



2013 Air Quality Progress Report for **Dundee City Council**

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

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Executive Summary

This document is the 2013 Progress Report on air quality for the Dundee City Council area. The report focuses on each of the pollutants listed in Air Quality Regulations that were monitored within the council area during 2012, these were; nitrogen dioxide (NO₂), sulphur dioxide (SO₂), and fine particulate matter (PM₁₀).

The review and assessments of air quality are carried out to determine if the pollutant levels that the public are exposed to will meet the health based National Air Quality Standards, or if additional local measures will need to be taken to address identified polluted areas.

Previous assessments of air quality established that there was no problem with the levels of some of the seven pollutants listed in the Regulations namely; benzene, carbon monoxide, 1,3-butadiene, sulphur dioxide and lead. However, exceedences of the annual mean standard for nitrogen dioxide (40 µg/m³) have been identified and an Air Quality Management Area was declared for this pollutant in July 2006. The AQMA was amended in October 2010 to include small particulates PM₁₀ (annual mean) (18 µg/m³) and again in March 2013 as a result of exceedences of the hourly objective for NO₂ (200 µg/m³ -18 allowed) on the north west arterial route.

The council produced an Action Plan in January 2011, which contains 32 measures designed to help improve air quality through efforts to tackle traffic emissions, education and raising awareness.

This Progress Report presents the 2012 NO₂, PM₁₀ and SO₂ monitoring results. Trends in pollutant concentrations and an update of local sources are also examined within the report. It contains information provided from lead officers taking forward each of the action plan measures. Information provided in the report will assist in other policy areas, such as transport and land use planning within the council. Each pollutant has been assessed in conjunction with the relevant guidance and the conclusions reached are:

Nitrogen dioxide (NO₂) – analysis of the 2012 data for nitrogen dioxide reconfirms the need for the AQMA and the Action Plan. There are 17 diffusion tube (and 3 associated continuous analyser) locations where the annual mean NO₂ concentration at façade is estimated to exceed the objective. The concentration at the Whitehall Street continuous analyser is also estimated to breach the annual mean objective. Potential exceedences were predicted at a further 14 locations where concentrations were close to (greater than 36 µg/m³) the objective. A new potential exceedence area has been identified at South Road (Denbank) which is an access route for Ninewells Hospital and Dundee Technology Park.

Thirty-six exceedences of the NO₂ hourly mean were recorded at the automatic monitoring station on Lochee Road; this breaches the hourly mean NAQS objective as only 18 are allowed. Analysis has shown that the majority of exceedences occur at peak times on weekdays during the winter months.

NO₂ annual mean concentrations throughout the city have generally increased since the AQMA was declared in 2006. The greatest increases in pollutant concentrations have been recorded along the city centre bus corridor, the north west arterial route and associated access roads, major junctions on the Kingsway and at Stannergate roundabout on Broughty Ferry Road. Large increases (greater than 6 µg/m³) between 2011 and 2012 were detected in Whitehall Street, Whitehall Crescent, Dock Street and on the Kingsway. The annual mean concentration at the automatic monitor in Whitehall Street increased but decreased at all

other NO₂ monitors possibly, in part, owing to various traffic restrictions and management changes.

Small Particulates (PM₁₀) - The PM₁₀ NAQS 2004 annual mean objective continues to be achieved at all locations within the city, however in 2012 Dundee City Council measured concentrations of PM₁₀ above the stricter Scottish 2010 annual mean objective at Meadowside (BAM) and at Osiris monitors located in Stannergate and Seagate. Concentrations at two other Osiris monitors in Lochee Road and Logie Street were close to exceeding the annual mean objective. The Osiris units are indicative PM₁₀ monitors and owing to their relocation and hence low data capture, the 2012 annual mean had to be estimated (“annualised”) for all except Logie Street Osiris. The annual mean PM₁₀ exceedence at Stannergate roundabout is newly identified and will be the subject of further study.

The Scottish 24-hour mean objective was exceeded at two locations, Seagate and Lochee Road in 2012 using Osiris monitors. It is known that Osiris monitors tend to over-estimate the number of 24-hour mean exceedences, so these results should be treated with caution. However the gravimetric reference equivalent BAM at Meadowside measured four exceedences and had a 98.08th percentile value close to the objective. The potential for an exceedence of the 24-hour mean objective will remain under review at this location.

Over the long term there has been a slight reduction in annual mean PM₁₀ concentrations. However since 2008, levels have remained relatively stable with some year to year fluctuations at roadside and kerbside sites.

Sulphur Dioxide (SO₂) - The monitoring results for 2012 indicate that all the NAQS objectives for sulphur dioxide (SO₂) were met at the monitoring location in Dundee. A detailed assessment is not currently required for this pollutant.

Proposed Actions

Proposed actions arising from this Progress Report 2013 are as follows:

- Review the results of the new monitoring sites when a full year’s data becomes available, in particular: the Osiris units at Stannergate roundabout, the new NO₂ diffusion tubes installed in 2013, and the façade equivalent NO₂ diffusion tube installed at Carolina Court (A92T) where developer led monitoring had detected roadside NO₂ concentrations above the annual mean;
- Review the results of modelling studies being taken forward at Stannergate roundabout, Kingsway / Forfar Road, Kingsway / Myrekirk Road and Lochee Road and the city centre bus corridor;
- Compare diurnal profiles of pollutant concentrations and traffic (where available), in particular for Lochee Road;
- Investigate sources of biomass/solid fuel combustion in the local authority area to enable appropriate screening and report findings in subsequent LAQM reports as information becomes available;
- Take forward the planned actions highlighted in the Action Plan Progress Report; and
- Undertake the 2014 Progress Report.

Table of Contents

	GLOSSARY OF ACRONYMS AND DEFINITIONS	8
1	Introduction	10
1.1	Description of Local Authority Area	10
1.2	Purpose of Progress Report	11
1.3	Air Quality Objectives	11
1.4	Summary of Previous Review and Assessments	13
2	New Monitoring Data	21
2.1	Summary of Monitoring Undertaken	21
2.2	Comparison of Monitoring Results with Air Quality Objectives	32
3	New Local Developments	81
3.1	Road Traffic Sources	81
3.2	Other Transport Sources	82
3.3	Industrial Sources	82
3.4	Commercial and Domestic Sources	83
3.5	New Developments with Fugitive or Uncontrolled Sources	83
4	Local / Regional Air Quality Strategy	85
5	Planning Applications	86
6	Air Quality Planning Policies	90
7	Local Transport Plans and Strategies	94
8	Climate Change Strategies	95
9	Implementation of Action Plans	96
10	Conclusions and Proposed Actions	98
10.1	Conclusions from New Monitoring Data	98
10.2	Conclusions relating to New Local Developments	99
10.3	Other Conclusions	99
10.4	Proposed Actions	100
11	References	101

List of Tables

Table 1.2	Summaries of Review and Assessment Reports	13
Table 2.1	Details of Automatic Monitoring Sites	22
Table 2.1a	Description of Automatic Monitoring Sites	23
Table 2.2	Details of Non- Automatic Monitoring Sites	27
Table 2.3	Results of Automatic Monitoring for Nitrogen Dioxide: Comparison with Annual Mean and Hourly Mean Objectives	33
Table 2.4	Results of Nitrogen Dioxide Diffusion Tubes in 2012	39
Table 2.5	Predicted Exceedences of NO ₂ Annual Mean at Façade of Receptors	44
Table 2.6	Locations at risk of Exceeding NO ₂ Annual Mean at Façade of Receptors	45
Table 2.7	Comparison of Measured Background NO ₂ Results for 2012 with Scottish Government Background Map Data (Released April 2012)	62
Table 2.8	Results of Automatic Monitoring for PM ₁₀ : Comparison with Annual Mean Objective	65
Table 2.9	Results of Automatic Monitoring for PM ₁₀ : Comparison with 24-hour Mean Objective	68
Table 2.10	Comparison of Measured Background PM ₁₀ Results for 2012 with Scottish Government Background Map Data.	71
Table 2.11	Comparison of 24hr Mean Exceedence Events in Dundee with Wind Speed and Direction and Urban Background Sites	73
Table 2.12	Results of SO ₂ Automatic Monitoring at Broughty Ferry Road: Comparison with Objectives	78
Table 5.1:	SEA Objectives and Indicators for Air Quality	87
Table 6.1	Supportive Policies in the Dundee LDP to mitigate air quality impacts	91
Table A.1	Bias Factors from 2012 Co-location Studies from National Bias Adjustment Spreadsheet (Version 07/13)	103
Table A.2	Manual Approximate Orthogonal Regression Calculation 2012	104
Table A.3	Short-Term to Long-Term Monitoring Data Adjustment of Osiris Units	106
Table A.4	Short-Term to Long-Term Monitoring Data Adjustment of Nitrogen Dioxide Diffusion Tubes – Part 1	107
Table A.5	Short-Term to Long-Term Monitoring Data Adjustment of Nitrogen Dioxide Diffusion Tubes – Part 2	108
Table F2	Comparison of 2012 DfT Traffic Count Data with Previous Assessments	143
Table F3	Comparison of 2012 DCC Road Traffic Reduction Act Site Counts with Previously Assessed Counts	144

List of Figures

Figure 1.1	Map of AQMA Boundary	20
Figure 2.1	Map of Automatic Monitoring Sites	21
Figure 2.2a	Map of NO ₂ Diffusion Tubes in the City Centre	25
Figure 2.2b	Map of NO ₂ Diffusion Tubes to the East of the City	26
Figure 2.2c	Map of NO ₂ Diffusion Tubes to the West of the City	26
Figure 2.3	Annual Mean Nitrogen Dioxide Concentrations at Real-time Monitors from 2006 to 2012	34
Figure 2.4	Number of Exceedences of the NO ₂ Hourly Mean Objective (200µg/m ³) (18 Allowed) at Real Time Monitoring Locations in Dundee between 2006 and 2011	34
Figure 2.5	Trends in 99.8th Percentile of NO ₂ Hourly Mean Objective (200µg/m ³) 2006-2012	35
Figure 2.6	Analysis of the Frequency of Exceedences of the Hourly NO ₂ Objective at Automatic Monitoring Site on Lochee Road	36
Figure 2.7	Weekday, Saturday and Sunday Diurnal patterns of Hourly mean NO _x & NO ₂ (µg/m ³) at 5 Roadside sites and 1 Urban Background Location	37
Figure 2.8	Change in NO ₂ concentrations at 68 Diffusion tube monitoring locations between 2006 and 2012	47
Figure 2.9	NO ₂ Monitoring Locations in Union Street and Whitehall Street	48
Figure 2.10	Trends in NO ₂ Concentrations in Union St.	48
Figure 2.11	Trends in NO ₂ Concentrations in Whitehall St.	49
Figure 2.12	NO ₂ Monitoring Locations in Seagate	50
Figure 2.13	Trends in NO ₂ Concentrations in Seagate.	50
Figure 2.14	NO ₂ Diffusion Tube Locations in Nethergate	51
Figure 2.15	Trends in NO ₂ Diffusion Tube Concentrations in Nethergate.	51
Figure 2.16	NO ₂ Diffusion Tube Locations in Victoria Road / Meadowside	52
Figure 2.17	Trends in NO ₂ Diffusion Tube Concentrations in Victoria Road / Meadowside.	52
Figure 2.18	NO ₂ Diffusion Tube Locations in Albert Street / Dura Street	53
Figure 2.19	Trends in NO ₂ Diffusion Tube Concentrations in Albert Street / Dura Street.	53
Figure 2.20	NO ₂ Monitoring Locations in Lochee Road	54
Figure 2.21	Trends in NO ₂ Concentrations in Lochee Road	54
Figure 2.22	NO ₂ Diffusion Tube Locations in Logie Street	55
Figure 2.23	Trends in NO ₂ Diffusion Tube Concentrations in Logie St.	55
Figure 2.24	NO ₂ Diffusion Tube Locations in Albert St. / Arbroath Road	56
Figure 2.25	Trends in NO ₂ Diffusion Tube Concentrations in Albert St. / Arbroath Road	56
Figure 2.26	NO ₂ Diffusion Tube Locations on/near the Kingsway	57
Figure 2.27	Trends in NO ₂ Diffusion Tube Concentrations on/near the Kingsway	57
Figure 2.28	NO ₂ Diffusion Tube Locations on Bus Corridor	58
Figure 2.29	Trends in NO ₂ Diffusion Tube Concentrations on Bus Corridor	58
Figure 2.30	NO ₂ Diffusion Tube Locations on Inner Ring Road	59
Figure 2.31	Trends in NO ₂ Diffusion Tube Concentrations on Inner Ring Road	59
Figure 2.32	NO ₂ Diffusion Tube Location at Stannergate Roundabout	60
Figure 2.33	Trends in NO ₂ Diffusion Tube Concentration at Stannergate Roundabout	60
Figure 2.34	NO ₂ Diffusion Tube Location at Strathmore Avenue	61
Figure 2.35	Trends in NO ₂ Diffusion Tube Concentration at Strathmore Avenue	61
Figure 2.36	Urban Background NO ₂ Monitoring Locations	63
Figure 2.37	Trends in NO ₂ Concentrations at Urban Background Locations	63
Figure 2.38	Trends in Annual Mean PM ₁₀ Concentrations 2008 -2012 (Gravimetric equivalent data)	66
Figure 2.39	Trends in Annual Mean PM ₁₀ Concentrations 2001 - 2012 at Long-Term Monitoring Sites (un-factored data)	67
Figure 2.40	Trends in Number of Exceedences of PM ₁₀ 24hour Mean Objective 2010 (50µg/m ³ , 7 allowed) 2008-2012	69
Figure 2.41	Trends in 98.08 th Percentile of PM ₁₀ 24-hour Mean Objective 2010 (50µg/m ³) 2008-2012	70
Figure 2.42	Comparison of Dundee PM ₁₀ Monitoring Sites and Urban Background Locations from 31/01/2012 to 01/02/2012	74
Figure 2.43	Comparison of Dundee PM ₁₀ Monitoring Sites and Urban Background Locations on 16/02/2012	74
Figure 2.44	Comparison of Dundee PM ₁₀ Monitoring Sites and Urban Background Locations on 15/03/2012	75
Figure 2.45	Comparison of Dundee PM ₁₀ Monitoring Sites and Urban Background Locations on 23/03/2012 to 28/03/2012	75

Figure 2.46	Comparison of Dundee PM ₁₀ Monitoring Sites and Urban Background Locations on 24/05/2012 and 29/05/2012	76
Figure 2.47	Comparison of Dundee PM ₁₀ Monitoring Sites and Urban Background Locations on 03/08/2012 and 16/08/2012	76
Figure 2.48	Comparison of Dundee PM ₁₀ Monitoring Sites and Urban Background Locations on 10/10/2012	77
Figure 2.49	Comparison of Dundee PM ₁₀ Monitoring Sites and Urban Background Locations on 20/12/2012	77
Figure 2.50	Trends in Maximum (15min) SO ₂ Concentrations and Relevant Percentiles from 2002 to 2012	79
Figure 5.1	Strategic Development Areas and Projects within Dundee	87
Figure F.1	Department of Transport Count Point Locations in Dundee City Council	142

Appendices

Appendix A:	QA:QC Data	103
Appendix B:	VCM Methodology	111
Appendix C:	Pollution Reports	115
Appendix D:	Bias Calculations for Diffusion Tube Co-location Studies	129
Appendix E :	List of Industrial Processes	135
Appendix F :	Road Traffic Data	141
Appendix G :	Monthly Diffusion Tube Concentrations	145
Appendix H:	Action Plan Progress	151

GLOSSARY OF ACRONYMS AND DEFINITIONS

AADT	Annual Average Daily Traffic Flow
ADMS	An atmospheric air pollution dispersion model
AEA	AEA Energy & Environment
annualise	the means of estimating an annual mean from a shorter study period mean by comparison with full datasets from background AURN sites
AQ Archive	UK Air Quality Archive
AQAP	Air Quality Action Plan
AQMA	Air Quality Management Area
AQS	Air Quality Strategy
AURN	Automatic Urban and Rural Network (Defra funded air quality monitoring network)
CHP	Combined Heat and Power
CO	Carbon Monoxide
DCC	Dundee City Council
Defra	Department for Environment, Food and Rural Affairs
DERL	Dundee Energy Recycling Ltd
DMRB	Design Manual for Roads and Bridges
EC	European Community
EHTS	Environmental Health and Trading Standards Department
EPA	The Environmental Protection Act 1990
EPAQS	Expert Panel on Air Quality Standards
EU	European Union
GF	Ground floor
GIS	Geographical Information System
HDV	Heavy goods vehicles and buses
HGV	Heavy Goods Vehicle
IPC	Integrated Pollution Control
kerbside	0 to 1 metre from the kerb
LAQM.TG(03)	Local Air Quality Management: Technical Guidance (2003)
LAQM.TG(09)	Local Air Quality Management: Technical Guidance (2009)
LDP	Local Development Plan
LEZ	Low Emission Zone
Limit Value	An EU definition for a mandatory air quality standard of a pollutant listed in the air quality directives
MW	Mega Watts
mg/kg	Milligrams per Kilogram
mg/m ³	Milligrams per cubic metre
NAEI	National Atmospheric Emission Inventory
NAQS	National Air Quality Standard
NO	Nitric Oxide
NO ₂	Nitrogen Dioxide
NO _x	Oxides of nitrogen
ng/m ³	Nanograms per cubic metre
NRTF	National Road Traffic Forecast
Osiris	the brand name given by Turnkey Instruments Ltd. to their particle measuring nephelometer
P&T	Planning and Transportation
PM _{2.5}	Particulate Matter less than 2.5µm aerodynamic diameter
PM ₁₀	Particulate Matter less than 10µm aerodynamic diameter
Pb	Lead
percentile	The percentage of results below a given value
ppb	Parts per billion
ppm	Parts per million

receptor	In this study, the relevant location where air quality is assessed or predicted (for example, houses, hospitals and schools)
roadside	1 to 5 m from the kerb
SCA	Smoke Control Area
SED	Solvent Emissions Directive
SEPA	Scottish Environment Protection Agency
SO ₂	Sulphur Dioxide
SPG	Supplementary Planning Guidance
Street Canyon	A relatively narrow street with buildings on both sides, where the height of the buildings is generally greater than the width of the road
TEA	Triethanolamine
TEOM	Tapered Element Oscillating Microbalance
UKAS	United Kingdom Accreditation Service
USA	Updating and Screening Assessment
µg/m ³	Micrograms per cubic metre
VOC	Volatile Organic Compound
vpd	Vehicles per day
WASP	Workplace Analysis Scheme for Proficiency

1 Introduction

1.1 Description of Local Authority Area

Dundee City is located on the north bank of the river Tay in the Tay valley. The Dundee City Council area covers approx. 63 square kilometres (24 square miles) and is geographically the smallest local authority area in Scotland. It is bordered by Perth and Kinross Council to the west and by Angus Council to the north and east. The former Tayside Regional Council area previously covered all three councils and Dundee continues to serve as the regional centre for this area and north-east Fife, with an estimated catchment population of some 400,000 people.

Dundee is the fourth largest city in Scotland and the most recent estimate of Dundee's population is 147,800 (National Registers of Scotland (NRS) 2012 27/08/2013). This equates to a population density of 2346 people per square kilometre.

Dundee is served by an airport which has daily flights to London City. Dundee also has a modern deep-water port and large harbour area. The port area has been a major industrial and commercial source of employment and wealth creation for Dundee and the Central Waterfront project is one of the key priorities in terms of re-connecting the city and its people with the river.

The City is almost entirely urban and suburban in character and is a hub for many routes. It is connected to Fife by the Tay road and rail bridges. The A92 crosses the Tay and emerges in the centre of Dundee. There is an inner ring road, the Marketgait, and five arterial routes - Broughty Ferry Road, Arbroath Road, Riverside Drive, Lochee Road and Forfar Road. There is an outer-ring road, the Kingsway, which consists of the A90(T), the main route from Edinburgh/Perth to Aberdeen, and the A972(T), the route to Arbroath. There are a significant number of busy road junctions across the City. A large proportion of roads in the City have a gradient due to a central topographical feature, The Law, the plug of an extinct volcano (height 174 metres above sea level). The main sources of pollution in the area are from the road traffic emissions from these routes, with additional emissions from industrial sources, most of which are located around the periphery of the city and in the port area.

In common with many Scottish cities the architecture consists of a significant number of 4 or 5-storey tenemental properties creating numerous street canyons. In the commercial centres, a common feature of these tenemental properties is that commercial premises are located on the ground floor with residential premises on the floors above. The main shopping area in the city is pedestrianised.

1.2 Purpose of Progress Report

This report fulfils the requirements of the Local Air Quality Management process as set out in Part IV of the Environment Act (1995), the Air Quality Strategy for England, Scotland, Wales and Northern Ireland 2007 and the relevant Policy and Technical Guidance documents. The LAQM process places an obligation on all local authorities to regularly review and assess air quality in their areas, and to determine whether or not the air quality objectives are likely to be achieved. Where exceedences are considered likely, the local authority must then declare an Air Quality Management Area (AQMA) and prepare an Air Quality Action Plan (AQAP) setting out the measures it intends to put in place in pursuit of the objectives.

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

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

1.3 Air Quality Objectives

The air quality objectives applicable to LAQM in **Scotland** are set out in the Air Quality (Scotland) Regulations 2000 (Scottish SI 2000 No 97), the Air Quality (Scotland) (Amendment) Regulations 2002 (Scottish SI 2002 No 297), and are shown in Table 1.1. This table shows the objectives in units of microgrammes per cubic metre $\mu\text{g}/\text{m}^3$ (milligrammes per cubic metre, mg/m^3 for carbon monoxide) with the number of exceedences in each year that are permitted (where applicable).

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

Pollutant	Air Quality Objective		Date to be achieved by
	Concentration	Measured as	
Benzene	16.25 µg/m ³	Running annual mean	31.12.2003
	3.25 µg/m ³	Running annual mean	31.12.2010
1,3-Butadiene	2.25 µg/m ³	Running annual mean	31.12.2003
Carbon monoxide	10 mg/m ³	Running 8-hour mean	31.12.2003
Lead	0.50 µg/m ³	Annual mean	31.12.2004
	0.25 µg/m ³	Annual mean	31.12.2008
Nitrogen dioxide	200 µg/m ³ not to be exceeded more than 18 times a year	1-hour mean	31.12.2005
	40 µg/m ³	Annual mean	31.12.2005
Particulate Matter (PM ₁₀) (gravimetric)	50 µg/m ³ , not to be exceeded more than 7 times a year	24-hour mean	31.12.2010
	18 µg/m ³	Annual mean	31.12.2010
Sulphur dioxide	350 µg/m ³ , not to be exceeded more than 24 times a year	1-hour mean	31.12.2004
	125 µg/m ³ , not to be exceeded more than 3 times a year	24-hour mean	31.12.2004
	266 µg/m ³ , not to be exceeded more than 35 times a year	15-minute mean	31.12.2005

1.4 Summary of Previous Review and Assessments

As established by the Environment Act 1995 Part IV, all local authorities in the UK are under a statutory duty to undertake an air quality assessment within their area and determine whether they are likely to meet the air quality objectives for a number of pollutants. The process of review and assessment of air quality undertaken by local authorities is set out under the Local Air Quality Management (LAQM) regime and involves a phased three yearly assessment of local air quality. Where the results of the review and assessment process highlight that problems in the attainment of health-based objectives for air quality will arise, the authority is required to declare an Air Quality Management Area (AQMA) – a geographic area defined by high levels of pollution and exceedences of health-based standards.

The LAQM regime was first set down in the 1997 National Air Quality Strategy (NAQS) and introduced the idea of local authority 'Review and Assessment'. The Government and Devolved Administrations subsequently published policy and technical guidance related to the review and assessment processes in 1998. This guidance has since been reviewed and the latest documents include Policy Guidance (LAQM.PGS (09)) and Technical Guidance (LAQM.TG (09)). The guidance lays down a progressive, but continuous, framework for the local authorities to carry out their statutory duties to monitor, assess and review air quality in their area and produce action plans to meet the air quality objectives.

A summary of the conclusions of previous rounds of review and assessment are presented in **Table 1.2** below. A map of the boundary of the Air Quality Management Area for nitrogen dioxide (NO₂) and particulate matter (PM₁₀) is shown in **Figure 1.1** below.

Table 1.2 Summaries of Review and Assessment Reports

REVIEW & ASSESSMENT REPORTS	BRIEF SUMMARY of OUTCOMES
Stage 1 (1998)	The principle conclusion of Dundee City Council's Stage 1 report was that it was necessary to proceed to the next stage of assessment for all seven of the key LAQM pollutants (nitrogen dioxide (NO ₂), particulate matter (PM ₁₀), lead, carbon monoxide (CO), benzene, 1,3-butadiene and sulphur dioxide(SO ₂)). The chief reasons for this conclusion were a lack of available information relating to potentially significant traffic and industrial pollution sources within the city.
Stage 2 (2000)	Additional monitoring was carried out and additional information was obtained concerning industrial and traffic sources. Screening assessments incorporating this new information were carried out in accordance with national guidance and concluded that the National Air Quality Standards and Objectives (NAQS) would be achieved in Dundee.

REVIEW & ASSESSMENT REPORTS	BRIEF SUMMARY of OUTCOMES
Updating and Screening Assessment (2003)	<p>The imposition of stricter pollutant thresholds, changes in the technical guidance and methodologies for assessment led to an investigation of new areas. This review concluded that the NAQS for carbon monoxide, benzene, 1,3-butadiene and lead would be achieved. It was also concluded that a detailed assessment would be required as a result of potential exceedences of the NAQS for NO₂ and PM₁₀ at busy roads and junctions and to investigate the likelihood of exceedences of the NAQS for sulphur dioxide at new residential premises introduced close to an industrial source.</p>
Detailed Assessment (2005)	<p>The detailed assessment of NO₂ and PM₁₀ from traffic sources identified exceedences of the NAQS annual mean standard for NO₂ at relevant receptors in the city centre and along the north-west arterial route.</p> <ul style="list-style-type: none"> • NO₂ - the detailed assessment established the need for Dundee City Council to declare an Air Quality Management Area (AQMA), carry out a further assessment of NO₂ and develop an Action Plan to try and reduce pollution levels in exceedence areas. • PM₁₀ -there was insufficient confidence in the modelled results for 2010 and it was concluded that additional monitoring and modelling would be required to determine whether an AQMA was also required for PM₁₀. • SO₂ -the detailed assessment concluded that the NAQS would be achieved at new residential developments introduced close to an industrial source and that an AQMA was not required for this pollutant.
Progress Report (2005)	<p>2004 monitoring data and new local developments with the potential to affect air quality were assessed in accordance with statutory guidance and the conclusions reached were:</p> <ul style="list-style-type: none"> • Benzene - no AQMA required for Benzene, as a result monitoring was discontinued. • NO₂ - identified additional areas of exceedence of the NO₂ annual mean at relevant receptors on the north-west arterial route. 22 exceedences of the hourly mean NAQS for NO₂ were recorded at the Lochee Road monitoring site. 18 of the 22 occurred during water main rehabilitation works which caused traffic congestion in the vicinity of the monitor. The results were not thought to be representative of the ambient conditions in the area and no AQMA was considered necessary at that time. • PM₁₀ - the results for 2004 indicated that the 2004 and 2010 NAQS for PM₁₀ would be achieved at the Broughty Ferry Road and background monitoring sites. Exceedences of the 2010 annual mean and daily mean NAQS were recorded at the Union Street monitoring location. These were investigated and it was considered that low data capture, local demolition works and the temporary re-routing of buses along Union St during the construction of a bus-interchange in Whitehall St has contributed to these exceedences and the monitored concentrations did not represent the normal ambient concentrations. • SO₂ - monitoring indicated that no AQMA was required.

REVIEW & ASSESSMENT REPORTS	BRIEF SUMMARY of OUTCOMES
Updating and Screening Assessment (2006)	<p>The Updating and Screening Assessment (USA) 2006 marked the beginning of the third round of review and assessment and required the re-examination all of the seven LAQM pollutants. 2005 data and any significant changes in pollutant sources and public exposure to pollutants were examined in accordance with statutory guidance. The conclusions reached were:</p> <ul style="list-style-type: none"> • that the NAQS for CO, benzene, 1,3-butadiene, lead and SO₂ would be achieved and hence no detailed assessment would be needed. • NO₂ - the report confirmed the need for the AQMA for NO₂ (which was declared for the whole city in July 2006) and identified an additional exceedence area in the city centre, one of the main bus corridors (Meadowside). • PM₁₀ - the report concluded that the only monitored PM₁₀ concentrations predicted to breach the annual mean NAQS for 2010 was the monitoring location in Union Street this was investigated and it was determined that major construction projects in the vicinity might have had an influence on the levels recorded and these may not be truly represent ambient concentrations at this location.
Progress Report (2007)	<p>2006 monitoring data and new local developments with the potential to affect air quality were assessed in accordance with statutory guidance and the conclusions reached were:</p> <ul style="list-style-type: none"> • NO₂ - analysis of the 2006 data re-confirmed the need for the AQMA and the development of an Action Plan. Two new areas of potential exceedence of the annual mean NAQS were identified on the north-east arterial route. (Kingsway/Forfar Road and Albert Street/Arbroath Road). • PM₁₀ - Dundee City Council operate a local Partisol/TEOM co-location study which allows a local gravimetric correction factor to be calculated. This was used to correct TEOM and Osiris data in the monitoring network. Using this factor, exceedences of the 2010 PM₁₀ NAQS were predicted at the following monitoring locations in the city centre and the north-west arterial route: <ul style="list-style-type: none"> • Victoria Road / Hilltown Junction, Seagate, Logie Street, and Lochee Road. • The Union Street site was also very close to exceeding the annual mean for 2010 and remains an area of concern due to increasing PM₁₀ at this city centre location. There were also potential exceedences of the daily mean NAQS predicted at the Osiris monitoring locations. The 2006 PM₁₀ monitoring results indicated that a detailed assessment would be required for PM₁₀. • SO₂ - the monitoring results for 2006 indicate that all NAQS objectives were met at the monitoring locations in Dundee. Exceedences of the 15min mean NAQS occurred at the Broughty Ferry Road site, these were well below the 35 exceedences allowed and were thought to have been caused by certain shipping movements and activities. A detailed assessment of this pollutant was not required, but monitoring data would be kept under review.

REVIEW & ASSESSMENT REPORTS	BRIEF SUMMARY of OUTCOMES
<p>Further Assessment of Nitrogen Dioxide and Detailed Assessment of Particulate Matter PM₁₀ (2009)(FA/DA)</p>	<p>The FA/DA combined the detailed assessment of PM₁₀ with a further assessment of both NO₂ and PM₁₀. It examined the 2007 monitoring data and established the main sources of pollution in the exceedence areas and the reduction in pollutant levels necessary to meet the NAQS. The report confirmed the need for the existing AQMA for NO₂ and concluded that an AQMA should be declared for PM₁₀. The report also estimated that 4,600 people were living in areas at risk of exceeding the NAQS for NO₂ and PM₁₀ and concluded that significant reductions in pollutant concentrations are required to meet the annual mean NAQS for both pollutants. The results of the source apportionment exercise are summarised below:</p> <ul style="list-style-type: none"> • Source apportionment of NO_x, indicates road traffic emissions of NO_x are the main contribution to total NO_x concentrations, as they account for 74 - 91% of the total NO_x concentrations at receptors. Heavy-duty vehicles (HDVs) contribute around 38 - 77% to the total NO_x concentrations at receptors and exceed the LDV contributions. HDV contributions are disproportionately high given their proportion within the vehicle fleet in the AQMA. • Source apportionment of PM₁₀, indicates background sources of PM₁₀ (e.g. sea salt) make a significant contribution to total PM₁₀ concentrations, as they account for 28-59% of the total PM₁₀ concentrations at receptors, with the majority of this being made up of secondary particulates, residual and salt contributions. Road traffic contributes 41% to 72% of the total PM₁₀ concentration at receptors. Light duty vehicles (LDVs) contribute around 7 – 24 and heavy-duty vehicles (HDVs) contribute around 11-36% to the total PM₁₀ concentrations at receptors. Brake and tyre wear contribute around 13-29% to the total PM₁₀ concentrations at receptors. HDV contributions are disproportionately high given their proportion within the vehicle fleet in the AQMA. On Commercial Street and Seagate, where there are significant bus movements, the HDV contribution exceeds the LDV contribution. <p>(HDV - is a collective term for heavy goods vehicles (HGV) and buses)</p>
<p>Updating and Screening Assessment 2009 (2010)</p>	<p>The Updating and Screening Assessment (USA) 2009 marked the beginning of the fourth round of review and assessment and required the re-examination all of the seven LAQM pollutants. This was carried out in accordance with revised statutory guidance and examined 2008 data and any significant changes in pollutant sources and public exposure to pollutants. The conclusions reached were:</p> <ul style="list-style-type: none"> • that the NAQS for CO, benzene, 1,3-butadiene, lead and SO₂ would be achieved and hence no detailed assessment would be needed. <p>NO₂ - the report re-confirmed the need for the AQMA for NO₂ (which was declared for the whole city in July 2006) and identified an additional potential annual mean exceedence area in Strathmore Avenue. Diffusion tube monitoring also indicated potential exceedences of the hourly mean NAQS in the vicinity of Victoria Road / Meadowside junction and informed the need for automatic monitoring to investigate whether an additional AQMA is required for hourly mean NAQS for NO₂. Monitoring programmed to begin in 2011.</p>

REVIEW & ASSESSMENT REPORTS	BRIEF SUMMARY of OUTCOMES
	<ul style="list-style-type: none"> • PM₁₀ - the report noted that monitored PM₁₀ concentrations at Lochee Road and Seagate breach the annual mean NAQS for 2010. Combined with the predicted exceedences of the 2010 PM₁₀ annual mean in the FA/DA, it was concluded that an AQMA should be declared. Consequently, the 2006 AQMA order was amended in October 2010 to include PM₁₀. • the revised statutory guidance contained a new requirement to review and assess biomass combustion sources. The review did not identify any sources within the local authority area that met the criteria for assessment. However, it was considered there was insufficient information available to adequately assess these sources. This will be reported in subsequent review and assessment reports as information becomes available.
Progress Report 2010	<p>2009 monitoring data and new local developments with the potential to affect air quality were assessed in accordance with statutory guidance and the conclusions reached were:</p> <p>SO₂ - New monitoring data for 2010 show the objectives for SO₂ are being achieved. Sulphur dioxide concentrations measured at the Broughty Ferry Road monitoring location remained low and achieved the objectives during 2009.</p> <p>PM₁₀ - PM₁₀ objectives for 2004 are being met at all monitoring locations within the city. However, there is a risk of exceedence of the 2010 PM₁₀ annual mean objective being exceeded at roadside sites. The 2010 PM₁₀ daily mean was also exceeded at the monitoring location in Seagate using the VCM corrected data, but not when the local gravimetric correction factor was applied to the data. Osiris monitoring units have a tendency to over-estimate the number of exceedences compared to TEOMs. The council intend to install a reference equivalent PM₁₀ analyser in this area, and the need for a detailed assessment or AQMA in relation to the daily mean will be kept under review. A detailed assessment undertaken in 2009 for PM₁₀, also identified a risk of exceedence of the 2010 objectives at receptors adjacent to busy roads and junctions in the city centre</p> <p>NO₂ - Exceedences of the nitrogen dioxide annual mean objective continued to occur within the existing AQMA in 2009 and, after façade projections were calculated, concentrations at fourteen sites failed to meet the annual mean standard. Uncertainties associated with the distance calculator tool used to estimate pollutant concentrations at façade suggest that Strathmore Avenue may be a new potential area of exceedence; this will be kept under review.</p>
Progress Report 2011	<p>This Progress Report presented the 2010 NO₂, PM₁₀ and SO₂ monitoring results. Trends in pollutant concentrations were also examined within the report.</p> <p>Nitrogen dioxide (NO₂) – analysis of the 2010 data for nitrogen dioxide has reconfirmed the need for the AQMA and development of an Action Plan. One new area of potential exceedence of the annual mean has been identified at Strathmore Avenue.</p> <p>Sixty-seven exceedences of the NO₂ hourly mean were recorded at</p>

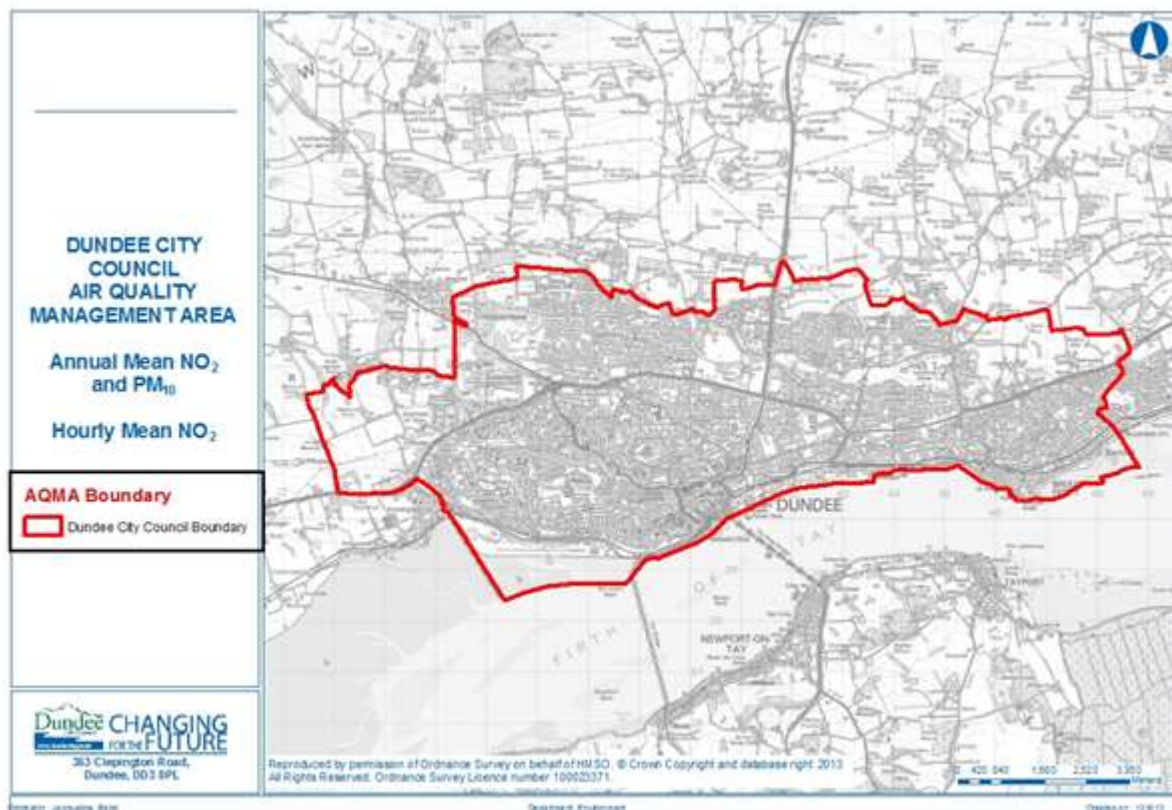
REVIEW & ASSESSMENT REPORTS	BRIEF SUMMARY of OUTCOMES
	<p>the automatic monitoring station on Lochee Road; this breaches the NAQS objective as only 18 are allowed. Analysis suggests this may have occurred as a result of traffic congestion caused by severe winter weather at the end of 2010. The need for a detailed assessment / AQMA for the hourly NO₂ will be kept under review.</p> <p>NO₂ annual mean concentrations throughout the city have increased since the AQMA was declared in 2006. The greatest increases in pollutant concentrations have been recorded along the city centre bus corridor, the north-west arterial route and associated access roads, major junctions on the Kingsway and at Stannergate Junction, on Broughty Ferry Road.</p> <p>Small Particulates (PM₁₀) - PM₁₀ objectives for 2004 are being met at all monitoring locations within the city. However, the 2010 PM₁₀ annual mean and 24-hour objective are being exceeded at roadside and kerbside Osiris sites. Osiris monitoring units are indicative only and the results should be treated with caution. In Spring 2011 the council installed reference equivalent PM₁₀ analysers in Lochee Road, Seagate and at the Victoria Rd/Meadowside junction, and the need for a detailed assessment or AQMA in relation to the daily mean will be kept under review. A detailed assessment undertaken in 2009 for PM₁₀, also identified a risk of exceedence of the 2010 objectives at receptors adjacent to busy roads and junctions in the city centre.</p> <p>Generally PM₁₀ concentrations between 2006 and 2009 levelled off or were decreasing slightly. However, monitoring locations on the north-west arterial route (Logie Street and Lochee Road) showed a significant increase in PM₁₀ concentrations in 2010.</p> <p>Sulphur Dioxide (SO₂) -The monitoring results for 2010 indicate that all the NAQS objectives were met at the monitoring location in Dundee. A detailed assessment is not currently required for this pollutant.</p> <p>SO₂ concentrations have declined at the Broughty Ferry Road monitoring station between 2002 and 2010; this is thought to be largely due to the introduction of low sulphur fuels at a nearby industrial process in the port. From 2002 to 2006 occasional exceedences of the 15min mean objective were recorded as a result of certain shipping activities/movements within the port.</p>
<p>Updating & Screening Assessment 2012</p>	<p>The Updating and Screening Assessment (USA) 2012 marked the beginning of the fifth round of review and assessment and required the re-examination all of the seven LAQM pollutants. This was carried out in accordance with statutory guidance and examined 2011 data and any significant changes in pollutant sources and public exposure to pollutants.</p> <p>New monitoring data for 2011 confirmed the need for the Air Quality Management Area (AQMA) in relation to exceedences of the NO₂ and PM₁₀ National Air Quality Strategy (NAQS) annual mean objectives and the subsequent Air Quality Action Plan (AQAP). The USA 2012 identified the need to amend the existing AQMA order to include the hourly objective for nitrogen dioxide. The need to include the daily objective for PM₁₀ will be kept under review.</p> <p>The conclusions reached are summarised below:</p>

REVIEW & ASSESSMENT REPORTS	BRIEF SUMMARY of OUTCOMES
	<p>That the NAQS for CO, benzene, 1,3-butadiene, lead and SO₂ would be achieved and hence no detailed assessments of these pollutants were required.</p> <p>NO₂ - Dundee City Council measured concentrations of NO₂ above the annual mean objective at relevant locations within the AQMA, previously declared for NO₂ and PM₁₀ annual mean (i.e. the whole council area). However, uncertainties associated with the distance calculator tool used to estimate NO₂ concentrations at façade suggested that the number of locations where the objective was breached at façade would exceed the number estimated (7). NO₂ annual mean concentrations decreased between 2010 and 2011 at the majority of monitoring locations except Whitehall Street. Throughout the city NO₂ annual mean concentrations have generally increased since the AQMA was declared in 2006. The greatest increases in pollutant concentrations have been recorded along the city centre bus corridor, the north-west arterial route and associated access roads, major junctions on the Kingsway and at Stannergate Junction. In Strathmore Avenue additional monitoring has shown that the potential problem area is highly localised and in 2011 the NO₂ annual mean objective was met at this location.</p> <p>Dundee City Council measured concentrations of NO₂ above the 1-hour objective at one location (Lochee Road) for three consecutive years. This is thought to have occurred as a result of traffic congestion caused by the impact of the severe winter weather on the road network in 2009 and 2010. The winter weather was less severe during 2011 and the number of exceedences was still greater than the 18 allowed (43). In view of the ongoing exceedences of the hourly NO₂ objective at Lochee Road, and the advice of the Scottish Government's consultants¹, it was considered necessary to amend the AQMA order to include the hourly objective (11th March 2013). Despite recording an annual mean in excess of 60 µg/m³, the real-time monitor in Meadowside did not record any exceedences of the hourly objective. However, the new monitoring station was only installed in June 2011 (52.3% data capture) so a true comparison with the hourly objective was not possible. The potential for exceedences of the hourly objective at this location will be kept under review.</p> <p>PM₁₀ objectives for 2004 were met at all locations within the city, however Dundee City Council measured concentrations of PM₁₀ above the 2010 annual mean at Osiris units (Lochee Road, Logie Street, Victoria Road and Seagate), Union Street (TEOM & Osiris) and at two of the new BAMs (Lochee Road and Meadowside). The new BAMs had low data capture in 2011 and the results were annualised. At most locations PM₁₀ concentrations between 2006 and 2009 remained level or decreased slightly. Monitoring locations on the north-west arterial route (Logie Street and Lochee Road) showed a significant increase in PM₁₀ concentrations in 2010 and 2011. Annual mean concentrations also increased in Seagate in 2011 and in Union Street. Road works from May to November in 2011 are thought to have contributed to the annual mean exceedence in Union Street.</p> <p>Only the kerbside Osiris units recorded more than 7 exceedences</p>

¹ Progress Report Appraisal Report PR-648

REVIEW & ASSESSMENT REPORTS	BRIEF SUMMARY of OUTCOMES
	<p>allowed of the 24-hour objective. Osiris units are indicative monitors and have a tendency to over-estimate the number of exceedences, although the doubling of the number of exceedences recorded at Lochee Road and Seagate between 2010 and 2011 is significant. The council installed reference equivalent PM₁₀ analysers (BAMs) in Lochee Road, Seagate and at the Victoria Rd / Meadowside junction during 2011. The data capture at these monitors was low and the number of exceedences recorded did not exceed the 7 allowed but the 98.08th percentile was close to 50 µg/m³ at Meadowside. The need to amend the AQMA order in relation to the daily mean will be reviewed as more data becomes available.</p> <p>SO₂ - New monitoring data for 2011 showed that the NAQS objectives for SO₂ are being achieved. SO₂ concentrations have declined at the Broughty Ferry Road monitoring station between 2002 and 2011; this is thought to be largely due to the introduction of low sulphur fuels at a nearby industrial process in the port. From 2002 to 2006 occasional exceedences of the 15min mean objective were recorded as a result of certain shipping activities/movements within the port; these were well within the number allowed</p>

Figure 1.1 Map of AQMA Boundary



2 New Monitoring Data

2.1 Summary of Monitoring Undertaken

2.1.1 Automatic Monitoring Sites

Dundee City Council carried out automatic monitoring at 17 sites throughout Dundee in 2012. Four of the OSIRIS units used to monitor PM₁₀ were re-located in September 2012. All other stations were operational throughout 2012. Siting automatic monitoring sites in urban areas is problematic and compromises mean that monitors cannot always be situated in the worst case location.

Details and descriptions of the automatic monitoring sites for 2012 are shown in **Figure 2.1**, **Table 2.1** and **Table 2.1a**.

Quality assurance and quality control procedures for automatic monitors are detailed in **Appendix A**.

Figure 2.1 Map of Automatic Monitoring Sites

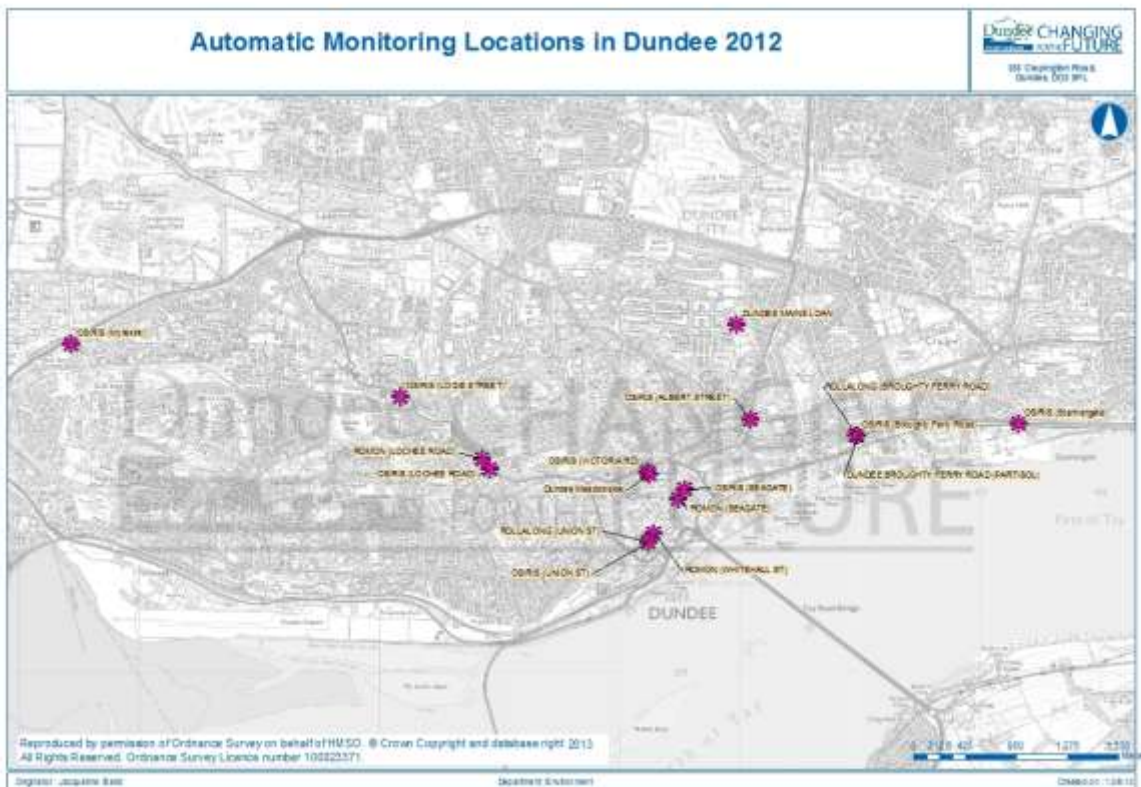


Table 2.1 Details of Automatic Monitoring Sites

Site ID (CM)	Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Inlet Height (m)	Pollutants Monitored	In AQMA? ¹ (Y/N)	Monitoring Technique	Relevant Exposure? (Y/N, with distance (m) from monitoring site to relevant exposure) ³	Distance to Kerb of Nearest Road (m) ⁴ (N/A if not applicable)	Does this Location Represent Worst-Case Exposure? ² ?
3	Broughty Ferry Road Rollalong	Urban Industrial	341970	730977	2.99	SO ₂	Y	UV Fluorescence ^a	Y, 0.00	n/a	No
					2.93	PM ₁₀		TEOM		6.88	
13	Broughty Ferry Road Partisol	Urban Industrial	341971	730978	2.84	PM ₁₀	Y	Partisol	Y, 0.00	n/a 6.11	No
4	Lochee Road Romon	Roadside	338861	730773	1.77	NO ₂	Y	Chemiluminescence ^b	Y, 2.24	1.15	No
					2.06	PM ₁₀		Beta Attenuation (BAM)			
8	Lochee Road Osiris	Kerbside	338920	730693	3.22	PM ₁₀	Y	Osiris (nephthalometer)	Y, 2.20	0.60	Yes
9	Logie Street Osiris	Kerbside	338176	731298	3.31	PM ₁₀	Y	Osiris (nephthalometer)	Y, 1.65	0.57	Yes
12	Mains Loan	Urban Background	340972	731893	1.80	NO ₂	Y	Chemiluminescence ^c	N, 0.00	n/a	No
					1.98	PM ₁₀		TEOM			
5	Seagate Romon	Roadside	340487	730446	1.70	NO ₂	Y	Chemiluminescence ^b	Y, 2.00	1.10	No
					2.06	PM ₁₀		Beta Attenuation (BAM)			
10	Seagate Osiris	Kerbside	340539	730528	2.95	PM ₁₀	Y	Osiris (nephthalometer)	Y, 1.64	0.63	No
2	Union Street Rollalong	Roadside	340235	730091	2.92	NO ₂	Y	Chemiluminescence ^c	Y, 3.55	1.64	Yes
					3.00	PM ₁₀		TEOM		1.75	
7	Union Street Osiris	Roadside	340235	730090	2.99	PM ₁₀	Y	Osiris (nephthalometer)	Y, 2.48	2.59	Yes
11	Victoria Road Osiris	Kerbside	340230	730673	3.28	PM ₁₀	Y	Osiris (nephthalometer)	Y, 2.7	0.30	No
6	Whitehall Street Romon	Roadside	340278	730156	1.80	NO ₂	Y	Chemiluminescence ^b	Y, 1.86	3.26	No
14	Meadowside Romon	Roadside	340243	730653	2.26	NO ₂	Y	Chemiluminescence ^d	Y, 0.42	1.60	Yes
					2.17	PM ₁₀		Beta Attenuation (BAM)		1.63	
15	Albert Street Osiris	Kerbside	341090	731105	3.15	PM ₁₀	Y	Osiris (nephthalometer)	Y, 1.54	0.89	Yes
16	Broughty Ferry Road Osiris	Urban Industrial	341970	730977	3.00	PM ₁₀	Y	Osiris (nephthalometer)	Y, 0m	7.15	No
17	Myrekirk Osiris	Roadside	335438	731740	3.11	PM ₁₀	Y	Osiris (nephthalometer)	Y, 0.4	14.00	Yes
18	Stannergate Osiris	Roadside	343322	731073	3.11	PM ₁₀	Y	Osiris (nephthalometer)	Y, 1.93	1.16	Yes

Notes:

¹The whole of Dundee is an AQMA for NO₂ and PM₁₀

² Explanation provided in Box 3.1 of LAQM.TG(09): *Where results are presented for new monitoring sites, then a description of the sites should be provided. This should include the reason they were set up, for example, to represent worst-case relevant exposure alongside a particular road.*

³ Explanation provided in Box 3.1 of LAQM.TG(09), *When describing sites, it should be made clear whether they represent relevant exposure. For instance, if the site is kerbside, it would be appropriate to say that "the nearest relevant exposure is residential properties set back 5 m from the kerb."*

⁴ 'kerb' is taken as being the edge of the carriageway with flowing traffic

^a Equipment is model ML 9850A

^b Equipment is model ML 9841A

^c Equipment is model Thermo 42i

^d Equipment is model ML 2041

Table 2.1a Description of Automatic Monitoring Sites

Site ID	Site Name	Site Type	Description of automatic monitoring location
3	Broughty Ferry Road Rollalong	UI	On pavement in-line with residential properties adjacent to Broughty Ferry Road , and down-wind of the port and bitumen refinery
13	Broughty Ferry Road Partisol	UI	On pavement in-line with residential properties adjacent to Broughty Ferry Road , and down-wind of the port and bitumen refinery
4	Lochee Road Romon	R	Located on an inclined section of the north-west arterial (A923) route into the city. On pavement north of the junction with Cleghorn Street, canyon-like environment with 4-storey tenements to the east and steeply rising ground to the west. Does not take account of higher traffic flows south of Cleghorn St. There are ground floor flats bordering the pavement at this location & at the more trafficked section south of Cleghorn St.
8	Lochee Road Osiris	K	Discontinued in August 2012. On an inclined section of the north-west arterial route (A923) into the city, canyon-like environment with 5-storey tenements to the east and steeply rising ground to the west, situated between the junctions with Dudhope Terrace and Cleghorn Street. There are ground floor flats bordering the pavement at this location.
9	Logie Street Osiris	K	North-west arterial route (A923) into the city, close to the busy junction with Loons Road. There are first floor flats bordering the pavement at this location.
12	Mains Loan	UB	Located at background location, near playing fields away from busy roads and junctions
5	Seagate Romon	R	Located in a street canyon environment on the main bus corridor through the city centre, bounded on both sides with up to 5 storey tenements. There are ground floor flats bordering the pavement at this location.
10	Seagate Osiris	K	Discontinued in August 2012. Located on the eastern side of a street canyon on the main bus corridor through the city. There are ground floor flats bordering the pavement close to this location.
2	Union Street Rollalong	R	Located in a street canyon environment on the main bus corridor through the city centre, bounded on both sides with 4 storey tenements. There are first floor flats bordering the pavement at this location.
7	Union Street Osiris	R	Discontinued in August 2012. Located in a street canyon environment on the main bus corridor through the city centre, bounded on both sides with 4 storey tenements. There are first floor flats bordering the pavement at this location.
11	Victoria Road Osiris	K	Discontinued in August 2012. Located in a small canyoned section of Victoria Road (A929) an important city centre route and main bus route. There are ground floor flats bordering the pavement at this location
6	Whitehall Street Romon	R	Located in a city centre street canyon environment where there is a main bus interchange and bounded on both sides with 4-5 storey tenements. There are flats at first floor in the street and third floor flats bordering the pavement at the monitoring location.
14	Meadowside Romon	R	Located on the northern side of a street canyon on the main bus corridor, on an incline, near traffic lights and near where traffic exits from a multi-storey car park. There are ground floor flats bordering the pavement at this location
15	Albert Street Osiris*	K	Installed in September 2012, on a steep section of the north-east arterial route (A929) in a street canyon environment bounded on both sides by 4-storey tenements and just uphill from a signalised junction. There are first floor flats bordering the pavement at this location.
16	Broughty Ferry Road Osiris*	UI	On pavement in-line with residential properties adjacent to Broughty Ferry Road , and down-wind of the port and bitumen refinery. Co-located with TEOM and Partisol to provide a local gravimetric correction factor for Osiris units.
17	Myrekirk Osiris*	R	Installed in September 2012, at the Kingsway A90(T)/ Myrekirk roundabout on Dundee's outer-ring road which was reconfigured as part of a new superstore development. Location is approximately in line with nearby residential properties, relative to westbound traffic movements. However, monitor is closer to the junction's north-south movements whereas the residential properties are closer to westbound queues.
18	Stannergate Osiris*	R	Installed in September 2012, at Stannergate Roundabout on the south-eastern arterial route (A930) into the city, which is also the eastern access to the port. Located on lamppost closer to the road than nearby houses.

* new location

2.1.2 Non-Automatic Monitoring Sites

Dundee City Council operates an extensive network of nitrogen dioxide passive diffusion tube monitors throughout the city. These are all located within the AQMA with the majority located close to busy roads and junctions in the city centre, along the main arterial routes and the outer ring road (the Kingsway).

Several new diffusion tubes were added to the network during 2012, at the following locations.

High Street Lochee (ID154)

Diffusion tube monitoring sites had been previously located in this district centre, but had been removed because of continual theft and also the results were consistently below the threshold. A diffusion tube was re-deployed in this area in response to a complaint from a local resident alleging that the recent environmental improvements to the streetscape had led to increased congestion owing to traffic being unable to pass buses when stopped at the bus stop.

Carolina Court (ID155)

This background tube was located south of the A92(T), and downwind of industrial facilities. A developer led monitoring campaign has identified roadside NO₂ concentrations above the annual mean threshold by the trunk road. A new diffusion tube location is planned for 2013 at a distance that is more representative of receptor facades relative to the trunk road.

Whitehall Crescent (McIntyres) (ID161)

Environmental improvements in Union Street meant there was no longer any suitable street furniture or façade locations to replace the tube that was previously located on the south east side of Union Street (Union Street – McIntyres ID65). This tube was positioned at the nearest suitable location. The tube located half way up the east side of Union Street (Union Street- Goodfellows ID64) was also discontinued for the same reason.

St. Andrews Street PB (façade) (ID162)

This tube replaced the previous one at this location St. Andrews Street PB (ID57) which was at a kerbside location.

Meadowside / Bell Street (ID163)

This tube was installed to help determine the extent of the exceedance area in Meadowside. Unfortunately the street sign was removed shortly after installation. A replacement has been installed south of this location in 2013.

Lower Broughty Ferry Road (ID164)

This background tube is in the vicinity of the Stannergate roundabout, a major junction on the south eastern arterial route and close to the eastern port access. This replaced the previous background tube in the area which was unfortunately removed during the road infrastructure improvements to the port access.

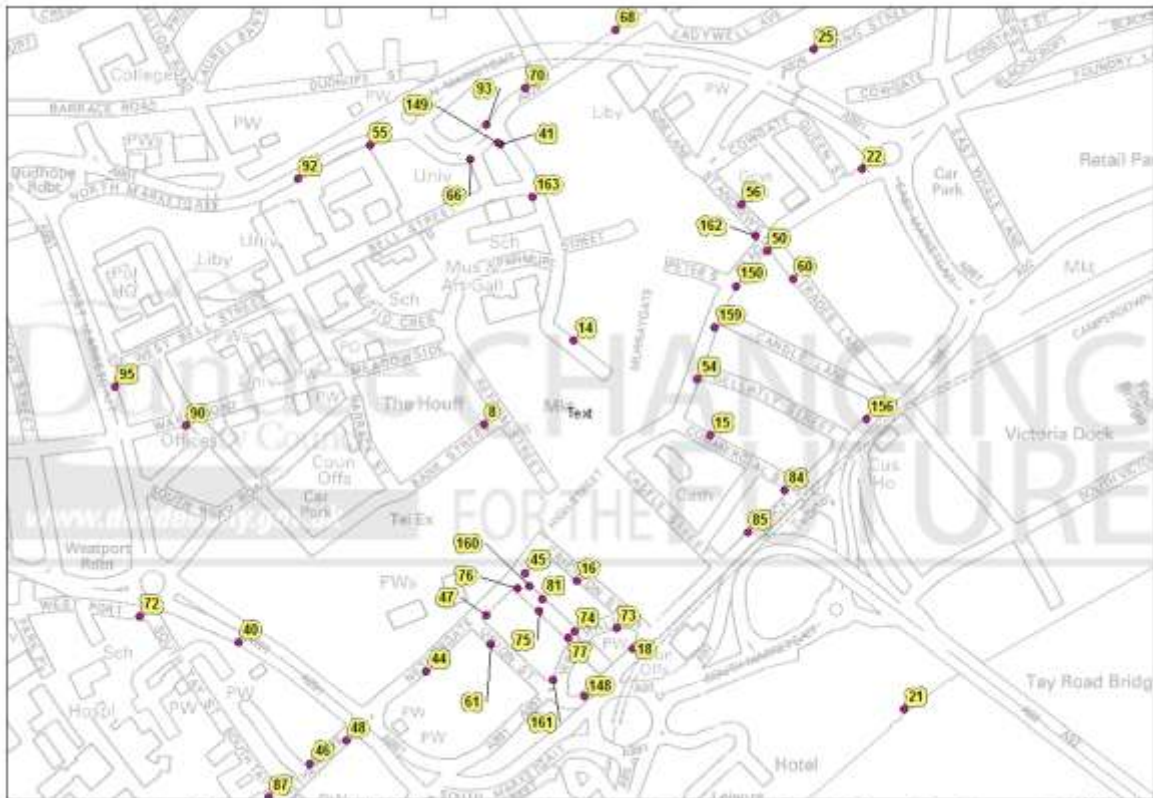
Broughty Ferry Road (59) (2) (ID166)

This replaced the tube Broughty Ferry Road 59 (ID144) when the lamppost it was on was replaced with a new one which is one metre further back from the kerb than the previous location.

Details for each of the diffusion tubes deployed in the network are shown in **Table 2.2**. Maps illustrating the extent of the network are shown in **Figures 2.2a to 2.2c**.

NO₂ diffusion tubes used in Dundee tend to over-read compared to automatic analysers and need to be bias corrected. QA/QC procedures and bias correction methodologies are discussed in **Appendix A**.

