



2012 Air Quality Updating and
Screening Assessment for
Aberdeen City Council

In fulfillment of Part IV of the
Environment Act 1995
Local Air Quality Management

July 2012

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Executive Summary

This Updating and Screening Assessment has been undertaken to fulfil Aberdeen City Council's duty to annually review and assess air quality. The Report provides the latest monitoring results and discusses the implications for air quality management in Aberdeen. In writing the Report, the Council has regard to the Government's published guidance LAQM.TG(09).

In 2011 the annual mean nitrogen dioxide level (NO₂) continued to exceed the national air quality objective across the City Centre Air Quality Management Area (AQMA). Pockets of exceedances were also recorded within the Wellington Road and Anderson Drive/Haudagain Roundabout/Auchmill Road AQMAs indicating the 3 AQMAs remain valid. Levels at monitoring locations were generally similar to previous years with the exception of the Union Street continuous monitor which recorded a 25% decrease in the annual mean concentration. The reason for the significant reduction is unknown as there has been no change in traffic volume or characteristic. Data was considered valid, however equipment malfunction is a potential factor.

There were no exceedances of the NO₂ 1 hour objective at the continuous monitoring sites although diffusion tube data suggested potential exceedances at specific locations in the City Centre AQMA.

The annual mean PM₁₀ objective was exceeded at Wellington Road, Market St and Union Street. There appeared to be a slight rise in PM₁₀ concentrations in 2011 compared to 2010 and 2009, although trends cannot be properly assessed due to the differently methodology applied to adjust data prior to 2009 and equipment replacement.

A rise in the number of occasions the 24 hour mean exceeded 50µgm⁻³ was observed at Market Street, Union Street, King Street and Wellington Road with the objective exceeded at Wellington Road and Market Street for the first time.

Outwith the AQMAs, only the diffusion tube at Ellon Road indicated a potential exceedance of the annual mean NO₂ objective. Concentrations at this site have historically been just below the objective. PM₁₀ concentrations also marginally exceeded the annual mean objective at the King Street continuous monitoring site for the first time.

A study of the impact of the Union Square retail complex adjacent to the City Centre AQMA indicated traffic levels are likely to have risen along the main approaches resulting in a 2% increase in emissions across the AQMA. Modelling indicated more substantial rises in emissions may occur at specific parts of the network, including the Market Street and College Street approaches to the development. Further detailed dispersion modelling will be carried out in 2012 to predict the air quality impact of Union Square and other potential development and traffic infrastructure measures at relevant receptors. Detailed modelling and assessment of King Street and Ellon Road will be included in the modelling study to indicate the likelihood of future exceedances of the air quality objectives along these road links.

A study to assess emissions from shipping and their impact on the City Centre AQMA was also completed in 2011. The assessment predicted emissions of nitrogen oxides from shipping contributed a maximum of $6.6\mu\text{g m}^{-3}$ to the annual mean NO_2 concentrations at a location of relevant population exposure (16% of the annual mean objective), whilst emissions of PM_{10} were predicted to contribute a maximum of $2.26\mu\text{g m}^{-3}$ to the annual mean concentration (6% of the annual mean objective). Generally, the impacts were predicted to be less than approximately 5% of the total ambient NO_2 and PM_{10} concentration. It was concluded that, whilst emissions from shipping are not likely to cause an exceedance of the annual mean air quality objectives, they do contribute to existing exceedances in specific areas near the Harbour.

A new Air Quality Action Plan was approved in March 2011 covering the 3 AQMAs. The majority of measures in the Plan are concerned with reducing the impact of transport emissions. These include greater modal shift away from car usage; encouragement to uptake lower emitting vehicles; road infrastructure improvements; traffic management measures and the development of integrated planning and policy.

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1 Introduction

1.1 Description of Local Authority Area

Aberdeen is situated on the east coast of Scotland by the North Sea and has a population of 220,000. The city acts as a focus for employment, service and leisure activities both for residents of Aberdeen and the surrounding area.

There is little heavy industry within the city and much of the economy is based around services to the oil industry. Road traffic is the main source of atmospheric pollution. Aberdeen's road transportation system is constrained by the River Dee to the south of the city and the River Don to the north therefore there are limited routes to either arrive at or pass around the city. Construction of a Western Peripheral Route around the city was due to commence during 2010, however an appeal against the development was lodged in the Court of Session in May 2010. While the appeal outcome, announced in March 2012, was in favour of the development, a further appeal was lodged to the Supreme Court in April 2012. Progression of the project has been delayed until the appeal outcome is determined. The A90 and A96 trunk roads, A93 North Deeside Road, A956 Ellon Road and A956 Wellington Road are the most significant routes to converge or pass through the city centre. Much of the commuter traffic entering the city comes from the neighbouring Aberdeenshire.

Aberdeen Harbour is located in the city centre and is a thriving environment acting as the UK's main base for supply vessels to offshore installations. There are also regular ferries to The Shetland and Orkney Islands. Aberdeen Airport (Dyce) is located around 7km to the northwest of the city.

1.2 Purpose of Report

This report fulfils the requirements of the Local Air Quality Management process as set out in Part IV of the Environment Act (1995), 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 **Scotland** are set out in the Air Quality (Scotland) Regulations 2000 (Scottish SI 2000 No 97), the Air Quality (Scotland) (Amendment) Regulations 2002 (Scottish SI 2002 No 297), and are shown in Table 1.1. This table shows the objectives in units of microgrammes per cubic metre $\mu\text{g}/\text{m}^3$ (milligrammes per cubic metre, mg/m^3 for carbon monoxide) with the number of exceedences in each year that are permitted (where applicable).

Table 1.1 Air Quality Objectives included in Regulations for the purpose of LAQM in Scotland

Pollutant	Air Quality Objective		Date to be achieved by
	Concentration	Measured as	
Benzene	16.25 $\mu\text{g}/\text{m}^3$	Running annual mean	31.12.2003
	3.25 $\mu\text{g}/\text{m}^3$	Running annual mean	31.12.2010
1,3-Butadiene	2.25 $\mu\text{g}/\text{m}^3$	Running annual mean	31.12.2003
Carbon monoxide	10.0 mg/m^3	Running 8-hour mean	31.12.2003
Lead	0.5 $\mu\text{g}/\text{m}^3$	Annual mean	31.12.2004
	0.25 $\mu\text{g}/\text{m}^3$	Annual mean	31.12.2008
Nitrogen dioxide	200 $\mu\text{g}/\text{m}^3$ not to be exceeded more than 18 times a year	1-hour mean	31.12.2005
	40 $\mu\text{g}/\text{m}^3$	Annual mean	31.12.2005
Particles (PM₁₀) (gravimetric)	50 $\mu\text{g}/\text{m}^3$, not to be exceeded more than 7 times a year	24-hour mean	31.12.2010
	18 $\mu\text{g}/\text{m}^3$	Annual mean	31.12.2010
Sulphur dioxide	350 $\mu\text{g}/\text{m}^3$, not to be exceeded more than 24 times a year	1-hour mean	31.12.2004
	125 $\mu\text{g}/\text{m}^3$, not to be exceeded more than 3 times a year	24-hour mean	31.12.2004
	266 $\mu\text{g}/\text{m}^3$, not to be exceeded more than 35 times a year	15-minute mean	31.12.2005

1.4 Summary of Previous Review and Assessments

The outcomes of the first, second, third and fourth rounds of the review and assessment process for NO₂ and PM₁₀ are described in sections 1.4.1-1.4.4. All rounds of the process concluded levels of carbon monoxide, benzene, 1,3-butadiene, sulphur dioxide and lead in Aberdeen are unlikely to exceed the national air quality objectives.

1.4.1 First Round of Review and Assessment

The first round of the review and assessment process predicted exceedances of the annual mean objective for NO₂ in parts of the city centre. An Air Quality Management Area (AQMA) was declared in June 2001 centering around Market Street and Union Street. Following subsequent Detailed Assessments in 2001 and 2002 the AQMA was slightly amended in March 2003 to include adjoining areas.

1.4.2 Second Round of Review and Assessment

The second round of review and assessment confirmed levels of NO₂ continued to exceed the annual mean objective in the city centre, including streets adjacent to the AQMA. Exceedances of the 1-hour objective were also predicted on Market Street. Additionally, exceedances of the new annual mean objective for PM₁₀, to be achieved by 2010, were also predicted in the city centre. Following a Detailed Assessment, the AQMA was amended in January 2005 to include all areas of current or predicted exceedances of both the NO₂ and 2010 PM₁₀ annual mean objectives in the city centre and the 1-hour NO₂ objective on Market Street.

The Detailed Assessment also predicted annual mean levels close to the NO₂ objective and potential exceedances of the objective at several locations outwith the city centre, particularly around Haudagain roundabout on Great Northern Road/Anderson Drive (A96). Further monitoring was recommended prior to the consideration of an AQMA in this area. A feasibility study into a Western Peripheral Route (AWPR) around Aberdeen that would remove a significant amount of traffic from the Haudagain roundabout/Anderson Drive corridor was carried out in 2006.

Emissions from Aberdeen Harbour were considered in the Detailed Assessment. It was concluded that emission contributed to elevated levels of NO₂ and PM₁₀ in the Market Street and Guild Street areas, but do not cause exceedances of the objectives.

An Air Quality Action Plan was also published in July 2006 detailing measures to improve the air quality in the AQMA. These included

- Pedestrianisation of Union Street and associated road infrastructure improvements
- Additional controlled parking

- Additional Park and Ride facilities
- Green Transport Plans
- Improved Public Transport
- Increase Public Awareness of Air Quality Issues
- Construction of a Western Peripheral Route around the city (AWPR)

1.4.3 Third Round of Review and Assessment

A further Updating and Screening Assessment and Progress Reports were completed in 2006, 2007 and 2008 respectively. NO₂ levels across the City and PM₁₀ levels on Union Street were found to be similar to previous years. In 2007 elevated levels of PM₁₀ were recorded on Market St due to roadworks and the development of Union Square adjacent to the continuous monitoring station. Potential exceedances of the annual mean objective for both PM₁₀ and NO₂ were again predicted on the Anderson Drive/Haudagain roundabout corridor even with the construction of the AWPR and on parts of Wellington Road.

A Detailed Assessment was completed in March 2008 and concluded that the annual mean NO₂ objective and the annual mean 2010 PM₁₀ objective were likely to be exceeded in 2010 at the Haudagain roundabout (A96/A90), locations along the A90 Anderson Drive and Wellington Road (Queen Elizabeth II Bridge to Balnagask Road) without the AWPR. With the AWPR exceedances were still predicted on Wellington Road although levels slightly below the objectives were predicted on the Haudagain roundabout/Anderson Drive corridor.

Wellington Road (Queen Elizabeth II Bridge to Balnagask Road) was designated an AQMA in November 2008 as a result of the Detailed Assessment and annual mean NO₂ and PM₁₀ levels recorded in the 2008 Progress Report. The Haudagain roundabout/Anderson Drive corridor was also declared an AQMA for both pollutants as NO₂ monitoring in the vicinity of the roundabout has frequently recorded measurements in excess of the objective and the AWPR would not be completed until 2012 at the earliest.

The Detailed Assessment also considered NO₂ and PM₁₀ levels on King Street. Although potential exceedances of both objectives were identified, there was a lack of monitoring data in the area to confirm the likelihood of exceedances. Accordingly further monitoring was recommended prior to any decision being made on the requirement for an AQMA on King Street.

1.4.4 Fourth Round of Review and Assessment

The 2009 Updating and Screening Assessment and 2010 Progress Report completed in July 2009 and July 2010 respectively confirmed measured NO₂ levels were again similar to previous years with the exception of Market Street. The Market Street monitoring station was relocated in 2008 and the lower levels recorded at the new site are attributable to the more open nature of the site and reduced congestion. Both reports confirmed continued widespread exceedances of the NO₂ annual mean objective within the City Centre AQMA and pockets of exceedances within the Wellington Road and Anderson Drive/Haudagain roundabout AQMA.

A City Centre modelling study completed in March 2010 indicated potential exceedances of the annual mean NO₂ objective just outwith the AQMAs, however additional monitoring confirmed NO₂ levels well below the objective with the exception of Auchmill Road. The 1-hour objective was met at all sites in 2009, although the objective was exceeded for the first time at Union Street in 2008.

PM₁₀ levels were lower in 2009 compared to previous years. It is believed that the replacement of TEOMs with FDMS and the use of the VCM for the first time contributed to the lower values. The 2010 annual mean was exceeded only at Market Street and Wellington Road, although the objective was reached at Union Street. There were no exceedances of the 24-hour objective.

Modelling of the City Centre reported in March 2010 predicted widespread exceedances of the annual mean PM₁₀ objective outwith the AQMAs, however the modelling was based on pre 2010 data and 2010 data suggested the modelling over predicted measured concentrations.

The 2011 Progress Report confirmed continued exceedances of the annual mean PM₁₀ and NO₂ objectives across the 3 AQMAs. Diffusion tube results identified likely exceedances just outwith the existing boundaries of the City Centre and Anderson Drive/Haudagain roundabout AQMAs. These AQMAs were extended in November 2011 to include the following areas:

- City Centre AQMA: Victoria Road to the junction with Sinclair Road, Bridge Street and West North Street to the junction with Littlejohn Street
- Anderson Drive/Haudagain roundabout AQMA: Auchmill Road to the junction with Howes Road.

Additionally, the Union Street continuous monitoring recorded exceedances of the 1 hour NO₂ objective. As diffusion tube data indicated likely exceedances at several sites across the City Centre AQMA, the AQMA was also amended to include exceedance of the 1 hour objective.

A new Air Quality Action Plan (AQAP) covering all 3 AQMAs was adopted in March 2011. Measures to improve air quality were grouped into the following 6 categories:

- Modal Shift and Influencing Travel Choice
- Lower Emissions and Cleaner Vehicles
- Road Infrastructure
- Traffic Management
- Planning and Policies
- Non-Transport Measures

Maps of the 3 AQMAs are shown in Figures A1-A3 in Appendix A.

