



# 2014 Air Quality Progress Report for **Dundee City Council**

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

**Date (November, 2014)**

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# Executive Summary

This document is the 2014 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 2013, these were; nitrogen dioxide (NO<sub>2</sub>), sulphur dioxide (SO<sub>2</sub>), and fine particulate matter (PM<sub>10</sub>).

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 (NAQS), 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 anticipated risk of exceeding the NAQS for five 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 (40µg/m<sup>3</sup>) 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 PM<sub>10</sub> (annual mean) (18 µg/m<sup>3</sup>) and again in March 2013 as a result of exceedences of the hourly objective for NO<sub>2</sub> (200 µg/m<sup>3</sup> -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 2013 NO<sub>2</sub>, PM<sub>10</sub> and SO<sub>2</sub> 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 (NO<sub>2</sub>)** – analysis of the 2013 data for nitrogen dioxide reconfirms the need for the AQMA and the Action Plan. There are 13 diffusion tube (and 3 associated continuous analyser) locations where the annual mean NO<sub>2</sub> concentration at façade is estimated to exceed the objective. There are a further 16 locations at risk of breaching the objective. A new potential exceedence area has been identified at West Marketgait near Guthrie Street on the inner ring road (A991).

An exceptionally high number (99) of exceedences of the NO<sub>2</sub> hourly mean were recorded at the automatic monitoring station on Lochee Road (A923); this breaches the hourly mean NAQS objective as only 18 are allowed. The NO<sub>2</sub> hourly mean at Lochee Road has been reducing since 2010 and no other monitoring station within the city (including the Seagate) has breached the limit of 18 therefore a more detailed analysis of this information will require to be carried out.

NO<sub>2</sub> annual mean concentrations throughout the city have shown both increases and decreases 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 (A923) and associated access roads, major junctions on the Kingsway, Stannergate roundabout and the inner ring road. Between 2012 and 2013 large decreases (> 4 µg/m<sup>3</sup>) were recorded at diffusion tubes located at Stannergate roundabout, Forfar Road near the

Kingsway, Lochee Road, Rankine Street, and Meadowside. Moderate increases ( $>2 \mu\text{g}/\text{m}^3$ ) were recorded at diffusion tubes located in: Whitehall Street; Logie Street; Muirton Road; East Port Roundabout on the inner ring road; Seagate near the bus station; Nethergate and the Kingsway (A90T) near Mains Loan.

**Small Particulates (PM<sub>10</sub>)** - The PM<sub>10</sub> NAQS 2004 annual mean objective continues to be achieved at all locations within the city, however in 2013 concentrations of PM<sub>10</sub> above the stricter Scottish 2010 annual mean objective were measured at Meadowside (BAM) and Stannergate Osiris. Concentrations at Lochee Road (BAM) and Osiris monitors in Albert Street and Logie Street were close to exceeding the annual mean objective. The Osiris units are indicative PM<sub>10</sub> monitors.

The PM<sub>10</sub> NAQS 2004 24-hour objective continues to be met at all locations within the city, however, the stricter Scottish 24-hour mean objective (2010) was exceeded at two Osiris monitors located at Stannergate Roundabout and Albert Street in 2013. Both locations experienced transient PM<sub>10</sub> events as a consequence of localised road works and it is known that Osiris monitors have a tendency to over-estimate the number of 24-hour mean exceedences. A detailed assessment for the short-term Scottish objective is not considered necessary at this time though future monitoring results at these locations will be kept under review.

There has been a reduction in annual mean PM<sub>10</sub> concentrations, at the majority of sites with five or more year's data. An increasing trend was observed at Osiris monitors when located in Lochee Road and Seagate, and a slight increase is evident at TEOM and Partisol monitors located at Broughty Ferry Road. Some year to year fluctuations are evident at roadside and kerbside sites.

**Sulphur Dioxide (SO<sub>2</sub>)** - The monitoring results for 2013 indicate that all the NAQS objectives for sulphur dioxide (SO<sub>2</sub>) 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 2014 are as follows:

- All locations with exceedences identified by new 2013 monitoring data lie within the existing AQMA that was declared for the PM<sub>10</sub> and NO<sub>2</sub> annual mean and NO<sub>2</sub> hour-mean objectives. A detailed assessment for the short-term Scottish PM<sub>10</sub> objective is not considered necessary at this time though future monitoring results at Stannergate roundabout and Albert Street will be kept under review;
- As part of the ongoing review and assessment of air quality in Dundee a new diffusion tube site at Horsewater Wynd has been added to the network in 2014. Several of the new diffusion tube sites added to the network in 2013 were not continued into 2014 as the measured annual mean NO<sub>2</sub> concentrations were well below the objective. These will be detailed in next year's report;
- Review monitoring to account for any newly identified relevant exposure;
- Continue monitoring at Union Street to determine the effect of the traffic accessing the city centre via the new link road from the Central Waterfront road network;
- 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;
- Seek advice from the LAQM helpdesk on how best to assess the impacts of the various sources on the possible PM<sub>10</sub> exceedences at Stannergate roundabout;
- Compare diurnal profiles of pollutant concentrations and traffic (where available), in particular for Lochee Road;

## **Dundee City Council**

- Take forward the assessments of new developments identified in Section 3, as information becomes available;
- 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 2015 Updating and Screening Assessment.

# Table of Contents

	GLOSSARY OF ACRONYMS AND DEFINITIONS.....	9
<b>1</b>	<b>Introduction.....</b>	<b>11</b>
1.1	Description of Local Authority Area.....	11
1.2	Purpose of Progress Report .....	12
1.3	Air Quality Objectives .....	12
1.4	Summary of Previous Review and Assessments.....	14
<b>2</b>	<b>New Monitoring Data .....</b>	<b>24</b>
2.1	Summary of Monitoring Undertaken .....	24
2.1.1	Automatic Monitoring Sites .....	24
2.1.2	Non-Automatic Monitoring Sites .....	27
2.2	Comparison of Monitoring Results with Air Quality Objectives .....	36
2.2.1	Nitrogen Dioxide (NO <sub>2</sub> ) .....	36
2.2.1.1	Automatic Monitoring Data .....	36
2.2.1.2	Diffusion Tube Monitoring Data .....	48
2.2.1.3	Overview of Diffusion Tube NO <sub>2</sub> Concentrations in Areas of Concern .....	57
2.2.1.4	Overview of NO <sub>2</sub> Monitoring Concentrations at Urban Background Locations.....	73
2.2.2	Particulate Matter (PM <sub>10</sub> ) .....	75
2.2.3	Sulphur Dioxide (SO <sub>2</sub> ).....	91
	Summary of Compliance with AQS Objectives .....	93
<b>3</b>	<b>New Local Developments.....</b>	<b>94</b>
3.1	Road Traffic Sources .....	94
3.2	Other Transport Sources .....	95
3.3	Industrial Sources .....	95
3.4	Commercial and Domestic Sources.....	96
3.5	New Developments with Fugitive or Uncontrolled Sources .....	97
<b>4</b>	<b>Local / Regional Air Quality Strategy .....</b>	<b>99</b>
<b>5</b>	<b>Planning Applications .....</b>	<b>100</b>
<b>6</b>	<b>Air Quality Planning Policies .....</b>	<b>104</b>
<b>7</b>	<b>Local Transport Plans and Strategies .....</b>	<b>108</b>
<b>8</b>	<b>Climate Change Strategies.....</b>	<b>109</b>
<b>9</b>	<b>Implementation of Action Plans.....</b>	<b>110</b>
<b>10</b>	<b>Conclusions and Proposed Actions.....</b>	<b>112</b>
10.1	Conclusions from New Monitoring Data.....	112

10.2	Conclusions relating to New Local Developments .....	113
10.3	Other Conclusions .....	113
10.4	Proposed Actions.....	114
<b>11</b>	<b>References .....</b>	<b>116</b>

## List of Tables

Table 1.1	Air Quality Objectives included in Regulations for the purpose of LAQM in Scotland	13
Table 1.2	Summaries of Review and Assessment Reports	14
Table 2.1	Details of Automatic Monitoring Sites	25
Table 2.1a	Description of Automatic Monitoring Sites	26
Table 2.2	New Diffusion Tube Locations 2013	27
Table 2.3	Discontinued Diffusion Tube Locations 2013	28
Table 2.4	Details of Non-Automatic Monitoring Sites	31
Table 2.5	Results of Automatic Monitoring for Nitrogen Dioxide: Comparison with Annual Mean and Hourly Mean Objectives	40
Table 2.6	Results of Nitrogen Dioxide Diffusion Tubes in 2013	49
Table 2.7	Predicted Exceedences of NO <sub>2</sub> Annual Mean at Façade of Receptors	55
Table 2.8	Locations at risk of Exceeding NO <sub>2</sub> Annual Mean at Façade of Receptors	56
Table 2.9	Comparison of Measured Background NO <sub>2</sub> Results for 2013 with Scottish Government Background Map Data (Released June 2014)	73
Table 2.10	Results of Automatic Monitoring for PM <sub>10</sub> : Comparison with Annual Mean Objective	76
Table 2.11	Results of Automatic Monitoring for PM <sub>10</sub> : Comparison with NAQS 24-hour Mean Objective	79
Table 2.12	Results of Automatic Monitoring for PM <sub>10</sub> : Comparison with Scottish 24-hour Mean Objective	82
Table 2.13	Comparison of Measured Background PM <sub>10</sub> Results for 2013 with Scottish Government Background Map Data.	84
Table 2.14	Comparison of Eight 24hr Mean Exceedence 'Events' in Dundee with Wind Speed and Direction and Urban Background Sites	86
Table 2.15	Results of SO <sub>2</sub> Automatic Monitoring at Broughty Ferry Road: Comparison with Objectives	91
Table 6.1	Supportive Policies in the Dundee LDP to mitigate air quality impacts	106
Table A.1	Bias Factors from 2013 Co-location Studies and National Bias Adjustment Spreadsheet (Version 06/14)	118
Table A.2	Manual Approximate Orthogonal Regression Calculation 2013	119
Table A.3	Short-Term to Long-Term Monitoring Data Adjustment of Automatic Analysers	120
Table A.4	Short-Term to Long-Term Monitoring Data Adjustment of Nitrogen Dioxide Diffusion Tubes – Part 1121	
Table A.5	Short-Term to Long-Term Monitoring Data Adjustment of Nitrogen Dioxide Diffusion Tubes – Part 2122	
Table F1	Department Of Transport Count Locations	154
Table F2	Comparison of 2013 DfT Traffic Count Data with Previous Assessments	156
Table F3	Comparison of 2013 DCC Road Traffic Reduction Act Site Counts with Previously Assessed Counts	157

## List of Figures

Figure 1.1	Map of AQMA Boundary	23
Figure 2.1	Map of Automatic Monitoring Sites	24
Figure 2.2a	Map of NO <sub>2</sub> Diffusion Tubes in the City Centre	29
Figure 2.2b	Map of NO <sub>2</sub> Diffusion Tubes to the East of the City	29
Figure 2.2c	Map of NO <sub>2</sub> Diffusion Tubes to the West of the City	30
Figure 2.3	Annual Mean Nitrogen Dioxide Concentrations at Real-time Monitors from 2006 to 2013	41
Figure 2.4	Number of Exceedences of the NO <sub>2</sub> Hourly Mean Standard (200µg/m <sup>3</sup> ) (18 Allowed) at Real Time Monitoring Locations in Dundee between 2006 and 2013	41
Figure 2.5	Overview of 99.8th Percentile values of NO <sub>2</sub> Hourly Mean compared with the short-term standard (200µg/m <sup>3</sup> ), 2006-2013	42
Figure 2.6	Analysis of the Frequency of Exceedences of the Hourly NO <sub>2</sub> Objective at Automatic Monitoring Site on Lochee Road	43
Figure 2.7	Comparison of winter and summer diurnal profiles of NO <sub>2</sub> at roadside sites (NB all data is recorded as hour-ending and in GMT)	44
Figure 2.8	Comparison of Lochee Road hourly exceedences 2009-13 with corresponding average temperatures and traffic flows by month	44
Figure 2.9	Weekday, Saturday and Sunday Diurnal patterns of Hourly mean NO <sub>x</sub> & NO <sub>2</sub> (µg/m <sup>3</sup> ) at 5 Roadside sites and 1 Urban Background Location	45
Figure 2.10	Comparison of weekday, Saturday and Sunday diurnal patterns of hourly mean Lochee Rd NO <sub>2</sub> with traffic flows (vehicles/hr) for Lochee Road and Rankine Street (inbound & outbound)	46
Figure 2.11	Comparisons of daily NO <sub>2</sub> concentrations at Lochee Road with daily temperatures and nearby traffic flows in 2013	47
Figure 2.12	Change in NO <sub>2</sub> concentrations at 48 Diffusion tube monitoring locations between 2006 and 2013	58
Figure 2.13	NO <sub>2</sub> Monitoring Locations in Union Street and Whitehall Street	59
Figure 2.14	Overview of NO <sub>2</sub> Concentrations in Union St.	59
Figure 2.15	Overview of NO <sub>2</sub> Concentrations in Whitehall St.	60
Figure 2.16	NO <sub>2</sub> Monitoring Locations in Seagate	61
Figure 2.17	Overview of NO <sub>2</sub> Concentrations in Seagate.	61
Figure 2.18	NO <sub>2</sub> Diffusion Tube Locations in Nethergate	62
Figure 2.19	Overview of NO <sub>2</sub> Diffusion Tube Concentrations in Nethergate.	62
Figure 2.20	NO <sub>2</sub> Diffusion Tube Locations in Victoria Road / Meadowside	63
Figure 2.21	Overview of NO <sub>2</sub> Diffusion Tube Concentrations in Victoria Road / Meadowside.	63
Figure 2.22	NO <sub>2</sub> Diffusion Tube Locations in Albert Street / Dura Street	64
Figure 2.23	Overview of NO <sub>2</sub> Diffusion Tube Concentrations in Albert Street / Dura Street.	64
Figure 2.24	NO <sub>2</sub> Monitoring Locations in Lochee Road	65
Figure 2.25	Overview of NO <sub>2</sub> Concentrations in Lochee Road	65
Figure 2.26	NO <sub>2</sub> Diffusion Tube Locations in Logie Street	66
Figure 2.27	Overview of NO <sub>2</sub> Diffusion Tube Concentrations in Logie St.	66
Figure 2.28	NO <sub>2</sub> Diffusion Tube Locations in Albert St. / Arbroath Road	67
Figure 2.29	Overview of NO <sub>2</sub> Diffusion Tube Concentrations in Albert St. / Arbroath Road	67
Figure 2.30	NO <sub>2</sub> Diffusion Tube Locations on/near the Kingsway	68
Figure 2.31	Overview of NO <sub>2</sub> Diffusion Tube Concentrations on/near the Kingsway	68
Figure 2.32	NO <sub>2</sub> Diffusion Tube Locations on Bus Corridor	69
Figure 2.33	Overview of NO <sub>2</sub> Diffusion Tube Concentrations on Bus Corridor	69
Figure 2.34	NO <sub>2</sub> Diffusion Tube Locations on Inner Ring Road	70
Figure 2.35	Overview of NO <sub>2</sub> Diffusion Tube Concentrations on Inner Ring Road	70
Figure 2.36	NO <sub>2</sub> Diffusion Tube Location at Stannergate Roundabout	71
Figure 2.37	Overview of NO <sub>2</sub> Diffusion Tube Concentration at Stannergate Roundabout	71
Figure 2.38	NO <sub>2</sub> Diffusion Tube Location at Strathmore Avenue	72
Figure 2.39	Overview of NO <sub>2</sub> Diffusion Tube Concentration at Strathmore Avenue	72
Figure 2.40	Urban Background NO <sub>2</sub> Monitoring Locations	74
Figure 2.41	Overview of NO <sub>2</sub> Concentrations at Urban Background Locations	74
Figure 2.42	Overview of Annual Mean PM <sub>10</sub> Concentrations 2008 -2013 (Gravimetric equivalent data)	77
Figure 2.43	Possible trends in Annual Mean PM <sub>10</sub> Concentrations 2008 - 2013 at Long-Term Monitoring Sites (gravimetric equivalent data)	78
Figure 2.44	Frequency of Exceedences of PM <sub>10</sub> 24hour Mean Objective 2010 (50µg/m <sup>3</sup> , 7 allowed) 2008-2013	80
Figure 2.45	Overview of NAQS PM <sub>10</sub> 24-hour Mean Objective 2004 - 90 <sup>th</sup> Percentile of Daily Means (cf.50µg/m <sup>3</sup> ) 2008-2013	81
Figure 2.46	Overview of Scottish PM <sub>10</sub> 24-hour Mean Objective 2010 – 98.08 <sup>th</sup> Percentile of Daily Means (cf.50µg/m <sup>3</sup> ) 2008-2013	83
Figure 2.47	Comparison of Dundee PM <sub>10</sub> Monitoring Sites and Urban Background Locations from 26/02/2013 to 10/03/2013 (Events 1 & 2)	87

Figure 2.48	Comparison of Dundee PM <sub>10</sub> Monitoring Sites and Urban Background Locations from 03/04/2013 to 11/04/2013 (Event 3)	87
Figure 2.49	Comparison of Dundee PM <sub>10</sub> Monitoring Sites and Urban Background Locations from 17/05/2013 to 22/05/2013 (Event 4)	88
Figure 2.50	Comparison of Dundee PM <sub>10</sub> Monitoring Sites and Urban Background Locations from 27/06/2013 to 04/07/2013 (Event 5)	88
Figure 2.51	Comparison of Dundee PM <sub>10</sub> Monitoring Sites and Urban Background Locations from 18/08/2013 and 25/08/2013 (Event 6)	89
Figure 2.52	Comparison of Dundee PM <sub>10</sub> Monitoring Sites and Urban Background Locations from 11/09/2013 and 18/09/2013 (Event 7)	89
Figure 2.53	Comparison of Dundee PM <sub>10</sub> Monitoring Sites and Urban Background Locations from 29/09/2013 to 08/10/2013 (Event 8)	90
Figure 2.54	Overview of Maximum (15min) SO <sub>2</sub> Concentrations and Relevant Percentiles from 2002 to 2013	92
Figure 3.1	Long Reach Grabber Used in Demolition Tayside House	98
Figure F.1	Department of Transport Count Point Locations in Dundee City Council	155

### Appendices

Appendix A:	QA:QC Data	118
Appendix B:	VCM Methodology	125
Appendix C:	Pollution Reports	129
Appendix D:	Bias Calculations for Diffusion Tube Co-location Studies	143
Appendix E:	List of Industrial Processes	148
Appendix F :	Road Traffic Data	154
Appendix G :	Monthly Diffusion Tube Concentrations	158
Appendix H:	Comparison of hourly NO <sub>2</sub> concentrations at Lochee Road with temperature and local traffic flows	163
Appendix I:	Action Plan Progress Report	164

## 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
HSL	Health & Safety Laboratory
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 <sup>3</sup>	Milligrams per cubic metre
NAEI	National Atmospheric Emission Inventory
NAQS	National Air Quality Standard
NO	Nitric Oxide
NO <sub>2</sub>	Nitrogen Dioxide
NO <sub>x</sub>	Oxides of nitrogen
ng/m <sup>3</sup>	Nanograms per cubic metre
NPL	National Physical Laboratory
NRS	National Registers of Scotland
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 <sub>2.5</sub>	Particulate Matter less than 2.5µm aerodynamic diameter

PM <sub>10</sub>	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 <sub>2</sub>	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
SULP	Sustainable Urban Logistics Plan
TEA	Triethanolamine
TEOM	Tapered Element Oscillating Microbalance
UKAS	United Kingdom Accreditation Service
USA	Updating and Screening Assessment
µg/m <sup>3</sup>	Micrograms per cubic metre
VCM	Volatile Correction Method
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 with an estimated population of 148,170 (National Registers of Scotland (NRS) 2013 mid-year estimate). This equates to a population density of 2352 people per square kilometre.

Dundee is served by an airport which has daily flights to London. 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 (A991), and five arterial routes - Broughty Ferry Road (A930), Arbroath Road (A92), Riverside Drive (A85), Lochee Road (A923) and Forfar Road (A929). 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 (LAQM) 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 LAQM 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,  $\text{mg}/\text{m}^3$  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 <sup>3</sup>	Running annual mean	31.12.2003
	3.25 µg/m <sup>3</sup>	Running annual mean	31.12.2010
1,3-Butadiene	2.25 µg/m <sup>3</sup>	Running annual mean	31.12.2003
Carbon monoxide	10 mg/m <sup>3</sup>	Running 8-hour mean	31.12.2003
Lead	0.50 µg/m <sup>3</sup>	Annual mean	31.12.2004
	0.25 µg/m <sup>3</sup>	Annual mean	31.12.2008
Nitrogen dioxide	200 µg/m <sup>3</sup> not to be exceeded more than 18 times a year	1-hour mean	31.12.2005
	40 µg/m <sup>3</sup>	Annual mean	31.12.2005
Particulate Matter (PM <sub>10</sub> ) (gravimetric)	50 µg/m <sup>3</sup> , not to be exceeded more than 7 times a year	24-hour mean	31.12.2010
	18 µg/m <sup>3</sup>	Annual mean	31.12.2010
Sulphur dioxide	350 µg/m <sup>3</sup> , not to be exceeded more than 24 times a year	1-hour mean	31.12.2004
	125 µg/m <sup>3</sup> , not to be exceeded more than 3 times a year	24-hour mean	31.12.2004
	266 µg/m <sup>3</sup> , 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 work towards achieving 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 (NO<sub>2</sub>) and particulate matter (PM<sub>10</sub>) 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 <sub>2</sub> ), particulate matter (PM <sub>10</sub> ), lead, carbon monoxide (CO), benzene, 1,3-butadiene and sulphur dioxide(SO <sub>2</sub> ) ). 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 NO<sub>2</sub> and PM<sub>10</sub> 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 NO<sub>2</sub> and PM<sub>10</sub> from traffic sources identified exceedences of the NAQS annual mean standard for NO<sub>2</sub> at relevant receptors in the city centre and along the north-west arterial route.</p> <ul style="list-style-type: none"> <li>• <b>NO<sub>2</sub></b> - the detailed assessment established the need for Dundee City Council to declare an Air Quality Management Area (AQMA), carry out a further assessment of NO<sub>2</sub> and develop an Action Plan to try and reduce pollution levels in exceedence areas.</li> <li>• <b>PM<sub>10</sub></b> -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 PM<sub>10</sub>.</li> <li>• <b>SO<sub>2</sub></b> -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.</li> </ul>
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"> <li>• <b>Benzene</b> - no AQMA required for Benzene, as a result monitoring was discontinued.</li> <li>• <b>NO<sub>2</sub></b> - identified additional areas of exceedence of the NO<sub>2</sub> annual mean at relevant receptors on the north-west arterial route. 22 exceedences of the hourly mean NAQS for NO<sub>2</sub> 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.</li> <li>• <b>PM<sub>10</sub></b> - the results for 2004 indicated that the 2004 and 2010 NAQS for PM<sub>10</sub> 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.</li> <li>• <b>SO<sub>2</sub></b> - monitoring indicated that no AQMA was required.</li> </ul>

REVIEW & ASSESSMENT REPORTS	BRIEF SUMMARY of OUTCOMES
<p>Updating and Screening Assessment (2006)</p>	<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"> <li>• that the NAQS for CO, benzene, 1,3-butadiene, lead and SO<sub>2</sub> would be achieved and hence no detailed assessment would be needed.</li> <li>• <b>NO<sub>2</sub></b> - the report confirmed the need for the AQMA for NO<sub>2</sub> (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).</li> <li>• <b>PM<sub>10</sub></b> - the report concluded that the only monitored PM<sub>10</sub> 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.</li> </ul>
<p>Progress Report (2007)</p>	<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"> <li>• <b>NO<sub>2</sub></b> - 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).</li> <li>• <b>PM<sub>10</sub></b> - 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 PM<sub>10</sub> NAQS were predicted at the following monitoring locations in the city centre and the north-west arterial route: <ul style="list-style-type: none"> <li>• Victoria Road / Hilltown Junction, Seagate, Logie Street, and Lochee Road.</li> </ul> </li> <li>• The Union Street site was also very close to exceeding the annual mean for 2010 and remains an area of concern due to increasing PM<sub>10</sub> at this city centre location. There were also potential exceedences of the daily mean NAQS predicted at the Osiris monitoring locations. The 2006 PM<sub>10</sub> monitoring results indicated that a detailed assessment would be required for PM<sub>10</sub>.</li> <li>• <b>SO<sub>2</sub></b> - 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.</li> </ul>

REVIEW & ASSESSMENT REPORTS	BRIEF SUMMARY of OUTCOMES
<p>Further Assessment of Nitrogen Dioxide and Detailed Assessment of Particulate Matter PM<sub>10</sub> (2009 )(FA/DA)</p>	<p>The FA/DA combined the detailed assessment of PM<sub>10</sub> with a further assessment of both NO<sub>2</sub> and PM<sub>10</sub>. 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 NO<sub>2</sub> and concluded that an AQMA should be declared for PM<sub>10</sub>. The report also estimated that 4,600 people were living in areas at risk of exceeding the NAQS for NO<sub>2</sub> and PM<sub>10</sub> 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"> <li>• <b>Source apportionment of NO<sub>x</sub></b>, indicates road traffic emissions of NO<sub>x</sub> are the main contribution to total NO<sub>x</sub> concentrations, as they account for 74 - 91% of the total NO<sub>x</sub> concentrations at receptors. Heavy-duty vehicles (HDVs) contribute around 38 - 77% to the total NO<sub>x</sub> concentrations at receptors and exceed the LDV contributions. HDV contributions are disproportionately high given their proportion within the vehicle fleet in the AQMA.</li> <li>• <b>Source apportionment of PM<sub>10</sub></b>, indicates background sources of PM<sub>10</sub> (e.g. sea salt) make a significant contribution to total PM<sub>10</sub> concentrations, as they account for 28-59% of the total PM<sub>10</sub> 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 PM<sub>10</sub> concentration at receptors. Light duty vehicles (LDVs) contribute around 7 – 24 and heavy-duty vehicles (HDVs) contribute around 11-36% to the total PM<sub>10</sub> concentrations at receptors. Brake and tyre wear contribute around 13-29% to the total PM<sub>10</sub> 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.</li> </ul> <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 of all 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"> <li>• that the NAQS for CO, benzene, 1,3-butadiene, lead and SO<sub>2</sub> would be achieved and hence no detailed assessment would be needed.</li> </ul> <p><b>NO<sub>2</sub></b> - the report re-confirmed the need for the AQMA for NO<sub>2</sub> (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 NO<sub>2</sub>. Monitoring programmed to begin in 2011.</p>

REVIEW & ASSESSMENT REPORTS	BRIEF SUMMARY of OUTCOMES
	<ul style="list-style-type: none"> <li>• <b>PM<sub>10</sub></b> - the report noted that monitored PM<sub>10</sub> concentrations at Lochee Road and Seagate breach the annual mean NAQS for 2010. Combined with the predicted exceedences of the 2010 PM<sub>10</sub> 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 PM<sub>10</sub>.</li> <li>• 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.</li> </ul>
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><b>SO<sub>2</sub></b> - New monitoring data for 2010 show the objectives for SO<sub>2</sub> are being achieved. Sulphur dioxide concentrations measured at the Broughty Ferry Road monitoring location remained low and achieved the objectives during 2009.</p> <p><b>PM<sub>10</sub></b> - PM<sub>10</sub> objectives for 2004 are being met at all monitoring locations within the city. However, there is a risk of exceedence of the 2010 PM<sub>10</sub> annual mean objective being exceeded at roadside sites. The 2010 PM<sub>10</sub> 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 PM<sub>10</sub> 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 PM<sub>10</sub>, also identified a risk of exceedence of the 2010 objectives at receptors adjacent to busy roads and junctions in the city centre</p> <p><b>NO<sub>2</sub></b> - 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 NO<sub>2</sub>, PM<sub>10</sub> and SO<sub>2</sub> monitoring results. Trends in pollutant concentrations were also examined within the report.</p> <p><b>Nitrogen dioxide (NO<sub>2</sub>)</b> – 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 NO<sub>2</sub> 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 NO<sub>2</sub> will be kept under review.</p> <p>NO<sub>2</sub> 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><b>Small Particulates (PM<sub>10</sub>)</b> - PM<sub>10</sub> objectives for 2004 are being met at all monitoring locations within the city. However, the 2010 PM<sub>10</sub> 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 PM<sub>10</sub> 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 PM<sub>10</sub>, 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 PM<sub>10</sub> 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 PM<sub>10</sub> concentrations in 2010.</p> <p><b>Sulphur Dioxide (SO<sub>2</sub>)</b> -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>SO<sub>2</sub> 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 &amp; 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 NO<sub>2</sub> and PM<sub>10</sub> 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 PM<sub>10</sub> 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 SO<sub>2</sub> would be achieved and hence no detailed assessments of these pollutants were required.</p> <p><b>NO<sub>2</sub></b> - Dundee City Council measured concentrations of NO<sub>2</sub> above the annual mean objective at relevant locations within the AQMA, previously declared for NO<sub>2</sub> and PM<sub>10</sub> annual mean (i.e. the whole council area). However, uncertainties associated with the distance calculator tool used to estimate NO<sub>2</sub> concentrations at façade suggested that the number of locations where the objective was breached at façade would exceed the number estimated (7). NO<sub>2</sub> annual mean concentrations decreased between 2010 and 2011 at the majority of monitoring locations except Whitehall Street. Throughout the city NO<sub>2</sub> 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 NO<sub>2</sub> annual mean objective was met at this location.</p> <p>Dundee City Council measured concentrations of NO<sub>2</sub> 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 NO<sub>2</sub> objective at Lochee Road, and the advice of the Scottish Government's consultants<sup>1</sup>, it was considered necessary to amend the AQMA order to include the hourly objective (11<sup>th</sup> March 2013). Despite recording an annual mean in excess of 60 µg/m<sup>3</sup>, 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><b>PM<sub>10</sub></b> objectives for 2004 were met at all locations within the city, however Dundee City Council measured concentrations of PM<sub>10</sub> above the 2010 annual mean at Osiris units (Lochee Road, Logie Street, Victoria Road and Seagate ), Union Street (TEOM &amp; 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 PM<sub>10</sub> 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 PM<sub>10</sub> 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>

<sup>1</sup> 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 PM<sub>10</sub> 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 98.08<sup>th</sup> percentile was close to 50 µg/m<sup>3</sup> 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><b>SO<sub>2</sub></b> - New monitoring data for 2011 showed that the NAQS objectives for SO<sub>2</sub> are being achieved. SO<sub>2</sub> 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>
<p>Progress Report 2013</p>	<p>Dundee City Council has examined the results from monitoring in 2012. Concentrations within the AQMA, previously declared for NO<sub>2</sub> and PM<sub>10</sub> annual mean and NO<sub>2</sub> the hourly mean (i.e. the whole council area), still exceed the relevant objectives and the AQMA should remain.</p> <p><b>NO<sub>2</sub></b> - Dundee City Council has measured concentrations of NO<sub>2</sub> 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 NO<sub>2</sub> 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. There are at least a further 14 locations at risk of breaching 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.</p> <p>NO<sub>2</sub> 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 (&gt;6 µg/m<sup>3</sup>) between 2011 and 2012 were detected in Whitehall Street, Whitehall Crescent, Dock Street and on the Kingsway.</p> <p>Dundee City Council has measured concentrations of NO<sub>2</sub> 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.</p> <p><b>PM<sub>10</sub></b> - The PM<sub>10</sub> NAQS 2004 annual mean objective continues to be</p>

REVIEW & ASSESSMENT REPORTS	BRIEF SUMMARY of OUTCOMES
	<p>achieved at all locations within the city, however in 2012 Dundee City Council has measured concentrations of PM<sub>10</sub> 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 PM<sub>10</sub> 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 PM<sub>10</sub> exceedence at Stannergate roundabout is newly identified and will be the subject of further study.</p> <p>Over the long term there has been a slight reduction in annual mean PM<sub>10</sub> concentrations. However since 2008 levels have remained relatively stable with some year to year fluctuations at roadside and kerbside sites.</p> <p>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 98.08<sup>th</sup> 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.</p> <p><b>SO<sub>2</sub></b> - The monitoring results for 2012 indicate that all the NAQS objectives for sulphur dioxide (SO<sub>2</sub>) were met at monitoring locations in Dundee. A detailed assessment is not currently required for this pollutant.</p> <p>SO<sub>2</sub> 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.</p>



## 2 New Monitoring Data

### 2.1 Summary of Monitoring Undertaken

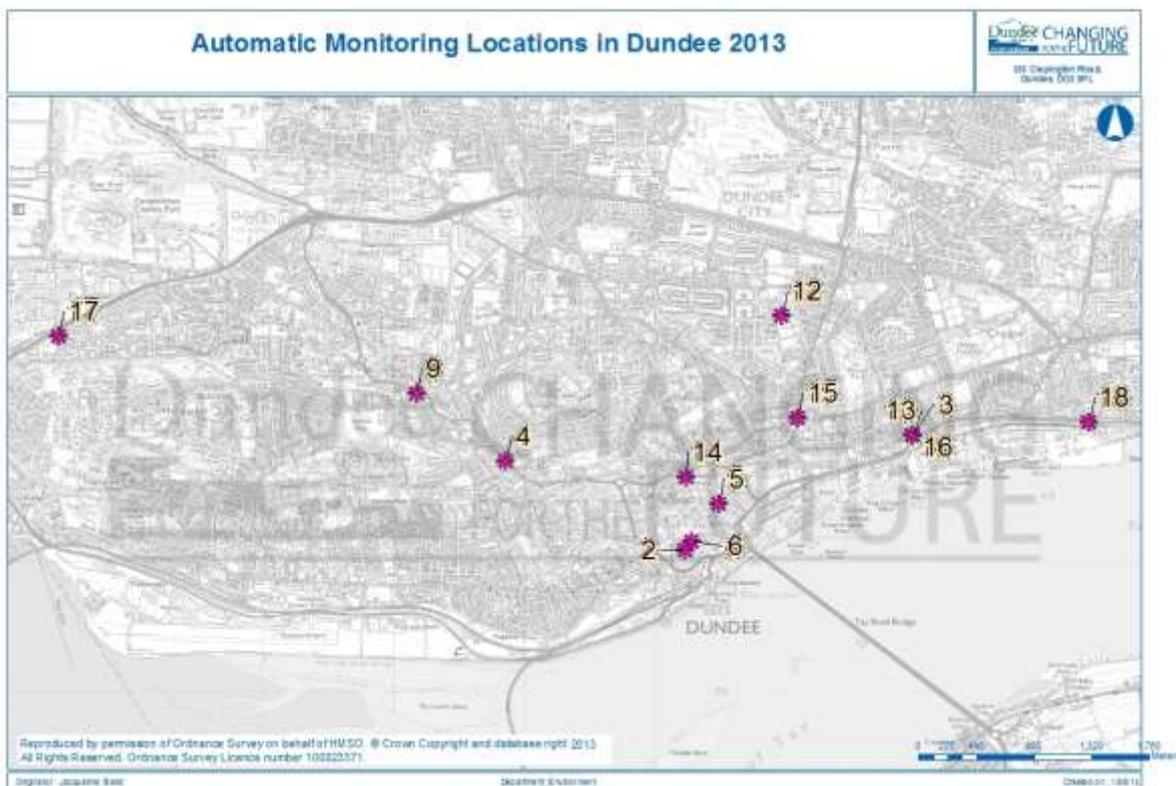
#### 2.1.1 Automatic Monitoring Sites

Dundee City Council carried out automatic monitoring at 13 sites throughout Dundee in 2013. Four nitrogen oxide analysers were renewed in 2013 these are located at Union Street, Whitehall Street, Seagate and Lochee Road. . The PM<sub>10</sub> analyser (TEOM) at Union Street was also replaced in 2013 with a different type of analyser (BAM). All stations were operational throughout 2013. 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 2013 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**



Note: Numbers shown correspond to the Site ID in **Table 2.1**

**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? <sup>1</sup> (Y/N)	Monitoring Technique	Relevant Exposure? (Y/N, with distance (m) from monitoring site to relevant exposure) <sup>3</sup>	Distance to Kerb of Nearest Road (m) <sup>4</sup> (N/A if not applicable)	Does this Location Represent Worst-Case Exposure? <sup>2</sup> ?
3	Broughty Ferry Road Rollalong	Urban Industrial	341970	730977	2.99	SO <sub>2</sub>	Y	UV Fluorescence <sup>a</sup>	Y, 0.00	n/a	No
					2.93	PM <sub>10</sub>		TEOM		6.88	
13	Broughty Ferry Road Partisol	Urban Industrial	341971	730978	2.84	PM <sub>10</sub>	Y	Partisol	Y, 0.00	n/a 6.11	No
4	Lochee Road Romon	Roadside	338861	730773	1.77	NO <sub>2</sub>	Y	Chemiluminescence <sup>b</sup>	Y, 2.24	1.15	No
					2.06	PM <sub>10</sub>		Beta Attenuation (BAM)			
9	Logie Street Osiris	Kerbside	338176	731298	3.31	PM <sub>10</sub>	Y	Osiris (nephthalometer)	Y, 1.65	0.57	Yes
12	Mains Loan	Urban Background	340972	731893	1.80	NO <sub>2</sub>	Y	Chemiluminescence <sup>c</sup>	N, 0.00	n/a	No
					1.98	PM <sub>10</sub>		TEOM			
5	Seagate Romon	Roadside	340487	730446	1.70	NO <sub>2</sub>	Y	Chemiluminescence <sup>b</sup>	Y, 2.00	1.10	No
					2.06	PM <sub>10</sub>		Beta Attenuation (BAM)			
2	Union Street Rollalong	Roadside	340235	730091	2.92	NO <sub>2</sub>	Y	Chemiluminescence <sup>b</sup>	Y, 3.55	1.64	Yes
					3.00	PM <sub>10</sub>		TEOM		1.75	
6	Whitehall Street Romon	Roadside	340278	730156	1.80	NO <sub>2</sub>	Y	Chemiluminescence <sup>b</sup>	Y, 1.86	3.26	No
14	Meadowside Romon	Roadside	340243	730653	2.26	NO <sub>2</sub>	Y	Chemiluminescence <sup>d</sup>	Y, 0.42	1.60	Yes
					2.17	PM <sub>10</sub>		Beta Attenuation (BAM)		1.63	
15	Albert Street Osiris	Kerbside	341090	731105	3.15	PM <sub>10</sub>	Y	Osiris (nephthalometer)	Y, 1.54	0.89	No
16	Broughty Ferry Road Osiris	Urban Industrial	341970	730977	3.00	PM <sub>10</sub>	Y	Osiris (nephthalometer)	Y, 0m	7.15	No
17	Myrekirk Osiris	Roadside	335438	731740	3.11	PM <sub>10</sub>	Y	Osiris (nephthalometer)	Y, 0.4	14.00	No
18	Stannergate Osiris	Roadside	343322	731073	3.11	PM <sub>10</sub>	Y	Osiris (nephthalometer)	Y, 1.93	1.16	No

**Notes:**

<sup>1</sup> The whole of Dundee is an AQMA for NO<sub>2</sub> and PM<sub>10</sub>

<sup>2</sup> Explanation provided in para.3.11 page3-3 LAQM.TG(09): The term 'worst-case' is used to represent those places, "where concentrations are expected to be highest, and where the public may be exposed over the relevant averaging period of the objectives"

<sup>3</sup> 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."*

<sup>4</sup> 'Kerb' is taken as being the edge of the carriageway with flowing traffic

<sup>a</sup> Equipment is model ML 9850A

<sup>b</sup> During 2013 equipment was updated from model ML 9841A to model API T200

<sup>c</sup> Equipment is model Thermo 42i

<sup>d</sup> 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. Co-located with TEOM and Partisol to provide a local gravimetric correction factor for Osiris units.
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.
9	Logie Street Osiris	K	On the outbound side of the north-west arterial route (A923), at the busy signalised junction with Loons Road & Muirton 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. Does not experience the higher pollution levels closer to the bus stances to the east, where there are ground floor flats bordering the narrower pavement (i.e. not the worst case 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. There are plans to open up access to this street by linking it with the A991 South Marketgait and new boulevards of the waterfront development which has the potential to increase vehicle numbers and emissions within the street canyon.
6	Whitehall Street Romon	R	Located on the east side of a city centre street canyon environment where there is a main bus interchange and bounded on both sides with 4-5 storey tenements. Owing to the location of the bus stances, traffic emissions are greater on the west side where residential flats border the pavement at 1st floor level. There are flats at third floor flats bordering the pavement at the monitoring location (i.e.this is not the worst-case pollution location).
14	Meadowside Romon	R	Located on the north west side of a street canyon on the main bus corridor, on an uphill 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. The monitor is at the building facade and hence represents worst case exposure.
15	Albert Street Osiris	K	Next to the city-bound carriageway 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. Downhill traffic potentially queues back to the monitor where there are first floor flats bordering the pavement. However, the pavement of the steep uphill carriageway is bordered by ground floor residential properties and so the monitoring location may not represent the worst case exposure 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 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 at Stannergate roundabout on the south-east 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. Down prevailing wind of the railway, the port, unmade trafficked ground and commercial activities that may generate dust. Proposed port expansion is predicted to generate more traffic close to this monitor.

## 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).

A comprehensive review of the diffusion tube network was carried during 2013, with 25 new tube locations added to the network and 30 sites where monitoring was discontinued.

**Tables 2.2 and 2.3** detail the new and discontinued tubes and the reasons for the change.

**Table 2.2 New Diffusion Tube Locations 2013**

Site ID	NAME	x	y	Site type	Reasons
167	Albert Street (191)	341161	731535	K	To replace discontinued tubes in Albert Street and better represent relevant exposure (ground floor flats at roadside).
168	Arbroath Road (27)	341223	731089	R	To determine the extent of the impact of queuing traffic in the area
169	Dura Street (30)	341021	731434	R	To investigate possible new exceedence area
170	Monifieth Road (4)	346554	730919	R	To investigate possible new exceedence area
171	Claypotts / Arbroath Road (502)	345347	732080	R	To investigate possible new exceedence area
172	Pitkerro Road (3)	341227	731629	R	To investigate possible new exceedence area
173	Old Glamis Road(9) / Balgray Street	339941	732251	K	To investigate possible new exceedence area
174	Clepington Road (172)	339974	732147	K	To investigate possible new exceedence area
175	Coupar Angus Road (38)	337414	732164	R	To investigate possible new exceedence area
176	Logie Street / Grays Lane	338062	731366	R	To investigate possible new exceedence area
177	Kingsway / Strathmartine Road (279)	339179	732896	R	To investigate possible new exceedence area
178	Hawkhill / Horsewater Wynd	339576	730223	K	To investigate possible new exceedence area
179	Albert Street (15) (Facade)	341092	731121	R	To investigate possible new exceedence area, and provide a better test site for the distance calculator tool
180	Albert Street (15) (Roadside)	341091	731121	K	To investigate possible new exceedence area, and provide a better test site for the distance calculator tool
181	Myrekirk Terrace (8)	335458	731767	R	To provide a monitoring site closer to façade in this area
182	Meadowside (28)	340298	730550	K	To help delineate the extent of an existing exceedence area.
183	West Marketgait / Guthrie Street	339805	730338	R	To investigate possible new exceedence area
184	Victoria Road (104) / William Street	340697	730950	R	To investigate possible new exceedence area
185	Murraygate (46)	340409	730484	UB	To provide a replacement urban background location in the city centre
186	Carolina Court 30 mph sign	342342	731083	R	A developer led monitoring campaign predicted NO <sub>2</sub> concentrations above the annual mean at residential facades by a trunk road (A92(T)). In June 2013 this additional tube was located at a distance that is more representative of the receptor facades relative to the trunk road.
187	Albert Street (81)	341113	731265	K	To investigate possible new exceedence area
188	Commercial Street (9)	340544	730291	R	To help delineate the impact of queuing traffic in the area
189	Myrekirk Road (29)	335420	731726	R	To replace a long-term site discontinued due to re-alignment of roundabout
190	Seagate (97)	340516	730499	R	To replace site discontinued due to removal of street furniture
191	Victoria Road (4) - India Buildings	340213	730633	R	To help delineate the impact of queuing traffic in the area

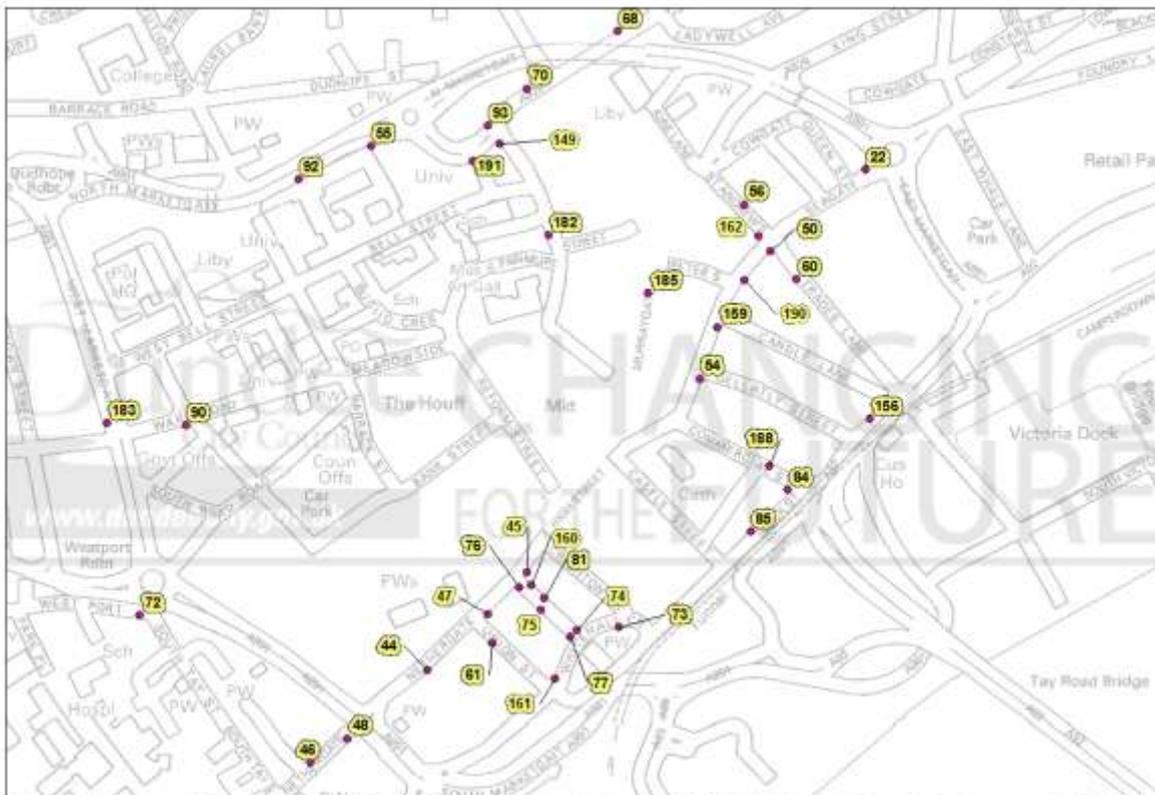
**Table 2.3 Discontinued Diffusion Tube Locations 2013**

Site ID	NAME	x	y	Site type	Reasons
2	Albert Street (Fish)	341139	731476	K	Consistently below the objective
3	Albert Street (Shandon Place)	341171	731574	R	Consistently below the objective
6	Arthurstone Terrace (10)	341051	731203	K	Consistently below the objective
8	Bank St/ Reform St -New Site	340228	730337	K	Consistently below the objective
12	Claypotts Junction	345315	732103	R	Consistently below the objective
14	Commercial St	340328	730431	K	Consistently below the objective
15	Commercial Street (Waterstones)	340481	730325	R	Re-located to better represent queuing traffic
16	Crichton St	340331	730162	K	Consistently below the objective
18	Dock St (14) Sheridans	340395	730086	K	Inaccessible due to roadworks
21	Earl Grey Place (Park)	340699	730019	UB	Inaccessible due to roadworks
23	Harefield Road (35)	338360	731855	K	Consistently below the objective
24	Hilltown (Suites)	340088	731116	R	Consistently below the objective
25	King St (12 & 14)	340598	730757	K	Consistently below the objective
29	Kingsway/ Strathmartine Rd (S)	339221	732836	K	Re-located to north side of roundabout where receptors closer to road
40	Marketgait	339953	730094	R	Consistently below the objective
41	Meadowside	340245	730651	R	Site no longer required - other tubes located closer to façade
43	Myrekirk Road	335420	731733	K	Street Sign removed during roadworks - new tube installed nearby
66	Victoria Road	340212	730633	R	Street Sign removed during roadworks - new tube installed nearby
69	Victoria Road / Cotton Road	340740	730996	K	Re-located to better represent queuing traffic
87	Nethergate / South Tay St	339987	729919	R	Consistently below the objective
88	Queen Street - Broughty Ferry	346207	731007	R	Consistently below the objective
95	West Marketgait	339814	730380	K	Re-located to west side where receptors closer to road
146	Mains Loan	340972	731893	UB	Co-location study discontinued as not used for bias correction
148	Dock Street - Tay Hotel	340340	730033	K	Inaccessible due to roadworks
150	Seagate 95-97	340511	730492	R	Street Sign removed - new tube installed nearby
152	Strathmore Avenue - 337	339522	731875	K	Below the objective
153	Strathmore Avenue - Ped X	339667	731878	R	Below the objective
154	High Street - Lochee (106)	337900	731560	R	Below the objective
157	Albert St (71-73)	341106	731223	K	Below the objective
163	Meadowside - Bell St.	340282	730592	K	Street Sign removed - new tube installed nearby

Details for each of the diffusion tubes deployed in the network in 2013 are shown in **Table 2.4**. Maps illustrating the extent of the network are shown in **Figures 2.2a to 2.2c**.

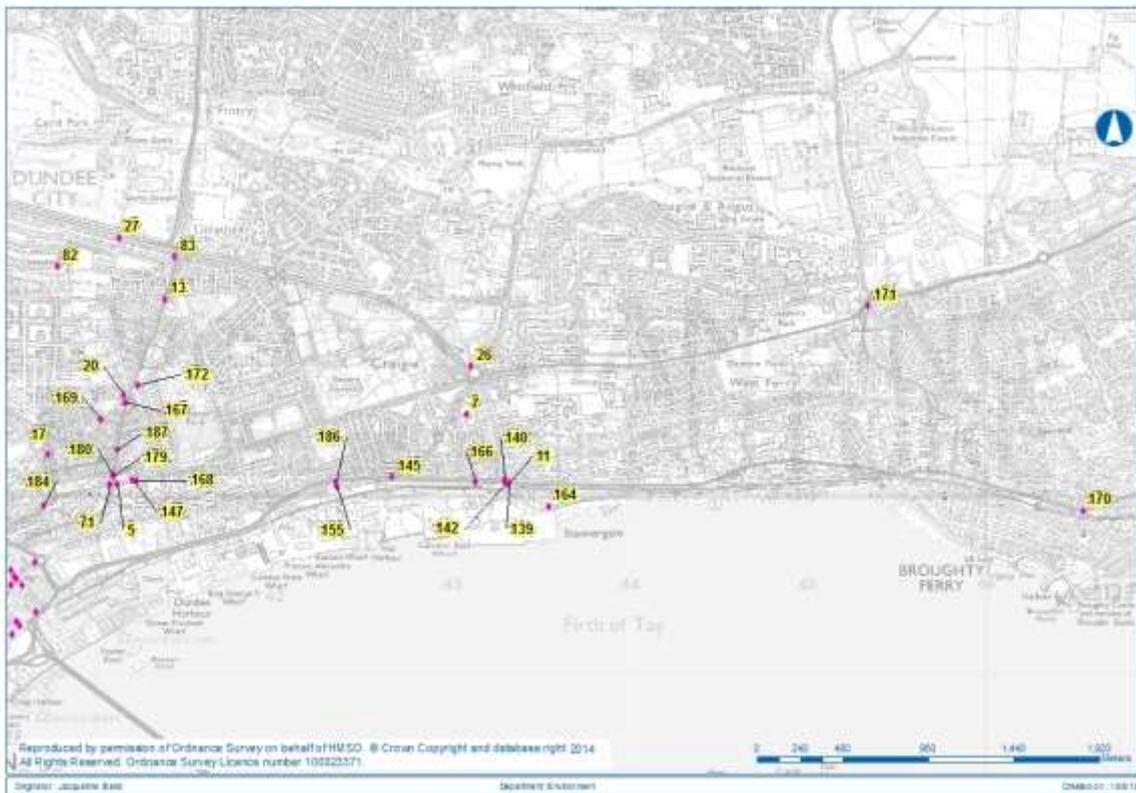
NO<sub>2</sub> diffusion tubes used in Dundee tend to over-read compared to automatic analysers and need to be bias corrected. QA/QC procedures and bias correction methodologies are discussed in **Appendix A**.

Figure 2.2a Map of NO<sub>2</sub> Diffusion Tubes in the City Centre



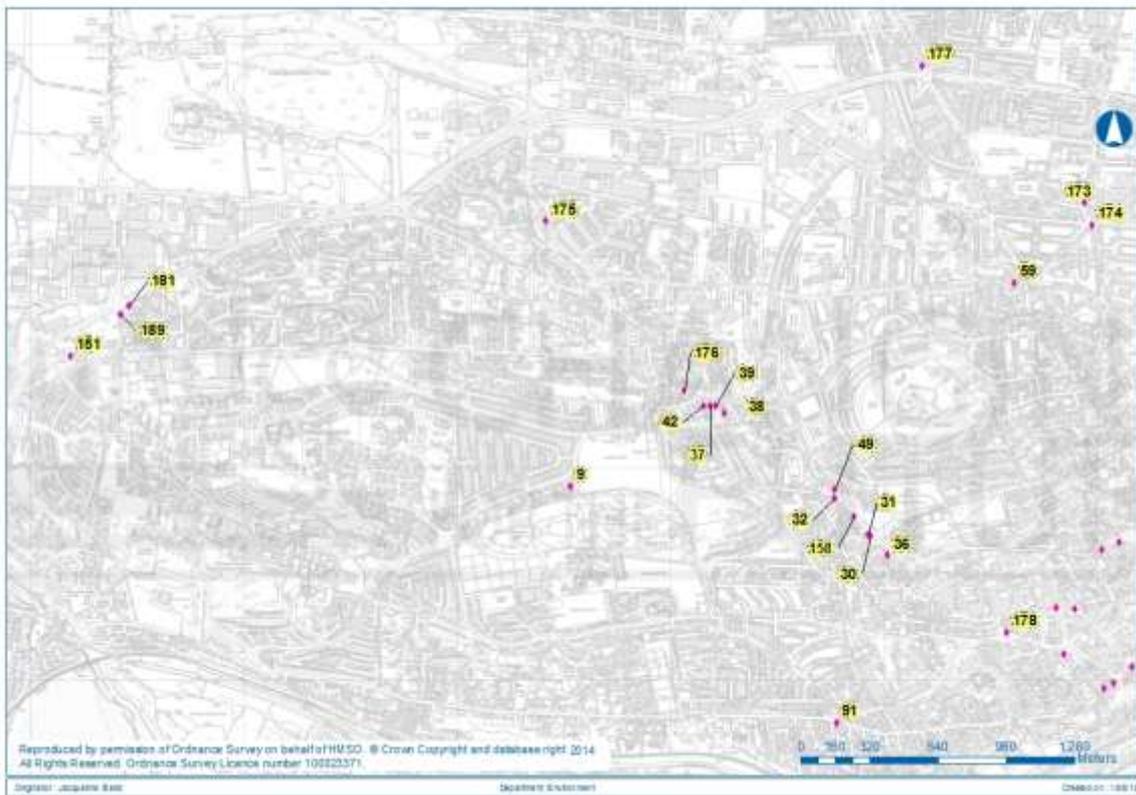
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Figure 2.2b Map of NO<sub>2</sub> Diffusion Tubes to the East of the City



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Figure 2.2c Map of NO<sub>2</sub> Diffusion Tubes to the West of the City



**Table 2.4 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
179	Albert Street (15) (Facade)	R	341092	731121	2.36	N	0.25	2.04	Y
180	Albert Street (15) (Roadside)	K	341091	731121	2.40	N	1.75	0.54	N
167	Albert Street (191)	K	341161	731535	2.53	N	2.70	0.62	N
187	Albert Street (81)	K	341113	731265	2.53	N	2.95	0.47	N
5	Arbroath Road (13)	K	341111	731070	2.75	N	Y (2.52)	0.73	Y
168	Arbroath Road (27)	R	341223	731089	2.53	N	2.43	1.88	N
147	Arbroath Road 38	K	341202	731097	2.47	N	Y (2.97)	0.50	N
7	Balgavies Place	UB	343082	731465	2.44	N	N	n/a	N
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 (Streetsign)	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
155	Carolina Court	UB	342353	731058	2.44	N	N	0.56 (33.34 to the A92(T))	N

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?*
186	Carolina Court 30 mph sign	R	342342	731083	2.37	N	-0.38	7.60	Y
171	Claypotts / Arbroath Road (502)	R	345347	732080	2.47	N	5.30	11.20	N
174	Clepington Road (172)	K	339974	732147	2.60	N	1.91	0.41	N
13	Clepington Road/Forfar Road	K	341385	732121	2.66	N	Y (8.28)	0.78	Y
84	Commercial St / Dock St. (40)	R	340565	730263	2.73	N	Y (0.17)	2.78	Y
188	Commercial Street (9)	R	340544	730291	2.31	N	2.44	2.57	N
175	Coupar Angus Road (38)	R	337414	732164	2.45	N	2.36	2.10	N
17	Dens Road Crossing	R	340725	731238	2.67	N	Y (2.49)	1.20	Y
85	Dock St Carol Whyte (21)	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
169	Dura Street (30)	R	341021	731434	2.63	N	0.22	1.42	N
20	Dura Street (Fortes) (100)	K	341150	731576	2.58	N	Y (1.65)	0.57	N
22	Eastport Roundabout	R	340651	730623	2.69	N	Y (1.56)	1.00	Y
83	Forfar Road (104)	K	341437	732360	2.57	N	Y (7.68)	0.67	Y
178	Hawkhill / Horsewater Wynd	K	339576	730223	2.44	N	4.26	0.81	N
177	Kingsway / Strathmartine Road (279)	R	339179	732896	2.47	N	3.63	3.14	N
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
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

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?*
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
176	Logie Street / Grays Lane	R	338062	731366	2.45	N	1.58	4.40	N
39	Loons Road (1)	R	338211	731293	2.73	N	Y (0.5)	1.90	Y
164	Lower Broughty Ferry Road	UB	343545	730942	2.57	N	N	3.15	N
182	Meadowside (28)	K	340298	730550	2.53	N	2.95	0.80	N
149	Meadowside (Romon) Average	R	340243	730653	2.05	Y	Y (0.33)	1.85	Y
170	Monifieth Road (4)	R	346554	730919	2.40	N	3.52	2.85	N
42	Muirton Road (6)	R	338152	731293	2.50	N	Y (0.3)	1.11	Y
185	Murraygate (46)	UB	340409	730484	2.52	N	n/a	n/a	N
189	Myrekirk Road (29)	R	335420	731726	2.34	N	5.17	2.00	N
181	Myrekirk Terrace (8)	R	335458	731767	2.46	N	1.64	11.20	N
48	Nethergate (132) / Marketgait	R	340074	729984	2.60	N	Y (3.6)	1.33	Y
44	Nethergate (B&B)(88)	K	340163	730061	2.14	N	Y (5)	0.86	Y
45	Nethergate (Bradford)(6)	R	340274	730171	2.65	N	Y (2.51)	1.25	Y
46	Nethergate (Charlie T)(95)	K	340033	729957	2.57	N	Y (1.84)	0.86	Y
47	Nethergate (Trades House)(40)	R	340230	730124	2.65	N	Y (2.72)	1.26	Y

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?*
173	Old Glamis Road(9) / Balgray Street	K	339941	732251	2.42	N	1.27	0.75	N
91	Perth Rd 320	K	338776	729798	2.55	N	Y (3.78)	0.42	Y
172	Pitkerro Road (3)	R	341227	731629	2.61	N	1.42	1.92	N
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
190	Seagate (97)	R	340516	730499	2.28	N	0.00	2.26	Y
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
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)(26)	K	340516	730584	2.69	N	Y (1.77)	0.71	Y
162	St. Andrews St PB (facade)/Seagate(116)	R	340532	730548	2.52	N	Y (0.18)	2.53	Y
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
93	Victoria Road (10)(Osiris)	K	340230	730673	2.55	N	Y (2.7)	0.30	Y
184	Victoria Road (104) / William Street	R	340697	730950	2.52	N	1.50	1.36	N
191	Victoria Road (4) - India Buildings	R	340213	730633	2.25	N	0.00	2.77	Y
68	Victoria Road (60)	R	340375	730779	2.73	N	Y (0.56)	2.18	Y
70	Victoria Road/Hilltown	R	340274	730714	2.77	N	Y (2.01)	1.15	N

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?*
71	Victoria St / Albert Street	K	341071	731072	2.58	N	Y (1.7)	0.75	Y
90	Ward Road / N. Lindsay St.	R	339893	730336	2.68	N	Y (72)	2.24	Y
183	West Marketgait / Guthrie Street	R	339805	730338	2.42	N	2.02	1.16	N
72	Westport (2)	R	339842	730122	2.62	N	Y (2.5)	0.46 (12m to W. M'tgait)	Y
73	Whitehall Cr (Xpresso)(4)	K	340376	730109	2.62	N	Y (3)	0.88	Y
161	Whitehall Crescent - (McIntyres)/Union St. (50)	K	340305	730051	2.54	N	Y (4.78)	0.64	N
74	Whitehall St (Brj)(40)	K	340330	730106	2.76	N	Y (3.57)	0.78	Y
75	Whitehall St (Bus)(5)	R	340289	730128	2.58	N	Y (3.17)	2.51	N
76	Whitehall St (Deb A)(1)	K	340265	730153	2.68	N	Y (5.57)	0.88	N
77	Whitehall St (Deb E)(15)	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)(12)	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 NO<sub>2</sub> & PM<sub>10</sub>

K= kerbside (within 1m of a kerb), R=roadside (2-5m from kerb), UB=Urban Background

\*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 (NO<sub>2</sub>)

#### 2.2.1.1 Automatic Monitoring Data

The 2013 results of the automatic monitoring stations for nitrogen dioxide are shown in **Table 2.5** and **Figures 2.3 – 2.5**, along with results from previous years. The automatic monitoring site at Mains Loan collected less than 9 months valid data in 2013 and hence the measurements needed to be “annualised” (as described in Box 3.2 of LAQM.TG(09)). The sites chosen for the annualisation and the resulting factor are detailed in **Appendix A5**. It should be noted that for a strict comparison against the objective there must be a data capture of more than 90% throughout the calendar year, so details of data capture are included in the table for 2013 and all previous years.