Figure 2.2a Map of NO₂ Diffusion Tubes in the City Centre



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Figure 2.2b Map of NO₂ Diffusion Tubes to the East of the City

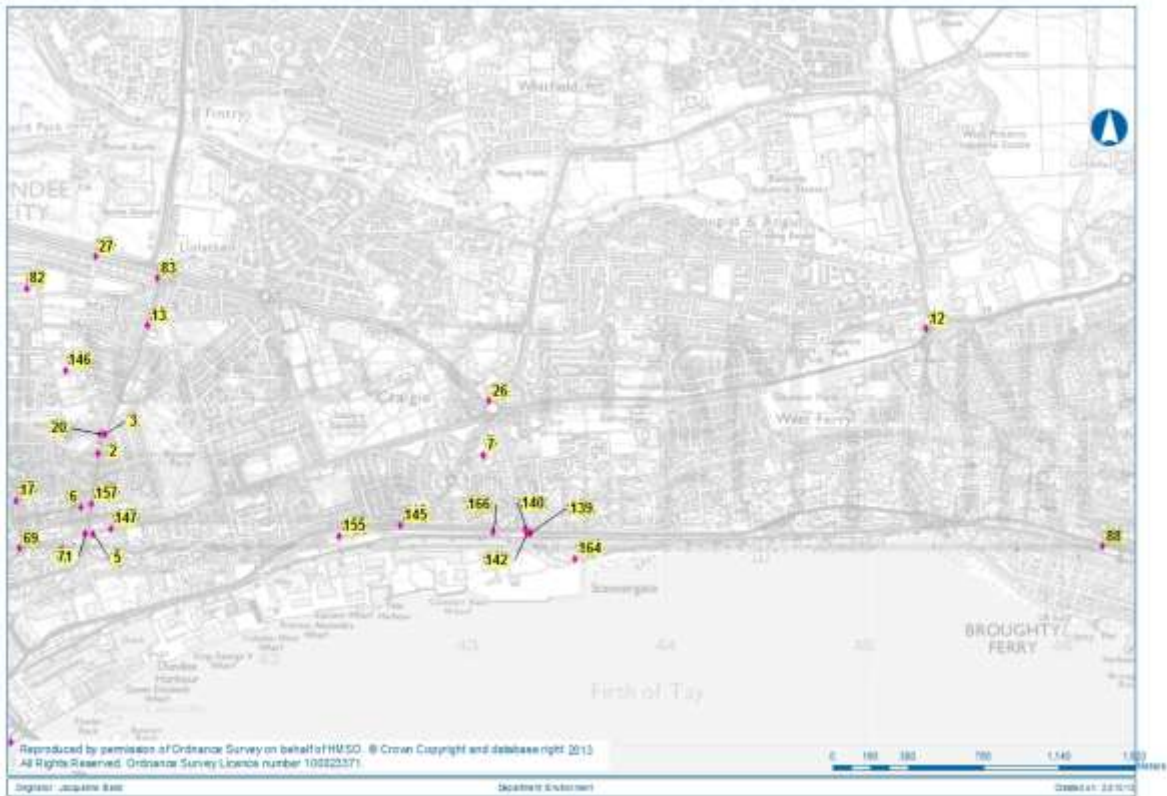


Figure 2.2c Map of NO₂ Diffusion Tubes to the West of the City

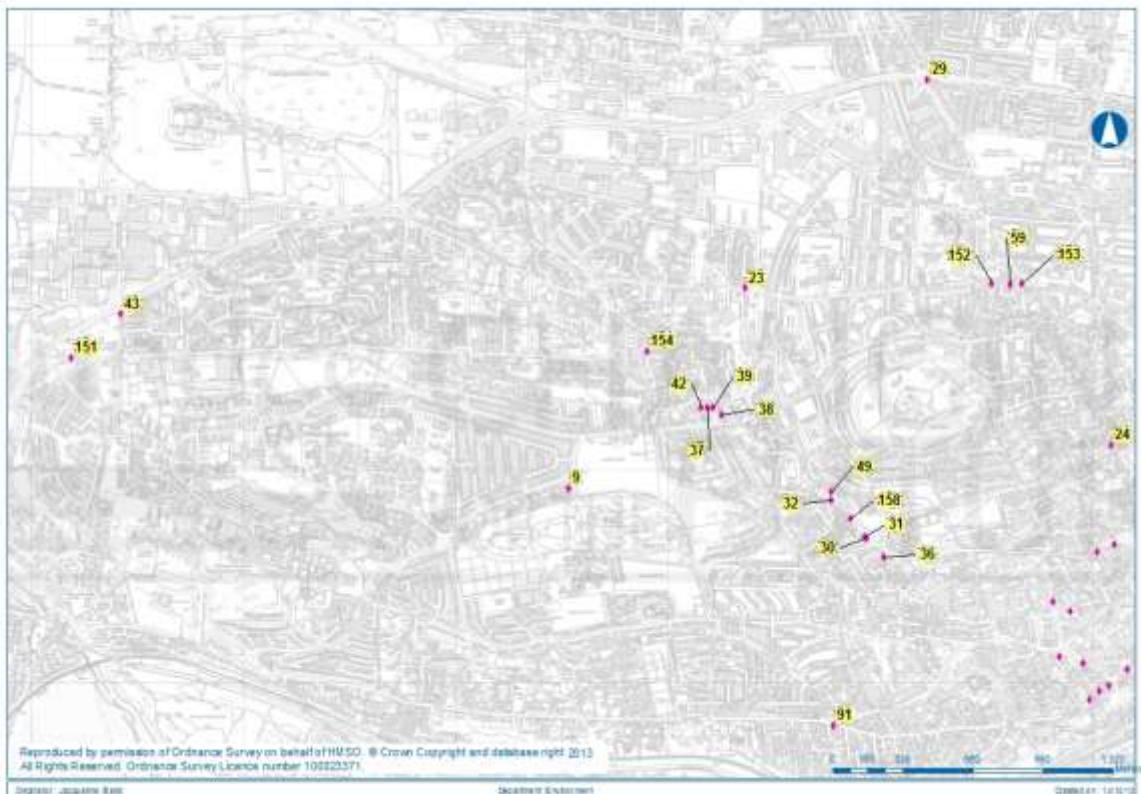


Table 2.2 Details of Non- Automatic Monitoring Sites

Site ID (DT)	Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Site Height (m)	Is Monitoring Co-located with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) from monitoring site to relevant exposure)	Distance to Kerb of Nearest Road (m) (N/A if not applicable)	Does this Location Represent Worst-Case Exposure?*
92	Abertay 2	R	340019	730612	2.36	N	Y (2.01)	1.95	N
157	Albert St (71-73)	K	341106	731223	2.70	N	Y (2.93)	0.91	N
2	Albert Street (Fish)	K	341139	731476	2.74	N	Y (2.27)	0.57	Y
3	Albert Street (Shandon Place)	R	341171	731574	2.74	N	Y (7.57)	1.09	N
5	Arbroath Road (13)	K	341111	731070	2.75	N	Y (2.52)	0.73	Y
147	Arbroath Road 38	K	341202	731097	2.47	N	Y (2.97)	0.50	N
6	Arthurstone Terrace (10)	K	341051	731203	2.66	N	Y (1.75)	0.89	Y
7	Balgavies Place	UB	343082	731465	2.44	N	N	n/a	N
8	Bank St/ Reform St -New Site	K	340228	730337	2.53	N	Y (1.31)	0.51	Y
9	Birnam Place	UB	337531	730914	2.63	N	N	0.47	N
145	Broughty Ferry Rd - Greendykes	R	342662	731112	2.44	N	Y (7.72)	4.10	N
139	Broughty Ferry Rd 141 (Downpipe)	R	343317	731072	2.44	N	Y (0.2)	4.32	Y
142	Broughty Ferry Rd 141 (Street sign)	R	343302	731075	2.32	N	Y (0.2)	3.82	N
140	Broughty Ferry Rd Post Box (Opp. 141) Lp66	R	343297	731096	2.59	N	Y (8.5)	2.10	N
11	Broughty Ferry Road (141)	R	343322	731073	2.69	N	Y (1.98)	1.32	Y
166	Broughty Ferry Road Lampost 59 (2)	R	343129	731081	2.69	N	Y (4.53)	2.97	N
164	Broughty Ferry Road - Lower	UB	343545	730942	2.57	N	N	3.15	N

Dundee City Council

Site ID (DT)	Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Site Height (m)	Is Monitoring Co-located with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) from monitoring site to relevant exposure)	Distance to Kerb of Nearest Road (m) (N/A if not applicable)	Does this Location Represent Worst-Case Exposure?*
155	Carolina Court	UB	342353	731058	2.44	N	N	0.56 (33.34 to the A92(T))	N
12	Claypotts Junction	R	345315	732103	2.47	N	Y (3.3)	8.30	N
13	Clelington Road/Forfar Road	K	341385	732121	2.66	N	Y (8.28)	0.78	Y
14	Commercial St	K	340328	730431	2.74	N	Y (2.9)	0.57	Y
84	Commercial St / Dock St 2	R	340565	730263	2.73	N	Y (0.17)	2.78	Y
15	Commercial Street (Waterstones)	R	340481	730325	2.80	N	Y (2.04)	2.60	Y
16	Crichton St	K	340331	730162	2.53	N	Y (4.08)	0.53	Y
17	Dens Road Crossing	R	340725	731238	2.67	N	Y (2.49)	1.20	Y
18	Dock St (14) Sheridans	K	340395	730086	2.80	N	Y (3.24)	0.78	Y
85	Dock St Carol Whyte (2)	R	340524	730216	2.39	N	Y (0.34)	5.13	Y
156	Dock Street - 57	R	340656	730343	2.51	N	Y (3.25)	2.53	N
148	Dock Street - Tay Hotel	K	340340	730033	2.50	N	Y (3.24)	0.92	N
20	Dura Street (Forte)(No.98)	K	341150	731576	2.58	N	Y (1.65)	0.57	N
21	Earl Grey Place (Park)	UB	340699	730019	2.70	N	N	n/a	N
22	Eastport Roundabout	R	340651	730623	2.69	N	Y (1.56)	1.00	Y
83	Forfar Road	K	341437	732360	2.57	N	Y (7.68)	0.67	Y
23	Harefield Road (35)	K	338360	731855	2.55	N	Y (11.75)	0.53	Y
154	High Street - Lochee	R	337900	731560	2.40	N	Y (2.05)	2.72	N
24	Hilltown (Suites)	R	340088	731116	2.63	N	Y (0.5)	1.66	N
25	King St (12 & 14)	K	340598	730757	2.69	N	Y (1.84)	0.60	Y

Dundee City Council

Site ID (DT)	Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Site Height (m)	Is Monitoring Co-located with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) from monitoring site to relevant exposure)	Distance to Kerb of Nearest Road (m) (N/A if not applicable)	Does this Location Represent Worst-Case Exposure?*
26	Kingsway E. Roundabout	R	343107	731740	2.66	N	Y (14.3)	2.90	N
27	Kingsway/ Mains Loan 1	R	341124	732468	2.56	N	Y (15.4)	6.20	Y
29	Kingsway/ Strathmartine Rd (S)	K	339221	732836	2.94	N	Y (16.8)	0.64	N
30	Lochee Rd (138)	K	338936	730680	2.75	N	Y (2.06)	0.44	N
31	Lochee Rd (140) Traffic Lts	R	338927	730685	2.62	N	Y (0.25)	2.22	Y
32	Lochee Rd (184)	K	338767	730856	2.35	N	Y (3.19)	0.73	Y
158	Lochee Rd (Romon) Average	R	338861	730773	2.04	Y	Y (2.03)	1.34	N
36	Lochee Rd/Polepark Rd	K	339016	730586	2.65	N	Y (9.21)	0.95	Y
37	Logie Street (114)	R	338184	731293	2.70	N	Y (0.53)	1.73	Y
38	Logie Street (98)	K	338252	731258	2.62	N	N	0.84	N
39	Loons Road (1)	R	338211	731293	2.73	N	Y (0.5)	1.90	Y
146	Mains Loan	UB	340972	731893	1.76	N	N	n/a	N
40	Marketgait	R	339953	730094	2.70	N	Y (3.5)	1.30	Y
41	Meadowside	R	340245	730651	2.67	N	Y (1.26)	1.00	Y
163	Meadowside - Bell St.	K	340282	730592	2.34	N	Y (2.53)	0.94	N
149	Meadowside (Romon) Average	R	340243	730653	2.05	Y	Y (0.33)	1.85	Y
42	Muirton Road (6)	R	338152	731293	2.50	N	Y (0.3)	1.11	Y
43	Myrekirk Road	K	335420	731733	2.56	N	Y (16.4)	0.95	N
44	Nethergate (B&B)(88)	K	340163	730061	2.14	N	Y (5)	0.86	Y
45	Nethergate (Bradford)	R	340274	730171	2.65	N	Y (2.51)	1.25	Y
46	Nethergate (Charlie T)	K	340033	729957	2.57	N	Y (1.84)	0.86	Y

Dundee City Council

Site ID (DT)	Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Site Height (m)	Is Monitoring Co-located with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) from monitoring site to relevant exposure)	Distance to Kerb of Nearest Road (m) (N/A if not applicable)	Does this Location Represent Worst-Case Exposure?*
47	Nethergate (Trades House)	R	340230	730124	2.65	N	Y (2.72)	1.26	Y
87	Nethergate / South Tay St	R	339987	729919	2.62	N	Y (0.38)	2.24	Y
48	Nethergate/ Marketgait	R	340074	729984	2.60	N	Y (3.6)	1.33	Y
91	Perth Rd 320	K	338776	729798	2.55	N	Y (3.78)	0.42	Y
88	Queen Street - Broughty Ferry	R	346207	731007	2.53	N	Y (0)	2.85	Y
49	Rankine St (2)	R	338768	730900	2.70	N	Y (0.4)	1.76	Y
50	Seagate	R	340545	730532	2.80	N	Y (0.19)	1.94	N
159	Seagate (Romon) Average	R	340487	730446	1.73	Y	Y (1.81)	1.29	N
54	Seagate (Yates)(7-9)	R	340467	730388	2.84	N	Y (0.9)	1.70	N
150	Seagate 95-97	R	340511	730492	1.97	N	Y (0.19)	2.39	Y
55	Soapwork Lane	R	340099	730650	2.77	N	Y (as facade)	3.51	Y
151	South Road - Denbank	R	335188	731528	2.36	N	Y (0.28)	1.79	Y
56	St Andrews St (Jaf)	K	340516	730584	2.69	N	Y (1.77)	0.71	Y
162	St. Andrews St PB (facade)	R	340532	730548	2.52	N	Y (0.18)	2.53	Y
152	Strathmore Avenue - 337	K	339522	731875	2.47	N	Y (1.45)	0.55	N
153	Strathmore Avenue - Ped X	R	339667	731878	2.39	N	Y (0.95)	1.05	N
59	Strathmore Avenue (353)	K	339609	731871	2.69	N	Y (1.45)	0.67	Y
60	Trades Lane (31)	K	340575	730500	2.69	N	Y (1.82)	0.44	Y
61	Union St (Rollalong) Average	R	340235	730091	2.66	Y	Y (3.25)	1.20	Y
66	Victoria Road	R	340212	730633	2.33	N	Y (3)	1.22	Y

Dundee City Council

Site ID (DT)	Site Name	Site Type	X OS Grid Reference	Y OS Grid Reference	Site Height (m)	Is Monitoring Co-located with a Continuous Analyser (Y/N)	Relevant Exposure? (Y/N with distance (m) from monitoring site to relevant exposure)	Distance to Kerb of Nearest Road (m) (N/A if not applicable)	Does this Location Represent Worst-Case Exposure?*
68	Victoria Road (60)	R	340375	730779	2.73	N	Y (0.56)	2.18	Y
93	Victoria Road (Osiris)	K	340230	730673	2.55	N	Y (2.7)	0.30	Y
69	Victoria Road / Cotton Road	K	340740	730996	2.76	N	Y (1.3)	0.82	Y
70	Victoria Road/Hilltown	R	340274	730714	2.77	N	Y (2.01)	1.15	N
71	Victoria St / Albert Street	K	341071	731072	2.58	N	Y (1.7)	0.75	Y
90	Ward Road	R	339893	730336	2.68	N	Y (72)	2.24	Y
95	West Marketgait	K	339814	730380	2.72	N	Y (2.34)	0.67	Y
72	Westport (2)	R	339842	730122	2.62	N	Y (2.5)	0.46 (12m to W.M'tgait)	Y
73	Whitehall Cr (Xpresso)	K	340376	730109	2.62	N	Y (3)	0.88	Y
161	Whitehall Crescent - (McIntyres)	K	340305	730051	2.54	N	Y (4.78)	0.64	N
74	Whitehall St (Brj)	K	340330	730106	2.76	N	Y (3.57)	0.78	Y
75	Whitehall St (Bus)	R	340289	730128	2.58	N	Y (3.17)	2.51	N
76	Whitehall St (Deb A)	K	340265	730153	2.68	N	Y (5.57)	0.88	N
77	Whitehall St (Deb E)	K	340322	730098	2.65	N	Y (4.55)	0.75	Y
160	Whitehall St (Romon) Average	R	340278	730156	1.79	Y	Y (1.65)	3.49	N
81	Whitehall St (Tiso)	R	340293	730142	2.78	N	Y (2.67)	3.00	Y
82	Woodside Avenue	UB	340776	732307	2.59	N	N	0.55	N

Notes:

The whole of Dundee is an AQMA for NO2 & PM10

K= kerbside (within 1m of a kerb), R=roadside (2-5m from kerb), UB=Urban Background, where 'kerb' is taken as being the edge of the carriageway with flowing traffic.

*The Y/N categories have been assigned on the consideration of exposure over the annual mean averaging period. However - some sites serve a dual purpose i.e. there may also be reason to assess the 1hrly exposure. Consequently it is possible for some city sites to be 'N' for Annual mean because they aren't at facade - but 'Y' for 1hrly because members of the public could be present for 1hr.

2.2 Comparison of Monitoring Results with Air Quality Objectives

2.2.1 Nitrogen Dioxide (NO₂)

Automatic Monitoring Data

The 2012 results of the automatic monitoring stations for nitrogen dioxide are shown in **Table 2.3** and **Figures 2.3 – 2.5**, along with results from previous years. None of the automatic monitoring sites had less than 9 months data in 2012 and hence the results did not need to be “annualised” (as described in Box 3.2 of LAQM.TG(09)).

Annual Mean Concentrations

Exceedences of the annual mean NAQS for NO₂ were recorded at four stations in 2012: Lochee Road, Seagate, Whitehall Street and Meadowside. For the second year in a row the highest annual mean NO₂ concentration was recorded at Meadowside. The concentration was lower than in 2012, but this may be attributable to the 14 weeks of traffic restrictions in the street. These are known hotspot locations and are located within an AQMA declared as a result of exceedences of the annual mean. Annual mean concentrations at these locations were still estimated to exceed the standard when predicted to façade using the methodology detailed in Box 2.3 of LAQM.TG(09), i.e. Lochee Road 45.3 µg/m³, Seagate 41.5 µg/m³, Whitehall Street 41.4 µg/m³ and Meadowside 52.1 µg/m³.

Figure 2.3 shows the annual mean NO₂ concentrations at automatic monitoring locations since 2006. Concentrations decreased at all locations between 2011 and 2012 except for Whitehall Street, which showed a significant increase. Concentrations had been below the objective for the previous 3 years but the increase resulted in an exceedence.

Hourly Mean Concentrations

Figure 2.4 shows the number of exceedences of the NO₂ hourly mean objective (200µg/m³) (no more than 18 allowed in a year) at each of the real time monitoring locations in Dundee between 2006 and 2012. This shows that the objective was met at all the monitoring locations except Lochee Road in 2012.

In 2012 the measured data capture was less than 90%, at Seagate, Union Street and Whitehall Street monitors. Therefore it is more appropriate to express short-term concentrations as percentile values that approximate to the permitted number of exceedences. Generally, if the value of the 99.8th percentile is greater than 200 µg/m³, then it is likely that the allowed number of hourly mean exceedences will have been breached. The 99.8th percentile values from 2006 are shown in **Figure 2.5**. Examination of these confirms the only location where the hourly mean objective is breached is Lochee Road.

Severe winter weather in 2009, 2010 and the beginning of 2011 are thought to have contributed significantly to the number of exceedences recorded in these years. The monitoring site is located on the north-west arterial route which can become increasingly congested during severe adverse weather when alternative routes are difficult for drivers to negotiate.

An analysis of the frequency of the 36 exceedences recorded in 2012 is shown in **Figure 2.6**. This shows that the majority of exceedences at this location occur during weekdays at peak times in the winter. The diurnal distribution of hourly exceedences in 2011 data presented in the USA 2012 was wrongly offset by one hour, the 2011 data presented in **Figure 2.6** of this report shows the corrected data.

Table 2.3 Results of Automatic Monitoring for Nitrogen Dioxide: Comparison with Annual Mean and Hourly Mean Objectives

Site ID	Location	Site type	NAQS NO ₂ Objectives & annual data statistics	Annual Results ^{a,b,c}						
				2006	2007	2008	2009	2010	2011	2012
CM 4	Lochee Road	R	Annual mean Objective (40 ug/m ³)	49.0	52.8	52.9	54.2	55.0	58.2	52.9
			Valid data capture for the year (%) (* denotes less than recommended 90%)	63.4*	93.0	92.0	87.5*	94.7	39.2*	96.5
			No. of exceedences of the hourly mean (200ug/m ³), not to be breached >18 times per year	0	0	4	23	67	43	36
			99.8 th Percentile of the hourly means (ug/m ³)	141.0	157.5	175.6	206.2	242.6	241.6	227.8
CM 5	Seagate	R	Annual mean Objective (40 ug/m ³)	43.0	49.1	51.4	48.4	51.0	52.2	47.6
			Valid data capture for the year (%) (* denotes less than recommended 90%)	60.7*	93.9	81.6*	74.3*	80*	80.9*	88.1*
			No. of exceedences of the hourly mean (200ug/m ³), not to be breached >18 times per year	0	1	0	1	0	2	0
			99.8 th Percentile of the hourly means (ug/m ³)	119.0	141.2	141.3	152.8	134.8	156.5	143.9
CM 2	Union Street	R	Annual mean Objective (40 ug/m ³)	39.0	35.8	42.9	45.2	40.0	35.6	31.7
			Valid data capture for the year (%) (* denotes less than recommended 90%)	59.9*	99.3	99.7	99.7	90.7	99.5	84.2*
			No. of exceedences of the hourly mean (200ug/m ³), not to be breached >18 times per year	0	0	11	2	0	0	0
			99.8 th Percentile of the hourly means (ug/m ³)	133.0	132.1	182.3	165.2	141.9	133.1	98.5
CM 6	Whitehall Street	R	Annual mean Objective (40 ug/m ³)	39.8	42.0	46.7	37.8	36.0	34.7	44.4
			Valid data capture for the year (%) (* denotes less than recommended 90%)	85.1*	90.6	75.6*	93.2	88.9*	83.6*	87.1*
			No. of exceedences of the hourly mean (200ug/m ³), not to be breached >18 times per year	0	0	0	0	0	0	0
			99.8 th Percentile of the hourly means (ug/m ³)	106.0	136.8	139.4	111.3	101.1	117.8	136.4
CM 14	Meadowside	R	Annual mean Objective (40 ug/m ³)						66.4	53.9
			Valid data capture for the year (%) (* denotes less than recommended 90%)						52.3*	97.3
			No. of exceedences of the hourly mean (200ug/m ³), not to be breached >18 times per year						0	0
			99.8 th Percentile of the hourly means (ug/m ³)						157.3	169.2
CM 12	Mains Loan	UB	Annual mean Objective (40 ug/m ³)						11.6	9.8
			Valid data capture for the year (%) (* denotes less than recommended 90%)						75.5*	97.3
			No. of exceedences of the hourly mean (200ug/m ³), not to be breached >18 times per year						0	0
			99.8 th Percentile of the hourly means (ug/m ³)						80.7	62.5

Notes ^a All monitoring sites are located within an AQMA for NO₂ and PM₁₀

^b Monitoring period and data capture is for the full calendar year for all monitoring sites

^c Exceedences of the air quality objectives are shown in bold

Results in shaded cells have been period adjusted according to the methodology outlined in Box 3.2 of LAQM.TG(09)

CM = continuous monitor, R = Roadside, UB = Urban Background

Figure 2.3 Annual Mean Nitrogen Dioxide Concentrations at Real-time Monitors from 2006 to 2012

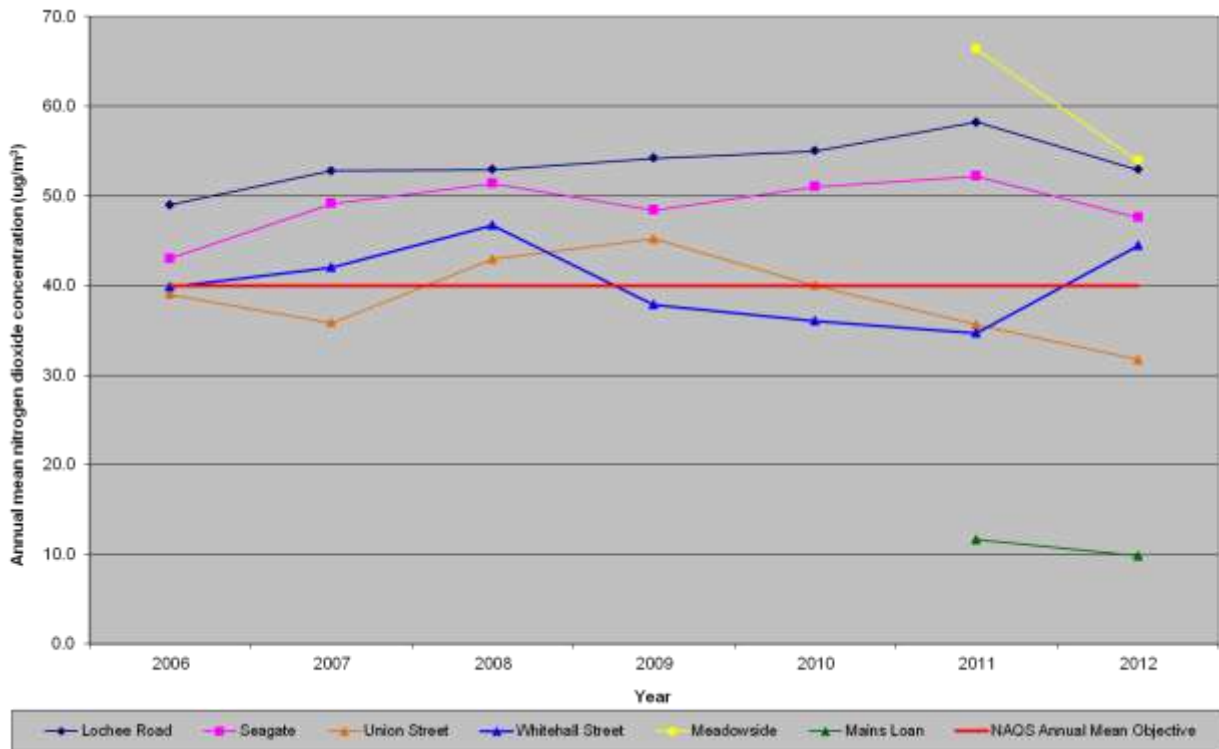


Figure 2.4 Number of Exceedences of the NO₂ Hourly Mean Objective (200µg/m³) (18 Allowed) at Real Time Monitoring Locations in Dundee between 2006 and 2011

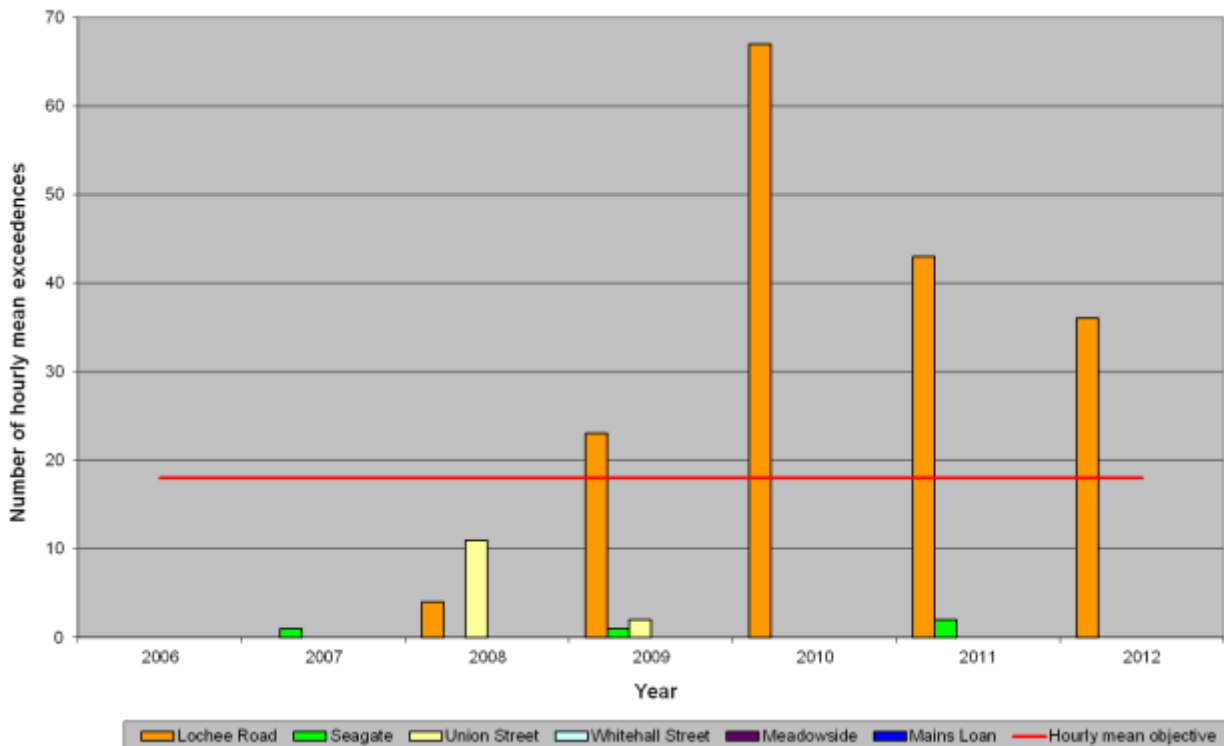
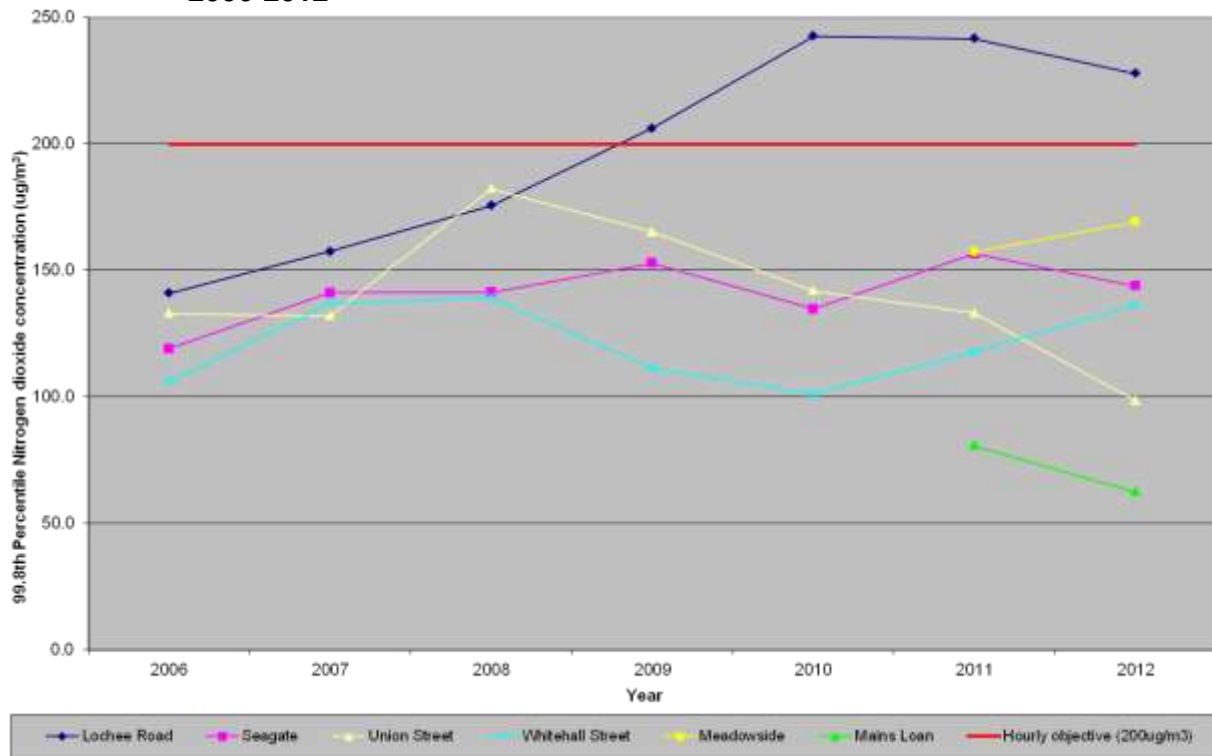


Figure 2.5 Trends in 99.8th Percentile of NO₂ Hourly Mean Objective (200µg/m³) 2006-2012



Further analysis of monitored concentrations is afforded by plotting diurnal profiles of hourly mean concentrations of NO₂ and NO_x for 2012, as shown in **Figure 2.7** (note the different y-axis scales of the graphs). Comparisons can be made between the urban background concentrations (at Mains Loan) and the different roadside locations for the average weekday, Saturday and Sunday. Differences between NO₂ and NO_x concentrations at monitoring locations provide insight into the characteristics of the location and its proximity to sources of combustion and vehicular emissions. Some of the key points to note in **Figure 2.7** are:

- Concentrations of NO₂ and NO_x are higher on weekdays than at weekends,
- In nearly all cases the morning weekday peak is higher than the evening peak, though at Meadowside and Lochee Rd the evening peak is spread over 2 hours,
- Concentrations of NO₂ and NO_x remain elevated for longer overnight on Friday and Saturday nights, particularly for Lochee Rd, and
- The ratio of NO₂ to NO_x is much higher (denoting that most NO_x emissions have converted to NO₂ by the time they reach the monitor) at the background site than at roadside locations. Meadowside and Seagate show the lowest NO₂ conversion ratio.

It is notable that traffic volumes (AADTs) have generally decreased since 2008 in most areas of the city, including Lochee Road, see **Appendix F, Table F3**. Such decreases have not necessarily been accompanied by decreases in concentrations of pollutants measured at roadside. By comparing diurnal profiles of pollutant concentrations with diurnal traffic profiles (where available) it may be possible to gain greater insight into the causes of the pollution and help inform better solutions to local hotspots, in particular at Lochee Road which is currently the only location where the hourly objective is breached.

Figure 2.6 Analysis of the Frequency of Exceedences of the Hourly NO₂ Objective at Automatic Monitoring Site on Lochee Road

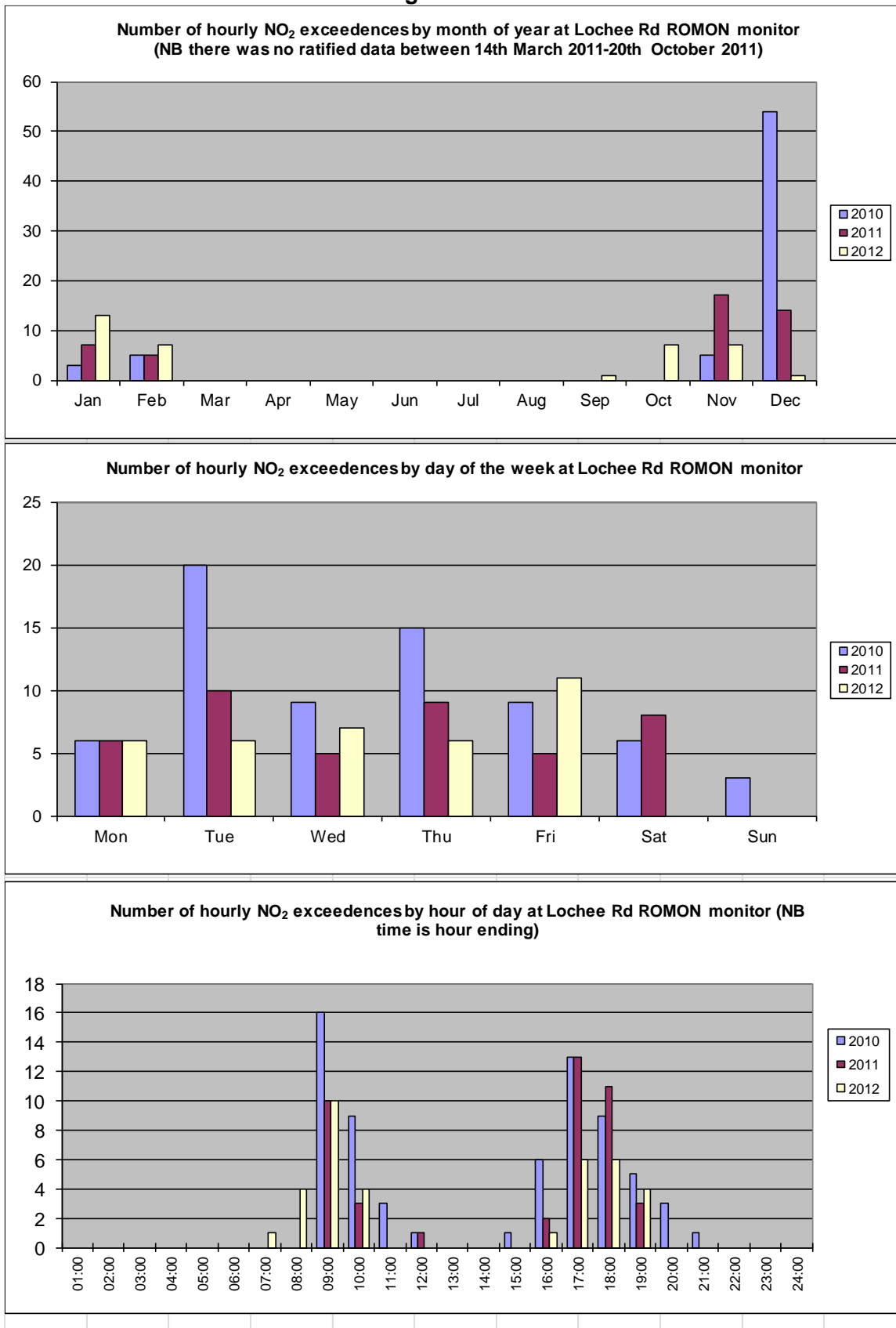
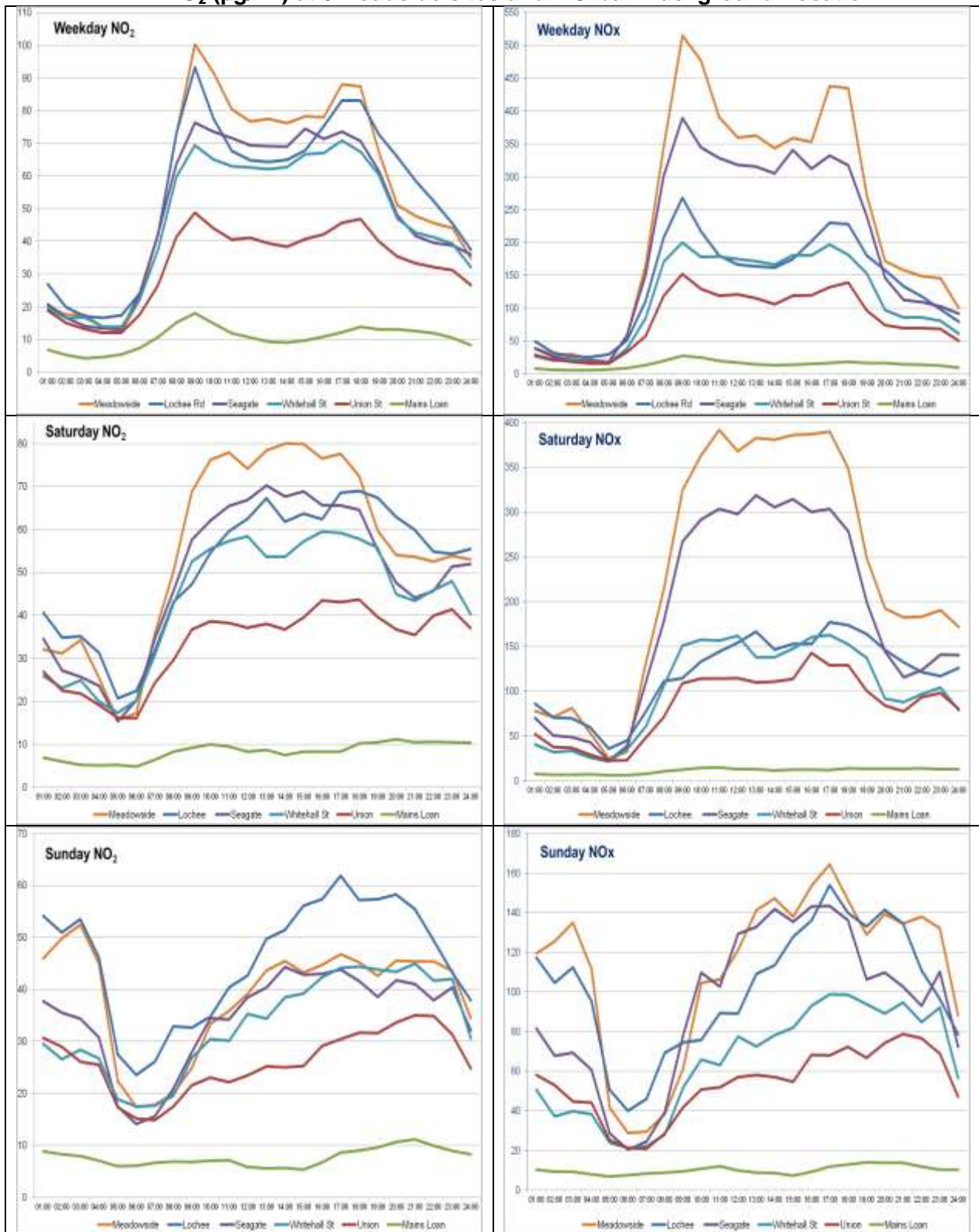


Figure 2.7 Weekday, Saturday and Sunday Diurnal patterns of Hourly mean NO_x & NO₂ (µg/m³) at 5 Roadside sites and 1 Urban Background Location



Notes:
 All GMT monitoring data adjusted for daylight saving (25/3/2012, 01:00 to 28/10/2012, 02:00)
 Times are for hour ending
 Note the different scales on the y-axes

Diffusion Tube Monitoring Data

The nitrogen dioxide diffusion tube results for 2012 are summarised in the **Table 2.4**. The full 2012 dataset (monthly mean values) is included in **Appendix G**. Eleven of the diffusion tube locations had less than 9 months data in 2012 and hence the results needed to be annualised as described in Box 3.2 of LAQM.TG(09). The sites chosen for the annualisation and the resulting factors are detailed in **Appendix A5**. The local bias-correction factor (**0.88**) derived for Dundee sites has been applied to the 2012 results. **Appendix A1-A3** details how the local bias correction factor was derived.

The 2012 data show that concentrations measured at 27 diffusion tube sites exceeded the annual mean NO₂ objective. As the Dundee AQMA encompasses the whole local authority area all of these locations are within the existing AQMA. Further consideration of these sites was made with regard to the likely exposure at nearest residential receptors using the LAQM distance calculator tool. Of these, the predicted concentrations were estimated to exceed the NAQS at receptors at 17 sites. All of these locations are in known areas of exceedence. Uncertainties associated with the distance calculator tool suggest that there are at least a further 14 locations where the objective may be exceeded.

One new potential exceedence area was identified at South Road (Denbank) 36.3 µg/m³ when predicted to façade. This diffusion tube is located on a road used to access / egress Ninewells Hospital and Dundee Technology Park (a Principle Economic Development Area). Significant evening peak time queuing is evident in this location from traffic heading for the Kingsway (outer ring road).

The LAQM.TG(09) guidance considers that there could be a potential risk of breaching the hourly NO₂ standard, where the annual mean NO₂ concentration is greater than (>) 60µg/m³. There were no diffusion tubes with an annual mean NO₂ concentration >60µg/m³ in 2012.

Table 2.4 Results of Nitrogen Dioxide Diffusion Tubes in 2012

Site Type (DT)	Location	x	y	Site Type	Annual mean NO2 conc ($\mu\text{g}/\text{m}^3$) adjusted for bias							2012 Data Capture %	2012 Annual mean NO2 at receptor ($\mu\text{g}/\text{m}^3$)	
					2006 bias (0.78)	2007 bias (0.86)	2008 bias (0.87)	2009 bias (0.83)	2010 bias (0.79)	2011 bias (0.78)	2012 bias (0.88)			
1	Abertay	340047	730629	K	42.5	46.5	48.5							
92	Abertay 2	340019	730612	R				47.2	42.5	40.1	41.5	91.7	37.8	
157	Albert Street (71-73)	341106	731223	K						29.7	30.4	91.7	27.1	
2	Albert Street (Fish)	341139	731476	K	30.0	30.7	32.8	34.7	33.9	29.2	31.7	91.7	28.0	
3	Albert Street (Shandon Place)	341171	731574	R	32.3	34.3	39.0	39.0	38.2	35.1	35.7	91.7	28.6	
4	Albert Street 1	341104	731210	K	32.1	33.0	37.9	37.4	36.0					
5	Arbroath Road (13)	341111	731070	K	37.4	38.0	40.2	45.4	40.8	36.6	39.9	91.7	34.0	
147	Arbroath Road (38)	341202	731097	K						34.6	39.4	91.7	32.4	
6	Arthurstone Terrace (10)	341051	731203	K	22.6	23.1	25.4	25.2	24.9	21.4	22.3	91.7	21.6	
7	Balgavies Place	343082	731465	UB	15.3	17.6	18.9	18.6	19.1	17.1	18.0	91.7	n/a	
8	Bank St/ Reform St	340228	730337	K	26.4	29.4	28.2	30.9	27.7	26.6	28.0	91.7	26.0	
9	Birnam Place	337531	730914	UB	9.6	10.8	11.7	11.0	11.4	9.6	10.4	91.7	n/a	
10	Brook Street (B.F.)	346293	730872	K	21.8	22.9	23.1							
144	Broughty Ferry Rd LP 59	343129	731082	R						22.2				
166	Broughty Ferry Rd LP 59(2)	343129	731081	R							26.1	75.0	24.3	
140	Broughty Ferry Rd (L/P 66)	343297	731096	R						34.2	35.4	91.7	29.1	
139	Broughty Ferry Rd (141 Downpipe)	343317	731072	R						36.5	37.4	91.7	37.2	
11	Broughty Ferry Road (141)	343322	731073	R	35.6	40.4	45.3	46.9	44.2	42.5	44.2	91.7	39.3	
145	Broughty Ferry Rd (Greendykes)	342662	731112	R						32.6	36.2	83.3	31.0	
142	Broughty Ferry Rd (St. Sign)	343302	731075	R						27.3	32.2	91.7	32.0	
141	Broughty Ferry Rd Lower (L/P 5)	343415	730944	UB						17.1				
164	Broughty Ferry Rd - Lower	343545	730942	UB							16.7	66.7	n/a	
155	Carolina Court	342353	731058	UB							22.5	83.3	n/a	
12	Claypotts Junction	345315	732103	R	22.7	24.6	28.0	27.5	29.0	25.4	26.5	91.7	25.6	

Site Type (DT)	Location	x	y	Site Type	Annual mean NO2 conc ($\mu\text{g}/\text{m}^3$) adjusted for bias							2012 Data Capture %	2012 Annual mean NO2 at receptor ($\mu\text{g}/\text{m}^3$)
					2006 bias (0.78)	2007 bias (0.86)	2008 bias (0.87)	2009 bias (0.83)	2010 bias (0.79)	2011 bias (0.78)	2012 bias (0.88)		
13	Cleington Road/ Forfar Road	341385	732121	K	33.5	36.8	38.5	40.7	39.8	34.7	38.0	91.7	29.0
14	Commercial St	340328	730431	K	31.3	33.5	36.2	34.2	31.2	27.8	29.9	91.7	26.3
84	Commercial St/Dock St 2	340565	730263	R	35.6	38.6	41.9	42.2	41.3	37.6	41.2	83.3	40.9
15	Commercial Street (Waterstones)	340481	730325	R	34.9	40.2	47.4	43.2	43.3	38.0	39.5	75.0	36.5
16	Crichton St	340331	730162	K	28.6	31.6	34.0	33.7	31.3	29.0	31.6	83.3	26.7
17	Dens Road Crossing	340725	731238	R	30.2	35.2	36.0	36.6	34.9	31.7	32.8	91.7	29.5
18	Dock St (14)	340395	730086	K	37.1	46.7	43.8	43.1	42.0	36.3	33.1	83.3	28.7
156	Dock St (57)	340656	730343	R						43.4	53.1	91.7	46.1
148	Dock St - Tay Hotel	340340	730033	K							32.9	75.0	28.7
19	Dock St (Unicorn)(No.60)	340659	730348	R	33.3	37.6	40.8	39.6	42.2	36.3			
85	Dock St Carol Whyte (2)	340524	730216	R	36.3	37.8	37.5	38.2	38.3	34.2	40.8	75.0	40.4
20	Dura Street (Forte) (No.98)	341150	731576	K	34.0	39.4	41.6	43.0	41.1	36.4	39.6	91.7	34.5
21	Earl Grey Place (Park)	340699	730019	UB	20.2	20.6	20.7	21.8	23.2	19.4	22.8	91.7	n/a
22	Eastport Roundabout	340651	730623	R	30.5	35.5	35.9	35.2	34.4	33.1	32.0	91.7	29.5
83	Forfar Road	341437	732360	K	40.2	45.7	50.2	52.6	49.1	45.6	50.2	91.7	35.5
23	Harefield Road (35)	338360	731855	K	29.2	32.6	36.0	32.5	29.8	27.7	29.8	91.7	23.7
154	High Street Lochee (106)	337900	731560	R							23.2	75.0	22.5
24	Hilltown (Suites)	340088	731116	R	31.0	33.2	35.4	35.6	34.2	29.5	32.4	91.7	31.6
25	King St (12 & 14)	340598	730757	K	26.4	28.7	30.1	31.1	29.1	26.5	27.2	91.7	25.1
26	Kingsway E. Roundabout	343107	731740	R	33.9	40.0	42.6	44.9	40.7	40.7	40.3	91.7	30.5
27	Kingsway/ Mains Loan 1	341124	732468	R	29.9	34.1	37.8	35.1	36.7	31.3	34.4	91.7	28.2
28	Kingsway/ Pitkerro Rd	341963	732303	R	26.6	30.7	26.7						
29	Kingsway/ Strathmartine Rd (S)	339221	732836	K	37.4	43.3	45.0	43.2	46.3	39.4	45.9	91.7	29.4
30	Lochee Rd (138)	338936	730680	K	45.5	52.6	57.4	56.9	56.9	52.7	53.4	91.7	43.0
31	Lochee Rd (140) Traffic Lts	338927	730685	R	45.3	53.4	57.0	57.2	57.4	51.9	54.8	91.7	53.8
32	Lochee Rd (184)	338767	730856	K	31.9	38.1	39.1	40.2	39.7	36.9	37.6	91.7	31.7
158	Lochee Rd (Romon) mean of 3 tubes	338861	730773	K	39.2	49.2	51.4	51.2	50.4	47.2	48.7	91.7	42.8

Site Type (DT)	Location	x	y	Site Type	Annual mean NO2 conc ($\mu\text{g}/\text{m}^3$) adjusted for bias							2012 Data Capture %	2012 Annual mean NO2 at receptor ($\mu\text{g}/\text{m}^3$)
					2006 bias (0.78)	2007 bias (0.86)	2008 bias (0.87)	2009 bias (0.83)	2010 bias (0.79)	2011 bias (0.78)	2012 bias (0.88)		
36	Lochee Rd/Polepark Rd	339016	730586	K	26.8	30.9	32.3	33.9	33.4	29.0	31.8	91.7	25.7
37	Logie Street (114)	338184	731293	R	46.9	52.2	58.2	57.0	56.9	53.7	54.6	91.7	52.4
38	Logie Street (98)	338252	731258	K	32.7	35.2	34.5	35.0	33.4	31.9	34.5	91.7	31.7
39	Loons Road (1)	338211	731293	R	36.1	39.1	45.3	43.9	44.8	38.4	42.0	91.7	40.7
146	Mains Loan mean of 3 tubes	340972	731893	UB						12.2	15.0	91.7	n/a
40	Marketgait	339953	730094	R	29.3	33.0	35.8	34.7	32.5	30.8	31.1	91.7	27.7
41	Meadowside	340245	730651	R	52.1	61.4	63.5	55.8	57.2	53.0	59.0	91.7	52.4
163	Meadowside - Bell St	340282	730592	K							49.1	25.0	41.3
149	Meadowside (Romon) mean of 3 tubes	340243	730653	R						56.4	56.9	91.7	55.4
42	Muirton Road (6)	338152	731293	R	26.1	28.4	29.2	30.4	30.4	26.5	27.2	91.7	26.7
43	Myrekirk Road	335420	731733	K	27.5	32.9	32.3	35.1	34.9	29.5	34.2	91.7	25.3
44	Nethergate (B&B)(88)	340163	730061	K	40.0	43.1	49.1	48.6	48.1	44.8	50.2	91.7	38.4
45	Nethergate (Bradford)	340274	730171	R	35.8	37.4	43.2	41.9	38.7	38.0	42.3	91.7	36.9
46	Nethergate (Charlie T)	340033	729957	K	34.8	39.1	38.4	38.2	37.5	32.5	35.9	91.7	32.1
47	Nethergate (Trades House)	340230	730124	R	34.5	39.6	44.6	41.8	38.9	38.1	42.5	91.7	36.8
87	Nethergate/South Tay St	339987	729919	R	25.4	29.6	30.1	29.3	29.8	24.4	24.5	25.0	24.3
48	Nethergate/ Marketgait	340074	729984	R	29.8	36.0	35.2	35.4	33.9	30.2	33.5	91.7	29.4
86	Perth Rd / Hawkhill	338742	729828	K	23.5	25.0	22.9						
91	Perth Rd 320	338776	729798	K			36.5	39.9	37.6	36.0	36.3	91.7	29.4
88	Queen St B/F	346207	731007	R			29.8	31.3	30.1	25.1	27.7	91.7	27.7
49	Rankine St (2)	338768	730900	R	31.7	39.9	42.6	44.9	45.5	40.5	44.4	91.7	43.2
50	Seagate	340545	730532	R	39.0	42.3	45.9	44.9	42.3	40.2	39.4	75.0	39.0
150	Seagate 95-97	340511	730492	R						46.2	51.4	91.7	50.8
54	Seagate (Yates)(7-9)	340487	730446	R	35.1	40.5	38.3	41.5	39.4	35.6	38.4	83.3	36.5
159	Seagate(Romon) mean of 3 tubes	340467	730388	K	42.3	47.5	50.8	51.4	48.9	45.0	49.2	91.7	43.6
55	Soapwork Lane	340099	730650	R	29.6	35.0	35.8	36.9	35.4	32.8	34.8	91.7	34.8

Site Type (DT)	Location	x	y	Site Type	Annual mean NO2 conc ($\mu\text{g}/\text{m}^3$) adjusted for bias							2012 Data Capture %	2012 Annual mean NO2 at receptor ($\mu\text{g}/\text{m}^3$)	
					2006 bias (0.78)	2007 bias (0.86)	2008 bias (0.87)	2009 bias (0.83)	2010 bias (0.79)	2011 bias (0.78)	2012 bias (0.88)			
151	South Road (Denbank)	335188	731528	R							34.6	36.9	91.7	36.3
56	St Andrews St (JAF)	340516	730584	K	32.7	34.8	40.4	36.9	36.7	33.5	36.2	91.7	32.2	
57	St Andrews St (PB)	340532	730551	K	35.0	41.5	41.6	41.5	40.4	38.1				
162	St Andrews St PB (façade)	340532	730548	R							38.8	91.7	38.5	
58	St Mary Flats	339039	730624	R	18.4	20.6	19.8							
153	Strathmore Ave - Ped X	339667	731878	R						26.7	29.4	83.3	28.0	
152	Strathmore Avenue - 337	339522	731875	K						29.9	35.0	83.3	31.3	
59	Strathmore Avenue (353)	339609	731871	K	35.0	38.0	42.6	40.3	39.9	35.5	38.8	91.7	34.5	
60	Trades Lane (31)	340575	730500	K	29.2	36.3	33.3	32.8	32.6	29.4	30.4	91.7	27.2	
61	Union St (Rollalong) mean of 3 tubes	340235	730091	R	39.1	43.4	44.7	45.3	40.7	36.2	34.6	91.7	30.3	
64	Union Street (Goodfellows)	340274	730069	K	28.2	32.4	34.1	32.6	32.1	26.9				
65	Union Street (McIntyres)	340293	730051	K	29.0	32.7	33.2	33.5	32.8	28.9				
66	Victoria Road	340212	730633	R	32.1	36.7	38.4	37.5	36.2	30.9	34.2	91.7	30.2	
67	Victoria Road (10)	340225	730667	R	29.7	32.9	34.0							
68	Victoria Road (60)	340375	730779	R	35.2	41.1	43.8	44.0	40.8	38.6	42.2	91.7	40.9	
93	Victoria Road (OSIRIS)	340230	730673	K				38.5	37.5	33.8	36.2	83.3	29.7	
69	Victoria Road / Cotton Road	340740	730996	K	31.3	36.6	37.4	38.1	36.5	34.0	36.7	75.0	33.3	
70	Victoria Road/Hilltown	340274	730714	R	47.8	55.8	60.9	59.5	57.9	52.8	57.9	91.7	49.7	
71	Victoria St/Albert St	341071	731072	K	31.7	34.1	35.2	36.5	35.2	33.8	34.8	91.7	31.2	
90	Ward Rd	339893	730336	R			34.5	35.7	33.3	32.4	30.2	91.7	29.5	
89	West Bell St	339815	730395	R			36.0							
95	West Marketgait	339814	730380	K				44.1	38.2	35.0	37.2	91.7	32.1	
72	Westport (2)	339842	730122	R	33.6	38.9	41.3	42.1	37.5	37.0	37.7	91.7	31.6	
73	Whitehall Cr (Xpresso)	340376	730109	K	27.2	30.3	30.6	30.4	29.5	26.1	37.6	75.0	32.1	
161	Whitehall Cr - McIntyres	340305	730051	K							29.8	91.7	25.5	
74	Whitehall St (Brj)	340330	730106	K	32.2	36.3	37.8	35.8	35.5	33.1	39.7	91.7	32.8	
75	Whitehall St (Bus)	340289	730128	R	42.8	48.6	51.7	48.6	43.4	45.7	49.5	91.7	43.3	

Site Type (DT)	Location	x	y	Site Type	Annual mean NO ₂ conc (µg/m ³) adjusted for bias							2012 Data Capture %	2012 Annual mean NO ₂ at receptor (µg/m ³)
					2006 bias (0.78)	2007 bias (0.86)	2008 bias (0.87)	2009 bias (0.83)	2010 bias (0.79)	2011 bias (0.78)	2012 bias (0.88)		
76	Whitehall St (Deb A)	340265	730153	K	38.5	43.4	50.3	46.9	42.5	41.4	47.3	91.7	36.2
77	Whitehall St (Deb E)	340322	730098	K	32.2	36.9	39.6	38.3	37.1	34.7	37.9	91.7	30.8
160	Whitehall St (Romon) mean of 3 tubes	340278	730156	R	33.2	38.5	42.7	38.9	36.5	36.0	41.6	91.7	39.2
81	Whitehall St (Tiso)	340293	730142	R	34.8	38.8	42.6	40.2	37.1	35.8	39.6	91.7	36.2
82	Woodside Avenue	340776	732307	UB	15.6	18.1	18.5	17.7	17.5	15.4	16.2	91.7	n/a

Notes

- All diffusion tube are located within an AQMA for NO₂ and PM₁₀ annual mean.
- Monitoring period and data capture percentage is for the full calendar year.
- The means shown in the highlighted cells have been “annualised” as in Box 3.2 of LAQM.TG(09), the methodology was detailed in the USA 2009.
- Exceedences of the air quality objectives are shown in bold & red. Orange values denote those at risk of exceeding the objective.
- Definitions and siting criteria for each site type can be found in Box A1.2 (LAQM.TG:09), K=kerbside, R=Roadside, UB=Urban Background.
- If an exceedence is measured at a monitoring site not representative of public exposure, NO₂ concentration at the nearest relevant exposure should be estimated based on the “NO₂ fall-off with distance” calculator (<http://laqm.defra.gov.uk/tools-monitoring-data/no2-falloff.html>), and results should be discussed in a specific section. The procedure is also explained in [Box 2.3 of Technical Guidance LAQM.TG\(09\)](#) (<http://laqm.defra.gov.uk/technical-guidance/index.html?d=page=30>).

The diffusion tubes monitoring sites where NO₂ concentrations exceeded the annual mean objective were assessed using the procedures and equations set out in LAQM.TG(09) (Box2.3), to determine whether exceedences are likely to occur at the nearest relevant receptor. As in previous years, the average of three urban background monitoring locations (Balgavies Place, Earl Grey Place (Park) and Woodside Avenue) was used to provide the background concentration (18.9µg/m³) for these comparisons. Background sites were selected in accordance with the selection criteria contained in Box A1.2 of LAQM.TG(09). Of the 27 sites that recorded an exceedence in 2012, all were located within the AQMA.

There is considerable uncertainty associated with the use of the distance calculator tool. An example of this can be illustrated using two of the diffusion tube sites on Lochee Road. Lochee Rd (138) is located at kerbside and Lochee Rd (140) is located close to (25cm) the residential façade at the same location. When the distance calculator is used to predict the drop-off in pollutant concentrations between the two tubes it calculates that pollution levels will drop from 53.4 µg/m³ to 43.6 µg/m³, i.e. a drop off of 9.8 µg /m³. The actual monitored value at the façade tube was 54.8 µg/m³, an increase of 1.2 µg/m³.

The following 17 sites exceeded the NAQS annual mean when the distance calculator tool was used to estimate concentrations at relevant receptors:

Table 2.5 Predicted Exceedences of NO₂ Annual Mean at Façade of Receptors

GIS ID	LOCATION	x	y	2012 Measured annual mean NO₂ concentration (µg/m³)	2012 Predicted annual mean NO₂ concentration at Receptor (µg/m³)
84	Commercial St /Dock St	340565	730263	41.2	40.9
85	Dock St (Carol Whyte)	340524	730216	40.8	40.4
156	Dock St (57)	340656	730343	53.1	46.1
30	Lochee Rd (138)	338936	730680	53.4	43.0
31	Lochee Rd (140 Traffic Lts)	338927	730685	54.8	53.8
158	Lochee Rd (Romon) Average	338861	730773	48.7	42.8
37	Logie St (114)	338184	731293	54.6	52.4
39	Loons Rd (1)	338211	731293	42.0	40.7
41	Meadowside	340245	730651	59.0	52.4
163	Meadowside/Bell Street	340282	730592	49.1	41.3
149	Meadowside (Romon) Average	340243	730653	56.9	55.4
49	Rankine St (2)	338768	730900	44.4	43.2
150	Seagate (97)	340511	730492	51.4	50.8
159	Seagate (Romon) Average	340487	730446	49.2	43.6
68	Victoria Rd (60)	340375	730779	42.2	40.9

GIS ID	LOCATION	x	y	2012 Measured annual mean NO ₂ concentration (µg/m ³)	2012 Predicted annual mean NO ₂ concentration at Receptor (µg/m ³)
70	Victoria Rd / Hilltown	340274	730714	57.9	49.7
75	Whitehall St (Bus)	340289	730128	49.5	43.3

A further 14 locations were close to exceeding the NAQS annual mean (>36µg/m³) when the distance calculator tool was used to estimate concentrations at relevant receptors.

