



2011 Air Quality Progress Report for Glasgow City Council

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

April 2011

Local Authority Officer	Dom Callaghan
--------------------------------	-------------------------------

Department	Public Health Group
Address	231 George Street, Glasgow G1 1RX
Telephone	0141 287 6628
e-mail	dom.callaghan@glasgow.gov.uk

Report Reference number	
Date	April 2011

Executive Summary

Local Authorities are required to regularly review and assess the air quality within their area of responsibility. This Review and Assessment process is the basis of local air quality management and is intended to compare current and future concentrations of key air pollutants against the objectives detailed in the regulations as part of the National Air Quality Strategy. This report comprises Glasgow City Council's Progress Report as part of Round 4 of review and Assessment. This Progress Report has looked in detail at the new monitoring data available since the last round of review and assessment as well as considering the impact from various potential sources of pollution.

Previous rounds of review and assessment have shown the potential for exceedences of the Objectives included in the Air Quality Regulations at a number of locations outwith the existing Air Quality Management Areas. The 2010 Detailed Assessment highlighted the possibility of exceedences of the annual mean NO₂ objective at both the Bridge Street and Queen Margaret Drive areas of the city. These exceedences have been confirmed by monitoring results from 2010 included within this Progress Report. It is therefore the intention of Glasgow City Council to extend the current City Centre AQMA and Byres Rd / Dumbarton Rd AQMA to cover the areas of exceedence of this objective.

Diffusion tube monitoring has also shown new exceedences of the annual mean NO₂ objective at Napiershall Street, Paisley Road West, Crow Road and Urrdale Road. Glasgow City Council has placed further diffusion tubes in the area of these exceedences to help define their geographical extent. Glasgow City Council intend to conduct a Detailed Assessment of these areas once sufficient additional monitoring has been undertaken.

Previous rounds of review and assessment have shown exceedences of the 1-hour objective for NO₂ at the Glasgow Kerbside site. These exceedences have continued during 2010 and it is the intention of Glasgow City Council to amend the City Centre AQMA to reflect the exceedences of this objective at this location. The 1-hour objective has also been exceeded at Glasgow Centre, however, this appears to be due to specific local factors which are best tackled outwith the LAQM process. Specifically, the placement of diesel generators serving a temporary market has caused breaches of the objective level. Glasgow City Council is currently in talks with market operators and regulators to minimise the air quality impact of these generators.

Low data collection for the Glasgow Anderston site meant that the 99.8th percentile of hourly means was used to calculate compliance with the 1-hour objective. This gave a value of 204 µg/m³ showing that there is a possibility that the objective would be exceeded at this location. However, the annual mean NO₂ level at this location was below the objective level for 2010. Therefore it is the intention of Glasgow City Council to continue monitoring at this location to establish whether exceedences of the 1-hour objective are repeated.

The 2010 Detailed Assessment considered a number of areas within Glasgow in respect of the PM₁₀ annual mean objective. The results of the modelling were inconclusive and the report recommended that further monitoring be conducted to supplement the modelling exercise. Monitoring results show that the PM₁₀ annual mean objective due to be achieved by the end of 2010 is being exceeded at every monitoring location within the city with the exception of Glasgow Anderston. A further Detailed Assessment would serve little purpose at this stage and as such, Glasgow City Council propose to declare an AQMA covering the entire city in respect of the 2010 PM₁₀ annual mean objective.

The PM₁₀ 24-hour objective due to be achieved by the end of 2010 was exceeded at six locations within the city. Glasgow City Council therefore propose to declare an AQMA covering the entire city in respect of the PM₁₀ 24-hour objective.

Table of contents

1	Introduction	8
1.1	Description of Local Authority Area	8
1.2	Purpose of Progress Report	8
1.3	Air Quality Objectives	8
1.4	Summary of Previous Review and Assessments	10
2	New Monitoring Data	15
2.1	Summary of Monitoring Undertaken	15
2.2	Comparison of Monitoring Results with Air Quality Objectives	25
3	New Local Developments	40
3.1	Road Traffic Sources	40
3.2	Other Transport Sources	42
3.3	Industrial Sources	44
3.4	Commercial and Domestic Sources	45
3.5	New Developments with Fugitive or Uncontrolled Sources	46
4	Conclusions and Proposed Actions	47
10.1	Conclusions from New Monitoring Data	47
10.2	Conclusions relating to New Local Developments	49
10.3	Proposed Actions	49
5	References	51

List of Tables

Table 1.1	Air Quality Objectives included in regulations for the purpose of Local Air Quality Management in Scotland
Table 1.2	Summary of Previous Rounds of Review and Assessment
Table 2.1	Details of Automatic Monitoring Sites
Table 2.2a-d	Details of Non-Automatic NO ₂ Monitoring Sites
Table 2.3	Details of Non-Automatic Benzene Sites
Table 2.4	Details of Non-Automatic Lead Monitoring Sites
Table 2.5	Results of Automatic Monitoring for Nitrogen Dioxide: Comparison with Annual Mean Objective
Table 2.6	Results of Automatic Monitoring for Nitrogen Dioxide: Comparison with 1-hour Mean Objective
Table 2.7a-d	Results of Nitrogen Dioxide Diffusion Tubes
Table 2.8	Results of PM ₁₀ Automatic Monitoring: Comparison with Annual Mean Objective
Table 2.9	Results of PM ₁₀ Automatic Monitoring: Comparison with 24-hour Mean Objective
Table 2.9	Results of SO ₂ Automatic Monitoring: Comparison with Objectives
Table 2.10	Measured Annual Means and Maximum 8-hour Running Means for CO
Table 2.11	Annual Mean Lead Levels
Table 2.12	Results of PM _{2.5} Automatic Monitoring: Comparison with Annual Mean Objective

List of Figures

- Fig 1.1 Map of AQMA Boundaries
- Fig 1.2 Parkhead Cross Air Quality Management Area
- Fig 1.3 Byres Rd and Dumbarton Rd Air Quality Management Area
- Fig 1.4 City Centre Air Quality Management Area
- Fig 2.1 Map of Automatic Monitoring Sites
- Fig 2.2 Map of Nitrogen Dioxide Diffusion Tubes
- Fig 2.3a Trends in Annual Mean Nitrogen Dioxide Concentration Measured at Automatic Monitoring Sites
- Fig 2.4 Annual Mean NO₂ Levels Within Byres Rd & Dumbarton Rd AQMA
- Fig 2.5 Annual Mean NO₂ Levels Within Parkhead Cross AQMA
- Fig 2.6 Annual Mean PM₁₀ Levels from Automatic Monitoring
- Fig 2.7 Monthly Mean Benzene Levels Measured by Diffusion Tube

1 Introduction

1.1 Description of Local Authority Area

Glasgow City Council, serving a population of around 590,000, is Scotland's largest local authority. As the largest city in Scotland, Glasgow is a centre for business, manufacturing and retail. As such, the city attracts a large daily influx of people and traffic from the surrounding areas.

The city of Glasgow lies at the western end of the Clyde Valley which takes its name from the river which runs through the city.

Glasgow in many ways typifies the modern developed city where road traffic tends to be the major air quality concern, superseding a long industrial heritage.

1.2 Purpose of Progress Report

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

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

1.3 Air Quality Objectives

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

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

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

1.4 Summary of Previous Review and Assessments

The Environment Act 1995 requires that local authorities review the air quality within their boundaries. Where the review concludes that air quality objectives will not be met within the statutory timeframe then the local authority is required to designate an Air Quality Management Area (AQMA). The local authority is then required to produce an air quality action plan (AQAP) to demonstrate how the authority intends to work towards meeting the air quality objectives within its AQMA.

Glasgow's first AQMA was declared in 2002 for NO₂ within the City Centre area. Since that time further assessments have concluded that the boundary of the original AQMA required to be increased and that new AQMAs were required for both Parkhead Cross and for the Byres Rd / Dumbarton Rd area.

Table 1.2 below shows a summary of the previous rounds of review and assessment and a brief description of the outcomes from each.

Table 1.2 Summary of Previous Rounds of Review and Assessment

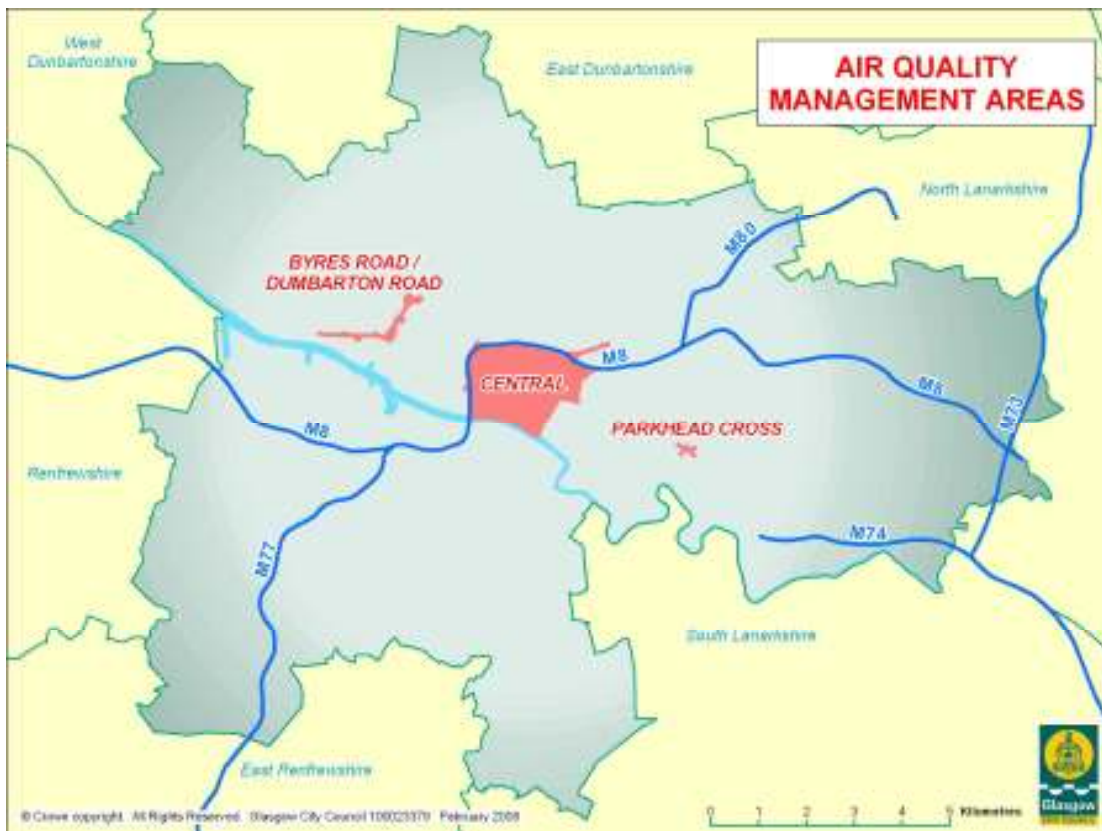
Report	Date Produced	Outcome
Stage I	1998	Proceed to Stage II for CO. Proceed to Stage III for NO ₂ and PM ₁₀
Stage II	2000	Concluded that levels of CO and SO ₂ will meet objectives.
Stage III	2001	Recommended an AQMA be declared for the city centre for NO ₂
USA	2003	Proceed to DA for NO ₂ , SO ₂ and PM ₁₀
Stage IV	2004	Confirmed city centre AQMA declared for NO ₂
Detailed Assessment	2005	Recommended AQMA's be declared for NO ₂ at Parkhead Cross and Dumbarton Rd / Byres Rd. Extension of city centre AQMA to Royston Rd and recommended declaration of the city centre as an AQMA for PM ₁₀
Progress Report	2005	Reported on continuing monitoring and recommended new monitoring at various locations
USA	2006	Proceed to DA for NO ₂ in a variety of areas. Recommended new monitoring of PM ₁₀ at various locations
Detailed Assessment	2007	Recommended additional NO ₂ monitoring at locations of concern
Further Assessment	2008	Confirmed ongoing exceedences of the objectives in the declared AQMA's
Progress Report	2008	Confirmed ongoing exceedences of the objectives in the declared AQMA's and predicted likely exceedences of PM ₁₀ objectives for 2010
USA	2009	Proceed to DA for NO ₂ at a variety of locations and

