



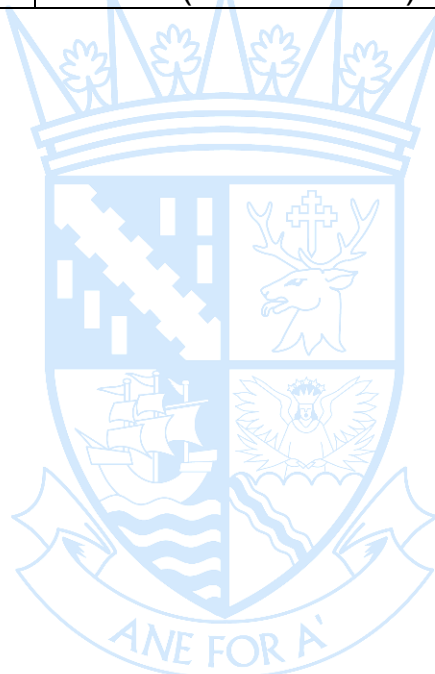
Falkirk Council

2012 Air Quality Updating and Screening Assessment

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

August 2012

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Executive Summary

Falkirk Council has examined the monitoring results for its area and concludes that no Detailed Assessments are required for any pollutant. The Grangemouth AURN (located in Inchyra Park) and Grangemouth Moray automatic sites, both within the Grangemouth SO₂ Air Quality Management Area, breached the 15-minute objective in 2011. The hourly and daily objectives were met at these two sites. The SO₂ monitoring sites outside the Grangemouth AQMA continue to meet all three objectives.

All sites except the Falkirk West Bridge St site met the Scottish PM₁₀ objectives in 2011. This site recorded a concentration of 18.7 µg/m³ and was close to recording a breach of the daily objective with a 98th percentile concentration of 49 µg/m³ (five daily exceedances were recorded). All sites met the UK / EU PM₁₀ objectives in 2011. As discussed in the Further Assessment report for Falkirk Town Centre and subsequent communications with the Scottish Government it will be proposed to Falkirk Council elected Members that the Falkirk Town Centre AQMA declaration be amended to include PM₁₀ and that the hourly NO₂ AQMA is revoked.

The NO₂ objectives were not breached at any of the automatic monitoring sites in 2011. Some diffusion tube sites breached the NO₂ annual objective in 2011 but most were in the Falkirk Town Centre or Haggs AQMAs. One tube, NA83, did record a breach of the objective with the R&A factor applied. However, with the more appropriate local roadside (Park St) factor and once the distance to the nearest receptor is taken account of there was no exceedance. The benzene and 1,3 butadiene non-automatic monitoring continues to show that the objectives were met in 2011 at locations where there are relevant receptors.

The Banknock PM₁₀ AQMA was declared in August 2011. Skene Group has disposed of their interest in Cowdenhill Quarry with operations ceasing in July 2011. Osiris monitoring continues, with a TEOM installation and the Further Assessment under way.

The remainder of the assessment required for an Updating and Screening Assessment has shown no requirement for a Detailed Assessment. Eleven DMRB runs were conducted for road traffic emissions and showed no breaches of the NO₂ or PM₁₀ objectives. Emissions from other transport sources did not require further consideration.

There were no significant changes to industrial emissions although three biomass operations are proposed (but have not been granted planning permission yet). The changes to quarry operations in the Banknock PM₁₀ AQMA have been noted with monitoring continuing in the area and the Further Assessment underway. It is considered that cumulative effects of small biomass boilers do not need to be looked at further. The review found no requirement for a Detailed Assessment for any pollutant.

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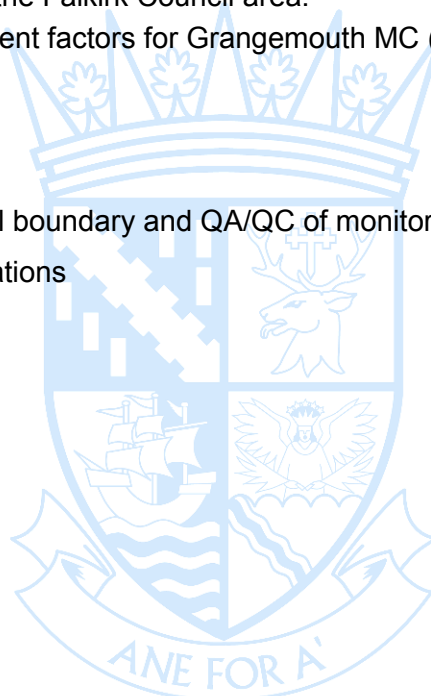
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Abbreviations

AADT	Annual Average Daily Traffic (flow)
AQMA	Air Quality Management Area
ATD	Atomic Thermal Desorption
AURN	Automatic Urban and Rural Network
DA	Devolved Administration
DMRB	Design Manual for Roads and Bridges
FDMS	Filter Dynamics Measurement System
HDVs	Heavy Duty Vehicles
LAQM	Local Air Quality Management
LSO	Local Site Operator
MOVA	Microprocessor Optimised Vehicle Actuation
n/a	not applicable
n/m	not measured
NO ₂	Nitrogen dioxide
PM _{10 / 2.5}	Particulate matter (less than 10 / 2.5 µm in diameter)
PR	Progress Report
QA/QC	Quality Assurance / Quality Control
PPC	Pollution, Prevention and Control (Regulations)
R&A	Review and Assessment (Helpdesk, run by Defra / DAs)
SAQN	Scottish Air Quality Network
SEPA	Scottish Environmental Protection Agency
SO ₂	Sulphur dioxide
TEOM	Tapered Element Oscillating Microbalance.
U&SA	Updating and Screening Assessment
VCM	Volatile Correction Model

1 Introduction

1.1 Description of Local Authority Area

Falkirk Council is a unitary authority located in Central Scotland, see Figure A1. The Falkirk Council area encompasses 290 square kilometres with a population of approximately 151,000. The area extends from Banknock in the west to Blackness in the east and from South Alloa in the north to Limerigg in the south. It is bordered by the local authorities of North Lanarkshire, Stirling and West Lothian, with Clackmannanshire and Fife located on the north side of the Firth of Forth.

The area contains the port of Grangemouth and depends for its prosperity on a broad industrial base which includes sizeable industrial areas in Falkirk and Grangemouth. These industrial areas are diverse and vary from an oil refinery, associated chemical industry and dockland in Grangemouth through to bus manufacturing in Camelon (Falkirk). The main towns and population base in the area are Bo'ness, Denny, Falkirk, Grangemouth and Larbert with the south of the area around Slamannan being more rural in nature.

Three motorways pass through the area, the M80, M876 and M9, in addition to the main rail line connecting Glasgow and Edinburgh and the rail lines connecting Glasgow / Edinburgh with Stirling and the north. The area also contains the Falkirk wheel which connects the Union canal with the Forth and Clyde canal.

1.2 Purpose of Report

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

The aim of an Updating and Screening Assessment (U&SA) is to identify any matters that have changed which may lead to risk of an air quality objective being exceeded. A checklist approach and screening tools are used to identify significant new sources or changes and whether there is a need for a Detailed Assessment.

Note that the Local Air Quality Management process is separate and has different rules to those that the UK Government is required to use when reporting data and compliance to the European Union.

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 $\mu\text{g}/\text{m}^3$ (and milligrammes per cubic metre, mg/m^3 for carbon monoxide) with the number of exceedances in each year that are permitted (where applicable).

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

Pollutant	Concentration	Measured as	Compliance date
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 (PM_{10} , gravimetric)	50 $\mu\text{g}/\text{m}^3$, not to be exceeded more than 35 times a year	24-hour mean	31/12/2004
	40 $\mu\text{g}/\text{m}^3$	Annual 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
	18 $\mu\text{g}/\text{m}^3$	Annual mean	31/12/2010
Sulphur dioxide	266 $\mu\text{g}/\text{m}^3$, not to be exceeded more than 35 times a year	15-minute mean	31/12/2005
	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

1.4 Summary of Previous Review and Assessments

A summary of work in the last three years is provided in this Section.

Revised Detailed Assessment of Banknock, May 2009

Following the Scottish Government's appraisal of the original Banknock Detailed Assessment, a revised report was submitted. This considered emissions of PM₁₀ and NO₂ from road traffic emissions in Haggs and Banknock. Following completion of a full year of automatic NO₂ monitoring at Kerr Crescent in Haggs a revised model assessment was undertaken. The revised atmospheric dispersion model included the high level of HGV traffic accessing the nearby quarry in Banknock and the traffic flows along the A80. The monitoring results and modelling assessment indicated that there were exceedances of the annual mean NO₂ objective at locations of relevant exposure in Haggs and Banknock. There were no predicted exceedances of the annual mean or 24-hour mean objectives for PM₁₀.

It was recommended that the automatic analyser at Kerr Crescent be maintained and additional diffusion tube monitoring was undertaken on the north side of Kilsyth road. It was concluded that there was a requirement for an AQMA to reflect the exceedances of the annual mean NO₂ objective. At the time of writing the Council is awaiting the Scottish Government's appraisal of this report.

For text in this section, 1.4, to this point: reference 1.

Consultation on the declaration of two AQMAs for NO₂ in Falkirk town centre, May 2009

Following analysis of the results of additional NO₂ monitoring and a Detailed Assessment of road traffic in Falkirk town centre, Falkirk Council identified measured exceedances of the annual mean NO₂ objective and modelled exceedances of the 1-hour mean objective.

Grangemouth AQMA Action Plan Update, May 2009

As recommended by the Review and Assessment Helpdesk, Falkirk Council submitted a separate report detailing the progress made with the Action Plan for the Grangemouth AQMA. The key measures of this Action Plan include the continuation of the text alert system for SEPA and INEOS and the extension of the working group to include INEOS and the Scottish Government. In addition, work is currently underway on a revised Further Assessment, this will provide improved modelling for the Grangemouth area and discuss the SO₂ monitoring data collected by the Council.

2009 Updating and Screening Assessment, August 2009

A review of pollutant monitoring data and atmospheric emissions sources within Falkirk Council area has been undertaken. The assessment compared the available monitoring data to national air quality standards (NAQS) in order to identify any existing exceedances of the standards.

The review of emission sources identified that emissions from shipping, rail, road traffic, domestic and industrial emissions had not changed significantly since the last round of review and assessment.

NO₂ concentrations measured during 2008 exceeded annual mean NAQS objective at some monitoring locations in Falkirk town centre. Falkirk Council is currently undertaking a consultation on the boundaries for two proposed Air Quality Management Areas (AQMA) within Falkirk.

NO₂ concentrations measured during 2008 exceeded the annual mean NAQS objective at the automatic monitoring site in Haggs. A Detailed Assessment submitted in May 2009 is currently being appraised by the Scottish Government. This report concluded that an AQMA would be required for NO₂ around the A80 slip road junction in Haggs / Banknock.

Monitoring of SO₂ within the Grangemouth AQMA indicates that the 15-minute mean SO₂ objective continues to be exceeded. In addition, the number of SO₂ exceedances has increased since 2006. The Action Plan update therefore concluded that the AQMA is still required. Monitoring of PM₁₀, benzene and 1,3-butadiene indicates that concentrations are below the NAQS objective levels and there are no predicted exceedances for the objective year of 2010.

Additional Further Assessment for the Grangemouth AQMA, April 2010.

An additional Further Assessment for the Grangemouth AQMA was submitted, this executive summary was shown in Section 6 of the 2010 Progress Report (PR). Included as part of this report were polar roses (wind direction and speed versus concentration) plotted by Falkirk Council using Openair. This provided further insights into the monitoring data and was presented to the working group meeting for the AQMA in February 2010.

Progress Report 2010

A review of Falkirk Council's monitoring data for 2009 showed that the 15-minute objective continued to be breached in the Grangemouth AQMA. In 2009 the Grangemouth Moray site recorded 65 exceedances. This is greater than the 35 allowed by the objective. All SO₂ monitors outside the AQMA met the 15-minute objective, with all sites meeting the hourly and daily SO₂ objectives. A breach of the 2010 annual PM₁₀ objective was recorded at the Falkirk West Bridge St site in 2009. This result will be used in the Falkirk Town Centre Further Assessment. Therefore the Council will wait for this report to be completed before considering whether to adjust the current AQMA.

Since the 2009 U&SA Falkirk Council has declared three AQMA for NO₂, two are in Falkirk Town Centre and one in the Haggs and Banknock area. In addition, the Banknock area near Cowdenhill Quarry remains subject to a Detailed Assessment for PM₁₀. An Action Plan update for the Grangemouth AQMA was given. Falkirk Council continues to work on the measures outlined in the plan. In addition, a statement by INEOS about their tail gas treatment and other SO₂ emission reduction work was also included the report.

It was concluded that no new Detailed Assessments were required, as exceedances of any objectives are covered by existing Detailed or Further Assessments, AQMAs or there are no relevant receptors.

A review of changes to local emission sources indicated a number of roads were identified where Heavy Duty Vehicles (HDVs) accounted for 20% more of the total traffic flows. However, no Detailed Assessment is required for these or any other transport, industrial or domestic developments since the 2009 U&SA.

Progress Report 2011

Falkirk Council has examined the monitoring results for its area and concludes that no Detailed Assessments are required for any pollutant.

As in previous years a breach of the 15-minute SO₂ objective was recorded in 2010 at the Grangemouth Moray site. This site is within the Grangemouth AQMA, which was declared in November 2005 and for which an Action Plan is in place. The Grangemouth AURN site also recorded a breach of the objective. This is understood to be the first breach of the 15-minute SO₂ objective at an AURN site. The sites outside the AQMA continue to meet the objectives, including the new Polmont site. The work in relation to the Grangemouth AQMA continues as per the Action Plan. The INEOS Tail Gas Treatment work that was described in the 2010 Progress Report was granted planning permission in December 2010.

The Falkirk Town Centre and Haggs Further Assessments have been submitted. A breach of the Scottish annual PM₁₀ objective was recorded at the Falkirk West Bridge St site in 2010. As a result of these reports it is proposed that NO_x monitoring will cease and PM₁₀ monitoring will commence at Falkirk Grahams Rd. PM₁₀ monitoring may also commence at the Haggs site as result of the Further Assessment. At the time of writing the Scottish Government has rejected the Falkirk Town Centre Further Assessment, therefore no recommendation can be made in relation to the Falkirk Town Centre AQMAs. The development of the Action Plans for these AQMAs continues.

The benzene and 1,3 butadiene diffusion tubes continue to show that the objectives were met in 2010 at locations where there are relevant receptors. Monitoring will continue at Denny Cross and Glensburgh Road for NO₂ and an additional benzene tube has been located at Kinneil Kerse.

A review of the road traffic flow data available for the Falkirk Council area has highlighted one road that has shown an increase in traffic but according to the guidance does not need considering further. Changes to Pollution, Prevention and Control (PPC) permits in Falkirk Council area were discussed and did not need to be considered further.

An AQMA for PM₁₀ in Banknock has been approved in principal by elected Members and a consultation conducted.

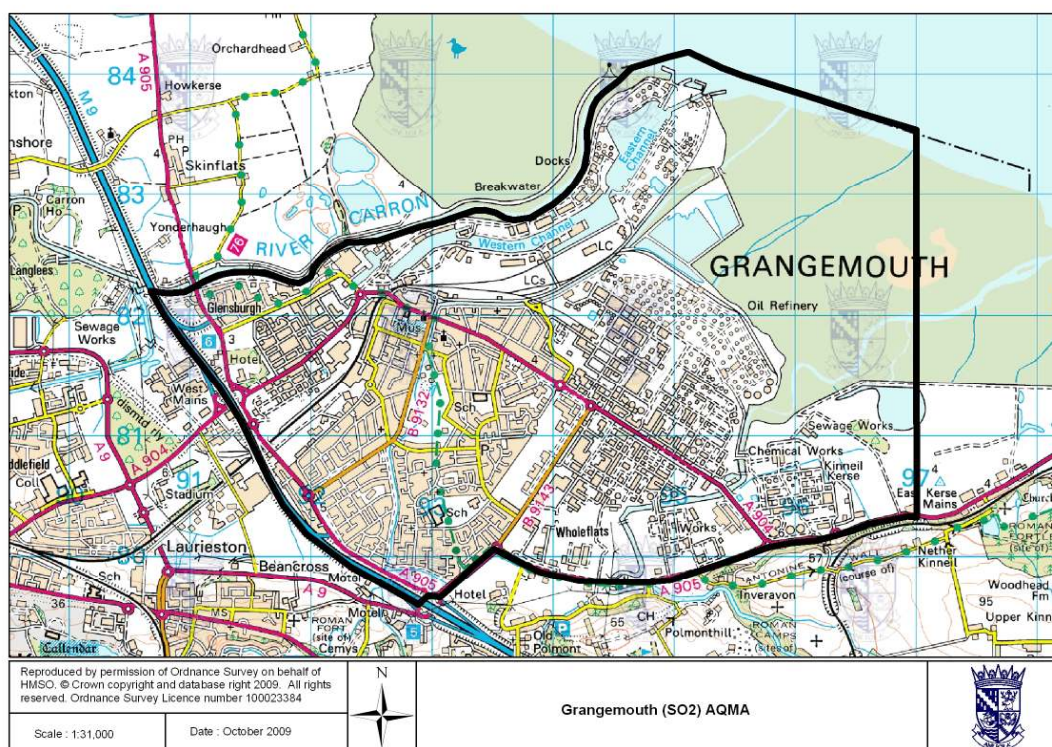
AQMAs

Falkirk Council declared an AQMA for a likely breach of the 15-minute SO₂ objective in the Grangemouth area in November 2005, see Figure 1.1a. This AQMA is in relation to industrial emissions.

