



# 2015 Updating and Screening Assessment for **Aberdeen City Council**

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

June 2015

<b>Local Authority Officer</b>	Nick Glover
<b>Department</b>	Environmental Health & Trading Standards
<b>Address</b>	Aberdeen City Council Marischal College Business Hub 15 Broad Street Aberdeen AB10 1AB
<b>Telephone</b>	01224 523 737
<b>e-mail</b>	poll@aberdeencity.gov.uk
<b>Report Reference number</b>	001
<b>Date</b>	June 2015

## 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 2014 the annual mean nitrogen dioxide level ( $\text{NO}_2$ ) 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.

The annual mean  $\text{NO}_2$  at the Union Street automatic monitoring site has been decreasing since 2012. The  $\text{NO}_2$  annual objective at the Market Street continuous monitoring site has also continued to fall since 2012 and this year just met the objective.

There were no exceedances of the  $\text{NO}_2$  1 hour objective at the continuous monitoring sites. Concentrations  $>60\mu\text{g m}^{-3}$  were not recorded at any of the diffusion tube locations across the city suggesting the 1-hour objective was met.

The annual mean  $\text{PM}_{10}$  objective was exceeded at Wellington Road and Market Street.

The annual mean  $\text{PM}_{10}$  objective continued to be marginally exceeded at the King Street continuous monitoring station. Concentrations from the BAM monitor at this location may be elevated during prolonged periods of heavy rain and sea mist. Further assessment is still not proposed at this time, however concentrations will continue to be monitored and reviewed to determine if further action is necessary.

The Market Street continuous monitor was the only site that exceeded the 24 hour mean (22 days  $>50\mu\text{g m}^{-3}$ ).

There appears to be a slight decrease in  $\text{PM}_{10}$  concentrations in 2014 compared to 2013.

There were no exceedances of the objectives at any other location outwith the AQMAs.

The 2014 monitoring data has not identified the need to proceed to a Detailed Assessment for any pollutant.

# Table of contents

<b>1</b>	<b>Introduction .....</b>	<b>8</b>
1.1	Description of Local Authority Area .....	8
1.2	Purpose of Report.....	8
1.3	Air Quality Objectives .....	8
1.4	Summary of Previous Review and Assessments .....	10
1.4.1	First Round of Review and Assessment.....	11
1.4.2	Second Round of Review and Assessment .....	11
1.4.3	Fourth Round of Review and Assessment .....	12
1.4.4	Fifth Round Review and Assessment.....	13
<b>2</b>	<b>New Monitoring Data .....</b>	<b>20</b>
2.1	Summary of Monitoring Undertaken.....	20
2.1.1	Automatic Monitoring Sites .....	20
2.1.2	Non-Automatic Monitoring Sites .....	22
2.2	Comparison of Monitoring Results with Air Quality Objectives .....	28
2.2.1	Nitrogen Dioxide .....	28
2.2.2	PM <sub>10</sub> .....	40
2.2.3	Sulphur Dioxide.....	45
2.2.4	Benzene.....	45
2.2.5	Other pollutants monitored .....	45
2.2.6	Summary of Compliance with AQS Objectives .....	46
<b>3</b>	<b>Road Traffic Sources .....</b>	<b>47</b>
3.1	Narrow Congested Streets with Residential Properties Close to the Kerb .....	48
3.2	Busy Streets Where People May Spend 1-hour or More Close to Traffic.....	48
3.3	Roads with a High Flow of Buses and/or HGVs. ....	48
3.4	Junctions.....	49
3.5	New Roads Constructed or Proposed Since the Last Round of Review and Assessment.....	49
3.6	Roads with Significantly Changed Traffic Flows.....	51
3.7	Bus and Coach Stations .....	51
<b>4</b>	<b>Other Transport Sources.....</b>	<b>52</b>
4.1	Airports.....	52
4.2	Railways (Diesel and Steam Trains) .....	53
4.2.1	Stationary Trains.....	53
4.2.2	Moving Trains .....	53
4.3	Ports (Shipping) .....	53
<b>5</b>	<b>Industrial Sources.....</b>	<b>56</b>
5.1	Industrial Installations .....	56

5.1.1	New or Proposed Installations for which an Air Quality Assessment has been Carried Out.....	56
5.1.2	Existing Installations where Emissions have Increased Substantially or New Relevant Exposure has been Introduced .....	56
5.1.3	New or Significantly Changed Installations with No Previous Air Quality Assessment.....	56
5.2	Major Fuel (Petrol) Storage Depots .....	57
5.3	Petrol Stations.....	57
5.4	Poultry Farms.....	57
<b>6</b>	<b>Commercial and Domestic Sources .....</b>	<b>58</b>
6.1	Biomass Combustion – Individual Installations .....	58
6.2	Biomass Combustion – Combined Impacts.....	59
6.3	Domestic Solid-Fuel Burning .....	59
<b>7</b>	<b>Fugitive or Uncontrolled Sources.....</b>	<b>60</b>
<b>8</b>	<b>Conclusions and Proposed Actions.....</b>	<b>61</b>
8.1	Conclusions from New Monitoring Data .....	61
8.2	Conclusions from Assessment of Sources .....	62
8.3	Proposed Actions.....	62
<b>9</b>	<b>References.....</b>	<b>64</b>

## List of Tables

Table 1.1	Air Quality Objectives included in Regulations for the purpose of LAQM in Scotland
Table 1.2	Summary of Air Quality Reports and Outcomes
Table 2.1	Details of Automatic Monitoring Sites
Table 2.2	Details of Non-Automatic Monitoring Sites
Table 2.3	Results of Automatic Monitoring for Nitrogen Dioxide: Comparison with Annual Mean Objective
Table 2.4	Results of Automatic Monitoring for Nitrogen Dioxide: Comparison with 1 hour Mean Objective
Table 2.5	Results of Nitrogen Dioxide Diffusion Tubes 2014
Table 2.6	Results of Nitrogen Dioxide Diffusion Tubes (2010 to 2014)
Table 2.7	Results of PM <sub>10</sub> Automatic Monitoring: Comparison with Annual Mean Objective
Table 2.8	Results of PM <sub>10</sub> Automatic Monitoring: Comparison with 24-hour Mean Objective
Table 2.9	Results of PM <sub>2.5</sub> Automatic Monitoring: Comparison with Annual Mean Objective
Table 2.10	Results of Automatic Monitoring for Ozone: Comparison with Annual Mean Objective

Table 3.1	Aberdeen City Council Local Plan 2012 Proposed Major Developments
Table 4.1	Aberdeen Harbour Vessel movements in 2014
Table 6.1	Biomass Installations
Table A1	Bias Factor Calculations
Table A2:	Adjustment to estimate annual mean (2013)
Table A3	Measured 4-Weekly Diffusion Tube Data
Table A4:	Measured 4-Weekly Diffusion Tube Data (TDC locations 2013)
Table A5:	Diffusion Tube concentrations showing calculations to façade
Table A6:	Diffusion Tube concentrations showing calculations to façade (TDC Locations 2013)

## **List of Figures**

Figure 1.1:	Map of City Centre AQMA
Figure 1.2:	Map of Anderson Drive/Haudagain roundabout/Auchmill Road AQMA
Figure 1.3:	Map of Wellington Road AQMA
Figure 2.1:	Map of Automatic Monitoring Sites
Figure 2.2:	Trends in Annual Mean Nitrogen Dioxide Concentrations measures at Automatic Monitoring Sites
Figure 2.3:	Trends in Annual Mean PM <sub>10</sub> Concentrations
Figure B1:	Wind Speed and Direction and PM10 Data Trend at Market Street Continuous Monitoring Station 2013

**Appendices**

- Appendix A QA/QC Data
- Appendix B Wind Speed and Direction and PM10 Data Trend at Market Street

# 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 commenced in 2014, and completion is anticipated by 2018. 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 exceedances 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,  $\text{mg}/\text{m}^3$  for carbon monoxide) with the number of exceedances 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 $\text{mg}/\text{m}^3$	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 ( $\text{PM}_{10}$ ) (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  $\text{NO}_2$  and  $\text{PM}_{10}$  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<sub>2</sub> 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 NO<sub>2</sub> 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<sub>10</sub>, 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 NO<sub>2</sub> and 2010 PM<sub>10</sub> annual mean objectives in the city centre and the 1-hour NO<sub>2</sub> objective on Market Street.

Emissions from Aberdeen Harbour were considered in the Detailed Assessment. It was concluded that emissions from shipping contributed to elevated levels of NO<sub>2</sub> and PM<sub>10</sub> in the Market Street and Guild Street areas, but do not cause exceedance 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. NO<sub>2</sub> levels across the City and PM<sub>10</sub> levels on Union Street were found to be similar to previous years. In 2007 elevated levels of PM<sub>10</sub> were recorded on Market St due to road works and the development of the Union Square retail park adjacent to the continuous monitoring station. Potential exceedances of the annual mean objective for both PM<sub>10</sub> and NO<sub>2</sub> were predicted on the Anderson Drive/Haudagain roundabout corridor even with the construction of the proposed Aberdeen Western Peripheral Route (AWPR) and on parts of Wellington Road.

A Detailed Assessment completed in March 2008 concluded that the annual mean NO<sub>2</sub> objective and the annual mean 2010 PM<sub>10</sub> 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 NO<sub>2</sub> and PM<sub>10</sub> levels recorded in the 2008 Progress Report. The Haudagain roundabout/Anderson Drive corridor was also declared an AQMA for both pollutants as NO<sub>2</sub> monitoring in the vicinity of the roundabout had 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 NO<sub>2</sub> and PM<sub>10</sub> 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.

### **1.4.3 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 NO<sub>2</sub> 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 NO<sub>2</sub> annual mean objective within the City Centre AQMA and pockets of exceedances within the Wellington Road and Anderson Drive/Haudagain roundabout AQMAs.

PM<sub>10</sub> levels were lower in 2009 compared to previous years. It is believed that the replacement of Errol Place TEOM with an FDMS and the use of the VCM for the first time contributed to the lower values.

In 2010 diffusion tube concentrations identified likely exceedances of the annual mean objective 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 NO<sub>2</sub> 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

#### **1.4.4 Fifth Round Review and Assessment**

The 2012 Updating and Screening Assessment again confirmed continued exceedances of the annual mean PM<sub>10</sub> and NO<sub>2</sub> objectives across the 3 AQMAs. NO<sub>2</sub> and PM<sub>10</sub> levels were broadly 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 dramatic decrease is unknown but equipment malfunction may have been a factor, especially as traffic flows remained the same.

There were no exceedances of the 1 hour NO<sub>2</sub> objective. A slight rise in the number of exceedances of the 24 hour PM<sub>10</sub> objective at Market St, Union St, King St and Wellington Road was observed.

A study of emissions from shipping and their impact on the City Centre AQMA was also completed in 2011. It was concluded that, whilst emissions from shipping are not likely to cause an exceedance of the annual mean objectives, they do contribute to existing exceedances in specific areas near the Harbour.

The 2012 monitoring data confirmed concentrations continued to exceed the annual mean NO<sub>2</sub> and PM<sub>10</sub> objectives within the 3 AQMAs and the 1 hour NO<sub>2</sub> and 24 hour PM<sub>10</sub> objectives within the City Centre and Wellington Road AQMAs.

The annual mean PM<sub>10</sub> objective was also marginally exceeded at the King Street continuous monitoring station. Concentrations from the BAM monitor at this location may be elevated during prolonged periods of heavy rain and sea mist. A Detailed

Assessment was not proposed at that time, however concentrations to be monitored and reviewed to determine if further action is necessary. There were no exceedances of the objectives at any other location outwith the AQMAs.

The 2013 monitoring data indicates the current AQMAs remain valid and Aberdeen City Council has no proposals to undertake any Detailed Assessments during 2014.

The Progress Report included information on the implementation of the measures within the 2011 Air Quality Action Plan. Significant progress had been made in the development of the Car Club, the integration of air quality within planning policies and initial steps in the development of a City Centre Masterplan, including a potential Low Emission Zone or Strategy.

Table 1.2 summarises the outcome of previous air quality reports.

**Table 1.2 Summary of Air Quality Reports and Outcomes**

<b>Report</b>	<b>Outcomes</b>
Stages 1, 2, 3 and 4 Reports 2000-2003	City centre AQMA declared in June 2001 due to predicted exceedances of annual mean NO <sub>2</sub> objective. Area of AQMA extended in March 2003.
Updating and Screening Assessment August 2003	Detailed Assessment of NO <sub>2</sub> and PM <sub>10</sub> recommended in city centre and assessment of Aberdeen Harbour.
Detailed Assessment August 2004	Extension of city centre AQMA for NO <sub>2</sub> and inclusion of predicted exceedances of 1-hour objective on Market Street. City Centre AQMA declared for PM <sub>10</sub> 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 <sub>2</sub> and PM <sub>10</sub> 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 <sub>2</sub> and PM <sub>10</sub> recommended on Wellington Road, Anderson Dr/Haudagain 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 <sub>2</sub> and 2010 PM <sub>10</sub> 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 <sub>2</sub> diffusion tubes at potential areas of exceedances. Modelling of City Centre PM <sub>10</sub> and NO <sub>2</sub> recommended to support proposed new Action Plan.
City Centre modelling study March 2010	City Centre modelling predicted widespread exceedances of annual mean PM <sub>10</sub> objective and minor potential areas of exceedances of the NO <sub>2</sub> 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 <sub>2</sub> objective.

