

2010 Air Quality Progress Report for *Aberdeen City Council*

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

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Local	Aileen Brodie					
Authority	Principal Environmental Hea					
Officer	Officer					

Department	Housing and Environment					
Address	Environmental Protection Section,					
	4 th Floor St Nicholas House, Broad					
	Street, Aberdeen AB10 1BX					
Telephone	01224 523737					
e-mail	poll@aberdeencity.gov.uk					
	abrodie@aberdeencity.gov.uk					

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Executive Summary

This Progress Report 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 2009 the annual mean nitrogen dioxide (NO₂) concentration 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/Haudigan roundabout AQMAs. Levels at monitoring sites were generally similar to previous years with the exception of the Market Street continuous monitoring station. The station required to be relocated due to the construction of the Union Square retail development. The limited data available for 2009 indicates concentrations are significantly lower at the new location between Market Street and Poynernook Road. This is probably due to the more open nature of the site and lower congestion in the area. The 1-hour objective was met at all the continuous monitoring stations, although there is insufficient data for Market Street to properly assess if exceedance is likely at the new site.

Outwith the AQMAs data from the new King Street continuous monitoring station and bias adjusted diffusion tube data did not record any exceedances of the NO₂ objectives.

The 2005 PM_{10} (particulate) objectives were met at all continuous monitoring stations, although only limited data was available for the new Market Street site. The 2010 annual mean objective was exceeded at the Wellington Road continuous monitoring station. Concentrations at the Union Street continuous monitoring station were at the objective value. As with NO₂, PM₁₀ concentrations at the new Market Street site were lower than in previous years, however the available data suggests levels are still well above the annual mean objective. The objective was met at the Anderson Drive, Errol Place and the new King Street continuous monitoring stations. There were no exceedances of the 2010 24-hour objective, although the limited Market Street data suggests exceedances are likely.

The Volatile Correction Model (VCM) was used to adjust PM_{10} data, where appropriate, to report 2009 data. Additionally an FDMS replaced the TEOM at Errol Place in February 2009. As a result data cannot be directly compared with previous years, however measured concentrations suggest a 1.14 correction factor rather than a 1.3 factor is more appropriate to correct the historical TEOM data. The 2009 Updating and Screening Assessment and subsequent modelling of City Centre PM_{10} concentrations in 2010 indicated potential exceedance of the 2010 annual mean objective across a wide area of the City Centre and beyond the boundary of the current AQMA. However, the 2009 data and use of the 1.14 factor would indicate less exceedance than previously anticipated. Monitoring in 2010 will further assist in determining PM_{10} concentrations and whether the boundary of the AQMA is appropriate.

No Detailed Assessment or amendment to the AQMAs for nitrogen dioxide or PM_{10} is proposed at this time.

The opening of the Union Square retail park between Market Street and Guild Street in November 2009 and associated infrastructure changes is the only new or proposed development with the potential to significantly impact on air quality. The development will be considered in greater detail in future reports.

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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 is due to commence during 2010. 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 is also a daily fish market and regular ferries to Shetland and Orkney Islands. Aberdeen Airport (Dyce) is located around 7km to the northwest of the city.

1.2 Purpose of Progress Report

Progress Reports are required in the intervening years between the three-yearly Updating and Screening Assessment reports. Their purpose is to maintain continuity in the Local Air Quality Management process.

They are not intended to be as detailed as Updating and Screening Assessment Reports, or to require as much effort. However, if the Progress Report identifies the risk of exceedence of an Air Quality Objective, the Local Authority (LA) should undertake a Detailed Assessment immediately, and not wait until the next round of Review and Assessment.

1.3 Air Quality Objectives

The air quality objectives applicable to LAQM in 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, $\mu g/m^3$ (milligrammes per cubic metre, $mg'm^3$ for carbon monoxide) with the number of exceedences in each year that are permitted (where applicable).

Pollutant		Date to be	
	Concentration	Measured as	achieved by
Benzene	16.25 μg/m ³	Running annual mean	31.12.2003
	3.25 μg/m ³	Running annual mean	31.12.2010
1,3-Butadiene	2.25 µg/m ³	Running annual mean	31.12.2003
Carbon monoxide	10.0 mg/m ³	Running 8-hour mean	31.12.2003
Lead	0.5 <i>µ</i> g/m ³	Annual mean	31.12.2004
	0.25 <i>µ</i> g/m ³	Annual mean	31.12.2008
Nitrogen dioxide	200 μ g/m ³ not to be exceeded more than 18 times a year	1-hour mean	31.12.2005
	40 μg/m ³	Annual mean	31.12.2005
Particles (PM ₁₀) (gravimetric)	50 μ g/m ³ , not to be exceeded more than 35 times a year	24-hour mean	31.12.2004
	50 μ g/m ³ , not to be exceeded more than 7 times a year	24-hour mean	31.12.2010
	40 <i>µ</i> g/m ³	Annual mean	31.12.2004
	18 <i>µ</i> g/m ³	Annual mean	31.12.2010
Sulphur dioxide	350 μ g/m ³ , not to be exceeded more than 24 times a year	1-hour mean	31.12.2004
	125 μ g/m ³ , not to be exceeded more than 3 times a year	24-hour mean	31.12.2004
	266 μ g/m ³ , not to be exceeded more than 35 times a year	15-minute mean	31.12.2005

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

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 NO_2 and PM_{10} 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 NO_2 in parts of the city centre. An Air Quality Management Area (AQMA) was declared in June 2001 centring 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 PM_{10} 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 PM_{10} 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 Haudigan 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 Haudigan 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 NO_2 and PM_{10} 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 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 PM_{10} levels on Union Street were found to be similar to previous years. In 2007 elevated levels of PM_{10} 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 PM_{10} and NO_2 were again predicted on the Anderson Drive/Haudigan 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 NO_2 objective and the annual mean 2010 PM_{10} objective were likely to be exceeded in 2010 at the Haudigan 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 Haudigan 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 NO_2 and PM_{10} levels recorded in the 2008 Progress Report. The Haudigan roundabout/Anderson Drive corridor was also declared an AQMA for both pollutants as NO_2 monitoring in the vicinity of the roundabout has frequently recorded measurements in excess of the objective and the AWPR will not be completed until 2012 at the earliest.

The Detailed Assessment also considered NO_2 and PM_{10} 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

An Update and Screening Assessment completed in July 2009 indicated potential exceedances of the NO₂ annual mean objective at areas just outwith the existing AQMAs, including George St, Rosemount Place, Auchmill Road and King St and potential exceedances of the 1-hour objective on Union St. Potential exceedances of the 2010 annual mean PM_{10} objective were also predicted. Further monitoring was recommended in conjunction with modelling of the city centre to determine the likelihood and extent of potential exceedances.

The city centre modelling study was completed in March 2010. Exceedances of the annual mean NO_2 objective were mainly predicted within the existing AQMA with the potential for additional exceedances at locations just outwith the AQMA. The report

recommended additional monitoring outwith the AQMA where elevated levels of NO_2 were predicted. The modelling predicted widespread exceedance of the 2010 annual mean PM_{10} objective both within and outwith the AQMA. Those receptors not predicted to exceed the objective were typically restricted to the fringes of the city centre, set back from busy roads.

1.4.4 Summary Table of Review and Assessment Reports and Outcomes

Table 1.2 summarises the outcome of previous air quality reports

Report	Outcomes		
Stages 1, 2, 3 and 4	City centre AQMA declared in June 2001 due to predicted		
Reports 2000-2003	exceedances of annual mean NO ₂ objective. Area of AQMA		
	extended in March 2003		
Updating and	Detailed Assessment of NO ₂ and PM ₁₀ recommended in city		
Screening	centre and assessment of Aberdeen Harbour		
Assessment August			
2003			
Detailed Assessment	Extension of city centre AQMA for NO ₂ and inclusion of		
August 2004	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	Update of monitoring results and new developments		
Screening			
Assessment July 2006			
Air Quality Action Plan	Detailed measures to improve air quality in the AQMA		
July 2006			
Progress Report June	Detailed Assessment of NO ₂ and PM ₁₀ recommended on		
2007	Wellington Road, Anderson Dr/Haudigan		
	roundabout/Auchmill Rd corridor and King Street		
Detailed Assessment	AQMAs declared November 2008 on Anderson		
March 2008	Drive/Haudigan 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	Update of monitoring results and new developments and		
2008	progress on implementation of the Air Quality Action Plan		
Updating and	Update of monitoring results. Recommended additional NO ₂		
Screening	diffusion tubes at potential areas of exceedances. Modelling		
Assessment July 2009	of City Centre PM_{10} and NO_2 recommended to support		
Other Operators and all	proposed new Action Plan		
City Centre modelling	woodening predicted widespread exceedances of annual		
study March 2010	mean Pivi ₁₀ objective and minor potential areas of		
	exectances of the NO_2 annual mean objective outwith the		
	AQMA		

Table 1.2Air Quality Reports and Outcomes

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

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.

King Street is a new site that began operation in November 2008. Market St was adjacent to a former railway goods yard, however equipment 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/Poynernook 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, cumulating in the replacement of the TEOM with a BAM in March 2010 and a replacement NO_x analyser in April 2010.