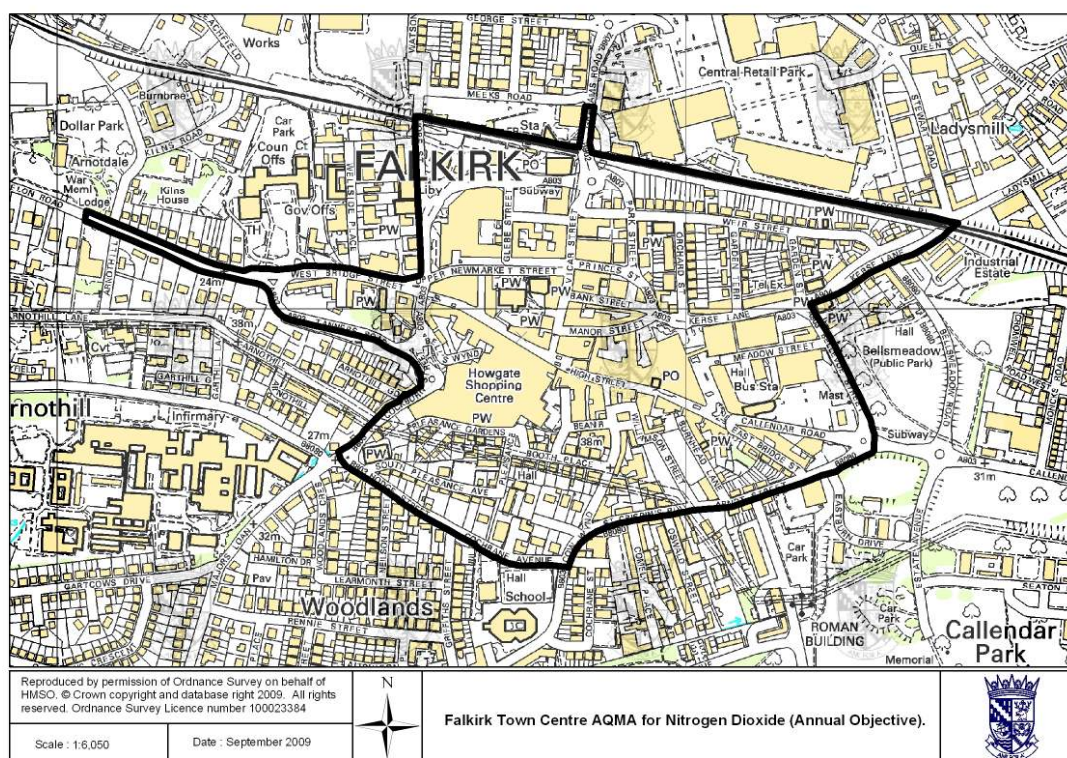
Falkirk Council declared AQMAs for NO₂ in Falkirk Town Centre and Haggs in March 2010, see Figures 1.1b to d. An AQMA was declared in the Banknock area in August 2011 in relation to breaches of the Scottish and potential breaches of the UK PM₁₀ objectives, see Figure 1.1e. An update on all AQMAs and / or Action Plans is given in Section 8.

Figure 1.1 Maps of AQMA Boundaries

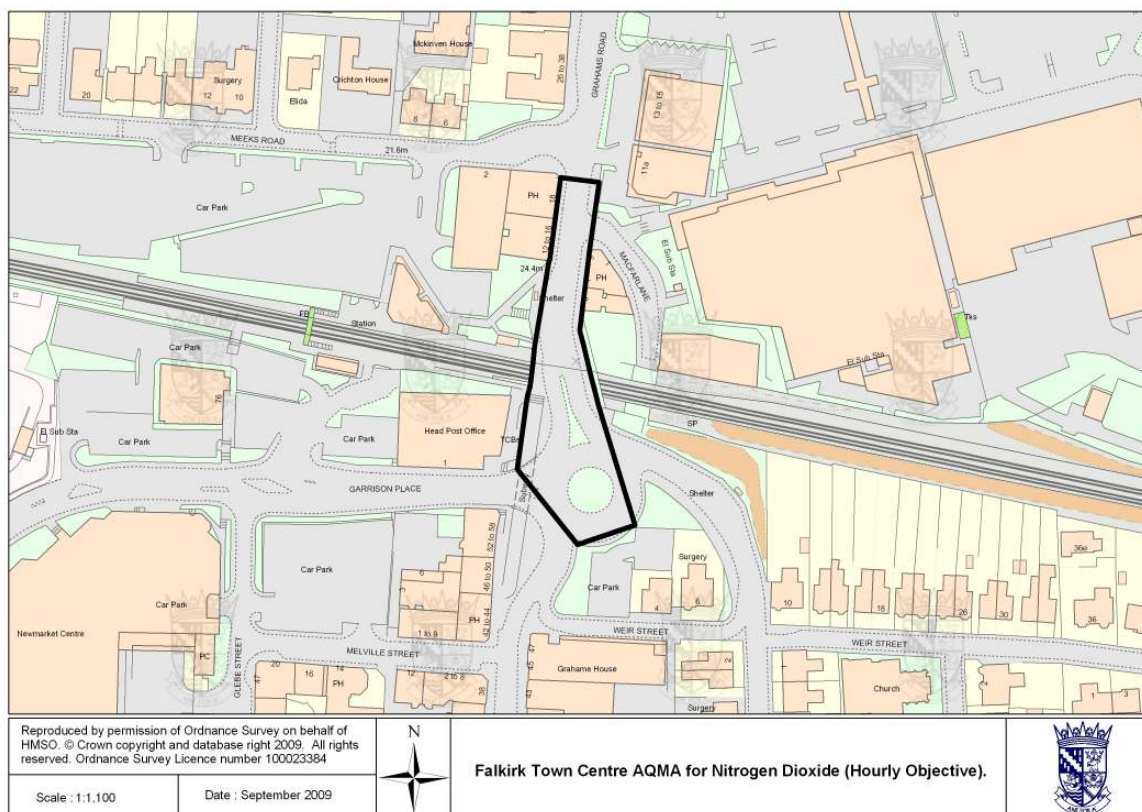
a.) Grangemouth AQMA, declared November 2005.



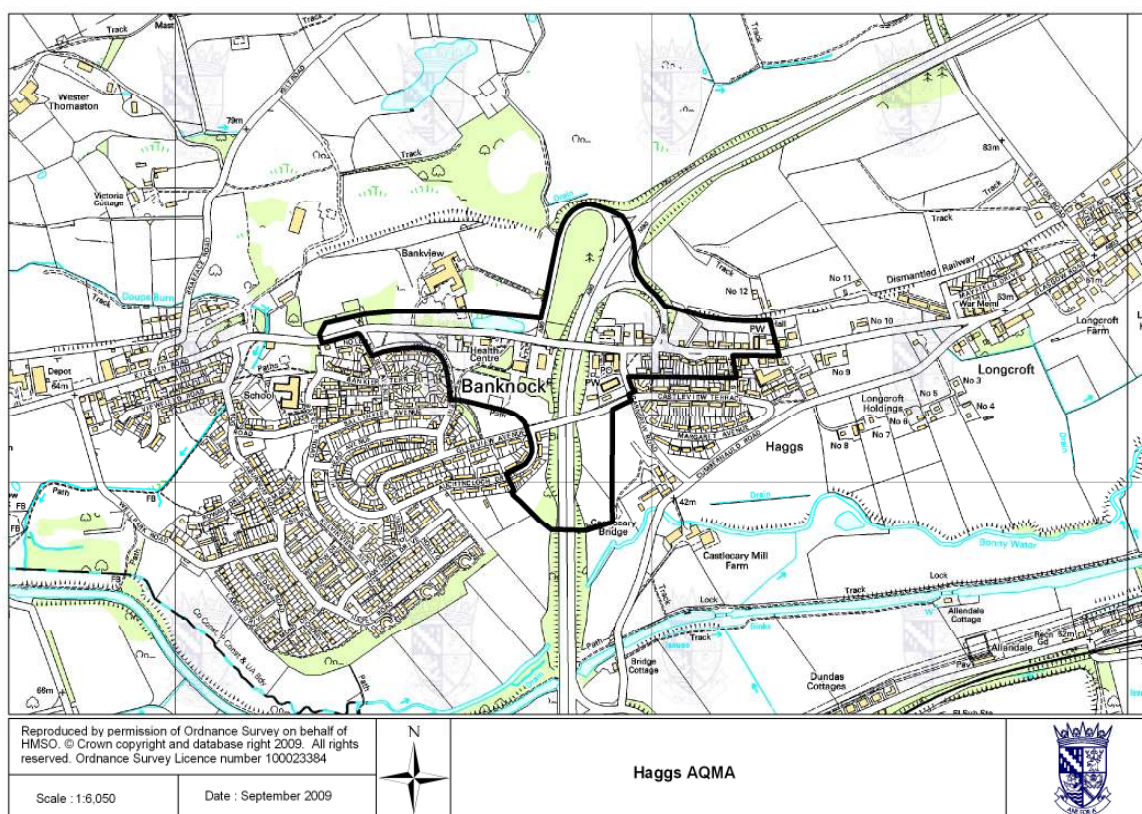
b.) Falkirk Town Centre AQMA (annual NO_2), declared March 2010.



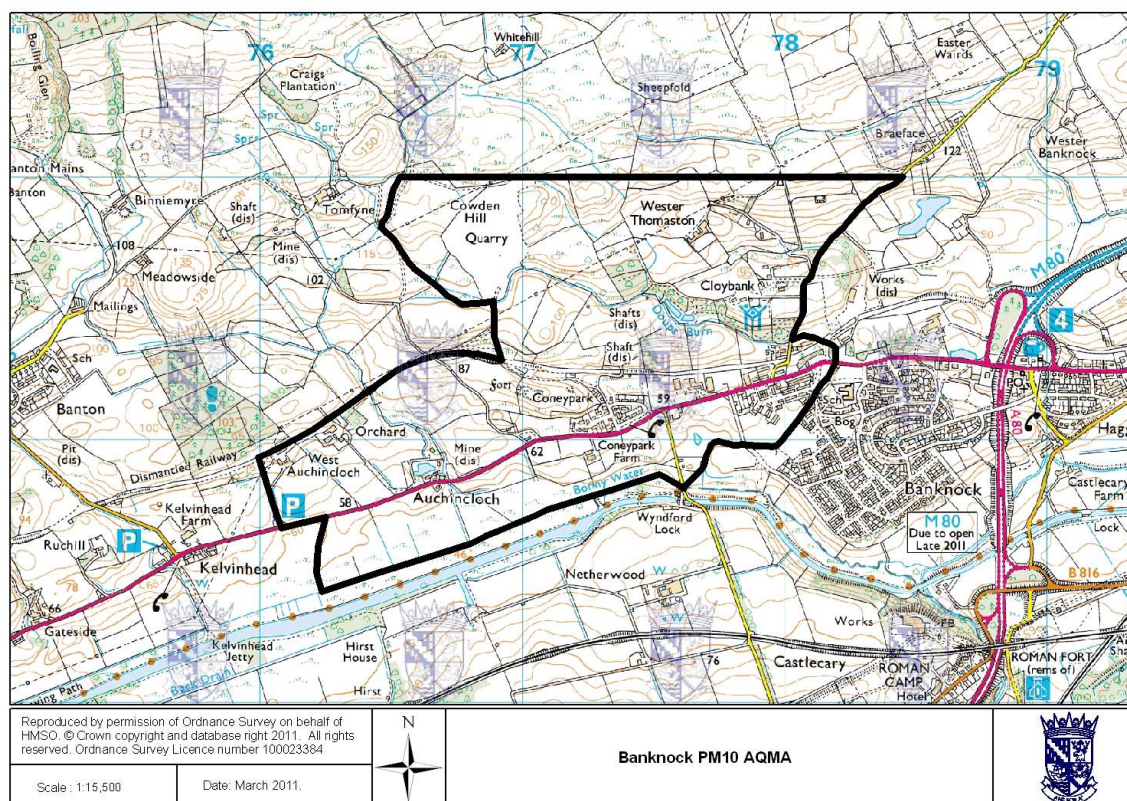
c.) Falkirk Town Centre AQMA (hourly NO_2), declared March 2010.



d.) Banknock and Haggs AQMA (annual NO₂), declared March 2010.



e.) Banknock AQMA (PM₁₀), declared August 2011.



2 New Monitoring Data

2.1 Summary of Monitoring Undertaken

2.1.1 Automatic Monitoring Sites

In 2011 Falkirk Council operated automatic monitoring stations at 11 locations from Banknock in the west to Bo'ness in the east. The automatic monitoring was conducted for the following pollutants: PM_{2.5}, PM₁₀, NO₂ and SO₂. Falkirk Council operates two sites that are affiliated to the UK Automatic Urban and Rural Network (AURN): the Grangemouth (Inchyra Park) site (NO_x, SO₂, PM₁₀^{*}, PM_{2.5}^{*}, and a pumped benzene diffusion tube*) and the Grangemouth Moray site (NO_x). AURN data is used as part of the UK's reporting to the EU. The remaining analyser at the Grangemouth Moray site (SO₂), along with five other monitoring sites, is affiliated to the Scottish Air Quality Network (SAQN). The four remaining sites are not affiliated to either network. The details of the QA / QC and network affiliation for each monitoring site and analysers are shown in the Appendix, Table A2.

There have been no new monitoring sites installed in 2011. However, the following changes have been made to the automatic monitoring network:

- Falkirk Hope St (PM₁₀ TEOM): ceased operation in October 2011 as the PM₁₀ objectives have been met at this site for the last three years.
- Grangemouth Moray (PM₁₀ TEOM): ceased operation in October 2011 as the PM₁₀ objectives have been met at this site for the last three years.
- Falkirk Grahams Road (NO_x and PM₁₀ TEOM): The NO_x analyser at this site was installed in relation to the potential breach of the hourly NO₂ objective. The monitoring showed that the hourly objective is being met, thus the analyser ceased operation in September 2011. A PM₁₀ (TEOM) commenced operation on 20th December 2011. The PM₁₀ monitoring results are not reported for this analyser given the short period of monitoring.
- In February 2012 the analysers at the Grangemouth AURN (NO_x and SO₂) and Grangemouth Moray (NO_x) sites were replaced as part of a Defra / DA led programme to upgrade the AURN affiliate analysers. This was part of a UK wide programme to ensure that these analysers are compliant with the standards required for submitting monitoring data to the EU. These requirements are not relevant to LAQM analysers as the data is not submitted to the EU.

The following changes to the monitoring network that are currently scheduled are:

- Haggs: A PM₁₀ TEOM is due to commence operation following the Further Assessment report.
- Banknock: A PM₁₀ TEOM is due to commence operation to contribute to the Further Assessment report.

* Defra / DA owned equipment.

Table 2.1 Details of Automatic Monitoring Sites

Site Number and Name	Site Type	OS Grid Ref	Pollutants Monitored	Technique / Equipment Supplier	In AQMA?	Relevant exposure?	Distance to kerb of road, m.	Represent worst-case exposure?
A2. Banknock 1	Roadside.	277348	PM ₁₀	Osiris	Y (PM ₁₀)	Y (1 m)	6 m	N
A3. Bo'ness	Urban background / industrial.	299815	SO ₂	Horiba	N	Y (5 m)	22 m *	N #
A4. Falkirk Haggs	Roadside.	278977	NO ₂	ML	Y (NO ₂)	Y (5 m)	2 m	Y
A5. Falkirk Hope St	Roadside.	288688	NO ₂ , SO ₂ , PM ₁₀ .	NO _x and SO ₂ : Horiba, PM ₁₀ : TEOM.	Y (NO ₂) Proposed PM ₁₀ .	Y (1 m)	5 m	N @
A6. Falkirk Park St	Roadside.	288892	NO ₂ , SO ₂ , PM ₁₀ .	NO _x and SO ₂ : Horiba, PM ₁₀ : TEOM.	Y (NO ₂), proposed PM ₁₀ .	Y (1 m)	5 m	Y
A7. Falkirk West Bridge St	Roadside.	288457	NO ₂ , PM ₁₀	NO _x : ML, PM ₁₀ : TEOM.	Y (NO ₂), proposed PM ₁₀ .	Y (1 m)	2 m	Y
A8. Grangemouth AURN (Inchyra Park)	Urban background / industrial.	293830	Benzene, NO ₂ , PM ₁₀ , PM _{2.5} , SO ₂ .	Benzene (pumped tube), PM: FDMS. NO _x and SO ₂ : ML.	Y (SO ₂)	Y (5 m)	20 m	Y
A9. Grangemouth Moray	Urban background / industrial.	293469	NO ₂ , SO ₂ , PM ₁₀ .	SO ₂ and NO _x : Horiba, PM ₁₀ : TEOM.	Y (SO ₂)	Y (1 m)	25 m	Y
A10. Grangemouth Municipal Chambers	Urban background / industrial.	292816	NO ₂ , SO ₂ , PM ₁₀ .	NO _x and SO ₂ : Horiba, PM ₁₀ : TEOM.	Y (SO ₂)	Y (1 m)	40 m	Y
A11. Polmont	Urban background.	293483	SO ₂	SO ₂ : Horiba.	N	Y (1 m)	35 m *	N #
A12. Falkirk Grahams Rd	Roadside.	288823	NO _x , PM ₁₀	NO _x : ML, PM ₁₀ : TEOM.	Y (NO ₂), proposed PM ₁₀ .	Y (1 m)	10 m	N

Note: * Stated but not relevant to the pollutant and / or reason for monitoring.

Location not designed to represent worst case exposure but to confirm boundaries of Grangemouth AQMA.

@ Distances to relevant exposure may not apply to all pollutants, due to shorter time period for SO₂.

2.1.2 Non-Automatic Monitoring Sites

In 2011 Falkirk Council monitored nitrogen dioxide at 73 locations, benzene at 23 locations and 1,3 butadiene at seven locations using non-automatic methods (i.e. diffusion tubes). The increase in the number of locations is due to several site changes occurring and these are listed below. A benzene pumped diffusion tube (Defra / DA equipment) was also in operation at the Grangemouth AURN (A8) site. From 2012 the number of sites using tubes for monitoring benzene and 1,3 butadiene has decreased as the results obtained continue to be well within the objective.