Table 1.2 summarises the outcome of previous air quality reports.

Table 1.2 Summary of Air Quality Reports and Outcomes

Report	Outcomes
Stages 1, 2, 3 and 4 Reports 2000-2003	City centre AQMA declared in June 2001 due to predicted exceedances of annual mean NO ₂ objective. Area of AQMA extended in March 2003
Updating and Screening Assessment August 2003	Detailed Assessment of NO ₂ and PM ₁₀ recommended in city centre and assessment of Aberdeen Harbour
Detailed Assessment August 2004	Extension of city centre AQMA for NO ₂ and inclusion of predicted exceedances of 1-hour objective on Market Street. City Centre AQMA declared for PM ₁₀ due to predicted exceedances of the 2010 annual mean objective. Concluded emissions from Aberdeen Harbour do not cause exceedances of objectives, but contribute to elevated levels of NO ₂ and PM ₁₀ on Market Street and Guild Street areas
Progress Report 2005	Update of monitoring results and new developments
Updating and Screening Assessment July 2006	Update of monitoring results and new developments
Air Quality Action Plan July 2006	Detailed measures to improve air quality in the AQMA
Progress Report June 2007	Detailed Assessment of NO ₂ and PM ₁₀ recommended on Wellington Road, Anderson Dr/Haudigan roundabout/Auchmill Rd corridor and King Street
Detailed Assessment March 2008	AQMAs declared November 2008 on Anderson Drive/Haudagain roundabout and Wellington Rd (Queen Elizabeth II Bridge – Balnagask Rd) due predicted exceedances of NO ₂ and 2010 PM ₁₀ annual mean objectives
Progress Report May 2008	Update of monitoring results and new developments and progress on implementation of the Air Quality Action Plan
Updating and Screening Assessment July 2009	Update of monitoring results. Recommended additional NO ₂ diffusion tubes at potential areas of exceedances. Modelling of City Centre PM ₁₀ and NO ₂ recommended to support proposed new Action Plan
City Centre modelling study March 2010	City Centre modelling predicted widespread exceedances of annual mean PM ₁₀ objective and minor potential areas of exceedances of the NO ₂ annual mean objective outwith the AQMA
Progress Report July 2010	Update of monitoring results and progress in the development of a new Air Quality Action Plan covering the 3 AQMAs
Progress Report June 2011	Update of monitoring results, extension of City Centre and Anderson Drive/Haudagain roundabout AQMAs and amendment of City Centre AQMA to include exceedance of the 1 hour NO ₂ objective
Air Quality Action Plan March 2011	Detailed measures to improve air quality across the 3 AQMAs

2 New Monitoring Data

2.1 Summary of Monitoring Undertaken

2.1.1 Automatic Monitoring Sites

There are 6 continuous monitoring sites in Aberdeen. Details of pollutants monitored, equipment types and site locations are described in Table 2.1. Figure A4 in Appendix A shows the site locations. QA/QC procedures are detailed in Appendix B.

The Market St site required to be removed in October 2008 due to the construction of the adjacent Union Square retail park. A new site at the junction of Market Street/Poynerook Road commenced collecting data in July 2009. However, as the equipment had been in storage for a number of months, various operational problems occurred during the initial months of operation both for the NO_x analyser and the TEOM, culminating in the replacement of the TEOM with a BAM in March 2010 and a replacement NO_x analyser in April 2010.

Table 2.1 Details of Automatic Monitoring Sites

Site Name	Site Type	OS Grid Ref		Pollutants Monitored	Monitoring Technique	In AQMA?	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?
Errol Place	Background	X394397	Y807392	PM ₁₀ , PM _{2.5} , O ₃ , NO ₂ (NO, NO _x)	FDMS FDMS Chemiluminescence	N	N/A	N/A	N
Union Street	Roadside	X393656	Y805967	PM ₁₀ , NO ₂ (NO, NO _x)	TEOM Chemiluminescence	Y	Y(2m)	2m	Y
Market Street	Roadside	X394560	Y805677	PM ₁₀ , NO ₂ (NO, NO _x)	BAM Chemiluminescence	Y	Y(0m)	2m	N
Anderson Drive	Roadside	X392506	Y804186	PM ₁₀ , NO ₂ (NO, NO _x)	TEOM Chemiluminescence	Y	Y(10m)	6m	N
Wellington Road	Roadside	X394395	Y804779	PM ₁₀ , NO ₂ (NO, NO _x)	TEOM Chemiluminescence	Y	Y(5m)	4m	Y
King Street	Roadside	X394333	Y808770	PM ₁₀ , NO ₂ (NO, NO _x)	BAM Chemiluminescence	N	Y(10m)	3m	N

2.1.2 Non-Automatic Monitoring Sites

Levels of nitrogen dioxide are also monitored across the city via diffusion tubes attached to lamppost and downpipes. Figure A4 in Appendix A shows the site locations. The diffusion tubes provide an indication of longer-term average NO₂ concentrations and highlight areas of high NO₂ concentrations. Tubes are co-located in triplicate at all the continuous monitoring sites detailed in Table 2.1 to enable the bias adjustment of the city wide survey. Duplicate tubes are also co-located at several city centre sites. Table 2.2 provides details of diffusion tube 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?	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?
Bucksburn Primary Sch, Inverurie Road	Roadside	389744	809575	NO ₂	Y	Y (façade)	8m	N
885 Gt Northern Rd	Roadside	391167	809161	NO ₂	Y	Y (11m)	3m	Y
549 N Anderson Dr	Roadside	391394	808949	NO ₂	Y	Y (17m)	3m	Y
38 Ellon Rd	Roadside	394652	809714	NO ₂	N	Y(7m)	3m	Y
520 King St	Roadside	394236	808066	NO ₂	N	Y(9m)	0.1m	N
86 Victoria Rd, Torry	Roadside	394764	805197	NO ₂	N	Y(façade)	3m	Y
Wellington Rd//Kerloch Pl	Roadside	394411	804407	NO ₂	Y	Y(façade)	3m	Y
107 Anderson Dr	Roadside	392337	804340	NO ₂	Y	Y(14m)	3m	Y
31 Market St	Roadside	394258	806157	NO ₂	Y	Y(façade)	3m	Y
184/192 Market St	Roadside	394530	805708	NO ₂	Y	Y(façade)	3m	Y
105 King St	Roadside	394406	806637	NO ₂	Y	Y(façade)	3m	Y
40 Union St	Roadside	394284	806284	NO ₂	Y	Y(façade)	3m	Y
Music Hall, Union St	Roadside	393777	806030	NO ₂	Y	Y(façade)	6m	Y
Dyce Prim, Gordon	Urban	389046	812794	NO ₂	N	Y(N/A)	N/A	N

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Ter	background							
Northfield swimming pool	Urban background	390801	808132	NO ₂	N	Y(N/A)	N/A	N
Guild St/Market St	Roadside	394336	806097	NO ₂	Y	Y(facade)	5m	Y
43/45 Union St	Roadside	394284	806284	NO ₂	Y	Y(façade)	3m	Y
14 Holburn St	Roadside	393305	805734	NO ₂	Y	Y(façade)	3m	Y
468 Union St	Roadside	393386	805826	NO ₂	Y	Y(façade)	3m	Y
212 King St	Roadside	394400	806842	NO ₂	N	Y(façade)	4m	N
26 King St	Roadside	394449	806453	NO ₂	Y	Y(façade)	4m	Y
104 King St	Roadside	394425	806634	NO ₂	Y	Y(façade)	4m	Y
785 Gt Northern Rd	Roadside	391458	809102	NO ₂	N	Y(façade)	3m	Y
40 Auchmill Rd	Roadside	389913	809603	NO ₂	N	Y(facade)	3m	Y
21 Holburn St	Roadside	393323	805728	NO ₂	Y	Y(façade)	3m	Y
147 Holburn St	Roadside	393323	805728	NO ₂	N	Y(façade)	3m	N
80 Holburn St	Roadside	393233	805565	NO ₂	Y	Y(façade)	3m	Y
61 Holburn St	Roadside	393275	805624	NO ₂	Y	Y(5m)	3m	Y
469 Union St	Roadside	393400	805811	NO ₂	Y	Y(façade)	3m	Y
209 Union St	Roadside	393795	806009	NO ₂	Y	Y(façade)	5m	Y
249 Union St	Roadside	393170	805120	NO ₂	Y	Y(façade)	5m	Y
Willowbank	Roadside	393642	805503	NO ₂	N	Y(5m)	3m	N

Rd/Albury Rd								
East North St	Roadside	394505	806529	NO ₂	Y	Y(façade)	4m	Y
404 King Street	Roadside	394317	807527	NO ₂	N	Y(façade)	9m	N
Riverside House, Riverside Drive	Roadside	39425	804873	NO ₂	N	Y(façade)	6m	N
115 Menzies Rd/Wellington Rd	Roadside	394403	804799	NO ₂	Y	Y(12m)	1m	Y
137 Wellington Road	Roadside	394697	803735	NO ₂	N	Y(17m)	14m	N
Wellington Road / 4 Nigg Kirk Road	Roadside	394719	803329	NO ₂	N	Y(7m)	3m	N
819 Gt Northern Rd	Roadside	391293	809136	NO ₂	Y	Y(façade)	3m	Y
852 Fullerton Ct (facade)	Facade	391353	809158	NO ₂	Y	Y(façade)	7m	Y
852 Fullerton Ct (roadside)	Roadside	391352	809151	NO ₂	Y	Y(7m)	0.1m	Y
248 George St	Roadside	393868	806741	NO ₂	N	Y(façade)	2m	N
25 Rosemount Pl	Roadside	393424	806685	NO ₂	N	Y(3m)	3m	N
214 Rosemount Pl	Roadside	392897	806352	NO ₂	N	Y(façade)	3m	N
111 S Anderson Dr	Facade	392311	804349	NO ₂	Y	Y(façade)	13m	N
West North Street	Roadside	394277	806671	NO ₂	Y	Y(façade)	4m	Y

2.2 Comparison of Monitoring Results with AQ Objectives

2.2.1 Nitrogen Dioxide

The Union Street and Market Street continuous monitoring sites are on busy city centre roads and are representative of population exposure for NO₂. Union Street is the city's main shopping street with shops on the ground floor properties and commercial premises and flats on the 1st, 2nd and 3rd floors. Almost all of the city's bus routes pass along at least part of Union Street and the inside lane of both sides of the road are designated bus lanes. Market Street is adjacent to Aberdeen Harbour and has a high proportion of HGV's travelling between the north-east of Scotland, the Harbour and locations to the south of Aberdeen. The street is used by pedestrians travelling to the city centre from residential properties to the south of the river Dee, visiting the new Union Square retail park and people working around the Harbour area. There are a small number of 1st, 2nd and 3rd floor flats. Emissions from Aberdeen Harbour also contribute to the pollution on Market Street.

The Anderson Drive site is 4m from the kerb and is not representative of population exposure as residential properties are set back 10-20m from the kerb. Similarly the site at Wellington Road is around 3-4m closer to the kerb than residential properties in the area. The nearest properties are 10m from the King Street site, however the location is typical of flatted properties close to the kerb at other locations on King Street. Errol Place is representative of typical residential properties close to the city centre but not adjacent to a major road.

Diffusion tubes on Market Street, Union Street and the majority of those on Holburn Street and King Street within the city centre are at building façade and are representative of population exposure. Some of the tubes outwith the city centre are at roadside locations with the façade of the nearest relevant property 5-20m back from the roadside. Procedures within LAQM.TG(09) have been used to estimate the concentration at the nearest receptor where appropriate.

Automatic Monitoring Data

Table 2.3 shows the annual mean NO₂ concentrations at the continuous monitoring sites for NO₂ from 2007-2011. Concentrations at Union Street, Market Street and Wellington Road continue to exceed the annual mean objective. At Errol Place, Anderson Drive, King Street concentrations are well below the objective. The Anderson Drive AQMA was declared due to predicted exceedances of the annual mean objective at locations elsewhere along the Anderson Drive/Haudagain roundabout corridor.

Trends in the annual mean concentration are shown in Figure 2.1. Levels in 2011 were broadly similar to previous years with the exception of Union Street where the

value of $44\mu\text{g m}^{-3}$ was $15\mu\text{g m}^{-3}$ less than 2010 and significantly less than the period 2007-2010. The reason for such a dramatic decrease is unclear. There were operational issues with the analyser, however the data has been fully ratified and checked by AEA Technology and no reason can be provided to suggest the data is invalid. While the economic downturn may have influenced traffic flows and congestion elsewhere in the UK, the impact in Aberdeen has been less due to the buoyant oil industry. Traffic flows in 2010 and 2011 at the Union Street monitoring station were almost identical with an annual AADT of 16752 in 2010 and 16728 in 2011. There were no road infrastructure changes or other measures in the area likely to have influenced air quality.

The Market Street site, which is in the City Centre, also recorded slightly lower levels in 2011. The concentration at Wellington Road was similar to 2010, although significantly higher than 2009.

Table 2.3 Results of Automatic Monitoring of Nitrogen Dioxide: Comparison with Annual Mean Objective

Site ID	Site Type	Within AQMA?	Valid Capture period monitoring % ^a	Data for of Capture 2011 % ^b	Annual Mean Concentration $\mu\text{g}/\text{m}^3$				
					2007	2008	2009	2010	2011
Errol Place	Urban Background	N		95.7	23	25	26	21	23
Union Street	Roadside	Y		86.3	53	54	56 ^c	59	44
Market Street	Roadside	Y		95.5	62 ^d	73 ^d	38 ^c	44	40
Anderson Drive	Roadside	Y		95.4	28	25	24	27	23
Wellington Road	Roadside	Y		93.6	N/A	40 ^c	43	52	51
King Street	Roadside	N		95.2	n/A	N/A	32	29	32

^a data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

^b 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 data has been seasonally adjusted to provide “annualised” data using procedures within TG(09), where monitoring was not carried out for the full year.