**Table 1.2 Summary of Air Quality Reports and Outcomes - Continued**

<b>Report</b>	<b>Outcomes</b>
Air Quality Action Plan March 2011	Detailed measures to improve air quality across the 3 AQMAs.
Updating and Screening Assessment July 2012	Update of monitoring results and planning developments. Assessment of emissions from Aberdeen Harbour.
Action Plan Progress Report January 2013	Update of progress in the Action Plan implementation, including specific indicators and trend analysis.
Progress report September 2013	Update of monitoring results. Additional diffusion tubes will be located near sensitive receptors along the route of the proposed 3 <sup>rd</sup> Don Crossing
Progress report 2014	Update of monitoring results and Action Plan progress.



Figure 1.1 Map of City Centre AQMA

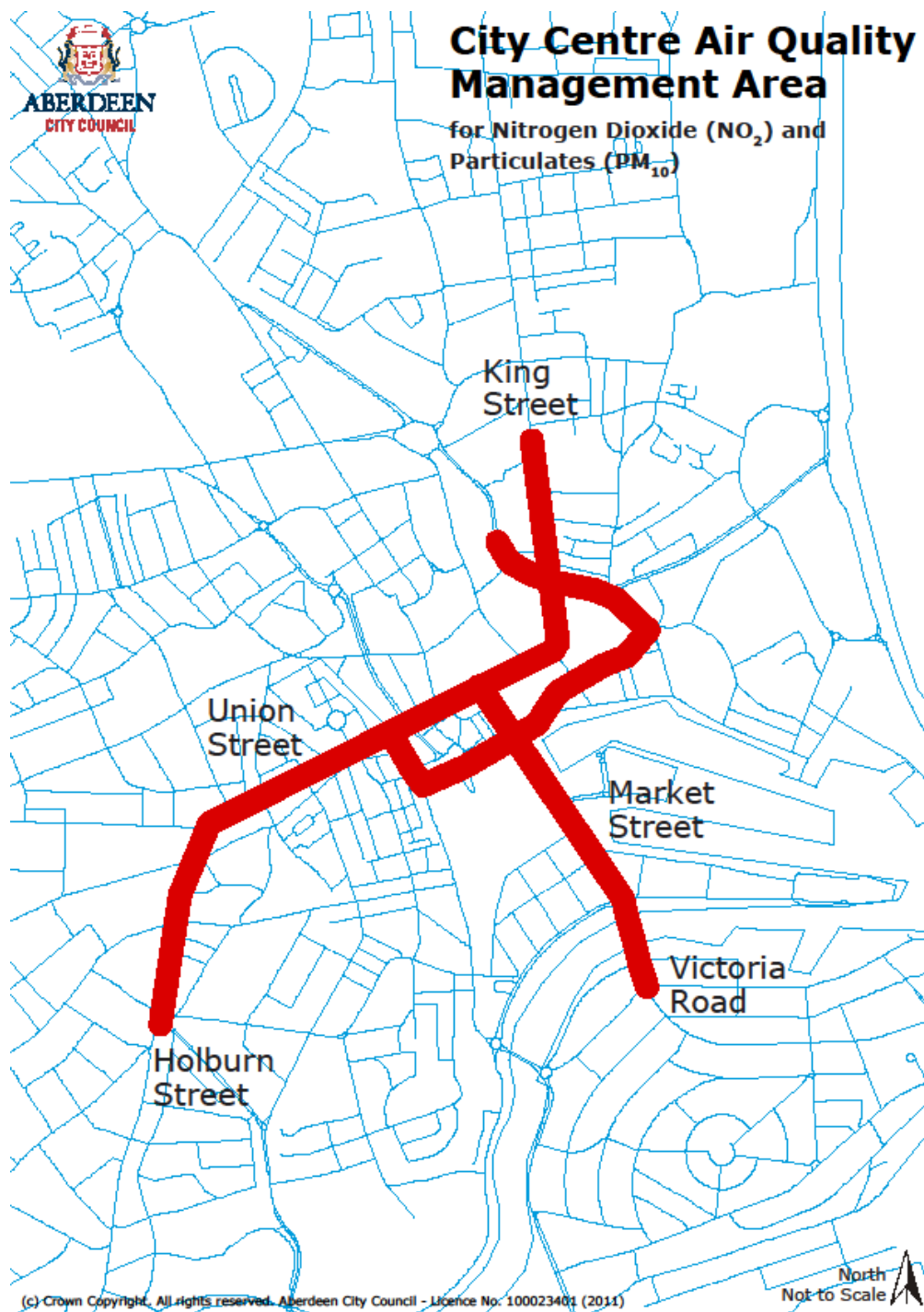


Figure 1.2: Map of Anderson Drive/Haudagain roundabout/Auchmill Road AQMA

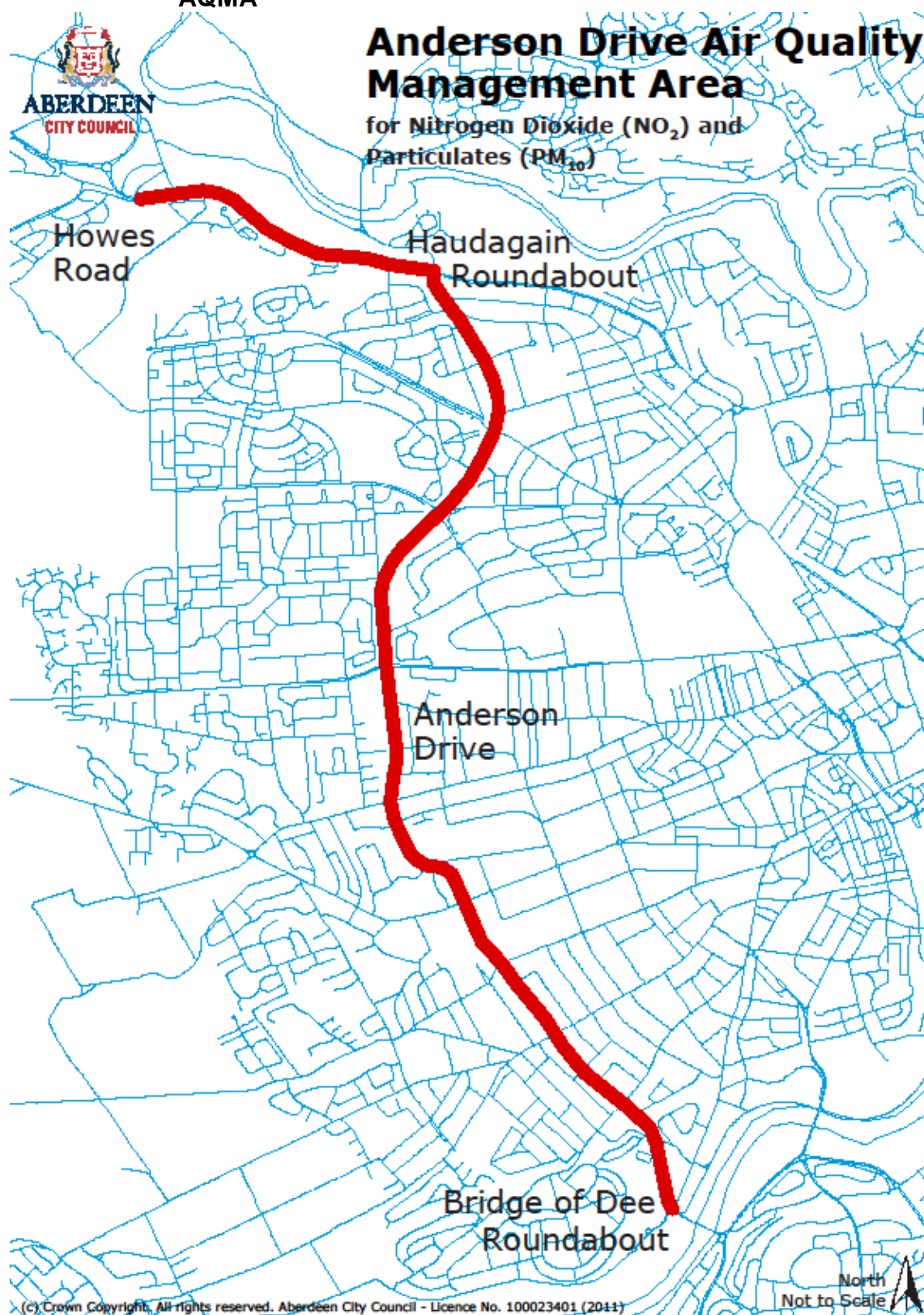
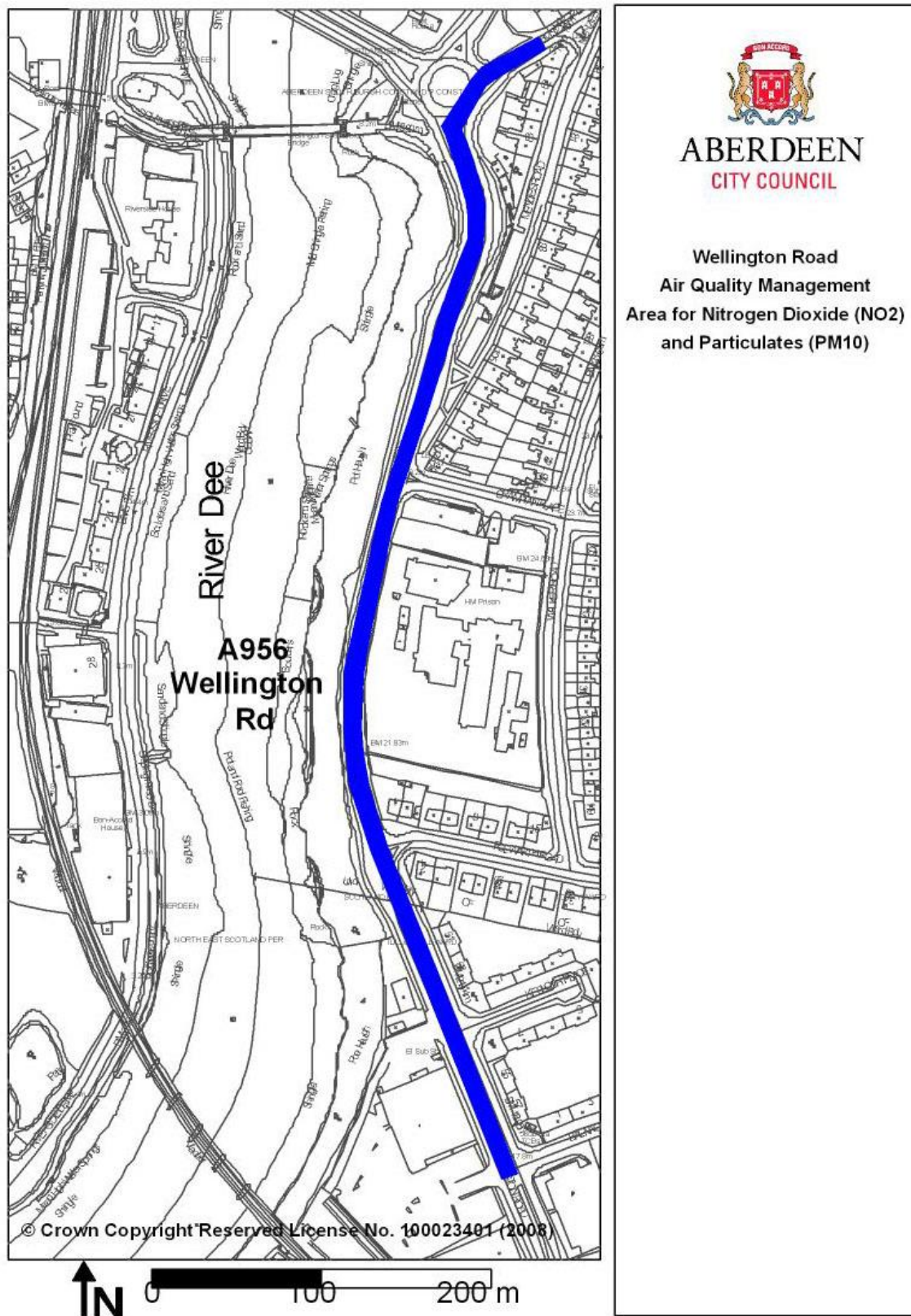


Figure 1.3: Map of Wellington Road AQMA





## 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 2.1 shows the site locations. QA/QC procedures are detailed in Appendix A.