Details of the type of tubes used and the QA / QC are given in the Appendix. Monitoring has ceased at the following non-automatic sites since the 2011 Progress Report:

- NA10 Muirhall Road, Larbert (NO₂): No longer considered necessary, within objective.
- NA27 West Bridge St (1,3 butadiene): No longer considered necessary, within objective.
- NA42 Municipal Chambers, Grangemouth (1,3 butadiene): No longer considered necessary, within objective.
- NA45 Northern Distributor Road, Bainsford: No longer considered necessary as no receptors at site. Site NA48 (Hayfield) remains in place that represents relevant receptors in the area and site NA103 (Merchiston Gardens) commenced operation representing receptors behind this road.
- NA49 Lennox Terrace, Grangemouth (NO₂ and 1,3 butadiene): background site, no longer considered necessary.
- NA55 Inchyra station (NO₂): with AURN automatic NO_x monitor at site, single tube not considered necessary.
- NA57 Inchyra Road (1,3 butadiene): No longer considered necessary, within objective.
- NA66 Holehouse, Slamannan (NO₂, benzene): rural site. Moved to a location closer to the remainder of the diffusion tube network but still relatively rural.
- NA74 Hope St AQ station (NO₂): with automatic NO_x monitor at site, single tube not considered necessary. Benzene: objectives being met so no longer necessary.
- NA79 Gartcows Road, Falkirk (NO₂): No longer considered necessary, site meeting objectives.
- NA84 Carriden Brae, Bo'ness (NO₂): No longer considered necessary, site meeting objectives.
- NA91 Grahams Rd bridge west, Falkirk (NO₂): This site is not considered necessary with the likely revocation of the hourly AQMA. Two sites remain in the area.
- NA92 Cochrane Avenue, Falkirk (NO₂): No longer considered necessary as the site is meeting the objectives.

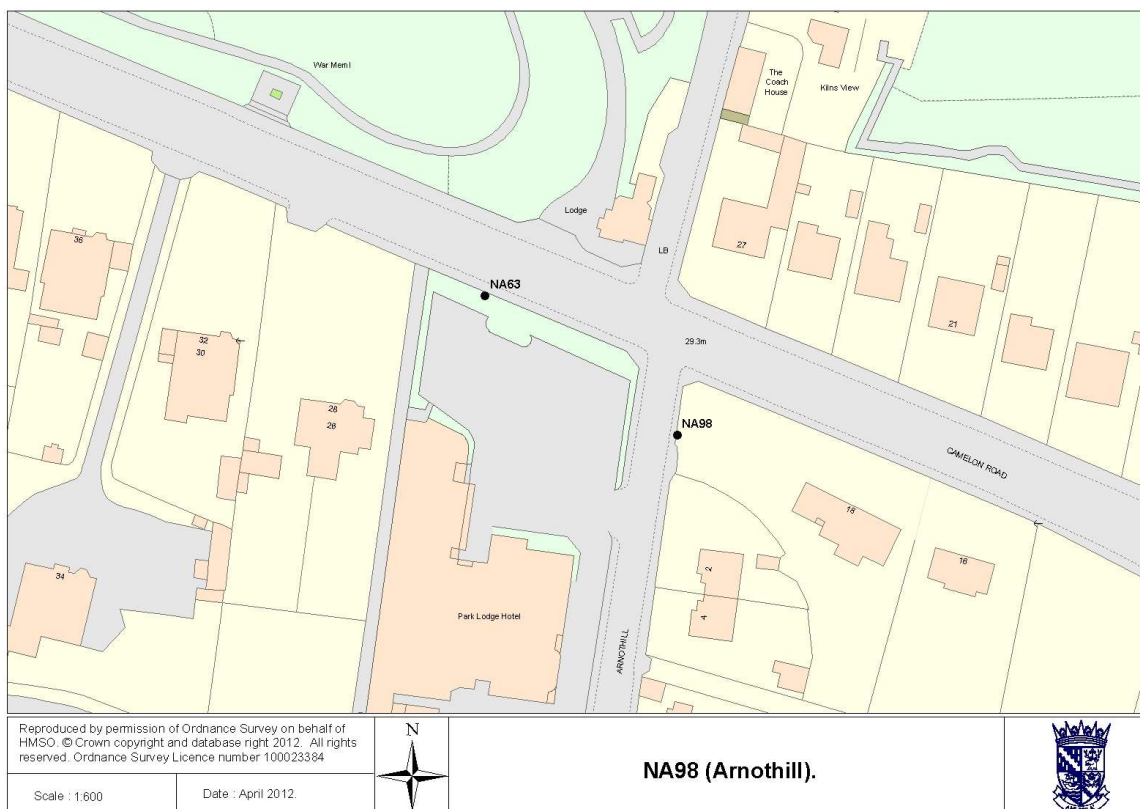
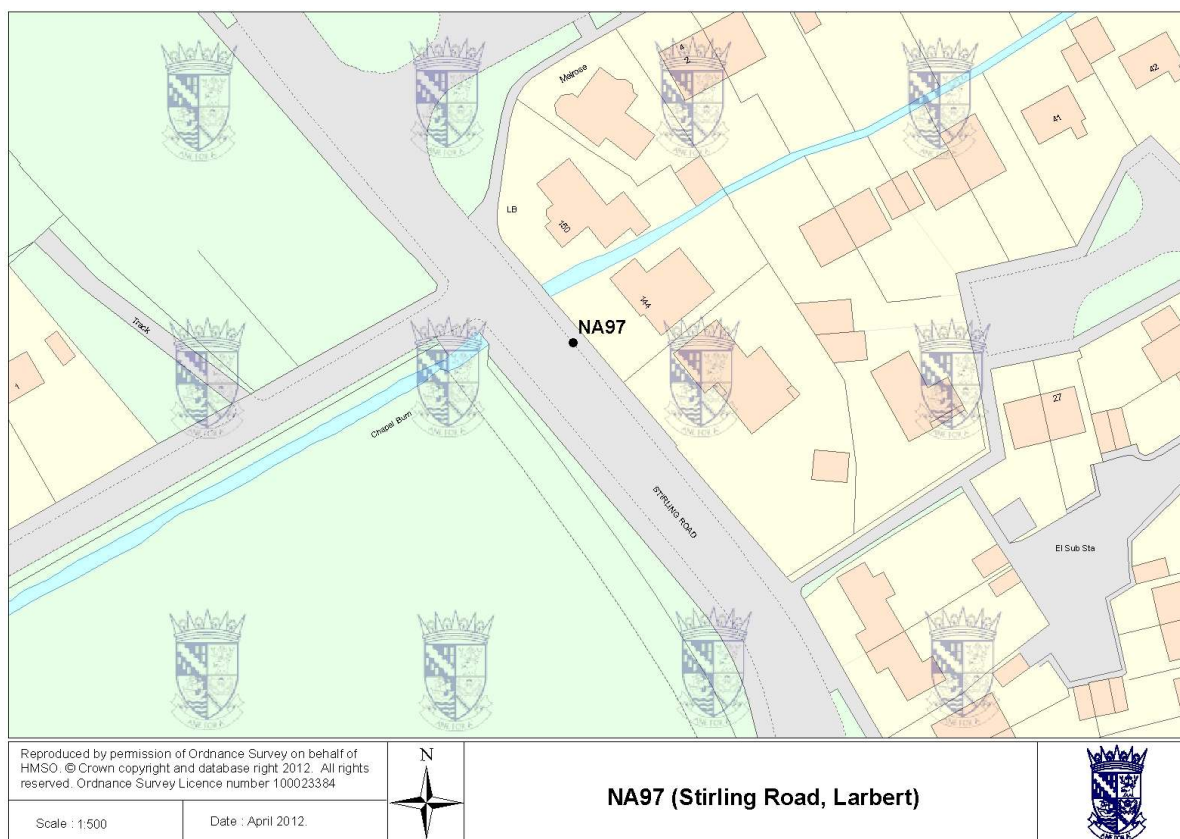
In 2011 the following non-automatic sites commenced operation, with their locations shown in Figure 2.2:

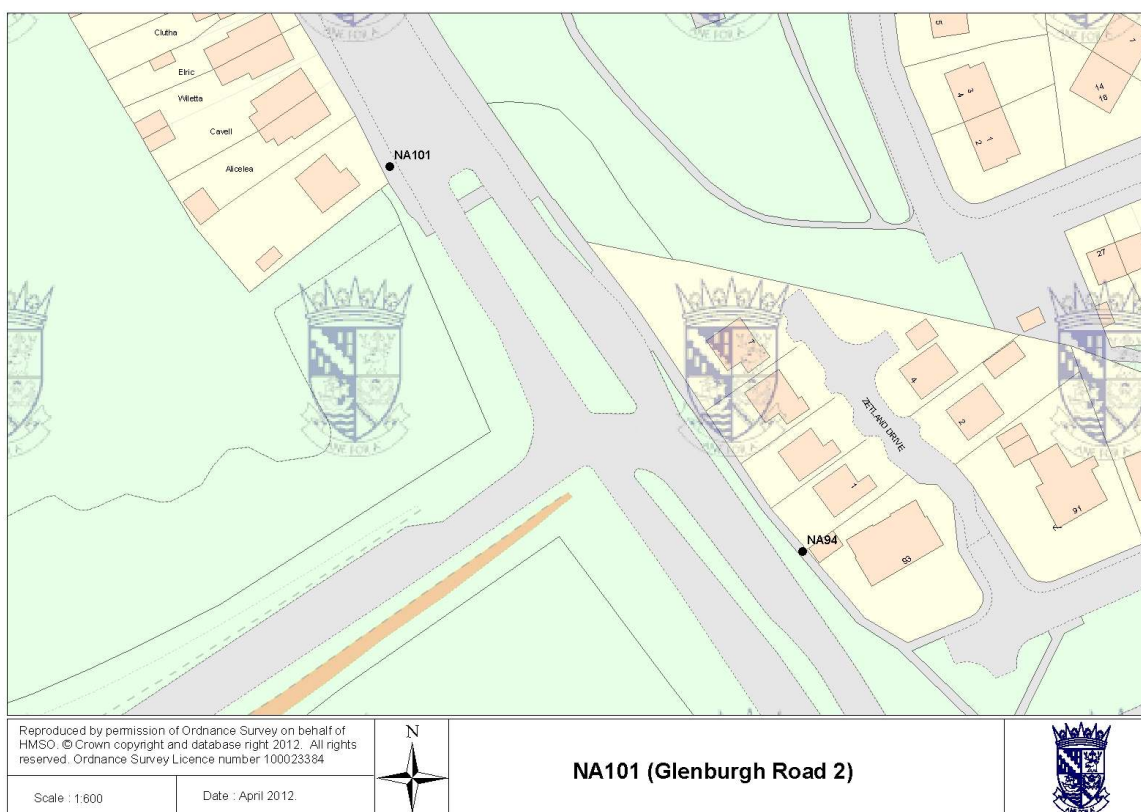
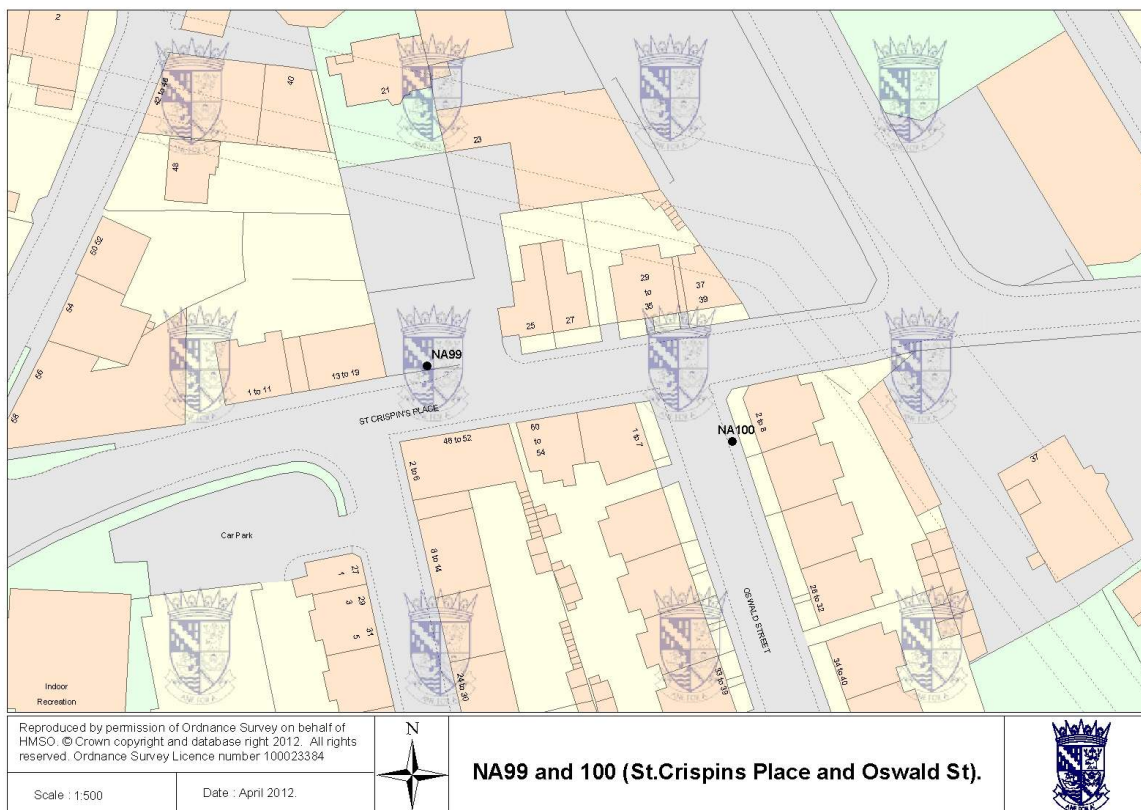
- NA97 Stirling Road, Larbert (NO₂): In vicinity of the new Forth Valley Royal Hospital.
- NA98 Arnothill, Falkirk (NO₂): New site following Falkirk Town Centre Further Assessment.
- NA99 St Crispin's Place, Falkirk (NO₂): New site following Falkirk Town Centre Further Assessment.
- NA100 Oswald St, Falkirk (NO₂): New site following Falkirk Town Centre Further Assessment.
- NA101 Glensburgh Road 2, Grangemouth (NO₂): opposite side to tube NA95 which is recording elevated NO₂ concentrations.
- NA102 East Kerse Mains, Bo'ness (benzene): Monitoring not conducted in this location before. The site is not immediately next to receptors, but represents the general area and for operational safety is considered suitable.
- NA103 Merchiston Gardens (NO₂): represents receptors in vicinity of northern distributor road.
- NA104 Powdrake Road, Grangemouth (1,3 butadiene): considered to be closest receptor to the refinery.
- NA105 West of Shieldhill (NO₂ and benzene): replacement rural site for NA66.

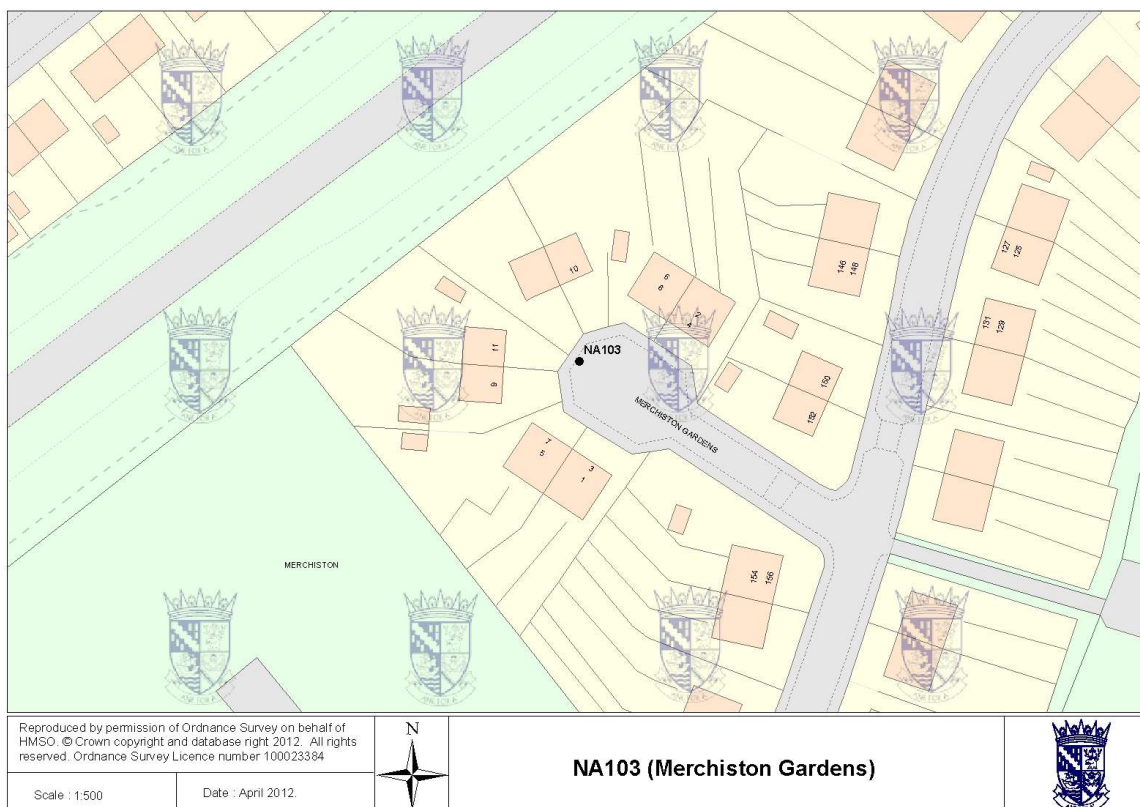
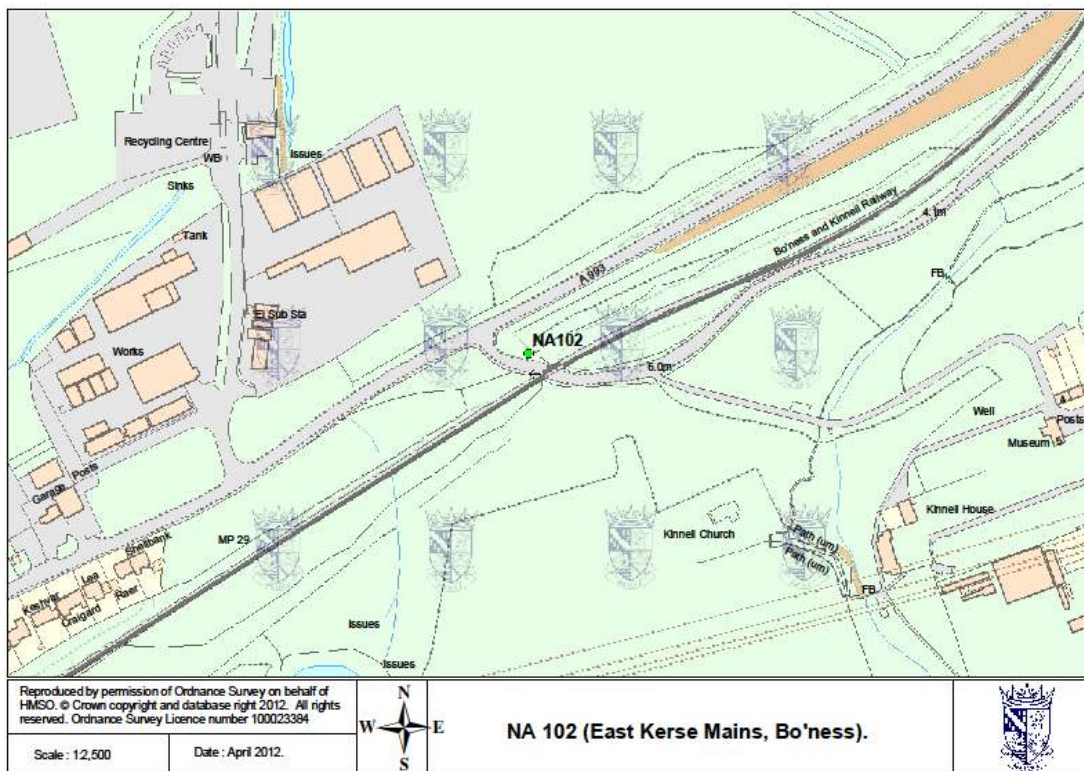
Falkirk Council carried out two triplicate studies in 2011. This involves three NO₂ diffusion tubes being co-located along with an automatic monitoring station. This enables the diffusion tube results to be bias adjusted accounting for their difference to an automatic monitor. One was carried at the Grangemouth Municipal Chambers site (NA42 / A10), an urban background site. The second was carried at the Falkirk Park St site (NA70 / A6), a roadside site, with results from both sites contributing to the R&A bias factor for 'Harwell Scientifics' (now part of Environmental Scientifics Group).

