2010 Air Quality Progress Report for

Stirling Council

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

Date November 2010

Local Authority Officer	Anne Fitzsimons

Department	Environmental Health
Address	Municipal Buildings, Stirling
Telephone	01786 432204
e-mail	fitzsimonsa@stirling.gov.uk

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Executive Summary

The 2010 Progress Report for Stirling Council followed the guidance in TG09 Technical Guidance. New monitoring data for NO2 and PM10 was analysed to determine if any air quality objectives had been exceeded during 2009.

It was determined that the only exceedence of an air quality objective within the Council area was at Craigs Roundabout where the levels of PM10 exceeded the 2010 objective of 18 μg/m3 by 1 μg/m3. However, concentrations of PM10 had probably been increased due to extensive demolition work close to the monitoring location and may be lower in the future. Further monitoring will be carried out to determine if this is the case.

New sources of atmospheric emissions were investigated and assessed to determine if any sources would cause an exceedence of air quality objectives for any pollutant. It was determined that there were no new emission sources, or sources that had not been previously assessed, that could result in air quality objectives being exceeded.
Overall, it was concluded that there is no requirement to proceed to a Detailed Assessment for any pollutant at present. The next report to be completed will be the 2011 Progress Report.

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1 Introduction

1.1 Description of Local Authority Area

Stirling Council is located in the centre of Scotland and covers approximately 2,196 square kilometres. The Council is bordered by East Dunbartonshire Council to the south west, West Dunbartonshire Council to the west, Argyll and Bute Council to the north-west, Perth and Kinross Council to the north, Clackmannanshire Council and Falkirk Council to the east and North Lanarkshire Council to the south. A map of Stirling Council is provided in Figure 1.

The population of the Stirling Council area is approximately 86,000 with the majority of the residents based in or around Stirling in the urbanised region of the south east. The main population centres are Stirling, Cowie, Callander, Bridge of Allan, Dunblane and Aberfoyle. The north and western part of Stirling Council area is largely rural with a few small population centres in Killin, Kippen, Buchlyvie, Lochearnhead, Gartmore and Balfron. The majority of industrial and commercial businesses are based in the south-eastern area around Stirling, Cowie, Bridge of Allan and Dunblane. Stirling Council covers a large area extending from the densely populated central belt to the foothills of the Grampian Mountains. The south-eastern part of the council area is relatively flat and encompasses the upper section of the Forth Valley, which is aligned east-west. The eastern border of the Council area is marked by the Ochil Hills. The southern boundary of the Council area is marked by the Campsie Hills and Kilsyth Hills. The northern and western areas of Stirling Council area have relatively complex terrain including several lochs, forests and Munros.

1.2 Purpose of Progress Report

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

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

1.3 Air Quality Objectives

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

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 μg/m^3	Running annual mean	31.12.2003
	3.25 μg/m^3	Running annual mean	31.12.2010
1,3-Butadiene	2.25 μg/m^3	Running annual mean	31.12.2003
Carbon monoxide	10.0 mg/m^3	Running 8-hour mean	31.12.2003
Lead	0.5 μg/m^3	Annual mean	31.12.2004
	0.25 μg/m^3	Annual mean	31.12.2008
Nitrogen dioxide	200 μg/m^3 not to be exceeded more than 18 times a year	1-hour mean	31.12.2005
	40 μg/m^3	Annual mean	31.12.2005
Particles (PM_{10}) (gravimetric)	50 μg/m^3, not to be exceeded more than 35 times a year 50 μg/m^3, not to be exceeded more than 7 times a year	24-hour mean 24-hour mean	31.12.2004 31.12.2010
	40 μg/m^3 18 μg/m^3	Annual mean Annual mean	31.12.2004 31.12.2010
Sulphur dioxide	350 μg/m^3, not to be exceeded more than 24 times a year	1-hour mean	31.12.2004
	125 μg/m^3, not to be exceeded more than 3 times a year	24-hour mean	31.12.2004
	266 μg/m^3, not to be exceeded more than 35 times a year	15-minute mean	31.12.2005

1.4 Summary of Previous Review and Assessments

Stirling Council submitted an Updating and Screening Assessment (U&SA) in April 2006. The report concluded that there was unlikely to be an exceedence of the AQS objectives at locations of relevant public exposure. The measured NO2 annual mean concentration at Port Street in Stirling was, however, close to the AQS objective. It was also identified that two industrial sites had reduced or were proposing a reduction in atmospheric emissions. The report also highlighted that due to proposed commercial and domestic developments in the Stirling area there was likely to be an increase in road traffic flows in the south-east of the Council area.

The Progress Report in 2007 identified that annual mean pollutant concentrations at Port Street remained close to the objective; however, the site had a low data capture rate and so the results may not be reliable. It was, therefore, recommended that additional monitoring be undertaken. PM10 concentrations at Craigs Roundabout were determined to be at risk of exceeding the 2010 annual mean objective. Further monitoring and a re-evaluation of the results in 2008 was recommended.

The main air quality concerns within the Stirling Council area are, therefore, the elevated concentrations of NO2 and PM10 along the A9 and A84 in central Stirling, which are primarily due to road traffic emissions. Although previously measured concentrations were below AQS objectives at locations of relevant public exposure, concentrations were close to the objective limits.

The Progress Report in 2008 found that the results of the NO2 monitoring indicated that it is unlikely that the air quality objectives will be exceeded. The PM10 monitoring did, however, identify a risk of the 2010 annual mean objective being exceeded at Craigs Roundabout, based on a forward projection of 2007 annual mean measured concentrations. However, the exceedence was predicted only when the 1.3 adjustment factor had been applied. Based on the updated industrial, domestic, commercial and road traffic information, it was concluded that there was no risk of any other AQS objective being exceeded in the Stirling Council area.

2 New Monitoring Data

2.1 Summary of Monitoring Undertaken

2.1.1 Automatic Monitoring Sites

Stirling Council operates two automatic analysers. One is located at Craigs Roundabout and one at Main Street, Cowie. At Craigs Roundabout, there is a chemiluminescence NOx automatic analyser and a Tapered Element Oscillating Microbalance (TEOM) analyser. At Main Street, Cowie, there is an OSIRIS light scattering monitor. Details of the automatic monitoring sites are presented in Table 2.1. The locations of all monitoring locations (automatic and non-automatic) within the Council area are presented in Figures 2 and 3 in Appendix A. There were no changes to the automatic monitoring sites during 2009.

Figure 2.1 Map of Automatic Monitoring Sites

See Appendix B

Table 2.1 Details of Automatic Monitoring Sites

Site Name	Site Type	OS Grid Ref		Pollutants Monitored	Monitoring Technique	In AQMA?	Relevant Exposure? (Y/N with distance (m) to relevant exposure)	Distance to kerb of nearest road (N/A if not applicable)	Does this location represent worst-case exposure?
Craigs Roundabout	Roadside	279944	693005	NO_2,	NOx	N	Y (5m)	3m	Y
Craigs Roundabout	Roadside	279944	693005	NO_2, PM_{10}	TEOM	N	Y (5m)	3m	Y
Main Street, Cowie	Industrial	283579	689017	PM_{10}	OSIRIS	N	Y	N/A	Y

2.1.2 Non-Automatic Monitoring

Stirling Council maintained a network of 22 diffusion tube monitoring sites until March 2009. From April onwards, the number of sites was reduced to 10. The monitoring locations are presented in Table 2.2.