#### Annual Mean Concentrations

Exceedences of the annual mean NAQS objective for NO<sub>2</sub> were recorded at four stations in 2013: Lochee Road, Seagate, Whitehall Street and Meadowside. The highest annual mean NO<sub>2</sub> concentration was recorded at Seagate. The concentrations at the other 3 exceedence locations were lower than in 2012. 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 roadside locations where the objective was exceeded were still estimated to exceed the standard (or were close to exceeding >36 µg/m<sup>3</sup>) when predicted to façade using the methodology detailed in Box 2.3 of LAQM.TG(09), i.e. Lochee Road 44.3 µg/m<sup>3</sup>, Seagate 47.4 µg/m<sup>3</sup>, Whitehall Street 39 µg/m<sup>3</sup> and Meadowside 47.5 µg/m<sup>3</sup>.

**Figure 2.3** shows the annual mean NO<sub>2</sub> concentrations at automatic monitoring locations since 2006. Annual mean NO<sub>2</sub> concentrations decreased between 2012 and 2013 at three of the automatic monitoring stations located in exceedence areas except for Seagate where concentrations increased significantly. Year to year changes to concentrations are common and weather conditions are a key influence. The reason for the large increase in Seagate which is out of keeping with the changes monitored at other sites is unclear. Refurbishment of the traffic lights at the Commercial Street/Seagate junction took place during February 2013 and this caused some congestion during the few weeks the work was being carried out. However, it is anticipated that the improvements to the traffic light controls will reduce the likelihood of congestion in Seagate and potentially lead to improvements in monitored concentrations. Statistically significant trends, or even a reasonable overview of how concentrations are changing, usually only become meaningful when complete data records extend over five years or more. Eight years data are presented but caution should be exercised when inferring trends as many of the annual averages presented had less than 90% valid data capture, details of which are presented in **Table 2.5**.

#### Hourly Mean Concentrations

**Figure 2.4** shows the number of exceedences of the NO<sub>2</sub> hourly mean standard (200µg/m<sup>3</sup>) (no more than 18 allowed in a year) at each of the real time monitoring locations in Dundee between 2006 and 2013. This shows that the objective was met at all the monitoring locations in 2013 except Lochee Road which had 99 exceedences.

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. Generally, if the value of the 99.8<sup>th</sup> percentile is greater than

200 $\mu\text{g}/\text{m}^3$ , then it is likely that the allowed number of hourly mean exceedences will have been breached. Expressing short-term concentrations as 99.8<sup>th</sup> percentile values provides easier inter-year comparison of data and examination of trends. The 99.8<sup>th</sup> percentile values from 2006 are shown in **Figure 2.5**. This shows that the only location where the hourly mean objective have ever been breached is Lochee Road. Percentile concentrations increased, between 2012 and 2013 at four locations: Lochee Rd, Seagate, Union St and Mains Loan.

An analysis of the frequency of the 99 exceedences recorded at Lochee Road is shown in **Figure 2.6** alongside those recorded in 2010 to 2012. In common with previous years the majority of exceedences occurred during weekdays at peak times in the winter<sup>2</sup>. However, for the first time exceedences occurred overnight and more often at the weekend. All the overnight exceedences and the majority of the weekend events happened in February during which time there was a stable high pressure system over the UK<sup>3</sup> with low temperatures locally (see **Appendix H**). Further, since the installation of BAM analysers in the roadside monitoring sites, from June 2011 it has been possible to compare ambient temperatures at 4 monitoring locations. Comparison shows that the lowest average temperature was recorded at the Lochee Road monitoring location (from June 2011 to Dec 2013).

It is known that concentrations of nitrogen dioxide exhibit seasonal patterns, with higher concentrations more likely to occur during cold weather (winter months) when the normal convection processes are reduced resulting in a more stable atmosphere and less dispersion of pollutants. **Figure 2.7** compares the winter and summer diurnal profiles of NO<sub>2</sub> concentrations at roadside sites in Dundee. As the roadside monitoring locations are less than 2km apart it could be assumed that meteorological impacts would be similar at all sites. This is not the case with Lochee Rd experiencing far larger differences between the average summer and winter hourly concentrations than the other roadside sites

Further analysis of monitored concentrations is afforded by plotting diurnal profiles of hourly mean concentrations of NO<sub>2</sub> and NO<sub>x</sub> for 2013, as shown in **Figure 2.9** (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 NO<sub>2</sub> and NO<sub>x</sub> 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 2.9** are:

- Concentrations of NO<sub>2</sub> and NO<sub>x</sub> are higher on weekdays than at weekends,
- Where pollution data shows distinctive peaks, 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 NO<sub>2</sub> and NO<sub>x</sub> remain elevated for longer overnight on Friday and Saturday nights, particularly for Lochee Rd,
- The ratio of NO<sub>2</sub> to NO<sub>x</sub> is much higher (denoting that most NO<sub>x</sub> emissions have converted to NO<sub>2</sub> by the time they reach the monitor) at the background site (0.72) than at roadside locations. Lochee Road has the highest NO<sub>2</sub> conversion ratio (0.47) of the roadside sites followed by Whitehall Street(0.43), Union Street(0.42), Seagate(0.35), and Meadowside(0.3) has the lowest, and
- The largest NO<sub>2</sub> peaks are seen at Lochee Road which is a main commuter route to/from the city centre and correspond with weekday diurnal traffic patterns (as shown in **Figure 2.10**).

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

<sup>2</sup> 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.

<sup>3</sup> Air Pollution in the UK 2013", Published by the Department for Environment, Food and Rural Affairs, September 2014 [http://uk-air.defra.gov.uk/library/annualreport/viewonline?year=2013\\_issue\\_1](http://uk-air.defra.gov.uk/library/annualreport/viewonline?year=2013_issue_1)

necessarily been accompanied by decreases in concentrations of pollutants measured at roadside. Average monthly traffic flows from 2009 to 2013 recorded at traffic counters near to the Lochee Road monitor are shown in **Figure 2.8**. From January 2009 to March 2012 traffic patterns were largely stable but become less predictable thereafter with particularly large fluctuations in outbound Lochee Road traffic. Also from December 2012 the predominant flow on Rankine Street changed from outbound to inbound and remained so throughout 2013. It is hard to know the cause of these unusual fluctuations so the most recent traffic counts should be interpreted with caution. Overall there appears to be a slight reduction in traffic so it is hard to correlate traffic flows with the frequency of 1-hour NO<sub>2</sub> exceedences by month. However, the pattern of exceedences looks closely related to the average monthly temperatures.

During 2013 Lochee Road monitor recorded the highest number of hourly NO<sub>2</sub> exceedences ever measured in Dundee. Focussing in on the 2013 data, **Figure 2.11** shows comparisons of daily average NO<sub>2</sub> concentrations with the corresponding day's temperature (measured at the monitor) and the traffic flows measured on two of the nearby roads. Applying a best-fit line to the scatterplots, calculating and then comparing the R values<sup>4</sup> (shown in the charts) provides a means of determining the strength of any correlation between the traffic flows and NO<sub>2</sub>, as well as temperature and NO<sub>2</sub>. A moderate correlation (i.e. when R=+/-0.5 to 0.75) is seen with inbound traffic flows on Rankine Street, and weak correlations (i.e. when R=+/-0.25 to 0.5) with temperature and outbound traffic flows on Rankine Street. Oddly there's no apparent correlation with traffic flows on Lochee Road though it maybe that the number of outliers in the graphs undermine this analytical approach. It should be noted however that the monitor is closer to Rankine Street than the worst case exposure location, which is on Lochee Road nearer the junction with Dudhope Terrace.

Other factors that may also influence the high number of 1-hour exceedences in winter on Lochee Road could be NO<sub>2</sub> emissions from other combustion sources such as space heating, in particular burning of solid fuels and to a lesser extent gas central heating. Most properties around the monitor are residential, which unlike commercial properties are more likely to produce emissions overnight. From the council's corporate address gazetteer numbers of residential properties within a 250m radius of each of the roadside monitors were counted and compared, see below:

- Lochee Road (1003 residences)
- Seagate (824 residences)
- Meadowside (738 residences)
- Whitehall Street (426 residences)
- Union Street (353 residences)

Lochee Road has the highest density of residential properties surrounding the monitor and it is known that domestic NO<sub>x</sub> emissions can contribute to raising background concentrations of NO<sub>2</sub>.

The monitor is on an uphill slope and next to the outbound carriageway of Lochee Road. Topographically the land rises steeply either side of the Lochee Road creating a valley which is further emphasised by 4 storey tenemental properties to the east. Emissions from vehicles travelling uphill with engines under load will often be even greater in the winter owing to engines being colder and less efficient. In addition, tax incentives have lead to an increasing uptake of diesel vehicles across the UK vehicle fleet which have been shown to produce higher direct NO<sub>2</sub> emissions than petrol fuelled vehicles and may also play a role in the measurement of increasing exceedences of the 1-hour standard.

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<sup>4</sup> Pearson's correlation coefficient

Air quality on Lochee Road is affected by a combination of factors. These appear to include influences of meteorology, local topography, domestic emissions and incentivisation of diesel vehicles and hence it is going to be very challenging to improve air quality on this key arterial route by traffic management of local vehicles alone. The opportunity to compare the road count data with pollution data and meteorological data for other years as well as 2013 may provide greater understanding for the frequency of 1-hour exceedences at this location.

Table 2.5 Results of Automatic Monitoring for Nitrogen Dioxide: Comparison with Annual Mean and Hourly Mean Objectives

Site ID	Location	Site type	NAQS NO <sub>2</sub> Objectives & annual data statistics	Annual Results <sup>a,b,c</sup>							
				2006	2007	2008	2009	2010	2011	2012	2013
CM 4	Lochee Road	R	Annual mean Objective (40 ug/m <sup>3</sup> )	49.0	52.8	52.9	54.2	55.0	58.2	52.9	51.6
			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	99.6
			No. of exceedences of the hourly mean (200ug/m <sup>3</sup> ), not to be breached >18 times per year	0	0	4	23	67	43	36	99
			99.8 <sup>th</sup> Percentile of the hourly means (ug/m <sup>3</sup> )	141.0	157.5	175.6	206.2	242.6	241.6	227.8	256.5
CM 5	Seagate	R	Annual mean Objective (40 ug/m <sup>3</sup> )	43.0	49.1	51.4	48.4	51.0	52.2	47.6	55.0
			Valid data capture for the year (%) (* denotes less than recommended 90%)	60.7*	93.9	81.6*	74.3*	80*	80.9*	88.1*	87.8*
			No. of exceedences of the hourly mean (200ug/m <sup>3</sup> ), not to be breached >18 times per year	0	1	0	1	0	2	0	10
			99.8 <sup>th</sup> Percentile of the hourly means (ug/m <sup>3</sup> )	119.0	141.2	141.3	152.8	134.8	156.5	143.9	171.9
CM 2	Union Street	R	Annual mean Objective (40 ug/m <sup>3</sup> )	39.0	35.8	42.9	45.2	40.0	35.6	31.7	30.5
			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*	96.7
			No. of exceedences of the hourly mean (200ug/m <sup>3</sup> ), not to be breached >18 times per year	0	0	11	2	0	0	0	0
			99.8 <sup>th</sup> Percentile of the hourly means (ug/m <sup>3</sup> )	133.0	132.1	182.3	165.2	141.9	133.1	98.5	107.1
CM 6	Whitehall Street	R	Annual mean Objective (40 ug/m <sup>3</sup> )	39.8	42.0	46.7	37.8	36.0	34.7	44.4	41.2
			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*	99.0
			No. of exceedences of the hourly mean (200ug/m <sup>3</sup> ), not to be breached >18 times per year	0	0	0	0	0	0	0	0
			99.8 <sup>th</sup> Percentile of the hourly means (ug/m <sup>3</sup> )	106.0	136.8	139.4	111.3	101.1	117.8	136.4	118.4
CM 14	Meadowside	R	Annual mean Objective (40 ug/m <sup>3</sup> )						66.4	53.9	49.1
			Valid data capture for the year (%) (* denotes less than recommended 90%)						52.3*	97.3	90.7
			No. of exceedences of the hourly mean (200ug/m <sup>3</sup> ), not to be breached >18 times per year						0	0	0
			99.8 <sup>th</sup> Percentile of the hourly means (ug/m <sup>3</sup> )						157.3	169.2	147.8
CM 12	Mains Loan	UB	Annual mean Objective (40 ug/m <sup>3</sup> )						11.6	9.8	11.5
			Valid data capture for the year (%) (* denotes less than recommended 90%)						75.5*	97.3	72.6*
			No. of exceedences of the hourly mean (200ug/m <sup>3</sup> ), not to be breached >18 times per year						0	0	0
			99.8 <sup>th</sup> Percentile of the hourly means (ug/m <sup>3</sup> )						80.7	62.5	84.8

Notes <sup>a</sup> All monitoring sites are located within an AQMA for NO<sub>2</sub> and PM<sub>10</sub>

<sup>b</sup> Monitoring period and data capture is for the full calendar year for all monitoring sites

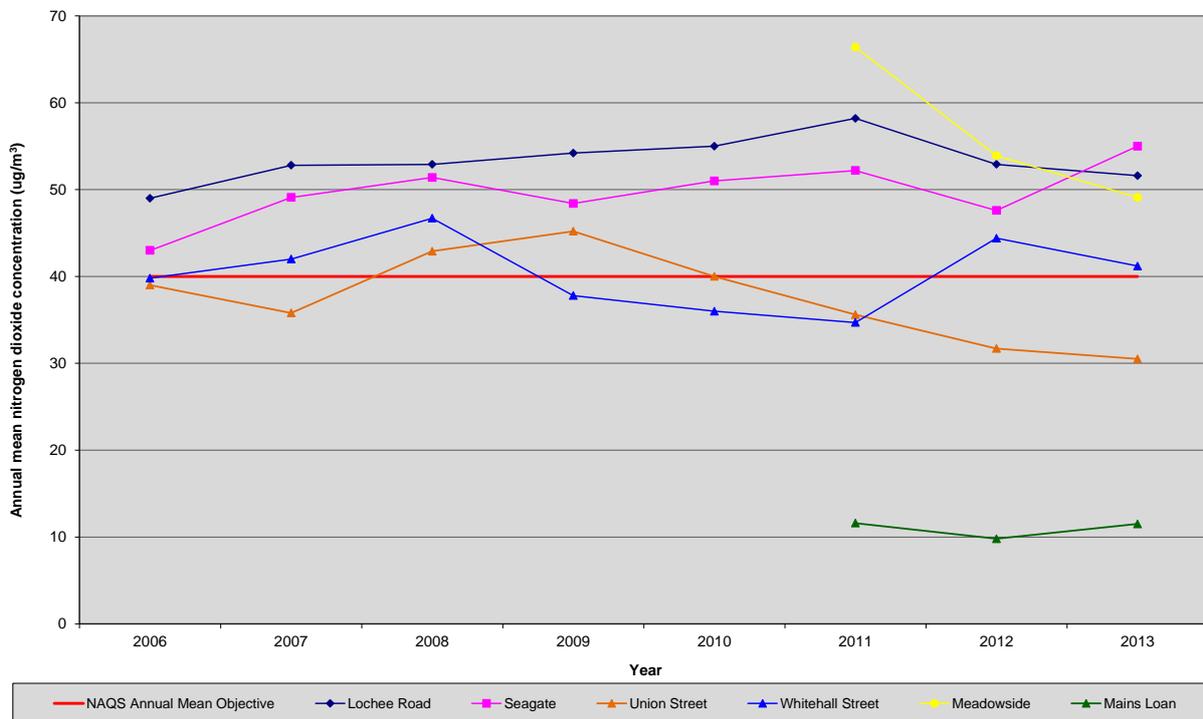
<sup>c</sup> Exceedences of the air quality objectives are shown in bold

\* indicates less than 90% data capture - for a strict comparison against the objectives data capture should be > 90% throughout the calendar year

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 2013**



**Figure 2.4 Number of Exceedences of the NO<sub>2</sub> Hourly Mean Standard (200µg/m<sup>3</sup>) (18 Allowed) at Real Time Monitoring Locations in Dundee between 2006 and 2013**

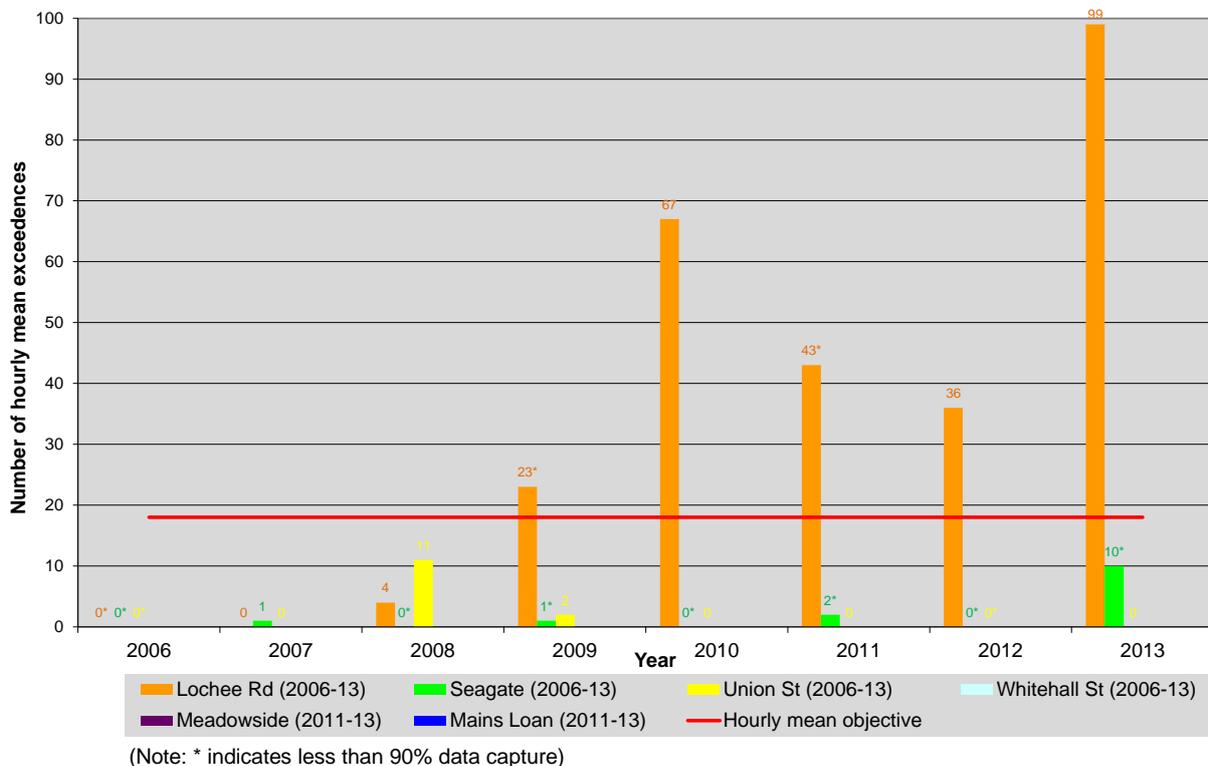
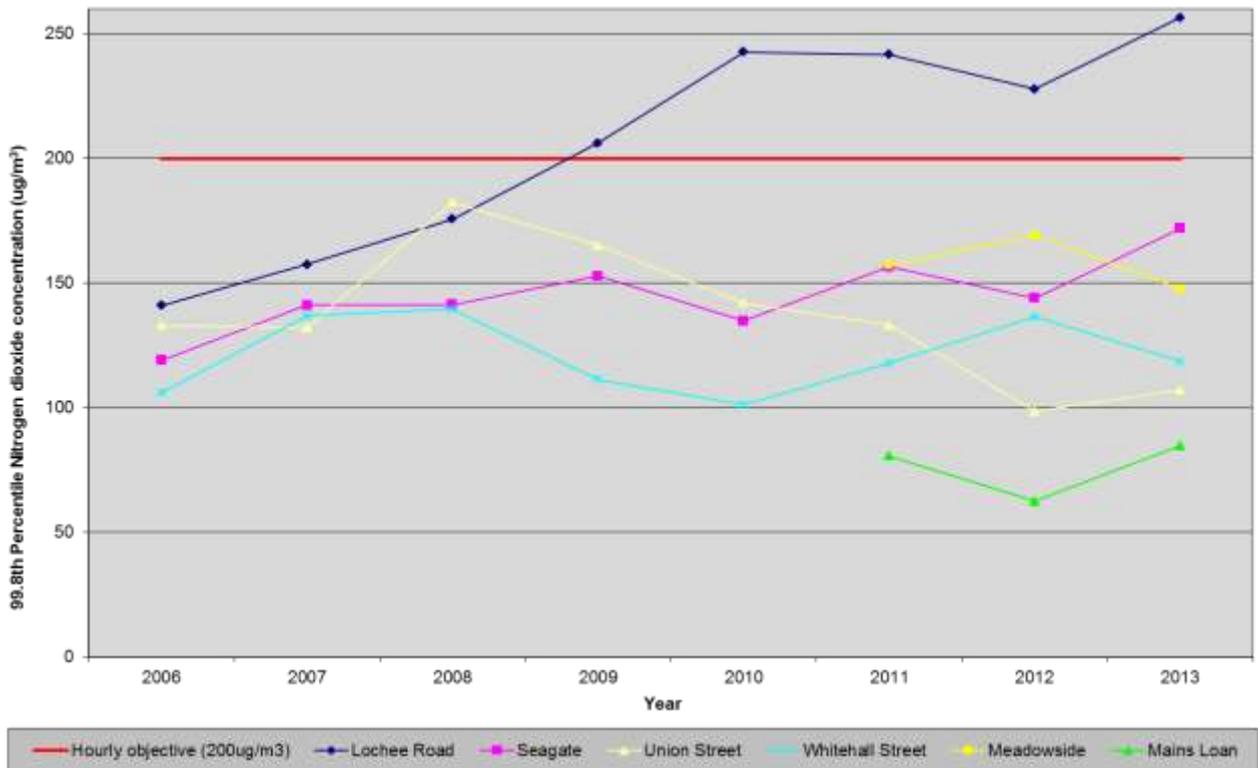
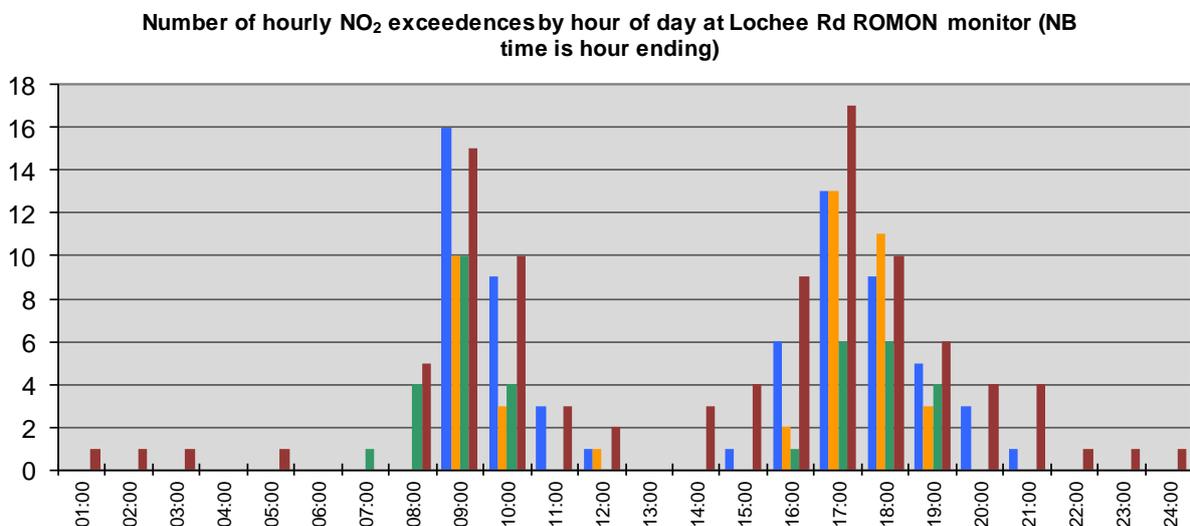
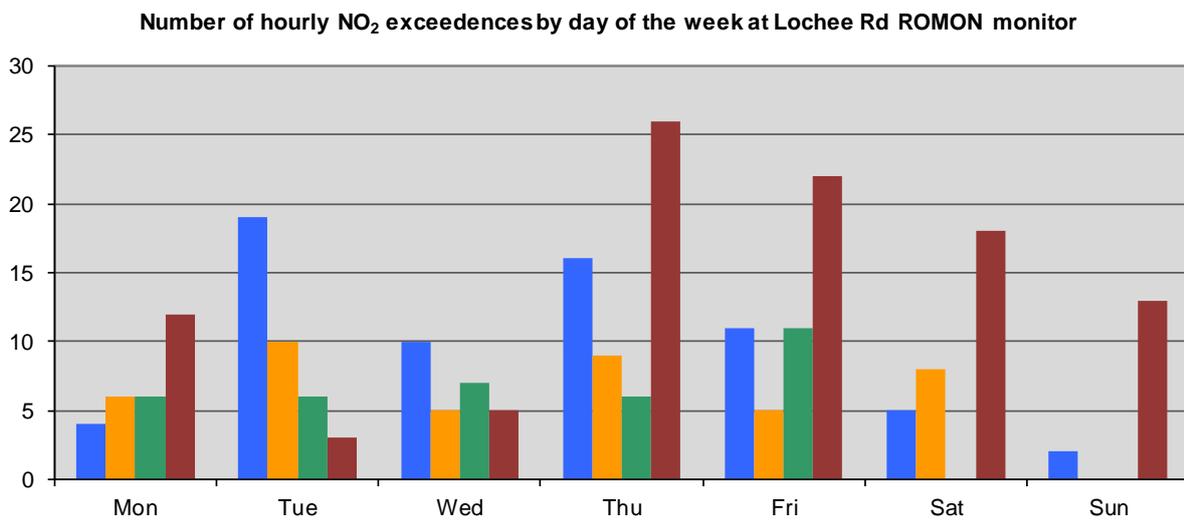
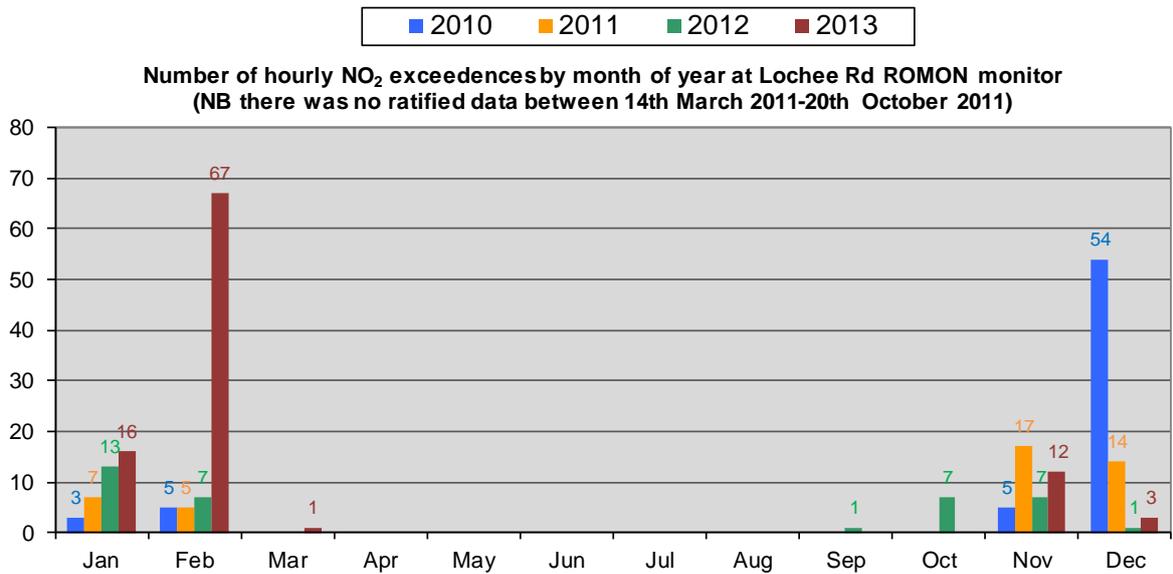


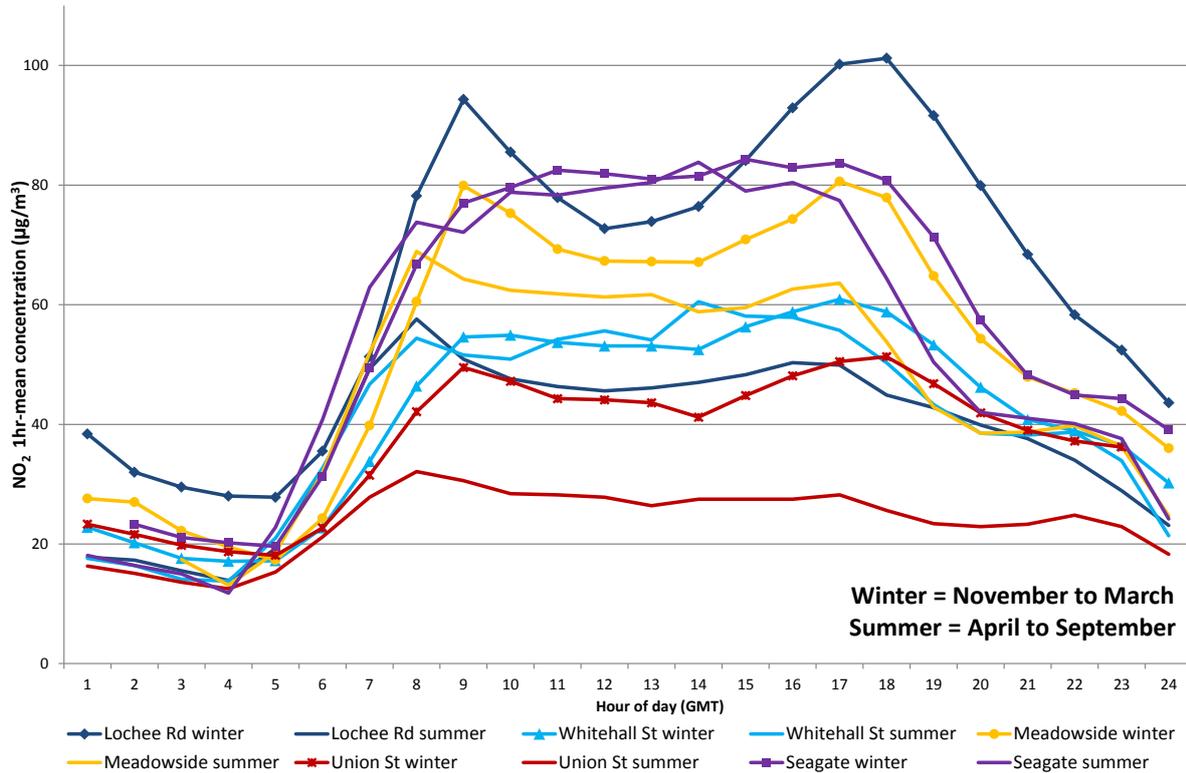
Figure 2.5 Overview of 99.8th Percentile values of NO<sub>2</sub> Hourly Mean compared with the short-term standard (200µg/m<sup>3</sup>), 2006-2013



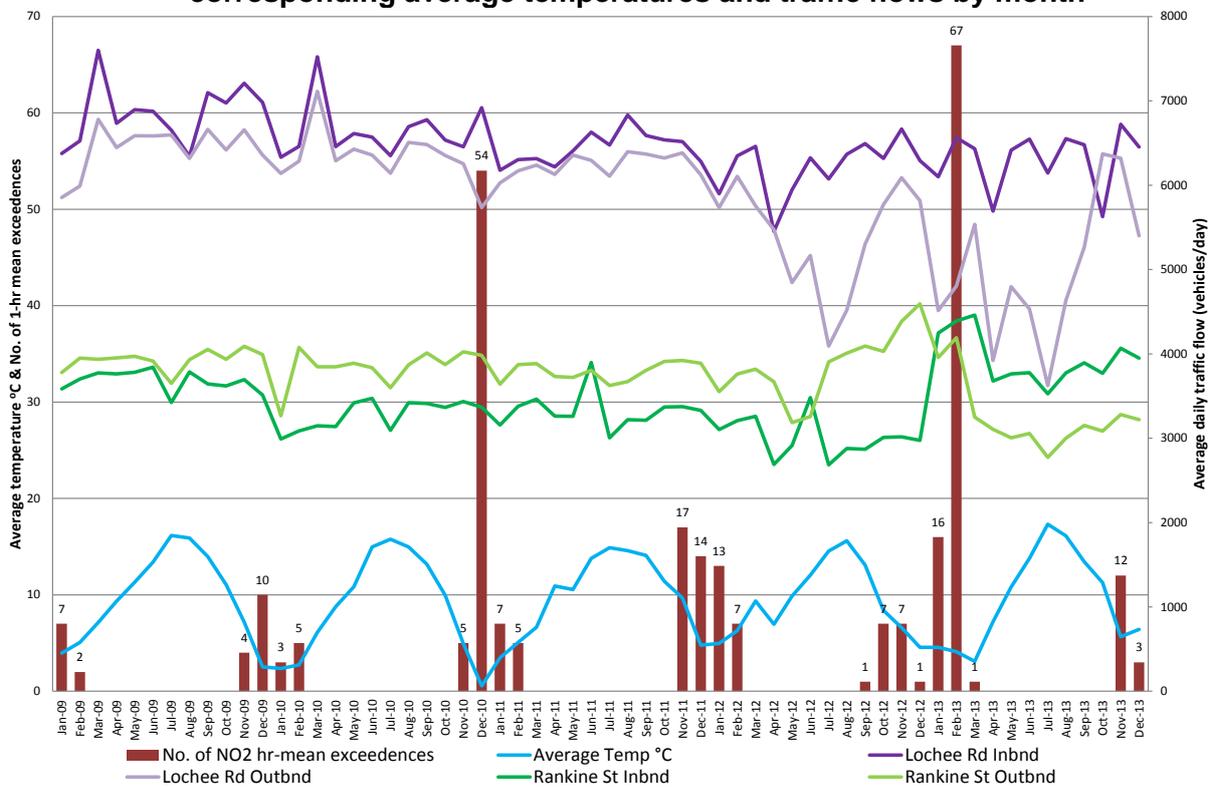
**Figure 2.6 Analysis of the Frequency of Exceedences of the Hourly NO<sub>2</sub> Objective at Automatic Monitoring Site on Lochee Road**



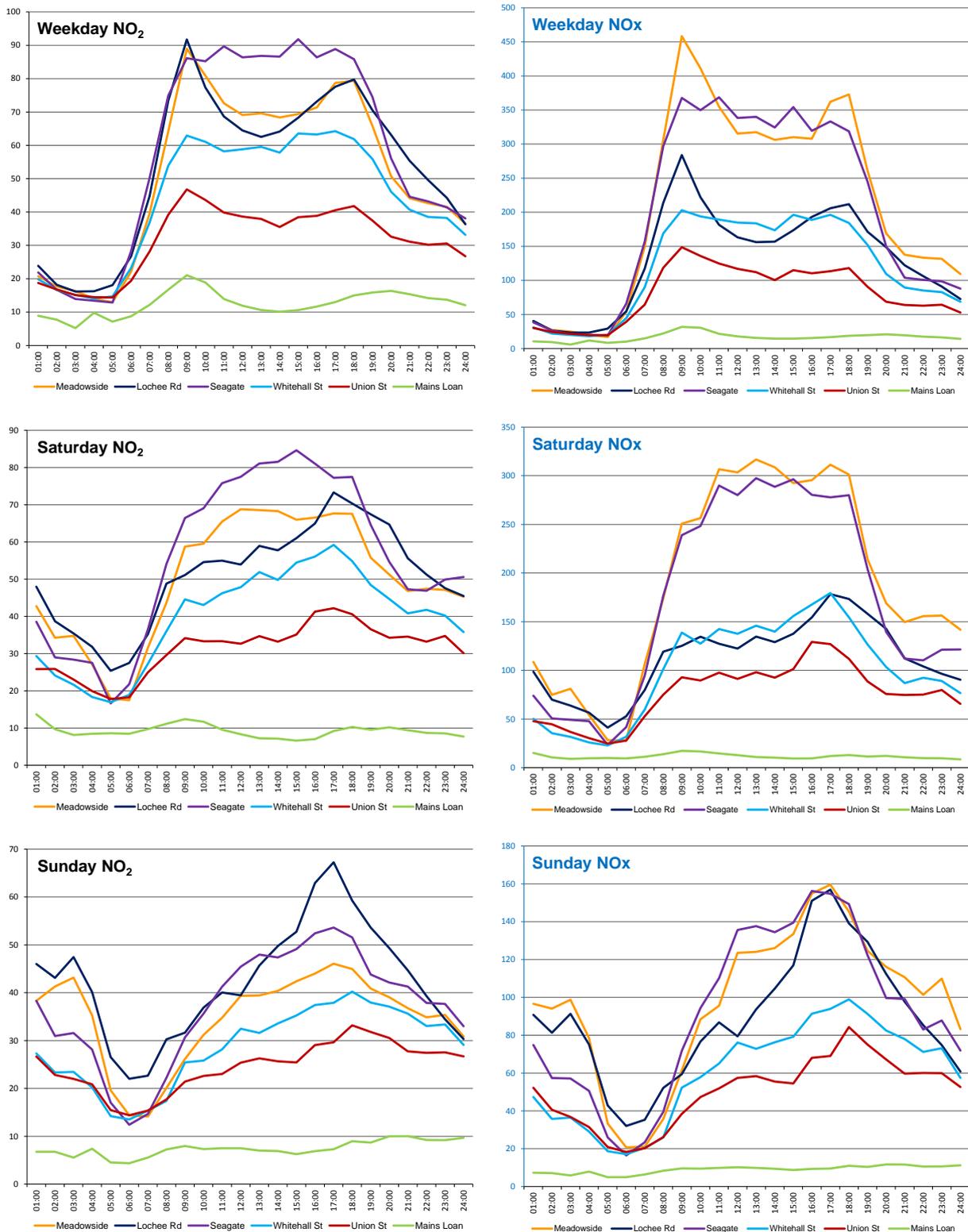
**Figure 2.7 Comparison of winter and summer diurnal profiles of NO<sub>2</sub> at roadside sites (NB all data is recorded as hour-ending and in GMT)**



**Figure 2.8 Comparison of Lochee Road hourly exceedences 2009-13 with corresponding average temperatures and traffic flows by month**



**Figure 2.9 Weekday, Saturday and Sunday Diurnal patterns of Hourly mean NO<sub>x</sub> & NO<sub>2</sub> (µg/m<sup>3</sup>) at 5 Roadside sites and 1 Urban Background Location**



**Notes:**  
 All GMT monitoring data adjusted for daylight saving (31/3/2013, 01:00 to 27/10/2013, 02:00)  
 Times are for hour ending  
 Note the different scales on the y-axes

**Figure 2.10 Comparison of weekday, Saturday and Sunday diurnal patterns of hourly mean Lochee Rd NO<sub>2</sub> with traffic flows (vehicles/hr) for Lochee Road and Rankine Street (inbound & outbound)**

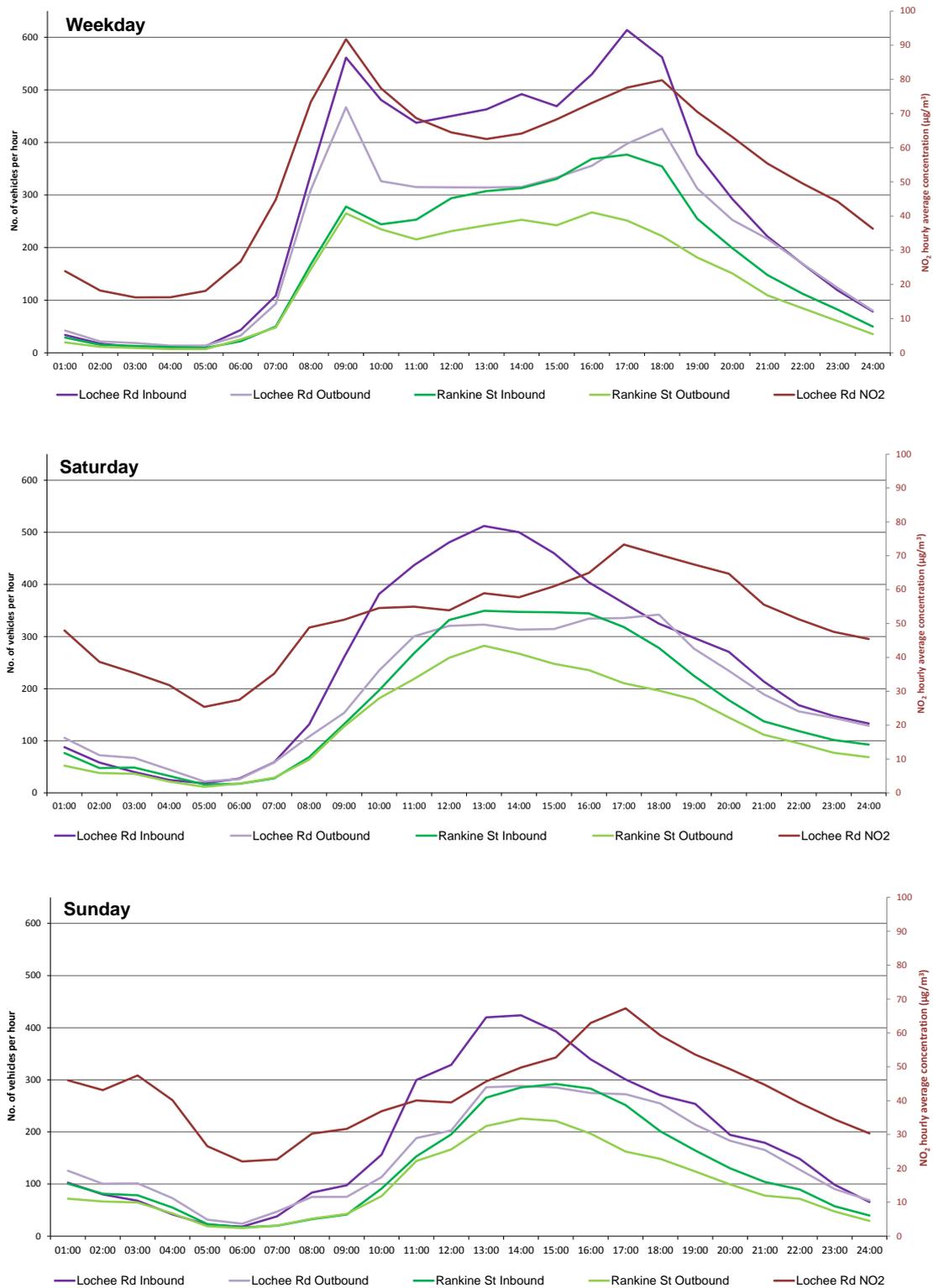


Figure 2.11 Comparisons of daily NO<sub>2</sub> concentrations at Lochee Road with daily temperatures and nearby traffic flows in 2013



### 2.2.1.2 Diffusion Tube Monitoring Data

The nitrogen dioxide diffusion tube results for 2013 are summarised in the **Table 2.6**. The full 2013 dataset (monthly mean values) is included in **Appendix G**. Four of the diffusion tube locations had less than 9 months data in 2013 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 (**0.87**) derived for Dundee sites has been applied to the 2013 results. **Appendix A1-A3** details how the local bias correction factor was derived.

The 2013 data show that concentrations measured at 23 diffusion tube sites exceeded the annual mean NO<sub>2</sub> 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 13 sites. At least, a further 16 locations were at risk of exceeding the objective (i.e >36µg/m<sup>3</sup>) when predicted to façade.

One new potential exceedence area was identified at West Marketgait near Guthrie Street (DT 183) 43.6 µg/m<sup>3</sup> when predicted to façade. This diffusion tube is located on the inner ring road (A991).

The LAQM.TG(09) guidance considers that there could be a potential risk of breaching the hourly NO<sub>2</sub> standard, where the annual mean NO<sub>2</sub> concentration is greater than (>) 60µg/m<sup>3</sup>. There were no diffusion tubes with an annual mean NO<sub>2</sub> concentration >60µg/m<sup>3</sup> at façade in 2013.

Table 2.6 Results of Nitrogen Dioxide Diffusion Tubes in 2013

Site Id.	Location	x	y	Site Type	Annual mean NO2 conc ( $\mu\text{g}/\text{m}^3$ ) adjusted for bias								2013 Data Capture %	2013 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)	2013 bias (0.87)		
DT 1	Abertay	340047	730629	K	42.5	46.5	48.5							
DT 92	Abertay 2	340019	730612	R				47.2	42.5	40.1	41.5	40.2	100.0	36.7
DT 179	Albert Street (15) (Facade)	341092	731121	R								36.5	91.7	36.1
DT 180	Albert Street (15) (Roadside)	341091	731121	K								38.0	100.0	33.1
DT 167	Albert Street (191)	341161	731535	K								36.5	100.0	31.1
DT 157	Albert Street (71-73)	341106	731223	K						29.7	30.4			
DT 187	Albert Street (81)	341113	731265	K								31.8	100.0	27.4
DT 2	Albert Street (Fish)	341139	731476	K	30.0	30.7	32.8	34.7	33.9	29.2	31.7			
DT 3	Albert Street (Shandon Place)	341171	731574	R	32.3	34.3	39.0	39.0	38.2	35.1	35.7			
DT 4	Albert Street 1	341104	731210	K	32.1	33.0	37.9	37.4	36.0					
DT 5	Arbroath Road (13)	341111	731070	K	37.4	38.0	40.2	45.4	40.8	36.6	39.9	38.3	100.0	32.9
DT 168	Arbroath Road (27)	341223	731089	R								34.1	100.0	31.2
DT 147	Arbroath Road (38)	341202	731097	K						34.6	39.4	37.6	100.0	31.3
DT 6	Arthurstone Terrace (10)	341051	731203	K	22.6	23.1	25.4	25.2	24.9	21.4	22.3			
DT 7	Balgavies Place	343082	731465	UB	15.3	17.6	18.9	18.6	19.1	17.1	18.0	17.0	100.0	n/a
DT 8	Bank St/ Reform St	340228	730337	K	26.4	29.4	28.2	30.9	27.7	26.6	28.0			
DT 9	Birnam Place	337531	730914	UB	9.6	10.8	11.7	11.0	11.4	9.6	10.4	10.1	100.0	n/a
DT 10	Brook Street (B.F.)	346293	730872	K	21.8	22.9	23.1							
DT 144	Broughty Ferry Rd LP 59	343129	731082	R						22.2				
DT 166	Broughty Ferry Rd LP 59(2)	343129	731081	R							26.1	25.6	100.0	24.1
DT 140	Broughty Ferry Rd (L/P 66)	343297	731096	R						34.2	35.4	31.8	100.0	27.0
DT 139	Broughty Ferry Rd (141 Downpipe)	343317	731072	R						36.5	37.4	32.4	100.0	32.2
DT 11	Broughty Ferry Road (141)	343322	731073	R	35.6	40.4	45.3	46.9	44.2	42.5	44.2	39.9	100.0	35.9
DT 145	Broughty Ferry Rd (Greendykes)	342662	731112	R						32.6	36.2	36.4	100.0	31.2
DT 142	Broughty Ferry Rd (St. Sign)	343302	731075	R						27.3	32.2	30.4	100.0	30.3
DT 141	Broughty Ferry Rd Lower (L/P 5)	343415	730944	UB						17.1				

Site Id.	Location	x	y	Site Type	Annual mean NO2 conc (µg/m <sup>3</sup> ) adjusted for bias								2013 Data Capture %	2013 Annual mean NO2 at receptor (µg/m <sup>3</sup> )	
					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)	2013 bias (0.87)			
DT 164	Broughty Ferry Rd - Lower	343545	730942	UB								16.7	15.6	100.0	n/a
DT 155	Carolina Court	342353	731058	UB								22.5	21.6	100.0	n/a
DT 186	Carolina Court 30 mph sign	342342	731083	R									28.6	58.3	28.8
DT 171	Claypotts / Arbroath Road (502)	345347	732080	R									28.6	91.7	27.1
DT 12	Claypotts Junction	345315	732103	R	22.7	24.6	28.0	27.5	29.0	25.4	26.5				
DT 174	Clelington Road (172)	339974	732147	K								31.4	25.0	27.8	
DT 13	Clelington Road/ Forfar Road	341385	732121	K	33.5	36.8	38.5	40.7	39.8	34.7	38.0	36.4	100.0	28.2	
DT 14	Commercial St	340328	730431	K	31.3	33.5	36.2	34.2	31.2	27.8	29.9				
DT 84	Commercial St/Dock St 2	340565	730263	R	35.6	38.6	41.9	42.2	41.3	37.6	41.2	40.1	91.7	39.7	
DT 188	Commercial Street (9)	340544	730291	R								43.1	100.0	39.1	
DT 15	Commercial Street (Waterstones)	340481	730325	R	34.9	40.2	47.4	43.2	43.3	38.0	39.5				
DT 175	Coupar Angus Road (38)	337414	732164	R								32.9	91.7	30.5	
DT 16	Crichton St	340331	730162	K	28.6	31.6	34.0	33.7	31.3	29.0	31.6				
DT 17	Dens Road Crossing	340725	731238	R	30.2	35.2	36.0	36.6	34.9	31.7	32.8	32.1	100.0	29.1	
DT 18	Dock St (14)	340395	730086	K	37.1	46.7	43.8	43.1	42.0	36.3	33.1				
DT 156	Dock St (57)	340656	730343	R						43.4	53.1	53.9	100.0	46.8	
DT 148	Dock St - Tay Hotel	340340	730033	K							32.9				
DT 19	Dock St (Unicorn)(No.60)	340659	730348	R	33.3	37.6	40.8	39.6	42.2	36.3					
DT 85	Dock St Carol Whyte (2)	340524	730216	R	36.3	37.8	37.5	38.2	38.3	34.2	40.8	42.6	91.7	42.1	
DT 169	Dura Street (30)	341021	731434	R								29.6	100.0	29.2	
DT 20	Dura Street (Forte) (No.98)	341150	731576	K	34.0	39.4	41.6	43.0	41.1	36.4	39.6	36.9	100.0	32.5	
DT 21	Earl Grey Place (Park)	340699	730019	UB	20.2	20.6	20.7	21.8	23.2	19.4	22.8				
DT 22	Eastport Roundabout	340651	730623	R	30.5	35.5	35.9	35.2	34.4	33.1	32.0	35.2	100.0	32.1	
DT 83	Forfar Road	341437	732360	K	40.2	45.7	50.2	52.6	49.1	45.6	50.2	45.9	100.0	33.3	
DT 23	Harefield Road (35)	338360	731855	K	29.2	32.6	36.0	32.5	29.8	27.7	29.8				
DT 178	Hawkhill / Horsewater Wynd	339576	730223	K								29.6	75.0	25.9	
DT 154	High Street Lochee (106)	337900	731560	R							23.2				

Site Id.	Location	x	y	Site Type	Annual mean NO2 conc ( $\mu\text{g}/\text{m}^3$ ) adjusted for bias								2013 Data Capture %	2013 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)	2013 bias (0.87)		
DT 24	Hilltown (Suites)	340088	731116	R	31.0	33.2	35.4	35.6	34.2	29.5	32.4			
DT 25	King St (12 & 14)	340598	730757	K	26.4	28.7	30.1	31.1	29.1	26.5	27.2			
DT 177	Kingsway / Strathmartine Road (279)	339179	732896	R								38.3	100.0	34.4
DT 26	Kingsway E. Roundabout	343107	731740	R	33.9	40.0	42.6	44.9	40.7	40.7	40.3	39.5	100.0	30.2
DT 27	Kingsway/ Mains Loan 1	341124	732468	R	29.9	34.1	37.8	35.1	36.7	31.3	34.4	36.4	100.0	29.5
DT 28	Kingsway/ Pitkerro Rd	341963	732303	R	26.6	30.7	26.7							
DT 29	Kingsway/ Strathmartine Rd (S)	339221	732836	K	37.4	43.3	45.0	43.2	46.3	39.4	45.9			
DT 30	Lochee Rd (138)	338936	730680	K	45.5	52.6	57.4	56.9	56.9	52.7	53.4	51.2	100.0	41.5
DT 31	Lochee Rd (140) Traffic Lts	338927	730685	R	45.3	53.4	57.0	57.2	57.4	51.9	54.8	52.8	100.0	51.9
DT 32	Lochee Rd (184)	338767	730856	K	31.9	38.1	39.1	40.2	39.7	36.9	37.6	36.1	100.0	30.7
DT 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	44.4	100.0	39.4
DT 36	Lochee Rd/Polepark Rd	339016	730586	K	26.8	30.9	32.3	33.9	33.4	29.0	31.8	29.6	100.0	24.6
DT 37	Logie Street (114)	338184	731293	R	46.9	52.2	58.2	57.0	56.9	53.7	54.6	54.8	100.0	52.6
DT 38	Logie Street (98)	338252	731258	K	32.7	35.2	34.5	35.0	33.4	31.9	34.5	37.5	75.0	34.2
DT 176	Logie Street / Grays Lane	338062	731366	R								24.1	100.0	23.7
DT 39	Loons Road (1)	338211	731293	R	36.1	39.1	45.3	43.9	44.8	38.4	42.0	40.3	100.0	39.2
DT 146	Mains Loan mean of 3 tubes	340972	731893	UB						12.2	15.0			
DT 40	Marketgait	339953	730094	R	29.3	33.0	35.8	34.7	32.5	30.8	31.1			
DT 41	Meadowside	340245	730651	R	52.1	61.4	63.5	55.8	57.2	53.0	59.0			
DT 163	Meadowside - Bell St	340282	730592	K							49.1			
DT 182	Meadowside (28)	340298	730550	K								38.4	91.7	32.7
DT 149	Meadowside (Romon) mean of 3 tubes	340243	730653	R						56.4	56.9	49.9	100.0	48.7
DT 170	Monifieth Road (4)	346554	730919	R								25.2	91.7	24.0
DT 42	Muirton Road (6)	338152	731293	R	26.1	28.4	29.2	30.4	30.4	26.5	27.2	30.0	83.3	29.4
DT 185	Murraygate (46)	340409	730484	UB								25.9	83.3	n/a
DT 43	Myrekirk Road	335420	731733	K	27.5	32.9	32.3	35.1	34.9	29.5	34.2			
DT 189	Myrekirk Road (29)	335420	731726	R								34.8	75.0	30.1