The local and R&A Helpdesk bias adjustment factors suggest that the diffusion tubes over-read NO₂ compared to the automatic monitors. Falkirk Council has used the R&A helpdesk factor for the 2011 results as there are a mixture of roadside and background sites. However, it should be noted that when this factor is used for the roadside sites the result is conservative (i.e. a higher concentration is stated) for these diffusion tubes. This is because in 2011 the R&A factor was noticeably higher than the Park St factor, 0.84 vs 0.77, see Appendix for calculations.

Figure 2.2 Maps of new Non-Automatic Monitoring Sites







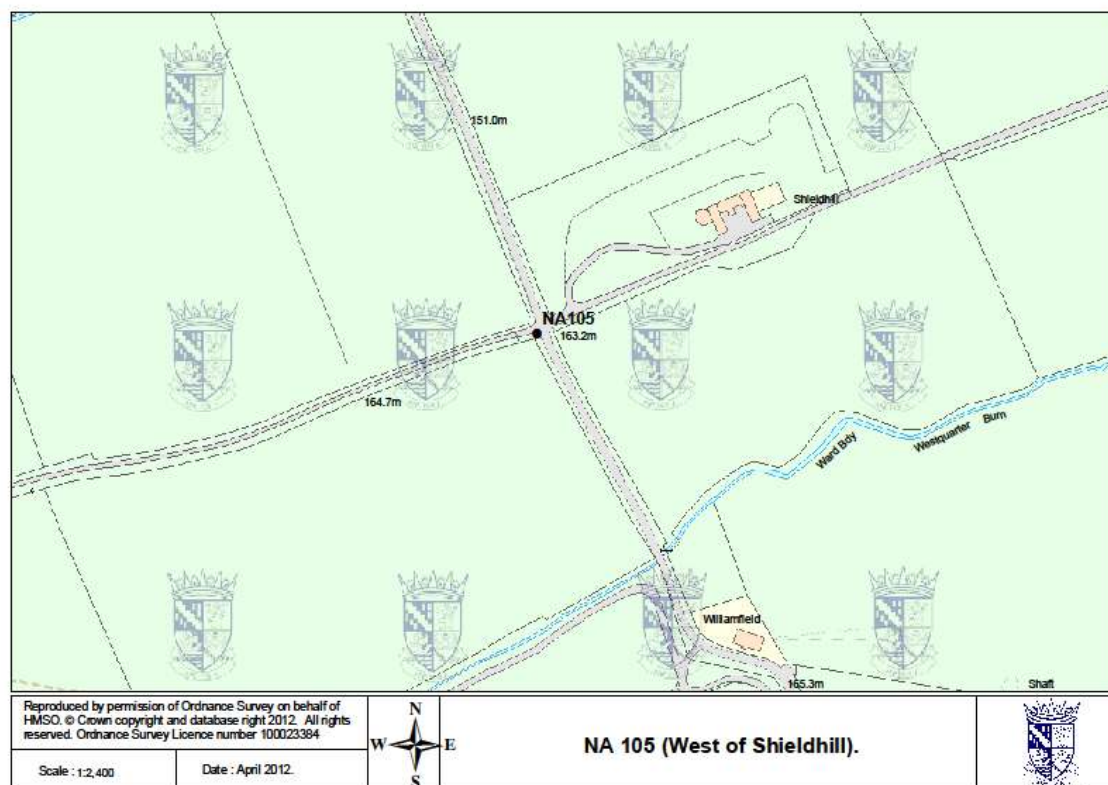
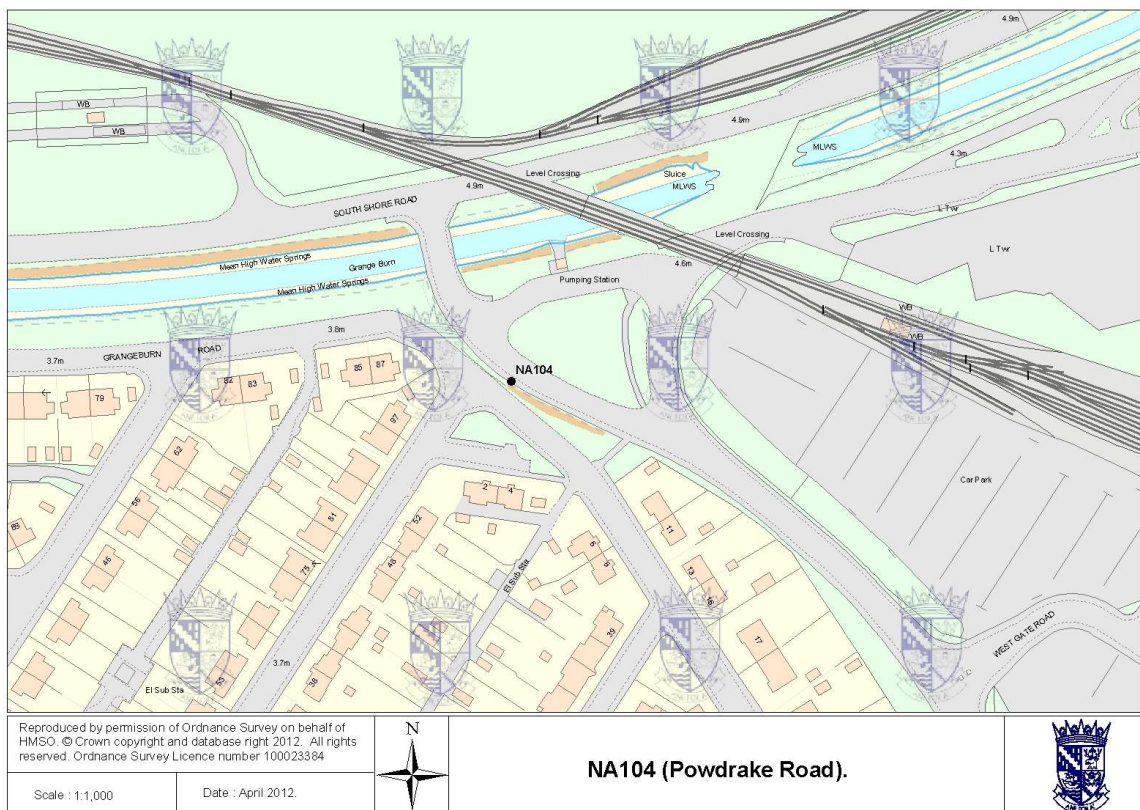


Table 2.2 Details of Non-Automatic Monitoring Sites

Site	Location	Site Type	OS Grid Ref (x, y)		Pollutants Monitored	In AQMA?	Relevant exposure? (m)	Distance to kerb (nearest road), m.	Worst-case Location?
NA3	Tinto Drive, Grangemouth.	Urban background.	293427	680386	NO ₂ .	Y (SO ₂).	Y (<5)	<10	N
NA5	Copper Top pub, Camelon.	Roadside.	287332	680333	NO ₂ .	N	Y (<2)	0.6 (traffic island)	Y
NA7	Irving Parish Church, Camelon.	Urban background.	287324	680442	NO ₂ .	N	Y (<5)	<10	N
NA9	Bellsdyke Rd, Larbert.	Roadside.	286048	683542	NO ₂ .	N	Y (<2)	0.7	Y
NA10	Muirhall Rd, Larbert.	Urban centre.	286025	683435	NO ₂ .	N	Y (<5)	<5	Y
NA13	Graeme High School.	Roadside.	290197	679622	NO ₂ .	N	Y (<2)	3	Y
NA19	Kilsyth Rd, Banknock.	Roadside.	278779	679301	NO ₂ .	Y (NO ₂).	Y (<2)	2.2	Y
NA20	Garngrew Rd, Hags.	Urban background.	278979	679155	NO ₂ .	N	Y (<5)	<10	N
NA21	Grangemouth Rd, College.	Roadside.	290112	680500	Benzene, NO ₂ .	N	Y (<2)	1.8	Y
NA24	Kerse Lane, Falkirk.	Roadside.	289187	680024	Benzene, NO ₂ .	Y (NO ₂).	Y (<2)	3	Y
NA26	Weir St, Falkirk.	Urban background.	289207	680123	NO ₂ .	Y (NO ₂).	Y (<5)	<10	N
NA27	West Bridge St, Falkirk.	Roadside.	288490	680055	Benzene, 1,3 butadiene, NO ₂ .	Y (NO ₂).	Y (<2)	0.5	Y
NA29	Wellside Place, Falkirk.	Urban background.	288465	680220	NO ₂ .	N	Y (<5)	<10	N
NA36	Kerr Crescent, Hags.	Roadside.	278985	679273	NO ₂ .	Y (NO ₂).	Y (<5)	2.1	N
NA37	Denny Town House.	Urban centre.	281226	682526	Benzene, NO ₂ .	N	Y (<5)	<5	Y
NA38	Larbert Village Primary School.	Urban background.	285930	682318	Benzene, NO ₂ .	N	Y (<5)	<10	N
NA41	Seaview Place, Bo'ness.	Roadside.	299722	681594	Benzene, NO ₂ .	N	Y (<2)	0.1	Y

Table 2.2 Details of Non-Automatic Monitoring Sites continued

Site	Location	Site Type	OS Grid Ref (x, y)		Pollutants Monitored	In AQMA?	Relevant exposure? (m)	Distance to kerb (nearest road), m.	Worst-case Location?
NA42	Municipal Chambers, Grangemouth.	Urban centre / industrial.	292816	682009	1,3 butadiene, benzene, NO ₂ *.	Y (SO ₂).	Y (<5)	<10	Y
NA44	Greenpark Drive, Polmont.	Urban background.	293436	678938	Benzene, NO ₂ .	N	Y (<5)	<10	N
NA45	N.Distributor Rd, Bainsford.	Roadside.	288444	681178	NO ₂ .	N	N	1.6	Y
NA46	West Bridge St traffic lights, Falkirk.	Roadside.	288543	680045	Benzene, 1,3 butadiene.	N	Y (<2)	3.6	Y
NA47	Thistle Avenue, Grangemouth.	Roadside.	292000	680300	NO ₂ .	Y (SO ₂).	Y (<2)	1.3	Y
NA48	Hayfield, Falkirk.	Urban background.	289200	681580	NO ₂ .	N	Y (<5)	<10	N
NA49	Lennox Terrace, Grangemouth.	Urban background / industrial.	293600	680250	Benzene, 1,3 butadiene, NO ₂ .	Y (SO ₂).	Y (<5)	<10	Y
NA50	Upper Newmarket St, Falkirk.	Urban background.	288671	680047	NO ₂ .	Y (NO ₂).	Y (<5)	<10	N
NA51	Mary St, Laurieston.	Roadside.	290965	679490	NO ₂ .	N	Y (1)	4.5	Y
NA52	Main St, Larbert.	Roadside.	285866	682356	NO ₂ .	N	Y (<2)	4.4	Y
NA53	Denny Cross.	Roadside.	281211	682727	NO ₂ .	N	Y (<2)	0.8	Y
NA55	Inchyra Station.	Urban background / industrial.	293830	681022	Benzene, 1,3 butadiene, NO ₂ .	Y (SO ₂).	Y (<5)	<2	N
NA56	Albert Avenue, Grangemouth.	Urban background / industrial.	293859	681962	Benzene, 1,3 butadiene, NO ₂ .	Y (SO ₂).	Y (<5)	<10	Y
NA57	Inchyra Road, Grangemouth.	Urban background / industrial.	294028	680829	Benzene, 1,3 butadiene, NO ₂ .	Y (SO ₂).	Y (<5)	<10	Y

Table 2.2 Details of Non-Automatic Monitoring Sites continued

Site	Location	Site Type	OS Grid Ref (x, y)		Pollutants Monitored	In AQMA?	Relevant exposure? (m)	Distance to kerb (nearest road), m.	Worst-case Location?
NA58	Callendar Rd, Falkirk.	Roadside.	289667	679724	NO ₂ .	N	Y (<2)	0.5	Y
NA59	Carron Rd, Bainsford.	Roadside.	288392	681931	NO ₂ .	N	Y (<2)	1.2	Y
NA60	Ronades Rd, Carron.	Roadside.	288133	681587	NO ₂ .	N	Y (<2)	1.6	Y
NA61	Canal Rd, Falkirk.	Roadside.	287976	680656	NO ₂ .	N	Y (<2)	1.5	Y
NA62	Arnot St, Falkirk.	Roadside.	289125	679705	NO ₂ .	Y (NO ₂).	Y (<2)	1.2	Y
NA63	Camelon Rd, Falkirk.	Urban background.	288055	680134	NO ₂ .	On boundary NO ₂ .	Y (<5)	<10	N
NA64	New Hallglen Rd, Falkirk.	Roadside.	288807	678422	NO ₂ .	N	Y (<2)	1.7	Y
NA65	Redding Rd, Redding.	Roadside.	291356	678644	NO ₂ .	N	Y (<2)	0.6	Y
NA66	Holehouse, Slamannan.	Rural.	289450	672035	Benzene, NO ₂ .	N	N (<20)	<10	N
NA67	Queen St, Falkirk.	Urban background.	289430	680433	NO ₂ .	N	Y (<5)	<10	N
NA68	Bellevue St, Falkirk.	Roadside.	289234	679945	NO ₂ .	Y (NO ₂).	Y (<2)	1.7	Y
NA69	Kerse Lane, Falkirk.	Roadside.	289022	679990	NO ₂ .	Y (NO ₂).	Y (<2)	2.3	Y
NA70	Park St AQ station, Falkirk.	Roadside.	288892	680070	NO ₂ .*	Y (NO ₂).	Y (<2)	4.7	Y
NA71	Park St, Falkirk.	Roadside.	288910	680112	NO ₂ .	Y (NO ₂).	Y (<2)	1.5	Y
NA72	Vicar St, Falkirk.	Roadside.	288824	680120	NO ₂ .	Y (NO ₂).	Y (<2)	1.5	Y
NA73	West Bridge St RHS, Falkirk.	Roadside.	288467	680048	NO ₂ .	Y (NO ₂).	Y (<2)	0.3	Y
NA74	Hope St AQ station.	Roadside.	288688	680218	Benzene, NO ₂ .	Y (NO ₂).	Y (<2)	5.4	Y