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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	Roadside	X394397	Y807392	PM ₁₀ , PM _{2.5} , O ₃ , NO ₂ (NO, NO _x)	FDMS FDMS Chemilumin escence	N	N/A	N/A	Ν
Union Street	Roadside	X393656	Y805967	PM ₁₀ , NO ₂ (NO, NO _x)	TEOM Chemilumin escence	Y	Y(2m)	2m	Υ
Market Street	Roadside	X394408	Y805893	PM ₁₀ , NO ₂ (NO, NO _x)	TEOM Chemilumin escence	Y	Y(0.5m)	2m	Y
Anderson Drive	Roadside	X392506	Y804186	PM ₁₀ , NO ₂ (NO, NO _x)	TEOM Chemilumin escence	Y	Y(10m)	6m	Ν
Wellington Road	Roadside	X394395	Y804779	PM ₁₀ , NO ₂ (NO, NO _x)	TEOM Chemilumin escence	Y	Y(5m)	4m	Y
King Street	Roadside	X394333	Y808770	PM ₁₀ , NO ₂ (NO, NO _x)	BAM Chemilumin escence	N	Y(10m)	3m	N

2.1.2 Non-Automatic Monitoring

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 NO_2 concentrations and highlight areas of high NO_2 concentrations. Tubes are co-located in triplicate at all the continuous monitoring sites 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.

Aberdeen City Council – ScotlandTable 2.2Details of Non- Automatic Monitoring Sites

Bucksburn Primary Sch	Roadside	X389744	Y809575	NO ₂	Y	Y (façade)	8m	Ν
Site Name	Site Type	OS Grid Ref		Pollutants Monitored	In AQMA ?	Relevant Exposure? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road (N/A if not applicable)	Worst-case Location?
885 Gt Northern Rd	Roadside	X391167	Y809161	NO ₂	Y	Y (11m)	3m	Y
549 N Anderson Dr	Roadside	X391394	Y808949	NO ₂	Y	Y (17m)	3m	Y
38 Ellon Rd	Roadside	X394652	Y809714	NO ₂	N	Y(7m)	3m	Y
520 King St	Roadside	X394236	Y808066	NO ₂	N	Y(9m)	0.1m	Ν
86 Victoria Rd, Torry	Roadside	X394764	Y805197	NO ₂	N	Y(façade)	3m	Y
Wellignton Rd//Kerloch Pl	Roadside	X394411	Y804407	NO ₂	Y	Y(façade)	3m	Y
107 Anderson Dr	Roadside	X392337	Y804340	NO ₂	Y	Y(14m)	3m	Y
31 Market St	Roadside	X394258	Y806157	NO ₂	Y	Y(façade)	3m	Y
184/192 Market St	Roadside	X394530	Y805708	NO ₂	Y	Y(façade)	3m	Y
105 King St	Roadside	X394406	Y806637	NO ₂	Y	Y(façade)	3m	Y
40 Union St	Roadside	X394284	Y806284	NO ₂	Y	Y(façade)	3m	Y
Music Hall, Union St	Roadside	X393777	Y806030	NO ₂	Y	Y(façade)	6m	Y
Dyce Prim, Gordon Ter	Urban background	X389046	Y812794	NO ₂	N	Y(N/A)	N/A	Ν
Northfield swimming pool	Urban background	X390801	Y808132	NO ₂	N	Y(N/A)	N/A	Ν

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Guild St/Market St	Roadside	X394336	Y806097	NO ₂	Y	Y(facade)	5m	Y
43/45 Union St	Roadside	X394284	Y806284	NO ₂	Y	Y(façade)	3m	Y
14 Holburn St	Roadside	X393305	Y805734	NO ₂	Y	Y(façade)	3m	Y
468 Union St	Roadside	X393386	Y805826	NO ₂	Y	Y(façade)	3m	Y
212 King St	Roadside	X394400	Y806842	NO ₂	N	Y(façade)	4m	N
26 King St	Roadside	X394449	Y806453	NO ₂	Y	Y(façade)	4m	Y
104 King St	Roadside	X394425	Y806634	NO ₂	Y	Y(façade)	4m	Y
785 Gt Northern Rd	Roadside	X391458	Y809102	NO ₂	N	Y(façade)	3m	Y
40 Auchmill Rd	Roadside	X389913	Y809603	NO ₂	N	Y(facade)	3m	Y
21 Holburn St	Roadside	X393323	Y805728	NO ₂	Y	Y(façade)	3m	Y
147 Holburn St	Roadside	X393323	Y805728	NO ₂	N	Y(façade)	3m	N
80 Holburn St	Roadside	X393233	Y805565	NO ₂	Y	Y(façade)	3m	Y
61 Holburn St	Roadside	X393275	Y805624	NO ₂	Y	Y(5m)	3m	Y
469 Union St	Roadside	X393400	Y805811	NO ₂	Y	Y(façade)	3m	Y
209 Union St	Roadside	X393795	Y806009	NO ₂	Y	Y(façade)	5m	Y
249 Union St	Roadside	X393170	Y805120	NO ₂	Y	Y(façade)	5m	Y
Willowbank Rd/Albury Rd	Roadside	X393642	Y805503	NO ₂	N	Y(5m)	3m	N
East North St	Roadside	X394505	Y806529	NO ₂	Y	Y(façade)	4m	Y
404 King Street	Roadside	X394317	Y807527	NO ₂	N	Y(façade)	9m	N
Riverside House, Riverside Drive	Roadside	X39425	Y804873	NO ₂	N	Y(façade)	6m	N

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115 Menzies Rd/Wellington Rd	Roadside	X394403	Y804799	NO ₂	Y	Y(12m)	1m	Y			
137 Wellington Road	Roadside	X394697	Y803735	NO ₂	N	Y(17m)	14m	Ν			
Wellington Road / 4 Nigg Kirk Road	Roadside	X394719	Y803329	NO ₂	Ν	Y(7m)	3m	Ν			
819 Gt Northern Rd	Roadside	X391293	Y809136	NO ₂	Y	Y(façade)	3m	Υ			
852 Fullerton Ct (facade)	Facade	X391353	Y809158	NO ₂	Y	Y(façade)	7m	Υ			
852 Fullerton Ct (roadside)	Roadside	X391352	Y809151	NO ₂	Y	Y(7m)	0.1m	Y			
248 George St	Roadside	X393868	Y806741	NO ₂	Ν	Y(façade)	2m	Ν			
25 Rosemount Pl	Roadside	X393424	Y806685	NO ₂	Ν	Y(3m)	3m	Ν			
214 Rosemount Pl	Roadside	X392897	Y806352	NO ₂	Ν	Y(façade)	3m	Ν			
111 S Anderson Dr	Facade	X392311	Y804349	NO ₂	Y	Y(façade)	13m	Ν			

2.2 Comparison of Monitoring Results with Air Quality 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 is a bus lane. 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 the monitoring results 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

Tables 2.3a and 2.3b show the annual mean and number of exceedances of the 1-hour objective for NO₂ obtained from the continuous monitoring stations in 2007, 2008 and 2009. Data for the Union Street and Market Street sites is only available for the periods January – September 2009 and August – December 2009 respectively. Although data capture is less than 75%, the seasonally adjusted annual mean has been calculated using the Errol Place background data to enable comparison with previous years at the Union Street site. As the Market St station was relocated it is not appropriate to compare data at the new site with previous years. Appendix B shows the calculation for the short to long term adjustment (annualisation) of continuous monitoring data.

The seasonally adjusted concentration of 56 ugm⁻³ at Union Street (measured concentration 52 ugm⁻³) was well above the annual mean objective and similar to previous years. The objective was also exceeded at the Wellington Road continuous

monitoring site in 2009, the first full year of monitoring. However, when projected to the nearest façade the predicted concentration was 38ugm⁻³ and just below the objective. Neither site exceeded the 1-hour objective in 2009, although this objective was exceeded at Union St in 2008. As monitoring has been carried out at the site for 9 years, the exceedance of the 1-hour objective in 2008 may be atypical.

The annual mean concentrations at Errol Place and Anderson Drive, which is within an AQMA, were well below the objective and similar to values in previous years. The Anderson Drive AQMA was declared due to predicted exceedances of the annual mean objective at locations elsewhere along the Anderson Drive/Haudigan roundabout corridor. The objective was also met at the new King Street site.

Unfortunately only limited data was available for Market Street in 2009 as a new site required to be identified and equipment subsequently relocated. Intermittent data over the period July-November 2009 recorded a seasonally adjusted mean of 38ugm⁻³ (measured concentration 40 ugm⁻³) and 2 exceedances of the 1-hour objective. This is much less than the annual mean in previous years indicating NO₂ levels at the new site are likely to be much less and potentially below the objective. This may be due the more open area of the site and less standing traffic.

Trends in annual mean NO_2 concentrations at the continuous monitoring stations are shown in Figure 2.1. There has been no noticeable decrease in concentrations despite improvements in vehicle emissions. This trend is similar to other cities elsewhere in the UK and may be due to an increase in the proportion of NO_2 directly emitted to the atmosphere rather than via the oxidation of NO to NO_2 .