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/Poynerbrook Road commenced collecting data in July 2009.

The Market St TEOM was replaced with a BAM in March 2010 and a replacement NOx analyser installed in April 2010. The Union Street NOx analyser was replaced in February 2012 due to recurrent technical problems during 2011.

The TEOM PM10 monitor at the Union Street automatic monitoring station was replaced with a TEOM 1405-DF Ambient Particulate Dichotomous Monitor with FDMS for PM2.5 and PM10 in April 2014.

**Figure 2.1 Map of Automatic Monitoring Sites**

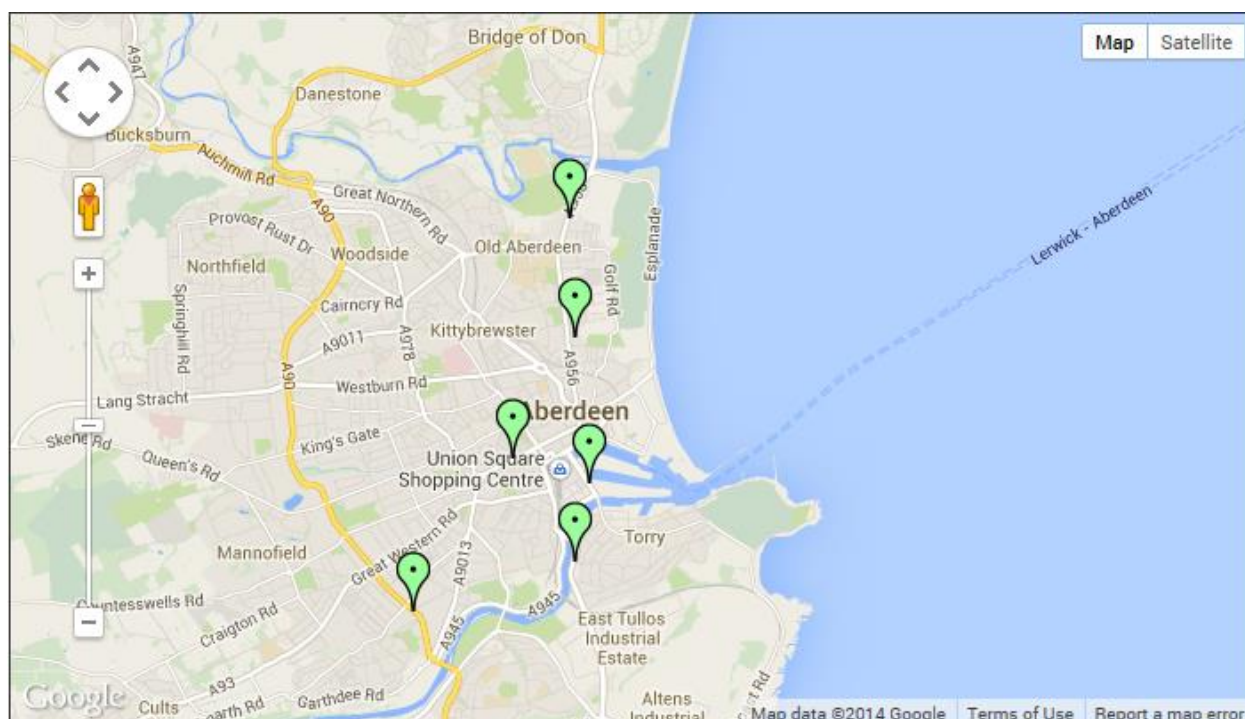


Table 2.1 Details of Automatic Monitoring Sites

Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Monitoring Technique	Relevant Exposure? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road (N/A if not applicable)	Does this location represent worst-case exposure?
Errol Place	Background	X394397	Y807392	PM <sub>10</sub> , PM <sub>2.5</sub> , O <sub>3</sub> , NO <sub>2</sub> (NO, NO <sub>x</sub> )	N	TEOM FDMS Chemiluminescence	N/A	N/A	N
Union Street	Roadside	X393656	Y805967	PM <sub>10</sub> , NO <sub>2</sub> (NO, NO <sub>x</sub> )	Y	Dichotomous Monitor FDMS Chemiluminescence	Y(2m)	2m	Y
Market Street	Roadside	X394560	Y805677	PM <sub>10</sub> , NO <sub>2</sub> (NO, NO <sub>x</sub> )	Y	BAM Chemiluminescence	Y(0m)	2m	N
Anderson Drive	Roadside	X392506	Y804186	PM <sub>10</sub> , NO <sub>2</sub> (NO, NO <sub>x</sub> )	Y	TEOM Chemiluminescence	Y(10m)	6m	N
Wellington Road	Roadside	X394395	Y804779	PM <sub>10</sub> , NO <sub>2</sub> (NO, NO <sub>x</sub> )	Y	TEOM Chemiluminescence	Y(5m)	4m	Y
King Street	Roadside	X394333	Y808770	PM <sub>10</sub> , NO <sub>2</sub> (NO, NO <sub>x</sub> )	N	BAM Chemiluminescence	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 lampposts and downpipes. Tube details and locations are listed in Table 2.2. The diffusion tubes provide an indication of longer-term average NO<sub>2</sub> concentrations and highlight areas of high NO<sub>2</sub> 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?	Is monitoring collocated with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road (N/A if not applicable)	Does this location represent worst-case exposure?
Bucksburn Primary Sch, Inverurie Road	Roadside	389744	809575	NO <sub>2</sub>	Y	N	Y (façade)	8m	N
885 Gt Northern Rd	Roadside	391167	809161	NO <sub>2</sub>	Y	N	Y (11m)	3m	Y
549 N Anderson Dr	Roadside	391394	808949	NO <sub>2</sub>	Y	N	Y (17m)	3m	Y
38 Ellon Rd	Roadside	394652	809714	NO <sub>2</sub>	N	N	Y(7m)	3m	Y
520 King St	Roadside	394236	808066	NO <sub>2</sub>	N	N	Y(9m)	0.1m	N
86 Victoria Rd, Torry	Roadside	394764	805197	NO <sub>2</sub>	N	Y	Y(façade)	3m	Y
Wellington Rd//Kerloch Pl	Roadside	394411	804407	NO <sub>2</sub>	Y	N	Y(façade)	3m	Y
107 Anderson Dr	Roadside	392337	804340	NO <sub>2</sub>	Y	N	Y(14m)	3m	Y
31 Market St	Roadside	394258	806157	NO <sub>2</sub>	Y	N	Y(façade)	3m	Y
184/192 Market St	Roadside	394530	805708	NO <sub>2</sub>	Y	N	Y(façade)	3m	Y
105 King St	Roadside	394406	806637	NO <sub>2</sub>	Y	N	Y(façade)	3m	Y

Aberdeen City Council

Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Is monitoring collocated with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road (N/A if not applicable)	Does this location represent worst-case exposure?
40 Union St	Roadside	394284	806284	NO <sub>2</sub>	Y	N	Y(façade)	3m	Y
Music Hall, Union St	Roadside	393777	806030	NO <sub>2</sub>	Y	N	Y(façade)	6m	Y
Dyce Prim, Gordon Ter	Urban background	389046	812794	NO <sub>2</sub>	N	N	Y(N/A)	N/A	N
Northfield swimming pool	Urban background	390801	808132	NO <sub>2</sub>	N	N	Y(N/A)	N/A	N
Guild St/Market St	Roadside	394336	806097	NO <sub>2</sub>	Y	N	Y(facade)	5m	Y
43/45 Union St	Roadside	394294	806266	NO <sub>2</sub>	Y	N	Y(façade)	3m	Y
14 Holburn St	Roadside	393305	805734	NO <sub>2</sub>	Y	N	Y(façade)	3m	Y
468 Union St	Roadside	393386	805826	NO <sub>2</sub>	Y	N	Y(façade)	3m	Y
212 King St	Roadside	394400	806842	NO <sub>2</sub>	N	N	Y(façade)	4m	N
26 King St	Roadside	394449	806453	NO <sub>2</sub>	Y	N	Y(façade)	4m	Y
104 King St	Roadside	394425	806634	NO <sub>2</sub>	Y	N	Y(façade)	4m	Y
785 Gt Northern Rd	Roadside	391458	809102	NO <sub>2</sub>	N	N	Y(façade)	3m	Y
40 Auchmill Rd	Roadside	389913	809603	NO <sub>2</sub>	N	Y	Y(facade)	3m	Y



Aberdeen City Council

Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Is monitoring collocated with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road (N/A if not applicable)	Does this location represent worst-case exposure?
21 Holburn St	Roadside	393332	805748	NO <sub>2</sub>	Y	N	Y(façade)	3m	Y
147 Holburn St	Roadside	393214	805367	NO <sub>2</sub>	N	N	Y(façade)	3m	N
80 Holburn St	Roadside	393233	805565	NO <sub>2</sub>	Y	N	Y(façade)	3m	Y
61 Holburn St	Roadside	393275	805624	NO <sub>2</sub>	Y	N	Y(5m)	3m	Y
469 Union St	Roadside	393400	805811	NO <sub>2</sub>	Y	N	Y(façade)	3m	Y
209 Union St	Roadside	393795	806009	NO <sub>2</sub>	Y	N	Y(façade)	5m	Y
249 Union St	Roadside	393170	805120	NO <sub>2</sub>	Y	N	Y(façade)	5m	Y
Willowbank Rd/Albury Rd	Roadside	393642	805503	NO <sub>2</sub>	N	N	Y(5m)	3m	N
East North St	Roadside	394505	806529	NO <sub>2</sub>	Y	N	Y(façade)	4m	Y
404 King Street	Roadside	394317	807527	NO <sub>2</sub>	N	N	Y(façade)	9m	N
Riverside House, Riverside Drive	Roadside	39425	804873	NO <sub>2</sub>	N	N	Y(façade)	6m	N
115 Menzies Rd/Wellington Rd	Roadside	394403	804799	NO <sub>2</sub>	Y	N	Y(12m)	1m	Y

Aberdeen City Council

Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Is monitoring collocated with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road (N/A if not applicable)	Does this location represent worst-case exposure?
137 Wellington Road	Roadside	394697	803735	NO <sub>2</sub>	N	N	Y(17m)	14m	N
Wellington Road / 4 Nigg Kirk Road	Roadside	394719	803329	NO <sub>2</sub>	N	N	Y(7m)	3m	N
819 Gt Northern Rd	Roadside	391293	809136	NO <sub>2</sub>	Y	N	Y(façade)	3m	Y
852 Fullerton Ct (facade)	Facade	391353	809158	NO <sub>2</sub>	Y	N	Y(façade)	7m	Y
852 Fullerton Ct (roadside)	Roadside	391352	809151	NO <sub>2</sub>	Y	N	Y(7m)	0.1m	Y
248 George St	Roadside	393868	806741	NO <sub>2</sub>	N	N	Y(façade)	2m	N
25 Rosemount Pl	Roadside	393424	806685	NO <sub>2</sub>	N	N	Y(3m)	3m	N
214 Rosemount Pl	Roadside	392897	806352	NO <sub>2</sub>	N	N	Y(façade)	3m	N
111 S Anderson Dr	Facade	392311	804349	NO <sub>2</sub>	Y	N	Y(façade)	13m	N
West North Street	Roadside	394277	806671	NO <sub>2</sub>	Y	N	Y(façade)	4m	Y
Powis Terrace	Roadside	393368	807511	NO <sub>2</sub>	N	N	Y(5m)	0.1m	Y
139 Gt. Northern Road	Roadside	393091	808229	NO <sub>2</sub>	N	N	Y(10m)	0.1m	Y
142 Gt. Northern Road	Roadside	392969	808460	NO <sub>2</sub>	N	N	Y(11m)	3m	Y
St. Machar Dr/Dunbar St.	Roadside	394015	808483	NO <sub>2</sub>	N	N	Y(6m)	0.1m	Y
Gordon Mills Road/10 Meadow Place	Roadside	393111	809287	NO <sub>2</sub>	N	N	Y(12m)	2m	Y
90 Tillydrone Av	Roadside	393342	809066	NO <sub>2</sub>	N	N	Y(6m)	0.1m	Y
47 Tillydrone Av	Roadside	393581	808740	NO <sub>2</sub>	N	n	Y(9m)	0.1m	Y

Aberdeen City Council

Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Is monitoring collocated with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road (N/A if not applicable)	Does this location represent worst-case exposure?
36 - 38 School Road	Roadside	394358	808434	NO <sub>2</sub>	N	N	Y(14m)	2m	Y
Ellon Road/Balgownie Crescent	Roadside	394629	809740	NO <sub>2</sub>	N	N	Y(9m)	2m	Y
Fairview Drive	Urban Background	392239	810163	NO <sub>2</sub>	N	N	N/A	N/A	N
Park Place/Constitution St	Roadside	394628	806692	NO <sub>2</sub>	N	N	Y(16m)	0.1m	Y

## 2.2 Comparison of Monitoring Results with Air Quality Objectives

The Union Street and Market Street continuous monitoring sites are on busy city centre roads and are representative of population exposure for NO<sub>2</sub>. Union Street is the city's main shopping street with shops on the ground level and commercial premises and flats on the 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> 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 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> 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.