		proceed to DA for PM ₁₀ citywide
Progress Report	2010	Highlighted exceedences of NO ₂ hourly objective at Glasgow Kerbside site
Detailed Assessment	2010	Recommended extension of city centre AQMA to Bridge St for NO ₂ . Recommended further monitoring city wide for PM ₁₀ and Queen Margaret Drive for NO ₂

1.4.1 Air Quality Management Areas

Glasgow City Council has declared three Air Quality Management Areas across the city. The areas are shown in Figure 1.1

Figure 1.1 Map of AQMA Boundaries

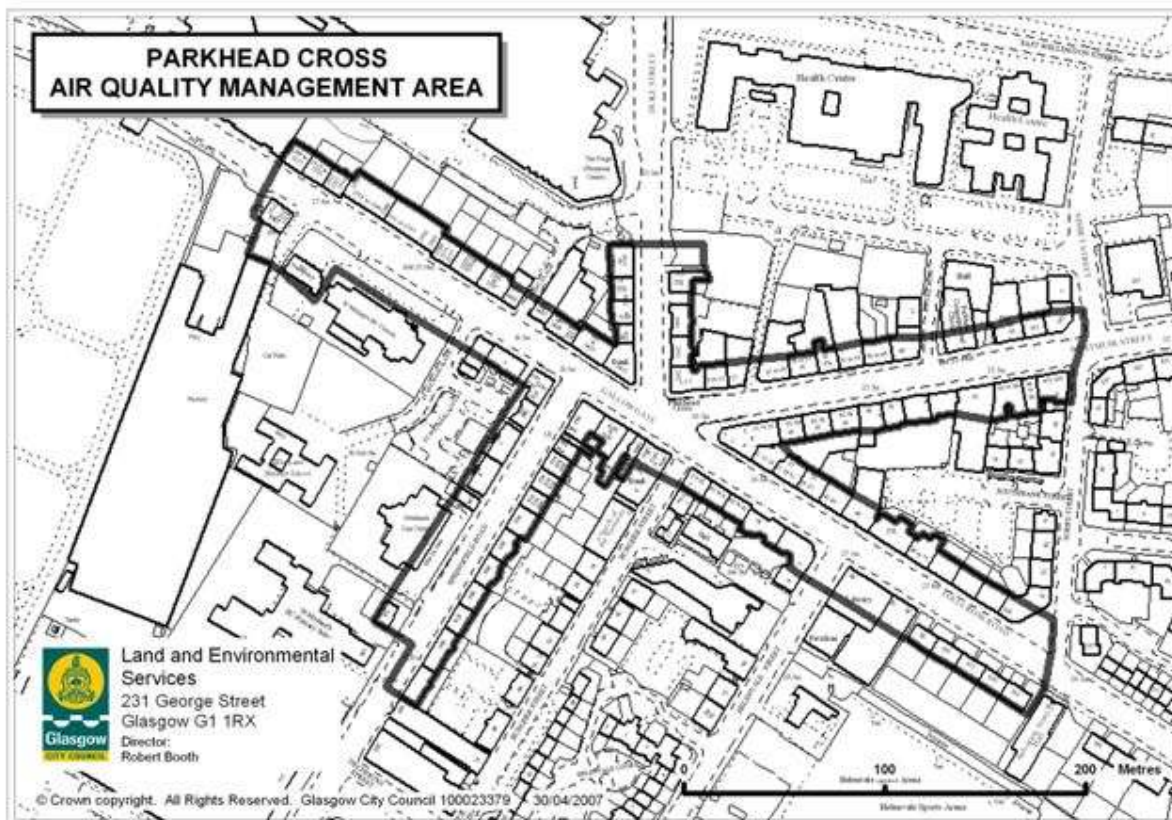


1.4.1.1 Parkhead Cross

Parkhead Cross is formed by the convergence of five roads in Glasgow’s east end. The roads are Westmuir Street, Tollcross road, Springfield Road, Duke Street and Gallowgate. The area is a mixture of commercial and residential properties within

mostly tenement properties. This area was declared in respect of the annual mean NO₂ objective.

Fig 1.2 Parkhead Cross Air Quality Management Area

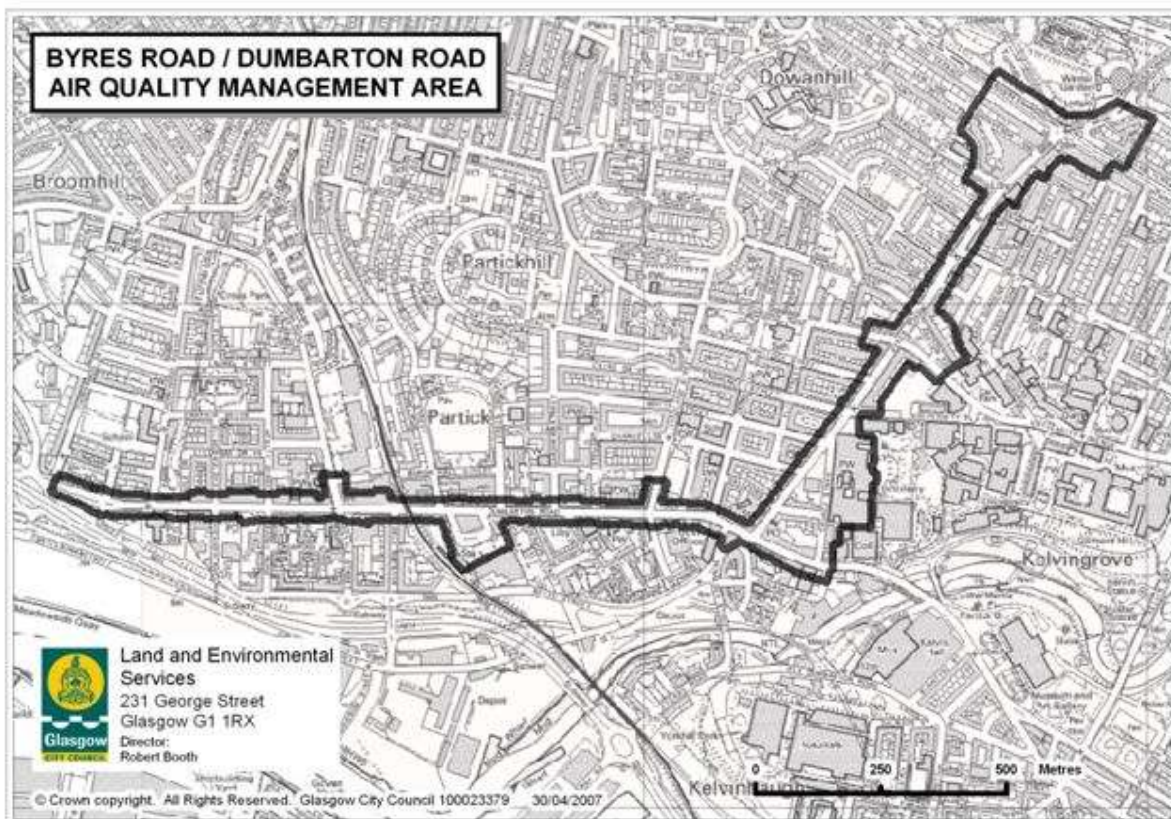


The detailed street listing for this AQMA can be found in the 1st July 2007 order.

1.4.1.2 Byres Road and Dumbarton Road

Byres Road and Dumbarton Road are at the heart of Glasgow's west end and comprise a mixture of residential and commercial properties within mostly tenement type properties. The Area covers from the junction of Byres Road and Great Western Road south to Dumbarton Road and west along Dumbarton Road as far as Thornwood Drive roundabout. This area was declared in respect of the annual mean NO₂ objective

Fig 1.3 Byres Rd and Dumbarton Rd Air Quality Management Area



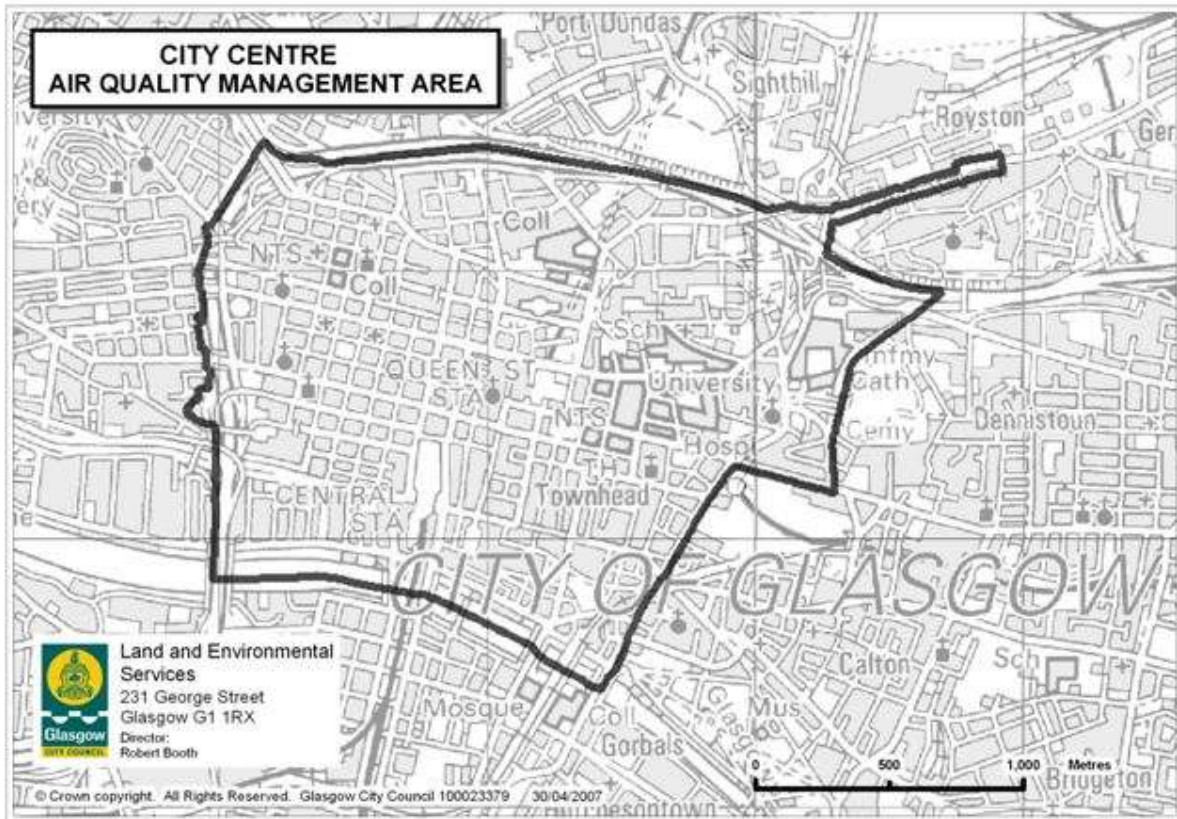
The detailed street listing for this AQMA can be found in the 1st July 2007 order.