Figure 2.2 Map of Non-Automatic Monitoring Sites

See Appendix B

Table 2.2 Details of Non- 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?
Port Street, Stirling	Kerbside	279655	693240	NO_2	N	Y (m)	0.5m	Y
Main Street, Callander	Roadside	262863	707910	NO_2	N	Y (m)	2m	Y
Henderson Street, Bridge of Allan	Roadside	279177	697497	NO_2	N	Y (m)	1.5m	Y
Stirling Road, Dunblane	Roadside	278081	700580	NO_2	N	Y (m)	2m	Y
Edinample, Lochearnhead	Rural background	259827	722674	NO_2	N	Y (m)	0.5m	Y
Main Street, Aberfoyle	Roadside	252174	700998	NO_2	N	Y (m)	0.5m	Y
Balfron Road, Killearn	Roadside	252313	686066	NO_2	N	Y (m)	1m	Y
Northend, Cambusbarron	Suburban	277899	692787	NO_2	N	Y (m)	1.5m	Y
Causewayhea d Rbt, Stirling	Kerbside	280522	695694	NO_2	N	Y (m)	2m	Y
Springkerse Road, Stirling	Industrial	280493	692925	NO_2	N	Y (m)	1m	Y
St Modans, Stirling	Roadside	279520	691252	NO_2	N	Y (m)	2m	Y
Lennox Avenue, Stirling	Urban centre	279354	691933	NO_2	N	Y (m)	1m	Y
Craigs Roundabout (1)	Roadside	279987	693043	NO_2	N	Y (m)	1.5m	Y
Redland Tiles, Cowie	Kerbside	283545	688910	NO_2	N	Y (m)	0.5m	Y

Ochil View, Cowie	Other	284351	688923	NO_2	N	Y (m)	1m	Y
Dunmore Street, Balfron	Roadside	254833	688597	NO_2	N	Y (m)	1m	Y
Craigs Roundabout (2) (automatic analyser)	Roadside	279944	693005	NO_2	N	Y (m)	3m	Y
Port Street (2), Stirling	Roadside	279634	693160	NO_2	N	Y (m)	0.5m	Y
Alloa Road Roundabout	Roadside	282075	695057	NO_2	N	Y (m)	2.5m	Y
Main Street, Plean	Roadside	283222	687582	NO_2	N	Y (m)	2m	Y
Drip Road, Stirling	Roadside	279030	694720	NO_2	N	Y (m)	2.5m	Y
Gowanhill Gardens, Stirling	Roadside	278896	694425	NO_2	N	Y (m)	2m	Y

2.2 Comparison of Monitoring Results with Air Quality Objectives

STIRLING CRAIGS ROUNDABOUT
1st January to 31st December 2009

These data have been fully ratified by AEA

POLLUTANT	PM_{10}*+	NO_2	NO_X
Number Very High	0	0	-
Number High	0	0	-
Number Moderate	14	0	-
Number Low	8633	8260	-
Maximum 15-minute mean	401 µg m^{-3}	172 µg m^{-3}	693 µg m^{-3}
Maximum hourly mean	401 µg m^{-3}	151 µg m^{-3}	623 µg m^{-3}
Maximum running 8-hour mean	122 µg m^{-3}	98 µg m^{-3}	388 µg m^{-3}
Maximum running 24-hour mean	69 µg m^{-3}	80 µg m^{-3}	279 µg m^{-3}
Maximum daily mean	63 µg m^{-3}	80 µg m^{-3}	266 µg m^{-3}
Average	19 µg m^{-3}	26 µg m^{-3}	55 µg m^{-3}
Data capture	98.2 %	94.3 %	94.3 %

* PM_{10} Gravimetric Equivalent µg m^{-3}
\+ PM_{10} as measured by a TEOM using the VCM for Gravimetric Equivalent
All mass units are at 20°C and 1013mb
NO_X mass units are NO_X as NO_2 µg m^{-3}

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

2.2.1 Nitrogen Dioxide

Automatic Monitoring Data

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

Site ID	Location	Within AQMA?	Data Capture for monitoring period [a] %	Data Capture for full calendar year 2009 [b] %	Annual mean concentrations ($\mu g/m^3$)		
					2007 [c, d]	2008 [c,d]	2009 [c]
17	Craigs Roundabout	N	98.2	98.2	29.3	29.9	26

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

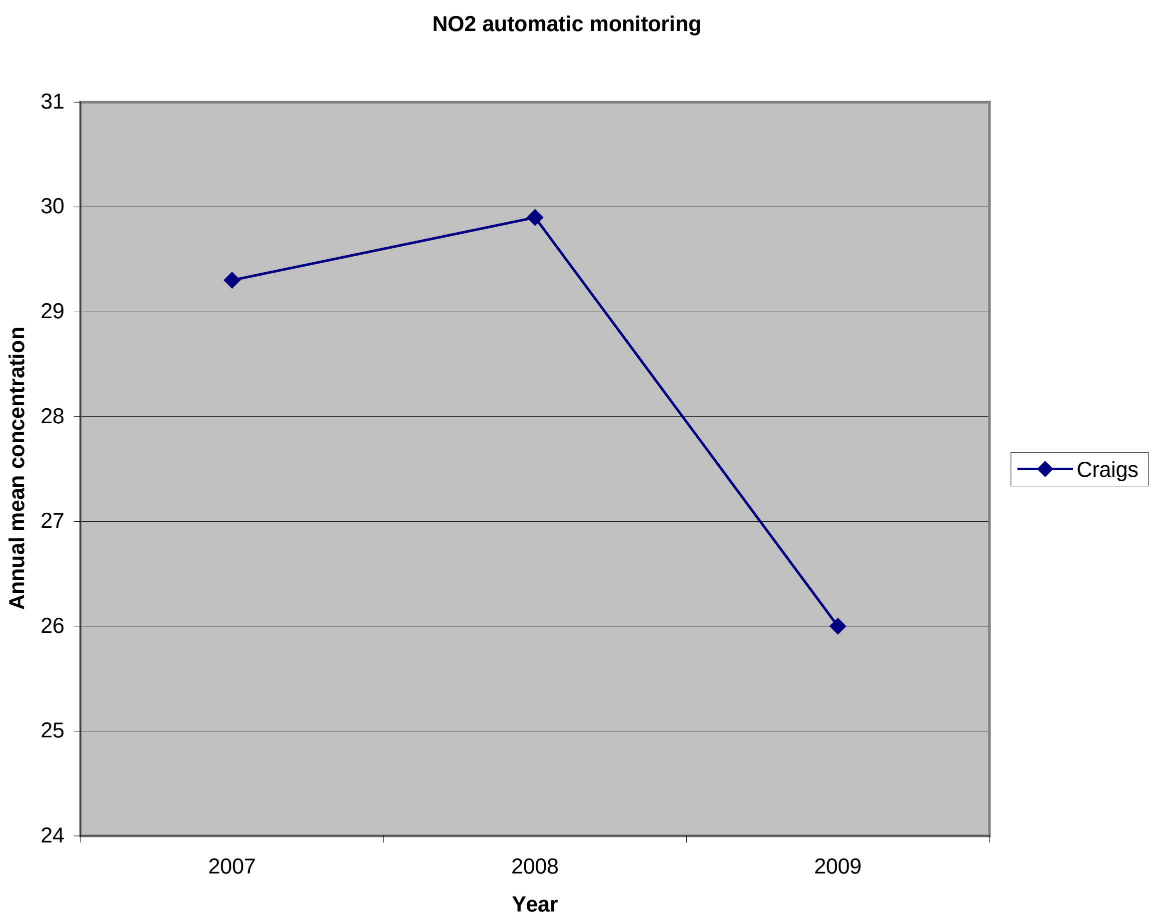
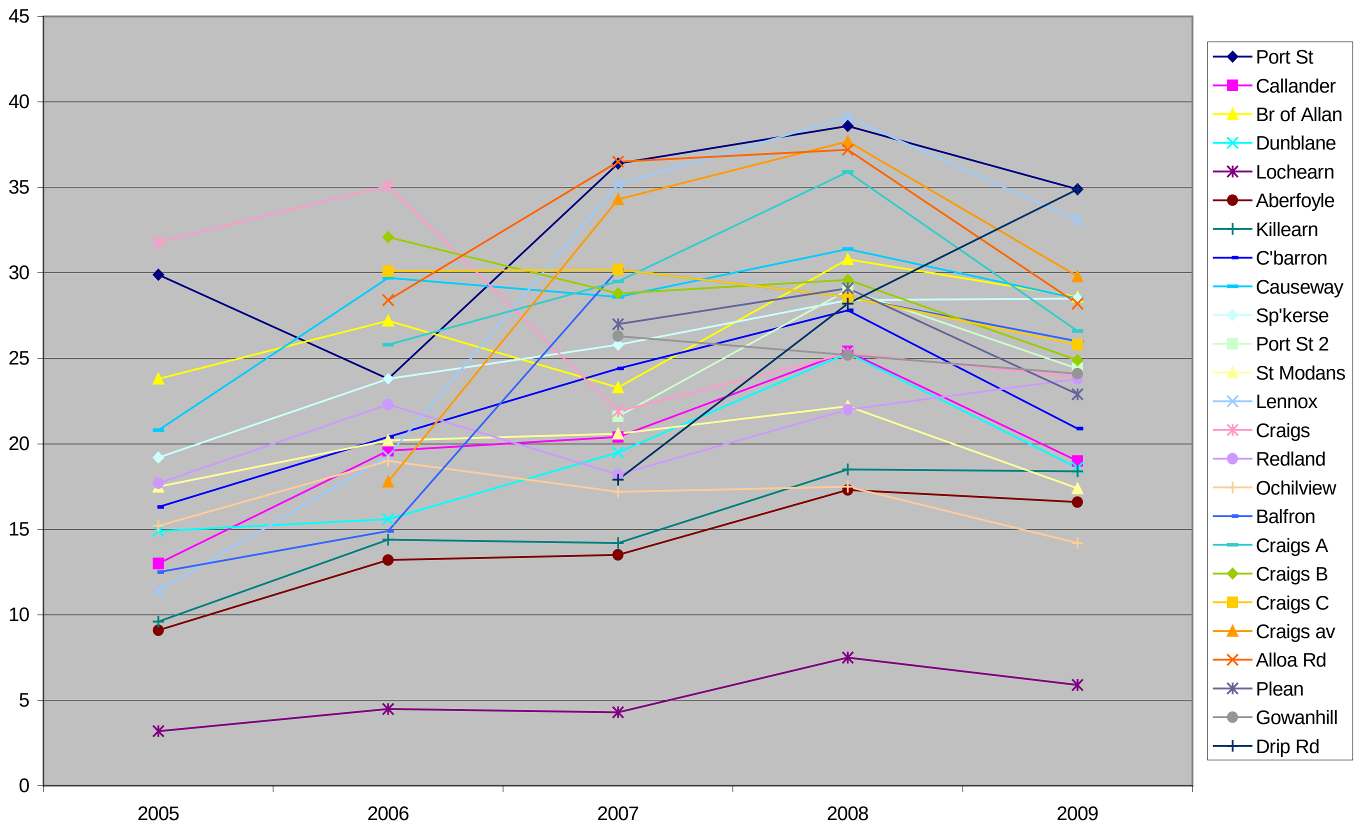