Table 2.6 Locations at risk of Exceeding NO₂ Annual Mean at Façade of Receptors

GIS ID	LOCATION	x	y	2012 Measured annual mean NO ₂ concentration (µg/m ³)	2012 Predicted annual mean NO ₂ concentration at Receptor (µg/m ³)
92	Abertay 2	340019	730612	41.5	37.8
139	Broughty Ferry Rd (141 Downpipe)	343317	731072	37.4	37.2
11	Broughty Ferry Rd (141)	343322	731073	44.2	39.3
15	Commercial St (Waterstones)	340481	730325	39.4	36.5
44	Nethergate (B&B)	340163	730061	50.2	38.4
45	Nethergate (Bradford)	340274	730171	42.3	36.9
47	Nethergate (Trades House)	340230	730124	42.5	36.8
50	Seagate	340545	730532	39.4	39.0
54	Seagate (Yates)	340467	730388	38.4	36.5
151	South Road (Denbank)	335188	731528	36.9	36.3
162	St Andrews St (PB) Façade	340532	730548	38.8	38.5
76	Whitehall St (Deb A)	340265	730153	47.3	36.2
160	Whitehall St (Romon) Average	340278	730156	41.6	39.2
81	Whitehall St (Tiso)	340293	730142	39.6	36.2

2.1.1.1 Trends in Real-time Monitor and Diffusion Tube NO₂ Concentrations in Areas of Concern

Figure 2.8 shows the difference between 2006 and 2012 bias corrected diffusion tube annual mean results for those 68 tube sites that have been present for six years. Five locations have lower concentrations than in 2006 and 63 have higher concentrations. The greatest increases in pollutant concentrations over this time period have been recorded along the city centre bus corridor, the north-west arterial route and associated access roads, major junctions on or near the Kingsway and at Stannergate roundabout on Broughty Ferry Road.

Figures 2.8 to 2.35 show the detailed trends in real-time monitor and bias-corrected diffusion tube NO₂ concentrations between 2006 and 2012 in areas of concern throughout the city. These include:

- Union Street
- Seagate
- Victoria Rd / Meadowside
- Lochee Road
- Albert St. / Arbroath Rd.
- Main Bus Corridor
- Stannergate Roundabout
- Whitehall Street
- Nethergate
- Albert St / Dura St.
- Logie St
- Kingsway / Forfar Rd.
- Inner Ring Road
- Strathmore Avenue

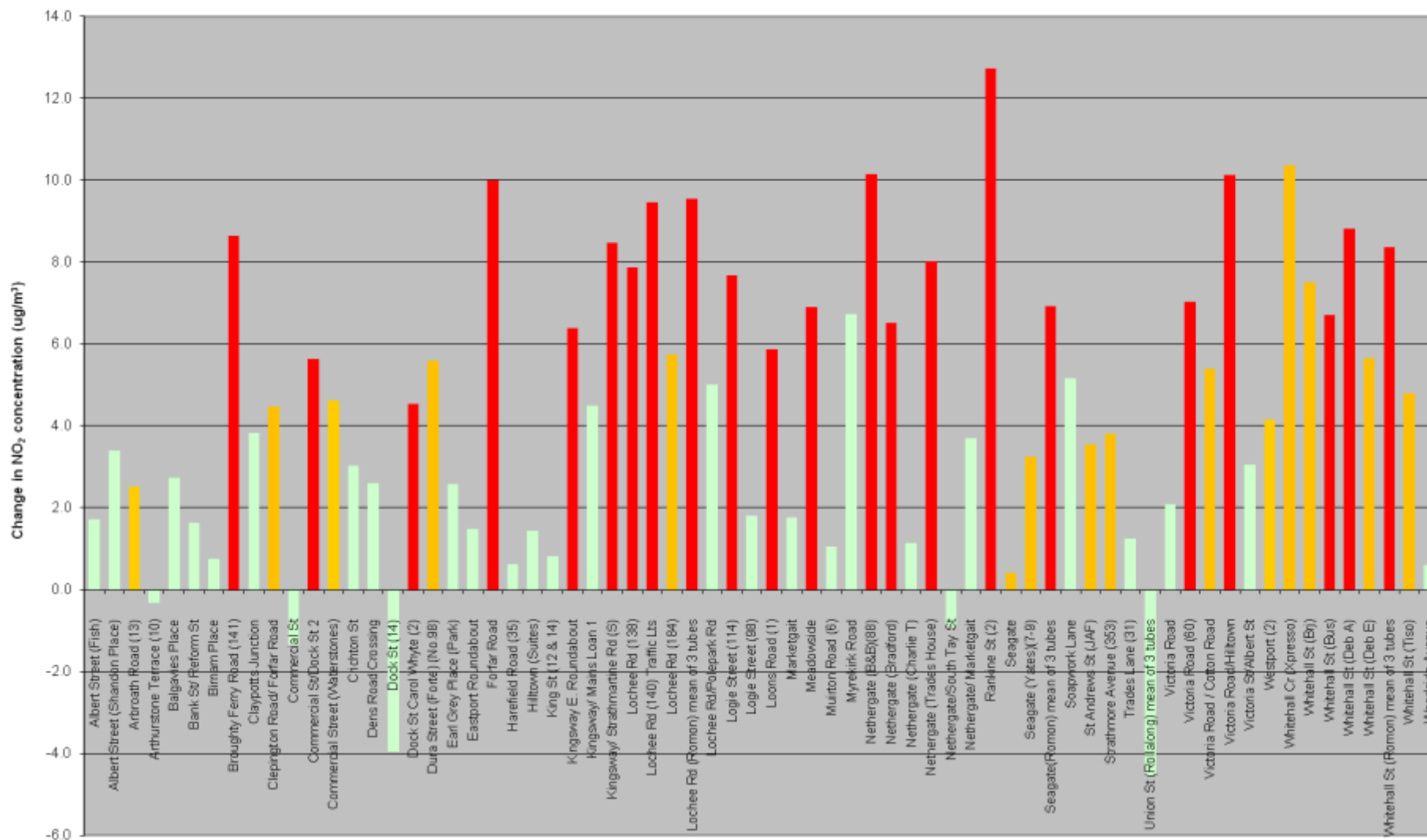
All of these locations have been described in previous review and assessment reports. A new potential exceedence area has been identified at South Road (Denbank) which is located on an access road between the Kingsway and Ninewells Hospital and Dundee Technology Park.

Annual mean NO₂ concentrations decreased between 2011 and 2012 at all of the automatic monitoring stations except for Whitehall Street. It is thought that changes to how traffic and buses move around Whitehall Crescent may have contributed to the increased concentrations in this area with corresponding decreases seen in Union Street. Diffusion tube concentrations in Whitehall Street and Whitehall Crescent also increased with decreases seen in Union Street and at the western end of Dock Street. The improvement in Meadowside concentrations is probably explained by the rerouting of all southbound traffic, which amounted to the removal of approximately a quarter of all bus movements in the street, during the 14 week lane closure for gas main replacement.

Concentrations of NO₂ measured by diffusion tubes increased at the majority of diffusion tube sites between 2011 and 2012. The largest increases (>6 µg/m³) were recorded in Whitehall Street, Whitehall Crescent and in Dock Street close to where the South Marketgait has been re-aligned and where the new Tay Bridge ramps are being constructed. A large increase was also recorded on the Kingsway.

From the long-term trends presented in **Figures 2.8 to 2.35** it is evident that NO₂ concentrations do not show a consistent downward trend and in most cases concentrations remain higher in 2012 than in 2006 when the AQMA was declared.

Figure 2.8 Change in NO₂ concentrations at 68 Diffusion tube monitoring locations between 2006 and 2012
 (N.B. Red columns are locations where the annual mean air quality objective is exceeded, and orange columns are locations at risk of exceeding.)



Union Street & Whitehall Street

Figure 2.9 NO₂ Monitoring Locations in Union Street and Whitehall Street

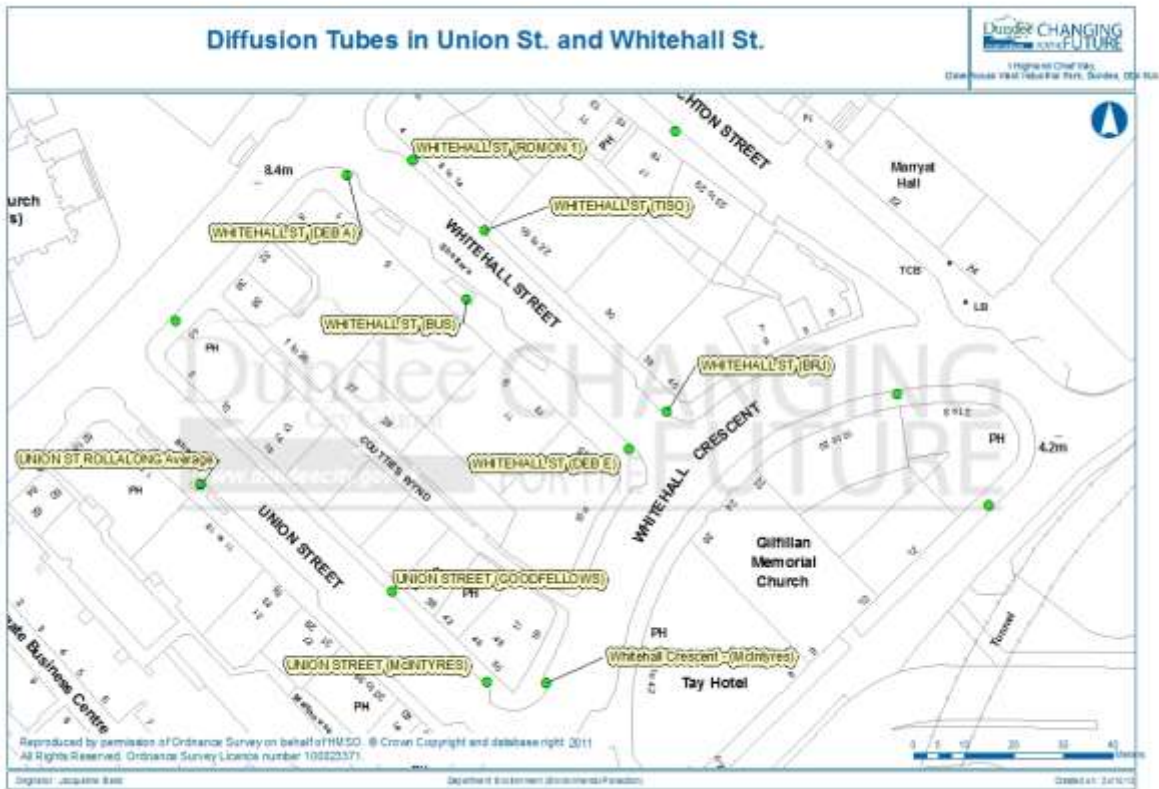


Figure 2.10 Trends in NO₂ Concentrations in Union St.

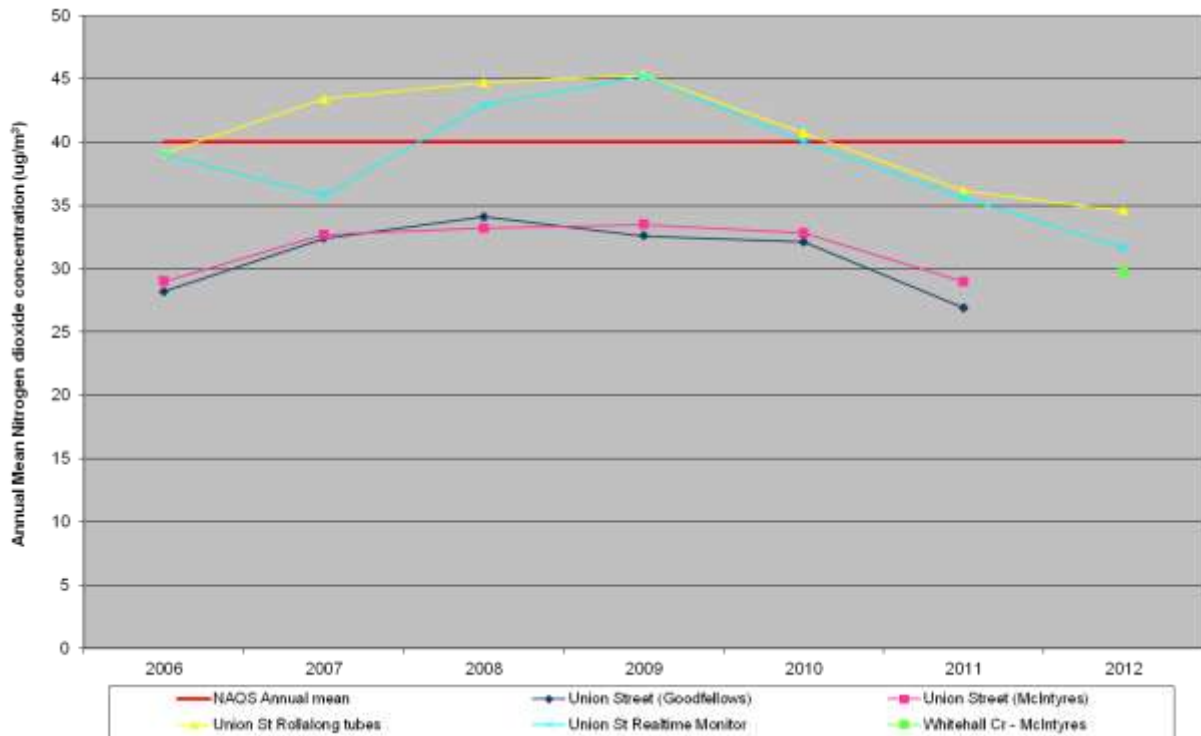
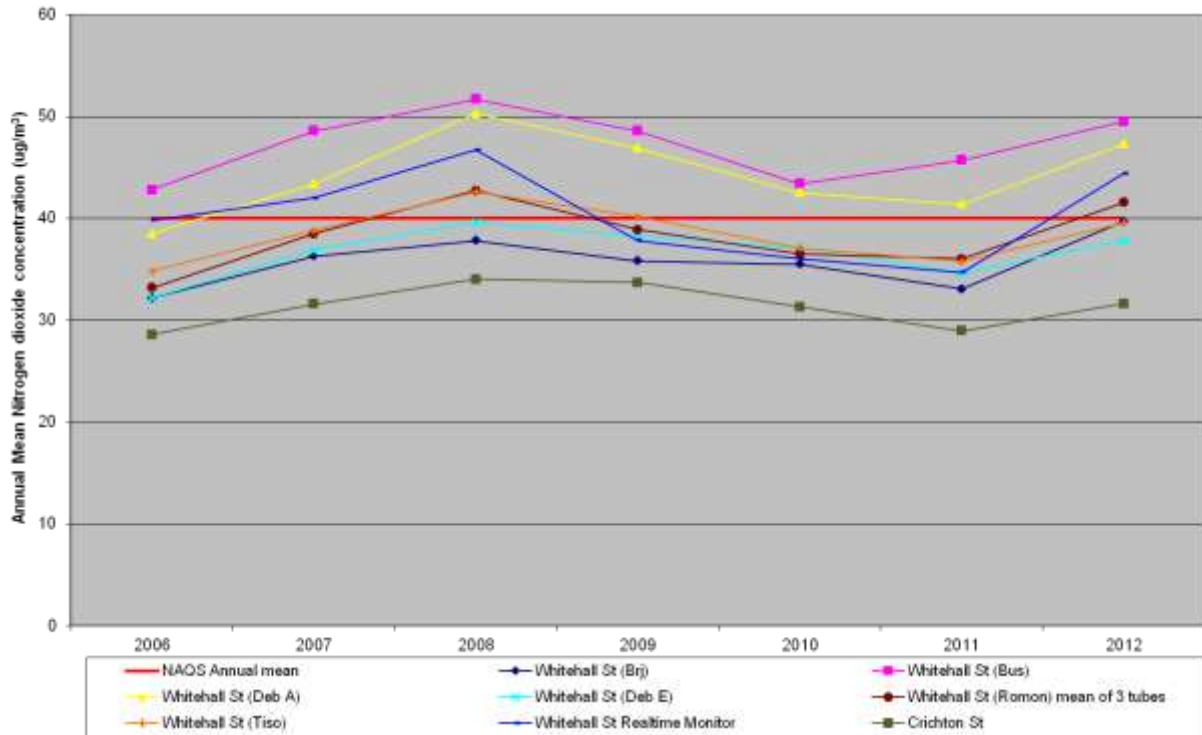


Figure 2.11 Trends in NO₂ Concentrations in Whitehall St.



Seagate
 Figure 2.12 NO₂ Monitoring Locations in Seagate

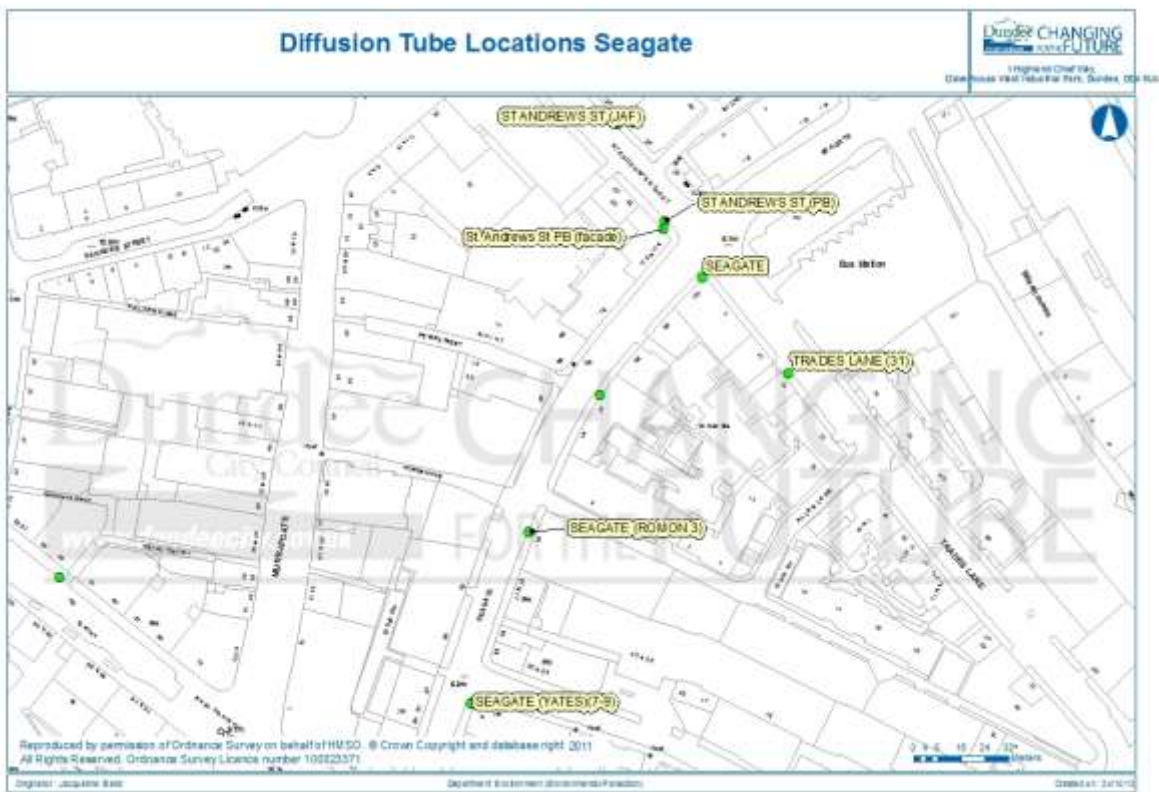
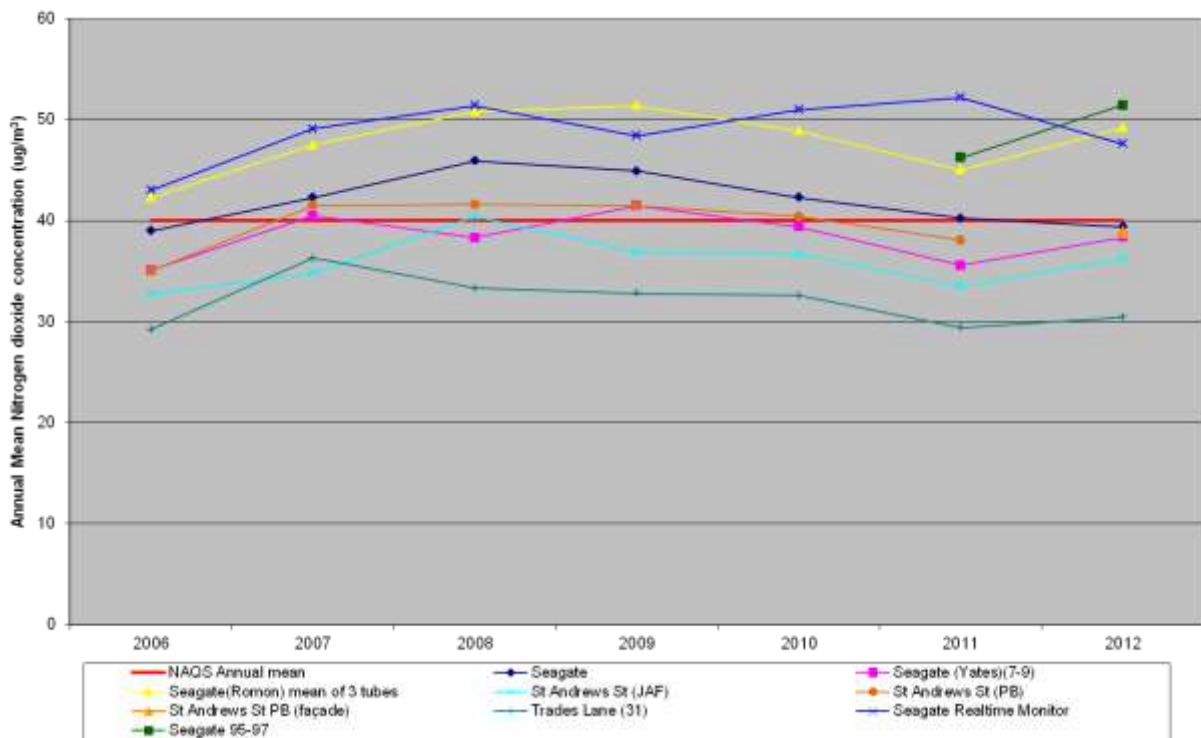


Figure 2.13 Trends in NO₂ Concentrations in Seagate.



Nethergate
 Figure 2.14 NO₂ Diffusion Tube Locations in Nethergate

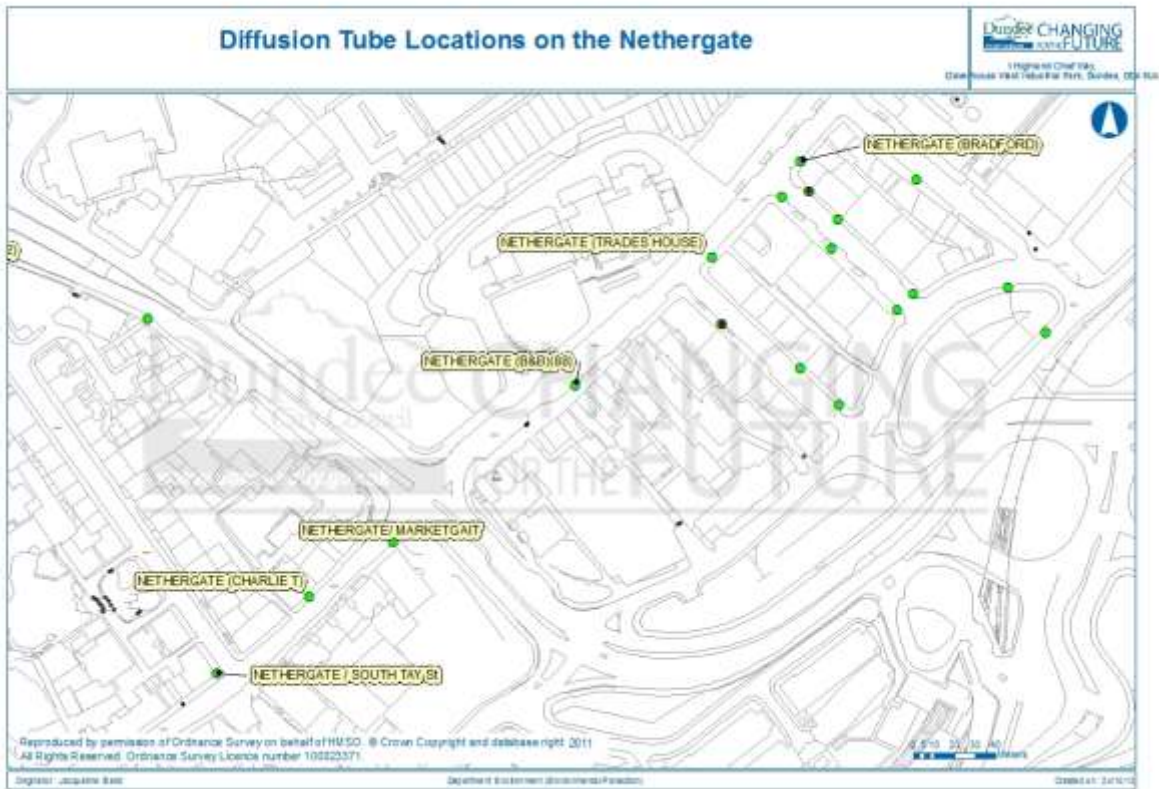
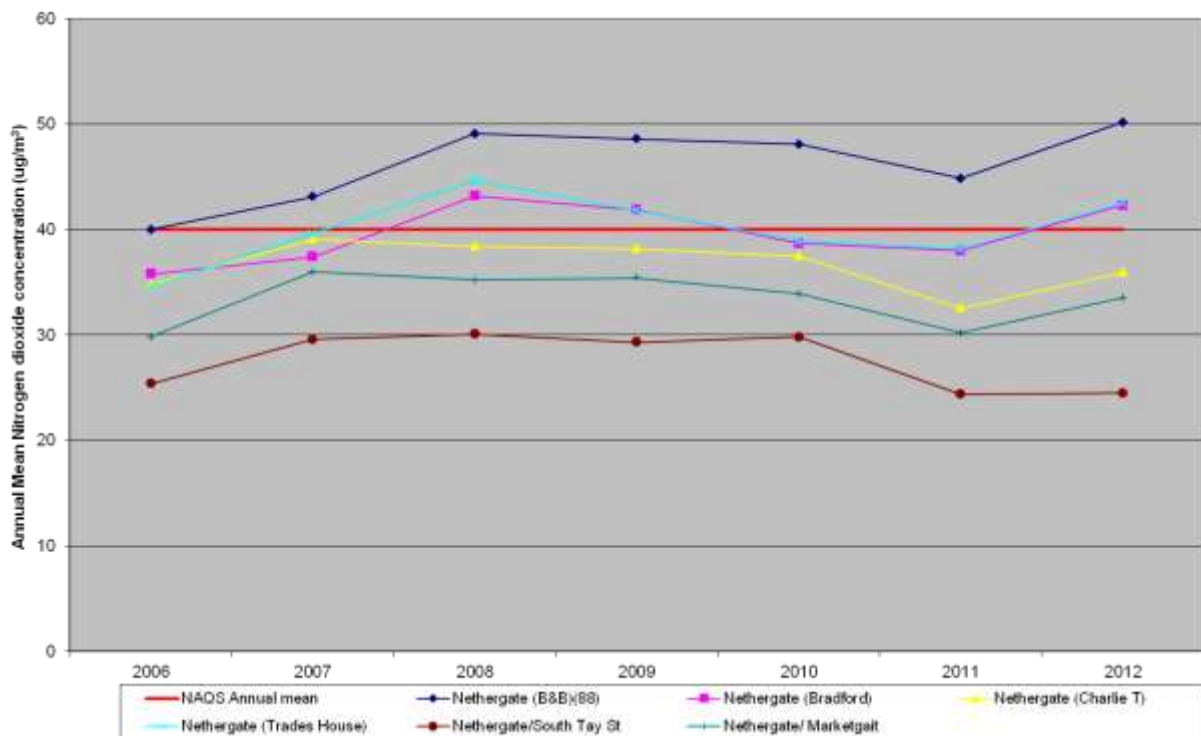


Figure 2.15 Trends in NO₂ Diffusion Tube Concentrations in Nethergate.



Victoria Road / Meadowside

Figure 2.16 NO₂ Diffusion Tube Locations in Victoria Road / Meadowside

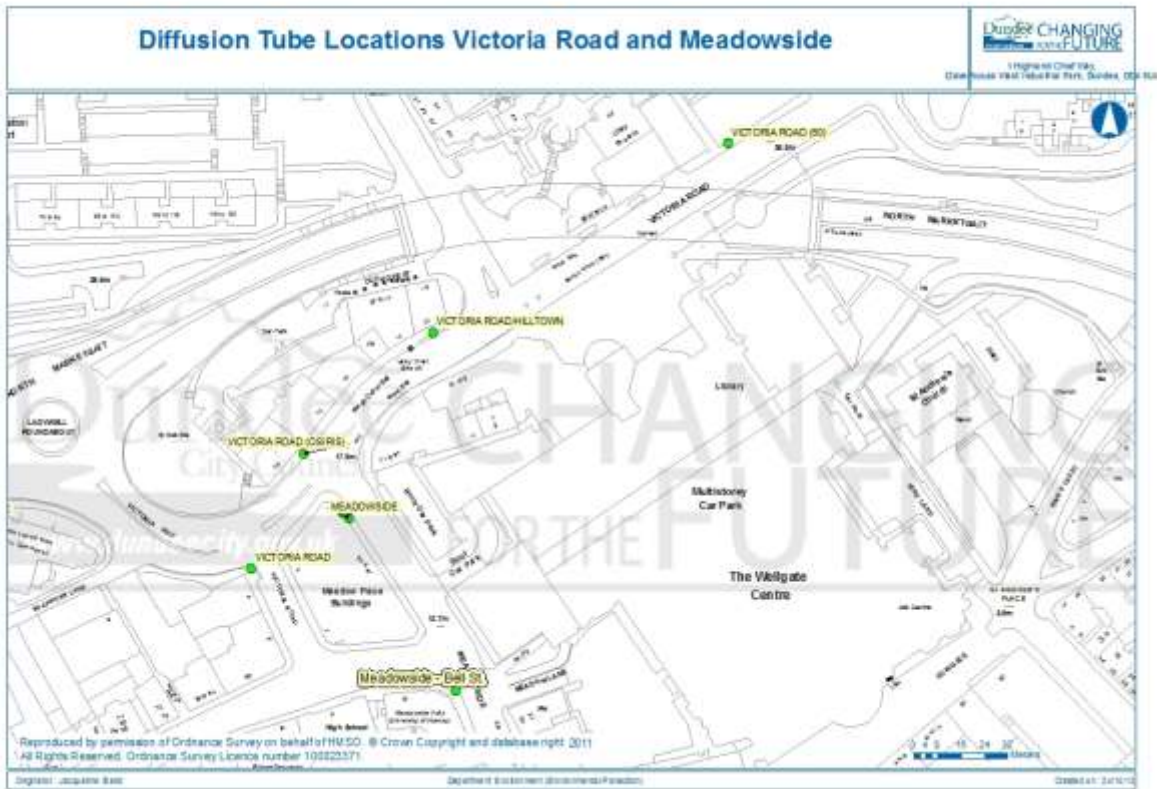
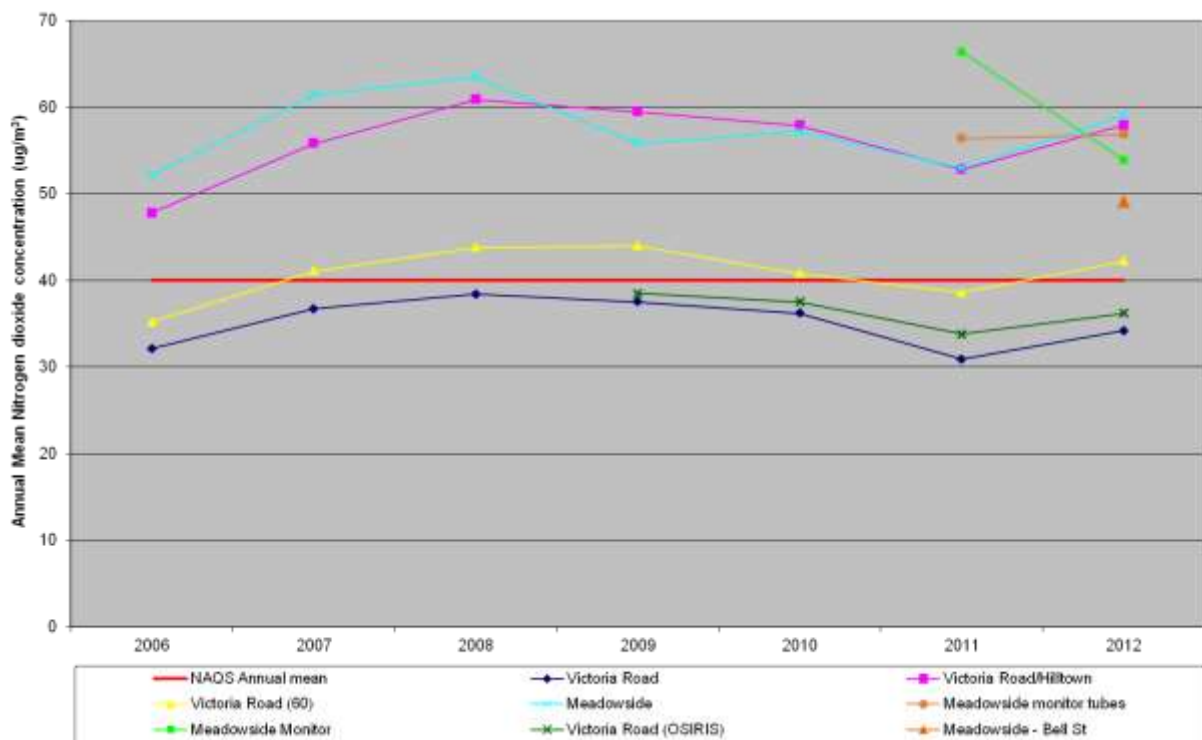


Figure 2.17 Trends in NO₂ Diffusion Tube Concentrations in Victoria Road / Meadowside.



Albert Street / Dura Street

Figure 2.18 NO₂ Diffusion Tube Locations in Albert Street / Dura Street

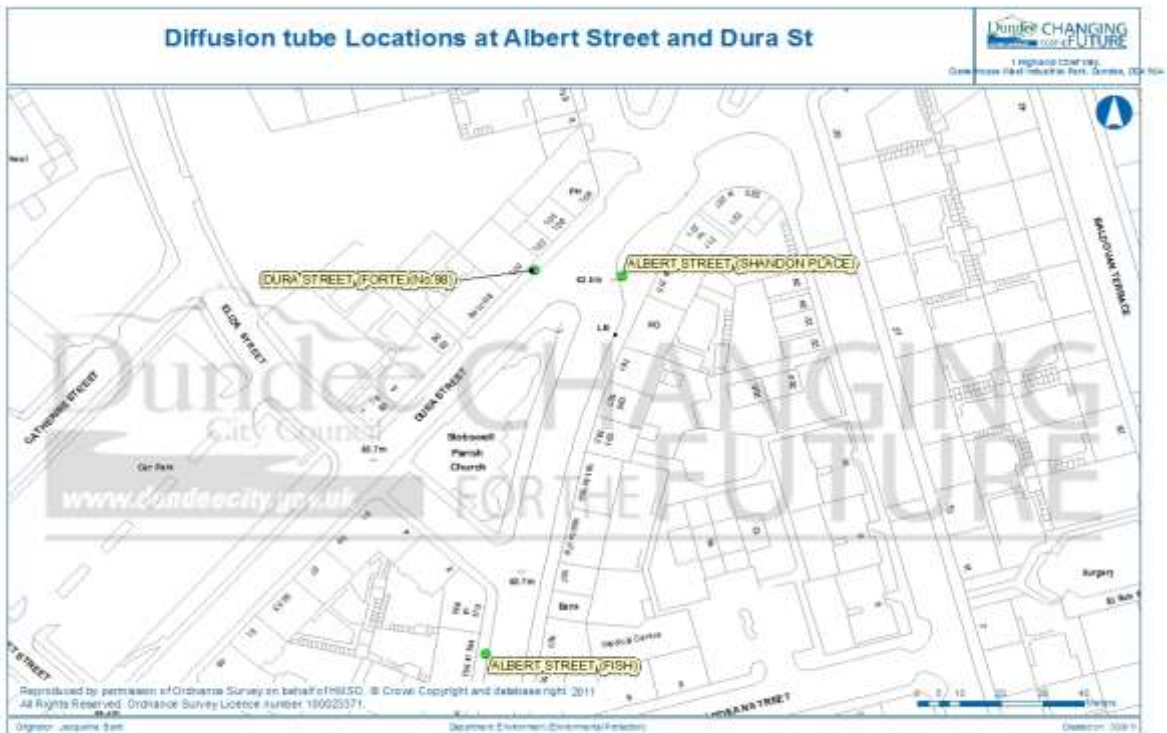
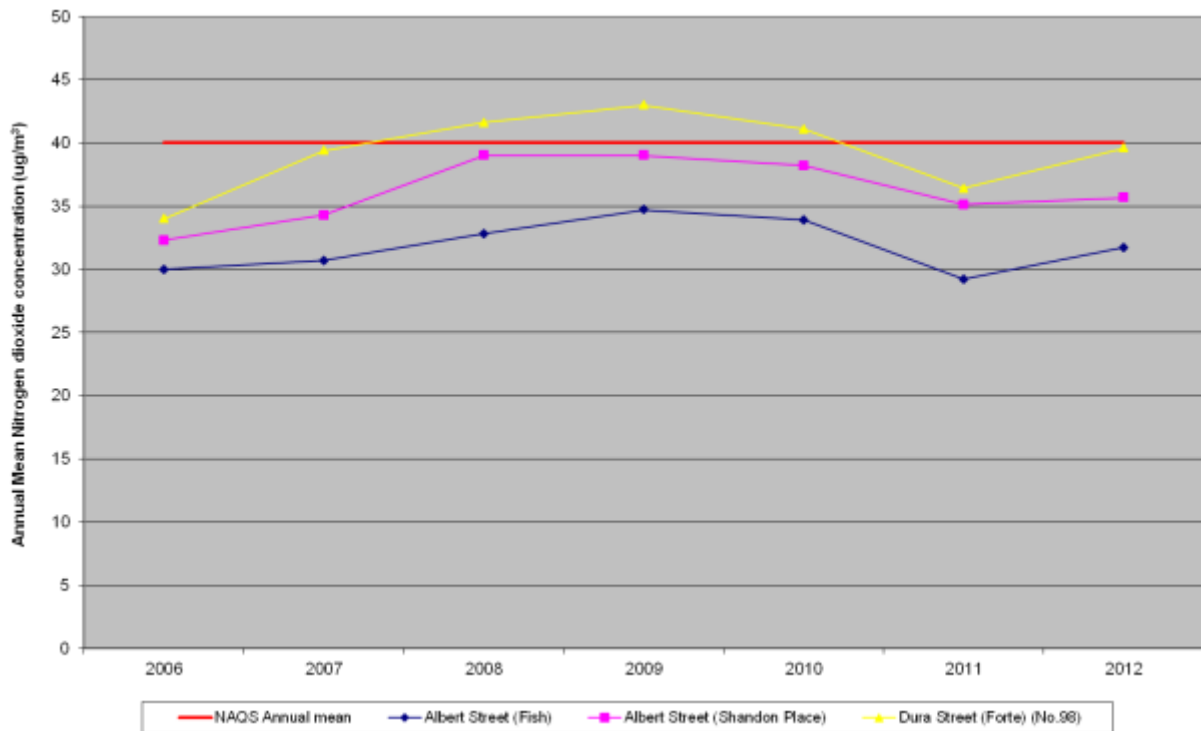


Figure 2.19 Trends in NO₂ Diffusion Tube Concentrations in Albert Street / Dura Street.

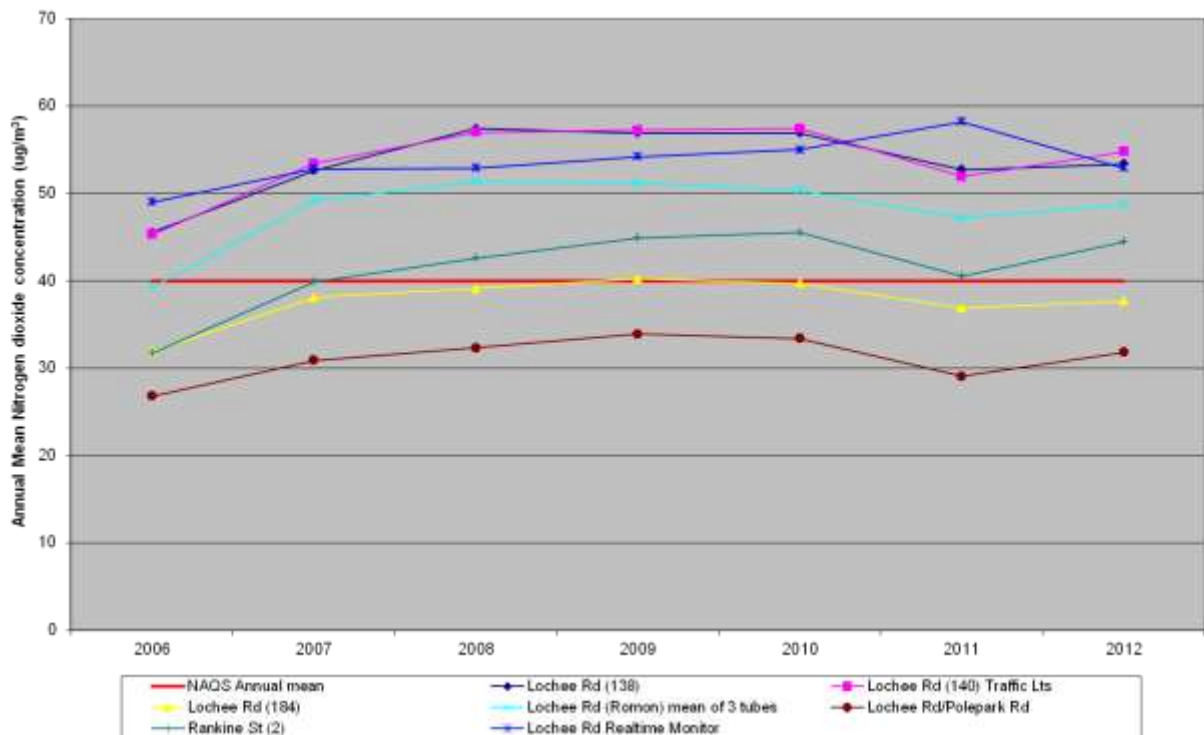


Lochee Road

Figure 2.20 NO₂ Monitoring Locations in Lochee Road



Figure 2.21 Trends in NO₂ Concentrations in Lochee Road



Logie Street
 Figure 2.22 NO₂ Diffusion Tube Locations in Logie Street

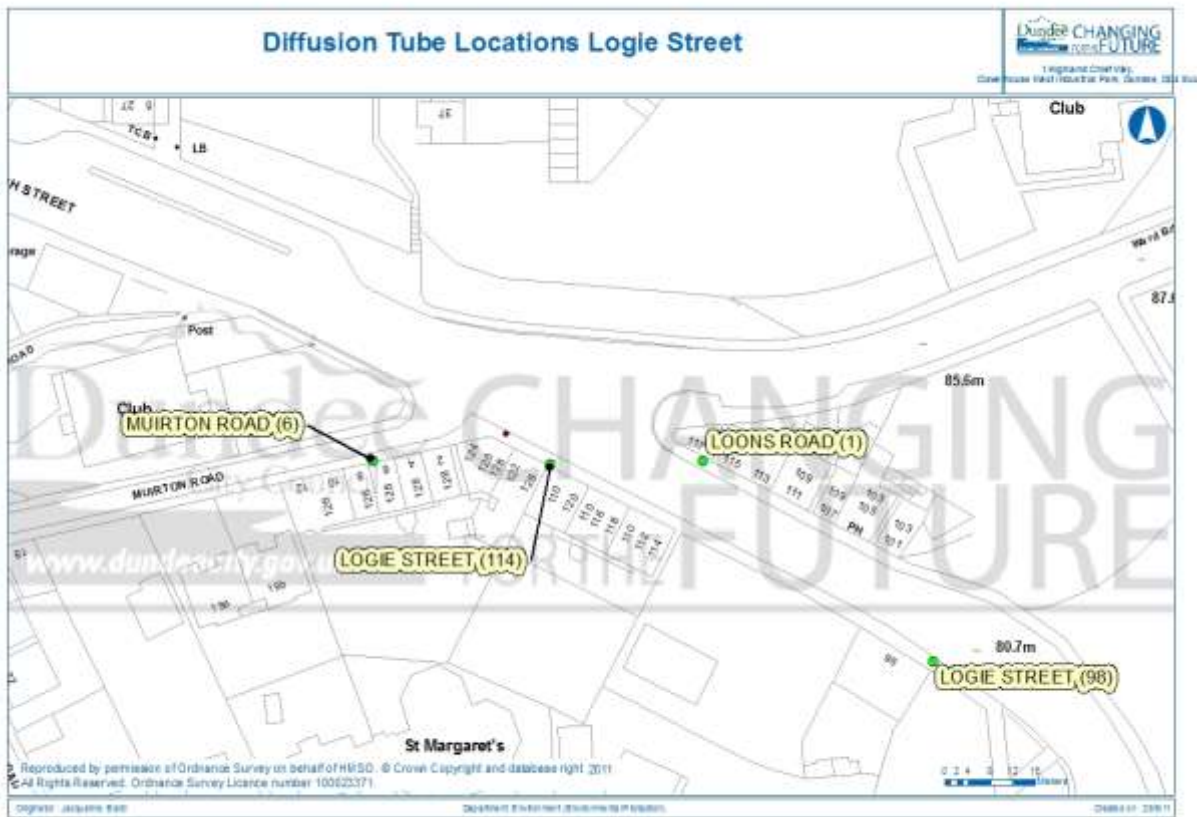
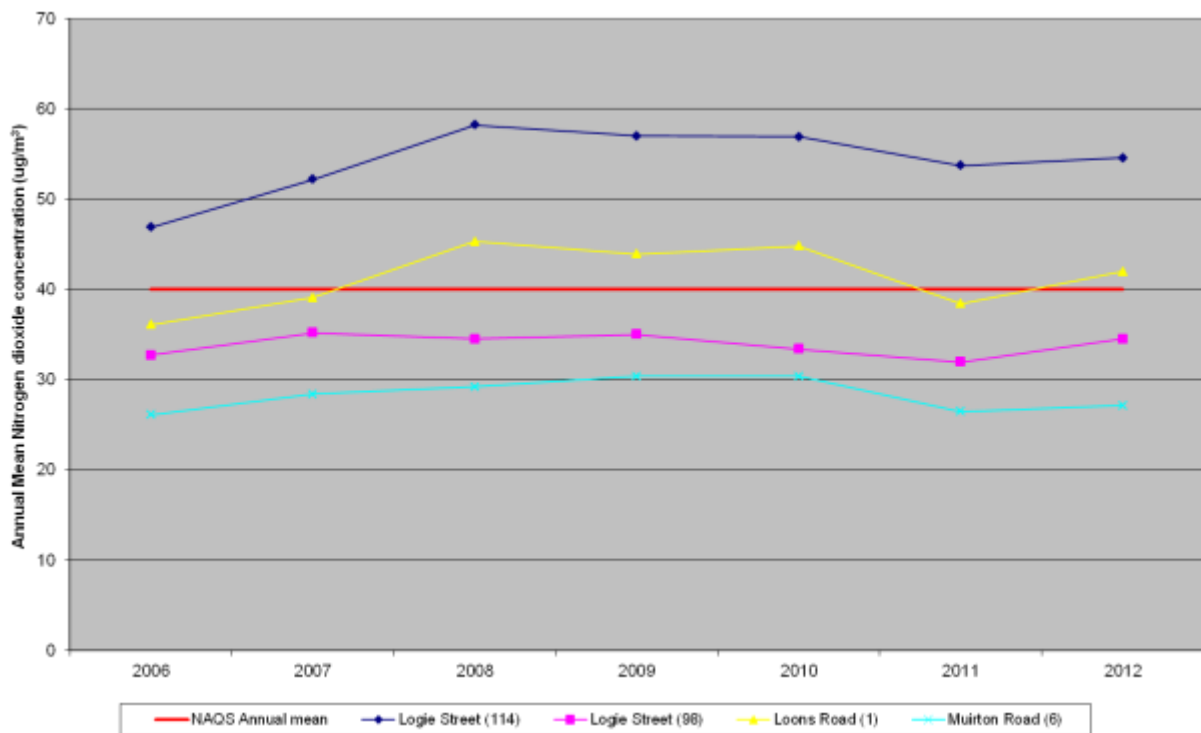


Figure 2.23 Trends in NO₂ Diffusion Tube Concentrations in Logie St.



Albert Street / Arbroath Road

Figure 2.24 NO₂ Diffusion Tube Locations in Albert St. / Arbroath Road

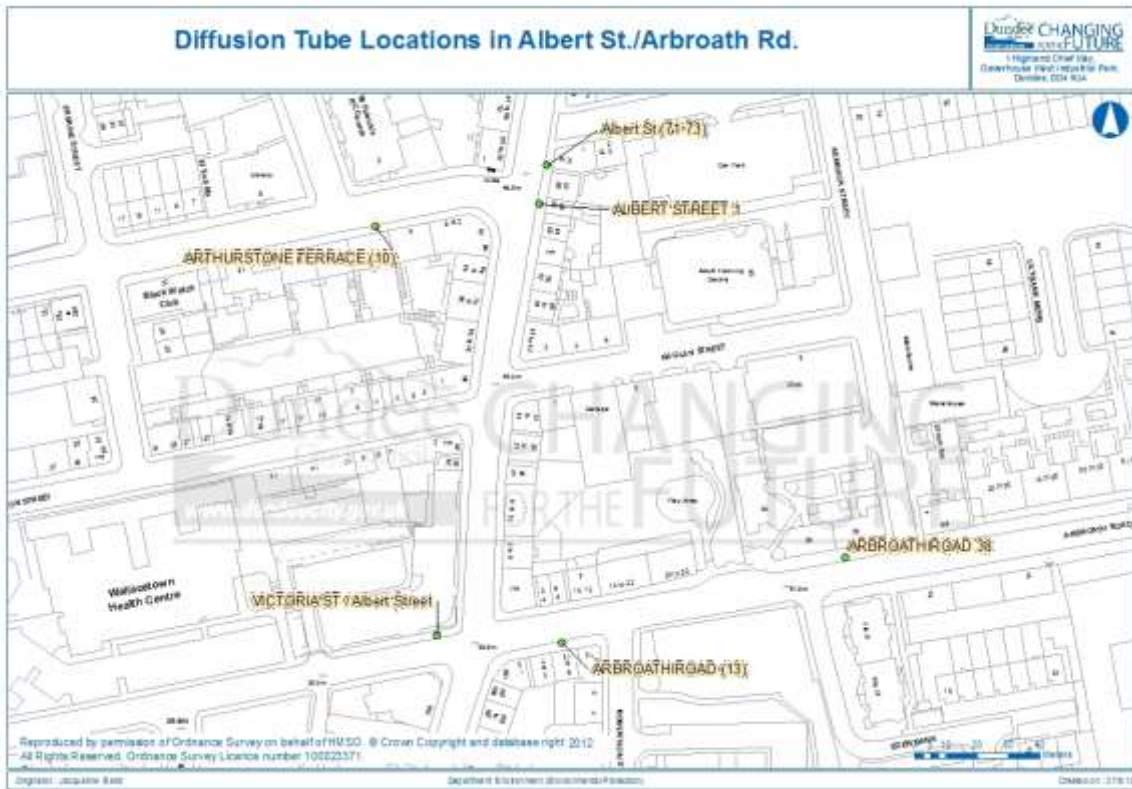
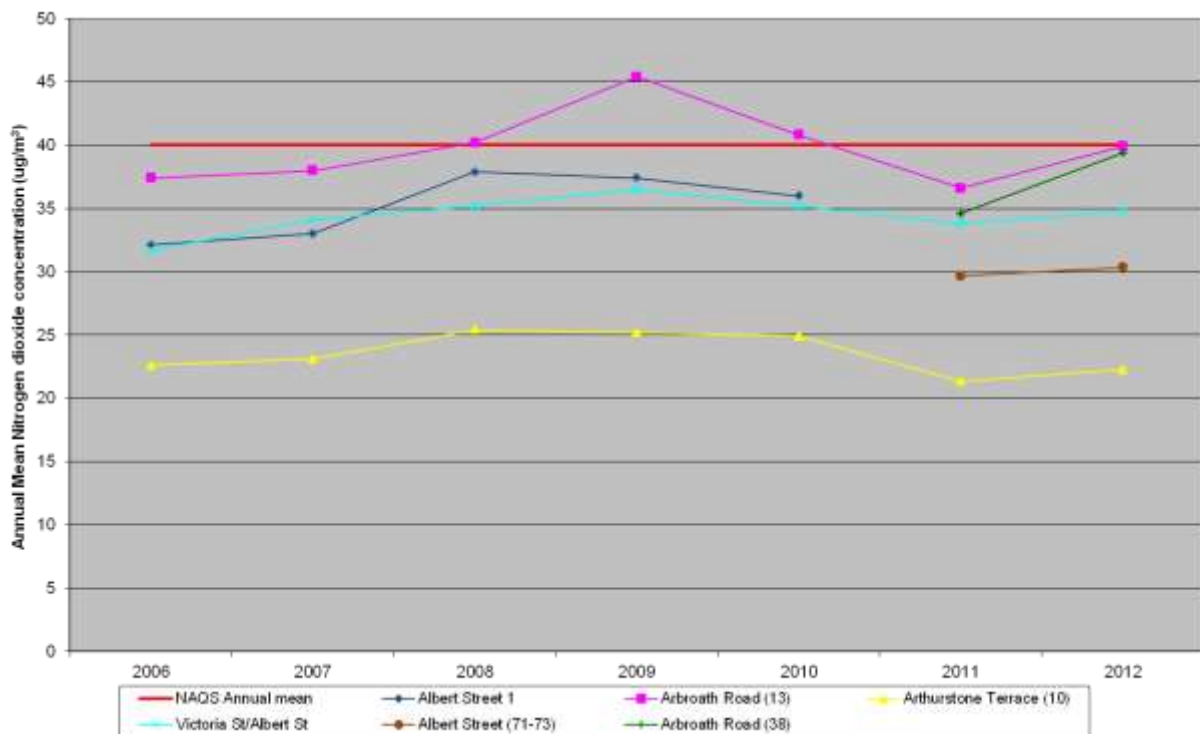


Figure 2.25 Trends in NO₂ Diffusion Tube Concentrations in Albert St. / Arbroath Road



Kingsway / Forfar Road.