^d The Market Street site ceased operation in October 2008 due to the development of the adjacent land and was relocated in 2009. Data capture for 2008 and 2009 was 77% and 36% respectively.

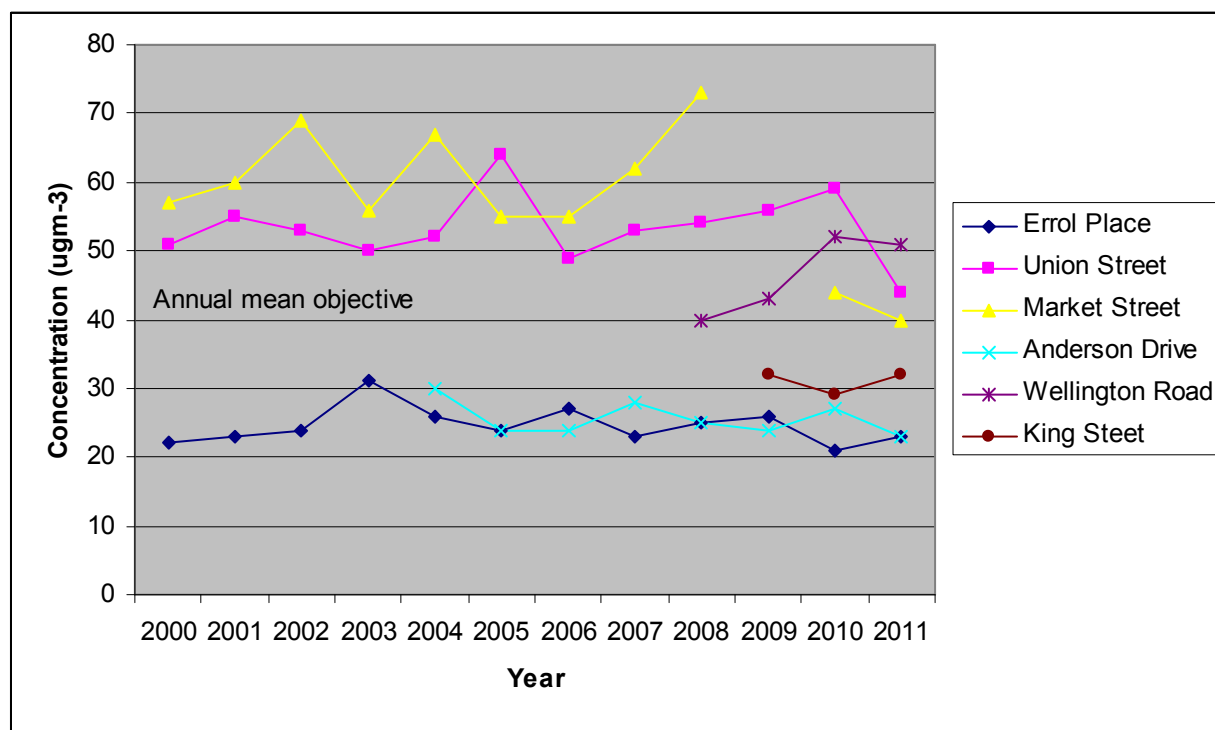
Figure 2.1 Trends in Annual Mean Nitrogen Dioxide Concentrations measures at Automatic Monitoring Sites

Table 2.4 shows the number of exceedances of the 1-hour objective at the automatic monitoring sites. In 2011 all sites were well below the objective value of 18 permitted exceedances per year. Union Street only recorded 6 exceedances (86.3% data capture) compared to 17 in 2010 (78.9% data capture).

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

Site ID	Site Type	Within AQMA?	Valid Capture period monitoring % ^a	Data for Valid Capture % ^b	Number of Exceedances of Hourly Mean (200 µg/m ³)				
					2007	2008	2009	2010	2011
A1	Errol Place	N		95.7	0	0	0	0(101)	0
A2	Union Street	Y		86.3	13	21	10(190)	17(202)	6(168)
A3	Market Street	Y		95.5	39	94 ^d (244)	2(175)	0(157)	1
A4	Anderson Drive	Y		95.4	0	2	0	0(111)	0
A5	Wellington Road	Y		93.6	N/A	0(153)	0	1	4
A6	King Street	N		95.2	N/A		0	0	0

^a data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

^b 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 Where data capture is less than 90% the 99.8th percentile of hourly means is presented in brackets

^d The Market Street site ceased operation in October 2008 due to the development of the adjacent land and was relocated in 2009. Data capture for 2008 and 2009 were 77% and 36% respectively

Diffusion Tube Monitoring Data

Table 2.5 shows the results of the diffusion tube monitoring. Tubes have been bias adjusted using the methodology described in LAQM.TG(09). In recent years there has been a significant variation in the bias factors for the different continuous monitoring sites. The national helpline recommended adjustment of 2010 data using the factor from the nearest continuous monitoring site for the 2011 Progress Report. For roadside sites, this value ranged from 0.82 (King Street) to 1.0 (Union Street).

Bias factors in 2011 again varied across the city and were generally lower than previous years. Table B1 in Appendix B shows the bias factor calculations. These are summarised below:

Diffusion Tube Site	Value
Union Street	0.75
Market Street	0.77
Anderson Drive	0.91
King Street	0.87
Wellington Road	0.96
Errol Place	0.67

As recommended by the national helpline, the orthogonal regression of the roadside sites was used to adjust the roadside diffusion tubes (value 0.864) and Errol Place was used to adjust background sites. Union Street was excluded due to concerns about data validity. In previous years the factor at Union Street consistently ranged from 0.95-1.0.

Uncorrected 4-weekly diffusion tube data, bias adjustment calculations and calculations to correct to façade where appropriate are shown in Tables C1-C3 in Appendix C.

The majority of diffusion tubes within the City Centre AQMA continued to exceed the annual mean objective. Concentrations greater than $60\mu\text{g m}^{-3}$ were recorded at several sites indicating a risk of exceedance of the 1-hour objective. The AQMA was extended in 2011 to include Victoria Road, Torry and West North Street as a result of previous measured exceedances, however concentrations at the Victoria Rd site were below the objective in 2011. Monitoring at West North Street commenced in autumn 2011 and results from this site will be reported in the 2013 Progress Report. Bias corrected values in the City Centre were lower than previous years however uncorrected values were similar to previous years. The lower values reported may be a consequence of the lower bias factor applied to adjust the 2011 City Centre tubes rather than from an actual reduction in concentrations.

Bias adjusted values within the Wellington Road and Anderson Dr/Haudigan roundabout/Auchmill Road AQMAs were consistent with previous years. Concentrations at several sites within both AQMAs exceeded the annual mean objective. These values agreed with the values in previous years indicating pockets of exceedances across the AQMAs.

Outwith the AQMAs concentrations at all sites were well below the objective with the exception of 38 Ellon Road which reached the objective for the first time. Historically concentrations at this site have been slightly below the objective. Continued monitoring in 2012 will assist in identifying whether exceedance of the NO₂ annual mean objective is likely at this location. The southern section of Ellon Road will be included within the proposed modelling of King Street reported in section 2.6.

Table 2.5 Results of Nitrogen Dioxide Diffusion Tubes in 2011

Site ID	Location	Site Type	Within AQMA?	Triplicate or Collocated Tube	Data Capture 2011 (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 Roadside (RD) = 0.864 urban background (UB) = 0.67) 2011 ($\mu\text{g}/\text{m}^3$)
1	Bucksburn Primary Sch, Inverurie Road	Roadside	Y	Single	11 months	N/A	Y	33
2	885 Gt Northern Rd	Roadside	Y	Single	12 months	N/A	Y	41
3	549 North Anderson Dr	Roadside	Y	Single	12 months	N/A	Y	28
4	38 Ellon Rd	Roadside	N	Single	11 months	N/A	Y	40
5	520 King St	Kerbside	N	Co-located	9 months	N/A	Y	30
6	86 Victoria Rd, Torry	Roadside	Y	Co-located	12 months	N/A	Y	33
7	Wellington Rd/Kerloch Pl	Roadside	Y	Single	12 months	N/A	Y	45
8	107 Anderson Dr	Roadside	Y	Single	12 months	N/A	Y	42
9	31 Market St	Roadside	Y	Co-located	12 months	N/A	Y	52
10	184/192 Market St	Roadside	Y	Co-located	12 months	N/A	Y	64
11	105 King St	Roadside	Y	Co-located	11 months	N/A	Y	63
12	40 Union St	Roadside	Y	Co-located	12 months	N/A	Y	51
13	Music Hall, Union St	Roadside	Y	Co-located	12 months	N/A	Y	42

Site ID	Location	Site Type	Within AQMA?	Triplicate or Collocated Tube	Data Capture 2011 (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 Roadside (RD) = 0.864 urban background (UB) = 0.67) 2011 ($\mu\text{g}/\text{m}^3$)
14	Dyce Prim, Gordon Ter	Urban background	N	Single	12 months	N/A	Y	9
15	Northfield swimming pool	Urban background	N	Single	12 months	N/A	Y	11
16	Guild St/Market St	Roadside	Y	Co-located	12 months	N/A	Y	46
17	43/45 Union St	Roadside	Y	Co-located	12 months	N/A	Y	55
18	14 Holburn St	Roadside	Y	Co-located	11 months	N/A	Y	55
19	468 Union St	Roadside	Y	Co-located	12 months	N/A	Y	54
20	212 King St	Roadside	N	Co-located	12 months	N/A	Y	37
21	26 King St	Roadside	Y	Co-located	12 months	N/A	Y	43
22	104 King St	Roadside	Y	Co-located	12 months	N/A	Y	48
23	785 Gt Northern Rd	Roadside	Y	Single	12 months	N/A	Y	32
24	40 Auchmill Rd	Roadside	Y	Single	10 months	N/A	Y	41
25	21 Holburn St	Roadside	Y	Single	12 months	N/A	Y	47
26	147 Holburn St	Roadside	N	Single	10 months	N/A	Y	31
27	80 Holburn St	Roadside	Y	Co-located	12 months	N/A	Y	31
28	61 Holburn St	Roadside	Y	Co-located	12 months	N/A	Y	38
29	469 Union St	Roadside	Y	Co-located	12 months	N/A	Y	63
30	209 Union St	Roadside	Y	Single	12 months	N/A	Y	57
31	249 Union St	Roadside	Y	Co-located	12 months	N/A	Y	35
32 ^c	Willowbank Rd/Albury Rd	Roadside	N	Single	7 months	N	Y	27

Site ID	Location	Site Type	Within AQMA?	Triplicate or Collocated Tube	Data Capture 2011 (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 Roadside (RD) = 0.864 urban background (UB) = 0.67)
								2011 ($\mu\text{g}/\text{m}^3$)
33	East North St	Roadside	Y	Co-located	12 months	N/A	Y	51
34	404 King Street	Roadside	N	Co-located	12 months	N/A	Y	35
35 ^c	Riverside House, Riverside Drive	Roadside	N	Single	8 months	N	Y	27
36	115 Menzies Rd/Wellington Rd	Roadside	Y	Co-located	12 months	N/A	Y	31
37	137 Wellington Road	Roadside	N	Single	12 months	N/A	Y	31
38 ^c	Wellington Road / 4 Nigg Kirk Road	Roadside	N	Single	7 months	N	Y	31
39	819 Gt Northern Rd	Roadside	Y	Single	9 months	N/A	Y	55
40	852 Fullerton Ct (facade)	Roadside	Y	Single	12 months	N/A	Y	36
41	852 Fullerton Ct (roadside)	kerbside	Y	Single	9 months	N/A	Y	22
42 ^c	248 George St	Roadside	N	Single	8 months	N	Y	35
43 ^c	25 Rosemount Pl	Roadside	N	Single	8 months	N	Y	28
44 ^c	214 Rosemount Pl	Roadside	N	Single	8 months	N	Y	26
45	111 South Anderson Drive	Roadside	Y	Single	10 months	N/A	Y	29

^a data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

^b 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 monitoring ceased in September 2011 as sites consistently recorded levels below the annual mean objective

Table 2.6 Results of Nitrogen Dioxide Diffusion Tubes (2007 to 2011)

Site ID	Site Type	Within AQMA?	Annual mean concentration (adjusted for bias) $\mu\text{g}/\text{m}^3$				
			2007 (Bias Adjustment Factor = RD 1.03 UB 0.89)	2008 (Bias Adjustment Factor = RD 0.97 UB 0.88)	2009 (Bias Adjustment Factor = RD 0.89 UB 0.74)	2010* (Bias Adjustment Factor = nearest site 0.76-1.0)	2011 (Bias Adjustment Factor RD = 0.864 UB = 0.67)
1	Bucksburn Primary Sch, Inverurie Road	Y	37	37	33	37	33
2	885 Gt Northern Rd	Y	40	40	41	39	41
3	549 North Anderson Dr	Y	27	27	27	30	28
4	38 Ellon Rd	N	38	38	38	31	40
5	520 King St	N	25	25	30	31	30
6	86 Victoria Rd, Torry	Y	39	39	34	41	33
7	Wellington Rd/Kerloch Pl	Y	47	47	43	45	45
8	107 Anderson Dr	Y	44	44	42	42	42
9	31 Market St	Y	58	58	55	63	52
10	184/192 Market St	Y	75	75	64	76	64
11	105 King St	Y	70	70	67	66	63
12	40 Union St	Y	62	62	53	62	51