Table 2.3b Results of Automatic Monitoring for Nitrogen Dioxide: Comparison with 1-hour Mean Objective

Site ID	Location	Within AQMA?	Data Capture for monitoring period [a] %	Data Capture for full calendar year 2009 [b] %	Number of Exceedences of hourly mean (200 μg/m^3)		
					2007 [c]	2008 [c]	2009
17	Craigs Roundabout	N	98.2	98.2	0	0	0

Figure 2.4 Trends in Annual Mean Nitrogen Dioxide Concentration Measured at Diffusion Tube Monitoring Sites.



Diffusion Tube Monitoring Data

Table 2.4 Results of Nitrogen Dioxide Diffusion Tubes

Site ID	Location	Within AQMA ?	Data Capture for monitoring period[a] %	Data Capture for full calendar year 2009[b] %	Annual mean concentrations ($\mu g/m^3$)		
					2007 [c, d]	2008 [c,d]	2009 [c]
1	Port Street, Stirling	N	100	100	36.4	38.6	34.9
2	Main Street, Callander	N	100	25	20.4	25.4	19.0
3	Henderson Street, Bridge of Allan	N	92	92	23.3	30.8	28.6
4	Stirling Road, Dunblane	N	100	100	19.5	25.3	18.6
5	Edinample, Lochearnhead	N	100	25	4.3	7.5	5.9
6	Main Street, Aberfoyle	N	100	25	13.5	17.3	16.6
7	Balfron Road, Killearn	N	66	17	14.2	18.5	18.4
8	Northend, Cambusbarron	N	100	25	24.4	27.8	20.9
9	Causewayhead Rbt, Stirling	N	100	25	28.6	31.4	28.5
10	Springkerse Road, Stirling	N	100	25	25.8	28.4	28.5
11	St Modans, Stirling	N	100	92	21.6	29.0	24.4
12	Lennox Avenue, Stirling	N	83	83	20.6	22.2	17.4
13	Craigs Roundabout (1)	N	100	100	35.2	39.1	33.1
14	Redland Tiles, Cowie	N	100	25	21.9	25.3	23.9
15	Ochil View, Cowie	N	100	25	18.2	22.0	23.8
16	Dunmore Street, Balfron	N	100	25	17.2	17.5	14.2
17A	Craigs Roundabout (2) (automatic analyser)	N	100	100	30.2	28.6	26.0
17B	Craigs Roundabout (2) (automatic analyser)	N	100	100	29.5	35.9	26.6
17C	Craigs Roundabout (2) (automatic analyser)	N	100	100	28.8	29.6	24.9
	(Co-location study average)	N	100	100	30.2	28.6	25.8
18	Port Street (2), Stirling	N	92	92	34.3	37.7	29.8
19	Alloa Road Roundabout	N	100	100	36.5	37.2	28.2
20	Main Street, Plean	N	100	100	27.0	29.1	22.9
21	Drip Road, Stirling	N	100	25	26.3	25.2	24.1
22	Gowanhill Gardens, Stirling	N	66	17	17.9	28.2	34.9

2.2.2 PM_{10}

Table 2.5a Results of PM_{10} Automatic Monitoring: Comparison with Annual Mean Objective

Site ID	Location	Within AQMA?	Data Capture for monitoring period [a] %	Data Capture for full calendar year 2009 [b] %	Annual mean concentrations (μg/m³)		
					2007 [c, d]	2008 [c,d]	2009 [c]
17	Craigs Roundabout	N	98.2	98.2	19.9	16.1	**19**
14	Main Street, Cowie	N	90.7	90.7	9.6	7.8	8.86

Table 2.5b Results of PM_{10} Automatic Monitoring: Comparison with 24-hour Mean Objective

Site ID	Location	Within AQMA?	Data Capture for monitoring period [a] %	Data Capture 2009 [b] %	Number of Exceedences of daily mean objective (50 μg/m³)		
					2007 [c]	2008 [c]	2009 [c]
17	Craigs Roundabout	N	98.2	98.2	4	0	4
14	Main Street, Cowie	N	90.7	90.7	1	0	0

2.2.3 Sulphur Dioxide

Stirling Council does not undertake any monitoring for SO2.

2.2.4 Benzene

Stirling Council does not undertake any monitoring for benzene.

2.2.5 Other pollutants monitored

Stirling Council does not undertake any monitoring for other pollutants.

2.2.6 Summary of Compliance with AQS Objectives

Stirling Council has examined the results from monitoring in the Stirling area. Concentrations are all below the objectives, with the exception of Craigs Roundabout. While concentrations of PM10 were above the annual mean objective, this was probably due to demolition work being carried out in the area at this time. Therefore there is no need to proceed to a Detailed Assessment at present, although this will be reconsidered after further monitoring.

3 New Local Developments

3.1 Road Traffic Sources

Stirling Council confirms that there are no new roads meeting the criteria outlined below.

- 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.
- Bus or coach stations.