Figure 2.26 NO₂ Diffusion Tube Locations on/near the Kingsway

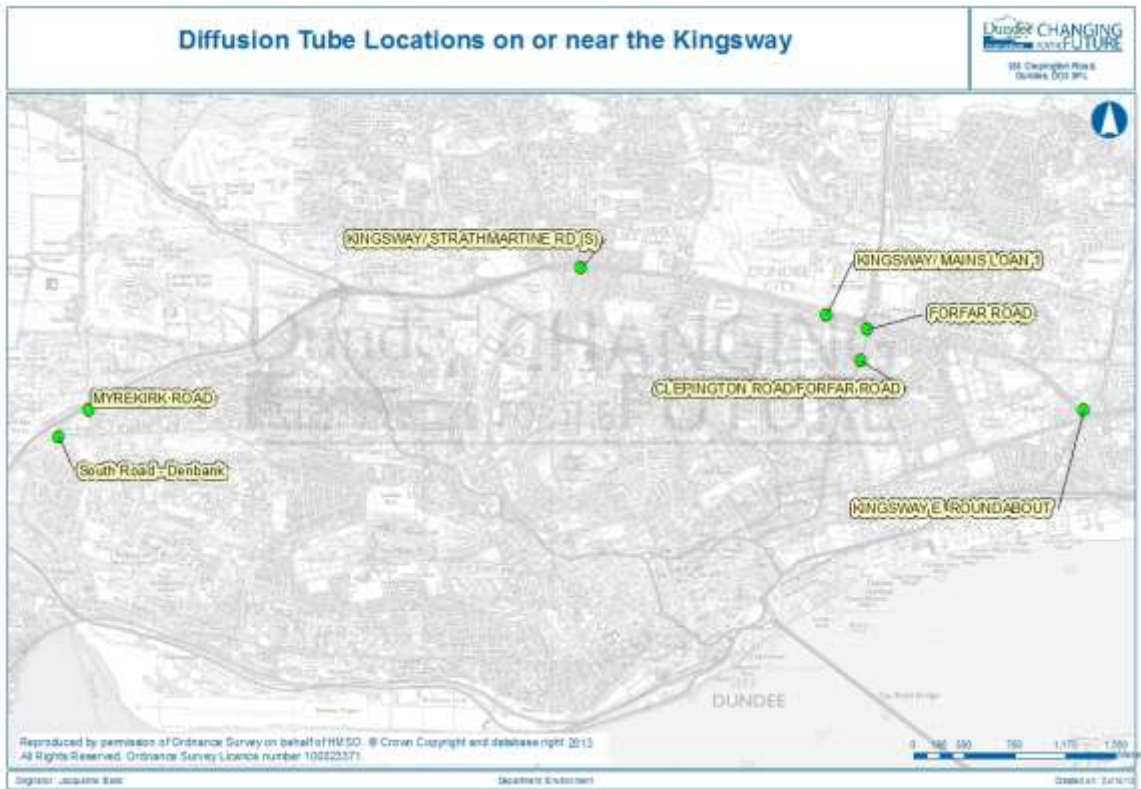
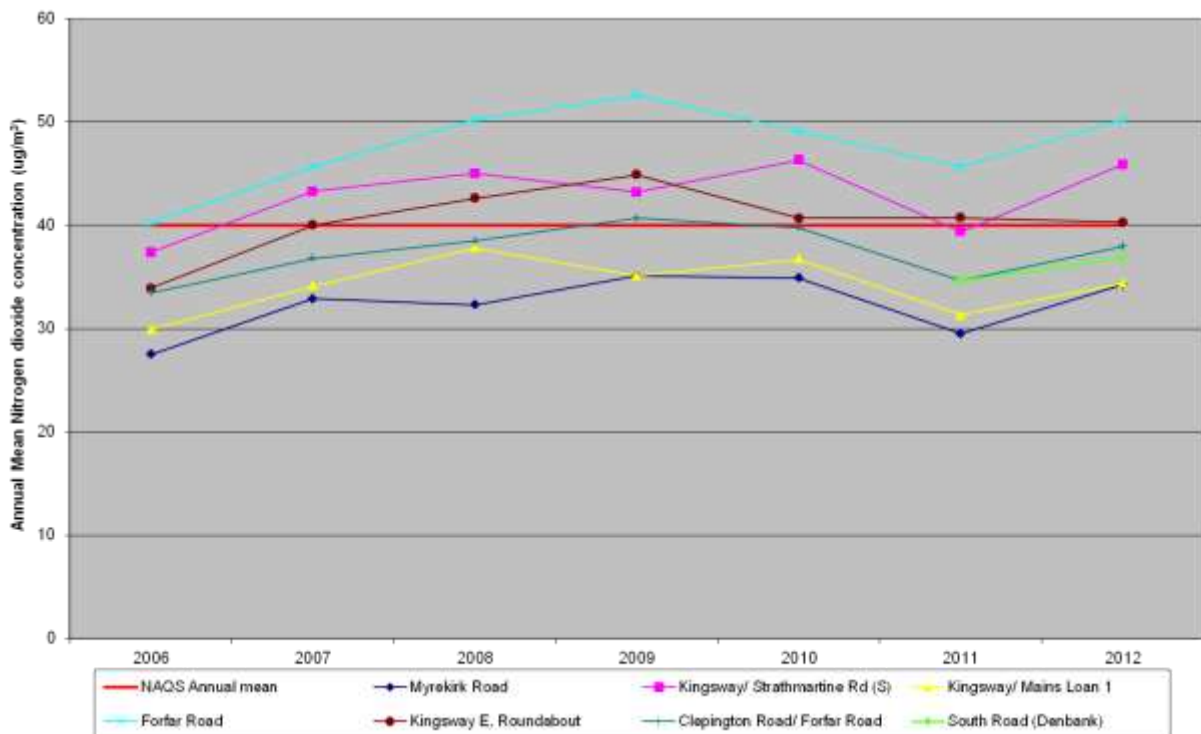


Figure 2.27 Trends in NO₂ Diffusion Tube Concentrations on/near the Kingsway



Bus Corridor

Figure 2.28 NO₂ Diffusion Tube Locations on Bus Corridor

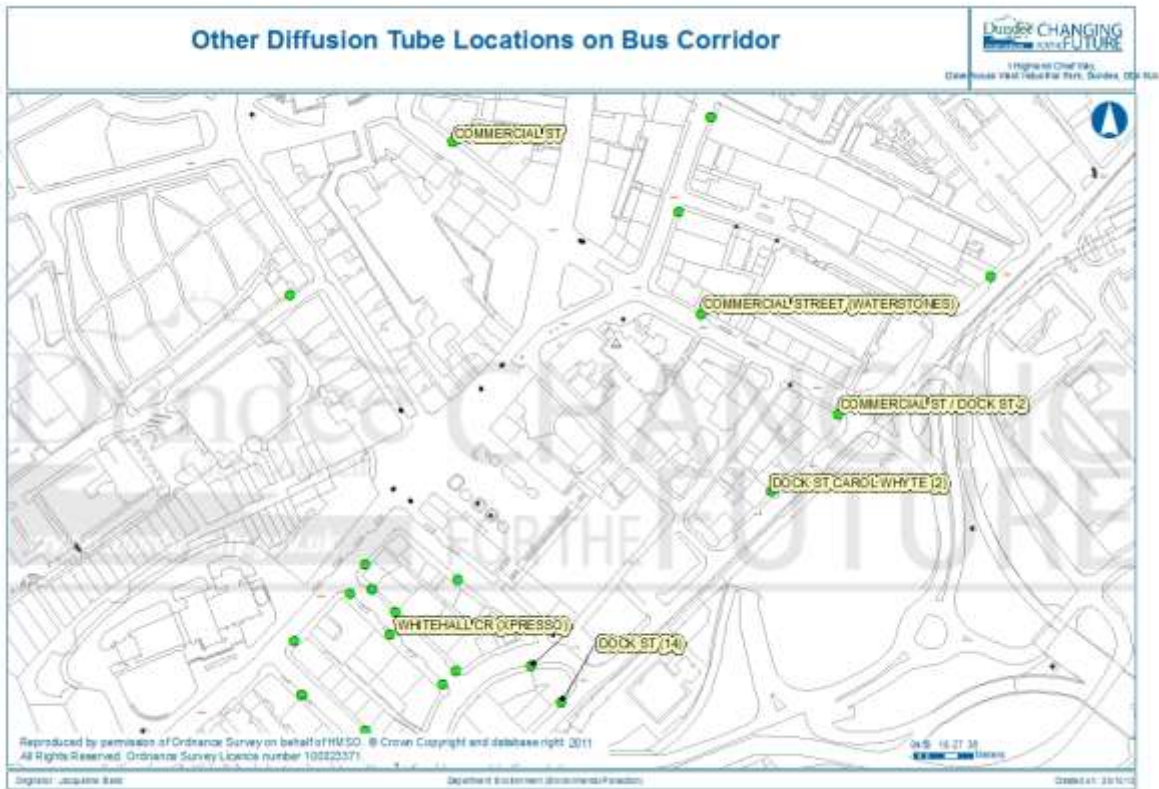
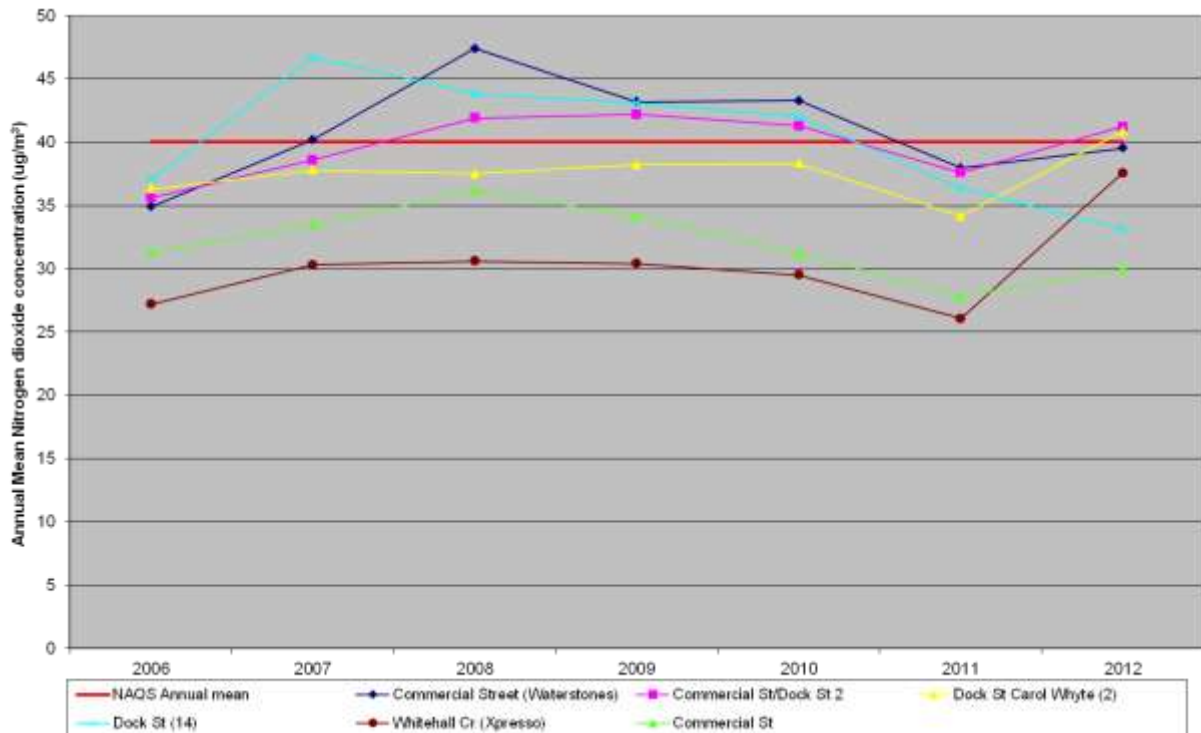


Figure 2.29 Trends in NO₂ Diffusion Tube Concentrations on Bus Corridor



Inner Ring Road

Figure 2.30 NO₂ Diffusion Tube Locations on Inner Ring Road

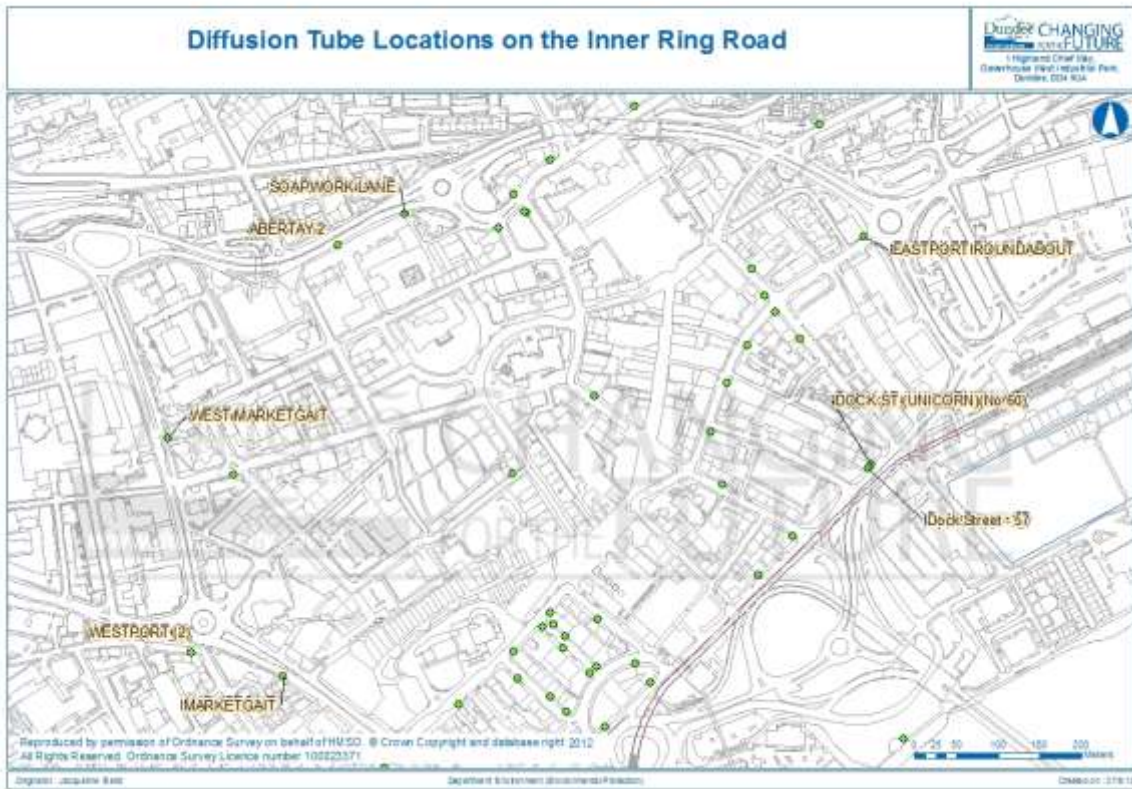
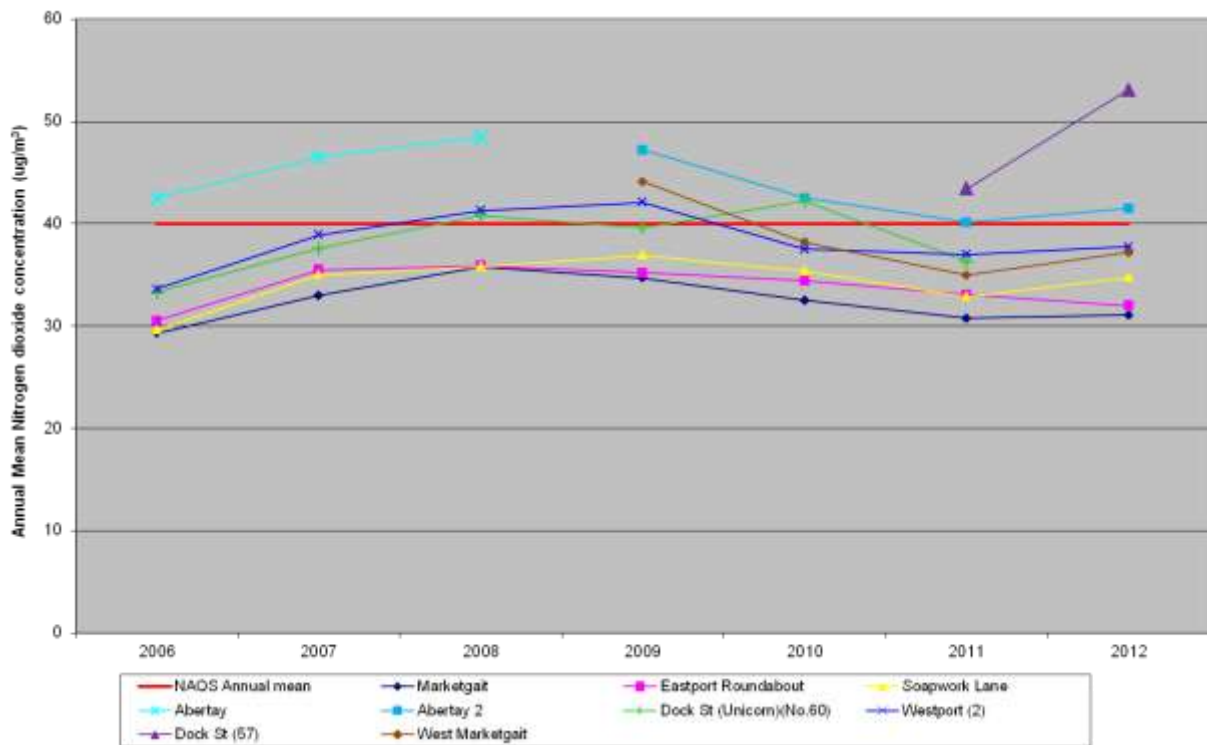


Figure 2.31 Trends in NO₂ Diffusion Tube Concentrations on Inner Ring Road



Stannergate Roundabout

Figure 2.32 NO₂ Diffusion Tube Location at Stannergate Roundabout

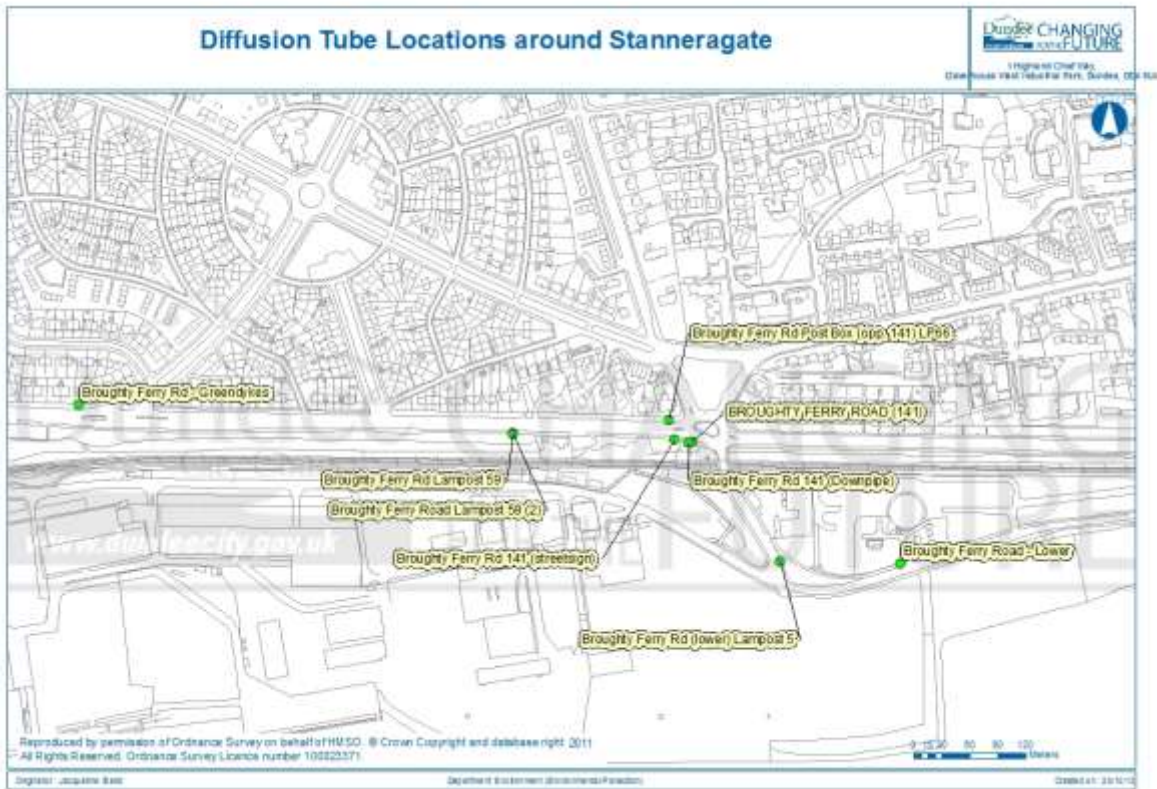
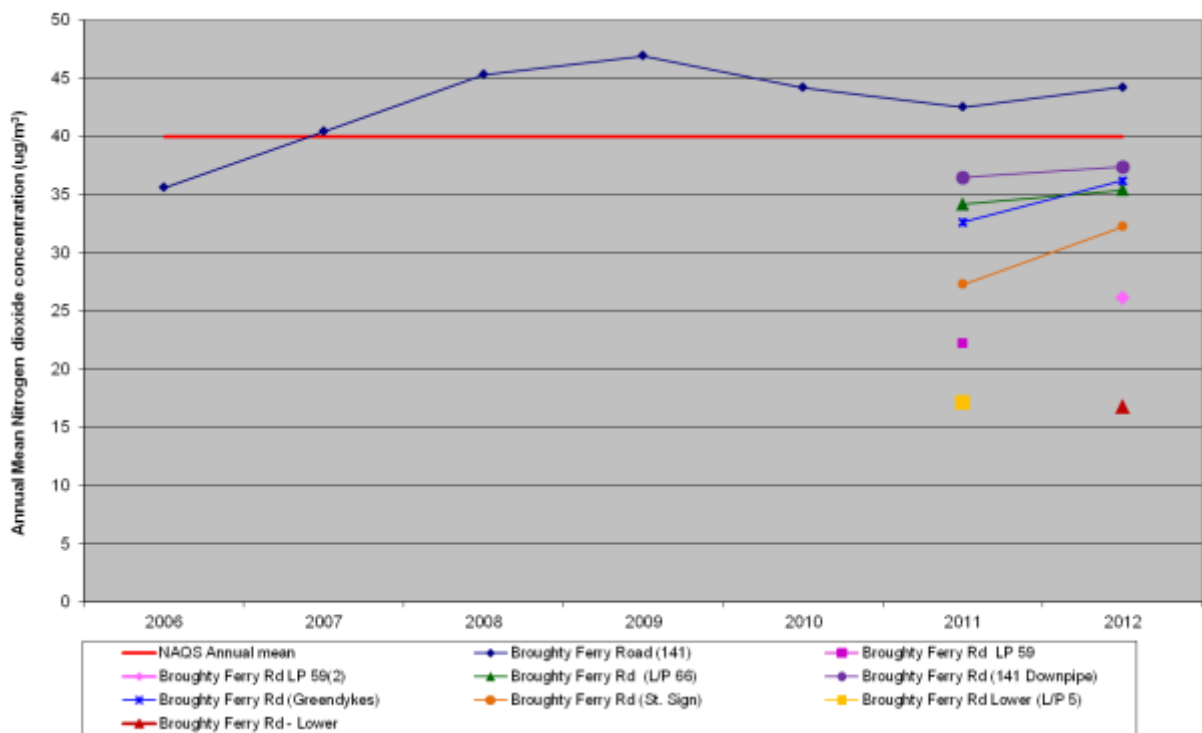


Figure 2.33 Trends in NO₂ Diffusion Tube Concentration at Stannergate Roundabout



Strathmore Avenue

Figure 2.34 NO₂ Diffusion Tube Location at Strathmore Avenue

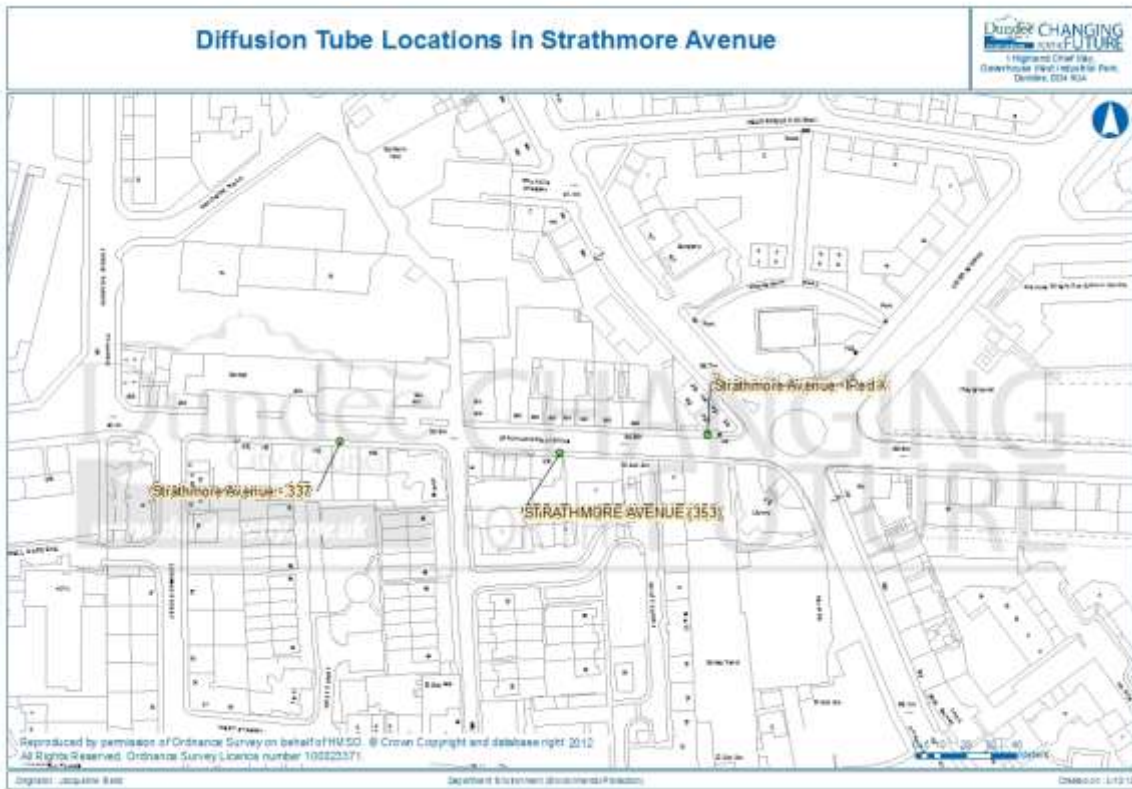
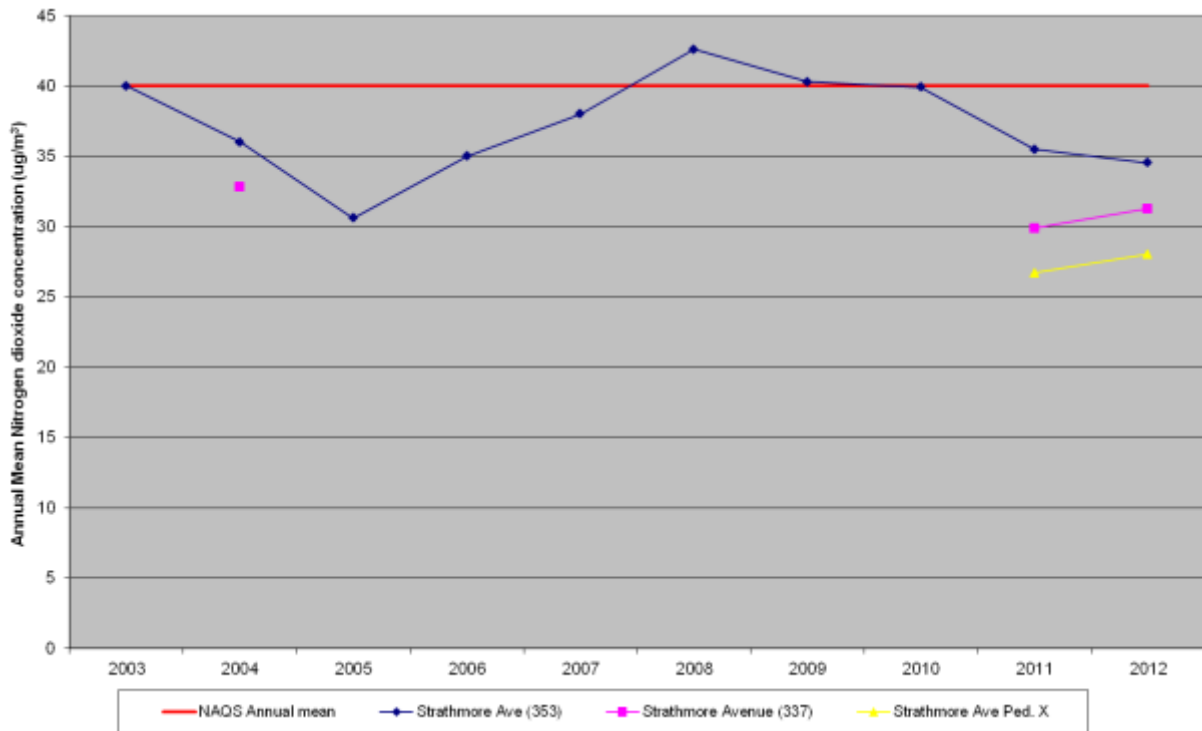


Figure 2.35 Trends in NO₂ Diffusion Tube Concentration at Strathmore Avenue



2.1.1.2 Trends in NO₂ Monitoring Concentrations at Urban Background Locations

Dundee City Council operated 7 urban background NO₂ monitoring locations in 2012. Diffusion tubes were deployed at all 7 sites and co-located with the automatic analyser at Mains Loan. These locations are shown in **Figure 2.36**. The 2012 NO₂ annual mean urban background concentrations were mostly lower than the Scottish Government modelled background NO₂ concentrations published as (1km x 1km) maps² in April 2012 (see **Table 2.7**). Concentrations measured at Mains Loan (by both diffusion tubes and automatic analyser) were significantly lower than modelled. The diffusion tubes at Carolina Court and Balgavies Place recorded higher NO₂ concentrations than the mapped background.

Table 2.7 Comparison of Measured Background NO₂ Results for 2012 with Scottish Government Background Map Data (Released April 2012)

Location	Grid Square	Measured Annual Mean 2012 (bias 0.88) (µg/m ³)	Scottish Government Mapped Concentration 2012 (µg/m ³)
Birnam Place	337500 : 730500	10.4	13.7
Woodside Avenue	340500 : 732500	16.2	18.5
Balgavies Place	343500 : 731500	18.0	17.7
Earl Grey Place	340500 : 730500	22.8	25.9
Mains Loan Tubes (Mean of 3 tubes)	340500 : 731500	15.0	20.8
Mains Loan Automatic Monitor	340500 : 731500	9.8	20.8
Broughty Ferry Road Lower	343500 : 730500	16.7	18.6
Carolina Court	342500 : 731500	22.5	19.1

NO₂ concentrations at urban background locations have remain relatively stable over the past 7 years as illustrated in **Figure 2.37**. The increase in background concentrations recorded at Earl Grey Place is thought to be due to road re-alignments associated with the Central Waterfront Project.

² http://www.scottishairquality.co.uk/maps.php?n_action=data

Figure 2.36 Urban Background NO₂ Monitoring Locations

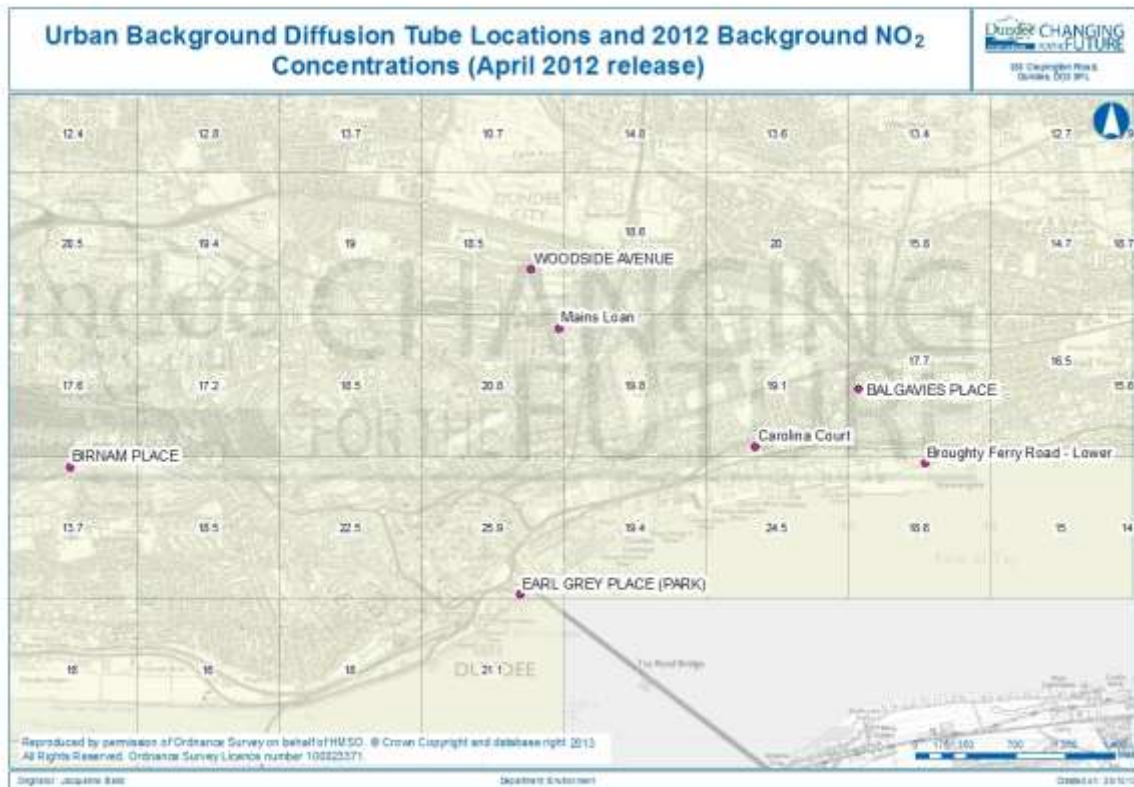
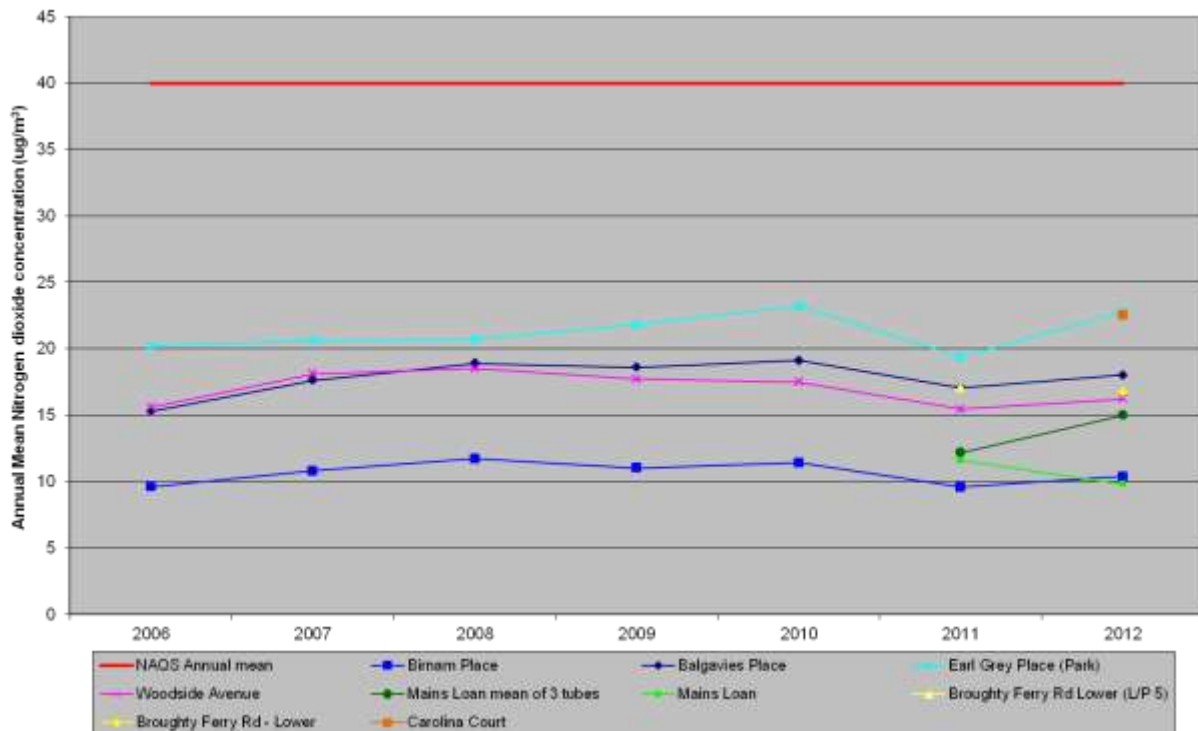


Figure 2.37 Trends in NO₂ Concentrations at Urban Background Locations



2.2.2 Particulate Matter (PM₁₀)

Dundee City Council undertook automatic monitoring of PM₁₀ at fourteen sites in the city in 2012. These are all located within the Dundee AQMA (NO₂ and PM₁₀ annual mean) with one at an urban background location, another downwind of an industrial facility in the port, and the rest either at busy roads and junctions in the city centre or by main arterial routes.

Dundee City Council uses four types of measurement methods for PM₁₀ monitoring:

- The Partisol sampler is an equivalent method with the EU reference method for measuring particulates. The Partisol gravimetric sampler collects daily samples onto a filter for subsequent weighing to determine the PM₁₀ concentration;
- The Tapered Element Oscillating Microbalance (TEOM) system determines particulate concentrations by continuously weighing particles that are deposited onto a filter. This is an approved analyser for detailed and further assessments although it is not gravimetric equivalent;
- The Beta Attenuation Monitor (BAM). These devices draw sampled air at a constant flow rate through a section of paper tape, on which particles from the air are collected. At the beginning and end of the sampling period (1 to 24 hours), transmission of beta particles through the tape (from a source inside the instrument) is measured. The difference between the two measurements, caused by the particulate matter collected on the tape, is used to determine the concentration; and
- The Osiris particulate monitors supplied by Turnkey Instruments are nephelometers, which size and count individual particles as they pass through a laser beam. These are indicative analysers which are suitable as a screening tool for LAQM. Annual means compare favourably with TEOM monitored means but peak values tend to be exaggerated, so these results should be treated with some caution.

Details and locations of these monitoring stations can be found in **Tables 2.1** and **2.1a** and **Figure 2.1**

TEOM and Osiris monitors have heated inlets. These tend to drive off volatile organic particulate matter and in consequence the measured concentrations tend to be lower than those measured by gravimetric reference standard monitors. QA/QC procedures and gravimetric correction of the PM₁₀ analysers is discussed in **Appendix A6**.

Owing to the relocation of 4 of the Osiris units during 2012, eight of the automatic monitoring sites had less than 9 months data and hence the results needed to be annualised as described in Box 3.2 of LAQM.TG(09). The sites chosen for the annualisation and the resulting factors are detailed in **Appendix A5**. The gravimetric equivalent monitoring results for 2012 are shown in **Tables 2.8 & 2.9** along with results for the previous years for which VCM corrected data was available (2008 – 2012). Trends in measured concentrations both corrected and un-factored can be seen in **Figures 2.38 – 2.41**.

Table 2.8 Results of Automatic Monitoring for PM₁₀: Comparison with Annual Mean Objective

Site ID (CM)	Location & (Type of monitor)	Site Type	Confirm Gravimetric Equivalent (Y or N/A)	Annual Mean Concentrations (µg/m ³) & Valid data capture (%)									
				2008		2009		2010		2011		2012	
2	Union St (TEOM)	R	Y	16.9	99.7	16.5	99.2	17.0	90.5	18.8	99.4	15.5	76.3
7	Union St (Osiris)	R	Y*	16.9	92.3	16.6	86.1	16.8	92.9	18.9	92.0	15.5	64.3
3	Broughty Ferry Rd (TEOM)	UI	Y	15.2	95.4	14.8	98.7	15.6	99.0	16.1	98.6	14.2	97.9
13	Broughty Ferry Rd (Partisol)	UI	Y	14.0	97.3	14.2	100.0	14.1	93.7	15.2	99.7	14.3	100.0
16	Broughty Ferry Rd (Osiris)	UI	Y*	n/a		n/a		n/a		n/a		13.4	28.0
12	Mains Loan (TEOM)	UB	Y	11.4	99.7	12.6	84.1	12.6	99.1	12.8	93.1	11.4	98.0
5	Seagate (BAM)	R	Y	n/a		n/a		n/a		17.1	62.2	14.1	98.7
10	Seagate (Osiris)	K	Y*	20.3	92.6	18.1	74.2	20.5	93.2	23.6	93.8	20.6	64.7
14	Meadowside (BAM)	R	Y	n/a		n/a		n/a		23.3	50.6	18.6	97.7
11	Victoria Rd (Osiris)	K	Y*	17.6	92.6	17.1	91.6	21.0	91.1	19.5	93.8	15.5	64.7
4	Lochee Rd (BAM)	R	Y	n/a		n/a		n/a		19.4	72.0	16.5	99.2
8	Lochee Rd (Osiris)	K	Y*	21.1	92.6	18.3	87.3	24.8	93.0	26.3	93.9	18.3	64.5
9	Logie St (Osiris)	K	Y*	19.0	92.1	15.8	91.9	22.1	93.0	21.6	93.9	18.0	90.0
17	Myrekirk Tce (Osiris)	R	Y*	n/a		n/a		n/a		n/a		16.1	28.0
15	Albert St (Osiris)	K	Y*	n/a		n/a		n/a		n/a		16.8	28.0
18	Stannergate (Osiris)	R	Y*	n/a		n/a		n/a		n/a		19.9	28.0

Notes:

Y* - Osiris data has been corrected using an Osiris / TEOM co-location study and then using the VCM method to give an approximate gravimetric equivalent result

Values in bold indicate an exceedence of the PM10 annual mean AQS objective of 18µg/m3

Means show n in the highlighted cells have been "annualised" as in Box 3.2 of LAQM.TG(09) if valid data capture is less than 75%

R=Roadside, UI=Urban Industrial, UB=Urban Background, K=Kerbside

Figure 2.38 Trends in Annual Mean PM₁₀ Concentrations 2008 -2012 (Gravimetric equivalent data)

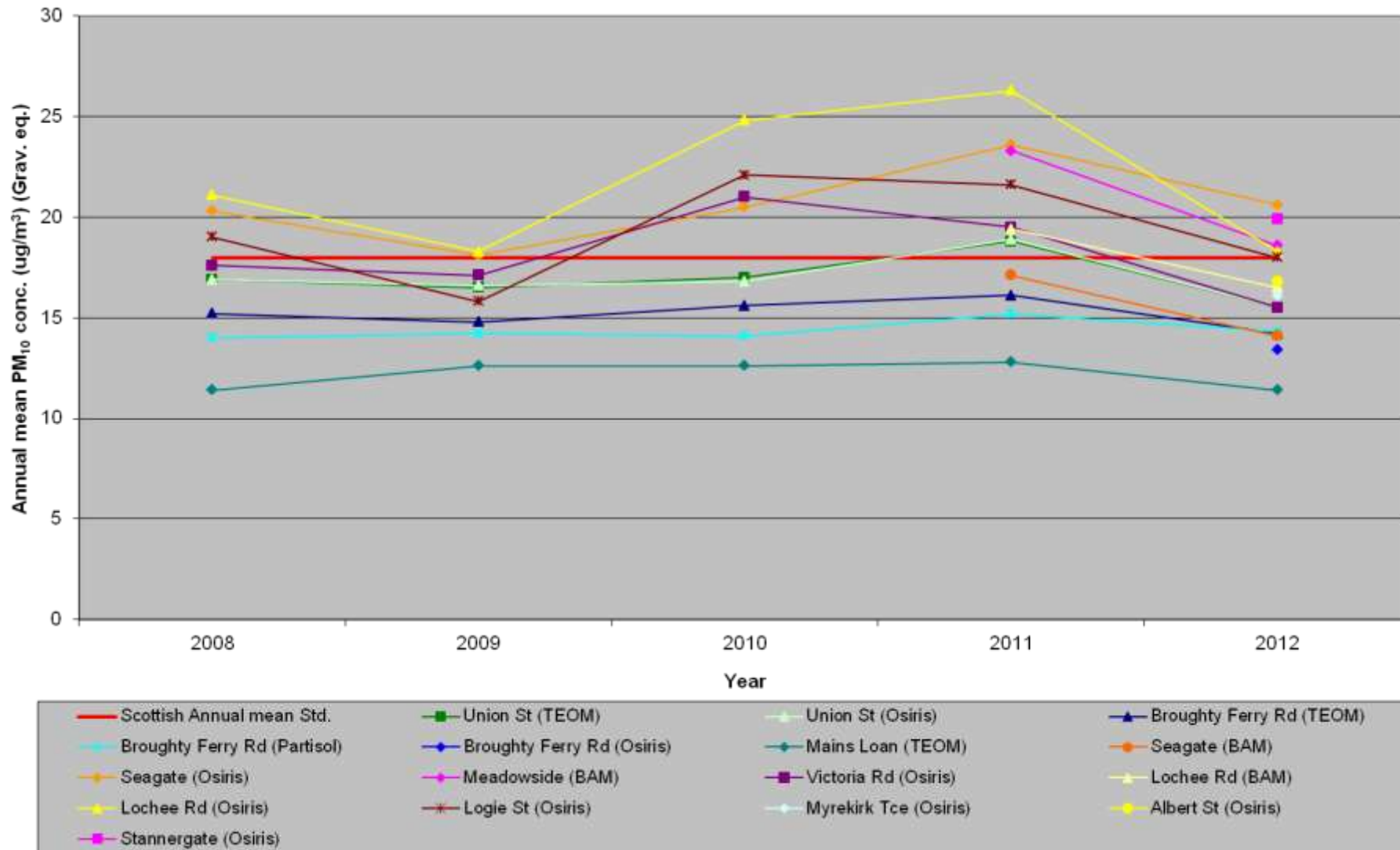


Figure 2.39 Trends in Annual Mean PM₁₀ Concentrations 2001 - 2012 at Long-Term Monitoring Sites (un-factored data)

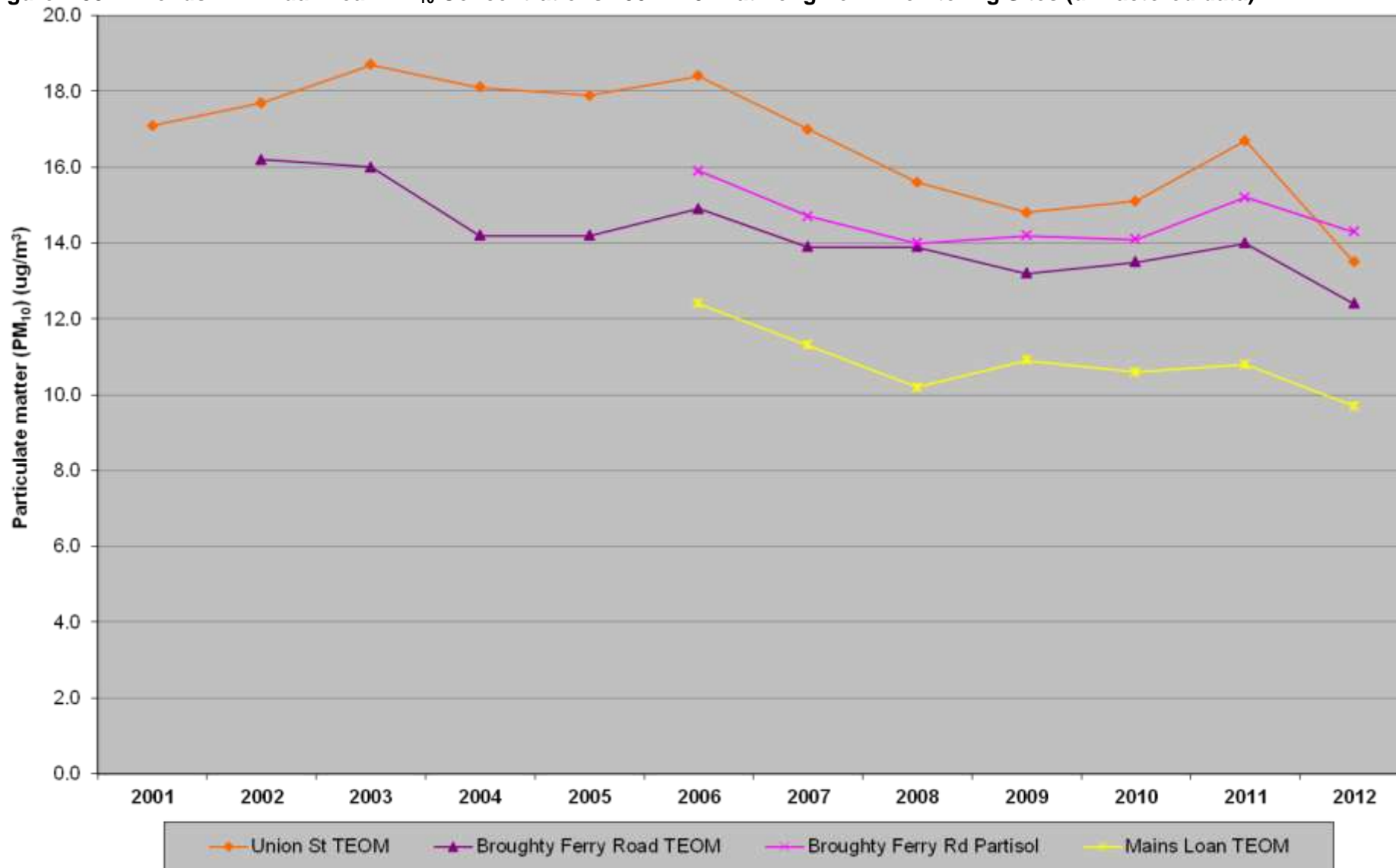


Table 2.9 Results of Automatic Monitoring for PM₁₀: Comparison with 24-hour Mean Objective

Site ID (CM)	Location & (Type of monitor)	Site Type	Valid Data Capture 2012 %	Confirm Gravimetric Equivalent (Y or N/A)	Number of Daily Means > 50µg/m ³ (not to be exceeded more than 7 times per year) & (98.08 th percentile (µg/m ³))									
					2008		2009		2010		2011		2012	
2	Union St (TEOM)	R	76.5	Y	0	(40.3)	2	(33.4)	0	(37.7)	1	(42.8)	2	(36.3)
7	Union St (Osiris)	R	63.9	Y*	4	(47.0)	6	(47.9)	0	(38.8)	5	(48.0)	2	(42.3)
3	Broughty Ferry Rd (TEOM)	UI	98.1	Y	0	(37.8)	2	(35.3)	0	(39.8)	0	(40.3)	2	(35.8)
13	Broughty Ferry Rd (Partisol)	UI	100.0	Y	1	(35.6)	2	(34.5)	0	(36.8)	1	(41.9)	3	(37.5)
16	Broughty Ferry Rd (Osiris)	UI	27.9	Y*	n/a		n/a		n/a		n/a		0	(30.5)
12	Mains Loan (TEOM)	UB	98.4	Y	0	(30.7)	0	(31.3)	0	(30.0)	0	(33.4)	1	(31.9)
5	Seagate (BAM)	R	98.6	Y	n/a		n/a		n/a		1	(38.1)	1	(37.2)
10	Seagate (Osiris)	K	64.8	Y*	12	(49.7)	8	(51.1)	9	(49.6)	23	(65.0)	13	(59.5)
14	Meadowside (BAM)	R	96.7	Y	n/a		n/a		n/a		4	(49.8)	4	(47.5)
11	Victoria Rd (Osiris)	K	63.9	Y*	7	(50.4)	6	(47.7)	7	(49.8)	11	(53.7)	2	(42.3)
4	Lochee Rd (BAM)	R	99.5	Y	n/a		n/a		n/a		2	(43.5)	3	(42.6)
8	Lochee Rd (Osiris)	K	64.5	Y*	10	(57.4)	4	(44.0)	16	(62.5)	30	(70.4)	6	(50.7)
9	Logie St (Osiris)	K	89.9	Y*	9	(54.9)	0	(38.7)	12	(62.7)	17	(53.8)	5	(46.3)
17	Myrekirk Tce (Osiris)	R	27.9	Y*	n/a		n/a		n/a		n/a		0	(30.1)
15	Albert St (Osiris)	K	27.9	Y*	n/a		n/a		n/a		n/a		0	(43.3)
18	Stannergate (Osiris)	R	27.9	Y*	n/a		n/a		n/a		n/a		0	(35.9)

Notes:

Y* - Osiris data has been corrected using an Osiris / TEOM co-location study and then using the VCM method to give an approximate gravimetric equivalent result

Means shown in the highlighted cells have been "annualised" as in Box 3.2 of LAQM.TG(09) if valid data capture is less than 75%

R=Roadside, UI=Urban Industrial, UB=Urban Background, K=Kerbside

Values in bold indicate an exceedance of the PM₁₀ 24-hour mean objective (50µg/m³) which is not to be exceeded > 7 times per year

Figure 2.40 Trends in Number of Exceedences of PM₁₀ 24hour Mean Objective 2010 (50µg/m³, 7 allowed) 2008-2012

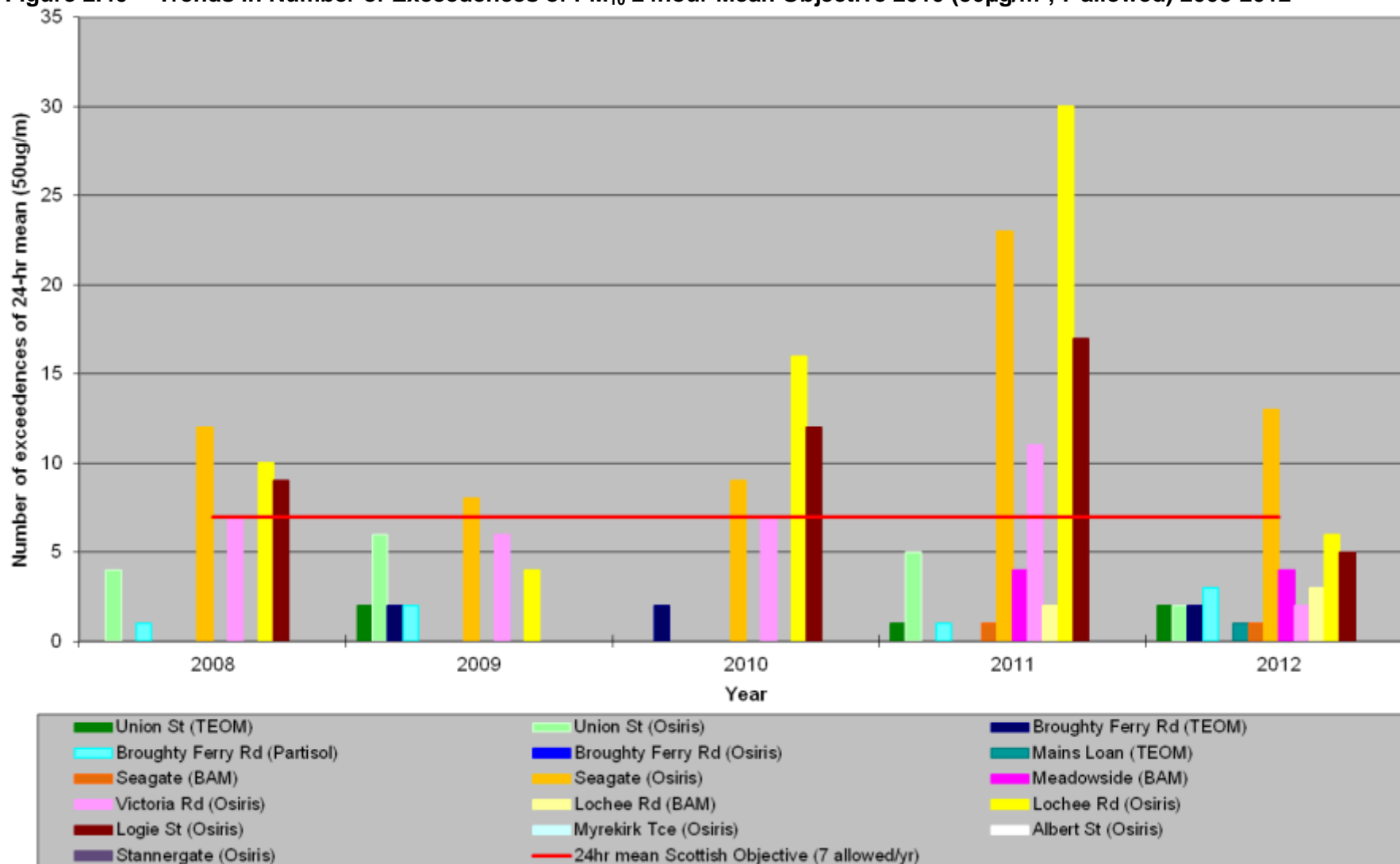
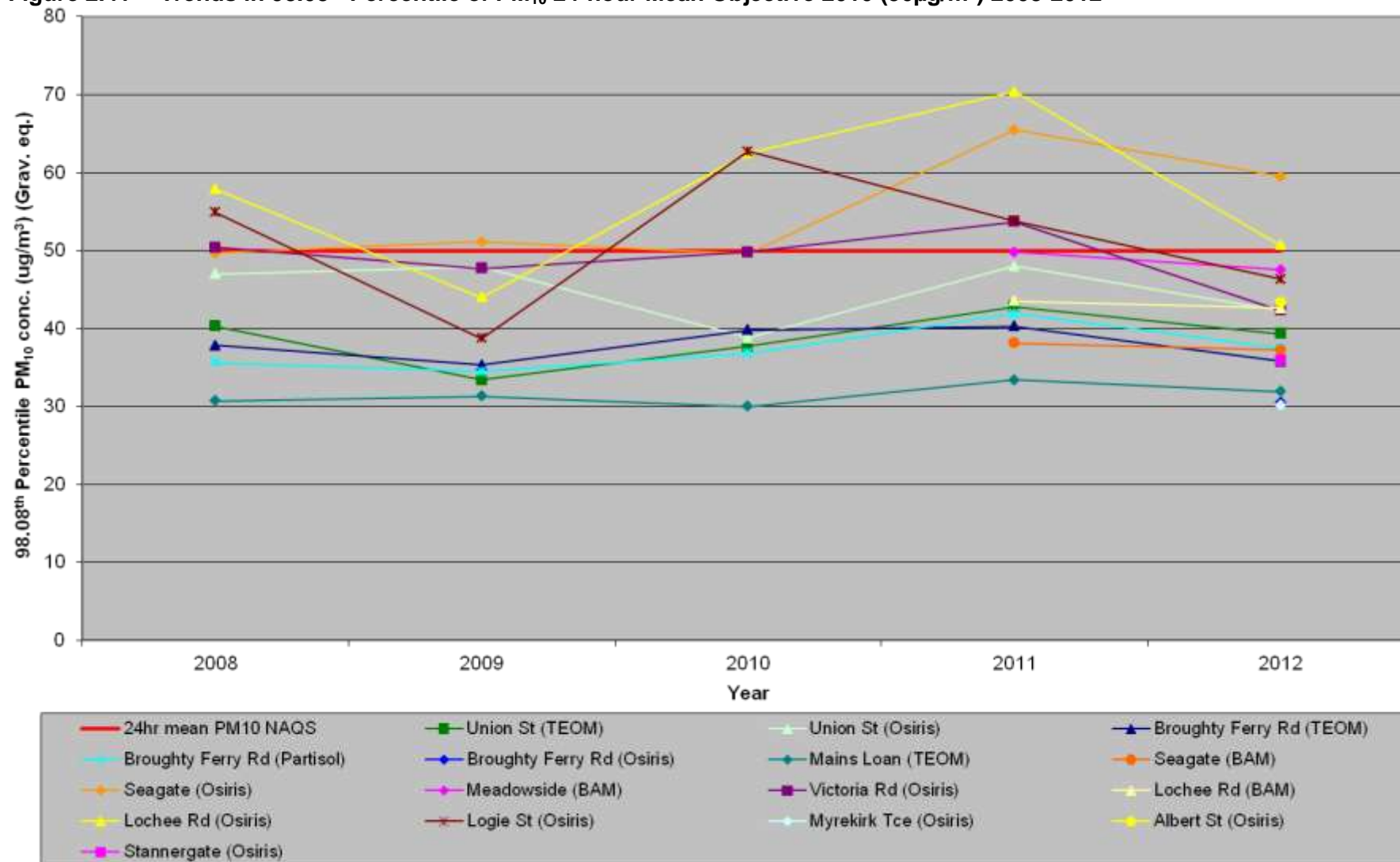


Figure 2.41 Trends in 98.08th Percentile of PM₁₀ 24-hour Mean Objective 2010 (50µg/m³) 2008-2012



Annual Mean PM₁₀ Concentrations

Monitoring results in **Table 2.8** indicate the NAQS 2004 annual mean PM₁₀ objective (40µg/m³) is being met. However, there were exceedences of the Scottish 2010 PM₁₀ annual mean objective (18µg/m³) recorded at Meadowside (BAM) and at Osiris units located at Stannergate roundabout and Seagate. Another 2 Osiris units were close to exceeding the 2010 objective in Lochee Road and Logie Street. The Osiris units are indicative PM₁₀ monitors and the 2012 results have been annualised as the units were re-located after their annual service and calibration. 2012 provided the first full year's data for the three new BAM monitors that were installed in 2011. In all cases data capture was greater than 90% so the potential annual mean exceedence reported for Meadowside in the last USA can be confirmed. It should be noted that the 14 week southbound lane closure in Meadowside during 2012 removed approximately a quarter of all the usual bus movements from the street and so the annual mean value reported (18.6 µg/m³) may be optimistic.

A minimum of 5 years data is required to show a reliable trend. VCM adjusted concentrations have been available since 2008, therefore the following examination of trends in PM₁₀ concentrations is based on either un-factored data or VCM corrected data.

Long term trends in un-factored monitored concentrations between 2001 and 2012 are shown in **Figure 2.39** for four sites. Overall a slight downward trend in PM₁₀ concentrations is evident at all four sites. However this decrease is not so obvious in the past five year's gravimetric equivalent data, shown in **Figure 2.38**. All 2012 concentrations were lower than in 2011 but there is no definite trend over the five years and concentrations remain relatively stable particularly at the background site. Some yearly fluctuations are obvious at roadside and kerbside sites, which can be affected by local factors such as road works (e.g. Meadowside), demolition and construction activities. Year on year fluctuations are also possible as a consequence of climatic effects and trans-boundary pollution episodes.

The 2012 PM₁₀ annual mean urban background concentration was generally in good agreement with the Scottish Government modelled background PM₁₀ concentrations published as (1km x 1km) maps³ in April 2012 (see **Table 2.10**).

Table 2.10 Comparison of Measured Background PM₁₀ Results for 2012 with Scottish Government Background Map Data.

Location	Grid Square	Measured Annual Mean PM ₁₀ (µg/m ³)	Scottish Government Mapped Concentration (µg/m ³)
Mains Loan (VCM)	340500:731500	11.4	12.4

24-hour Mean PM₁₀ Concentrations

Monitoring results in **Table 2.9** and **Figure 2.40** show that the Scottish 24-hour mean objective of 50µg/m³ (not to be exceeded more than 7 times per year), was breached at the Osiris unit when located in Seagate, which recorded 13 exceedences of the 24-hour objective despite only 65% data capture. Where the measured data capture is less than 90%, it is considered more appropriate to express short-term concentrations as percentile values that approximate to the permitted number of exceedences. For PM₁₀, if the value of the 98.08th percentile of 24-hour mean concentrations is greater than 50µg/m³, then it is likely that the allowed number of daily mean exceedences will have been breached. Nine of the

³ http://www.scottishairquality.co.uk/maps.php?n_action=data

monitoring sites had less than 90% data capture in 2012. Examination of the 98.08th percentile values indicates another potential exceedence ($50.7\mu\text{g}/\text{m}^3$) at the Osiris monitor at Lochee Road. However, Osiris units are indicative monitors and have a tendency to over-estimate the number of 24-hour mean exceedences, so the results for these monitors should be treated with some caution.

Of the gravimetric reference equivalent monitors, Meadowside BAM had the highest number of 24-hour mean exceedences (4) as was also the case in 2011. Unlike last year there is sufficient data capture to provide proper comparison with the objective. The 98.08th percentile value decreased (possibly as a consequence of the 14 week southbound lane closure in the street) but is still close to the objective value, so the potential for an exceedence of the 24-hour mean objective will remain under review at this location.

Expressing short-term concentrations as 98.08th percentile values provides easier inter-year comparison of data and examination of trends, see **Figure 2.41**. Concentrations have remained stable or decreased at all sites between 2011 and 2012. The significant increase measured at Seagate in 2011 decreased but remained above the 24-hour mean objective in 2012. Concentrations at this monitor are thought to have been influenced by building work nearby.

An analysis of the frequency of these exceedences is shown in **Table 2.11**. This showed that the majority occurred across nine "Events" during which times the wind speeds were mostly low. The Events (1, 3 and 4) occurring at the end of January and during March were witnessed throughout the UK and have been documented by Defra⁴. Comparisons of Dundee daily PM_{10} concentrations with those from urban background monitoring locations in Scotland for each of the nine identified exceedence episodes are shown in **Figures 2.42 to 2.49**. The majority of these Events coincided with widespread raised background concentrations.

Two of the Events were clearly local:

- Event 2 on the 16th February 2012 recorded at the Seagate Osiris is thought to have been caused by nearby construction activities, and
- Event 8 on the 10th October 2012 recorded at Albert Street Osiris coincided with carriageway resurfacing works close to the monitor.