1.4.1.3 City Centre Air Quality Management Area

The city centre area has been extensively developed with a large number of multi-storey properties for both commercial and residential use.

The city centre AQMA is loosely bound by the M8 motorway to the west and north (with slight protrusions at North Street and Royston Road), by High Street and Saltmarket to the east and by the river Clyde to the south. This area was declared in respect of the annual mean NO₂ objective and later declared in respect of the annual mean PM₁₀ objective.

Fig 1.4 City Centre Air Quality Management Area



2 New Monitoring Data

2.1 Summary of Monitoring Undertaken

2.1.1 Automatic Monitoring Sites

Glasgow City Council operates an extensive monitoring network across the city to measure ambient levels of air pollutants.

Automated monitoring equipment is located at eleven sites with three of the units (Glasgow Kerbside, Glasgow Centre and the City Chambers) forming part of the Department for Environment, Food and Rural Affairs (DEFRA) Automated Urban and Rural Network (AURN).

Equipment located at the sites measure a variety of air pollutants including NO₂, carbon monoxide, sulphur dioxide and PM₁₀. Instruments at these sites are calibrated according to the specific site guidelines by the Local Site Operators and audits are carried out every six months by AEA Technology. All of the automatic air quality data we gather is independently ratified by AEA Technology and made available for viewing by the public at the Scottish Government funded air quality website at: <http://www.scottishairquality.co.uk>

Figure 2.1 Map of Automatic Monitoring Sites

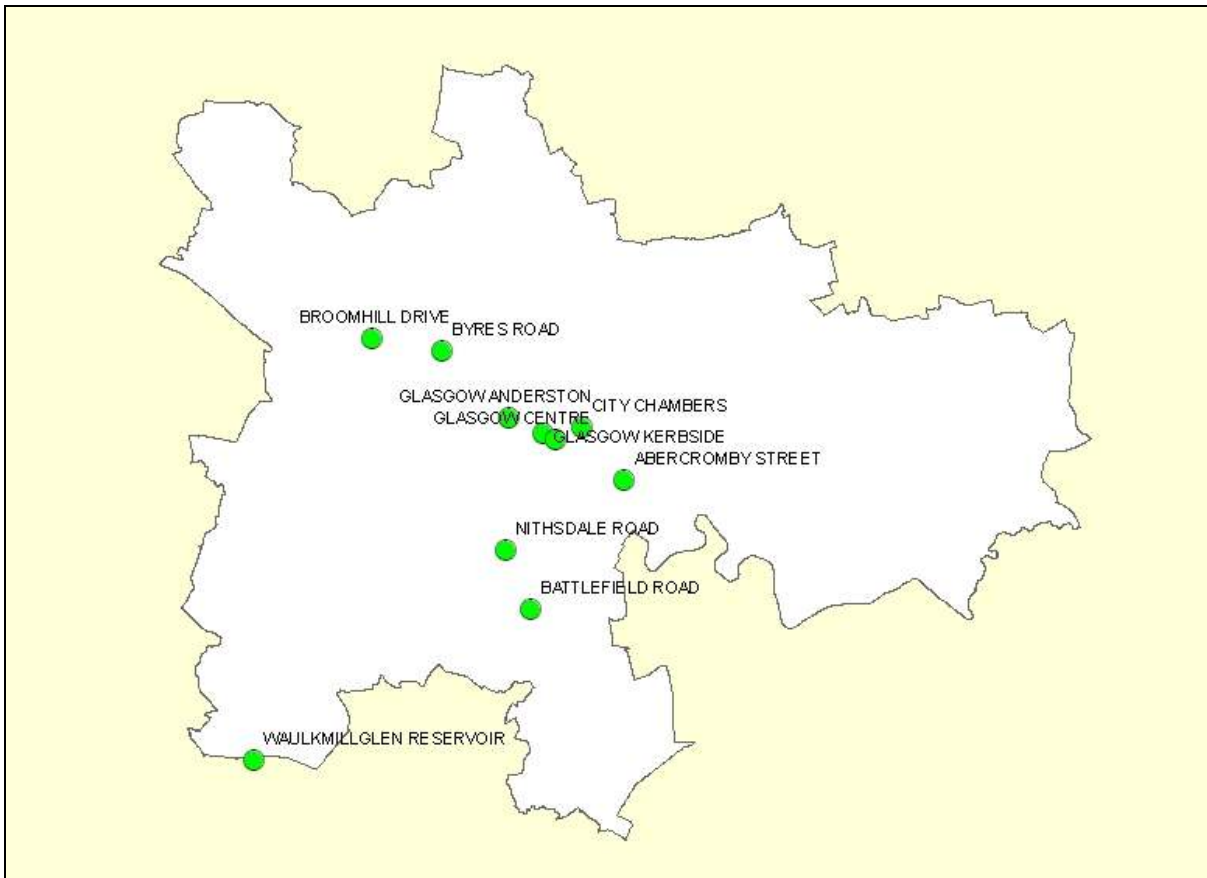


Table 2.1 Details of Automatic Monitoring Sites

Site Name	Site Type	OS Grid Ref	Pollutants Monitored	In AQMA?	Relevant Exposure? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road (N/A if not applicable)	Worst-case Location?
Glasgow Kerbside	Kerbside	X 258708 Y 665200	NO ₂ PM ₁₀ Hydrocarbon	Y	Y	1m	Y
Glasgow Centre	Urban Centre	X 258902 Y 665028	NO ₂ PM ₁₀ CO O ₃ SO ₂	Y	Y	>10m	N
Glasgow Chambers	Urban Background	X 259528 Y 665308	NO ₂	Y	Y	3m	N
Glasgow Anderston	Urban Background	X 257925 Y 665487	NO ₂ PM ₁₀ CO SO ₂	Y	Y	N/A	N
Glasgow Byres Rd	Roadside	X 256526 Y 666933	NO ₂ PM ₁₀ CO	Y	Y	3m	Y
Glasgow Battlefield Rd	Roadside	X 258427 Y 661385	NO ₂ PM ₁₀	N	Y	3m	Y
Glasgow Abercromby St	Roadside	X 260420 Y 664175	PM ₁₀	N	Y	3m	Y
Glasgow Broomhill	Roadside	X 255030 Y 667195	PM ₁₀	N	Y	3m	Y
Glasgow Nithsdale Rd	Roadside	X 257883 Y 662673	PM ₁₀	N	Y	3m	Y
Glasgow Waulkmillglen Reservoir	Rural	X 252520 Y 658095	NO ₂ PM ₁₀ O ₃	N	N	N/A	N

The automatic monitoring sites Kerbside, Centre, Abercromby St, Broomhill and Nithsdale Rd contain FDMS TEOMs. PM₁₀ monitoring at other automatic sites are performed by standard TEOMs and the results expressed using the Volatile Correction Model adjustment.

2.1.2 Non-Automatic Monitoring Sites

Glasgow City Council operates a non-automatic monitoring network of diffusion tubes which measure NO₂ levels at almost 100 sites around the city. NO₂ diffusion tubes represent a simple, effective and low cost method of monitoring ambient concentrations of nitrogen dioxide in a large number of locations. However, NO₂ concentration data provided by diffusion tubes is limited to fairly long-term exposure. Tubes are generally exposed for periods of a month, annual mean concentrations determined and compared with the annual mean objective. Furthermore, the accuracy of diffusion tubes can vary depending on the preparation methodology, handling procedures and the identity of the analysing laboratory.

To correct for this possible bias in tube data, results are corrected using information gained from co-location studies. Triplicate tubes are co-located with the automatic NO₂ analysers at Glasgow Centre, Glasgow Kerbside, Glasgow Anderston and Byres Road. Concentrations detected by these tubes were compared against those recorded through chemiluminescent detection over the same sampling period and a bias-correction factor determined using the guidance outlined in LAQM.TG(09). For 2010 annual means a bias correction factor of 1.10 was used. Diffusion tubes utilised by Glasgow City Council are prepared and analysed by Glasgow City Council's Scientific Services. This laboratory participates in both the WASP scheme and the field intercomparison exercise managed by AEA. The laboratory also follows the procedures set out in the Harmonisation Practical Guidance.

In addition to these monitoring methods Glasgow City Council also operated benzene diffusion tubes at four sites across the city and lead levels are monitored by filter analysis at one further location. All analysis is conducted by Glasgow City Council Scientific Services Laboratory.

