, or further from the kerb than the receptor. The closer the monitor and the receptor are to each other, the more reliable the prediction will be. When your receptor is further from the kerb than your monitor, it is recommended that the receptor and monitor should be within 20m of each other. When your receptor is closer to the kerb than your monitor, it is recommended that the receptor and monitor should be within 10m of each other.

Note 2: The measurement and the background must be for the same year. The background concentration could come from the national maps published at www.airquality.co.uk, or alternatively from a nearby monitor in a background location.

Note 3: The calculator follows the procedure set out in Box 2.3 of LAQM TG(09). The results will have a greater uncertainty than the measured data. More confidence can be placed in results where the distance between the monitor and the receptor is small than where it is large.

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