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Site Id.	Location	x	y	Site Type	Annual mean NO2 conc ( $\mu\text{g}/\text{m}^3$ ) adjusted for bias								2013 Data Capture %	2013 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)	2013 bias (0.87)			
DT 181	Myrekirk Terrace (8)	335458	731767	R									30.4	100.0	29.8
DT 44	Nethergate (B&B)(88)	340163	730061	K	40.0	43.1	49.1	48.6	48.1	44.8	50.2	48.4		100.0	37.4
DT 45	Nethergate (Bradford)	340274	730171	R	35.8	37.4	43.2	41.9	38.7	38.0	42.3	41.7		100.0	36.4
DT 46	Nethergate (Charlie T)	340033	729957	K	34.8	39.1	38.4	38.2	37.5	32.5	35.9	34.3		100.0	30.9
DT 47	Nethergate (Trades House)	340230	730124	R	34.5	39.6	44.6	41.8	38.9	38.1	42.5	45.0		100.0	38.7
DT 87	Nethergate/South Tay St	339987	729919	R	25.4	29.6	30.1	29.3	29.8	24.4	24.5				
DT 48	Nethergate/ Marketgait	340074	729984	R	29.8	36.0	35.2	35.4	33.9	30.2	33.5	32.5		100.0	28.7
DT 173	Old Glamis Road(9) / Balgray Street	339941	732251	K								24.3		100.0	23.3
DT 86	Perth Rd / Hawkhill	338742	729828	K	23.5	25.0	22.9								
DT 91	Perth Rd 320	338776	729798	K			36.5	39.9	37.6	36.0	36.3	37.1		100.0	30.0
DT 172	Pitkerro Road (3)	341227	731629	R								29.6		91.7	28.2
DT 88	Queen St B/F	346207	731007	R			29.8	31.3	30.1	25.1	27.7				
DT 49	Rankine St (2)	338768	730900	R	31.7	39.9	42.6	44.9	45.5	40.5	44.4	40.1		100.0	39.1
DT 50	Seagate	340545	730532	R	39.0	42.3	45.9	44.9	42.3	40.2	39.4	41.9		100.0	41.4
DT 150	Seagate 95-97	340511	730492	R						46.2	51.4	40.7		25.0	40.3
DT 190	Seagate (97)	340516	730499	R								59.4		58.3	59.4
DT 54	Seagate (Yates)(7-9)	340487	730446	R	35.1	40.5	38.3	41.5	39.4	35.6	38.4	38.1		100.0	36.3
DT 159	Seagate(Romon) mean of 3 tubes	340467	730388	K	42.3	47.5	50.8	51.4	48.9	45.0	49.2	48.0		100.0	42.6
DT 55	Soapwork Lane	340099	730650	R	29.6	35.0	35.8	36.9	35.4	32.8	34.8	34.7		100.0	34.7
DT 151	South Road (Denbank)	335188	731528	R						34.6	36.9	34.7		91.7	34.2
DT 56	St Andrews St (JAF)	340516	730584	K	32.7	34.8	40.4	36.9	36.7	33.5	36.2	37.3		100.0	33.0
DT 57	St Andrews St (PB)	340532	730551	K	35.0	41.5	41.6	41.5	40.4	38.1					
DT 162	St Andrews St PB (façade)	340532	730548	R							38.8	36.4		100.0	36.1
DT 58	St Mary Flats	339039	730624	R	18.4	20.6	19.8								
DT 153	Strathmore Ave - Ped X	339667	731878	R						26.7	29.4				
DT 152	Strathmore Avenue - 337	339522	731875	K						29.9	35.0				
DT 59	Strathmore Avenue (353)	339609	731871	K	35.0	38.0	42.6	40.3	39.9	35.5	38.8	38.0		100.0	33.9

Site Id.	Location	x	y	Site Type	Annual mean NO2 conc (µg/m <sup>3</sup> ) adjusted for bias								2013 Data Capture %	2013 Annual mean NO2 at receptor (µg/m <sup>3</sup> )
					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)	2013 bias (0.87)		
DT 60	Trades Lane (31)	340575	730500	K	29.2	36.3	33.3	32.8	32.6	29.4	30.4	31.4	100.0	28.0
DT 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	34.8	100.0	30.5
DT 64	Union Street (Goodfellows)	340274	730069	K	28.2	32.4	34.1	32.6	32.1	26.9				
DT 65	Union Street (McIntyres)	340293	730051	K	29.0	32.7	33.2	33.5	32.8	28.9				
DT 66	Victoria Road	340212	730633	R	32.1	36.7	38.4	37.5	36.2	30.9	34.2			
DT 67	Victoria Road (10)	340225	730667	R	29.7	32.9	34.0							
DT 184	Victoria Road (104) / William Street	340697	730950	R								33.3	100.0	31.0
DT 191	Victoria Road (4) - India Buildings	340213	730633	R								32.7	100.0	32.7
DT 68	Victoria Road (60)	340375	730779	R	35.2	41.1	43.8	44.0	40.8	38.6	42.2	39.8	100.0	38.6
DT 93	Victoria Road (OSIRIS)	340230	730673	K				38.5	37.5	33.8	36.2	34.0	100.0	28.5
DT 69	Victoria Road / Cotton Road	340740	730996	K	31.3	36.6	37.4	38.1	36.5	34.0	36.7			
DT 70	Victoria Road/Hilltown	340274	730714	R	47.8	55.8	60.9	59.5	57.9	52.8	57.9	56.1	100.0	48.3
DT 71	Victoria St/Albert St	341071	731072	K	31.7	34.1	35.2	36.5	35.2	33.8	34.8	32.2	100.0	29.3
DT 90	Ward Rd	339893	730336	R			34.5	35.7	33.3	32.4	30.2	30.3	100.0	29.6
DT 89	West Bell St	339815	730395	R			36.0							
DT 95	West Marketgait	339814	730380	K				44.1	38.2	35.0	37.2			
DT 183	West Marketgait / Guthrie Street	339805	730338	R								50.7	100.0	44.1
DT 72	Westport (2)	339842	730122	R	33.6	38.9	41.3	42.1	37.5	37.0	37.7	39.0	100.0	32.6
DT 73	Whitehall Cr (Xpresso)	340376	730109	K	27.2	30.3	30.6	30.4	29.5	26.1	37.6	39.4	100.0	33.5
DT 161	Whitehall Cr - McIntyres	340305	730051	K							29.8	30.4	100.0	25.9
DT 74	Whitehall St (Brj)	340330	730106	K	32.2	36.3	37.8	35.8	35.5	33.1	39.7	39.7	100.0	32.9
DT 75	Whitehall St (Bus)	340289	730128	R	42.8	48.6	51.7	48.6	43.4	45.7	49.5	46.7	100.0	41.1
DT 76	Whitehall St (Deb A)	340265	730153	K	38.5	43.4	50.3	46.9	42.5	41.4	47.3	49.9	100.0	37.9
DT 77	Whitehall St (Deb E)	340322	730098	K	32.2	36.9	39.6	38.3	37.1	34.7	37.9	40.7	100.0	32.7
DT 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	43.1	100.0	40.6
DT 81	Whitehall St (Tiso)	340293	730142	R	34.8	38.8	42.6	40.2	37.1	35.8	39.6	41.8	100.0	38.0
DT 82	Woodside Avenue	340776	732307	UB	15.6	18.1	18.5	17.7	17.5	15.4	16.2	15.4	100.0	n/a

Notes for **Table 2.6**

- All diffusion tube are located within an AQMA for NO<sub>2</sub> and PM<sub>10</sub> annual mean. New Locations in 2013 are highlighted in pink.
- 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).
- 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, NO<sub>2</sub> concentration at the nearest relevant exposure should be estimated based on the “[NO<sub>2</sub> fall-off with distance” calculator](http://laqm.defra.gov.uk/tools-monitoring-data/no2-falloff.html) (<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 NO<sub>2</sub> 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. The average of urban background monitoring locations (Balgavies Place, Broughty Ferry Road (lower), Carolina Court, Murraygate and Woodside Avenue) was used to provide the background concentration (19.1µg/m<sup>3</sup>) for these comparisons. Background sites were selected in accordance with the selection criteria contained in Box A1.2 of LAQM.TG(09). Of the 23 sites that recorded an exceedence in 2013, 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 locations where there are diffusion tubes located at kerbside and at façade. These are on Lochee Road and Albert Street. Lochee Rd (138) (DT 38) is located at kerbside and Lochee Rd (140) (DT 31) is located close to (25cm) the residential façade nearby. When the distance calculator is used to predict the drop-off in pollutant concentrations between the two tubes it calculates that pollution levels drop from 51.2 µg/m<sup>3</sup> to 42.1 µg/m<sup>3</sup>, i.e. a drop off of 9.1 µg /m<sup>3</sup>. The actual monitored value at the façade tube was 52.8 µg/m<sup>3</sup>, an increase of 1.6 µg/m<sup>3</sup>. Albert St.(15) (Roadside) (DT 180) is located at kerbside and Albert St. (15) (Façade) is located close to (25cm) the residential façade nearby. When the distance calculator is used to predict the drop-off in pollutant concentrations between the two tubes it calculates that pollution levels drop from 38.0 µg/m<sup>3</sup> to 33.5 µg/m<sup>3</sup>, i.e. a drop off of 4.5 µg /m<sup>3</sup>. The actual monitored value at the façade tube was 36.5 µg/m<sup>3</sup>, a decrease of 1.5 µg/m<sup>3</sup>.

The following 13 sites exceeded the NAQS annual mean when the distance calculator tool was used to estimate concentrations at relevant receptors:

**Table 2.7 Predicted Exceedences of NO<sub>2</sub> Annual Mean at Façade of Receptors**

Site ID	Location	x	y	2013 Bias adjusted annual mean NO <sub>2</sub> concentration (µg/m <sup>3</sup> )	2013 Predicted annual mean NO <sub>2</sub> concentration at Receptor (µg/m <sup>3</sup> )
85	Dock St (Carol Whyte)	340524	730216	<b>42.6</b>	<b>42.1</b>
156	Dock St (57)	340656	730343	<b>53.9</b>	<b>46.8</b>
30	Lochee Rd (138)	338936	730680	<b>51.2</b>	<b>41.5</b>
31	Lochee Rd (140 Traffic Lts)	338927	730685	<b>52.8</b>	<b>51.9</b>
37	Logie St (114)	338184	731293	<b>54.8</b>	<b>52.6</b>
149	Meadowside (Romon) Average	340243	730653	<b>49.9</b>	<b>48.7</b>
50	Seagate	340545	730532	<b>41.9</b>	<b>41.4</b>
159	Seagate (Romon) Average	340487	730446	<b>48.0</b>	<b>42.6</b>
70	Victoria Rd / Hilltown	340274	730714	<b>56.1</b>	<b>48.3</b>
75	Whitehall St (Bus)	340289	730128	<b>46.7</b>	<b>41.1</b>
160	Whitehall St (Romon) Average	340278	730156	<b>43.1</b>	<b>40.6</b>
183	West Marketgait / Guthrie Street	339805	730338	<b>50.7</b>	<b>44.1</b>
190	Seagate (97)	340516	730499	<b>59.4</b>	<b>59.4</b>

A further 16 locations were close to exceeding the NAQS annual mean (>36µg/m<sup>3</sup>) when the distance calculator tool was used to estimate concentrations at relevant receptors.

**Table 2.8 Locations at risk of Exceeding NO<sub>2</sub> Annual Mean at Façade of Receptors**

Site ID	Location	x	y	2013 Bias adjusted annual mean NO <sub>2</sub> concentration (µg/m <sup>3</sup> )	2013 Predicted annual mean NO <sub>2</sub> concentration at Receptor (µg/m <sup>3</sup> )
92	Abertay 2	340019	730612	<b>40.2</b>	36.7
84	Commercial St /Dock St	340565	730263	<b>40.1</b>	39.7
158	Lochee Rd (Romon) Average	338861	730773	<b>44.4</b>	39.4
39	Loons Rd (1)	338211	731293	<b>40.3</b>	39.2
44	Nethergate (B&B)	340163	730061	<b>48.4</b>	37.4
45	Nethergate (Bradford)	340274	730171	<b>41.7</b>	36.4
47	Nethergate (Trades House)	340230	730124	<b>45.0</b>	38.7
49	Rankine St (2)	338768	730900	<b>40.1</b>	39.1
150	Seagate (95-97)	340511	730492	<b>40.7</b>	<b>40.3</b>
54	Seagate (Yates)	340467	730388	38.1	36.3
162	St Andrews St (PB) Façade	340532	730548	36.4	36.1
68	Victoria Rd (60)	340375	730779	39.8	38.6
76	Whitehall St (Deb A)	340265	730153	<b>49.9</b>	37.9
81	Whitehall St (Tiso)	340293	730142	<b>41.8</b>	38.0
179	Albert Street (15) (Facade)	341092	731121	36.5	36.1
188	Commercial Street (9)	340544	730291	<b>43.1</b>	39.1

Four of the new tubes installed in 2013 recorded concentrations that breached or were close to breaching the annual mean NAQS when predicted to façade, these are highlighted in pink in **Tables 2.7** and **2.8**.

### 2.2.1.3 Overview of Diffusion Tube NO<sub>2</sub> Concentrations in Areas of Concern

The AQMA was first declared in 2006, **Figure 2.12** shows the difference between 2006 and 2013 bias corrected diffusion tube annual mean results for those 48 tube sites that have been present for eight years. Three locations have lower concentrations than in 2006 and 45 have higher concentrations. The greatest increases in pollutant concentrations over this time period have been recorded at diffusion tubes located along the city centre bus corridor, the north-west arterial route (A923) and associated access roads, major junctions on or near the Kingsway, Stannergate roundabout and on the inner ring road.

To give a reasonable overview of how concentrations are changing, the bias-corrected diffusion tube NO<sub>2</sub> concentrations between 2006 and 2013 in areas of concern throughout the city have been plotted in **Figures 2.13 to 2.39**. 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

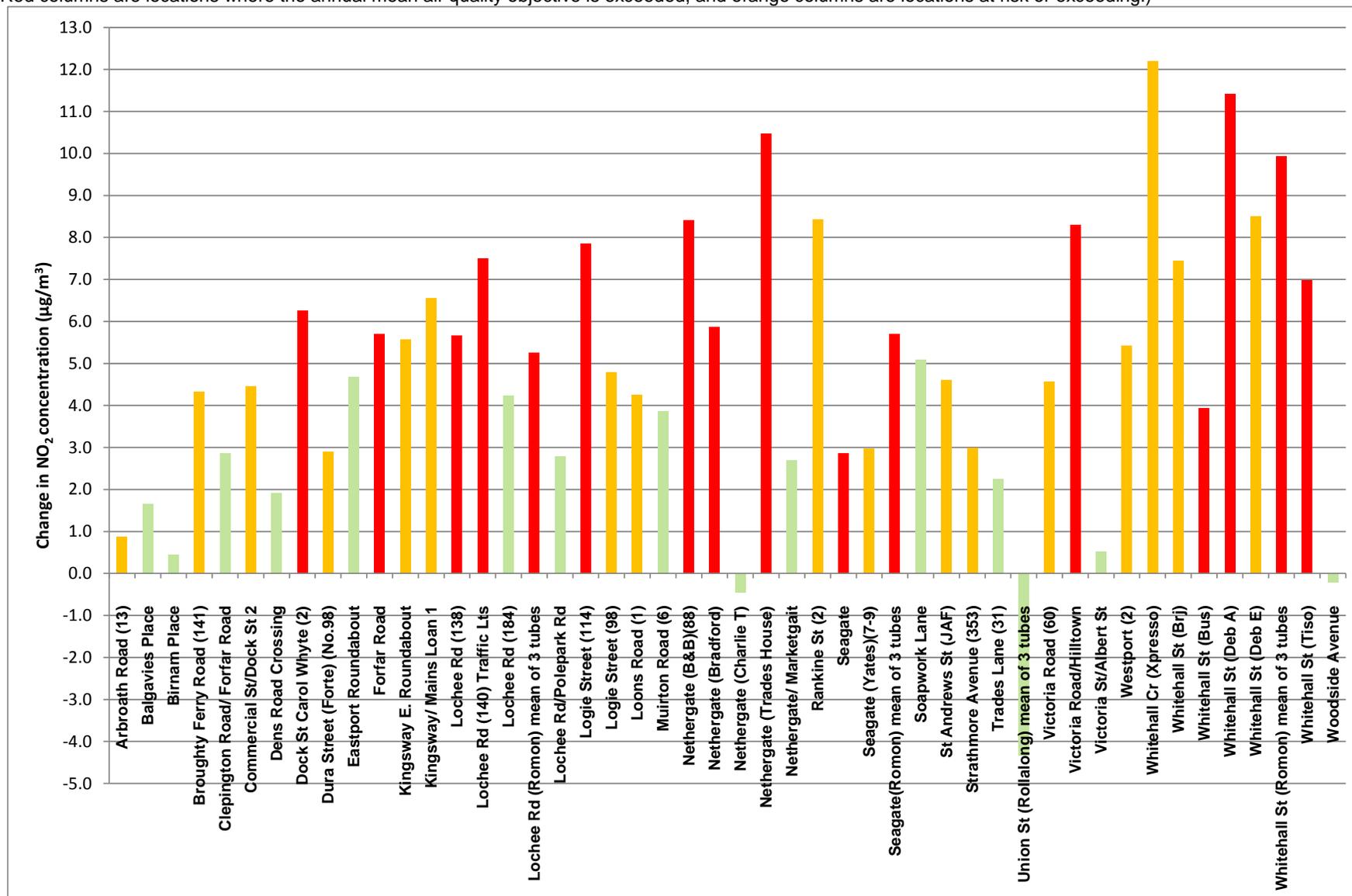
All of these locations have been described in previous review and assessment reports. A new exceedence has been identified on the inner ring road at West Marketgait (A991) near Guthrie Street.

Concentrations of NO<sub>2</sub> measured by diffusion tubes decreased at the majority of diffusion tube sites between 2012 and 2013. The largest decreases (>4µg/m<sup>3</sup>) were recorded at Stannergate Roundabout, Forfar Road near the Kingsway, Lochee Road, Rankine Street Meadowside and Seagate. The decrease seen at the tube in Seagate (DT 150) is out of keeping with the other monitoring locations in the area and may have been due to the low data capture and subsequent annualisation of this result. Of the diffusion tubes that showed an increase between 2012 and 2013, none recorded increases of more than 4µg/m<sup>3</sup>. The greatest increases (>2µg/m<sup>3</sup>) were recorded in Whitehall Street, Logie Street, Muirton Road East Port Roundabout on the inner ring road; Seagate near the bus station; Nethergate and Kingsway (A90(T)) near Mains Loan.

From the data presented in **Figures 2.13 to 2.39** it is evident that NO<sub>2</sub> concentrations do not show a consistent downward trend and in most cases concentrations remain higher in 2013 than in 2006 when the AQMA was declared.

**Figure 2.12 Change in NO<sub>2</sub> concentrations at 48 Diffusion tube monitoring locations between 2006 and 2013**

(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 2.13 NO<sub>2</sub> Monitoring Locations in Union Street and Whitehall Street

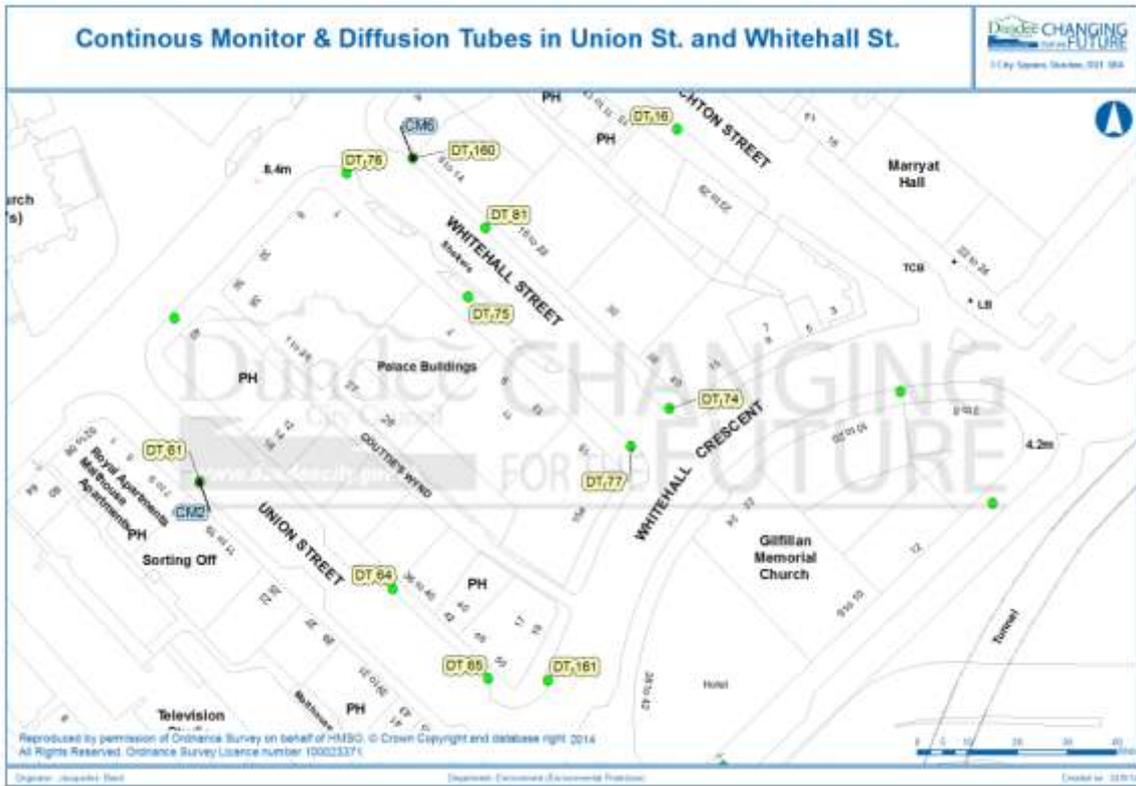
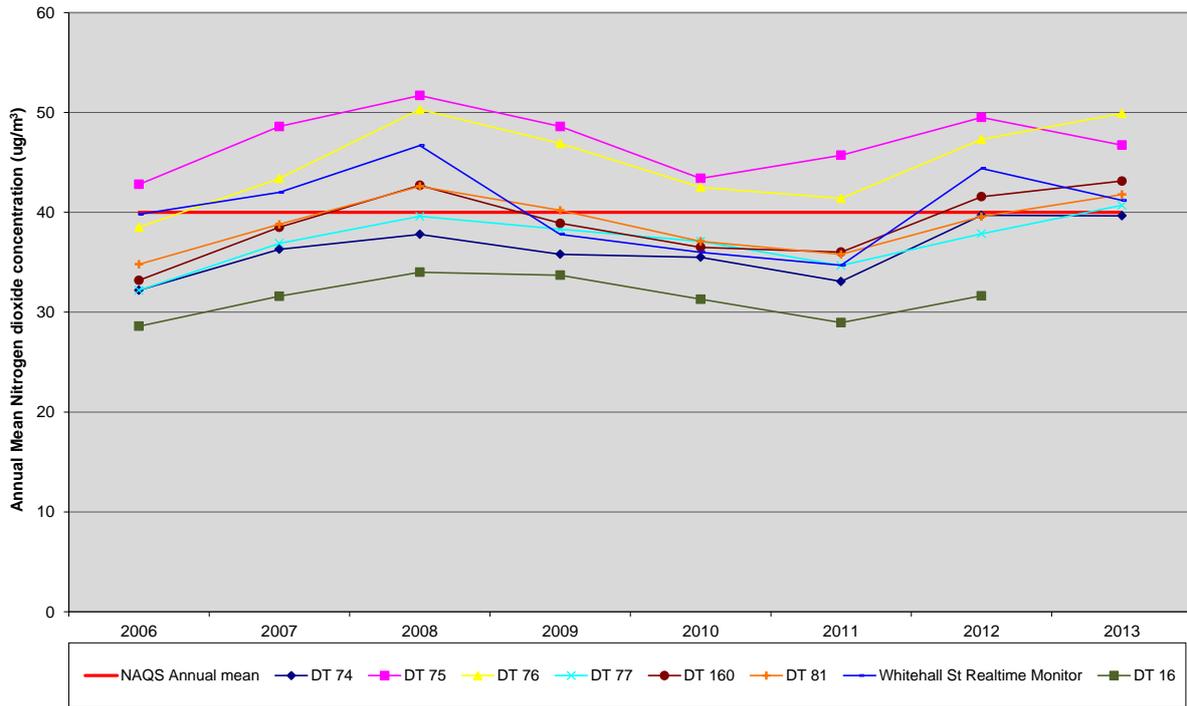


Figure 2.14 Overview of NO<sub>2</sub> Concentrations in Union St.



Figure 2.15 Overview of NO<sub>2</sub> Concentrations in Whitehall St.



Seagate

Figure 2.16 NO<sub>2</sub> Monitoring Locations in Seagate

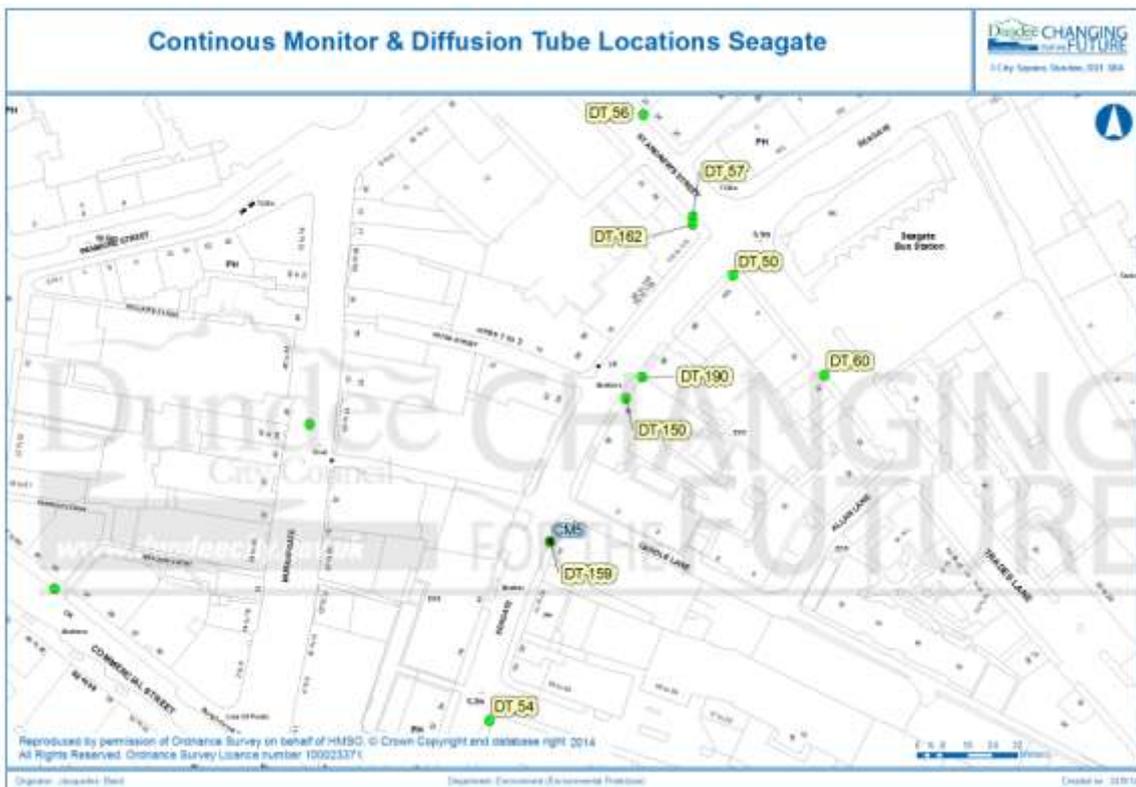
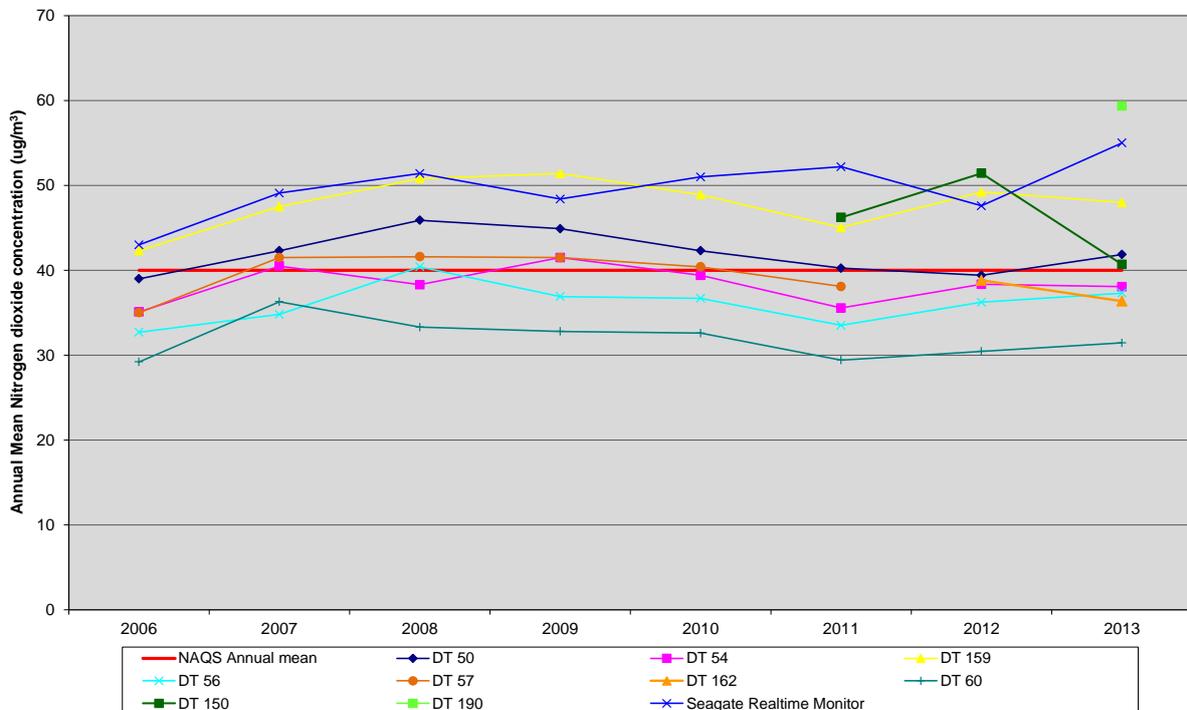


Figure 2.17 Overview of NO<sub>2</sub> Concentrations in Seagate.



Nethergate  
 Figure 2.18 NO<sub>2</sub> Diffusion Tube Locations in Nethergate

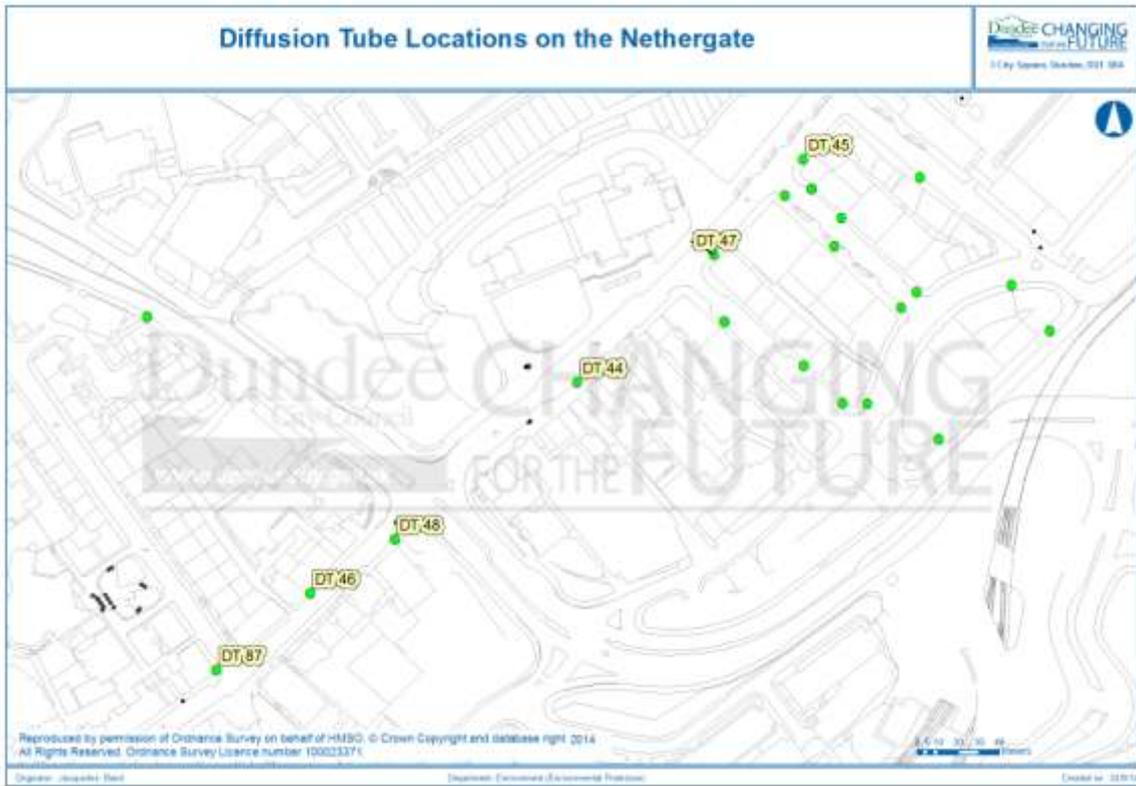
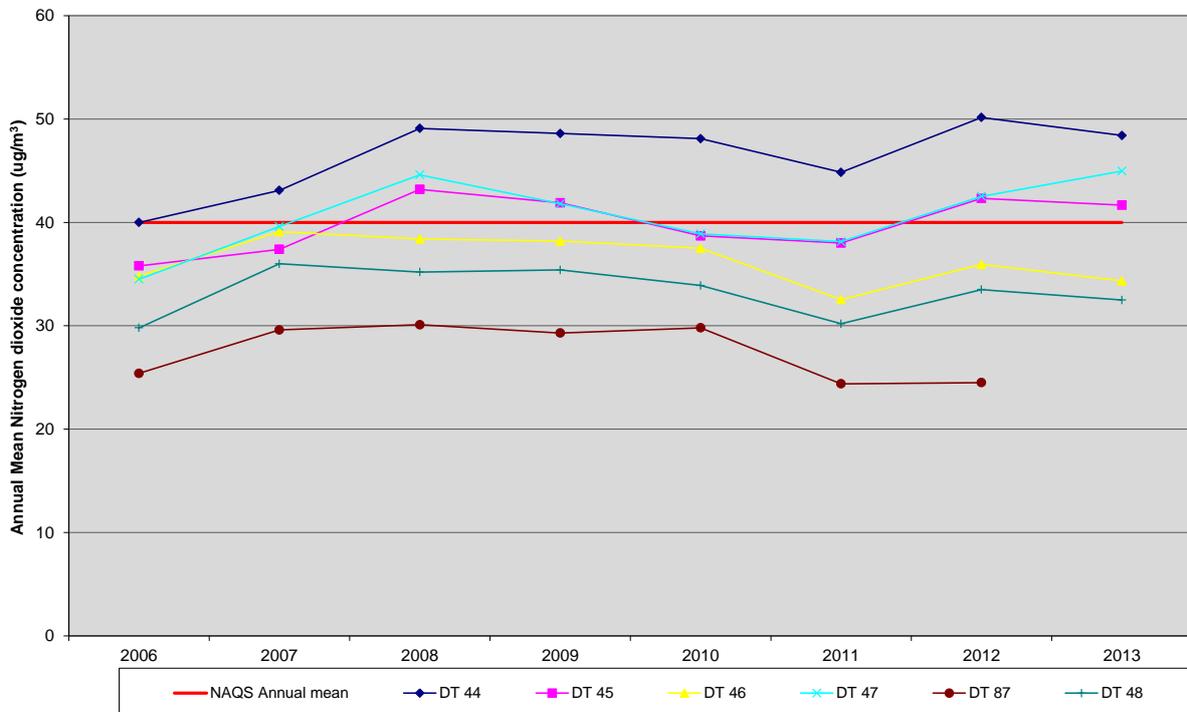


Figure 2.19 Overview of NO<sub>2</sub> Diffusion Tube Concentrations in Nethergate.



Victoria Road / Meadowside

Figure 2.20 NO<sub>2</sub> Diffusion Tube Locations in Victoria Road / Meadowside

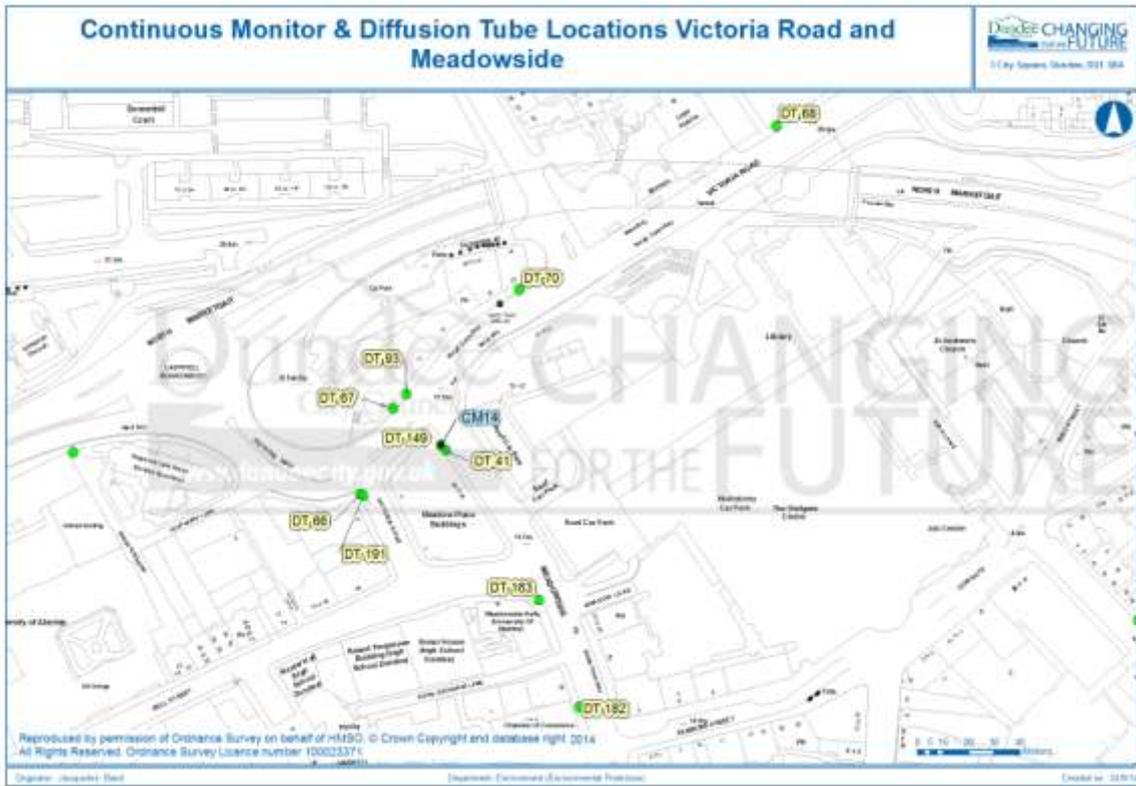
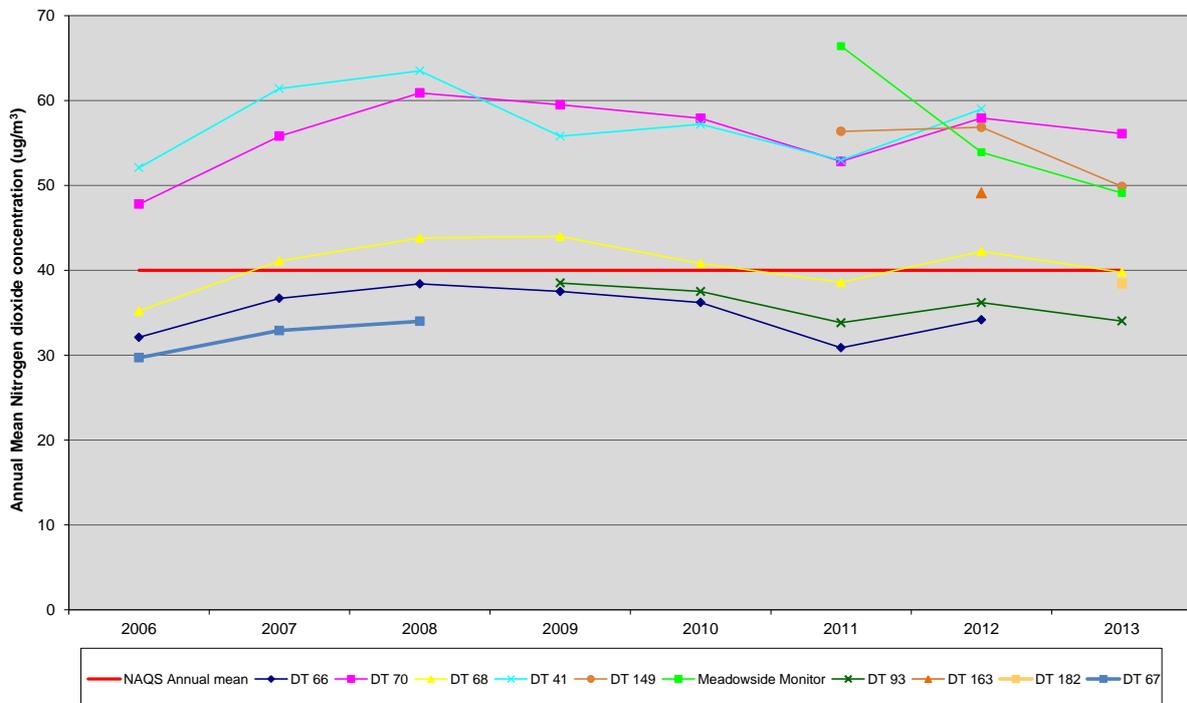


Figure 2.21 Overview of NO<sub>2</sub> Diffusion Tube Concentrations in Victoria Road / Meadowside.



Albert Street / Dura Street

Figure 2.22 NO<sub>2</sub> Diffusion Tube Locations in Albert Street / Dura Street

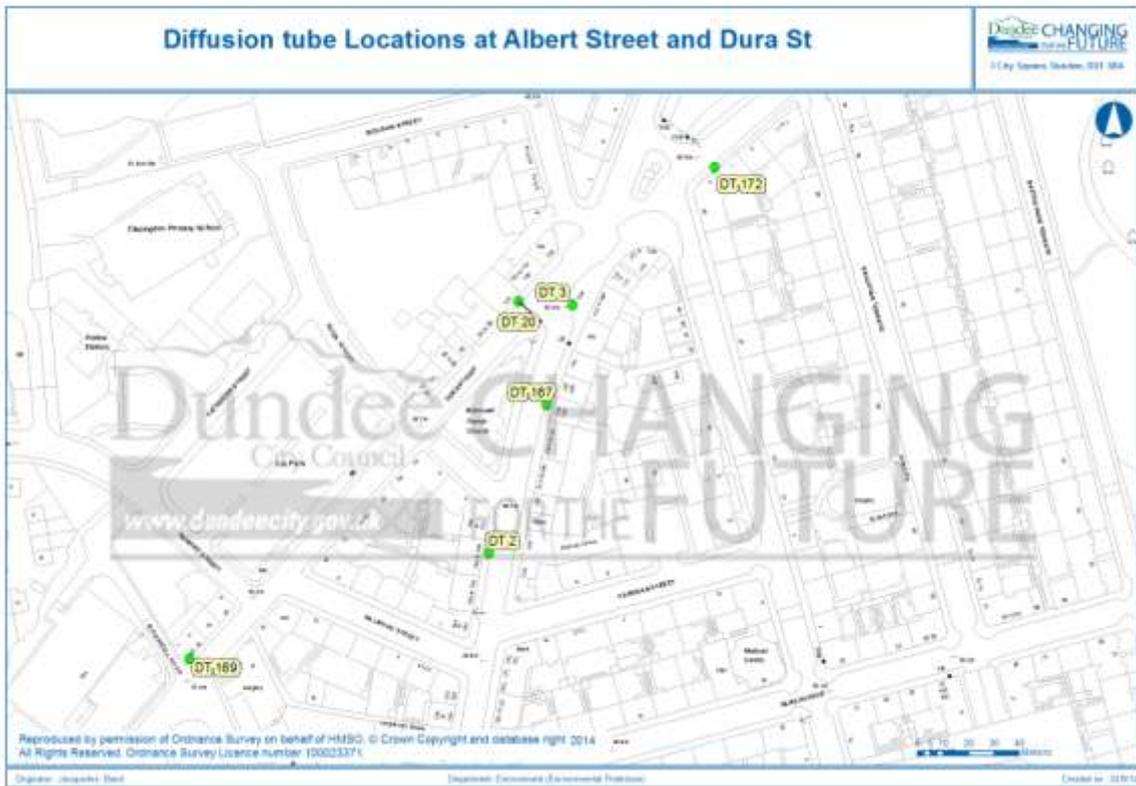
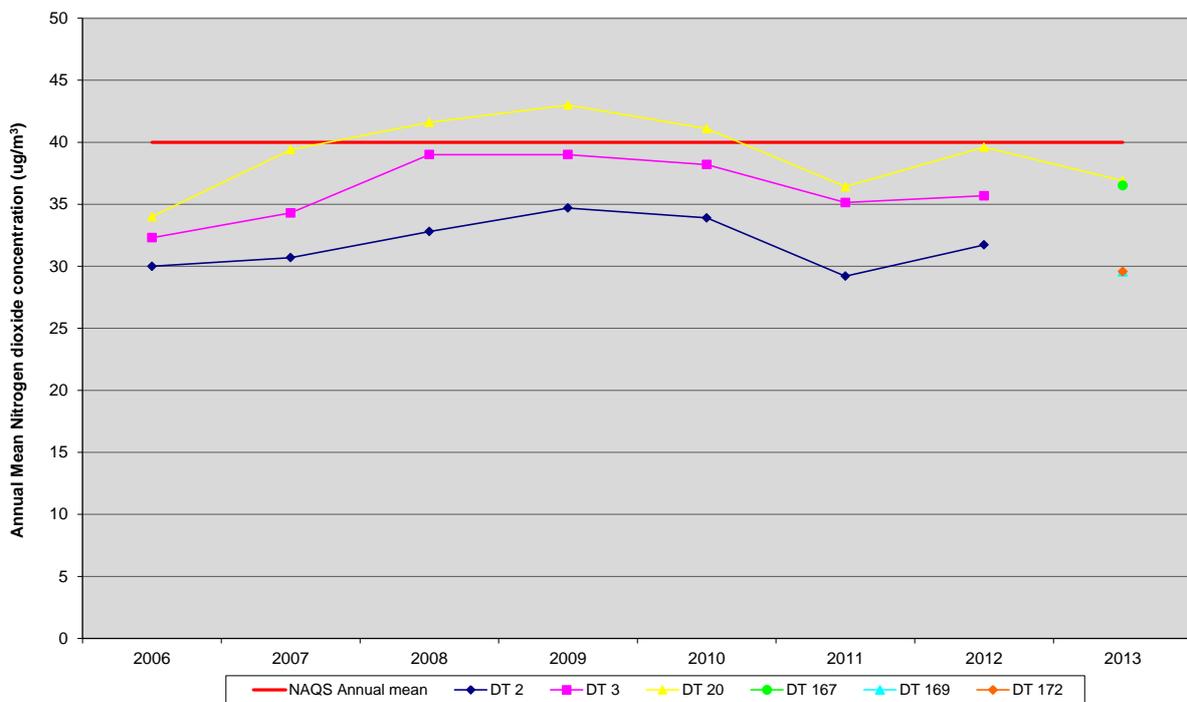


Figure 2.23 Overview of NO<sub>2</sub> Diffusion Tube Concentrations in Albert Street / Dura Street.



Lochee Road

Figure 2.24 NO<sub>2</sub> Monitoring Locations in Lochee Road

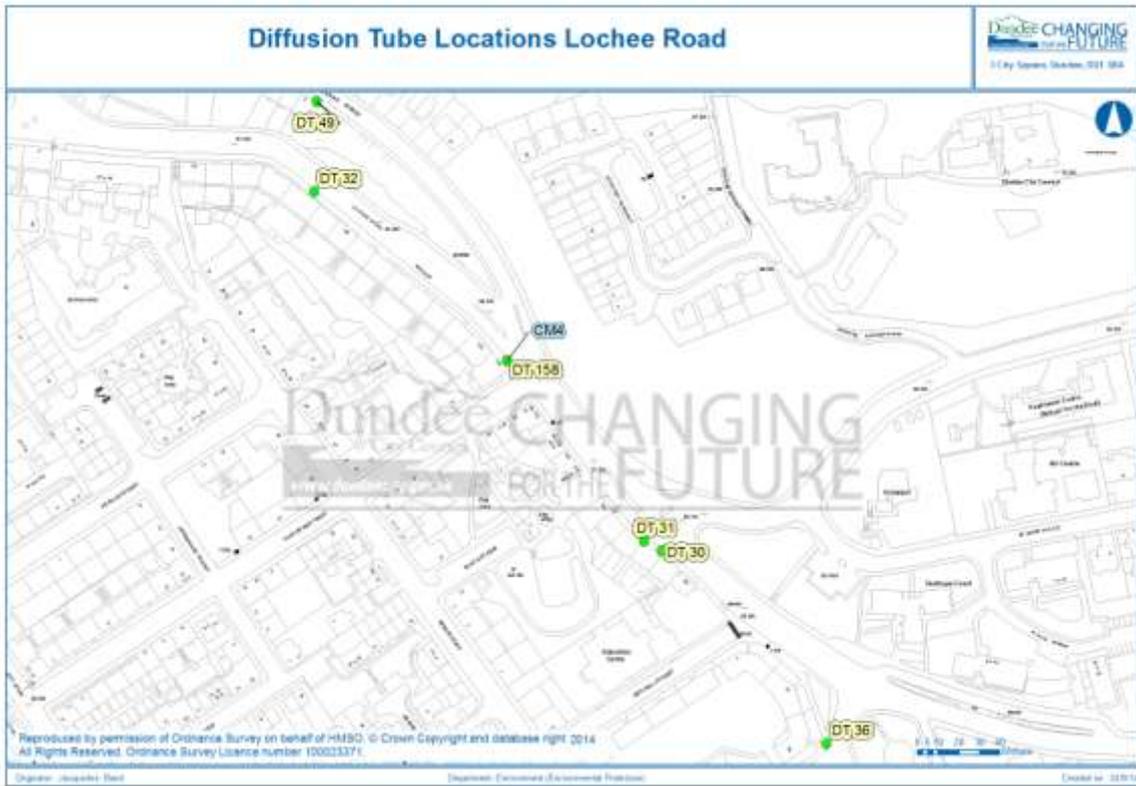
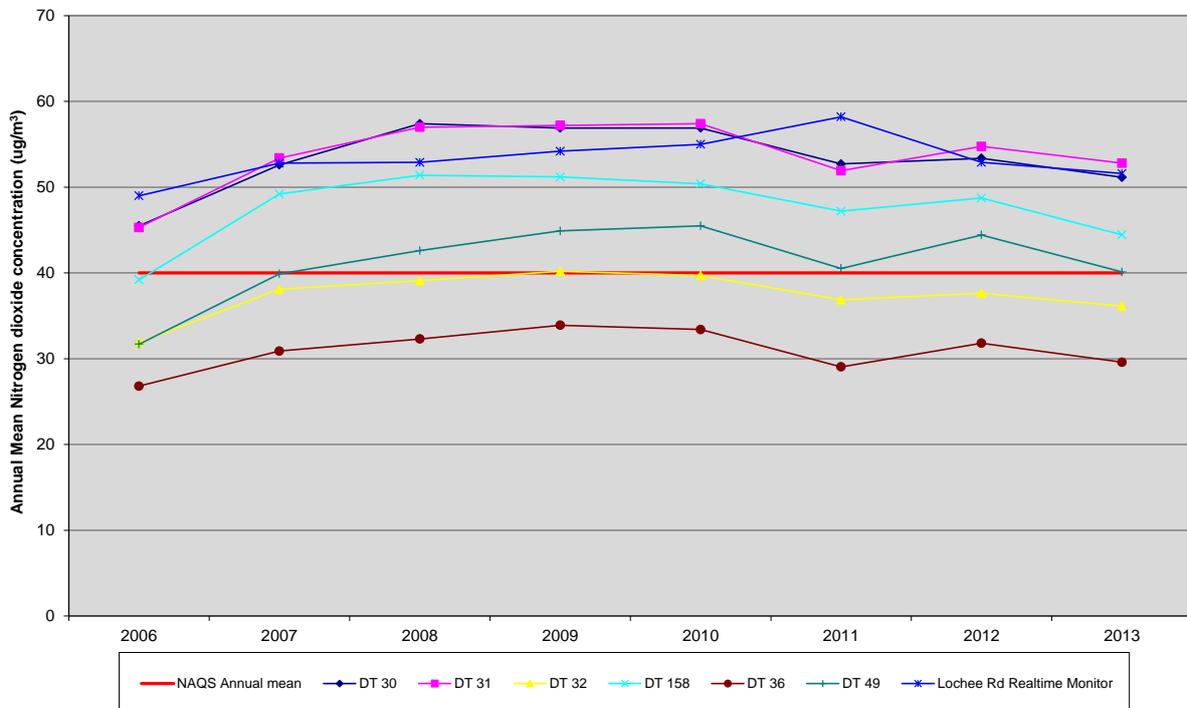


Figure 2.25 Overview of NO<sub>2</sub> Concentrations in Lochee Road



Logie Street  
 Figure 2.26 NO<sub>2</sub> Diffusion Tube Locations in Logie Street

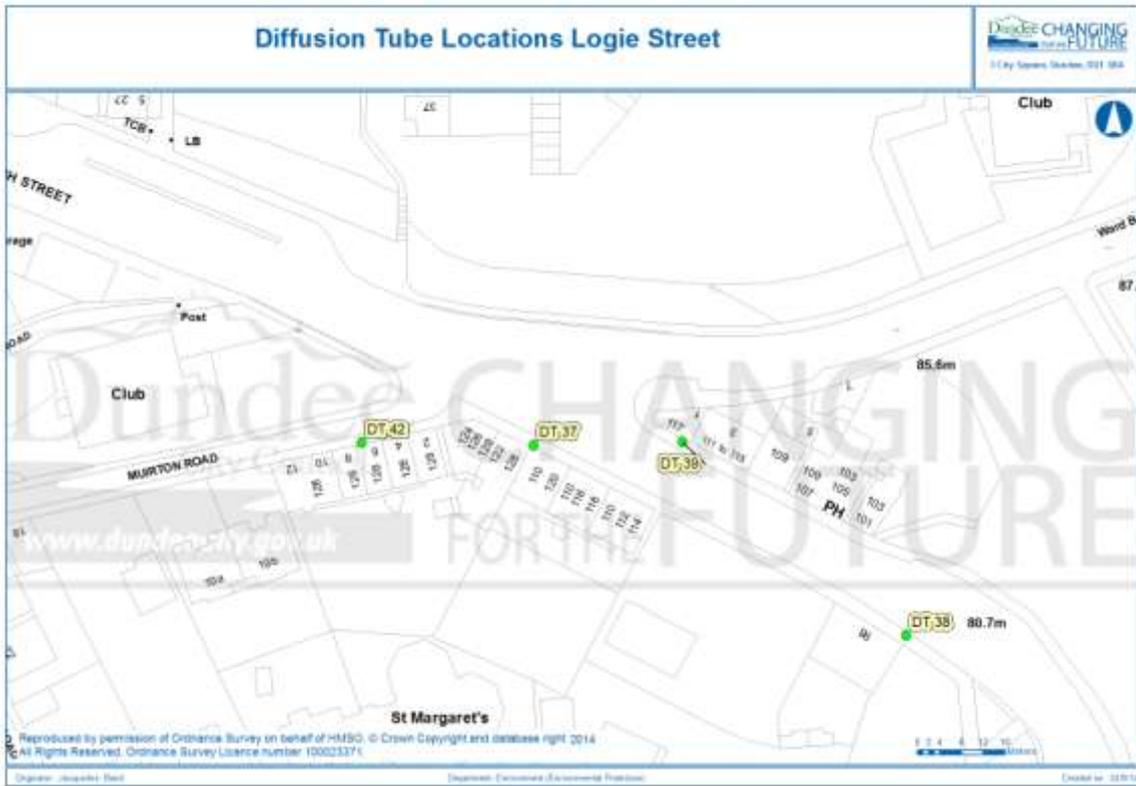
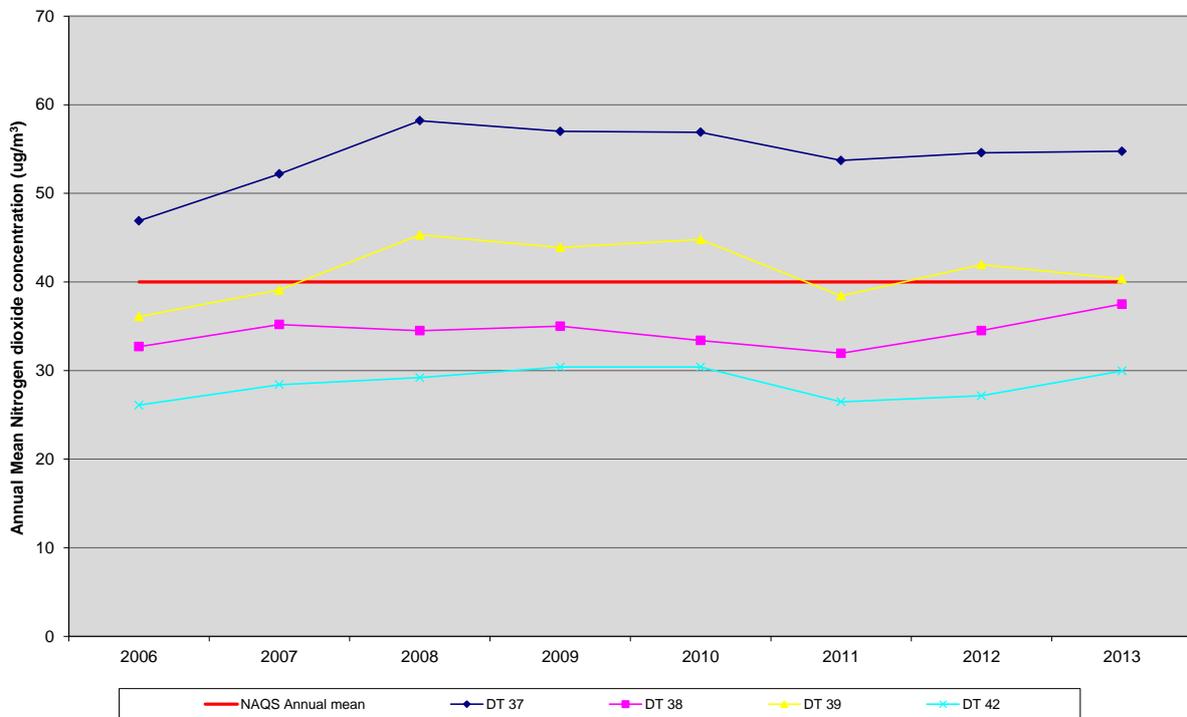


Figure 2.27 Overview of NO<sub>2</sub> Diffusion Tube Concentrations in Logie St.