Figure 2.2 Map of Nitrogen Dioxide Diffusion Tubes

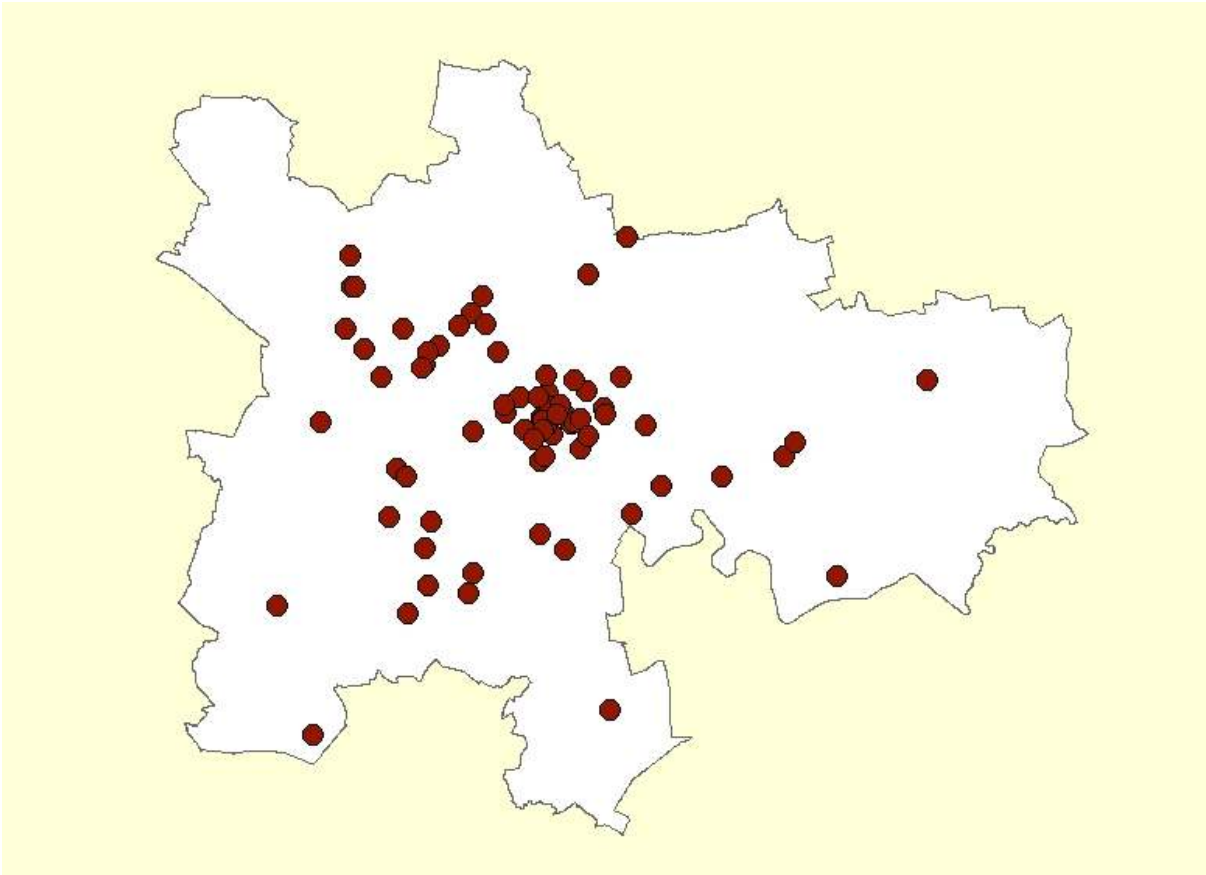


Table 2.2a Details of Non- Automatic NO₂ Monitoring Sites

Site Name	Site Type	OS Grid Ref	Pollutants Monitored	In AQMA?	Relevant Exposure? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road (N/A if not applicable)	Worst-case Location?
George Square	Urban Background	259296 665389	NO ₂	Y	N(30m)	30m	N
Union St	Roadside	258828 665204	NO ₂	Y	Y	3m	Y
Bath St	Roadside	258262 665851	NO ₂	Y	N (3m)	3m	Y
Glassford St	Roadside	259361 665252	NO ₂	Y	Y	3m	Y
Buchanan St	Roadside	259055 665468	NO ₂	Y	Y	3m	N
Castle St	Roadside	260068 665589	NO ₂	Y	Y	3m	N
Hope St 2	Roadside	258733 665363	NO ₂	Y	Y	3m	Y
Hope St 3	Kerbside	258856 665940	NO ₂	Y	N (5m)	1m	N
Montrose St	Roadside	259536 665313	NO ₂	Y	Y	3m	Y
Cochrane St	Roadside	259430 665316	NO ₂	Y	Y	3m	Y
Renfield St	Roadside	258896 665637	NO ₂	Y	Y	3m	Y
George St	Kerbside	259551 665380	NO ₂	Y	N (3m)	1m	Y
North St	Roadside	257906 665672	NO ₂	Y	N (15m)	3m	N
Hope St 1	Roadside	258730 665322	NO ₂	Y	Y	3m	Y
Gordon St	Roadside	258756 665346	NO ₂	Y	N (5m)	3m	N
Heilan'man's Umbrella North	Roadside	258770 665120	NO ₂	Y	Y	3m	Y
Saltmarket	Roadside	259545 664739	NO ₂	Y	Y	3m	Y
High St	Roadside	259732 664991	NO ₂	Y	Y	3m	Y
Dobbies Loan	Urban Background	259415 666194	NO ₂	Y	Y	3m	N

Table 2.2b Details of Non- Automatic NO₂ Monitoring Sites

Site Name	Site Type	OS Grid Ref	Pollutants Monitored	In AQMA?	Relevant Exposure? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road (N/A if not applicable)	Worst-case Location?
Cathedral Bridge	Roadside	259136 665661	NO ₂	Y	N (10m)	3m	N
Dundasvale St	Urban Background	258820 666306	NO ₂	Y	Y	15m	N
Royston Rd	Roadside	260429 666264	NO ₂	Y	N (5m)	3m	N
St Mungo Avenue	Urban Background	259392 665866	NO ₂	Y	Y	5m	N
Brown St	Roadside	258336 665122	NO ₂	Y	Y	3m	N
Broomielaw	Roadside	258562 664933	NO ₂	Y	N(5m)	3m	N
McLeod St 1	Urban Background	260077 665481	NO ₂	Y	Y	8m	N
Sauchiehall St	Urban Background	258639 665852	NO ₂	Y	N (10m)	N/A	N
Kennedy Path	Urban Background	259701 665983	NO ₂	Y	Y	10m	N
Dumbarton Rd	Roadside	256209 666525	NO ₂	Y	N (3m)	3m	Y
Lawrence St	Roadside	256295 666816	NO ₂	Y	N (5m)	2m	N
Cooperswell St	Roadside	256154 666478	NO ₂	Y	Y	4m	Y
Westmuir St	Roadside	262589 664139	NO ₂	Y	Y	3m	Y
Mossie Rd	Roadside	257235 662064	NO ₂	N	N (3m)	3m	Y
Bridge St	Roadside	258702 664480	NO ₂	Y	N (3m)	3m	Y
Finnieston St	Roadside	257235 665108	NO ₂	N	N(5m)	3m	Y
Hillcrest Rd	Roadside	265075 662001	NO ₂	N	N (5m)	3m	N
St Andrews Dr	Urban Background	256229 662587	NO ₂	N	Y	N/A	N

Table 2.2c Details of Non- Automatic NO₂ Monitoring Sites

Site Name	Site Type	OS Grid Ref	Pollutants Monitored	In AQMA?	Relevant Exposure? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road (N/A if not applicable)	Worst-case Location?
Haggs Rd	Roadside	256295 661792	NO ₂	N	Y	3m	Y
Pollokshaws Rd	Roadside	255864 661180	NO ₂	N	Y	5m	N
Queen Margaret Dr	Roadside	257435 668015	NO ₂	N	N (20m)	3m	Y
Napiershall St	Roadside	257790 666791	NO ₂	N	Y	4m	Y
Queen Margaret Dr 2	Roadside	257216 667639	NO ₂	N	Y	3m	Y
Queen Margaret Dr 3	Roadside	257012 667433	NO ₂	N	Y	3m	N
Oxford St	Roadside	258798 664570	NO ₂	N	Y	3m	N
Anniesland Cross	Roadside	254613 668886	NO ₂	N	Y	15m	N
Balshagray Ave	Roadside	254498 667291	NO ₂	N	Y	10m	N
Douglas Rd	Roadside	260203 659128	NO ₂	N	N (20m)	3m	Y
Main St (Bridgeton)	Roadside	260650 663319	NO ₂	N	Y	5m	Y
Aikenhead Rd	Roadside	259225 662579	NO ₂	N	Y	6m	Y
Langside Primary School	Roadside	257138 661617	NO ₂	N	N (5m)	3m	N
Thornwood Dr	Roadside	254903 666855	NO ₂	N	Y	3m	N
Springburn Rd	Roadside	269541 669268	NO ₂	N	Y	6m	Y
Paisley Rd West	Roadside	255599 664313	NO ₂	N	Y	3m	Y
Sutherland Avenue	Urban Background	256343 663153	NO ₂	N	N (10m)	5m	N
Belmont St	Roadside	257533 667418	NO ₂	N	N (5m)	3m	Y
Mallaig Pl	Urban background	253989 665298	NO ₂	N	N (20m)	6m	N
Govanhill St	Roadside	258678 662901	NO ₂	N	N (3m)	3m	N
Westercraigs	Urban Background	260942 665226	NO ₂	N	Y	15m	N

Table 2.2d Details of Non- Automatic NO₂ Monitoring Sites

Site Name	Site Type	OS Grid Ref	Pollutants Monitored	In AQMA?	Relevant Exposure? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road (N/A if not applicable)	Worst-case Location?
Inveresk Lane	Urban Background	264163 664856	NO ₂	N	Y	20m	N
Kippen St	Urban Background	259731 668488	NO ₂	N	N (5m)	3m	N
Sacone SW	Urban background	263920 664569	NO ₂	N	Y	20m	N
Invergarrie Rd	Urban Background	253821 658590	NO ₂	N	N (5m)	3m	N
Easterhouse	Roadside	267005 666217	NO ₂	N	Y	5m	N
Dunn St	Urban Background	261305 663928	NO ₂	N	Y	5m	N
Glasgow Harbour	Urban Background	255287 666276	NO ₂	N	Y	30m	N
Mosspark Boulevard	Urban Background	255436 663274	NO ₂	N	Y	15m	N
Crow Road	Roadside	254640 254730	NO ₂	N	Y	3m	Y
Whittingeham e Park	Roadside	254730 668207	NO ₂	N	Y	3m	N
Silverburn	Roadside	253047 661349	NO ₂	N	Y	5m	N
Hyndland Rd	Roadside	255764 667297	NO ₂	N	Y	4m	N
Urrdale Rd	Urban Background	255826 664118	NO ₂	N	Y	N/A	N

Table 2.3 Details of Non- Automatic Benzene Monitoring Sites

Site Name	Site Type	OS Grid Ref	Pollutants Monitored	In AQMA?	Relevant Exposure? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road (N/A if not applicable)	Worst-case Location?
Heilanmans Umbrella North	Roadside	258770 665121	Benzene	Y	Y	3m	Y
Hope Street	Kerbside	258738 665167	Benzene	Y	N (3m)	<1m	Y
Ochiltree Avenue	Roadside	254839 669295	Benzene	N	N (3m)	5m	Y
Pollokshaws Road	Roadside	255869 661185	Benzene	N	N (3m)	3m	Y

Table 2.4 Details of Non- Automatic Lead Monitoring Sites

Site Name	Site Type	OS Grid Ref	Pollutants Monitored	In AQMA?	Relevant Exposure ? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road (N/A if not applicable)	Worst-case Location?
Pattersons	Urban Background	267663 663336	Lead	N	Y	N/A	N

2.2 Comparison of Monitoring Results with Air Quality Objectives

Nitrogen Dioxide

Automatic Monitoring Data

Nitrogen dioxide is monitored using automatic analysers at seven locations; the three AUN sites, Glasgow Anderson, Byres Road, Battlefield Road and Waulkmillglen reservoir. Table 2.5 shows the measured annual mean at the all seven sites over the last three years.