Table 2.2 Details of Non-Automatic Monitoring Sites continued

Site	Location	Site Type	OS Grid Ref (x, y)		Pollutants Monitored	In AQMA?	Relevant exposure? (m)	Distance to kerb (nearest road), m.	Worst-case Location?
NA76	Tyrst Road, Stenhousemuir.	Roadside.	286851	683229	NO ₂ .	N	Y (<2)	<2	Y
NA77	Kinnaird Village.	Roadside.	286490	683775	Benzene, NO ₂ .	N	Y (<2)	3.9	Y
NA78	Glen Brae, Falkirk.	Roadside.	288525	678991	NO ₂ .	N	Y (<2)	2.6	Y
NA79	Gartcows Rd, Falkirk.	Roadside.	288491	679327	NO ₂ .	N	Y (<2)	1.3	Y
NA80	Cow Wynd, Falkirk.	Roadside.	288765	679456	Benzene, NO ₂ .	N	Y (<2)	1.8	Y
NA81	Grahams Rd, Falkirk.	Roadside.	288834	680898	Benzene, NO ₂ .	N	Y (<2)	0.5	Y
NA82	Castings Ave, Falkirk.	Roadside.	288858	681036	NO ₂ .	N	Y (<2)	<2	Y
NA83	Main St, Bainsford.	Roadside.	288614	681415	NO ₂ .	N	Y (<2)	0.5	Y
NA84	Carriden Brae, Bo'ness.	Roadside.	301874	680592	NO ₂ .	N	Y (<2)	0.9	Y
NA85	Auchinloch Dr, Banknock.	Roadside.	278752	679049	NO ₂ .	Y (NO ₂).	Y (<2)	<2	Y
NA86	Wolfe Rd, Falkirk.	Urban background.	289667	679871	NO ₂ .	N	Y (<2)	2	N
NA87	M80 slip south, Hags.	Roadside.	279017	679305	Benzene, 1,3 butadiene, NO ₂ .	Y (NO ₂).	Y (<2)	1.6	Y
NA88	Ure Crescent, Bonnybridge.	Roadside.	282444	681074	NO ₂ .	N	Y (<2)	1.7 (16 to M876)	Y
NA89	Grahams Rd/Meeks Rd, Falkirk.	Roadside.	288853	680328	NO ₂ .	N	Y (<2)	2.2	Y
NA90	Grahams Rd bridge east, Falkirk.	Roadside.	288855	680234	NO ₂ .	Y (NO ₂).	Y (<2)	2.2	Y
NA91	Grahams Rd bridge west, Falkirk.	Roadside.	288835	680291	NO ₂ .	Y (NO ₂).	Y (<2)	2.9	Y
NA92	Cochrane Avenue, Falkirk.	Roadside.	288743	679606	NO ₂ .	Y (NO ₂).	Y (<2)	1.7	Y

Table 2.2 Details of Non-Automatic Monitoring Sites continued

Site	Location	Site Type	OS Grid Ref (x, y)		Pollutants Monitored	In AQMA?	Relevant exposure? (m)	Distance to kerb (nearest road), m.	Worst-case Location?
NA94	A905 (Glensburgh Rd), Grangemouth.	Roadside.	291213	681927	NO ₂ .	Y (SO ₂).	Y (7 m)	5.4	Y
NA95	Rae St, Stenhousemuir (2)	Roadside.	286778	683175	NO ₂ , benzene.	N	Y (2 m)	1.5	Y
NA96	Sclandersburn Road, Denny	Roadside.	280334	681873	NO ₂ .	N	Y (6 m)	2.4 m (15 m to M80)	Y
NA97	Stirling Road, Larbert	Roadside.	285239	683263	NO ₂ .	N	Y (11.2 m)	3.3	Y
NA98	Arnothill, Falkirk	Urban background.	288095	680105	NO ₂ .	N	Y (23 m)	1.6	N
NA99	St Crispins Place, Falkirk	Roadside.	288924	679675	NO ₂ .	Y (NO ₂).	Y (7.6 m)	2.7	Y
NA100	Oswald St, Falkirk	Urban background.	288977	679662	NO ₂ .	N	Y (3.8 m)	1.5	N
NA101	Glensburgh Road (2), Grangemouth	Roadside.	291127	682007	NO ₂ .	N	Y (7 m)	0.9	Y
NA102	East Kerse Mains, Bo'ness	Urban background.	297968	680684	Benzene	N	N (see comments)	23 m (main road)	N
NA103	Merchiston Gardens	Urban background.	288270	680989	NO ₂ .	N	Y (12.5 m)	1.6	N
NA104	Powdrake Road, Grangemouth	Urban background / industrial.	293788	682054	1,3 butadiene	Y (SO ₂).	Y (40 m)	1.8	Y
NA105	West of Shieldhill	Rural.	288284	676881	NO ₂ , benzene.	N	N	1.7	N

* Triplicate study carried out at this site.

2.2 Comparison of Monitoring Results with Air Quality Objectives

2.2.1 Nitrogen Dioxide

Automatic Monitoring Data

In 2011 all of Falkirk Council's automatic monitoring sites met the nitrogen dioxide (NO₂) objectives. All automatic sites, whether background or roadside, recorded a decrease compared to the 2010 concentrations.

The Haggs (A4) site saw the greatest reduction with a decrease of 7.6 µg/m³ between 2011 and 2010. There are two potential reasons that the decline at this site is greater compared to other sites. The road works that were occurring in the vicinity of the analyser, for the A80 upgrade, ceased with the motorway fully opening in August 2011. This may have reduced congestion in the area. In addition, as discussed in more detail in Section 7, the Cowdenhill Quarry ceased operation in July 2011. This resulted in no lorry movements attributable to the quarry affecting the monitoring site.

Note that the Haggs concentration for 2010 has changed compared to the data submitted in the original 2011 Progress Report. This was following an update to the data from AEA in September 2011 and was corrected in the September version of the report. The concentration for 2010 is now 42.5 µg/m³. This also applies to Grangemouth MC data, with an update from AEA in October 2011, with the concentration increasing to 26 µg/m³. The changes to the results do not affect any conclusions but does mean that the Haggs concentration was closer to the objective than previously reported.

Figure 2.3 shows long terms trends for the Grangemouth AURN and Haggs sites, including some provisional 2012 data. There is a slight downward trend in NO₂ concentrations at the background Grangemouth AURN site between 2001 and 2011. However, a significant decrease has been recorded at the Haggs site compared to both the peak in 2010 and compared with the concentrations recorded in 2009.

Table 2.3 Results of Automatic Monitoring of Nitrogen Dioxide: Comparison with Annual Mean Objective (40 µg/m³).

Site	Location	Within AQMA?	Data Capture for period of monitoring %	Data Capture 2011 %	Annual Mean Concentration µg/m ³		
					2009	2010	2011
A4	Falkirk Haggs	Y	n/a	93.9	37.6 *	42.5	34.4
A5	Falkirk Hope St	Y	n/a	96.7	23.8	27.7	24.1
A6	Falkirk Park St	Y	n/a	94.9	29	32.9	28.5
A7	Falkirk West Bridge St	Y	n/a	60.9	38.2	43.8	35.9 * #
A8	Grangemouth AURN	N	n/a	95	17.7	19.3 *	15.1
A9	Grangemouth Moray	N	n/a	97.4	19.3	23.3	17.3
A10	Grangemouth MC	N	n/a	97.6	22.8	26	21.6
A12	Falkirk Grahams Rd	Y	99.5	74.4	n/m	31.7 * #	30.3 * #

* Annual data capture less than 90%.

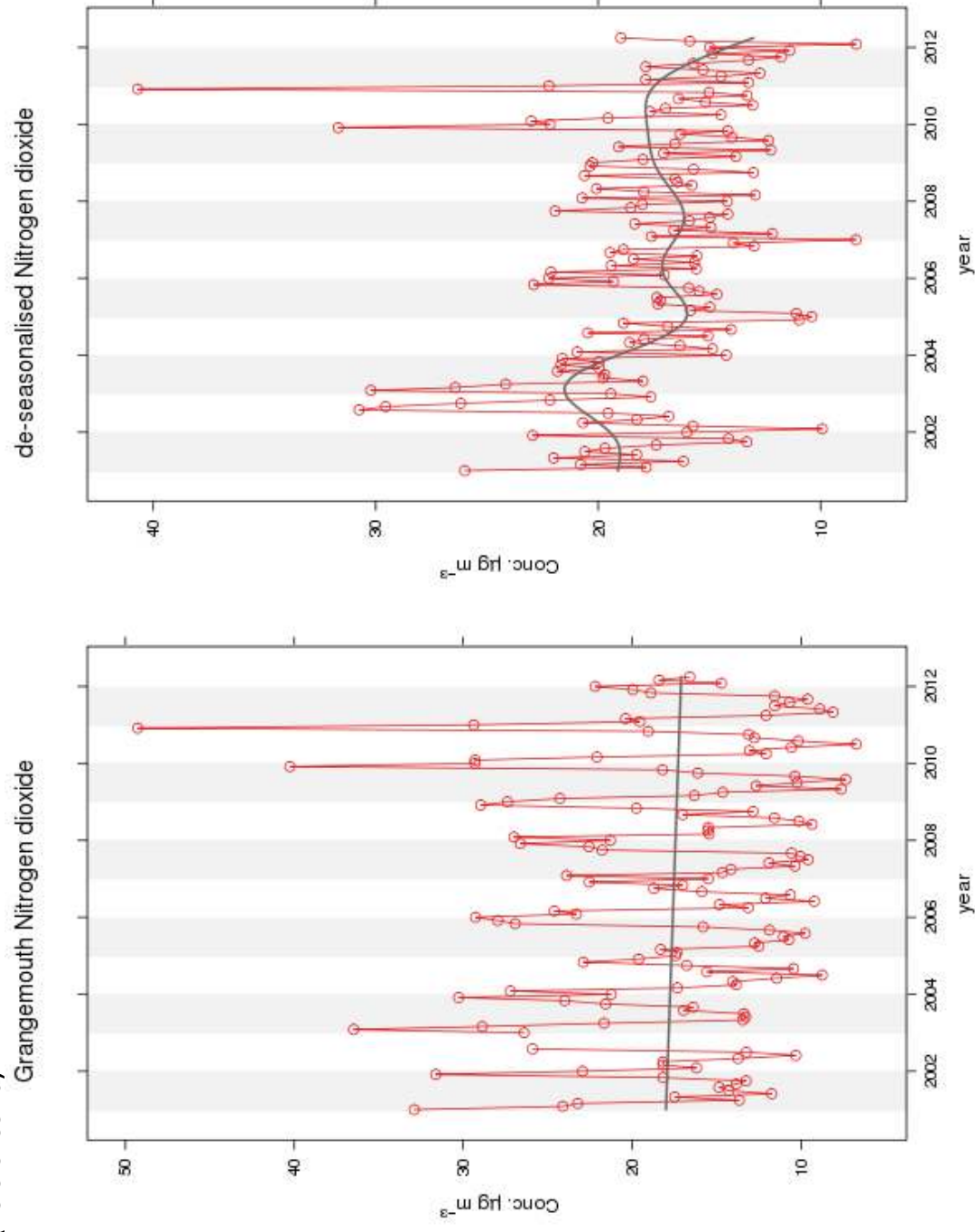
Data annualised, measured concentrations were Falkirk West Bridge St: 37.6 µg/m³ and Falkirk Grahams Rd: 30 µg/m³.

Table 2.4 Results of Automatic Monitoring for Nitrogen Dioxide: Comparison with 1-hour mean Objective (18 exceedances of 200 $\mu\text{g}/\text{m}^3$).

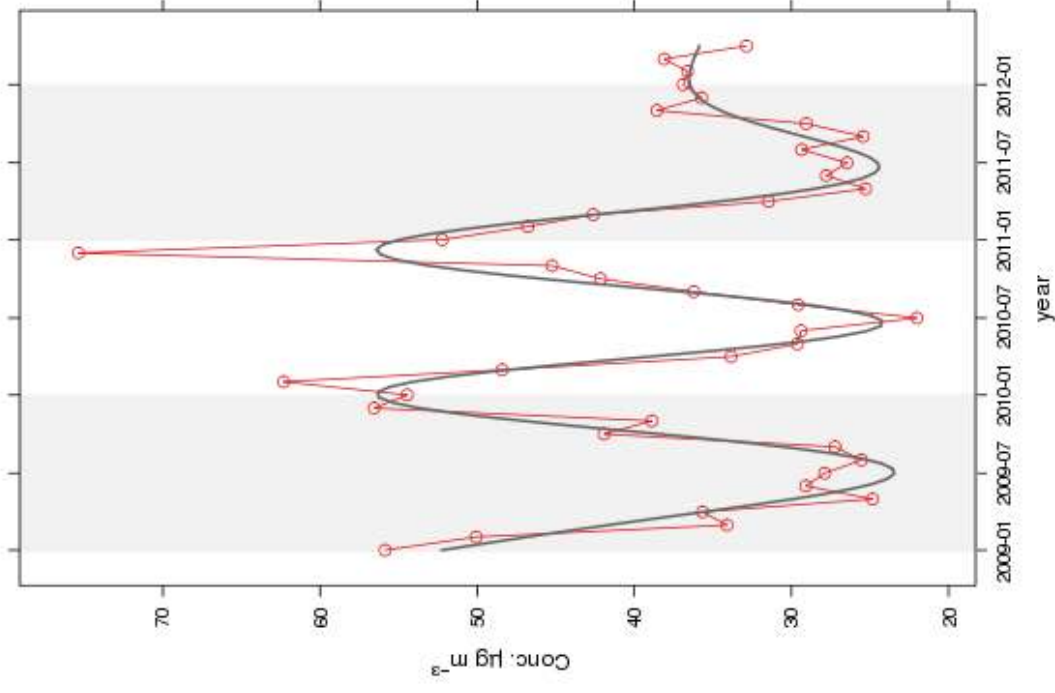
Site	Location	Within AQMA?	Data Capture for period of monitoring %	Data Capture 2011 %	Number of Exceedances of Hourly Mean (200 $\mu\text{g}/\text{m}^3$) (99.8 th percentile in brackets)		
					2009	2010	2011
A4	Falkirk Haggs	Y	n/a	93.9	1 (159) *	1 (164)	0 (142)
A5	Falkirk Hope St	Y	n/a	96.7	0 (88)	0 (109)	0 (111)
A6	Falkirk Park St	Y	n/a	94.9	0 (107)	0 (107)	0 (97)
A7	Falkirk West Bridge St	Y	n/a	60.9	0 (120)	0 (126)	0 (113) *
A8	Grangemouth AURN	N	n/a	95	0 (103)	0 (124) *	0 (78)
A9	Grangemouth Moray	N	n/a	97.4	0 (94)	0 (134)	0 (84)
A10	Grangemouth MC	N	n/a	97.6	0 (104)	0 (136)	0 (86)
A12	Falkirk Grahams Rd	Y	99.5	74.4	n/m	* 0 (135)	0 (102) *

* Annual data capture less than 90%.

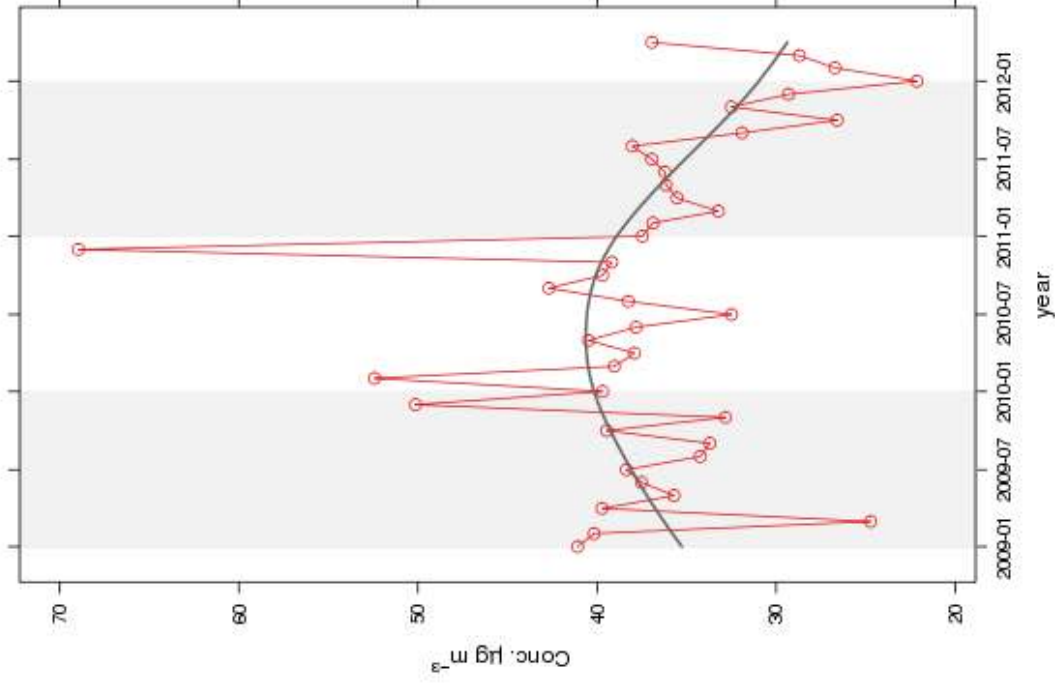
Figure 2.3 Trends in Annual Mean Nitrogen Dioxide Concentrations at Two Automatic Monitoring Sites.
(Reference 2a)



Falkirk Hags Nitrogen dioxide



de-seasonalised Nitrogen dioxide



Diffusion Tube Monitoring Data

Table 2.5 shows the annual NO₂ concentrations in 2011 for Falkirk Council's diffusion tubes, as well as results previously reported for 2009 and 2010. The diffusion tubes that were in use for all of 2011 with recorded data capture below 75% and those tubes that started operation part way through the year have been annualised. The tubes that ceased operation during 2011 have not been annualised. None of the results in Table 2.5 have been distance corrected with this being carried out as appropriate.

The following diffusion tubes recorded a concentration greater than the annual NO₂ objective of 40 µg/m³ in 2011 with the application of the R&A bias factor:

- NA27 West Bridge St, Falkirk: this site is in the Falkirk Town Centre AQMA and is close to the Falkirk West Bridge St site (A7).
- NA36 Kerr Crescent, Haggs: this site is in the Haggs AQMA.
- NA45 Northern Distributor Road, Bainsford: this site is not representative of any receptors and so has been discontinued.
- NA62 Arnot St, Falkirk: this site in the Falkirk Town Centre AQMA.
- NA83 Main St, Bainsford: With the R&A factor applied the concentration recorded at the tube was 43.6 µg/m³, this decreases to 39.9 µg/m³ with the distance to the nearest receptor taken into account. However, with the local roadside factor (from Falkirk Park St, A6) applied the results are 40.0 µg/m³ at the tube and 36.8 µg/m³ at the receptor. It is therefore considered that a Detailed Assessment is not required. In addition, the area was also included in the Falkirk Town Centre Further Assessment and a new set of traffic lights have been installed at the junction of Main St and Bankside (just south of NA83's location) in February 2012. With MOVA now in use at these lights this should improve the capacity of and reduce delays at the junction by about 10%. The tube shall remain in place and its location is shown in Figure 2.4.