Albert Street / Arbroath Road

Figure 2.28 NO<sub>2</sub> Diffusion Tube Locations in Albert St. / Arbroath Road

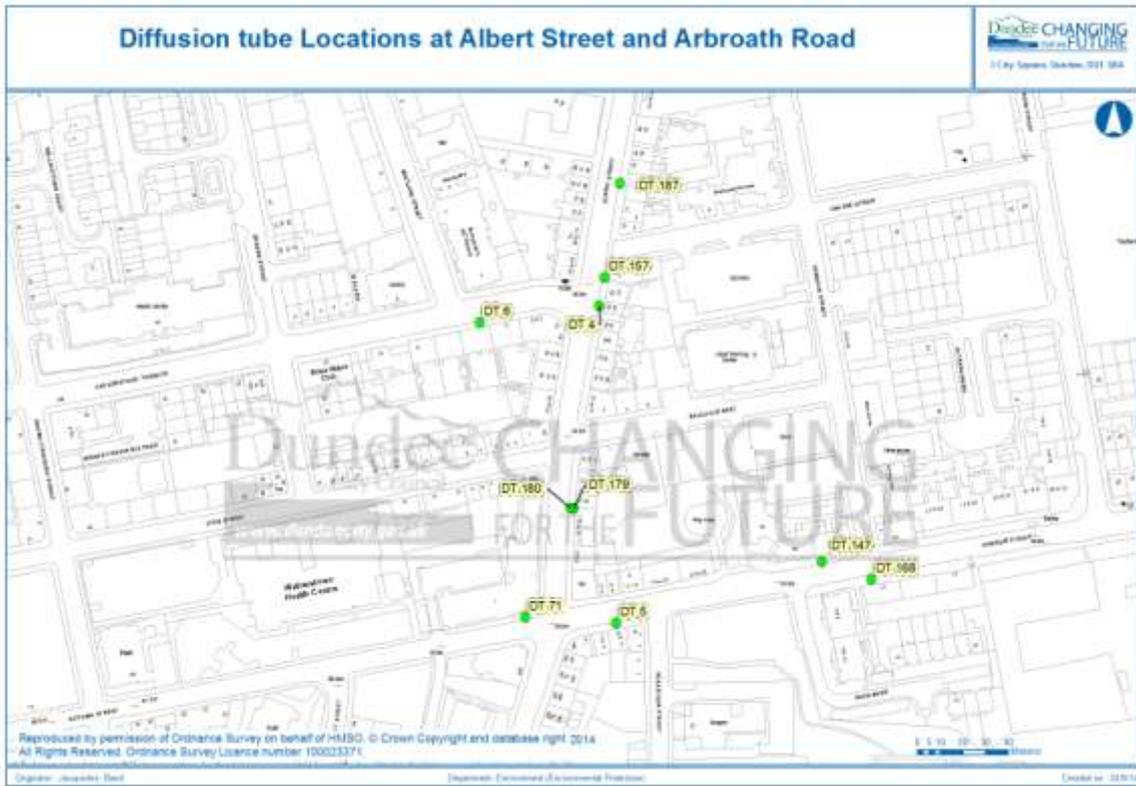
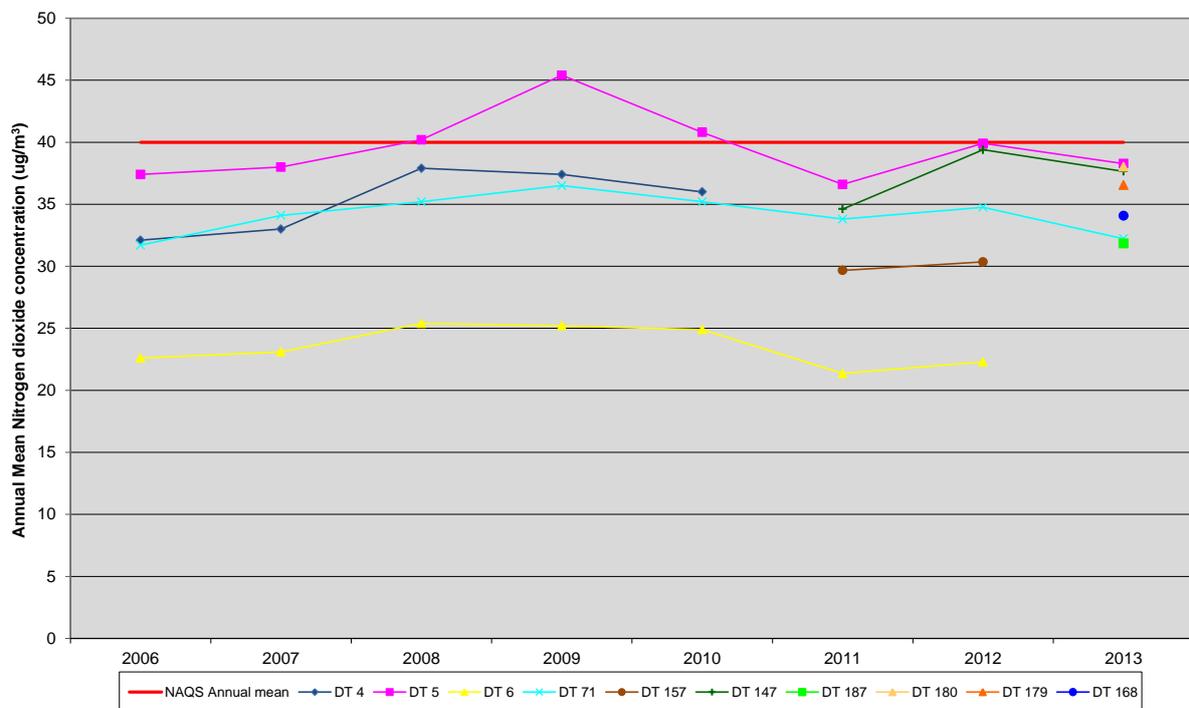


Figure 2.29 Overview of NO<sub>2</sub> Diffusion Tube Concentrations in Albert St. / Arbroath Road



Kingsway / Forfar Road.

Figure 2.30 NO<sub>2</sub> Diffusion Tube Locations on/near the Kingsway

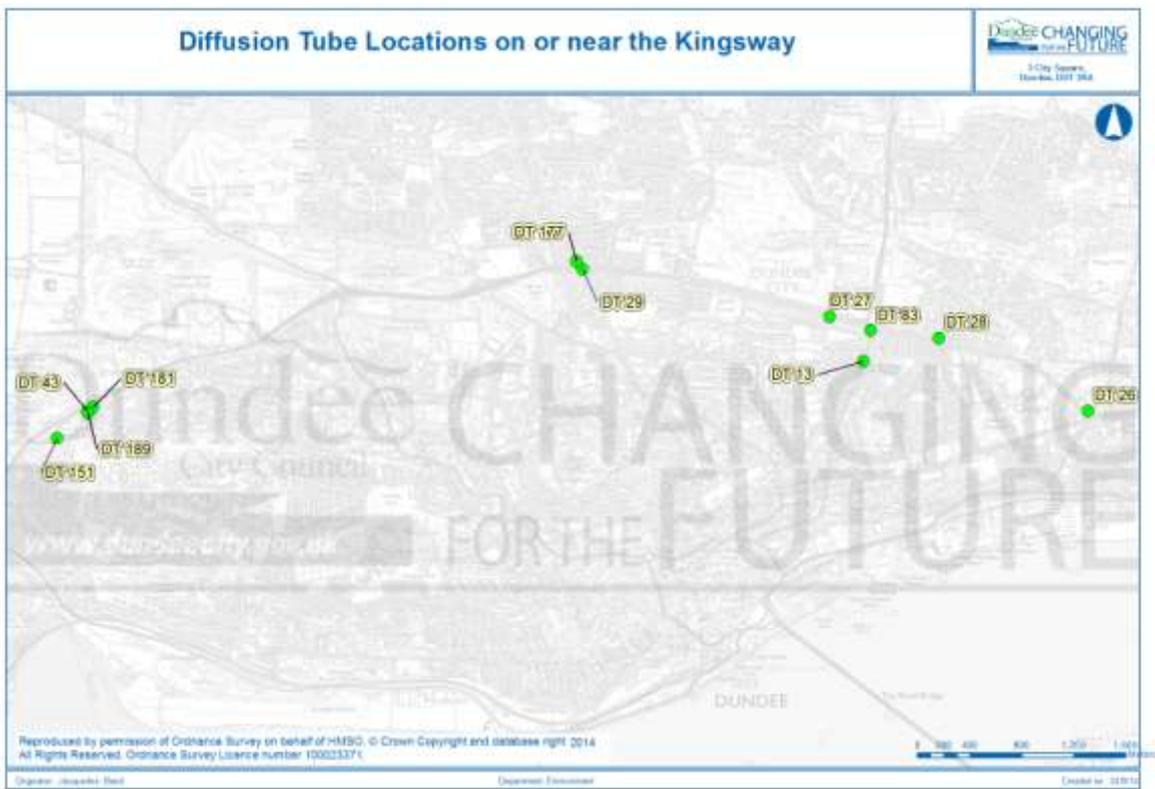
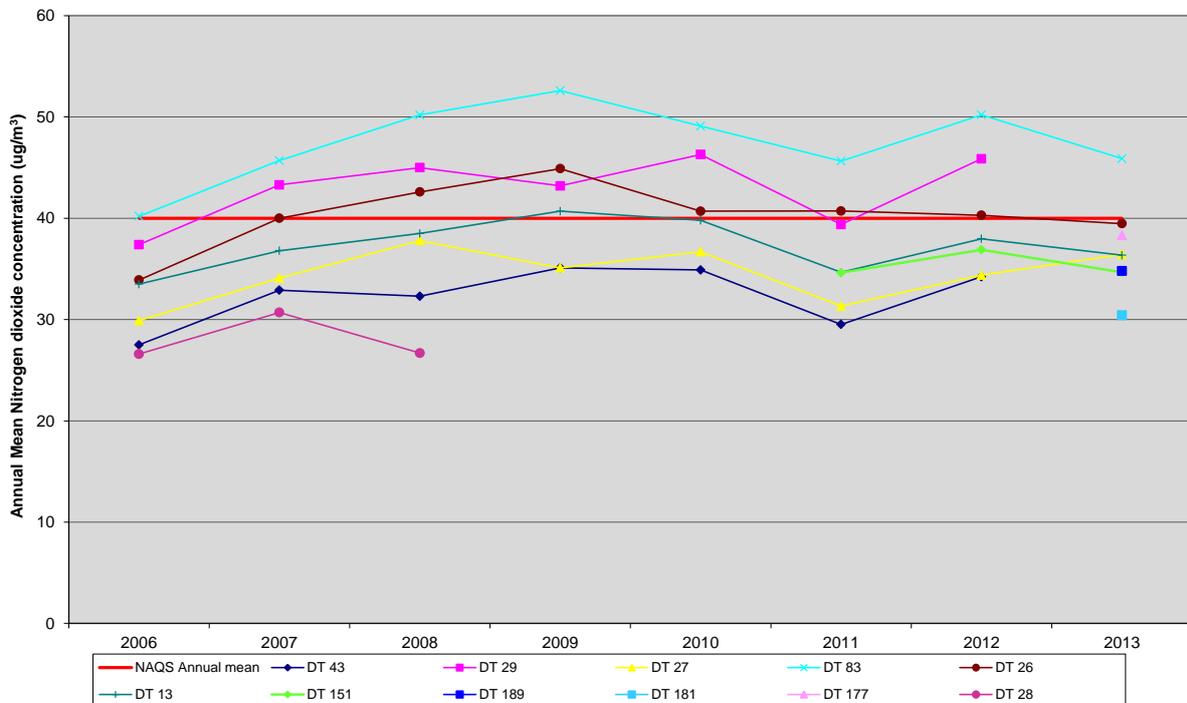


Figure 2.31 Overview of NO<sub>2</sub> Diffusion Tube Concentrations on/near the Kingsway



Bus Corridor

Figure 2.32 NO<sub>2</sub> Diffusion Tube Locations on Bus Corridor

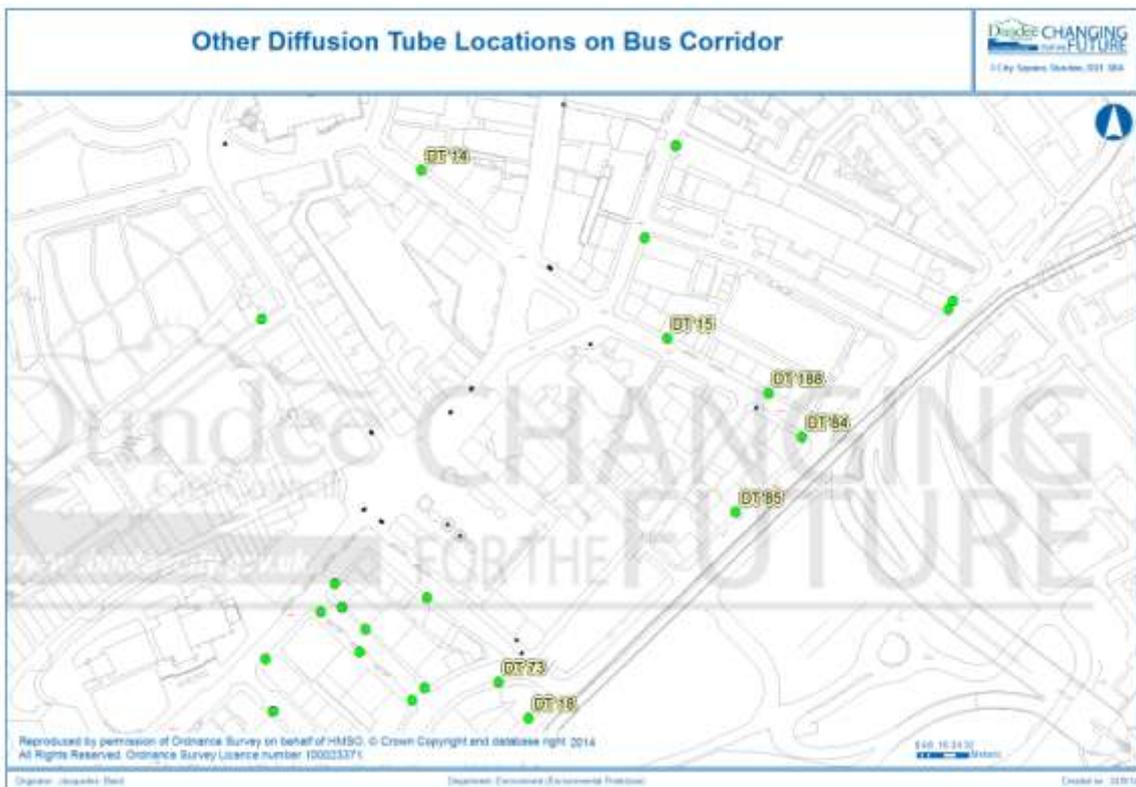
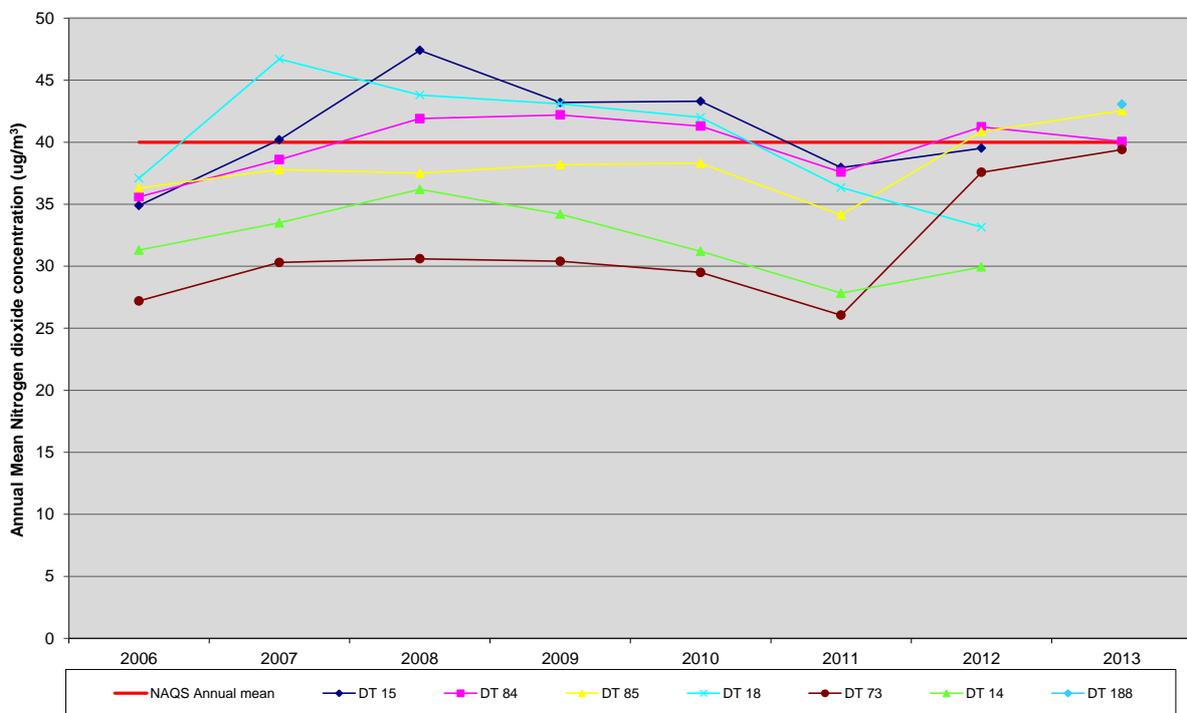


Figure 2.33 Overview of NO<sub>2</sub> Diffusion Tube Concentrations on Bus Corridor



Inner Ring Road

Figure 2.34 NO<sub>2</sub> Diffusion Tube Locations on Inner Ring Road

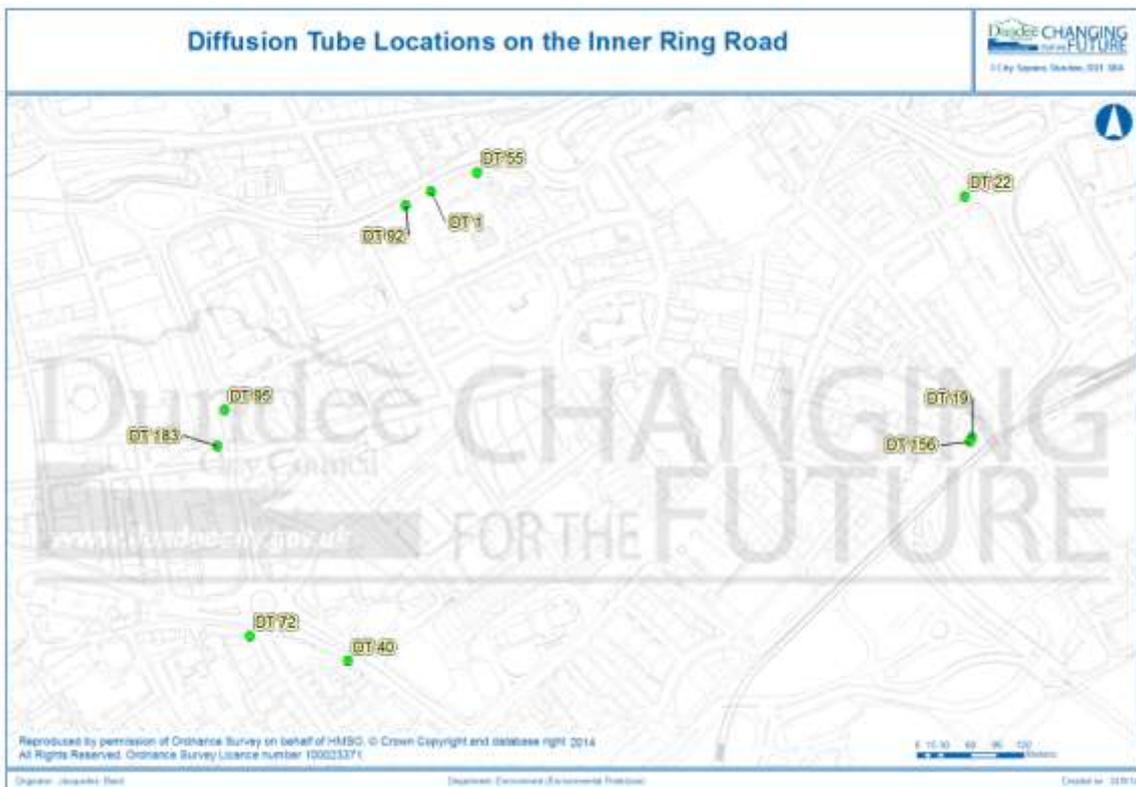
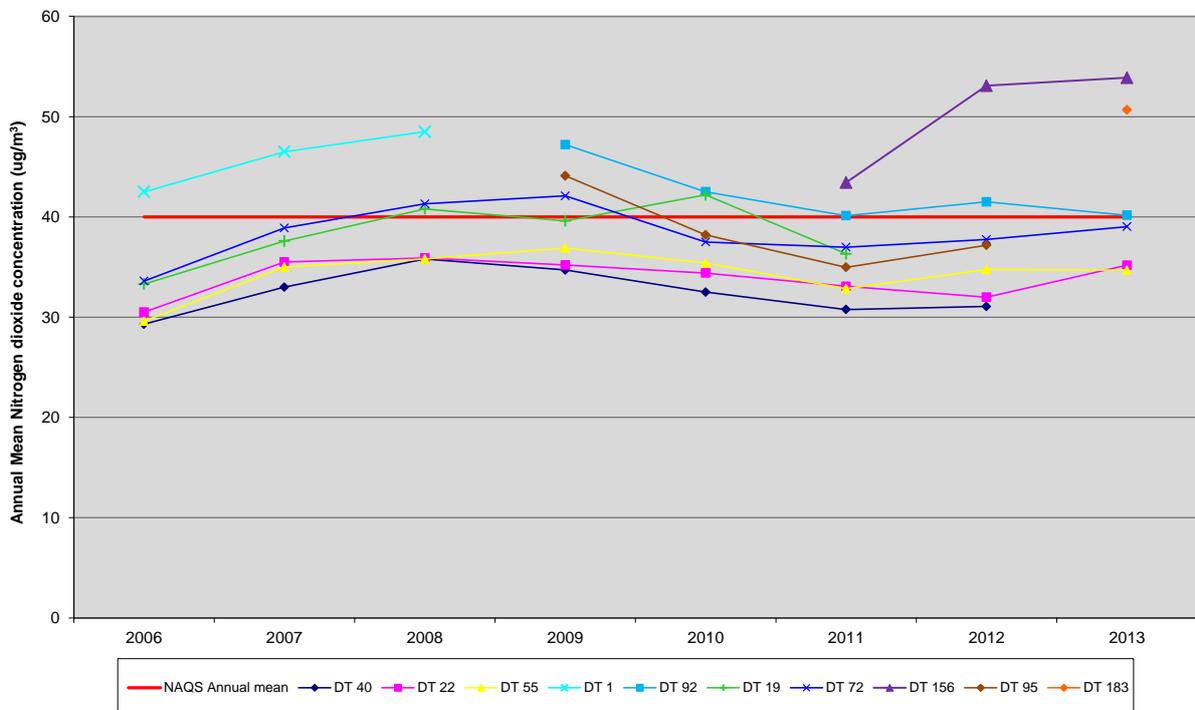


Figure 2.35 Overview of NO<sub>2</sub> Diffusion Tube Concentrations on Inner Ring Road



Stannergate Roundabout

Figure 2.36 NO<sub>2</sub> Diffusion Tube Location at Stannergate Roundabout

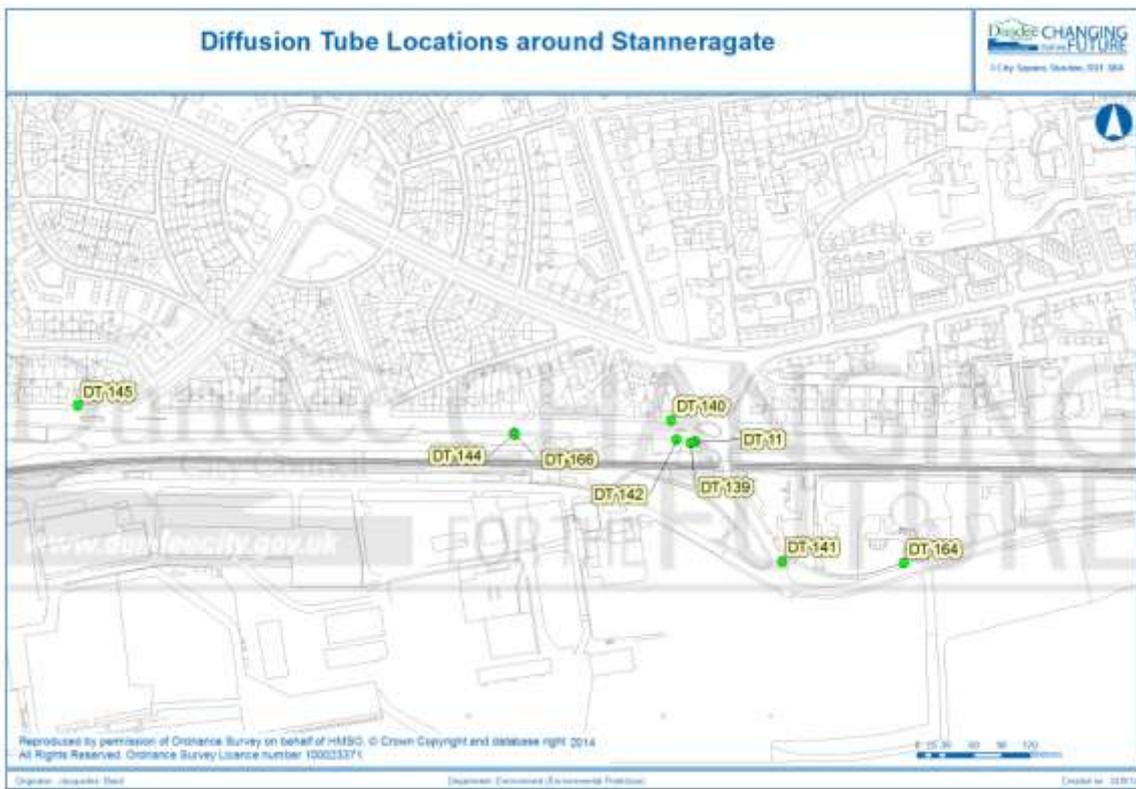
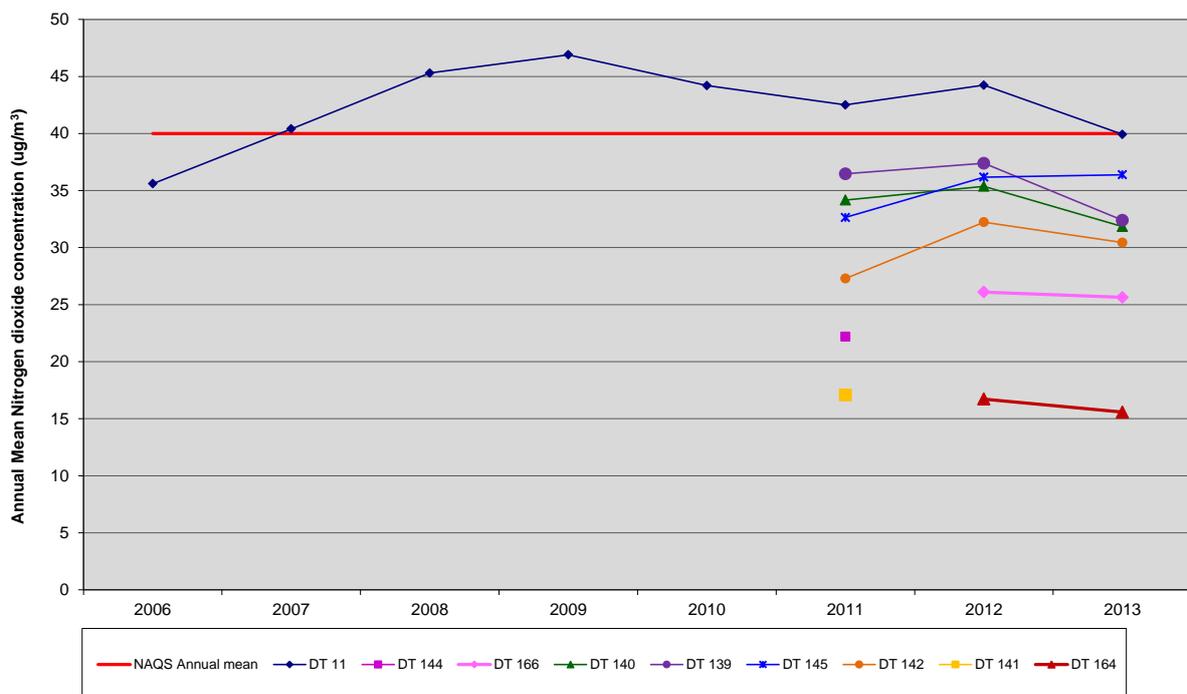


Figure 2.37 Overview of NO<sub>2</sub> Diffusion Tube Concentration at Stannergate Roundabout



Strathmore Avenue

Figure 2.38 NO<sub>2</sub> Diffusion Tube Location at Strathmore Avenue

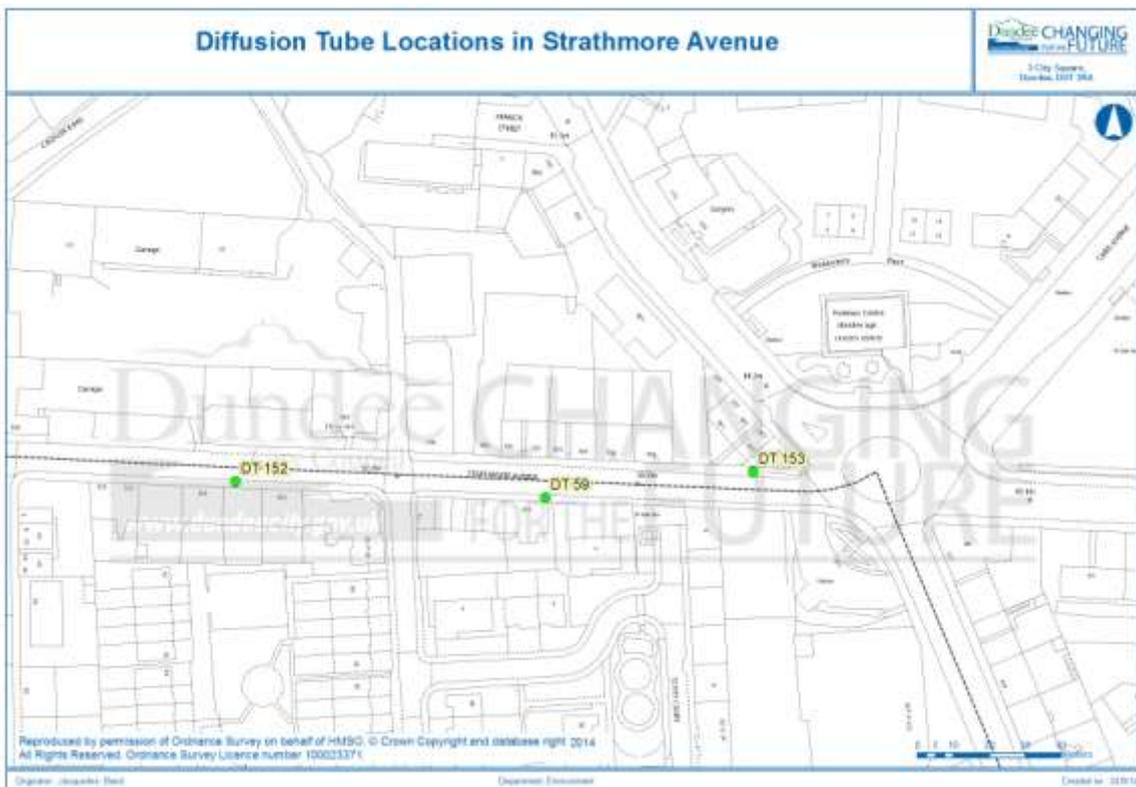
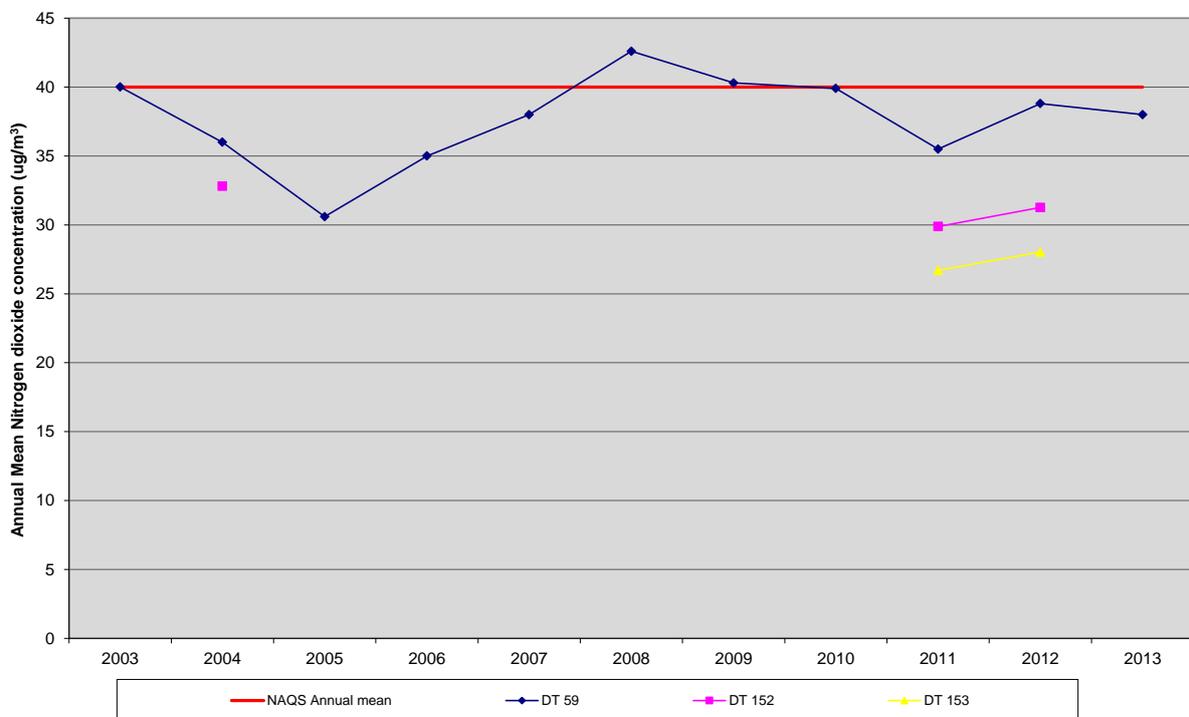


Figure 2.39 Overview of NO<sub>2</sub> Diffusion Tube Concentration at Strathmore Avenue



Note: The 2013 Progress Report showed an inaccurate value for tube DT59 in 2012, the figure above has been corrected.

### 2.2.1.4 Overview of NO<sub>2</sub> Monitoring Concentrations at Urban Background Locations

Dundee City Council operated 7 urban background NO<sub>2</sub> monitoring locations in 2013. Diffusion tubes were deployed at 6 sites, and the automatic analyser at Mains Loan (CM 12) is at an urban background location. These locations are shown in **Figure 2.40** along with Scottish Government modelled background NO<sub>2</sub> concentrations published as (1km x 1km) maps<sup>5</sup> in June 2014. A comparison of measured and modelled background concentrations is shown in **Table 2.9**. The measured 2013 NO<sub>2</sub> annual mean urban background concentrations were mostly greater than the Scottish Government modelled concentrations. Concentrations measured at Mains Loan were significantly lower than modelled. The diffusion tubes located to the east of the city and in the city centre recorded higher NO<sub>2</sub> concentrations than the modelled background, whilst those to the west and north of the city centre recorded concentrations lower than the modelled backgrounds.

**Table 2.9 Comparison of Measured Background NO<sub>2</sub> Results for 2013 with Scottish Government Background Map Data (Released June 2014)**

Site ID	Location	Grid Square	Measured Annual Mean 2013 (bias 0.87) (µg/m <sup>3</sup> )	Scottish Government Mapped Concentration 2013 (µg/m <sup>3</sup> )
DT 9	Birnam Place	337500 : 730500	10.1	11.5
DT 82	Woodside Avenue	340500 : 732500	15.4	17.2
DT 7	Balgavies Place	343500 : 731500	17.0	15.3
DT 185	Murraygate (46)	340500 : 730500	25.9	22.0
CM 12	Mains Loan Automatic Monitor	340500 : 731500	11.5*	17.3
DT 165	Broughty Ferry Road Lower	343500 : 730500	15.6	12.6
DT 155	Carolina Court	342500 : 731500	21.6	16.7

Note - \* denotes annualised mean

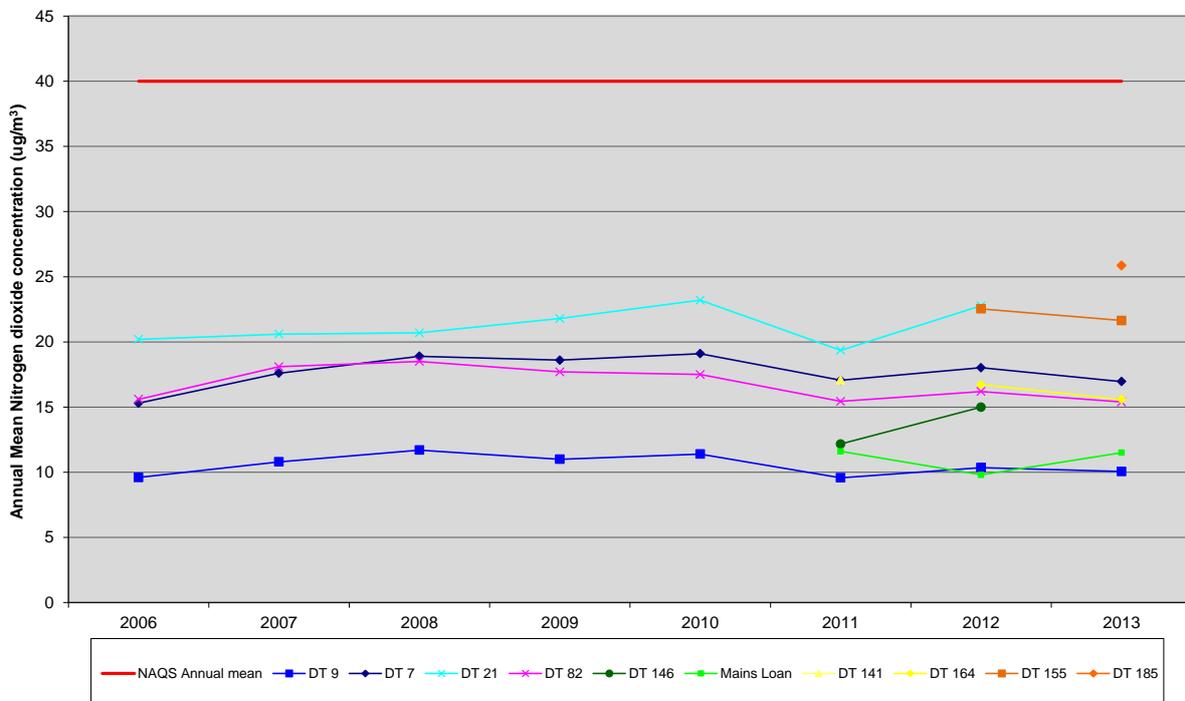
NO<sub>2</sub> concentrations at urban background locations have remain relatively stable over the past 8 years as illustrated in **Figure 2.41**. The fluctuations in background concentrations recorded at Earl Grey Place (DT 21) are thought to have been influenced by road re-alignments associated with the Central Waterfront Project. This urban background location was replaced in 2013 by one on the Murraygate (DT 185), which is a pedestrianized shopping area in the city centre.

<sup>5</sup> [http://www.scottishairquality.co.uk/maps.php?n\\_action=data](http://www.scottishairquality.co.uk/maps.php?n_action=data)

Figure 2.40 Urban Background NO<sub>2</sub> Monitoring Locations



Figure 2.41 Overview of NO<sub>2</sub> Concentrations at Urban Background Locations



## 2.2.2 Particulate Matter (PM<sub>10</sub>)

Dundee City Council undertook automatic monitoring of PM<sub>10</sub> at ten sites in the city in 2013. These are all located within the Dundee AQMA (NO<sub>2</sub> and PM<sub>10</sub> 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 PM<sub>10</sub> 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 PM<sub>10</sub> 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, data is corrected to gravimetric using the Volatile Correction Method (VCM) ( see **Appendix B** );
- 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 PM<sub>10</sub> analysers is discussed in **Appendix A6**.

None of the automatic monitoring sites had less than 9 months data and hence the results did not need to be annualised as described in Box 3.2 of LAQM.TG(09). However, for strict comparison against the objectives there must be a data capture of more than 90% throughout the calendar year, so details of the data capture are included in the tables for 2013 and all previous years.

The gravimetric equivalent monitoring results for 2013 are shown in **Tables 2.10 - 2.12** along with results for the previous years for which VCM corrected data was available (2008 – 2013). An overview of measured concentrations can be seen in **Figures 2.42 - 2.46**. It should be noted that errors have been identified in the previously published versions of **Tables 2.10 - 2.12**, the data presented in this report has been amended and should be used in preference to those previously reported. None of the amendments would have altered the conclusions of previous reports.

Table 2.10 Results of Automatic Monitoring for PM<sub>10</sub>: 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 <sup>3</sup> ) & Valid data capture (%)											
				2008		2009		2010		2011		2012		2013	
2	Union St (TEOM/BAM)	R	Y	16.9	99.7	16.5	99.2	17.0	90.5	<b>18.8</b>	99.4	15.5*	76.3	15.1	98.9
7	Union St (Osiris)	R	Y <sup>G</sup>	16.9	92.3	16.6*	86.1	16.8	92.9	<b>18.9</b>	92.0	15.5*	64.3	n/a	
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	15.9	96.4
13	Broughty Ferry Rd (Partisol)	UI	Y	13.9	97.3	14.2	100.0	14.1	93.7	15.2	99.7	14.3	100.0	15.1	97.0
16	Broughty Ferry Rd (Osiris)	UI	Y <sup>G</sup>	n/a		n/a		n/a		n/a		13.4*	28.0	15.0*	89.8
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	11.9	94.0
5	Seagate (BAM)	R	Y	n/a		n/a		n/a		17.1*	62.2	14.1	98.7	16.0	96.8
10	Seagate (Osiris)	K	Y <sup>G</sup>	<b>20.3</b>	92.6	18.1*	74.2	<b>20.5</b>	93.2	<b>23.6</b>	93.8	<b>20.6*</b>	64.7	n/a	
14	Meadowside (BAM)	R	Y	n/a		n/a		n/a		<b>23.3*</b>	50.6	<b>18.6</b>	97.7	<b>18.6</b>	90.5
11	Victoria Rd (Osiris)	K	Y <sup>G</sup>	17.6	92.6	17.1	91.6	<b>21.0</b>	91.1	<b>19.5</b>	93.8	15.5*	64.7	n/a	
4	Lochee Rd (BAM)	R	Y	n/a		n/a		n/a		<b>19.4*</b>	72.0	16.5	99.2	17.9	96.9
8	Lochee Rd (Osiris)	K	Y <sup>G</sup>	<b>21.1</b>	92.6	18.3*	87.3	<b>24.8</b>	93.0	<b>26.3</b>	93.9	18.3*	64.5	n/a	
9	Logie St (Osiris)	K	Y <sup>G</sup>	<b>19.0</b>	92.1	15.8	91.9	<b>22.1</b>	93.0	<b>21.6</b>	93.9	18.0	90.0	16.5	92.1
17	Myrekirk Tce (Osiris)	R	Y <sup>G</sup>	n/a		n/a		n/a		n/a		16.1*	28.0	15.5	94.0
15	Albert St (Osiris)	K	Y <sup>G</sup>	n/a		n/a		n/a		n/a		16.8*	28.0	18.3	95.7
18	Stannergate (Osiris)	R	Y <sup>G</sup>	n/a		n/a		n/a		n/a		<b>19.9*</b>	28.0	<b>24.5*</b>	81.9

Notes:

Y<sup>G</sup> - 2008-12 Osiris data has been corrected using an Osiris/TEOM co-location study and then the VCM method to give an approximate gravimetric equivalent result. 2013 data was adjusted using a factor derived from colocation study with the Partisol

\* indicates less than 90% data capture - for a strict comparison against the objectives data capture should be > 90% throughout the calendar year

Values in **bold** indicate an exceedence of the PM10 annual mean AQS objective of 18µg/m<sup>3</sup>

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

Figure 2.42 Overview of Annual Mean PM<sub>10</sub> Concentrations 2008 -2013 (Gravimetric equivalent data)

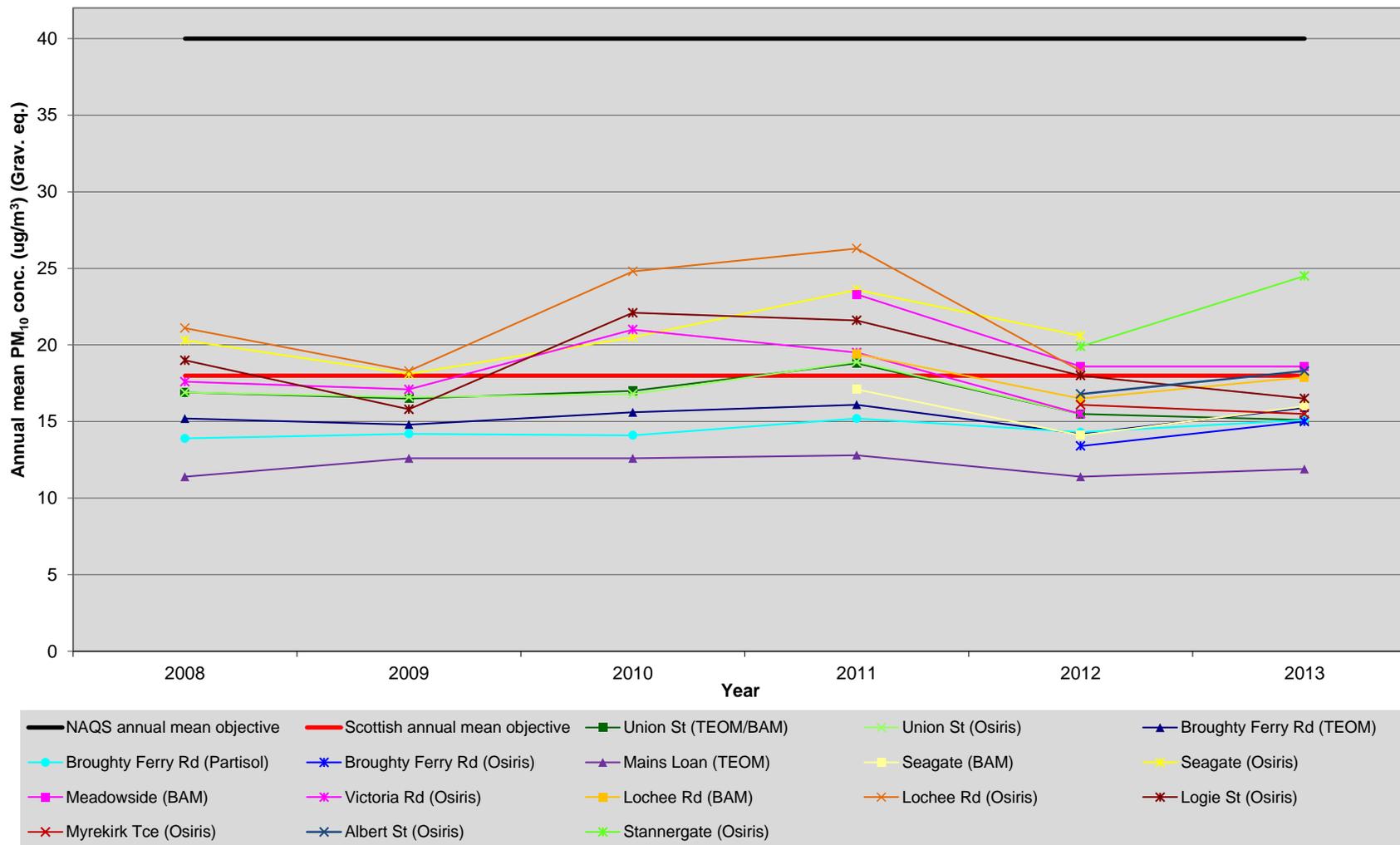


Figure 2.43 Possible trends in Annual Mean PM<sub>10</sub> Concentrations 2008 - 2013 at Long-Term Monitoring Sites (gravimetric equivalent data)

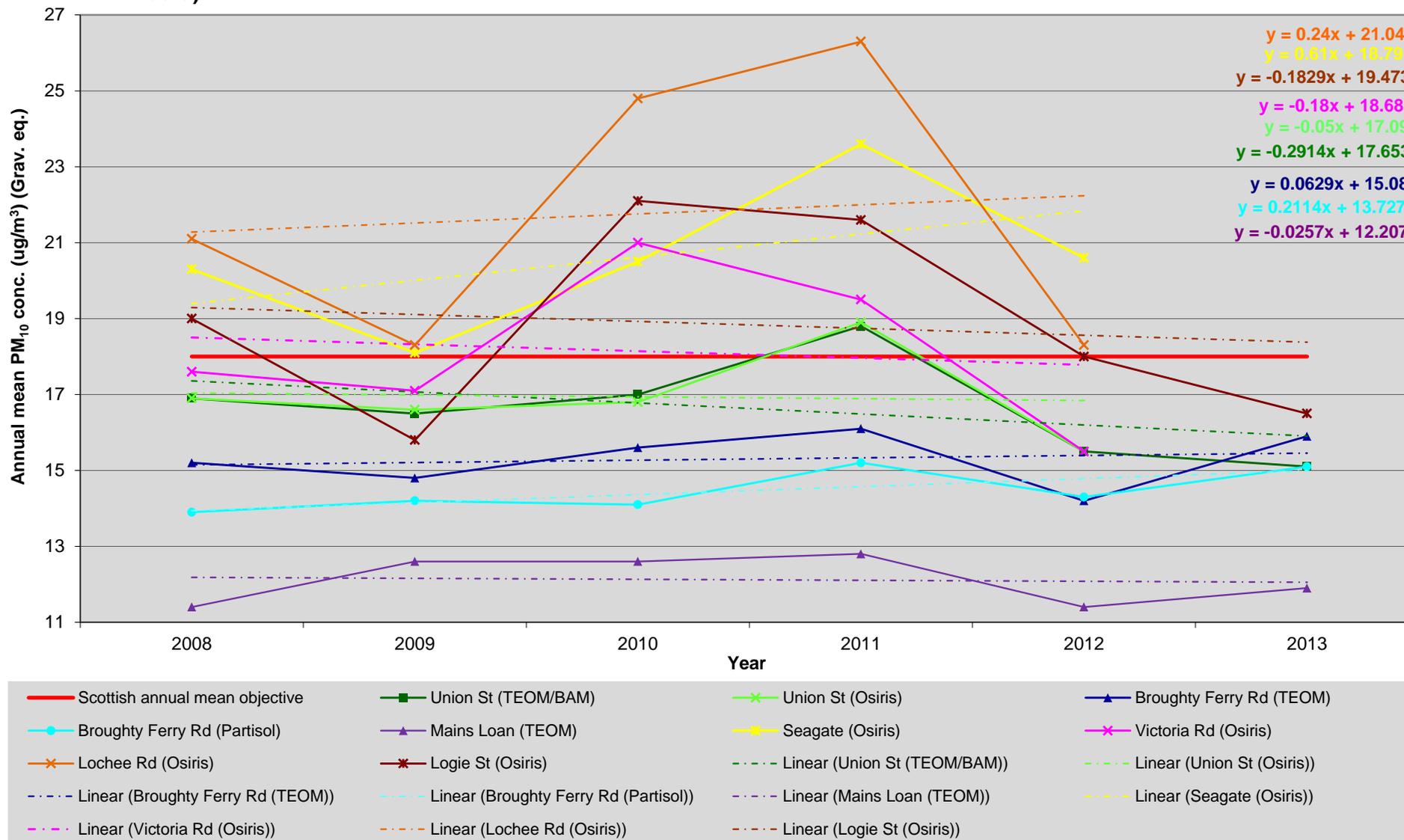


Table 2.11 Results of Automatic Monitoring for PM<sub>10</sub>: Comparison with NAQS 24-hour Mean Objective

Site ID (CM)	Location & (Type of monitor)	Site Type	Valid Data Capture 2013 (%)	Confirm Gravimetric Equivalent (Y or N/A)	Number of Daily Means > 50µg/m <sup>3</sup> (not to be exceeded more than 35 times per year) & (90 <sup>th</sup> percentile (µg/m <sup>3</sup> ))											
					2008		2009		2010		2011		2012		2013	
2	Union St (TEOM/BAM)	R	98.9	Y	0	(24.1)	2	(24.3)	0*	(26.6)	1	(32.2)	2*	(26.0)	1	(27.0)
7	Union St (Osiris)	R	n/a	Y <sup>G</sup>	4	(29.2)	6*	(25.9)	0	(27.5)	2	(48.0)	2*	(29.2)	n/a	
3	Broughty Ferry Rd (TEOM)	UI	97.0	Y	0	(24.4)	2	(23.1)	0	(25.4)	0	(27.4)	2	(23.5)	3	(25.6)
13	Broughty Ferry Rd (Partisol)	UI	97.0	Y	1	(24.4)	2	(24.1)	0	(23.3)	1	(29.8)	3	(25.5)	2	(24.9)
16	Broughty Ferry Rd (Osiris)	UI	89.3	Y <sup>G</sup>	n/a		n/a		n/a		n/a		0*	(19.3)	4*	(26.1)
12	Mains Loan (TEOM)	UB	94.0	Y	0	(18.4)	0	(20.0)	0	(20.8)	0	(22.5)	1	(20.6)	1	(19.5)
5	Seagate (BAM)	R	98.6	Y	n/a		n/a		n/a		1*	(25.6)	1	(24.1)	4	(28.1)
10	Seagate (Osiris)	K	n/a	Y <sup>G</sup>	<b>12</b>	(32.9)	<b>8*</b>	(30.4)	<b>9</b>	(35.8)	<b>20</b>	(40.6)	<b>13*</b>	(42.3)	n/a	
14	Meadowside (BAM)	R	91.2	Y	n/a		n/a		n/a		4*	(35.1)	4	(32.0)	4	(29.1)
11	Victoria Rd (Osiris)	K	n/a	Y <sup>G</sup>	7	(28.9)	6	(29.4)	7	(35.3)	<b>11</b>	(37.6)	3*	(30.7)	n/a	
4	Lochee Rd (BAM)	R	98.1	Y	n/a		n/a		n/a		2*	(30.9)	3	(26.5)	3	(28.1)
8	Lochee Rd (Osiris)	K	n/a	Y <sup>G</sup>	<b>10</b>	(31.6)	4*	(27.2)	<b>16</b>	(41.3)	<b>28</b>	(47.9)	6*	(35.6)	n/a	
9	Logie St (Osiris)	K	95.6	Y <sup>G</sup>	<b>9</b>	(30.8)	3	(25.6)	<b>12</b>	(37.4)	<b>16</b>	(41.8)	5*	(34.4)	2	(27.7)
17	Myrekirk Tce (Osiris)	R	95.6	Y <sup>G</sup>	n/a		n/a		n/a		n/a		0*	(22.1)	2	(25.1)
15	Albert St (Osiris)	K	95.6	Y <sup>G</sup>	n/a		n/a		n/a		n/a		2*	(24.9)	7	(32.8)
18	Stannergate (Osiris)	R	81.4	Y <sup>G</sup>	n/a		n/a		n/a		n/a		0*	(28.1)	<b>9*</b>	(38.7)