3.2 Other Transport Sources

Stirling Council confirms that there are no other transport sources meeting the criteria outlined below.

- 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.
- Ports for shipping.

3.3 Industrial Sources

Stirling Council confirms that there are no new/newly identified industrial sources meeting the criteria outlined below.

- **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 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.
- Poultry farms.

3.4 Commercial and Domestic Sources

Stirling Council confirms that there are no new/newly identified commercial and domestic sources meeting the criteria outlined below.

- Biomass combustion plant – individual installations.
- Areas where the combined impact of several biomass combustion sources may be relevant.
- Areas where domestic solid fuel burning may be relevant.

3.5 New Developments with Fugitive or Uncontrolled Sources

Stirling Council confirms that there are no new/newly identified potential sources of fugitive or uncontrolled particulate matter meeting the criteria outlined below.

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

Stirling 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.

4 Local / Regional Air Quality Strategy

A Draft Local Air Quality Strategy was produced in 2006 but this will require to be updated. The Strategy will be reviewed in the near future.

5 Planning Applications

The following new developments have been granted planning permission within the Stirling Council area.

Most of the new developments are likely to have some impact on local air quality. Emissions of dust and particulate matter are likely to occur from stone extraction from the quarry. These are also likely to be increased during the construction phases of the new building developments. During the construction phase there will also be an increase in HGV traffic in the vicinity of the development sites. Increased volumes of HGV traffic may result in an increase in local particulate concentrations due to both the use of diesel fuel and through dust from construction.

Following completion of new housing, retail or industrial developments, it is possible that there will be a local increase in road traffic due to increased domestic residents or customers and visitors to business or retail units. The exact number of vehicles will depend on the scale of the development and the overall impact will depend on the increased volume of traffic on the affected roads.

It is concluded that these proposed developments would have a minimal impact on local air quality.

New developments:

Renewal of outline planning permission for proposed hotel with 18 hole golf course and clubhouse, public footpath/cycleway, construction of access road and new junction at land at Park of Keir, Dunblane

Limited period of stone extraction from extant quarry for use in restoration and conservation of parapets on A9-200 Stevenson Bridge at land between Craigmill House and 79 Alloa Road, Causewayhead, Stirling

Proposed remix of house types to provide an additional 34 Housing Association units and an increase in 8 private development units at land between Polmaise Home Farm and King George's Field, St Ninians Road, Cambusbarron

Mixed use development comprising Class 1 (Retail), Class 3 (Food and Drink), Class 7 (Hotel), Class 9 (Houses) and Class 11 (Assembly and Leisure) at land and buildings in Burghmuir Industrial Estate, Stirling

Erection of 136 dwelling houses (amendment to previously approved layout) at former Wallace High School, Dumyat Road, Causewayhead, Stirling

Proposed development of 196500 square feet Class 4 offices and 17700 square feet Class 11 leisure buildings, associated roads, parking and landscape treatment at land north west of Pirnhall Services, Bannockburn

Proposed six storey hotel development with ancillary bar and restaurant, including servicing access and landscape details at land and property at 14-16 and former toilets, Dumbarton Road, Stirling

Development of new college campus facilities (Use Class 10), associated access, parking and ancillary works at Kildean Auction Market, Drip Road, Raploch, Stirling

6 Air Quality Planning Policies

Stirling Council has produced a Sustainable Development Strategy and Action Plan which outlines several policies which will have an indirect effect of minimising local atmospheric emissions. Central to the emission reductions are the land-use planning and transport objectives which aim at reducing the need to travel and providing communities with adequate access to all services (education, health, retail, public transport, leisure and recreation).

Levels of NO2 and PM10 are listed as a sustainability development indicator for environmental services. The Council Travel Plan, provision of supplementary planning guidance, promotion of green travel plans for industry, business and commercial sites as well as the proposed review of fuel use by the council fleet in addition to the local structure and transport strategies are all likely to aid the minimisation of local air quality impacts from transport and industry.

7 Local Transport Plans and Strategies

Stirling Council's Local Transport Strategy (LTS) is an umbrella document encompassing the City Transport Strategy, the National Park Transport Strategy and the Smaller Towns and Villages Transport Strategy. It lays down a policy framework for sustainable transportation, and the individual supporting strategies outline how projects, plans and services will be used on the ground to turn policy into action.

The City Transport Strategy (CTS) is the first of three delivery strategies that form part of the Local Transport Strategy. Transport Strategies for the National Park in Stirling Council and the smaller towns and villages are to be developed over the next 2 years.

The strategies developed by Stirling Council fit into a wider framework of Regional and National Strategies. Stirling Council is a member of the TACTRAN Regional Partnership which also includes Perth and Kinross, Dundee and Angus Councils.

8 Climate Change Strategies

Stirling Council is working in partnership with Going Carbon Neutral Stirling. (www.goingcarbonneutralstirling.org.uk)

Going Carbon Neutral Stirling is a behaviour change model which aims:

- To create, sustain and evaluate meaningful and collaborative carbon reduction through the Carbon Cutter Plan
- To achieve between 8% to 10% CO2 reductions each year for each participant
- To create a tipping point in Stirling by engaging over a third of the region's population
- To create a toolkit of best practice which can then be used elsewhere in the country
- To inspire and support politicians who make choices which protect our population against the impacts of climate change
- To promote a greater sense of wellbeing in Stirling

The Carbon Cutter Plan (CCP) is a weekly/monthly plan of smart and straightforward actions which reduces emissions and helps us live a low carbon lifestyle. All the actions help slow climate change, but some will also reduce pollution, help save money on fuel bills, minimise waste sent to landfill and help promote the personal health benefits of cycling, walking and eating local food as well as helping to create safer and better connected communities.

Carbon Management Plan

In conjunction with the Carbon Trust, Stirling Council has created a plan to decrease carbon emissions. This plan covers many areas of emissions: lighting, heating, waste, travel etc and has the potential to reduce carbon emissions by 23% over 5 years.

The council is also creating new frameworks for local housing, local development and strategic environment assessments. Stirling is continuing to develop recycling solutions for residents. This includes the recent introduction of food waste recycling.

9 Implementation of Action Plans

As Stirling Council currently does not have an AQMA, an action plan has not been implemented.

10 Conclusions and Proposed Actions

10.1 Conclusions from New Monitoring Data

During 2009, Stirling Council undertook monitoring of NO2 and PM10 concentrations at various locations. The results indicate that the NO2 air quality objectives were met during 2009 at all monitoring locations. Measured NO2 concentrations during 2007, 2008 and 2009 are similar, with no significant increase or decrease identified at most sites. However, the annual mean PM10 concentration of 19 µg m^{-3} exceeded the new objective of 18 µg m^{-3} by 1µg m^{-3}. This increase from the 2008 figure of 16.1 µg m^{-3} may have been partly due to dust produced by the demolition of nearby commercial buildings which was carried out in 2009. Further monitoring will be carried out in 2010 to ascertain if this is the case. There are no existing AQMAs within the Council area. It is therefore concluded that a Detailed Assessment is not required at present because of monitoring data.

10.2 Conclusions relating to New Local Developments

There are no new local developments which will require more detailed consideration in the next Updating and Screening Assessment and none which would give rise to the need for a Detailed Assessment.

10.3 Other Conclusions

A planning application for the erection of a waste to energy facility comprising a unit to sort pre-approved wastes for recycling or reprocessing and a processing plant generating energy from suitable wastes has been received. This includes plant suitable for supplying steam or hot water generated as a by-product of the main processes to a possible future district heating scheme. If this development is approved, it will require more detailed consideration in the next Updating and Screening Assessment.

10.4 Proposed Actions

The assessment has identified that it is not necessary to proceed to a Detailed Assessment for any pollutant.
No new areas where additional monitoring is required have been identified.
No further action is required; therefore, the next report to be required is the 2011 Progress Report.

11 References

Defra et al, 2009. Local Air Quality Management, Technical Guidance LAQM.TG(09).