			Data	Data Capture	Annual mean concentrations (µg/m³)		
Site ID	Location	Within AQMA?	Capture for monitoring period ^a %	for full calendar year 2009 ^b %	2007	2008	2009 °
A1	Errol Place	Ν		96.1	23	25	26
A2	Union Street	Y	96.0	70.0	53	54	56 [°]
A3	Market Street	Y	97.8	36.0	62	73 ^d	38 ^c
A4	Anderson Drive	Y		94.6	28	25	24
A5	Wellington Road	Y		96.6	N/A	40 ^c	43
A6	King Street	Ν		89.1	N/A	N/A	32

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

^adata capture for the Union St and Market St monitoring periods as monitoring was only carried out for part of the year

^bdata 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 Union Street and Market Street 2009 data and Wellington Road 2008 data have been seasonally adjusted to provide "annualised" data using Errol Place background data and procedures within TG(09). There are no other urban background sites within 50 miles of Aberdeen.

^d The Market Street site ceased operation in October 2008 due construction works at a neighbouring development site. 2008 data collection was only 77%. The site was relocated and 2009 data is for the new site.



Figure 2.1 Trends in Annual Mean Nitrogen Dioxide Concentration Measured at Automatic Monitoring Sites.

Site ID	Location	Within	Data Capture for monitoring	Data Capture for full calendar	Number of Exceedences of hourly mean (200 µg/m³)		
			period %	year 2009 %	2007	2008	2009
A1	Errol Place	Ν		96.1	0	0	0
A2	Union Street	Y	96.4	70	13	21	10(190)
A3	* ¹ Market Street	Y	97.8	36	39	94*(244)	2(175)
A4	Anderson Drive	Y		94.6	0	2	0
A5	Wellington Road	Y		96.1	N/A	0(153)	0
A6	King Street	Ν		89.1	N/A	N/A	0

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

 Mean Objective

Where data capture is less than 90% the 99th percentile of hourly means is presented in brackets. * The Market Street site ceased operation in October 2008 due construction works at a neighbouring development site. 2008 data collection was only 77%

Diffusion Tube Monitoring Data

Table 2.4 shows the results of the diffusion tube monitoring. Tubes have been biased adjusted using the methodology described in LAQM.TG(09). In previous years there was a clear difference in the bias factor for the Errol Place continuous monitoring site compare to roadside sites. Accordingly, the Errol Place bias adjustment factor was used to correct background diffusion tube sites and the mean factor for the roadside sites was used to correct the roadside diffusion tube sites.

The 2009 co-located data included the new King St and Wellington Road continuous monitoring stations and results showed a greater variation in bias adjustment factors across all the sites, although the individual factors for Anderson Drive and Union Street were identical to 2008. As a result, Table 2.4 shows the 2009 diffusion tube data with 2 adjustment factors: factor A and factor B. Façade concentrations are shown in brackets where appropriate. Table A6 in Appendix C shows calculations to project roadside concentrations to façade.

Bias factor A shows background diffusion tubes corrected with the Errol Place factor and roadside tubes corrected with the mean of the roadside bias factors (Union St, Wellington Road, Anderson Dr and King St continuous monitoring sites). Bias factor B shows data corrected using the bias factor from the most relevant continuous monitoring site. Where there is no nearby continuous monitoring station data was adjusted using the mean of the roadside sites. The following summarises bias factor B used for the various monitoring sites:

Diffusion Tube Sites	Bias Factor Applied	Value
City Centre AQMA	Union St CM	0.95
King Street (outwith city	King St CM	0.89
centre AQMA)		
Wellington Road	Wellington Rd CM	0.76
Anderson Drive	Anderson Dr CM	0.98
Sites with no relevant CM	Mean of roadside CMs	0.89

Concentrations at most sites, particularly within the city centre, were lower than in previous years with the application of bias factor A. The 2009 bias adjustment factor A for roadside sites was 8% less than the 2008 value. However, if bias factor B is applied then there is greater similarity between 2009 data and previous years and also between the relevant continuous monitoring and diffusion tube data for each of the AQMAs. It may therefore be more appropriate to apply the most relevant bias factor from the continuous monitoring sites to adjust the diffusion tubes within the 3 AQMAs. Measured diffusion tube concentrations were generally similar to previous years.

Information and tables showing 4-weekly, uncorrected diffusion tube data bias adjustment factor calculations and calculations to correct roadside sites to façade where appropriate are shown in Appendix C.

All diffusion tubes within the city centre AQMA continue to exceed the annual mean objective, with the exception of 249 Union Street, 212 King St and 82 Holburn Street. Tubes located at 885 and 819 Great Northern Road and 107 Anderson Drive within the Anderson Drive/Haudigan roundabout AQMA also exceed the objective, although tubes elsewhere on the AQMA corridor are below the objective. These readings agree with the 2008 Detailed Assessment which predicted pockets of exceedances along the corridor. Similarly, the tube at 115 Menzies Road/Wellington Road within the Wellington Road AQMA exceeds the objective.

Outwith the AQMAs, the concentration at 40 Auchmill Road just outwith the Anderson Dr AQMA is just below the objective using factor A and B. As there is no continuous monitoring station close to this site the mean of the continuous stations was considered the most appropriate bias factor. The concentration at 404 King St was 40ugm⁻³ (6 months seasonally adjusted data) using both factors, however levels at the King St continuous monitor and the diffusion tube at 520 King Street were below the objective. Concentrations at new diffusion tubes on George Street and Rosemount Place installed as a result of the conclusions from the 2009 Updating and Screening Assessment were below the objective as were all other sites outwith the AQMAs.

Table 2.5 Results of Nitrogen Dioxide Diffusion Tubes

				Data	Annual	mean	conce	entrations
			Data Capture	Capture	adjusted	l for	bias	(µg/m³)
		Within	for	for full	correcte	d to	façade	where
Site ID	Location		monitoring	calendar	relevant			
			period ^a	year				
			%	2009 [°]	2007	2008	2009 ^c	
				%				
							Bias	Bias
							Factor A	Factor B
1	Bucksburn	V		100		27	33	22
I	Primary Sch	T		100	36	37	33	33
2	885 Gt Northern	V		92		53(40)	54(41)	54(41)
-	Rd			02	53(47)	,	•,	•,
3	549 N Anderson	Y		100	07(00)	37(27)	36(27)	36(27)
•	Dr				37(28)	•• (=•)	••(=:)	••(=:)
4	38 Ellon Rd	N		100	44(41)	44(38)	44 (38)	45(39)
5	520 King St	Ν		100	48(44)	45 (25)	45 (30)	45 (30)
6	86 Victoria Rd,	Ν		100	41	39	34	36
	Torry				41			
7	Wellignton	Y		100	66(62)	47	43	36(36)
	Rd/Kerloch Pl				00(02)			
8	107 Anderson Dr	Y		92	62(49)	64(44)	59(42)	65(45)
9	31 Market St	Y		100	57	58	55	59
10	184/192 Market St	Y		100	80	75	64	68
11	105 King St	Y		92	70	70	67	71
12	40 Union St	Y		100	67	62	53	57
13	Music Hall, Union	Y		100	56	52	45	48
14	Sl Duno Drim	N		100		10	11	11
14	Gordon Tor	IN		100	13	12	11	11
15	Northfield	N		02		15	13	13
15	swimming pool			52	14	15	15	15
16	Guild St/Market St	Y		100	59	63	53	56
17	43/45 Union St	Y		92	58	60	54	58
18	14 Holburn St	Ŷ		100	64	59	53	57
19	468 Union St	Y		100	66	64	55	59
20	212 King St	N		100	38* ¹	38	36	39
21	26 King St	Y		100	45	46	44	47
22	104 King St	Y		100	52	52	47	50
23	785 Gt Northern	N		92	40(00)	42 (34)	39(32)	39(32)
	Rd				43 (39)	. ,	. ,	. ,
24	40 Auchmill Rd	Ν		92	47	47	39	39
25	21 Holburn St	Y		100	56	56	49	52
26	147 Holburn St	Ν		100	38	38	35	37
27	80 Holburn St	Y		100	39	36	38	35
28	61 Holburn St	Y		100	47	47(43)	41(38)	44 (41)
29	469 Union St	Y		100	70	71	65	69
30	209 Union St	Y		92	58	61	57	61
31	249 Union St	Y		100	39	39	36	38
32	Willowbank	N		100	23 ^d	24	22(21)	24(23)
	Rd/Albury Rd		ļ		d			
33	East North St	Y	400	100	52 [°]	54	53	56
34	404 King Street	N	100	54	38 °	41	40°(40)	40(40)
35	Riverside House,	N		100	30 ^d	31	28	23
26		V		100		60/47	60/44	EO (20)
30	RdWellington Rd	T		100	72(65) ^d	00(47)	00(44)	30 (30)
		1	1	1				

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37	137 Wellington Road	N		100	39(37) ^d	36(34)	33(32)	27(27)
38	Wellington Road / 4 Nigg Kirk Road	N		100	39(37) ^d	34(30)	32(31)	27(26)
39	819 Gt Northern Rd	Y		85	N/A	N/A	54	54
40	852 Fullerton Ct (facade)	Y		85	N/A	N/A	36	36
41	852 Fullerton Ct (roadside)	Y		92	N/A	N/A	49 (29)	49 (29)
42	248 George St	N	100	59	N/A	N/A	34 ^c	36 ^c
43	25 Rosemount Pl	Ν	100	59	N/A	N/A	30(30) ^c	33(33) ^c
44	214 Rosemount Pl	N	100	59	N/A	N/A	26 °	28 °

^adata capture for the monitoring period, in cases where monitoring was only carried out for part of the year (sites

^bdata 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%.) ^cdata for sites 34, 42, 43 and 44 have been "annualised" as in Box 3.2 of TG(09) as monitoring was not carried out

for the full year. ^d Data for period June – December 2007

2.2.2 PM₁₀

The Union Street and Market Street continuous monitoring locations are representative of population exposure for PM_{10} 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 2.5a and 2.5b show the annual mean and number of exceedances of the 24 hour objective for PM_{10} obtained from the continuous monitoring sites in 2007, 2008 and 2009. TEOM and BAM data has been corrected to gravitational equivalent using the processes described in Appendix B. All data was ratified and corrected to gravitational equivalent by AEA. 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 2.5a therefore reports 2007 and 2008 data with both correction factors.

