

2015 Air Quality Updating and Screening Assessment for Belfast City Council

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

April 2015



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Executive Summary.

Belfast City Council has completed this 2015 Updating and Screening Assessment 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 (09).

In completing this Updating and Screening Assessment, we have undertaken a review of potentially significant sources of air pollution across the city in order to identify new sources, sources with increased emissions and locations close to air pollution sources where public exposure did not previously exist.

In addition, 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.

We have declared four air quality management areas across the city for exceedences of nitrogen dioxide and particulate matter short and long-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. However, sustained improvements in particulate matter within the M1 Motorway / A12 Westlink air quality management area means that the council and its relevant authority partners are currently in the process of revoking this AQMA for this pollutant.

In terms of new sources of ambient air pollution, there have been few significant industrial developments across the city over recent years and the economic downturn has meant that the construction of domestic housing has declined also, thereby reducing the potential for introduction of new public exposure.

Accordingly, the council has not identified any new roads or road junctions that require a detailed assessment. In addition, it is the council's view that we do not need to proceed to a detailed assessment for any other transport modes including airports, bus stations, railways and ports. No new industrial processes have been established in the city and existing processes have not significantly increased their emissions. Furthermore, we have assessed the impact of the fuel storage depot at Airport Road West within the Port of Belfast previously, and of the recently opened petrol stations, none meets the requirements for a detailed assessment

Finally, the council is not aware of any new poultry farms, biomass combustion installations or fugitive sources of particulate material within city confines.

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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 333,871. 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 (SO₂) and particulate matter (PM₁₀), 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 sulphur dioxide. Exceedences of the objectives for particulate matter have been restricted to a major arterial road transport route that traverses the city. 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 for a combination of both modelled and monitored

exceedences of nitrogen dioxide and particulate matter short and longer-term objectives. We published our 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. Of the outstanding 10% of actions, it is considered that the majority of these would have had limited additional impact within our air quality management areas.

Although Belfast City Council is directed to comply with the provisions of the Air Quality Strategy for England, Scotland, Wales and Northern Ireland via Part III of the Environment (Northern Ireland) Order 2002, the council is aware also of the pressing need to achieve European Commission air quality limit values at national level in accordance with the schedules prescribed in Directive 2008/50/EC in respect of ambient air quality and cleaner air for Europe and the 4th Daughter Directive. It should be noted that the deadline for achieving limit values for nitrogen dioxide was 1st January 2010 but unfortunately this was not achieved at all locations across the city. In order to address elevated levels of nitrogen dioxide, the council along with relevant partners are in the process of developing a new air quality action plan for the city that contains a manageable number of proven air quality mitigation measures. The measures will be quantified in relation to health benefits and will demonstrate how their successful implementation will deliver compliance with the nitrogen dioxide Limit Value.

1.2 Purpose of Report.

This report fulfils the requirements of the Local Air Quality Management process as established via 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. The objective of this Updating and Screening Assessment is to identify any matters that have changed which may lead to risk of an air quality objective being exceeded. A checklist approach and screening tools are used to identify significant new sources or changes and whether there is a need for a Detailed Assessment. The USA report should provide an update of any outstanding information requested previously in review and assessment reports.

1.3 Air Quality Objectives.

The air quality objectives applicable to LAQM **in Northern Ireland** are set out in the Air Quality Regulations (Northern Ireland) 2003, Statutory Rules of Northern Ireland 2003, no. 342, and are shown in table 1.1. This table shows the objectives in units of microgrammes per cubic metre μ gm⁻³ (milligrammes per cubic metre, mgm⁻³ for carbon monoxide) with the number of exceedences in each year that are permitted.

Pollutant	Air Quality (Date to be achieved	
Tonutant	Concentration	Measured as	by
Benzene	16.25 μgm ⁻³	Running annual mean	31.12.2003
	3.25 μgm⁻³	Running annual mean	31.12.2010
1,3-Butadiene	2.25 μgm⁻³	Running annual mean	31.12.2003
Carbon monoxide	10.0 mgm ⁻³	Running 8-hour mean	31.12.2003
Lood	0.5 μgm ⁻³	Annual mean	31.12.2004
Leau	0.25 μgm ⁻³	Annual mean	31.12.2008
Nitrogen dioxide	200 μgm ⁻³ not to be exceeded more than 18 times a year	1-hour mean	31.12.2005
	40 µgm⁻³	Annual mean	31.12.2005
Particles (PM ₁₀) (gravimetric)	50 µgm ⁻³ not to be exceeded more than 35 times a year	24-hour mean	31.12.2004
(9.2)	40 μgm ⁻³	Annual mean	31.12.2004
	350 μgm ⁻³ not to be exceeded more than 24 times a year	1-hour mean	31.12.2004
Sulphur dioxide	125 μgm ⁻³ , not to be exceeded more than 3 times a year	24-hour mean	31.12.2004
	266 μgm ⁻³ , not to be exceeded more than 35 times a year	15-minute mean	31.12.2005

Table 1.1 Air Quality Objectives included in Regulations for the purpose of LAQM in Northern Ireland.

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. In addition, the solid black line denotes the Belfast City Council boundary with Lisburn City Council.

- 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 Map of AQMA Boundaries



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 recent reports including the 2012 Updating and Screening Assessment and the 2013 Progress Report have identified sustained improvements in particulate matter within the M1 Motorway / A12 Westlink air quality management area. The Council and its relevant authority partners will consider revocation for this pollutant during 2015.

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

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.

Title	Publication date
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

Table 1.2 Historical Belfast City Council Air Quality Reports.

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

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 technical staff 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 Updating and Screening Assessment 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 processess 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 (PM₁₀) 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 PM₁₀ 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 Map of Automatic Monitoring Sites

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

Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Monitoring Technique	Relevant Exposure? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road (N/A if not applicable)	Does this location represent worst- case exposure?
Belfast Centre AURN site Lombard Street	Urban Centre	333898	374358	Nitrogen dioxide, sulphur dioxide, carbon monoxide, ozone and particulate matter (PM ₁₀ and PM _{2.5})	Ν	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
Belfast Ormeau Road	Roadside	334272	373012	Nitrogen dioxide	Y	Chemiluminescence	Y (6 m)	3 m	Y
Belfast Ballyhackamore	Roadside	337911	373972	Nitrogen dioxide	Y	Chemiluminescence	Y (7 m)	1.5 m	Y
Belfast Stockman's Lane	Roadside	331010	371252	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
Belfast Westlink Roden Street	Roadside	332617	373431	Nitrogen dioxide	Y	Chemiluminescence	Y (20 m)	5 m	Y

Table 2.1 Details of Automatic Monitoring Sites.	
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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 operates a range of 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 NO₂ 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, Westlink 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 colocation 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. Outputs from the spreadsheet for treatment of Belfast City Council's 2014 data are included in Appendix A to this report. The outputs also show monthly nitrogen dioxide monitoring data for each diffusion tube site for 2014 where available.