Appendices

Appendix A:

QA/QC Data

Appendix B:

Map of Stirling Council Area

Map of NO2 diffusion tube sites

Map of PM10 monitoring sites

Tables for NO2 calculations

Appendix A: QA:QC Data

Diffusion Tube Bias Adjustment Factors

The NO_2 diffusion tube bias adjustment calculations were carried out using the Stirling Craigs Roundabout co-location study for the periods January - March 09 and April – December 09 to correspond to the change in analysis laboratories. The following adjustment factors were determined for these periods:

January - March 09 = 1.08 (poor precision)
April – December 09 = 0.92 (good precision)

The poor precision of the bias adjustment calculation for the January - March tube study indicated that 1.08 was not an accurate factor to use. As a result it was considered better to use the 2008 adjustment factor (which was 1.06) for correcting tube data during January - March. The April – December tube data were found to have good precision. In this case 0.92 was suitable to use for correcting tube data during April – December. The following adjustment factors were therefore used:

January - March 09 = **1.06**
April – December 09 = **0.92**

Both adjusted diffusion tube datasets were used together to calculate the NO_2 annual averages.

PM Monitoring Adjustment

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

The VCM uses purge (volatile) particulate matter measurements provided by FDMS (Filter Dynamics Measurement System) instruments located within 130 km of the TEOM in question to assess the loss of particulate matter (PM_{10}) from the TEOM. The TEOM measurements are then corrected to ambient pressure and temperature using meteorological data from met monitoring sites within 260 km of the TEOM. The volatile fraction is then added back onto the TEOM measurements to give Gravimetric Equivalent mass concentrations.

This is a short summary outlining the method used by AEA for correcting the 2009 Scottish TEOM data in the Scottish database.

Method

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

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

Hourly average temperatures from Edinburgh Airport and pressures measurements from Edinburgh Gogarbank meteorological monitoring stations were used in the model. These sites were selected as a good representation the weather in the central belt of Scotland and are also located approximately 150 km from Aberdeen, which is within the specified 260 km limit.

Hourly average purge measurements from all Scottish FDMS monitoring sites within the Scottish Government-run network (SAQD) and the 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 4 FDMS sites were used for correcting Aberdeen TEOM data and 24 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[1] 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.

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

TEOM Locations	FDMS Sites used in VCM	Monitoring Network
Aberdeen	Aberdeen PM_{10}	AURN
	Aberdeen $PM_{2.5}$	AURN
	Angus Forfar	SAQD
	Fife Cupar	SAQD
Central Scotland	Angus Forfar	SAQD
	Auchencorth Moss PM_{10}	AURN
	Auchencorth Moss $PM_{2.5}$	AURN
	East Dunbartonshire Kirkintilloch	SAQD
	East Renfrewshire Sheddens	SAQD
	Edinburgh PM_{10}	AURN
	Edinburgh $PM_{2.5}$	AURN
	Fife Cupar	SAQD
	Fife Rosyth	SAQD
	Glasgow Abercromby	SAQD
	Glasgow Broomhill	SAQD
	Glasgow Centre PM_{10}	AURN
	Glasgow Centre $PM_{2.5}$	AURN
	Glasgow Kerbside PM_{10}	AURN
	Glasgow Kerbside $PM_{2.5}$	AURN
	Glasgow Nithsdale Road	SAQD
	Grangemouth PM_{10}	AURN
	Grangemouth $PM_{2.5}$	AURN
	Paisley Gordon St	SAQD
	S. Lanarkshire East Kilbride	SAQD
	W. Dunbartonshire Clydebank	SAQD
	W. Lothian Broxburn	SAQD
	W. Lothian Linlithgow	SAQD
	W. Lothian Uphall	SAQD

VCM and the SAQD

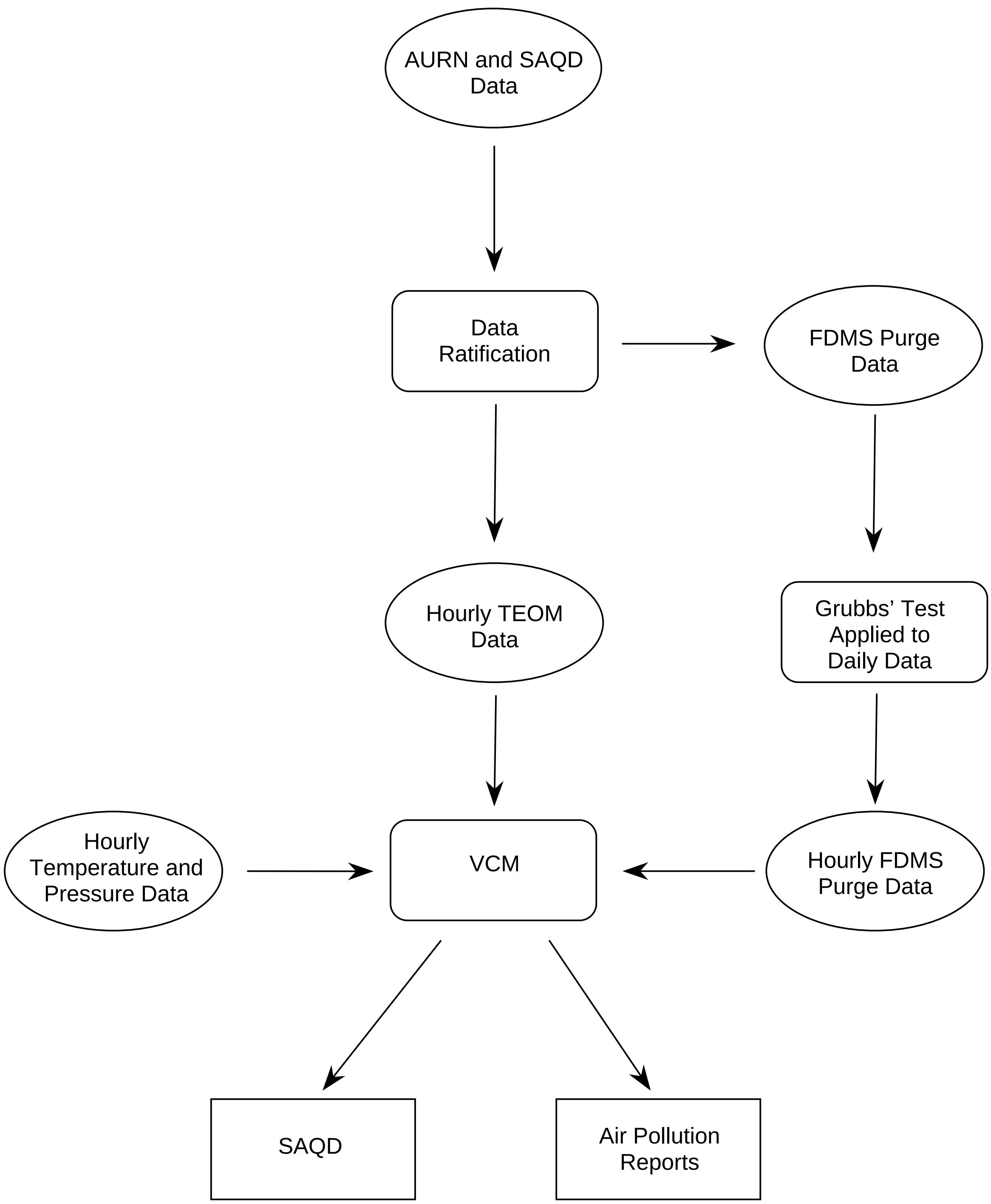
[1] Grubbs' Test is a statistical method for identifying outliers within a dataset. For more information visit the Engineering Statistics Handbook at:

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

All VCM corrected data have been made available on the SAQD website via an additional selection option in the data download pages. The Air Pollution reports provided to all Local Authorities now include VCM corrected PM_{10} statistics. If a PM_{10} analyser has been upgraded to an FDMS from a TEOM during 2009, the statistics quoted are calculated using the combination of VCM corrected data and FDMS data.