Data for Market Street was only available for the period August-October 2009 and has been annualised using the process within TG(09). Similarly data for Wellington Road was only available for July-December 2008 and therefore has been annualised. Appendix B shows the calculation for the short to long term adjustment of data.

The 2004 annual mean and 24-hour objectives were met at all sites in 2009. The limited data from Market Street indicates compliance is likely.

Concentrations at Wellington Road exceeded the annual mean objective to be met in 2010. At Union Street the concentration reached the 2010 objective value. Concentrations at Errol Place, Anderson Drive and the new King Street site were below the 2010 objective. The limited value from Market Street indicates exceedance of the annual mean objective is likely. As there were 3 exceedances of the 24-hour objective over a 3 month period, exceedance of this objective is also likely. The 24-hour objective to be met in 2010 was met at all other sites.

It is difficult to directly compare 2009 values with previous years as the reported 2009 TEOM data has been corrected to gravitational equivalent using the VCM corrected model. Additionally, the TEOM at Errol Place was replaced with an FDMS monitor in February 2009 and the Market station is at a new location. With the exception of Market St, concentrations in Table 2.5a are broadly similar to 2007 and 2008 using the 1.14 correction factor to gravitational equivalent. Exceptionally high levels were recorded at Market St in 2007 and 2008 due to the neighbouring construction works. The limited 2009 data at the new Market Street site indicates that levels at this location are significantly lower, possibly due to more open nature of the site and less standing traffic.

Trends in annual mean PM_{10} concentrations can be considered by comparing measured TEOM concentrations without correction to gravitational equivalent. The measured concentrations over the period 2001-2009 are shown in Figure 2.2. It

appears that there has been a slight reduction in concentrations over the period at the Union Street and Anderson Drive sites, although this trend is not evident at Errol Place. It is not possible to consider trends at Market Street due to the construction works adjacent to the site in 2007 and 2008.

Table 2.5a Results of PM₁₀ Automatic Monitoring: Comparison with Annual **Mean Objective**

			Data	Data Capture	Annι (μg/n	ual mo n³)	ean	concer	ntrations
Site ID	ite ID Location		Capture for monitoring period ^ª %	for full calendar year 2009 ^b %	2007		2008		2009
Correct	ion Factor to G	ravitationa	al Equivalen	it	1.3	1.14	1.3	1.14	
A1	Errol Place	Ν		97.2	17	15	18	16	15
A2	Union Street	Y		96.8	19	17	22	19	18
A3	*Market St	Y	74	22.4	84	74	80 ^d	70 ^d	28 ^c
A4	Anderson Dr	Y		96	17	15	18	16	15
A5	Wellington Rd	Y		93.3	N/A	N/A	26	23°	23
A6	King Street	Ν		92.2	N/A				17

^adata capture for Market St monitoring periods as monitoring was only carried out for part of the year ^bdata 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 Market Street 2009 data and Wellington Road 2008 data have been seasonally adjusted to provide "annualised" data using Errol Place background data and procedures within TG(09). There are no other urban background

sites within 50 miles of Aberdeen. The Market Street site ceased operation in October 2008 due construction works at a neighbouring development site. 2008 data collection was only 77%. The site was relocated and 2009 data is for the new site.

Table 2.5b Results of PM₁₀ Automatic Monitoring: Comparison with 24-hour **Mean Objective**

Site ID	Location	Within AQMA?	Data Capture for monitoring period ^a	Data Capture 2009 ^b %	Number of Exceedences of d mean objective (50 µg/m ³)		ices of daily
			%		2007	2008	2009
A1	Errol Place	Ν		97.2	4	2	4
A2	Union Street	Y		96.8	0	1 (39)	1
A3	Market St	Y	74	22.4	116	148 ^c (170)	3 (86)
A4	Anderson Dr	Y		96	5	0	1
A5	Wellington Rd	Y		93.3	N/A	3 (46)	5
A6	King Street	Ν		92.2	N/A	N/A	2

Where data capture is less than 90% the 99th percentile of hourly means is presented in brackets. ^adata capture for Market St monitoring periods as monitoring was only carried out for part of the year

^bdata 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 construction works at a neighbouring development

site. 2008 data collection was only 77%



Figure 2.2 Trends in Annual Mean PM_{10} Concentration Measured at Automatic Monitoring Sites.

The 2009 data for Errol Place and King Street are from MDFS and BAM monitors

2.2.3 Sulphur Dioxide

No monitoring of sulphur dioxide was carried out in 2008 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 benzene was carried out in 2008 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. The measured annual mean was 7ugm⁻³ (60.6% data capture) suggesting that the new $PM_{2.5}$ objective value of 12ugm⁻³, to be achieved by 2020, is likely to be met at urban background sites in Aberdeen. Measuring in future years will determine whether the target of a 15% reduction in concentrations at urban background sites, measured as a 3-year mean is being achieved.

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 2.6 shows the annual mean concentration and number of exceedances of the 8-hour running mean at Errol Place over the period 2005-2009. It can be seen that the annual mean was consistent 2005-2008, although lower in 2009. Changes in ozone are reflective of meteorological conditions and the poor summer in 2009 may have influenced concentrations in 2009. The number of exceedances of the 8-hour objective has varied considerably.

Table 2.6 Results of Automatic Monitoring for Ozone:Annual MeanConcentration

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

2.2.6 Summary of Compliance with AQS Objectives

Aberdeen City Council has examined the results from monitoring in the district. Concentrations outside of the AQMA are all below the objectives at relevant locations, therefore there is no need to proceed to a Detailed Assessment.

3 New Local Developments

The new Union Square retail park located between Market Street and Guild Street within the City Centre AQMA opened in November 2009. The development comprises of shops, restaurants, a multi-screen cinema, hotel and approximately 1000 car parking spaces. Access to the car park is via Market Street. Planning permission for the development was granted in 2000 against the recommendations of air quality experts within the authority. An air quality assessment was carried out, however little monitoring data was available at that time and the assessment was based on anticipated traffic movements. The impact was predicted to be low due substantial improvements to the road layout and traffic management systems. The assessment is of little value in terms of guidance within the current LAQM regime.

Significant traffic congestion was evident on Market Street, Guild Street and the surrounding area in the immediate period following the opening of the centre and leading up to Christmas. Air quality monitoring during 2010 will assist in determining the impact of the development on City Centre pollution levels.

3.1 Road Traffic Sources

A new bus station opened in 2008 to replace the Guild Street station and serves passengers travelling outwith Aberdeen both to other cities across Scotland and towns and villages in the north east. The new station is connected to the Union Square retail park. The bus station is on the site of the previous bus station and there is no significant change in total bus movements, however buses now enter the station via Market Street. Egress remains via Guild Street. Bus flows around parts of Market Street/Guild Street have therefore changed. Traffic flows on Market Street and adjoining streets may have also changed due to the new road layout associated with the opening of Union Square.

There are no other significant changes to road traffic sources since the last Updating and Screening Assessment.

3.2 Other Transport Sources

There are no other transport sources that are new since the last Updating and Screening Assessment.

3.3 Industrial Sources

There are no new industrial installations, major fuel storage deports, petrol stations or poultry farms since the last Updating and Screening Assessment.

3.4 Commercial and Domestic Sources

Table 3.1 summarises planning applications that were considered during 2009 for proposed new biomass combustion plants. A summary of each development and the outcome of air quality assessments is also provided. There are no areas where the

combined impact of several biomass combustion sources or where domestic solid fuel burning may be relevant.