Figure 2.2 Map Non-Automatic Monitoring Sites

Table 2.2 Details of Non-Automatic Monitoring Sites

Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Is monitoring collocated with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road (N/A if not applicable)	Does this location represent worst-case exposure?
Royal Victoria Hospital	Urban Background	332522	373708	NO ₂	Ν	N	>70	>80	N/A
Black's Road	Roadside	329782	369522	NO ₂	Y	N	30	2	Y
61 Cromac Street	Roadside	334220	373853	NO ₂	Y	N	10	3	Y
Ravenhill Road	Roadside	335014	373942	NO ₂	Y	N	45	5	Y
Queen's Bridge	Roadside	334570	374393	NO ₂	N	N	13	1	Y
North Road	Urban Background	337551	374151	NO ₂	Ν	N	On School Wall	135	N/A
Donegall Square South	Roadside	333837	373950	NO ₂	Ν	Ν	Ν	N/A	Υ
Short Strand	Roadside	334980	374254	NO ₂	N	N	28	1	Y
301 Ormeau Road	Roadside	334503	372176	NO ₂	Y	N	25	7	Y
Knock Road	Roadside	338718	373918	NO ₂	Y	N	27	1.5	Y
Great George's Street	Kerbside	333981	375102	NO ₂	Y	N	40	0.5	Y
Lisburn Road	Roadside	332114	371492	NO ₂	N	N	8	1.5	Y
Shaftesbury Square	Kerbside	333594	373283	NO ₂	Ν	N	Ν	N/A	Y
Lombard Street	Urban Centre	333898	374358	NO ₂	N	Y	N	N/A	Y
Albert Clock	Roadside	334212	374489	NO ₂	N	N	3.5	2.5	Y
Stockman's Lane	Roadside	331007	371254	NO ₂	Y	Y	15	2	Y
Ballyhackamore	Roadside	337911	373972	NO ₂	Y	Y	36	1.5	Y

Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Is monitoring collocated with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road (N/A if not applicable)	Does this location represent worst-case exposure?
Whitewell Road	Roadside	333563	380450	NO ₂	N	N	35	13	Ŷ
Donegall Road	Kerbside	333022	373122	NO ₂	Ν	N	2	1	Y
Grosvener Road and Falls Road	Roadside	332252	373878	NO ₂	N	Ν	25	2	Y
Falls Road and Andersonstown	Roadside	330716	372519	NO ₂	Ν	N	35	2	Y
Station Road	Roadside	337252	375555	NO ₂	Ν	Ν	28	2	Y
Malone Road	Roadside	332478	370289	NO ₂	N	Ν	18	2	Y
Great Victoria Street	Roadside	333548	373772	NO ₂	Ν	Ν	Ν	N/A	Y
College Square East	Roadside	333498	374241	NO ₂	Ν	Ν	3	3	Y
Chichester Street	Roadside	334147	374123	NO ₂	Ν	N	2	3	Y
Cromac & Ormeau Avenue	Kerbside	334085	373542	NO ₂	Y	Ν	3	1	Y
Glenmachan Street	Roadside	331999	372881	NO ₂	Y	N	12	2	Y
Creche on M1/Westlink	Roadside	333006	374061	NO ₂	Y	N	10	1.5	Y
Ormeau Road (junction with Ravenhill Road)	Roadside	334943	371342	NO ₂	Y	N	10	2	Y

Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Is monitoring collocated with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road (N/A if not applicable)	Does this location represent worst-case exposure?
Upper Newtownards Road & Hollywood Road	Roadside	336519	374233	NO ₂	Ν	Ν	40	7	Y
Crumlin Road	Roadside	333195	375279	NO ₂	N	N	10	2	Y
228 Antrim Road	Roadside	333288	376143	NO ₂	N	Ν	18	2	Y
Shore Road (Ivan Street end)	Roadside	334174	376384	NO ₂	Ν	Ν	2.5	3.5	Υ
York Street	Roadside	334212	375614	NO ₂	Y	N	5	2	Y
2 Rosetta Court	Roadside	334963	371167	NO ₂	N	Ν	Building Façade	9	Y
Strand Walk	Roadside	335038	374384	NO ₂	N	N	24	1.5	Y
St. Anne's Close	Roadside	329773	369915	NO ₂	Ν	Ν	Building Façade	20	Y
Queens Square	Kerbside	334208	374507	NO ₂	Ν	Ν	Building Façade	5	Y

2.2 Comparison of Monitoring Results with AQ Objectives.

2.2.1 Nitrogen Dioxide

Automatic Monitoring Data

Tables 2.3 and 2.4 summarise recent monitoring data from the council's nitrogen dioxide automatic analysers for 2014 and preceding years from 2010. 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 has 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 2014 annual mean concentration has dropped to $28 \,\mu/gm^{-3}$. 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 high 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 μ g/m⁻³ annual mean objective for nitrogen dioxide with levels averaging around 54 μ g/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 $40 \ \mu g/m^{-3}$, with an average of $37 \mu g/m^{-3}$ annual mean over the previous three 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 μ g/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 locaiton to identify trends.

Table 2.3 Results of Automat	ic Monitoring of Nitrogen	Dioxide: Comparison with	Annual Mean Objective
	5 5		

			Valid Data		A	Annual Mean Concentration μg/m ³					
Site ID	Site Type	Within AQMA?	Capture for period of monitoring % ^a	Valid Data Capture 2014 % ^b	2010* ^c	2011* ^c	2012* ^c	2013* ^c	2014 ^c		
Belfast Centre	Urban Centre	Ν	92	92	35	28	29	31	31		
Belfast Ormeau Road	Roadside	Υ	82	82	36	35	53	N/A	28		
Belfast Ballyhackamore	Roadside	Υ	96	96	45	37	38	37	35		
Belfast Stockman's Lane	Roadside	Y	98	98	66	63	N/A	53	56		
Belfast Westlink Roden Street	Roadside	Y	98	98	N/A	33	39	38	35		

^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 Box 3.2 of TG(09), if monitoring was not carried out for the full year.

*Annual mean concentrations for previous years are optional.



Figure 2.3 Trends in Annual Mean Nitrogen Dioxide Concentrations measures at Automatic Monitoring Sites

			Valid Data		Number of Exceedences of Hourly Mean (200 μg/m ³)					
Site ID	Site Type	Within AQMA?	Capture for period of monitoring % ^a	Valid Data Capture 2014 % ^b	2010* ^c	2011* ^c	2012* ^c	2013* ^c	2014 ^c	
Belfast Centre	Urban Centre	N	92	92	0	0	5	2	0	
Belfast Ormeau Road	Roadside	Y	82	82	0	0	3	N/A	0(98)	
Belfast Ballyhackamore	Roadside	Y	96	96	1	0	3	0	2	
Belfast Stockman's Lane	Roadside	Y	98	98	56	40	32 (227)	13	14	
Belfast Westlink Roden Street	Roadside	Y	98	98	1	3	13	2	0	

Table 2.4 Results of Automatic Monitoring for Nitrogen Dioxide: Comparison with 1-hour mean Objective

^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 period of valid data is less than 90%, include the 99.8th percentile of hourly means in brackets

*Number of exceedences for previous years are 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 39 diffusion tubes at relevant locations across the city. Data from these tubes for 2014 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 2013 nitrogen dioxide diffusion tube monitoring, it is noted that the concentrations have slightly increased from last year at a number of locations. Annual mean exceedences during 2014 occurred at Black's Road, Cromac Street, Knock Road, Great George's Street, Stockmans Lane, Glenmachan Street and York Street 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, Malone Road, Great Victoria Street, Chichester Street and Antirm Road. Further assessment using the Defra NO₂ distance calculator was initiated to confirm if these excedeences apply to relevant receptors where applicable (Great Victoria Street location has no relevant exposure and Antrim Road annual mean was 41µg/m³ with the receptor distance at 18metres so these two locations were not further assessed. The calculated results as provided in Appendix B predicted that concentrations were below the objective in relation to relevant receptors at Short Strand and Malone Road, however slightly above the objective at Albert Clock and Chichester Street. These three monitoring locations with predicted exceedences are in the city centre and the elevated concentration are considered to be short term, attributed to the ongoing road works associated with Belfast on the Move (creation of bus lanes as infrastructure for the introduction of Belfast Rapid Transit). It is not considered practical to undertake a detailed assessment on these locations until the works are complete as the monitoring data is not representative of a typical year. In addition the calculated results assume that the monitor and receptor have similar elevations (at ground level), however all these receptors are apartments at second floor level or above whereby the concentrations will be further diluted.