A flow chart showing the overall process employed for VCM correcting 2009 SAQD TEOM data is shown in Figure 1.

Figure 1 Process used for VCM Correcting SAQD TEOM Data



Short-term to Long-term Data adjustment

Monitoring at 12 of the NO2 diffusion tube sites was discontinued after March 2009. The following figures were used to annualise the data for these sites. (Average: 0.82)

Average between two dates and times (GMT)

Site name	Channel	Start date	Start time	End date	End time	Average	Data capture	Units
Glasgow Waulkmillglen Reservoir	Nitrogen Dioxide	01/01/2009	0	31/12/2009	23	12	94	µg m-3 (20'C 1013mb)
Glasgow Waulkmillglen Reservoir	Nitrogen Dioxide	01/01/2009	0	31/03/2009	23	14	99.3	µg m-3 (20'C 1013mb)
Grangemouth	Nitrogen Dioxide	01/01/2009	0	31/12/2009	23	18	90.4	µg m-3 (20'C 1013mb)
Grangemouth	Nitrogen Dioxide	01/01/2009	0	31/03/2009	23	23	98.3	µg m-3 (20'C 1013mb)

	Jan - Dec 09 (Am)	Jan - Mar 09 (Pm)	Am/Pm
Glasgow Waulkmillglen Reservoir	12	14	0.86
Grangemouth	18	23	0.78
		Average:	0.82

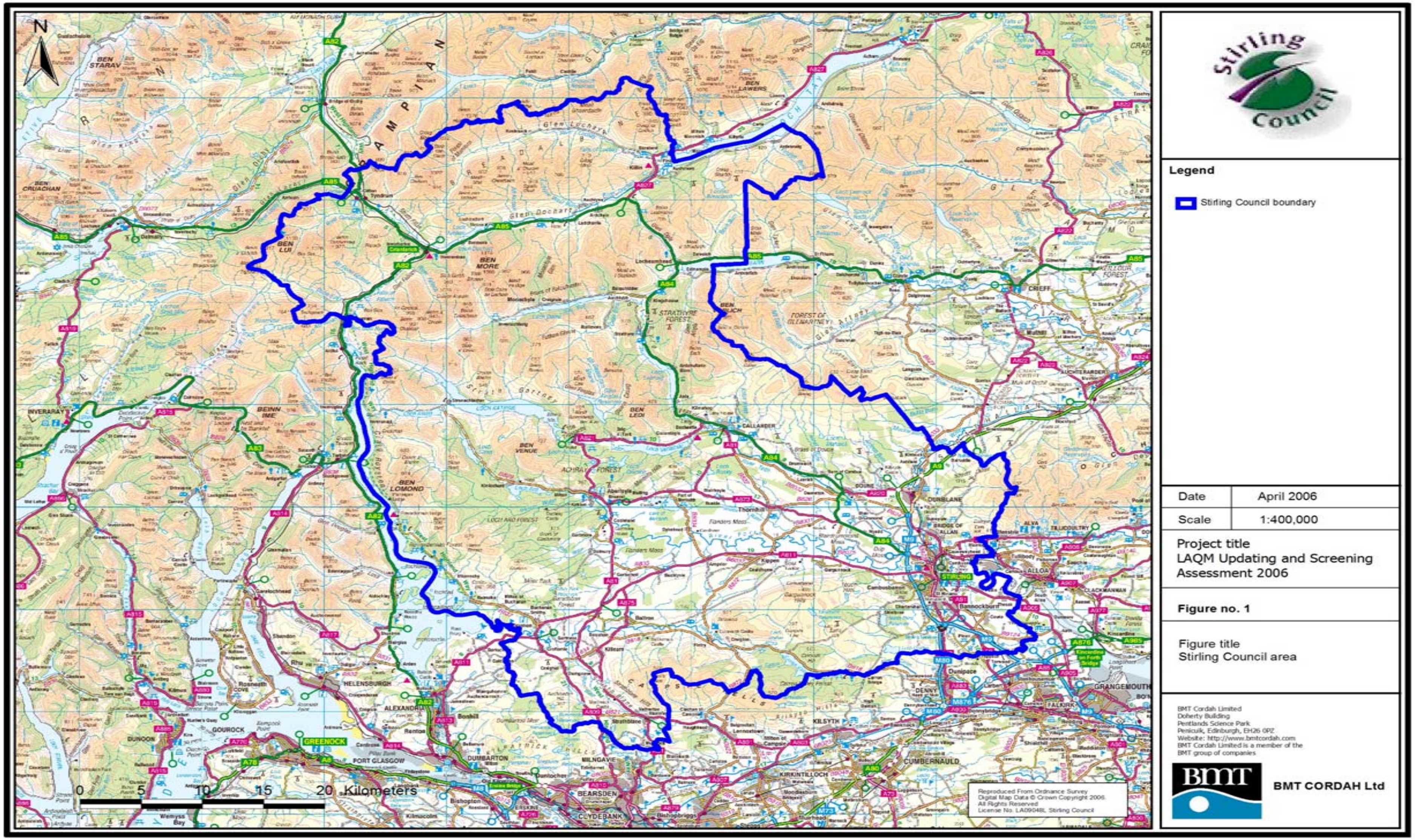
QA/QC of automatic monitoring

The automatic monitoring equipment is audited every 6 months by AEA, Glengarnock Technology Centre, Lochshore Business Park, Glengarnock. It is serviced and calibrated by Casella Measurement.

QA/QC of diffusion tube monitoring

From January to March 2009 the NO2 diffusion tubes used by Stirling Council were prepared and analysed by Bodycote Health Sciences using the 50% triethanolamine (TEA) in water method. Bodycote is accredited to undertake NO2 diffusion tube analysis by the United Kingdom Accreditation Service (UKAS).

From April onwards the City of Edinburgh Council Scientific Services Laboratory performed NO2 Tube analysis using the harmonised method ED48673043 Issue 1a, Feb 2008, with a few minor changes which have been approved by AEA. The Laboratory is UKAS accredited and has good performance in both WASP and NETCEN QA schemes.