⁴ "Air Pollution in the UK 2012", Published by the Department for Environment, Food and Rural Affairs, September 2013

Table 2.11 Comparison of 24hr Mean Exceedence Events in Dundee with Wind Speed and Direction and Urban Background Sites

Dates of exceedences of the NAQS 24hr mean PM ₁₀ in Dundee _i	1		2	3	4						5	6	7			8	9	No. of exceedences	
	31/1/12 Tue	1/2/12 Wed	16/2/12 Thu	15/3/12 Thu	23/3/12 Fri	24/3/12 Sat	25/3/12 Sun	26/3/12 Mon	27/3/12 Tue	28/3/12 Wed	24/5/12 Thu	29/5/12 Tue	13/8/12 Mon	14/8/12 Tue	16/8/12 Thu	10/10/13 Thu	20/12/12 Thu		
Average wind direction & speed (degrees, m/s)	121 3.8	147 2.4	259 2.5	243 2.1	82 2.1	70 1.0	211 0.9	238 1.1	252 1.4	275 1.7	60 2.2	83 1.6	92 2.6	85 1.6	152 2.0	292 1.1	110 6.9		
Roadside	Dundee Union St (TEOM-VCM)	36.3	30.8	18.3	40.4	31.7	36.3	50.5	65.9	38.5	40.2	35.5	28.9	30.8	29.1	27.3	24.3	25.5	2
	Dundee Union St OSIRIS-VCM	28.4	24.6	19.3	No data	38.4	41.2	69.8	80.1	38.9	43.4	38.5	38.4	48.1	45.8	36.4	No data	No data	2
	Dundee Meadowside (BAM-G)	37.8	39.9	24.5	No data	34.8	40.8	59.6	72.3	40.8	47.3	48.4	37.8	66.6	56.3	42.9	34.9	37.3	4
	Dundee Victoria Rd OSIRIS-VCM	30.4	25.6	17.6	49.2	42.8	47.0	74.8	75.0	31.6	44.1	42.2	41.0	53.8	49.3	33.6	No data	No data	3
	Dundee Seagate (BAM-G)	42.8	30.3	17.4	39.5	36.1	31.4	46.5	65.0	34.6	33.4	39.8	32.9	37.2	36.9	26.1	22.8	39.2	1
	Dundee Seagate OSIRIS-VCM	50.8	61.5	65.3	64.5	52.5	51.2	81.1	96.6	47.2	50.0	50.9	51.2	57.8	52.5	57.4	No data	No data	13
	Dundee Lochee Rd (BAM-G)	29.4	26.6	22.9	48.3	28.3	35.5	55.6	63.6	42.5	45.5	45.4	28.2	51.5	40.2	31.3	No data	33.2	3
	Dundee Lochee Rd OSIRIS-VCM	36.2	37.7	24.8	61.2	39.7	51.0	87.6	98.5	50.4	54.6	44.0	38.9	49.1	40.4	35.9	No data	No data	6
	Dundee Logie St OSIRIS-VCM	38.7	40.6	20.8	58.6	41.5	52.5	79.6	87.9	46.4	62.2	41.2	45.4	49.4	37.6	34.7	23.6	39.0	5
	Dundee Albert St OSIRIS-VCM	No data	No data	No data	No data	No data						No data	No data	No data			56.5	54.4	2
	Dundee Myrekirk Tce OSIRIS-VCM	No data	No data	No data	No data	No data						No data	No data	No data			18.8	36.4	0
Downwind of Port	Dundee Stannergate OSIRIS-VCM	No data	No data	No data	No data						No data	No data	No data			29.3	47.0	0	
	Dundee Broughty Ferry Rd PARTISOL	54.2	49.6	14.8	31.7	30.4	19.2	65.0	52.1	35.0	37.5	42.9	23.9	34.4	35.6	23.3	22.9	29.6	3
	Dundee Broughty Ferry Rd (TEOM-VCM)	35.7	29.5	16.0	34.6	36.4	35.5	50.8	78.5	42.2	45.8	40.7	30.0	30.7	32.3	21.5	22.7	28.1	2
	Dundee Broughty Ferry Rd OSIRIS-VCM	No data	No data	No data	No data						No data	No data	No data			23.9	34.8	0	
Urban Background	Dundee Mains Loan (TEOM-VCM)	33.8	23.0	12.7	29.9	30.4	34.7	48.3	51.0	29.9	34.3	34.0	23.8	27.8	22.3	18.9	18.7	25.0	1
	Aberdeen Errol PI (TEOM FDMS)	34.0	20.9	11.6	28.3	24.4	24.9	46.1	57.0	34.8	27.6	27.3	14.1	35.8	29.2	26.3	13.1	37.4	1
	Grangemouth (TEOM FDMS)	33.4	No data	13.1	31.7	35.9	41.9	52.6	60.5	33.2	37.4	37.0	22.2	21.9	18.2	17.3	27.7	13.5	2
	North Lanarkshire Cumbernauld (VCM)	33.6	27.0	14.5	30.1	37.4	47.1	48.9	59.0	No data		29.5	19.5	18.8	11.0	16.0	25.5	10.3	1
	Edinburgh St Leonards (TEOM FDMS)	38.7	25.8	19.9	34.0	43.8	40.4	57.6	62.8	39.8	36.3	39.8	27.3	No data			24.0	7.2	2
	Falkirk Grangemouth MC (VCM)	No data	28.3	14.8	32.1	35.6	41.1	53.2	58.6	38.3	41.3	40.1	24.7	No data			No data	24.5	2

Figure 2.42 Comparison of Dundee PM₁₀ Monitoring Sites and Urban Background Locations from 31/01/2012 to 01/02/2012

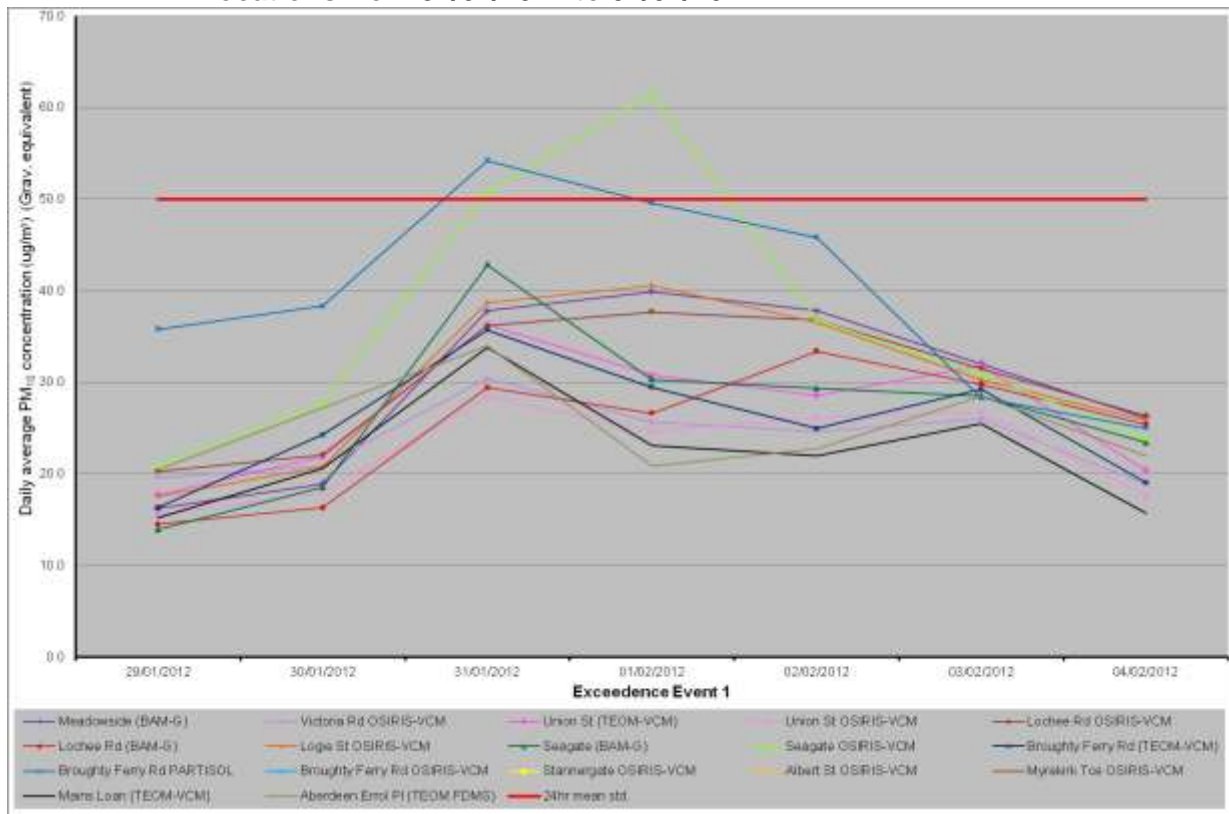


Figure 2.43 Comparison of Dundee PM₁₀ Monitoring Sites and Urban Background Locations on 16/02/2012

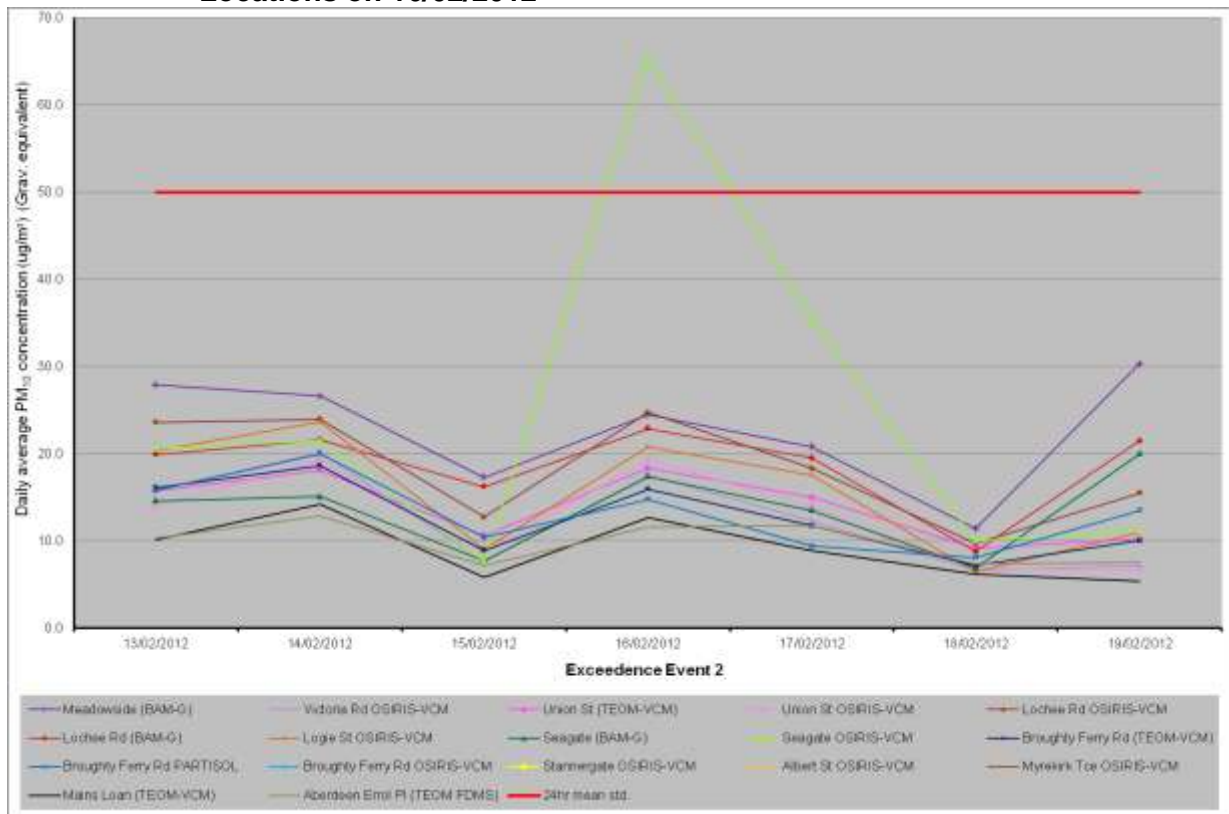


Figure 2.44 Comparison of Dundee PM₁₀ Monitoring Sites and Urban Background Locations on 15/03/2012

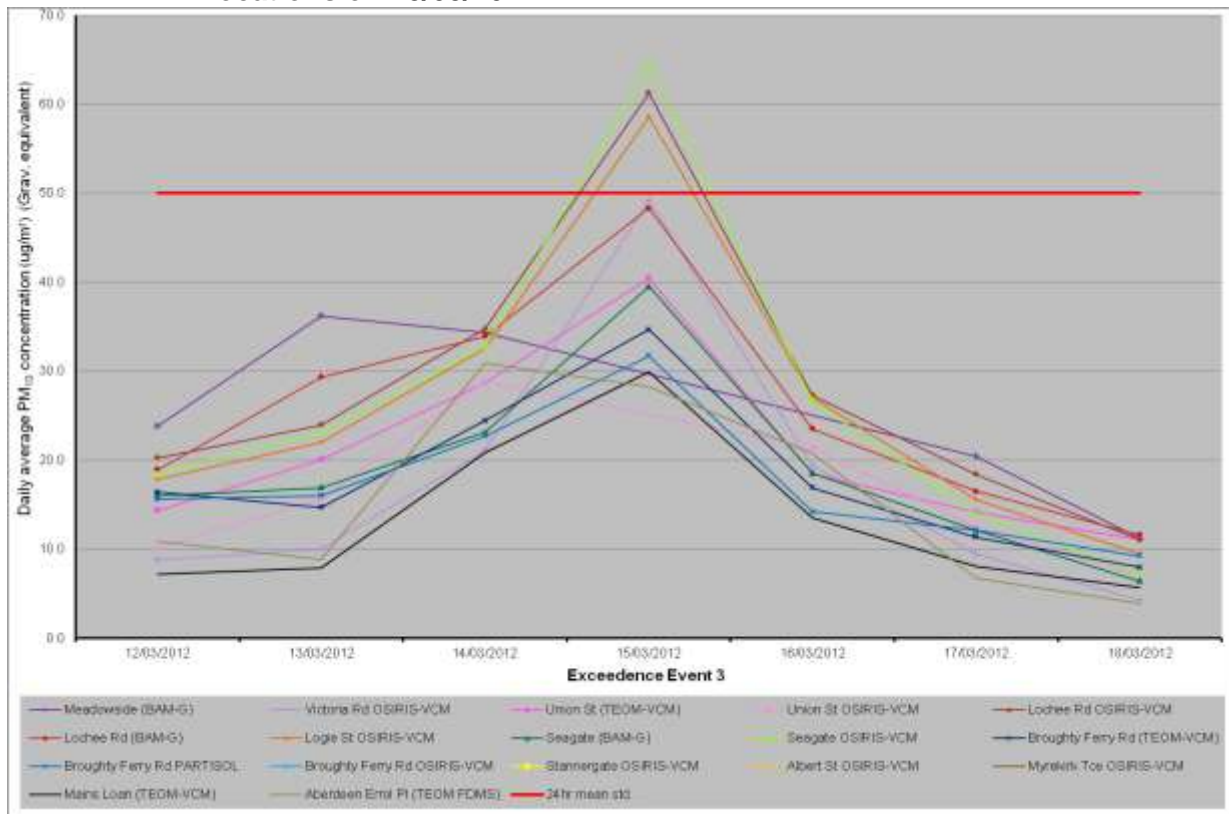


Figure 2.45 Comparison of Dundee PM₁₀ Monitoring Sites and Urban Background Locations on 23/03/2012 to 28/03/2012

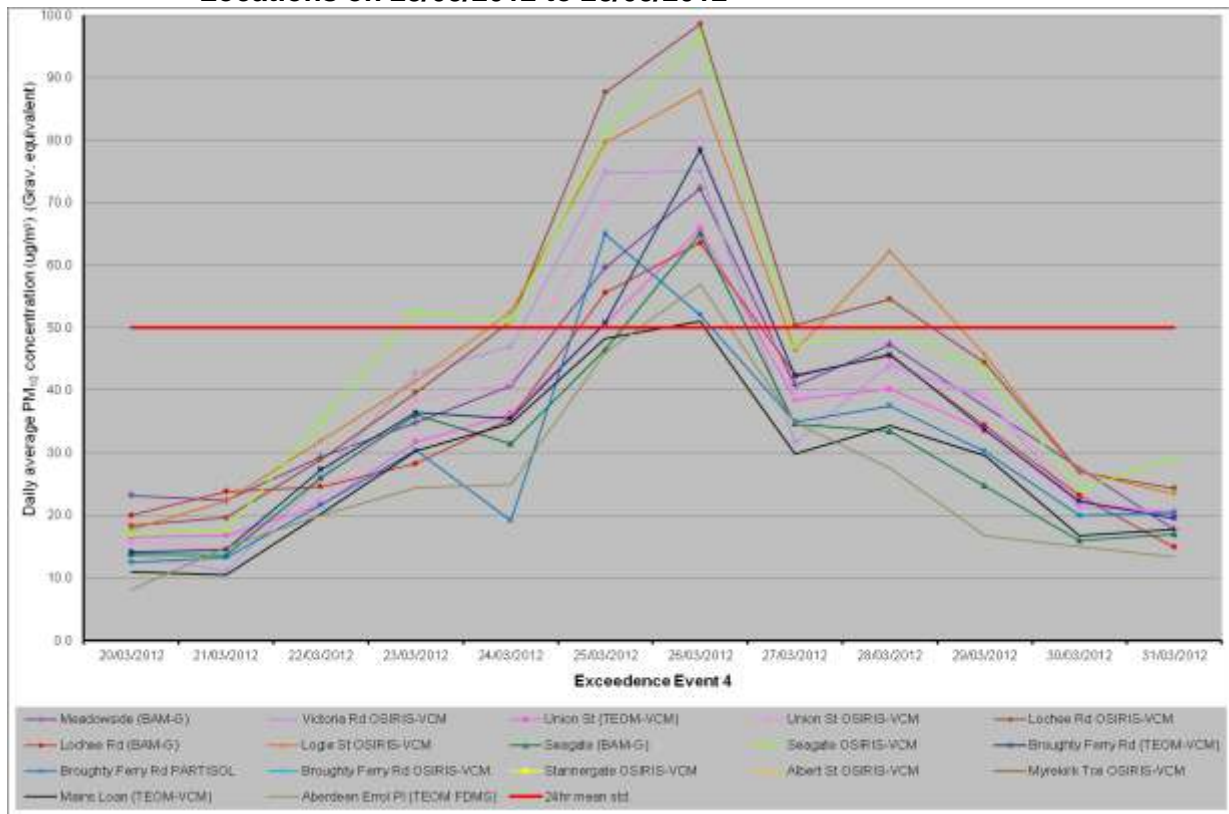


Figure 2.46 Comparison of Dundee PM₁₀ Monitoring Sites and Urban Background Locations on 24/05/2012 and 29/05/2012

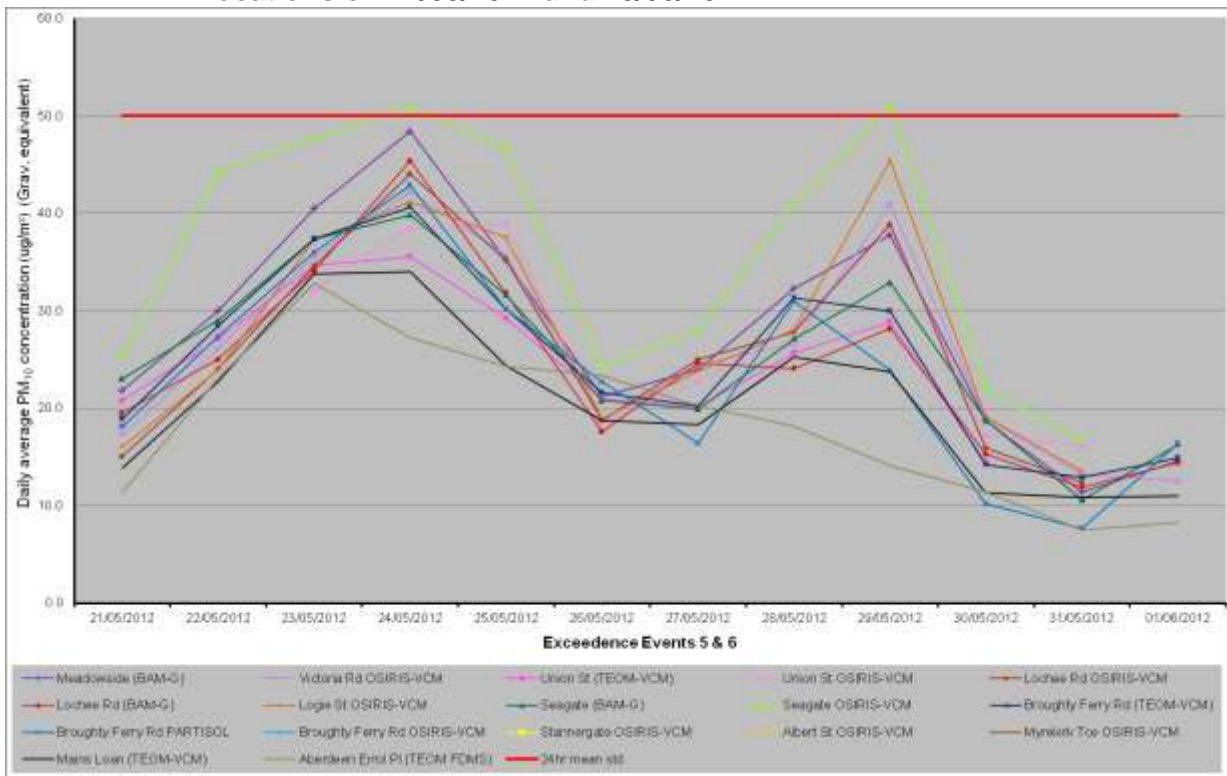


Figure 2.47 Comparison of Dundee PM₁₀ Monitoring Sites and Urban Background Locations on 03/08/2012 and 16/08/2012

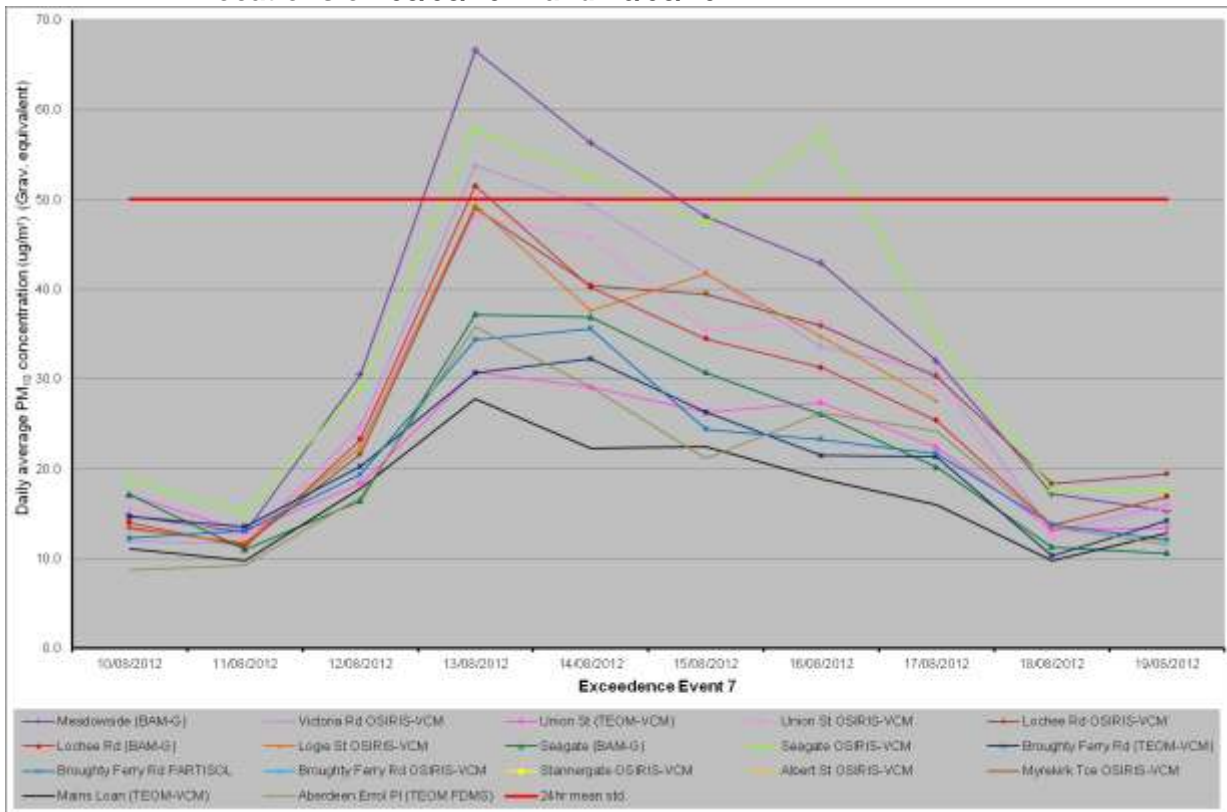


Figure 2.48 Comparison of Dundee PM₁₀ Monitoring Sites and Urban Background Locations on 10/10/2012

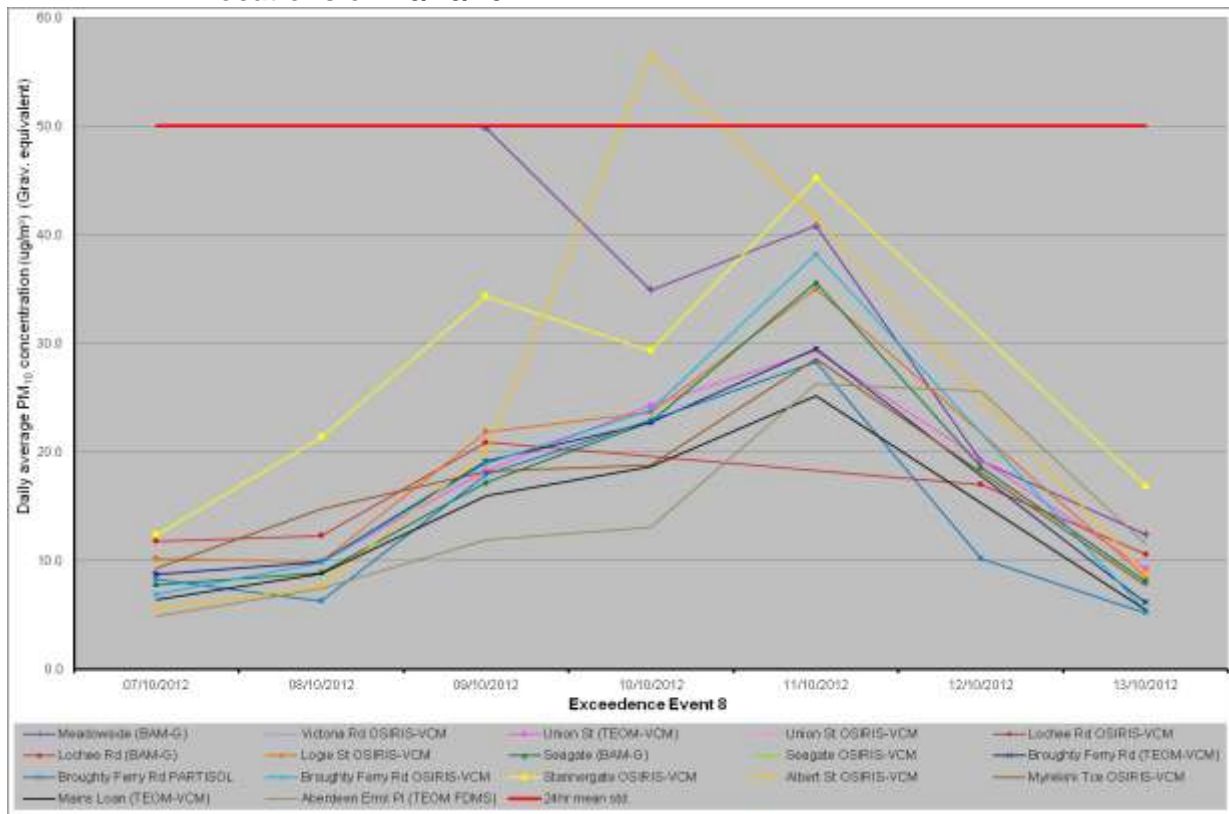
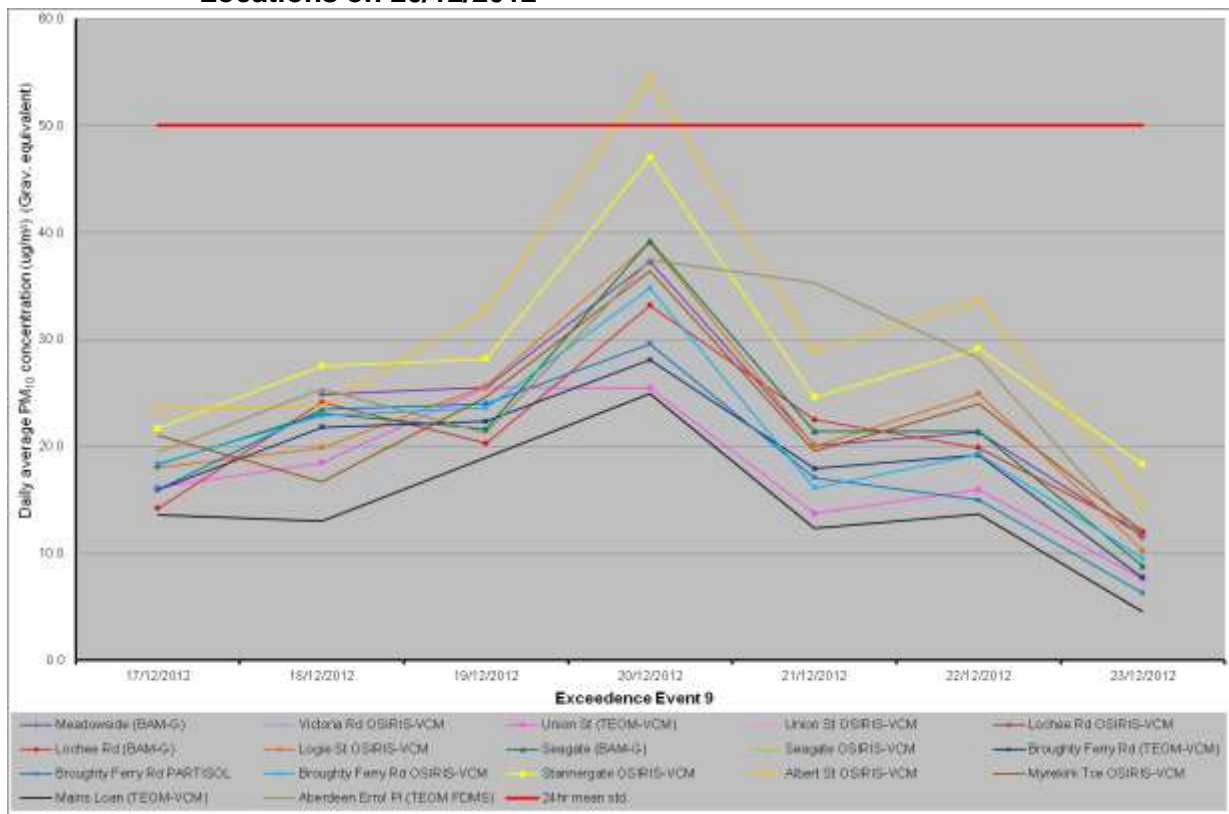


Figure 2.49 Comparison of Dundee PM₁₀ Monitoring Sites and Urban Background Locations on 20/12/2012



2.2.3 Sulphur Dioxide (SO₂)

Dundee City Council measures SO₂ at one location - at Broughty Ferry Road. The monitor is located close to residential receptors located downwind of an urban industrial facility and the port. The UV fluorescence analyser is operated under similar protocols to the AURN stations and the unit is audited twice yearly by AEA. Data are ratified with reference to the Technical Guidance (LAQM.TG(09)).

Results for 2012 are shown in **Table 2.12** below, along with the results for previous years. Concentrations of SO₂ are very low and all the objectives were met. The number of exceedences of each objective is given alongside the relevant percentile value.

As shown in **Figure 2.50**, SO₂ concentrations have declined at the Broughty Ferry Road monitoring station between 2002 and 2012. This is largely consistent with the introduction of low sulphur fuels (required by regulations since 1st January 2003) at a nearby industrial process (bitumen refinery) in the port. In previous reports, occasional exceedences of the 15min mean objective had been recorded as a result of certain shipping activities/movements within the port. The last recorded exceedences were in 2006. In recent years the sulphur content of marine fuels has decreased significantly, to the extent that fuel oil for ship use at sea in Sulphur Emission Control Areas specified in the MARPOL Convention⁵ (which includes the North Sea), is limited to 1.5% sulphur by weight (the average in European waters pre-2007 was of the order 3%). In addition, since January 2010 ships lying at berth in European Union ports have to burn distillate oil with a sulphur content of not greater than 0.1% by weight.

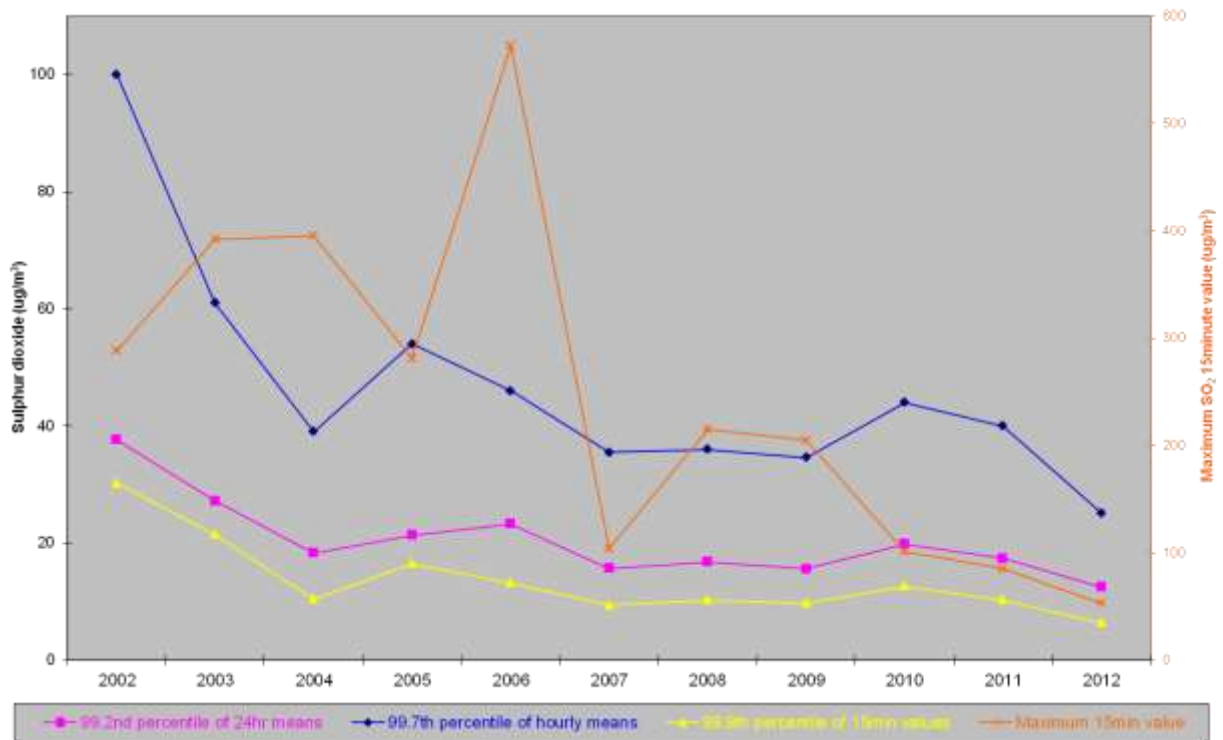
Table 2.12 Results of SO₂ Automatic Monitoring at Broughty Ferry Road: Comparison with Objectives

Location : Dundee Broughty Ferry Road, Site ID : CM3, Site Type : Urban Industrial												
Year	24hr mean objective				1hr mean objective				15min mean objective			
	No. of exceedences >125ug/m ³ (3 allowed per year)	Max (ug/m ³)	99.2 nd percentile (ug/m ³)	data capture %	No. of exceedences >350ug/m ³ (24 allowed per year)	Max (ug/m ³)	99.7 th percentile (ug/m ³)	data capture %	No. of exceedences >266ug/m ³ (35 allowed per year)	Max (ug/m ³)	99.9 th percentile (ug/m ³)	data capture %
2002	0	69.7	37.6	92.1	0	207.7	100	92	1	288	165	90.4
2003	0	53.7	27.2	97.3	0	267.3	61	97.5	6	392	117	95.4
2004	0	33.3	18.3	100	0	294.2	39	100	5	395	57	97.9
2005	0	54	21.3	94.8	0	235.1	54	95	2	281	90	93
2006	0	50.1	23.3	96.2	0	277.5	46	96.6	5	572	72	94.5
2007	0	19.6	15.7	99.7	0	68.8	36	99.6	0	104	51	97.5
2008	0	24.5	16.8	97.5	0	137.8	36	97.5	0	215	56	95.6
2009	0	17.4	15.6	93.4	0	119.8	35	93.4	0	205	53	91.5
2010	0	27.4	19.8	96.4	0	92.3	44	96.5	0	101	69	94.5
2011	0	11.0	17.4	82.7	0	66.5	40	83.0	0	85	56	81.3
2012	0	14.8	12.5	94.0	0	42.3	25	93.7	0	53	35	92.6

Notes: The monitoring station is located within an AQMA for NO₂ and PM₁₀.
Data capture percentages are for a full calendar year.

⁵ Marpol is the International Convention for the Prevention of Pollution from Ships, 1973 as modified by the Protocol of 1978, Annex VI -Prevention of air pollution from ships.

Figure 2.50 Trends in Maximum (15min) SO₂ Concentrations and Relevant Percentiles from 2002 to 2012



Summary of Compliance with AQS Objectives

Dundee City Council has examined the results from monitoring in 2012. Concentrations within the AQMA, previously declared for NO₂ and PM₁₀ annual mean and NO₂ the hourly mean (i.e. the whole council area), still exceed the relevant objectives and the AQMA should remain.

Dundee City Council has measured concentrations of NO₂ above the annual mean objective at relevant locations within the AQMA. There are 17 diffusion tube (and 3 associated continuous analyser) locations where the annual mean NO₂ concentration at façade is estimated to exceed the objective. The concentration at the Whitehall Street continuous analyser is also estimated to breach the annual mean objective at the building façade. Owing to uncertainties associated with the distance calculator tool, there are potential exceedences at a further 14 locations. A new potential exceedence area has been identified at South Road (Denbank) which is an access route for Ninewells Hospital and Dundee Technology Park.

Dundee City Council has measured concentrations of NO₂ above the 1-hour objective at one location (Lochee Road) for four consecutive years. The patterns of exceedences suggest this may have occurred as a result of traffic congestion caused by the impact of the severe winter weather on the road network in 2009 and 2010. The winter weather was less severe in 2011 and 2012 but the number of exceedences recorded in 2012 is still greater than the 18 allowed (36). This area is within the AQMA declared in relation to breaches of the hourly objective.

The PM₁₀ NAQS 2004 annual mean objective continues to be achieved at all locations within the city, however Dundee City Council has measured concentrations of PM₁₀ above the stricter Scottish 2010 annual mean objective at Meadowside (BAM) and at Osiris units located in Stannergate and Seagate. Concentrations at two other Osiris monitors in Lochee Road and Logie Street were close to exceeding the annual mean objective. The Osiris units are indicative PM₁₀ monitors and owing to their relocation and hence low data capture, the 2012 annual mean had to be estimated ("annualised") for all except Logie Street Osiris.

The Scottish 24-hour mean objective was exceeded at two locations, Seagate and Lochee Road in 2012 using Osiris monitors. It is known that Osiris monitors tend to over-estimate the number of 24-hour mean exceedences, so these results should be treated with caution. However, the gravimetric reference equivalent BAM at Meadowside measured four exceedences and had a 98.08th percentile value which was close to the objective. Consequently the potential for an exceedence of the 24hour mean objective will remain under review at this location, especially as 2012 records for Meadowside may be favourable owing to the 14week lane closure in the street.

New monitoring data for 2012 show all the objectives for SO₂ are being achieved.

3 New Local Developments

3.1 Road Traffic Sources

Under this section the Council is required to identify any of the following which are new since the last Updating and Screening Assessment:

- Narrow congested streets with residential properties close to the kerb,
- Busy streets where people may spend one hour or more close to traffic,
- Roads with a high flow of buses and/or HGVs,
- Junctions.
- New roads constructed or proposed since the last Updating and Screening Assessment,
- Roads with significantly changed traffic flows, and
- Bus or coach stations.

Screening of available updated traffic count data is presented in **Appendix F**. A review of Department for Transport traffic count data (see **Table F2**) identified a greater than 10% increase in traffic flows on the Kingsway (east of Myrekirk roundabout). Since the last USA (2012) alterations to the Kingsway / Myrekirk Road roundabout, which forms part of the trunk road network through the city, have taken place as part of a new superstore development. The air quality assessment that accompanied the proposals predicted a new exceedence of the PM₁₀ annual mean standard as a result of the development⁶. A condition requiring post development pollution monitoring & modelling was applied to the planning consent, this study is programmed to commence in 2014. One of the council Osiris monitors was relocated to a receptor façade equivalent location close to this roundabout in 2012.

A strategic transport project to strengthen the road bridge over the railway and improve HGV access to the port was completed in 2012 and has the potential to result in an increase in HGVs entering the port from the east. The eastern port access is close to the existing annual mean NO₂ and PM₁₀ exceedence location at Stannergate roundabout. This area could also be potentially impacted upon by other developments in the vicinity such as the proposed biomass power station at the port; the eastern port expansion and the already consented wind turbine manufacturing plant⁷. The Council intend to undertake traffic micro-simulation modelling and air dispersion modelling of Dundee's east arterial routes, including Stannergate roundabout, in 2013/14 to try to identify traffic/road infrastructure measures that may improve air quality.

New junctions and roads have been constructed and others are proposed as part of the Central Waterfront Development Masterplan 2001 - 2031, described previously in the Progress Report 2005. The closest receptors to these changes are located on Dock Street which is already an identified exceedence area. The need for review and assessments of the new roads and junctions will be examined in subsequent reports as necessary.

⁶ <http://idoxwam.dundeeccity.gov.uk/WAM133/doc/Report-345111.PDF?extension=.PDF&id=345111&location=VOLUME2&contentType=application/pdf&pageCount=1>
⁷ http://idoxwam.dundeeccity.gov.uk/idoxpa-web/files/7041BE0BD1BEC4C5E14EEC0E473A9E5B/pdf/12_00558_PPPM-STRATEGIC_TRANSPORT_ASSESSMENT-429412.pdf

3.2 Other Transport Sources

Under this section the Council is required to identify any of the following which are new since the last Updating and Screening Assessment:

- Airports,
- Locations where diesel or steam trains are regularly stationary for periods of 15 minutes or more, with potential for relevant exposure within 15m,
- Locations with a large number of movements of diesel locomotives, and potential long-term relevant exposure within 30m, and
- Ports for shipping.

There are no new developments since the last USA (2012) that meet the above description/criteria.

3.3 Industrial Sources

Under this section the Council is required to identify any of the following which are new since the last Updating and Screening Assessment:

- **Industrial installations:** new or proposed installations for which an air quality assessment has been carried out,
- **Industrial installations:** existing installations where emissions have increased substantially (>30%), or new relevant exposure has been introduced,
- **Industrial installations:** new or significantly changed installations with no previous air quality assessment,
- Major fuel storage depots storing petrol,
- Petrol stations, and
- Poultry farms.

The proposed wind turbine manufacturing plant at the Port of Dundee may have an impact on air quality depending on the type of processes involved, no details were available at the planning permission in principle stage and the need for a detailed assessment of this facility will be kept under review.

SEPA were consulted regarding any changes meeting the above criteria at SEPA regulated sites. **Appendix E** summarises SEPA's responses (in the white columns) and screens the processes against the above criteria (orange columns). New exposure was identified close to some SEPA regulated processes but these were not processes requiring review and assessment. One process had relocated within Dundee; however this is not a process that requires review and assessment. Several processes had stopped operating, closed or surrendered permits since the last USA. One process obtained a variation to their permit to increase particulate emissions from May 2013. The increase in emissions was estimated to be less than 7.5%.⁸ This does not constitute a substantial rise in emissions (>30%) as detailed in Box 5.5 of LAQM.TG(09), and therefore an updated assessment is not required.

⁸ Attachment 4 – Non Technical Summary Nynas UK AB PPC Permit PPC/A/1013015 (13 March 2013) viewed during meeting with Stuart Anderson SEPA on 23 Oct 2013.

3.4 Commercial and Domestic Sources

Under this section the Council is required to identify any of the following which are new since the last Updating and Screening Assessment:

- Biomass⁹ combustion plant – individual installations (50kW to 20MW).
- Areas where the combined impact of several biomass combustion sources may be relevant.
- Areas where domestic solid fuel burning may be relevant.

Since the last USA, there have been no new biomass combustion installations nor areas identified where the combined impact of several biomass sources may be relevant. Smoke Control Orders cover most of the local authority area and there are currently no areas identified with significant solid fuel use, though enquiries/complaints to the Council about domestic solid fuel burning are on the increase. The USA had also concluded that there was insufficient information to adequately fulfil the requirements of this section. It is hoped that an analysis of Census data¹⁰, when available will assist with the identification of any areas where there may be a significant number of houses burning solid fuel as their primary source of heating.

3.5 New Developments with Fugitive or Uncontrolled Sources

Under this section the Council is required to identify any of the following which are new since the last Updating and Screening Assessment:

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

Since the last USA (2012) planning permission in principle has been granted for a wind turbine manufacturing facility at the Port of Dundee. There is a potential for fugitive emissions to be generated during the construction phase which would involve the demolition of existing facilities prior to the construction of the new facility. An Air Quality Screening Assessment¹¹ submitted in support of the application concluded that:

“The significance of the effects of potential emissions from the construction phase has been assessed as ‘negligible’, following the adoption of suitable mitigation measures ...”

Proposed mitigation measures include (*inter-alia*): erection of solid barriers to site boundary; hard surfacing and effective cleaning of haul routes; effective vehicle cleaning and wheel washing; use of covered chutes and skips; wrapping of buildings to be demolished; use of water as a dust suppressant and the re-vegetation of earthworks and exposed areas.

⁹ Note (from DEFRA FAQ 2009): the term ‘biomass’ strictly applies to all solid fuels made from plants, i.e. coal, smokeless fuels, wood, straw etc... However, the term biomass is now frequently taken to be synonymous with renewable fuels such as wood and straw. For the purposes of air quality review and assessment the strict definition of biomass is applicable.

¹⁰ Question H9 “What type of central heating does this accommodation have?”

¹¹ “Port of Dundee – Proposed Mixed Manufacturing and Assembly Facility Air Quality Screening Assessment” Scottish Enterprise October 2012 Prepared by White Young Green Planning & Environment Job Number:A078815

Since the last USA there has been an increase in the use of unmade roads and ground within the most eastern area of the Port. This area is within 200m of residential properties and the Stannergate Osiris. During 2012 part of the site was occupied by contractors involved in the nearby rail bridge strengthening works. Some evidence of “track-out” onto a public road was visible during the works but there were no complaints. Monitoring will be continued and will be kept under review.

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

- Proposed Wind Turbine Manufacturing Plant at the Port, and
- Increased Traffic Flows on the Kingsway (east of Myrekirk Roundabout).

These will be taken into consideration in the next Updating and Screening Assessment.

It was also concluded that there is insufficient information to adequately fulfil the requirements of the section on Commercial and Domestic Sources of biomass/solid fuel. It is hoped that an analysis of Census data¹², when available will assist with the identification of any areas where there may be a significant number of houses burning solid fuel as their primary source of heating.

¹² Question H9 “What type of central heating does this accommodation have?”

4 Local / Regional Air Quality Strategy

The relevant Policy Guidance¹³ documents recommend that all Local Authorities (particularly those that have not had to declare an AQMA and do not expect to declare one in future, but which have areas close to the AQS Objectives), should consider drawing up a Local Air Quality Strategy. Dundee has an Air Quality Management Area and Action Plan covering the whole of the administrative area and as such it has not been considered necessary to date to adopt a Local Air Quality Strategy. The need for a regional air quality strategy will be kept under review.

¹³ <http://www.scotland.gov.uk/Topics/Environment/waste-and-pollution/Pollution-1/16215/PG09>

5 Planning Applications

Progress Reports only need to take account of planning applications that have been approved.

However, this part of the Progress Report is useful for highlighting planning applications for new developments which have not yet been approved but which could impact upon air quality. This can help give a picture of areas where changes may occur and also where combined impacts of several developments may become important.

As reported in Section 3.1, a strategic transport project to strengthen the road bridge over the railway and improve HGV access to the port was completed in 2012. This has the potential to result in an increase in HGVs entering the port from the east. The eastern port access is close to the existing exceedance area (for NO₂ and PM₁₀) at Stannergate roundabout. This area could also be potentially impacted upon by other proposed developments in the vicinity such as the biomass power station; the eastern port expansion and the already consented wind turbine manufacturing plant.

The Scottish Government's National Renewables Infrastructure Plan identifies the Port of Dundee as a potential location for manufacturing, installation and maintenance of off-shore wind infrastructure. The Port of Dundee is also recognised as one of two Low Carbon Renewables Enterprise Areas to encourage businesses in this sector to set up and grow in Scotland. Land within the Port area is limited, hence the proposed expansion, and the complimentary designation of land within the Claverhouse East Energy Park as an Enterprise Area to accommodate developments not requiring immediate quayside access.

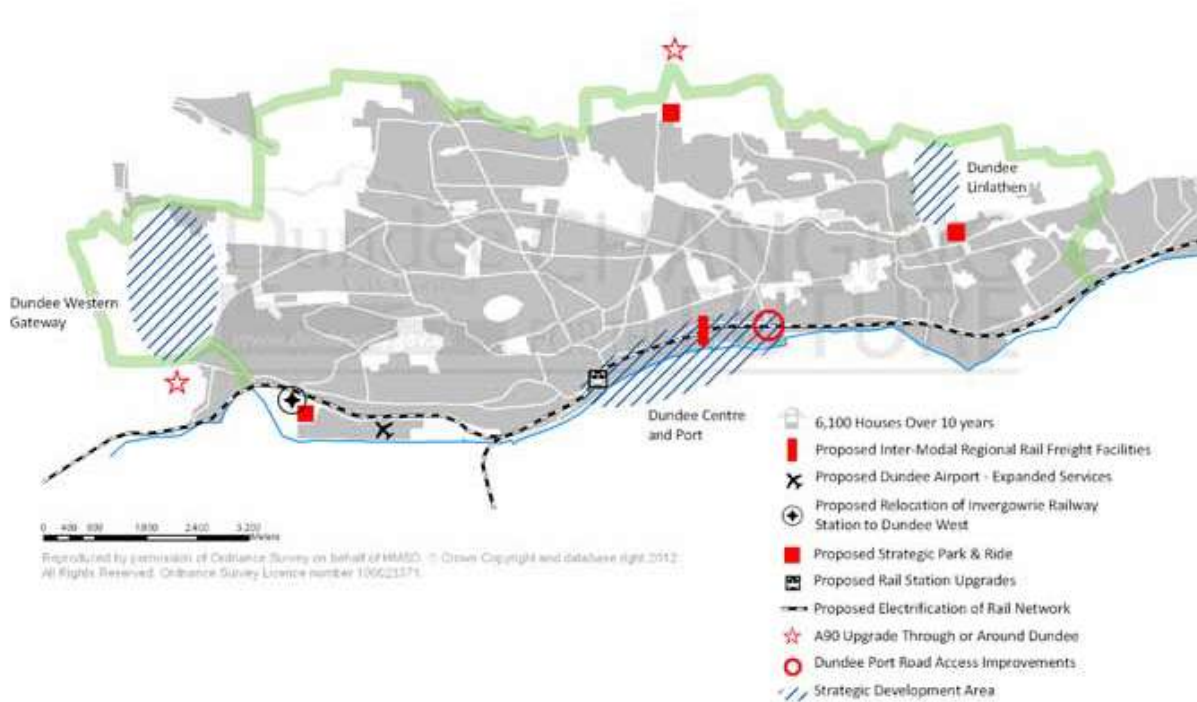
Strategic Development Areas

The Port of Dundee coupled with the Central Waterfront is one of three Strategic Development Areas identified in the Proposed Local Development Plan (LDP) along with Dundee Western Gateway (50 hectares of employment land) and Linlathen (40 hectares of employment land) north of the A92 on the east of the city. These areas are shown in **Figure 5.1**¹⁴ along with housing land requirement for the plan period, and major infrastructure and transport proposals.

The Strategic Development Areas are safeguarded in the Proposed Local Development Plan for future growth opportunities in key sectors with the exception of the Western Gateway, which is a long term (Post 2024) allocation in the TAYplan.

¹⁴ extracted from the Proposed Local Development Plan, October 2012, Figure 4, page 11

Figure 5.1 Strategic Development Areas and Projects within Dundee



Strategic Environmental Assessment (SEA) of the Proposed Local Development Plan¹⁵

The Environmental Report and associated Annexes^{16,17}, which form part of the SEA of the proposed LDP, recognise that air quality within the city is worsening and that there is a need for supporting policies within the LDP to promote the Air Quality Action Plan and also the need for Supplementary Planning Guidance on air quality. Specific policies within the LDP are highlighted within the Environmental Report as having a potential impact on air quality. The air quality criteria (Objectives and Indicators) used by the SEA to examine the proposed LDP impacts are shown in **Table 5.1**.

Table 5.1: SEA Objectives and Indicators for Air Quality

Topic	SEA Objective	SEA Resource Indicators
Human Health	3. To maximise the health and well-being of the population through improved environmental quality and access	Effect of Plan on indicators for: a. air quality
Air Quality	6. To protect and enhance air quality	Effect of Plan on indicators for: a. impact on Air Quality legislative limits in AQMA

¹⁵ http://www.dundeeccity.gov.uk/sites/default/files/publications/CD_LDP_Environment%20_Report_March13.pdf

¹⁶ http://www.dundeeccity.gov.uk/sites/default/files/publications/CD_LDPSEA_Annex_1_Economic_Growth.pdf

¹⁷ http://www.dundeeccity.gov.uk/sites/default/files/publications/CD_LDP_Annex_2_Quality_Housing.pdf

The Environment Report's comments upon these specific LDP policies are summarised below:

Policy 1: Principal Economic Development Areas

"The reduction in the Principal Economic Development Areas (EDA) west of the Technology Park reduces the potential for further pressure on air quality in this part of the City. Continuation of this existing allocation brings no new pressure on air quality legislative limits."

Policy 2: Specialist Economic Development Areas

"The change of designation of this existing allocation from Principal to Specialist EDA generally brings no new pressure on air quality legislative limits. New land identified at the rail yards could generate traffic which affects the City Centre Hot Spot areas. Air Quality Supplementary Planning Guidance (SPG) will address the impact of any development in this location."

Policy 5: Tourism & Leisure Developments

Tourism & Leisure developments are highlighted as having a potential cumulative impact on air quality legislative limits. *"The locational choice for tourism and leisure developments should restrict the need for visitors from outside the local area to travel to destinations once arriving in the City however there is a potential impact from visitors from the local area accessing local transport to get to the destinations"*.

Policy 8: Housing Land Release

"The TAYplan Strategic Development Plan requires the identification of housing land within Dundee to accommodate an average annual build rate of 610 houses. This equates to a total requirement over the period of the Local Development Plan (2014 to 2024) of around some 6100 houses. The Housing Land Audit (March 2012) for Dundee identified that there was already an existing generous supply of land for housing across the City. At current build rates that would provide a supply of around 4337 units by 2014. The remaining units required to make up the supply for the 10 year period of the Plan are to be accommodated on the sites identified"¹⁸ on the Proposals Map¹⁹.

"The strategy for identifying additional housing land necessary to meet the identified build rate has been to give priority to the reuse of brownfield land within the existing urban area and to focus the limited greenfield land release to the Strategic Development Area (Policy 4 TAYplan Strategic Development Plan) identified at the Western Gateway."

"Some sites may have an impact on air quality hot spot areas within Dundee, mainly on arterial routes. LDP policies on air quality and accessibility of new developments should help to minimise air quality issues over time. Any cumulative impact will be monitored through the Air Quality Action Plan."²⁰

Policy 20(c): City Centre Extending and Upgrading

New Shopping Provision at the Overgate and Wellgate Shopping Centres and within the proposed Central Waterfront Area is highlighted as having *"potential cumulative and synergistic negative effects"* on air quality.

¹⁸ <http://www.dundee.gov.uk/sites/default/files/publications/Proposed%20Dundee%20Local%20Development%20Plan%20-%20as%20Modified%20Oct13.pdf>, paragraph 7.4 & 7.5

¹⁹ <http://www.dundee.gov.uk/sites/default/files/publications/Proposed%20Dundee%20Local%20Development%20Plan%202012%20Proposals%20Map.pdf>

²⁰ http://www.dundee.gov.uk/sites/default/files/publications/CD_LDPSEA_Annex_7_Site_Assessment.pdf

Policy 25: Gallagher Retail Park Extension

The possible extension of Gallagher Retail Park to include the adjacent bus depot is also highlighted within the Environmental Report as having “*potential cumulative and synergistic negative effects*” on air quality.

Policy 30: Biomass Energy Generating Plant

The “*potential negative impact on air quality*”²¹ from biomass is recognised within the Environmental Report and the need for air quality assessments and mitigation are included within the policy (see **Section 6**).

²¹ http://www.dundee.gov.uk/sites/default/files/publications/CD_LDP_Annex_4_Sustainable_Natural.pdf

6 Air Quality Planning Policies

The proposed Local Development Plan²² contains several policies which may help mitigate the direct and potential cumulative impacts that development can have on air quality. These specific policies are detailed in **Table 6.1** and relate to general economic development areas, funding of infrastructure, renewable energy generation (biomass), air quality and sustainable transport. Extracts from the proposed LDP outlining the Policies are provided (*in italics*):

General Economic Development Areas – Policy 3

“Where existing industrial areas are close to housing, the protection of residential amenity is considered key in assessing the acceptability of new development proposals. Proposals for new business/industrial development or expansion of existing businesses provide an opportunity to improve the environmental quality of business and industrial areas in terms of landscaping, building design, air quality, energy efficiency and waste management.”

Funding of On and Off Site Infrastructure Provision – Policy 19

“Infrastructure provision, for example roads, schools, open and green space, street lighting and drainage, is a necessary part of most development proposals. As part of the development process it is normal for the developer to meet the capital costs for infrastructure such as roads, footways and street lighting within the site area of the development. In some instances, the impact upon the infrastructure extends beyond the boundaries of the development site. In these instances, where it can be recognised that the need for infrastructure improvement or provision in a surrounding area is as a result of the development of a site within the area, it is not unreasonable to expect the development to make a contribution to these improvements. In addition, the opportunity to also seek the improvement of green infrastructure through developer contributions should be considered.” Annex 3 to Environment Report for the Proposed LDP suggests that there could be “*potential contribution to the provision of air quality infrastructure through Air Quality SPG and Action Plan*”²³.

Renewable Energy – Policy 30

“The Climate Change (Scotland) Act 2009, which amended the Planning etc (Scotland) Act 2006, specifically requires Local Development Plans to contribute to the reduction of CO₂ emissions”....“by encouraging the installation of low and zero carbon generating technology such as solar panels, wind turbines or ground source heat pumps in new development. The percentage contribution that low and zero carbon technology is expected to make to the overall reduction in carbon emissions must increase over the lifespan of the Local Development Plan. The impact, knowledge and understanding of the various methods of renewable energy generation is developing at a fast pace and the favoured methods of energy production are under constant review. In these circumstances it would not be prudent for the Proposed Local Development Plan to specify a preference for some forms of energy generation over others. However, there will be a range of energy technologies that are more suited to urban locations.” The Environmental Report of the proposed LDP recognises the potential negative impacts on air quality related to biomass and so the LDP includes a specific policy for Biomass Energy Generating Plant.

Air Quality – Policy 44

“Sustainable development proposals should aim to minimise local air pollutant emissions and traffic impacts. Supplementary Planning Guidance will be developed to set out the

²² <http://www.dundee.gov.uk/sites/default/files/publications/Proposed%20Dundee%20Local%20Development%20Plan%20-%20as%20ModifiedOct13.pdf>

²³ http://www.dundee.gov.uk/sites/default/files/publications/CD_LDP_Annex_2_Quality_Housing.pdf

circumstances when an assessment of the potential impact of particular types of development on existing and future air quality may be required.

Planning applications that have the potential to be detrimental to air quality, or those which introduce new exposure to areas of existing poor air quality should be accompanied by an air quality assessment of the likely impact of the development.”

Sustainable and Accessible Transport – Policies 54, 55 and 57

“Dundee is a compact city with the opportunity to promote high levels of accessibility and efficient transportation provision to all developments. The Local Transport Strategy (LTS) for Dundee sets out 3 key objectives of a sustainable transportation package for the City: Reducing the need to travel, Promoting alternative modes of travel; and Restraining the use of the private car.”

The Local Development Plan cannot deliver these objectives in their entirety, or in isolation, but includes supportive policies that seek to achieve the 3 key objectives of the LTS.

“The TAYplan Action Programme identified the four areas where the potential for strategic park and ride facilities are being investigated by Tactran. These are at: Dundee West where a preferred site immediately to the east of the Nature Park at Riverside Drive has been identified; at the A90 Dundee North at Forfar Road and the A92 Dundee East at Monifieth which are longer term possibilities and will be reassessed once other sites around the City have been established and at the A92 South of Tay Bridge which is within Fife. In addition, to the Park and Ride facilities the Regional Transport Strategy Delivery Plan and TAYplan Action Programme identify the potential to improve the rail infrastructure within the City with the potential relocation of Invergowrie rail station to Dundee West” (Proposal 1) adjacent to the proposed Park and Ride at Dundee West.

Table 6.1 Supportive Policies in the Dundee LDP to mitigate air quality impacts

Policy	Statement
3	<p>General Economic Development Areas In areas designated as General Economic Development Areas, proposals for Class 4, 5 and 6 developments will be supported. Other uses of a wider industrial nature such as car showrooms, wholesaling and scrap yards may be permitted provided;</p> <p>1) there is no detrimental impact on neighbouring uses and local residential amenity, 2) there is no unacceptable traffic impact and, 3) the scale of development is appropriate to the size and location of the site. Other uses within these areas will not be supported.</p>
19	<p>Funding of On and Off Site Infrastructure Provision The City Council, where necessary and appropriate, will seek to secure developer contributions towards the cost of infrastructure provision both on and off site. The principles that guide the preparation of the Developer Contributions Supplementary Guidance are:</p> <p>1) fair and proportionate developer contributions for all development on sites allocated in either the Dundee Local Development Plan or in terms of windfall development; 2) developer contributions will be sought where a need for new or improved services, facilities or infrastructure has been identified that relates directly to the proposed development; 3) flexibility in approach to ensure that development can be brought forward in difficult economic circumstances while ensuring that the development has no net detriment; and 4) facilitate informed decision making by those involved in the development process, allowing potential financial implications to be factored into development appraisals</p>

Policy	Statement
	prior to commercial decisions and actions being undertaken.
30	<p>Biomass Energy Generating Plant Major biomass plants, not ancillary to wider development proposals, will be directed to the existing principal or general economic development areas. Any development at the Port of Dundee Principal Economic Development Area should not have an adverse effect, either alone or in combination with other proposals or projects, on the integrity of any Natura Site.</p> <p>Proposals for small scale biomass or district heating schemes outwith existing principal or general economic development areas, other than single user or domestic appliances, will only be acceptable where their primary function is the production of heat or combined heat and power for local residential or business consumption. Development may be acceptable where:</p> <ol style="list-style-type: none"> 1) the Council is satisfied that there will be no significant negative effects in terms of their scale, design, location, emissions, landscape setting, storage facilities, and cumulative impact, odour, noise and storage requirements, and, 2) Levels of pollutants have been minimised through the use of best available technology, including abatement technology.
44	<p>Air Quality There is a general presumption against development proposals that could significantly increase air pollution or introduce people into areas of elevated pollution concentrations unless mitigation measures are adopted to reduce the impact to levels acceptable to the Council.</p>
54	<p>Active Travel New development should be designed in order to:</p> <ol style="list-style-type: none"> 1) minimise the need to travel by private car, 2) improve access to services, and 3) promote healthy lifestyles by encouraging active travel. <p>All developments which border an existing or proposed core path must ensure that it is immediately and easily accessible from that development by provision of appropriate* facilities.</p> <p>All developments should make provision for walking and cycle access, including cycle parking and walking/cycle routes and to a standard that affords it priority over motorised transport. This requirement may be applied flexibly where the re-use of existing buildings is involved. Walking and cycling routes should be fully useable prior to the first occupation of a new development.</p> <p>*appropriate - refers to the specification choice of: footways, footpaths, cycle ways or shared surface paths</p>
55	<p>Accessibility of New Developments All development proposals that generate travel should be designed to be well served by all modes of transport. In particular the sustainable modes of walking, cycling and public transport should be afforded priority and allow walkable access to local amenities.</p> <p>Development proposals will be required to:</p> <ol style="list-style-type: none"> 1) Incorporate facilities on-site (and/or off-site through developer contributions) for walking, cycling and public transport networks, including road/junction improvements and cycle parking. Developments without direct links to adjacent walking and cycling networks will not be supported; and 2) Incorporate measures to permit access to public transport networks within a walking distance of no more than 400m from the centre of the development 3) Have no detrimental effect on the capacity or functioning of the existing road or rail networks; and 4) Ensure that safe and adequate provision is made for road freight and waste access, loading and unloading, and 5) Comply with Dundee City Council's roads design standards 'Streets Ahead'.

Policy	Statement
57	<p>Car Parking</p> <p><u>City Centre Developments</u> All new developments, or alterations to existing developments within the city centre area will be required to comply with the Central Dundee Parking Strategy.</p> <p><u>New Developments Outwith City Centre</u> All new developments shall be required to comply with Dundee City Council's adopted guidance on road standards, (Streets Ahead) with the national maximum parking standards and the national minimum disabled parking standards. Car parks provided exclusively for employees should incorporate the provision of infrastructure to install charging points for electric vehicles.</p>
Proposal 1	Riverside Park & Ride Transport Interchange²⁴

The proposed Local Development Plan is due to be adopted in 2014. Following this a report will be sent to the City Development Committee seeking approval of the Draft Air Quality Supplementary Planning Guidance as statutory planning guidance.

²⁴ <http://www.dundee.gov.uk/sites/default/files/publications/Proposed%20Dundee%20Local%20Development%20Plan%20-%20as%20ModifiedOct13.pdf> , page 64

7 Local Transport Plans and Strategies

It should be noted that in Scotland there is no legal requirement for local authorities to produce a 'Local Transport Plan'. However, Dundee City Council adopted the five high level objectives of the Government's white paper "A New Deal for Transport: Better for Everyone" (1998), and produced a its own Local Transport Strategy (LTS) in 2000. The key objectives of the white paper are outlined below:

1. To promote the integration of all forms of transport and land use planning, leading to a better, more efficient transport system.
2. To promote accessibility to everyday facilities for all, especially those without a car.
3. To contribute to an efficient economy, and to support sustainable economic growth in appropriate locations.
4. To protect and enhance the built and natural environment.
5. To improve safety for all travellers.

The objectives of accessibility, economy, environment, safety and integration, and the balance between them have been integrated into the LTS. The strategy can be basically described using a three pronged approach, namely:

- Reducing the need to Travel
- Promoting Alternative Modes of Travel
- Restraining the Use of the Private Car

The LTS contains also contains targets related to air quality (4 and 5) :

Targets

4 To ensure all National Air quality Standards are achieved within the timescale set by the National Air Quality Strategy.

5 To have an Air Quality Action Plan in operation by year 2001

The Local Transport Strategy is due to be reviewed in 2014, although the draft Local Development Plan (see **Sections 5 and 6** of this report) embodies the 3 broad principles of the LTS. i.e.: reducing the need to travel; promoting alternative modes of travel; and restraining the use of the private car. The LDP policies promote active travel, sustainable accessibility for new developments and exert control over parking arrangements, which are all intended to minimise impacts on the environment.

8 Climate Change Strategies

The Scottish Government considers it particularly important that climate change and air quality policies are properly integrated. There will be situations where policies to reduce greenhouse gas emissions will have benefits for air quality, and vice-versa; such situations should be fully exploited. The National Air Quality Strategy acknowledges that there will often be co-benefits for air quality and climate change policies where certain measures are taken, such as reduced consumption of fossil fuel. However, without proper consideration, there is the possibility that some policies to mitigate climate change will have a negative impact on air quality.

Dundee City Council's Climate Change Framework 2008-2015 and Action Plan 2008-2011 was approved on 14th April 2008. The Framework sets out how the Council will tackle climate change by reducing carbon dioxide emissions and adapting its services to the impacts of climate change. The Carbon Trust's Public Sector Carbon Management plan was approved in April 2009, with an Implementation Plan taken forward.

One of the objectives of the Action Plan is Air Quality - *“Ensure that actions taken to reduce greenhouse gases do not have an adverse impact on air quality and vice versa.”*

Energy efficiency is a key part of the Climate Change Framework and Action Plan and actions are proposed to reduce energy and improve efficiency within Council buildings, investigate and, where feasible, install renewable energy sources for Council properties, and improve the energy efficiency performance of new and existing housing.

Planning is also highlighted as a key area where climate change considerations must be integrated to ensure sustainable development and adaptation to future climate change impacts.

Many actions being taken forward with respect to climate change will additionally secure local air quality benefits and therefore are of relevance to the Air Quality Action Plan, e.g. establishment of the Corporate Fleet Management Section and uptake of electric powered fleet and provision of charging infrastructure by the Council.

9 Implementation of Action Plans

Dundee City Council's Air Quality Action Plan (AQAP) was published in January 2011 and it focuses on the key identified pollutants and sources affecting air quality in the Council's administrative area – namely NO₂ and PM₁₀, with road traffic emissions identified as the main contributor. There are 32 measures within the Action Plan, which have been designed to help improve air quality through efforts to tackle traffic emissions, education and raising awareness.