**Notes:**

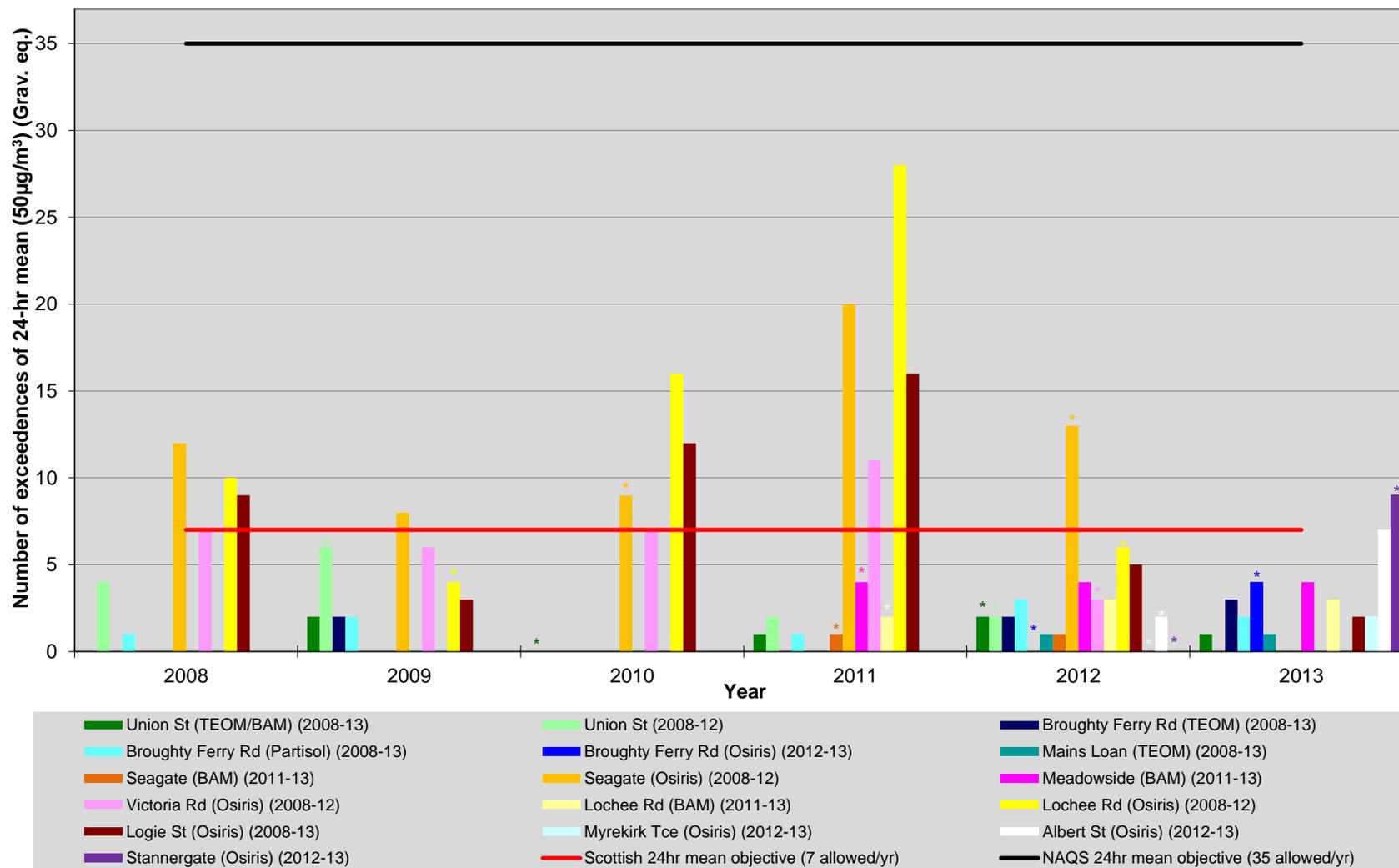
Y<sup>G</sup> - 2008-12 Osiris data has been corrected using an Osiris/TEOM co-location study and then the VCM method to give an approximate gravimetric equivalent result. 2013 data was adjusted using a factor derived from a year's co-location study with the Partisol

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

Values in bold indicate an exceedance of the PM<sub>10</sub> 24-hour mean objective (50ug/m<sup>3</sup>) which is not to be exceeded > 35 times per year

Figure 2.44 Frequency of Exceedences of PM<sub>10</sub> 24hr Mean Objective 2010 (50µg/m<sup>3</sup>, 7 allowed) 2008-2013



(Note: \* indicates less than 90% data capture)

Figure 2.45 Overview of NAQS PM<sub>10</sub> 24-hour Mean Objective 2004 - 90<sup>th</sup> Percentile of Daily Means (cf.50µg/m<sup>3</sup>) 2008-2013

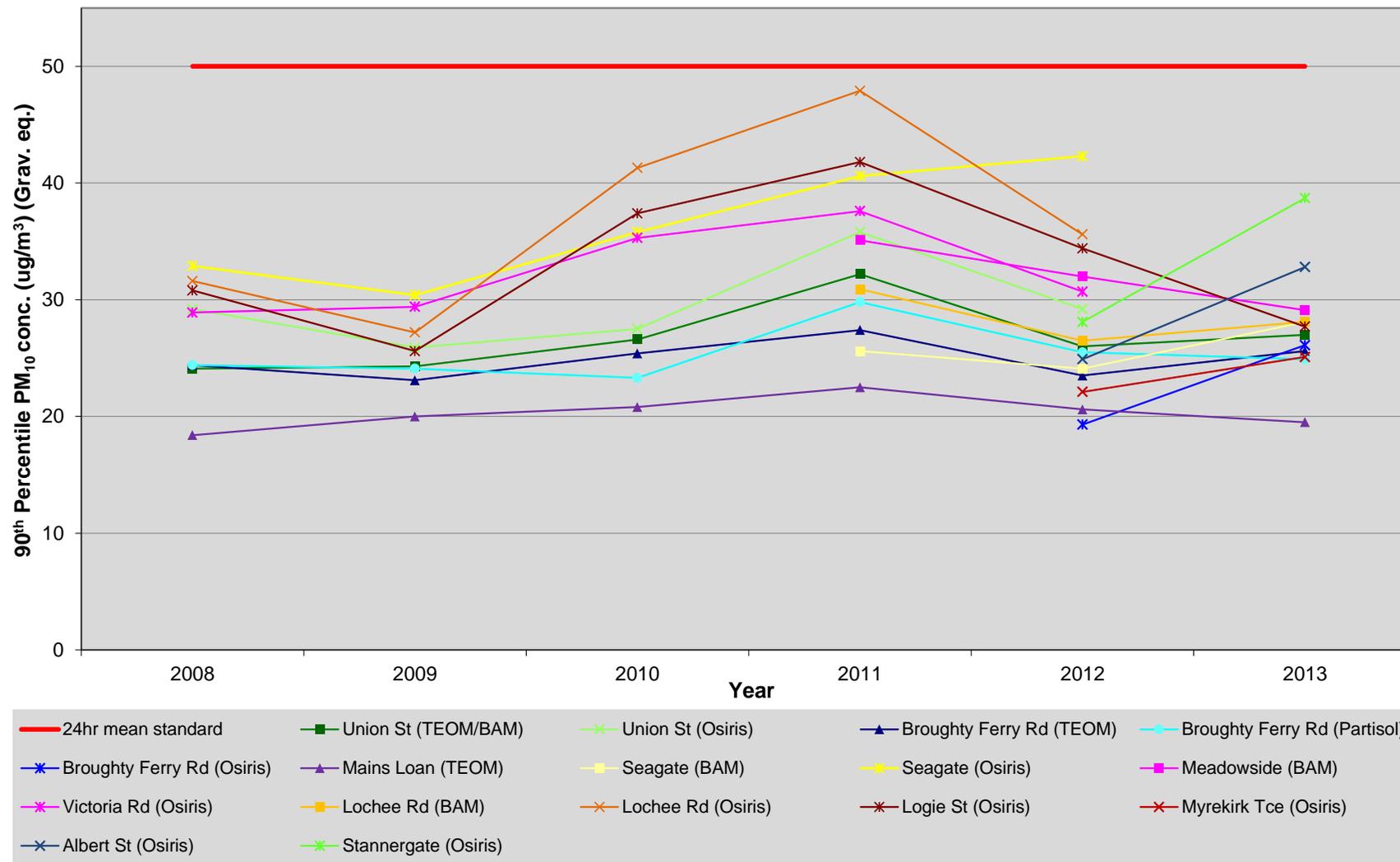


Table 2.12 Results of Automatic Monitoring for PM<sub>10</sub>: Comparison with Scottish 24-hour Mean Objective

Site ID (CM)	Location & (Type of monitor)	Site Type	Valid Data Capture 2013 (%)	Confirm Gravimetric Equivalent (Y or N/A)	Number of Daily Means > 50µg/m <sup>3</sup> (not to be exceeded more than 7 times per year) & (98.08 <sup>th</sup> percentile (µg/m <sup>3</sup> ))											
					2008		2009		2010		2011		2012		2013	
2	Union St (TEOM/BAM)	R	98.9	Y	0	(40.3)	2	(33.4)	0*	(37.7)	1	(42.8)	2*	(36.3)	1	(37.8)
7	Union St (Osiris)	R	n/a	Y <sup>G</sup>	4	(47.0)	6*	(47.9)	0	(38.8)	2	(48.0)	2*	(42.3)	n/a	
3	Broughty Ferry Rd (TEOM)	UI	97.0	Y	0	(37.6)	2	(35.3)	0	(39.8)	0	(40.3)	2	(35.8)	3	(42.5)
13	Broughty Ferry Rd (Partisol)	UI	97.0	Y	1	(35.6)	2	(34.5)	0	(36.8)	1	(41.9)	3	(37.5)	2	(43.5)
16	Broughty Ferry Rd (Osiris)	UI	89.3	Y <sup>G</sup>	n/a		n/a		n/a		n/a		0*	(30.5)	4*	(47.3)
12	Mains Loan (TEOM)	UB	94.0	Y	0	(30.5)	0	(31.3)	0	(30.0)	0	(33.4)	1	(31.9)	1	(28.8)
5	Seagate (BAM)	R	98.6	Y	n/a		n/a		n/a		1*	(38.1)	1	(37.2)	4	(40.4)
10	Seagate (Osiris)	K	n/a	Y <sup>G</sup>	<b>12</b>	<b>(56.6)</b>	<b>8*</b>	<b>(53.5)</b>	<b>9</b>	<b>(52.7)</b>	<b>20</b>	<b>(65.0)</b>	<b>13*</b>	<b>(59.5)</b>	n/a	
14	Meadowside (BAM)	R	91.2	Y	n/a		n/a		n/a		4*	(49.8)	4	(47.5)	4	(43.9)
11	Victoria Rd (Osiris)	K	n/a	Y <sup>G</sup>	7	(50.4)	6	(47.7)	7	(49.8)	<b>11</b>	<b>(53.7)</b>	3*	(48.0)	n/a	
4	Lochee Rd (BAM)	R	98.1	Y	n/a		n/a		n/a		2*	(43.5)	3	(42.6)	3	(38.8)
8	Lochee Rd (Osiris)	K	n/a	Y <sup>G</sup>	<b>10</b>	<b>(57.9)</b>	4*	(44.0)	<b>16</b>	<b>(62.5)</b>	<b>28</b>	<b>(70.4)</b>	6*	<b>(50.7)</b>	n/a	
9	Logie St (Osiris)	K	95.6	Y <sup>G</sup>	<b>9</b>	<b>(54.9)</b>	3	(44.7)	<b>12</b>	<b>(62.7)</b>	<b>16</b>	<b>(53.8)</b>	5*	(46.3)	2	(39.0)
17	Myrekirk Tce (Osiris)	R	95.6	Y <sup>G</sup>	n/a		n/a		n/a		n/a		0*	(30.1)	2	(35.9)
15	Albert St (Osiris)	K	95.6	Y <sup>G</sup>	n/a		n/a		n/a		n/a		2*	(43.3)	7	<b>(51.2)</b>
18	Stannergate (Osiris)	R	81.4	Y <sup>G</sup>	n/a		n/a		n/a		n/a		0*	(35.9)	<b>9*</b>	<b>(54.1)</b>

**Notes:**

Y<sup>G</sup> - 2008-12 Osiris data has been corrected using an Osiris/TEOM co-location study and then the VCM method to give an approximate gravimetric equivalent result. 2013 data was adjusted using a factor derived from a year's co-location study with the Partisol

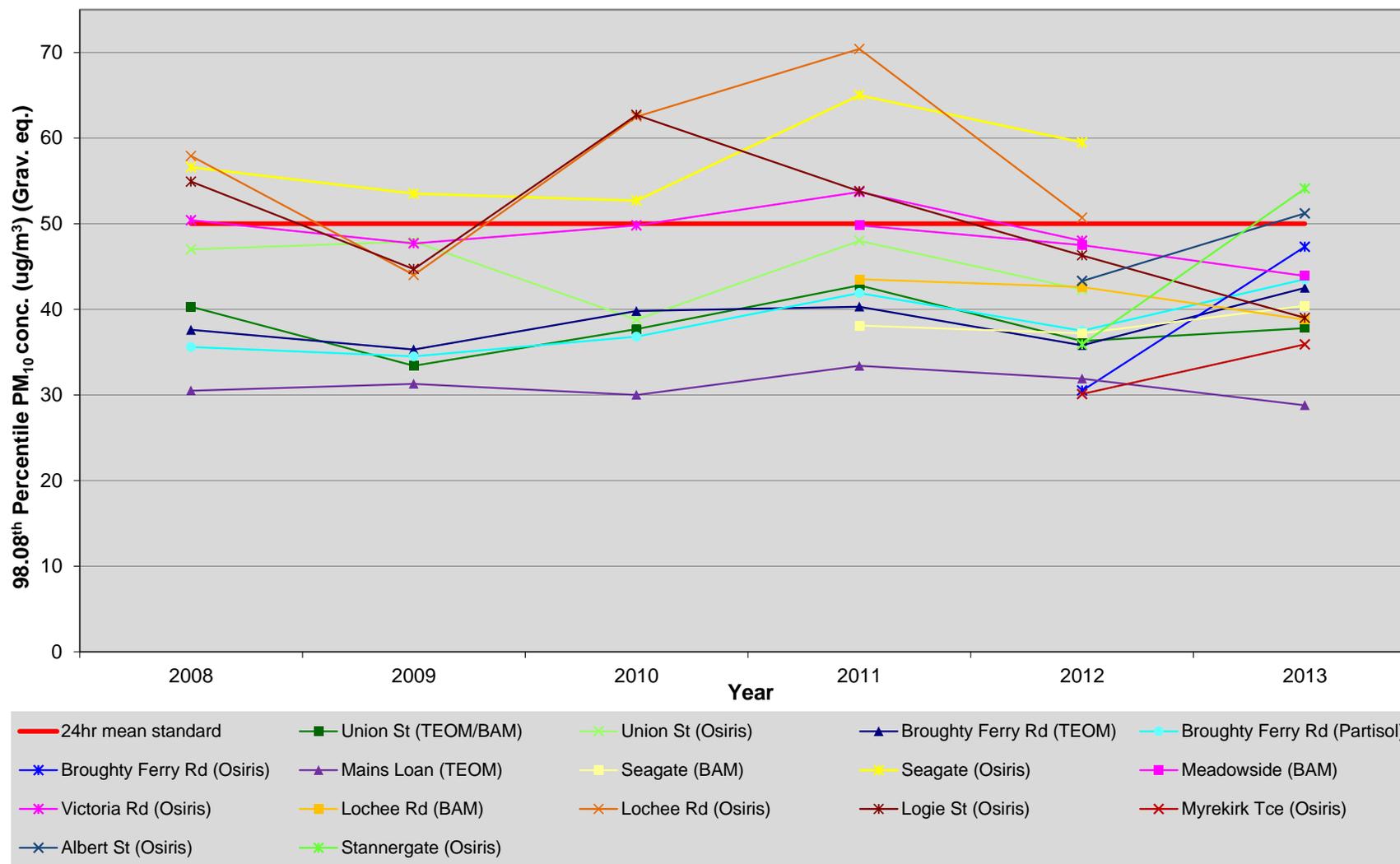
Means show n in the highlighted cells have been "annualised" as in Box 3.2 of LAQM.TG(09) if valid data capture is less than 75%

\* The 98th percentiles are show n in brackets next to the number of 24-hour mean exceedences. When data capture is less than 90% (show n by \*), the percentiles should be consulted in preference to the reported number of exceedences.

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

Values in bold indicate an exceedence of the PM<sub>10</sub> 24-hour mean objective (50ug/m<sup>3</sup>) which is not to be exceeded > 7 times per year

Figure 2.46 Overview of Scottish PM<sub>10</sub> 24-hour Mean Objective 2010 – 98.08<sup>th</sup> Percentile of Daily Means (cf.50µg/m<sup>3</sup>) 2008-2013



## Annual Mean PM<sub>10</sub> Concentrations

Annual mean monitoring results are shown in **Table 2.10**, and indicate that the NAQS 2004 annual mean PM<sub>10</sub> objective (40µg/m<sup>3</sup>) continues to be met at all monitoring locations. However, there were exceedences of the Scottish 2010 PM<sub>10</sub> annual mean objective (18µg/m<sup>3</sup>) recorded at Meadowside (BAM) and at the Osiris unit located at Stannergate roundabout. Another 2 Osiris units were close to exceeding the 2010 objective in Albert Street and Logie Street, as was the BAM located in Lochee Road. The Osiris units are indicative PM<sub>10</sub> monitors and the 2013 results provided the first full year's data for the four Osiris units relocated in 2012. It should be noted that the annual mean concentrations for each of the BAM analysers in 2013 is based on ratified 15min values derived from the hourly averages recorded by the BAM (see **Appendix A4**).

Statistically significant trends, or even a reasonable overview of how concentrations are changing, usually only become meaningful when complete data records extend over five years or more. VCM adjusted concentrations have been available since 2008, therefore the examination of trends in PM<sub>10</sub> concentrations is based on VCM corrected TEOM data.

Annual means for those sites with 5 or more years of data are shown in **Figure 2.43**. Linear trend lines and associated equations have been applied to identify how pollution concentrations are changing over time. However, these need to be interpreted with caution as a high proportion of the data presented is based on less than 90% data capture (see **Table 2.10** for details). A slight downward trend in PM<sub>10</sub> concentrations is evident at the majority of sites with five or more years of data. An increasing trend was observed at Osiris monitors when they were located in Lochee Road and Seagate. A slight increase is also evident at the TEOM and Partisol monitors located at Broughty Ferry Road. The majority of sites measured higher concentrations in 2013 than in 2012 (though nine out of sixteen locations in 2012 had less than 90% data capture). Some yearly fluctuations are obvious at roadside and kerbside sites, which can be affected by local factors such as road works, demolition and construction activities. Year on year fluctuations are also possible as a consequence of climatic effects and trans-boundary pollution episodes.

The 2013 PM<sub>10</sub> annual mean urban background concentration was generally in good agreement with the Scottish Government modelled background PM<sub>10</sub> concentrations published as (1km x 1km) maps<sup>6</sup> in June 2013 (see **Table 2.13**).

**Table 2.13 Comparison of Measured Background PM<sub>10</sub> Results for 2013 with Scottish Government Background Map Data.**

Location	Grid Square	Measured Annual Mean PM <sub>10</sub> (µg/m <sup>3</sup> )	Scottish Government Mapped Concentration (µg/m <sup>3</sup> )
Mains Loan (VCM)	340500:731500	11.9	12.8

## 24-hour Mean PM<sub>10</sub> Concentrations

Monitoring results in **Table 2.11** and **Figures 2.44 & 2.45** show that the NAQS 2004 24-hour mean objective of 50µg/m<sup>3</sup> (not to be exceeded more than 35 times per year), continues to be met at all monitoring locations. Monitoring results in **Table 2.12** and **Figures 2.44 & 2.46** show that the Scottish 24-hour mean objective of 50µg/m<sup>3</sup> (not to be exceeded more than 7 times per year), was exceeded at two Osiris monitors located at Stannergate Roundabout and Albert Street in 2013. Stannergate Osiris recorded 9 exceedences of the 24-hour

<sup>6</sup> [http://www.scottishairquality.co.uk/maps.php?n\\_action=data](http://www.scottishairquality.co.uk/maps.php?n_action=data)

objective. 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 PM<sub>10</sub>, if the value of the 98.08<sup>th</sup> percentile of 24-hour mean concentrations is greater than 50µg/m<sup>3</sup>, then it is likely that the allowed number of daily mean exceedences will have been breached. Examination of the 98.08<sup>th</sup> percentile values indicates another potential exceedence (51.2µg/m<sup>3</sup>) at the Osiris monitor in Albert Street. 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, the highest numbers of 24-hour mean exceedences (4) were recorded at Meadowside BAM and Seagate BAM. The 98.08<sup>th</sup> percentile value decreased at Meadowside but increased at Seagate.

Expressing short-term concentrations as 98.08<sup>th</sup> percentile values provides easier inter-year comparison of data and examination of possible trends, see **Figure 2.46**. The 98.08<sup>th</sup> percentile values increased at the majority of sites between 2012 and 2013. The large increases seen at the relocated Osiris units may be partly due to having a full year's worth of data in 2013 compared to 2012. The increases at Stannergate, Myrekirk and Albert Street Osiris monitors may also have been influenced by nearby roadworks during 2013.

An analysis of the frequency of these exceedences is shown in **Table 2.14**. This showed that the majority occurred across eight "Events" at times with variable wind speeds and directions. Event (1) occurring at the end of February and early March was due to a stable high pressure system over the UK, leading to poor dispersion conditions, which combined with incoming pollution from continental Europe to create exceedences, as documented by Defra<sup>7</sup> and the Scottish Government<sup>8</sup>. Comparisons of Dundee daily average PM<sub>10</sub> concentrations with those from urban background monitoring locations in Scotland for each of the eight identified exceedence episodes are shown in **Figures 2.47 to 2.53**. The majority of these events coincided with widespread raised background concentrations.

Three of the events were clearly local:

- Event 3 on 5<sup>th</sup> and 6<sup>th</sup> April 2013 recorded at the Albert Street Osiris coincided with nearby road resurfacing after a gas main replacement;
- Event 6 on 29<sup>th</sup> June 2013 recorded at Stannergate Osiris coincided with carriageway resurfacing works close to the monitor, and
- Event 8 on the 13<sup>th</sup> September 2013 recorded at Stannergate Osiris. The likely cause is unclear but the date coincides with a trial run of the movement of large wind turbine parts from the Port of Dundee to a wind farm near Stonehaven; the route included Stannergate roundabout.

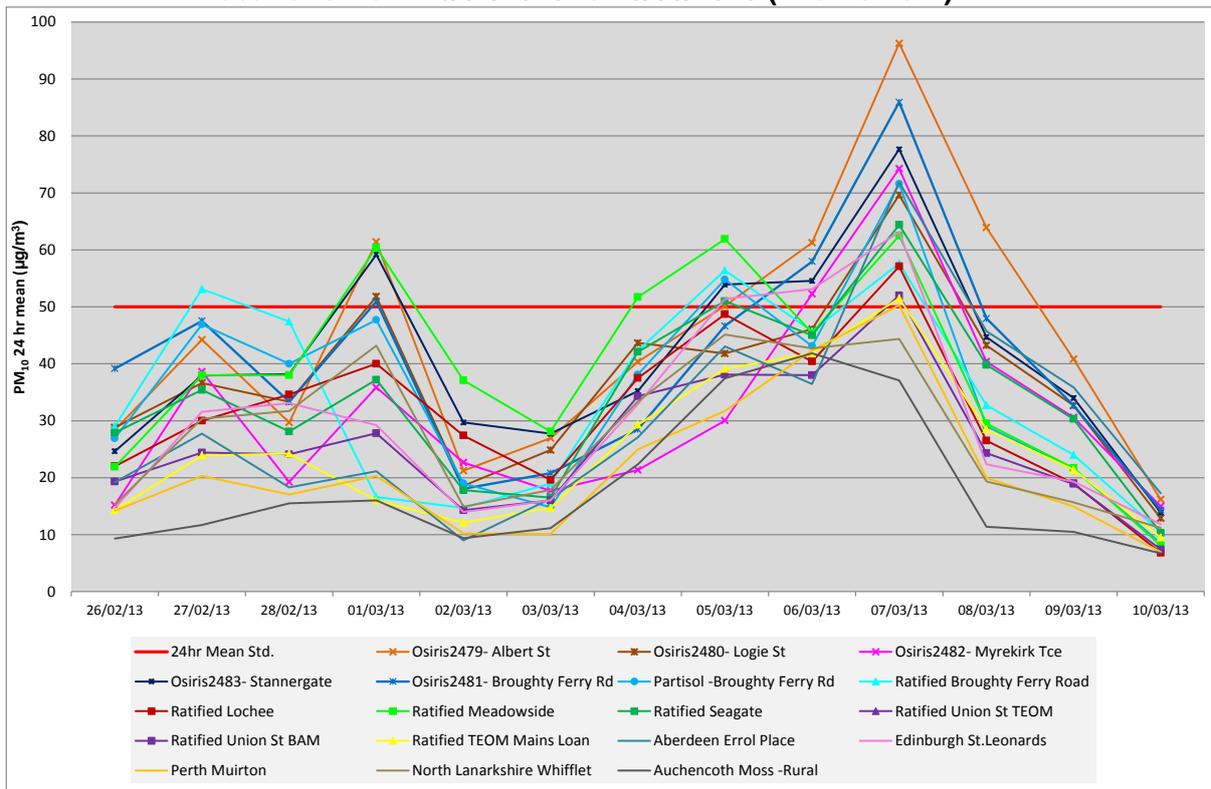
<sup>7</sup> "Air Pollution in the UK 2013", Published by the Department for Environment, Food and Rural Affairs, September 2014 [http://uk-air.defra.gov.uk/library/annualreport/viewonline?year=2013\\_issue\\_1](http://uk-air.defra.gov.uk/library/annualreport/viewonline?year=2013_issue_1)

<sup>8</sup> <http://www.scottishairquality.co.uk/news/index?id=466>

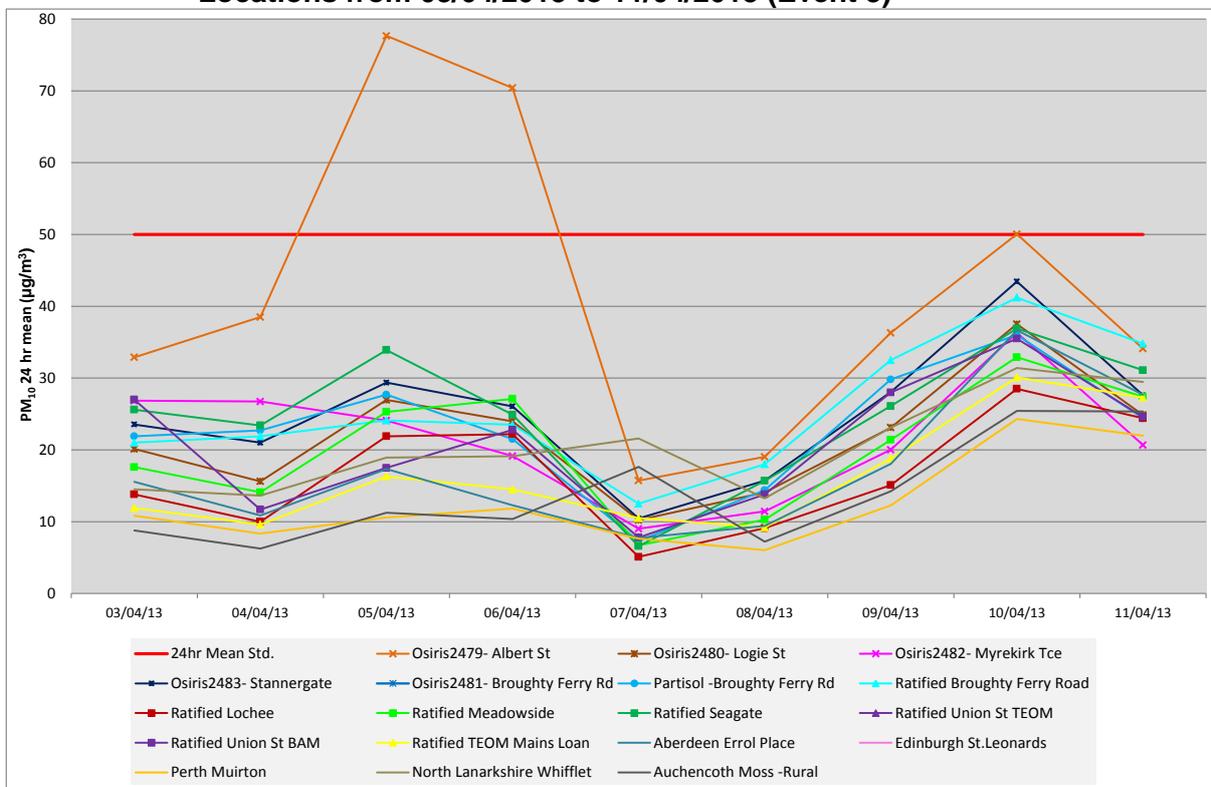
**Table 2.14 Comparison of Eight 24hr Mean Exceedence ‘Events’ in Dundee with Wind Speed and Direction and Urban Background Sites**

	Dates when the PM <sub>10</sub> 24hr-mean std. was exceeded in Dundee	<u>1</u>		<u>2</u>				<u>3</u>		<u>4</u>	<u>5</u>		<u>6</u>	<u>7</u>	<u>8</u>		No. of daily exceedences at monitor	
		27/02/13	01/03/13	04/03/13	05/03/13	06/03/13	07/03/13	08/03/13	05/04/13	06/04/13	19/05/13	29/06/13	30/06/13	20/08/13	13/09/13	02/10/13		03/10/13
		Wed	Fri	Mon	Tue	Wed	Thu	Fri	Fri	Sat	Sun	Sat	Sun	Tue	Fri	Wed		Thu
		Average wind speed (m/s) & dominant wind direction																
Roadside	Dundee Union St (BAM-G)	24.4	27.8	34.3	38.1	38	52	24.3	17.5	22.8	28.7	16.2	10.4	19.5	13	48	44.9	1
	Dundee Meadowside (BAM-G)	38	60.4	51.7	61.9	45.4	62.5	29.5	25.3	27.1	38	18.8	12.5	33.2	21.5	no data		4
	Dundee Seagate (BAM-G)	35.4	37.2	42.1	51	45	64.4	39.8	33.9	24.9	33.6	16.2	10.7	24.7	no data	53.4	55.6	4
	Dundee Lochee (BAM-G)	30	40	37.5	48.7	40.4	57.1	26.5	21.9	22.2	36.5	16	13.1	32.6	19.9	57.5	58.8	3
	Dundee Logie St (Osiris-G)	36.6	51.8	43.7	41.8	46.1	69.6	43.2	27.0	24.0	35.1	17.8	11.7	38.2	18.5	32.6	31.5	2
	Dundee Albert St (Osiris-G)	44.2	61.4	40.4	50.2	61.3	96.3	63.9	77.7	70.4	49.2	19.1	12.3	31.1	15.4	46.5	53.5	7
	Dundee Myrekirk Tce (BAM-G)	38.6	35.9	21.3	30.0	52.3	74.3	40.4	24.1	19.1	31.4	20.4	14.3	30.8	11.9	35.9	36.1	2
Downwind of Port	Dundee Stannergate (Osiris-G)	38.0	59.2	35.2	53.9	54.6	77.7	44.7	29.4	26.1	54.6	99.8	51.6	52.0	56.9	no data		9
	Dundee Broughty Ferry Rd (Partisol)	46.9	47.7	38.1	54.8	43.1	71.6	29	27.7	21.5	30.2	16.3	11.3	21.5	13.5	50.2	43.5	2
	Dundee Broughty Ferry Rd (TEOM-VCM)	53.1	16.6	42.3	56.4	45.7	57.6	32.7	24.1	23.5	27.2	no data		23	13.9	47.2	38.9	3
	Dundee Broughty Ferry Rd (Osiris-G)	47.5	50.9	28.5	46.6	58.0	85.9	48.0	no data		51.6	17.7	11.6	31.9	13.3	37.0	50.3	4
Urban Background	Dundee Mains Loan (TEOM-VCM)	23.9	16	29.3	39.1	41.8	51.5	28.5	16.3	14.5	20.5	no data		19.5	no data	37.6	30.4	1
	Aberdeen Errol PI (TEOM-FDMS)	27.8	21.1	27.1	43.0	36.5	71.9	45.7	17.3	12.3	40.6	12.0	7.8	no data	11.8	38.3	41.7	1
	Edinburgh St Leonards (TEOM-FDMS)	31.6	29.2	32.9	51.4	53.1	63.1	22.3	no data		23.3	15.8	10.5	22.0	14.5	31.5	20.7	3
	North Lanarkshire Whifflet (TEOM-VCM)	30.4	43.2	33.4	45.1	42.7	44.4	19.3	18.9	19.1	18.6	no data		23.0	12.5	21.1	15.6	0
	Perth Muirton (TEOM-FDMS)	20.3	20.3	25.0	31.7	42.3	50.3	20.0	10.6	11.8	18.1	no data		7.9	8.8	7.4	2.8	0

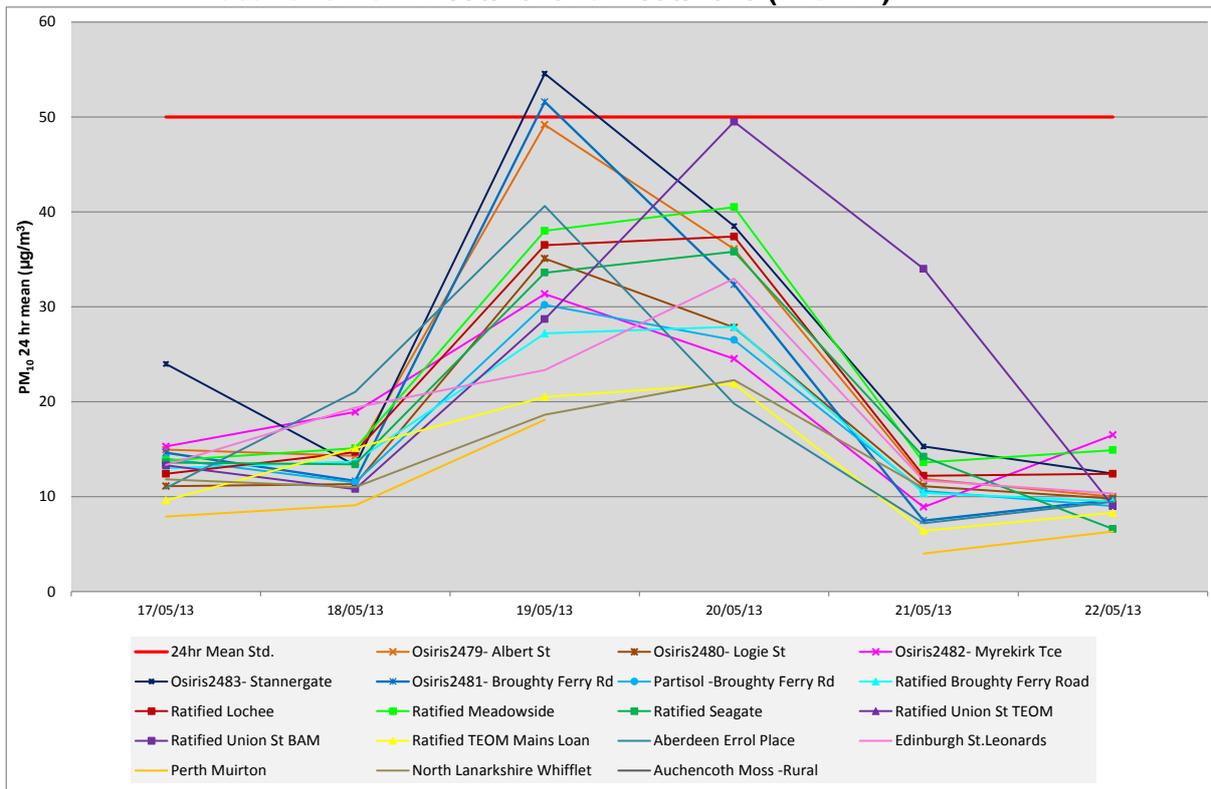
**Figure 2.47 Comparison of Dundee PM<sub>10</sub> Monitoring Sites and Urban Background Locations from 26/02/2013 to 10/03/2013 (Events 1 & 2)**



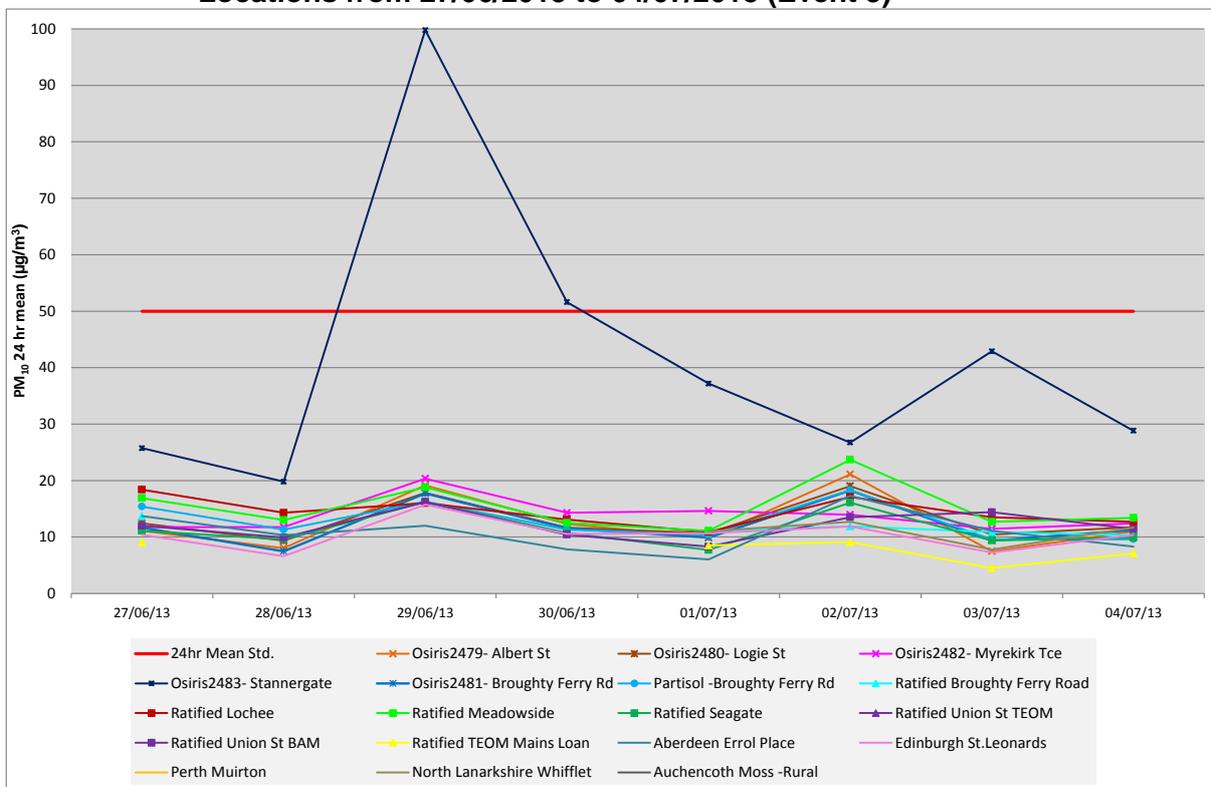
**Figure 2.48 Comparison of Dundee PM<sub>10</sub> Monitoring Sites and Urban Background Locations from 03/04/2013 to 11/04/2013 (Event 3)**



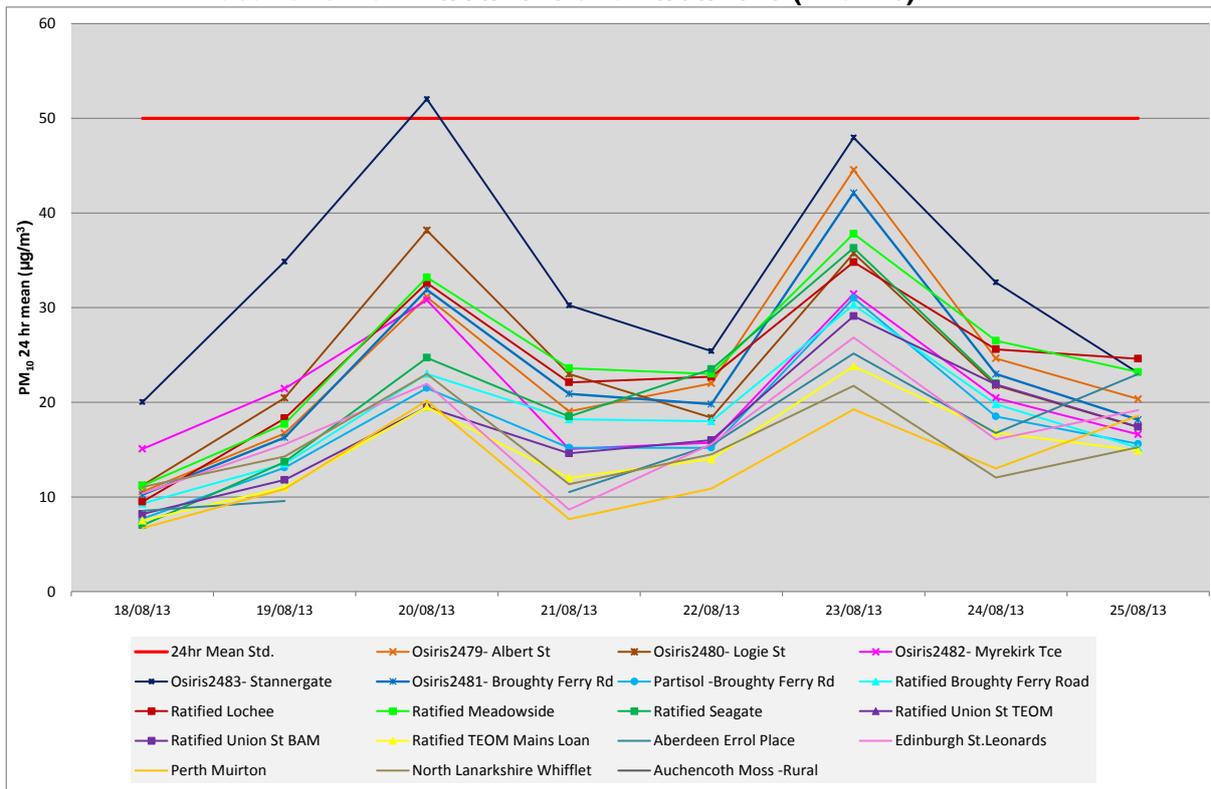
**Figure 2.49 Comparison of Dundee PM<sub>10</sub> Monitoring Sites and Urban Background Locations from 17/05/2013 to 22/05/2013 (Event 4)**



**Figure 2.50 Comparison of Dundee PM<sub>10</sub> Monitoring Sites and Urban Background Locations from 27/06/2013 to 04/07/2013 (Event 5)**



**Figure 2.51 Comparison of Dundee PM<sub>10</sub> Monitoring Sites and Urban Background Locations from 18/08/2013 and 25/08/2013 (Event 6)**



**Figure 2.52 Comparison of Dundee PM<sub>10</sub> Monitoring Sites and Urban Background Locations from 11/09/2013 and 18/09/2013 (Event 7)**

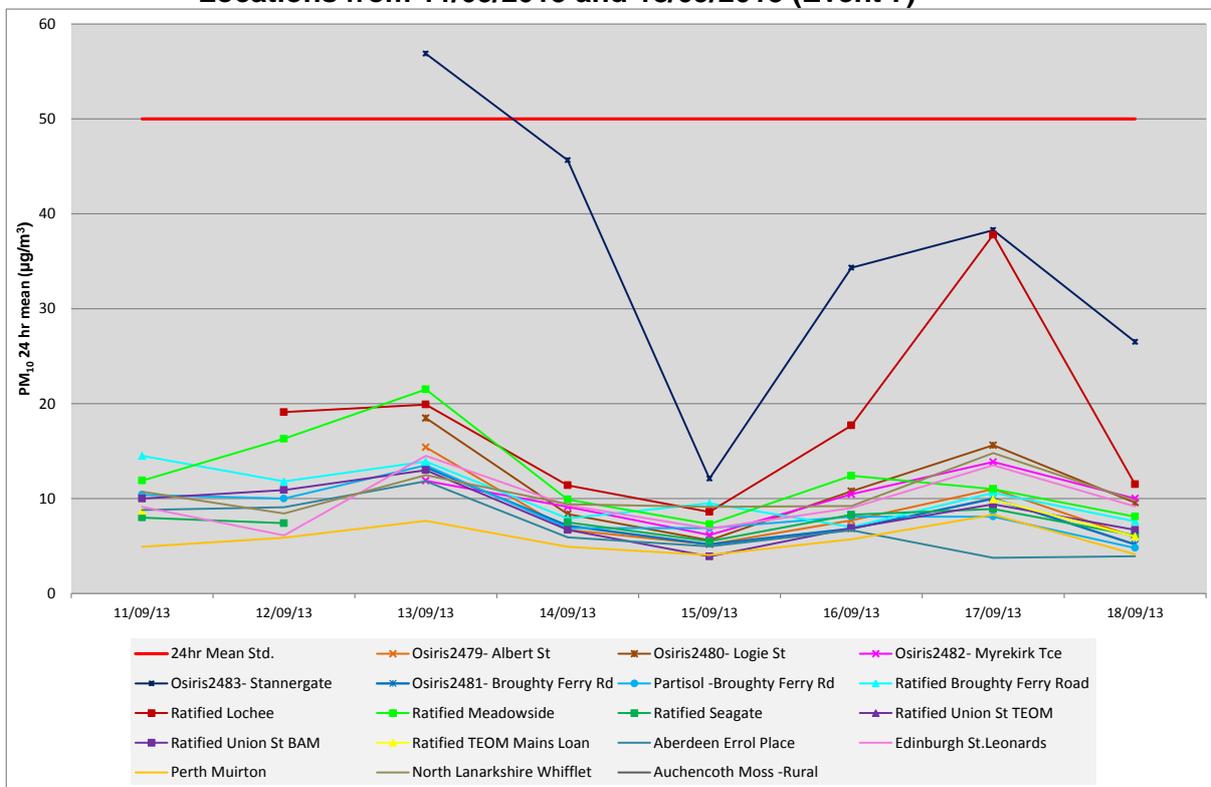
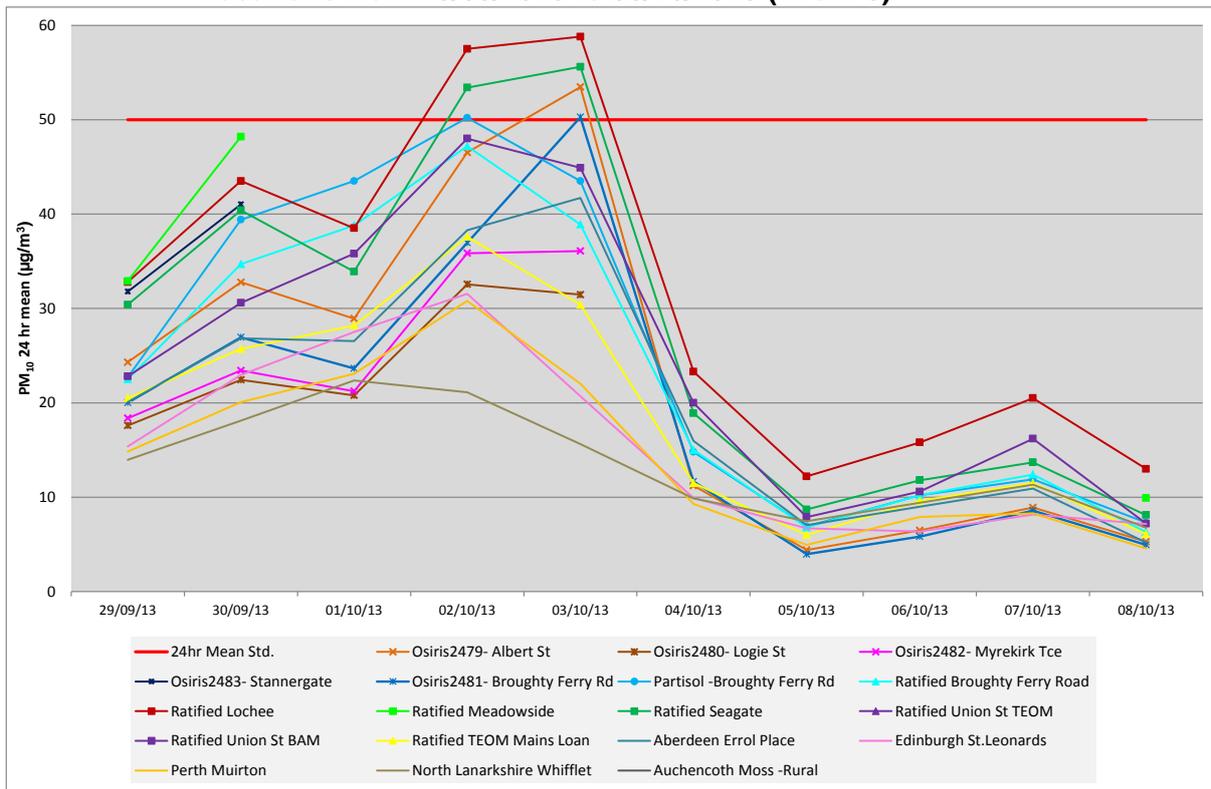


Figure 2.53 Comparison of Dundee PM<sub>10</sub> Monitoring Sites and Urban Background Locations from 29/09/2013 to 08/10/2013 (Event 8)



### 2.2.3 Sulphur Dioxide (SO<sub>2</sub>)

Dundee City Council measures SO<sub>2</sub> at one location, on 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 2013 are shown in **Table 2.15**, along with the results for previous years. Concentrations of SO<sub>2</sub> are very low and all three objectives were met. The number of exceedences of each objective is given alongside the relevant percentile value.

As shown in **Figure 2.54**, SO<sub>2</sub> concentrations have declined at the Broughty Ferry Road monitoring station between 2002 and 2013. This is largely consistent with the introduction of low sulphur fuels (required by regulations since 1<sup>st</sup> 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 Convention<sup>9</sup> (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.

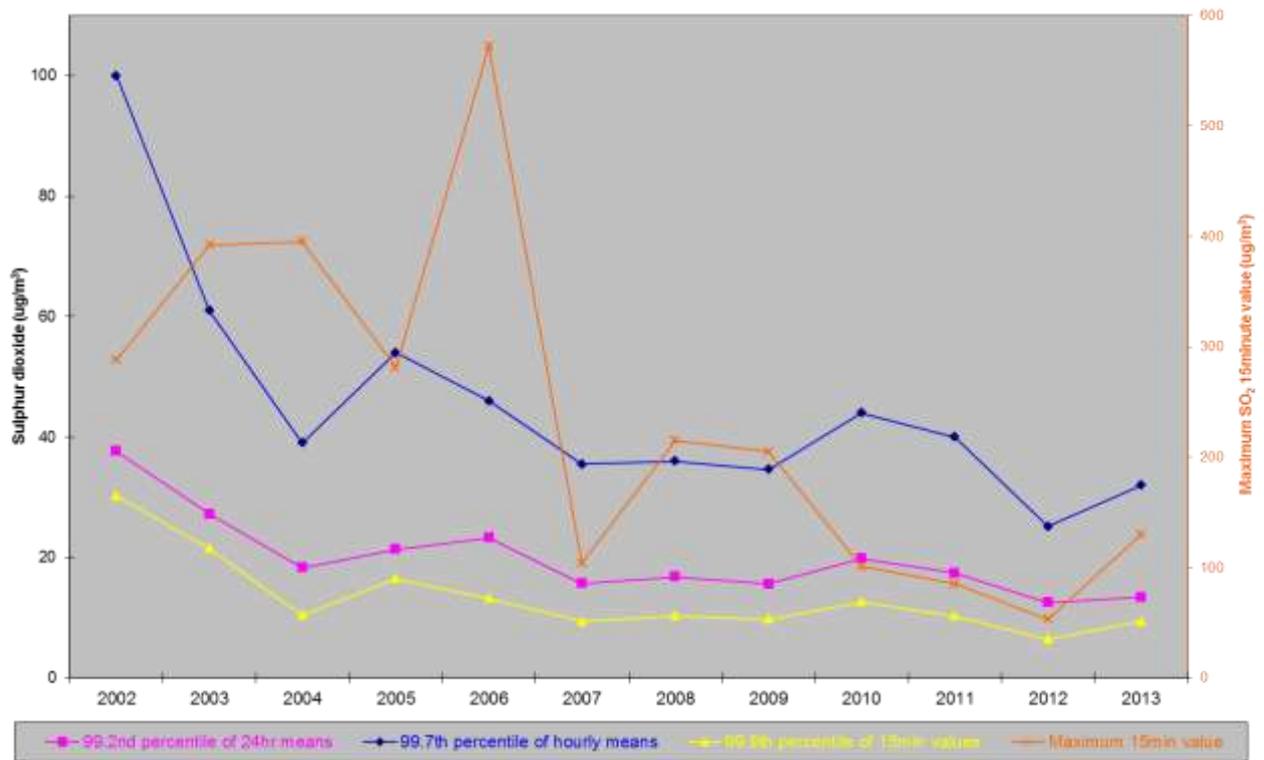
**Table 2.15 Results of SO<sub>2</sub> Automatic Monitoring at Broughty Ferry Road: Comparison with Objectives**

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 <sup>3</sup> (3 allowed per year)	Max (ug/m <sup>3</sup> )	99.2 <sup>nd</sup> percentile (ug/m <sup>3</sup> )	data capture %	No. of exceedences >350ug/m <sup>3</sup> (24 allowed per year)	Max (ug/m <sup>3</sup> )	99.7 <sup>th</sup> percentile (ug/m <sup>3</sup> )	data capture %	No. of exceedences >266ug/m <sup>3</sup> (35 allowed per year)	Max (ug/m <sup>3</sup> )	99.9 <sup>th</sup> percentile (ug/m <sup>3</sup> )	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
2013	0	17.6	13.4	98.4	0	64.3	32	98.5	0	130	51	97.5

Notes: The monitoring station is located within an AQMA for NO<sub>2</sub> and PM10.  
Data capture percentages are for a full calendar year.

<sup>9</sup> 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 2.54 Overview of Maximum (15min) SO<sub>2</sub> Concentrations and Relevant Percentiles from 2002 to 2013



It should also be noted, though it is too soon to be evident in the data, that the bitumen refinery stopped refining oil in December 2013.

## Summary of Compliance with AQS Objectives

Dundee City Council has examined the results from monitoring in 2013. Concentrations within the AQMA, previously declared for NO<sub>2</sub> and PM<sub>10</sub> annual mean and NO<sub>2</sub> 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 NO<sub>2</sub> above the annual mean objective at relevant locations within the AQMA. There are 13 diffusion tube (and 3 associated continuous analyser) locations where the annual mean NO<sub>2</sub> concentration at façade is estimated to exceed the objective. The concentration at the Whitehall Street continuous analyser is close to breaching the annual mean objective at the nearest façade. There are at least a further 16 locations at risk of breaching the objective. A new potential exceedence area has been identified at West Marketgait near Guthrie Street on the inner ring road (A991).

Dundee City Council has measured concentrations of NO<sub>2</sub> above the 1-hour objective at one location (Lochee Road) for five consecutive years. Ninety-nine exceedences (18 allowed per year) were recorded in 2013. Analysis of the patterns of these exceedences has shown that the majority occur at peak traffic times on weekdays during the winter months. However it is thought that traffic may not be the sole cause of these exceedences, e.g. topography, meteorology and domestic heating are factors that may contribute. This area is within the AQMA declared in relation to breaches of the hourly objective.

The PM<sub>10</sub> NAQS 2004 annual mean objective continues to be met at all locations within the city; however Dundee City Council has measured concentrations of PM<sub>10</sub> above the stricter Scottish 2010 annual mean objective at Meadowside (BAM) and Stannergate Osiris. Concentrations at Lochee Road (BAM) and Osiris monitors located in Albert Street and Logie Street were close to exceeding the annual mean objective. The Osiris units are indicative PM<sub>10</sub> monitors.

The PM<sub>10</sub> NAQS 2004 24-hour objective continues to be met at all locations within the city, however, the stricter Scottish 24-hour mean objective (2010) was exceeded at two Osiris monitors located at Stannergate Roundabout and Albert Street in 2013. Both locations experienced transient PM<sub>10</sub> events as a consequence of localised road works and it is known that Osiris monitors have a tendency to over-estimate the number of 24-hour mean exceedences. A detailed assessment for the short-term Scottish objective is not considered necessary at this time though future monitoring results at these locations will be kept under review.

New monitoring data for 2013 show all the objectives for SO<sub>2</sub> 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 PM<sub>10</sub> annual mean standard as a result of the development<sup>10</sup>. 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. The 2013 PM<sub>10</sub> annual mean for this monitor (Myrekirk Terrace, CM17) was 15.8µ/m<sup>3</sup>.

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. Routes to the eastern port access pass through the PM<sub>10</sub> exceedence location at Stannergate roundabout. This area could also be potentially impacted upon by other developments in the vicinity such as the proposed eastern port expansion and the already consented wind turbine manufacturing plant<sup>11</sup>. The proposal to locate a biomass power station within the port is no longer being pursued. 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 management/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. A new road linking the Central Waterfront road network with the city centre at the south end of Union Street is proposed. There is potential for this to impact on air quality if this results in a increase in the number of vehicles using this street canyon. The need for review and assessments of the new roads and junctions will be examined in subsequent reports as necessary.

<sup>10</sup> <http://idoxwam.dundeeecity.gov.uk/WAM133/doc/Report-345111.PDF?extension=.PDF&id=345111&location=VOLUME2&contentType=application/pdf&pageCount=1>

<sup>11</sup> [http://idoxwam.dundeeecity.gov.uk/idoxpa-web/files/7041BE0BD1BEC4C5E14EEC0E473A9E5B/pdf/12\\_00558\\_PPPM-STRATEGIC\\_TRANSPORT\\_ASSESSMENT-429412.pdf](http://idoxwam.dundeeecity.gov.uk/idoxpa-web/files/7041BE0BD1BEC4C5E14EEC0E473A9E5B/pdf/12_00558_PPPM-STRATEGIC_TRANSPORT_ASSESSMENT-429412.pdf)

In 2012, the Council approved the masterplan<sup>12</sup> for the redevelopment of the Highgate area of the Lochee district centre. Its completion in the summer of 2014 will deliver a new road linking the bypass with the High Street, a public transport hub, new car parking and event space, new public realm infrastructure and new development sites for a range of uses within the boundary of the new District Centre providing greater choice of commercial and residential buildings within the High Street area. Increases in traffic and bus services to the area and the introduction of sensitive receptors close to busy roads have the potential to impact on air quality.