N
0 5 10 15 20 Kilometers
STIRLING
CALLANDER
DUNBLANE
BRIDGE OF ALLAN
CRIEFF
ALLOA
FALKIRK
GRANGEMOUTH
CUMBERNAULD
KILSYTH
KIRKINTILLOCH
MILNGAVIE
BEARSDEN
CLYDEBANK
DUMBARTON
ALEXANDRIA
HELENSBURGH
GREENOCK
GOUROCK
DUNOON
INVERARAY
BEN LOMOND
BEN LEDI
BEN VENUE
BEN MORE
BEN LUI
BEN LAWERS
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Stirling Council
Legend
Stirling Council boundary
Date April 2006
Scale 1:400,000
Project title
LAQM Updating and Screening
Assessment 2006
Figure no. 1
Figure title
Stirling Council area
BMT Cordah Limited
Doherty Building
Pentlands Science Park
Penicuik, Edinburgh, EH26 0PZ
Website: http://www.bmtcordah.com
BMT Cordah Limited is a member of the
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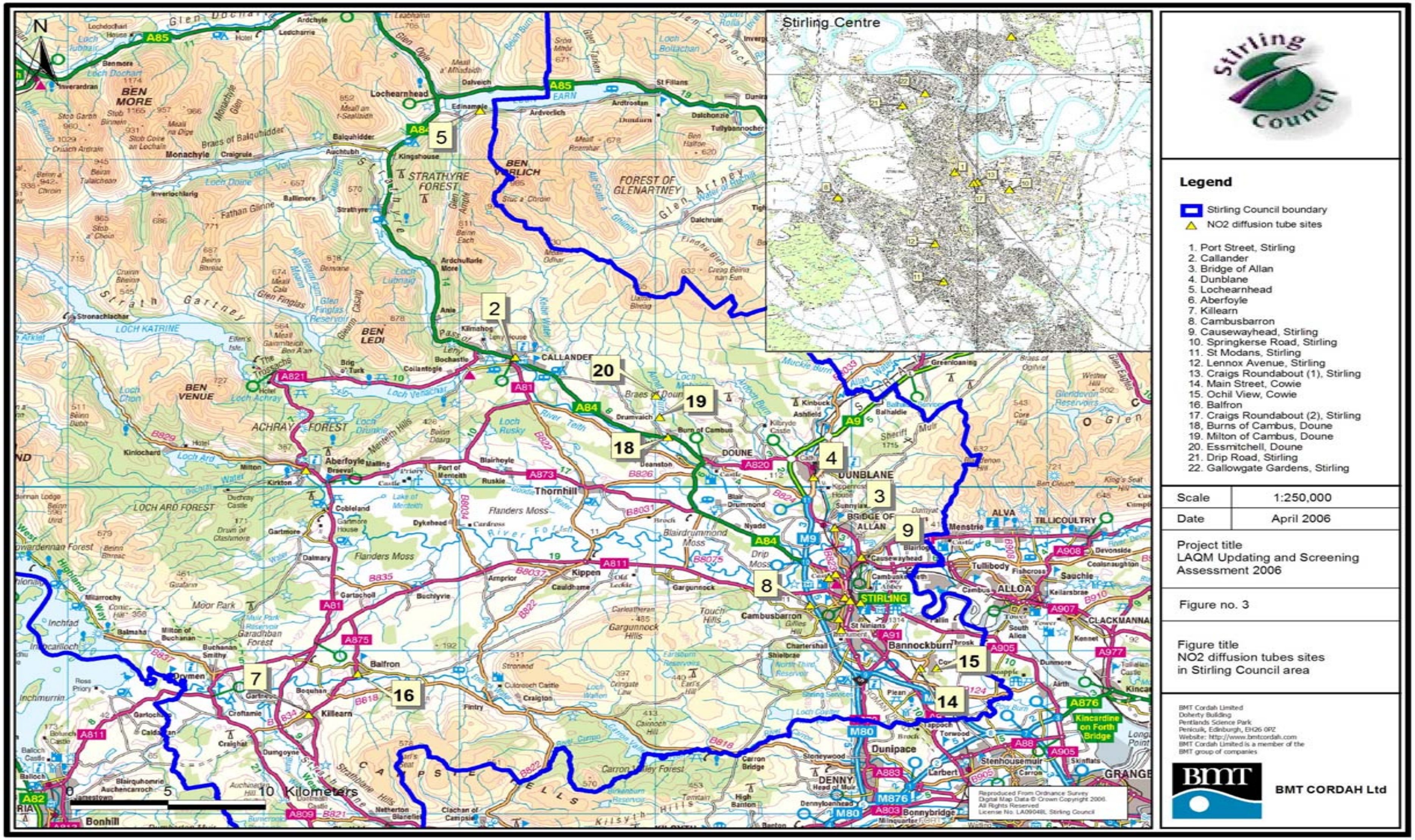
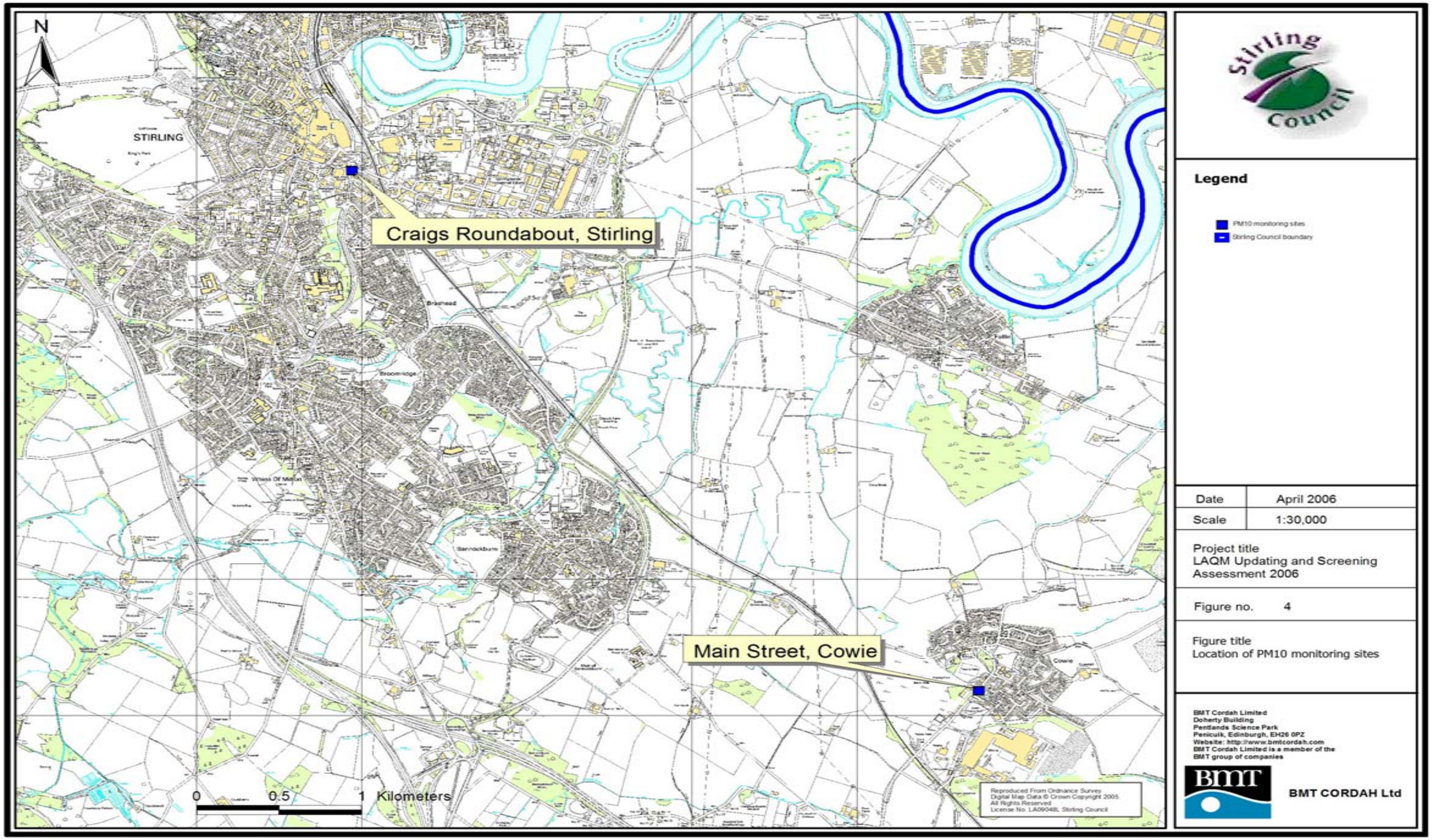


Map of NO2 diffusion tube sites



Map of PM10 monitoring sites

Checking Precision and Accuracy of Triplicate Tubes

AEA Energy & Environment
From the AEA group

	Diffusion Tubes Measurements									Automatic Method		Data Quality Check	
Period	Start Date dd/mm/yyyy	End Date dd/mm/yyyy	Tube 1 μgm^{-3}	Tube 2 μgm^{-3}	Tube 3 μgm^{-3}	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean	Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
1	07/01/2009	06/02/2009	37.1	48.8	39.5	42	6.2	15	15.4	41	95.4	Good	Good
2	06/02/2009	04/03/2009	29.5	40.4	37.5	36	5.6	16	14.0	36	95.4	Good	Good
3	04/03/2009	01/04/2009	34.4	16.9	15.3	22	10.6	48	26.3	31	93.4	Poor Precision	Good
4										29	95.7		Good
5										23	95.5		Good
6										19	95.4		Good
7			0.0							16	95.4		Good
8										14	95.6		Good
9										16	90.8		Good
10										24	90.7		Good
11										27	93.8		Good
12										36	92.9		Good
13													