Table 2.5 Results of Automatic Monitoring for Nitrogen Dioxide: Comparison with Annual Mean Objective

Location	Within AQMA?	Relevant public exposure? Y/N	Data Capture for full calendar year 2010 %	Annual mean concentrations ($\mu\text{g}/\text{m}^3$)		
				2008	2009	2010
Glasgow Kerbside	Y	N	97.0	82	78	84
Glasgow Centre	Y	Y	97.7	35	42	44
Glasgow Chambers	Y	Y	97.3	48	46	49
Glasgow Anderston	Y	Y	81.8	32	36	38
Glasgow Byres Rd	Y	Y	92.4	43	40	47
Glasgow Battlefield Rd	N	Y	81.8	32	34	30
Glasgow Waulkmillglen Reservoir	N	N	99.3	12	12	16

Figure 2.3 shows that the Kerbside, Chambers and Byres Road sites are recording concentrations of nitrogen dioxide which are continually breaching the annual mean

objective. In addition to this the Glasgow Centre site also recorded exceedences of the annual mean NO₂ objective for 2009 and 2010.

Figure 2.3 Trends in Annual Mean Nitrogen Dioxide Concentration Measured at Automatic Monitoring Sites.

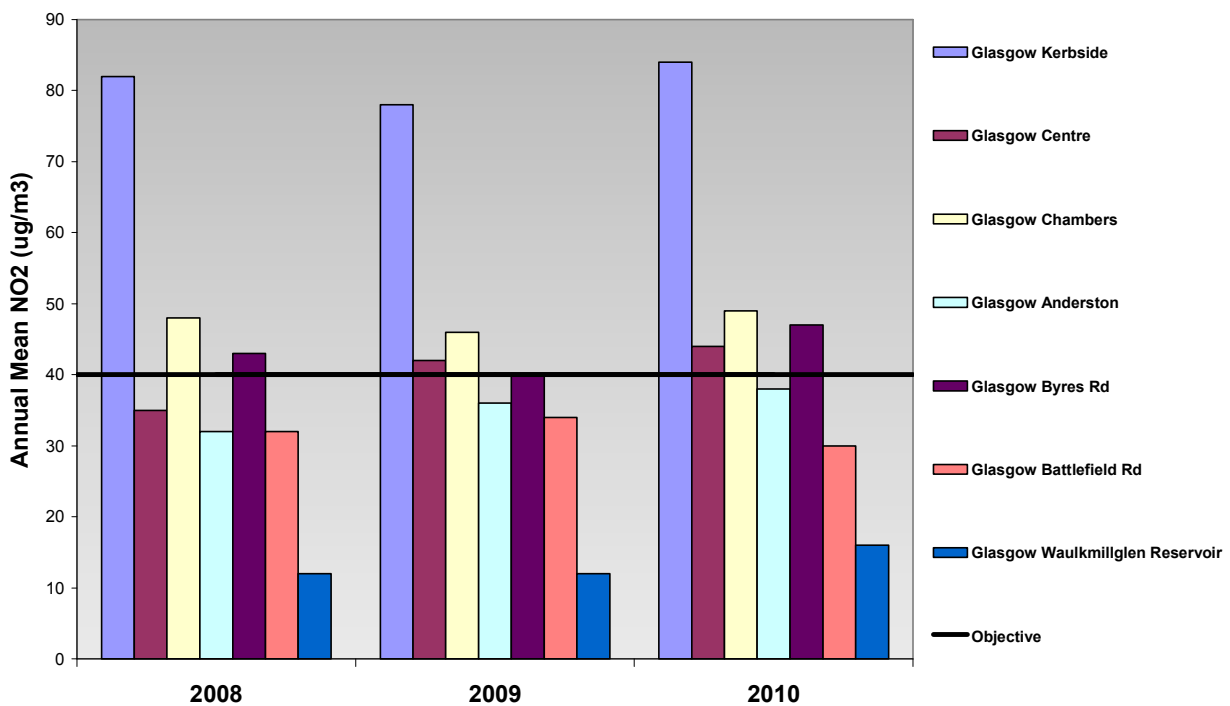


Table 2.6 shows the number of exceedences of the 200µg/m³ hourly objective. The Glasgow Kerbside site regularly breaches the permitted 18 exceedences of this objective per year. However, in 2009 and 2010 the Glasgow Centre site also breached this objective.

Table 2.6 Results of Automatic Monitoring for Nitrogen Dioxide: Comparison with 1-hour Mean Objective

Location	Within AQMA?	Relevant public exposure? Y/N	Data Capture for full calendar year 2010 ^b %	Number of Exceedences of hourly mean (200 µg/m ³) If the period of valid data is less than 90% of a full year, include the 99.8 th percentile of hourly means in brackets.		
				2008 ^c	2009 ^c	2010
Glasgow Kerbside	Y	Y	97.0	72	57	97
Glasgow Centre	Y	Y	97.7	0 (175)	48	56
Glasgow Chambers	Y	Y	97.3	0	12	10
Glasgow Anderston	Y	Y	81.8	1 (137)	4	16 (204)
Glasgow Byres Rd	Y	Y	92.4	6	0	14
Glasgow Battlefield Rd	N	Y	81.8	0	1	0 (146)
Glasgow Waulkmillglen Reservoir	N	N	99.3	0 (87)	0	0

Diffusion Tube Monitoring Data

Tables 2.7a – 2.7d show the annual mean NO₂ concentrations measured using diffusion tubes. All values have been corrected for bias using the factor appropriate for the year represented (2008 = 0.87, 2009 = 1.09, 2010 = 1.10).

Table 2.7a Results of Nitrogen Dioxide Diffusion Tubes within City Centre AQMA

Location	Data Collection 2010 (%)	Annual mean concentrations (µg/m ³) Adjusted for bias		
		2008	2009	2010
Hope St	42	83	64	91
George Square	83	47	44	52
Union St	83	66	61	72
Bath St	100	60	53	56
Glassford St	100	67	51	51
Castle St	100	40	32	40
Hope St 3	100	62	57	61
Montrose St	100	41	42	47
Cochrane St	100	-	44	54
Renfield St	92	66	54	60
George St	100	57	53	51
North St	83	44	40	40
Heilan'man's Umbrella North	100	91	76	84
Saltmarket	100	47	43	48
High St	100	58	54	57
Dobbies Loan	92	31	32	33
Cathedral Bridge	100	59	60	59
Dundasvale St	83	35	36	39
Royston Rd	100	49	42	44
St Mungo Avenue	83	35	38	42
Brown St	100	40	32	38
McLeod St	100	39	39	40
Sauchiehall St	100	51	46	51
Kennedy Path	100	36	31	37
Buchanan St	58	-	-	59
Broomielaw	92	54	51	51

Table 2.7b Results of Nitrogen Dioxide Diffusion Tubes within the Byres Rd & Dumbarton Rd AQMA

Location	Data Collection 2010 (%)	Annual mean concentrations ($\mu\text{g}/\text{m}^3$) Adjusted for bias		
		2008	2009	2010
Dumbarton Rd	92	38	40	37
Lawrence St	100	33	30	31
Cooperswell St	100	33	27	32
Queen Margaret Dr 3	100	39	45	46

Figure 2.4 below shows that the diffusion tube at Queen Margaret Drive 3 breaches the annual mean objective for NO₂. However, the other diffusion tubes within this AQMA are showing levels of NO₂ within the objective.

Figure 2.4 Annual Mean NO₂ Levels Within Byres Rd & Dumbarton Rd AQMA

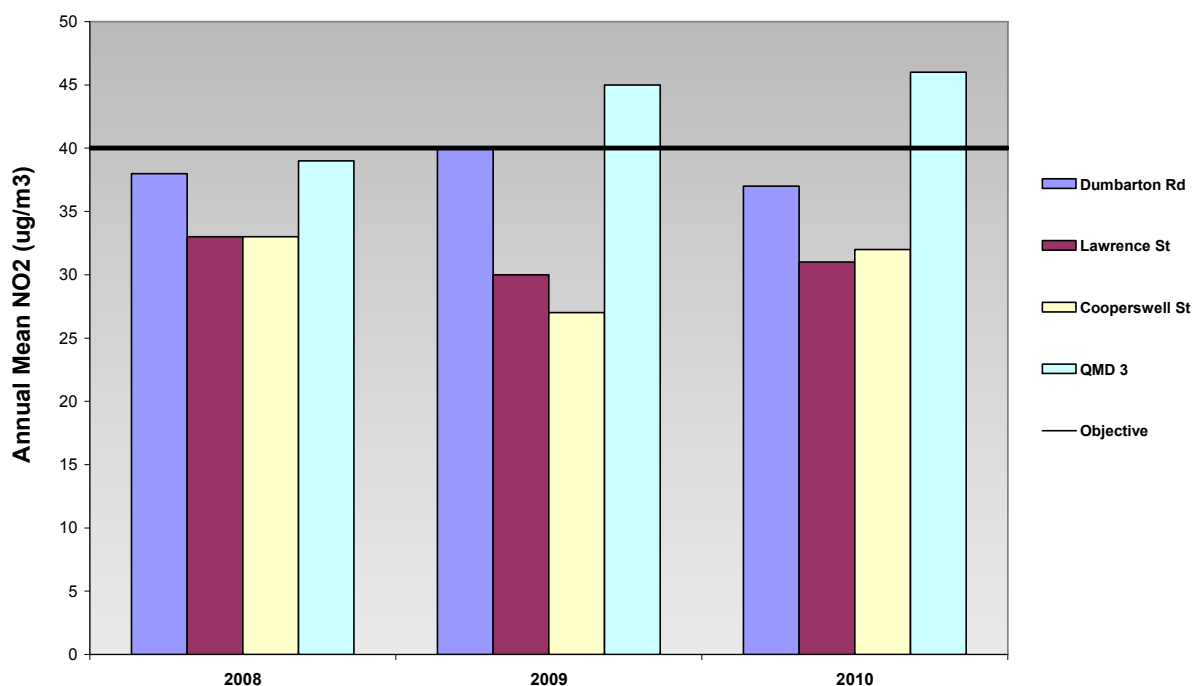


Table 2.7c Results of Nitrogen Dioxide Diffusion Tubes Within the Parkhead Cross AQMA

Location	Data Collection 2010 (%)	Annual mean concentrations ($\mu\text{g}/\text{m}^3$) Adjusted for bias		
		2008	2009	2010
Westmuir St	100	49	49	52