Plans to change the use of part of the Wellgate Shopping Centre, in the city centre, to include an eight screen cinema were approved in 2013<sup>13</sup>. The shopping centre is accessible by a variety of transport modes including walking, cycling, public transport and private car. It also has an existing multi-storey car park; which exits onto Meadowside, a known air quality hotspot. Increased use of the car park and extension to the hours of use has the potential to impact on air quality in this area. A condition has been applied to the consent requiring the provision of electric vehicle charging points, or other mitigation measures prior to the first use of the new facility.

### 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 at

<sup>12</sup> <http://www.dundee.gov.uk/reports/reports/25-2012.pdf>

<sup>13</sup> <http://idoxwam.dundee.gov.uk/idoxpa-web/applicationDetails.do?activeTab=summary&keyVal=MPRIDOGCFOD00>

the granting of planning permission in principle, and the need for a detailed assessment of this facility will be kept under review.

SEPA were consulted regarding any changes that meet 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%.<sup>14</sup> 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. The same process stopped refining oil in December 2013 which will have resulted in an overall decrease in emissions.

An application for a new gas fired combined heat and power plant (CHP) with associated stack at the University of Dundee was granted planning approval in 2013<sup>15</sup>. The proposed stack installation is in close proximity to three existing CHP stacks and main boiler house stack. A preliminary screening assessment for NO<sub>2</sub> was carried out using the nomogram provided for short stacks in the technical guidance (Fig. 5.3 - LAQM TG.09). This nomogram was selected as the total emissions from the existing units and the new CHP were assumed to be emitted from the shortest stack. The effective stack height was assumed to be zero due to the presence of a taller building within a distance of 5 stack heights. The actual emission rate exceeded the target emission rate for the nearest receptor, indicating that a detailed assessment was required. However the applicants provided a more accurate air dispersion model carried out in 2009. This indicated that though existing impacts are significant the air quality objectives would be achieved if the new CHP emissions used the main boiler house stack. It is not known whether the University will decide to pursue the installation modelled or the arrangement granted planning permission. If the latter arrangement is pursued then an updated air dispersion model will be required, to take account of the different emission parameters, stack location, up-to-date background concentrations, locations of receptors (including those at height), and the contribution from local roads.

### 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:

- Biomass<sup>16</sup> 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

<sup>14</sup> 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.

<sup>15</sup> <http://idoxwam.dundee.gov.uk/idoxpa-web/simpleSearchResults.do?action=firstPage>

<sup>16</sup> 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.

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. Owing to the inclusion of a question on central heating an analysis of Census data<sup>17</sup>, when available, may 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 Assessment<sup>18</sup> 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.

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.

Since the last USA several dust complaints were received during the demolition of Tayside House along with a near exceedence of the 24-hour mean was recorded at Union Street (BAM) on the 20<sup>th</sup> May 2013. Tayside House was a prominent 18-storey tower block to the south of the city centre with approx. 300 residences within a 200m radius. It was demolished to accommodate the new road layout for the Central Waterfront. The building was also located approx. 200m to the east of the Union Street monitoring station. As the building was above an underground railway tunnel, it could not be demolished using explosives and instead had to be demolished in stages from late 2012 to mid-way through 2013. Due to the close proximity to nearby residences dust mitigation measures were included throughout the demolition process to minimise the likelihood of complaints and nuisance to residents. The upper floors were removed on a floor by floor basis using small robotic breakers and

<sup>17</sup> Question H9 “What type of central heating does this accommodation have?”

<sup>18</sup> “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

controlled drop zones. Once the upper floors were removed a long reach grabber (see **Figure 3.1**) was then used to reduce the building to a height at which it would be safe to use conventional machine demolition. The long reach grabber was on site from May to July 2013 and should have had high-level water sprayers close to the grabber but these had not been fitted. This did not initially result in complaints but did when the weather was dry and the wind direction was toward nearby residences. Complaints were received on 5 separate days during May and June, but as the height of the building reduced fugitive dust emissions were better controlled by low-level water sprayers. The site has now been cleared.

**Figure 3.1 Long Reach Grabber Used in Demolition Tayside House**



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),
- New road linking central waterfront development road network with city centre road network accessing areas of concern,
- Highgate Redevelopment, Lochee,
- Proposed cinema development at the Wellgate Shopping Centre, and
- Proposed Combined Heat & Power Plant at the University of Dundee.

These will be taken into consideration in the next Updating and Screening Assessment, or as information becomes available.

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. An analysis of Census data, when available may 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.

## 4 Local / Regional Air Quality Strategy

The relevant Policy Guidance<sup>19</sup> 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.

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<sup>19</sup> <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, it is useful to highlight planning applications for new developments which have not yet been approved but which could impact upon air quality as this can help give a picture of areas where changes may occur and also where combined impacts of several developments may become important.

A proposal of application notice was received in 2013 regarding a new mixed use development including; a food store, employment land, pub and restaurant<sup>20</sup>. The development is proposed on Kingsway East opposite an existing retail park and could have an impact on air quality due to the proximity of sensitive receptors to the access road.

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 and has the potential to result in an increase in HGVs entering the port from the east. Routes to the eastern port access pass through the PM<sub>10</sub> exceedence location at Stannergate roundabout. This area could also be potentially impacted upon by the proposed eastern port expansion and the already consented wind turbine manufacturing plant. The proposal to locate a biomass power station within the port is no longer being pursued.

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

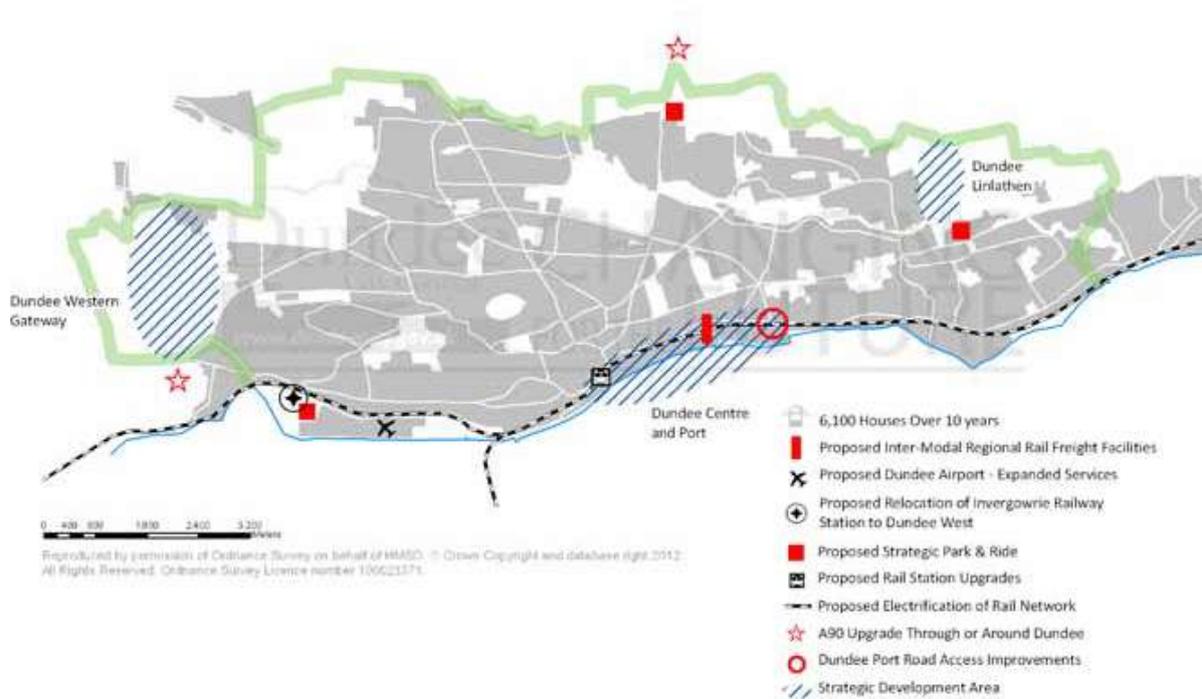
The Port of Dundee coupled with the Central Waterfront is one of three Strategic Development Areas identified in the Local Development Plan (LDP) along with Dundee Western Gateway (50 hectares of employment land) and Linlathen (40 hectares of employment land) north of the A92 on the east of the city. These areas are shown in **Figure 5.1**<sup>21</sup> along with housing land requirement for the plan period, and major infrastructure and transport proposals.

The Strategic Development Areas are safeguarded in the 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.

<sup>20</sup> <http://idoxwam.dundee.gov.uk/idoxpa-web/simpleSearchResults.do?action=firstPage>

<sup>21</sup> 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 Plan<sup>22</sup>**

The Environmental Report and associated Annexes<sup>23, 24</sup>, which formed part of the SEA of the proposed LDP, recognised that air quality within the city was worsening and that there was 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
<b>Human Health</b>	<b>3.</b> To maximise the health and well-being of the population through improved environmental quality and access	Effect of Plan on indicators for: <b>a.</b> air quality
<b>Air Quality</b>	<b>6.</b> To protect and enhance air quality	Effect of Plan on indicators for: <b>a.</b> impact on Air Quality legislative limits in AQMA

<sup>22</sup> [http://www.dundeeccity.gov.uk/sites/default/files/publications/CD\\_LDP\\_Environment%20\\_Report\\_March13.pdf](http://www.dundeeccity.gov.uk/sites/default/files/publications/CD_LDP_Environment%20_Report_March13.pdf)

<sup>23</sup> [http://www.dundeeccity.gov.uk/sites/default/files/publications/CD\\_LDPSEA\\_Annex\\_1\\_Economic\\_Growth.pdf](http://www.dundeeccity.gov.uk/sites/default/files/publications/CD_LDPSEA_Annex_1_Economic_Growth.pdf)

<sup>24</sup> [http://www.dundeeccity.gov.uk/sites/default/files/publications/CD\\_LDP\\_Annex\\_2\\_Quality\\_Housing.pdf](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"<sup>25</sup> on the Proposals Map<sup>26</sup>.*

*"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."<sup>27</sup>*

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.

<sup>25</sup> <http://www.dundee.gov.uk/sites/default/files/publications/Proposed%20Dundee%20Local%20Development%20Plan%20-%20as%20Modified%20Oct13.pdf>, paragraph 7.4 & 7.5

<sup>26</sup> <http://www.dundee.gov.uk/sites/default/files/publications/Proposed%20Dundee%20Local%20Development%20Plan%202012%20Proposals%20Map.pdf>

<sup>27</sup> [http://www.dundee.gov.uk/sites/default/files/publications/CD\\_LDPSEA\\_Annex\\_7\\_Site\\_Assessment.pdf](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*”<sup>28</sup> 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**).

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<sup>28</sup> [http://www.dundee.gov.uk/sites/default/files/publications/CD\\_LDP\\_Annex\\_4\\_Sustainable\\_Natural.pdf](http://www.dundee.gov.uk/sites/default/files/publications/CD_LDP_Annex_4_Sustainable_Natural.pdf)

## 6 Air Quality Planning Policies

Dundee City Council adopted the Dundee Local Development Plan (LDP) on 5 December 2013<sup>29</sup>. The Local Development Plan for Dundee contains the spatial strategy that will guide future development up to 2024 and shows which land is being allocated to meet the City's development needs and where new development should and should not happen. The Plan contains policies and proposals covering the principal land use issues in the City and will provide the context in which decisions on planning applications will be made. The Local Development Plan will be reviewed at five yearly intervals to ensure that an up to date plan is in place at all times to guide future development in the City. The Local Development Plan 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 (including biomass), air quality and sustainable transport. Extracts from the LDP outlining the Policies are provided (*in italics*):

### **General Economic Development Areas – Policy 3 (paragraph 5.29)**

*“Where existing industrial areas are close to housing, the protection of residential amenity will be 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 (paragraph 7.28)**

*“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 draft LDP suggested that there could be *“potential contribution to the provision of air quality infrastructure through Air Quality SPG and Action Plan”*<sup>30</sup>.

### **Renewable Energy – Policy 30 (paragraphs 9.3,9.4 and 9.5)**

*“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 CO<sub>2</sub> 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.”* **Biomass** : Major energy generating plants require to be supplied

<sup>29</sup> <http://www.dundee.gov.uk/localdevplan>

<sup>30</sup> [http://www.dundee.gov.uk/sites/default/files/publications/CD\\_LDP\\_Annex\\_2\\_Quality\\_Housing.pdf](http://www.dundee.gov.uk/sites/default/files/publications/CD_LDP_Annex_2_Quality_Housing.pdf)

*with large quantities of virgin biomass materials, waste materials, or a combination of both. These require to be transported to the site via road, rail or sea. Given the scale and nature of the operation of these plants they are more suited to existing employment areas. District Heating Schemes would be supported in preference to a large number of individual biomass schemes and may be acceptable out with existing employment areas. All major biomass plant will be expected to mitigate emissions by installation of appropriate abatement technology. An air quality assessment may be required as an integral part of the planning process for applications for biomass energy generating schemes. Guidance related to air quality assessments will be contained in the Supplementary Guidance being prepared for Air Quality". The Environmental Report of the draft LDP recognised 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 (paragraphs 9.27 and 9.28)**

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

Draft Air Quality Supplementary Planning Guidance (SPG) will be consulted upon as part of a package of SPGs in 2014.

**Sustainable and Accessible Transport – Policies 54, 55, 57 and Proposal 1 (paragraphs 10.1, 10.15, 10.16 and 10.17)**

*"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 [Strategic Transport Projects Review](#) Project 8 sets out the aim to make public transport more competitive with the car by providing highly visible and accessible Park & Ride sites on key commuter routes. The provision of new strategic Park & Ride sites will encourage the use of public transport and help make city centres and employment areas more easily accessible."*

*"TAYplan Action Programme identified the four areas where the potential for strategic Park & 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 & 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. It is intended to progress a business case to further investigate the potential for this relocation option. The area of Dundee being considered for the potential relocation of Invergowrie Rail Station is along Riverside and likely to be in close proximity to the proposed Park & Ride facility."*

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

Policy	Statement
3	<p><b>General Economic Development Areas</b>            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.</p> <p>Other uses within these areas will not be supported.</p>
19	<p><b>Funding of On and Off Site Infrastructure Provision</b>            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 prior to commercial decisions and actions being undertaken.</p>
30	<p><b>Biomass Energy Generating Plant</b>            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> <p>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.</p>
44	<p><b>Air Quality</b>            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>

Policy	Statement
54	<p><b>Active Travel</b>            New development should be designed in order to:</p> <ol style="list-style-type: none"> <li>1) minimise the need to travel by private car,</li> <li>2) improve access to services, and</li> <li>3) promote healthy lifestyles by encouraging active travel.</li> </ol> <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><small>*appropriate - refers to the specification choice of: footways, footpaths, cycle ways or shared surface paths</small></p>
55	<p><b>Accessibility of New Developments</b>            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"> <li>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</li> <li>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</li> <li>3) Have no detrimental effect on the capacity or functioning of the existing road or rail networks; and</li> <li>4) Ensure that safe and adequate provision is made for road freight and waste access, loading and unloading, and</li> <li>5) Comply with Dundee City Council's roads design standards 'Streets Ahead'.</li> </ol>
57	<p><b>Car Parking</b>  <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.  <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	<p><b>Riverside Park &amp; Ride Transport Interchange</b><sup>31</sup>            The City Council supports the establishment of Park &amp; Ride facilities on land to the east of the Nature Park at Riverside Drive. In addition, the Council supports the further investigation, including the preparation of a business case, for the potential relocation of Invergowrie Rail Station to Dundee West.</p>

<sup>31</sup> Dundee West site at Wright Avenue rejected by Development Management Committee October 2013 – see update re Measure % in Action Plan Progress Report **Appendix I**

## 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

A review of The Local Transport Strategy is scheduled to begin in 2014, although the 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. Dundee City Council is engaging with European partners to look at collaborative opportunities for sustainability and integration in transport, including new engine technologies, behaviour change strategies and development of new intelligent transport systems.

## 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 NO<sub>2</sub> and PM<sub>10</sub>, 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 2013.

The progress made on implementing the measures contained within DCC's AQAP 2011 is listed in **Appendix I** 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.

It can be difficult to attribute changes in monitored pollutant concentrations to the success of individual action plan measures. This can be because the impacts of different measures may overlap. Other impacts are so widespread and diffuse that they are unlikely to be detectable from the normal year-on-year changes caused by other factors such as meteorology and, from the rising primary NO<sub>2</sub> emissions associated with the increasing proportion of diesel vehicles on the roads. Hence surrogate indicators are used where possible.

Some of the main action points completed in 2013/14 are summarized below:

- Introduction of the ECOSTARS Fleet Recognition Scheme to Dundee, with 12 inaugural members. This is a fleet accreditation system that acknowledges greener fleets (see Case Study)
- Improvements to Bus Fleets carried out by National Express (Dundee) and Stagecoach; e.g. 9 New Hybrid Buses introduced
- Improvements carried out to DCC fleet, over 80 vehicles replaced as part of a programme of continual change
- Infrastructure changes to increase separation distances between receptors and road traffic at hotspot location in Meadowside.

Notable actions being taken forward in 2014/15 include:

- Expansion of the highly praised behavioural change primary school programme to include all primary schools in Dundee.
- Review of city centre bus corridor emissions modelling in respect of potential low emission strategy/LEZ options
- Expansion of Bluetooth traffic speed monitoring to include the Lochee Road Corridor
- Investigation of Traffic Management Options in /around Seagate including possible bus stop relocation
- Expansion of ECOSTARS scheme to include taxi operators
- Upgrades to Cycling & Walking Networks around the port and across the railway.

## CASE STUDY: Introduction of the ECOSTARS Fleet Recognition Scheme



Dundee ECO Stars Fleet Recognition Scheme was successfully launched on the 13th December 2013 with 12 inaugural members (1173 vehicles). The ECOSTARS Fleet Recognition Scheme is designed to provide recognition, guidance and advice to operators of goods vehicles, and buses and coaches, who are implementing operational best practice measures, to improve efficiency, reduce fuel consumption and reduce fleet emissions – all helping to improve local air quality, maximise carbon savings and tackle climate change.

The scheme also intends to raise awareness among operators of commercial vehicles of the important role they can play in helping to improve local air quality, through improved fleet environmental performance. It also provides the opportunity to profile best practice examples adopted and implemented by leading fleets to a wider audience, including other operators, customers and the general public.

### The key messages that the scheme are:

- Operational efficiency measures, particularly in relation to operating cleaner vehicles and effectively managing fuel use, can lead to financial savings and improved environmental performance
- The scheme is able to provide recognition (in the form of acknowledgement at the vehicle level and also at the whole operation level), as well as support, for those operators implementing operational efficiency measures
- Signing up to the scheme and receiving recognition for measures already implemented can help to raise the profile of an organisation's commitment to operational and environmental performance, particularly in the eyes of customers, competitors and local communities
- Effective Fuel Management Programmes, comprising individual component measures such as monitoring and targeting fleet fuel use, driver training and use of supporting equipment and systems, lie at the heart of operational efficiency
- Reduced fuel consumption means reduced operating costs and reduced environmental impact, through reduced vehicle emissions. This leads to both financial and environmental (including carbon) savings

Membership of the scheme is free of charge, regardless of fleet size

## 10 Conclusions and Proposed Actions

### 10.1 Conclusions from New Monitoring Data

Each pollutant has been assessed in conjunction with the relevant guidance and the conclusions reached are:

**Nitrogen dioxide (NO<sub>2</sub>)** – analysis of the 2013 data for nitrogen dioxide reconfirms the need for the AQMA and the Action Plan. There are 13 diffusion tube (and 3 associated continuous analyser) locations where the annual mean NO<sub>2</sub> concentration at façade is estimated to exceed the objective. The concentration at the Whitehall Street continuous analyser is close to breaching the annual mean objective at the nearest façade. There are at least a further 16 locations at risk of breaching the objective. A new potential exceedence area has been identified at West Marketgait near Guthrie Street on the inner ring road (A991).

Ninety nine exceedences of the NO<sub>2</sub> hourly mean were recorded at the automatic monitoring station on Lochee Road (A923); 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. However it is thought that traffic may not be the sole cause of these exceedences; e.g. topography, meteorology and domestic heating are factors that may contribute.

NO<sub>2</sub> 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 (A923) and associated access roads, major junctions on the Kingsway, Stannergate roundabout and the inner ring road. Between 2012 and 2013 large decreases (> 4 µg/m<sup>3</sup>) were recorded at diffusion tubes located at Stannergate roundabout, Forfar Road near the Kingsway, Lochee Road, Rankine Street, and Meadowside. Moderate increases (>2 µg/m<sup>3</sup>) were recorded at diffusion tubes located in: Whitehall Street; Logie Street; Muirton Road; East Port Roundabout on the inner ring road; Seagate near the bus station; Nethergate and the Kingsway (A90T) near Mains Loan.

**Small Particulates (PM<sub>10</sub>)** - The PM<sub>10</sub> NAQS 2004 annual mean objective continues to be achieved at all locations within the city, however in 2013 concentrations of PM<sub>10</sub> above the stricter Scottish 2010 annual mean objective were measured at Meadowside (BAM) and Stannergate Osiris. Concentrations at Lochee Road (BAM) and Osiris monitors in Albert Street and Logie Street were close to exceeding the annual mean objective. The Osiris units are indicative PM<sub>10</sub> monitors.

The PM<sub>10</sub> NAQS 2004 24-hour objective continues to be met at all locations within the city, however, the stricter Scottish 24-hour mean objective (2010) was exceeded at two Osiris monitors located at Stannergate Roundabout and Albert Street in 2013. Both locations experienced transient PM<sub>10</sub> events as a consequence of localised road works and it is known that Osiris monitors have a tendency to over-estimate the number of 24-hour mean exceedences. A detailed assessment for the short-term Scottish objective is not considered necessary at this time though future monitoring results at these locations will be kept under review.

There has been a slight reduction in annual mean PM<sub>10</sub> concentrations, at the majority of sites with five or more year's data. An increasing trend was observed at Osiris monitors

when located in Lochee Road and Seagate, and a slight increase is evident at TEOM and Partisol monitors located at Broughty Ferry Road. Some year to year fluctuations are evident at roadside and kerbside sites.

**Sulphur Dioxide (SO<sub>2</sub>)** - The monitoring results for 2013 indicate that all the NAQS objectives for sulphur dioxide (SO<sub>2</sub>) were met at the monitoring location in Dundee. A detailed assessment is not currently required for this pollutant.

## 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),
- New road linking central waterfront development road network with city centre road network accessing areas of concern,
- Highgate Redevelopment, Lochee,
- Proposed cinema development at the Wellgate Shopping Centre, and
- Proposed Combined Heat & Power Plant at the University of Dundee.

These will be taken into consideration in the next Updating and Screening Assessment, or as information becomes available.

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. An analysis of Census data, when available may 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

Points of note from other sections are summarised below:

**Local/Regional Air Quality Strategy, Section 4** concludes that a Local Air Quality Strategy is not necessary as the AQMA and Action Plan covers the whole administrative area. The need for a regional air quality strategy will be kept under review.

**Planning Applications, 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.

**Air Quality Planning Policies, Section 6** illustrates the policies and proposals in the LDP which are intended to mitigate these impacts. The Local Development Plan for Dundee was adopted in 2013 and contains the spatial strategy that will guide future development up to 2024. The LDP will be reviewed at five yearly intervals. Draft Air Quality Supplementary Planning Guidance (SPG) will be consulted upon as part of a package of SPGs in 2014.

**Local Transport Plans and Strategies, Section 7** highlights 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 Local Development Plan (LDP) which is reviewed in **Sections 5 & 6**.

**Implementation of Action Plans, Section 9 and Appendix I** 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.

Some of the main action points completed in 2013/14 are summarized below:

- Introduction of the ECOSTARS Fleet Recognition Scheme to Dundee, with 12 inaugural members. This is a fleet accreditation system that acknowledges greener fleets;
- Improvements to Bus Fleets carried out by National Express (Dundee) and Stagecoach, e.g. 9 New Hybrid Buses introduced;
- Improvements carried out to DCC fleet, over 80 vehicles replaced as part of a programme of continual change; and
- Infrastructure changes to increase separation distances between receptors and road traffic at hotspot location in Meadowside.

Notable actions being taken forward in 2014/15 include:

- Expansion of the highly praised behavioural change primary school programme to include all primary schools in Dundee.
- Review of city centre bus corridor emissions modelling in respect of potential low emission strategy/LEZ options
- Expansion of Bluetooth traffic speed monitoring to include the Lochee Road Corridor
- Investigation of Traffic Management Options in /around Seagate including possible bus stop relocation
- Expansion of ECOSTARS scheme to include taxi operators
- Upgrades to Cycling & Walking Networks around the port and across the railway.

## 10.4 Proposed Actions

Proposed actions arising from this Progress Report 2014 are as follows:

- All locations with exceedences identified by new 2013 monitoring data lie within the existing AQMA that was declared for the PM<sub>10</sub> and NO<sub>2</sub> annual mean and NO<sub>2</sub> hour-mean objectives. A detailed assessment for the short-term Scottish PM<sub>10</sub> objective is not considered necessary at this time though future monitoring results at Stannergate roundabout and Albert Street will be kept under review;
- As part of the ongoing review and assessment of air quality in Dundee a new diffusion tube site at Horsewater Wynd has been added to the network in 2014. Several of the new diffusion tube sites added to the network in 2013 were not continued into 2014 as the measured annual mean NO<sub>2</sub> concentrations were well below the objective. These will be detailed in next year's report;
- Review monitoring to account for any newly identified relevant exposure;
- Continue monitoring at Union Street to determine the effect of the traffic accessing the city centre via the new link road from the Central Waterfront road network;
- 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;

- Seek advice from the LAQM helpdesk on how best to assess the impacts of the various sources on the possible PM<sub>10</sub> exceedences at Stannergate roundabout;
- Compare diurnal profiles of pollutant concentrations and traffic (where available), in particular for Lochee Road;
- Take forward the assessments of new developments identified in Section 3, as information becomes available;
- 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 2015 Updating and Screening Assessment.

## 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: Comparison of hourly NO<sub>2</sub> concentrations at Lochee Road with temperature and local traffic flows

Appendix I: Action Plan Progress Report

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 Website<sup>32</sup> for Tayside Scientific Services is **0.78** (Spreadsheet version 06/14). This is based on 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 roadside automatic nitrogen dioxide analysers. There were co-location studies carried out at 5 automatic monitoring locations in 2013. 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 2013. 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 over the previous 5 quarterly WASP rounds up to December 2013 (see **Appendix A7**). The automatic analyser period means are calculated from mid-day on tube changeover days.

**Table A.1 Bias Factors from 2013 Co-location Studies and National Bias Adjustment Spreadsheet (Version 06/14)**

Site Type <sup>3</sup>	Site Name	Length of Study (months)	Diffusion Tube Mean Conc. (Dm) (µg/m <sup>3</sup> )	Automatic Monitor Mean Conc. (Cm) (µg/m <sup>3</sup> )	% DC <sup>1</sup>	Bias (B)	Tube Precision <sup>2</sup>	Bias Adjustment Factor (A) (Cm/Dm)
R	Lochee Road	12	51	52	100	-2.0%	G	<b>1.02</b>
R	Meadow side	10	59	50	99	18.0%	G	<b>0.85</b>
R	Seagate	10	54	54	99	0.0%	G	<b>1.00</b>
R	Union Street	12	40	31	97	30.0%	G	<b>0.77</b>
R	Whitehall Street	12	50	41	99	20.0%	G	<b>0.83</b>
K	Marylebone Road Intercomparison	12	103	81	n/a	27.6%	G	<b>0.78</b>

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

<sup>32</sup> <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. 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 Consultants<sup>33</sup> (AQC) (see **Table A.2**). The factor obtained using only local roadside sites was **0.88**, and **0.87** when the kerbside site at Marylebone Road was included. The **0.87** bias correction factor has been used to bias correct diffusion tube data presented in this report.

**Table A.2 Manual Approximate Orthogonal Regression Calculation 2013**

Co-location Sites 2012	Site Type <sup>1</sup>	Bias Factor A	Bias B
Lochee Road	R	1.02	-2%
Meadowside	R	0.85	18%
Seagate	R	1	0%
Union St	R	0.77	30%
Whitehall St	R	0.83	20%
<b>Mean Local</b>		0.89	13.2%
<b>National:</b>			
Marylebone Road Intercomparison	K	0.78	27.6%
<b>Combined Local &amp; National:</b>			
Mean Combined		0.88	15.6%

Manual orthogonal regression Calculation as para 2.4 AQC doc <sup>2</sup>		
Express as a factor	Add 1	Inverse
0.132	1.132	<b>0.88</b>
0.156	1.156	<b>0.87</b>

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 (PM<sub>10</sub>) 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 PM<sub>10</sub> 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.

<sup>33</sup> <http://laqm.defra.gov.uk/documents/NO2-Diffusion-Tube-Collocation-Methodology.pdf>

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. For comparison with the NAQS objectives annual mean concentrations are calculated from an hourly timebase. It should be noted that the annual mean concentrations for each of the BAM analysers in 2013 is based on ratified 15min values derived from the hourly averages recorded by the BAM. BAM analysers record one PM<sub>10</sub> value for each hour. The logger at each site records 4 identical 15 min values (e.g.00:15, 00:30, 00:45 and 01:00) to represent the hourly average recorded by the BAM. It was discovered that during 2013 some of these 15 min values had been allocated incorrectly by the logger (e.g. 00:00, 00:15, 00:30 and 00:45). The consequence of this is that some of the hourly averages calculated would be incorrect. The issue was discussed with Ricardo-AEA<sup>34</sup> and it was agreed that, in this instance, the annual average would be better calculated from the 15 min values. However, the hourly values and annual means for the DCC BAMs on the Scottish Government website<sup>35</sup> remain based on the hourly averages from the logger, some of which are incorrect.

TEOM PM<sub>10</sub> data presented in this report is corrected using the VCM method (see **Appendix B**). BAM PM<sub>10</sub> 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).

One of the Osiris units has been co-located with the Partisol 2025 at the urban industrial site at Broughty Ferry Road since September 2012, thus allowing the annual mean Osiris results presented in this report to be gravimetrically corrected prior to reporting. The gravimetric factor applied was 1.1.

### A5 - Short-term to Long-term Data adjustment

Annualisation of data was carried out for one NOx analyser (Mains Loan) and 4 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 Automatic Analysers**

Locations	Site Type	Count	Data capture %	Annual Mean, Am (µg/m <sup>3</sup> )	Period Mean, Pm (µg/m <sup>3</sup> )	Ratio, Am/Pm	Average Ratio, R <sub>a</sub>	NO <sub>2</sub> Annual Mean (annualised) (µg/m <sup>3</sup> )
Falkirk_Grangemouth_MC	UB	8671	99.0	20.2	19.7	1.026	1.018	
Bush Estate - Rural	rural	8654	98.8	6.4	6.7	0.968		
Glasgow Anderston	UB	8407	96.0	28.2	26.7	1.059		
Grangemouth Moray	UB	8683	99.1	17.3	17.2	1.008		
Edinburgh St Leonards	UB	8685	99.1	22.2	21.5	1.029		
<b>Mains Loan</b>	UB	6357	72.6	n/a	11.3	x Average ratio =		<b>11.5</b>
<b>Notes:</b>								
UB = Urban Background, R = Roadside, K = Kerbside								
Blue shaded cells are Urban Background or Rural sites - data was selected & downloaded from www.scottishairquality.co.uk								

<sup>34</sup> Personal communication between Rachel Brooks DCC and Stephen Stratton Ricardo-AEA

<sup>35</sup> 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 PL	BIRNAM PL	WOODSIDE AVE	CAROLINA COURT LP6	MURRAYGATE (46)	B/FERRY RD LOWER	
<b>Annual Mean, Am (µg/m<sup>3</sup>)</b>		19.5	11.6	17.7	24.9	29.7	17.9	
<b>Period Mean, Pm (µg/m<sup>3</sup>)</b>	Jun13-Dec13	18.7	10.6	16.2	23.9	27.9	17.8	
	Jan13-Mar13	25.6	15.8	23.7	32.8		21.5	
	May-Oct13, Dec13	16.1	9.5	14.5	20.1		15.1	<b>Average Ratio, R<sub>a</sub></b>
<b>Ratio, Am/Pm</b>	Jun13-Dec13	1.044	1.099	1.090	1.042	1.065	1.008	<i>1.058</i>
	Jan13-Mar13	0.762	0.734	0.748	0.758		0.833	<i>0.767</i>
	May-Oct13, Dec13	1.209	1.227	1.221	1.240		1.182	<i>1.216</i>

**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, Pm ( $\mu\text{g}/\text{m}^3$ )	Average Ratio, $R_a$	NO <sub>2</sub> Annual Mean (annualised) ( $\mu\text{g}/\text{m}^3$ )
186	Carolina Court 30mph sign	Jun13-Dec13	31.1	1.058	32.9
174	Cleington Rd (172)	Jan13-Mar13	47.1	0.767	36.1
150	Seagate (95-97)	Jan13-Mar13	61.0	0.767	46.8
190	Seagate (97)	May-Oct13, Dec13	56.1	1.216	68.2

#### **A6 - QA/QC of Automatic Monitoring**

All analysers (excluding OSIRIS units) are audited twice yearly by an external consultant, Ricardo-AEA. The gas analyser at Broughty Ferry Road has on-site gases traceable to the National Physical Laboratory (NPL) standards (provided under contract by Ricardo-AEA) and is calibrated automatically every 4 days. 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 NO<sub>2</sub> 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 NO<sub>2</sub> diffusion tube analysis, and the Annual Field Inter-Comparison Exercise. These provide strict performance criteria for participating laboratories to meet, thereby ensuring NO<sub>2</sub> 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 2008<sup>36</sup>, and is UKAS accredited for the analysis of nitrogen dioxide. Tayside Scientific Services has demonstrated satisfactory performance over the past five quarterly WASP rounds.<sup>37</sup> 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 NO<sub>2</sub> PT forms an integral part of the UK NO<sub>2</sub> 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%.

<sup>36</sup> AEA Energy & Environment (2008), Diffusion Tubes for Ambient NO<sub>2</sub> Monitoring : Practical Guidance for Laboratories and Users

<sup>37</sup> [http://laqm.defra.gov.uk/documents/LAQM-WASP-Rounds-116-123-\(January-2012--December-2013\)-NO2-report.pdf](http://laqm.defra.gov.uk/documents/LAQM-WASP-Rounds-116-123-(January-2012--December-2013)-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

### “Volatile Correction Model

#### Background

The EU Directive on Ambient Air Quality<sup>38</sup> and the UK Air Quality Strategy<sup>39</sup> set targets and limit values for PM<sub>10</sub> concentrations in terms of gravimetric measurements referenced to the EU reference method of measurement (EN 12341). It has long been recognised that PM<sub>10</sub> measurements made with many automatic PM<sub>10</sub> monitors are not equivalent to the EU reference method. However, these analysers are widely used since they provide hourly resolved data and have many operational advantages over the manual reference method. Hence, correction factors, most noticeably the 1.3 correction factor for the TEOM analyser, have been widely used for many years. In setting the value of 1.3 as a correction factor, it was recognized that this was a conservative factor and that TEOMx1.3 data were likely to overestimate PM<sub>10</sub> concentrations. In Scotland, a lower correction factor of 1.14, which was based on intercomparison data obtained in Edinburgh, has also been widely used.

The results of the formal UK PM<sub>10</sub> Equivalence Study<sup>40</sup> carried out in 2006, showed that data from the TEOM could not be considered as equivalent to the EU reference method, whether or not a correction factor was used. The reason for this is that the TEOM heats the filter used to collect PM<sub>10</sub> to 50°C in order to eliminate the possible interference from water vapour – this heating also removes some of the more volatile components of the particulate matter.

In the new modification to the TEOM – the FDMS TEOM, the volatile fraction of PM<sub>10</sub> is measured separately and used to correct the data in order to obtain results that are equivalent to the EU reference method. The equivalence of the FDMS TEOM analyser to the EU reference method was confirmed in the UK Equivalence study. Note that this study also showed that a number of other PM<sub>10</sub> analysers could also provide data equivalent to the EU reference method - Partisol 2025, FDMS Model B, Opsis SM200 Beta Attenuation Monitor (BAM), Opsis SM200 sampler (with slope and intercept correction) and the Met One BAM (with slope correction).

King’s College London (KCL) have developed a relationship utilising FDMS purge (volatile PM<sub>10</sub>) measurements to correct data from nearby TEOM analysers. These corrected data were tested for equivalence with the EU reference method and shown to pass the appropriate criteria. Since then, as additional FDMS data have become available throughout the UK, the geographic range of the model has been extended and on-going tests have shown that any TEOM located within 130km of a FDMS TEOM can be corrected with data from that analyser.

KCL has developed a user-friendly web portal (<http://www.volatile-correction-model.info/Default.aspx>), to enable the model to be applied in a straightforward step-by-step approach. The model enables the user to input daily or hourly-average pressure, temperature measurements and purge measurements (volatile measurements) from Filter Dynamics Measurement System (FDMS) analysers. The measured volatile fraction is then added to the TEOM measurements giving the corrected data.

#### Use of the VCM in Scotland

The VCM correction of Scottish PM<sub>10</sub> data was first undertaken for the 2008 dataset. As the VCM method was relatively new and, hourly meteorological data for pressure were not readily available, the corrections were undertaken on a daily, rather than hourly basis. These corrected data were provided to the local authorities and made available on the Scottish Air Quality website as a separate data spreadsheet.

<sup>38</sup> Directive 2008/50/EC Of The European Parliament and of The Council of 21 May 2008 on ambient air quality and cleaner air for Europe <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:152:0001:0044:EN:PDF>

<sup>39</sup> The Air Quality Strategy for England, Scotland, Wales and Northern Ireland. July 2007. CM 7169 <http://www.scotland.gov.uk/Topics/Environment/Pollution/16215/6116>

<sup>40</sup> UK Equivalence Programme for Monitoring of Particulate Matter. David Harrison Bureau Veritas UK Ltd. June 2006 (BV/AQ/AD202209/DH/2396) [http://www.airquality.co.uk/archive/reports/cat05/0606130952\\_UKPMEquivalence.pdf](http://www.airquality.co.uk/archive/reports/cat05/0606130952_UKPMEquivalence.pdf)

However, additional refinement of the VCM model has been undertaken and hourly meteorological data for all parameters has been sourced. As a result, VCM correction of the 2009 to 2013 datasets has been undertaken on an hourly basis. This also brings into line the processing of the Scottish local authority data with that of the AURN.

The TEOM measurements are recorded with an inbuilt correction factors of  $1.03x+3$  (where x is the raw TEOM measurement) as mandated by the US Environmental Protection Agency. This is first removed and the data are then corrected to ambient pressure and temperature (as required by the EU Directive) using meteorological data from met monitoring sites within 260 km of the TEOM.

Data from FDMS analysers within 130 km of the TEOM are then used to provide an estimate of the volatile particle concentration at the TEOM location. This estimated volatile fraction is then added back onto the TEOM measurements to give Gravimetric Equivalent mass concentrations.

The following data were used as inputs to the VCM:

- Hourly average temperatures ( $^{\circ}\text{C}$ )
- 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 2013 corrections, temperature and pressure data from Edinburgh Airport meteorological monitoring stations were utilised. This site was selected as a good representation weather conditions in the central belt of Scotland.

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 34 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' Test<sup>41</sup> 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.

The corrected data for 2013 and calculated summary statistics have been provided to the local authorities. In addition, the SAQD website database now shows all ratified TEOM data for 2013 as VCM corrected data via an additional selection option in the data download pages.

A flow chart showing the overall process employed for VCM correction of 2013 SAQD TEOM data is shown in Figure 1.

However, note that it is not possible to correct historical data with the VCM as measurements of volatile particle concentrations are not available prior to 2008."

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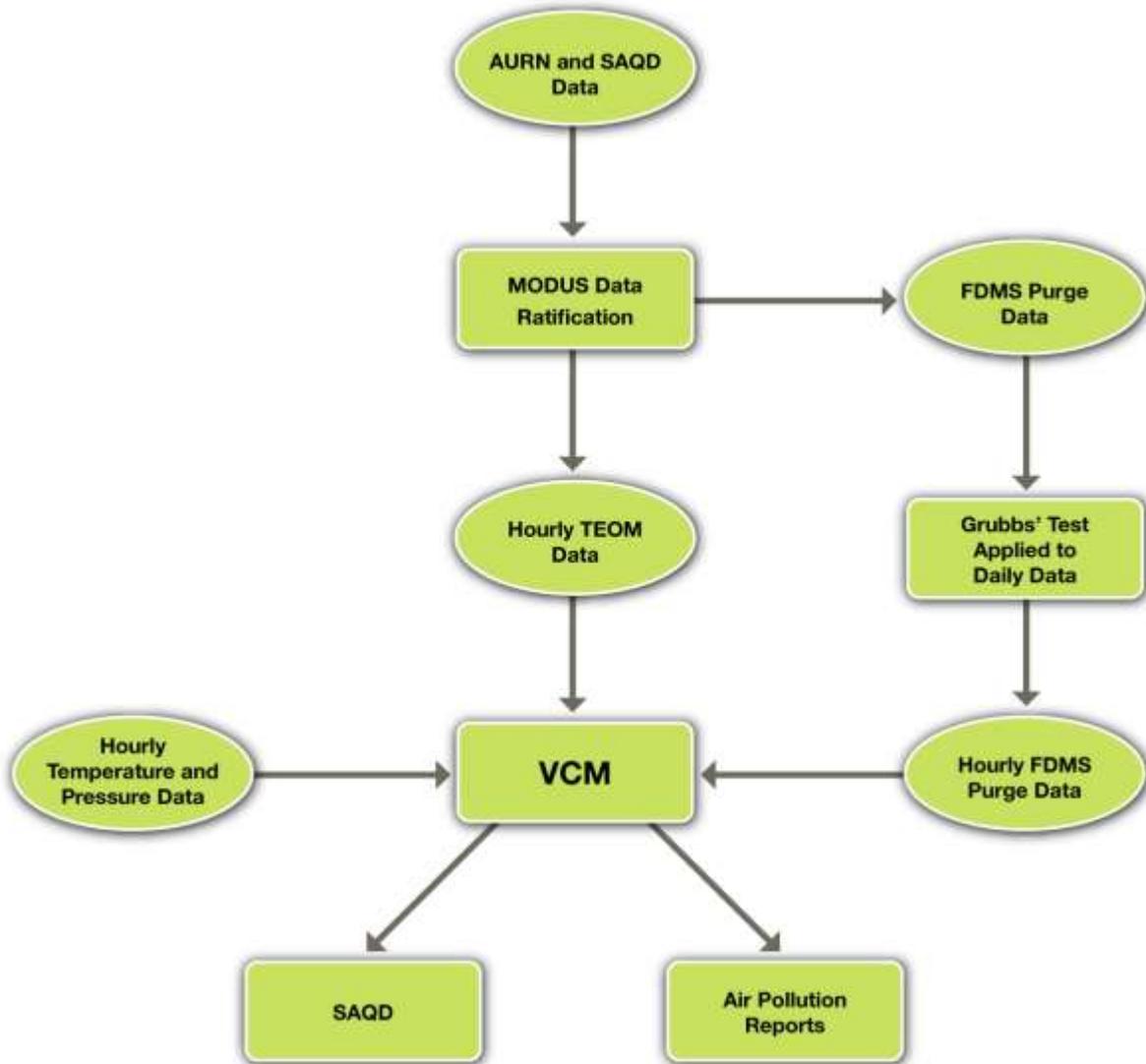
<sup>41</sup> Grubbs' Test is a statistical method for identifying outliers within a dataset. For more information visit the Engineering Statistics Handbook at:

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

*"Table 1 FDMS Monitoring Sites used for VCM Correcting TEOM Data 2013*

FDMS Sites used in VCM	Monitoring Network
Aberdeen	AURN
Auchencorth Moss PM10 PM25	AURN
East Ayrshire Kilmarnock John Finnie	SAQD
East Ayrshire St Marnock St FDMS	SAQD
East Dunbartonshire Kirkintilloch	SAQD
East Dunbartonshire Milngavie	SAQD
East Renfrewshire Sheddens	SAQD
Edinburgh Queensferry Road	SAQD
Edinburgh St Leonards	AURN
Fife Cupar	SAQD
Fife Dunfermline	SAQD
Fife Kirkcaldy	SAQD
Fife Rosyth	SAQD
Glasgow Abercromby Street	SAQD
Glasgow Anderston	AURN
Glasgow Broomhill	SAQD
Glasgow Burgher St	SAQD
Glasgow Byres Road	SAQD
Glasgow Kerbside	AURN
Glasgow Nithsdale Road	SAQD
Grangemouth	AURN
Paisley Gordon Street	SAQD
Paisley St James St	SAQD
Perth Muirton	SAQD
South Ayrshire Ayr Harbour	SAQD
South Ayrshire Ayr High St	SAQD
South Lanarkshire East Kilbride	SAQD
South Lanarkshire Hamilton	SAQD
South Lanarkshire Raith Interchange	AURN
South Lanarkshire Rutherglen	SAQD
West Lothian Broxburn	SAQD
West Lothian Linlithgow High St 2	SAQD
West Lothian Linlithgow High Street	SAQD
West Lothian Newton	SAQD

Figure 1 Process used for VCM Correcting SAQD TEOM Data "



Appendix C: Pollution Reports

Produced by Ricardo-AEA on behalf of the Scottish Government

**DUNDEE BROUGHTY FERRY ROAD**  
**1<sup>st</sup> January to 31<sup>st</sup> December 2013**

These data have been fully ratified by Ricardo-AEA

POLLUTANT	PM <sub>10</sub> *	SO <sub>2</sub>
Maximum 15-minute mean	-	130 µg m <sup>-3</sup>
Maximum hourly mean	160 µg m <sup>-3</sup>	64 µg m <sup>-3</sup>
Maximum daily mean	58 µg m <sup>-3</sup>	18 µg m <sup>-3</sup>
Average	16 µg m <sup>-3</sup>	4 µg m <sup>-3</sup>
Data capture	96 %	98.5 %

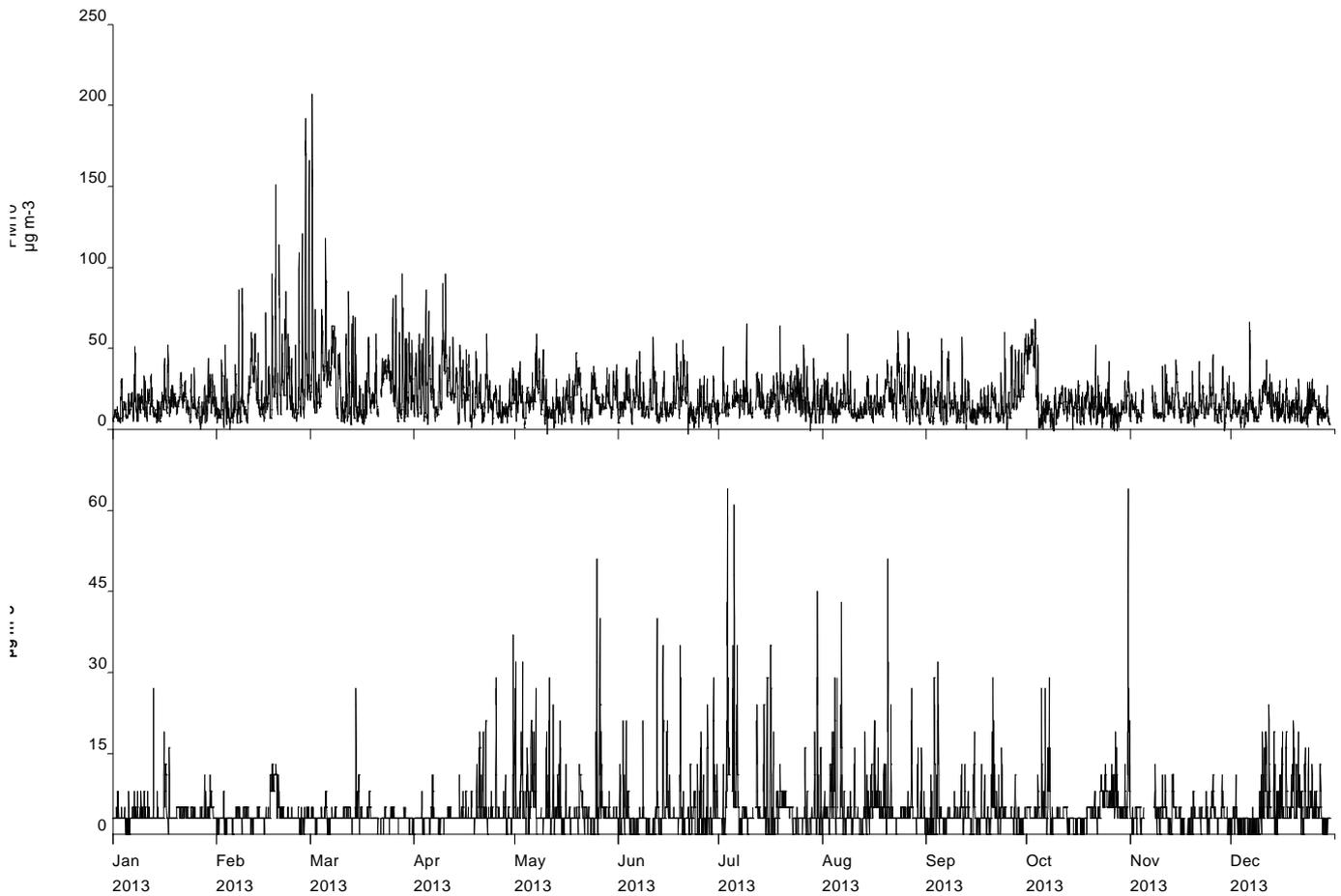
\* PM<sub>10</sub> measured by a TEOM and using VCM for Gravimetric Equivalent mass concentrations. All gaseous pollutant mass units are at 20°C and 1013 mb. Particulate matter concentrations are reported at ambient temperature and pressure.