The following diffusion tubes recorded a concentration close to the objective (36 to 40 µg/m³) in 2011 with the application of the R&A bias factor:

- NA24 Kerse Lane, Falkirk: this site is in the Falkirk Town Centre AQMA.
- NA68 Bellevue St, Falkirk: this site is in the Falkirk Town Centre AQMA.
- NA73 West Bridge St RHS, Falkirk: this site is in the Falkirk Town Centre AQMA and is on the opposite side of the street to the Falkirk West Bridge St (A7) automatic monitoring station.
- NA87 M80 slip south, Haggs: this site is in the Haggs AQMA.
- NA88 Ure Crescent, Bonnybridge: the site has shown a marginal increase from 35 µg/m³ in 2010 to 36 µg/m³ in 2011. The site is close to the M876 but the receptors are further back from the road than the tube, monitoring will continue. A DMRB run for the closest receptor to this stretch of the M876 gave a NO₂ concentration of 35.2 µg/m³ (NA88 holds its current location as it is accessible).
- NA89 Grahams Rd / Meeks Rd, Falkirk: this site is just to the north of the Falkirk Town Centre AQMA but is meeting the objective.

- NA90 Grahams Rd bridge east, Falkirk: this site is in the Falkirk Town Centre AQMA.
- NA94, Glensburgh Road, Grangemouth: this site was discussed in the 2011 Progress Report. The concentration at the location of the tube has decreased from $41 \mu\text{g}/\text{m}^3$ in 2010 to $37 \mu\text{g}/\text{m}^3$ in 2011. The concentration at the receptor has reduced from $38.1 \mu\text{g}/\text{m}^3$ in 2010 to $36.1 \mu\text{g}/\text{m}^3$ in 2011. In absolute terms it would be expected that the decrease at the receptor would be lower than that recorded at the tube. However, the background concentration used (from the national mapping) in the distance calculation has increased between 2010 and 2011. The additional site on the opposite side of the road (NA101) met the objective in 2011. A new retail distribution site is being built close to this tube location and so the tubes sites will continue to be sited as at present.

Figure 2.4 The location of tube NA83.

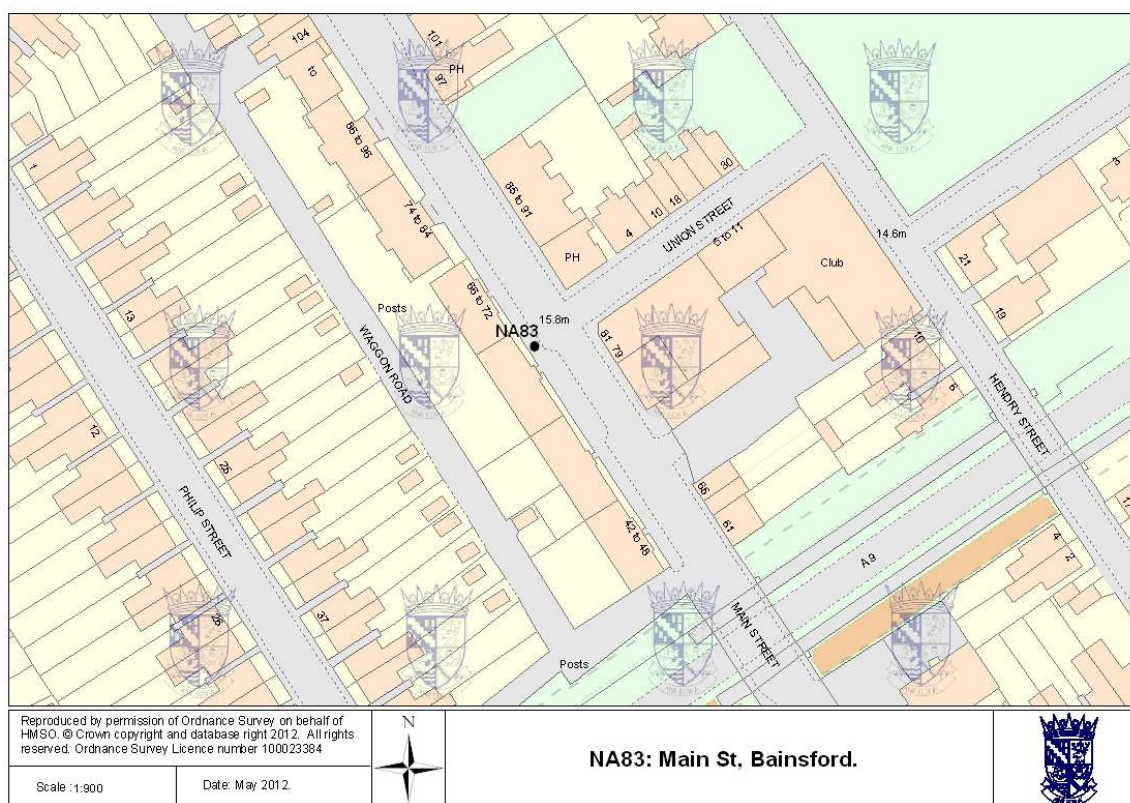


Table 2.5 Results of Nitrogen Dioxide Diffusion Tubes in 2011

Site	Location	Within AQMA?	Data capture for monitoring period, %	Data capture for 2011, %	Annual mean concentrations ($\mu\text{g}/\text{m}^3$)		
					2009 (0.81)	2010 (0.85)	2011 (0.84)
NA3	Tinto Drive, Grangemouth.	Y (SO_2).	n/a	100	21	23	21
NA5	Copper Top pub, Camelon.	N	n/a	100	31	29	31
NA7	Irving Parish Church, Camelon.	N	n/a	100	22	24	21
NA9	Bellsdyke Rd, Larbert.	N	n/a	100	29	30	28
NA10	Muirhall Rd, Larbert.	N	100	33.3	26	27	31
NA13	Graeme High School.	N	n/a	83.3	34	40	32
NA19	Kilsyth Rd, Banknock.	Y (NO_2).	n/a	66.7	37	34	33 *
NA20	Garncrew Rd, Hags.	N	n/a	100	27	30	25
NA21	Grangemouth Rd, College.	N	n/a	100	36	35	33
NA24	Kerse Lane, Falkirk.	Y (NO_2).	n/a	83.3	37	37	40
NA26	Weir St, Falkirk.	Y (NO_2).	n/a	100	22	26	22
NA27	West Bridge St, Falkirk.	Y (NO_2).	n/a	92	50	48	51
NA29	Wellside Place, Falkirk.	N	n/a	100	22	25	21
NA36	Kerr Crescent, Hags.	Y (NO_2).	n/a	100	49	45	47
NA37	Denny Town House.	N	n/a	83.3	19	21	20
NA38	Larbert Village Primary School.	N	n/a	83.3	25	27	21

Table 2.5 Results of Nitrogen Dioxide Diffusion Tubes in 2011 continued

Site	Location	Within AQMA?	Data capture for monitoring period, %	Data capture for 2011, %	Annual mean concentrations		
					2009 (0.81)	2010 (0.85)	2011 (0.84)
NA41	Seaview Place, Bo'ness.	N	n/a	100	27	30	25
NA42	Municipal Chambers, Grangemouth.	Y (SO ₂).	n/a	100	22	24	22
NA44	Greenpark Drive, Polmont.	N	n/a	66.7	19	24	17 *
NA45	N.Distributor Rd, Bainsford.	N	n/a	83.3	42	41	43
NA47	Thistle Avenue, Grangemouth.	Y (SO ₂).	n/a	91.7	24	29	25
NA48	Hayfield, Falkirk.	N	n/a	100	21	26	22
NA49	Lennox Terrace, Grangemouth.	Y (SO ₂).	n/a	83.3	24	28	22
NA50	Upper Newmarket St, Falkirk.	Y (NO ₂).	n/a	91.7	29	29	26
NA51	Mary St, Laurieston.	N	n/a	83.3	30	32	30
NA52	Main St, Larbert.	N	n/a	100	31	32	30
NA53	Denny Cross.	N	n/a	100	34	39	33
NA55	Inchyra Station.	Y (SO ₂).	n/a	83.3	20	24	17
NA57	Inchyra Road, Grangemouth.	Y (SO ₂).	n/a	100	32	29	28
NA58	Callendar Rd, Falkirk.	N	n/a	100	26	25	23
NA59	Carron Rd, Bainsford.	N	n/a	100	34	30	32
NA60	Ronades Rd, Carron.	N	n/a	83.3	30	30	31
NA61	Canal Rd, Falkirk.	N	n/a	91.7	30	31	30
NA62	Arnot St, Falkirk.	Y (NO ₂).	n/a	100	41	46	43

Table 2.5 Results of Nitrogen Dioxide Diffusion Tubes in 2011 continued

Site	Location	Within AQMA?	Data capture for monitoring period, %	Data capture for 2011, %	Annual mean concentrations ($\mu\text{g}/\text{m}^3$)		
					2009	2010	2011
NA63	Camelon Rd, Falkirk.	On boundary NO ₂ .	n/a	91.7	45	39	42
NA64	New Hallglen Rd, Falkirk.	N	n/a	100	20	24	20
NA65	Redding Rd, Redding.	N	n/a	83.3	24	28	24
NA66	Holehouse, Slamannan.	N	n/a	83.3	11	13	10
NA67	Queen St, Falkirk.	N	n/a	83.3	30	36	33
NA68	Bellevue St, Falkirk.	Y (NO ₂).	n/a	100	33	32	36
NA69	Kerse Lane, Falkirk.	Y (NO ₂).	n/a	100	35	34	35
NA70	Park St AQ station, Falkirk.	Y (NO ₂).	n/a	100	31	32	32
NA71	Park St, Falkirk.	Y (NO ₂).	n/a	100	39	36	41
NA72	Vicar St, Falkirk.	Y (NO ₂).	n/a	100	31	39	34
NA73	West Bridge St RHS, Falkirk.	Y (NO ₂).	n/a	100	37	40	37
NA74	Hope St AQ station.	Y (NO ₂).	n/a	83.3	28	31	27
NA76	Tyrst Road, Stenhousemuir.	N	n/a	100	25	28	24
NA77	Kinnaird Village.	N	n/a	75	22	32	31
NA78	Glen Brae, Falkirk.	N	n/a	100	34	39	32
NA79	Gartcows Rd, Falkirk.	N	100	33.3	26	31	33
NA80	Cow Wynd, Falkirk.	N	n/a	100	34	36	33
NA81	Grahams Rd, Falkirk.	N	n/a	91.7	35	36	34

Table 2.5 Results of Nitrogen Dioxide Diffusion Tubes in 2011 continued

Site	Location	Within AQMA?	Data capture for monitoring period, %	Data capture for 2011, %	Annual mean concentrations		
					2009 (0.81)	2010 (0.85)	2011 (0.84)
NA82	Castings Ave, Falkirk.	N	n/a	100	23	27	23
NA83	Main St, Bainsford.	N	n/a	100	46	37	44
NA84	Carriden Brae, Bo'ness.	N	100	33.3	17	20	20
NA85	Auchinloch Dr, Banknock.	Y (NO ₂).	n/a	100	26	33	25
NA86	Wolfe Rd, Falkirk.	N	n/a	100	17	23	18
NA87	M80 slip south, Hags.	Y (NO ₂).	n/a	83.3	32 *	36	36
NA88	Ure Crescent, Bonnybridge.	N	n/a	75	25 *	35	36
NA89	Grahams Rd/Meeks Rd, Falkirk.	N	n/a	91.7	32 *	32	37
NA90	Grahams Rd bridge east, Falkirk.	Y (NO ₂).	n/a	83.3	30 *	39	37
NA91	Grahams Rd bridge west, Falkirk.	Y (NO ₂).	70	58.3	33 *	38	29
NA92	Cochrane Avenue, Falkirk.	Y (NO ₂).	n/a	33.3	26 *	28	33
NA94	A905 (Glensburgh Rd), Grangemouth.	Y (SO ₂).	n/a	66.7	37 *	41	37 *
NA95	Rae St, Stenhousemuir (2)	N	n/a	83.3	n/m	21*	16
NA96	Sclandersburn Road, Denny	N	90	75	n/m	27*	28
NA97	Stirling Road, Larbert	N	n/a	83.3	n/m	n/m	29
NA98	Arnothill, Falkirk	N	100	66.7	n/m	n/m	26 *
NA99	St Crispins Place, Falkirk	Y (NO ₂).	100	50	n/m	n/m	34 *
NA100	Oswald St, Falkirk	N	100	66.7	n/m	n/m	22 *

Table 2.5 Results of Nitrogen Dioxide Diffusion Tubes in 2011 continued

Site	Location	Within AQMA?	Data capture for monitoring period, %	Data capture for 2011, %	Annual mean concentrations		
					2009 (0.81)	2010 (0.85)	2011 (0.84)
NA101	Glensburgh Road (2), Grangemouth	N	100	66.7	n/m	n/m	28 *
NA103	Merchiston Gardens	N	100	16.7	n/m	n/m	22 *
NA105	West of Shieldhill	N	100	16.7	n/m	n/m	11 *

2.2.2 PM₁₀

Falkirk Council measured PM₁₀ concentrations at eight locations in 2011. The only site to breach the Scottish PM₁₀ objective was the Falkirk West Bridge St site with an annual average concentration of 18.7 µg/m³ (short-term to long term adjustment done due to data capture). Five daily exceedances were recorded with the 98th percentile just under the limit value of 50 µg/m³ at 49 µg/m³. The UK / EU objectives were met at all sites in 2011.

All other sites met the Scottish PM₁₀ objectives in 2011. This includes the Banknock 1 site which is located in the Banknock AQMA. This site met the objectives with either a 1.14 or a 1.3 factor applied to the Osiris monitoring data. The number of daily exceedances recorded in 2011 was three and this compares to the 18 recorded in 2010 (with a 1.3 factor applied four exceedances in 2011 and 30 in 2010). The annual concentration in 2011 was 15.2 µg/m³, this compares to 20.7 µg/m³ in 2010 (with a 1.3 factor the concentration was 17.3 µg/m³ in 2011 compared to 23.7 µg/m³ in 2010). The Banknock 1 data has not been annually adjusted due to the likely local sources influencing this site.

Skene Group disposed of their interest in Cowdenhill Quarry during 2011 with operations ceasing in July 2011. An environmental scoping report has been issued for a new quarry, which includes air quality. This quarry will be in proximity to the previous Cowdenhill quarry but located in the North Lanarkshire Council area. The proposals state that the existing access road, running through the Falkirk Council area, will be used, but also the access road would be upgraded. The TEOM installation in the area has been delayed due to electrical supply issues and storm damage to the enclosure but the installation will still go ahead being mindful of the new quarry proposal.

The PM₁₀ monitoring results for Falkirk Grahams Rd are not reported due to the very short period of monitoring in 2011.

Figure 2.5 shows long-term trends for the Grangemouth AURN site (2001 and 2002 data is not included due to low data capture of 75% and 57% respectively). The site met the Scottish and UK PM₁₀ objectives in 2011. Trends in PM₁₀ should be treated with slight caution as there have been changes in monitoring techniques and the correction factor used, but there does seem to be a slight long term decline when the 1.14 factor is used and a clearer decline with the 1.3 factor. (A TEOM was in use from 2000 to 2007, with a TEOM and VCM correction used from 2008 to April 2009 followed by a FDMS.)

Table 2.7 Results of Automatic Monitoring of PM₁₀: Comparison with Annual Mean Objectives (18 and 40 µg/m³)

Site	Site Type	Within AQMA?	Data Capture for Monitoring Period %	Data Capture 2011 %	Reference Equivalent	Annual mean concentration, µg/m ³		
						2009	2010	2011
A2. Banknock 1	Roadside	Y	n/a	87.4	1.14 [1.3] factor applied.	13.3 [15.1] * #	20.7 [23.7] *	15.2 [17.3] *
A5. Falkirk Hope St	Roadside	Proposed.	96.5	72.4	Y, VCM	15	15	15.2 * #
A6. Falkirk Park St	Roadside.	Proposed.	n/a	93.2	Y, VCM	15	17	15.6
A7. Falkirk West Bridge St	Roadside.	Proposed.	n/a	75.7	Y, VCM	22.3 *	21 *	18.7 * #
A8. Grangemouth AURN	Urban background / industrial.	N	n/a	98.7	Y, FDMS	12.5	14.4	14.1
A9. Grangemouth Moray	Urban background / industrial.	N	97.8	73.8	Y, VCM	14	14	14.8* #
A10. Grangemouth Municipal Chambers	Urban background / industrial.	N	n/a	87.3	Y, VCM	14	15	15.1 * #

* Annual data capture less than 90%.

Data annualised, measured concentrations were: Falkirk Hope St: 15.1 µg/m³, Falkirk West Bridge St: 19.4 µg/m³, Grangemouth Moray: 14.8 µg/m³ and Grangemouth MC 15.1 µg/m³.

Banknock 1 commenced operation 21st October 2009. Falkirk Hope St and Grangemouth Moray ceased operation October 2011.