Finally, there is also a noticable increase in concentration at the Whitewell Road site. Upon reveiw of this road, taking account of new development this tube was relocated in 2014 to an area more representative of exposure. Despite this increase the concentrations do not exceed the relevant objectives.

Site ID	Location	Site Type	Within AQMA?	Triplicate or Collocated Tube	Data Capture 2014 (Number of Months or %)	Data with less than 9 months has been annualised (Y/N)	Confirm if data has been distance corrected (Y/N)	Annual mean concentration (Bias Adjustment factor = 0.95) 2014 (μg/m ³)
1	Royal Victoria Hospital	Urban Background	Ν	-	100	N/A	N	23
2	Black's Road	Roadside	Y	-	100	N/A	Ν	42
3	61 Cromac Street	Roadside	Y	-	100	N/A	Ν	42
4	Ravenhill Road	Roadside	Y	-	92	N/A	Ν	30
5	Queen's Bridge	Roadside	N	-	83	N/A	Ν	34
6	North Road	Urban Background	Ν	-	75	N/A	Ν	15
7	Donegall Square South	Roadside	N	-	100	N/A	Ν	38
9	Short Strand	Roadside	Ν	-	92	N/A	Ν	47
10	301 Ormeau Road	Roadside	Y	-	100	N/A	Ν	35
12	Knock Road	Roadside	Y	-	100	N/A	Ν	47
13	Great George's Street	Kerbside	Y	-	100	N/A	Ν	50
14	Lisburn Road	Roadside	Ν	-	92	N/A	Ν	30
15	Shaftesbury Square	Kerbside	Ν	-	100	N/A	Ν	38
16,19,20	Lombard Street	Urban Centre	Ν	Triplicate and Co-located	100	N/A	Ν	32
17	Albert Clock	Roadside	N	-	100	N/A	Ν	47
21,22,56	Stockman's Lane	Roadside	Y	Triplicate and Co-located	100	N/A	Ν	55
23,24,32	Ballyhackamore	Roadside	Y	Triplicate and Co-located	83	N/A	Ν	35
25	Whitewell Road	Roadside	Ν	-	58	Y	Ν	33
26	Donegall Road	Kerbside	N	-	92	N/A	Ν	36

Table 2.5 Results of Nitrogen Dioxide Diffusion Tubes in 2014

					Data	Data with	Confirm if	Annual mean
					Capture	less than 9	data has	concentration
				Triplicate	2014	months has	been	(Bias Adjustment
				or	(Number	been	distance	factor = 0.95)
			Within	Collocated	of Months	annualised	corrected	
Site ID	Location	Site Type	AQMA?	Tube	or %)	(Y/N)	(Y/N)	2014 (μg/m³)
27	Grosvener Road	Roadside	N	_	67	v v	N	34
	Falls Road and				07	l	N	54
28	Andersonstown	Roadside	N	-	100	N/A		29
30	Station Road	Roadside	N	-	92	N/A	Ν	24
31	Malone Road	Roadside	N	-	75	N/A	Ν	45
33	Great Victoria Street	Roadside	Ν	-	92	N/A	Ν	42
34	College Square	Roadside	N				Ν	
	East	Reducide		-	58	Y		40
35	Chichester Street	Roadside	N	-	100	N/A	N	49
36	Cromac & Ormeau Avenue	Kerbside	Y	-	83	N/A	Ν	36
37	Glenmachan Street	Roadside	Y	-	83	N/A	Ν	43
	Creche on	Deedeide	V				Ν	
38	M1/Westlink	Roadside	Ŷ	-	92	N/A		35
	Ormeau Road						Ν	
39	(junction with	Roadside	Y					
	Ravenhill Road)			-	83	N/A		30
	Upper Newtownards						N	
40	Road &	Roadside	N					
	Hollywood Road			-	100	N/A		29
41	Crumlin Road	Roadside	Ν	-	83	N/A	Ν	34
42	228 Antrim Road	Roadside	N	-	83	N/A	N	41
44	Shore Road (Ivan Street end)	Roadside	N	-	92	N/A	N	34
59	York Street	Roadside	N	-	92	N/A	Ν	48
60	2 Rosetta Court	Roadside	N	-	100	N/A	Ν	30
61	Strand Walk	Roadside	N	-	83	N/A	N	31

				Triplicate or	Data Capture 2014 (Number	Data with less than 9 months has been	Confirm if data has been distance	Annual mean concentration (Bias Adjustment factor = 0.95)
		0:4 a Tama	Within	Collocated	of Months	annualised	corrected	0044 (
Site ID	Location	Site Type	AQIVIA ?	lube	or %)	(Y/N)	(Y/N)	2014 (µg/m²)
62	St. Anne's Close	Roadside	N	-	83	N/A	N	32
63	Queens Square	Kerbside	N	-	100	N/A	N	40

Table 2.6 Results of Nitrogen Dioxide Diffusion Tubes (2010 to 2014)

				Annual mean concentration (adjusted for bias) μg/m ³							
Site ID	Site Type	Within AQMA?	2010* (Bias Adjustment Factor = 0.92)	2011* (Bias Adjustment Factor = 0.81)	2012* (Bias Adjustment Factor = 0.85)	2013* (Bias Adjustment Factor = 0.94)	2014 (Bias Adjustment Factor = 0.95)				
1	Royal Victoria Hospital	Ν	25	21	22	24	23				
2	Black's Road	Y	46	40	40	43	42				
3	61 Cromac Street	Y	48	36	36	45	42				
4	Ravenhill Road	Y	36	25	29	32	30				
5	Queen's Bridge	Ν	29	23	30	33	34				
6	North Road	Ν	21	18	16	17	15				
7	Donegall Square South	Ν	48	36	35	38	38				
9	Short Strand	N	50	40	43	47	47				
10	301 Ormeau Road	Y	35	31	31	35	35				
12	Knock Road	Y	48	38	40	46	47				
13	Great George's Street	Y	55	45	48	52	50				
14	Lisburn Road	N	38	27	27	28	30				
15	Shaftesbury Square	Ν	43	36	34	38	38				
16,19,20	Lombard Street	N	35	29	29	31	32				

				Annual mean concentration (adjusted for bias) μg/m ³								
			2010*	2011*	2012*	2013*	2014					
Site ID	Site Type	Within AQMA?	(Bias Adjustment Factor = 0.92)	(Bias Adjustment Factor = 0.81)	(Bias Adjustment Factor = 0.85)	(Bias Adjustment Factor = 0.94)	(Bias Adjustment Factor = 0.95)					
17	Albert Clock	Ν	47	40	39	47	47					
21,22,56	Stockman's Lane	Y	63	64	59	55	55					
23,24,32	Ballyhackamore	Y	44	39	37	37	35					
25	Whitewell Road	Ν	25	16	19	23	33					
26	Donegall Road	Ν	34	28	35	39	36					
27	Grosvener Road and Falls Road	Ν	40	34	30	34	34					
28	Falls Road and Andersonstown	Ν	33	29	29	31	29					
30	Station Road	N	25	22	24	23	24					
31	Malone Road	N	28	21	39	44	45					
33	Great Victoria Street	Ν	44	37	39	42	42					
34	College Square East	Ν	44	32	33	39	40					
35	Chichester Street	Ν	56	39	47	46	49					
36	Cromac & Ormeau Avenue	Y	41	33	32	33	36					
37	Glenmachan Street	Y	39	38	-	40	43					
38	Creche on M1/Westlink	Y	38	31	31	34	35					
39	Ormeau Road (junction with Ravenhill Road)	Y	33	25	25	29	30					
40	Upper Newtownards Road & Holywood Road	N	29	26	27	29	29					