In 2013 eleven new diffusion tube locations were established in the north of the city to assess any impact of the Third Don crossing due to open in December 2015. The tubes are at roadside locations with the façade of the nearest relevant property 2-20m back from the roadside. Procedures within LAQM.TG(09) have been used to estimate the concentration at the nearest receptor where appropriate.

### 2.2.1 Nitrogen Dioxide

#### Automatic Monitoring Data

Table 2.3 shows the annual mean NO<sub>2</sub> concentrations at the automatic continuous monitoring stations for NO<sub>2</sub> from 2009-2014.

The annual mean concentration at Anderson Drive and Wellington Road are best estimates due to valid data capture being 76%. Data capture was low at both sites due to equipment breakdown. The data is not "annualised" in accordance with

LAQM.TG(09) due to the lack of other local background continuous monitoring sites and the periods of data collection being sporadic over the 12 month.

The data trend at Wellington Road and Anderson Drive is similar to recent years, therefore the concentrations are considered to be representative for the year.

Concentrations at Union Street and Wellington Road continue to exceed the annual mean objective although the levels are slightly lower than last year. The annual mean of  $40\mu\text{g}/\text{m}^3$  at Market Street is the lowest it has been since 2011. At Errol Place, Anderson Drive and 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. Errol Place and King Street are outwith the AQMAs.

Trends in the annual mean concentration are shown in Figure 2.2. Concentrations at Errol Place, Market Street, King Street and Union Street were similar to previous years.

Table 2.4 shows the number of exceedances of the 1-hour objective at the automatic monitoring sites. There were no exceedances of the hourly mean at any site in 2015 and therefore the hourly  $\text{NO}_2$  objective was met at all sites objective ( $200\mu\text{g}/\text{m}^3$  – not to be exceeded more than 18 times per year).

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

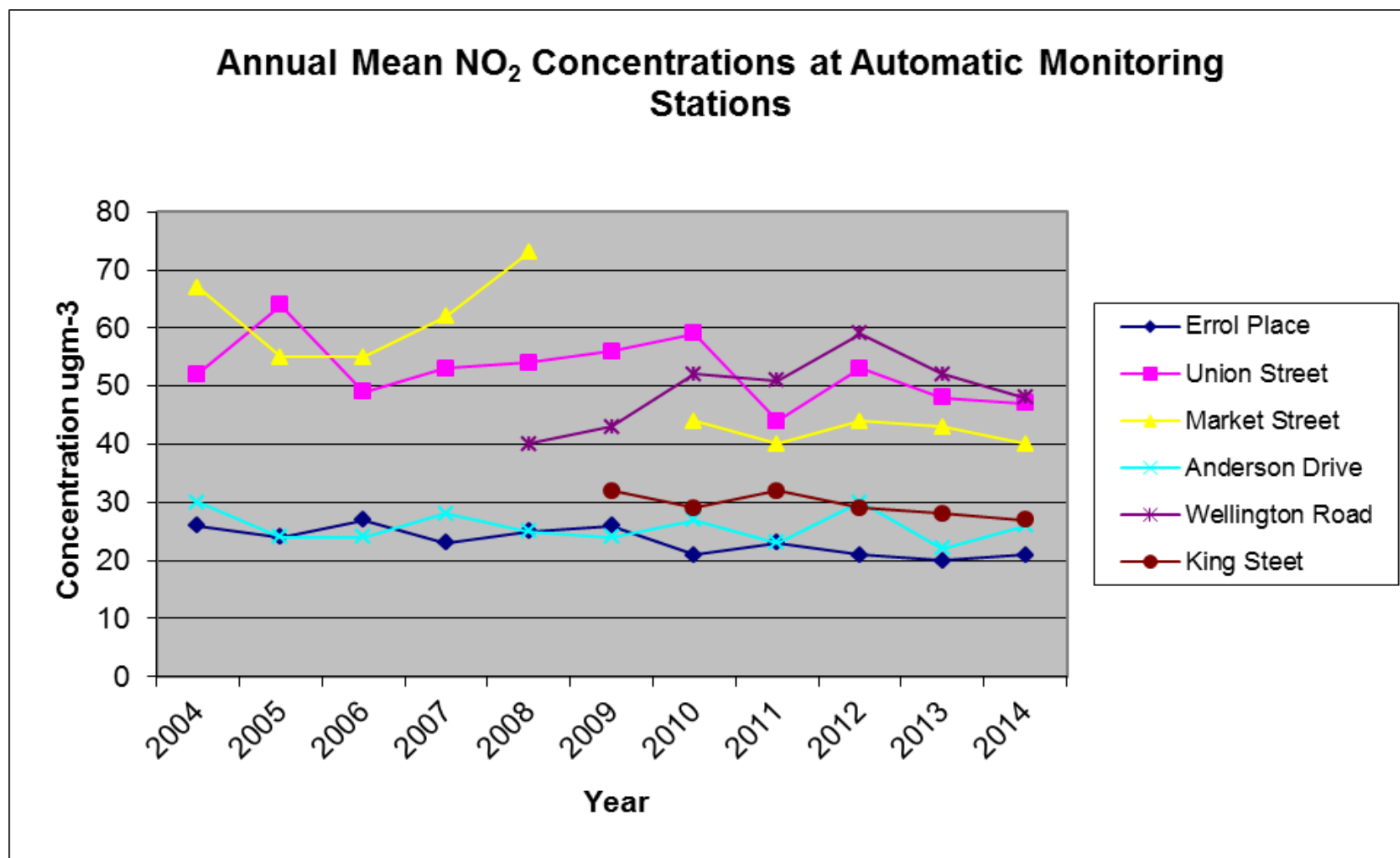
Site ID	Site Name	Site Type	Within AQMA?	Valid Data Capture for period of monitoring % <sup>a</sup>	Valid Data Capture 2014 % <sup>b</sup>	Annual Mean Concentration $\mu\text{g}/\text{m}^3$				
						2010	2011	2012	2013	2014
A1	Errol Place	Background	N		94.1	21	23	21	20 <sup>c</sup>	21
A2	Union Street	Roadside	Y		93.6	<b>59</b>	<b>44</b>	<b>53</b>	<b>48</b>	<b>47</b>
A3	Market Street	Roadside	Y		95.3	<b>44</b>	<b>40</b>	<b>44</b>	<b>43</b>	40
A4	Anderson Drive	Roadside	Y		76.2	27	23	30	22	26 <sup>c</sup>
A5	Wellington Road	Roadside	Y		76.6	<b>52</b>	<b>51</b>	<b>59</b>	<b>52</b>	<b>48<sup>c</sup></b>
A6	King Street	Roadside	N		94	29	32	29	28	27

<sup>a</sup> data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

<sup>b</sup> 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%).

<sup>c</sup> Although collection is almost 75% data has not been annualised in accordance with LAQM.TG(09) since the periods of data collection were sporadic over the 12 month period. Measured mean concentration is of data collected and therefore is a best estimate.

Figure 2.2: Trends in Annual Mean Nitrogen Dioxide Concentrations measures at Automatic Monitoring Sites



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

Site ID	Site Name	Site Type	Within AQMA?	Valid Data Capture for period of monitoring % <sup>a</sup>	Valid Data Capture 2014 % <sup>b</sup>	Number of Exceedences of Hourly Mean (200 µg/m <sup>3</sup> )				
						2010 <sup>c</sup>	2011 <sup>c</sup>	2012 <sup>c</sup>	2013 <sup>c</sup>	2014 <sup>c</sup>
A1	Errol Place	Background	N		94	0(101)	0	0	0 (86)	0
A2	Union Street	Roadside	Y		93.6	17(202)	6(168)	1	0	0
A3	Market Street	Roadside	Y		95.3	0(157)	1	0	1	0
A4	Anderson Drive	Roadside	Y		76.2	0(111)	0	0	0	0(111)
A5	Wellington Road	Roadside	Y		76.6	1	4	10	6	0(163)
A6	King Street	Roadside	N		94	0	0	0(108.4)	0	0

<sup>a</sup> data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

<sup>b</sup> 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%).

<sup>c</sup> The 99.8<sup>th</sup> percentile of hourly means in brackets where period of valid data is less than 90%.



## Diffusion Tube Monitoring Data

Table 2.5 details the results of the diffusion tube monitoring. Tubes have been bias adjusted using the methodology described in LAQM.TG(09). Details on the bias factors and adjustment calculations are in Appendix A.

Uncorrected 4-weekly diffusion tube data and calculations to correct to façade where appropriate are shown in Tables A3 to A6 in Appendix A.

The majority of diffusion tubes within the City Centre AQMA continued to exceed the annual mean objective although the levels were generally lower than those recorded in 2013. No sites recorded concentrations greater than 60ugm-3 and therefore the possibility of exceeding the 1-hour objective was very low.

The AQMA was extended in 2011 to include Victoria Road, Torry and West North Street as a result of previous measured exceedances at Victoria Road and modelling carried out in 2010. The concentration at the Victoria Road site was below the objective in 2013 and has remained below the objective in 2014.

Monitoring at West North Street commenced in autumn 2011. The annual mean in 2012, 2013 and 2014 are well below the objective. Measurements will continue over the next few years to indicate whether the modelling over estimated concentrations at this location.

Bias adjustment concentrations at the majority of City Centre sites were generally lower in 2014 compared to 2013 and 2012.

Concentrations at several sites within both the Wellington Road and Anderson Dr/Haudigan roundabout/Auchmill Road AQMAs continue to exceed the annual mean objective and suggest pockets of exceedances across the AQMAs.

In August 2013 additional diffusion tubes were located near sensitive receptors along the route of the proposed 3rd Don Crossing to assess both the impact on receptors in the vicinity of the new route and to monitor any reduction in NO<sub>2</sub> concentrations along the existing road network where the traffic flow is expected to reduce. The tubes are identified by the site ID prefix "TDC". Levels recorded in 2013 and 2014 are reported. Due to the locations, all TDC tubes are façade corrected except TDC 10 which is an urban background site.

All the TDC monitoring locations recorded levels well below the objective in 2013 and 2014. The results provide data with the current road layout prior to the new route opening in December 2015.

Table 2.5 Results of Nitrogen Dioxide Diffusion Tubes in 2014

Site ID	Location	Site Type	Within AQMA?	Triplicate or Collocated Tube	Data Capture 2014 (Number of Months or %)	Data with less than 9 months has been annualised (Y/N)	Confirm if data has been distance corrected (Y/N)	Annual mean concentration (Bias Adjustment factor = RD 0.816, UB 0.816
								2014 ( $\mu\text{g}/\text{m}^3$ )
DT1	Buckburn Primary Sch, Inverurie Road	Roadside	Y	Single	11		N	32.7
DT2	885 Gt Northern Rd	Roadside	Y	Single	12		Y	38.2
DT3	549 N Anderson Dr	Roadside	Y	Single	10		Y	26.7
DT4	38 Ellon Rd	Roadside	N	Single	12		Y	29.6
DT5	520 King St	Roadside	N	Co-located	10		Y	24.9
DT6	86 Victoria Rd, Torry	Roadside	N	Co-located	12		N	35
DT7	Wellington Rd//Kerloch Pl	Roadside	Y	Single	7	N	N	<b>45.6<sup>a</sup></b>
DT8	107 Anderson Dr	Roadside	Y	Single	11		Y	33.1
DT9	31 Market St	Roadside	Y	Co-located	12		N	<b>57.5</b>
DT10	184/192 Market St	Roadside	Y	Co-located	12		N	<b>53.9</b>
DT11	105 King St	Roadside	Y	Co-located	11		N	<b>55.3</b>
DT12	40 Union St	Roadside	Y	Co-located	12		N	<b>51.3</b>
DT13	Music Hall, Union St	Roadside	Y	Co-located	12		N	<b>40.5</b>
DT14	Dyce Prim, Gordon Ter	Urban background	N	Single	12		N	10.5
DT15	Northfield swimming pool	Urban background	N	Single	11		N	16.5
DT16	Guild St/Market St	Roadside	Y	Co-located	11		N	<b>48.6</b>
DT17	43/45 Union St	Roadside	Y	Co-located	11		N	<b>55</b>
DT18	14 Holburn St	Roadside	Y	Co-located	11		N	<b>47.5</b>
DT19	468 Union St	Roadside	Y	Co-located	12		N	<b>51.4</b>