Figure 2.5 Annual Mean NO₂ Levels Within Parkhead Cross AQMA

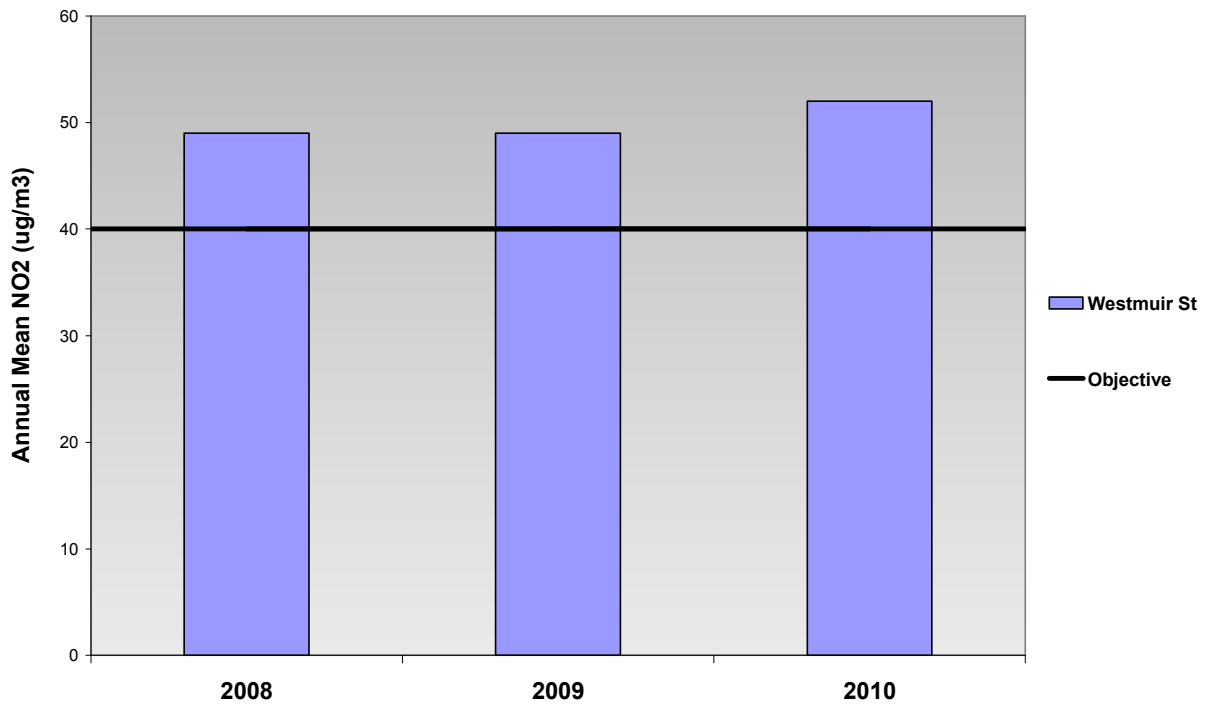


Table 2.7d Results of Nitrogen Dioxide Diffusion Tubes outwith the existing AQMAs

Location	Data Collection 2010 (%)	Annual mean concentrations ($\mu\text{g}/\text{m}^3$) Adjusted for bias		
		2008	2009	2010
Mossie Rd	100	35	36	37
Bridge St / Norfolk St	83	50	43	43
Finnieston St	92	48	37	39
Hillcrest Rd	100	22	26	26
St Andrews Dr	100	22	21	24
Haggs Rd	100	36	36	36
Pollokshaws Rd	100	27	27	29
Queen Margaret Dr	100	32	35	34
Napiershall St	100	37	35	40
Queen Margaret Dr 2	100	42	39	41
Oxford St	100	32	38	37
Annie'sland Cross	100	39	29	35
Balshagray Ave	100	30	32	33
Dougrie Rd	100	23	23	25
Main St (Bridgeton)	83	25	27	28
Aikenhead Rd	92	29	27	31
Langside Primary School	83	22	24	25
Thornwood Dr	83	25	26	29
Springburn Rd	92	30	31	37
Paisley Rd West	100	37	33	42
Sutherland Avenue	92	21	20	23
Belmont St	100	26	28	31
Mallaig Pl	92	29	27	29
Govanhill St	100	30	31	32
Westercraigs	100	27	25	26
Inveresk Lane	100	20	20	26
Kippen St	92	21	28	27
Sacone SW	100	21	22	27
Invergarrie Rd	100	16	19	23
Easterhouse	100	21	20	22
Dunn St	83	26	23	31
Glasgow Harbour	100	27	28	34
Hyndland Road	83	-	32	35
Silverburn	100	-	23	23
Mosspark Boulevard	100	26	28	30
Crow Rd	92	-	-	45
Whittingehame Dr	100	-	-	26
Urrdale Rd	58	-	-	41

The results from Urrdale Rd were gathered over a seven month period. The results from this site have been annualised according to the method laid out in Box 3.2 of TG(09). An average ratio of 0.96 was used to correct this value.

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

Location	Within AQMA?	Data Capture for full calendar year 2010 %	Annual mean concentrations (µg/m ³)		
			2008	2009	2010
Glasgow Kerbside	Y	97.8	23	26	29
Glasgow Centre	Y	25.9	16	25	21
Glasgow Anderston	Y	80.5	14	20	16
Glasgow Byres Rd	N	92.0	18	19	23
Glasgow Battlefield Rd	N	90.1	15	16	19
Glasgow Abercromby St	N	89.7	19	18	21
Glasgow Broomhill	N	92.4	19	18	19
Glasgow Nithsdale Rd	N	76.6	21	17	21
Glasgow Waulkmillglen	N	80.5	11	11	16

* Figures highlighted in red show exceedences of the objective due to be achieved by the end of 2010.

Problems with the FDMS TEOM at the Glasgow Centre site resulted in a particularly low data capture for 2010. The results from this site have been annualised according to the method laid out in Box 3.2 of TG(09). An average ratio of 0.93 was used to correct this value.

As shown above, all locations within Glasgow, with the exception of Anderston and Waulkmillglen, are recording PM₁₀ values in excess of the objective.

Figure 2.6 Annual Mean PM₁₀ Levels from Automatic Monitoring

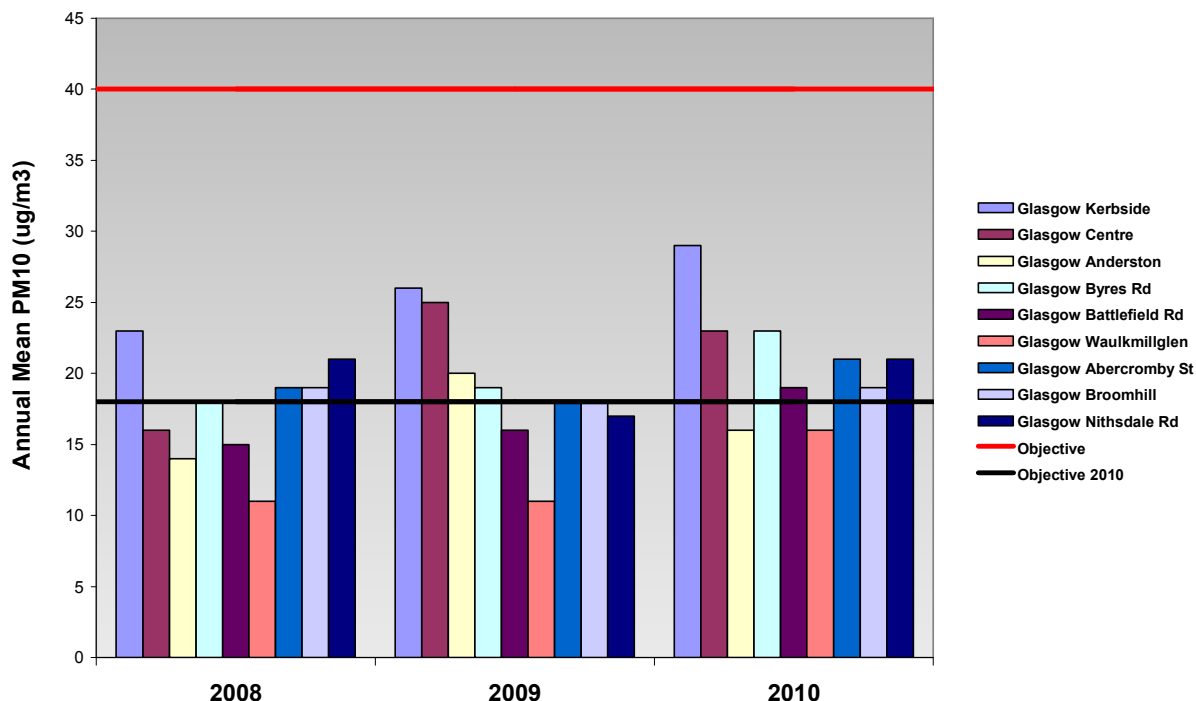


Table 2.8 Results of PM₁₀ Automatic Monitoring: Comparison with 24-hour Mean Objective

Location	Within AQMA?	Data Capture 2010 ^b %	Number of Exceedences of daily mean objective (50 µg/m ³) If data capture < 90%, include the 98 th percentile (in Scotland) of daily means in brackets.		
			2008	2009	2010
Glasgow Kerbside	Y	97.8	10	18	25
Glasgow Centre	Y	25.9	0	21	7 (80)
Glasgow Anderston	Y	80.5	1	12	4 (45)
Glasgow Byres Rd	N	92.0	1	2	9
Glasgow Battlefield Rd	N	90.1	0	2 (42)	1
Glasgow Abercromby St	N	89.7	9	7	9 (60)
Glasgow Broomhill	N	92.4	8	7	9
Glasgow Nithsdale Rd	N	76.6	7	6	10 (57)
Glasgow Waulkmillglen	N	80.5	0	0	4

2.2.2 Sulphur Dioxide

Sulphur Dioxide is measured at two sites in Glasgow using automatic analysers. Table 2.10 shows the measured annual mean concentrations of SO₂ measured at the Glasgow Centre and Glasgow Anderston sites.

The air quality objectives for SO₂ are 15-minute, 1-hour and 24-hour means. There were no measured exceedences of these objectives in Glasgow.