			Annual mean concentration (adjusted for bias) μg/m ³							
Site ID	Site Type	Within AQMA?	2010* (Bias Adjustment Factor = 0.92)	2011* (Bias Adjustment Factor = 0.81)	2012* (Bias Adjustment Factor = 0.85)	2013* (Bias Adjustment Factor = 0.94)	2014 (Bias Adjustment Factor = 0.95)			
41	Crumlin Road	N	36	31	32	34	34			
42	228 Antrim Road	Ν	41	37	34	37	41			
44	Shore Road (Ivan Street end)	Ν	37	30	30	33	34			
59	York Street	N	-	40	41	47	48			
60	2 Rosetta Court	N	-	28	29	34	30			
61	Strand Walk	N	-	30	33	31	31			
62	St. Anne's Close	N	-	26	27	30	32			
63	Queens Square	N	-	33	37	41	40			

*Optional

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

The following graphs shows trends in nitrogen dioxide diffusion tube data from 2010 where data exists.





2.2.2 PM₁₀

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 (PM₁₀) 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 μ 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. PM₁₀ 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 this data which demonstrates sustained improvements in particulate matter, the council considers it is appropriate to revoke the M1 Motorway / A12 Westlink air quality management area for exceedences of the particulate matter annual and 24-hour mean objectives. Accordingly, the council and its relevant authority partners are currently in the process of revoking this AQMA for this pollutant.

Γable 2.7 Results of Automatic Monitorin	g of PM ₁₀ : Comparison with	Annual Mean Objective
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			Valid Data	Valid	Confirm	Annual Mean Concentration μg/m ³					
Site ID	Site Type	Within AQMA?	Capture for monitoring Period % ^a	Data Capture 2014 % ^b	Gravimetric Equivalent (Y or NA)	2010* ^c	2011* ^c	2012* ^c	2013* ^c	2014 ^c	
Belfast Centre Lombard Street	Urban Centre	Ν	97	97	Y	-	-	15	-	16	
Belfast Stockman's Lane	Roadside	Y	97	97	Y	26	24	-	24	21	
Belfast Westlink Roden Street	Roadside	Y	45	45	Y	23	23	26	23	-	

^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 Box 3.2 of TG(09), if monitoring was not carried out for the full year.

* Optional

Table 2.8 Results of Automatic Monitoring for PM₁₀: Comparison with 24-hour mean Objective

						Number	of Exceede	ences of 24-H	lour Mean (5	0 μg/m³)
Site ID	Site Type	Within AQMA?	Valid Data Capture for monitoring Period % ^a	Valid Data Capture 2014 % ^b	Confirm Gravimetric Equivalent	2010* ^c	2011* ^c	2012* ^c	2013* ^c	2014 ^c
Belfast Centre Lombard Street	Urban Centre	N	97	97	Y	-	-	7	-	5
Belfast Stockman's Lane	Roadside	Y	97	97	Y	18(42)	6(41)	-	11	4
Belfast Westlink Roden Street	Roadside	Y	45	45	Y	10 (39)	11	11	13(43)	-

^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 is less than 90%, include the 90th percentile of 24-hour means in brackets

* Optional



Figure 2.5 Trends in Annual Mean PM₁₀ Concentrations at Belfast monitoring sites.

2.2.3 Sulphur Dioxide.

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 2014.

Table 2.9 Results of Automatic Monitoring of SO ₂ :	Comparison with Annual Mean Objectives
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			Valid Data	Valid	Number of Exceedences (percentile in bracket μg/m³) ^c				
Site ID	Site Type	Within AQMA?	Capture for monitoring Period % ^a	Data Capture 2014 % ^b	15-minute Objective (266 μg/m³)	1-hour Objective (350 μg/m ³)	24-hour Objective (125 μg/m ³)		
Belfast Centre Lombard Street	Urban Centre	N	96	96	0	0	0		

^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 is less than 90%, include the relevant percentile in brackets

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 ($3.25 \mu g/m^{-3}$ annual mean) or the 2010 EU Limit Value ($5 \mu g/m^{-3}$ annual mean) for benzene has been monitored in Belfast since 2002.

Previous rounds of R&A and monitored results going back to 2010 provided in Table 3.0 below confirm that there is no exceedence of the running annual mean of $3.25 \ \mu g$ m⁻³ for Benzene within Belfast. Therefore, a Detailed Assessment is not considered necessary.

Table 3.0 Results of monitoring for benzene: Annual mean levels for the Belfast Centre Lombard Street site 2010 – 2014.

Site	Site	Within	Valid Data		Runnin concent	g annua trations	al mean (µg/m³)	
ID	type	AQMA?	2014 %	2010	2011	2012	al mean ; (μg/m ³) 2013 0.60	2014
Belfast Centre	Urban Centre	Ν	100	0.79	0.57	0.55	0.60	0.64

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 Road Traffic Sources.

3.1 Narrow Congested Streets with Residential Properties Close to the Kerb.

It should be noted that in Northern Ireland, the Department for Regional Development and its TransportNI Agency has responsibility for the transport planning and maintenance of the road network. Accordingly, the Roads Service maintains and improves the road network and infrastructure in order to keep it safe, effective and reliable. In the earlier rounds of the review and assessment process, the council obtained a copy of the Belfast road transportation model which comprised traffic data for around 5,600 road nodes across the city. In addition, the council has bolstered this data through supplementary traffic counts in congested streets and we have sought to undertake monitoring at these locations through the use of diffusion tubes and automatic analysers. For this reason, we believe that we have a good understanding of traffic and development control patterns across the city and, on this basis, we believe that there are no newly identified congested streets with a vehicle flow above 5,000 vehicles per day and residential properties close to the kerb that have not been adequately considered either in previous rounds of the review and assessment process or by monitoring.

Belfast City Council confirms that there are no new/newly identified congested streets with a flow above 5,000 vehicles per day and residential properties close to the kerb, that have not been adequately considered in previous rounds of Review and Assessment.

3.2 Busy Streets Where People May Spend 1-hour or More Close to Traffic.

Belfast City Council confirms that there are no new / newly identified busy streets where people may spend 1 hour or more close to traffic.

3.3 Roads with a High Flow of Buses and/or HGVs.

In earlier rounds of the review and assessment process, Belfast City Council conducted screening assessments of the Belfast road network in order to identify locations with a high incidence of buses and / or heavy goods vehicles. In accordance with government's technical guidance LAQM.TG(09), an unusually high proportion can be taken to be greater than 20% heavy duty vehicles. The only part of the road network within Belfast that historically approached this criterion was the M1 Motorway / A12 Westlink corridor with approximately 15% of heavy duty vehicles. On this basis, a detailed review and assessment was completed and this corridor was designated as an air quality management area for both short and longer-term exceedences of the nitrogen dioxide and particulate matter objectives. This air quality management area has been the subject of mitigation measures as part of the Air Quality Action Plan for Belfast and, as a result, the council and relevant authorities are currently in the process of revoking the M1 Motorway / A12 Westlink AQMA for particulate matter objectives. The declaration for nitrogen dioxide will remain. Since the 2014 Progress Report, there have been no newly identified roads that meet the above-mentioned criterion for high flows of buses and / or HGVs.

Belfast City Council confirms that there are no new / newly identified roads with high flows of heavy-duty vehicles.

3.4 Junctions.

Belfast City Council confirms that there are no new or newly identified busy junctions or busy roads.