Site ID	Location	Site Type	Within AQMA?	Triplicate or Collocated Tube	Data Capture 2014 (Number of Months or %)	Data with less than 9 months has been annualised (Y/N)	Confirm if data has been distance corrected (Y/N)	Annual mean concentration (Bias Adjustment factor = RD 0.816, UB 0.816)
								2014 ( $\mu\text{g}/\text{m}^3$ )
DT20	212 King St	Roadside	N	Co-located	12		N	33.3
DT21	26 King St	Roadside	Y	Co-located	9		N	<b>43.3</b>
DT22	104 King St	Roadside	Y	Co-located	11		N	<b>45.2</b>
DT23	785 Gt Northern Rd	Roadside	N	Single	11		Y	37.2
DT24	40 Auchmill Rd	Roadside	N	Single	12		N	28.8
DT25	21 Holburn St	Roadside	Y	Single	10		N	<b>50.3</b>
DT26	147 Holburn St	Roadside	N	Single	12		N	28.7
DT27	82 Holburn St	Roadside	Y	Co-located	10		N	28.4
DT28	61 Holburn St	Roadside	Y	Co-located	12		Y	<b>40.1</b>
DT29	469 Union St	Roadside	Y	Co-located	12		N	<b>57.9</b>
DT30	209 Union St	Roadside	Y	Single	10		N	<b>53.4</b>
DT31	249 Holburn St	Roadside	Y	Co-located	11		N	33.2
DT33	East North St	Roadside	Y	Co-located	12		N	<b>44.5</b>
DT34	404 King Street	Roadside	N	Co-located	11		N	31.2
DT36	115 Menzies Rd/Wellington Rd	Roadside	Y	Co-located	12		Y	<b>41</b>
DT37	137 Wellington Road	Roadside	N	Single	12		Y	26.9
DT39	819 Gt Northern Rd	Roadside	Y	Single	11		N	<b>53.3</b>
DT40	852 Fullerton Ct (facade)	Facade	Y	Single	12		N	35
DT41	852 Fullerton Road (roadside)	Roadside	Y	Single	12		Y	26.4
DT45	111 S Anderson Dr	Facade	Y	Single	9		N	<b>42.4</b>
DT46	West North Street	Roadside	Y	Single	11		N	30.4
TDC 1	Powis Terrace	Roadside	N	Single	12		Y	33.2

Site ID	Location	Site Type	Within AQMA?	Triplicate or Collocated Tube	Data Capture 2014 (Number of Months or %)	Data with less than 9 months has been annualised (Y/N)	Confirm if data has been distance corrected (Y/N)	Annual mean concentration (Bias Adjustment factor = RD 0.816, UB 0.816)
								2014 ( $\mu\text{g}/\text{m}^3$ )
TDC 2	139 Gt. Northern Road	Roadside	N	Single	12		Y	23.2
TDC 3	142 Gt. Northern Road	Roadside	N	Single	11		Y	29.1
TDC 4	St. Machar Dr/Dunbar St.	Roadside	N	Single	12		Y	22.8
TDC 5	Gordon Mills Road/10 Meadow Place	Roadside	N	Single	12		Y	16.3
TDC 6	90 Tillydrone Av	Roadside	N	Single	10		Y	15.6
TDC 7	47 Tillydrone Av	Roadside	N	Single	12		Y	19.2
TDC 8	36 - 38 School Road	Roadside	N	Single	12		Y	21.9
TDC 9	Ellon Road/Balgownie Crescent	Roadside	N	Single	12		Y	28.1
TDC 10	Fairview Drive	Urban Background	N	Single	12		N	13.7
TDC 11	Park Place/Constitution St	Roadside	N	Single	9		Y	30.3

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

Site ID	Site Type	Within AQMA?	Annual mean concentration (adjusted for bias) $\mu\text{g}/\text{m}^3$				
			2010 (Bias Adjustment Factor = nearest site 0.76-1.0)	2011 (Bias Adjustment Factor = RD 0.864, UB 0.67)	2012 (Bias Adjustment Factor = RD 0.898, UB 0.78)	2013 (Bias Adjustment Factor = RD 0.894, UB 0)	2014 (Bias Adjustment Factor = RD 0.816, UB 0.816)
DT1	Roadside	Y	37	33	34	31.6	32.7
DT2 <sup>b</sup>	Roadside	Y	39	41	40	42	38.2
DT3 <sup>b</sup>	Roadside	Y	30	28	29	27.5	26.7
DT4 <sup>b</sup>	Roadside	N	31	40	37	34.8	29.6
DT5 <sup>b</sup>	Roadside	N	31	30	29	28.4	24.9
DT6	Roadside	Y	41	33	41	34.4	35
DT7	Roadside	Y	45	45	42	46.3	45.6 <sup>a</sup>
DT8 <sup>b</sup>	Roadside	Y	42	42	46	39.1 <sup>a</sup>	33.1
DT9	Roadside	Y	63	52	59	57.6	57.5
DT10	Roadside	Y	76	64	71	70.4	53.9
DT11	Roadside	Y	66	63	62	64.7	55.3
DT12	Roadside	Y	62	51	57	54.3	51.3
DT13	Roadside	Y	57	42	48	43.4	40.5
DT14	Urban background	N	13	9	10	12.9 <sup>c</sup>	10.5
DT15	Urban background	N	18	11	13	14.5 <sup>c</sup>	16.5
DT16	Roadside	Y	63	46	54	52.3	48.6
DT17	Roadside	Y	61	55	54	58.2	55
DT18	Roadside	Y	67	55	61	50.1	47.5
DT19	Roadside	Y	68	54	61	54.9	51.4
DT20	Roadside	N	38	37	36	35.8	33.3
DT21	Roadside	Y	46	43	43	44.5	43.3
DT22	Roadside	Y	52	48	49	51.1	45.2
DT23 <sup>b</sup>	Roadside	N	36	32	33b	27.6	37.2

Site ID	Site Type	Within AQMA?	Annual mean concentration (adjusted for bias) $\mu\text{g}/\text{m}^3$				
			2010 (Bias Adjustment Factor = nearest site 0.76-1.0)	2011 (Bias Adjustment Factor = RD 0.864, UB 0.67)	2012 (Bias Adjustment Factor = RD 0.898, UB 0.78)	2013 (Bias Adjustment Factor = RD 0.894, UB 0)	2014 (Bias Adjustment Factor = RD 0.816, UB 0.816)
DT24	Roadside	N	44	41	47	39.8 <sup>a</sup>	28.8
DT25	Roadside	Y	55	47	55	40.5	50.3
DT26	Roadside	N	38	31	33	31.7	28.7
DT27	Roadside	Y	38	31	33	31.6 <sup>a</sup>	28.4
DT28 <sup>b</sup>	Roadside	Y	44	38	44 <sup>b</sup>	40.5	40.1
DT29	Roadside	Y	65	63	56	63.3	57.9
DT30 <sup>b</sup>	Roadside	Y	62	57	55 <sup>c</sup>	56.1	53.4
DT31	Roadside	Y	41	35	38	37.2	33.2
DT32	Roadside	N	27	27	N/A	N/A	N/A
DT33	Roadside	Y	53	51	52	51	44.5
DT34	Roadside	N	33	35	33	33.9	31.2
DT35	Roadside	N	30	27	N/A	N/A	N/A
DT36 <sup>b</sup>	Roadside	Y	42	31	48	43.4	41
DT37 <sup>b</sup>	Roadside	N	32	31	36	30.9	26.9
DT38 <sup>b</sup>	Roadside	N	33	31	N/A	N/A	N/A
DT39	Roadside	Y	55	55	69 <sup>a</sup>	63.8	53.3
DT40	Roadside	Y	40	36	36	36.6	35
DT41 <sup>b</sup>	Roadside	Y	28	22	30	25.4	26.4
DT42	Roadside	N	38 <sup>a</sup>	35	N/A	N/A	N/A
DT43 <sup>b</sup>	Roadside	N	32 <sup>a</sup>	28	N/A	N/A	N/A
DT44	Roadside	N	30 <sup>a</sup>	26	N/A	N/A	N/A
DT45	Roadside	Y	32	29	36	37.1	42.4
DT46	Roadside	Y	N/A	N/A	30	33	30.4
TDC1 <sup>b</sup>	Roadside	N	N/A	N/A	N/A	38.8 <sup>d</sup>	33.2
TDC2 <sup>b</sup>	Roadside	N	N/A	N/A	N/A	25.9 <sup>d</sup>	23.2
TDC3 <sup>b</sup>	Roadside	N	N/A	N/A	N/A	37.5 <sup>d</sup>	29.1

Site ID	Site Type	Within AQMA?	Annual mean concentration (adjusted for bias) $\mu\text{g}/\text{m}^3$				
			2010 (Bias Adjustment Factor = nearest site 0.76-1.0)	2011 (Bias Adjustment Factor = RD 0.864, UB 0.67)	2012 (Bias Adjustment Factor = RD 0.898, UB 0.78)	2013 (Bias Adjustment Factor = RD 0.894, UB 0)	2014 (Bias Adjustment Factor = RD 0.816, UB 0.816)
TDC4 <sup>b</sup>	Roadside	N	N/A	N/A	N/A	25.3 <sup>d</sup>	22.8
TDC5 <sup>b</sup>	Roadside	N	N/A	N/A	N/A	17.4 <sup>d</sup>	16.3
TDC6 <sup>b</sup>	Roadside	N	N/A	N/A	N/A	16.8 <sup>d</sup>	15.6
TDC7 <sup>b</sup>	Roadside	N	N/A	N/A	N/A	22.3 <sup>d</sup>	19.2
TDC8 <sup>b</sup>	Roadside	N	N/A	N/A	N/A	24.3 <sup>d</sup>	21.9
TDC9 <sup>b</sup>	Roadside	N	N/A	N/A	N/A	31.3 <sup>d</sup>	28.1
TDC10	Urban Background	N	N/A	N/A	N/A	14.8 <sup>d</sup>	13.7
TDC11 <sup>b</sup>	Roadside	N	N/A	N/A	N/A	33 <sup>d</sup>	30.3

<sup>a</sup> Although collection is <75% data has not been annualised in accordance with LAQM.TG(09) since the periods of data collection was sporadic over the 12 month period.

<sup>b</sup> Concentrations at nearest relevant receptor have been estimated using the “NO2 fall-off with distance calculator” described in LAQM.TG.(09) and are discussed in section Appendix A.

<sup>c</sup> data not bias adjusted due to lack of continuous UB data.

<sup>d</sup> Results not reported in 2014 update report. Annualisation correction and façade correction factors discussed in Appendix A.

### 2.2.2 PM<sub>10</sub>

The Union Street and Market Street continuous monitoring locations are representative of population exposure for PM<sub>10</sub> 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 PM<sub>10</sub> obtained from the continuous monitoring sites over the period 2010-2014. All data was ratified by Ricardo-AEA (RAEA). TEOM and BAM data from 2009 has been corrected to gravitational equivalent by AEA Technology using the procedures described in Appendix A.

The TEOM located at Union Street was replaced with a FDMS in April 2014. The FDMS then developed a fault requiring it to be removed from site for repair, hence less than 90% valid data capture.

The annual mean objective was exceeded at Market Street, Wellington Road and King Street continuous monitoring sites. Concentrations were below the objective at Errol Place Anderson Drive and Union Street.

King Street has exceeded the annual mean objective by 1ugm<sup>-3</sup> since 2011. The King Street site is outwith the existing AQMAs. During 2012 it became apparent that the BAMs at both Market Street and King Street were recording significantly elevated levels during prolonged periods of wet weather or sea mist in the area.

Market Street recorded exceedances of both the annual mean and 24-hour PM<sub>10</sub> air quality objectives, although the levels were lower than in 2013. The majority of the 24-hour exceedances occurred in March to May and September. During these times exceedances predominantly occurred when there was light south east winds combined with drizzle/damp and sea haar.

Levels >50ugm<sup>-3</sup> were recorded at the Wellington Road continuous monitoring station on 2 occasions and at King Street on 5 occasions. These exceedances occurred on similar days to the Market Street exceedances, but at lower concentrations. As there were fewer than seven 24-hour periods of concentrations >50ugm<sup>-3</sup> the 24 hour objective was met at Wellington Road and King Street.

Figure C1 provides a plot of PM<sub>10</sub> at Market Street against wind direction and speed during 2014. The plots used meteorological data from Aberdeen Airport which is located 7km north west of the Harbour and less influenced by on coastal effects. The link between weather conditions and PM<sub>10</sub> concentrations is clearly evident.

Although Market Street has been fitted with a heat exchanger to reduce the influence of moisture on the BAM, it has been noted that levels at both this site, and King



Street, may be raised during prolonged periods of damp weather. It was not possible to install a heat exchanger at the King Street site due to the BAM model type.

It is proposed to collocate the existing BAM at Market Street with a fine dust monitor and emission measurement system (FiDAS) in 2015 to assess the degree of meteorological influences.

Annual Average daily flow data for Market Street, collated by Transport Scotland, showed a marginal increase in vehicles (although a slight reduction in HGV) in 2014 compared to 2013. The increase is unlikely to be a significant factor in annual mean and daily exceedances air quality objective seen for 2014.