Name	Location	Grid	Capacity	Description
		reference		
Seaton CHP	School	X394849	1x1.4MW plant	Biogas derived
	Road/Golf	Y808541	2x0.7MW plant	from
	Road			gasification of
				woodchip
Foresterhill	Westburn	X391700	4.5MW biomass	Woodchip
Energy Centre,	Road	Y806905	boiler	process
Aberdeen			2x6.5MW gas fired	
Royal Infirmary			steam boilers	
			7MW gas turbine	
			CHP unit	
SEPA Office	Greyhope	X395400	110kW biomass	Wood pellet
Development	Road, Torry	Y805400	boiler	process

 Table 3.1 Biomass combustion plant considered during 2009

Seaton CHP

The development is situated in an open area adjacent to the North Sea and away from other industrial and commercial process and major roads. Background NO₂ and PM_{10} concentrations are low. The proposed process is unusual as the CHP units will combust the biogas derived from the gasification of woodchips. The main pollutant of concern is NO₂ and not PM₁₀. A screening assessment concluded there would be no risk of exceedance of the PM₁₀ objectives, but a Detailed Assessment was recommended due to the risk of exceedance of the NO₂ objectives.

An air quality assessment was carried out by Enviros Consultancy Limited in November 2009. Dispersion modelling predicted short-term NO_2 peak concentrations close to the 1-hour NO2 objective based on a worst case scenario. Predicted emissions were well below the annual mean NO_2 objective. Once operational, if a risk of exceedance of the 1-hour NO_2 objective becomes evident lower emissions can be achieved by variations to operational procedures.

Foresterhill Energy Centre, Aberdeen Royal Infirmary

The development is in a suburban area away from other significant industrial and commercial processes. The Anderson Drive AQMA is within 500m of the Energy Centre, however the AQMA was declared due to potential exceedances of the NO_2 and PM_{10} objectives at specific 'hotspots' along a 5km road link. The Energy Centre is 2km from the 'hotspots' and PM_{10} and NO_2 concentrations at receptors within 2km of the Energy Centre are below the objective.

An air quality assessment was carried out in December 2008 by Mott McDonald. The modelling predicted emissions to be 'extremely small' or 'very small' in magnitude and 'negligible' in terms of the significance criteria, except for the annual mean PM_{10} effects which were classed as 'slight adverse'. In all cases the relevant predicted concentrations were below the relevant objectives, including locations within the Anderson Drive AQMA. The maximum predicted contributions to the annual mean ground level concentrations and resultant predicted environmental concentrations

inclusive of ambient concentrations for PM_{10} were 0.27ugm⁻³ and 15ugm⁻³. The corresponding values for NO₂ were 0.79ugm⁻³ and 16ugm⁻³ respectively.

SEPA Office Development

An air quality screening assessment was carried out for PM_{10} by the applicant in November 2009. Emissions of NO_2 were not considered significant. The maximum predicted annual mean PM_{10} concentration was 0.05ugm⁻³. This value was predicted to occur within 100m of the source and outwith any AQMAs or other areas of air quality concern.

3.5 New Developments with Fugitive or Uncontrolled Sources

No potential sources of fugitive or uncontrolled particulate matter were identified that are new since the last Updating and Screening Assessment.

Aberdeen City Council has identified the following new or previously unidentified local developments which may impact on air quality in the Local Authority area.

- Union Square retail develop
- The following biomass combustion plant
- a) Seaton CHP, School Road/Golf Road
- b) Foresterhill Energy Centre, Aberdeen Royal Infirmary, Westburn Road
- c) SEPA Office Development, Greyhope Road, Torry

All of the biomass processes were the subject of air quality assessment and no exceedance of the air quality objectives are predicted as a result of the developments. These will not require further assessment. The Union Square retail development will be taken into consideration in the next Updating and Screening Assessment, scheduled for 2012.

4 Local / Regional Air Quality Strategy

There is no local or region Air Quality Strategy covering the Aberdeen area, however there are various City and Regional initiatives ongoing that consider air quality issues. These include work carried out by NETRANS and NHS Grampian described in Section 7.

5 Planning Applications

Section 3.4 describes biomass plant considered in the planning process. Table 5.1 provides information on other planning applications that have the potential to impact on air quality.

Table 5.1 Planning Applications with Potential Air Quality Impact

Location		Date	Development
43-45 Market	St	31/07/200	Demolition of existing buildings and erection of
9			hotel extension over 6 floors, including
			conference accommodation, office
			accommodation (over 11 floors), street
			accessed retail units
Garthdee	Rd,	16/11/200	Approx 35,000sq m of new teaching space,
Garthdee	Campus	9	social facilities and staff accommodation.
AB10 7QE			Additional car parking, junction, road and
			environmental improvements

43/45 Market St

The development is within the City Centre AQMA. Only 27 additional car parking spaces are proposed to complement the existing 10. The development will have minimal impact on air quality and no air quality assessment was required.

Garthdee Campus

 PM_{10} and NO_2 concentrations at the application location are currently well below the objectives and no local exceedances are predicted following completion of the development. The development may result in a small increase in car journeys within the Anderson Drive AQMA, however this is not considered significant as university lectures commence at 10am to avoid peak hour congestion. No air quality assessment was carried out.

6 Air Quality Planning Policies

The Aberdeen City and Shire Structure Plan was approved in August 2009 and sets out the council's development policies over the next 25 years. No specific reference is made to air quality as these are considered in the Local Plan and Transport Strategy.

The Council's Local Plan was approved in June 2008 and has a specific air quality policy. The policy requires an air quality assessment for proposed developments that could have a significant effect on air quality and also contains a presumption against developments which would have significantly adverse impacts on air quality in the AQMA, or elsewhere that would be likely to breach the national air quality standards.

The 2008 Plan is under review and a new draft Local Plan is being developed for consultation during 2010. Work is progressing on the development of an air quality policy and associated Supplementary Planning Guidance for inclusion in the 2010 draft.

Guidance on biomass installations and a biomass boiler information request form, both based on the Environmental Protection UK publications, have also been produced for developers.

7 Local Transport Plans and Strategies

Aberdeen's Local Transport Strategy (LTS) was approved in March 2008 and details policies and interventions the council will adopt to guide the planning and improvement of the local transport network over the period 2008-2012. The draft Air Quality Action Plan (AQAP) and LTS are intrinsically linked and many of the actions within the draft AQAP build on the LTS. Various remedial measures outlined throughout the LTS are designed to improve air quality at hot spots, primarily through travel planning issues that aim to encourage model shift by improving the attractiveness of walking, cycling and public transport. Specific policies and actions cover issues such as car parking, land use and travel planning, traffic management and infrastructure measures. Environmental Objective ENV3 is to 'reduce air quality throughout the City' with a target to comply with the national air quality objectives by 2012.

Various other initiatives are ongoing to address transport issues. For example, the Council works closely with Nestrans (the Transport Partnership for Aberdeen City and Aberdeenshire). The purpose of Nestrans is to develop and deliver a long term regional transport strategy and take forward transport improvements that support and improve the economy, environment and quality of life across Aberdeen City and Shire. The Nestrans Regional Transportation Strategy (RTS), developed in consultation with partners including Aberdeen City Council, received Ministerial approval in July 2008. Specific objectives within the Strategy that relate to air quality and climate change are as follows:

- Reduce the proportion of journeys made by cars and especially single occupant cars
- Reduce the environmental impact of transport in line with national targets
- Reduce growth in vehicle kilometres travelled.

Nestrans also produced a Freight Action Plan and Bus Action Plan in 2009 for Aberdeen City and Shire. Both of these Plans and the RTS complement and build on the objectives within the LTS by setting out measures to provide more sustainable transport within in the area.

Additionally, NHS Grampian is developing a Health and Transport Action Plan (HTAP). A working group, with representation from the Council's Pollution Team, meets monthly to progress the Plan. The development and implementation of measures that will improve air quality will be key objectives of the HTAP. Issues being considered include an improved public transport service, improved access to public transport and health care facilities, the development and promotion of travel plans by partner organisations and a reduction in emissions from vehicle fleets operated by partner organisations.

8 Climate Change Strategies

Aberdeen City Council does not have a Climate Change Strategy, however a Carbon Management Plan was adopted in April 2010. The Plan covers the period 2010-2015 and aims to reduce CO2 emissions from Council buildings, vehicles, street lighting and landfill by 23% by 2015 and 42% by 2020. In 2007 Aberdeen City Council, along with other Scottish local authorities, signed the Climate Change Declaration demonstrating ongoing commitment to combating the effects of climate change. Aberdeen's Climate Declaration Report 2009 considers actions to reduce emissions from specific council operations and the wider authority area.

No specific reference is made to air quality in either report, however the majority of proposed actions will have a positive impact on air quality. For example, the Carbon Management Plan considers the council's fleet, including the introduction of alternative weekly collections to reduce the number of journeys, business travel plans and a review of the council's car usage, car parking and travel plans. Emissions from premises are also considered with the replacement of inefficient oil fired burners in schools and the main council office and a general reduction in energy usage. There are a few proposals within the Plan that will have a potential negative air quality impact. For example, an increase in fleet vehicles using biodiesel from 2 to 20 and the provision of a biomass boiler within the new main council building. As the existing council building uses oil, the overall impact will be positive.

Officers in the council responsible for climate change are part of the air quality action plan working group to ensure that future climate change and air quality policies are complementary.

9 Implementation of Action Plans

Table 9 shows progress in the implementation of the 2006 City Centre Action Plan. This Plan is now outdated and a new Plan is being developed to cover the 3 AQMAs. Progress in the implementation of measures within the 2006 Plan during 2009 was limited due to resources being concentrated on the development of the draft 2010 Action Plan. Consultation on the draft Plan will commence in summer 2010 and it is anticipated the final Plan will be published towards the end of this year.