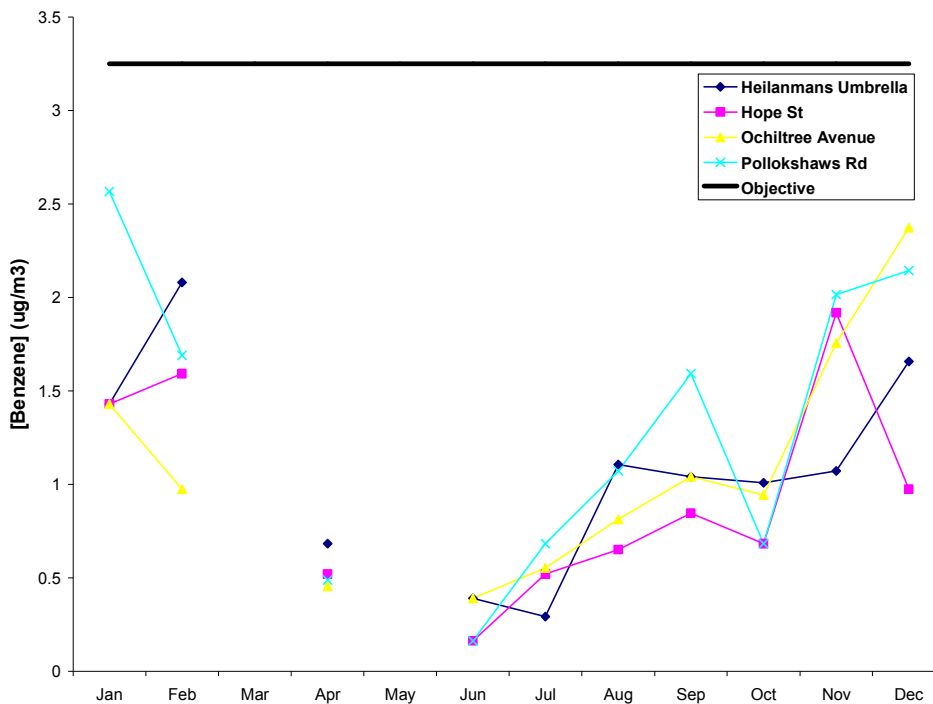
Table 2.10 Results of SO₂ Automatic Monitoring: Comparison with Objectives

Location	Data Capture 2010 %	Number of Exceedences of:		
		15-minute Objective (266 µg/m ³)	1-hour Objective (350 µg/m ³)	24-hour Objective (125 µg/m ³)
Glasgow Centre	98.8	0	0	0
Glasgow Anderston	77.2	0	0	0

2.2.3 Benzene

Benzene is measured using diffusion tubes at four sites in Glasgow. The tubes at these sites have been in operation since early 2006. The tubes are exposed for one month at a time and then analysed. The results can be seen in Figure 2.7

Figure 2.7 Monthly Mean Benzene Levels Measured by Diffusion Tube



As Figure 2.7 shows, the diffusion tubes within Glasgow read consistently below the objective level which, in Scotland, is a running annual mean of 3.25 $\mu\text{g}/\text{m}^3$.

2.2.4 Carbon Monoxide

Table 2.11 shows CO concentrations measured at three sites using automatic analysers. The air quality objective for Scotland for CO is a running 8-hour mean of 10.0 mg/m³. In Glasgow there have been no exceedences of this objective.

Table 2.11 Measured Annual Means and Maximum 8-hour Running Means for CO

	Data Capture 2010 (%)	Measured Annual Mean (mg/m ³)			Maximum 8hr running mean (mg/m ³)		
		2008	2009	2010	2008	2009	2010
Glasgow Centre	98.6	0.3	0.2	0.3	2.8	1.9	2.4
Glasgow Anderston	81.6	0.2	0.1	0.2	2.2	1.6	2.5
Glasgow Byres Rd	92.5	0.3	0.3	0.3	2.9	1.8	2.9

2.2.5 Lead

Glasgow City Council operates a monitoring site for lead. This is located close to Paterson's tip in the east end of the city. In lead monitoring, a measured volume of air is passed through a filter. Particulate matter is gathered on the filter and analysed using wet chemical techniques to determine the concentration of lead deposited.

Annual mean lead levels recorded at this site are significantly below the Air Quality Strategy objective of 0.25µg/m³.

Table 2.12 Annual Mean Lead Levels

	Annual mean lead (µg/m ³)		
	2008	2009	2010
Pattersons	0.027	0.026	0.022

2.2.6 Ozone

Glasgow City Council measures ozone at two locations, Glasgow Centre and Glasgow Waulkmillglen Reservoir. Ozone is a secondary pollutant and the highest concentrations are generally measured remotely from sources of pollution. This is seen in Glasgow where the Glasgow Centre site observed no exceedences of the running 8-hour mean objective set at 100 µg/m³. In contrast, the rural site at Glasgow Waulkmillglen Reservoir had 22 exceedences of this objective during 2010.

2.2.7 PM_{2.5}

The Scottish Government has set objective levels for PM_{2.5} at 12 µg/m³ to be achieved by 2020. PM_{2.5} is currently measured at two locations within Glasgow, Glasgow Centre and Glasgow Kerbside. Results for 2010 can be seen in Table 2.13

Table 2.13 Results of PM_{2.5} Automatic Monitoring: Comparison with Annual Mean Objective 2010

	Data Capture 2010 (%)	Measured Annual Mean 2010 (µg/m³)
Glasgow Centre	99.0	12
Glasgow Kerbside	96.3	23

In addition to the annual mean objective, there is a target of a 15% reduction in concentrations at urban background locations measured as a three year mean. There is insufficient monitoring data at this stage to gauge progress towards this objective.

2.2.8 Summary of Compliance with AQS Objectives

Glasgow City Council has measured concentrations of nitrogen dioxide above the annual mean objective at relevant locations outwith the existing AQMA's. Measurements of PM₁₀ above the annual mean objective have also been made at relevant locations outwith the existing AQMA's. Exceedences of the 1-hour mean for NO₂ have been observed or extrapolated at a further three locations within the city centre AQMA. This area has not previously been declared in respect of the 1-hour objective.

NO₂ Annual Mean Objective

Exceedences of the NO₂ annual mean objective were observed at the diffusion tubes located at Bridge St, Napiershall Street, Queen Margaret Drive 2, Paisley Road West, Crow Road and Urrdale Rd.

NO₂ 1-hour Mean Objective

Exceedences of the NO₂ 1-hour mean were observed using the automatic analysers located at Glasgow Kerbside and Glasgow Centre. The 99.8th percentile of results from Glasgow Anderston was 204 based on a data capture of 81.8% .

Closer inspection of the data from Glasgow Centre reveals that 40 of the hourly exceedences occurred within a three day span. This coincided with the timing of a local market and the placement of diesel generators at very close proximity to the sampling inlet. The Public Health Group of Glasgow City Council are undertaking discussions with the market organisers to minimise the impact of the location of the generators.

PM₁₀ Annual Mean Objective

Exceedences of the PM₁₀ annual mean objective have been observed at seven of the nine automatic analysers. Those sites outwith the existing city centre AQMA for this objective are Glasgow Byres Rd, Glasgow Battlefield Rd, Glasgow Abercromby St,

Glasgow Broomhill and Glasgow Nithsdale Rd. The site at Glasgow Waulkmillglen, which is located in a rural location to the south west of the city, recorded an annual mean of $16 \mu\text{g}/\text{m}^3$ for 2010. This indicates that the background level is very close to the $18 \mu\text{g}/\text{m}^3$ objective.

It should be noted that the objective referred to above is the annual mean PM_{10} objective for Scotland. This is to be achieved by the end of 2010 and, at $18 \mu\text{g}/\text{m}^3$, is significantly lower than the UK objective of $40 \mu\text{g}/\text{m}^3$. No monitoring sites within Glasgow have recorded an exceedence of the UK objective.

PM_{10} 24-hour Mean Objective

Exceedences of the PM_{10} 24-hour mean objective have been observed at six of the nine automatic analysers. There is currently no AQMA's declared for exceedences of the 24-hour mean objective. The sites recording breaches of the objective are Glasgow Kerbside, Glasgow Centre, Glasgow Byres Rd, Glasgow Abercromby Street, Glasgow Broomhill and Glasgow Nithsdale Rd.

As with the annual mean objective, Scotland has adopted a significantly lower objective for the PM_{10} 24-hour objective which is to be achieved by the end of 2010. The number of permitted exceedences of the objective has been reduced from 35 to 7. No monitoring sites within Glasgow have recorded an exceedence of the UK objective.

3 New Local Developments

3.1 Road Traffic Sources

3.1.1 Narrow Congested Streets with Residential Properties Close to the Kerb

A location with a combination of high traffic volume and narrow streets is where exceedences of the objectives are most likely. Slow moving, stop/start driving can cause high emissions, with buildings on either side of the road reducing dispersion. Such locations should be assessed for potential exceedences of the air quality objectives.

Previous rounds of review and assessment have considered these streets in some detail. No new streets which meet the criteria have been identified.

3.1.2 Busy Streets Where People May Spend 1-hour or More Close to Traffic

There are certain locations where members of the public may be expected to spend 1-hour or more on a regular basis, such as shopping areas. These need to be assessed if they are next to a busy road where there is the potential for exceedences of the 1-hour objective for NO₂.

Glasgow has a number of locations such as these. However, the busiest streets for traffic and for shopping are currently within the existing boundary of the city centre AQMA. Therefore, these will not require to be assessed further at the present time. No new streets which meet the criteria have been identified.

3.1.3 Roads with a High Flow of Buses and/or HGVs.

Certain streets may not have an exceptionally high traffic flow, but if there is a high proportion of buses or heavy goods vehicles (HGVs), which are large emitters of NO_x, there may still be elevated concentrations of pollution.

Outwith the existing AQMA's it is considered that there are no roads which meet the criteria laid out in LAQM.TG(09).

3.1.4 Junctions and Busy Roads

Busy road junctions are areas where concentrations of NO₂ can increase due to build up of traffic. Busy junctions are those with more than 5000 vehicles per day where the annual mean PM₁₀ background in 2010 is expected to be above 15µg/m³. Alternatively it can be considered if there are more than 10,000 vehicles per day where the mean background level in 2010 is expected to be below 15µg/m³. It is not necessary to assess those junctions that do not have relevant exposure.

It is considered that all junctions which meet the above criteria have been evaluated in previous rounds of review and assessment.

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

Previous rounds of review and assessment have considered the potential impact on air quality from two major proposed new roads. These are the M74 extension and the East End Regeneration Route. At present both of these roads are under construction with the M74 extension due for completion later in 2011. The EERR is due for completion in 2012. Air quality monitoring has been undertaken along both of these routes to help quantify any potential impact. Monitoring will continue after the routes are completed.

At the present time there are no new major roads proposed for within the city of Glasgow.

3.1.6 Roads with Significantly Changed Traffic Flows

Those roads which were previously at risk of exceeding the objectives may be subject to higher concentration of pollutants if there has been a 'large' increase in traffic flow, where 'large' is defined as,

"...more than 25% increase in traffic flow."

The road network in Glasgow has not undergone any major changes that could lead to such an increase in traffic flow since the last round of review and assessment.

3.1.7 Bus and Coach Stations

Because of the high volume of buses and coaches using bus stations on a regular basis, there is a risk of exceedences of the hourly objective for NO₂. The main bus station in Glasgow is Buchanan Bus Station, located within the city centre AQMA.

This bus station has been extensively assessed in previous rounds of review and assessment.

3.2 Other Transport Sources

3.2.1 Airports

Aircraft are significant sources of nitrogen oxide emissions, most particularly during takeoff. It is thought that they can make a significant contribution to ground-level concentrations when they are below 200m.