The trend at the Errol Place monitoring site suggests the annual mean background concentration has remained steady. Concentrations at Anderson Drive and Wellington Road and Union Street have also remained steady over the period 2010-2014.

**Table 2.7 Results of Automatic Monitoring of PM<sub>10</sub>: Comparison with Annual Mean Objective**

Site ID	Site Type	Within AQMA?	Valid Data Capture for monitoring Period % <sup>a</sup>	Valid Data Capture 2014 % <sup>b</sup>	Confirm Gravimetric Equivalent (Y or NA)	Annual Mean Concentration $\mu\text{g}/\text{m}^3$				
						2010	2011	2012	2013	2014
A1	Urban Background	N		93.4	N/A	13	14	12	13	15
A2	Roadside	Y		78.5	Y	<b>18</b>	<b>22</b>	<b>21</b>	<b>20</b>	18 <sup>d</sup>
A3	Roadside	Y		94.1	Y	<b>22<sup>c</sup></b>	<b>22</b>	<b>23</b>	<b>35</b>	<b>26</b>
A4	Roadside	Y		98.8	Y	14	16	15	15	15
A5	Roadside	Y		98.3	Y	<b>22</b>	<b>24</b>	<b>23</b>	<b>22</b>	<b>21</b>
A6	Roadside	N		95.2	Y	18	<b>19</b>	<b>19</b>	<b>19</b>	<b>19</b>

<sup>a</sup> data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

<sup>b</sup> 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%).

<sup>c</sup> Data has been seasonally adjusted to provide “annualised” data using the Errol Place background site and procedures within TG(09).

<sup>d</sup> PM10 instruments: TEOM from 1st January 2014 to 10th April 2014. FDMS from 11th April 2014.

Table 2.8 Results of Automatic Monitoring for PM<sub>10</sub>: Comparison with 24-hour mean Objective

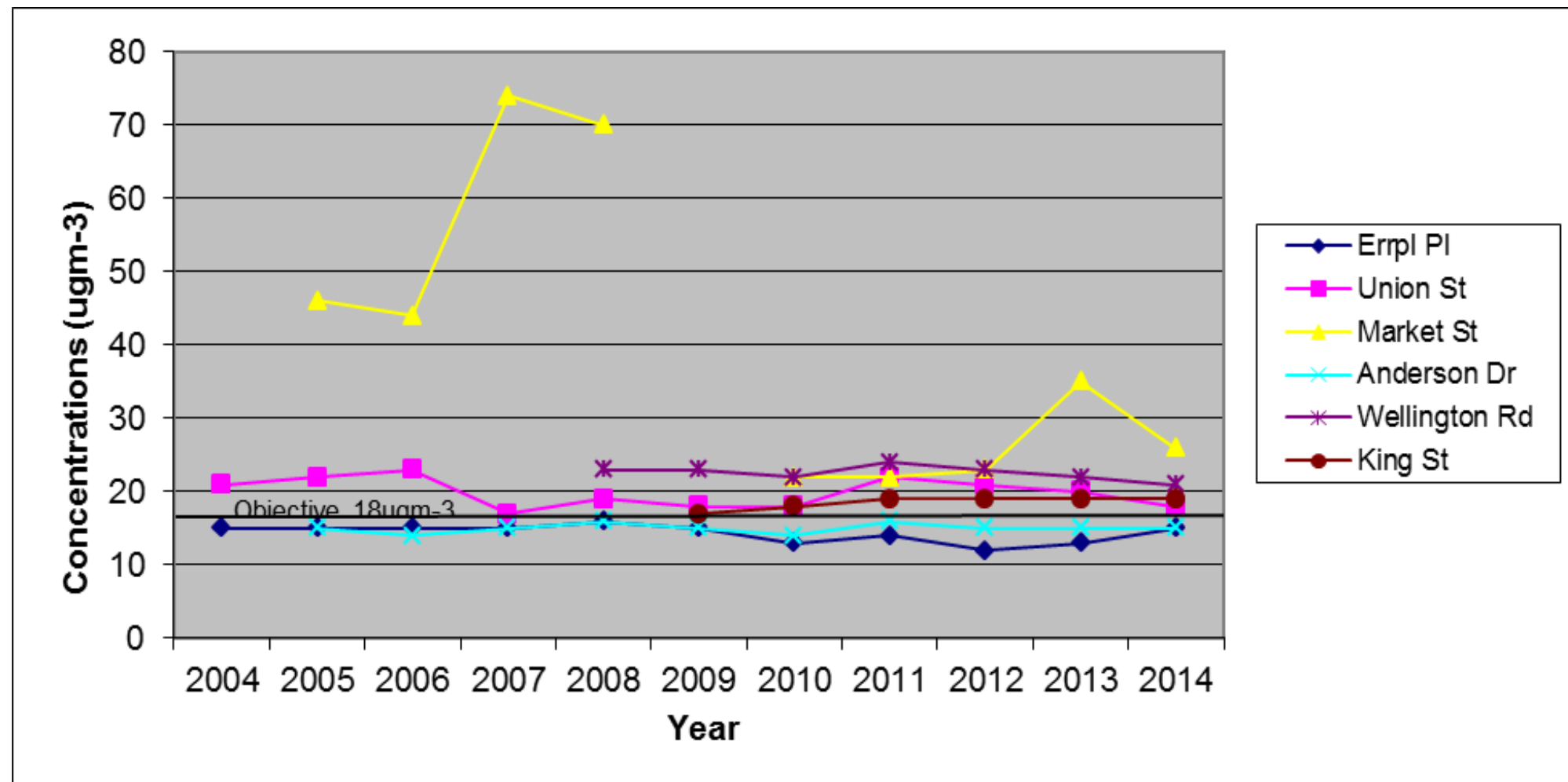
Site ID	Site Type	Within AQMA?	Valid Data Capture for monitoring Period % <sup>a</sup>	Valid Data Capture 2014 % <sup>b</sup>	Confirm Gravimetric Equivalent	Number of Exceedances of 24-Hour Mean (50 µg/m <sup>3</sup> )				
						2010 <sup>c</sup>	2011 <sup>c</sup>	2012 <sup>c</sup>	2013 <sup>c</sup>	2014 <sup>c</sup>
A1	Urban Background	N		93.4	N/A	1	1	1	1 (42)	0
A2	Roadside	Y		78.5	Y	0	4	3	4	0 (32) <sup>d</sup>
A3	Roadside	Y		94.1	Y	<b>6(53)</b>	<b>15</b>	<b>15(71.1)</b>	<b>59</b>	<b>22</b>
A4	Roadside	Y		98.8	Y	0(32)	0	0	1	0
A5	Roadside	Y		98.3	Y	1	<b>8</b>	<b>10</b>	7	2
A6	Roadside	N		95.2	Y	4	7(38)	6	4	5

<sup>a</sup> i.e. data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

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

<sup>c</sup> data capture is less than 90%. The 90<sup>th</sup> percentile of 24-hour means in brackets

<sup>d</sup> PM10 instruments: TEOM from 1st January 2014 to 10th April 2014. FDMS from 11th April 2014.

Figure 2.3 Trends in Annual Mean PM<sub>10</sub> Concentrations

### 2.2.3 Sulphur Dioxide

No monitoring of sulphur dioxide was carried out in 2014 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

#### PM<sub>2.5</sub>

Monitoring of PM<sub>2.5</sub> at Errol Place (A1) commenced in February 2009 as part of the UK automatic urban network (AUN). The new objectives for PM<sub>2.5</sub> 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 2009-2014. These results indicate the PM<sub>2.5</sub> objective of 12 $\mu\text{g m}^{-3}$ , to be achieved by 2020, is likely to be met at urban background sites in Aberdeen. Concentrations have increased slightly 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<sub>2.5</sub> concentrations.

Monitoring of PM<sub>2.5</sub> at Union Street (A2) commenced in April 2014 following the installation of FDMS. However data capture in 2014 was only 14%.

**Table 2.9 Results of PM<sub>2.5</sub> Automatic Monitoring: Comparison with the Annual Mean Objective**

Year	Data Capture for Monitoring Period (%)	Annual Mean ( $\mu\text{g m}^{-3}$ )
2009	60.6	7
2010	80.0	7
2011	90.8	8
2012	96.4	9
2013	83.0	9
2014	87.0	10

## Ozone

Monitoring of ozone is also carried out at Errol Place as part of the AURN. 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  $100\mu\text{g m}^{-3}$  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 2005-2014.

The annual mean has remained steady compared to previous years. Changes in ozone are reflective of meteorological conditions and the variable number of exceedance of the 8 hour objective over the monitoring period is likely to be attributable to the changeable weather.

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

Year	Data Capture for Monitoring Period (%)	Annual Mean ( $\mu\text{g m}^{-3}$ )	Number of 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
2012	99.4	44	7
2013	88.0	47	0
2014	93.4	46	4

### 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 Road Traffic Sources

The 2012 Updating and Screening Assessment commented on the number of major residential and industrial developments and the associated transportation interventions planned in Aberdeen over the period 2010-2023. Table 3.1 lists major developments as described in the 2012 Aberdeen City Local Plan.

**Table 3.1 Aberdeen City Council Local Plan 2012 Proposed Major Developments**

Location (location within Aberdeen)	Local Development Plan Period		Future Years
	2007-2016	2017-2023	2024-2030
Countesswells (west)	2150	850	
	10 ha employment		
Deeside (west)	554	150	
	5 ha employment		
Kingswells/Greenfern (west/northwest)	1520	350	
	50 ha employment		
Dyce/Bucksburn (northwest)	3300	1200	
	49.5 ha employment		
Bridge of Don/Grandholm (northeast)	3210	2100	2300
			18.5 ha employment or higher education and research
<b>Total</b>	<b>10,934</b>	<b>4,650</b>	<b>2300</b>
	<b>104.9ha employment</b>		<b>18.5 ha employment or higher education and research</b>

Various Masterplans were developed over the period 2012-2014 describing in detail the development proposals. Planning applications have been submitted for areas within the Masterplans. A number of other smaller residential developments of <500 properties and major industrial/commercial premises have also received planning permission in recent years. Other major developments, including a new Park and Ride facility and an Exhibition and Conference Centre, incorporating hotel and retail facilities, to the north of the City are also going through the planning process. Furthermore, similar scaled residential developments are progressing in Aberdeenshire Council just outwith the Aberdeen City boundary and will impact on the road network within the City.

Cumulatively these developments have the potential to impact significantly on the existing road network within Aberdeen, particularly the Wellington Road and Anderson Drive/Haudagain/Auchmill Road AQMAs. Air quality assessments and

other sustainability measures to reduce the need to travel by car have been required during the masterplanning and development control processes, with consideration given to cumulative impacts. While the road infrastructure measures described in section 3.5 will assist in the redistribution of vehicles and support improved air quality, the scale of development will continue to present air quality challenges on the existing road network. As part of the air quality Action Planning process the Local Authority aims to developing additional measures and policies to support sustainable transport and air quality improvement during 2015.

### **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.**

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



### 3.4 Junctions

#### Haudagain Roundabout Improvements

The Haudagain roundabout is a junction between several major roads in Aberdeen which is currently operating over capacity. This causes significant queues and delays to traffic and exceedances of the air quality objectives both at the roundabout and on approach roads. Traffic flows on the approach roads are >30,000 vehicles per day, including a high percentage of HGVs.

Transport Scotland appointed a design consultant in May 2013 to consider options to improve the junction and the preferred improvements were approved in autumn 2014. Draft orders for the compulsory purchase of areas of land along the proposed route were produced in early 2015, however the improvement works are not due to be completed until 2018 after the completion of the AWPR. Detailed air quality modelling is currently being carried out to assess the impact of the improvements both within the existing AQMA and adjacent to sensitive receptors along the new link. Further information will be provided in the 2016 air quality report.

Aberdeen City Council has assessed new/newly identified junctions meeting the criteria in Section A.4 of Box 5.3 in TG(09), and concluded that **it will be necessary to proceed to a Detailed Assessment for Nitrogen dioxide and PM<sub>10</sub> for Haudagain roundabout**

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

The 2009 and 2012 Updating and Screening Assessments described proposals for several new roads within Aberdeen. The following information details the current position regarding the construction of these developments and other proposed works.

#### Aberdeen Western Peripheral Route (AWPR)

Following a very lengthy legal dispute lasting several years, construction works on the AWPR finally commenced in early 2015 with a projected completion date of winter 2017. The Craibstone and Dyce junctions near Aberdeen airport are scheduled to open by autumn 2016. As previously reported, the AWPR will allow traffic to travel around the City, and will particularly benefit the Anderson Drive/Haudagain/Auchmill Road AQMA where a 10% reduction in traffic flow and up to 20% reduction in HGV's is predicted. Reduced traffic flows are predicted across the City, including the City Centre and King Street. However, a number of major developments, including large offices, hotels, commercial and residential developments have already been

constructed close to the new route and adjacent to the A96, A944 and A956, with the potential to impact on the Anderson Drive/Haudagain/Auchmill Road and Wellington Road AQMAs. Further developments are also proposed therefore compliance with the air quality objectives within these AQMAs will remain challenging.