Since the publication of the AQAP, there have not been any modifications to the scope of the plan or the boundaries of the AQMA. The AQAP Progress Report is prepared to fulfil the requirement on reporting on the implementation of the measures contained within the AQAP and to work towards achievement of the air quality objectives. This report covers the period January to December 2012.

The progress made on implementing the measures contained within DCC's AQAP 2011 is listed in **Appendix H** using the table recommended in the Local Air Quality Management Technical Guidance TG (09), Chapter 4 Table 4.3, and contains updates provided by lead officers for each of the various measures.

Some of the main action points completed in 2012/13 are summarized below:

- Alterations to the North-west arterial route to free up road space and reduce congestion;
- Upgrade of the Urban Traffic Management Control (UTMC) system to improve traffic flows and reduce congestion in two problem areas (Lochee Road and Seagate);
- Improvements to Bus Fleets carried out by National Express (Dundee) and Stagecoach;
- Improvements carried out to DCC fleet, including electric vehicles & charging infrastructure (see case study²⁵);
- New Freight Routing Tool introduced by TACTRAN;
- Supplementary Planning Guidance on Air Quality developed.

Notable actions being taken forward in 2013/14 include:

- Expansion of the highly praised behavioural change primary school programme to include all primary schools in Dundee.
- Introduction of the ECOSTARS Fleet Recognition Scheme to Dundee
- Review of city centre bus corridor emissions modelling in respect of potential low emission strategy/LEZ options

²⁵ Taken from Dundee City Council Report "Reporting on Scotland's Climate Change Declaration: Year 5 – 2012/13 (March 2013)
<http://www.dundee.gov.uk/reports/agendas/p&r200513pub.pdf>

CASE STUDY: Implementing an EV Policy and Making it Work

- ❖ Electric Vehicle (EV) Core Group set up and prioritised key areas for implementation:
 - Establish an EV fleet through a phased approach.
 - Create necessary charging infrastructure network to ensure future public access.
 - Align with Staff Travel Plan and Sustainable Transport Team
 - Maximise staff utilisation through effective training and promotion.
- ❖ First phase secured £100,000 through the 'Low Carbon Vehicle Procurement Support Scheme' for the purchase of 6 EV's to replace existing diesel and petrol vehicles for Dundee City Council, NHS Tayside and Tayside Police.
- ❖ Dundee City Council invested a further £97,000 for the purchase of 4 EV's and charging infrastructure to replace 6 existing diesel vehicles within its Environment Department.
- ❖ The trial scheme gave the Council its first opportunity to evaluate EV's in a wide range of operating scenarios via a pool car system and to provide feedback to the Scottish Government on their use and suitability across different operating environments, throughout a 12 month evaluation period.
- ❖ Analysis of initial trial of 4 EV's showed that they cost approximately £290 of electricity (generated from renewable sources) for 14,392 miles compared with £2,302 fuel of a diesel equivalent and equating to 3.52 tonnes of CO₂ saved.
- ❖ Phase 2 secured almost £289,000 funding from the 'Electric Vehicle and Plugged In Places Charging Infrastructure Procurement Support Schemes'. This enabled Dundee City Council, NHS Tayside and the University of Dundee to purchase a further 12 electric cars, vans (of which 9 were Council) and charging infrastructure, taking the total capital investment in Dundee to over £562,000 in two years.
- ❖ Strategic network of charging stations mapped across city according to the largest Council office hubs. Has enabled 'pool car hubs' of EV's and charging facilities to be located closest to need.
- ❖ Robust business case made for each new pool car hub with Corporate Fleet Section working with departments to provide co-ordinated series of driver training sessions.
- ❖ 90 trained users with a further 107 waiting for efficient driver training or vehicle capacity to be identified before they are able to join a car pool.
- ❖ Vehicles continually monitored through tracking system to ensure full utilisation.
- ❖ In total, Dundee City Council has now invested in 23 EV's (9 in Car Pools; 2 Vehicles in Ground Maintenance; 5 Vans on Laundry / Finance / Trades; 6 Dedicated Cars), 1 Fast Charger and 7 Dual Charging Points which will reduce carbon emissions by approximately 54.34 tonnes per year. It is estimated that the 23 vehicles will remove approximately 230,000 work miles that were previously driven in diesel or petrol engines.
- ❖ Won a 2013 COSLA Bronze Excellence Award.
- ❖ Further 17 EV's ordered for Car Pool and expansion of fleet of small vans for Trades as well as plans to increase city wide infrastructure for publicly available points.



10 Conclusions and Proposed Actions

10.1 Conclusions from New Monitoring Data

Dundee City Council has examined the results from monitoring in 2012. Concentrations within the AQMA, previously declared for NO₂ and PM₁₀ annual mean and NO₂ the hourly mean (i.e. the whole council area), still exceed the relevant objectives and the AQMA should remain.

Dundee City Council has measured concentrations of NO₂ above the annual mean objective at relevant locations within the AQMA. There are 17 diffusion tube (and 3 associated continuous analyser) locations where the annual mean NO₂ concentration at façade is estimated to exceed the objective. The concentration at the Whitehall Street continuous analyser is also estimated to breach the annual mean objective at the building façade. Owing to uncertainties associated with the distance calculator tool, there are potential exceedences at a further 14 locations. A new potential exceedence area has been identified at South Road (Denbank) which is an access route for Ninewells Hospital and Dundee Technology Park.

NO₂ annual mean concentrations throughout the city have generally increased since the AQMA was declared in 2006. The greatest increases in pollutant concentrations have been recorded along the city centre bus corridor, the north west arterial route and associated access roads, major junctions on the Kingsway and at Stannergate roundabout, on Broughty Ferry Road. Large increases (>6 µg/m³) between 2011 and 2012 were detected in Whitehall Street, Whitehall Crescent, Dock Street and on the Kingsway.

Dundee City Council has measured concentrations of NO₂ above the 1-hour objective at one location (Lochee Road) for four consecutive years. The patterns of exceedences suggest this may have occurred as a result of traffic congestion caused by the impact of the severe winter weather on the road network in 2009 and 2010. The winter weather was less severe in 2011 and 2012 but the number of exceedences recorded in 2012 is still greater than the 18 allowed (36). This area is within the AQMA declared in relation to breaches of the hourly objective.

The PM₁₀ NAQS 2004 annual mean objective continues to be achieved at all locations within the city, however in 2012 Dundee City Council has measured concentrations of PM₁₀ above the stricter Scottish 2010 annual mean objective at Meadowside (BAM) and at Osiris units located in Stannergate and Seagate. Concentrations at two other Osiris monitors in Lochee Road and Logie Street were close to exceeding the annual mean objective. The Osiris units are indicative PM₁₀ monitors and owing to their relocation and hence low data capture, the 2012 annual mean had to be estimated (“annualised”) for all except Logie Street Osiris. The aforementioned annual mean PM₁₀ exceedence at Stannergate roundabout is newly identified and will be the subject of further study.

Over the long term there has been a slight reduction in annual mean PM₁₀ concentrations. However since 2008 levels have remained relatively stable with some year to year fluctuations at roadside and kerbside sites.

The Scottish 24-hour mean objective was exceeded at two locations, Seagate and Lochee Road in 2012 using Osiris monitors. It is known that Osiris monitors tend to over-estimate the number of 24-hour mean exceedences, so these results should be treated with caution.

However, the gravimetric reference equivalent BAM at Meadowside measured four exceedences and had a 98.08th percentile value which was close to the objective. Consequently the potential for an exceedence of the 24hour mean objective will remain under review at this location, especially as 2012 data for Meadowside may be favourable owing to the 14 week lane closure in the street.

The monitoring results for 2012 indicate that all the NAQS objectives for sulphur dioxide (SO₂) were met at monitoring locations in Dundee. A detailed assessment is not currently required for this pollutant.

SO₂ concentrations have declined at the Broughty Ferry Road monitoring station between 2002 and 2012; this is thought to be largely due to the introduction of low sulphur fuel at a nearby industrial process in the port. From 2002 to 2006 occasional exceedences of the 15min mean objective were recorded as a result of certain shipping activities/movements within the port; these were well within the number allowed.

10.2 Conclusions relating to New Local Developments

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

- Proposed Wind Turbine Manufacturing Plant at the Port
- Increased Traffic Flows on the Kingsway (east of Myrekirk Roundabout)

These will be taken into consideration in the next Updating and Screening Assessment.

It was also concluded that there was insufficient information to adequately fulfil the requirements of the section on Commercial and Domestic Sources of biomass/solid fuel. It is hoped that an analysis of Census data²⁶, when available will assist with the identification of any areas where there may be a significant number of houses burning solid fuel as their primary source of heating.

10.3 Other Conclusions

Section 7 of the report highlighted the upcoming review of the Local Transport Strategy (LTS), due in 2014. The current LTS contains targets to improve air quality. Its principles of reducing the need to travel; promoting alternative modes of travel; and restraining the use of the private car are embodied within the draft Local Development Plan (LDP) which is reviewed in **Sections 5 & 6**.

Section 5 details those policies identified in the Strategic Environmental Assessment of the LDP which are likely to impact on air quality e.g. strategic development areas, tourism & leisure, housing land release and renewable energy. **Section 6** illustrates the policies and proposals in the LDP which are intended to mitigate these impacts. The proposed Local Development Plan is due to be adopted in 2014. Following this a report will be sent to the City Development Committee seeking approval of the Draft Air Quality Supplementary Planning Guidance as statutory planning guidance.

Section 9 and **Appendix H** outline the progress made on implementing the measures contained within DCC's AQAP 2011 and contain updates provided by lead officers for each of the various measures.

²⁶ Question H9 "What type of central heating does this accommodation have?"

Some of the main action points completed in 2012/13 are summarized below:

- Alterations to the North-west arterial route to free up road space and reduce congestion;
- Upgrade of the Urban Traffic Management Control (UTMC) system to improve traffic flows and reduce congestion in two problem areas (Lochee Road and Seagate);
- Improvements to Bus Fleets carried out by National Express (Dundee) and Stagecoach;
- Improvements carried out to DCC fleet, including electric vehicles & charging infrastructure;
- New Freight Routing Tool introduced by TACTRAN;
- Supplementary Planning Guidance on Air Quality developed.

Notable actions being taken forward in 2013/14 include:

- Expansion of the highly praised behavioural change primary school programme to include all primary schools in Dundee;
- Introduction of the ECOSTARS Fleet Recognition Scheme to Dundee;
- Review of city centre bus corridor emissions modelling in respect of potential low emission strategy/LEZ options.

10.4 Proposed Actions

Proposed actions arising from this Progress Report 2013 are as follows:

- Review the results of the new monitoring sites when a full year's data becomes available, in particular: the Osiris unit at Stannergate roundabout, the new NO₂ diffusion tubes installed in 2013, and the façade equivalent NO₂ diffusion tube installed at Carolina Court (A92T) where developer led monitoring had detected roadside NO₂ concentrations above the annual mean;
- Review the results of modelling studies being taken forward at Stannergate roundabout, Kingsway / Forfar Road, Kingsway / Myrekirk Road and Lochee Road and the city centre bus corridor;
- Compare diurnal profiles of pollutant concentrations and traffic (where available), in particular for Lochee Road;
- Investigate sources of biomass/solid fuel combustion in the local authority area to enable appropriate screening and report findings in subsequent LAQM reports as information becomes available;
- Take forward the planned actions highlighted in the Action Plan Progress Report; and
- Undertake the 2014 Progress Report.

11 References

This report includes references where appropriate throughout the text as footnotes.

Appendices

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

Appendix B: VCM Methodology

Appendix C: Pollution Reports

Appendix D: Bias Calculations for Diffusion Tube Co-location Studies

Appendix E : List Of Industrial Processes

Appendix F : Road Traffic Data

Appendix G : Monthly Diffusion Tube Concentrations

Appendix H : Action Plan Progress

Appendix A: QA:QC Data

A1 - Diffusion Tube Bias Adjustment Factors

The diffusion tubes are supplied by Gradko and analysed by Tayside Scientific Services utilising the 20% Triethanolamine (TEA) in water preparation method. Diffusion tubes are exposed for 4 to 5 weeks in accordance with the recommended dates supplied by DEFRA. The method for preparing and analysing tubes has remained unchanged since 2001. The bias adjustment factor available on the LAQM Support Website²⁷ for Tayside Scientific Services is **0.84** (Spreadsheet version 07/13). This is based on the 6 co-location studies from Dundee City Council (5 roadside sites and one urban background location) and the kerbside National inter-comparison site at Marylebone Road.

A2 - Factor from Local Co-location Studies

Dundee City Council co-locates three nitrogen dioxide diffusion tubes with each of the automatic nitrogen dioxide analysers. There were co-location studies carried out at 6 automatic monitoring locations in 2012. Five were at roadside sites and one at an urban background location. The factor for each study is shown in **Table A.1** along with the factor for the national inter-comparison site at Marylebone Road in London. A minimum of 9 months is required to make a valid bias calculation. All the Dundee City Council co-location studies met the criteria in 2012. The QA/QC procedures for all Dundee City Council automatic analysers is detailed in **Appendix A6** and is equivalent to the Automatic Urban and Rural Network (AURN), which is run by the national government. Tayside Scientific Services have demonstrated satisfactory performance for the analysis of diffusion tubes in each of the quarterly WASP rounds in 2012 (see **Appendix A7**). The automatic analyser period means are calculated from mid-day on tube changeover days.

Table A.1 Bias Factors from 2012 Co-location Studies from National Bias Adjustment Spreadsheet (Version 07/13)

Site Type ³	Site Name	Length of Study (months)	Diffusion Tube Mean Conc. (Dm) ($\mu\text{g}/\text{m}^3$)	Automatic Monitor Mean Conc. (Cm) ($\mu\text{g}/\text{m}^3$)	%DC ¹	Bias (B)	Tube Precision ²	Bias Adjustment Factor (A) (Cm/Dm)
R	Lochee Road	11	55	54	96	2.6%	G	0.97
UB	Mains Loan	11	17	10	97	63.0%	G	0.61
R	Meadow side	11	65	55	97	17.1%	G	0.85
R	Seagate	10	55	49	96	12.0%	G	0.89
R	Union Street	9	41	33	97	22.5%	G	0.82
R	Whitehall Street	10	47	44	98	6.0%	G	0.94
K	Marylebone Road Intercomparison	12	105	95	n/a	11.3%	G	0.90

1- %DC = Percentage Data Capture on the automatic analyser for the periods used
 2 - Tube precision is determined as follows: G = G precision - coefficient of variation (CV) of diffusion tube replicates is considered G when the CV of eight or more periods is less than 20%, and the average CV of all monitoring periods is less than 10%; P = P precision - CV of four or more periods >20% and/or average CV >10%; S = Single tube, therefore not applicable; na = not available.
 3 -R= Roadside, K= Kerbside, UB= Urban Background

²⁷ <http://laqm.defra.gov.uk/bias-adjustment-factors/national-bias.html>

A3 - Discussion of Choice of Factor to Use

The majority of nitrogen dioxide diffusion tubes operated by Dundee City Council are located at roadside or kerbside locations. In view of this it was considered appropriate to use an overall factor derived from roadside and kerbside sites, omitting the factor obtained from the urban background location. A manual approximate orthogonal regression calculation using Bias B figures (obtained from the precision and accuracy spreadsheets in **Appendix D**) was carried out for the local roadside sites separately and incorporating the national intercomparison kerbside site at Marylebone Road. The calculation was carried out in accordance with the guidance available on the Defra website prepared by Air Quality Consultants²⁸ (AQC) (see **Table A.2**) The factor obtained in both cases was **0.88**.

Table A.2 Manual Approximate Orthogonal Regression Calculation 2012

Co-location Sites 2012	Site Type ¹	Bias Factor A	Bias B
Lochee Road	R	0.97	3%
Meadowside	R	0.85	18%
Seagate	R	0.89	13%
Union St	R	0.82	23%
Whitehall St	R	0.94	7%
Mains Loan	UB	0.6	66%
Mean Local (inc Mains Loan)		0.85	21.67%
Mean Local		0.89	12.80%

Manual orthogonal regression Calculation as para 2.4 AQC doc ²		
Express as a factor	Add 1	Inverse
0.22	1.22	0.82
0.13	1.13	0.88

National:			
Marylebone Road Intercomparison	K	0.90	11.3%

Combined Local & National:			
Mean Combined (inc Mains Loan)		0.85	20%
Mean Combined		0.89	13%

0.19	1.19	0.84
0.13	1.13	0.88

Notes:

1 - R= Roadside, K= Kerbside, UB= Urban Background

2 - Paragraph 2.4 of AQC's report states, "For most purposes, a reasonable approximation of our method can be derived by averaging the bias values, expressed as a factor, i.e. -16% is -0.16. Next add 1 to this value, e.g. -0.16 + 1.00 equals 0.84 in this example, then take the inverse to give the bias adjustment factor 1/0.84 = 1.19. (This will not be exactly the same as the correction factor calculated using orthogonal regression, but will be reasonably close). IT IS IMPORTANT NOT TO AVERAGE THE ADJUSTMENT FACTORS."

A4 - PM Monitoring Adjustment

Dundee utilise several methods for monitoring particulate matter (PM₁₀) within the city. The Partisol is a reference equivalent method and has been used historically to determine a local correction factor for the TEOMs, which were designated as non-equivalent in 2006. In addition, DCC have five Osiris analysers, four of which were re-located during 2012. These are also non-equivalent but their measurements are considered indicative of particulate concentrations. Dundee commenced a yearly study in 2005 to compare the PM₁₀ data measured using an Osiris analyser with that from a TEOM. This study determined that the Osiris generally exaggerates peak values compared to the TEOM. Three Beta-Attenuation Monitors (BAM) were added to the network in 2011. These are gravimetric equivalent and have been installed in existing monitoring stations on the main bus corridor through the city centre and on the north-west arterial route.

²⁸ <http://laqm.defra.gov.uk/documents/NO2-Diffusion-Tube-Collocation-Methodology.pdf>

TEOM PM₁₀ data presented in this report is corrected using the VCM method (see **Appendix B**). BAM PM₁₀ data has been corrected for slope by Ricardo-AEA (0.83333). Data from the Osiris monitors are checked in-house and are adjusted using a local co-location factor (see below) and using the VCM correction model 2012 supplied by Ricardo-AEA.

Four of the Osiris units were re-located during 2012, hence two co-location studies have been used to adjust the data from these units. The first was from 01/01/2012 to 27/08/2012 at Union Street. The second was from 18/09/2012 to 31/12/12 at Broughty Ferry Road. Comparing equivalent hourly averages in 2012 for the TEOM and Osiris at Union Street and Broughty Ferry Road gave the following correction factors of **1.0373** and **0.9323** respectively. The Union Street factor has been applied to the data from the Osiris units located Victoria Road, Union Street, Lochee Road and Seagate. The Broughty Ferry Road factor has been applied to the data from the Osiris monitors located in Albert Street, Broughty Ferry Road, Myrekirk Terrace and at Stannergate roundabout. Consequently, the annual mean Osiris results presented in this report have been adjusted prior to gravimetric correction factors being applied.

A5 - Short-term to Long-term Data adjustment

Annualisation of data was carried out for 8 Osiris units and 11 diffusion tubes using the methodology outlined in Box 3.2 of LAQM.TG(09). This is illustrated in **Tables A3 to A5**

Table A.3 Short-Term to Long-Term Monitoring Data Adjustment of Osiris Units

Locations	Site Type	Count	Data capture %	Annual Mean, Am (µg/m ³)	Period Mean, Pm (µg/m ³)	Ratio, Am/Pm	Average Ratio, R _a	PM ₁₀ Annual Mean (annualised) (µg/m ³)
Aberdeen Errol Place	UB	8453	96.2	12.4	13.7	0.906	0.941	
Grangemouth	UB	8250	93.9	14.1	14.7	0.959		
N. Lanarkshire Cumbernauld	UB	8490	96.7	12.9	13.3	0.972		
Dundee Mains Loan	UB	8611	98.0	11.4	12.3	0.928		
Victoria Rd Osiris	K	5680	64.7	n/a	16.4	x Average ratio =		15.5
Aberdeen Errol Place	UB	8453	96.2	12.4	13.7	0.906	0.941	
Grangemouth	UB	8250	93.9	14.1	14.7	0.959		
N. Lanarkshire Cumbernauld	UB	8490	96.7	12.9	13.3	0.972		
Dundee Mains Loan	UB	8611	98.0	11.4	12.3	0.928		
Union St Osiris	R	5648	64.3	n/a	16.4	x Average ratio =		15.5
Aberdeen Errol Place	UB	8453	96.2	12.4	13.7	0.906	0.941	
Grangemouth	UB	8250	93.9	14.1	14.7	0.959		
N. Lanarkshire Cumbernauld	UB	8490	96.7	12.9	13.3	0.972		
Dundee Mains Loan	UB	8611	98.0	11.4	12.3	0.928		
Lochee Rd Osiris	K	5668	64.5	n/a	19.5	x Average ratio =		18.3
Aberdeen Errol Place	UB	8453	96.2	12.4	13.6	0.907	0.941	
Grangemouth	UB	8250	93.9	14.1	14.7	0.959		
N. Lanarkshire Cumbernauld	UB	8490	96.7	12.9	13.3	0.971		
Dundee Mains Loan	UB	8611	98.0	11.4	12.3	0.928		
Seagate Osiris	K	5685	64.7	n/a	21.9	x Average ratio =		20.6
Aberdeen Errol Place	UB	8453	96.2	12.4	10.4	1.185	1.120	
Grangemouth	UB	8250	93.9	14.1	13.4	1.051		
N. Lanarkshire Cumbernauld	UB	8490	96.7	12.9	12.3	1.050		
Dundee Mains Loan	UB	8611	98.0	11.4	9.6	1.192		
Albert St Osiris	K	2456	28.0	n/a	15.0	x Average ratio =		16.8
Aberdeen Errol Place	UB	8453	96.2	12.4	10.4	1.186	1.120	
Grangemouth	UB	8250	93.9	14.1	13.4	1.052		
N. Lanarkshire Cumbernauld	UB	8490	96.7	12.9	12.3	1.051		
Dundee Mains Loan	UB	8611	98.0	11.4	9.6	1.193		
Broughty Ferry Rd	R	2458	28.0	n/a	12.0	x Average ratio =		13.4
Aberdeen Errol Place	UB	8453	96.2	12.4	10.4	1.186	1.120	
Grangemouth	UB	8250	93.9	14.1	13.4	1.052		
N. Lanarkshire Cumbernauld	UB	8490	96.7	12.9	12.3	1.050		
Dundee Mains Loan	UB	8611	98.0	11.4	9.6	1.193		
Myrekirk Tce Osiris	R	2458	28.0	n/a	14.4	x Average ratio =		16.1
Aberdeen Errol Place	UB	8453	96.2	12.4	10.4	1.186	1.120	
Grangemouth	UB	8250	93.9	14.1	13.4	1.052		
N. Lanarkshire Cumbernauld	UB	8490	96.7	12.9	12.3	1.050		
Dundee Mains Loan	UB	8611	98.0	11.4	9.6	1.193		
Stannergate Osiris	R	2458	28.0	n/a	17.8	x Average ratio =		19.9

Notes:

UB = Urban Background, R = Roadside, K = Kerbside

Blue shaded cells are all Urban Background sites - data was selected & downloaded from www.scottishairquality.co.uk

Table A.4 Short-Term to Long-Term Monitoring Data Adjustment of Nitrogen Dioxide Diffusion Tubes – Part 1

		Urban Background Locations							
		Balgavies PI	Birnam PI	Carolina Court	Earl Grey PI (Park)	Mains Loan (Automatic)	Mains Loan	Woodside Ave	
Annual Mean, Am ($\mu\text{g}/\text{m}^3$)		20.5	11.8	25.6	25.9	9.8	17.0	18.4	
Period Mean, Pm ($\mu\text{g}/\text{m}^3$)	29/2/12 - 28/3/12, 25/4/12 - 27/6/12 & 1/8/12 - 3/1/13	18.7	11.2	25.0	24.0	9.5	15.6	17.0	
	4/1/12 - 28/3/12, 30/5/12 - 27/6/12 & 1/8/12 - 3/1/13	22.4	12.5	27.5	27.3	11.0	18.2	19.6	
	4/1/12 - 29/2/12, 28/3/12 - 25/4/12, 30/5/12 - 27/6/12 & 1/8/12 - 3/1/13	21.8	12.1	26.5	27.1	10.7	17.8	19.0	
	4/1/12 - 27/6/12 & 1/8/12 - 31/10/12	18.3	10.9	23.5	23.8	9.5	15.7	17.0	
	4/1/12 - 27/6/12, 1/8/12 - 26/9/12 & 31/10/12 - 28/11/12	19.0	11.0	23.4	24.4	9.5	15.9	17.4	
	4/1/12 - 1/2/12, 29/2/12 - 28/4/12, 30/5/12 - 27/6/12 & 1/8/12 - 3/1/13	21.2	11.7	25.8	26.2	11.0	17.0	18.6	
	25/4/12 - 27/6/12 & 1/8/12 - 29/8/13	9.0	8.4	17.1	14.3	6.0	10.1	10.8	
	4/1/12 - 28/3/12	27.0	14.6	32.1	31.4	13.3	22.2	24.1	
	4/1/12 - 1/2/12, 29/2/12 - 27/6/12 & 29/8/12 - 3/1/13	20.6	11.5	25.3	26.1	10.7	16.9	18.5	
	4/1/12 - 25/4/12, 30/5/12 - 27/6/12, 1/8/12 - 26/9/13 & 31/10/12 - 3/1/13	21.7	12.1	26.5	26.8	10.4	17.5	19.0	
4/1/12 - 1/2/12, 29/2/12 - 27/6/12, 1/8/12 - 26/9/13 & 31/10/12 - 3/1/13	19.4	11.3	24.0	24.6	9.9	16.0	17.5	Average Ratio, R_a	
Ratio, Am/Pm	29/2/12 - 28/3/12, 25/4/12 - 27/6/12 & 1/8/12 - 3/1/13	1.094	1.051	1.025	1.079	1.033	1.093	1.080	1.065
	4/1/12 - 28/3/12, 30/5/12 - 27/6/12 & 1/8/12 - 3/1/13	0.913	0.938	0.933	0.948	0.892	0.936	0.937	0.928
	4/1/12 - 29/2/12, 28/3/12 - 25/4/12, 30/5/12 - 27/6/12 & 1/8/12 - 3/1/13	0.938	0.971	0.967	0.953	0.919	0.959	0.970	0.954
	4/1/12 - 27/6/12 & 1/8/12 - 31/10/12	1.117	1.084	1.089	1.087	1.030	1.087	1.080	1.082
	4/1/12 - 27/6/12, 1/8/12 - 26/9/12 & 31/10/12 - 28/11/12	1.076	1.071	1.093	1.060	1.034	1.072	1.056	1.066
	4/1/12 - 1/2/12, 29/2/12 - 28/4/12, 30/5/12 - 27/6/12 & 1/8/12 - 3/1/13	0.967	1.003	0.994	0.986	0.895	1.000	0.990	0.976
	25/4/12 - 27/6/12 & 1/8/12 - 29/8/13	2.276	1.407	1.495	1.810	1.681	1.685	1.709	1.723
	4/1/12 - 28/3/12	0.759	0.808	0.798	0.824	0.735	0.767	0.765	0.779
	4/1/12 - 1/2/12, 29/2/12 - 27/6/12 & 29/8/12 - 3/1/13	0.996	1.027	1.011	0.992	0.918	1.009	0.993	0.992
	4/1/12 - 25/4/12, 30/5/12 - 27/6/12, 1/8/12 - 26/9/13 & 31/10/12 - 3/1/13	0.943	0.973	0.966	0.965	0.945	0.973	0.968	0.962
4/1/12 - 1/2/12, 29/2/12 - 27/6/12, 1/8/12 - 26/9/13 & 31/10/12 - 3/1/13	1.058	1.041	1.067	1.054	0.994	1.066	1.052	1.047	

Table A.5 Short-Term to Long-Term Monitoring Data Adjustment of Nitrogen Dioxide Diffusion Tubes – Part 2

Site ID (DT)	Locations	Period dates	Period Mean, P _m (µg/m ³)	Average Ratio, R _a	NO ₂ Annual Mean (annualised) (µg/m ³)
164	Broughty Ferry Rd Lower	29/2/12 - 28/3/12, 25/4/12 - 27/6/12 & 1/8/12 - 3/1/13	17.8	1.065	19.0
166	Broughty Ferry Rd L/P 59 (2)	4/1/12 - 28/3/12, 30/5/12 - 27/6/12 & 1/8/12 - 3/1/13	31.9	0.928	29.6
15	Commercial St (Waterstones)	4/1/12 - 29/2/12, 28/3/12 -25/4/12, 30/5/12 - 27/6/12 & 1/8/12 - 3/1/13	47	0.954	44.8
148	Dock St (Tay Hotel)	4/1/12 - 27/6/12 & 1/8/12 - 31/10/12	34.6	1.082	37.4
85	Dock St (Carol Whyte)	4/1/12 - 27/6/12, 1/8/12 - 26/9/12 & 31/10/12 - 28/11/12	43.5	1.066	46.4
154	High Street Lochee (106)	4/1/12 - 1/2/12, 29/2/12 - 28/4/12, 30/5/12 - 27/6/12 & 1/8/12 - 3/1/13	26.9	0.976	26.3
163	Meadowside/Bell Street	25/4/12 - 27/6/12 & 1/8/12 - 29/8/13	32.4	1.723	55.8
87	Nethergate/South Tay St	4/1/12 - 28/3/12	35.7	0.779	27.8
50	Seagate	4/1/12 - 1/2/12, 29/2/12 - 27/6/12 & 29/8/12 - 3/1/13	45.1	0.992	44.8
69	Victoria Rd / Cotton Rd	4/1/12 - 25/4/12, 30/5/12 - 27/6/12, 1/8/12 - 26/9/13 & 31/10/12 - 3/1/13	43.3	0.962	41.6
73	Whitehall Cr (Xpresso)	4/1/12 - 1/2/12, 29/2/12 - 27/6/12, 1/8/12 - 26/9/13 & 31/10/12 - 3/1/13	40.7	1.047	42.6

A6 - QA/QC of Automatic Monitoring

All analysers (excluding OSIRIS units) are audited twice yearly by an external consultant, Ricardo-AEA. The gas analysers at Union Street and Broughty Ferry Road have on-site gases traceable to the National Physical Laboratory (NPL) standards (provided under contract by Ricardo-AEA) and are calibrated automatically every 4 days and daily respectively (Broughty Ferry Road changed to every 3 days mid-way through the year 13/6/2012). The remaining gas analysers do not have on-site gases and are manually calibrated every 3 weeks by Ricardo- AEA using NPL traceable gas.

Dundee City Council secured funding from the Scottish Executive to commission Ricardo-AEA to assist with data management and ratification procedures. Dundee joined the 'Calibration Club' run by Ricardo-AEA at the end of 2006. Ricardo-AEA have ratified all the real-time monitoring data reported from 2006 onwards (excluding the Osiris units) and have provided the Air Pollution Reports shown in **Appendix C**

All instruments (excluding OSIRIS units) are serviced and calibrated every 6-months by the equipment supplier. OSIRIS units undergo quarterly flow checks and filter changes as well as annual service and calibration by the manufacturers (Turnkey Instruments).

A7 - QA/QC of Diffusion Tube Monitoring

Monitoring of NO₂ concentrations using passive diffusion tubes is widely used throughout the UK. Provided that care is taken with the storage, handling and analysis of the tubes, and an appropriate "bias-adjustment" factor is applied, the overall uncertainty of the annual mean is expected to be about +/-20%. The key issues to be considered are the performance of the laboratory, the precision of the diffusion tubes, and the application of a suitable bias adjustment factor. These issues are considered in turn below.

Laboratory Performance

The diffusion tubes used by Dundee City Council are supplied by Gradko and analysed by Tayside Scientific Services utilising the 20% Triethanolamine (TEA) in water preparation method. Tayside Scientific Services participate in the Workplace Analysis Scheme for Proficiency (WASP) for NO₂ diffusion tube analysis, and the Annual Field Inter-Comparison Exercise. These provide strict performance criteria for participating laboratories to meet, thereby ensuring NO₂ concentrations reported are robust. The lab' follows the procedures set out in the Working Group on Harmonisation of Diffusion Tubes Practical Guidance that was published in February 2008²⁹, and is UKAS accredited for the analysis of nitrogen dioxide. Tayside Scientific Services has demonstrated satisfactory performance over the past five quarterly WASP rounds.³⁰ Two diffusion tubes from each monthly batch are used as blanks. These tubes are not exposed but are taken round during the monthly deployment and collection and stored in the refrigerator during the exposure period. They are analysed along with the appropriate batch of exposed tubes. The purpose of the blanks is to determine whether contamination occurred during the preparation or deployment.

The Workplace Analysis Scheme for Proficiency (WASP) is an independent analytical proficiency-testing (PT) scheme, operated by the Health and Safety Laboratory (HSL). WASP NO₂ PT forms an integral part of the UK NO₂ Network's QA/QC, and is a useful tool in assessing the analytical performance of laboratories supplying diffusion tubes to Local Authorities for use in the context of Local Air Quality Management (LAQM). With consent from the participating laboratories, HSL provides summary proficiency testing data to the LAQM Helpdesk for hosting on the web-pages at <http://laqm.defra.gov.uk/diffusion-tubes/qa-qc-framework.html>.

Defra and the Devolved Administrations advise that diffusion tubes used for Local Air Quality Management should be obtained from laboratories that have demonstrated satisfactory performance in the WASP scheme. Although WASP remains an independent proficiency-testing scheme, laboratory performance in WASP is also assessed by the National Physical Laboratory (NPL) in conjunction with separate data from the Field Intercomparison Exercise carried out at Marylebone Road, central London. The information is used to help the laboratories to identify if they have problems and may assist devising measures to improve their performance.

Tube Precision

For the purposes of Local Air Quality Management, tube precision is separated into two categories, "Good" or "Poor", as follows: tubes are considered to have "good" precision where the coefficient of variation of duplicate or triplicate diffusion tubes for eight or more periods during the year is less than 20%, and the average CV of all monitoring periods is less than 10%. Tubes are considered to have "poor" precision where the CV of four or more periods is greater than 20% and/or the average CV is greater than 10%.

²⁹ AEA Energy & Environment (2008), Diffusion Tubes for Ambient NO₂ Monitoring : Practical Guidance for Laboratories and Users

³⁰ [http://laqm.defra.gov.uk/documents/LAQM-WASP-Rounds-112-119-\(January-2011--December-2012\)-NO2-report.pdf](http://laqm.defra.gov.uk/documents/LAQM-WASP-Rounds-112-119-(January-2011--December-2012)-NO2-report.pdf)

A spreadsheet tool has been developed to calculate the overall precision of a particular co-location study or any sets of duplicate or triplicate results. The tube precision calculated using this spreadsheet is shown in **Appendix D** and are summarised in **Table A.1**. The distinction between "good" and "poor" precision is an indicator of how well the same measurement can be reproduced. This precision reflects the laboratory's performance/consistency in preparing and analysing the tubes, as well as the subsequent handling of the tubes in the field. Any laboratory can show "poor" precision for a particular period/co-location study, if this is due to poor handling of the tubes in the field.

Suitable Bias Adjustment Factor

The discussion and calculation of a suitable bias adjustment factor is detailed in **Appendix A3**.

Appendix B: VCM Methodology



TEOM Data Correction Using the Volatile Correction Model - 2012

Introduction

Ricardo-AEA has been funded by the Scottish Government to provide Volatile Correction Model (VCM) corrected TEOM (Tapered Element Oscillating Microbalance) data to Local Authorities under the Scottish Air Quality Database and Website (SAQD) project.

The VCM uses reference (volatile) particulate matter measurements provided by FDMS (Filter Dynamics Measurement System) instruments located within 130 km of the TEOM in question to assess the loss of particulate matter (PM₁₀) from the TEOM. The TEOM measurements, without the applied USEPA correction factors of $1.03x+3$ (where x is the raw TEOM measurement), are then corrected to ambient pressure and temperature using meteorological data from met monitoring sites within 260 km of the TEOM. The volatile fraction is then added back onto the TEOM measurements to give Gravimetric Equivalent mass concentrations.

This is a short summary outlining the method used by Ricardo-AEA for correcting the 2012 Scottish TEOM data in the Scottish database.

Method

The following data have been used as inputs to the VCM:

- Hourly average temperatures (°C)
- Hourly average pressures (mbar)
- Hourly average TEOM concentrations ($\mu\text{g m}^{-3}$)
- Hourly average FDMS purge concentrations ($\mu\text{g m}^{-3}$)

For the 2012 corrections, temperature and pressure data from both Aberdeen Dyce Airport and Edinburgh Gogarbank meteorological monitoring stations were utilised. These two sites were selected as a good representation weather conditions in Aberdeen and the central belt of Scotland, respectively.

Hourly average purge measurements from all Scottish FDMS monitoring sites within the Scottish Government-run network (SAQD) and the UK national network (AURN) were used for the correction. Table 1 lists the sites used for correcting hourly TEOM data from Central Scotland and Aberdeen. A total of 3 FDMS sites were used for correcting Aberdeen TEOM data and 23 FDMS sites used for correcting data from TEOM sites located in the central belt of Scotland.

Any outliers in the FDMS purge measurements were identified using Grubbs' Test¹ on daily average data. All hourly data within a day identified as an outlier were then removed from the data set and the average of each hourly purge measurement from the FDMS sites was calculated and used in the VCM calculations.

¹ Grubbs' Test is a statistical method for identifying outliers within a dataset. For more information visit the Engineering Statistics Handbook at:

<http://www.itl.nist.gov/div898/handbook/eda/section3/eda35h.htm>



Table 1 FDMS Monitoring Sites used in VCM Correcting TEOM Data from Aberdeen and Central Scotland Monitoring Sites

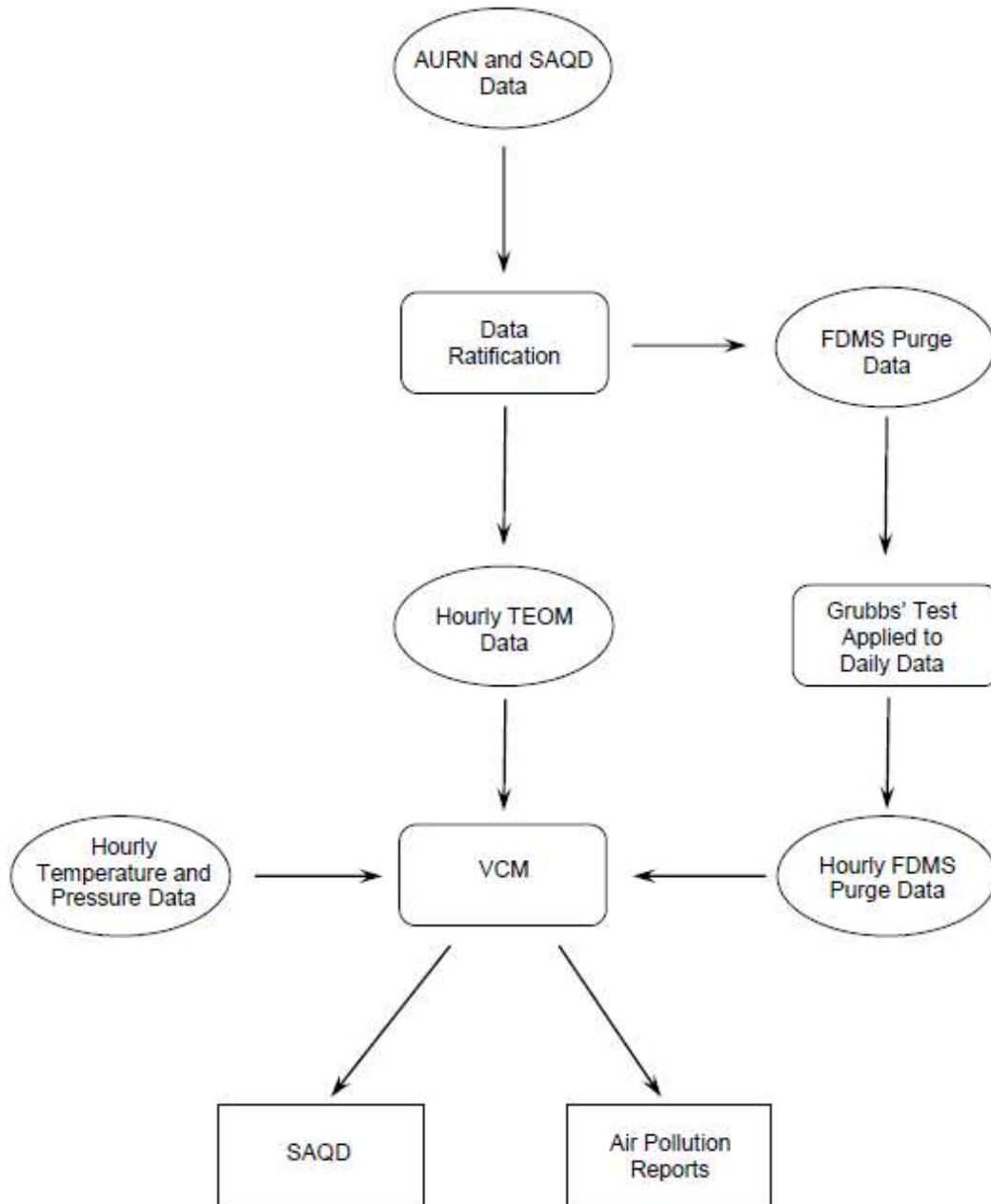
TEOM Locations	FDMS Sites used in VCM	Monitoring Network
Aberdeen	Aberdeen	AURN
	Angus Forfar	SAQD
	Fife Cupar	SAQD
Central Scotland	Auchencorth Moss	AURN
	East Dunbartonshire Kirkintilloch	SAQD
	East Dunbartonshire Milngavie	SAQD
	Edinburgh Queensferry Road	SAQD
	Fife Cupar	SAQD
	Fife Dunfermline	SAQD
	Fife Kirkcaldy	SAQD
	Glasgow Abercromby Street	SAQD
	Glasgow Anderston	SAQD
	Glasgow Broomhill	SAQD
	Glasgow Burgher St	SAQD
	Glasgow Byres Road	SAQD
	Glasgow Centre	AURN
	Glasgow Kerbside	SAQD
	Glasgow Nithsdale Road	SAQD
	Grangemouth	AURN
	Paisley Gordon Street	SAQD
	Paisley St James St	SAQD
	South Lanarkshire Raith Interchange	SAQD
	South Lanarkshire Rutherglen	SAQD
West Lothian Broxburn	SAQD	
West Lothian Linlithgow High Street	SAQD	
West Lothian Newton	SAQD	

VCM and the SAQD

All 2012 VCM corrected data have been made available on the SAQD website via an additional selection option in the data download pages and in the individual site statistics tabs.

A flow chart showing the overall process employed for VCM correcting 2012 SAQD TEOM data is shown in Figure 1.

Figure 1 Process used for VCM Correcting SAQD TEOM Data





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For further information regarding VCM or for carrying out your own correction please visit the following website:

<http://www.volatile-correction-model.info/Default.aspx>

Appendix C: Pollution Reports

Produced by Ricardo-AEA on behalf of the Scottish Government

DUNDEE BROUGHTY FERRY ROAD
1st January to 31st December 2012

These data have been fully ratified by Ricardo-AEA

POLLUTANT	PM ₁₀ [*]	SO ₂
Maximum 15-minute mean	-	53 µg m ⁻³
Maximum hourly mean	128 µg m ⁻³	43 µg m ⁻³
Maximum daily mean	78 µg m ⁻³	15 µg m ⁻³
Average	14 µg m ⁻³	4 µg m ⁻³
Data capture	97.8 %	93.7 %

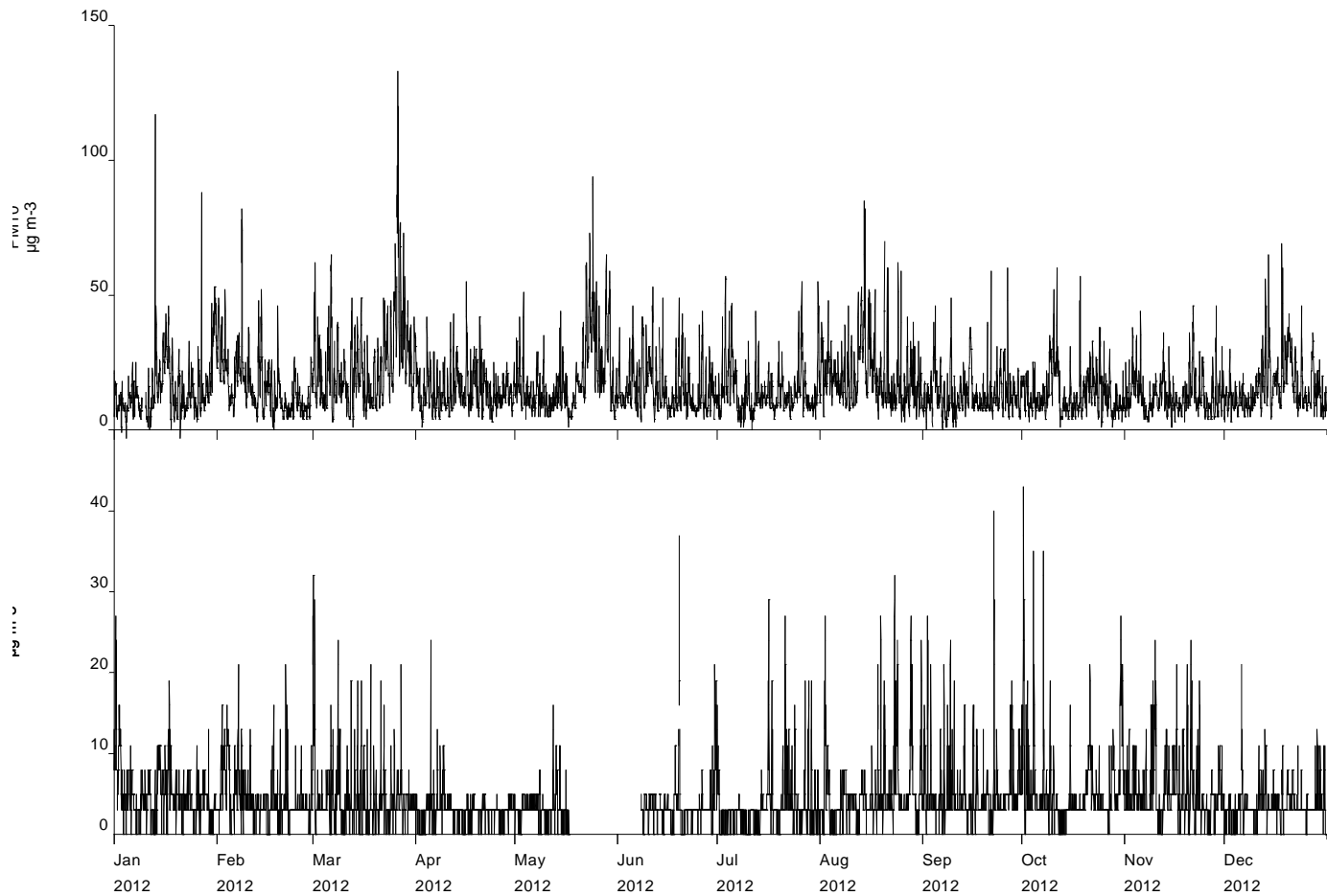
* PM₁₀ as measured by a TEOM using the VCM for Gravimetric Equivalent concentrations. All gaseous pollutant mass units are at 20°C and 1013 mb. Particulate matter concentrations are reported at ambient temperature and pressure.

Pollutant	Air Quality Regulations (2000) and Air Quality (Scotland) Amendment Regulations 2002	Exceedences	Days
PM ₁₀ Particulate Matter (Gravimetric)	Daily mean > 50 µg m ⁻³	1	1
PM ₁₀ Particulate Matter (Gravimetric)	Annual mean > 18 µg m ⁻³	0	-
Sulphur Dioxide	15-minute mean > 266 µg m ⁻³	0	0
Sulphur Dioxide	Hourly mean > 350 µg m ⁻³	0	0
Sulphur Dioxide	Daily mean > 125 µg m ⁻³	0	0

Note: For a strict comparison against the objectives there must be a data capture of >90% throughout the calendar year

Produced by AEA on behalf of the Scottish Government

Dundee Broughty Ferry Road Hourly Mean Data for 1st January to 31st December 2012



Date Created: 19/03/2013

Produced by Ricardo-AEA on behalf of the Scottish Government

DUNDEE MAINS LOAN 1st January to 31st December 2012

These data have been fully ratified by AEA

POLLUTANT	PM ₁₀ [*]	NO ₂	NO _x
Maximum hourly mean	74 µg m ⁻³	92 µg m ⁻³	355 µg m ⁻³
Maximum daily mean	51 µg m ⁻³	52 µg m ⁻³	115 µg m ⁻³
Average	11 µg m ⁻³	10 µg m ⁻³	13 µg m ⁻³
Data capture	99.5 %	97.3 %	97.3 %

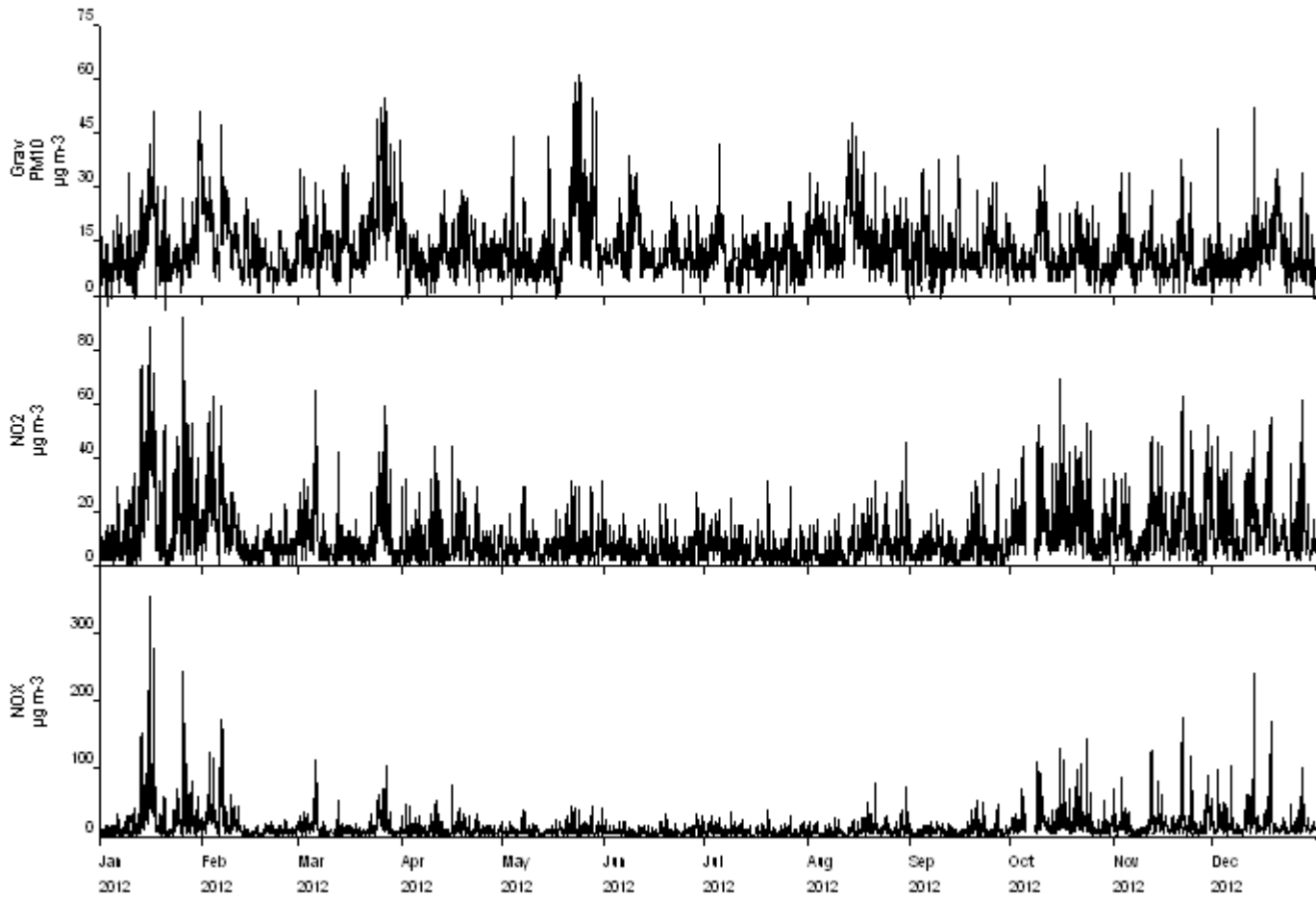
* PM₁₀ as measured by a TEOM using the VCM for Gravimetric Equivalent concentrations.
All gaseous pollutant mass units are at 20°C and 1013 mb. Particulate matter concentrations are reported at ambient temperature and pressure.
NO_x mass units are NO_x as NO₂ µg m⁻³

Pollutant	Air Quality Regulations (2000) and Air Quality (Scotland) Amendment Regulations 2002	Exceedences	Days
PM ₁₀ Particulate Matter (Gravimetric)	Daily mean > 50 µg m ⁻³	1	1
PM ₁₀ Particulate Matter (Gravimetric)	Annual mean > 18 µg m ⁻³	0	-
Nitrogen Dioxide	Annual mean > 40 µg m ⁻³	0	-
Nitrogen Dioxide	Hourly mean > 200 µg m ⁻³	0	0

Note: For a strict comparison against the objectives there must be a data capture of >90% throughout the calendar year

Produced by AEA on behalf of the Scottish Government

**Dundee Mains Loan
Hourly Mean Data for 1st January to 31st December 2012**



Date Created: 19/03/2013

Produced by Ricardo-AEA on behalf of Dundee City Council

DUNDEE MEADOWSIDE 1st January to 31st December 2012

These data have been fully ratified by Ricardo-AEA

POLLUTANT	PM ₁₀ *	NO ₂	NO _x
Maximum hourly mean	146 µg m ⁻³	195 µg m ⁻³	1454 µg m ⁻³
Maximum daily mean	72 µg m ⁻³	110 µg m ⁻³	625 µg m ⁻³
Average	19 µg m ⁻³	54 µg m ⁻³	223 µg m ⁻³
Data capture	97.7 %	97.3 %	97.3 %

* PM₁₀ instruments:

BAM using a gravimetric factor of 0.83333 for Indicative Gravimetric Equivalent from 1st January 2012

All gaseous pollutant mass units are at 20°C and 1013mb. Particulate matter concentrations are reported at ambient temperature and pressure.

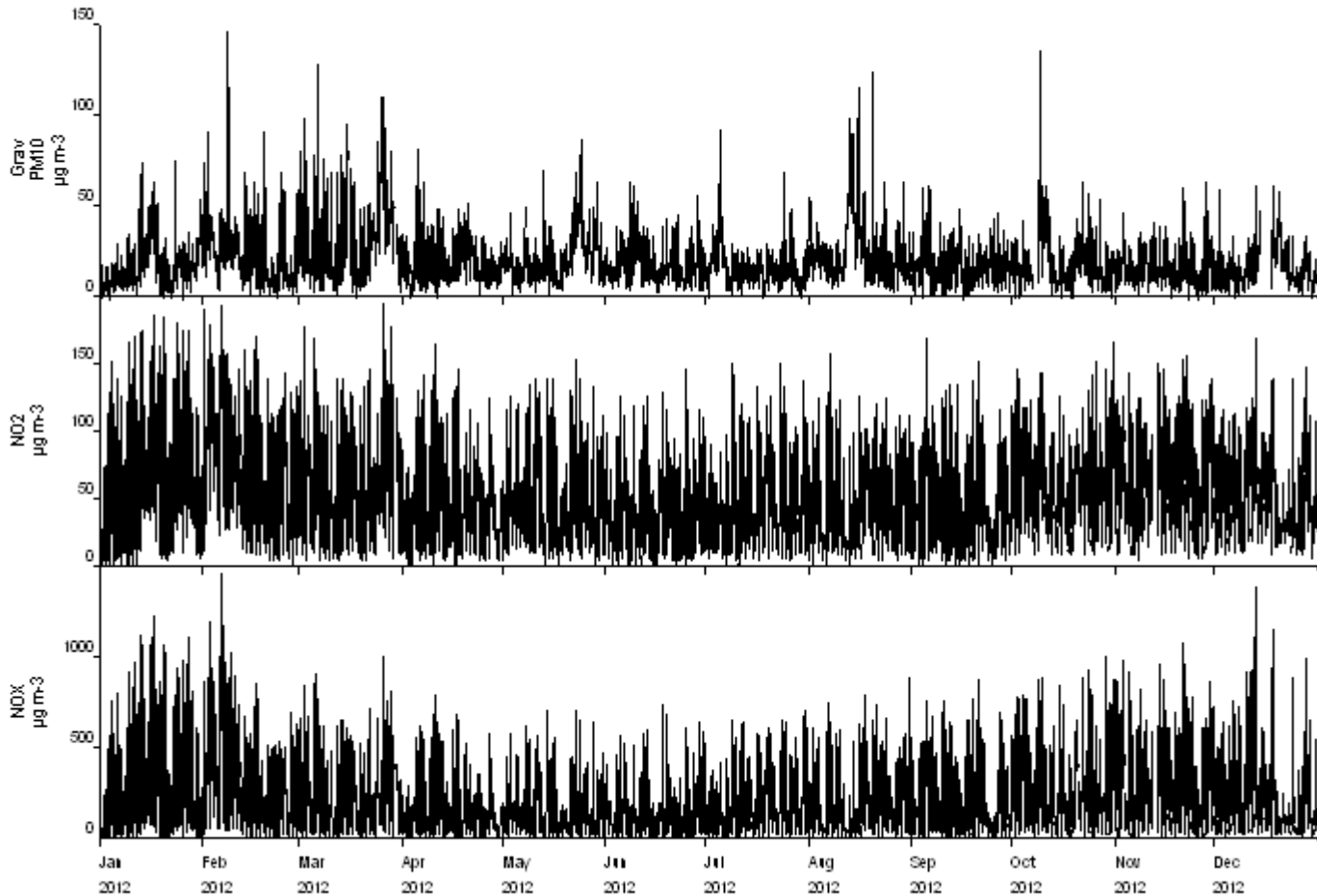
NO_x mass units are NO_x as NO₂ µg m⁻³

Pollutant	Air Quality Regulations (2000) and Air Quality (Scotland) Amendment Regulations 2002	Exceedences	Days
PM ₁₀ Particulate Matter (Gravimetric)	Daily mean > 50 µg m ⁻³	4	4
PM ₁₀ Particulate Matter (Gravimetric)	Annual mean > 18 µg m ⁻³	1	-
Nitrogen Dioxide	Annual mean > 40 µg m ⁻³	1	-
Nitrogen Dioxide	Hourly mean > 200 µg m ⁻³	0	0

Note: For a strict comparison against the objectives there must be a data capture of >90% throughout the calendar year

Produced by Ricardo-AEA on behalf of Dundee City Council

**Dundee Meadowside
Hourly Mean Data for 1st January to 31st December 2012**



Date Created: 19/03/2013

Produced by Ricardo-AEA on behalf of the Scottish Government

DUNDEE SEAGATE 1st January to 31st December 2012

These data have been fully ratified by Ricardo-AEA

POLLUTANT	PM ₁₀ *	NO ₂	NO _x
Maximum hourly mean	147 µg m ⁻³	164 µg m ⁻³	1287 µg m ⁻³
Maximum daily mean	65 µg m ⁻³	118 µg m ⁻³	570 µg m ⁻³
99.8th percentile of hourly means	-	145 µg m ⁻³	-
Average	14 µg m ⁻³	48 µg m ⁻³	182 µg m ⁻³
Data capture	98.7 %	88.1 %	88.1 %

* PM₁₀ instruments:

BAM using a gravimetric factor of 0.83333 for Indicative Gravimetric Equivalent from 1st January 2012

All gaseous pollutant mass units are at 20°C and 1013 mb. Particulate matter concentrations are reported at ambient temperature and pressure.

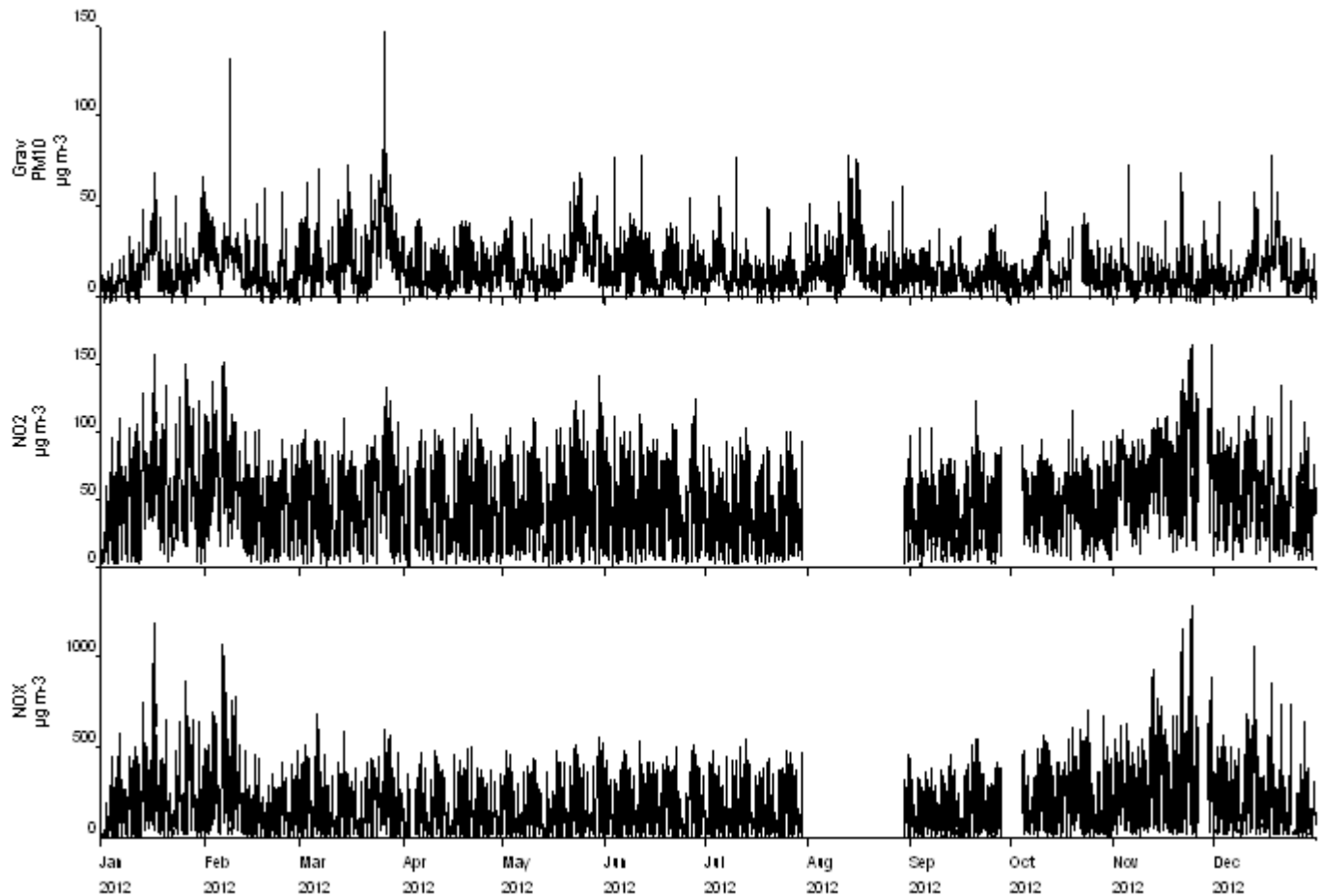
NO_x mass units are NO_x as NO₂ µg m⁻³

Pollutant	Air Quality Regulations (2000) and Air Quality (Scotland) Amendment Regulations 2002	Exceedences	Days
PM ₁₀ Particulate Matter (Gravimetric)	Daily mean > 50 µg m ⁻³	1	1
PM ₁₀ Particulate Matter (Gravimetric)	Annual mean > 18 µg m ⁻³	0	-
Nitrogen Dioxide	Annual mean > 40 µg m ⁻³	1	-
Nitrogen Dioxide	Hourly mean > 200 µg m ⁻³	0	0

Note: For a strict comparison against the objectives there must be a data capture of >90% throughout the calendar year

Produced by Ricardo-AEA on behalf of the Scottish Government

**Dundee Seagate
Hourly Mean Data for 1st January to 31st December 2012**



Date Created: 19/03/2013

Produced by Ricardo-AEA on behalf of the Scottish Government

DUNDEE LOCHEE ROAD 1st January to 31st December 2012

These data have been fully ratified by Ricardo-AEA

POLLUTANT	PM ₁₀ *	NO ₂	NO _x
Maximum hourly mean	207 µg m ⁻³	311 µg m ⁻³	1320 µg m ⁻³
Maximum daily mean	64 µg m ⁻³	145 µg m ⁻³	472 µg m ⁻³
Annual mean	17 µg m ⁻³	53 µg m ⁻³	130 µg m ⁻³
Data capture	99.2 %	96.5 %	96.5 %

* PM₁₀ instruments:

BAM using a gravimetric factor of 0.83333 for Indicative Gravimetric Equivalent from 1 January 2012

All gaseous pollutant mass units are at 20°C and 1013 mb. Particulate matter concentrations are reported at ambient temperature and pressure.