3.5 New Roads Constructed or Proposed Since the Last Round of Review and Assessment.

Belfast City Council confirms that there are no new or proposed roads that meet the criteria for review and assessment at this time.

3.6 Roads with Significantly Changed Traffic Flows.

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

3.7 Bus and Coach Stations.

Belfast City Council confirms that there are no relevant bus stations in the Local Authority area that have not been considered in previous rounds of the review and assessment process. The council therefore concludes that it will not be necessary to proceed to a Detailed Assessment.

4 Other Transport Sources.

4.1 Airports.

Belfast City Council has previously considered the air quality impact of the George Best Belfast City Airport and, on the basis of ambient monitoring data for nitrogen dioxide, concluded that an air quality management area did not need to be declared for the airport. In order to provide ongoing surety regarding the air quality impact of the airport, we have maintained a nitrogen dioxide diffusion tube at Station Road in East Belfast adjacent to the nearest residential receptors to the airport. It should be noted that the Station Road diffusion tube is located so as to take account also of the impact of nearby road traffic on the Sydenham Bypass and of the Belfast to Bangor rail line.

Annual mean levels of nitrogen dioxide at Station Road have remained consistently around 22-24 μ gm⁻³ since 2007; comfortably below the annual mean objective of 40 μ gm⁻³. Therefore, we are content that any changes to airport operations over recent years have had little impact upon ambient air quality at the nearest relevant receptors. Therefore, it is considered that a further Detailed Assessment for this existing airport is not required at this juncture.

Belfast City Council confirms that there are no new airports within the Local Authority area.

4.2 Railways (Diesel and Steam Trains).

4.2.1 Stationary Trains.

Belfast City Council confirms that there are no new locations where diesel or steam trains are regularly stationary for periods of 15 minutes or more, with potential for relevant exposure within 15m.

4.2.2 Moving Trains.

Belfast City Council confirms that there are no new locations with a large number of movements of diesel locomotives, and potential long-term relevant exposure within 30m.

4.3 Ports (Shipping).

Referring to the government's technical guidance regarding the treatment of ports and shipping, the screening assessment approach is to collect information regarding the number of ship movements per year, where such movements are confined to large ships, including cross-channel ferries, roll-on and roll-off vessels, container ships and cruise liners and movements number between 5,000 and 15,000 per annum. This movement data is contrasted subsequently with the potential for relevant exposure within 250 metres of the shipping berths. We have obtained activity data from the Port of Belfast who have confirmed that the number of ship movements during 2014 was around 12,000. However, an analysis of the geographic location of the Port conforms that there is little potential for relevant public exposure for 15-minute periods within 250 metres. The majority of ferry terminals are now located within the Port confines at Westbank Road off Dargan Road. This area is predominantly used for industrial and commercial activities and the nearest residential properties are in excess of 2,200 metres away.

Belfast City Council confirms that there are no new ports or shipping that meet the specified criteria within the Local Authority area.

5 Industrial Sources.

5.1 Industrial Installations.

5.1.1 New or Proposed Installations for which an air quality assessment has been carried out.

In Northern Ireland, the permitting of prescribed industrial activities under the Pollution Prevention and Control (Industrial Emissions) Regulations (Northern Ireland) 2013 is undertaken by both local authorities and the Industrial Pollution and Radiochemical Inspectorate (IPRI) of the Department of Environment. The IPRI has responsibility for the permitting of what are defined as Part A and B processes and district councils permit Part C processes. Part A processes have the greatest capacity to pollute and as a result can impact detrimentally upon air, land and water. For this reason, they require an integrated approach to controlling whereas Part B and Part C processes are regulated for emissions to air only.

In order to complete the 2015 Update and Screening Assessment, Belfast City Council liaised with the IPRI regarding Part A and B processes. The public register of Northern Ireland Part A and B processes is accessible on the Department of Environment website via the following web link:

www.doeni.gov.uk/niea/pollution-home/ippc/ipc-public-registers/listofpartabprocessesppc.htm

Officers from the Industrial Pollution and Radiochemical Inspectorate have confirmed that there are no new or proposed Part A or B industrial installations for which planning approval has been granted within the Belfast City Council area or nearby in a neighbouring authority. In addition, they have confirmed that there have been no significant increases in the emission profiles of any existing industrial processes or the introduction of new relevant exposure.

In relation to Part C processes, the council's Industrial Pollution Control Officer has confirmed also that there are no new or proposed Part C industrial installations for which planning approval has been granted within the Belfast City Council area or nearby in a neighbouring authority. Neither have there been significant increases in the emission profiles of existing industrial processes or the introduction of new relevant exposure. Belfast City Council confirms that there are no new or proposed industrial installations for which planning approval has been granted within its area or nearby in a neighbouring authority.

5.1.2 Existing Installations where Emissions have increased substantially or New Relevant Exposure has been introduced.

Belfast City Council confirms that there are no industrial installations with substantially increased emissions or new relevant exposure in their vicinity within its area or nearby in a neighbouring authority.

5.1.3 New or Significantly Changed Installations with No Previous Air Quality Assessment.

Belfast City Council confirms that there are no new or proposed industrial installations for which planning approval has been granted within its area or nearby in a neighbouring authority.

5.2 Major Fuel (Petrol) Storage Depots.

There is a major fuel storage depot within the Local Authority area, but its impact has been considered in previous updating and screening and review and assessment reports.

5.3 Petrol Stations.

Belfast City Council confirms that there are no new petrol stations meeting the specified criteria.

5.4 **Poultry Farms**.

Belfast City Council confirms that there are no new poultry farms meeting the specified criteria within the local authority district.

6 Commercial and Domestic Sources.

6.1 **Biomass Combustion – Individual Installations.**

Belfast City Council confirms that there are no new biomass combustion plants in the Local Authority area.

6.2 **Biomass Combustion – Combined Impacts.**

Belfast City Council confirms that there are no new biomass combustion plants in the Local Authority area.

6.3 Domestic Solid-Fuel Burning.

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

7 Fugitive or Uncontrolled Sources.

Belfast City Council confirms that there are no new relevant potential sources of fugitive particulate matter emissions in the Local Authority area.

8 Conclusions and Proposed Actions.

8.1 Conclusions from new monitoring data.

Belfast City Council has presented a range of monitoring data within this Updating and Screening 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 2014.

Nevertheless, 2014 monitoring data for nitrogen dioxide confirms continuing exceedences of the annual mean objective for nitrogen dioxide in the vicinity of Stockman's 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, the monitoring site at Roden Street indicates compliance with both annual and hourly mean objectives for nitrogen dioxide along this section of the A12 Westlink, suggesting that 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 have revealed sustained exceedences of the nitrogen dioxide annual mean objective. For example, since 2007 to 2010 annual mean concentrations have typically been around 45 µgm⁻³. However, since 2011 the data has 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. In addition, the Belfast City Air Quality Action Plan was completed

substantially during 2010 and, therefore, it is unclear whether the additional improvements in ambient conditions can be ascribed fully to the Action Plan. 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.

As was mentioned previously, Belfast Ormeau Road site experienced extensive problems with the air conditioning in 2012 and 2013; this prevented the monitoring equipment working to full capacity and the site was upgraded in 2014 which has resolved this problem. We therefore do not consider any data from this site obtained in 2012 and 2013 to be defensible. 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.

Exceedences also occurred at a number of monitoring locations which are not currently declared as air quality management areas including, Short Strand, Albert Clock, Malone Road, Great Victoria Street, Chichester Street and Antirm Road. Further assessment using the Defra NO₂ distance calculator was initiated to confirm that concentrations were below the objective in relation to relevant receptors at these locations. Exceedences calculated at Albert Clock and Chichester Street are considered to be short term, attributed to the ongoing road works associated with Belfast on the Move (creation of bus lanes as infrastructure for the introduction of Belfast Rapid Transit). It is not considered practical to undertake a detailed assessment on these locations until the works are complete as the monitoring data is not representative of a typical year.