The Aberdeen section of the AWPR is through mainly rural areas and concentrations at sensitive receptors along the route will remain well below the air quality objectives.

### **3<sup>rd</sup> Don Crossing**

Construction of the new crossing over the River Don in the north of Aberdeen commenced in 2014 and is due to be completed by the end of 2015. As reported in the 2012 USA, the additional crossing is designed to reduce congestion over the existing bridge where NO<sub>2</sub> and PM10 concentrations at sensitive receptors are close to the air quality objectives. Background concentrations along the new route are low and modelling using the AAQIRE software predicted levels well below the objectives at sensitive receptors. While the crossing will have a positive impact on air quality along the majority of existing busy roads, dispersion modelling did indicate a slight increase in NO<sub>2</sub> concentrations at several locations, particularly King Street in the vicinity of the existing AQMA. As reported in section 2.2.1, diffusion tubes have been installed at various locations along the existing road network and proposed new route to monitor before/after construction air quality impacts.

### **Berryden Corridor**

The Council is committed to upgrading the existing Berryden corridor, a bottle neck approximately 1km to the north of the City Centre. NO<sub>2</sub> and PM10 concentrations at existing receptors are currently below the air quality objectives, however proposed new roads are likely to have traffic flows >10,000 vehicles per day therefore there is a potential for new exposure. Preliminary design works have been completed and budgets approved. Works are currently programmed to commence mid 2016 with completion by mid 2018, however as planning permission is required for parts of the development, the start date may be delayed. An air quality assessment, including detailed dispersion modelling, will be required as part of the development process and further information on the air quality impacts provided in the 2016 air quality report.

### **City Centre Masterplan**

The Council appointed specialised consultants in 2014 to devise a long term plan for the regeneration of Aberdeen City Centre. A Masterplan was published for consultation in early 2015. Sustainable transport and an improved public transport network are key elements. For example, the Masterplan includes a proposal to remove private cars from some streets, including parts of Union St, creating approximately 43,600 sq m (11 acres) of additional space for pedestrians and cyclists, the introduction of taxi and bus only streets and bus priority measures on priority routes. Further information will be provided in the 2016 air quality report and Action Plan updates as the Masterplan develops.

Aberdeen City Council has assessed new/proposed roads meeting the criteria in Section A.5 of Box 5.3 in TG(09), and concluded that **it will be necessary to proceed to a Detailed Assessment for Nitrogen dioxide and PM<sub>10</sub> for the Berryden Corridor**

### **3.6 Roads with Significantly Changed Traffic Flows**

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

### **3.7 Bus and Coach Stations**

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 of Scotland is the transport hub for Europe's oil and gas industry. 3 769 697 passengers passed through the airport and 6483 tonnes of freight (including mail) were transported in 2014. Applying the criteria within LAQM.TG(09), the total equivalent passenger throughput was approximately 3.8 million passengers per annum (mppa).

Aberdeen Airport Ltd routinely subcontract Ricardo AEA to undertake an assessment of air pollution at Aberdeen Airport. The most recent monitoring was over a 6 monthly period between November 2013 and July 2014 via diffusion tubes located at 17 airside and non-airside locations. Diffusion tubes were annualised and bias adjusted in accordance with TG(09). The national adjustment bias adjustment factor of 0.81 was used. The bias adjustment factor derived from Errol Place automatic collected data could not be used due to poor data capture.

The highest concentration measured within the airfield was  $65\mu\text{g m}^{-3}$ .

Landside the highest concentration was  $31\mu\text{g m}^{-3}$  at the terminal car park. The concentration at Cordyce View, the nearest residential property was  $14\mu\text{g m}^{-3}$  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  $\text{NO}_x$  background concentration of  $44\mu\text{g m}^{-3}$  at the nearest residential properties and also within the airfield. Although the total equivalent passenger throughput is less than 10 mppa, the background  $\text{NO}_x$  concentration was above  $25\mu\text{g m}^{-3}$ . 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.

## 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 2014. It has been assumed all vessels arriving also departed.

**Table 4.1 Aberdeen Harbour Vessel movements in 2014**

<b>Vessel Type</b>	<b>Number vessel movements</b>
Cargo	1010
Cruise	14
Ferries	1362
Fishing	166
Oil Related	11742
Recreational	29
<b>Total</b>	<b>14323</b>

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).

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 NO<sub>2</sub> and PM<sub>10</sub> 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 auxiliary 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  $6.6\mu\text{g m}^{-3}$  to the annual mean NO<sub>2</sub> concentrations at a location of relevant population exposure (16% of the annual mean objective), whilst emissions of PM<sub>10</sub> 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<sub>2</sub> and PM<sub>10</sub> 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.

There are plans to build a second harbour at Nigg Bay located approximately 2km to the south of the existing harbour. An additional harbour is required to meet increased shipping demands and accommodate larger off-shore and cruise vessels that cannot currently berth at the existing harbour.

Aberdeen Harbour Board, Scottish Enterprise and Aberdeen City Council are in the process of preparing a Development Framework for Nigg Bay, Altens and East Tullos. This framework will consider the long term development and regeneration opportunities arising as a result of the proposed new harbour at Nigg Bay. Progress of this development and any impact on air quality will be reported in future air quality annual reports. Environmental Impact Assessments are to be undertaken.

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 2012-2014. 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	Woodside Medical Centre, Woodside, Aberdeen	X392927 Y808086	2013	199kwh	Wood pellet facility	ADMS assessment predicted imperceptible impact at receptors. Max annual mean NO <sub>2</sub> contribution at receptors 0.1ugm-3 and PM <sub>10</sub> contribution 0.27ugm-3. Background concentrations low.
2	Stoneywood CHP, Stoneywood Mills, Aberdeen	X390000 Y810500	2012	76MW biomass boiler and 7MW gas fired boiler	Wood chips. Abatement includes bag filtration system	AERMOD dispersion model predicted negligible impact at receptors. Max annual mean NO <sub>2</sub> contribution at receptors 0.6ugm-3, PM <sub>10</sub> contribution 0.07ugm-3 and PM <sub>2.5</sub> 0.07ugm-3. Background concentrations low.

Both installations are in areas of low background concentrations. Woodside Medical Centre is located within a residential area with a number of tenement properties and garden areas close to the site. Although there was no risk of exceedance of the air quality objectives, concerns were raised at the planning stage regarding the potential smell and nuisance impact on upper floors of the nearby flats and in gardens. The assessment considered particulate deposition rates at receptors. The maximum level was only 0.14% of the commonly applied 200mg/m<sup>2</sup>/day benchmark and considered unlikely to cause nuisance.

The proposed biomass plant at Stoneywood Papermills is >50MW and therefore comes under the remit of SEPA under the PPC regime. SEPA had no concerns about the air quality emissions.

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. 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 PM<sub>10</sub> 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 occurred during period 2012-2014. Conditions to control dust emissions were incorporated within planning permission for the developments. Visual inspections during works 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 Union Street continuous monitoring station and diffusion tubes confirmed NO<sub>2</sub> concentrations within the City Centre AQMA continue to exceed the annual mean objective. However, NO<sub>2</sub> levels at both Union Street and Market Street have been decreasing since 2012 and the annual mean objective was just met this year at the Market Street continuous monitoring station.

The annual mean and 24 hour PM<sub>10</sub> objectives were met at Union Street, however as in previous years, the objectives were exceeded on Market Street. It is likely that a proportion of the 24-hour exceedances at the site were due to local meteorological conditions.

Annual mean NO<sub>2</sub> and PM<sub>10</sub> 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 NO<sub>2</sub> and PM<sub>10</sub> concentrations exceed the annual mean air quality objectives. Although the monitoring station is slightly closer to the roadside than relevant receptors, diffusion tube monitoring confirmed exceedance of the NO<sub>2</sub> objective elsewhere within the Wellington Road AQMA.

There were no exceedances of the NO<sub>2</sub> one hour mean objective at any of the automatic sites, the first time this has occurred in the last 5 years. Diffusion tube data also recorded no sites with an annual mean >60ugm<sup>-3</sup> suggesting exceedances of the 1 hour objective were unlikely across the city.

The annual mean PM<sub>10</sub> objective also continued to be marginally exceeded at the King Street continuous monitoring station. Concentrations from the BAM monitor at this location may be elevated during prolonged periods of heavy rain and sea mist. Further assessment is still not proposed at this time, however concentrations will continue to be monitored and reviewed to determine if further action is necessary.

There appears to be a slight decrease in PM<sub>10</sub> concentrations in 2014 compared to 2013.

There were no exceedances of the objectives at any other location outwith the AQMAs.

New monitoring data has not identified a need for any other additional monitoring or changes to the existing AQMAs and no other LAQM Tasks have been identified.

## 8.2 Conclusions from Assessment of Sources

In relation to road junctions, detailed air quality modelling is currently being carried out to assess the impact of the improvements both within the existing AQMA and adjacent to sensitive receptors along the new Haudagain roundabout improvements. Further information will be provided in the 2016 air quality report.

The Third Don Crossing is due to open in December 2015. Diffusion tubes have been installed at various locations along the existing road network and the proposed new route to monitor air quality impacts before/after construction.

An air quality assessment, including detailed dispersion modelling, of the proposed Berryden Corridor will be carried out as part of the development process. Further information on the air quality impacts will be provided in the 2016 air quality report.

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 AQMA.

## 8.3 Proposed Actions

- The new monitoring data has not identified the need to proceed to a Detailed Assessment for any pollutant. Proposed major road developments including the Haudagain roundabout and Berryden Corridor improvements will require detailed assessments for NO<sub>2</sub> and PM<sub>10</sub>.
- Continue monitoring (non automatic) near sensitive receptors along the route of the proposed 3<sup>rd</sup> Don Crossing and the existing road network where traffic flows are expected to reduce.
- Co-locate additional PM<sub>10</sub> monitoring equipment with the existing BAM at the Market Street automatic monitoring site to indicate the potential influence of the weather conditions on the BAM monitoring.

- A City Centre LEZ feasibility study commenced in 2014 to model the change in pollution concentrations that may be achieved from the implementation of various potential actions, and to determine those actions that would have the most beneficial air quality effects. Scenarios modelled included:
  - Freight out of hours deliveries
  - Smaller sized vehicles, for example through an Urban Delivery Centre
  - Minimum Euro Standard/LEZ for HGV, bus and car classifications
  - Reduction in diesel cars

Draft report information indicated all of the scenarios were predicted to have beneficial effects, although only a few scenarios that focused on removing older HGVs and reducing the number of diesel cars were predicted to be substantial. Further information on the feasibility study will be provided in the 2016 annual report.

- Undertake a Tailpipe Vehicle Emission Study in conjunction with The University of Leeds during April 2015. Real time vehicle exhaust emissions will be measured across a range of sites in Aberdeen over 2 weeks using remote sensor equipment. Cameras will record number plates that can be used to identify emissions from each vehicle. Data can then be used to compare actual emissions with published manufacture data for various EURO classifications and vehicle types. The information will also help determine local fleet emissions and support the LEZ feasibility study. Results from the study will be provided in the 2016 annual report.
- The next course of action is to submit a 2016 Air Quality Progress Report.

## 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 2012
- 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
- 21 Aberdeen City Council Updating and Screening Assessment July 2012
- 22 Aberdeen City Council Progress Report September 2013
- 23 Aberdeen City Council Progress Report October 2014





# Appendices

Appendix A: QA/QC Data

Appendix B: Wind Speed and Direction and PM10 Data Trend at Market Street  
Continuous Monitoring Station 2014

## Appendix A: 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 triplicate co-located tubes. Table A1 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.

**Table A1: 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	28	21	0.77	0.77	96	13
Union Street	55	46	0.83	0.85	96	12
Wellington Road	53	47	0.89	0.89	94	12
King Street	33	27	0.82	0.82	94	13
Market Street	52	40	0.77	0.78	95	12
Anderson Drive	18	25	1.38	1.38	90	11

### Diffusion Tube Bias Adjustment Factors

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

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. 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.

### Discussion of Choice of Factor to Use

An average of all adjustment factors from Accuracy excluding CV > 20% results was taken. The Anderson Drive calculated adjustment factor is an outlier when compared to the rest and therefore was excluded the average calculation. There is only one study in the national bias adjustment spreadsheet for Marylebone Road with a calculated factor of 0.75. This confirms that the Anderson Drive result is an outlier.

The bias adjustment at Errol Place (background) was the same as Market Street (roadside) with a value of 0.77. Therefore a bias adjustment factor of 0.816 for adjusting all tube data has been used as a more conservative bias rather than a separate bias for background and roadside.