Pollutant	Air Quality Regulations (2000) and Air Quality (Scotland) Amendment Regulations 2002	Exceedences	Days
PM <sub>10</sub> Particulate Matter (Gravimetric)	Daily mean > 50 µg m <sup>-3</sup>	4	4
PM <sub>10</sub> Particulate Matter (Gravimetric)	Annual mean > 18 µg m <sup>-3</sup>	0	-
Sulphur Dioxide	15-minute mean > 266 µg m <sup>-3</sup>	0	0
Sulphur Dioxide	Hourly mean > 350 µg m <sup>-3</sup>	0	0
Sulphur Dioxide	Daily mean > 125 µg m <sup>-3</sup>	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 Broughty Ferry Road  
Hourly Mean Data for 1<sup>st</sup> January to 31<sup>st</sup> December 2013**



Date Created: 06/10/2014

Produced by AEA on behalf of the Scottish Government

## DUNDEE MAINS LOAN

### 1<sup>st</sup> January to 31<sup>st</sup> December 2013

These data have been fully ratified by AEA

POLLUTANT	PM <sub>10</sub> *	NO <sub>2</sub>	NO <sub>x</sub>
Maximum hourly mean	69 µg m <sup>-3</sup>	103 µg m <sup>-3</sup>	288 µg m <sup>-3</sup>
Maximum daily mean	52 µg m <sup>-3</sup>	55 µg m <sup>-3</sup>	94 µg m <sup>-3</sup>
99.8 <sup>th</sup> percentile of hourly means	-	84 µg m <sup>-3</sup>	-
Average	12 µg m <sup>-3</sup>	11 µg m <sup>-3</sup>	15 µg m <sup>-3</sup>
Data capture	95 %	72.6 %	72.6 %

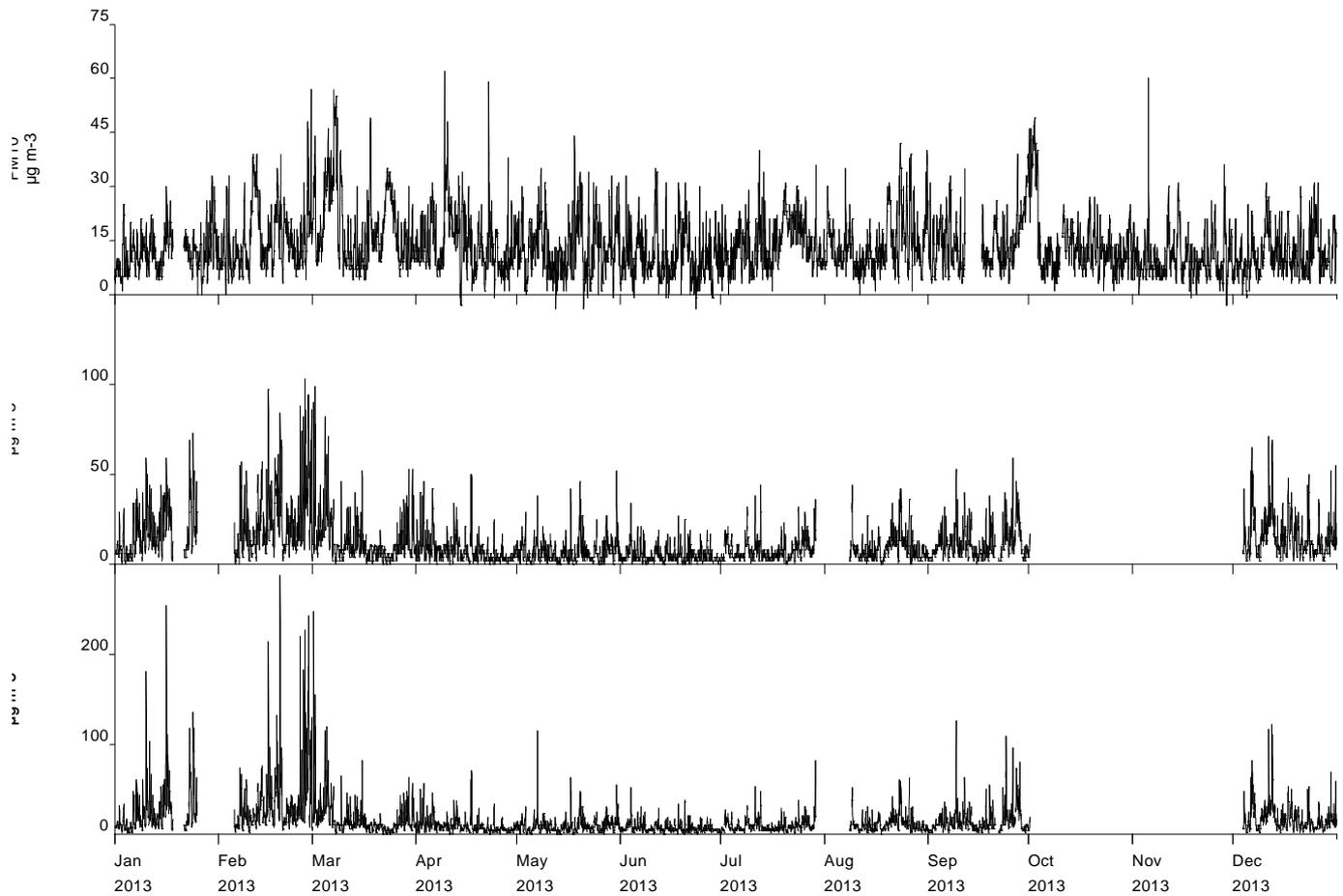
\* PM<sub>10</sub> measured by a TEOM and using VCM for Gravimetric Equivalent mass concentrations. All gaseous pollutant mass units are at 20°C and 1013 mb. Particulate matter concentrations are reported at ambient temperature and pressure. NO<sub>x</sub> mass units are NO<sub>x</sub> as NO<sub>2</sub> µg m<sup>-3</sup>

Pollutant	Air Quality Regulations (2000) and Air Quality (Scotland) Amendment Regulations 2002	Exceedences	Days
PM <sub>10</sub> Particulate Matter (Gravimetric)	Daily mean > 50 µg m <sup>-3</sup>	1	1
PM <sub>10</sub> Particulate Matter (Gravimetric)	Annual mean > 18 µg m <sup>-3</sup>	0	-
Nitrogen Dioxide	Annual mean > 40 µg m <sup>-3</sup>	0	-
Nitrogen Dioxide	Hourly mean > 200 µg m <sup>-3</sup>	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 Mains Loan  
Hourly Mean Data for 1<sup>st</sup> January to 31<sup>st</sup> December 2013**



Date Created: 06/10/2014

Produced by Ricardo-AEA on behalf of Dundee City Council

## DUNDEE MEADOWSIDE 1<sup>st</sup> January to 31<sup>st</sup> December 2013

These data have been fully ratified by Ricardo-AEA

POLLUTANT	PM <sub>10</sub> *	NO <sub>2</sub>	NO <sub>x</sub>
Maximum hourly mean	177 µg m <sup>-3</sup>	197 µg m <sup>-3</sup>	1135 µg m <sup>-3</sup>
Maximum daily mean	63 µg m <sup>-3</sup>	98 µg m <sup>-3</sup>	482 µg m <sup>-3</sup>
Average	19 µg m <sup>-3</sup>	49 µg m <sup>-3</sup>	194 µg m <sup>-3</sup>
Data capture	91.0 %	90.7 %	90.7 %

\* PM<sub>10</sub> instruments:

BAM using a gravimetric factor of 0.83333 for Indicative Gravimetric Equivalent from 1<sup>st</sup> January 2013

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

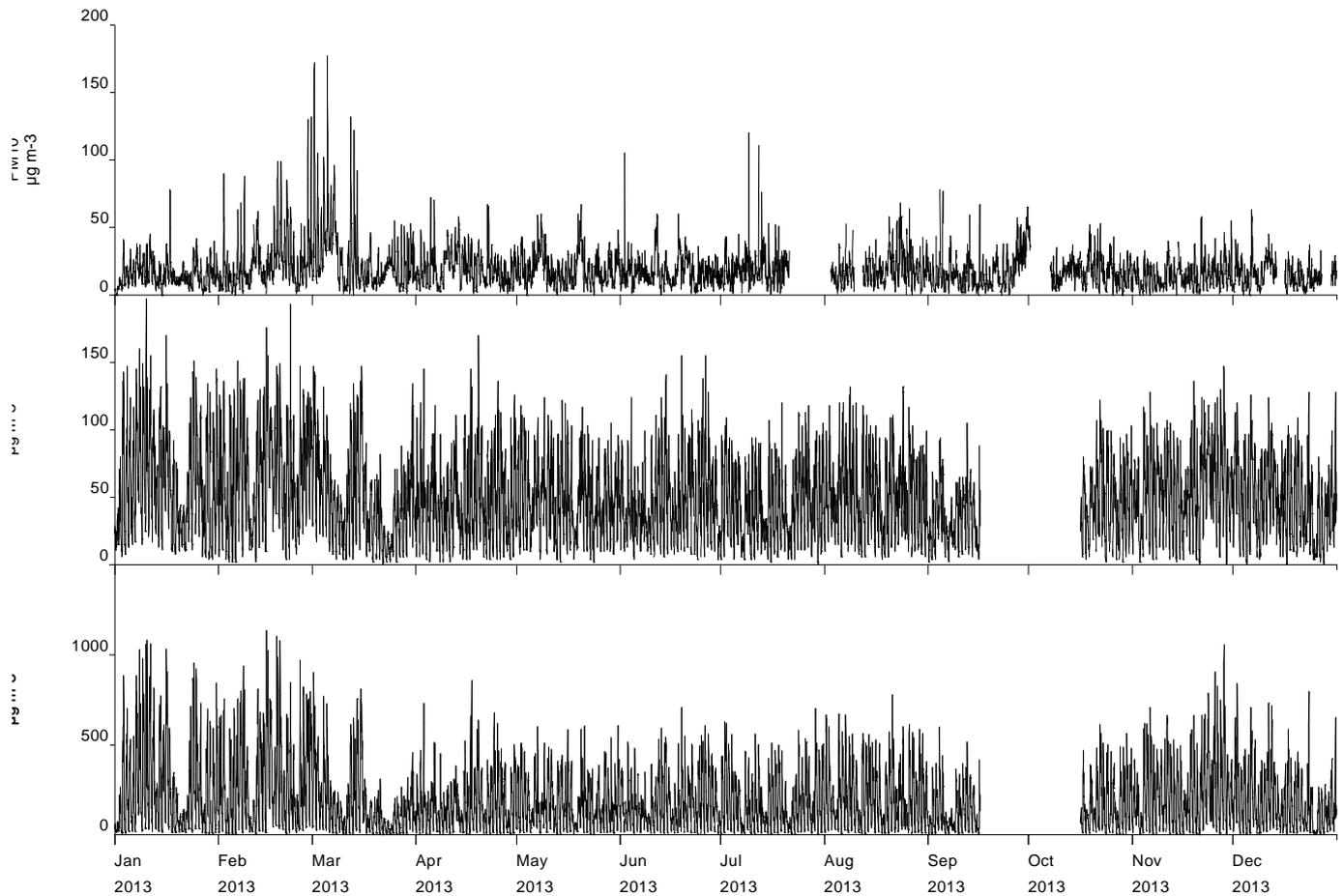
NO<sub>x</sub> mass units are NO<sub>x</sub> as NO<sub>2</sub> µg m<sup>-3</sup>

Pollutant	Air Quality Regulations (2000) and Air Quality (Scotland) Amendment Regulations 2002	Exceedences	Days
PM <sub>10</sub> Particulate Matter (Gravimetric)	Daily mean > 50 µg m <sup>-3</sup>	4	4
PM <sub>10</sub> Particulate Matter (Gravimetric)	Annual mean > 18 µg m <sup>-3</sup>	0	-
Nitrogen Dioxide	Annual mean > 40 µg m <sup>-3</sup>	1	-
Nitrogen Dioxide	Hourly mean > 200 µg m <sup>-3</sup>	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 1<sup>st</sup> January to 31<sup>st</sup> December 2013



Date Created: 08/10/2014

Produced by Ricardo-AEA on behalf of the Scottish Government

## DUNDEE LOCHEE ROAD 1<sup>st</sup> January to 31<sup>st</sup> December 2013

These data have been fully ratified by Ricardo-AEA

POLLUTANT	PM <sub>10</sub> *	NO <sub>2</sub>	NO <sub>x</sub>
Maximum hourly mean	262 µg m <sup>-3</sup>	369 µg m <sup>-3</sup>	1182 µg m <sup>-3</sup>
Maximum daily mean	59 µg m <sup>-3</sup>	183 µg m <sup>-3</sup>	445 µg m <sup>-3</sup>
Average	18 µg m <sup>-3</sup>	52 µg m <sup>-3</sup>	124 µg m <sup>-3</sup>
Data capture	97.3 %	99.6 %	99.6 %

\* PM<sub>10</sub> instruments:

BAM using a gravimetric factor of 0.83333 for Indicative Gravimetric Equivalent from 1<sup>st</sup> January 2013

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

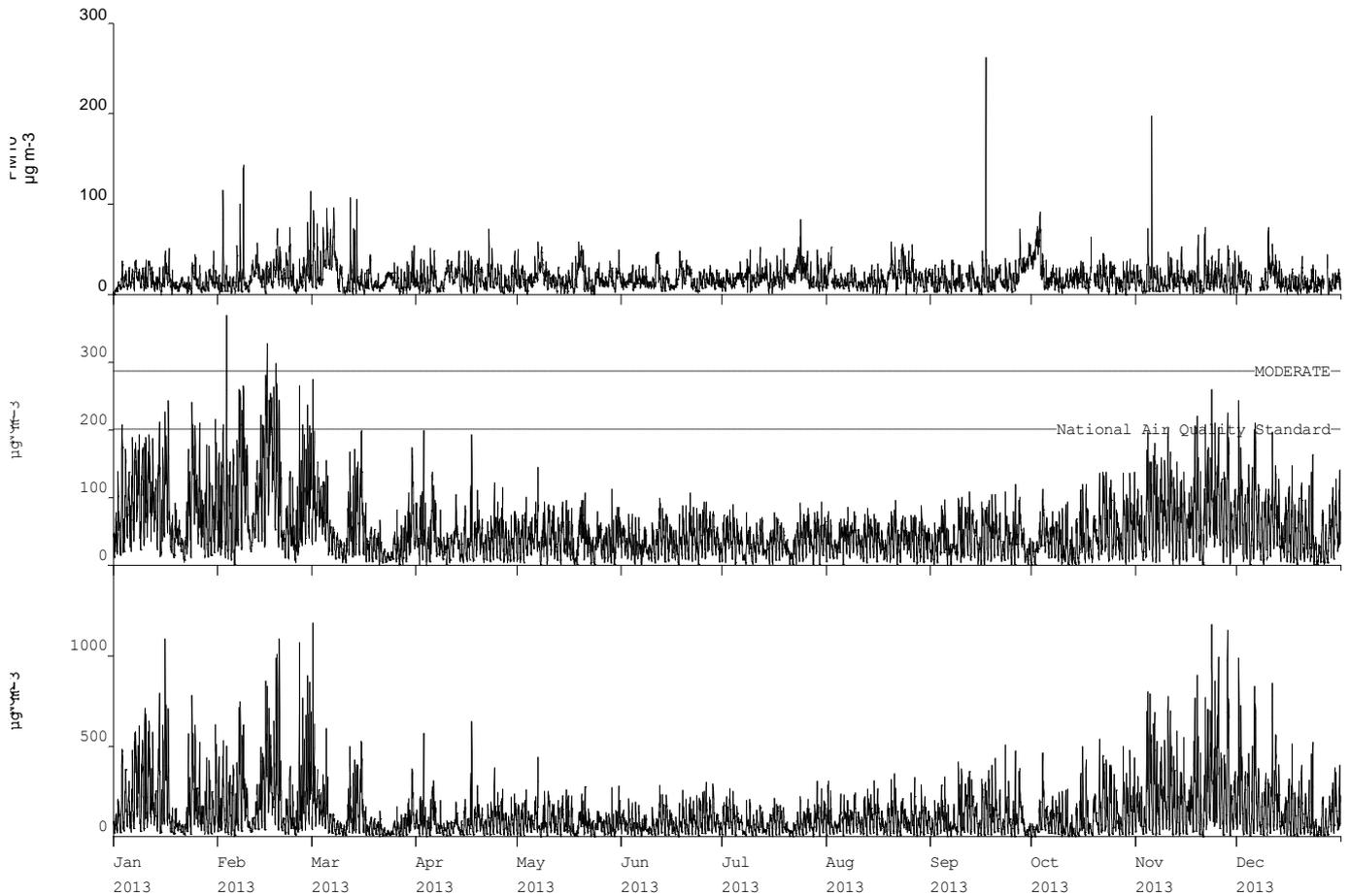
NO<sub>x</sub> mass units are NO<sub>x</sub> as NO<sub>2</sub> µg m<sup>-3</sup>

Pollutant	Air Quality Regulations (2000) and Air Quality (Scotland) Amendment Regulations 2002	Exceedences	Days
PM <sub>10</sub> Particulate Matter (Gravimetric)	Daily mean > 50 µg m <sup>-3</sup>	3	3
PM <sub>10</sub> Particulate Matter (Gravimetric)	Annual mean > 18 µg m <sup>-3</sup>	0	-
Nitrogen Dioxide	Annual mean > 40 µg m <sup>-3</sup>	1	-
Nitrogen Dioxide	Hourly mean > 200 µg m <sup>-3</sup>	100	34

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 1<sup>st</sup> January to 31<sup>st</sup> December 2013**



Date Created: 10/09/2014

Produced by AEA on behalf of the Scottish Government

## DUNDEE SEAGATE 1<sup>st</sup> January to 31<sup>st</sup> December 2013

These data have been fully ratified by Ricardo-AEA

POLLUTANT	PM <sub>10</sub> *	NO <sub>2</sub>	NO <sub>x</sub>
Maximum hourly mean	180 µg m <sup>-3</sup>	298 µg m <sup>-3</sup>	1639 µg m <sup>-3</sup>
Maximum daily mean	65 µg m <sup>-3</sup>	150 µg m <sup>-3</sup>	713 µg m <sup>-3</sup>
Average	16 µg m <sup>-3</sup>	55 µg m <sup>-3</sup>	182 µg m <sup>-3</sup>
Data capture	97.7 %	87.8 %	87.8 %

\* PM<sub>10</sub> instruments:

BAM using a gravimetric factor of 0.83333 for Indicative Gravimetric Equivalent from 1<sup>st</sup> January 2013

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

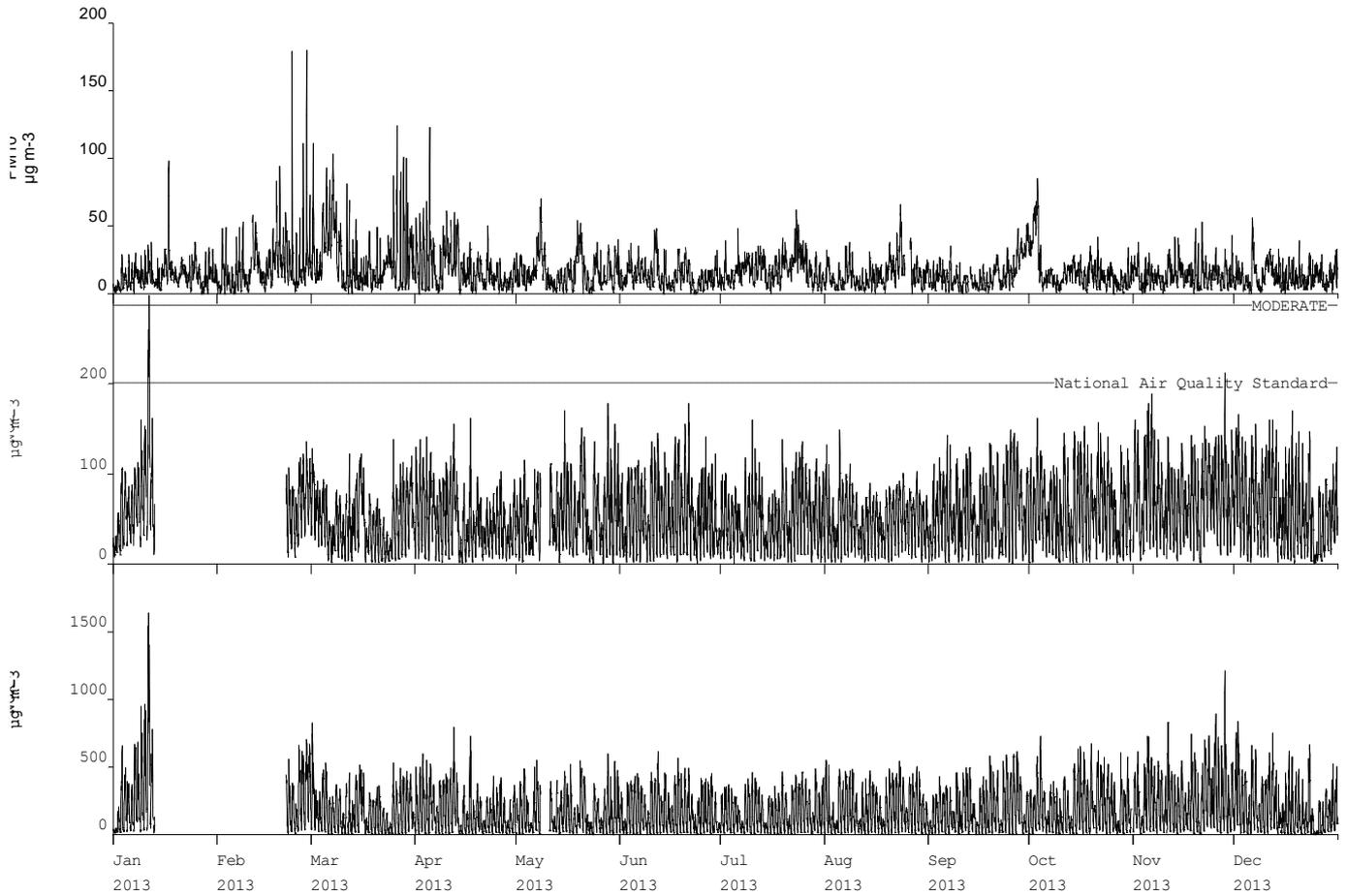
NO<sub>x</sub> mass units are NO<sub>x</sub> as NO<sub>2</sub> µg m<sup>-3</sup>

Pollutant	Air Quality Regulations (2000) and Air Quality (Scotland) Amendment Regulations 2002	Exceedences	Days
PM <sub>10</sub> Particulate Matter (Gravimetric)	Daily mean > 50 µg m <sup>-3</sup>	4	4
PM <sub>10</sub> Particulate Matter (Gravimetric)	Annual mean > 18 µg m <sup>-3</sup>	0	-
Nitrogen Dioxide	Annual mean > 40 µg m <sup>-3</sup>	1	-
Nitrogen Dioxide	Hourly mean > 200 µg m <sup>-3</sup>	10	2

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 1<sup>st</sup> January to 31<sup>st</sup> December 2013



Date Created: 08/10/2014

Produced by Ricardo-AEA on behalf of the Scottish Government

## DUNDEE UNION STREET 1<sup>st</sup> January to 31<sup>st</sup> December 2013

These data have been fully ratified by Ricardo-AEA

POLLUTANT	PM <sub>10</sub> *	NO <sub>2</sub>	NO <sub>x</sub>
Maximum hourly mean	217 µg m <sup>-3</sup>	143 µg m <sup>-3</sup>	714 µg m <sup>-3</sup>
Maximum daily mean	52 µg m <sup>-3</sup>	92 µg m <sup>-3</sup>	233 µg m <sup>-3</sup>
Average	15 µg m <sup>-3</sup>	31 µg m <sup>-3</sup>	76 µg m <sup>-3</sup>
Data capture	98.4 %	96.7 %	96.7 %

\* PM<sub>10</sub> instruments:

BAM using a gravimetric factor of 0.83333 for Indicative Gravimetric Equivalent from 22<sup>nd</sup> February 2013

TEOM using VCM for Gravimetric Equivalent mass concentrations from 1<sup>st</sup> January 2013 to 20<sup>th</sup> February 2013.

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

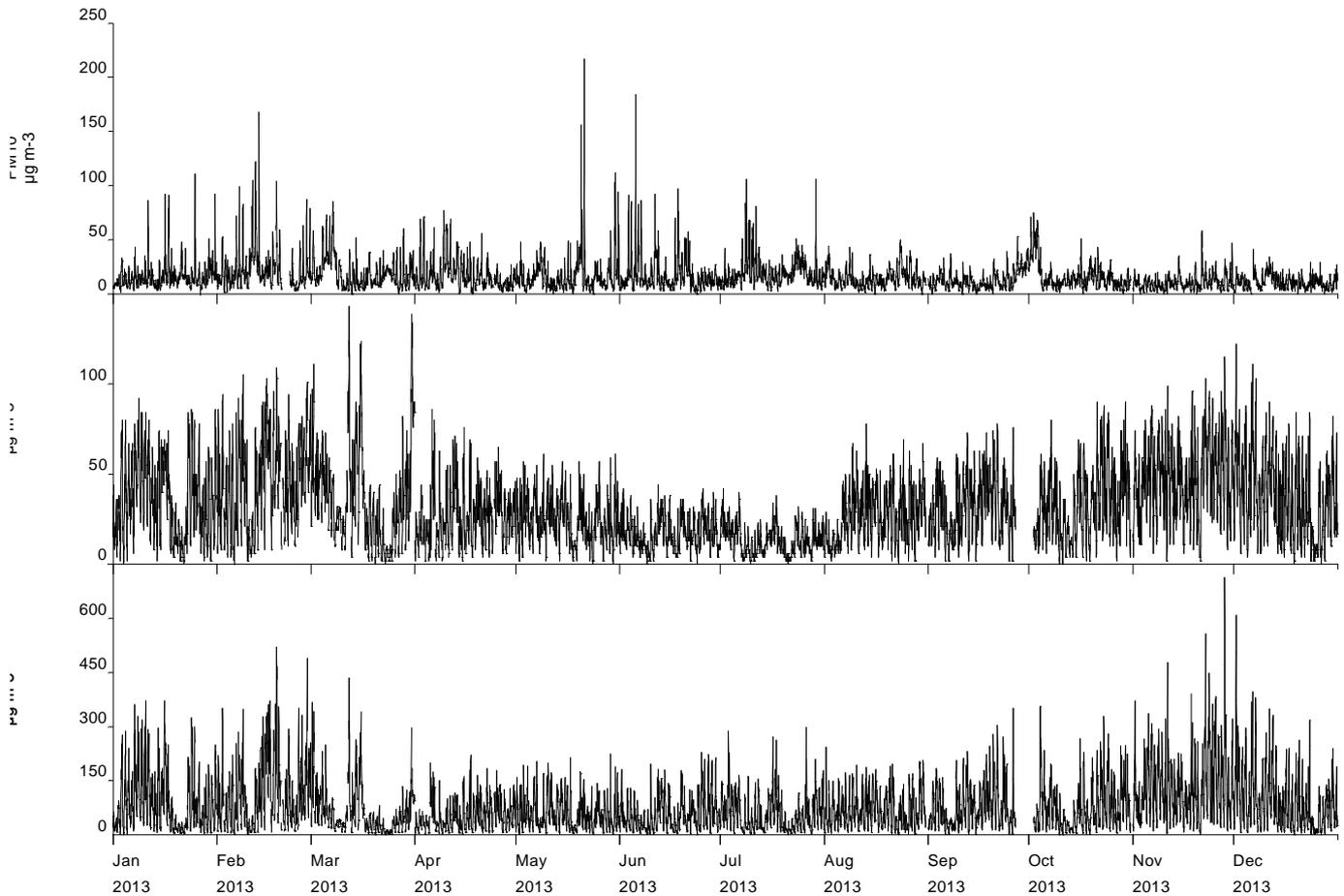
NO<sub>x</sub> mass units are NO<sub>x</sub> as NO<sub>2</sub> µg m<sup>-3</sup>

Pollutant	Air Quality Regulations (2000) and Air Quality (Scotland) Amendment Regulations 2002	Exceedences	Days
PM <sub>10</sub> Particulate Matter (Gravimetric)	Daily mean > 50 µg m <sup>-3</sup>	1	1
PM <sub>10</sub> Particulate Matter (Gravimetric)	Annual mean > 18 µg m <sup>-3</sup>	0	-
Nitrogen Dioxide	Annual mean > 40 µg m <sup>-3</sup>	0	-
Nitrogen Dioxide	Hourly mean > 200 µg m <sup>-3</sup>	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 1<sup>st</sup> January to 31<sup>st</sup> December 2013**



Date Created: 22/10/2014

Produced by Ricardo-AEA on behalf of the Scottish Government

## DUNDEE WHITEHALL STREET 1<sup>st</sup> January to 31<sup>st</sup> December 2013

These data have been fully ratified by Ricardo-AEA

POLLUTANT	NO <sub>2</sub>	NO <sub>x</sub>
Maximum hourly mean	141 µg m <sup>-3</sup>	806 µg m <sup>-3</sup>
Maximum daily mean	71 µg m <sup>-3</sup>	287 µg m <sup>-3</sup>
Average	41 µg m <sup>-3</sup>	109 µg m <sup>-3</sup>
Data capture	99 %	99 %

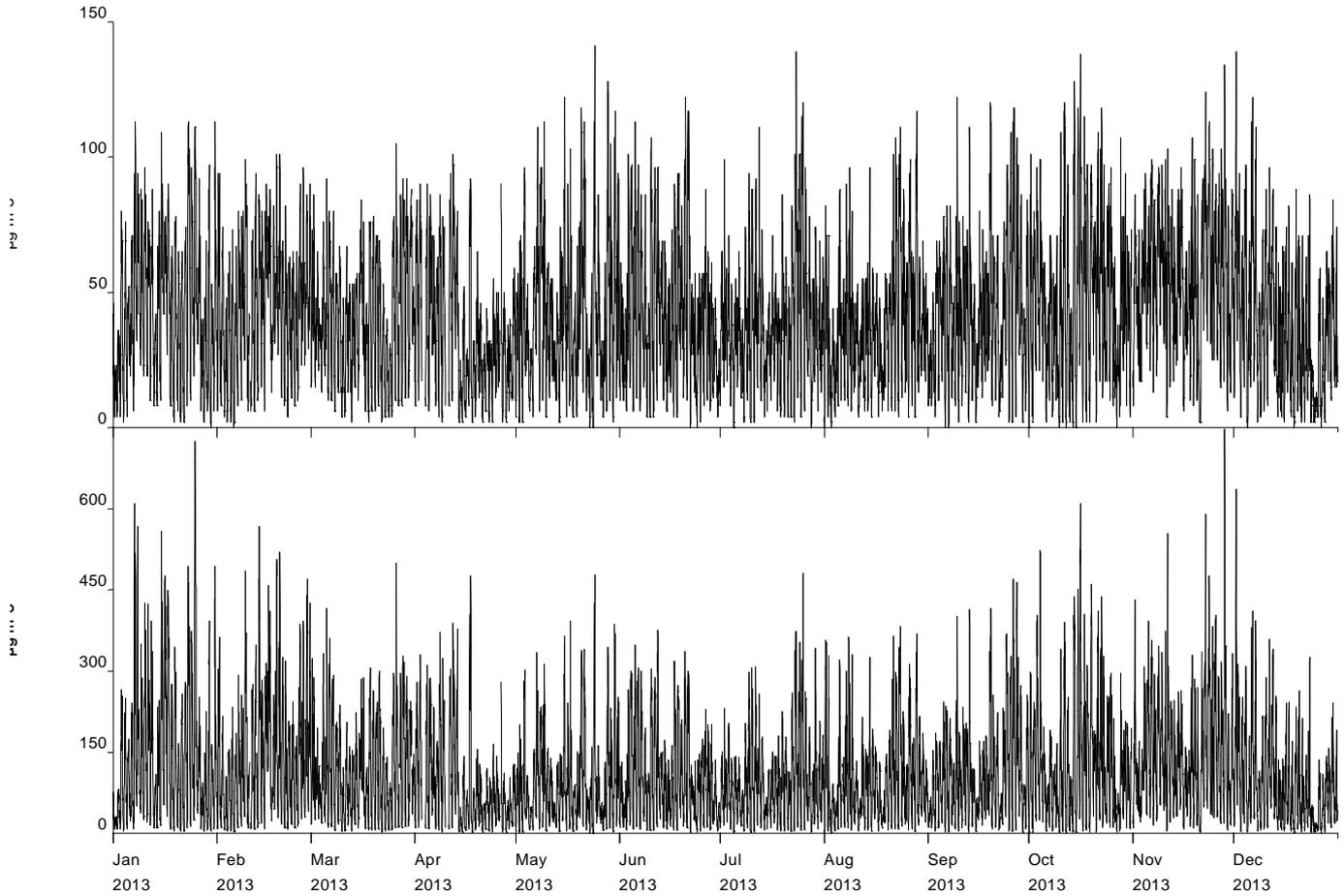
All gaseous pollutant mass units are at 20°C and 1013 mb.  
NO<sub>x</sub> mass units are NO<sub>x</sub> as NO<sub>2</sub> µg m<sup>-3</sup>

Pollutant	Air Quality Regulations (2000) and Air Quality (Scotland) Amendment Regulations 2002	Exceedences	Days
Nitrogen Dioxide	Annual mean > 40 µg m <sup>-3</sup>	1	-
Nitrogen Dioxide	Hourly mean > 200 µg m <sup>-3</sup>	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 1<sup>st</sup> January to 31<sup>st</sup> December 2013**



Date Created: 02/10/2014

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 $\mu\text{gm}^{-3}$	Tube 2 $\mu\text{gm}^{-3}$	Tube 3 $\mu\text{gm}^{-3}$	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean
1	03/01/2013	30/01/2013	61.3	64.0	63.4	63	1.4	2	3.5
2	30/01/2013	27/02/2013	60.1	71.7	64.6	65	5.8	9	14.5
3	27/02/2013	27/03/2013	50.6	51.4	49.8	51	0.8	2	2.0
4	27/03/2013	24/04/2013	36.4	42.4	44.1	41	4.0	10	10.0
5	24/04/2013	29/05/2013	43.6	44.0	44.1	44	0.3	1	0.7
6	29/05/2013	26/06/2013	42.2	42.3	43.9	43	1.0	2	2.4
7	26/06/2013	31/07/2013	43.4	45.1	43.0	44	1.1	3	2.8
8	31/07/2013	04/09/2013	43.1	44.6	45.4	44	1.2	3	2.9
9	04/09/2013	01/10/2013	46.3	43.9	43.0	44	1.7	4	4.2
10	01/10/2013	30/10/2013	46.8	44.7	48.6	47	2.0	4	4.8
11	30/10/2013	04/12/2013	70.3	74.1	64.7	70	4.7	7	11.7
12	04/12/2013	08/01/2014	59.0	57.9	55.2	57	2.0	3	4.9
13									

Automatic Method		Data Quality Check	
Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
86.3	99.4	Good	Good
96.6	99.9	Good	Good
50.5	98.7	Good	Good
40.5	99.4	Good	Good
38.5	99.6	Good	Good
35.8	99.9	Good	Good
34.7	99.8	Good	Good
36.4	99.5	Good	Good
38.9	99.7	Good	Good
42.0	99.9	Good	Good
74.0	99.5	Good	Good
49.5	99.4	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**

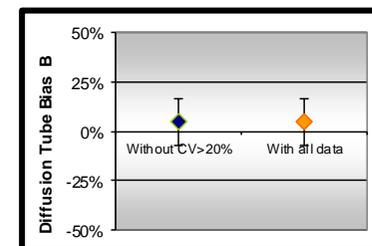
(Check average CV & DC from Accuracy calculations)

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

Precision **12 out of 12 periods have a CV smaller than 20%**

Accuracy (with 95% confidence interval) without periods with CV larger than 20%	
Bias calculated using 12 periods of data	
Bias factor A	1.02 (0.91 - 1.16)
Bias B	-2% (-14% - 10%)
Diffusion Tubes Mean:	51 $\mu\text{gm}^{-3}$
Mean CV (Precision):	4
Automatic Mean:	52 $\mu\text{gm}^{-3}$
Data Capture for periods used:	100%
Adjusted Tubes Mean:	52 (46 - 59) $\mu\text{gm}^{-3}$

Accuracy (with 95% confidence interval) WITH ALL DATA	
Bias calculated using 12 periods of data	
Bias factor A	1.02 (0.91 - 1.16)
Bias B	-2% (-14% - 10%)
Diffusion Tubes Mean:	51 $\mu\text{gm}^{-3}$
Mean CV (Precision):	4
Automatic Mean:	52 $\mu\text{gm}^{-3}$
Data Capture for periods used:	100%
Adjusted Tubes Mean:	52 (46 - 59) $\mu\text{gm}^{-3}$



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 $\mu\text{gm}^{-3}$	Tube 2 $\mu\text{gm}^{-3}$	Tube 3 $\mu\text{gm}^{-3}$	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean
1	03/01/2013	30/01/2013	60.7	59.9	57.7	59	1.6	3	3.9
2	30/01/2013	26/02/2013	60.0	56.3	57.5	58	1.9	3	4.7
3	26/02/2013	27/03/2013	60.9	51.6	64.2	59	6.5	11	16.2
4	27/03/2013	24/04/2013	62.2	59.6	56.2	59	3.0	5	7.5
5	24/04/2013	29/05/2013	50.5	47.0	52.6	50	2.8	6	7.0
6	29/05/2013	26/06/2013	56.6	57.2	55.8	57	0.7	1	1.7
7	26/06/2013	31/07/2013	58.6	52.4	54.5	55	3.2	6	7.8
8	31/07/2013	04/09/2013	52.1	48.8	47.2	49	2.5	5	6.2
9	04/09/2013	02/10/2013	47.1	51.0	51.1	50	2.3	5	5.7
10	02/10/2013	30/10/2013	58.9	59.5	56.0	58	1.9	3	4.6
11	30/10/2013	04/12/2013	56.2	62.6	59.7	60	3.2	5	8.0
12	04/12/2013	08/01/2014	50.0	49.4	44.7	48	2.9	6	7.2
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
77.2	35.2	Good	or Data Capture
57.3	18.2	Good	or Data Capture
46.6	99.1	Good	Good
51.8	99.0	Good	Good
49.6	91.9	Good	Good
55.7	99.9	Good	Good
48.5	99.6	Good	Good
47.0	99.5	Good	Good
56.8	100.0	Good	Good
60.2	99.4	Good	Good
72.3	97.6	Good	Good
54.1	99.2	Good	Good

Overall survey -->

Good precision	Poor Overall DC
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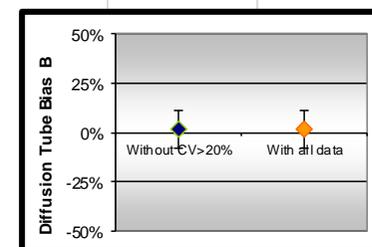
(Check average CV & DC from Accuracy calculations)

Site Name/ ID:	Dundee Seagate
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Precision	12 out of 12 periods have a CV smaller than 20%
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<b>Accuracy (with 95% confidence interval)</b>	
without periods with CV larger than 20%	
Bias calculated using 10 periods of data	
Bias factor A	1 (0.91 - 1.1)
Bias B	0% (-9% - 10%)
Diffusion Tubes Mean:	54 $\mu\text{gm}^{-3}$
Mean CV (Precision):	5
Automatic Mean:	54 $\mu\text{gm}^{-3}$
Data Capture for periods used:	99%
Adjusted Tubes Mean:	54 (50 - 60) $\mu\text{gm}^{-3}$

<b>Accuracy (with 95% confidence interval)</b>	
WITH ALL DATA	
Bias calculated using 10 periods of data	
Bias factor A	1 (0.91 - 1.1)
Bias B	0% (-9% - 10%)
Diffusion Tubes Mean:	54 $\mu\text{gm}^{-3}$
Mean CV (Precision):	5
Automatic Mean:	54 $\mu\text{gm}^{-3}$
Data Capture for periods used:	99%
Adjusted Tubes Mean:	54 (50 - 60) $\mu\text{gm}^{-3}$



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 $\mu\text{gm}^{-3}$	Tube 2 $\mu\text{gm}^{-3}$	Tube 3 $\mu\text{gm}^{-3}$	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean
1	03/01/2013	30/01/2013	49.4	44.8	43.3	46	3.2	7	7.9
2	30/01/2013	26/02/2013	42.9	47.5		45	3.3	7	29.2
3	26/02/2013	27/03/2013	37.1	37.9	35.1	37	1.4	4	3.6
4	27/03/2013	24/04/2013	35.7	34.2	30.5	33	2.7	8	6.6
5	24/04/2013	29/05/2013	34.0	35.9	34.8	35	1.0	3	2.4
6	29/05/2013	26/06/2013	33.0	31.2	35.6	33	2.2	7	5.5
7	26/06/2013	31/07/2013	36.4	34.6	37.8	36	1.6	4	4.0
8	31/07/2013	04/09/2013	36.1	36.9	40.1	38	2.1	6	5.3
9	04/09/2013	02/10/2013	34.5	34.4	33.5	34	0.6	2	1.4
10	02/10/2013	30/10/2013	43.5	39.0	43.8	42	2.7	6	6.7
11	30/10/2013	04/12/2013	63.9	58.5	58.7	60	3.1	5	7.6
12	04/12/2013	08/01/2014	40.4	39.3	44.5	41	2.7	7	6.8
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
36.3	99.7	Good	Good
42.4	94.3	Good	Good
35.8	94.7	Good	Good
28.9	94.3	Good	Good
25.3	99.8	Good	Good
17.3	100.0	Good	Good
13.8	99.9	Good	Good
26.2	97.6	Good	Good
31.3	80.8	Good	Good
31.9	99.7	Good	Good
47.2	97.5	Good	Good
33.1	99.8	Good	Good

Overall survey -->

Good precision	Good Overall DC
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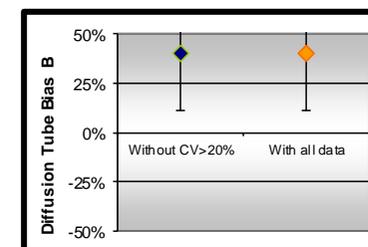
(Check average CV & DC from Accuracy calculations)

Site Name/ID:	Dundee Union Street
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Precision	12 out of 12 periods have a CV smaller than 20%
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<b>Accuracy (with 95% confidence interval)</b>	
without periods with CV larger than 20%	
Bias calculated using 12 periods of data	
Bias factor A	0.77 (0.63 - 0.99)
Bias B	30% (1% - 59%)
Diffusion Tubes Mean:	40 $\mu\text{gm}^{-3}$
Mean CV (Precision):	5
Automatic Mean:	31 $\mu\text{gm}^{-3}$
Data Capture for periods used:	97%
Adjusted Tubes Mean:	31 (25 - 40) $\mu\text{gm}^{-3}$

<b>Accuracy (with 95% confidence interval)</b>	
WITH ALL DATA	
Bias calculated using 12 periods of data	
Bias factor A	0.77 (0.63 - 0.99)
Bias B	30% (1% - 59%)
Diffusion Tubes Mean:	40 $\mu\text{gm}^{-3}$
Mean CV (Precision):	5
Automatic Mean:	31 $\mu\text{gm}^{-3}$
Data Capture for periods used:	97%
Adjusted Tubes Mean:	31 (25 - 40) $\mu\text{gm}^{-3}$



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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 $\mu\text{gm}^{-3}$	Tube 2 $\mu\text{gm}^{-3}$	Tube 3 $\mu\text{gm}^{-3}$	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean
1	03/01/2013	30/01/2013	53.3	51.8	53.2	53	0.8	2	2.1
2	30/01/2013	26/02/2013	52.8	54.6	54.3	54	1.0	2	2.4
3	26/02/2013	27/03/2013	56.3	59.3	53.9	57	2.7	5	6.7
4	27/03/2013	24/04/2013	54.0	51.7	52.0	53	1.3	2	3.1
5	24/04/2013	29/05/2013	41.9	46.6	42.5	44	2.6	6	6.4
6	29/05/2013	26/06/2013	52.5	50.7	47.7	50	2.4	5	6.0
7	26/06/2013	31/07/2013	49.6	48.3	46.1	48	1.8	4	4.4
8	31/07/2013	04/09/2013	43.1	43.8	43.8	44	0.4	1	1.0
9	04/09/2013	02/10/2013	43.1	47.0	47.4	46	2.4	5	5.9
10	02/10/2013	30/10/2013	56.8	53.0	52.1	54	2.5	5	6.2
11	30/10/2013	04/12/2013	54.9	57.5	55.4	56	1.4	2	3.4
12	04/12/2013	08/01/2014	37.1	40.6	36.2	38	2.3	6	5.8
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
45.5	100.0	Good	Good
43.3	98.5	Good	Good
38.7	100.0	Good	Good
38.8	92.6	Good	Good
38.0	98.9	Good	Good
42.7	99.7	Good	Good
37.6	99.8	Good	Good
36.8	99.6	Good	Good
42.8	99.9	Good	Good
46.6	99.6	Good	Good
49.5	99.3	Good	Good
36.2	99.8	Good	Good

Overall survey -->

Good precision	Good Overall DC
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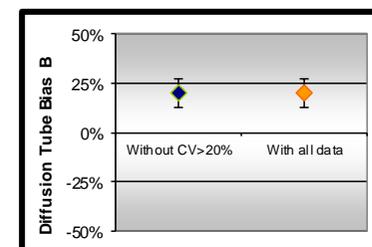
(Check average CV & DC from Accuracy calculations)

Site Name/ID:	Dundee Whitehall Street
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Precision	12 out of 12 periods have a CV smaller than 20%
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<b>Accuracy (with 95% confidence interval)</b>	
without periods with CV larger than 20%	
Bias calculated using 12 periods of data	
Bias factor A	0.83 (0.79 - 0.89)
Bias B	20% (12% - 27%)
Diffusion Tubes Mean:	50 $\mu\text{gm}^{-3}$
Mean CV (Precision):	4
Automatic Mean:	41 $\mu\text{gm}^{-3}$
Data Capture for periods used:	99%
Adjusted Tubes Mean:	41 (39 - 44) $\mu\text{gm}^{-3}$

<b>Accuracy (with 95% confidence interval)</b>	
WITH ALL DATA	
Bias calculated using 12 periods of data	
Bias factor A	0.83 (0.79 - 0.89)
Bias B	20% (12% - 27%)
Diffusion Tubes Mean:	50 $\mu\text{gm}^{-3}$
Mean CV (Precision):	4
Automatic Mean:	41 $\mu\text{gm}^{-3}$
Data Capture for periods used:	99%
Adjusted Tubes Mean:	41 (39 - 44) $\mu\text{gm}^{-3}$



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Appendix E: List of Industrial Processes

Process Name/Address	Process Type	PPC Sector	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	IPPC S5.01	No	No	No	Yes, previously assessed	No	No	Resumed operation (Oct' 13) - after fire damage. No change to emissions or emission limits.
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) Stopped refining oil Dec 2013. Expected to switch to gas 2015.
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.

Process Name/Address	Process Type	PPC Sector	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
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
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

Process Name/Address	Process Type	PPC Sector	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
Tapedrive 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
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

Process Name/Address	Process Type	PPC Sector	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
Stay-Press Dry Cleaning Centre, Dundee	Chapter 7: SED Activities	Chapter 7: SED Activities	No	No	No	No	No	No	Surrendered
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

Dundee City Council

Process Name/Address	Process Type	PPC Sector	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 Road-Dundee	Chapter 6: Other Activities, Pet Food Manufacture	6.8.a	No	No	No	No	No	No	No change

Process Name/Address	Process Type	PPC Sector	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
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	SEPA investigated dust complaint - concluded quarry not source.
Health Care Environmental Services, Nobel Road, Wester Gourdie Ind. Estate	Chapter 5 Waste Management PartA 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	Yes, but no relevant receptors	No	No	New site

**Notes:**

Yes\* see Section 3.3

No? see Section 3.3

~ with reference to Annex 2 Appendix E TG.03

Part A - Processes shaded purple

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

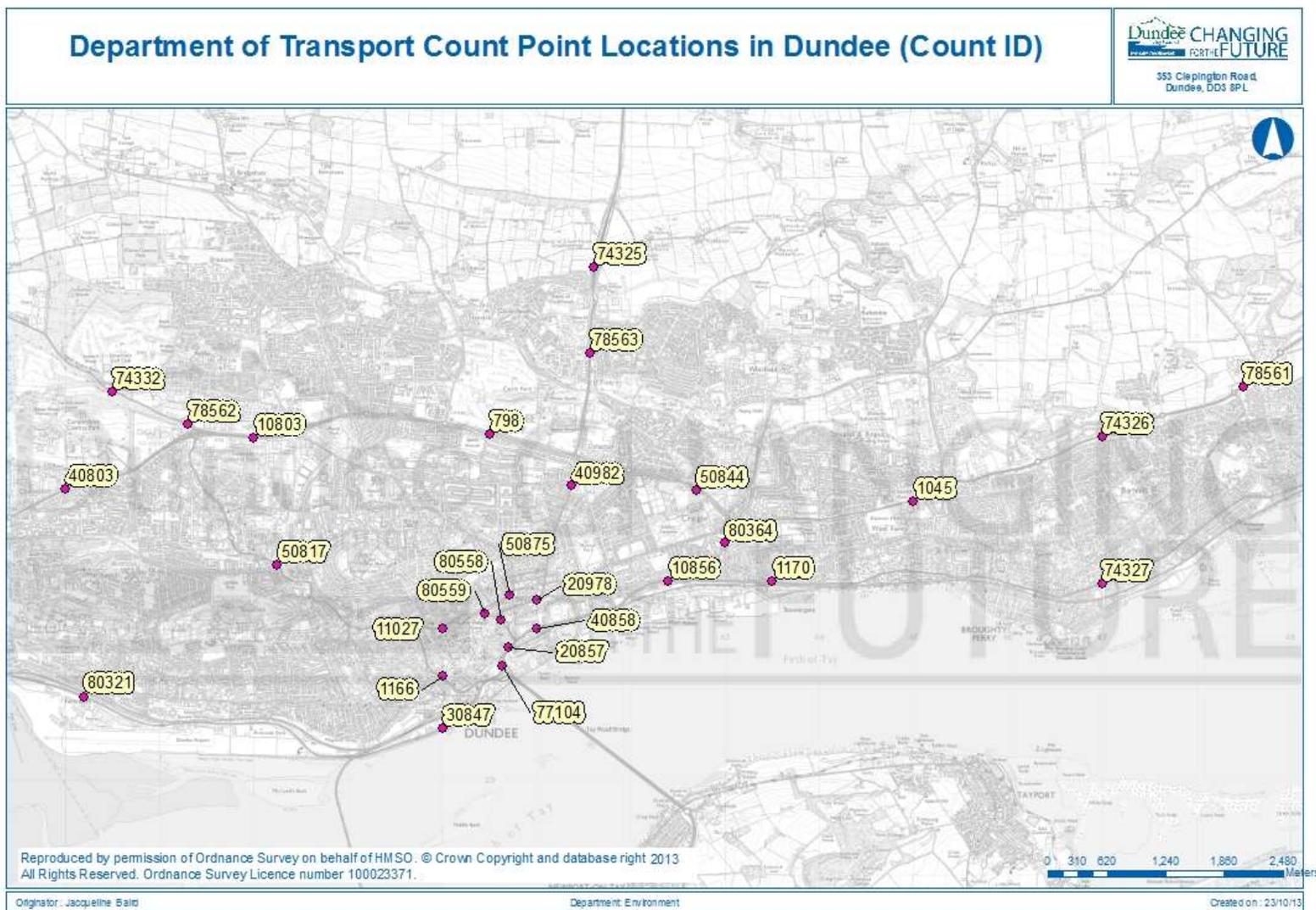


Table F2 Comparison of 2013 DfT Traffic Count Data with Previous Assessments

2013 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	2013 AADF	HDV %													
798	38206	7.4												n	no relevant receptors
1045	21865	5.0					29001	10						n	less than previous
1166	21435	3.3	28956	7					20472	7.1				n	less than previous
1170	13558	1.2							17799	2.3				n	less than previous
10803	41771	9.5												n	no relevant receptors
10856	29897	4.0					33981	6						n	less than previous
11027	29719	1.2	21538	6			32787	1.63	29699	2.8				n	less than previous
20857	35131	4.0	34328	8			37078	4.3						n	less than previous
20978	1075	40.2			1059	49.8							1.5	n	less than 10 percent increase
30847	19529	3.8					18515	3.3			21089	2.8		n	less than previous
40803	37396	10.0					32907	13					13.6	y	>than 10% increase
40858	25186	4.1												n	no relevant receptors
40982	8294	6.9	12506	11	11767	4.5			8684	7.8				n	less than previous
50817	15942	4.5	20730	8			17299	2	17347	5.8				n	less than previous
50844	22498	5.5												n	no relevant receptors
50875	11283	8.2	13680	16	15413	9.8	15413	10.3						n	less than previous
74325	24488	8.2												n	no relevant receptors
74326	22433	4.8									23667	3.7		n	less than previous
74327	7047	3.1					15619	7						n	less than previous
74332	9811	3.0												n	no relevant receptors
77104	27052	4.0												n	no relevant receptors
78561	16707	6.1												n	no relevant receptors
78562	10401	3.0												n	no relevant receptors
78563	26909	8.2												n	no relevant receptors
80321	14163	4.7												n	no relevant receptors
80364	14487	5.6					14231	6					1.8	n	less than 10 percent increase
80558	17757	2.8	17622	7	16779	3.6							0.8	n	less than 10 percent increase
80559	14497	1.5	22168	4			18612	2.9						n	less than previous
y	see section 3.1														

**Table F3 Comparison of 2013 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)	2013 AADT	Date	Assessment or DMRB Required?	Reason
Arbroath Road (E of Kenilworth Ave)	y	n	13189	12957	13048	13283	<b>13142</b>	2013	n	less than previous
Blackness Road ( W of Marchfield)	y	n		6193	6360	5911	<b>5102</b>	2013	n	less than previous
Broughty Ferry Road (E of Dalgleish Rd)	y	n	33981			27315	<b>29322</b>	2013	n	less than previous
Dens Road (S of Hillbank Rd)	y	n	10859	11025	11323	10062	<b>9744</b>	2013	n	less than previous
Forfar Road (N of Janefield Pl)	y	n	9276	8220	8278	8861	<b>8768</b>	2013	n	less than 10,000vpd,not narrow congested, PM <sub>10</sub> background less than 15ug/m <sup>3</sup>
Hilltown (N of Stirling St)	y	y		5598	5749	5416	<b>5608</b>	2013	n	less than 10,000vpd,not narrow congested, PM <sub>10</sub> background less than 15ug/m <sup>3</sup>
Lochee Road (N of Rankine St)	y	n	13018	13291	13384	12684	<b>11603</b>	2013	n	less than previous
Perth Road (E of Windsor St)	y	n	8343	7560	7764	7053	<b>7180</b>	2013	n	less than 10,000vpd,not narrow congested, PM <sub>10</sub> background less than 15ug/m <sup>3</sup>
Pitkerro Road (S of Baxter Park)	y	n	9159	10102	10375	8675	<b>8827</b>	2013	n	less than 10,000vpd,not narrow congested, PM <sub>10</sub> background less than 15ug/m <sup>3</sup>
Rankine Street (N of Lochee Rd)	y	n	8098	7931	8145	7115	<b>7188</b>	2013	n	less than 10,000vpd,not narrow congested, PM <sub>10</sub> background less than 15ug/m <sup>3</sup>
Riverside Drive (nr Airport)	n	n	18818	19054	19187	17024	<b>16213</b>	2013	n	no relevant receptors
Rosebank Street (N of Kinloch St)	y	n				4426	<b>4621</b>	2013	n	less than 10,000vpd,not narrow congested, PM <sub>10</sub> background less than 15ug/m <sup>3</sup>
Tay Bridge	n	n		25419	25597	25235	<b>24770</b>	2013	n	less than previous

Appendix G : Monthly Diffusion Tube Concentrations

Site Id. (DT)	Location	x	y	Jan-13	Feb-13	Mar-13	Apr-13	May-13	Jun-13	Jul-13	Aug-13	Sep-13	Oct-13	Nov-13	Dec-13	Mean	% Data	Period Adj Factor	Annual Mean	Annual Mean bias (0.87)
92	Abertay 2	340019	730612	51.3	53.3	58.3	37.4	39.4	44.5	42.5	39.8	43.2	49.4	48.9	45.9	46.2	100	1	46.2	40.2
179	Albert St (15)(Façade)	341092	731121	53.2	47.1	41.9	40.5	35.0	40.6	-	36.1	41.4	44.0	42.4	39.9	42.0	91.7	1	42.0	36.5
180	Albert St (15)(Roadside)	341091	731121	54.2	47.2	43.6	40.2	38.2	48.3	39.8	36.3	44.3	44.4	51.7	36.4	43.7	100	1	43.7	38.0
187	Albert St (81)	341113	731265	48.5	41.2	35.8	31.8	30.8	33.6	32.3	27.9	33.1	41.5	44.9	37.8	36.6	100	1	36.6	31.8
167	Albert St (191)	341161	731535	55.1	47.3	50.1	48.0	37.0	40.9	35.9	31.3	37.7	46.3	39.4	34.7	42.0	100	1	42.0	36.5
5	Arbroath Rd (13)	341111	731070	46.9	57.0	43.7	34.0	38.4	37.3	41.4	41.9	37.9	44.2	59.8	45.5	44.0	100	1	44.0	38.3
168	Arbroath Rd (27)	341223	731089	47.6	53.0	41.6	37.9	32.2	34.9	30.9	31.9	35.0	40.7	47.5	36.8	39.2	100	1	39.2	34.1
147	Arbroath Rd (38)	341202	731097	47.8	57.5	53.0	34.7	36.9	35.9	35.7	36.7	35.5	43.0	61.0	41.6	43.3	100	1	43.3	37.6
7	Balgavies PI	343082	731465	28.1	28.0	20.7	11.7	14.6	10.3	11.3	14.3	16.9	21.4	32.5	24.1	19.5	100	1	19.5	17.0
9	Birnam PI	337531	730914	17.1	15.9	14.4	9.4	8.0	8.2	7.9	7.8	10.5	13.2	15.7	10.6	11.6	100	1	11.6	10.1
164	B/Ferry Rd Lower	343545	730942	22.9	24.8	16.8	8.0	18.1	8.1	11.4	13.3	12.8	19.4	36.4	22.9	17.9	100	1	17.9	15.6
140	B/Ferry Rd Lp66	343297	731096	43.5	48.5	33.4	31.6	29.5	26.1	27.8	33.0	33.1	33.5	56.6	42.6	36.6	100	1	36.6	31.8
139	B/Ferry Rd (141) Downpipe	343317	731072	37.3	52.1	34.8	30.3	31.1	30.2	31.3	31.1	31.4	35.8	58.6	42.9	37.2	100	1	37.2	32.4
11	Broughty Ferry Rd (141)	343322	731073	50.4	52.0	45.4	37.6	39.1	38.7	41.0	42.4	43.3	48.5	62.8	49.5	45.9	100	1	45.9	39.9
142	B/Ferry Rd (141)(Street Sign)	343302	731075	42.0	48.5	37.6	32.6	27.8	27.9	25.0	26.6	30.5	39.2	50.8	31.4	35.0	100	1	35.0	30.4
166	B/Ferry Rd Lp59(2)	343129	731081	38.7	41.2	31.3	25.3	20.3	21.1	20.5	20.9	28.1	29.9	44.2	32.1	29.5	100	1	29.5	25.6
145	B/Ferry Rd Greendykes	342662	731112	47.5	54.4	44.4	37.5	35.0	36.5	31.6	34.7	39.4	40.0	56.3	44.6	41.8	100	1	41.8	36.4
	B/Ferry Rd/Carolina Court	342347	731089	60.6	68.7	56.8	45.2	36.9	46.1	44.1	39.2	49.6	55.6	61.4	43.4	50.6	100	1	50.6	44.0
155	Carolina Court Lp6	342353	731058	34.5	36.3	27.7	16.7	16.0	14.5	16.2	17.0	22.9	26.6	42.7	27.4	24.9	100	1	24.9	21.6
186	Carolina Court 30Mph Sign	342342	731083	-	-	-	-	-	26.2	25.7	23.9	28.8	34.7	48.2	30.3	31.1	58.3	1.058	32.9	28.6
171	Claypotts/Arbroath Rd (502)	345347	732080	42.4	38.2	28.8	22.7	26.8	18.5	21.1	-	26.8	33.7	62.0	40.1	32.8	91.7	1	32.8	28.6
13	Cleington Rd/ Forfar Rd	341385	732121	50.1	56.2	43.8	37.4	33.6	32.5	31.8	36.8	41.3	40.1	58.5	39.3	41.8	100	1	41.8	36.4
174	Cleington Rd (172)	339974	732147	49.0	47.8	44.5	-	-	-	-	-	-	-	-	-	47.1	25.0	0.767	36.1	31.4

Dundee City Council

Site Id. (DT)	Location	x	y	Jan-13	Feb-13	Mar-13	Apr-13	May-13	Jun-13	Jul-13	Aug-13	Sep-13	Oct-13	Nov-13	Dec-13	Mean	% Data	Period Adj Factor	Annual Mean	Annual Mean bias (0.87)
188	Commercial St (9)	340544	730291	53.5	59.2	61.7	54.1	45.9	45.4	46.0	39.8	43.2	49.2	56.0	39.9	49.5	100	1	49.5	43.1
84	Commercial St /Dock St (40)	340565	730263	52.7	-	48.1	45.0	44.9	36.3	42.1	42.0	48.0	46.0	60.6	40.7	46.0	91.7	1	46.0	40.1
175	Coupar Angus Rd (38)	337414	732164	48.4	48.3	45.6	28.7	24.6	30.4	27.8	-	25.7	60.4	44.9	31.5	37.8	91.7	1	37.8	32.9
17	Dens Rd (Crossing)	340725	731238	46.1	45.4	39.8	32.9	30.6	28.2	30.3	35.6	31.1	37.4	48.5	37.1	36.9	100	1	36.9	32.1
85	Dock St (21)	340524	730216	49.3	60.5	51.3	43.1	43.6	48.0	43.2	-	44.5	53.2	63.2	38.1	48.9	91.7	1	48.9	42.6
156	Dock St (57)	340656	730343	77.5	80.7	58.9	50.9	55.6	43.3	52.8	53.4	53.2	61.3	89.9	65.7	61.9	100	1	61.9	53.9
169	Dura St (30)	341021	731434	43.1	45.2	40.5	34.1	27.4	27.6	26.5	23.5	31.3	35.7	41.4	31.4	34.0	100	1	34.0	29.6
20	Dura St (100)	341150	731576	51.2	55.8	44.6	43.1	33.7	39.8	34.7	33.9	35.6	46.9	52.0	37.6	42.4	100	1	42.4	36.9
22	Eastport Roundabout	340651	730623	46.7	49.5	43.7	36.7	37.9	35.6	35.9	31.2	36.7	41.8	51.6	37.9	40.4	100	1	40.4	35.2
83	Forfar Rd (104)	341437	732360	62.7	58.3	49.1	45.3	47.6	47.5	45.9	49.6	52.0	52.1	71.3	51.6	52.8	100	1	52.8	45.9
178	Hawkhill/Horsewater Wynd	339576	730223	42.9	41.4	44.3	36.3	26.8	32.0	-	-	27.6	-	30.9	24.5	34.1	75.0	1	34.1	29.6
26	Kingsway East Roundabout	343107	731740	49.0	48.3	44.3	37.4	37.3	42.2	42.4	39.4	43.5	43.1	63.8	53.7	45.4	100	1	45.4	39.5
27	Kingsway/ Mains Loan	341124	732468	52.2	52.9	54.5	49.0	34.7	49.2	40.3	29.9	40.6	38.5	32.7	28.2	41.9	100	1	41.9	36.4
177	Kingsway/Strathmartine Rd (N)	339179	732896	52.3	58.0	38.8	38.8	33.9	32.4	36.9	40.8	38.9	38.4	65.7	53.5	44.0	100	1	44.0	38.3
30	Lochee Rd (138)	338936	730680	71.1	76.6	56.5	50.6	53.3	53.7	51.2	49.0	50.8	54.6	74.9	63.3	58.8	100	1	58.8	51.2
31	Lochee Rd (140)(Traffic Lts)	338927	730685	69.1	80.9	55.4	51.0	50.9	55.6	53.5	59.4	52.5	56.1	79.7	64.2	60.7	100	1	60.7	52.8
32	Lochee Rd (184)	338767	730856	54.6	56.0	39.8	31.9	34.5	32.3	33.1	35.3	35.2	34.4	60.1	51.2	41.5	100	1	41.5	36.1
	Lochee Rd (Romon 1)	338861	730773	61.3	60.1	50.6	36.4	43.6	42.2	43.4	43.1	46.3	46.8	70.6	59.0	50.3	100	1	50.3	43.7
	Lochee Rd (Romon 2)	338861	730773	64.0	71.7	51.4	42.4	44.0	42.3	45.1	44.6	43.9	44.7	74.1	57.9	52.2	100	1	52.2	45.4
	Lochee Rd (Romon 3)	338861	730773	63.4	64.6	49.8	44.1	44.1	43.9	43.0	45.4	43.0	48.6	64.7	55.2	50.8	100	1	50.8	44.2
158	Lochee Rd (Romon) Average	338861	730773	62.9	65.5	50.6	41.0	43.9	42.8	43.8	44.4	44.4	46.7	69.8	57.4	51.1	100	1	51.1	44.4
36	Lochee Rd/Polepark Rd	339016	730586	41.7	48.9	36.3	29.4	23.1	28.2	26.7	24.5	33.6	35.0	50.8	30.0	34.0	100	1	34.0	29.6
176	Logie St/Grays Lane	338062	731366	37.3	37.2	33.5	24.9	19.1	22.6	22.7	18.8	26.9	25.0	39.2	25.9	27.8	100	1	27.8	24.1
37	Logie St (114)	338184	731293	76.4	82.2	60.6	55.2	47.5	53.8	47.9	59.0	59.3	61.4	87.7	64.2	62.9	100	1	62.9	54.8
38	Logie St (98)	338252	731258	47.9	52.6	43.3	35.1	34.0	-	-	-	36.9	40.8	58.3	39.0	43.1	75.0	1	43.1	37.5