In conclusion, it is considered that our 2014 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.

8.2 Conclusions from Assessment of Sources.

The assessment of new or altered sources of air pollution for 2014 has led the council to conclude that there are no new roads or road junctions within the city that require a detailed assessment. In addition, there are no new roads that have a significant proportion of heavy-duty vehicles or significantly changed traffic flows. No new bus stations have been constructed in the city and it is the council's view that the air quality impact of the George Best Belfast City Airport is well understood at relevant receptors through ambient monitoring data. There are no new locations in the city where stationary or moving trains are likely to detrimentally impact upon relevant receptors and the location of Port of Belfast means also that shipping is unlikely to impact detrimentally upon relevant receptors.

There are no new permitted industrial processes within Belfast and existing processes have not significantly increased their emissions profiles. Furthermore, no new relevant exposure has been introduced in the vicinity of the permitted processes.

No new major fuel storage depots have been established within Belfast since the last round of review and assessment and, of the few new petrol stations that have opened, the only one with a significant throughput is excluded from a detailed assessment through the lack of relevant exposure and the presence of emission abatement equipment.

There are no poultry farms within the city and neither is the council aware of any biomass combustion plants. In addition, the council is not aware of any significant new areas of domestic solid fuel use.

Finally, the council is not aware of any new sources of significant fugitive particulate matter emission within the city confines.

8.3 **Proposed Actions.**

In conclusion, the 2015 Updating and Screening Assessment 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 will be revoked for exceedences of particulate matter in 2015 following Council approval.

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 is currently in draft form and has been circulated for consultation with completation anticipated in Spetember 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.

9 References.

Air Quality Strategy for England, Scotland, Wales and Northern Ireland 2007 <u>http://www.official-documents.gov.uk/document/cm71/7169/7169_i.asp</u>

Belfast City Council, 2012, Belfast Update and Screening Assessment, April 2012. <u>http://www.airqualityni.co.uk/reports.php</u>

Belfast City Council, 2014, Belfast Progress Report, April 2014. <u>http://www.airqualityni.co.uk/reports.php</u>

Belfast City Air Quality Action Plan and Air Quality Management Areas. <u>http://www.belfastcity.gov.uk/airquality/reports.asp#quality</u>

Defra 'Workplace Analysis Scheme for Proficiency (WASP) NO2 diffusion tubes proficiency tests'. <u>http://laqm.defra.gov.uk/diffusion-tubes/ga-qc-framework.html</u>

Directive 2008/50/EC in respect of ambient air quality and cleaner air for Europe Environment (Northern Ireland) Order 2002. www.legislation.gov.uk/nisi/2002/3153/contents/made http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32008L0050:en:NOT

Environment (Northern Ireland) Order 2002. http://www.legislation.gov.uk/nisi/2002/3153/contents/made

Northern Ireland Air – Air Quality in Northern Ireland website http://www.airqualityni.co.uk/

Appendices.

Appendix A: Quality assurance and quality control of monitoring data.

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 the Defra Site Operators Manual for the Automatic Urban and Rural Network, published in 2009.

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.

In addition, we also routinely monitor operating parameters for our particulate monitoring equipment including a Met One Instruments Beta Attenuation Monitor and a number of Filter Dynamics Measurement System (FDMS) equipped Tapered Element Oscillating Microbalances (TEOMs). The particulate sampling filters within these instruments are changed as required.

Where an instrument is found not be operating within normal operating parameters, we refer the matter promptly to Enviro Technology Services 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.TG(09). 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.

Non automatic sampling data.

Nitrogen Dioxide Diffusion Tube Bias Adjustment Factors.

As in previous years, we have employed a triplicate colocation 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:



Adjustment of	Adjustment of SINGLE Tubes										B AEA	A Energy & Environment						
												Adjusted measurement (95% confidence interval)						
			Diff	usior	n Tuk	be Me	asu	reme	nts							With all the data		
														Davis	Mallal	Piac Factor A 0.05 (0.99, 1.03)		
Site Name/ID		Periods					Kaw	valid	Bias B 6% (-2% - 14%)									
	1	2	3	4	5	6	7	8	9	10	11	12	13	wean	penoas	Tube Precision: 6 Automatic DC: 97%		
1. RVH	35.7	26.7	23.9	22.0	24.1	17.8	16.8	14.1	27.1	25.9	29.1	26.5		24.1	12	Adjusted with 95% Cl 23 (21 - 25)		
2. Blacks Rd	56.3	45.9	46.8	40.8	44.4	40.6	39.8	44.4	43.2	37.7	49.1	44.6		44.5	12	Adjusted with 95% Cl 42 (39 - 46)		
3. 61 Cromac Str	51.3	49.4	45.6	45.7	38.2	44.8	34.1	41.0	45.0	43.9	52.4	44.3		44.6	12	Adjusted with 95% Cl 42 (39 - 46)		
4. Ravenhill Rd	39.6	28.2	33.5	30.7	35.4		25.4	25.7	36.6	31.3	35.6	30.9		32.1	11	Adjusted with 95% Cl 30 (28 - 33)		
5. Queens Bridge	46.6	32.5	41.0	34.5		33.8		28.6	29.0	35.7	41.0	36.4		35.9	10	Adjusted with 95% Cl 34 (32 - 37)		
6. North Road		24.8	24.8	12.8	13.4	11.8	11.5	12.0	15.1		20.5			16.3	9	Adjusted with 95% Cl 15 (14 - 17)		
7. Donegal Sq. South	49.7	41.0	41.3	38.2	43.0	33.7	34.1	32.0	39.5	43.3	50.5	39.5		40.5	12	Adjusted with 95% Cl 38 (36 - 42)		
9. Short Strand	56.2	42.1	52.0	47.7	52.3	46.3		41.7	52.8	47.6	55.8	49.7		49.5	11	Adjusted with 95% Cl 47 (44 - 51)		
10. 301 Ormeau Rd	46.3	40.7	35.2	33.6	37.1	31.3	28.1	34.9	32.6	39.4	40.0	40.3		36.6	12	Adjusted with 95% Cl 35 (32 - 38)		
12. Knock Rd	58.5	42.5	48.8	50.7	48.4	45.6	39.2	43.6	57.2	53.2	58.4	47.8		49.5	12	Adjusted with 95% Cl 47 (44 - 51)		
13. Gr Georges Str	64.0	40.6	55.1	54.6	57.5	56.9	40.7	52.4	55.2	55.0	48.9	47.7		52.4	12	Adjusted with 95% Cl 50 (46 - 54)		
14. Lisburn Rd	41.5	34.0	35.8	38.6		24.7	20.4	23.8	30.3	36.5	31.2	33.4		31.8	11	Adjusted with 95% Cl 30 (28 - 33)		
15. Shaftesbury Sq	54.6	37.9	43.0	39.4	41.8	38.3	34.3	30.6	39.9	41.7	45.4	36.3		40.3	12	Adjusted with 95% Cl 38 (35 - 41)		
17. Albert Clock	57.2	51.0	50.3	51.4	51.3	55.8	33.9	37.0	45.7	46.6	65.6	46.6		49.4	12	Adjusted with 95% Cl 47 (43 - 51)		
25. Whitewell Rd				42.5	43.6	57.6			29.2	22.9	41.9	22.0		37.1	7	Adjusted with 95% Cl 35 (33 - 38)		
26. Donegal Rd	44.6	33.2	40.8	35.0	37.6		29.6	33.1	41.5	40.5	43.8	37.9		37.9	11	Adjusted with 95% Cl 36 (33 - 39)		
27. Grovesner Rd	52.1			31.0		26.5	23.3	29.0	33.1	35.9	48.3			34.9	8	Adjusted with 95% Cl 33 (31 - 36)		
28. Falls and Andytown	39.5	28.4	35.1	28.4	32.5	26.1	26.3	22.0	29.1	29.7	35.4	28.5		30.1	12	Adjusted with 95% Cl 29 (26 - 31)		
30. Station Rd	29.0	30.6	32.4	22.3	16.3	21.6	19.1	21.7	24.1		35.3	26.8		25.4	11	Adjusted with 95% Cl 24 (22 - 26)		
31 Newforge Lane	62.3	41.2	54.6	41.8	43.6				45.6	43.0	62.1	36.7		47.9	9	Adjusted with 95% Cl 45 (42 - 49)		
33 Great Victoria Street	55.3	46.4		36.7	49.4	37.4	34.0	42.0	43.9	47.4	47.7	48.0		44.4	11	Adjusted with 95% Cl 42 (39 - 46)		
34 College Square East	49.9				41.6			28.3	39.3	44.9	53.5	32.7		41.4	7	Adjusted with 95% Cl 39 (36 - 43)		
35 Chichester Street	55.2	44.1	55.0	46.5	56.0	58.9	39.5	48.6	57.0	47.8	69.8	44.5		51.9	12	Adjusted with 95% Cl 49 (46 - 53)		
36 Cromac/Ormeau Avenue	44.6	37.8	35.8	32.1	34.7	30.6			38.4	41.8	49.0	38.7		38.3	10	Adjusted with 95% Cl 36 (34 - 39)		
37 Westlink/Glennochan Str	56.5	48.8	47.2	42.7		38.5	30.7	38.0	40.6	47.9	59.4			45.0	10	Adjusted with 95% Cl 43 (40 - 46)		
The bias adjustr	ent fa	ector i	ised ii	thes	e calc	ulatio	ns inc	lude :	all the	data	and n	o scro	enina	of data d	lue to noor r	precision has been applied		