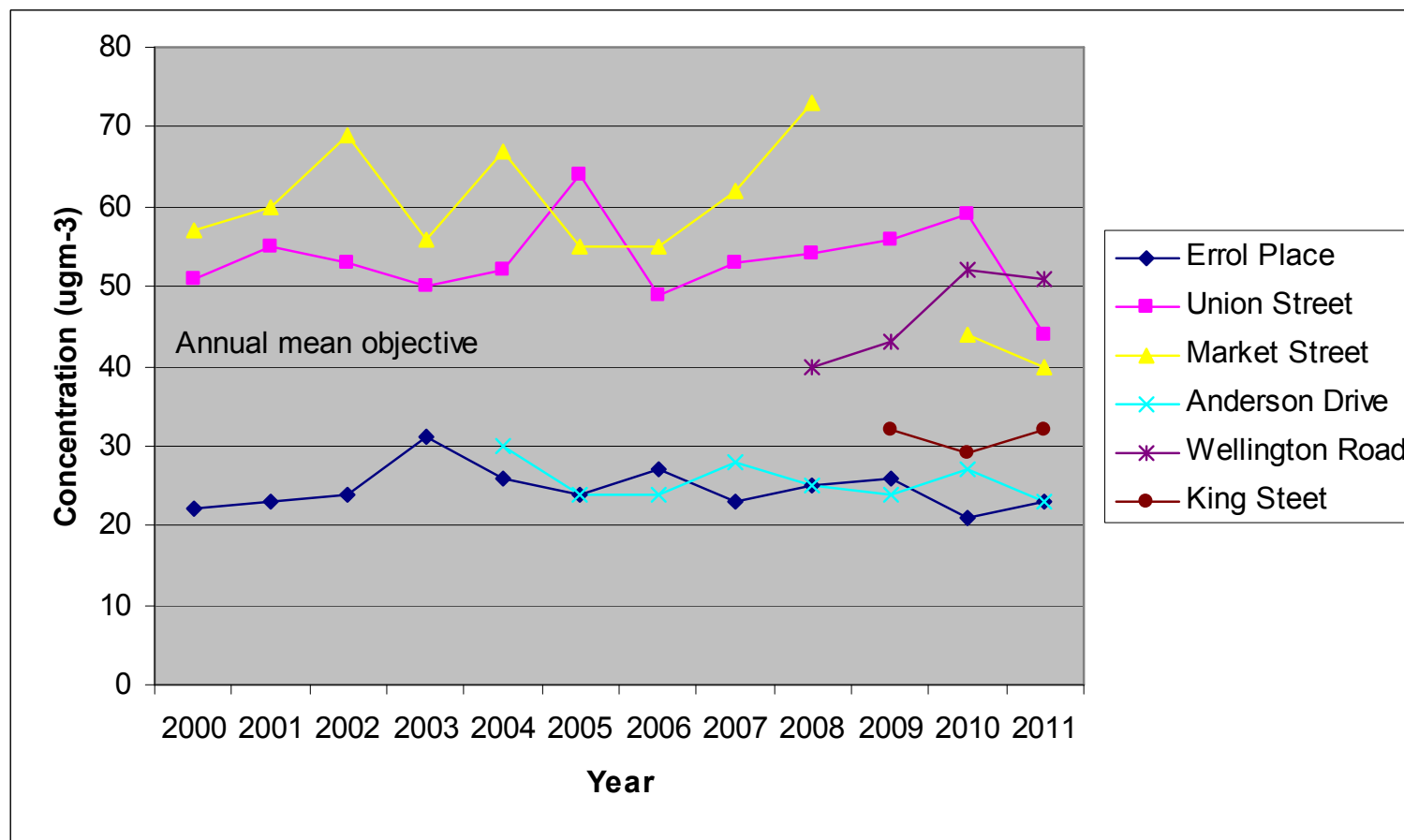
Site ID	Site Type	Within AQMA?	Annual mean concentration (adjusted for bias) $\mu\text{g}/\text{m}^3$				
			2007 (Bias Adjustment Factor = RD 1.03 UB 0.89)	2008 (Bias Adjustment Factor = RD 0.97 UB 0.88)	2009 (Bias Adjustment Factor = RD 0.89 UB 0.74)	2010* (Bias Adjustment Factor = nearest site 0.76-1.0)	2011 (Bias Adjustment Factor RD = 0.864 UB = 0.67)
13	Music Hall, Union St	Y	52	52	45	57	42
14	Dyce Prim, Gordon Ter	N	12	12	11	13	9
15	Northfield swimming pool	N	15	15	13	18	11
16	Guild St/Market St	Y	63	63	53	63	46
17	43/45 Union St	Y	60	60	54	61	55
18	14 Holburn St	Y	59	59	53	67	55
19	468 Union St	Y	64	64	55	68	54
20	212 King St	N	38	38	36	38	37
21	26 King St	Y	46	46	44	46	43
22	104 King St	Y	52	52	47	52	48
23	785 Gt Northern Rd	N	34	34	32	36	32
24	40 Auchmill Rd	Y	47	47	39	44	41
25	21 Holburn St	Y	56	56	49	55	47
26	147 Holburn St	N	38	38	35	38	31
27	80 Holburn St	Y	36	36	38	38	31
28	61 Holburn St	Y	43	43	38	44	38

Site ID	Site Type	Within AQMA?	Annual mean concentration (adjusted for bias) $\mu\text{g}/\text{m}^3$				
			2007 (Bias Adjustment Factor = RD 1.03 UB 0.89)	2008 (Bias Adjustment Factor = RD 0.97 UB 0.88)	2009 (Bias Adjustment Factor = RD 0.89 UB 0.74)	2010* (Bias Adjustment Factor = nearest site 0.76-1.0)	2011 (Bias Adjustment Factor = RD 0.864 UB = 0.67)
29	469 Union St	Y	71	71	65	65	63
30	209 Union St	Y	61	61	57	62	57
31	249 Union St	Y	39	39	36	41	35
32 ^c	Willowbank Rd/Albury Rd	N	24	24	21	27	27
33	East North St	Y	54	54	53	53	51
34	404 King Street	Y	41	41	40	33	35
35	Riverside House, Riverside Drive	N	31	31	28	30	27
36	115 Menzies Rd/Wellington Rd	Y	47	47	44	42	31
37	137 Wellington Road	N	34	34	32	32	31
38 ^c	Wellington Road / 4 Nigg Kirk Road	N	30	30	31	33	31
39	819 Gt Northern Rd	Y	N/A	N/A	54	55	55
40	852 Fullerton Ct (facade)	Y	N/A	N/A	36	40	36
41	852 Fullerton Ct (roadside)	Y	N/A	N/A	49(29)	28	22

Site ID	Site Type	Within AQMA?	Annual mean concentration (adjusted for bias) $\mu\text{g}/\text{m}^3$				
			2007 (Bias Adjustment Factor = RD 1.03 UB 0.89)	2008 (Bias Adjustment Factor = RD 0.97 UB 0.88)	2009 (Bias Adjustment Factor = RD 0.89 UB 0.74)	2010* (Bias Adjustment Factor = nearest site 0.76-1.0)	2011 (Bias Adjustment Factor RD = 0.864 UB = 0.67)
42 ^c	248 George St	N	N/A	N/A	34 ^c	38	35
43 ^c	25 Rosemount PI	N	N/A	N/A	30	32	28
44 ^c	214 Rosemount PI	N	N/A	N/A	26	30	26
45	111 South Anderson Drive	Y	N/A	N/A	N/A	32	29

* For 2010 data the air quality helpline recommended adjusting each diffusion tube site data using the bias factor calculated from the nearest continuous monitoring co-located site. For 2011 data the helpline recommended adjusting roadside tubes using the bias factor calculated from the orthogonal regression of the roadside sites (excluding Union Street) and background sites using the Errol Place factor.

Figure 2.1 Trends in Annual Mean Nitrogen Dioxide Concentrations measured at Diffusion Tube Monitoring Sites



2.2.2 PM₁₀

The Union Street and Market Street continuous monitoring locations are representative of population exposure for PM₁₀ due to the proximity of flats in the area. Anderson Drive and Wellington Road are both closer to the kerb than the façade of the nearest residential properties and are not representative of population exposure. The nearest properties are 10m from the King Street site, however the location is typical of flatted properties close to the kerb at other locations on King Street. Errol Place is representative of typical residential properties close to the city centre but not adjacent to a major road.

Tables 2.7 and 2.8 show the annual mean and number of exceedances of the 24 hour objective for PM₁₀ obtained from the continuous monitoring sites over the period 2007-2011. All data was ratified by AEA Technology. TEOM and BAM data from 2009 has been corrected to gravitational equivalent by AEA Technology using the processes described in Appendix B. Prior to 2009 the annual mean concentration for TEOM monitoring sites in Scotland required to be reported with a 1.3 and a 1.14 correction factor to gravitational equivalent. Table 2.7 therefore reports 2007 and 2008 data with both correction factors.

The annual mean objective was exceeded at Market Street, Union Street, Wellington Road and King Street continuous monitoring sites. Concentrations were below the objective at Errol Place and Anderson Drive. There was an increase of 1ugm⁻³ at King Street, which is significant as the increase caused the objective to be exceeded for the first time. The King Street monitoring site is outwith the existing AQMAs.

It is difficult to assess medium/long term trends in annual mean PM₁₀ concentrations due to the different methodologies applied to correct data and replacement of the Errol Place and Market Street TEOMs with FDMS and BAM equipment. Additionally the Market Street site is at a new location. Concentrations at Union Street, Errol Place, King Street and Anderson Drive were higher in 2011 compared to 2010 and 2009, most noticeably at Union Street which recorded a 4ugm⁻³ increase. This observation was surprising given the lower NO₂ concentration recorded. Exceptionally high levels were recorded at the old Market St in 2007 and 2008 due to the neighbouring construction works. Data from the new Market Street site indicates levels at this location are significantly lower, probably due to more open nature of the site and less congestion.

An increase in the number of occasions when the 24 hour mean exceeded 50ugm⁻³ was also observed at King Street, Wellington Road and Union Street in 2011 compared to previous years. The objective was exceeded at both Wellington Road and the new Market Street site for the first time. At Market Street the number of exceedances increased significantly compared to previous years (15 in 2011 compared to 6 in 2010 and 3 in 2009). This may be attributed to the increased popularity of the Union Street retail centre which opened in November 2009 with access to the public car park via Market Street. Raised levels across all sites generally occurred during periods of light winds and misty weather conditions although occasionally higher levels were during periods of strong NE/E winds.

Table 2.7 Results of Automatic Monitoring of PM₁₀: Comparison with Annual Mean Objective

Site ID	Site Type	Within AQMA?	Valid Data Capture for monitoring Period % ^a	Valid Data Capture 2011 % ^b	Confirm Gravimetric Equivalent (Y or NA)	Annual Mean Concentration µg/m ³						
						2007* ^c		2008* ^c		2009* ^c	2010* ^c	2011 ^c
TEOM Correction factor to gravitational equivalent						1.3	1.4	1.3	1.14			
A1	Errol Place	N		95.3		17	15	18	16	15	13	14
A2	Union Street	Y		96.9		19	17	22	19	18	18	22
A3	Market Street	Y		94.5		84 ^d	74 ^d	80 ^d	70 ^d	28 ^c	22 ^c	22
A4	Anderson Drive	Y		97.9		17	15	18	16	15	14	16
A5	Wellington Road	Y		93.7		N/A	N/A	26 ^c	23 ^c	23	22	24
A6	King Street	N		83.1		N/A	N/A	N/A	N/A	17	18	19

^a data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

^b 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 data has been seasonally adjusted to provide “annualised” data using Errol Place background and procedures within TG(09),

^d The Market Street site ceased operation in October 2008 due to construction works at a neighbouring development site. 2008 data data collection was 77%. The site was relocated in 2009.

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

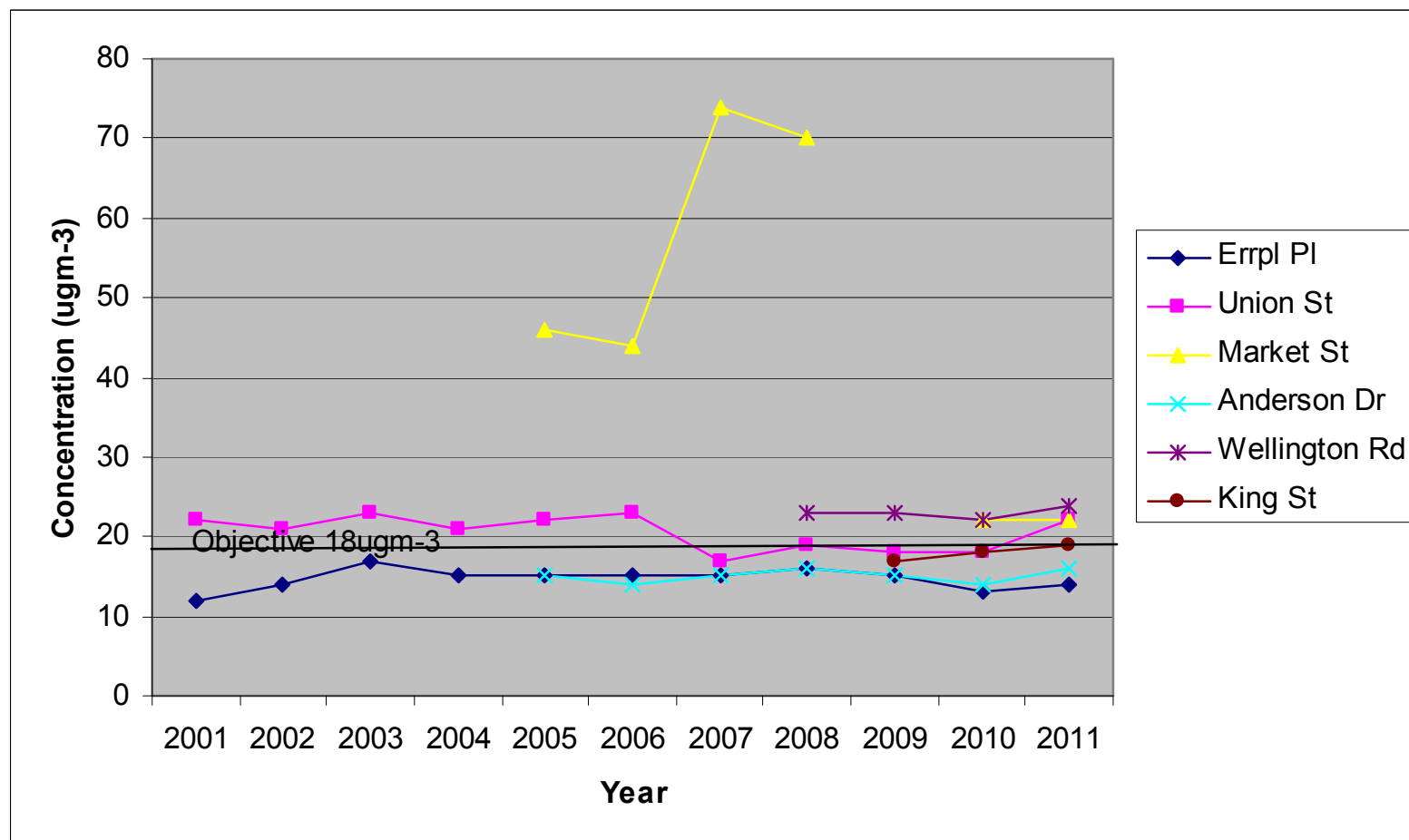
Site ID	Site Type		Valid Data Capture for monitoring Period % ^a	Valid Data Capture 2011 % ^b	Confirm Gravimetric Equivalent	Number of Exceedences of 24-Hour Mean (50 µg/m ³)				
						2007*	2008*	2009*	2010*	2011
A1	Errol Place	N		95.3		4	2	4	1	1
A2	Union Street	Y		96.9		0	1(39)	1	0	4
A3	Market Street	Y		94.5		116	148(170)	3(86)	6(53)	15
A4	Anderson Drive	Y		97.9		5	0	1	0(32)	0
A5	Wellington Road	Y		93.7		N/A	3(46)	5	1	8
A6	King Street	N		83.1		N/A	N/A	2	4	7 (38)

Where data capture is less than 90% the 98th percentile of hourly means is presented in brackets.