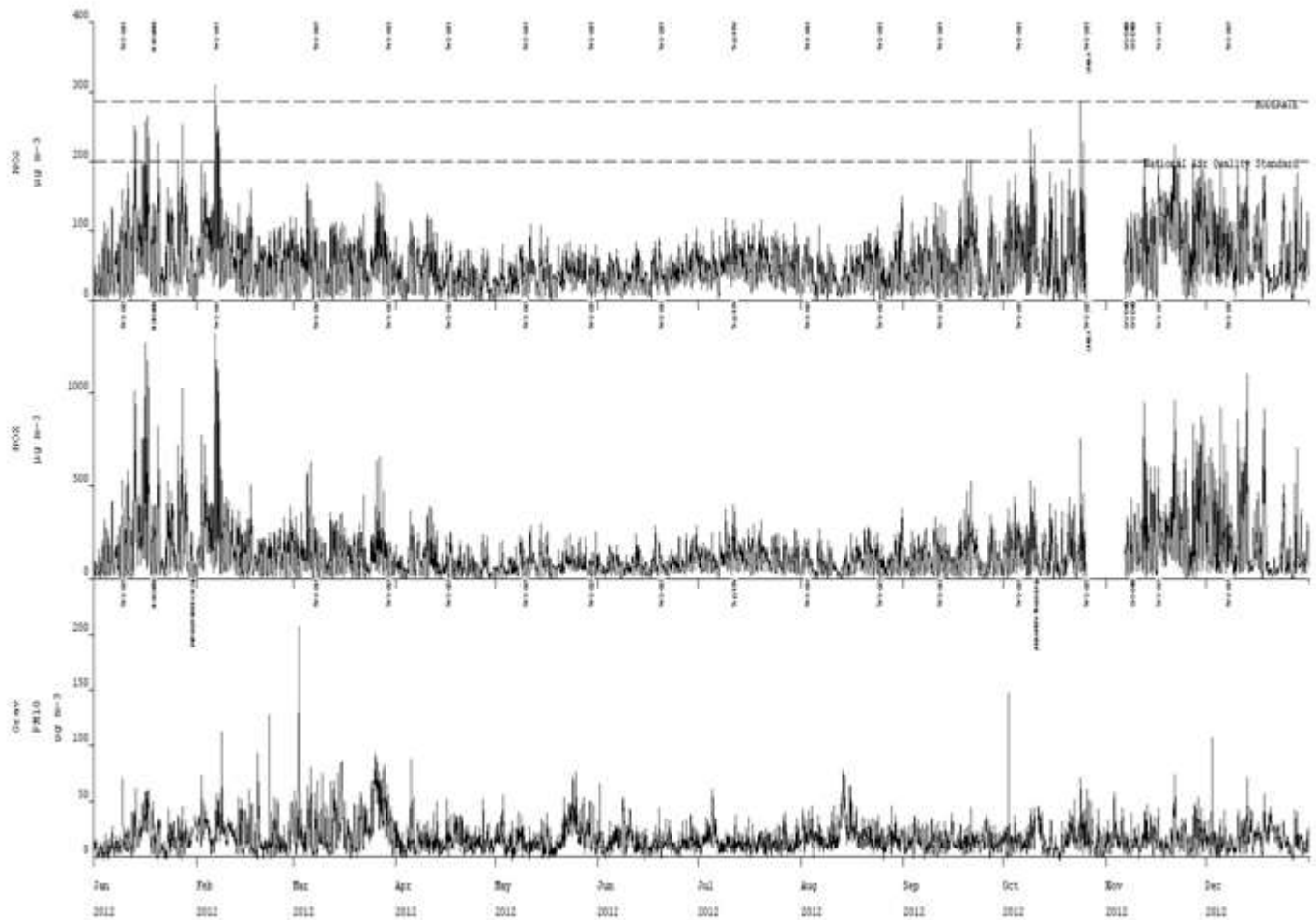
NO_x mass units are NO_x as NO₂ µg m⁻³

Pollutant	Air Quality Regulations (2000) and Air Quality (Scotland) Amendment Regulations 2002	Exceedences	Days
PM ₁₀ Particulate Matter (Gravimetric)	Daily mean > 50 µg m ⁻³	3	3
Nitrogen Dioxide	Annual mean > 40 µg m ⁻³	1	-
Nitrogen Dioxide	Hourly mean > 200 µg m ⁻³	38	20

Note: For a strict comparison against the objectives there must be a data capture of >90% throughout the calendar year

Produced by Ricardo-AEA on behalf of the Scottish Government

**Dundee Lochee Road
Hourly Mean Data for 1st January to 31st December 2012**



Date Created: 30/08/2013

Produced by AEA on behalf of Dundee CC

DUNDEE UNION STREET
1st January to 31st December 2012

These data have been fully ratified by AEA

POLLUTANT	PM ₁₀ *	NO ₂	NO _x
Maximum hourly mean	101 µg m ⁻³	128 µg m ⁻³	858 µg m ⁻³
Maximum daily mean	66 µg m ⁻³	69 µg m ⁻³	290 µg m ⁻³
99.8th percentile of hourly means	-	99 µg m ⁻³	-
98.08th percentile of daily means	36 µg m ⁻³	-	-
Average	15 µg m ⁻³	32 µg m ⁻³	79 µg m ⁻³
Data capture	77.7 %	84.2 %	84.2 %

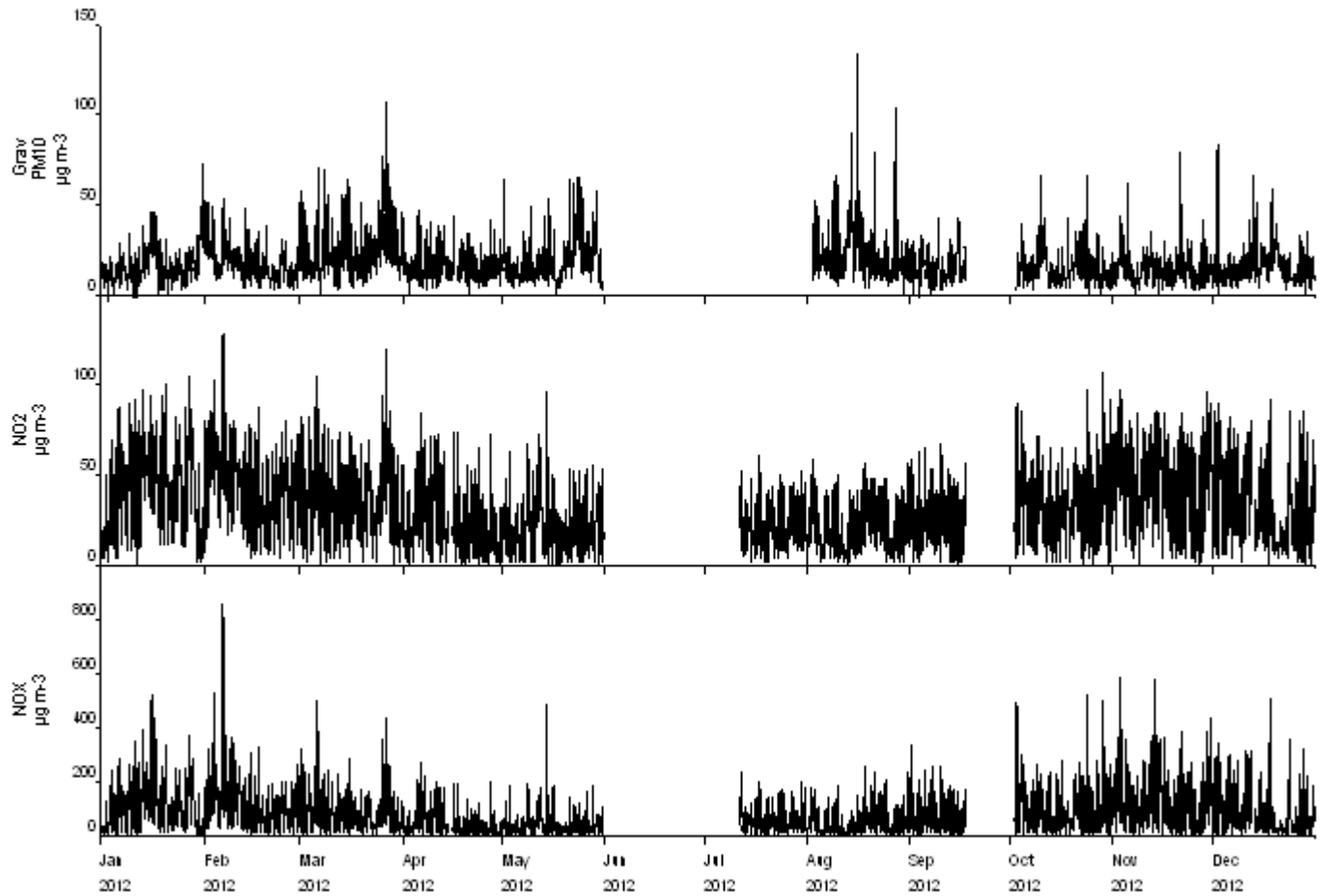
* PM₁₀ as measured by a TEOM using a gravimetric factor of 1.3 for Indicative Gravimetric Equivalent
 All gaseous pollutant mass units are at 20°C and 1013 mb. Particulate matter concentrations are reported at ambient temperature and pressure.
 NO_x mass units are NO_x as NO₂ µg m⁻³

Pollutant	Air Quality Regulations (2000) and Air Quality (Scotland) Amendment Regulations 2002	Exceedences	Days
PM ₁₀ Particulate Matter (Gravimetric)	Daily mean > 50 µg m ⁻³	2	2
PM ₁₀ Particulate Matter (Gravimetric)	Annual mean > 18 µg m ⁻³	0	-
Nitrogen Dioxide	Annual mean > 40 µg m ⁻³	0	-
Nitrogen Dioxide	Hourly mean > 200 µg m ⁻³	0	0

Note: For a strict comparison against the objectives there must be a data capture of >90% throughout the calendar year

Produced by Ricardo-AEA on behalf of the Scottish Government

**Dundee Union Street
Hourly Mean Data for 1st January to 31st December 2012**



Date Created: 20/03/2013

Produced by Ricardo-AEA on behalf of the Scottish Government

DUNDEE WHITEHALL STREET 1st January to 31st December 2012

These data have been fully ratified by AEA

POLLUTANT	NO ₂	NO _x
Maximum hourly mean	172 µg m ⁻³	844 µg m ⁻³
99.8th percentile of hourly means	138 µg m ⁻³	-
Average	45 µg m ⁻³	107 µg m ⁻³
Data capture	87.1 %	87.1 %

All gaseous pollutant mass units are at 20°C and 1013 mb.

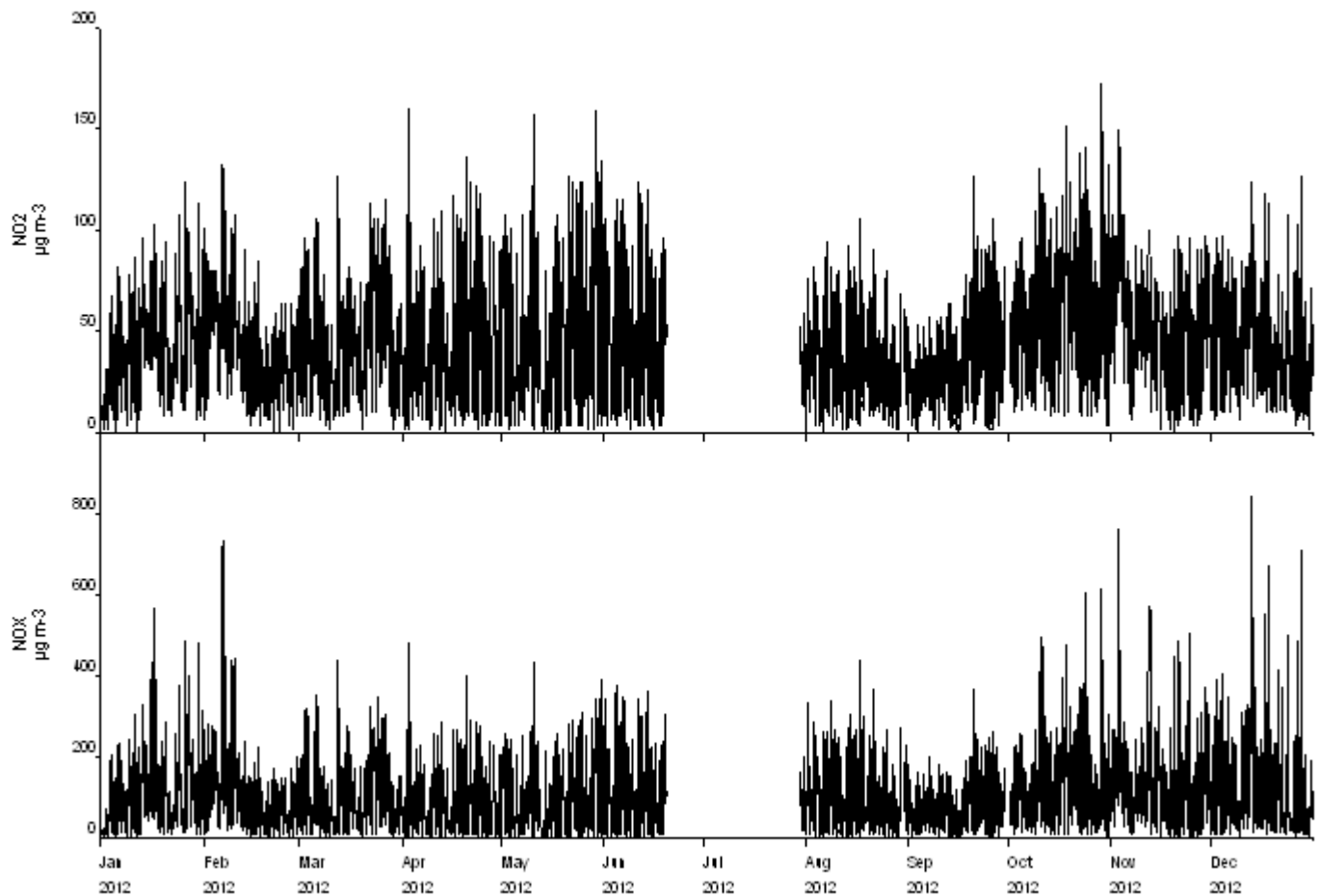
NO_x mass units are NO_x as NO₂ µg m⁻³

Pollutant	Air Quality Regulations (2000) and Air Quality (Scotland) Amendment Regulations 2002	Exceedences	Days
Nitrogen Dioxide	Annual mean > 40 µg m ⁻³	1	-
Nitrogen Dioxide	Hourly mean > 200 µg m ⁻³	0	0

Note: For a strict comparison against the objectives there must be a data capture of >90% throughout the calendar year

Produced by Ricardo-AEA on behalf of the Scottish Government

**Dundee Whitehall Street
Hourly Mean Data for 1st January to 31st December 2012**



Date Created: 20/03/2013

Appendix D: Bias Calculations for Diffusion Tube Co-location Studies

Checking Precision and Accuracy of Triplicate Tubes



Diffusion Tubes Measurements									
Period	Start Date dd/mm/yyyy	End Date dd/mm/yyyy	Tube 1 $\mu\text{g m}^{-3}$	Tube 2 $\mu\text{g m}^{-3}$	Tube 3 $\mu\text{g m}^{-3}$	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean
1	04/01/2012	01/02/2012	71.6	73.7	70.9	72	1.5	2	3.6
2	01/02/2012	29/02/2012	76.7	71.2	76.8	75	3.2	4	8.0
3	29/02/2012	28/03/2012	60.2	61.8	66.0	63	3.0	5	7.4
4	28/03/2012	25/04/2012	50.0	50.8	48.3	50	1.3	3	3.2
5	25/04/2012	30/05/2012	38.8	35.0	30.2	35	4.3	12	10.7
6	30/05/2012	27/06/2012	32.9	32.9	35.1	34	1.3	4	3.2
7	27/06/2012	31/07/2012							
8	31/07/2012	29/08/2012	47.0	44.9	43.1	45	2.0	4	4.8
9	29/08/2012	26/09/2012	47.7	49.5	50.7	49	1.5	3	3.8
10	26/09/2012	31/10/2012	58.4	52.5	49.9	54	4.4	8	10.8
11	31/10/2012	28/11/2012	65.3	72.5	73.7	71	4.5	6	11.3
12	28/11/2012	03/01/2013	63.6	63.9	62.1	63	1.0	2	2.4
13									

It is necessary to have results for at least two tubes in order to calculate the precision of the measurements

Automatic Method		Data Quality Check	
Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
69.3	99.4	Good	Good
64.0	99.7	Good	Good
53.9	100.0	Good	Good
38.3	99.6	Good	Good
32.8	99.4	Good	Good
35.4	99.3	Good	Good
52.7	97.6		Good
37.1	99.6	Good	Good
48.5	99.9	Good	Good
61.0	84.3	Good	Good
84.4	77.5	Good	Good
68.0	100.0	Good	Good

Overall survey --> **Good precision** **Good Overall DC**

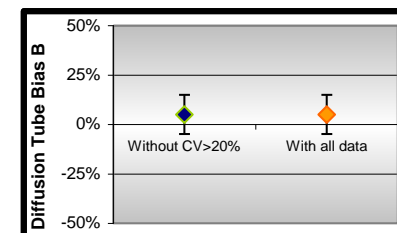
(Check average CV & DC from Accuracy calculations)

Site Name/ ID: **Dundee Lochee Road**

Precision **11 out of 11 periods have a CV smaller than 20%**

Accuracy (with 95% confidence interval)	
without periods with CV larger than 20%	
Bias calculated using 11 periods of data	
Bias factor A	0.97 (0.89 - 1.08)
Bias B	3% (-7% - 13%)
Diffusion Tubes Mean:	55 $\mu\text{g m}^{-3}$
Mean CV (Precision):	5
Automatic Mean:	54 $\mu\text{g m}^{-3}$
Data Capture for periods used:	96%
Adjusted Tubes Mean:	54 (49 - 60) $\mu\text{g m}^{-3}$

Accuracy (with 95% confidence interval)	
WITH ALL DATA	
Bias calculated using 11 periods of data	
Bias factor A	0.97 (0.89 - 1.08)
Bias B	3% (-7% - 13%)
Diffusion Tubes Mean:	55 $\mu\text{g m}^{-3}$
Mean CV (Precision):	5
Automatic Mean:	54 $\mu\text{g m}^{-3}$
Data Capture for periods used:	96%
Adjusted Tubes Mean:	54 (49 - 60) $\mu\text{g m}^{-3}$



Jaume Targa, for AEA
Version 04 - February 2011

Checking Precision and Accuracy of Triplicate Tubes



Diffusion Tubes Measurements									
Period	Start Date dd/mm/yyyy	End Date dd/mm/yyyy	Tube 1 μgm^{-3}	Tube 2 μgm^{-3}	Tube 3 μgm^{-3}	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean
1	04/01/2012	01/02/2012	24.7	25.5	25.7	25	0.5	2	1.3
2	01/02/2012	29/02/2012	24.4	22.7	24.5	24	1.0	4	2.5
3	29/02/2012	28/03/2012	16.5	17.6	18.3	17	0.9	5	2.3
4	28/03/2012	25/04/2012	14.0	11.5	15.1	14	1.8	14	4.6
5	25/04/2012	30/05/2012	9.4	9.0	12.0	10	1.6	16	4.0
6	30/05/2012	27/06/2012	8.3	8.4	9.1	9	0.4	5	1.1
7	27/06/2012	01/08/2012							
8	01/08/2012	29/08/2012	12.7	11.1	11.0	12	1.0	8	2.4
9	29/08/2012	26/09/2012	11.3	11.2	10.1	11	0.7	6	1.7
10	26/09/2012	31/10/2012	19.5	19.7	19.8	20	0.2	1	0.4
11	31/10/2012	28/11/2012	21.2	20.5	23.2	22	1.4	6	3.5
12	28/11/2012	03/01/2013	26.9	22.7	24.6	25	2.1	9	5.2
13									

Automatic Method		Data Quality Check	
Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
18.4	99.6	Good	Good
10.9	99.9	Good	Good
10.7	99.9	Good	Good
7.8	100.0	Good	Good
6.3	99.9	Good	Good
5.6	99.9	Good	Good
5.5	97.0		Good
6.1	99.9	Good	Good
6.4	99.6	Good	Good
13.4	88.7	Good	Good
13.2	91.7	Good	Good
14.2	92.0	Good	Good

It is necessary to have results for at least two tubes in order to calculate the precision of the measurements

Overall survey --> **Good precision** **Good Overall DC**

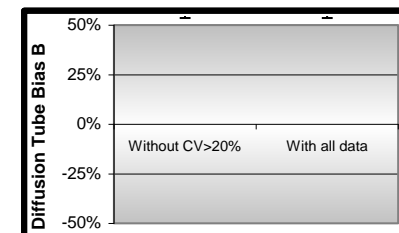
Site Name/ ID: **Dundee Mains Loan**

Precision **11 out of 11 periods have a CV smaller than 20%**

(Check average CV & DC from Accuracy calculations)

Accuracy (with 95% confidence interval) without periods with CV larger than 20%	
Bias calculated using 11 periods of data	
Bias factor A	0.6 (0.55 - 0.66)
Bias B	66% (51% - 81%)
Diffusion Tubes Mean:	17 μgm^{-3}
Mean CV (Precision):	7
Automatic Mean:	10 μgm^{-3}
Data Capture for periods used:	97%
Adjusted Tubes Mean:	10 (9 - 11) μgm^{-3}

Accuracy (with 95% confidence interval) WITH ALL DATA	
Bias calculated using 11 periods of data	
Bias factor A	0.6 (0.55 - 0.66)
Bias B	66% (51% - 81%)
Diffusion Tubes Mean:	17 μgm^{-3}
Mean CV (Precision):	7
Automatic Mean:	10 μgm^{-3}
Data Capture for periods used:	97%
Adjusted Tubes Mean:	10 (9 - 11) μgm^{-3}



Jaume Targa, for AEA
Version 04 - February 2011

Checking Precision and Accuracy of Triplicate Tubes



Diffusion Tubes Measurements									
Period	Start Date dd/mm/yyyy	End Date dd/mm/yyyy	Tube 1 μgm^{-3}	Tube 2 μgm^{-3}	Tube 3 μgm^{-3}	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean
1	04/01/2012	01/02/2012	76.8	72.2	75.8	75	2.4	3	6.0
2	01/02/2012	29/02/2012	80.4	81.7	72.7	78	4.9	6	12.1
3	29/02/2012	28/03/2012	60.3	77.9	74.5	71	9.3	13	23.2
4	28/03/2012	25/04/2012	64.6	62.3	61.4	63	1.7	3	4.1
5	25/04/2012	30/05/2012	50.7	52.4	58.6	54	4.2	8	10.3
6	30/05/2012	27/06/2012	46.4	49.9	51.6	49	2.7	5	6.6
7	27/06/2012	01/08/2012							
8	01/08/2012	29/08/2012	66.8	65.8	66.1	66	0.5	1	1.3
9	29/08/2012	26/09/2012	59.1	62.2	58.7	60	1.9	3	4.8
10	26/09/2012	31/10/2012	59.6	67.4	66.9	65	4.4	7	10.8
11	31/10/2012	28/11/2012	78.2	66.2	73.4	73	6.0	8	15.0
12	28/11/2012	03/01/2013	49.0	62.5	59.9	57	7.2	13	17.8
13									

Automatic Method		Data Quality Check	
Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
68.5	100.0	Good	Good
69.7	100.0	Good	Good
60.6	100.0	Good	Good
50.2	96.0	Good	Good
45.7	99.4	Good	Good
39.6	99.9	Good	Good
46.8	96.9		Good
46.4	95.8	Good	Good
47.5	97.3	Good	Good
57.0	95.6	Good	Good
65.3	91.5	Good	Good
54.1	96.2	Good	Good

It is necessary to have results for at least two tubes in order to calculate the precision of the measurements

Overall survey --> **Good precision** **Good Overall DC**

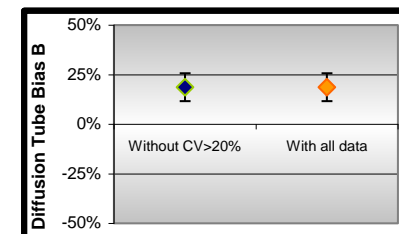
Site Name/ ID: **Dundee Meadowside**

Precision **11 out of 11 periods have a CV smaller than 20%**

(Check average CV & DC from Accuracy calculations)

Accuracy (with 95% confidence interval)	
without periods with CV larger than 20%	
Bias calculated using 11 periods of data	
Bias factor A	0.85 (0.8 - 0.91)
Bias B	18% (10% - 25%)
Diffusion Tubes Mean:	65 μgm^{-3}
Mean CV (Precision):	6
Automatic Mean:	55 μgm^{-3}
Data Capture for periods used:	97%
Adjusted Tubes Mean:	55 (52 - 59) μgm^{-3}

Accuracy (with 95% confidence interval)	
WITH ALL DATA	
Bias calculated using 11 periods of data	
Bias factor A	0.85 (0.8 - 0.91)
Bias B	18% (10% - 25%)
Diffusion Tubes Mean:	65 μgm^{-3}
Mean CV (Precision):	6
Automatic Mean:	55 μgm^{-3}
Data Capture for periods used:	97%
Adjusted Tubes Mean:	55 (52 - 59) μgm^{-3}



Jaume Targa, for AEA
Version 04 - February 2011

Diffusion Tubes Measurements									
Period	Start Date dd/mm/yyyy	End Date dd/mm/yyyy	Tube 1 μgm^{-3}	Tube 2 μgm^{-3}	Tube 3 μgm^{-3}	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean
1	04/01/2012	01/02/2012	54.1	57.0	55.5	56	1.5	3	3.6
2	01/02/2012	29/02/2012	60.1	56.6	63.2	60	3.3	6	8.2
3	29/02/2012	28/03/2012	58.0	50.7	57.9	56	4.2	8	10.4
4	28/03/2012	25/04/2012	56.6	58.7	47.8	54	5.8	11	14.4
5	25/04/2012	30/05/2012	53.4	56.3	55.2	55	1.5	3	3.6
6	30/05/2012	27/06/2012	53.5	53.7	53.5	54	0.1	0	0.3
7	27/06/2012	01/08/2012							
8	01/08/2012	29/08/2012	62.9	63.6	65.2	64	1.2	2	2.9
9	29/08/2012	26/09/2012	46.3	47.1	44.5	46	1.3	3	3.3
10	26/09/2012	31/10/2012	51.3	54.8	54.9	54	2.1	4	5.1
11	31/10/2012	28/11/2012	61.8	61.4	58.5	61	1.8	3	4.5
12	28/11/2012	03/01/2013	56.7	56.2	58.5	57	1.2	2	3.0
13									

It is necessary to have results for at least two tubes in order to calculate the precision of the measurements

Automatic Method		Data Quality Check	
Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
56.0	99.4	Good	Good
52.8	99.3	Good	Good
47.2	100.0	Good	Good
43.3	96.0	Good	Good
44.3	99.6	Good	Good
44.3	99.9	Good	Good
38.3	94.8		Good
		Good	
37.6	94.0	Good	Good
45.8	82.9	Good	Good
68.7	94.5	Good	Good
49.4	92.7	Good	Good

Overall survey --> **Good precision** **Good Overall DC**

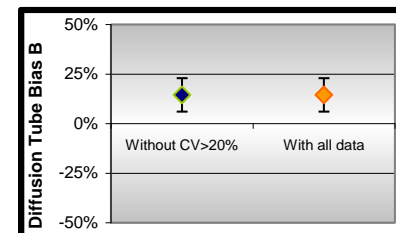
(Check average CV & DC from Accuracy calculations)

Site Name/ ID: **Dundee Seagate**

Precision **11 out of 11 periods have a CV smaller than 20%**

Accuracy (with 95% confidence interval)	
without periods with CV larger than 20%	
Bias calculated using 10 periods of data	
Bias factor A	0.89 (0.83 - 0.96)
Bias B	13% (4% - 21%)
Diffusion Tubes Mean:	55 μgm^{-3}
Mean CV (Precision):	4
Automatic Mean:	49 μgm^{-3}
Data Capture for periods used:	96%
Adjusted Tubes Mean:	49 (46 - 53) μgm^{-3}

Accuracy (with 95% confidence interval)	
WITH ALL DATA	
Bias calculated using 10 periods of data	
Bias factor A	0.89 (0.83 - 0.96)
Bias B	13% (4% - 21%)
Diffusion Tubes Mean:	55 μgm^{-3}
Mean CV (Precision):	4
Automatic Mean:	49 μgm^{-3}
Data Capture for periods used:	96%
Adjusted Tubes Mean:	49 (46 - 53) μgm^{-3}



Jaume Targa, for AEA
Version 04 - February 2011

Checking Precision and Accuracy of Triplicate Tubes



Diffusion Tubes Measurements									
Period	Start Date dd/mm/yyyy	End Date dd/mm/yyyy	Tube 1 μgm^{-3}	Tube 2 μgm^{-3}	Tube 3 μgm^{-3}	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean
1	04/01/2012	01/02/2012	48.2	48.6	44.4	47	2.3	5	5.8
2	01/02/2012	29/02/2012	54.9	54.9	54.9	55	0.0	0	0.0
3	29/02/2012	28/03/2012	50.0	46.8	50.1	49	1.9	4	4.7
4	28/03/2012	25/04/2012	32.0	27.2	29.8	30	2.4	8	6.0
5	25/04/2012	30/05/2012	21.7	23.9	22.6	23	1.1	5	2.7
6	30/05/2012	27/06/2012	24.7	25.4	25.0	25	0.4	1	0.9
7	27/06/2012	31/07/2012							
8	31/07/2012	29/08/2012	30.5	32.3	29.2	31	1.6	5	3.9
9	29/08/2012	26/09/2012	39.4	40.1	38.8	39	0.7	2	1.6
10	26/09/2012	31/10/2012	42.0	40.9	43.8	42	1.5	3	3.6
11	31/10/2012	28/11/2012	52.1	44.4	54.0	50	5.1	10	12.6
12	28/11/2012	03/01/2013	42.9	37.1	43.6	41	3.6	9	8.9
13									

It is necessary to have results for at least two tubes in order to calculate the precision of the measurements

Automatic Method		Data Quality Check	
Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
43.0	99.6	Good	Good
44.2	100.0	Good	Good
37.0	99.9	Good	Good
26.1	96.3	Good	Good
20.1	100.0	Good	Good
22.9	4.0	Good	for Data Capture
22.5	57.2		for Data Capture
20.6	99.9	Good	Good
25.6	69.3	Good	for Data Capture
33.1	82.5	Good	Good
42.0	100.0	Good	Good
33.9	97.9	Good	Good

Overall survey --> **Good precision** **Poor Overall DC**

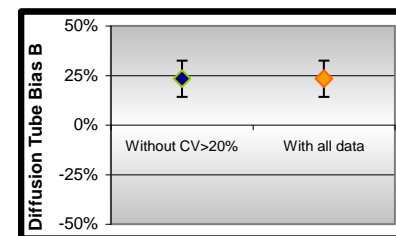
(Check average CV & DC from Accuracy calculations)

Site Name/ ID: **Dundee Union Street**

Precision **11 out of 11 periods have a CV smaller than 20%**

Accuracy (with 95% confidence interval)	
without periods with CV larger than 20%	
Bias calculated using 9 periods of data	
Bias factor A	0.82 (0.76 - 0.88)
Bias B	23% (13% - 32%)
Diffusion Tubes Mean:	41 μgm^{-3}
Mean CV (Precision):	5
Automatic Mean:	33 μgm^{-3}
Data Capture for periods used:	97%
Adjusted Tubes Mean:	33 (31 - 36) μgm^{-3}

Accuracy (with 95% confidence interval)	
WITH ALL DATA	
Bias calculated using 9 periods of data	
Bias factor A	0.82 (0.76 - 0.88)
Bias B	23% (13% - 32%)
Diffusion Tubes Mean:	41 μgm^{-3}
Mean CV (Precision):	5
Automatic Mean:	33 μgm^{-3}
Data Capture for periods used:	97%
Adjusted Tubes Mean:	33 (31 - 36) μgm^{-3}



Jaume Targa, for AEA
Version 04 - February 2011

Checking Precision and Accuracy of Triplicate Tubes



Diffusion Tubes Measurements									
Period	Start Date dd/mm/yyyy	End Date dd/mm/yyyy	Tube 1 μgm^{-3}	Tube 2 μgm^{-3}	Tube 3 μgm^{-3}	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean
1	04/01/2012	01/02/2012	50.0	49.7	51.8	51	1.1	2	2.8
2	01/02/2012	29/02/2012	47.3	47.9	50.7	49	1.8	4	4.5
3	29/02/2012	28/03/2012	54.3	53.5	49.8	53	2.4	5	6.0
4	28/03/2012	25/04/2012	47.6	41.2	48.8	46	4.1	9	10.1
5	25/04/2012	30/05/2012	45.3	37.5	42.3	42	3.9	9	9.8
6	30/05/2012	27/06/2012	50.6	51.4	47.7	50	1.9	4	4.8
7	27/06/2012	31/07/2012							
8	31/07/2012	29/08/2012	51.4	51.8	46.8	50	2.8	6	6.9
9	29/08/2012	26/09/2012	36.8	39.7	38.1	38	1.5	4	3.6
10	26/09/2012	31/10/2012	49.6	45.4	48.5	48	2.2	5	5.4
11	31/10/2012	28/11/2012	42.6	51.3	51.9	49	5.2	11	12.9
12	28/11/2012	03/01/2013	40.2	47.8	49.3	46	4.9	11	12.1
13									

It is necessary to have results for at least two tubes in order to calculate the precision of the measurements

Automatic Method		Data Quality Check	
Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
43.8	99.9	Good	Good
40.8	100.0	Good	Good
44.7	100.0	Good	Good
41.8	99.9	Good	Good
46.7	99.8	Good	Good
47.0	72.3	Good	for Data Capture
25.7	3.0		for Data Capture
36.7	95.3	Good	Good
33.7	91.7	Good	Good
57.5	93.7	Good	Good
50.8	98.8	Good	Good
43.8	100.0	Good	Good
Overall survey -->		Good precision	Poor Overall DC

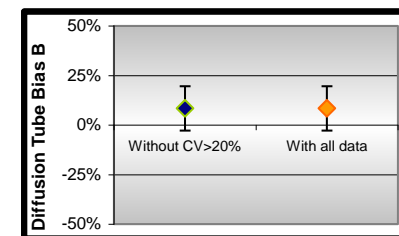
(Check average CV & DC from Accuracy calculations)

Site Name/ ID: Dundee Whitehall Street

Precision 11 out of 11 periods have a CV smaller than 20%

Accuracy (with 95% confidence interval)	
without periods with CV larger than 20%	
Bias calculated using 10 periods of data	
Bias factor A	0.94 (0.85 - 1.05)
Bias B	7% (-5% - 18%)
Diffusion Tubes Mean:	47 μgm^{-3}
Mean CV (Precision):	6
Automatic Mean:	44 μgm^{-3}
Data Capture for periods used:	98%
Adjusted Tubes Mean:	44 (40 - 49) μgm^{-3}

Accuracy (with 95% confidence interval)	
WITH ALL DATA	
Bias calculated using 10 periods of data	
Bias factor A	0.94 (0.85 - 1.05)
Bias B	7% (-5% - 18%)
Diffusion Tubes Mean:	47 μgm^{-3}
Mean CV (Precision):	6
Automatic Mean:	44 μgm^{-3}
Data Capture for periods used:	98%
Adjusted Tubes Mean:	44 (40 - 49) μgm^{-3}



Jaume Targa, for AEA
Version 04 - February 2011

Appendix E : List of Industrial Processes

Process Name/Address	Process Type	PG Note	New source since USA 2012?	Existing process with new exposure?	Substantial change >30% ?	Process Potentially Requiring Review & Assessment~	Nomogram screening assessment required?	Detailed assessment Required?	SEPA Comments
Rockwell Solutions, Wester Gourdie, Dundee	Chapter 6: Other Activities Surface treating with organic solvents - Also Chapter 7 SED	6.4.b	No	Yes*	No	No	No	No	New Asda store nearby
Dundee Energy Recycling, Baldovie, Dundee	Chapter 5: Waste Management	5.1.c	No	No	No	Yes, previously assessed	No	No	Currently re-commissioning after fire damage
Nynas UK AB, East Camperdown Street, Dundee DD1 3LG	Chapter 1: Energy Industries	Section 1.2 Part A Paragraph (f) (i)	No	No	No ?	Yes, previously assessed	No	No	Variation to permit to increase particulate emission limits for small hot oil heater.(May 2013)
Nationwide Crash Repair Centres Ltd, Liff Road, Dundee	Chapter 6: Other Activities vehicle respraying	6.4.b	No	Yes*	No	No	No	No	New Asda store nearby but impact unlikely
Hanson Aggregates Piper Street, Dundee	Chapter 3: Mineral Industries cement batchers	3.1.a.(ii)	No	No	No	No	No	No	Not operating.
Subsea Protection Systems	Chapter 3: Mineral Industries cement batching	3.1.b	No	No	No	Yes, previously assessed	No	No	No Change
Discovery Filling Station	Chapter 1: Energy Industries-Petrol Station	1.2.c.(ii)	No	No	No	Yes, previously assessed	No	No	No Change

Process Name/Address	Process Type	PG Note	New source since USA 2012?	Existing process with new exposure?	Substantial change >30% ?	Process Potentially Requiring Review & Assessment	Nomogram screening assessment required?	Detailed assessment Required?	SEPA Comments
Brochtay Filling Station	Chapter 1: Energy Industries-Petrol Station	1.2.c.(ii)	No	No	No	Yes, previously assessed	No	No	No Change
Asda Stores Filling Station Kirkton	Chapter 1: Energy Industries-Petrol Station	1.2.c.(ii)	No	No	No	Yes, previously assessed	No	No	No Change
Tesco Stores Ltd, Methven Street, Dundee	Chapter 1: Energy Industries-Petrol Station	1.2.c.(ii)	No	No	No	Yes, previously assessed	No	No	Surrendered
BP Kingsway West Filling Station	Chapter 1: Energy Industries-Petrol Station	1.2.c.(ii)	No	No	No	Yes, previously assessed	No	No	No Change
Shell Caird Park	Chapter 1: Energy Industries-Petrol Station	1.2.c.(ii)	No	No	No	Yes, previously assessed	No	No	No Change
Shell UK Ltd, East Kingsway Dundee	Chapter 1: Energy Industries-Petrol Station	1.2.c.(ii)	No	No	No	Yes, previously assessed	No	No	Closed?
Asda Stores Ltd, Milton of Craigie, Dundee	Chapter 1: Energy Industries-Petrol Station	1.2.c.(ii)	No	No	No	Yes, previously assessed	No	No	No Change
Tesco Stores Ltd, Riverside Drive, Dundee	Chapter 1: Energy Industries-Petrol Station	1.2.c.(ii)	No	No	No	Yes, previously assessed	No	No	No Change
Somerfield Ltd, Marketgait F/S, Dundee	Chapter 1: Energy Industries-Petrol Station	1.2.c.(ii)	No	No	No	Yes, previously assessed	No	No	No Change
Sainsburys Supermarket Ltd, Dundee	Chapter 1: Energy Industries-Petrol Station	1.2.c.(ii)	No	No	No	Yes, previously assessed	No	No	No Change

Process Name/Address	Process Type	PG Note	New source since USA 2012?	Existing process with new exposure?	Substantial change >30% ?	Process Potentially Requiring Review & Assessment	Nomogram screening assessment required?	Detailed assessment Required?	SEPA Comments
Jet Petrol Station, Forfar Road, Dundee	Chapter 1: Energy Industries-Petrol Station	1.2.c.(ii)	No	No	No	Yes, previously assessed	No	No	No Change
Dens Metals Ltd, West Pitkerro, Dundee	Chapter 2: Production and Processing of Metals	2.2.a	No	No	No	Yes, previously assessed	No	No	Surrendered
Mctavish Ramsay Ltd, Barlow Ave, West Pitkerro	Chapter 6: Other Activities Timber Activity	6.6.(i)	No	No	No	No	No	No	Company in administration. Not operating
Johnsons, Asda Dundee	Chapter 7: SED Activities	Chapter 7: SED Activities	No	No	No	No	No	No	Surrendered
Breedon Aggregates Ltd, Longtown Street, Dundee	Chapter 3: Mineral Industries Cement Batching	3.1.a.(ii)	No	No	No	No, previously assessed	No	No	No Change
Aberdeen Valet Service Dundee	Chapter 7: SED Activities	Chapter 7: SED Activities	No	Site no longer operating.	Site no longer operating.	No	No	No	Surrendered
Lochee Drycleaning Centre Dundee	Chapter 7: SED Activities	Chapter 7: SED Activities	No	No	No	No	No	No	No Change
Ferry Laundrette Broughty Ferry	Chapter 7: SED Activities	Chapter 7: SED Activities	No	No	No	No	No	No	No Change
Stay-Press Dry Cleaning Centre, Dundee	Chapter 7: SED Activities	Chapter 7: SED Activities	No	No	No	No	No	No	No Change

Process Name/Address	Process Type	PG Note	New source since USA 2012?	Existing process with new exposure?	Substantial change >30% ?	Process Potentially Requiring Review & Assessment~	Nomogram screening assessment required?	Detailed assessment Required?	SEPA Comments
Care Clean, Dundee	Chapter 7: SED Activities	Chapter 7: SED Activities	No	No	No	No	No	No	No Change
Dignity Ltd, Dundee Crematorium, Dundee	Chapter 5: Waste Management	5.1c	No	No	No	No	No	No	No change
Laundry On Line, Annfield Road, Dundee	Chapter 7: SED Activities	Chapter 7: SED Activities	No	No	No	No	No	No	Relocated to Annfield Road
Wm Morrison Supermarkets Plc, Dundee	Chapter 1: Energy Industries-Petrol Station	1.2.c.(ii)	No	No	No	No	No	No	No Change
Wm Morrison Supermarkets plc, 1 Afton Way	Chapter 7: SED Activities	Chapter 7: SED Activities	No	No	No	No	No	No	No Change
Tesco Filling Station, South Road, Dundee	Chapter 1: Energy Industries-Petrol Station	1.2.c.(ii)	No	No	No	No	No	No	No Change
Halley Stevensons (Dyers & Finishers) Limited, Baltic Works, Annfield Road, Dundee DD1 5JH	Chapter 6: Other Activities	Section 6.4 Part A Paragraph (a)	No	No	No	No	No	No	No Change
Discovery Flexibles, Kemback St Dundee	Chapter 6: Other Activities surface treatment using organic solvents also Chapter 7 SED coating flexible packaging	6.4.b	No	No	No	No	No	No	No Change

Process Name/Address	Process Type	PG Note	New source since USA 2012?	Existing process with new exposure?	Substantial change >30% ?	Process Potentially Requiring Review & Assessment	Nomogram screening assessment required?	Detailed assessment Required?	SEPA Comments
J T Inglis, Riverside Works, Dundee	Chapter 6: Other Activities Textile Treatment	6.4.d	No	No	No	No	No	No	No cuprammonium process. Possible review of Part A status
Michelin Tyre Plant, Dundee	Chapter 6: Other Activities surface treatment of rubber with organic solvents also Chapter 7	6.4.b	No	No	No	Yes, previously assessed	No	No	New line but no real change to emissions
Michelin Tyre Plant, Dundee	Chapter 1: Energy Industries, Combustion	1.1.a	No	No	No	Yes, previously assessed	No	No	No Change
D C Thomson Printers, Dundee	Chapter 6: Other Activities printing process	6.4.b	No	No	No	No	No	No	Not operating permitted activity
Day International Ltd, Balgray St, Dundee	Chapter 6: Other Activities surface treatment of rubber with organic solvents	6.4.b	No	No	No	Yes, previously assessed	No	No	No Change
RMC Readymix Ltd, Dundee	Chapter 3: Mineral Industries, Cement Batching	3.1.a.(ii)	No	No	No	No	No	No	No change
Brown & Tawse Steelstock Ltd, Fowler RD West Pitkerro - Dundee	Chapter 6: Other Activities, paint spraying	6.4.a	No	No	No	No	No	No	No Change
Armitages Pet Products Ltd, Broughty Ferry	Chapter 6: Other Activities, Pet Food Manufacture	6.8.a	No	No	No	No	No	No	No change

Process Name/Address	Process Type	PG Note	New source since USA 2012?	Existing process with new exposure?	Substantial change >30% ?	Process Potentially Requiring Review & Assessment ~	Nomogram screening assessment required?	Detailed assessment Required?	SEPA Comments
Road- Dundee									
Tesco Stores Ltd, Kingsway Retail Park Dundee	Chapter 1: Energy Industries, Petrol Station	1.2.c.(ii)	No	No	No	No	No	No	No Change
Joinery and Timber Creations (65) Ltd,	Chapter 6: Other Activities, Timber Process	6.6.(i)	No	No	No	No, previously assessed	No	No	Waste wood boiler-permitted but not constructed or operating.
Ethiebeaton Quarry	Chapter 3 Mineral Activities - cement batching process 3.1a(ii), roadstone coating 3.5e, crushing and grinding 3.5c	3.1a(ii), 3.5e, 3.5c	No	No	No	Yes, previously assessed	No	No	No Change
Health Care Environmental Services, Nobel Road, Wester Gourdie Ind. Estate	Chapter 5 Waste Management Part A Treatment of Clinical waste	5.3a	No	No	No	No, previously assessed	No	No	No change
New PVR at Asda, Myrekirk Road	Chapter 1: Energy Industries, Petrol Station	1.2.c.(ii)	Yes	No	No	No	No	No	New site

Notes:

Yes* see Section 3.3

No? see Section 3.3

~ with reference to Annex 2 Appendix E TG.03

Appendix F : Road Traffic Data

Table F1 Department Of Transport Count Locations

Count Point Id	Road	Location of count	Easting	Northing
798	A90	Kingsway - E of Old Glamis Rd	340500	732650
1045	A92	Arbroath Rd - W of Claypotts	345000	731940
1166	A991	W Marketgait - N of Nethergate	340000	730100
1170	A930	Dundee Rd West - E of Stannergate	343500	731100
10803	A90	Kingsway - E of Coupar Angus Road	338000	732600
10856	A92	Broughty Ferry Rd - W of Dalgleish Rd	342400	731100
11027	A991	N Marketgait E of Bell St Car Park	340000	730600
20857	A92	Dock St - W of Trades Lane	340700	730400
20978	A929	Princes St - King St	341000	730900
30847	A85	Riverside Drive Nr Tesco	340000	729550
40803	A90	Kingsway West- E of Myrekirk	336000	732070
40858	A92	East Dock St. - Nr Gallacher Retail Park	341000	730600
40982	A929	Forfar Rd - N of Walrond St	341370	732100
50817	A923	Logie Street	338250	731270
50844	A972	Kingsway East - S of Longtown Road	342700	732060
50875	A929	Victoria Rd - W of William St .	340710	730950
74325	A90	A90 Forfar Rd - N of Jack Martin Way	341610	734400
74326	A92	Arbroath Rd - E of Balgillo Rd East	347000	732620
74327	A930	Monifeith Rd - Nr Reres Rd	347000	731070
74332	A923	Coupar Angus Rd - Camperdown Park	336500	733090
77104	A92	S Marketgait - below Tay Bridge Ramps	340630	730200
78561	A92	Arbroath Rd E of West Grange Road	348500	733150
78562	A923	Coupar Angus Rd - E of Leisure Park	337300	732750
78563	A90	A90 Forfar Rd - Nr Hebrides Drive	341570	733500
80321	A85	Riverside Ave - S of Riverside Place	336200	729880
80364	A92	Greendykes Rd - N of Balgavies Ave	343000	731500
80558	A991	East Marketgait - N of Eastport	340620	730690
80559	A991	East Marketgait - N of King Street	340450	730750

Figure F.1 Department of Transport Count Point Locations in Dundee City Council

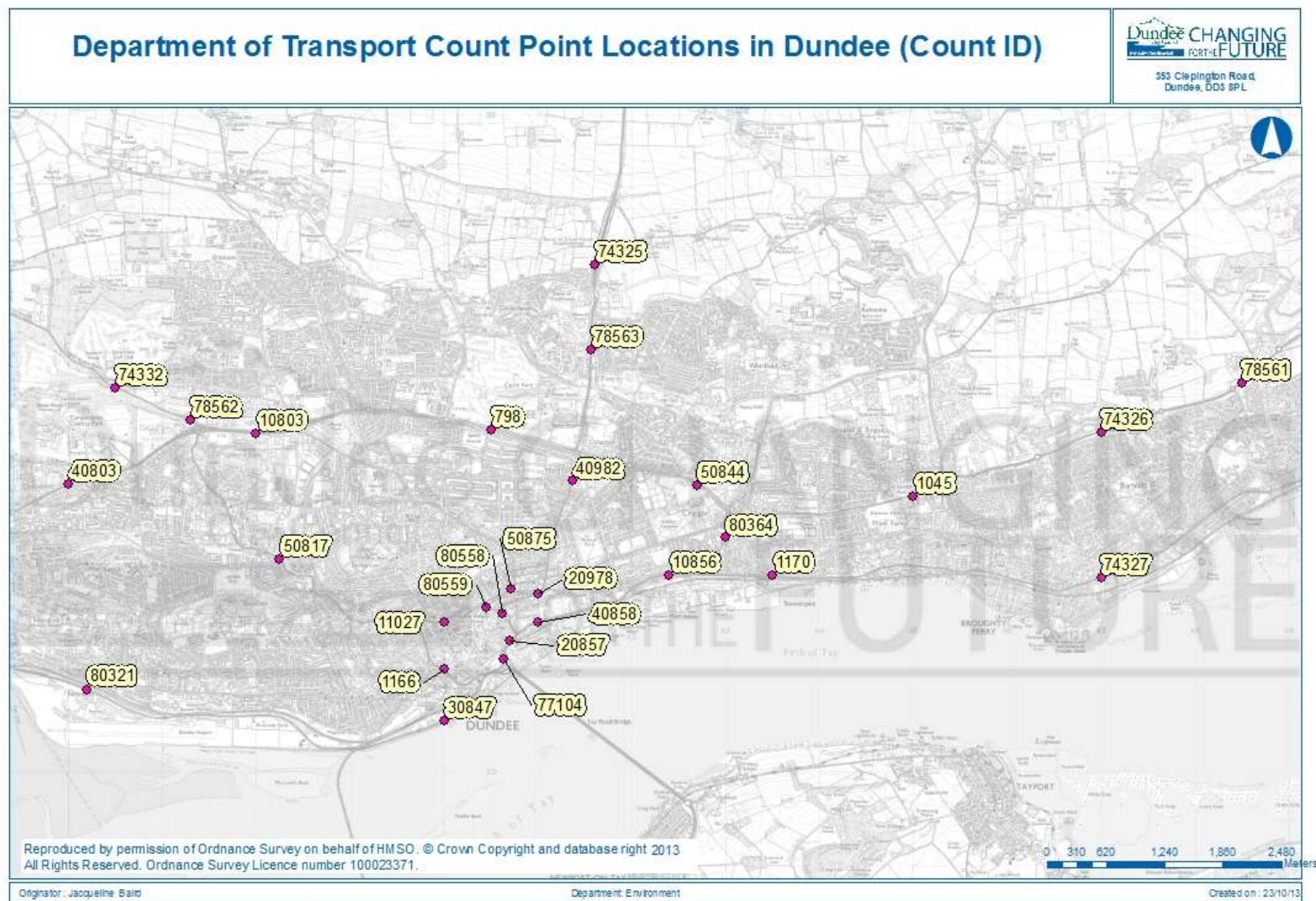


Table F2 Comparison of 2012 DfT Traffic Count Data with Previous Assessments

2012 Traffic Data			Predicted 2010 traffic flow assessed in 2003 USA	Estimated HDV % in 2003	Predicted 2010 traffic flow assessed in 2005 DA	Estimated HDV % in 2005	Predicted 2010 traffic flow assessed in 2006 USA	Estimated HDV % in 2006	Predicted 2010 traffic flow assessed in 2009 FA-DA	Estimated HDV % in 2007	2012 USA(2011 AADF)	2012 USA (HDV %)	percent increase (in AADF)	Assessment - DMRB required	Reasons
Count Point Id	2012 AADF	HDV %													
798	38368	7.5												n	no relevant receptors
1045	21962	5.0					29001	10						n	less than previous
1166	21532	3.3	28956	7					20472	7.1				n	less than previous
1170	13614	1.1							17799	2.3				n	less than previous
10803	41813	9.5												n	no relevant receptors
10856	30039	4.1					33981	6						n	less than previous
11027	29642	1.2	21538	6			32787	1.63	29699	2.8				n	less than previous
20857	35314	4.1	34328	8			37078	4.3						n	less than previous
20978	1060	39.1			1059	49.8								n	less than previous
30847	19603	3.6					18515	3.3			21089	2.8		n	less than previous
40803	37600	10.2					32907	13					14.3	y	>than 10% increase
40858	25292	4.1												n	no relevant receptors
40982	8288	6.7	12506	11	11767	4.5			8684	7.8				n	less than previous
50817	15965	4.4	20730	8			17299	2	17347	5.8				n	less than previous
50844	26500	5.6												n	no relevant receptors
50875	13391	8.3	13680	16	15413	9.8	15413	10.3						n	less than previous
74325	24632	8.4												n	no relevant receptors
74326	22501	4.7									23667	3.7		n	less than previous
74327	9131	4.4					15619	7						n	less than previous
74332	9809	3.0												n	no relevant receptors
77104	27192	4.1												n	no relevant receptors
78561	16673	6.1												n	no relevant receptors
78562	10398	3.0												n	no relevant receptors
78563	27068	8.4												n	no relevant receptors
80321	14218	4.6												n	no relevant receptors
80364	14483	5.5					14231	6					1.8	n	less than 10 percent increase
80558	17811	2.8	17622	7	16779	3.6							1.1	n	less than 10 percent increase
80559	14545	1.5	22168	4			18612	2.9						n	less than previous
y	see section 3.1														

Table F3 Comparison of 2012 DCC Road Traffic Reduction Act Site Counts with Previously Assessed Counts

Site	Receptor within 10m	Receptor within 2m	2005 AADT (USA 2006)	2008 AADT (USA 2009)	2010 AADT (USA 2009)	2011 AADT (USA 2012)	2012 AADT	Date	Assessment or DMRB Required?	Reason
Arbroath Road (E of Kenilworth Ave)	y	n	13189	12957	13048	13283	13697	2012	n	increase less than 10%
Blackness Road (W of Marchfield)	y	n		6193	6360	5911	5844	2012	n	less than previous
Broughty Ferry Road (E of Dalgleish Rd?)	y	n	33981			27315	24741	2012	n	less than previous
Dens Road (S of Hillbank Rd)	y	n	10859	11025	11323	10062	10178	2012	n	less than previous
Forfar Road (N of Janefield PI)	y	n	9276	8220	8278	8861	9053	2012	n	less than 10,000vpd,not narrow congested, PM ₁₀ background less than 15ug/m ³
Hilltown (N of Stirling St)	y	y		5598	5749	5416	5492	2012	n	less than 10,000vpd,not narrow congested, PM ₁₀ background less than 15ug/m ³
Lochee Road (N of Rankine St)	y	n	13018	13291	13384	12684	11603	2012	n	less than previous
Perth Road (E of Windsor St)	y	n	8343	7560	7764	7053	7184	2012	n	less than 10,000vpd,not narrow congested, PM ₁₀ background less than 15ug/m ³
Pitkerro Road (S of Baxter Park)	y	n	9159	10102	10375	8675	8608	2012	n	less than 10,000vpd,not narrow congested, PM ₁₀ background less than 15ug/m ³
Rankine Street (N of Lochee Rd)	y	n	8098	7931	8145	7115	6862	2012	n	less than 10,000vpd,not narrow congested, PM ₁₀ background less than 15ug/m ³
Riverside Drive (nr Airport)	n	n	18818	19054	19187	17024	15900	2012	n	no relevant receptors
Rosebank Street (N of Kinloch St)	y	n				4426	4489	2012	n	less than 10,000vpd,not narrow congested, PM ₁₀ background less than 15ug/m ³
Tay Bridge	n	n		25419	25597	25235	24753	2012	n	less than previous

Appendix G : Monthly Diffusion Tube Concentrations

Site ID	LOCATION	X	Y	Jan-12	Feb-12	Mar-12	Apr-12	May-12	Jun-12	Jul-12	Aug-12	Sep-12	Oct-12	Nov-12	Dec-12	Mean	% Data	Period Adj' Factor	Annual Mean	Annual Mean bias (0.88)
92	Abertay 2	340019	730612	45.7	50.1	51.7	38.0	44.6	40.1		53.2	40.5	49.8	55.1	50.0	47.2	91.7	n/a	47.2	41.5
3	Albert St (Shandon PI)	341171	731574	44.5	43.2	40.9	35.3	37.8	37.6		45.1	27.7	37.9	50.8	45.3	40.6	91.7	n/a	40.6	35.7
157	Albert St (71)	341106	731223	40.0	41.5	38.3	31.6	29.2	25.1		37.3	28.2	31.9	38.3	38.0	34.5	91.7	n/a	34.5	30.4
2	Albert St (Fish)	341139	731476	41.4	47.6	44.5	33.9	22.9	14.4		28.1	34.0	41.8	43.5	44.5	36.1	91.7	n/a	36.1	31.7
5	Arbroath Rd (13)	341111	731070	54.1	55.5	55.9	41.6	29.8	27.8		41.9	37.6	47.8	57.9	49.0	45.4	91.7	n/a	45.4	39.9
147	Arbroath Rd (38)	341202	731097	57.6	50.8	50.3	45.2	30.7	30.9		34.8	39.2	48.5	60.6	43.8	44.8	91.7	n/a	44.8	39.4
6	Arthurstone Tce (10)	341051	731203	34.0	23.7	30.9	20.6	21.0	14.7		29.3	17.4	26.0	31.4	29.6	25.3	91.7	n/a	25.3	22.3
7	Balgavies PI	343082	731465	30.9	28.0	22.1	16.6	6.7	8.1		12.2	17.3	23.1	29.4	30.9	20.5	91.7	n/a	20.5	18.0
8	Bank St/ Reform St	340228	730337	41.2	44.3	39.4	26.3	19.7	12.5		24.5	29.1	35.2	39.5	38.7	31.9	91.7	n/a	31.9	28.0
9	Birnam PI	337531	730914	16.2	15.5	12.0	8.2	8.4	5.9		10.8	8.5	12.2	13.4	18.4	11.8	91.7	n/a	11.8	10.4
164	Broughty Ferry Rd - Lower	343545	730942	-	-	22.0		7.2	7.4		11.4	12.8	21.0	29.7	30.8	17.8	66.7	1.067	19.0	16.7
140	Broughty Ferry Rd (LP 66)	343297	731096	54.3	55.1	48.4	35.1	22.2	20.5		28.3	33.3	44.1	51.6	49.3	40.2	91.7	n/a	40.2	35.4
139	Broughty Ferry Rd (141 Downpipe)	343317	731072	52.6	54.2	58.2	40.6	32.4	25.4		28.5	36.3	42.6	51.0	45.6	42.5	91.7	n/a	42.5	37.4
11	Broughty Ferry Rd (141)	343322	731073	56.1	64.1	58.9	43.7	42.5	39.0		40.9	42.5	51.7	58.9	54.7	50.3	91.7	n/a	50.3	44.2
142	Broughty Ferry Rd (St. Sign)	343302	731075	47.0	47.2	35.6	42.7	28.5	26.7		28.1	32.2	39.2	36.4	39.3	36.6	91.7	n/a	36.6	32.2
166	Broughty Ferry Rd LP 59(2)	343129	731081	40.5	37.8	31.0			16.7		21.8	22.0	32.2	43.0	41.8	31.9	75.0	0.929	29.6	26.0
145	Broughty Ferry Rd (Greendykes)	342662	731112		51.6	53.1	36.0	21.1	32.0		35.6	32.6	45.3	53.7	50.1	41.1	83.3	n/a	41.1	36.2
155	Carolina Court	342353	731058		34.9	29.3	21.4	15.0	17.9		18.5	22.0	29.1	28.5	39.5	25.6	83.3	n/a	25.6	22.5
12	Claypotts Junction	345315	732103	37.3	35.7	32.1	28.9	24.8	25.9		26.4	21.2	28.8	38.6	32.0	30.2	91.7	n/a	30.2	26.5
13	Clelington Rd/ Forfar Rd	341385	732121	47.5	49.8	48.7	47.9	29.8	31.1		32.9	35.4	48.3	53.1	50.2	43.2	91.7	n/a	43.2	38.0