Adjustment of	Adjustment of SINGLE Tubes																	
	Diffusion Tube Measurements										Adjusted measurement (95% confidence interval) with all the data							
Site Name/ID	F					P	erioc	riods						Raw	Valid	10 periods used in this calcuations Bias Factor A 0.94 (0.87 - 1.03) Bias B 6% (-3% - 15%)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	Weam	penous	Tube Precision: 5 Automatic DC: 97%		
38 Creche on M1/Westlink	43.1	34.2	46.5	40.4	40.1	36.5		20.9	39.5	36.6	46.7	28.8		37.6	11	Adjusted with 95% Cl 35 (33 - 39)		
39 Ormeau Rd/Ravenhill Rd		31.2	34.9	26.9	34.6		45.9	20.6	30.8	34.7	27.9	31.7		31.9	10	Adjusted with 95% Cl 30 (28 - 33)		
40 Hollywood Rd Arches	46.0	36.2	32.2	27.6	27.4	23.4	21.8	23.2	29.5	32.9	39.6	34.0		31.2	12	Adjusted with 95% Cl 29 (27 - 32)		
41 Crumlin Rd	44.4		40.1	36.7	35.4	37.1	28.1	29.1	35.1	36.6	44.3			36.7	10	Adjusted with 95% Cl 34 (32 - 38)		
42 228 AntrimRd	55.3	45.1	50.9		45.2		31.2	31.2	40.0	47.6	62.8	31.9		44.1	10	Adjusted with 95% Cl 41 (38 - 45)		
44 Shore Rd (Ivan St. End)	49.3	38.7	40.5	37.0	36.0	30.1	25.2	24.0	33.7	37.8	47.5			36.3	11	Adjusted with 95% Cl 34 (32 - 37)		
59 York Street	74.1	42.6	56.1	47.9	53.7	43.0	42.3		42.0	52.1	67.7	42.8		51.3	11	Adjusted with 95% Cl 48 (45 - 53)		
60 2 Rosetta Court	40.7	30.4	40.7	31.8	30.9	33.2	21.9	24.1	32.6	31.2	42.6	29.4		32.4	12	Adjusted with 95% Cl 30 (28 - 33)		
61 5-6 Strand Walk		35.9	35.4	30.1		31.3	23.0	29.8	35.7	34.4	40.2	31.4		32.7	10	Adjusted with 95% Cl 31 (28 - 34)		
62 St Anne's	42.4	31.9	34.3	37.4	35.3	31.6	23.1		33.2	31.9		42.2		34.3	10	Adjusted with 95% Cl 32 (30 - 35)		
63 Queen's Sq	51.0	39.7	49.6	43.6	40.3	42.9	32.8	33.8	41.5	47.6	38.3	44.1		42.1	12	Adjusted with 95% Cl 40 (37 - 43)		
The block in the														-6.4-4-		metalog has been evalued		
The bias adjustm	ient fa	ctor u	ised ii	n thes	e calc	ulatio	ns inc	ude a	all the	data	and n	o scre	ening	of data d	ue to poor p	recision has been applied.		

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 2014 sampling periods. In addition, the precision checks were also deemed 'good' for all sampling periods apart from one. The overall bias factor was calculated as 0.95.

Discussion of the choice of factor to use.

For those local authorities that do not wish, or are unable to undertake a triplicate diffusion tube colocation 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 2015 and cover sampling periods up until 2014. In 2014, 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 2014 locally derived bias adjustment factor of 0.95. Historially, we have always used our own bias adjustment factors and for consistancy in results we will continue with the same methodology.

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 2014 sampling period, Gradko's performance was assessed as follows:



Nitrogen Dioxide Proficiency Scheme 2014

	Proficiency Scheme - Nitrogen Dioxide 2014									
			Camspec	M550 - GL	М 7	QuAA	tro-GLM	9		
Date	Round	Assigned value	Measured concentration	z-Score	% Bias	Measured concentration	z-Score	% Bias		
Feb-14	WASP 124-1	0.90	0.91	0.14	1.2%	0.91	0.06	0.6%		
Feb-14	WASP 124-2	2.24	2.25	0.09	0.5%	2.31	0.41	2.9%		
Feb-14	WASP 124-3	2.24	2.25	0.07	0.4%	2.33	0.58	4.2%		
Feb-14	WASP 124-4	0.90	0.93	0.46	2.9%	0.92	0.32	1.9%		
May-14	AIR PT 1-1	1.39	1.44	0.48	3.6%	1.43	0.38	2.9%		
May-14	AIR PT 1-2	1.36	1.44	0.78	5.9%	1.40	0.39	2.9%		
May-14	AIR PT 1-3	0.97	0.95	-0.27	-2.1%	0.98	0.14	1.0%		
May-14	AIR PT 1-4	0.99	0.97	-0.27	-2.0%	0.99	0.0	0.0%		
Aug-14	AIR PT 3-1	1.84	1.84	0.0	0.0%	1.87	0.22	1.6%		
Aug-14	AIR PT 3-2	1.71	1.71	0.0	0.0%	1.72	0.08	0.6%		
Aug-14	AIR PT 3-3	1.66	1.65	-0.08	-0.6%	1.69	0.24	1.8%		
Aug-14	AIR PT 3-4	1.83	1.87	0.29	2.2%	1.88	0.36	2.7%		
Nov-14	AIR PT 4-1	2	1.99	-0.07	-0.5%	2.05	0.33	2.5%		
Nov-14	AIR PT 4-2	1.98	1.95	-0.2	-1.5%	2.01	0.2	1.5%		
Nov-14	AIR PT 4-3	1.15	1.15	0	0.0%	1.16	0.12	0.9%		
Nov-14	AIR PT 4-4	1.14	1.14	0	0.0%	1.15	0.12	0.9%		

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



Short-term to Long-term Data adjustment.