^a data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

^b 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 The Market Street site ceased operation in October 2008 due to construction works at a neighbouring development site. 2008 data data collection was 77%. The site was relocated in 2009.

Figure 2.2 Trends in Annual Mean PM₁₀ Concentrations

2.2.3 Sulphur Dioxide

No monitoring of sulphur dioxide was carried out in 2011 as previous assessments did not predict a likelihood of exceedance of the objectives and there has been no significant change in local emissions.

2.2.4 Benzene

No monitoring of sulphur dioxide was carried out in 2011 as previous assessments did not predict a likelihood of exceedance of the objectives and there has been no significant change in local emissions.

2.2.5 Other pollutants monitored

Monitoring of PM_{2.5} at Errol Place commenced in February 2009 as part of the UK automatic urban network (AUN). The new objectives for PM_{2.5} have not been incorporated into the LAQM regime and authorities are not required to review and assess air quality against the objectives. Table 2.9 shows the annual mean concentration from 2009-2011. These results indicate the PM_{2.5} objective of 12ugm⁻³, to be achieved by 2020, is likely to be met at urban background sites in Aberdeen. Concentrations have remained consistent over the 3-year monitoring period suggesting the target of a 15% reduction in concentrations at urban background sites, measured as a 3-year mean is unlikely to be met unless measures are adopted to reduce PM_{2.5} concentrations.

Table 2.9 Results of PM_{2.5} Automatic Monitoring: Comparison with the Annual Mean Objective

Year	Data Capture for Monitoring Period (%)	Annual Mean (ugm ⁻³)
2009	60.6	7
2010	80	7
2011	90.8	8

Monitoring of ozone is also carried out at Errol Place as part of the AUN. Concentrations of ozone are outwith the control of local authorities and hence ozone is not part of the Local Air Quality Management process. Action to reduce concentrations is a responsibility of the UK government and devolved administrations.

The national objective for ozone is a running 8-hour mean of 100ugm⁻³ not to be exceeded more than 10 times a year. Table 2.10 shows the annual mean concentration and number of exceedances of the 8-hour running mean at Errol Place over the period 2005-2011. It can be seen that the annual mean was lower in 2011 than previous years, with the exception of 2009. Changes in ozone are reflective of meteorological conditions and relatively poor summers in 2009 and 2010 may have influenced concentrations. The number of exceedances of the 8-hour objective has varied considerably and was higher in 2011 than previous years.

Table 2.10 Results of Automatic Monitoring for Ozone: Comparison with the Annual Mean Objective

Year	Data Capture for Monitoring Period (%)	Annual Mean (ugm⁻³)	Number of Days exceedances of 8-hour objective
2005	99.0	50	26
2006	99.0	48	13
2007	98.5	48	2
2008	98.9	50	30
2009	94.4	42	1
2010	90.3	44	0
2011	96.0	42	38

2.2.6 Summary of Compliance with AQS Objectives

Aberdeen City Council has measured concentrations of PM₁₀ above the annual mean objective on King Street and **will need to proceed to a Detailed Assessment**, for King Street extending from the existing AQMA to Ellon Road (junction with Balgownie Road).

3 Road Traffic Sources

The Union Square Retail Complex located between Market Street and Guild Street and adjoining the City Centre AQMA opened in November 2009. The complex also incorporates a new bus station to replace the old Guild Street station. This bus station provides all services to towns and villages within the wider Grampian area as well as inter-city services, although local services within Aberdeen are limited. Planning permission was granted in 2000 prior to current review and assessment procedures.

The complex incorporates 1700 car parking spaces accessed from a new junction on Market Street, Palmerston Road and College Street. Although located on the same site as the former bus station with the same bus operators and routes, the bus entry/exit changed to a one way system. Buses enter the station via a new junction on Market Street and exit from Guild Street. Previously both access and egress was on Guild Street,

As the development is adjacent to an existing AQMA, the criteria within LAQMA for road traffic sources does not require a further Detailed Assessment. However, increased traffic flows and congestion associated with the development have the potential to cause a deterioration in air quality and may effect the implementation of measures within the 2011 Air Quality Action Plan. The Market Street continuous monitor and traffic counter required to be relocated due to the site development and consequently it is not possible to compare measured pollution concentrations or traffic flows before and after development.

The Council's Local Plan was approved in 2011 and includes proposals for several major residential and commercial developments in the City over the period 2012-2023. Developments just outwith the City boundary are also proposed. In November 2011 MVA Consultancy was commissioned to investigate the potential cumulative air quality impact from any increased road traffic and congestion associated with these developments. Further information on this study is provided in Section 3.6.

The study also specifically considered the impact of Union Square via the following 2 transportation scenarios:

2010 Baseline Scenario: without Union Square: excludes the changes in traffic patterns and transport infrastructure associated with Union Square development:

2010 Baseline Scenario – with Union Square: Base Scenario plus traffic demand and relevant changes to access roads & junctions associates with Union Square development.

The modelling predicted NO_x and PM₁₀ emissions in the City Centre would increase by 1% (9.8 tonnes) and 1.5% (10.37 tonnes) as a result of Union Square. Potentially more substantial rises were also identified at specific parts of the network that are likely to have come under increased operational pressure, including intersections along the Market Street, Guild Street and College Street corridor. As a result of the

'higher level' modelling, a further more specific study is proposed to provide additional understanding of local variations in traffic and emission impacts on various City Centre streets. The study will include dispersion modelling to convert changes in emissions to pollution concentrations at relevant receptors.

3.1 Narrow Congested Streets with Residential Properties Close to the Kerb

Aberdeen 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

Aberdeen 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.

The HGV ADDT flow on Market Street is 5,000 (approx 17% of 30,000 AADT total flow) and people may spend 1 hour or more close to traffic. Changes to bus access/egress to the new bus station will have resulted in a small increase in the total HGV flow on the section of Market Street between Guild Street and the new junction to the bus station. Although the air quality impact of the increased bus flow is likely to be minor, bus movements will be considered in the proposed detailed modelling of Union Square.

Aberdeen City Council confirms that there are no new/newly identified roads with high flows of buses/HDVs.

3.4 Junctions

Two new junctions were created on Market Street to accommodate cars entering the Union Square car park and buses entering the new bus station. Alterations were also made to junctions around the Guild Street bus station. Although there has been no significant increase (>10% AADT) in traffic flow, congestion may have increased in the vicinity of these intersections. Additional congestion, especially of HGVs, has the potential to cause localised increased NO₂ and PM₁₀ concentrations. The impact of the new junctions will be considered in the detailed modelling of Union Square.

Aberdeen City Council confirms that there are no new/newly identified busy junctions/busy roads.

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

Aberdeen Western Peripheral Route

The Scottish Ministers announced their decision to proceed with the Aberdeen Western Peripheral Route (AWPR) in December 2009. Although the relevant Schemes and Orders were approved in March 2010, various legal challenges that are still ongoing have prevented the commencement of construction works. The AWPR will pass through mainly rural/suburban areas and an air quality assessment confirmed there is no risk of exceedance of the air quality objectives along the route. The AWPR will allow traffic to travel around the City, and will particularly benefit the Anderson Dr/Haudagain roundabout/Auchmill Road AQMA where a 10% reduction in traffic flow and up to 20% reduction in HGVs is predicted. Reduced traffic flows are also predicted across the City, including the City Centre and King Street, where a 5% traffic reduction is predicted. Obviously the new route will have a positive air quality benefit in Aberdeen, however without further interventions exceedances of the air quality objectives are still predicted.

3rd Don Crossing

The Council administration prior to the May 2012 local elections committed to an additional crossing over the River Don in the north of Aberdeen to ease congestion over the existing bridge with completion by 2016. Both PM₁₀ and NO₂ concentrations in the vicinity of the Bridge are close to the objective values. A detailed air quality assessment using AAQIRE software predicted a medium/large impact (up to 7ugm⁻³ increase in NO₂ and 3.1ugm⁻³ PM₁₀ respectively) at sensitive receptors close to the new crossing. Background levels are low at these receptors and the modelling predicted annual mean NO₂ and PM₁₀ concentrations well below the objective. The largest decrease in concentrations was predicted on the northern section of King Street (4ugm⁻³ NO₂) which is in the vicinity of the existing continuous monitor. The crossing would also have a significant positive impact on NO₂ concentrations on

Ellon Road. A slight increase ($1.1\mu\text{g m}^{-3}$ NO_2) was predicted on the southern section of King St close to the exiting AQMA. This increase is a consequence of a small increase in traffic flow of approximately 1000-1500 vehicles AADT (no increase in HVGs). Overall the modelling predicted a slight worsening of air quality with the scheme due to the local impact around the site of the new crossing, but would be described as 'neutral' under the Environmental Protection UK Development Control Planning for Air Quality Guidance (2010 update). It is uncertain whether the new Council administration is still committed to the development and no further consideration of the scheme is proposed at this time.

Aberdeen City Council has assessed new/proposed roads meeting the criteria in Section A.5 of Box 5.3 in TG(09). Detailed Assessments of the Aberdeen Western Peripheral Route and the 3rd Don Crossing have been completed and no further assessments are proposed at this time.

3.6 Roads with Significantly Changed Traffic Flows

No roads have been identified with more than 10,000 vehicles per day that have experience "large" increases in traffic. However the Aberdeen City 2011 Local Plan and the Aberdeen City and Shire Structure Plan 2009 include the provision of several major residential and commercial developments and associated transportation interventions in Aberdeen and just outwith the City boundary over the period 2011-2023. A 30% increase in annual mean vehicle kilometres is predicted. Cumulatively these developments have the potential to significantly impact on air quality. Planning permission has been granted for several developments and construction works commenced.

A modelling study was commissioned in 2011 to indicate the likely cumulative impact of the developments on air quality in Aberdeen. With the proposed transportation interventions and using current vehicle emission factor NO_2 and PM_{10} concentrations in the 3 AQMAs were predicted to reduce by 75-85% and 80-90% by 2023. However, further sensitivity tests that excluded predicted vehicle efficiency improvements predicted an increase in 40% by 2023. This 'high level' modelling indicated the importance of appropriate vehicle emission factors in modelling prediction scenarios. Further sensitivity tests are proposed in 2012 when the new vehicle emission factors become available.

Aberdeen City Council confirms that there are no new/newly identified roads with significantly changed traffic flows other than those described in sections 3.1-3.6.

3.7 Bus and Coach Stations

The Guild Street bus station was redeveloped and incorporated within the Union Square development. As described in section 3.4 the development included new bus access/egress routes. The new station is enclosed and there is no relevant exposure therefore no further air quality assessment is required.

Aberdeen City Council confirms that there are no relevant bus stations in the Local Authority area.

4 Other Transport Sources

4.1 Airports

Aberdeen airport is located at the perimeter of the city approximately 7 miles from the city centre. The airport serves the north east area and is the transport hub for Europe's oil and gas industry. Approximately 3.2 million passengers passed through the airport and 6,190 tonnes of freight were transported in 2011. Applying the criteria within LAQM.TG(09), the total equivalent passenger throughput was approximately 3.2 million passengers per annum (mppa).

Aberdeen Airport Ltd subcontracted AEA Technology to undertake an assessment of air pollution at Aberdeen Airport. The most recent monitoring was over a 6 monthly period between June 2010 and January 2011 via diffusion tubes located at 17 airside and non-airside locations. Diffusion tubes were annualised and bias adjusted in accordance with TG(09). Normally the Errol Place AUN site would be used to correct data, however the national bias adjustment factor of 0.95 was used due to the poor data capture from the Errol Place NO_x analyser in 2010. The Edinburgh St Leonard's and sites from the Scottish Government Air Quality database were used to annualise data, again due to the poor Errol Place data capture and lack of other AUN background monitoring sites in the vicinity.

The two highest concentrations were 43ugm⁻³ and 33 ugm⁻³ at stands within the airfield. Landside the highest concentration was 27 ugm⁻³ at the terminal front. The remaining sites recorded levels ranging from 13-26ugm⁻³. The concentration at Cordyce View, the nearest residential property was 15ugm⁻³ which is typical of the annual mean measured by Aberdeen City Council in previous years.