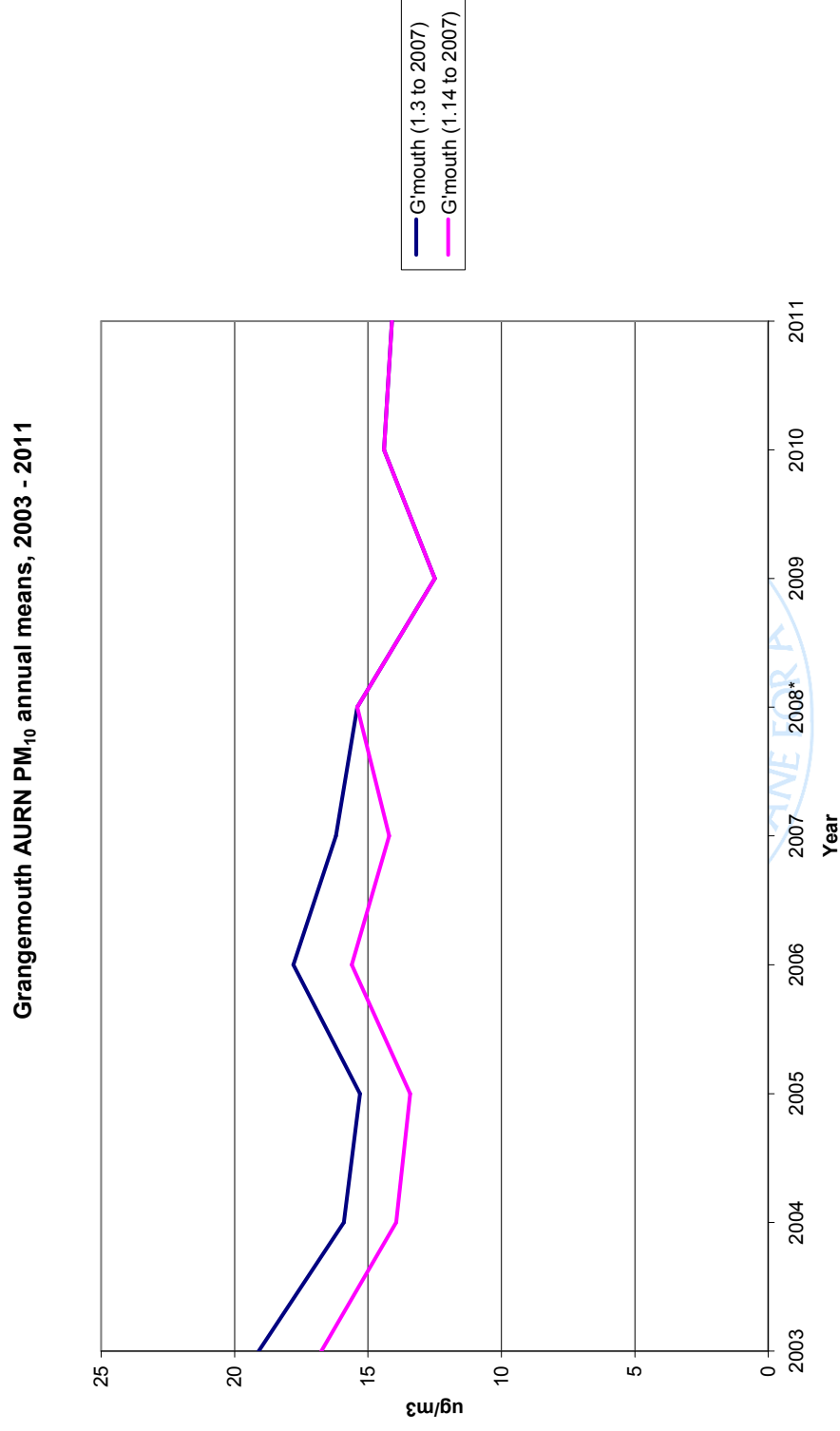
Table 2.8 Results of Automatic Monitoring for PM₁₀: Comparison with 24-hour mean Objectives (7 and 35 exceedances of 50 µg/m³)

Site	Site Type	Within AQMA?	Data Capture for monitoring Period %	Data Capture 2011 %	Reference Equivalent	Number of Exceedances of 50 µg/m ³		
						2009	2010	2011
A2. Banknock 1	Roadside	Y	n/a	87.4	No, 1.14 [1.3] factor applied.	0 (31) [0 (36)] * #	18 (60) [30 (68)] *	3 (37) [4 (42)] *
A5. Falkirk Hope St	Roadside	Proposed.	96.5	72.4	Y, VCM	1	0 (29)	1 (36) *
A6. Falkirk Park St	Roadside.	Proposed.	n/a	93.2	Y, VCM	2	1 (31)	2 (38)
A7. Falkirk West Bridge St	Roadside.	Proposed.	n/a	75.7	Y, VCM	0 *	7 (47) *	5 (49) *
A8. Grangemouth AURN	Urban background / industrial.	N	n/a	98.7	Y, FDMS	0	1 (38)	2 (38)
A9. Grangemouth Moray	Urban background / industrial.	N	97.8	73.8	Y, VCM	0	0 (27)	0 (33)
A10. Grangemouth Municipal Chambers	Urban background / industrial.	N	n/a	87.3	Y, VCM	0	0 (29)	0 (40)

* Annual data capture less than 90%.

Please note an error was made with percentiles in the 2010 Progress Report for the Banknock 1 site (but not in the Detailed Assessment).

Figure 2.5 Trends in Annual Mean PM₁₀ Concentrations



2.2.3 Sulphur Dioxide

In 2011 Falkirk Council monitored sulphur dioxide at seven locations, the results are shown in Table 2.9. The Grangemouth AURN and Grangemouth Moray sites continued to breach the 15-minute objective with the daily and hourly objectives being met. All other monitoring sites met all three objectives. This is consistent with results from previous years. No exceedances of limit / concentration values were recorded at any monitoring site outside the AQMA in 2011.

It is understood that the Tail Gas Treatment abatement being installed by INEOS, (as discussed in the 2010 and 2011 Progress Reports) will now be commissioned by the end of 2012 rather than by the previously reported June 2013. It is anticipated that this unit will reduce the number of exceedances in the Grangemouth AQMA such that the 15-minute objective is met (that is fewer than 35 exceedances per calendar year at a particular location).

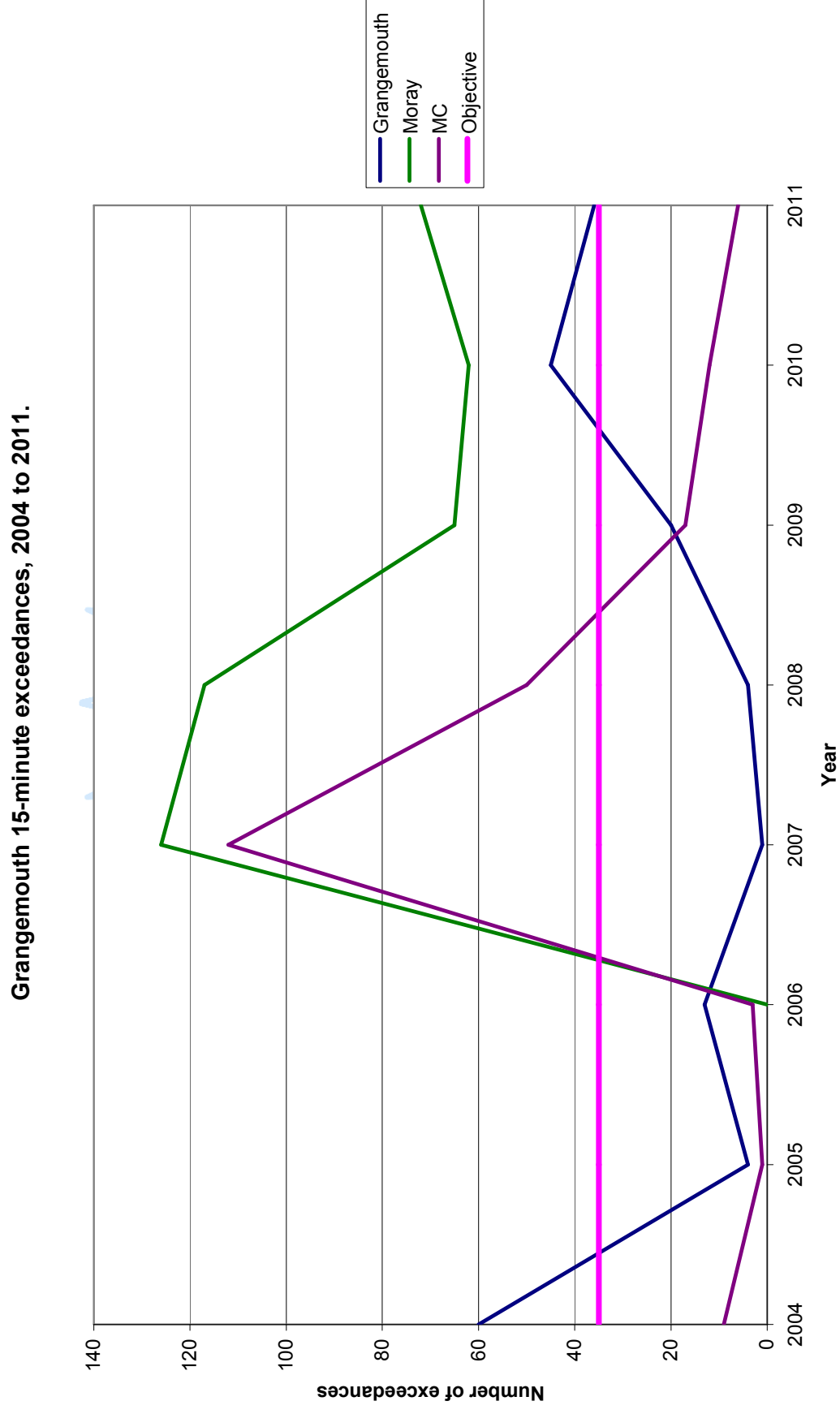
Falkirk Council also understands that Flue Gas Desulphurisation has been running on two of the units at Longannet Power Station since the end of 2010 with full commissioning due by the end of November 2012. A third unit is due for commissioning by the end of August 2013.

Long-term trends in the number of exceedances are shown in Figure 2.6, though these should be treated with slight caution as the annual data is subject to variation given weather and operating conditions as well as the short time period that exceedances actually occur over the course of the year. Pollution or polar roses can be more relevant and are shown for the three Grangemouth sites in Figure 2.7. These show fairly similar results to the roses that were plotted for 2009 data and submitted as part of the 2010 Further Assessment. However, it should be noted that the polar roses do show average concentrations rather than representing number of exceedances.

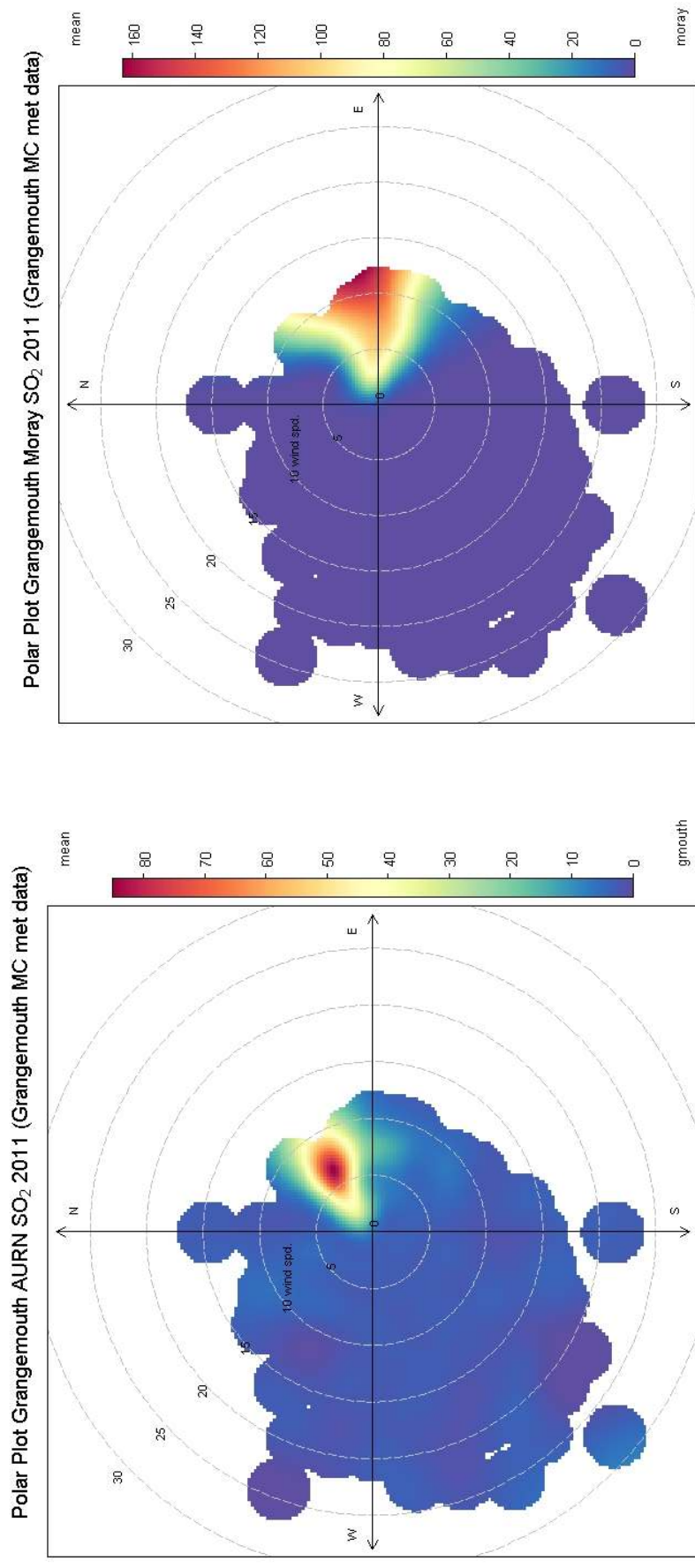
Table 2.9 Results of Automatic Monitoring of SO₂: Comparison with Objectives.

Site ID	Location	Within AQMA ?	Data Capture 2011 %	Number of Exceedances (percentiles in bracket, µg/m ³)		
				15-minute Objective (266 µg/m ³)	1-hour Objective (350 µg/m ³)	24-hour Objective (125 µg/m ³)
A3	Bo'ness	N	91.8	0 (103)	0 (55)	0 (18)
A5	Falkirk Hope St	N	97.6	0 (77)	0 (46)	0 (16)
A6	Falkirk Park St	N	94.8	0 (98)	0 (61)	0 (20)
A8	Grangemouth AURN	Y	97	36 (270)	2 (146)	0 (40)
A9	Grangemouth Moray	Y	97.1	72 (293)	1 (231)	2 (109)
A10	Grangemouth MC	Y	97.6	6 (202)	0 (293)	0 (48)
A11	Polmont	N	82.6	0 (69)	0 (39)	0 (15)

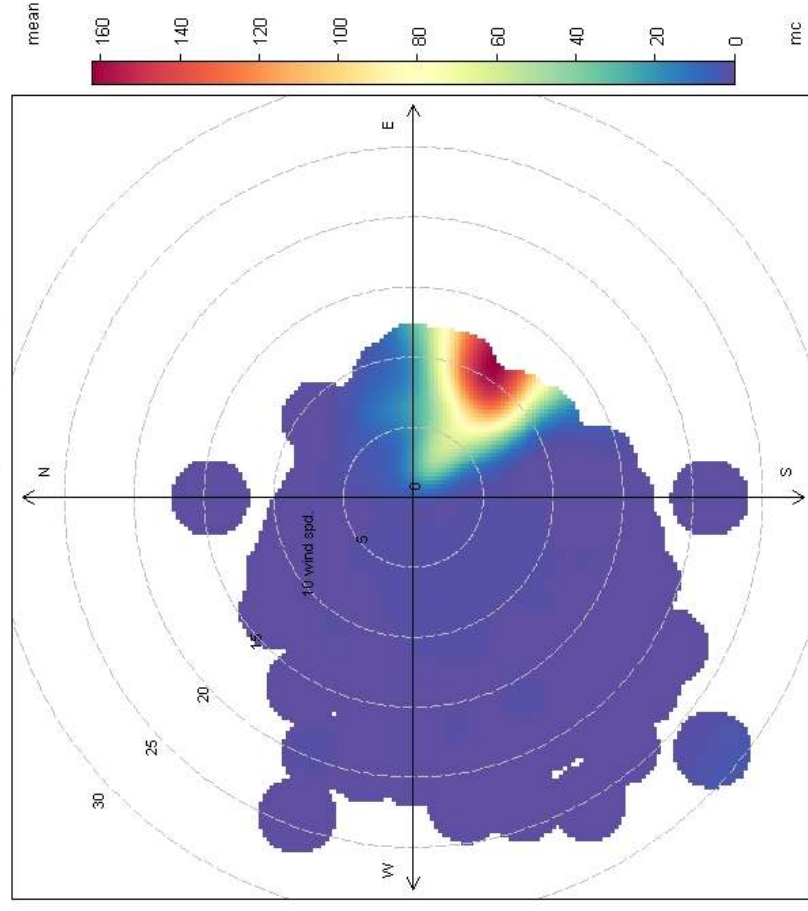
Figure 2.6 Trends of SO₂ Concentrations in the Grangemouth AQMA.



**Figure 2.7 Polar Plots of SO₂ Concentrations in the Grangemouth AQMA.
(Reference 2b)**



Polar Plot Grangemouth MC SO₂ 2011 (Grangemouth MC met data)



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2.2.4 Benzene

In 2011 Falkirk Council monitored benzene at 23 locations using diffusion tubes, including a pumped diffusion tube at the Grangemouth AURN (A8) site. The results from the pumped diffusion tube are shown in Table 2.7 and the results from the passive diffusion tube shown in Table 2.8.

All the benzene concentrations recorded by the tubes were within the air quality objectives. No annualisation has been done for any tube that recorded less than 75% data capture as there is little or no other monitoring data that can be used for the adjustment (the pumped benzene tube does not run over the same exposure periods).

A pumped diffusion tube is generally considered to be more accurate than passive diffusion tubes. The pumped diffusion tube at the Grangemouth AURN site recorded an annual average concentration of 1.26 $\mu\text{g}/\text{m}^3$ in 2011. The concentration recorded continues to be within the objectives and is a decrease compared to 2010.

Table 2.7 Results of pumped benzene diffusion tube.

Site	Location	Data capture, 2011, %.	Annual mean concentration, $\mu\text{g}/\text{m}^3$				
			2007	2008	2009	2010	2011
A8	Grangemouth AURN	100	1.08	1.2	1.27	1.42	1.26

Table 2.8 Results of benzene diffusion tubes.