Site ID	LOCATION	X	Y	Jan-12	Feb-12	Mar-12	Apr-12	May-12	Jun-12	Jul-12	Aug-12	Sep-12	Oct-12	Nov-12	Dec-12	Mean	% Data	Period Adj Factor	Annual Mean	Annual Mean bias (0.88)
14	Commercial St	340328	730431	37.5	33.3	35.2	35.5	28.3	31.9		32.2	23.9	36.7	40.0	39.8	34.0	91.7	n/a	34.0	29.9
84	Commercial St/Dock Street	340565	730263		58.1	53.7	48.5	30.5	34.8		41.5	43.2	49.6	58.3	50.4	46.9	83.3	n/a	46.9	41.2
15	Commercial St (Waterstones)	340481	730325	43.8	45.0		59.5		59.8		52.4	30.1	48.1	39.5	44.8	47.0	75.0	0.955	44.9	39.5
16	Crichton St	340331	730162	46.3	48.4	39.7	31.6	24.2	22.4		28.8	30.7		44.6	42.8	36.0	83.3	n/a	36.0	31.6
17	Dens Rd (Crossing)	340725	731238	46.1	45.2	43.2	31.8	19.0	24.6		37.8	32.0	41.3	52.6	36.4	37.3	91.7	n/a	37.3	32.8
148	Dock St (Tay Hotel)	340340	730033	33.9	35.4	33.4	40.1	36.5	52.7		24.0	22.7	33.1			34.6	75.0	1.082	37.4	32.9
85	Dock St (Carol Whyte)	340524	730216	48.7	49.9	51.8	50.8	28.6	30.0		33.2	39.4		59.2		43.5	75.0	1.067	46.4	40.8
18	Dock St (Sheridans)	340395	730086	56.3	57.1		35.0	27.0	30.5		27.8	27.3	35.8	41.5	38.4	37.7	83.3	n/a	37.7	33.1
156	Dock St (57)	340656	730343	72.2	72.4	76.5	58.0	34.4	34.6		48.9	55.1	68.9	77.6	65.0	60.3	91.7	n/a	60.3	53.1
20	Dura St (Fortes)	341150	731576	54.6	45.0	53.4	39.8	36.4	33.8		40.5	37.7	49.5	56.9	47.4	45.0	91.7	n/a	45.0	39.6
21	Earl Grey Pl (Park)	340699	730019	33.5	34.4	26.3	24.9	14.1	13.3		15.5	22.9	29.3	34.8	35.7	25.9	91.7	n/a	25.9	22.8
22	Eastport Roundabout	340651	730623	42.5	42.4	33.2	39.3	26.3	24.7		31.4	29.4	42.6	40.5	47.6	36.4	91.7	n/a	36.4	32.0
83	Forfar Rd	341437	732360	58.3	69.9	66.4	63.2	42.5	38.5		49.6	52.7	58.3	72.2	56.0	57.1	91.7	n/a	57.1	50.2
23	Harefield Rd (35)	338360	731855	43.3	40.6	38.5	28.0	26.0	25.2		28.5	25.6	34.0	44.0	39.2	33.9	91.7	n/a	33.9	29.8
154	High Street Lochee (106)	337900	731560	33.8		27.3	25.1		21.9		20.8	20.3	26.6	31.1	35.1	26.9	75.0	0.981	26.4	23.2
24	Hilltown (Suites)	340088	731116	46.5	43.5	43.0	31.0	33.3	29.6		34.2	29.8	34.7	40.7	39.1	36.9	91.7	n/a	36.9	32.4
25	King St (12/14)	340598	730757	35.6	42.2	43.3	26.1	18.1	16.0		25.7	26.2	33.2	36.2	37.7	30.9	91.7	n/a	30.9	27.2
26	Kingsway East Roundabout	343107	731740	61.1	57.9	54.2	37.6	27.9	31.0		43.2	38.8	48.3	59.6	44.1	45.8	91.7	n/a	45.8	40.3
27	Kingsway/ Mains Loan	341124	732468	41.5	36.0	38.8	47.9	32.6	42.2		40.8	27.2	38.9	40.7	43.2	39.1	91.7	n/a	39.1	34.4
29	Kingsway/ Strathmartine Rd (S)	339221	732836	53.4	66.4	60.0	59.4	39.8	36.8		35.3	49.8	55.3	65.6	51.6	52.1	91.7	n/a	52.1	45.9
30	Lochee Rd (138)	338936	730680	74.3	83.7	75.4	42.8	43.5	40.3		54.5	53.2	65.4	67.1	67.0	60.7	91.7	n/a	60.7	53.4
31	Lochee Rd (140 Traffic Lts)	338927	730685	72.8	74.8	68.8	49.6	41.9	43.6		58.7	58.5	67.2	79.7	68.8	62.2	91.7	n/a	62.2	54.8
32	Lochee Rd (184)	338767	730856	56.2	51.4	55.4	35.0	25.7	19.6		35.5	39.0	47.6	54.7	50.5	42.8	91.7	n/a	42.8	37.6

Site ID	LOCATION	X	Y	Jan-12	Feb-12	Mar-12	Apr-12	May-12	Jun-12	Jul-12	Aug-12	Sep-12	Oct-12	Nov-12	Dec-12	Mean	% Data	Period Adj Factor	Annual Mean	Annual Mean bias (0.88)
	Lochee Rd (Romon 1)	338861	730773	71.6	76.7	60.2	50.0	38.8	32.9		47.0	47.7	58.4	65.3	63.6	55.7	91.7	n/a	55.7	49.0
	Lochee Rd (Romon 2)	338861	730773	73.7	71.2	61.8	50.8	35.0	32.9		44.9	49.5	52.5	72.5	63.9	55.3	91.7	n/a	55.3	48.7
	Lochee Rd (Romon 3)	338861	730773	70.9	76.8	66.0	48.3	30.2	35.1		43.1	50.7	49.9	73.7	62.1	55.2	91.7	n/a	55.2	48.5
158	Lochee Rd (Romon) Average	338861	730773	72.1	74.9	62.7	49.7	34.7	33.6		45.0	49.3	53.6	70.5	63.2	55.4	91.7	n/a	55.4	48.7
36	Lochee Rd/Polepark Rd	339016	730586	63.5	47.7	31.1	25.9	23.1	23.2		27.8	27.7	36.3	51.3	40.0	36.1	91.7	n/a	36.1	31.8
37	Logie St (114)	338184	731293	78.5	84.8	76.7	54.8	36.9	34.7		60.6	45.5	62.6	79.5	67.6	62.0	91.7	n/a	62.0	54.6
38	Logie St (98)	338252	731258	54.6	50.4	45.4	36.9	19.9	16.1		29.2	35.7	43.7	52.5	47.0	39.2	91.7	n/a	39.2	34.5
39	Loons Rd (1)	338211	731293	56.5	50.7	44.6	51.5	37.8	41.9		45.3	37.6	51.4	56.9	50.4	47.7	91.7	n/a	47.7	42.0
40	Marketgait	339953	730094	34.7	38.9	38.4	34.6	29.7	32.8		37.2	26.3	36.8	42.3	36.6	35.3	91.7	n/a	35.3	31.1
	Mains Loan 1	340972	731893	24.7	24.4	16.5	14.0	9.4	8.3		12.7	11.3	19.5	21.2	26.9	17.2	91.7	n/a	17.2	15.1
	Mains Loan 2	340972	731893	25.5	22.7	17.6	11.5	9.0	8.4		11.1	11.2	19.7	20.5	22.7	16.4	91.7	n/a	16.4	14.4
	Mains Loan 3	340972	731893	25.7	24.5	18.3	15.1	12.0	9.1		11.0	10.1	19.8	23.2	24.6	17.6	91.7	n/a	17.6	15.5
146	Mains Loan Average	340972	731893	25.3	23.9	17.5	13.5	10.1	8.6		11.6	10.9	19.7	21.6	24.7	17.0	91.7	n/a	17.0	15.0
41	Meadowside	340245	730651	84.5	69.5	80.3	59.2	53.3	52.3		70.3	64.8	64.5	79.2	59.5	67.0	91.7	n/a	67.0	59.0
163	Meadowside/Bell Street	340282	730592	-	-	-	-	26.8	29.2		41.2		-	-	-	32.4	25.0	1.723	55.8	49.1
	Meadowside Romon 1	340243	730653	76.8	80.4	60.3	64.6	50.7	46.4		66.8	59.1	59.6	78.2	49.0	62.9	91.7	n/a	62.9	55.4
	Meadowside Romon 2	340243	730653	72.2	81.7	77.9	62.3	52.4	49.9		65.8	62.2	67.4	66.2	62.5	65.5	91.7	n/a	65.5	57.6
	Meadowside Romon 3	340243	730653	75.8	72.7	74.5	61.4	58.6	51.6		66.1	58.7	66.9	73.4	59.9	65.4	91.7	n/a	65.4	57.6
149	Meadowside (Romon) Average	340243	730653	74.9	78.3	70.9	62.8	53.9	49.3		66.2	60.0	64.6	72.6	57.1	64.6	91.7	n/a	64.6	56.9
42	Muirton Rd (6)	338152	731293	37.6	29.8	25.8	27.1	30.0	30.9		37.0	20.1	29.2	36.6	35.3	30.9	91.7	n/a	30.9	27.2
43	Myrekirk Rd	335420	731733	40.6	50.6	47.5	40.9	27.0	19.8		27.6	39.0	45.8	48.3	40.8	38.9	91.7	n/a	38.9	34.2
44	Nethergate (B&B)	340163	730061	56.9	58.9	63.4	55.4	51.2	58.2		65.4	44.6	56.1	58.7	58.1	57.0	91.7	n/a	57.0	50.2
45	Nethergate (Bradford)	340274	730171	66.0	56.2	57.0	39.7	38.3	34.1		46.5	45.9	49.7	52.8	42.8	48.1	91.7	n/a	48.1	42.3

Site ID	LOCATION	X	Y	Jan-12	Feb-12	Mar-12	Apr-12	May-12	Jun-12	Jul-12	Aug-12	Sep-12	Oct-12	Nov-12	Dec-12	Mean	% Data	Period Adj Factor	Annual Mean	Annual Mean bias (0.88)
46	Nethergate (Charlie T)	340033	729957	44.7	44.2	42.6	48.4	33.6	34.3		34.6	34.6	45.6	51.3	35.4	40.8	91.7	n/a	40.8	35.9
47	Nethergate (Trades House)	340230	730124	53.9	49.2	56.4	43.8	37.0	46.6		52.7	40.3	48.2	52.0	51.4	48.3	91.7	n/a	48.3	42.5
48	Nethergate/ Marketgait	340074	729984	38.1	39.5	45.4	40.4	29.7	31.0		32.3	33.7	43.5	38.9	46.3	38.1	91.7	n/a	38.1	33.5
87	Nethergate/South Tay St	339987	729919	36.6	35.9	34.7			-		-	-	-	-	-	35.7	25.0	0.78	27.8	24.5
91	Perth Rd 320	338776	729798	56.1	48.8	44.1	31.2	27.6	31.5		36.1	34.3	44.4	52.6	47.5	41.3	91.7	n/a	41.3	36.3
88	Queen St B/F	346207	731007	45.9	47.6	31.7	29.9	17.6	15.8		19.3	21.1	32.4	41.6	43.7	31.5	91.7	n/a	31.5	27.7
49	Rankine St (2)	338768	730900	64.1	70.4	62.7	47.3	32.1	33.6		34.0	40.7	54.6	58.5	57.4	50.5	91.7	n/a	50.5	44.4
50	Seagate	340545	730532	52.5		43.3	42.6	40.6	36.3			42.5	47.3	61.4	39.3	45.1	75.0	0.993	44.8	39.4
150	Seagate (97)	340511	730492	56.8	61.7	65.7	54.8	56.7	53.4		66.7	46.9	66.7	57.9	55.7	58.5	91.7	n/a	58.5	51.4
	Seagate (Romon 1)	340487	730446	54.1	60.1	58.0	56.6	53.4	53.5		62.9	46.3	51.3	61.8	56.7	55.9	91.7	n/a	55.9	49.2
	Seagate (Romon 2)	340487	730446	57.0	56.6	50.7	58.7	56.3	53.7		63.6	47.1	54.8	61.4	56.2	56.0	91.7	n/a	56.0	49.3
	Seagate (Romon 3)	340487	730446	55.5	63.2	57.9	47.8	55.2	53.5		65.2	44.5	54.9	58.5	58.5	55.9	91.7	n/a	55.9	49.2
159	Seagate (Romon) Average	340487	730446	55.5	60.0	55.5	54.4	55.0	53.6		63.9	46.0	53.7	60.6	57.1	55.9	91.7	n/a	55.9	49.2
54	Seagate (Yates)	340467	730388	47.9	47.1	44.1	41.8	39.8	35.0			34.0	46.3	52.0	47.8	43.6	83.3	n/a	43.6	38.4
55	Soapwork Lane	340099	730650	51.1	45.8	44.1	31.5	24.8	26.3		33.8	33.9	41.7	54.6	46.8	39.5	91.7	n/a	39.5	34.8
151	South Road (Denbank)	335188	731528	54.3	56.9	46.6	41.9	30.2	28.0		36.6	37.0	45.8	45.3	38.6	41.9	91.7	n/a	41.9	36.9
56	St Andrews St (Jaf)	340516	730584	47.0	45.9	44.2	38.6	35.8	35.3		41.6	27.0	42.3	49.3	46.0	41.2	91.7	n/a	41.2	36.2
162	St Andrews St (Pb) Façade	340532	730548	50.5	49.2	47.2	45.9	36.9	30.2		43.5	32.8	45.1	57.0	46.9	44.1	91.7	n/a	44.1	38.8
152	Strathmore Ave (337)	339522	731875	43.4	49.0	47.0	31.8	29.9			38.1	31.5	35.3	52.3	39.4	39.8	83.3	n/a	39.8	35.0
59	Strathmore Ave (353)	339609	731871	55.4	50.6	49.2	40.4	34.3	38.6		47.5	31.6	43.1	46.6	47.9	44.1	91.7	n/a	44.1	38.8
153	Strathmore Ave (Ped X)	339667	731878	35.6	33.7	31.5	37.9	31.4	29.3		31.7	24.8		38.8	39.4	33.4	83.3	n/a	33.4	29.4
60	Trades Lane (31)	340575	730500	37.6	46.4	38.2	28.2	28.4	19.8		30.3	28.9	35.7	49.7	37.4	34.6	91.7	n/a	34.6	30.4
	Union St (Rollalong 1)	340235	730091	48.2	54.9	50.0	32.0	21.7	24.7		30.5	39.4	42.0	52.1	42.9	39.9	91.7	n/a	39.9	35.1

Site ID	LOCATION	X	Y	Jan-12	Feb-12	Mar-12	Apr-12	May-12	Jun-12	Jul-12	Aug-12	Sep-12	Oct-12	Nov-12	Dec-12	Mean	% Data	Period Adj Factor	Annual Mean	Annual Mean bias (0.88)
	Union St (Rollalong 2)	340235	730091	48.6	54.9	46.8	27.2	23.9	25.4		32.3	40.1	40.9	44.4	37.1	38.3	91.7	n/a	38.3	33.7
	Union St (Rollalong 3)	340235	730091	44.4	54.9	50.1	29.8	22.6	25.0		29.2	38.8	43.8	54.0	43.6	39.7	91.7	n/a	39.7	34.9
61	Union St (Rollalong) Average	340235	730091	47.1	54.9	49.0	29.7	22.7	25.0		30.7	39.4	42.2	50.2	41.2	39.3	91.7	n/a	39.3	34.6
66	Victoria Rd	340212	730633	36.5	40.6	35.7	38.5	37.3	35.2		34.9	29.0	43.2	49.6	46.7	38.8	91.7	n/a	38.8	34.2
93	Victoria Rd (10)	340230	730673	44.3	43.1	42.1	43.9	45.5	27.7		35.5		41.9	40.6	46.7	41.1	83.3	n/a	41.1	36.2
68	Victoria Rd (60)	340375	730779	49.8	52.6	58.0	44.9	41.1	40.2		46.1	39.0	51.3	53.4	51.4	48.0	91.7	n/a	48.0	42.2
69	Victoria Rd / Cotton Rd	340740	730996	54.0	57.2	56.3	34.3		23.9		31.1	33.7		53.7	45.3	43.3	75.0	0.963	41.7	36.7
70	Victoria Rd / Hilltown	340274	730714	78.4	87.4	84.0	57.0	45.7	43.6		48.0	67.7	75.3	69.0	68.0	65.8	91.7	n/a	65.8	57.9
71	Victoria St / Albert St	341071	731072	40.2	42.4	39.1	45.2	30.1	39.9		33.8	30.3	40.7	48.1	44.7	39.5	91.7	n/a	39.5	34.8
90	Ward Rd	339893	730336	40.9	41.1	42.3	30.9	25.0	26.6		31.0	25.3	34.2	39.7	40.0	34.3	91.7	n/a	34.3	30.2
72	Westport (2)	339842	730122	48.3	59.7	53.9	33.1	22.2	27.4		32.4	40.1	49.3	54.7	50.7	42.9	91.7	n/a	42.9	37.7
95	West Marketgait	339814	730380	50.7	47.7	48.3	35.3	31.3	32.5		33.4	35.1	46.1	52.2	52.1	42.2	91.7	n/a	42.2	37.2
161	Whitehall Cr (McIntyres)	340305	730051	42.3	44.7	36.1	32.2	27.4	25.6		28.9	26.0	38.0	33.4	37.6	33.8	91.7	n/a	33.8	29.8
73	Whitehall Cr (Xpresso)	340376	730109	36.4		48.7	42.0	31.3	29.0		37.4	35.9		56.7	48.9	40.7	75.0	1.049	42.7	37.6
74	Whitehall St (Brj)	340330	730106	48.4	48.6	45.7	50.0	39.2	47.5		40.6	36.2	49.3	43.2	47.6	45.1	91.7	n/a	45.1	39.7
75	Whitehall St (Bus)	340289	730128	63.6	76.4	74.3	50.8	36.9	36.6		52.3	48.5	60.4	65.9	53.2	56.3	91.7	n/a	56.3	49.5
76	Whitehall St (Deb A)	340265	730153	55.6	64.0	71.3	48.0	44.0	40.2		54.3	50.7	54.9	57.6	50.8	53.8	91.7	n/a	53.8	47.3
77	Whitehall St (Deb E)	340322	730098	52.8	51.0	46.2	45.3	34.9	36.0		38.9	34.6	46.8	43.5	43.2	43.0	91.7	n/a	43.0	37.9
	Whitehall St (Romon 1)	340278	730156	50.0	47.3	54.3	47.6	45.3	50.6		51.4	36.8	49.6	42.6	40.2	46.9	91.7	n/a	46.9	41.3
	Whitehall St (Romon 2)	340278	730156	49.7	47.9	53.5	41.2	37.5	51.4		51.8	39.7	45.4	51.3	47.8	47.0	91.7	n/a	47.0	41.4
	Whitehall St (Romon 3)	340278	730156	51.8	50.7	49.8	48.8	42.3	47.7		46.8	38.1	48.5	51.9	49.3	47.8	91.7	n/a	47.8	42.1
160	Whitehall St (Romon) Average	340278	730156	50.5	48.6	52.5	45.9	41.7	49.9		50.0	38.2	47.8	48.6	45.8	47.2	91.7	n/a	47.2	41.6
81	Whitehall St (Tiso)	340293	730142	50.7	47.5	48.2	46.2	45.8	51.5		50.5	32.3	44.9	34.4	42.8	45.0	91.7	n/a	45.0	39.6

Site ID	LOCATION	X	Y	Jan-12	Feb-12	Mar-12	Apr-12	May-12	Jun-12	Jul-12	Aug-12	Sep-12	Oct-12	Nov-12	Dec-12	Mean	% Data	Period Adj' Factor	Annual Mean	Annual Mean bias (0.88)
82	Woodside Ave	340776	732307	26.9	24.4	20.9	14.8	10.8	10.2		11.3	13.4	20.6	24.1	25.0	18.4	91.7	n/a	18.4	16.2

Appendix H: Action Plan Progress

KEY TO TABLE

Potential Air Quality Benefits

Small 0 - 0.5 µg/m³
 Medium 0.5 - 1.0 µg/m³
 High greater than 1.0 µg/m³
 n/a not applicable

Action Plan Measure Priority Level	
High	
Medium	
Low	

Timescale (Years from 2011)	
Short	1 - 2
Medium	3 - 5
Long	6 +

Summary from Action Plan						Progress Report January to December 2012					
TRAFFIC MEASURES											
No.	Measure	Focus	Lead Authority	Planning Phase	Implementation Phase	Targets/ Indicators	Target Annual Emission Reduction in the AQMA	Progress to Date	Progress in Last 12 Months (Jan'12 - Dec'12)	Estimated Completion Date	Comments relating to emission reductions
1	Measure M1: Existing Road Infrastructure Improvements	<ul style="list-style-type: none"> ▣ ► City Centre Improvements - Union St 	DCC City Development Department (Transportation Division)			Implementation of improvements	High	Union Street improvements completed December 2011. Two way traffic was maintained. Pavement widths were altered and the bus stops have been removed to reduce congestion and bus idling.		Union Street improvements completed 2011	To continue real time monitoring in Union Street to measure improvements. Annual Mean NO ₂ and PM ₁₀ were below the threshold in 2012, but NO ₂ concentrations increased in Nethergate and Whitehall St.
		<ul style="list-style-type: none"> ► NW Arterial Route Improvement - Lochee Rd 							Alterations carried out at Lochee Road/Rankine Street in February 2012 removed central reservation to free up road space and reduce congestion	Completed 2012	Annual Mean NO ₂ concentrations and number of exceedences reduced in 2012 but still above the threshold

No.	Measure	Focus	Lead Authority	Planning Phase	Implementation Phase	Targets/ Indicators	Target Annual Emission Reduction in the AQMA	Progress to Date	Progress in Last 12 Months (Jan'12 - Dec'12)	Estimated Completion Date	Comments relating to emission reductions
		<ul style="list-style-type: none"> ▣ ► City Centre Improvements - Meadowside 		<p>Introduce alteration to traffic lights at Meadowside and 1 year trial closing of nearside lane to increase distance between traffic and receptors</p>	2013 +				<p>Meadowside - trial of lane closure at the north end of street to increase separation distance between traffic and receptors (26/11/12 lane closure for 2 weeks) results were inconclusive in AQ terms but no traffic management problems identified, thus gave confidence to identify cost feasible solutions for AQ improvements for longer term trial.</p>	2014	
		<ul style="list-style-type: none"> ► Arterial Route Improvements - Stannergate 		<p>Traffic/Pollution Modelling Dundee East area (including Stannergate roundabout) to identify options for AQ improvement</p>	2013					2014	
2	<p>Measure M2: DCC will enhance the Urban Traffic Management and Control (UTMC) system to reduce congestion</p>	<ul style="list-style-type: none"> ► Real-time traffic monitoring. ► Improved control regime to smooth out peak traffic. 	<p>DCC City Development Department (Transportation Division)</p>			<ul style="list-style-type: none"> ► 10% reduction in congestion (journey times) in targeted areas during peak times before and after implementation of measure. ► Annual review of impact 	Small	<p>Scheme designed to expand UTMC to two congested junctions in Lochee Rd AQ hotspots. Programmed for installation by end March 2012</p>	<ul style="list-style-type: none"> ► Schemes now implemented and the traffic management improvements will be assessed in terms of AQ improvements by Environment Service. ► UTMC to be implemented by March 2013 which will see further traffic management enhancements. ► Seagate / Commercial Street traffic light refurbishment to improve bus and traffic flows through this AQ hotspot on the main bus corridor. Coupled with increased enforcement of waiting restrictions to reduce congestion. ► Successful trial of bluetooth journey time monitoring of western arterial route, possibility of expansion to include AQ hotspots. 	2012+	

No.	Measure	Focus	Lead Authority	Planning Phase	Implementation Phase	Targets/ Indicators	Target Annual Emission Reduction in the AQMA	Progress to Date	Progress in Last 12 Months (Jan'12 - Dec'12)	Estimated Completion Date	Comments relating to emission reductions
				Implementation of UTMC improvements and carry out annual review to measure % reduction in congestion in line with target (TACTRAN Capital Grant funding for expanded automation of journey time monitoring to allow activation of traffic management systems to alleviate congestion.	2013					On-going	
				Improve traffic flow/ management strategies in Lochee Rd- introduce MOTES	2013						
				Paramic/AIRE modelling of key junctions - Kingsway/Forfar Road & Lochee Road Corridor to test option improvements	2013						

No.	Measure	Focus	Lead Authority	Planning Phase	Implementation Phase	Targets/ Indicators	Target Annual Emission Reduction in the AQMA	Progress to Date	Progress in Last 12 Months (Jan'12 - Dec'12)	Estimated Completion Date	Comments relating to emission reductions
3	Measure M3: DCC to identify partnership and funding to continue benefits of Smarter Choices/Smarter Places: Dundee Travel Active Programme	□ ► Identify and implement wider partnership to continue programme. † ► Identify funding.	DCC City Development Department (Transportation Division)			► Increase % of people who walk and cycle to work in Dundee. ► Identify funding for education		► Social Marketing Campaign undertaken - focussing on the Lochee Road corridor (Reported in AQAP 2012, Appendix 1). ► DCC initiated partnership with a local social enterprise to develop a Behavioural Change Centre of Excellence. ► Designed a programme of in-class workshops to promote sustainable and active travel in 11 primary schools. ► Established a new Bike Boost programme to promote cycling to work and other journeys. ► DCC is actively working to secure funds for future investment in Dundee Travel Active.	► Broughty Ferry has had Personalised Travel Planning delivered by Social Enterprise Positive Steps (awaiting publication of summary report). ► DCC staff travel policy now being implemented and this will further encourage modal shift to active modes. ► Investigating a school based travel behaviour change programme for 2013. ► 19.7% of people estimated to be walking or cycling to work in Dundee. The data is published by the Scottish Government every two years. The 19.7% data is taken from the Scottish Household Surveys undertaken in 2009 and 2010. The target in the City Development Service Plan 2012-2017 is 25%.	2012+ on-going scaled down	-
				Behavioural Change Primary School programme to promote sustainable travel options in all primary schools in Dundee.	April to June 2014				Jun-14		

No.	Measure	Focus	Lead Authority	Planning Phase	Implementation Phase	Targets/ Indicators	Target Annual Emission Reduction in the AQMA	Progress to Date	Progress in Last 12 Months (Jan'12 - Dec'12)	Estimated Completion Date	Comments relating to emission reductions
				3 "Doctor Bike" Safety Events planned for the City Square	2013/14						
4	Measure M4: DCC will introduce measures to improve bus services and reduce emissions	<input type="checkbox"/> ► Statutory Bus Quality Partnership. † <input checked="" type="checkbox"/> ► Voluntary Bus Quality Partnership	DCC City Development Department (Transportation Division)		2011+	► Identification of new corridors that directly benefit air quality.	Medium	Opportunities are being investigated as part of Air Quality Low Emission Charter		Medium Term	
						► Average age fleet and Euro category, fuel type				2012+ (Short Term)	

No.	Measure	Focus	Lead Authority	Planning Phase	Implementation Phase	Targets/ Indicators	Target Annual Emission Reduction in the AQMA	Progress to Date	Progress in Last 12 Months (Jan'12 - Dec'12)	Estimated Completion Date	Comments relating to emission reductions
4 cont.	Measure M4, cont.	<ul style="list-style-type: none"> ▣ ►Fleet Renewal – Emissions Improvements 	DCC City Development Department (Transportation Division)		2011+	►Fleet age, Euro class, fuel type	Medium	<ul style="list-style-type: none"> ► National Express Dundee introduced 15 new Euro V buses during December 2011 for use on Services 22 (Ninewells Hospital - City Centre-Downfield-Craigowl View) and 28/29 (Douglas-Charleston-Douglas via City Centre). ► During 2010/11 Stagecoach invested in 20 new Euro V double-deckers on its major Service 73 corridor (Ninewells-City Centre-Broughty Ferry-Carnoustie-Arbroath) and Service 20 (Dundee-Forfar). ► 4 new Euro V coaches also have also been introduced in new route (Dundee-Arbroath-Montrose-Aberdeen) 	<ul style="list-style-type: none"> ► No bids submitted for Green Bus fund 3 ► DCC looking at Hydrogen Fuel cell opportunities for buses in a collaborative approach through the Scottish Cities Alliance. ► National Express Dundee applied to Scottish Government's Green Bus Fund 2 and invest in hybrid engine technology. ► Stagecoach invested in 6 new Euro V buses on their Dundee to Blairgowrie route (Service 57) (Needs completed by John Berry's team) 	2012+	
						<ul style="list-style-type: none"> ► Lobby Scottish Government for fuel duty rebates for low carbon fleet 		<ul style="list-style-type: none"> Bus Service Operators Grant (BSOG) changes from April 2012 will reward use of cleaner fuels and incentivise the use of cleaner vehicles. 			

No.	Measure	Focus	Lead Authority	Planning Phase	Implementation Phase	Targets/ Indicators	Target Annual Emission Reduction in the AQMA	Progress to Date	Progress in Last 12 Months (Jan'12 - Dec'12)	Estimated Completion Date	Comments relating to emission reductions
				National Express Dundee will introduce nine Diesel Electric Hybrid buses into their fleet in April / May 2013 as per Green Bus Fund 2 bid success	2013						
				ECO Stars Dundee Fleet Management Recognition Scheme being introduced	2013/14						
4 cont.	Measure M4, cont.	► Tackling Idling Bus Emissions	DCC City Development Department (Transportation Division)		2011+	► Traffic Regulation Conditions within the city centre. ► 'No-idling' signage on bus routes. ► Driver Training/ Awareness Raising	Small			2012+	
4 cont.	Measure M4, cont.	□ ► Low Emission Zones (LEZ) for buses	DCC City Development Department (Transportation Division)	Bus Emission Modelling being undertaken to test likely improvements associated with various scenarios including possible LEZ for buses by 2017	2013	► Investigate the Traffic Regulation Conditions for LEZ in City Centre. ► Route choice for clean buses see Park & Ride facilities	High		none	Med Term, 2015-2016+	

No.	Measure	Focus	Lead Authority	Planning Phase	Implementation Phase	Targets/ Indicators	Target Annual Emission Reduction in the AQMA	Progress to Date	Progress in Last 12 Months (Jan'12 - Dec'12)	Estimated Completion Date	Comments relating to emission reductions
5	Measure M5: DCC will explore provision of Park and Ride facilities that do not have adverse impact on air quality	►† Provision of Park and Ride (P&R) facilities	DCC City Development Department (Transportation Division) & Tayside and Central Scotland Transport Partnership (TACTRAN)			<ul style="list-style-type: none"> ► Report on identification and prioritisation of P&R facilities ► Implementation of scheme ► Passenger numbers 	Medium	Site at Wright Avenue selected as preferred location for P&R at Dundee West and at site on south side of Tay Road Bridge identified for Dundee South, awaiting NE Local Plan inquiry	Dundee South P&R site at Tay Bridgehead now confirmed by NE Local Plan reporter and Dundee West selected as Wright Avenue. Both sites being taken forward with detailed design and Dundee West has been through pre - planning application consultation and detailed planning consent will be applied for in mid 2013.	Med Term 2014+	
				►Dundee South P&R site at Tay Bridgehead now confirmed by NE Local Plan reporter and Dundee West selected as Wright Avenue. Both sites being taken forward with detailed design and Dundee West has been through pre - planning application consultation and detailed planning consent will be applied for in mid 2013. ►DCC, Fife Council, TACTRAN and SESTRAN actively investigating funding opportunities to deliver the facilities 2014 / 2015.	2013-15						

No.	Measure	Focus	Lead Authority	Planning Phase	Implementation Phase	Targets/ Indicators	Target Annual Emission Reduction in the AQMA	Progress to Date	Progress in Last 12 Months (Jan'12 - Dec'12)	Estimated Completion Date	Comments relating to emission reductions
6	Measure M6: DCC will introduce measures to reduce emissions from Heavy Goods Vehicles	† ► Perth & Dundee Retail Freight Consolidation Centre	DCC City Development Department Transportation Division)& TACTRAN		2011+	► Implementation of scheme ► Vehicle fleet in the AQMA ► Study for the alternate system of retail freight	Small	Opportunities are being investigated as part of Air Quality Low Emission Charter (See AQAP2012 Appendix 2)		2012+	
6 cont.	Measure M6 cont.	□ ► Freight Quality Partnership (FQP)	DCC City Development Department Transportation Division)& TACTRAN			► Implementation of partnership ► Changes in hourly profile of HGVs in AQMA	Small	Dundee is included as part of Tactran's Regional FQP	► Opportunities are being investigated as part of Air Quality Low Emission Charter. ► Dundee is included as part of TACTRAN's Regional Freight Quality Partnership. ► A freight routing planning tool will be launched in 2013 by TACTRAN which should encourage HGVs to follow appropriate routes ► Dundee is participating in a pan European project investigating city logistics with carbon and emission reduction as important factors under investigation.	Long term	

No.	Measure	Focus	Lead Authority	Planning Phase	Implementation Phase	Targets/ Indicators	Target Annual Emission Reduction in the AQMA	Progress to Date	Progress in Last 12 Months (Jan'12 - Dec'12)	Estimated Completion Date	Comments relating to emission reductions
				A freight routing planning tool will be launched by TACTRAN which should encourage HGVs to follow appropriate routes	Jan-13						
				Dundee is participating in a pan European project (ENCLOSE) investigating city logistics with carbon and emission reduction as important factors under investigation	2013						
				ECO Stars Dundee Fleet Management Recognition Scheme being introduced							

No.	Measure	Focus	Lead Authority	Planning Phase	Implementation Phase	Targets/ Indicators	Target Annual Emission Reduction in the AQMA	Progress to Date	Progress in Last 12 Months (Jan'12 - Dec'12)	Estimated Completion Date	Comments relating to emission reductions	
7	Measure M7: DCC will seek improvements in emissions standards, including NO2 and PM ₁₀ for the council fleet and public service vehicles	□ ► Development of Green Procurement Strategy ► † To set target for Euro category/fuel type	► DCC Corporate Fleet Manager ► DCC Environment Department			► Approval of Strategy (Asset Management Plan) ► Average age fleet and Euro category, fuel type		► New Corporate Fleet Manager appointed December 2011 ► New Fleet Section will develop a reporting procedure to compare replacement vehicles in relation to emission improvements ► New Fleet Section will create a replacement plan for all vehicles to maintain fleet age profile ► Current make up of the waste collection fleet is 12 x Euro 3, 17 x Euro 4 and 23 x Euro 5. Fleet is continually moving towards newest Euro Category - See Measure 14	The Fleet section has replaced over 50 vehicles so far in 2012 all with improved emissions standards, with another 10 or so vehicles to arrive by the end of the financial year)	2012+		
				The development of an Asset Management Plan which will incorporate environmental issues as part of the replacement criteria	2013/14							
				Initial discussions for 2013/14 vehicle/plant replacement programme has identified improved emissions as a high priority	2013/14							
				Participation in ECO Stars Dundee-Fleet Management Recognition Scheme	2013							

No.	Measure	Focus	Lead Authority	Planning Phase	Implementation Phase	Targets/ Indicators	Target Annual Emission Reduction in the AQMA	Progress to Date	Progress in Last 12 Months (Jan'12 - Dec'12)	Estimated Completion Date	Comments relating to emission reductions		
8	Measure M8: DCC in consultation with the Taxi Liaison Group will explore means of reducing emissions from taxis and private car hire vehicles in AQMA	<ul style="list-style-type: none"> ▶ Enforce No idling for taxis ▶ ↑ Increase cleaner taxis 	<ul style="list-style-type: none"> ▶ DCC Support Services ▶ DCC City Development Department ▶ Tayside Police 			<ul style="list-style-type: none"> ▶ Traffic Regulation Conditions for 'No Idling' of taxis ▶ Explore the potential of introducing Licensing Conditions for minimum taxi Euro category for certain classes of vehicles ▶ Provide 'No Idling' street signage ▶ Monitoring for idling in place 	Medium	<ul style="list-style-type: none"> ▶ Opportunities are being investigated as part of Air Quality Low Emission Charter (See AQAP 2012 Appendix 2). ▶ Education Transport contracts to be let with condition that all vehicles must be euro 4 compliant 	<ul style="list-style-type: none"> ▶ Education Transport contracts were let with condition that all vehicles must be Euro 4 compliant ▶ Approximately 400 Taxi / PHC driver training sessions were made available - limited uptake... 	2012+			
				As part of Air Quality Low Emission Charter, continue to investigate opportunities for: Traffic Regulation Conditions for 'No Idling' of taxis;	2013/2014+								
				Explore the potential of introducing Licensing Conditions for minimum taxi Euro category for certain classes of vehicles;									
				Provide 'No Idling' street signage; Monitoring for idling.									

No.	Measure	Focus	Lead Authority	Planning Phase	Implementation Phase	Targets/ Indicators	Target Annual Emission Reduction in the AQMA	Progress to Date	Progress in Last 12 Months (Jan'12 - Dec'12)	Estimated Completion Date	Comments relating to emission reductions
				DCC also looking at collaborative work with taxi operators in developing an Electric Vehicle trial for taxis in Dundee							
9	Measure M9: DCC will investigate to initiate a Roadside Emission Testing (RET) scheme inside the AQMA and routes leading to AQMA	<ul style="list-style-type: none"> ▣ ► To investigate into the establishment of a programme of RET in the AQMA 	<ul style="list-style-type: none"> ► VOSA ► Tayside Police ► DCC Environment Department. 			<ul style="list-style-type: none"> ► Approval/non-approval of RET scheme ► Traffic Regulation Conditions if necessary. 	Small	No progress to date.	No progress to date, funding being sought to undertake feasibility study in 2013.	2013+	
				To seek funding to undertake feasibility study of introduction of RET	2013+						

No.	Measure	Focus	Lead Authority	Planning Phase	Implementation Phase	Targets/ Indicators	Target Annual Emission Reduction in the AQMA	Progress to Date	Progress in Last 12 Months (Jan'12 - Dec'12)	Estimated Completion Date	Comments relating to emission reductions
POLICY AND PARTNERSHIP WORKING MEASURES											
10	Measure M10: DCC will ensure local air quality is fully integrated into the Local Development Plan (LDP) process and development scenarios are appropriately assessed with respect to the potential impacts on air quality	<ul style="list-style-type: none"> ▶ Provide AQ policy within Local Development Plan with commitment to improve air quality ▶ Produce air quality Supplementary Planning Guidance (SPG) 	<ul style="list-style-type: none"> ▶ DCC City Development (Planning Division) ▶ DCC Environment Department. 			<ul style="list-style-type: none"> ▶ Adoption of Local Development Plan ▶ Adoption of Air Quality SPG 	Small	<ul style="list-style-type: none"> ▶ Main Issues Report Consultation exercise completed 2/12/2011. Proposed Plan by late autumn 2012. ▶ Method of integrating AQ into SPG being considered 	Air Quality Policy incorporated into draft LDP. Air Quality Supplementary Planning Guidance drafted.	2013 +	Mitigation measures introduced as appropriate.
				Supplementary Planning Guidance drafted. Report to go to City Development Committee following adoption of the Local Development Plan seeking approval as statutory planning guidance	2014						

No.	Measure	Focus	Lead Authority	Planning Phase	Implementation Phase	Targets/ Indicators	Target Annual Emission Reduction in the AQMA	Progress to Date	Progress in Last 12 Months (Jan'12 - Dec'12)	Estimated Completion Date	Comments relating to emission reductions
11	Measure M11: DCC will ensure effective co-ordination between climate change and air quality strategies and action plan measures	<input type="checkbox"/> ► Strategy to be developed to improve co-ordination between climate change and air quality strategies and action plan measures	► DCC Corporate Planning Department ► DCC City Development - (Property Division) ► DCC Environment Department.		2011+	► Implementation of co-ordination strategy ► Reciprocal attendance of air quality and climate change working groups/steering committees	Small	Currently being developed.	Procedure implemented for exchange of information between the Climate Change Board & Corporate Air Quality Steering Group	2012+	
12	Measure M12: DCC will continue its active involvement and support of TACTRAN	<input type="checkbox"/> ► Regularly attend meetings ► Provide feedback ► Provide necessary support	► DCC City Development Department. (Transport Division)			► Number of TACTRAN policies and proposals implemented	n/a	DCC will continue to support TACTRAN and focus on implementation of Regional Transport Strategy	The Council will continue to support TACTRAN and focus on implementation of Regional Transport Strategy throughout the period of this plan.	On-going	
				The Council will continue to support TACTRAN and focus on implementation of Regional Transport Strategy throughout the period of this plan	On-going						

No.	Measure	Focus	Lead Authority	Planning Phase	Implementation Phase	Targets/ Indicators	Target Annual Emission Reduction in the AQMA	Progress to Date	Progress in Last 12 Months (Jan'12 - Dec'12)	Estimated Completion Date	Comments relating to emission reductions
LEADING BY EXAMPLE MEASURES											
13	<p>Measure M13: ► DCC will promote the uptake and use of cleaner and/or alternative fuels where possible for transport ► DCC will explore the development of electric charging point infrastructure</p>	<p>□ ► Determine strategy/advise note and annually review content ► Install Electric Charging Facilities in Car Parks</p>	DCC City Development Department (Transportation Division)			<p>► List of any promotion campaigns planned / implemented ► Number / proportion of cleaner vehicles within fleets or clean fuels infrastructure in each financial year ► Number of electric charging points installed</p>	Small	<p>► See Measures 7 and 14 ► Electric vehicle charging station infrastructure for council vehicles is to be implemented by end June 2012 ► Electric Charging points to be installed in underground car park (below city square)</p>	<p>► Electric vehicle charging station infrastructure for council vehicles has been implemented with Electric Charging points installed in underground car park (below City Square). ► Pool EVs now available for city centre DCC staff and further expansion now being implemented across several DCC Multi Storey Car Parks and out of city centre DCC offices. ► Also investigating alternative Low Carbon Vehicle technologies i.e. Hydrogen Fuel cells ► 8 Electric vehicle charging stations installed by DCC (double-headed)</p>	2012+ on-going	
				See Measure 7-	2013/14 +						
14	<p>Measure M14: DCC will establish and implement a rolling programme for replacing older more polluting vehicles with newer cleaner vehicles, which comply with the prevailing EURO standard</p>	<p>□ ► Development of Green Procurement Strategy</p>	► DCC Corporate Fleet Manager		2011+	<p>□ Number / proportion of new/improved vehicles within fleets in each financial year</p>	Small	<p>► New Corporate Fleet Manager appointed December 2011. ► Procurement of vehicles is through Scotland Excel Framework which gives consideration to Green Credentials. 2011 saw the introduction of 6 electric vehicles with a further 6 to follow by end March 2012 ► See Measure 7</p>	<p>The Fleet section has replaced over 50 vehicles so far in 2012/13 all with improved emissions standards, with another 10 or so vehicles to arrive by the end of the financial year.</p>	2012+	

No.	Measure	Focus	Lead Authority	Planning Phase	Implementation Phase	Targets/ Indicators	Target Annual Emission Reduction in the AQMA	Progress to Date	Progress in Last 12 Months (Jan'12 - Dec'12)	Estimated Completion Date	Comments relating to emission reductions
				See Measure 7 & 13 with older more polluting vehicles being targeted							
15	Measure M15: DCC will improve the Council's vehicle fuel consumption efficiency by better management of fleet activities	<ul style="list-style-type: none"> □ ► Develop fleet management plan to improve fuel efficiency. ► Investigate fleet activities in relation to pollution hotspots e.g. waste management fleet routes 	<ul style="list-style-type: none"> ► DCC Corporate Fleet Manager ► DCC Environment Department 		2011+	<ul style="list-style-type: none"> ► Implementation of smarter driver programme ► Preparation / Implementation of Fleet management plan ► 10% reduction by 2013 for staff business travel and Corporate Fleet 	Small	<ul style="list-style-type: none"> ► New Fleet Section still under development. ► Environment Department LGV drivers have undertaken SAFED (Safe & Fuel Efficient Driving) as part of their decision driving training and there is a proposal to roll this out across all council drivers. ► New computerised Fleet Management Systems to be introduced will help monitor fuel use across the council. Fuel saving measures are being trialled in vehicles at the moment including Throttle Intervention Systems and Gear Box Prognostics 	<ul style="list-style-type: none"> ► Fleet Section are working with telematic company to improve information on reporting driving styles. ► Fleet section are beginning to develop action plan for rolling out Routesmart to plan routes for all council vehicles to assist with reducing mileage. ► Fuel cards have been introduced to reduce mileage for RCV's in the east of the city. 	2012+	
				See Measures 7,13,14. Use of driver style module in tracking system to be developed. Fuel usage to be included in future reporting to departments							

No.	Measure	Focus	Lead Authority	Planning Phase	Implementation Phase	Targets/ Indicators	Target Annual Emission Reduction in the AQMA	Progress to Date	Progress in Last 12 Months (Jan'12 - Dec'12)	Estimated Completion Date	Comments relating to emission reductions
16	Measure M16: DCC will promote options for better travel planning amongst Dundee City Council employees	<ul style="list-style-type: none"> ▣ ► Review DCC Travel Plan ► † DCC to investigate use of annual survey on how/what modes of transport employees use to travel to work 	DCC City Development (Transportation Division)		2011+	<ul style="list-style-type: none"> ► Implementation of DCC Travel Plan & review of progress with targets ► 10% reduction by 2013 in staff business travel ► % DCC employees walking/cycling to work 	Small	<ul style="list-style-type: none"> ► Staff Travel Policy adopted Autumn 2011. This includes CO2 usages for lease vehicles ► DCC senior managers will effectively implement staff travel policy 	<ul style="list-style-type: none"> ► Once a fixed term Sustainable Travel Officer is appointed - the issue of staff travel habits survey will be revisited. ► The staff travel policy is now coming on stream, and is encouraging innovation in terms of pool fleet and public and active travel by DCC officers / management to support staff travel. 	2012+	
				Sustainable Travel Officer(Fixed Term) unlikely to proceed in the short - term. Alternative mechanisms for All Staff Travel Habit Survey being considered (Survey Monkey)							
17	Measure M17: DCC will continue to promote and encourage their employees to consider the use of bicycles in their daily duties by providing cycle usage mileage	<ul style="list-style-type: none"> † ► Continue to investigate and develop the use of various incentive schemes ► Develop cycling strategies ► DCC to investigate use of annual survey on how/what modes of transport employees use to travel to work 	DCC City Development (Transportation Division)		2011+	<ul style="list-style-type: none"> ► % DCC employees walking/cycling to work ► Incorporate cycling measures within DCC Travel Plan in line with the new DCC Cycling Strategy to be developed 	Small	<ul style="list-style-type: none"> ► Get Cycling engaged to deliver cycling initiatives at DCC and other major employers in Dundee. ► Improved cycling facilities provided at Dundee House (Dundee City Council Headquarters) and other Council properties. 	<ul style="list-style-type: none"> ► Bike Boost and Cycle to Work initiatives delivered over the summer of 2012 to encourage staff to consider cycling. ► Staff Travel Policy implementation still at early stages 	2012+	

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18	Measure M18: DCC will assess the Council's energy needs, make recommendations and implement reductions of carbon emissions which result in corresponding reductions of NO ₂ and PM ₁₀ .	† ► DCC to implement annual energy reduction action plan	DCC City Development (Property Division)			► 10% reduction by 2013	Small	The Climate Change Board continues to implement the Council's Carbon Management Plan and current energy management projects. However, while there are a number of initiatives that when fully implemented should realise reductions in our CO ₂ emission, the current performance is not consistently improving. The agreed procedural arrangements to enable the Council to comply with the new mandatory UK-wide Carbon Reduction Commitment - Energy Efficiency Scheme have been implemented and the Councils reported Total Footprint Emissions for property are 38,471 tonnes of CO ₂ .	The Climate Change Board continues to implement the Council's Carbon Management Plan and current energy management projects. Revision to the Carbon Management Plan has been agreed by the Climate Change Board & Council Management Team including new annual aspirational reduction targets of 5% until 2020. The Councils reported CRC emissions are 34,267 tonnes of CO ₂ .	On-going	
				New annual aspirational reduction target of 5% until 2020	2013+						

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EDUCATION AND COMMUNITY MEASURES											
19	Measure M19: DCC to promote and support localised energy generation that doesn't compromise Air Quality in private households	<ul style="list-style-type: none"> ▣ ► Determine strategy/advise note and annually review content 	<ul style="list-style-type: none"> ► DCC Housing Department ► Solar Cities 		2011+	<ul style="list-style-type: none"> ► List of any promotion campaigns planned/ implemented 	Small	<ul style="list-style-type: none"> ► Solar PV – Annual 25,055kg C02 (nominated installers calculated figures) ► Solar thermal – Annual 197 kg C02 (nominated installers calculated figures)The above figures are all annual savings as not all installation dates have been collected yet to allow calculation of the actual amount saved within the project period. ► Participant in Maryfield and Coldside areas CO₂ reduction ► Groups pending start date = 59 ► Groups working with = 23 ► Groups Complete= 2 ► Total number of people engaged = 853 	Solar PV - Annual 25,055kg C02 (nominated installers calculated figures). Solar thermal - Annual 197 kg C02 (nominated installers calculated figures). The above figures are all annual savings as not all installation dates have been collected yet to allow calculation of the actual amount saved within the project period. Participant in Maryfield and Coldside areas CO2 reduction: Groups pending start date = 59 Groups working with = 23 Groups Complete = 2 Total number of people engaged = 853	2012+	

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20	<p>Measure M20: DCC will provide the public with relevant air quality information.</p>	<p>† ► Investigating the potential for uptake of an air pollution information system, such as Air Alert ► Improvements to AQ website information ► Make up to date air quality information available to the public through Councils digital website</p>	<p>► DCC Environment Department ► DCC City Development (Transportation Division)</p>			<p>► Investigate funding sources ► Implement Air Alert or similar service ► Improved rating of website in peer review ► Make AQ information available through Council's website ► Real Time Travel Information</p>	Small	<p>► Possible funding to improve air quality pages on the Council Website has been identified. ► The Scottish Government will be taking forward their "Know & Respond" service linked to the new air quality index in 2012. This allows people with respiratory conditions to be alerted when moderate and high pollution levels are forecast. The Council intend to provide a link and information about this service on the web-site when available. ► No Progress re improved rating of website. ► Real-time pollutant monitoring concentrations are available from the Scottish Air Quality Website (www.scottishairquality.co.uk). The Council intend to provide a link on the web-site to this service. ► No progress on provision of real-time information on pollution levels to assist traffic management through pollution hotspots.</p>	<p>► The new AQ webpages are still in the process of being constructed however in the meantime minor amendments have been made to the current website to ensure that information is accurate and up to date. ► A link to the 'Know & Respond' service has also been added to the existing webpages. ► The existing website achieved a higher rating in the 2012 peer review than the previous year.</p>	2012+	

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				<ul style="list-style-type: none"> ▶ Complete improvements to AQ website 	2013						
				<ul style="list-style-type: none"> ▶ Develop Database to enable DCC staff to better manage large volume of AQ data and make it more readily available to stakeholders 	2013/14						

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21	<p>Measure M21: DCC will continue its work to increase uptake and implementation of School and Workplace Travel Plans, particularly where likely to impact on the AQMA</p>	<p>↑ ► DCC to ensure all relevant commercial planning applications have travel plan conditions applied in accordance with current best practice. ► DCC to produce Travel Plan Strategy which: ► Details procedure for tracking & possible enforcement of planning conditions requiring travel plans. ► Details procedure for Travel Plan Information storage at DCC</p>	<p>► DCC City Development Department, (Planning Division, Transportation Division) ► DCC Education Department</p>			<p>► Develop Business Case for Travel Co-ordinator & identify potential funding streams. ► Number of new travel plans (need to show in terms of walking cycling - % of journeys saved). ► Identify & report on any Air Quality related Travel Plan targets from travel plan strategy and any relevant Travel Planning Team targets. ► Promotion of Travel Plan initiatives e.g. Sustrans' Travel Smart ► Implement & regularly review Travel Plan Strategy</p>	Small	<p>► Work in 2011 has focussed on reducing the impacts of school traffic on the Lochee Road hotspots. (See AQAP 2012 Appendix 1) ► Further work to promote sustainable travel in primary schools across Dundee is scheduled for 2012. ► DCC is working to create a full-time temporary travel planning officer post. ► Planning applications for significant developments are required to submit travel plans. The submission of travel plans is actively pursued and are approved, if appropriate.</p>	<p>Investigating development of city wide programme of pupil involvement (P5 - 7) in travel behaviour change. Education Department to be encouraged to refresh all school travel plans</p>	2012+	

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				See Measure 3- Behavioural Change Primary School programme to promote sustainable travel options in all primary schools in Dundee	2013						
22	Measure M22: DCC will continue working in partnerships with TACTRAN and local active travel networks to ensure that walking and cycling initiatives are promoted and supported in Dundee	<ul style="list-style-type: none"> □ ► Identify walking & cycling schemes (such as Park & Cycle). ► Identify walking & cycling promotional opportunities around Dundee City 	DCC City Development (Transportation Division)		2011+	<ul style="list-style-type: none"> ► Number of walking and/or cycling initiatives in operation. ► Establish the use of cycle monitoring counts at key points on cycle routes 	Small	<ul style="list-style-type: none"> ► Get Cycling engaged to undertake promotion of cycling. ► Positive Steps to take forward Dundee Travel Active Personal Travel Plans in Broughty Ferry. 	<ul style="list-style-type: none"> ► Get Cycling have delivered Bike Boost. ► Positive Steps implemented Dundee Travel Active Personal Travel Plans in Broughty Ferry ► Cycle to Work Scheme being promoted during august 2012 ► City Engineer currently implementing major cycling scheme at Douglas Terrace 	2012+	
				Transportation Division have submitted funding bids to Sustrans for FY13/14	2013/14						

23	<p>Measure M23: DCC will continue to work with transport providers to support and promote increased uptake of public transport modes</p>	<p>☐ ▶ Promote schemes such as the SQUID card including Dundee and surrounding towns. ▶ † Introduce smart and integrated ticketing</p>	<p>▶ DCC City Development (Transportation Division)</p>	2011+	<p>▶ % uptake schemes ▶ Passenger numbers</p>	Small	<p>The development of Smart Card based integrated ticketing (National Entitlement Card) is being undertaken by DCC, National Express and Transport Scotland. Initial products are expected to appear from Autumn 2012</p>	<p>Dundee City Council is working with Transport Scotland to ensure that the technical issues delaying implementation are overcome. This matter is now has the support of the Scottish Cities Alliance with a view to proof of concept for a Scottish roll out. Initial smart ticketing to go live early 2013. National Express Dundee have now commenced pilot with Dundee College. DCC commenced discussion with other transport operators in support of the Scottish Cities Alliance priority for smart ticketing</p>	2012+
				SMART Ticketing to Go Live early 2013	2013				
24	<p>Measure M24: DCC will continue to work in partnership with other organisations to promote and implement energy efficiency measures in Dundee</p>	<p>☐ ▶ To implement an Annual Action Plan of energy efficiency measures.</p>	<p>▶ DCC City Development (Property Division)</p>		<p>▶ Implementation of Annual Energy Efficiency Action Plan. ▶ Report reductions in energy use</p>	Small	<p>The Climate Change Board is considering the re-introduction of the Carbon Management Action Plan.</p>	<p>The Climate Change Board are considering the re-introduction of the Carbon Management Action Plan</p>	2012+
				The re-introduction of the Carbon Management Action Plan	2011+				

No.	Measure	Focus	Lead Authority	Planning Phase	Implementation Phase	Targets/ Indicators	Target Annual Emission Reduction in the AQMA	Progress to Date	Progress in Last 12 Months (Jan'12 - Dec'12)	Estimated Completion Date	Comments relating to emission reductions
MEASURES SECURING AIR QUALITY BENEFITS THROUGH STATUTORY FUNCTIONS											
25	<p>Measure M25: DCC Environment Department will comment upon planning applications to ensure that all relevant air quality issues are highlighted and mitigation measures are considered wherever possible</p>	<p>► The Environment Department (Environmental Protection Division) will continue to work with City Development (Planning Division) as Statutory Consultees</p>	<p>► DCC City Development Department (Planning Division) ► DCC Environment Department</p>			<p>► Total number of planning applications consultations responded to in each calendar year (changed from financial year) ► Percentage of the total planning applications responded to with air quality conditions/ assessments</p>	Small	<p>► Environment Department Officers check weekly planning lists and comment on all applications which may adversely impact on local air quality. ► 19 planning applications responded to. ► 16% had air quality conditions/ assessments (this included smoke control area informatives)</p>	<p>► Environment Department Officers commented on: ► 13 planning applications in 2012. ► 38% of the planning applications determined in the calendar year had air quality conditions.</p>	n/a	Mitigation measures to be conditioned as appropriate.
				see Measure 10 regarding the introduction of Supplementary Planning Guidance							

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26	Measure M26: DCC will enforce statutory legislation to control smoke, dust, fumes or gas emissions from commercial and domestic premises which are causing a nuisance or are prejudicial to health	<input type="checkbox"/> ► DCC will continue to monitor and enforce statutory legislation in this area	► DCC Environment Department.			► Number of relevant complaints in each financial year. ► % resolved	Small	► For period in 2010-11 financial year (01/01/11-31/03/11) a total of 15* relevant complaints were investigated of which 93% were resolved. ► For period in 2011-12 financial year (01/04/11 - 31/12/11), a total of 26** relevant complaints were investigated of which 69% had been resolved by 31/12/2011.	In 2012, officers investigated 21 relevant complaints, of which 90% were resolved	n/a	
Measure 26											
* Of the 15 complaints, 5 involved smoke from the chimney of a domestic property, 1 related to domestic bonfire smoke, 3 involved smoke from commercial / agricultural / construction bonfires, 5 involved construction / demolition dust and 1 involved emissions from an industrial premises.											
** Of the 26 complaints, 10 involved smoke from the chimney of a domestic property, 10 involved smoke from a domestic bonfire, 4 involved smoke from commercial / agricultural / construction bonfires, and 2 involved construction / demolition site dust.											
Note: In future targets/indicators will be per calendar year.											

No.	Measure	Focus	Lead Authority	Planning Phase	Implementation Phase	Targets/ Indicators	Target Annual Emission Reduction in the AQMA	Progress to Date	Progress in Last 12 Months (Jan'12 - Dec'12)	Estimated Completion Date	Comments relating to emission reductions
27	Measure M27: DCC will enforce relevant legislation to reduce the burning of commercial and domestic waste	<ul style="list-style-type: none"> ▣ ► DCC will continue to monitor and enforce legislation in this area 	<ul style="list-style-type: none"> ► DCC Environment Department 			<ul style="list-style-type: none"> ► Number of relevant complaints ► % resolved 	Small	<ul style="list-style-type: none"> ► 1 complaint of the burning of commercial waste was investigated under the Environmental Protection Act 1990 (EPA) Section 33 requirements which was resolved. ► 7 complaints of smoke from commercial bonfires were investigated under EPA Section 79 and Clean Air Act legislation. ► 11 complaints of smoke from the burning of domestic waste (domestic bonfires) were investigated under EPA Section 79 and Clean Air Act legislation in 2011 of which 94% of these complaints had been resolved by 31/12/2011 	In 2012 Officers dealt with 9 complaints of smoke from commercial bonfires and 17 complaints of smoke from the burning of domestic waste. 92% of these complaints were resolved.	n/a	

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28	Measure M28: DCC will promote composting in a bid to reduce pollution from domestic bonfires	† ► Reintroduce discount/promotion campaign for compost bins	► DCC Environment Department		2011+	► % uptake composting bins	Small	► The existing Waste Resources Action Programme (WRAP) subsidised discount compost bins ended due to funding cuts in March 2011 with a total of 5243 discounted bins being sold in the DCC area in the period between 2006 and end 2010 representing 2% of the total discounted bins for Scotland. The promotion of home composting continues under the Zero Waste Scotland campaign banner with a Recycling Projects Officer employed in the Environment Department. ► Composting is undertaken at the Environment Department's green waste processing facility at Riverside Drive. 37,526 brown bins for garden waste have been issued.	The area Zero Waste Scotland Volunteer Co-Ordinator continues to help promote the home composting message across Dundee. DCC staff continue to utilise educational talks etc. to reaffirm the message	2012+	
				The area Zero Waste Scotland Volunteer Co-Ordinator continues to help promote the home composting message across Dundee. DCC staff continue to utilise educational talks etc. to reaffirm the message							

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29	<p>Measure M29: DCC will continue to monitor a range of air pollutants throughout Dundee and make the monitoring information freely available to the public in an easily understandable form</p>	<p>† ► Continued support for Dundee Air Quality Monitoring Network</p>	<p>► DCC Environment Department.</p>			<p>► Number of monitoring sites ► Identification of sites in new hotspots ► Monitoring data via DCC website</p>	n/a	<p>► The Council currently have one real-time background monitoring site (Mains Loan), and real-time monitors located in the following seven hotspot locations: Victoria Road, Meadowside, Logie Street, Lochee Road, Seagate, Union St and Whitehall St. ► One new real-time monitoring site added in 2011 for PM₁₀ and NO₂ in hotspot area (Meadowside). ► 2 additional PM₁₀ "reference equivalent" analysers installed at hotspot locations in Lochee Road and Seagate in 2011. ► New NOx analyser installed at background location in 2011. ► Currently 98 NO₂ diffusion tube sites across the city. Located at busy roads and junctions and a number of background locations. 14 new diffusion tube locations added in 2011. ► One potential new hotspot identified for NO₂ in Strathmore Avenue based on 2009 data. Additional tubes deployed in the area in 2011. ► Ratified data for 2011 required before any new hot-spots can be determined ► See Measure 20 re monitoring data on the website</p>	<p>The Council currently have one real-time background monitoring site (Mains Loan), and real-time monitors located in the following locations: Broughty Ferry Road, Meadowside, Logie Street, Lochee Road, Seagate, Union Street, Whitehall St, Albert Street/Arbroath Road, Myrekirk Terrace and Stannergate. The monitors at Albert Street/Arbroath Road, Myrekirk Terrace and Stannergate were installed at these locations in September 2012. Currently there are 99 NO₂ diffusion tube sites across the city. These are located at busy roads and junctions, and at a number at background locations. 2 new NO₂ diffusion tube locations were added in 2012 while one 2011 diffusion tube site has been stopped in 2012. One 2011 site has been moved at it's location due to infrastructure changes. The Air Quality pages of the DCC website are currently being upgraded with links to current and historical monitoring data to be included within the final version.</p>	n/a	

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30	<p>Measure M30: DCC will ensure that all air quality monitoring data reported to the public is both accurate and precise by implementing quality control measures</p>	<p>□ ► Regular calibrations and filter changing of continuous monitoring equipment in DCC's air quality stations ► At least annual audit of air quality stations' equipment □ ► Appropriate use and care of NO₂ diffusion tubes regularly deployed around the City Council area.</p>	<p>► DCC Environment Department/ Tayside Scientific Services</p>			<p>► QA/QC measures adopted ► Auditing reports</p>	n/a	<p>► External consultant undertakes calibrations and filter changing of the continuous monitoring equipment in the air quality monitoring stations. ► Osiris meters - indicative PM₁₀ meters - filter change undertaken on quarterly basis and annual calibration. ► Audits of continuous monitoring stations' equipment undertaken by external consultants and auditing reports received. ► Public Analyst participates in Workplace Analysis Scheme for Proficiency (WASP) Scheme and field inter-comparison study.</p>	<p>External consultants undertake calibrations and filter changing of the continuous monitoring equipment in the air quality monitoring stations. Osiris meters - indicative PM₁₀ meters - filter change undertaken on quarterly basis and annual calibration. Audits of continuous monitoring stations; equipment undertaken by external consultants and auditing reports received. Public Analyst participates in Workplace Analysis Scheme for Proficiency (WASP) Scheme and field inter-comparison study.</p>	n/a	
				<p>Develop Database to enable DCC staff to better manage large volume of AQ data and make it more readily available to stakeholders</p>	2013/14						

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31	Measure M31: DCC will establish additional monitoring sites across the City in locations where poor air quality is suspected	<input type="checkbox"/> ► DCC will continue to carry out and report on their statutory duties under the Review & Assessment process for LAQM	► DCC Environment Department			► Poor air quality sites identified monitored and dealt with through the process of Review & Assessment. ► Additional monitoring sites established as and when required	n/a	► See Measure 29	► See Measure 29 ► The potential new hotspot identified for NO2 in Strathmore was assessed and it was determined that monitoring with the additional tubes in the area could cease..-	n/a	
				A review of the diffusion tube locations was undertaken in 2012 and 21 new sites identified as requiring monitoring during 2013	2013						
32	Measure M32: DCC will implement road traffic counts to inform the review and assessment process.	<input type="checkbox"/> ► Undertake classified traffic counts	► DCC Environment Department			► Classified traffic counts undertaken	n/a	Classified Traffic Counts Undertaken at 18 junctions in 2011.	Classified Traffic Counts undertaken at 18 junctions in Sept 2012	On-going	