One of the key Actions of the draft 2010 Action Plan is to undertake a feasibility study into the potential for a city centre LEZ. Funding for a study was obtained in 2009 and this work is continuing through 2010.

No.	Measure	Focus	Lead authority	Planning phase	Implemen- tation phase	Progress to date	Progress in last 12 months	Estimated completion date	Comments
1	Raise Public Awareness	Improve knowledge of health impacts of poor air quality	ACC	6 months	ongoing	-Web based public information system with real time data -Air quality promoted at ECO and other events -Leaflet produced 2006	Air quality/environmenta I information included in new city wide Variable Message System	Ongoing	Emission reduction not quantifiable
2	Use of cleaner fuels in council fleet	Sets a good example and reduces emissions	ACC	6 months	ongoing	-Council policy to replace LGVs after 7yrs, HGVs after 9yrs -particulate traps in pre- Euro 4 vehicles -2 LGVs on LPG -Vehicle tracking system on refuse vehicles to reduce routing and improve efficiency	Fortnightly collections being phased in to encourage waste recycling will additionally reduce routing	Ongoing	Council financial position restricting fleet replacement
3	Roadside emission testing	-Improve public awareness -media publicity	ACC	6 months	Annual vehicle testing	-Testing carried out in 2006, 2007, 2008	No testing undertaken	Ongoing	Traffic Wardens transferred to ACC in 2008 as City Wardens restricting availability of police to stop vehicles. Lack of media interest 2008 – new initiatives required for future years
4	Idling vehicles/re quest to switch off engine	Improve awareness of air quality issues	ACC	6 months	Ongoing	-Traffic wardens trained		Ongoing	No FPNs served. Traffic wardens replaced by City Wardens in 2008 and training required
5	Support	Improve	ACC/bus	6 months	Ongoing	-Quality Bus Partnership	NESTRANS Bus	Ongoing	

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No.	Measure	Focus	Lead authority	Planning phase	Implemen- tation phase	Progress to date	Progress in last 12 months	Estimated completion date	Comments
	increase use of public transport	service, information systems and fleet quality	compani es/Nestra ns			formed -2007-09 approx £1m invested on upgrading bus corridors and other improvements -Real time information on bus shelters	Action Plan produced Dec 2009		
6	Advisory signs for HGVs to avoid AQMA	Promote re- routing of HGVs from city centre	ACC	6 months	12 months	-signs not implemented -VMS car parking guidance system for city centre introduced 2007	NESTRANS Freight Action Plan produced Dec 2009		Re-routing of HGVs may result in increased HGVs on Anderson Dr AQMA
7	Developme nt Control – Green Transport Plans	Regulate traffic generation	ACC	ongoing	ongoing	-Development of regional car-share database -Introduction of Sustainable Travel Grant Scheme -Annual Green Transport Week -Annual Bike Week -Green Transport Plans required for all developments -Updated Council Travel Plan -Local Transport Strategy adopted (2008- 12)	Measures ongoing	Ongoing	
8	Air quality assessmen t required for all new developme nts/road schemes	Reduce impact of new developments	ACC	Ongoing	Ongoing	-assessments required for major developments and mitigation sought	Ongoing - Supplementary Planning Guidance (SPG) on air quality being developed	Ongoing	

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No.	Measure	Focus	Lead authority	Planning phase	Implemen- tation phase	Progress to date	Progress in last 12 months	Estimated completion date	Comments
9	Park and Ride	Reduce cars entering city centre	ACC, bus compani es	2 years	2012		Proposals for A90 and A956 progressing	2012	Completion dependent on progress of AWPR
10	Pedestriani sation of Union St and city centre road infrastructu re	Improved environment for residents/shop ping and improved/ alternative routes for vehicles	ACC		2012	-Traffic management/road infrastructure improvements in city centre e.g. Market St, College St	No progress		Pedestrianisation dependent on completion of AWPR. Dispersion modelling indicated overall air quality improvement
11	Parking Policy	Manage parking by Controlled Parking Zones, charging levels and enforcement	ACC	Ongoing	2-5 years	-New zones Ferryhill and George St	-Council Car Parking Strategy being developed -Regional Car Parking Strategy being developed	Ongoing 2010 for Strategies	
12	Accord Card	Quicker boarding of buses as money not required	ACC	2-5 years	2-5 years	-Accord Card introduced	Integrated ticketing being considered in Bus Action Plan		
13	AWPR	Alternative route to avoid city centre and existing peripheral routes	ACC/Abe rdeenshir e Council/S cottish Govt	2 years	2-5 years	-Route finalised March 2006. Public enquiry December 2008 and Ministerial final approval 2009.		2012	Appeal submitted by action group in June 2010 that will delay commencement of development
14	Cross-rail to/from city and outwith city	Improve rail provision and public use of rail travel	Nestrans	2-5 years	Över 7 years		Laurencekirk station opened May 2009 – greater public usage than predicted NESTRANS	Ongoing	Proposals for Kintore station ongoing

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No.	Measure	Focus	Lead authority	Planning phase	Implemen- tation phase	Progress to date	Progress in last 12 months	Estimated completion date	Comments
							developing rail action plan		

ACC - Aberdeen City Council Nestrans - the Transport Partnership for Aberdeen City and Aberdeenshire

10 Conclusions and Proposed Actions

10.1 Conclusions from New Monitoring Data

Data from continuous and diffusion tube monitoring confirmed the annual mean NO₂ objective continues to be exceeded at locations across the City Centre AQMA. Diffusion tube values just outwith the AQMA remain below the objective. Only 4 months of data is available from the new Market Street continuous monitoring station, however levels are considerably lower than at the previous site and appear to be around the annual mean objective. The more open nature of this site and less standing traffic is likely to account for the lower readings.

Exceedances of the 1-hour objective were routinely recorded at the former Market Street site and at Union Street in 2008, however the objective was met at Union Street in 2009 and is likely to be met at the new Market Street based on the limited data. Results indicate that the minor exceedance at Union Street in 2009 is atypical and the definition and area of the City Centre AQMA for NO₂ remains valid.

Diffusion tube monitoring on Wellington Road and the Anderson Drive/Haudigan roundabout corridor continue to show pockets of exceedance of the annual mean NO₂ objective within the Wellington Road and Anderson Drive/Haudigan roundabout AQMAs. The bias adjusted diffusion tube on Auchmill Road, outwith the Anderson Drive AQMA, is just below the objective, although exceedances have been observed in previous years. No change to the AQMA is proposed at this time, however data will be assessed in future years to determine if the boundary of the AQMA remains appropriate.

Data from the new King Street continuous monitoring station recorded NO₂ concentrations below the objectives. Although the 6-months seasonally adjusted diffusion tube at 404 King Street indicated potential exceedances of the annual mean objective, concentrations at other diffusion tube sites on King Street outwith the City Centre AQMA remain below the objective. Concentrations at new diffusion tubes on George Street and Rosemount Place, installed as a result of the conclusions from the 2009 Updating and Screening Assessment, were below the objective as were all other sites outwith the AQMAs.

The 2005 annual mean and 24-hour objectives for PM_{10} were met at all sites, although in previous years both objectives were exceeded at Market Street. The limited data from the new site suggests both objectives will be met at this location. Again, the location of the new monitoring station is likely to account for the lower readings in 2009.

Exceedances of the 2010 annual mean were recorded at Wellington Road. The concentration at Union Street was at the objective value of 18ugm⁻³. The seasonally adjusted 3 months of monitoring at Market Street indicates the annual mean objective is likely to be exceeded. The objective was met at the Errol Place, Anderson Drive and King Street continuous monitoring stations. The 24-hour

objective was met at all sites in 2009, however the limited Market Street data indicates there is a likelihood of exceedances in future years.

The 2009 Updating and Screening Assessment and dispersion modelling of the city centre in 2010 indicated likely exceedances of the annual mean objective across the city centre. These observations were based on the use of the 1.3 TEOM correction factor. As 2009 TEOM data was adjusted using the VCM correction model and an FDMS replaced the Errol Place TEOM, 2009 cannot be directly compared with previous years, however values indicate the 1.14 correction factor is perhaps more appropriate for Aberdeen sites. Accordingly, the extent of potential exceedances is likely to be less than previously anticipated.

10.2 Conclusions relating to New Local Developments

The only new local development that will require more detailed consideration in the next Updating and Screening Assessment is the Union Square retail park. Consideration will be given to the impact of the new bus access link to the bus station and other road alterations and additional car journeys with any associated increased congestion.

10.3 Other Conclusions

The 2006 City Centre Air Quality Action Plan is outdated and a new Plan is being developed to cover all 3 AQMAs. Consultation on the draft Action Plan will commence in the summer 2010 and it is hoped the new Plan will be adopted towards the end of 2010. A feasibility study into the potential for a City Centre LEZ commenced in 2009 and options will be considered in detail during 2010.

The Council's Local Plan is being reviewed and consultation on a new draft Plan will commence in 2010. An Air Quality policy and associated Supplementary Guidance are being developed to incorporate within the draft Plan.