### PM Monitoring Adjustment

All TEOM data between 2009 to 2014 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 RAEA Technology (RAEA) using a gravitational factor of 0.83333 at King Street and 0.96618 at Market Street for Gravitational Equivalent. The factors are different due to Market Street BAM having a heated inlet.

### Short-term to Long-term Data Adjustment

The annual mean concentration at Anderson Drive and Wellington Road are best estimates due to valid data capture being 76%. The data is not “annualised” in accordance with LAQM.TG(09) due to no other local background continuous monitoring sites available and data collection being sporadic over the 12 month period.

### Diffusion tube data 2013 – Third Don Crossing Project

Monitoring (diffusion tubes) near sensitive receptors along the route of the proposed 3<sup>rd</sup> Don Crossing and the existing road network where traffic flows are expected to reduce, commenced in August 2013. These diffusion tubes are prefixed with TDC. The 2013 data was not available for reporting in the 2014 Progress report but has been included in this report. The 2013 data has been annualised in accordance with LAQM.TG.(09).

The background automatic monitoring site at Errol place was not used in the calculation of the bias adjustment factor due to insufficient valid data capture in 2013. The average of all road side automatic monitoring sites in Aberdeen were used as factors. This provides a good estimate of the difference in period mean and annual mean NO<sub>2</sub> concentrations in Aberdeen. The ratios are detailed below in Table A2.

The bias factor used in 2013 were 0.894 for roadside sites and 0 for background sites.

**Table A2: Adjustment to estimate annual mean (2013)**

Site	Site Type	Annual Mean	Period Mean	Ratio
Anderson Dr	Roadside	22	18.15	1.212
King St	Roadside	28	30.42	0.920
Union St	Roadside	48	40.06	1.198
Market St	Roadside	43	38.61	1.114
Wellington Rd	Roadside	52	48.43	1.074
			Average	1.104

The Annulisation factor for diffusion tube ref TDC/11 is 1.011 due to only 4 months data being available.

### **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 Ricardo AEA (RAEA) at 6 monthly intervals. Data validation and ratification is also performed by RAEA.

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 NO<sub>2</sub>.

Data is checked daily (Monday-Friday). Should a problem be identified either by Council officers or by RAEA 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 NO<sub>2</sub> 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.

UKAS carried out an annual assessment of the laboratory in February 2015 to ensure laboratory guidance is being implemented. No problems were identified.

All results from the LGC (formerly WASP) nitrogen dioxide proficiency scheme performance were satisfactory (z-score < ± 2) during the period April 2014 to March 2015.

The laboratory participates monthly in the nitrogen dioxide "inter comparison" exercise, managed by the National Physical Laboratory. All results in April 2014 were satisfactory and the annual summary (produced by AEA Energy & Environment) indicates that the results were classified as "Good" throughout 2014 with a "Bias Correction Factor A" of 0.75.

## Diffusion tube Data and Calculations

**Table A3: Measured 4-Weekly Diffusion Tube Data**

Site	Site ID	1	2	3	4	5	6	7	8	9	10	11	12	Mean	Nos Periods
Bucksburn Primary School	DT1		37	28	42	41	43	47	38	40	44	38	43	40.1	11
885 Gt Northern Rd at Haudigan	DT2	46	50	44	59	72	72	63	64	58	73	56	70	60.6	12
549 North Anderson Drive	DT3	27	42			49	45	54	45	36	43	32	49	42.2	10
38 Ellon Road	DT4	56	56	55	45	24	9	29	28	34	47	52	52	40.6	12
Linksfield Cente, 520 King Street	DT5	45	46	51	34	29	34		36		43	45	41	40.4	10
86 Victoria Road, Torry	DT6	31	33	43	36	38	42	38	37	35	47	43	91	42.8	12
Wellington Rd/ Kerloch Place	DT7		65	56	45				53		51	54	67	55.9	7
107 South Anderson Drive	DT8	34	36		42	40	80	72	36	59	81	27	83	53.6	11
31 Market St	DT9	83	70	60	67	83	77	58	75	67	71	61	74	70.5	12
184/192 Market St	DT10	67	68	66	69	69	72	66	65	62	69	56	63	66.0	12
105 King St	DT11	75	76		67	66	64	49	64	70	90	48	77	67.8	11
40 Union St	DT12	53	75	67	62	66	66	58	64	61	65	55	63	62.9	12
Music Hall, Union St	DT13	45	43	52	52	55	56	47	45	46	48	51	56	49.7	12
Dyce Primary School	DT14	17	21	20	12	9	8	7	8	8	11	14	19	12.8	12
Northfield Swimming Pool	DT15	18	32	29	17	19	13	12	14	11		20	37	20.2	11
Guild St/ Market St roundabout	DT16	44	63	48	60	67	68	60	59	46	79	61		59.5	11
43/45 Union St	DT17	54	66	70	66	67	77	65	71	60	70		75	67.4	11
14 Holburn St	DT18	47	52		61	65	57	56	50	56	58	78	60	58.2	11
468 Union St	DT19	58	50	75	68	65	61	58	59	64	62	62	74	63.0	12
212 King St	DT20	44	57	53	37	34	32	28	36	34	43	38	53	40.8	12
26 King Street	DT21	49	58		48	50	46	46	58	47	76			53.1	9
Gala Bingo, 104 King St	DT22	50	59	62	50	58	60	55	55	44	56		60	55.4	11
785 Gt Northern Road	DT23	31		27	56	67	78	70	70	53	69	43	52	56.0	11
40 Auchmill Road	DT24	34	30	38	43	34	35	34	32	38	35	33	37	35.3	12
Run 4 It, 21 Holburn	DT25	52	62		57	85	70	55	54	49	71	62		61.7	10
147 Holburn Street	DT26	30	40	35	34	48	39	31	31	27	31	37	39	35.2	12
82 Holburn St	DT27	32	37	32	35	45		33	32	28		34	40	34.8	10
61 Holburn Street	DT28	49	51	60	46	60	53	45	46	38	48	61	56	51.1	12
469 Union Street	DT29	78	81	60	70	93	73	58	67	56	77	71	67	70.9	12
209 Union St	DT30	60	69		65	73	64		67	49	67	72	68	65.4	10
249 Holburn Street	DT31	37	45	42	38	50	43	34	39	32	43	45		40.7	11
East North Street	DT33	60	60	60	56	54	53	45	55	44	54	58	56	54.6	12
404 King Street	DT34	39	47	66	34	30	30	22	30		39	35	48	38.2	11
115 Wellington Road	DT36	55	52	62	56	82	57	70	65	57	72	62	71	63.4	12
137 Wellington Road	DT37	33	32	40	30	29	29	28	32	33	38	39	38	33.4	12
819 Gt Northern Rd	DT39		60	68	65	71	62	66	65	62	69	62	68	65.3	11
852 Fullerton Court	DT40	59	59	64	36	33	46	25	33	34	42	41	42	42.8	12
852 Fullerton Court Roadside	DT41	46	47	48	53	49	31	40	50	49	70	58	65	50.5	12
111 South Anderson Drive	DT45	66		38		72	42	39	77	32	32	70		52.0	9
West North Street	DT46		53	38	31	33	34	26	34	25	38	39	59	37.3	11

Table A3 continued: Measured 4-Weekly Diffusion Tube Data

Site	Site ID	1	2	3	4	5	6	7	8	9	10	11	12	Mean	Nos Periods
Powis Terrace	TDC/1	67	70	61	64	70	43	47	39	57	59	68	59	58.7	12
139 Gt. Northern Road.	TDC/2	50	42	39	39	38	31	31	29	41	36	45	43	38.7	12
142 Gt. Northern Road	TDC/3	41	40	58	44		32	33	33	46	38	60	43	42.5	11
St. Machar Dr/Dunbar St.	TDC/4	30	36	38	30	31	28	25	29	32	30	39	39	32.3	12
Gordon Mills Road/10 Meadow Place	TDC/5	25	24	21	19	18	15	13	14	19	19	37	30	21.2	12
90 Tillydrone Av	TDC/6	34	34	19	16	17	16	14	14	18	17			19.9	10
47 Tillydrone Av	TDC/7	35	24	28	21	27	19	17	14	23	24	36	34	25.2	12
36 - 38 School Road	TDC/8	42	32	32	22	26	22	21	23	25	28	31	40	28.7	12
Ellon Road/Balgownie Crescent	TDC/9	17	31	40	47	60	60	40	34	43	41	52	36	41.8	12
Fairview Drive	TDC/10	48	18	13	12	13	12	8	12	11	13	22	19	16.8	12
Park Place/Constitution St	TDC/11		41	44	36	36	29		32	37	35		46	37.3	9

Table A4: Measured 4-Weekly Diffusion Tube Data (TDC locations 2013)

Site	Site ID	1	2	3	4	5	6	7	8	9	10	11	12	Mean	Nos Periods
Powis Terrace	TDC/1								50	59	59	66	68	60.4	5
139 Gt. Northern Road.	TDC/2								31	36	39	41	46	38.6	5
142 Gt. Northern Road	TDC/3								38	40	43	45	45	42.2	5
St. Machar Dr/Dunbar St.	TDC/4								20	27	30	37	45	31.8	5
Gordon Mills Road/10 Meadow Place	TDC/5								14	16	19	22	25	19.2	5
90 Tillydrone Av	TDC/6								13	18	18	22	23	18.8	5
47 Tillydrone Av	TDC/7								20	24	26	34	37	28.2	5
36 - 38 School Road	TDC/8								25	24	24	28	38	27.8	5
Ellon Road/Balgownie Crescent	TDC/9								38	38	40	36	44	39.2	5
Fairview Drive	TDC/10								9	11	14	16	17	13.4	5
Park Place/Constitution St	TDC/11									35	37	45	50	41.8	4



**Table A5: Diffusion Tube concentrations showing calculations to façade (2014)**

Site ID	Site	Bias Measured Conc	Background Conc	Dist to kerb	Dist façade	Façade Conc
		Cy	Cb	Dy	Dz	Cz
2	885 Gt Northern Rd	49.4	15.9	3	11	38.2
3	549 North Anderson Dr	34.4	17.3	3	17	26.7
4	Ellon Rd	33.1	17.2	3	7	29.6
5	520 King Street	33.0	20	0.1	9	24.9
8	107 South Anderson Dr	43.8	17	3	14	33.1
23	785 Gt Northern Rd	45.7	15.9	3	9	37.2
28	61 Holburn St	41.7	29.5	3	5	40.1
36	115 Menzies Rd	51.7	26.2	1	8	41.0
37	137 Wellington Rd	27.3	23.8	10	13	26.9
41	Fullerton Court roadside	41.2	15.9	0.1	7	26.4
TDC/1	Powis Terrace.	47.9	20.57	0.1	5	33.2
TDC/2	139 Gt. Northern Road.	31.6	18.45	0.1	10	23.2
TDC/3	142 Gt. Northern Road.	34.7	18.07	3	11	29.1
TDC/4	St. Machar Dr.	26.3	20.02	0.1	6	22.8
TDC/5	Gordon Mills Road/10 Meadow Place.	17.3	15.03	2	12	16.3
TDC/6	Tillydrone Av.	16.2	15.03	0.1	6	15.6
TDC/7	Tillydrone Av.	20.5	18.45	0.1	9	19.2
TDC/8	36 - 38 School Road.	23.4	20.02	2	14	21.9
TDC/9	Ellon Road.	34.1	17.21	2	9	28.1
TDC/11	Park Place.	30.5	30.29	0.1	16	30.3

Dy -distance to kerb at which concentrations were measured

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

**Table A6: Diffusion Tube concentrations showing calculations to façade (TDC Locations 2013)**

Site ID	Site	Bias Measured Conc	Background Conc	Dist to kerb	Dist façade	Façade Conc
		Cy	Cb	Dy	Dz	Cz
TDC/1	Powis Terrace.	59.6	21.05	0.1	5	38.8
TDC/2	139 Gt. Northern Road.	38.1	18.9	0.1	10	25.9
TDC/3	142 Gt. Northern Road.	47.1	18.41	3	11	37.5
TDC/4	St. Machar Dr.	31.4	20.61	0.1	6	25.3
TDC/5	Gordon Mills Road/10 Meadow Place.	18.9	15.39	2	12	17.4
TDC/6	Tillydrone Av.	18.6	15.39	0.1	6	16.8
TDC/7	Tillydrone Av.	27.8	18.9	0.1	9	22.3
TDC/8	36 - 38 School Road.	27.4	20.61	2	14	24.3
TDC/9	Ellon Road.	38.7	17.68	2	9	31.3
TDC/11	Park Place.	37.7	31.02	0.1	16	33.0

Dy -distance to kerb at which concentrations were measured

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

## Appendix B: Wind Speed and Direction and PM10 Data Trend at Market Street Continuous Monitoring Station 2014

**Figure B1: Wind Speed and Direction and PM10 Data Trend at Market Street Continuous Monitoring Station 2014**