Glasgow International Airport is located outwith the city boundary and falls within the jurisdiction of Renfrewshire Council. Guidance suggests to,

...establish whether there is relevant exposure within 1000m of the airport boundary...

Since the airport is more than two kilometres from the city boundary, there is no relevant exposure and so emissions from aircraft takeoff are not predicted to have any effect on air quality in Glasgow.

3.2.2 Railways (Diesel and Steam Trains)

Diesel and coal-fired railway locomotives can potentially emit large quantities of SO₂, and if these engines are stationary while running for 15-minute periods or more, then there is a risk of exceedences of the 15-minute objective. Locations where this is likely to occur include stations, depots and junctions. For this to be an issue in terms of public exposure, there must be, according to the Technical Guidance, a potential for:

“regular outdoor exposure of members of the public within 15m of the stationary locomotives”.

It is considered unlikely that there will be any locations where diesel trains have their engines running for extended periods *and* where there is potential exposure for the public. Even in locations like Glasgow Central and Queen Street stations, where engines may idle occasionally, the areas where the public would wait are more than 15m from the locomotive engines. In addition, the potential exists for locomotive engines running at rail depots; however, such sites are not generally accessible to the public.

The main Glasgow to Edinburgh line has been identified as a section of track that may have a large number of movements of diesel locomotives. However, there are no areas along the route identified using the national background maps where the background annual mean NO₂ concentration is above 25 µg/m³.

3.2.5 Ports (Shipping)

Large ships, such as cross-Channel ferries or cruise ships, often use fuel oil which has a high sulphur content, and if there is a large amount of shipping traffic in the area around a port, there will be a risk of exceedences of the 15-minute objective. However, there is currently on average three freight ships a week visiting Glasgow, with an average draft of 1500 tonnes. Consequently, it is considered unlikely that this volume of traffic would cause any exceedences of the SO₂ objective. Therefore, *there is no requirement* to progress to a Detailed Assessment of SO₂ for this source.

3.3 Industrial Sources

Industrial sources can make a significant contribution in relation to the 1-hour objective. They are not as important in terms of annual mean concentrations.

No new industrial sources which could make a significant contribution to pollutant concentrations have commenced operation in Glasgow since the last round of review and assessment.

Existing industrial installations have been considered extensively in previous rounds of review and assessment. At present there are no existing installations with substantially increased emissions since prior assessment.

There are no major fuel (petrol) storage depots within the Local Authority area.

Petrol stations that are to be considered for benzene emissions are defined in the guidance as,

“..all petrol stations with an annual throughput of more than 2000m³ of petrol (2 million litres) per annum and with a busy road nearby.”

A busy road is identified as,

“..one with more than 30,000 vehicles per day.”

In Glasgow, there are no locations with a busy road, a sufficiently large petrol station and relevant exposure in the immediate vicinity. Two of the benzene diffusion tubes are located close to petrol stations to confirm this assertion. These are the Polokshaws Rd and the Ochiltree Avenue tubes. Results from these tubes are considerably and consistently below the objective level for benzene.

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

3.4 Commercial and Domestic Sources

Biomass burning can lead to an increase in PM₁₀ emissions, due to the nature of combustion. NO₂ levels can also be higher than in conventional gas installations. Rising prices for conventional fuels and pressure to reduce carbon emissions has seen the popularity of biomass as a fuel source grow.

At present Glasgow has no major biomass combustion plants. There have been early stage proposals, including the potential for a biomass boiler system at the Glasgow School of Art and a biodiesel CHP plant for the redevelopment of the Collegelands campus. These developments are currently undertaking air quality assessments and may be considered in more detail in later rounds of review and assessment.

In areas where domestic solid fuel is still in widespread use, there can be a problem with PM₁₀ concentrations. The growth in popularity of biomass in domestic situations, particularly the use of wood burning stoves could lead to potential problems with PM₁₀. At present within Glasgow, there is no area of 500 x 500m with sufficient numbers of small solid fuel burners to present a significant impact on PM₁₀ levels.

3.5 New Developments with Fugitive or Uncontrolled Sources

Fugitive emissions from a variety of sources can give rise to elevated PM₁₀ concentrations. Fugitive sources, i.e. dust has the potential to be a problem in the achievement of the PM₁₀ objectives, especially in Scotland where the objective level for 2010 is lower than in the rest of the UK. It is thought that dust emissions contain around 20% PM₁₀.

The guidance on dealing with these sources is to identify potential sources, and then determine whether there are dust concerns at the facility. This assessment should be based on dust complaints about the facility, air quality assessments already carried out or a visual inspection indicating significant dust.

The only potential sources which Glasgow contains within its boundaries are landfill sites, of which there are several. These have been considered in previous rounds of review and assessment where it was concluded that they would not have a significant impact on PM₁₀ concentrations.

Glasgow City Council confirms that there are no new or newly identified local developments which may have an impact on air quality within the Local Authority area.

Glasgow City Council confirms that all the following have been considered –

- **Road traffic sources**
- **Other transport sources**
- **Industrial sources**
- **Commercial and domestic sources**
- **New developments with fugitive or uncontrolled sources.**

4 Conclusions and Proposed Actions

4.1 Conclusions from New Monitoring Data

NO₂ Annual Mean Objective

Automatic analyser and diffusion tube monitoring of NO₂ within this Progress Report indicates that concentrations of NO₂ are likely to continue to exceed the National Air Quality Annual Mean Objective at several locations within the existing Air Quality Management Areas. The diffusion tube results also show that there continues to be the potential for exceedences of the NO₂ objective around the Bridge St / Norfolk St area. This area was considered in the 2010 Detailed Assessment and it was recommended that the city centre AQMA be extended to cover this area. Glasgow City Council is in the process of amending the AQMA to reflect this.

The exceedences located at Queen Margaret Drive 2 were also considered as part of the Detailed Assessment. The results of the modelling were inconclusive and the report recommended that monitoring be continued at this location. Since the exceedences of the annual mean objective have continued at this location, it is the opinion of Glasgow City Council that this area would be best served by extending the current Byres Rd / Dumbarton Rd AQMA to cover this location.

New exceedences of the annual mean objective were identified at Napiershall Street, Paisley Road West, Crow Road and Urrdale Road. Glasgow City Council has placed further diffusion tubes in the area of these exceedences to help define their geographical extent. Glasgow City Council intend to delay conducting a Detailed Assessment of these locations until sufficient data has been gathered to enable a comprehensive review of these areas to take place.

NO₂ 1-hour Mean Objective

Monitoring results show that the Glasgow Kerbside monitoring sites continues to show exceedences of the 1-hour mean objective for NO₂. Glasgow City Council propose to amend the existing city centre AQMA to reflect breaches at this location.

Exceedences have also been recorded at the Glasgow Centre site. However, these breaches appear to be related entirely to the presence of a market and the inappropriate placement of diesel generators. Glasgow City Council are currently in talks with market organisers to minimise the air quality impact of these generators.

The Glasgow Anderston site had a data collection of 81.8% for 2010. Because the collection rate was less than 90% the 99.8th percentile of hourly means was calculated. This value was 204 µg/m³ indicating a breach of the objective was possible. However, the annual mean NO₂ level at this location was within the objective level. Therefore, it is the intention of Glasgow City Council to continue monitoring at this location to establish if exceedences of the 1-hour mean objective are repeated.

PM₁₀ Annual Mean Objective

Previous rounds of review and assessment have shown the potential for exceedences of the 2010 objective for PM₁₀ at various locations throughout the city. As a result of this the 2010 Detailed Assessment considered a wide selection of areas across the city for PM₁₀. The results of the modelling were inconclusive and the report recommended that further monitoring be carried out to supplement the modelling exercise.

Monitoring results for 2010 show that the PM₁₀ annual mean objective is being exceeded at every monitoring location within the city with the exception of Glasgow Anderston. A further Detailed Assessment would serve little purpose at this stage and as such, Glasgow City Council propose to declare an AQMA covering the entire city boundary in respect of the PM₁₀ annual mean.

PM₁₀ 24-hour Mean Objective

The 2010 PM₁₀ 24-hour objective was exceeded at six locations within the city. These locations were spread throughout the city and as such, Glasgow City Council propose to declare an AQMA covering the entire city boundary in respect of the PM₁₀ 24-hour objective.

Monitoring results for carbon monoxide, sulphur dioxide, benzene, 1,3-butadiene and lead continue to show that in Glasgow, levels of these pollutants are well below the National Air Quality Objectives.

4.2 Conclusions relating to New Local Developments

Roads, transport, industrial and domestic sources of air pollution were considered as part of the Progress Report. It was shown that there are no new developments or changes to existing developments likely to lead to significant contributions to air pollution levels.

Environmental assessments relating to various developments for the 2014 Commonwealth Games are currently being undertaken. These developments may be considered in greater depth in future rounds of review and assessment.

4.3 Proposed Actions

Monitoring results have confirmed the findings of the 2010 Detailed Assessment that the PM₁₀ annual mean and hourly mean objectives are being exceeded at a majority of locations across the city. Therefore, Glasgow City Council propose to declare the entire area within the city boundary as an AQMA in respect of these exceedences.

Further monitoring has confirmed the findings of the 2010 Detailed Assessment that the NO₂ annual mean objective will continue to be breached at Bridge St. Therefore Glasgow City propose to extend the city centre AQMA to cover this area.

Diffusion tube monitoring has shown exceedences of the NO₂ annual mean at a number of locations across the city. Glasgow City council propose to conduct additional monitoring near these locations to establish the geographical extent of the exceedences for a future Detailed Assessment.

5 References

- Department of the Environment, Food and Rural Affairs (2000). Part IV The Environment Act 1995, Local Air Quality Management, Technical Guidance, LAQM.TG(09);
- Glasgow City Council (1998). Local Air Quality Management, Review and Assessment of Air Quality in Glasgow Stage 1;
- Glasgow City Council (2000). Local Air Quality Management, Review and Assessment of Air Quality in Glasgow Stage 2;
- Glasgow City Council (2001). Local Air Quality Management, Review and Assessment of Air Quality in Glasgow Stage 3;
- Glasgow City Council (2003). Local Air Quality Management, Review and Assessment of Air Quality in Glasgow Stage 4;
- Glasgow City Council (2003). Local Air Quality Management, Updating and Screening Assessment;
- Glasgow City Council (2004). Local Air Quality Action Plan;
- Glasgow City Council (2005). Local Air Quality Management, Detailed Assessment;
- Glasgow City Council (2005). Local Air Quality Management, Progress Report;
- Glasgow City Council (2007). Local Air Quality Management, Detailed Assessment;
- Glasgow City Council (2008). Local Air Quality Management, Further Assessment;
- Glasgow City Council (2008). Local Air Quality Management, Progress Report;
- Glasgow City Council (2010). Local Air Quality Management, Detailed Assessment;
- The Scottish Executive (2002). Air Quality (Scotland) Amended Regulations