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

Overall survey --> Poor precision | Good Overall DC

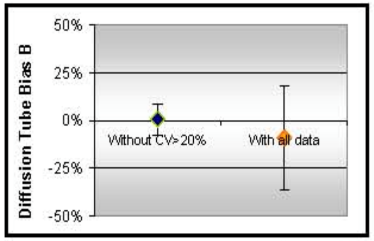
Site Name/ ID:

Precision 2 out of 3 periods have a CV smaller than 20%

(Check average CV & DC from Accuracy calculations)

Accuracy (with 95% confidence interval)
without periods with CV larger than 20%
Bias calculated using 2 periods of data
Bias factor A 0.99 (0.92 - 1.08)
Bias B 1% (-7% - 9%)
Diffusion Tubes Mean: 39 μgm^{-3}
Mean CV (Precision): 15 caution
Automatic Mean: 39 μgm^{-3}
Data Capture for periods used: 95%
Adjusted Tubes Mean: 38 (36 - 42) μgm^{-3}

Accuracy (with 95% confidence interval)
WITH ALL DATA
Bias calculated using 3 periods of data
Bias factor A 1.08 (0.84 - 1.54)
Bias B -8% (-35% - 20%)
Diffusion Tubes Mean: 33 μgm^{-3}
Mean CV (Precision): 26 caution
Automatic Mean: 36 μgm^{-3}
Data Capture for periods used: 95%
Adjusted Tubes Mean: 36 (28 - 51) μgm^{-3}



Jaume Targa
jaume.targa@aeat.co.uk
Version 03 - November 2006

Checking Precision and Accuracy of Triplicate Tubes

AEA Energy & Environment
From the AEA group

	Diffusion Tubes Measurements									Automatic Method		Data Quality Check	
Period	Start Date dd/mm/yyyy	End Date dd/mm/yyyy	Tube 1 µgm⁻³	Tube 2 µgm⁻³	Tube 3 µgm⁻³	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean	Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
1										41	95.4		Good
2										36	95.4		Good
3										31	93.4		Good
4	01/04/2009	28/04/2009	24.6	28.3	23.8	26	2.4	9	6.0	29	95.7	Good	Good
5	28/04/2009	03/06/2009	26.9	22.5	20.1	23	3.4	15	8.6	23	95.5	Good	Good
6	03/06/2009	30/06/2009	22.0	23.0	16.8	21	3.3	16	8.3	19	95.4	Good	Good
7	30/06/2009	29/07/2009	26.0	21.8	21.4	23	2.5	11	6.3	16	95.4	Good	Good
8	29/07/2009	01/09/2009	21.5	20.8	22.8	22	1.0	5	2.5	14	95.6	Good	Good
9	01/09/2009	30/09/2009	18.8	22.3	19.4	20	1.9	9	4.6	16	90.8	Good	Good
10	30/09/2009	02/11/2009	17.7	18.9	19.5	19	0.9	5	2.3	24	90.7	Good	Good
11	02/11/2009	30/11/2009	25.8	33.3	36.7	32	5.6	17	13.9	27	93.8	Good	Good
12	30/11/2009	07/01/2010	39.6	34.6	37.9	37	2.5	7	6.3	36	92.9	Good	Good
13													

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

Overall survey --> Good precision | Good Overall DC

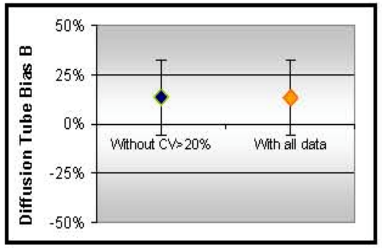
Site Name/ ID: Craig's Roundabout, Stirling

Precision 9 out of 9 periods have a CV smaller than 20%

(Check average CV & DC from Accuracy calculations)

Accuracy (with 95% confidence interval)
without periods with CV larger than 20%
Bias calculated using 9 periods of data
Bias factor A 0.92 (0.78 - 1.11)
Bias B 9% (-10% - 28%)
Diffusion Tubes Mean: 25 μgm^{-3}
Mean CV (Precision): 11 caution
Automatic Mean: 23 μgm^{-3}
Data Capture for periods used: 94%
Adjusted Tubes Mean: 23 (19 - 27) μgm^{-3}

Accuracy (with 95% confidence interval)
WITH ALL DATA
Bias calculated using 9 periods of data
Bias factor A 0.92 (0.78 - 1.11)
Bias B 9% (-10% - 28%)
Diffusion Tubes Mean: 25 μgm^{-3}
Mean CV (Precision): 11 caution
Automatic Mean: 23 μgm^{-3}
Data Capture for periods used: 94%
Adjusted Tubes Mean: 23 (19 - 27) μgm^{-3}



Jaume Targa
jaume.targa@aeat.co.uk
Version 03 - November 2006

NO_2 Tube Results

	Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09	Sep-09	Oct-09	Nov-09	Dec-09
Port St	57.9	28.2	35.8	39.1	29	33.8	34.9	31	22.4	23.3	37.2	67
Callander	33	13.8	18.9									
Br of Allan	50.4	37.5	20.7	23.7	22	22.9		26.8	25	20.8	36	39.2
Dunblane	35.9	23.6	13	16.1	13.5	12	15	16.1	14.1	13.8	21.3	37.7
Lochearn	12.4	4	4.3									
Aberfoyle	28.3	20.4	8.5									
Killearn	28.3	14.1										
C'barron	46.2	13.6	12.4									
Causeway	40.3	40.4	16.5									
Sp'kerse	52.6	32.9	12.8									
Port St 2	53.4	36.6	15.3	22.7	25.9	19.9	31.9	29.4	27		36.8	41.2
St Modans	67.7	34.7	22.2	19.6	20.4	18.8	16	16.4	12.4	15.4	27.5	28.5
Lennox	31.3	21.6		15	11.4	8.6	10.6	11.7	1	17.3	26.5	27.6
Craigs	109	19.3	15.7	28.2	28.2	27.5	28.9	28.2	23.7	24.7	27.7	49
Redland	41.2	26.1	15.3									
Ochilview	38.6	28.8	14.6									
Balfron	26.2	28.8	14.6									
Craigs A	37.1	29.5	34.4	24.6	26.9	22	26	21.5	18.8	17.7	25.8	39.6
Craigs B	48.8	40.4	16.9	28.3	22.5	23	21.8	20.8	22.3	18.9	33.3	34.6
Craigs C	39.5	37.5	15.3	23.8	20.1	16.8	21.4	22.8	19.4	19.5	36.7	37.9
Alloa Rd	19.7	36.3	35.2	30.4	29.6	30	27	25.1	26.5	21.1	39.1	33.7
Plean	42.4	42.2	24.4	18.5	17.3	17.2	16.8	15.6	13.9	6.2	27.8	38.9
Gowanhill	54.7	25.7										
Drip Rd	34	34.1	15.1									

Average between two dates and times (GMT)

Site name	Channel	Start date	Start time	End date	End time	Average	Data capture	U
Glasgow Waulkmillglen Reservoir	Nitrogen Dioxide	01/01/2009	0	31/12/2009	23	12	94	µg
Glasgow Waulkmillglen Reservoir	Nitrogen Dioxide	01/01/2009	0	31/03/2009	23	14	99.3	µg
Grangemouth	Nitrogen Dioxide	01/01/2009	0	31/12/2009	23	18	90.4	µg
Grangemouth	Nitrogen Dioxide	01/01/2009	0	31/03/2009	23	23	98.3	µg

	Jan - Dec 09 (Am)	Jan - Mar 09 (Pm)	Am/Pm
Glasgow Waulkmillglen Reservoir	12	14	0.86
Grangemouth	18	23	0.78
		Average:	0.82