There are residential properties located to the northeast of the airport that are within 1000m of the airport boundary. Mapped background concentrations for use in LAQM Review and Assessments predicted a maximum NO_x background concentration of 69ugm⁻³ at the nearest residential properties and 49 ugm⁻³ within the airfield. Although the total equivalent passenger throughput is less than 10 mppa, the background NO_x concentration was above 25ugm⁻³. The criteria in TG(09) suggest a Detailed Assessment may be required. However, the monitoring carried out by Aberdeen Airport Ltd and by Aberdeen City Council in recent years recorded levels well below the annual mean objective at the nearest sensitive receptors therefore no further assessment is proposed.

Aberdeen City Council confirms that there are no airports in the Local Authority area likely to cause exceedance of the air quality objectives.

4.2 Railways (Diesel and Steam Trains)

4.2.1 Stationary Trains

Aberdeen railway station is located in the city centre. There are no locations where diesel or steam locomotives are regularly stationary for periods of 15 minutes or more and where there is potential for regular outdoor exposure of individuals within 15m of the stationary locomotive.

Aberdeen City Council confirms that there are no 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

There are no sections of track in Aberdeen that have a large number of movements of diesel locomotives.

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

4.3 Ports (Shipping)

Aberdeen Harbour is located in the City Centre adjacent to Market Street, the City Centre AQMA and the new Union Square retail complex. There are flats on Market Street, Trinity Quay and Regent Quay approximately 100m from the Harbour. Additionally Market Street is used extensively by workers in the Harbour area and pedestrians commuting from residential areas to the north of the River Dee and the city centre.

Table 4.1 summarises the vessel entering and departing Aberdeen Harbour in 2011. It has been assumed all vessels arriving also departed.

Table 4.1 Aberdeen Harbour Vessel movements in 2011

Vessel Type	Number vessel movements
Cargo	1682
Cruise	18
Ferries	1434
Fishing	832
Miscellaneous	512
Naval	56
Oil Related	10824
Recreational	96
Research	114
Total	15568

Of the vessels listed in Table 4.1 only the ferries and cruise liners would be considered large in terms of LAQM.TG(09).

There are less than 5000 movements of large vessels per year and it is not necessary to proceed to a Detailed Assessment in terms of LAQM.TG(09). However, it is recognised that emissions from shipping activities do contribute to pollution levels in the area and in 2010 AECOM was commissioned by Aberdeen City Council to undertake a study of local air quality impacts due to shipping in Aberdeen Harbour. A previous study undertaken by Aberdeen University in 2004 indicated that, whilst ship emissions are unlikely to be the cause of exceedance of the air quality objectives, they are likely to contribute to the total pollution concentration.

Aberdeen Harbour is unique in the UK in that the majority of vessels are associated with the oil industry. These are supply boats of around 3000 tonnes gross and are generally modern vessels with powerful engines burning a high grade diesel type fuel (marine gas oil), with less than 0.2% sulphur. LAQM.TG(09) recommends only emissions of sulphur dioxide from vessels need to be assessed in the LAQM regime, however sulphur dioxide is not of concern in Aberdeen due to the fuel type burnt. Emissions of NO₂ and PM₁₀ are considered to be more important to the local environment and consequently the assessment concentrated on these pollutants.

The Harbour provides berths and services for three main types of vessels; oil tenders, fishing and ro-ro ferries. The berths closest to the city centre are all used by oil tenders, whilst the ferry terminal is further to the east, and fishing vessels mainly use a separate basin to the south. Emissions from shipping arise due to ships manoeuvring in the Harbour, and from hotelling, when the main engines are generally inactive and auxillary engines provide a base load for heating, lighting etc. There are also emissions associated with various other vehicle and dock-side equipment, such as loading cranes.

Detailed dispersion modelling was used to assess emissions from ships at the ten berths closest to the City Centre AQMA; Jamiesons, Trinity and Regent Quays, and the Northlink ferry terminal. Other berths were not assessed as they are further from the AQMA, and are generally not near areas of relevant public exposure. Detailed information regarding the number of vessel visits, duration spent at each of the ten modelled berths, and the engine power capacities was used for each ship. Emission

rates were determined from published factors, which were annualised according to the actual activity of each ship in 2010.

The assessment predicted emissions of nitrogen oxides from shipping contributed a maximum of $6.6\mu\text{g}\text{m}^{-3}$ to the annual mean NO_2 concentrations at a location of relevant population exposure (16% of the annual mean objective), whilst emissions of PM_{10} were predicted to contribute a maximum of $2.26\mu\text{g}\text{m}^{-3}$ to the annual mean concentration (6% of the annual mean objective). Generally, the impacts were predicted to be less than approximately 5% of the total ambient NO_2 and PM_{10} concentration. It was concluded that, whilst emissions from shipping are not likely to cause an exceedance of the annual mean air quality objectives, they do contribute to existing exceedances in specific areas near the Harbour.

Aberdeen City Council confirms that there are no 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

The Scottish Environmental Protection Agency (SEPA) was contacted to obtain details of installations licensed under the Integrated Pollution Prevention and Control (IPPC) regime. SEPA confirmed there are no new or proposed industrial installations or installations with substantially increased emissions or new exposure in Aberdeen or a nearby authority.

Aberdeen 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

Aberdeen 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

Aberdeen 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 are major fuel (petrol) storage depots within the Local Authority area, but these have been considered in previous reports.

5.3 Petrol Stations

The Scottish Environmental Protection Agency confirmed there are no petrol stations meeting the specified criteria.

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

5.4 Poultry Farms

Aberdeen City Council confirms that there are no poultry farms meeting the specified criteria.

6 Commercial and Domestic Sources

6.1 Biomass Combustion – Individual Installations

Table 6.1 describes the biomass combustion plant installed between 2009-2011. There are no plants in the adjoining authority likely to impact on air quality in Aberdeen City.

Table 6.1 Biomass Installations

Ref No	Site	Grid ref	Date/year approved	Capacity	Plant description	Air quality assessment Results
1	Seaton CHP, School Road	394849 808541	2009	1X1.4M W 2x0.7MW	Biogas derived from gasification of woodchip	Detailed ADMS assessment. No/minimal PM ₁₀ emissions as gasification process. Predicted max annual mean NO ₂ increase 17.4ug m ⁻³ at nearest receptors. Air quality objective exceedances not predicted, background concentrations low.
2	Aberdeen Royal Infirmary, Foresterhill	391700 806905	2009	4.5MW CHP	Woodchips, multi cyclone abatement	Detailed ADMS assessment predicted max annual mean PM ₁₀ increase of 0.12ug m ⁻³ and PM _{2.5} increase of 0.27ug m ⁻³ at nearest receptors. Air quality objective exceedances not predicted.
3	SEPA, Greyhope Ro, Torry	395400 805400	2010	110kW	Wood pellets	Nomograph assessment predicted max PM ₁₀ annual mean increase of 0.05ugm ⁻³ and 24 hour conc 0.33ugm ⁻³ . Air quality objective exceedances not predicted.
4	Marischal College, Broad St	394289 806513	2010	240kW	Wood pellets	Flue in existing refurbished building. Adj to City Centre AQMA. Detailed ADMS assessment predicted max NO ₂ increase of 0.48ugm ⁻³ and PM ₁₀ increase of 0.22ugm ⁻³ at nearest receptors. Predicted annual mean max NO ₂ increase of 0.12 ugm ⁻³ and PM ₁₀ increase

						of 0.06ugm ⁻³ at nearest receptors in AQMA.
5	Duthie Park, Polmuir Rd	393700 804600	2010	500kW	Wood chips	Assessment awaited. Design indicated limited risk of exceedance of objectives.

Installations 1-3 and 5 in Table 6.1 are in areas of low background concentrations and exceedance of the air quality objectives are considered unlikely. Site 4, Marischal College, is a refurbished building providing the main Council offices. The accommodation replaces the Council's former offices in St Nicholas House located directly across the road. St Nicholas House had an oil fired boiler and demolition of the building will commence in July 2012. The decision to install a biomass plant was made after submission of the planning application and without prior consultation with relevant council officers. A subsequent detailed air quality assessment predicted maximum impact on nearest receptors would not result in exceedance of the PM₁₀ quality objectives at locations outwith the AQMA. Within the AQMA, the maximum increase in annual mean NO₂ and PM₁₀ concentrations were 0.12ug m⁻³ and 0.06ug m⁻³ receptively.

Although the predicted impact is minor/negligible, any increase in pollution levels in, or adjacent to, the AQMA is undesirable. Following the installation of this biomass plant, the Council approved a policy that will not support biomass within an AQMA or adjacent defined buffer zone unless an air quality assessment can demonstrate the change in annual mean nitrogen dioxide (NO₂) and particulate (PM₁₀) concentrations will be negligible.

Aberdeen City Council has assessed the biomass combustion plant, and concluded that it will not be necessary to proceed to a Detailed Assessment.

6.2 Biomass Combustion – Combined Impacts

In recent years there has been a slight increase in the number of fireplaces within domestic premises converted to coal and wood burning stoves, however these have been within individual privately owned properties and the increase is currently not considered significant. Additionally it is also unlikely that a significant number of premises with new fireplaces and stoves use these installations as the main source of heating. The authority receives less than 10 complaints per year regarding smoke nuisance from domestic fuel burning. There are no new commercial or domestic developments that have been specifically designed with coal/wood fireplaces, stoves or boilers.

No specific investigation of domestic fuel burning has been carried out as the number of installations in any 500 x 500 grid square is currently considered to be insignificant in terms of contribution to PM₁₀ concentrations.

Aberdeen City Council confirms that there are no biomass combustion plant in the Local Authority area.

6.3 Domestic Solid-Fuel Burning

Historically no smoke control areas were declared in Aberdeen due to the relatively small number of domestic properties using coal as a fuel. Natural gas and electricity continue to be the main sources of heat generation. Although no specific investigation of solid fuel burning has been carried out, officer experience suggests there are unlikely to be any areas of about 500 x 500m with more than 50 houses burning coal/smokeless fuel as their primary source of heating.

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

7 Fugitive or Uncontrolled Sources

Emissions from existing quarrying and mineral extraction sites, landfills and waste management sites were considered in previous rounds of review and assessment and there have been no significant changes or new relevant exposure.

Several large commercial and housing developments have been constructed over the period 2009-2011. Conditions to control dust emissions were incorporated within planning permission for the developments and less than 10 complaints of dust nuisance over all sites were received. Visual inspections did not indicate significant dust emissions or dust tracked out of sites onto public roads.

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

8 Conclusions and Proposed Actions

8.1 Conclusions from New Monitoring Data

Data from the Market Street and Union Street continuous monitoring stations confirmed NO₂ and PM₁₀ concentrations within the City Centre AQMA continue to exceed the annual mean objectives. The 24 hour PM₁₀ objective was met at Union Street, however as in previous years, the objective was exceeded on Market Street. Diffusion tube values indicated likely pockets of exceedance of the 1 hour NO₂ objective across the AQMA.

Annual mean NO₂ and PM₁₀ concentrations at both the Anderson Drive and Errol Place continuous monitoring stations remain below the annual mean objectives. Although the Anderson Drive site is within the Anderson Drive/Haudigan roundabout/Auchmill Road AQMA, diffusion tube values along the route continue to exceed the annual mean objective at specific locations indicating the AQMA remains valid.

Data from the Wellington Road continuous monitoring station confirms NO₂ and PM₁₀ concentrations exceed the annual mean air quality objectives. The 24 hour PM₁₀ was also exceeded for the first time. Although the monitoring station is slightly closer to the roadside than relevant receptors, diffusion tube monitoring confirmed exceedance of the NO₂ objective elsewhere within the Wellington Road AQMA.

NO₂ concentrations in 2011 were generally similar to previous years with the exception of the Union Street continuous monitoring station where the annual mean was 15ugm⁻³ (25%) lower than previous years. The reason for the significant decrease is unknown and the data is considered valid, however analyser malfunction may have been a contributing factor. Data from a new analyser installed in February 2012 will assist in establishing the likely validity of the 2011 data.

There appeared to be a slight rise in PM₁₀ concentrations in 2011 compared to 2010 and 2009, although trends cannot be properly assessed due to the differently methodology applied to adjust data prior to 2009 and equipment replacement. A rise in the number of occasions the 24 hour mean exceeded 50ugm⁻³ was observed at Market Street, Union Street, King Street and Wellington Road with the objective exceeded at Wellington Road and Market Street for the first time.

Outwith the AQMAs, only the diffusion tube at Ellon Road indicated a potential exceedance of the annual mean NO₂ objective. Concentrations at this site have historically been just below the objective and this location will continue to be assessed in 2012. PM₁₀ concentrations also exceeded the annual mean objective at the King Street continuous monitoring site for the first time.

8.2 Conclusions from Assessment of Sources

The opening of the Union Square retail development in November 2009 adjacent to the City Centre AQMA, including the redevelopment of the Guild Street bus station and associated road infrastructure changes, may have had an adverse impact on air quality in the AQMA. The development would not cause exceedance of the NO₂ and PM₁₀ objectives outwith the AQMA and a Detailed Assessment was not required. Traffic modelling was carried out in 2012 identified specific junctions and road links likely to have come under increased operational pressure. A more specific study, including dispersion modelling, will be undertaken in 2012 to provide additional understanding of the local variations in traffic and air quality impact at relevant receptors.

Other proposed developments include the construction of the Aberdeen Western Peripheral Route (AWPR) and 3rd Don Crossing. The AWPR will ease traffic congestion on main arterial roads, particularly the Anderson Drive/Haudagain roundabout/Auchmill Road corridor and have a positive impact on pollution levels elsewhere in Aberdeen. It is unclear if the 3rd Don Crossing will proceed, however if it does go ahead there will be a positive impact at receptors close to the existing bridge, including the northern section of King Street and Ellon Road. Adverse impacts in the vicinity of the new crossing will not cause exceedance of the air quality objectives.

There were no other local developments, road transport, industrial installations or commercial/domestic sources identified that have the potential to cause exceedances outside the existing AQMAs.