10.4 Proposed Actions

Monitoring data has not identified a need to progress to a Detailed Assessment for any pollutant or changes to the existing monitoring programme.

There is no proposal to amend the boundary of the AQMAs at present, however 2010 data will require further consideration, particularly in relation to the following:

- Diffusion tube concentrations at 40 Auchmill Road and on King Street, outwith the City Centre AQMA
- The likelihood of exceedance of the 2010 annual mean PM₁₀ objective outwith the existing AQMAs, particularly around the City Centre

There are no other outstanding AQMA Tasks and the next course of action is to submit a 2010 Progress Report.

11 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 Local Air Quality Management Technical Guidance LAQM, TG(09), DEFRA, February 2009
- 12 Local Air Quality Management Policy, (PG)(S)(09), DEFRA, February 2009
- 13 Aberdeen City Council Updating and Screening Assessment, July 2009
- 14 Aberdeen City Council Air Quality Modelling Study, March 2010

Appendices

Appendix A

Figure A1 Map of City Centre AQMA



Figure A2 Map of Anderson Drive AQMA



Figure A3 Map of Wellington Road AQMA





Figure A4 Continuous Monitoring and Diffusion Tube Locations

Appendix B: QA:QC Data

Diffusion Tube Bias Adjustment Factors

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.

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.

Factor from Local Co-location Studies

Spreadsheets downloaded from the internet were used to calculate bias adjustment factors and the precision and accuracy of the co-located tubes. Table A1 summarises the bias adjustment factors. Only data with good precision and accuracy has been used. Market St data is included for reporting purposes only, the bias factor has not been applied to correct diffusion tube data. Errol Place is an urban background site while the others sites are roadside.

Туре	DT Value	CM Value	Bias Factor	CM Data Capture	No Monitoring Periods
Errol Place	33	24	0.74	99	11
Union Street	55	52	0.95	96	9
Market Street	49	40	0.81	96	5
Anderson Dr	26	25	0.98	96	10
King Street	37	33	0.89	99	12
Wellington	58	44	0.76	97	13
Road					

Table A1 Bias Factor Calculations

Discussion of Choice of Factor to Use

The web based spreadsheets of national bias adjustment factors was reviewed however the only entry for Aberdeen for 2009 was for one site with 9 months of data. Although the laboratory 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. A locally derived bias factor based on the co-located tubes at the continuous monitoring stations was used to adjust diffusion tube measurements at the other locations across the city. This process was considered appropriate rather than the use of the national bias adjustment factors 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. Data for Aberdeen will be included in the national factors in future years.

In 2008 there was a clear difference in the bias factor for the Errol Place urban background site compared to the roadside sites (Market Street, Anderson Drive and Union Street). The Errol Place factor was therefore used to correct background diffusion tube sites and the mean of the roadside sites to correct the roadside sites. In 2009 both the Errol Place and Wellington Road factors were significantly lower than other sites. The Review and Assessment Helpdesk advised there is no specific guidance on the use of different factors for different site types. As in previous years, the application of the Errol Place factor for background sites and the mean of the roadside sites (excluding Market Street) of 0.89 was considered a good approach.

A second bias factor (factor B) was also calculated as a result of the wide variation between the bias factors obtained from the co-located diffusion tube/roadside continuous monitoring sites. This factor is the factor from the nearest site where appropriate. For example, the factor B used for city centre diffusion tubes was the factor from the Union St continuous monitoring site and for tubes on Wellington Road the Wellington Road factor was used. Where there is no relevant continuous monitoring site close to a diffusion tube then the mean of the roadside sites was applied. The impact of factor B is discussed in section 2.2.

PM₁₀ Monitoring Adjustment

All TEOM data from Union Street, Anderson Drive and Wellington Road was corrected to gravitational equivalent by AEA using the Volatile Correction Model (VCM). Data for the TEOM present at Errol Place prior to the installation of the FDMS in February 2009 has been corrected using the 1.3 factor as TEOM corrected data for January 2009 was not available from AEA at the time of writing this report.

Data from the BAM at King Street was corrected by AEA using a gravitational factor of 0.83333 for Gravitational Equivalent.

Short-term to Long-term Data adjustment

NO₂ data for Union Street and Market Street was only available for the periods January-September and August-December respectively. Although data capture is less than 75%, the seasonally adjusted annual mean has been calculated using the Errol Place background data to enable comparison with previous years where appropriate. Table A2 shows the calculations to annualise the data. Errol Place is the only urban background site within 50 miles of Aberdeen. Monitoring at Wellington Road commenced in July 2008 and therefore data from July-December 2008 has similarly been annualised.

Table A2 Short to L	ong-term	Adjustment of	f Continuous	Monitoring NO ₂ Data
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Site	Site Type	Annual Mean (ugm ⁻³) (Am) ^b	Period Mean (ugm ⁻³) (Pm) ^a	Ratio (Am/Pm)
Errol Place	Urban	25.6	24.0 (for Union	1.07
2009 CM	background		Street data)	
Union St CM	Roadside	55.5 ^b	52	n/a

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Errol PI 2009	Urban	25.6	27.0 (for	0.95
СМ	background		Market St data)	
Market St CM	Roadside	38.0 ^b	40	n/a
Errol Place	Urban	25.4	27.5 (for	0.92
2008 CM	background		Wellington Rd	
			data)	
Wellington	Roadside	36.7 ^b	39.8	n/a
Road 2008 CM				

^aPeriod mean for Union St January–September 2009; Market Street August–October 2009; Wellington Road July-December 2008

^bPeriod mean adjusted using the ratio (Am/Pm) for Errol Place CM

2009 PM_{10} data for Market Street was only available for the period August-October. Data has therefore been annualised using the Errol Place background site. Similarly Wellington Road 2008 data has been annualised. Table A3 shows the calculations to annualise the data.

Site	Site Type	2009 Annual Mean (ugm ⁻³) (Am) ^b	Period Mean (ugm ⁻³) (Pm) ^a	Ratio (Am/Pm)
Errol Place CM	Urban	15.3	13.3 (for	1.15
	background		Market St CM)	
Market St CM	Roadside	27.6 ^b	24	n/a
Errol Place CM	Urban	18.1	18.2 (for	1.0
	background		Wellington Rd	
			CM)	
Wellington Rd CM	Roadside	26.5 ^b	26.5	n/a

Table /	A3 Short to	Long-term	Adjustment	of Continuous	Monitoring	PM ₁₀ data
						10

^aPeriod mean for Market Street August–October 2009 and Wellington Road July-December 2008 ^bPeriod mean adjusted using the ratio (Am/Pm) for Errol Place CM

QA/QC of automatic monitoring

All equipment is subject to the QA/QC procedure recommended with LAQM.TG(09). Equipment is serviced by the equipment supplier 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 AEA Technology plc at 6 monthly intervals. Data validation and ratification is also performed by AEA Technology plc.

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 AEA Technology 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

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 April 2010 to ensure laboratory guidance is being implemented. No problems were identified. The WASP Annual Performance Criteria for NO₂ Diffusion Tubes covering 2009 classified the laboratory as 'Good'.

Appendix C: Diffusion Tube Data and Calculations

															Mean	
Site	Ref	Мо	Monitoring Period								(ugm-3)	SD				
		1	2	3	4	5	6	7	8	9	10	11	12	13		
Bucksburn																
Primary School	1	35	43	37	37	39	32	40	35	29	34	35	41	42	37	4
885 Gt Northern																
Rd at Haudigan	2	50	67	59	58	69	54	73	54	55		58	69	62	61	7
549 North																
Anderson Drive	3	36	42	28	35	46	39	51	42	29	53	40	46	38	40	8
38 Ellon Road	4	53	66	61	49	45	35	33	34	46	48	44	54	66	49	11
Linksfield																
Centre, 520																
King Street	5	44	61	57	48	53	45	40	40	46	47	49	52	64	50	7
86 Victoria																
Road, Torry	6	33	47	36	38	43	30	46	35	31	38	35	35	50	38	6
Wellington Rd/	_	~~	50	47	50		07	- 4	10			40				40
Kerloch Place	1	36	50	47	53	52	37	51	43	41	38	43	63	68	48	10
107 South	0	60	74	70	05		40	66		45	50	70	77	07	CC	4.4
Anderson Drive	8	60	74	72	65	05	48	00	55	45	52	70	11	87	00	14
31 Market St	9	54	73	59	57	65	65	79	56	54	51	61	68	60	62	8
184/192 Market	40		~~	70	04	75	~~	70	74	~~	~~	70	70	0.5	70	~
St	10	56	80	73	84	75	62	78	74	60	65	70	79	85	72	9
105 King St	11	72	86	11	73		61	59	74	88	69	65	91	89	75	11
40 Union St	12	55	67	65	63	66	48	62	54	56	54	61	67	63	60	6
Music Hall,	10		~-													
Union St	13	49	65	62	50	46	41	48	41	36	43	47	66	53	50	9
Dyce Primary		~~	~~	10	40		~	~	-	10	10	10	00	~~	4-	~
School	14	22	23	13	13	14	9	8	1	10	13	12	23	22	15	6
Northfield	15	20	22	47	47	10	10	4.4		44	10	10	04	20	40	6
Swimming POOL	15	20	32	17	17	19	13	14			12	19	21	20	10	0
Stroundabout	16	72	60	61	16	62	70	67	59	12	51	55	59	59	50	0
	10	72	09	01	40	50	10	07	50	43	51	55	70	00	59	3
43/45 Union St	17	58	04	04	55	58	60		00	57	50	54	70	08	01	1
14 Holburn	18	63	80	66	62	54	55	54	47	44	59	53	65	72	60	10
468 Union St	19	61	65	72	53	56	55	68	54	48	71	60	77	67	62	9
212 King St	20	49	45	46	40	41	34	34	29	41	36	38	51	49	41	7
26 King Street	21	48	56	50	38	52	47	49	46	45	46	41	56	57	49	6
104 King St	22	51	49	48	46	65	58	60	50	49	46	42	60	60	53	7
785 Gt Northern																
Road at Shell																
garage	23	48	50	43	40	43	39	40	35	38	41		55	54	44	6
40 Auchmill																
Road	24	44	53	56	47	48	39	47	37	33	45		28	48	44	8
21 Holburn	25	54	61	63	48	60	65	65	48	46	44	46	63	54	55	8
147 Holburn																
Street	26	40	45	36	35	45	37	43	32	31	34	29	49	50	39	7
82 Holburn St																
(Malt Mill)	27	42	48	42	34	39	36	37	29	26	30	33	43	41	37	6
61 Holburn																_
Street	28	47	56	50	38	55	47	58	39	35	33	34	55	54	46	9
469 Union	00	~~	0.5	07	0.5	74	74		~	0.5	0.5		0.4		70	
Street	29	68	85	87	65	/4	/1	82	64	65	65	61	84	15	/3	9
209 Union St	30	58	69	65	45	66	70	70	56	59	57		71	80	64	9