Dundee City Council

Site Id. (DT)	Location	x	y	Jan-13	Feb-13	Mar-13	Apr-13	May-13	Jun-13	Jul-13	Aug-13	Sep-13	Oct-13	Nov-13	Dec-13	Mean	% Data	Period Adj Factor	Annual Mean	Annual Mean bias (0.87)
39	Loons Rd (1)	338211	731293	46.7	59.0	58.5	42.7	39.9	46.1	41.8	36.1	46.3	46.1	57.8	35.5	46.4	100	1	46.4	40.3
182	Meadowside (28)	340298	730550	48.9	52.5	43.1	40.7	41.2	-	35.3	39.3	37.1	38.7	55.3	53.6	44.2	91.7	1	44.2	38.4
	Meadowside (Romon 1)	340243	730653	62.5	72.7	49.5	56.8	52.1	56.2	61.7	55.7	46.7	54.5	64.1	59.5	57.7	100	1	57.7	50.2
	Meadowside (Romon 2)	340243	730653	68.1	67.8	45.9	60.2	56.7	55.5	59.8	53.1	49.5	39.2	58.8	59.6	56.2	100	1	56.2	48.9
	Meadowside (Romon 3)	340243	730653	65.4	74.2	60.1	55.5	58.8	58.5	57.9	56.3	44.3	51.8	65.0	49.6	58.1	100	1	58.1	50.6
149	Meadowside (Romon) Average	340243	730653	65.3	71.6	51.8	57.5	55.9	56.7	59.8	55.0	46.8	48.5	62.6	56.2	57.3	100	1	57.3	49.9
170	Monifieth Rd (4)	346554	730919	38.6	34.5	31.0	-	23.9	26.5	22.6	21.9	27.3	27.8	39.5	25.5	29.0	91.7	1	29.0	25.2
42	Muirton Rd (6)	338152	731293	44.1	44.7	42.1	36.7	24.4	31.0	27.7	-	27.2	35.8	-	30.6	34.4	83.3	1	34.4	30.0
185	Murraygate (46)	340409	730484	40.6	36.3	-	25.1	-	21.4	23.8	23.2	25.5	30.5	37.3	33.6	29.7	83.3	1	29.7	25.9
189	Myrekirk Rd (29)	335420	731726	-	49.0	-	-	29.9	32.5	34.7	33.8	36.6	40.1	64.1	39.2	40.0	75.0	1	40.0	34.8
181	Myrekirk Tce (8)	335458	731767	35.7	44.0	34.5	30.9	31.3	26.4	30.9	29.3	32.8	33.4	59.0	31.6	35.0	100	1	35.0	30.4
45	Nethergate (6)	340274	730171	51.4	57.7	46.5	46.5	45.6	40.6	46.6	46.7	41.2	47.9	55.4	48.6	47.9	100	1	47.9	41.7
47	Nethergate (40)	340230	730124	55.8	55.1	53.7	51.1	46.1	52.5	54.1	47.9	48.7	52.7	54.7	47.9	51.7	100	1	51.7	45.0
44	Nethergate (88)	340163	730061	58.4	55.5	73.4	39.8	53.4	62.0	55.0	51.9	53.4	58.2	56.7	50.1	55.7	100	1	55.7	48.4
48	Nethergate (132)/Marketgait	340074	729984	40.1	49.1	45.0	32.5	35.2	33.5	28.3	27.3	33.5	43.4	45.9	34.3	37.3	100	1	37.3	32.5
46	Nethergate (95)	340033	729957	44.5	51.4	47.9	37.3	36.4	34.8	31.0	28.5	34.1	42.1	53.0	32.7	39.5	100	1	39.5	34.3
173	Old Glamis Rd(9)/Balgray St	339941	732251	40.1	38.1	31.7	24.9	20.8	19.1	18.5	20.1	24.3	27.3	41.1	28.9	27.9	100	1	27.9	24.3
91	Perth Rd (320)	338776	729798	53.5	51.7	43.6	36.8	38.6	37.8	38.6	33.6	35.7	44.5	60.1	37.1	42.6	100	1	42.6	37.1
172	Pitkerro Rd (3)	341227	731629	40.9	45.0	41.9	33.1	28.2	-	25.5	24.8	30.8	34.6	37.0	32.1	34.0	91.7	1	34.0	29.6
49	Rankine St (2)	338768	730900	56.0	64.5	47.9	37.1	38.9	36.0	37.8	36.4	43.9	42.6	68.7	43.6	46.1	100	1	46.1	40.1
54	Seagate (9)	340467	730388	49.3	53.7	45.9	39.9	38.9	40.8	37.6	38.6	41.1	44.8	50.5	44.0	43.8	100	1	43.8	38.1
150	Seagate (95-97)	340511	730492	60.8	60.3	61.9	-	-	-	-	-	-	-	-	-	61.0	25.0	0.767	46.8	40.7
190	Seagate (97)	340516	730499	-	-	-	-	57.9	55.4	57.1	53.2	51.6	60.5	-	57.2	56.1	58.3	1.216	68.2	59.3
50	Seagate (101)	340545	730532	49.5	56.5	52.4	43.7	42.4	46.8	48.7	43.9	40.7	45.7	58.6	48.4	48.1	100	1	48.1	41.9
	Seagate (Romon 1)	340487	730446	60.7	60.0	60.9	62.2	50.5	56.6	58.6	52.1	47.1	58.9	56.2	50.0	56.2	100	1	56.2	48.9

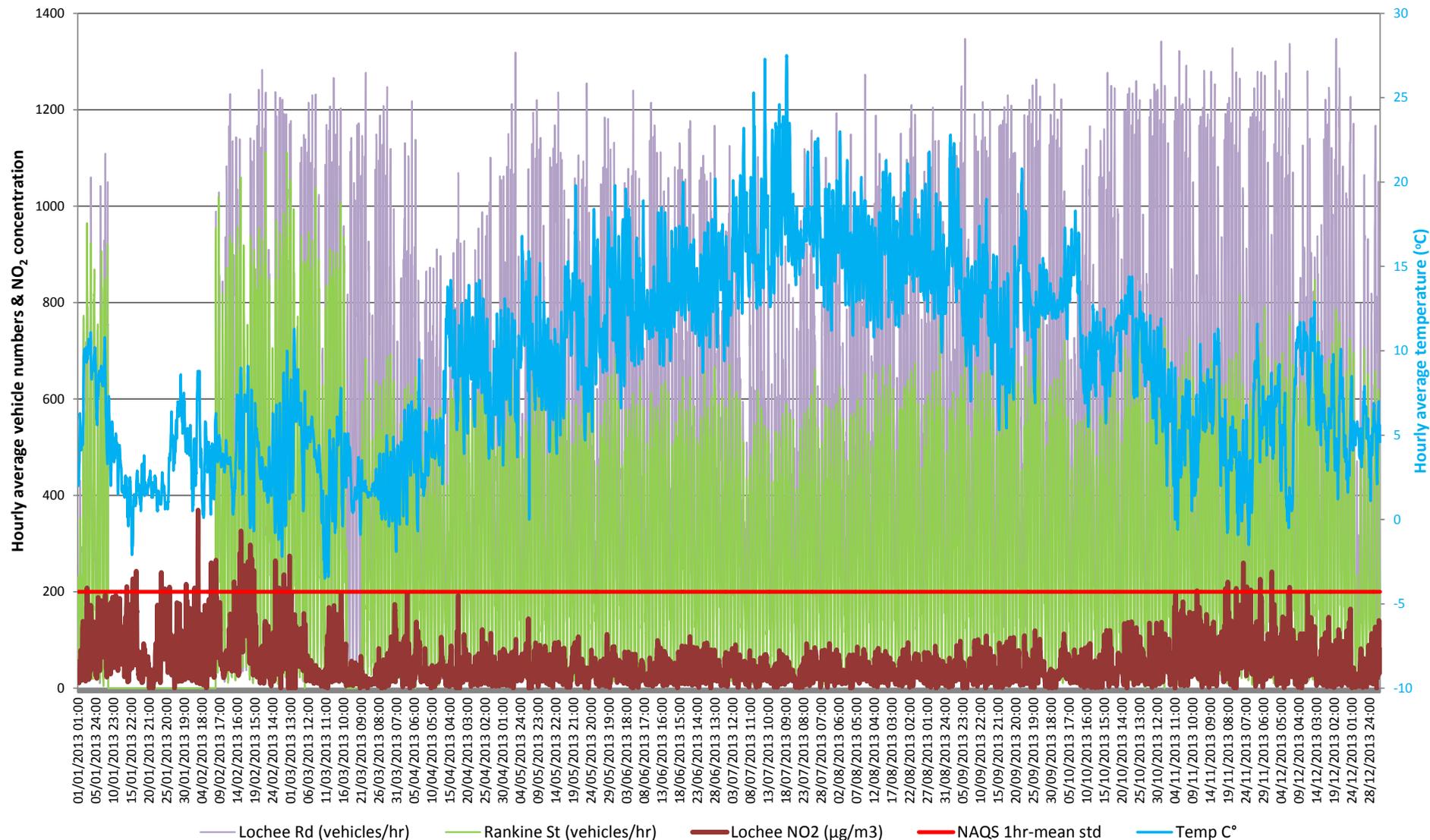
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Site Id. (DT)	Location	x	y	Jan-13	Feb-13	Mar-13	Apr-13	May-13	Jun-13	Jul-13	Aug-13	Sep-13	Oct-13	Nov-13	Dec-13	Mean	% Data	Period Adj Factor	Annual Mean	Annual Mean bias (0.87)
	Seagate (Romon 2)	340487	730446	59.9	56.3	51.6	59.6	47.0	57.2	52.4	48.8	51.0	59.5	62.6	49.4	54.6	100	1	54.6	47.5
	Seagate (Romon 3)	340487	730446	57.7	57.5	64.2	56.2	52.6	55.8	54.5	47.2	51.1	56.0	59.7	44.7	54.8	100	1	54.8	47.6
159	Seagate (Romon) Average	340487	730446	59.4	57.9	58.9	59.3	50.0	56.5	55.2	49.4	49.7	58.1	59.5	48.0	55.2	100	1	55.2	48.0
55	Soapwork Lane	340099	730650	47.6	48.9	44.5	32.9	33.6	32.5	33.5	30.4	35.2	41.2	55.6	42.5	39.9	100	1	39.9	34.7
151	South Road (1 Denbank)	335188	731528	44.2	54.4	43.9	33.0	30.4	30.8	-	34.1	40.2	40.2	55.7	31.5	39.9	91.7	1	39.9	34.7
162	St Andrews St/Seagate(116)	340532	730548	48.3	53.1	50.2	44.8	37.0	35.0	38.1	33.7	38.0	43.8	43.4	36.2	41.8	100	1	41.8	36.4
56	St Andrews St (26)	340516	730584	51.4	51.0	47.9	41.9	16.9	37.0	41.5	42.5	39.4	43.2	51.8	50.0	42.9	100	1	42.9	37.3
59	Strathmore Ave (353)	339609	731871	51.3	49.7	52.5	46.5	33.0	43.5	38.0	34.2	44.0	45.2	51.5	34.5	43.7	100	1	43.7	38.0
60	Trades Lane (31)	340575	730500	42.6	43.3	39.4	33.7	31.2	28.3	31.2	28.0	31.3	37.5	50.6	36.6	36.1	100	1	36.1	31.4
	Union St (Rollalong 1)	340235	730091	49.4	42.9	37.1	35.7	34.0	33.0	36.4	36.1	34.5	43.5	63.9	40.4	40.6	100	1	40.6	35.3
	Union St (Rollalong 2)	340235	730091	44.8	47.5	37.9	34.2	35.9	31.2	34.6	36.9	34.4	39.0	58.5	39.3	39.5	100	1	39.5	34.4
	Union St (Rollalong 3)	340235	730091	43.3	-	35.1	30.5	34.8	35.6	37.8	40.1	33.5	43.8	58.7	44.5	39.8	91.7	1	39.8	34.6
61	Union St (Rollalong) Average	340235	730091	45.8	45.2	36.7	33.5	34.9	33.3	36.3	37.7	34.1	42.1	60.4	41.4	40.0	100	1	40.0	34.8
191	Victoria Rd (4 India Buildings)	340213	730633	48.8	46.4	49.5	32.4	28.8	28.9	30.8	28.2	36.5	42.6	43.5	34.7	37.6	100	1	37.6	32.7
93	Victoria Rd (10)	340230	730673	46.6	48.2	47.2	40.0	32.3	31.8	33.9	30.0	34.8	42.5	47.4	34.6	39.1	100	1	39.1	34.0
70	Victoria Rd/Hilltown	340274	730714	70.7	76.9	59.3	50.7	60.2	58.4	55.4	58.6	62.7	66.6	81.9	72.4	64.5	100	1	64.5	56.1
68	Victoria Rd (60)	340375	730779	51.9	55.8	51.7	42.3	40.0	42.8	41.8	38.2	39.7	51.5	51.0	41.9	45.7	100	1	45.7	39.8
184	Victoria Rd (104)/William St	340697	730950	44.5	46.3	49.7	39.9	32.2	34.9	30.8	29.2	33.6	43.6	41.6	33.0	38.3	100	1	38.3	33.3
71	Victoria St / Albert St	341071	731072	45.9	45.5	43.0	31.4	32.7	31.9	30.8	27.1	34.4	40.1	49.0	32.7	37.0	100	1	37.0	32.2
90	Ward Rd / N. Lindsay St	339893	730336	30.9	40.5	37.3	36.8	31.6	30.7	30.7	29.3	29.3	39.1	38.3	43.4	34.8	100	1	34.8	30.3
72	Westport (2)	339842	730122	53.6	53.8	45.5	41.0	45.6	33.0	37.0	35.4	39.5	42.7	57.8	53.4	44.9	100	1	44.9	39.0
183	West Marketgait/Guthrie St	339805	730338	63.6	69.5	51.1	49.0	55.8	51.6	53.5	54.4	51.0	60.0	76.6	62.8	58.2	100	1	58.2	50.7
73	Whitehall Cr (4)	340376	730109	51.6	55.3	43.5	39.6	41.8	41.1	39.0	40.0	40.9	51.9	58.3	40.5	45.3	100	1	45.3	39.4
161	Whitehall Cr/Union St (50)	340305	730051	39.1	40.9	40.7	33.5	28.7	33.2	30.7	28.6	32.3	38.7	46.4	26.1	34.9	100	1	34.9	30.4
74	Whitehall St (40)	340330	730106	55.9	50.0	51.7	42.3	41.6	47.2	43.6	35.1	42.8	47.7	52.4	36.6	45.6	100	1	45.6	39.7

Dundee City Council

Site Id. (DT)	Location	x	y	Jan-13	Feb-13	Mar-13	Apr-13	May-13	Jun-13	Jul-13	Aug-13	Sep-13	Oct-13	Nov-13	Dec-13	Mean	% Data	Period Adj Factor	Annual Mean	Annual Mean bias (0.87)
81	Whitehall St (12)	340293	730142	53.4	53.9	60.9	48.3	40.2	51.5	45.7	44.8	42.3	49.7	48.8	36.8	48.0	100	1	48.0	41.8
76	Whitehall St (1)	340265	730153	62.8	65.7	59.3	52.4	50.5	53.8	62.3	54.4	50.2	56.8	65.9	54.3	57.4	100	1	57.4	49.9
75	Whitehall St (5)	340289	730128	62.8	64.6	51.9	50.4	48.2	50.3	53.2	52.5	48.8	52.1	61.2	48.6	53.7	100	1	53.7	46.7
77	Whitehall St (15)	340322	730098	52.8	55.7	52.4	45.5	42.9	44.7	41.6	41.9	42.7	51.6	51.1	38.5	46.8	100	1	46.8	40.7
	Whitehall St (Romon 1)	340278	730156	53.3	52.8	56.3	54.0	41.9	52.5	49.6	43.1	43.1	56.8	54.9	37.1	49.6	100	1	49.6	43.2
	Whitehall St (Romon 2)	340278	730156	51.8	54.6	59.3	51.7	46.6	50.7	48.3	43.8	47.0	53.0	57.5	40.6	50.4	100	1	50.4	43.9
	Whitehall St (Romon 3)	340278	730156	53.2	54.3	53.9	52.0	42.5	47.7	46.1	43.8	47.4	52.1	55.4	36.2	48.7	100	1	48.7	42.4
160	Whitehall St (Romon) Average	340278	730156	52.8	53.9	56.5	52.6	43.7	50.3	48.0	43.6	45.8	54.0	55.9	38.0	49.6	100	1	49.6	43.1
82	Woodside Ave	340776	732307	25.4	26.1	19.5	15.3	12.3	12.9	11.7	11.8	15.5	18.5	24.5	18.8	17.7	100	1	17.7	15.4

Appendix H: Comparison of hourly NO<sub>2</sub> concentrations at Lochee Road with temperature and local traffic flows



**Appendix I: Action Plan Progress Report**

**KEY TO TABLE**

**Potential Air Quality Benefits**

Small 0 - 0.5 µg/m<sup>3</sup>  
 Medium 0.5 - 1.0 µg/m<sup>3</sup>  
 High greater than 1.0 µg/m<sup>3</sup>  
 n/a not applicable

Action Plan Measure Priority Level	
High	
Medium	
Low	

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

2013 Updates are shown in blue text

Summary from Action Plan

Progress Report January to December 2013

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	Estimated Completion Date	Comments relating to emission reductions
1	Measure M1: Existing Road Infrastructure Improvements	► City Centre Improvements - Union St	DCC City Development Department (Transportation Division)			Implementation of improvements	High	Union Street Road Infrastructure 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 Road infrastructure improvements completed 2011	The levels of NO <sub>2</sub> at Union St have shown a consistent improving downwards trend to well below the objective level since 2010.
		► NW Arterial Route Improvement - Lochee Rd					Not estimated	Alterations carried out at Lochee Road/Rankine Street in February 2012 removed central reservation to free up road space and reduce congestion		Completed 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	Estimated Completion Date	Comments relating to emission reductions
1 cont		<ul style="list-style-type: none"> <li>► City Centre Improvements - Meadowside</li> </ul>		Introduce alteration to traffic lights at Meadowside and 1 year trial closing of nearside lane to increase distance between traffic and receptors	2013 +		Not estimated	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.	Installation of nearside lane closure using temporary paving completed in October 2013. Trial period of 1 year to allow impact on monitored concentrations to be studied..	2014/15	Levels of NO <sub>2</sub> have reduced since realtime monitoring was installed in 2011
1 cont		<ul style="list-style-type: none"> <li>► Arterial Route Improvements - Stannergate</li> </ul>		Traffic/Pollution Modelling Dundee East area (including Stannergate roundabout) to identify options for AQ improvement	2013		Not estimated		Consultants engaged in 2013 to carry out traffic micro-simulation modelling and air dispersion modelling.	2014	Modelling work on-going
1 cont		<ul style="list-style-type: none"> <li>► City Centre Improvements – Seagate / St. Andrews Street.</li> </ul>		Funding being sought for Financial Year 14/15 to provide engineering design and air dispersion modelling of changes to bus stop locations	2014/15		Not estimated		Transportation Division are developing traffic management options for Seagate and surrounding street	2015/16	
2	<p><b>Measure M2:</b> DCC will enhance the Urban Traffic Management and Control (UTMC) system to reduce congestion</p>	<ul style="list-style-type: none"> <li>► Real-time traffic monitoring.</li> <li>► Improved control regime to smooth out peak traffic.</li> </ul>	DCC City Development Department (Transportation Division)	Implementation of UTMC improvements and carry out annual review to measure % reduction in congestion in line with target		<ul style="list-style-type: none"> <li>► 10% reduction in congestion (journey times) in targeted areas during peak times before and after implementation of measure.</li> <li>► Annual review of impact</li> </ul>	Small	<p>Scheme designed to expand UTMC to two congested junctions in Lochee Rd AQ hotspots.</p> <p>Schemes now implemented and the traffic management improvements will be assessed in terms of AQ improvements by Environmental Protection Division. ► UTMC to be implemented in 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.</p>	Seagate / Commercial St Traffic Light Refurbishment Completed Feb 2013	Completed 2013	Annual mean NO <sub>2</sub> concentrations have decreased at Lochee Road since 2011). 2013 when the works were being implemented

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	Estimated Completion Date	Comments relating to emission reductions
2 cont				TACTRAN Capital Grant funding for expanded automation of journey time monitoring to allow activation of traffic management systems to alleviate congestion.	2013		Not estimated		Proposed to seek AQAP funding for FY 14/15 to expand Bluetooth Traffic Speed Monitoring System to include the Lochee Road corridor a known air pollution hotspot.  DCC and Transport Scotland are currently procuring combine system - looking to implement early 2014	On-going	n/a
				Improve traffic flow/ management strategies in Lochee Rd- introduce MOTES	2013		Not estimated		MOTES now unlikely to be deployed as it appears to have limited effect. Expansion of Bluetooth traffic speed monitoring to include the Lochee Road corridor being pursued		n/a
				Paramic/AIRE modelling of key junctions - Kingsway/Forfar Road & Lochee Road Corridor to test option improvements	2013		Not estimated		Consultants engaged in 2013 to carry out traffic micro-simulation modelling and air dispersion modelling.	2014	Modelling work 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	Estimated Completion Date	Comments relating to emission reductions
3	<b>Measure M3:</b> 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	Small	► 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.	2012+ on-going scaled down	A reduction in transport / unnecessary journeys however this may be difficult to measure.
				Behavioural Change Primary School programme to promote sustainable travel options in all primary schools in Dundee. Funding sought for FY 2014/15 to extend programme to P5 pupils over two academic years	March to Oct 2014			2012 summary - Broughty Ferry targeted for 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. ► Investigated 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%.	41% of trips to work by Active Travel (walking and cycling) in 2012. This figure is taken from Scottish households survey (SHS) undertaken in 2012 and relates to a very small sample size (92 people).		

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	Estimated Completion Date	Comments relating to emission reductions
3 cont.				3 "Doctor Bike" Safety Events planned for the City Square	2013/14				Doctor Bike has visited Dundee City Square several times offering bike maintenance workshops		As above
4	Measure M4: DCC will introduce measures to improve bus services and reduce emissions	<ul style="list-style-type: none"> <li>▣ ► Statutory Bus Quality Partnership. †</li> <li>► Voluntary Bus Quality Partnership</li> </ul>	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	Awaiting publication of Scottish Low Emission Strategy.	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	Estimated Completion Date	Comments relating to emission reductions
4 cont.	Measure M4, cont.	† ► Fleet Renewal – Emissions Improvements	DCC City Development Department (Transportation Division)		2011+	► Fleet age, Euro class, fuel type	Medium	<p>► 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).</p> <p>► 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)</p> <p>2012 summary - ► 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)</p>	<p>Through the Scottish Cities Alliance (SCA) investigations into potential for Hydrogen fuel alternatives are being developed with major EU funding opportunity hopefully being available 2014 - 2020. SCA and ten Cities are engaged with EU proposal in terms of Scotland's suitability for Hydrogen Fuel cell bus expansion.</p>	2013+	
						► Lobby Scottish Government for fuel duty rebates for low carbon fleet		<p>Bus Service Operators Grant (BSOG) changes from April 2012 will reward use of cleaner fuels and incentivise the use of cleaner vehicles.</p>	<p>Current enhanced BSOG available for operation of Diesel Electric Hybrid buses. Further investigate enhanced BSOG where Hydrogen Fuel Cell vehicles are introduced.</p>		

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	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				High profile launch event for the nine Hybrid Buses introduced by National Express Dundee – coupled with promotional work with local schools	2013	New cleaner emission vehicles are now successfully in operation
				ECO Stars Dundee Fleet Management Recognition Scheme being introduced	2013/14					See Measure 6 – National Express Dundee one of the 12 inaugural members	
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	► Opportunities being investigated as part of Air Quality Low Emission Charter (Reported in AQAP 2012, Appendix 2). ► National Express Dundee and Stagecoach have invested in in-vehicle monitoring systems and vehicles with auto-shutoff technology	Awaiting publication of Scottish Low Emission Strategy	2012+	
4 cont.	Measure M4, cont.	□ ► Low Emission Zones (LEZ) for buses	DCC City Development Department (Transportation Division)		2013	► Investigate the Traffic Regulation Conditions for LEZ in City Centre. ► Route choice for clean buses see Park & Ride facilities	High	Opportunities being investigated as part of Air Quality Low Emission Charter. (Reported in AQAP 2012, Appendix 2)	(see Measure 5 re Park and Ride Facilities)	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	Estimated Completion Date	Comments relating to emission reductions
				Bus Emission Modelling being undertaken to test likely improvements associated with various scenarios including possible LEZ for buses by 2017	2013/14				<p>Model of main City Centre Bus Corridor set up to model the impact of the following low emission Scenarios:</p> <p>S1 – 2017 All Buses Euro V                      S2 – 2017 All Buses Euro VI                      S3 – 2017 All Buses &amp; HGVs Euro V                      S4 – 2017 All Buses &amp; HGVs Euro VI</p> <p>Expected to report in 2014</p>	2014	

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5	<b>Measure M5:</b> DCC will explore provision of Park and Ride facilities that do not have adverse impact on air quality	<ul style="list-style-type: none"> <li>▶ Provision of Park and Ride (P&amp;R) facilities</li> </ul>	DCC City Development Department (Transportation Division) & Tayside and Central Scotland Transport Partnership (TACTRAN)			<ul style="list-style-type: none"> <li>▶ Report on identification and prioritisation of P&amp;R facilities</li> <li>▶ Implementation of scheme</li> <li>▶ Passenger numbers</li> </ul>	Medium	<p>Site at Wright Avenue selected as preferred location for P&amp;R at Dundee West and at site on south side of Tay Road Bridge identified for Dundee South and confirmed by NE Local Plan reporter.</p> <ul style="list-style-type: none"> <li>▶ Both sites taken forward with detailed design. Dundee West underwent pre - planning application consultation and detailed planning consent applied for in mid 2013.</li> </ul>	<p>Dundee West site at Wright avenue rejected by Development Management Committee, this will require TACTRAN and DCC to review Dundee area Park and Ride strategy. It is not anticipated that Dundee West Park and Ride option will be revisited in the timeframe of this monitoring framework. Wider strategy around city under review with TACTRAN, SESTRAN, Fife Council and Transport Scotland DCC, Fife Council, TACTRAN and SESTRAN actively investigating funding opportunities to deliver the facilities 2014 / 2015 onwards at Dundee South.</p>	+	
6	<b>Measure M6:</b> DCC will introduce measures to reduce emissions from Heavy Goods Vehicles	<ul style="list-style-type: none"> <li>▶ Perth &amp; Dundee Retail Freight Consolidation Centre</li> </ul>	DCC City Development Department Transportation Division) & TACTRAN		2011+	<ul style="list-style-type: none"> <li>▶ Implementation of scheme</li> <li>▶ Vehicle fleet in the AQMA</li> <li>▶ Study for the alternate system of retail freight</li> </ul>	Small	Opportunities being investigated as part of Air Quality Low Emission Charter (See AQAP2012 Appendix 2)	<p>LaMILO (Last Mile Logistics) projects to deliver exploratory social enterprise model freight consolidation based on successful Dutch model. ENCLOSE project developed and looking at Sustainable Urban Logistics Plan for Dundee (SULP)</p>	2012+	
6 cont.	<b>Measure M6 cont.</b>	<ul style="list-style-type: none"> <li>▶ Freight Quality Partnership (FQP)</li> </ul>	DCC City Development Department Transportation Division) & TACTRAN			<ul style="list-style-type: none"> <li>▶ Implementation of partnership</li> <li>▶ Changes in hourly profile of HGVs in AQMA</li> </ul>	Small	Dundee is included as part of Tactran's Regional FQP	<ul style="list-style-type: none"> <li>▶ Ongoing</li> </ul>	Long term	

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6 cont .				A freight routing planning tool will be launched by TACTRAN which should encourage HGVs to follow appropriate routes	Jan-13				Tactran Freight Planning Tool now established.		
				Dundee is participating in a pan European project (ENCLOSE) investigating city logistics with carbon and emission reduction as important factors under investigation	2013				Sustainable Urban Logistics Plan (SULP) to give legacy post ENCLOSE project in terms of energy efficient and 'green' city logistics		
6 cont .				ECO Stars Dundee Fleet Management Recognition Scheme being introduced	2013				Dundee ECO Stars Fleet Recognition Scheme was successfully launched on the 13th December 2013 with 12 inaugural members. This is a fleet accreditation system that acknowledges greener fleets. The Corporate Air Quality Steering Group intends to seek funding for future years.	Ongoing	A number of participating members are now demonstrating working towards operating greener fleets.

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7	Measure M7: DCC will seek improvements in emissions standards, including NO2 and PM <sub>10</sub> for the council fleet and public service vehicles	<ul style="list-style-type: none"> <li>□ ► Development of Green Procurement Strategy</li> <li>► To set target for Euro category/fuel type</li> </ul>	<ul style="list-style-type: none"> <li>► DCC Corporate Fleet Manager</li> <li>► DCC Environment Department</li> </ul>			<ul style="list-style-type: none"> <li>► Approval of Strategy (Asset Management Plan)</li> <li>► Average age fleet and Euro category, fuel type</li> </ul>		<ul style="list-style-type: none"> <li>► New Corporate Fleet Manager appointed December 2011</li> <li>► New Fleet Section to develop a reporting procedure to compare replacement vehicles in relation to emission improvements</li> <li>► New Fleet Section will create a replacement plan for all vehicles to maintain fleet age profile</li> <li>► 2011 make up of the waste collection fleet - 12 x Euro 3, 17 x Euro 4 and 23 x Euro 5. Fleet is continually moving towards newest Euro Category</li> <li>► The Fleet section has replaced 60 vehicles 2012/13 all with improved emissions standards</li> <li>► See also Measure 14</li> </ul>	<p>The Fleet Section has bought in over 50 new vehicles in 2013 - replacing the oldest and most polluting vehicles where possible. And have also undertaken an exercise with hire company to replace over 30 of the oldest hire vehicles in the fleet. ► 2 new Euro 6 engine Refuse Collection vehicles have been ordered to join the fleet in 2014.</p> <p>There are also 39 electric vehicles in the Council Fleet contributing to lower emissions.</p> <p>DCC Fleet in partnership with Transport Scotland looking to expand light goods / van fleet in FY14/15</p> <p>DCC Transportation delivering in partnership with Developing Car Clubs in Scotland and Co-Wheels seven additional car club vehicles all of which are Electric Vehicles</p>	2014+	
				The development of an Asset Management Plan which will incorporate environmental issues as part of the replacement criteria	2013/14			Small	Ongoing		
				Initial discussions for 2013/14 vehicle/plant replacement programme has identified improved emissions as a high priority	2013/14				Replaced over 30 of the oldest hire vehicles in the fleet.	An equivalent number of poorer quality emission vehicles have now been removed from service.	
				Participation in ECO Stars Dundee-Fleet Management Recognition Scheme	2013				DCC Fleet Achieved 4-Star Rating in ECO Stars Recognition Scheme as recognition for reducing the environmental impact of the Council's Fleet.	Ongoing	

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8	<b>Measure M8:</b> DCC in consultation with the Taxi Liaison Group will explore means of reducing emissions from taxis and private car hire vehicles in AQMA	► Enforce No idling for taxis ► † Increase cleaner taxis	► DCC Support Services ► DCC City Development Department ► Tayside Police			► 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	► 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. ► Approximately 400 Taxi / PHC driver training sessions were made available in FY 2013/13 -limited uptake alternative training options being considered	► Engaging with taxi operators who are actively investigating electrification of taxi fleet - one operator has indicated desire to convert diesel fleet to all electric (100+ vehicles), currently DCC working with partners to support this major proposal.	2012+	Objective to remove poor emission vehicles from service
				As part of Air Quality Low Emission Charter, continue to investigate opportunities for: Traffic Regulation Conditions for 'No Idling' of taxis;	2013/2014+			Ongoing			
				Explore the potential of introducing Licensing Conditions for minimum taxi Euro category for certain classes of vehicles;				Assuming successful implementation of the proposed ECOSTARS scheme for Taxi Operators, the Council will consider making achievement of a certain minimum star rating a pre-requisite for Council Contracted work.			
				Provide 'No Idling' street signage; Monitoring for idling.				No progress			

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8 cont.				DCC also looking at collaborative work with taxi operators in developing an Electric Vehicle trial for taxis in Dundee					Looking at City Wide rapid charger network to support individuals use, where they can't easily home charge and this will support a taxi fleet of EVs (over and above their home / depot charging infrastructure). Up to seven rapid chargers would be located in neighbourhoods city wide		
				Seek funding to allow expansion of ECOSTARS programme to include taxi operators	2014/15						
9	<b>Measure M9:</b> 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"> <li>▣ ► To investigate into the establishment of a programme of RET in the AQMA</li> </ul>	<ul style="list-style-type: none"> <li>► VOSA</li> <li>► Tayside Police</li> <li>► DCC Environment Department.</li> </ul>			<ul style="list-style-type: none"> <li>► Approval/non-approval of RET scheme</li> <li>► Traffic Regulation Conditions if necessary.</li> </ul>	Small	No progress to date, due to unsuccessful funding bid to Scottish Government in 2013/14	Unable to progress this year as funding was not provided, will seek funding in 2014/15 funding application.	2013+	
				To seek funding to undertake feasibility study of introduction of RET	2014/15+						

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<b>POLICY AND PARTNERSHIP WORKING MEASURES</b>											
10	<p><b>Measure M10:</b> 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</p>	<p>► Provide AQ policy within Local Development Plan with commitment to improve air quality ► Produce air quality Supplementary Planning Guidance (SPG)</p>	<p>► DCC City Development (Planning Division) ► DCC Environment Department.</p>			<p>► Adoption of Local Development Plan ► Adoption of Air Quality SPG</p>	Small	<p>► Main Issues Report Consultation exercise completed 2/12/2011. Proposed Plan by late autumn 2012. ► Method of integrating AQ into SPG considered. ► Air Quality Policy incorporated into draft LDP. Air Quality Supplementary Planning Guidance drafted</p>	<p>Air Quality SPG undergoing final alterations and will go to Committee as part of a package of SPGs on adoption of the Local Development Plan.</p>	2014 +	

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11	<b>Measure M11:</b> DCC will ensure effective co-ordination between climate change and air quality strategies and action plan measures	<ul style="list-style-type: none"> <li>□ ► Strategy to be developed to improve co-ordination between climate change and air quality strategies and action plan measures</li> </ul>	<ul style="list-style-type: none"> <li>► DCC Corporate Planning Department</li> <li>► DCC City Development - (Property Division)</li> <li>► DCC Environment Department.</li> </ul>		2011+	<ul style="list-style-type: none"> <li>► Implementation of co-ordination strategy</li> <li>► Reciprocal attendance of air quality and climate change working groups/steering committees</li> </ul>	Small	Procedure implemented for exchange of information between the Climate Change Board & Corporate Air Quality Steering Group.	All matters (e.g. Action Plan updates) which the Climate Change Board & Corporate Air Quality Steering Group requires attention in general, will be dealt with by the Director of Environment and / or the Strategic Management Team. In addition an Air Quality Progress Report will be brought to the Climate Change Board annually (Dec 2014).	2014+	
12	<b>Measure M12:</b> DCC will continue its active involvement and support of TACTRAN	<ul style="list-style-type: none"> <li>□ ► Regularly attend meetings</li> <li>► Provide feedback</li> <li>► Provide necessary support</li> </ul>	<ul style="list-style-type: none"> <li>► DCC City Development Department. (Transport Division)</li> </ul>			<ul style="list-style-type: none"> <li>► Number of TACTRAN policies and proposals implemented</li> </ul>	n/a	DCC will continue to support TACTRAN and focus on implementation of Regional Transport Strategy	No Change	On-going	

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<b>LEADING BY EXAMPLE MEASURES</b>											
13	<b>Measure M13:</b> ►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	□ ►Determine strategy/advise note and annually review content ►Install Electric Charging Facilities in Car Parks	DCC City Development Department (Transportation Division)			►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	Small	►See also Measures 7 and 14 ►►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)	►Looking at City Wide rapid charger network to support individuals use, where they can't easily home charge and this will support a taxi fleet of EVs (over and above their home / depot charging infrastructure). Up to seven rapid chargers would be located in neighbourhoods city wide, SSE have been asked to assist also.	2012+ on-going	
				See also Measure 7-	2013/14+						
14	<b>Measure M14:</b> 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	□ ►Development of Green Procurement Strategy	► DCC Corporate Fleet Manager		2011+	□ Number / proportion of new/improved vehicles within fleets in each financial year	Small	►New Corporate Fleet Manager appointed December 2011. ► Procurement of vehicles through Scotland Excel Framework which gives consideration to Green Credentials. 2011 saw the introduction of 6 electric vehicles with a further 6 by end March 2012 ► The Fleet section has replaced 60 vehicles 2012/13 all with improved emissions standards ►See also Measure 7	The oldest and some of the most polluting vehicles have been identified and will be replaced with the current Euro 5 engines in the 2013/14 replacement plan. ►2 new Euro 6 engine refuse collection vehicles ordered and will add to the existing rolling programme of replacing older and more polluting vehicles. ►Over 80 vehicles were replaced in 2013 and a programme of continual change is ongoing.	2014+	

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				See Measure 7 & 13 with older more polluting vehicles being targeted							
15	<b>Measure M15:</b> DCC will improve the Council's vehicle fuel consumption efficiency by better management of fleet activities	<ul style="list-style-type: none"> <li>↑ ▶ Develop fleet management plan to improve fuel efficiency.</li> <li>▶ Investigate fleet activities in relation to pollution hotspots e.g. waste management fleet routes</li> </ul>	<ul style="list-style-type: none"> <li>▶ DCC Corporate Fleet Manager</li> <li>▶ DCC Environment Department</li> </ul>		2011+	<ul style="list-style-type: none"> <li>▶ Implementation of smarter driver programme</li> <li>▶ Preparation / Implementation of Fleet management plan ▶ 10% reduction by 2013 for staff business travel and Corporate Fleet</li> </ul>	Small	<ul style="list-style-type: none"> <li>▶ New Fleet Section created (2012)</li> <li>▶ Environment Department LGV drivers have undertaken SAFED (Safe &amp; Fuel Efficient Driving) as part of their decision driving training and there is a proposal to roll this out across all council drivers.</li> <li>▶ New computerised Fleet Management Systems to be introduced will help monitor fuel use across the council. Fuel saving measures being trialled in vehicles including Throttle Intervention Systems and Gear Box Prognostics. Fleet Section are developing reports to help tackle idling issues, which will improve fuel efficiency. 25 of the new small vans are fitted with stop/start technology which will be monitored to ascertain benefits.</li> </ul> <p style="text-align: center;">See Also Measures 7,13,14</p>	<ul style="list-style-type: none"> <li>▶ Fleet Section are working with other departments and telematics company to develop reporting tools to monitor mileage and driving styles.</li> <li>▶ Fleet section is beginning to develop action plan for rolling out Routesmart to plan routes for all council vehicles to assist with reducing mileage.</li> <li>▶ Fuel cards have been introduced to reduce mileage for RCV's in the east of the city.</li> <li>▶ The Routesmart officers introduced the 1st new route in January 2014 and have an extensive programme to look at all refuse collection routes.</li> <li>▶ Analysis has also begun on the information provided by the telematics system in relation to idling time etc.</li> </ul>	2014+	
				Analysis of the information provided by the telematics system in relation to idling time etc.	2014+						

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16	<b>Measure M16:</b> DCC will promote options for better travel planning amongst Dundee City Council employees	<ul style="list-style-type: none"> <li>□ ► Review DCC Travel Plan</li> <li>► † DCC to investigate use of annual survey on how/what modes of transport employees use to travel to work</li> </ul>	DCC City Development (Transportation Division)		2011+	<ul style="list-style-type: none"> <li>► Implementation of DCC Travel Plan &amp; review of progress with targets</li> <li>► 10% reduction by 2013 in staff business travel</li> <li>► % DCC employees walking/cycling to work</li> </ul>	Small	<ul style="list-style-type: none"> <li>► Staff Travel Policy adopted Autumn 2011. This includes CO2 usages for lease vehicles</li> <li>► DCC senior managers will effectively implement staff travel policy</li> </ul> <p>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).</p> <p>Sustainable Travel Officer(Fixed Term) unlikely to proceed in the short -term. Alternative mechanisms for All Staff Travel Habit Survey being considered (Survey Monkey)</p>	<ul style="list-style-type: none"> <li>► Annual staff travel habits survey pending. But investigating a short snap survey to determine staff travel habits - aim for early March</li> </ul>	2014+	
17	<b>Measure M17:</b> 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"> <li>† ► Continue to investigate and develop the use of various incentive schemes</li> <li>► Develop cycling strategies</li> <li>► DCC to investigate use of annual survey on how/what modes of transport employees use to travel to work</li> </ul>	DCC City Development (Transportation Division)		2011+	<ul style="list-style-type: none"> <li>► % DCC employees walking/cycling to work</li> <li>► Incorporate cycling measures within DCC Travel Plan in line with the new DCC Cycling Strategy to be developed</li> </ul>	Small	<ul style="list-style-type: none"> <li>► Get Cycling engaged to deliver cycling initiatives at DCC and other major employers in Dundee.</li> <li>► Improved cycling facilities provided at Dundee House (Dundee City Council Headquarters) and other Council properties.</li> <li>► Bike Boost and Cycle to Work initiatives delivered over the summer of 2012 to encourage staff to consider cycling.</li> </ul>	<ul style="list-style-type: none"> <li>► Staff Travel Policy now fully implemented and walking and cycling modes are encouraged for shorter distances.</li> </ul>	2014+	

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18	<p><b>Measure M18:</b> DCC will assess the Council's energy needs, make recommendations and implement reductions of carbon emissions which result in corresponding reductions of NO<sub>2</sub> and PM<sub>10</sub>.</p>	<p>† ► DCC to implement annual energy reduction action plan</p>	<p>DCC City Development (Property Division)</p>			<p>► 10% reduction by 2013</p>	<p>Small</p>	<p>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<sub>2</sub> 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. <a href="#">The Council's reported Total Footprint Emissions for property were 36,506 tonnes of CO<sub>2</sub> (2011/12), 40,308 tonnes (2012/13).</a></p>	<p><a href="#">The Climate Change Board continues to implement the Council's Carbon Management Plan and current energy management projects. The Council's reported Carbon Reduction Commitment (CRC) emissions from properties are 35,485 tonnes of CO<sub>2</sub> (2013/14),</a></p> <p><a href="#">Fleet transport baseline figure of 5,976 ( i.e. reported 2007 estimate ) has seen a 5.7% overall reduction.</a></p>	<p>On-going</p>	
				<p>New annual aspirational reduction target of 5% until 2020</p>	<p>2013+</p>						

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<b>EDUCATION AND COMMUNITY MEASURES</b>											
19	<b>Measure M19:</b> DCC to promote and support localised energy generation that doesn't compromise Air Quality in private households	<ul style="list-style-type: none"> <li>▣ ► Determine strategy/advise note and annually review content</li> </ul>	<ul style="list-style-type: none"> <li>► DCC Housing Department</li> <li>► Solar Cities</li> </ul>		2011+	<ul style="list-style-type: none"> <li>► List of any promotion campaigns planned/ implemented</li> </ul>	Small	<ul style="list-style-type: none"> <li>► In 2012 Solar PV – Annual 25,055kg CO2 (nominated installers calculated figures)</li> <li>► Solar thermal – Annual 197 kg CO2 (nominated installers calculated figures)</li> </ul> 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 CO <sub>2</sub> reduction ► Groups pending start date = 59 ► Groups working with = 23 ► Groups Complete= 2 ► Total number of people engaged = 853	City-wide Solar PV review carried out following the Westminster Government's resolution of the Feed In tariff (FIT). 25 DCC locations are FIT compliant. A further 18 additional locations being considered based on energy generation and pay back periods. Financial assessment complete. Report to be brought forward recommending approval to proceed.	2012+	

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20	Measure M20: DCC will provide the public with relevant air quality information.	<p>†</p> <ul style="list-style-type: none"> <li>▶ Investigating the potential for uptake of an air pollution information system, such as Air Alert</li> <li>▶ Improvements to AQ website information</li> <li>▶ Make up to date air quality information available to the public through Councils digital website</li> </ul>	<ul style="list-style-type: none"> <li>▶ DCC Environment Department</li> <li>▶ DCC City Development (Transportation Division)</li> </ul>			<ul style="list-style-type: none"> <li>▶ Investigate funding sources</li> <li>▶ Implement Air Alert or similar service</li> <li>▶ Improved rating of website in peer review</li> <li>▶ Make AQ information available through Council's website</li> <li>▶ Real Time Travel Information</li> </ul>	Small	<ul style="list-style-type: none"> <li>▶ Funding to improve air quality pages on the Council Website identified. The Scottish Government have taken forward their "Know &amp; 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 have provide a link and information about this service on the web-site.</li> <li>▶ The existing website achieved a higher rating in the 2012 peer review than the previous year.</li> <li>▶ Real-time pollutant monitoring concentrations are available from the Scottish Air Quality Website (<a href="http://www.scottishairquality.co.uk">www.scottishairquality.co.uk</a>). The Council have provided a link on the web-site to this service.</li> <li>▶ No progress on provision of real-time information on pollution levels to assist traffic management through pollution hotspots.</li> </ul>	<p>New air quality webpages completed apart from section on Air Quality Planning due to Supplementary Planning Guidance not yet being finalised. Historical data for all monitoring points for 2006 to 2012 available via interactive map while address search function for smoke control areas also available. LAQM reports available for download including 2013 Progress report. Previous air quality pages have been removed. Air quality information was included on new bus route map that was delivered to 75000 residences in Dundee at end of June to start of July 2013. Workshops held at four primary schools in Broughty Ferry in April / May which included discussions on air quality.</p>	2012+	

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				► Complete improvements to AQ website	2013				Completed (see above)		
				► Develop Database to enable DCC staff to better manage large volume of AQ data and make it more readily available to stakeholders	2013/14				Initial discussions held with IT Department in regards to development of a database for the handling and retrieval of air quality monitoring data.		

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21	<b>Measure M21:</b> 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>† ► DCC to ensure all relevant commercial planning applications have travel plan conditions applied in accordance with current best practice.</p> <p>► DCC to produce Travel Plan Strategy which: ► Details procedure for tracking &amp; possible requirement for 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 &amp; identify potential funding streams.</p> <p>► Number of new travel plans (need to show in terms of walking cycling - % of journeys saved).</p> <p>► Identify &amp; report on any Air Quality related Travel Plan targets from travel plan strategy and any relevant Travel Planning Team targets.</p> <p>► Promotion of Travel Plan initiatives e.g. Sustrans' Travel Smart ► Implement &amp; regularly review Travel Plan Strategy</p>	Small	<p>► Work in 2011 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 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 approved, if appropriate.</p> <p>► In 2012 investigated development of city wide programme of pupil involvement (P5 - 7) in travel behaviour change. Education Department also encouraged to refresh all school travel plans</p>	<p>Funding secured to commence a city wide programme of pupil involvement (P5 - 7) in travel behaviour change. Education Department have agreed that all school travel plans will be reviewed over 13/14. Tender issued 22 November 2013 Contract Awarded and in class sessions will commence March through to September 2014, all P5 pupils in Dundee will be reached through in class sessions.</p>	2014+	

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				See Measure 3- Behavioural Change Primary School programme to promote sustainable travel options in all primary schools in Dundee	2013/14						
22	<b>Measure M22:</b> 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"> <li>↑ ► Identify walking &amp; cycling schemes (such as Park &amp; Cycle).</li> <li>► Identify walking &amp; cycling promotional opportunities around Dundee City</li> </ul>	DCC City Development (Transportation Division)		2011+	<ul style="list-style-type: none"> <li>► Number of walking and/or cycling initiatives in operation.</li> <li>► Establish the use of cycle monitoring counts at key points on cycle routes</li> </ul>	Small	<ul style="list-style-type: none"> <li>► Get Cycling engaged to undertake promotion of cycling and delivered Bike Boost.</li> <li>► Positive Steps implemented Dundee Travel Active Personal Travel Plans in Broughty Ferry</li> <li>► Cycle to Work Scheme being promoted during august 2012</li> <li>► City Engineer currently implementing major cycling scheme at Douglas Terrace</li> </ul>	<p>Transportation Division have secured further funding from Sustrans for FY13/14, which will deliver several off and on road cycle schemes, Permission to commence on Nynas land to undertake preliminary works to achieve off-road route around Port of Dundee. Also working with City Engineers at Riverside Drive / Seabraes Pedestrian Bridge, including pedestrian crossing improvements on Riverside Drive</p> <p>Works all underway and additional 'Safer Routes to School' funds bid for to implement minor improvements to support active travel to and from school</p>	2014+	
				Preliminary Works to achieve off-road cycle route around the Port of Dundee	2013/14						
				Provide Pedestrian Bridge over the railway at Riverside Drive / Seabraes	2013/14						

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23	<b>Measure M23:</b> DCC will continue to work with transport providers to support and promote increased uptake of public transport modes	□ ► Promote schemes such as the SQUID card including Dundee and surrounding towns. ► ↑ Introduce smart and integrated ticketing	► DCC City Development (Transportation Division)		2011+	► % uptake schemes ► Passenger numbers	Small	The development of Smart Card based integrated ticketing (National Entitlement Card) is being undertaken by DCC, National Express and Transport Scotland. Initial products were expected to appear from Autumn 2012. Dundee City Council working with Transport Scotland to ensure that the technical issues delaying implementation are overcome. Support achieved from the Scottish Cities Alliance with a view to proof of concept for a Scottish roll out. Initial smart ticketing planned to go live early 2013. National Express Dundee commenced pilot with Dundee College. DCC commenced discussion with other transport operators in support of the Scottish Cities Alliance priority for smart ticketing	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 has been successfully deployed by National Express Dundee and Dundee College. DCC commenced discussion with other transport operators in support of the Scottish Cities Alliance priority for smart ticketing - Delivery action Group hosted by DCC will commence 06 December 2013 the new Green Buses and the EcoMobility SHIFT assessment, and additional off peak bus services (funded by DCC) will raise profile and attractiveness of travelling by bus in Dundee. Scottish government review of Dundee rail fares will also attract new and retain existing passengers by making rail travel an attractive and more affordable option.	2012+	
				NEC SMART Ticketing to Go Live 2014	2014			July 2014			
24	<b>Measure M24:</b> DCC will continue to work in partnership with other organisations to promote and implement energy efficiency measures in Dundee	↑ ► To implement an Annual Action Plan of energy efficiency measures.	► DCC City Development (Property Division)			► Implementation of Annual Energy Efficiency Action Plan. ► Report reductions in energy use	Small	The Climate Change Board re-introduced the Carbon Management Action Plan in 2013  Examples of partnership initiatives undertaken by DCC can be viewed in the Council's annual 'Scotland's Climate Change Declaration' Report: <a href="http://www.keepsotlandbeautiful.org/sustainability-climate-change/sustainable-scotland-network/climate-change/scotlands-climate-change-declaration/">http://www.keepsotlandbeautiful.org/sustainability-climate-change/sustainable-scotland-network/climate-change/scotlands-climate-change-declaration/</a>  Examples include: Dundee Energy Advice Project; European ENCLOSE project (Energy Efficiency in City Logistics Services).	The Climate Change Board's continuous review of the Carbon Management Action Plan has identified a number of revisions required to support the climate change aspirations and to improve work in partnership with other organisations to promote and implement energy efficiency measures.	2012+	

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<b>MEASURES SECURING AIR QUALITY BENEFITS THROUGH STATUTORY FUNCTIONS</b>											
25	<p><b>Measure M25:</b> 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 consulted 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. ► In 2011 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>	<p>► Environment Department Officers check weekly planning lists and comment on all applications which may adversely impact on local air quality. 31 planning applications were responded to in 2013.</p>	n/a	<p>Suggestions on best practice and mitigation measures advised accordingly.</p>
				see Measure 10 regarding the introduction of Supplementary Planning Guidance							

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	Estimated Completion Date	Comments relating to emission reductions
26	<b>Measure M26:</b> 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	In 2013, officers investigated a total of 10 relevant complaints were investigated of which 90% have been resolved and one complaint is still being investigated.	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.											
<b>Note:</b> In future targets/indicators will be per calendar year.											

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27	<b>Measure M27:</b> DCC will enforce relevant legislation to reduce the burning of commercial and domestic waste	<ul style="list-style-type: none"> <li>□ ► DCC will continue to monitor and enforce legislation in this area</li> </ul>	<ul style="list-style-type: none"> <li>► DCC Environment Department</li> </ul>			<ul style="list-style-type: none"> <li>► Number of relevant complaints ► % resolved</li> </ul>	Small	<p>► 1 complaint of the burning of commercial waste was investigated under the Environmental Protection Act 1990 (EPA) Section 33 requirements which was resolved.</p> <p>► 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</p> <p>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</p>	<p>In 2013, officers have investigated 11 complaints of smoke from commercial bonfires under Environmental Protection and Clean Air legislation. 12 complaints of smoke from the burning of domestic waste (domestic bonfires) were investigated under the same legislation. 96% of these complaints have been resolved..</p>	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 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.  The Council continue to promote both the separate collection of garden waste for municipal composting operations, as well as home composting as a means of waste reduction. To that end, we continue to participate in the national home composting framework scheme - an online retail network of subsidised composting bins & accessories to help encourage self-management of organic waste - as well as providing a fortnightly kerbside collection service for garden waste across the city with seasonal additional uplifts for real Christmas trees which may otherwise end up in domestic bonfires. A total of 48 composting bins (and associated accessories) have been purchased through the home composting framework scheme during 2013	On-going	
				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><b>Measure M29:</b> 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 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. One new real-time monitoring site added in 2011 for PM<sub>10</sub> and NO<sub>2</sub> in hotspot area (Meadowside). ► 2 additional PM<sub>10</sub> "reference equivalent" analysers installed at hotspot locations in Lochee Road and Seagate in 2011. ► New NOx analyser installed at background location in 2011.</p> <p>► DCC operate an extensive network of NO<sub>2</sub> 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. 2 new NO<sub>2</sub> diffusion tube locations were added in 2012 while one 2011 diffusion tube was stopped in 2012. One 2011 site has been moved at it's location due to infrastructure changes.</p> <p>► One potential new hotspot identified for NO<sub>2</sub> in Strathmore Avenue based on 2009 data. Additional tubes deployed in the area in 2011 (see Measure 31). The potential new hotspot identified for NO<sub>2</sub> in Strathmore was assessed and it was determined that monitoring with the additional tubes in the area could cease <a href="#">Additional potential exceedance area identified at South Road (Denbank) in 2012..</a></p> <p>► See also Measure 20 re monitoring data on the website.</p>	<p>Currently there are 90 NO<sub>2</sub> diffusion tube sites across the city. These are located at busy roads and junctions, and at a number at background locations. A comprehensive review of the diffusion tube network took place in 2013. The network was extended to investigate new potential exceedance areas and a large number of sites that were consistently below the objective were removed from the network. 25 new diffusion tube sites were added to the network in 2013 and 30 were discontinued. A new exceedance of the annual mean NO<sub>2</sub> objective was identified at West Marketgait near Guthrie Street in 2013.</p> <p>The Air Quality pages of the DCC website have been upgraded with a new feature available to enable the public to view historical data for 2006 - 2012 period for all monitoring stations via an interactive map. This page also creates a graph for the monitoring results for those years to provide trend at monitoring location. A link to the Scottish Air Quality website is also present to allow real-time data to be viewed. All LAQM reports are summarised with some available for downloading, including 2013 Progress Report.</p>	n/a	<p>Annual mean concentrations of NO<sub>2</sub> at Strathmore Avenue and South Road (Denbank) were below the NAQS in 2013 when predicted to façade. .</p>

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30	<b>Measure M30:</b> DCC will ensure that all air quality monitoring data reported to the public is both accurate and precise by implementing quality control measures	☐ ► 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 NO <sub>2</sub> diffusion tubes regularly deployed around the City Council area.	► DCC Environment Department/ Tayside Scientific Services			► QA/QC measures adopted ► Auditing reports	n/a	► External consultant undertakes calibrations and filter changing of the continuous monitoring equipment in the air quality monitoring stations. ► Osiris meters - indicative PM <sub>10</sub> 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.	on-going	n/a	
				Develop Database to enable DCC staff to better manage large volume of AQ data and make it more readily available to stakeholders	2013/14				Initial discussions held with IT Department in regards to development of a database for the handling and retrieval of air quality monitoring data.	2015	

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31	<b>Measure M31:</b> DCC will establish additional monitoring sites across the City in locations where poor air quality is suspected	<ul style="list-style-type: none"> <li>□ ▶ DCC will continue to carry out and report on their statutory duties under the Review &amp; Assessment process for LAQM</li> </ul>	<ul style="list-style-type: none"> <li>▶ DCC Environment Department</li> </ul>			<ul style="list-style-type: none"> <li>▶ Poor air quality sites identified monitored and dealt with through the process of Review &amp; Assessment. ▶ Additional monitoring sites established as and when required</li> </ul>	n/a	<ul style="list-style-type: none"> <li>▶ 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.</li> </ul>	<ul style="list-style-type: none"> <li>▶ See Measure 29 ▶ A review of the diffusion tube locations was undertaken in 2012 and 21 new sites identified as requiring monitoring during 2013</li> </ul>	n/a	
				New site at Horsewater Wynd added to the network for 2014	2013						
32	<b>Measure M32:</b> DCC will implement road traffic counts to inform the review and assessment process.	<ul style="list-style-type: none"> <li>† ▶ Undertake classified traffic counts</li> </ul>	<ul style="list-style-type: none"> <li>▶ DCC Environment Department</li> </ul>			<ul style="list-style-type: none"> <li>▶ Classified traffic counts undertaken</li> </ul>	n/a	Classified Traffic Counts Undertaken at 18 junctions in 2011 ▶ Classified Traffic Counts undertaken at 18 junctions in Sept 2012.	Classified Traffic Counts were undertaken at 9 junctions in 2013.	On-going	