8.3 Proposed Actions

The Updating and Screening Assessment identified values at, or close, to the objectives on King Street and Ellon Road outwith the existing AQMAs. Detailed modelling of specific junctions and road links in the City Centre AQMA will be carried out to indicate the likely impact of the Union Square retail development on air quality. This modelling and associated air quality assessment will be extended to include the King Street/Ellon Road corridor to the junction with Balnagask Road. The assessment will additionally support a review of the interventions in the Air Quality Action Plan to indicate those that are likely to be most effective in improving air quality.

A number of significant commercial and retail development with associated transportation interventions are proposed in Aberdeen and just outwith the City boundary over the period 2011-2023. A cumulative air quality assessment was carried out in 2011 to indicate the potential impact on the 3 AQMAs. Further analysis is proposed in 2012 using the new emission factors when these become available and other relevant information to provide a better understanding of the impact of these developments.

9 References

- 1 The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, DETR July 2007.
- 2 Environment Act 1995.
- 3 The Air Quality (Scotland) Regulations 2000.
- 4 The Air Quality (Scotland)(Amendment) Regulations 2001.
- 5 Aberdeen City Council Updating and Screening Report August 2003.
- 6 Aberdeen City Council Detailed Assessment of Air Quality, August 2004.
- 7 Aberdeen City Council Air Quality Action Plan July 2006.
- 8 Aberdeen City Council Updating and Screening Assessment, July 2006
- 9 Aberdeen City Council Progress Report, June 2007
- 10 Aberdeen City Council Detailed Assessment, March 2008
- 11 Aberdeen City and Shire Structure Plan 2009
- 12 Local Air Quality Management Technical Guidance LAQM, TG(09), DEFRA, February 2009
- 13 Local Air Quality Management Policy, (PG)(S)(09), DEFRA, February 2009
- 14 Aberdeen City Council Updating and Screening Assessment, July 2009
- 15 Aberdeen City Council Air Quality Modelling Study, March 2010
- 16 Aberdeen City Council Progress Report, July 2010
- 17 Aberdeen City Council 2011 Local Plan
- 18 Aberdeen City Council Action Plan, March 2011
- 19 Aberdeen City Council Progress Report, July 2011
- 20 Aberdeen Harbour Local Air Quality Study, September 2011

Appendices

Appendix A

Figure A1 Map of City Centre AQMA

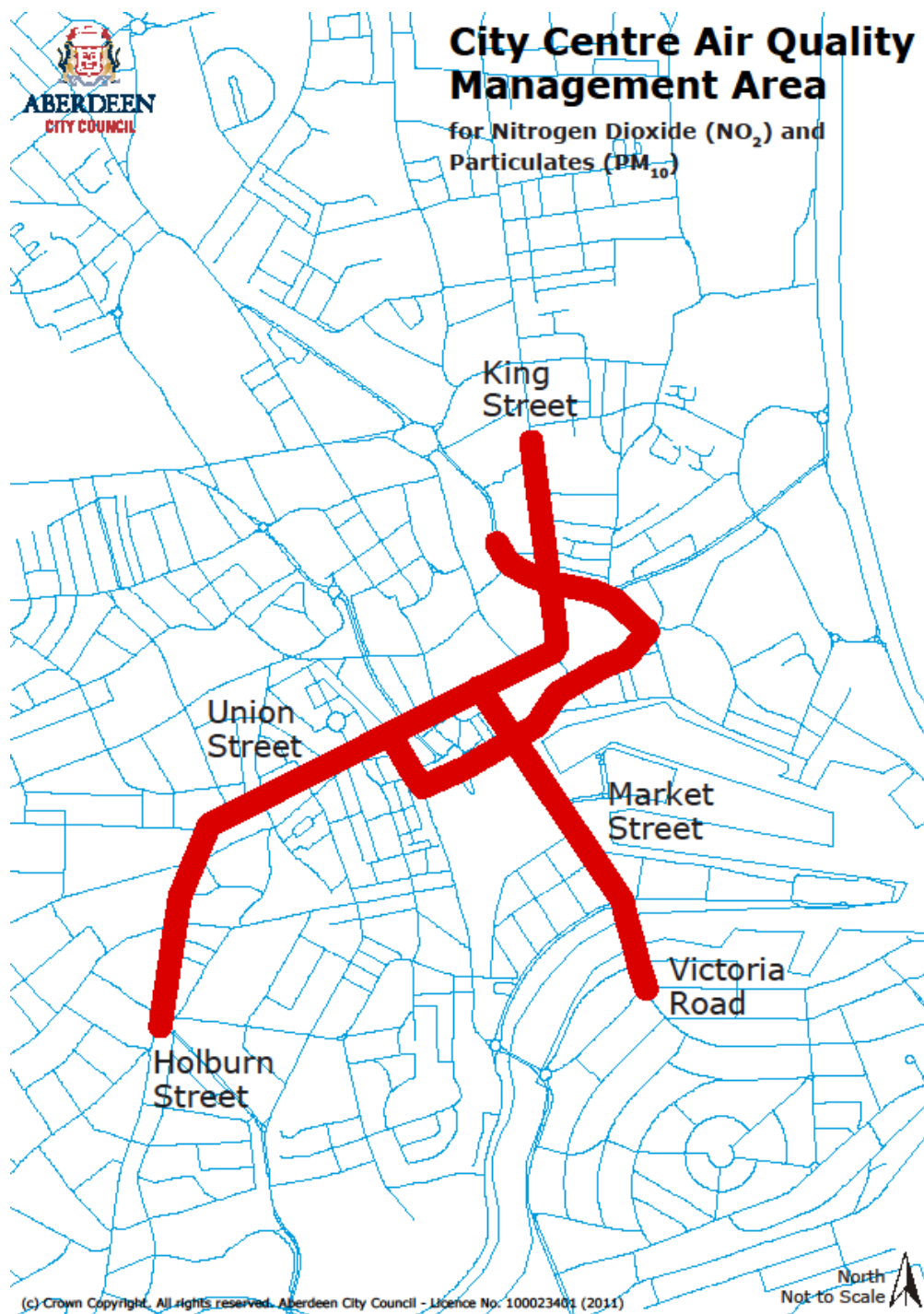


Figure A2 Map of Anderson Drive/Haudagain roundabout/Auchmill Road AQMA

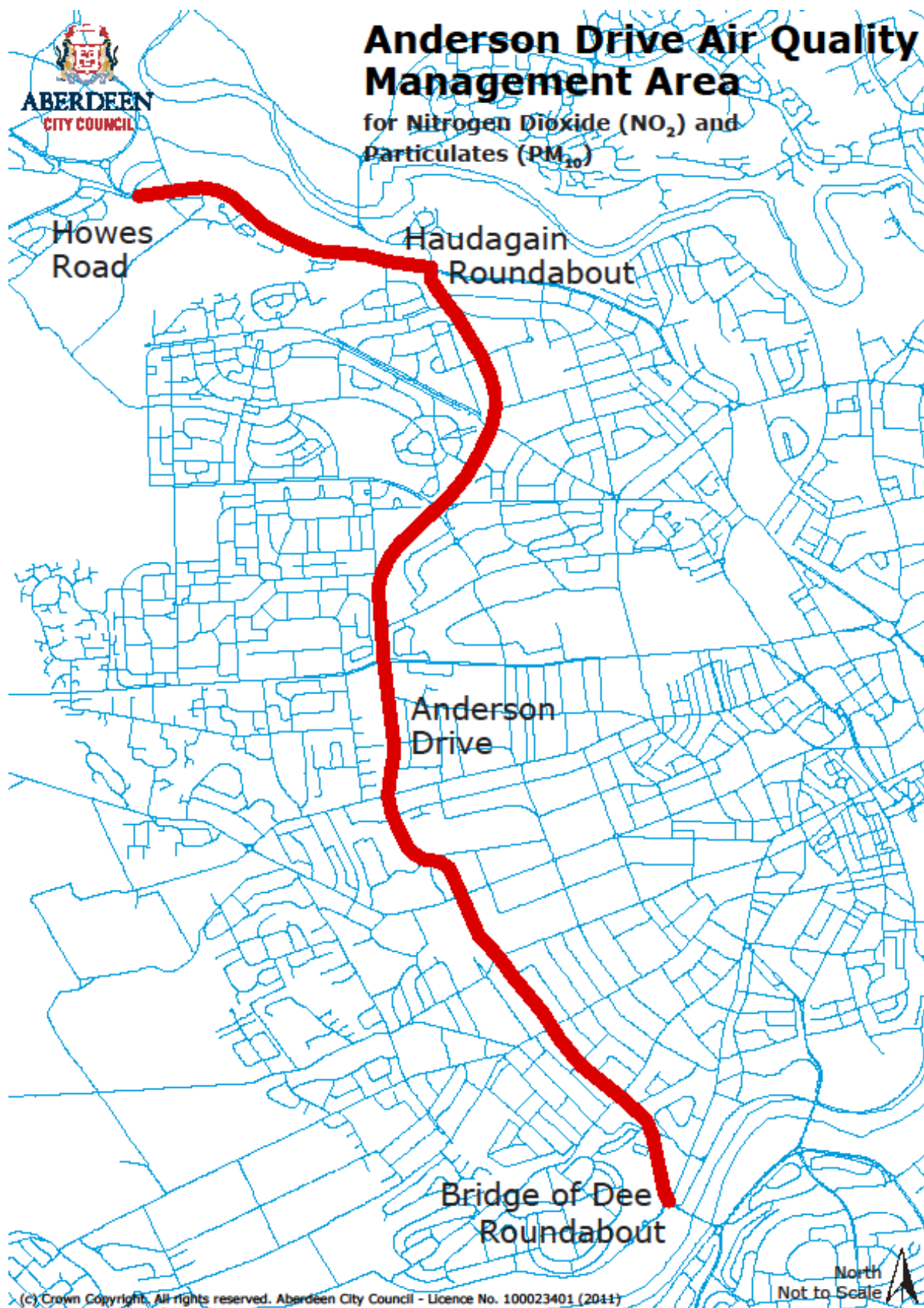


Figure A3 Map of Wellington Road AQMA

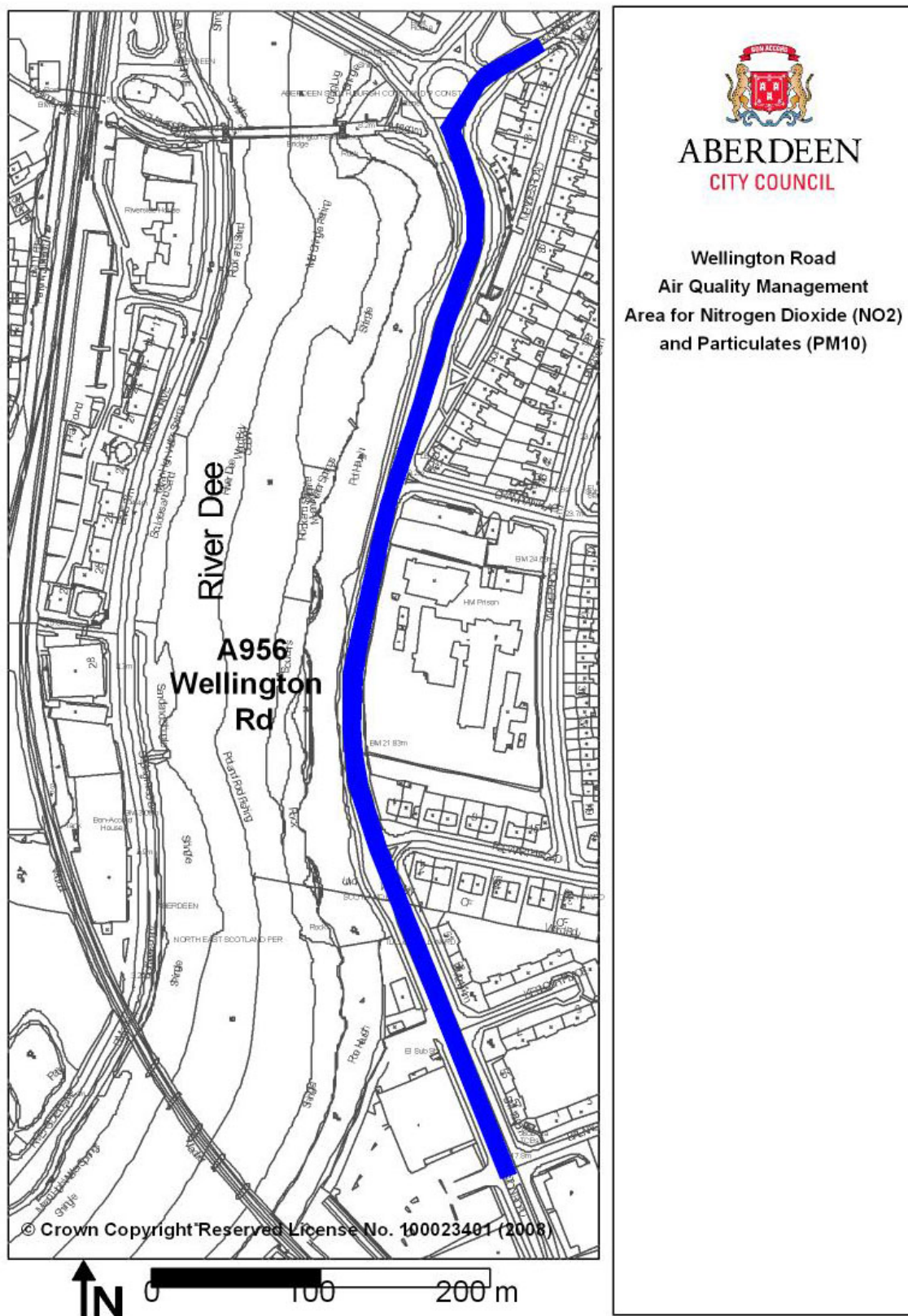


Figure A4 Continuous Monitoring and Diffusion Tube Locations



Appendix B: QA:QC Data

Factor from Local Co-location Studies

Spreadsheets downloaded from the DEFRA Local Air Quality Management website were used to calculate bias adjustment factors and the precision and accuracy of the co-located tubes. Table B1 summarises the bias adjustment factors. Only data with good precision and accuracy has been used. Errol Place is an urban background site while the others sites are roadside.