Table A4 Measured 4-weekly diffusion tube data

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249 Holburn Street	31	41	45	39	41	40	37	44	34	32	35	33	48	51	40	6
Willowbank	-		_			_	-		-	-				-		-
Road./Albury																
Rd	32	31	33	27	25	28	20		19	16	18	20	29	35	25	6
East North																
Street	33	59	66	69	59	60	47	57	52	54	52	52	65	72	59	7
404 King Street	34	48	60							29	36	39	52	52	45	11
Riverside																
House,																
Riverside Dr.	35	39	42	28	28	35	29	33	26	22	24	26	38		31	6
115 Wellington																
Road	36	53	69	61	67	85	61	84	66	59	56	63	66	78	67	10
137 Wellington																
Road	37	39	44	39	38	38	28	30	30	34	35	38	41	50	37	6
Wellington Rd /																
4 Nigg Kirk Rd	38	40	38	32	39	40	33	35	30	35	36	30	39	47	36	5
819 Gt Northern																
Rd	39		68	66	62	58	57	68	49	56	65		68	59	61	6
852 Fullerton																
Court	40		51	46	47	38	27	30	32	40	42		46	57	41	9
852 Fullerton																
Court Roadside	41		61	70	61	47	39	48	44	53	54	47	63	67	55	10
248 George St	42						33	39	31	30	34	35	49	46	37	7
25 Rosemount																
Place	43						32	35	25	29	27	28	50	44	34	9
214 Rosemount																
PI	44						27	27	20	22	24	29	38	41	29	7

Table A5 Annual Mean Biased adjusted diffusion tube data and correction to façade

Map Ref	Site	Measured Conc (ugm-3)	Bias Factor A Conc (ugm-3)	Façade Conc (ugm-3)	Bias Factor B site used (ugm-3)	Bias Factor B Conc (ugm-3)	Façade Conc (ugm-3)
1	Sch, Inverurie Rd	37	33	33	Mean	33	33
2	Road	61	54	41	Mean	54	41
3	549 North Anderson Dr	40	36	27	Mean	36	27
4	38 Ellon Road	49	44	38	KS	45	39
5	Linksfield Centre, 520 King St	50	45	30	KS	45	30
6	86 Victoria Road Torry	38	34	34	US	36	36
7	Wellington Rd/ Kerloch Pl	48	43	43	WR	36	36
8	107 Anderson Drive	66	59	42	AD	65	45
9	31 Market St	62	55	55	US	59	59
10	184/192 Market St	72	64	64	US	68	68
11	105 King Street	75	67	67	US	71	71
12	40 Union St	60	53	53	US	57	57
13	Music Hall Union St	50	45	45	US	48	48
14	Dyce Primary, Gordon Terr	15	11	11	EP	11	11
15	Northfield swimming pool, Keppleshill Cres	18	13	13	EP	13	13
16	Street	59	53	53	US	56	56
17	43/45 Union St	61	54	54	US	58	58
18	14 Holburn St	60	53	53	US	57	57
19	468 Union St	62	55	55	US	59	59
20	212 King Street	41	36	36	US	39	39
21	26 King Street	49	44	44	US	47	47
22	104 King St (Gala Bingo)	53	47	47	US	50	50
23	Road	44	39	32	Mean	39	32
24	40 Auchmill Road	44	39	39	Mean	39	39
25	21 Holburn St	55	49	49	US	52	52
26	147 Holburn Street	39	35	35	US	37	37
27	82 Holburn St	37	33	33	US	35	35
28	61 Holburn Street	46	41	41	US	44	41
29	469 Union Street	73	65	65	US	69	69
30	209 Union St	64	57	57	US	61	61
31	249 Holburn Street	40	36	36	US	38	38
	Willowbank						
32	Rd/Albury Rd	25	22	21	US	24	23
33	East North Street	59	53	53	US	56	56
34*	404 King Street	45	40	40	KS	40	40
35	Riverside House,	31	28	28	WR	28	28

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	Riverside Dr.						
36	115 Wellington Road	67	60	44	WR	50	38
37	137 Wellington Road	37	33	32	WR	27	27
	Wellington Rd / 4						
38	Nigg Kirk Rd	36	32	31	WR	27	26
	819 Great Northern						
39	Road	61	54	54	Mean	54	54
40	852 Fullerton Court	41	36	36	Mean	36	36
	852 Fullerton Court						
41	Roadside	55	49	29	Mean	49	29
42* ¹	248 George Street	38	34	34	US	36	36
43* ¹	25 Rosemount Place	35	31	31	US	33	33
	214 Rosemount						
44* ¹	Place	29	26	26	US	28	

Bias Factor A: Data corrected using Errol Place factor of 0.74 (sites 14 and 15) or mean of continuous monitoring sites factor of 0.89 (all other sites) Bias Factor B: Data corrected using most relevant continuous monitoring station. Factor A has been used where there is no representative continuous monitoring site

^{*1}Data for sites 42, 43 and 44 (7 periods of data) and 34 (6 periods of data) has been annualised as in Box 3.2 of TG(09) as monitoring was not carried out for the full year.

Table A6 Diffusion Tube concentrations showing calculations to façade (Factor A)

Site		Bias Factor A Conc Cy	Background Conc	Dist to kerb	Dist façade	Calculated Façade Conc
Ref	Site	(ugm- ³)	(ugm- ³)	Dy (m)	Dz (m)	(ugm- ³)
2	885 Gt Northern Rd	54	15	3	11	41
	549 North Anderson					
3	Dr	36	16	3	17	27
4	Ellon Rd	44	16	3	7	38
5	Linksfield Crossing	45	20	0.1	9	30
	107 South Anderson					
8	Dr	59	16	3	14	42
23	785 Gt Northern Rd	39	15	3	9	32
28	61 Holburn St	41	18	3	5	38
32	Willowbank Rd	22	18	3	5	21
36	115 Menzies Rd	60	21	1	8	44
37	137 Wellington Rd	33	24	10	13	32
	Wellington/Nigg Kirk					
38	Rd	32	24	3	7	30
	Fullerton Court					
41	roadside	49	15	0.1	7	29
43	25 Rosemount Place	30	22	3	3	30
	Wellington Rd CM	43	21	4	9	38

Table A7 Diffusion Tube concentrations showing calculations to façade (Factor B)

Site		Bias Factor B Conc Cy	Background Conc	Dist to kerb	Dist façade	Calculated Façade Conc
Ref	Site	(ugm-ĭ)	(ugm-č)	Dy (m)	Dz (m)	(ugm-ĭ)
2	885 Gt Northern Rd	54	15	3	11	41
	549 North Anderson					
3	Dr	36	16	3	17	27
4	Ellon Rd	37	16	3	7	39
5	Linksfield Crossing	50	20	0.1	9	30
	107 South Anderson					
8	Dr	65	16	3	14	45
23	785 Gt Northern Rd	39	15	3	9	32
28	61 Holburn St	44	18	3	5	41
32	Willowbank Rd	24	18	3	5	23
36	115 Menzies Rd	60	21	1	8	38
37	137 Wellington Rd	33	24	10	13	26
38	Wellington/Nigg Kirk Rd	32	24	3	7	30
	Fullerton Court					
41	roadside	49	15	0.1	7	29
43	25 Rosemount Place	33	22	3	3	33
	Wellington Rd CM	43	21	4	9	38

Dy - distance to kerb at which concentrations were measured Dz – distance to kerb at which concentrations are to be predicted