Guidance for the treatment of diffusion tube monitoring data, as highlighted 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 3.2 of the government's local air quality management technical guidance LAQM.TG(09).

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 each diffusion tube monitoring site, commensurate with the diffusion tube exposure periods. The adjustment ratios for our sites with less than 9 months of data are summarised in the following table:

Site	Site Type	2014 Annual Mean	Diffusion tube site	2014 Annual Mean for diffusion tube sampling period*	Ratio*	Average Ratio*
Belfast Centre AURN Site	Urban Centre	31	W/bitewell Road	33	0.95	0.94
Derry City Council Brooke Street Site	Urban Background	14	white well Road	15	0.93	0.94
Belfast Centre AURN Site	Urban Centre	31	Grosvenor Road	30	1.03	1 02
Derry City Council Brooke Street Site	Urban Background	14	Grosvenor Road	14	1.01	1.02
Belfast Centre AURN Site	Urban Centre	31	College Square	30	1.05	1 02
Derry City Council Brooke Street Site	Urban Background	14	Lasi	14	1.00	1.02

*Some numeric rounding has been applied to the data reported in this table.

Appendix B: Defra NO₂ Distance Calculator Results

Short Strand Monitoring Location

This cald ("recept monitor.	culator allows you to predict the annual mean NO ₂ concentration for a lo or") that is close to a monitoring site, but nearer or further the kerb tha The next sheet shows your results on a graph.	n the	Air Q	uality
	Enter o	lata into the	yellow cell	s
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 μ g/m ³)?	(Note 2)	27.5	μg/m ³
Step 4	What is your measured annual mean NO ₂ concentration (in μ g/m ³)?	(Note 2)	47	μg/m ³
Result	The predicted annual mean NO_2 concentration (in μ g/m ³) at your receptor	(Note 3)	36.1	μg/m ³
Note 1: In so http://laqm2. assumes the value of 0.1n your predict and the rece recommende note 2: The published at	me cases the term "kerb" may be taken to be the edge of the trafficked road - see the FAQ at defra.gov.uk/FAQs/Monitoring/Location/index.htm for further details. Distances should be measured ho at the monitor and receptor have similar elevations. Each distance should be greater than 0.1m and less m when the monitor is closer to the kerb than this is likely to be reasonable). The receptor is the location ion. The monitor can either be closer to the kerb than the receptor, or further from the kerb than the receptor are to each other, the more reliable the prediction will be. When your receptor is further from the kerb than the receptor are to each other, the more reliable the prediction will be. When your receptor is closer to the d that the receptor and monitor should be within 20m of each other. When your receptor is closer to the ed that the receptor and monitor should be within 10m of each other. measurement and the background must be for the same year. The background concentration could con www airquality could or alternatively from a nearby monitor in a background location.	rizontally from the s than 50m (In pra n for which you v eptor. The close kerb than your mo le kerb than your me from the nation	e kerb and actice, using a wish to make er the monitor nitor, it is monitor, it is mal maps	
Note 3: The	calculator follows the procedure set out in Box 2.3 of LAQM TG(09). The results will have a greater un	certainty than the	e measured	
uata. More (Jonnuence can be praced in results where the distance between the monitor and the receptor is small between the Proceedings of the receptor is small between the proceeding of the receptor is small between the recepto		n ye.	l

Albert Clock Monitoring Location

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.

	Enter o	lata into the	yellow cell	<u>ls</u>				
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 μ g/m ³)?	(Note 2)	27.5	μg/m ³				
Step 4	What is your measured annual mean NO ₂ concentration (in μ g/m ³)?	(Note 2)	47	μg/m ³				
Result	The predicted annual mean NO_2 concentration (in $\mu g/m^3$) at your receptor	(Note 3)	42.8	μg/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 data. More	calculator follows the procedure set out in Box 2.3 of LAQM TG(09). The results will have a greater un confidence can be placed in results where the distance between the monitor and the receptor is small t	certainty than th han where it is la	e measured arge.					
	Issue 4: 25/01/11. Created by Dr Ben Marner; Approved by Prof Duncan Laxen. Cont	act: benmarner@ac	consultants.co.	uk				

Malone Road Monitoring Location

This calculator allows you to predict the annual mean NO₂ 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. <u>Enter data into the yellow cells</u>

				_
Step 1	How far from the KERB was your measurement made (in metres)?	(Note 1)	2	metre
Step 2	How far from the KERB is your receptor (in metres)?	(Note 1)	14	metre
Step 3	What is the local annual mean background NO ₂ concentration (in μ g/m ³)?	(Note 2)	12	μg/m ³
Step 4	What is your measured annual mean NO ₂ concentration (in μ g/m ³)?	(Note 2)	45	μg/m ³
Result	The predicted annual mean NO $_2$ concentration (in $\mu g/m^3$) at your receptor	(Note 3)	30.0	μg/m ³
Note 1: In so nttp://laqm2.4 assumes tha value of 0.1r your predicti and the rece recommende recommende Note 2: The r published at	me cases the term "kerb" may be taken to be the edge of the trafficked road - see the FAQ at defra.gov.uk/FAQs/Monitoring/Location/index.htm for further details. Distances should be measured ho to the monitor and receptor have similar elevations. Each distance should be greater than 0.1m and less m when the monitor is closer to the kerb than this is likely to be reasonable). The receptor is the locatio on. The monitor can either be closer to the kerb than the receptor, or further from the kerb than the rece ptor are to each other, the more reliable the prediction will be. When your receptor is further from the 1 dd that the receptor and monitor should be within 20m of each other. When your receptor is closer to the dt that the receptor and monitor should be within 10m of each other. measurement and the background must be for the same year. The background concentration could con www.airquality.co.uk, or alternatively from a nearby monitor in a background location.	rizontally from th s than 50m (In pr. n for which you septor. The closs kerb than your m ne kerb than you me from the natio	ne kerb and actice, using a wish to make er the monitor onitor, it is r monitor, it is mal maps	
Note 3: The d data. More d	calculator follows the procedure set out in Box 2.3 of LAQM TG(09). The results will have a greater un confidence can be placed in results where the distance between the monitor and the receptor is small t	icertainty than th than where it is I	e measured arge.	
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Chichester Street Monitoring Location

This calc ("recepto monitor.	ulator allows you to predict the annual mean NO ₂ concentration for a lo or") that is close to a monitoring site, but nearer or further the kerb tha The next sheet shows your results on a graph.	ocation C) Air G	uality				
	Enter o	data into the y	<u>yellow cel</u>	ls				
Step 1	How far from the KERB was your measurement made (in metres)?	(Note 1)	3	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 μ g/m ³)?	(Note 2)	27.5	μg/m ³				
Step 4	What is your measured annual mean NO ₂ concentration (in μ g/m ³)?	(Note 2)	49	μg/m ³				
Result	The predicted annual mean NO_2 concentration (in μ g/m ³) at your receptor	(Note 3)	46.2	μg/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 concentration could come from the national maps								
Note 3: The o	calculator follows the procedure set out in Box 2.3 of LAQM TG(09). The results will have a greater un	certainty than the	measured					
data. More o	confidence can be placed in results where the distance between the monitor and the receptor is small t	han where it is la	rge.					
	Issue 4: 25/01/11. Created by Dr Ben Marner; Approved by Prof Duncan Laxen. Cont	taot: benmarner@aq	consultants.co.	.uk				