Diffusion Tube Bias Adjustment Factors

Table B1 Bias Factor Calculations

Type	DT Mean ($\mu\text{g m}^{-3}$)	CM Mean ($\mu\text{g m}^{-3}$)	Bias Factor A (%)	Bias Factor B (%)	CM Data Capture	No Monitoring Periods
Errol Place	34	23	67	49	95.7	13
Union Street	58	43	79	33	86.3	11
Wellington Road	54	52	96	5	93.6	12
King Street	37	32	87	15	95.2	12
Union Street	51	40	75	27	95.5	13
Anderson Drive	26	24	91	10	95.4	12

The tubes are provided by Gradko International and analysed by Aberdeen City Council's Public Analyst. The preparation technique is 20% tri-ethanolamine in water.

Discussion of Choice of Factor to Use

The web based spreadsheet of national bias adjustment factors (NBAFS) was reviewed however the information for Aberdeen is limited to one site. Although the Council's Public Analyst undertakes the analysis of diffusion tubes from neighbouring authorities, Aberdeen City Council is the only authority with continuous monitoring stations that can be used to calculate bias adjustment factors. Accordingly, a locally derived bias factor based on the co-located tubes at the Aberdeen continuous monitoring stations was used to adjust diffusion tube measurements at the other locations across the city. The Errol Place bias factor was used to adjust background sites and, on the advice of the national air quality helpline, the orthogonal regression of the roadside sites was used to adjust road site tubes. Union Street was omitted from the calculations due to the uncertainty of data validity. This process was considered appropriate due to the lack of other co-located studies using the laboratory for tube analysis, the remote location of Aberdeen from other conurbations and the good QA/QC performance of the laboratory. The National Bias Adjustment Factor Spreadsheet (NBAFS) 2011 correction factor for the Marleybone Road site is 0.85 which is similar to the Aberdeen value of 0.86. Data from all Aberdeen sites will be included in the NABFS in future years.

PM Monitoring Adjustment

All 2009, 2010 and 2011 TEOM data from Union Street, Anderson Drive and Wellington Road was corrected to gravitational equivalent by AEA using the Volatile Correction Model (VCM). Data from the BAMs at King Street and Market Street were also corrected by AEA Technology (AEAT) using a gravitational factor of 0.83333 for Gravitational Equivalent.

Short-term to Long-term Data adjustment

Data capture at all continuous monitoring sites was greater than 75% therefore no data required to be seasonally adjusted. Data from diffusion tubes, with the exception of those sites where monitoring ceased in September 2011, was also carried out for the full year. No seasonal adjustment has been carried out on these sites as concentrations are well below the annual mean objective.

QA/QC of automatic monitoring

All equipment is subject to the QA/QC procedure recommended with LAQM.TG(09). Equipment is serviced at 6 monthly intervals. The contract includes call outs to site for repairs and the routine replacement of consumables.

The Errol Place and Union Street sites are part of the UK's Automatic Urban Network. All sites are part of the Scottish Government data reporting process and subject to independent audit by AEAT at 6 monthly intervals. Data validation and ratification is also performed by AEAT.

The analysers perform daily automatic calibrations which are used to assess the routine performance of the analysers and any long term response drift. Manual calibrations are performed by trained Council officers every two weeks using a calibration mixture traceable to national standards. These calibrations act as a check on the operation of the analysers and enable determination of the instrument response factors used to calculate the concentration of NO₂.

Data is checked daily (Monday-Friday). Should a problem be identified either by Council officers or by AEAT the site is visited immediately and, if necessary, a further manual calibration is performed. Data considered suspect is deleted. Records are kept of instrument breakdowns, services and audits and any local activities or weather that may influence readings.

QA/QC of diffusion tube monitoring

Diffusion tube monitoring is carried in accordance with the procedures contained in the guidance 'Diffusion Tubes for Ambient NO₂ Monitoring: Practical Guidance for

Laboratories and Users' and LAQM.TG(09). All tubes, other than those co-located at the continuous analysers are attached to lampposts/downpipes at a height of 2m above ground level and exposed for 4 weeks. Co-located tubes are located in triplicate close to the analyser air intake. All exposure times are recorded. Three unexposed travel blanks are submitted to the laboratory with each batch of exposed tubes.

Aberdeen City Council's Public Analyst is UKAS accredited for the analysis of diffusion tubes and also participates in the WASP scheme and the monthly intercomparison exercise managed by AEA. UKAS carried out an annual assessment of the laboratory in March 2012 to ensure laboratory guidance is being implemented. No problems were identified. The WASP Annual Performance Criteria for NO₂ Diffusion Tubes covering 2011 classified the laboratory as 'Good'.

Appendix C: Diffusion Tube Data and Calculations

Table C1 Measured 4-Weekly Diffusion Tube Data

Site	Ref	Monitoring Period												Mean (μgm^{-3})	SD
		1	2	3	4	5	6	7	8	9	10	11	12		
Bucksburn Primary School	1	49	39	37	43	23	44	41	39	33	34	39		38.3	6.8
885 Gt Northern Rd at Haudigan	2	63	67	49	77	42	71	62	60	57	63	66	52	60.8	9.7
549 North Anderson Drive	3	38	50	30	58	19	51	57	50	34	34	47	28	41.3	12.5
38 Ellon Road	4	80	54	43	53	43	46	32		53	57	58	61	52.7	12.3
Linksfeld Centre, 520 King Street	5	70				39	43	33	44	51	58	61	55	49.2	11.7
86 Victoria Road, Torry	6	54	43	36	43	24	44	40	35	33	35	36	34	38.1	7.4
Wellington Rd/ Kerloch Place	7	64	50	53	60	35	52	48	46	48	49	64	53	51.8	8.1
107 South Anderson Drive	8	82	80	36	65	29	75	71	74	64	64	74	63	64.8	16.4
31 Market St	9	69	71	59	60	34	78	69	71	49	57	59	48	60.3	12.4
184/192 Market St	10	94	73	76	83	56	81	78	72	76	69	55	74	73.9	10.7
105 King St	11	93	78	79	73	59	68	58	63	67	78	81	83	73.3	10.6
40 Union St	12	70	69		38	55	59	51	62	61	60	60	62	58.8	8.8
Music Hall, Union St	13	58	51	53	52	40	57	46	46	45	47	47	50	49.3	5.2
Dyce Primary School	14	25	19	11	14	7	9	9	9	12	12	21	17	13.8	5.6
Northfield Swimming Pool	15	20	24	14	22	8	14	13	14	13	17	32	18	17.4	6.4
Guild St/ Market St roundabout	16	69	56	50	60	33	64	50	60	44	49	52	49	53.0	9.6
43/45 Union St	17	69	80	63	73	49	69	60	53	61	59	74	54	63.7	9.5
14 Holburn	18	99	65	73	95	52	63	42	49	58	59	52		64.3	18.2
468 Union St	19	82	67	64	68	46	62	45	62	56	60	61	75	62.3	10.5
212 King St	20	54	54	42	46	35	36	30	33	39	48	52	43	42.7	8.3
26 King Street	21	55	60	51	54	34	51	43	45	46	51	56	49	49.6	6.9
104 King St	22	59	66	49	70	38	56	50	53	49	51	62	52	54.6	8.7
785 Gt Northern Road at Shell garage	23	61	46	39	59	30	38	33	43	43	43	48	48	44.3	9.2
40 Auchmill Road	24	67	47	42	44	50	44	40	44	43	49			47.0	7.7
21 Holburn	25	69	64	52	56	37	61	52	53	44	46	65	51	54.2	9.4
147 Holburn Street	26	50	39	31	49	21	39	32	35	33	32			36.1	8.7
82 Holburn St (Malt Mill)	27	48	68	32	34	18	39	32	33	28	32	39	30	36.1	12.3
61 Holburn Street	28	59	55	42	50	26	55	41	45	38	35	57	43	45.5	10.0
469 Union	29	95	83	75	79	61	76	56	66	57	69	86	74	73.1	11.9

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Street															
209 Union St	30	76		66	75	47	63	56	56	56	66	80	79	65.5	11.0
249 Holburn Street	31	54	50	34	43	22	43	37	40	35	38	44	38	39.8	8.2
Willowbank Road./Albury Rd	32	41	35	28	29	17		21	21					27.4	8.5
East North Street	33	72	65	65	61	44	62	44	55	54	59	65	61	58.9	8.4
404 King Street	34	57	45	39	44	29	35	27	33	32	43	52	42	39.8	9.1
Riverside House, Riverside Dr.	35	41	33	26	37	17	32	30	27					30.4	7.3
115 Wellington Road	36	75	68	65	76	47	73	70	62	61	59	65	56	64.8	8.4
137 Wellington Road	37	54	44	43	27	31	36	30	30	39	36	44	45	38.3	8.0
Wellington Rd / 4 Nigg Kirk Rd	38	45	42	31		31	37	31	33					35.7	5.8
819 Gt Northern Rd	39	75	58	61	73	62	70	52	62	58	63	62	62	63.2	6.5
852 Fullerton Court	40	59	47	38	41	44	37	26	34	41	43	47	44	41.8	8.0
852 Fullerton Court Roadside	41		50	59	57	54		35	55		63	69	69	56.8	10.4
248 George St	42	49	46	37	39	24	42	41	39					39.6	7.4
25 Rosemount Place	43	42	45	31	36	19	37	25	32					33.4	8.6
214 Rosemount Pl	44	44	34	23	32	18	28	32	27					29.8	7.8
111 South Anderson Drive	45	45	40			14	41	39	36	27	31	34	27	33.4	9.1
West North Street										34	35	49	41	39.8	6.9

Table C2 Annual Mean Biased adjusted diffusion tube data and correction to façade

Map Ref	Site	Measured Conc ($\mu\text{g m}^{-3}$)	Bias Adjusted Conc ($\mu\text{g m}^{-3}$)	Façade Conc ($\mu\text{g m}^{-3}$)
1	Bucksburn Primary Sch, Inverurie Rd	38.3	32.8	32.8
2	885 Gt Northern Road	60.8	52.7	40.8
3	549 North Anderson Dr	41.3	35.4	28.3
4	38 Ellon Road	52.7	45.8	40
5	Linksfield Centre, 520 King St	49.2	42.3	30.2
6	86 Victoria Road Torry	38.1	32.8	32.8
7	Wellington Rd/ Kerloch Pl	51.8	44.9	44.9
8	107 Anderson Drive	64.8	56.2	41.9
9	31 Market St	60.3	51.8	51.8
10	184/192 Market St	73.9	63.9	63.9
11	105 King Street	73.3	63.1	63.1
12	40 Union St	58.8	51	51
13	Music Hall Union St	49.3	42.3	42.3
14	Dyce Primary, Gordon Terr	13.8	9.4	9.4
15	Northfield swimming pool, Keppleshill Cres	17.4	11.4	11.4
16	Guild St/ Market Street	53.0	45.8	45.8
17	43/45 Union St	63.7	55.3	55.3
18	14 Holburn St	64.3	55.3	55.3
19	468 Union St	62.3	53.6	53.6
20	212 King Street	42.7	37.2	37.2
21	26 King Street	49.6	43.2	43.2
22	104 King St (Gala Bingo)	54.6	47.5	47.5
23	785 Gt Northern Road	44.3	38.0	32.1
24	40 Auchmill Road	47.0	40.6	40.6
25	21 Holburn St	54.2	46.7	46.7
26	147 Holburn Street	36.1	31.1	31.1
27	82 Holburn St	36.1	31.1	31.1
28	61 Holburn Street	45.5	39.7	38.3
29	469 Union Street	73.1	63.1	63.1
30	209 Union St	65.5	57	57
31	249 Holburn Street	39.8	34.6	34.6
32	Willowbank Rd/Albury Rd	27.4	27.4	27.4
33	East North Street	58.9	51.0	51.0
34*	404 King Street	39.8	34.6	34.6
35	Riverside House, Riverside Dr.	30.4	26.8	26.8
36	115 Wellington Road	64.8	56.2	31
37	137 Wellington Road	38.3	32.8	31.1
38	Wellington Rd / 4 Nigg Kirk Rd	35.7	31.1	31.1
39	819 Great Northern Road	63.2	55.3	55.3
40	852 Fullerton Court	41.8	36.3	36.3
41	852 Fullerton Court Roadside	56.8	49.2	22

42	248 George Street	39.6	34.6	34.6
43	25 Rosemount Place	33.4	28.5	27.5
44	214 Rosemount Place	29.8	25.9	25.9
45	111 South Anderson Drive	33.4	28.5	28.5

Table C3 Diffusion Tube concentrations showing calculations to façade

Site Ref	Site	Bias Factor Conc Cy (ugm ⁻³)	Background Conc (ugm ⁻³)	Dist to kerb Dy (m)	Dist façade Dz (m)	Calculated Façade Conc (ugm ⁻³)
2	885 Gt Northern Rd	52.7	17.37	3	11	40.8
3	549 North Anderson Dr	35.4	19.55	3	17	28.3
4	Ellon Rd	45.8	19.43	3	7	40.0
5	Linksfild Crossing	42.3	22.76	0.1	9	30.2
8	107 South Anderson Dr	56.2	20.32	3	14	41.9
23	785 Gt Northern Rd	38.0	17.37	3	9	32.1
28	61 Holburn St	39.7	28.81	3	5	38.3
32	Willowbank Rd	23.3	28.81	3	5	52.6
36	115 Menzies Rd	56.2	28.54	1	8	31.0
37	137 Wellington Rd	32.8	31.42	10	13	31.1
38	Wellington/Nigg Kirk Rd	31.1	31.42	3	7	31.1
41	Fullerton Court roadside	49.2	17.37	0.1	7	22
43	25 Rosemount Place	28.5	23.1	3	6	27.5

Dy - distance to kerb at which concentrations were measured

Dz – distance to kerb at which concentrations are to be predicted