Site	Location	Within benzene AQMA?	Data capture for monitoring period, %	Data capture, 2011, %.	Annual mean concentration, $\mu\text{g}/\text{m}^3$		
					2009	2010	2011
NA3	Tinto Drive, Grangemouth	N	100	16.7	n/m	n/m	1.22
NA21	Grangemouth Road, College	N	n/a	91.7	1.16	0.92	0.92
NA24	Kerse Lane, Falkirk	N	100	33.3	1.04	0.95	1.15
NA27	West Bridge Street, Falkirk	N	n/a	91.7	2.58	1.4	1.49
NA37	Denny Town House	N	n/a	91.7	1.55	0.69	0.87
NA38	Larbert Village Primary School	N	n/a	83.3	1.41	0.75	1.36
NA41	Seaview Place, Bo'ness	N	n/a	91.7	1.13	1.03	2.19
NA42	Municipal Chambers, Grangemouth	N	n/a	91.7	1.59	1.17	0.91
NA44	Greenpark Drive, Polmont	N	n/a	91.7	2.37	1.01	0.84
NA46	West Bridge Street traffic lights, Falkirk	N	90	75	1.96	1.37	0.79
NA49	Lennox Terrace, Grangemouth	N	90	75	0.95	1.26	0.94
NA55	Inchyra Station	N	n/a	91.7	1.11	1.24	1.42
NA57	Inchyra Road, Grangemouth	N	n/a	91.7	1.12	1.37	1.31
NA66	Holehouse, Slamannan	N	90	75	0.57	0.89	0.8
NA74	Hope street AQ station	N	90	75	0.97	1.07	0.94
NA77	Kinnaird Village	N	n/a	83.3	0.75	0.75	0.63
NA80	Cow Wynd, Falkirk	N	n/a	91.7	0.85	1.12	1.11
NA81	Grahams Road, Falkirk	N	n/a	83.3	2.32	1.34	1.04
NA87	M80 slip south, Haggs	N	70	50	0.62	0.65	0.74
NA94	A905 (Glensburgh Rd), Grangemouth	N	n/a	91.7	n/m	n/m	0.77
NA95	Rae St, Stenhousemuir (2)	N	80	66.7	n/m	0.89	1.1
NA102	East Kerse Mains, Bo'ness	N	87.5	58.3	n/m	n/m	0.69
NA105	West of Shieldhill	N	100	16.7	n/m	n/m	0.91

Falkirk Council has noted that one of INEOS' community monitoring tubes recorded a breach of the Scottish benzene objective in 2011.^{Ref 3} The concentration recorded at the CO3 site was $3.9 \mu\text{g}/\text{m}^3$. This is the same monitoring site that was discussed in previous Progress Reports (2010 and 2011). It is not representative of relevant receptors and in addition Falkirk Council now has a tube in East Kerse Mains (NA102).

2.2.5 Other Pollutants Monitored

In 2011 Falkirk Council monitored 1,3 butadiene at seven locations using diffusion tubes. All the results were within the objective. Only one monthly result recorded a concentration above the limit of detection and so it is likely that the concentrations were lower than those stated in Table 2.9. The annual concentrations have increased from 2010, but this is due to the detection limits of the tubes being higher in 2011 compared to previous years.

All annual concentrations were within the objective. No annualisation has been done for the tubes that recorded less than 75% data capture as there is no other monitoring data to use for the adjustment. Given that all the results from the tubes are meeting the objective the number of tubes has been reduced to three (two in Grangemouth and one in Bo'ness) for 2012.

Table 2.9 Results from 1,3 butadiene diffusion tubes.

Site ID	Location	Within 1,3 butadiene AQMA?	Data capture for monitoring period, %.	Data capture for full calendar year, %.	Annual mean concentrations ($\mu\text{g}/\text{m}^3$)		
					2009	2010	2011
NA27	West Bridge Street, Falkirk	N	90	75	0.4	0.41	0.78
NA41	Seaview Place, Bo'ness	N	n/a	91.7	n/m	0.41	0.85
NA42	Municipal Chambers, Grangemouth	N	66.7	80	n/m	n/m	1.17
NA49	Lennox Terrace, Grangemouth	N	90	75	0.4	0.41	0.78
NA55	Inchyra Station, Grangemouth	N	n/a	91.7	0.4	0.41	0.85
NA57	Inchyra Road, Grangemouth	N	90	75	0.4	0.41	0.78
NA104	Powdrake Road, Grangemouth	N	16.7	100	n/m	n/m	1.16

A Defra / DA owned $\text{PM}_{2.5}$ FDMS-TEOM is in operation at Falkirk Council's Grangemouth AURN site. Local Authorities are not required to review $\text{PM}_{2.5}$ but the results are included here for completeness. As a site with a background classification the analyser forms part of the average pollution index (API) that the UK is required to report to the EU. The three year average concentration that this site will contribute to the API is $10.2 \mu\text{g}/\text{m}^3$.

The $\text{PM}_{2.5}$ results are shown in Table 2.10, the 2011 concentration is below the EU target and limit values and below the target value set by the Scottish Government.

Table 2.10 Results from $\text{PM}_{2.5}$ monitoring.

Site ID	Location	Data Capture for 2011 %	Annual mean concentrations ($\mu\text{g}/\text{m}^3$)		
			2009	2010	2011
A8	Grangemouth AURN	92.3	8.6	11	10.9

2.2.6 Summary of Compliance with AQS Objectives

Falkirk Council has examined its automatic and non-automatic monitoring results. The Grangemouth AURN and Grangemouth Moray automatic sites, both within the Grangemouth SO₂ AQMA, breached the 15-minute objective in 2011. The hourly and daily objectives were met at these two sites. The SO₂ monitoring sites outside the Grangemouth AQMA continue to meet all three objectives.

All sites except the Falkirk West Bridge St site met the Scottish PM₁₀ objectives in 2011. This site recorded a concentration of 18.7 µg/m³ and was close to recording a breach of the daily objective with a 98th percentile concentration of 49 µg/m³ (five daily exceedances were recorded). All sites met the UK / EU objectives in 2011. As discussed in the Further Assessment report for Falkirk Town Centre and subsequent communications with the Scottish Government it will be proposed to elected Members that the Falkirk Town Centre AQMA declaration is amended to include PM₁₀, but that the hourly NO₂ AQMA is revoked.

No automatic monitoring sites breached the NO₂ objectives in 2011. Some diffusion tube sites breached the NO₂ annual objective in 2011 but most were in the Falkirk Town Centre or Hags AQMAs. One diffusion tube, NA83, did record a breach of the objective with the R&A factor applied. However, with the more appropriate local roadside (Park St) factor an exceedance was not recorded at the nearest receptor.

All benzene and 1,3 butadiene diffusion tubes met the objectives in 2011 along with the pumped diffusion tube (benzene) at the Grangemouth AURN site. The Grangemouth AURN site met the PM_{2.5} EU target and limit values as well as the Scottish target value in 2011.



3 Road Traffic Sources

This and sections 4 to 7 will review any changes in the Falkirk Council area that may affect air quality, for example new transport sources, industrial emissions or new receptors. It will focus on locations which have not been assessed during the earlier rounds, or where there has been a change to an existing installation or a new development.

This section will review any changes to the following since the 2011 Progress Report:

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

The main pollutants that Local Authorities are required to assess from road traffic are NO₂ and PM₁₀. Emissions of benzene, 1,3 butadiene and carbon monoxide from road traffic are now insignificant.

In general the total amount of road traffic, by vehicle miles, on Falkirk Council's roads reached a peak in 2007 and has since declined. Using the year 2000 as a base year of 100, 2007 was equal to 117 with 2010 equal to 114. ^{Ref 4}

3.1 Narrow Congested Streets with Residential Properties Close to the Kerb

The technical guidance states that a Detailed Assessment should be made of any narrow congested streets identified where there is relevant exposure. Narrow congested streets are typically those where the AADT is greater than 5,000 with congestion occurring throughout the day (slow moving traffic with frequent stopping and starting throughout much of the day, traffic speed 25 kph or less) and with residential properties within 2 m of the kerb.

A review has not identified any new locations that are likely to be congested residential streets that have not been considered before or are not already in AQMAs.

Falkirk Council confirms that there are no new or newly identified congested streets, with a flow above 5,000 vehicles per day and residential properties close to the kerb, that have not been adequately considered in previous rounds of Review and Assessment.

3.2 Busy Streets Where People May Spend 1-hour or More in proximity to Traffic

The technical guidance states that a DMRB screening assessment should be undertaken for any road with an AADT greater than 10,000 vehicles per day where people may spend 1-hour or more in proximity to traffic (within 5 m of the road). Examples are likely to include town and city centres where shops are located near busy roads.

A review of the links has not highlighted any new locations where people may spend 1-hour or more in proximity to traffic.

Locations within Falkirk Town Centre have not been considered as this area is within an AQMA and has been subject to a recent Further Assessment. There is currently an AQMA in the Falkirk Town Centre for a potential breach of the hourly AQMA. However, following the Further Assessment it will be recommended to elected Members that this AQMA is revoked. In addition, the highest annual concentration recorded by any diffusion tube was 51 $\mu\text{g}/\text{m}^3$ (using the conservative R&A factor), well within the 60 $\mu\text{g}/\text{m}^3$ that would indicate a breach of the hourly objective.

Falkirk Council confirms that there are no new or newly identified busy streets where people may spend 1-hour or more in proximity to traffic.

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

The technical guidance specifies that a DMRB assessment should be undertaken for roads where the proportion of HDVs is greater than 20% of the traffic flow with a HDV flow of greater than 2,500 vehicles per day and where there is relevant exposure within 10 m of the road (20 m for conurbations greater than 2 million).

Transport planning has confirmed that there are no stretches of roads in the Falkirk Council area where the percentage of HDVs is greater than 20%. Therefore no further consideration is required.

Falkirk Council confirms that there are no new roads with high flows of HDVs.

3.4 Junctions and busy roads in Scotland

The technical guidance states that a DMRB screening assessment should be undertaken for roads and / or junctions (that have not been assessed before) where the AADT is greater than 10,000 vehicles per day and where there is relevant exposure within 10 m (20 m for conurbations greater than two million people). In addition, due to the much tighter Scottish PM_{10} objective a DMRB run is required where either the background concentration of PM_{10} is greater than 15 $\mu\text{g}/\text{m}^3$ and the AADT greater than 5,000 or where a 10% increase in flow has been recorded.

The amount of junction data available for this report was limited. However, this has been compensated by a much greater amount of flow data available for links compared to previous reports. DMRB runs were conducted for 11 locations, the results of which are shown in Table 3.1. The inputs and adjustment to the results are shown in the Appendix, Tables A5 to A7. This DMRB runs for this section have also included NO₂ for all the links, as some fall within the requirements of Section 3.6 for a DMRB run (an increase in flow greater than 25%).

The results do not indicate that any Detailed Assessments are required. The location that predicts the highest concentration is near the M876 at 35.2 µg/m³. This is within the objective and in addition a diffusion tube is already in place at a relevant receptor elsewhere on this link. The highest predicted PM₁₀ concentration is 16.9 µg/m³ at Main Street, Camelon, which is within the Scottish objective.

Table 3.1 Results of the DMRB runs for Section 3.4.

Road	Reason for DMRB run	NO ₂ annual mean, adjusted, µg/m ³	PM ₁₀ annual mean, adjusted, µg/m ³	Comments
A872/04 Stirling Street, Dunipace	Greater than 10% increase.	23.8	14.0	
A904/08 Earls Road, Grangemouth	Greater than 10% increase.	30.9	16.7	Grangemouth MC (A9) used as background.
A9/02 Stirling Road	Greater than 10% increase.	22.1	14.3	
A9/05 Stirling Road Torwood	Greater than 10% increase.	22.5	14.7	
B805/05, jct with B810 Shieldhill to B810 Polmont.	Greater than 10% increase.	23.5	14.1	
B810/02 Station Road, Polmont	Greater than 10% increase.	23.2	14.0	
A803 Main Street, Camelon	Done as compliment to Glasgow Rd, due to tube in place.	30.9	15.1	Tube NA7 used as background.
A803 Glasgow Road, Camelon	Background PM ₁₀ >15 with AADT > 5000 and receptors.	30.4	16.9	
M876, M80 to Checkbar	Greater than 10% increase.	35.2	15.9	
M876 North Broomage to Hill of Kinnaird	Greater than 10% increase.	23.1	15.4	
B902 Bainsford	Greater than 10% increase.	n/a	15.4	

Falkirk Council confirms that there are no newly identified busy junctions or roads that require a Detailed Assessment. However, the list of DMRB runs is used to guide future changes to the diffusion tube network.

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

This section reviews newly constructed or upgraded roads in the Falkirk Council area.

The upgrade of the A80 to motorway standard has been completed and was fully opened in August 2011. This route passes through the existing Haggs NO₂ AQMA and so does not need to be considered further. A PM₁₀ monitor is also due for installation at the automatic monitoring site.

There are new slip roads (entry eastbound / exit westbound) under construction at J2 of the M876. The work will benefit the local road network by removing journeys from nearby links such as the A88 Bellsdyke Rd. The link that these slip roads will connect to was included in a DMRB run (A9 / 05, Stirling Road, Torwood) for Section 3.4 due to a 10% increase in flow between 2010 and 2011. The predicted NO₂ concentration at the nearest receptor was 22.8 µg/m³, well within the objective. The nearby diffusion tube, NA97 (Stirling Road, Larbert), is meeting the objective and so may be moved to this area if there are no other areas that require monitoring.

Falkirk Council has assessed the major new roads meeting the criteria in Section A.5 of Box 5.3 in TG(09) and concluded that it will not be necessary to proceed to a Detailed Assessment.

3.6 Roads with Significantly Changed Traffic Flows

The guidance in Section 3.4 for Scottish authorities requires assessment of roads where traffic levels have increased by 10% or more for PM₁₀. The guidance for this section requires an increase of 25% but includes NO₂. The DMRB runs conducted in Section 3.4, where the requirement was for a link to have a 10% increase, included NO₂ and so does not need to be considered again.

Please see conclusion for Section 3.4.

3.7 Bus and Coach Stations

There are no new or significantly changed bus or coach stations within the Falkirk Council area.

Falkirk Council confirms that there are no relevant bus or coach stations in the Local Authority area.

3.8 Other significant developments affecting road traffic

Previous reports have included a discussion on significant developments within the area that are likely to impact upon local air quality. This section provides a brief outline of proposed developments within the Falkirk Council area that may impact upon local air quality, mostly through changes to road traffic volumes. A list of all significant developments is shown in Table 3.2.

Table 3.2 Significant (potential) developments for the Falkirk Council area.

Details	Address	Granted?	Comments
Erection of superstore, petrol filling station, car park, pedestrian and vehicular access, service yard and landscaping.	Wrangler Factory, Glasgow Road, Camelon, Falkirk	Granted.	DMRB run carried out for the area.
Class 6, a distribution warehouse, parking, SUDS, access roads, internal access road, landscape works and associated facilities	Land to the NW of Grangemouth technology park, Earls Road, Grangemouth.	Granted	NA95 and NA101 already operating in the area.
550 houses, neighbourhood centre including retail and community Uses, access junctions, new access roads, provision of a nature conservation area, associated roads and infrastructure.	Land To The North Of Bankview Nursing Home Kilsyth Road Banknock	Pending Decision	In AQMA, NO ₂ monitoring already conducted and PM ₁₀ to commence.
(Consultation on) Application under section 36 of the Electricity Act 1989 to construct and operate a biomass renewable energy plant with a net electrical output of 100 MWe.	Site to the West of Forth Ports Plc, Central Dock Road, Grangemouth.	Planning inquiry	
Tomfyne Quarry and restoration of Cowdenhill Quarry (access via existing route).	Closest settlements Banknock, Falkirk and Kilsyth, North Lanarkshire.	Environmental Scoping report.	In AQMA, Osiris monitoring already operating, TEOM to commence operation.
Replacement of existing CHP plant with 25MW biomass plant.	Earl's Gate Park, Earl's Road, Grangemouth	Environmental Scoping report.	In SO ₂ AQMA.

4 Other Transport Sources

This section considers the potential emissions to air from other types of transport. This includes airports, diesel and steam trains, both stationary and moving, and movements of ships to and from ports.

4.1 Airports

At its closest point Edinburgh airport is 11.5 km from the Falkirk Council boundary. The number of airport passenger movements between 2008 and 2011 is shown in Table 4.1. The airport does not need considering further as it is greater than 1 km from the Falkirk Council boundary and the number of passengers remains below the threshold of 10 million passengers.

Table 4.1 Number of passenger movements at Edinburgh Airport, 2008 to 2011.
Reference 5.

Year	Edinburgh Airport Passenger movements
2008	8,992,000
2009	9,043,000
2010	8,594,000
2011	9,384,000

Falkirk Council is not aware of any significant changes to Cumbernauld airport, which is a small airport just outside the Falkirk Council area boundary. There are no new airports either.

Falkirk Council confirms that there are no airports in the Local Authority area and none nearby that require a Detailed Assessment.

4.2 Railways (Diesel and Steam Trains)

Falkirk Council has previously assessed emissions from diesel and steam locomotives. Six rail lines are currently operational in or near to the Falkirk Council area:

- 1.) The main Edinburgh to Glasgow line passes east to west with stations at Polmont and Falkirk High,
- 2.) A route connecting Glasgow with Stirling passing southwest to northeast through the Council area with a station at Larbert,
- 3.) A route linking Edinburgh and Stirling passing southeast to northwest through the Council area with stations at Falkirk Grahamston, Camelon and Larbert,
- 4.) A freight line linking Grangemouth Docks and industrial complex to the mainline in the east of Falkirk,

5.) A part time heritage passenger route that operates steam and diesel locomotives between a junction east of Linlithgow on the main Edinburgh to Glasgow line and Bo'ness with stations at Birkhill, Kinneil and Bo'ness,

6.) A re-built line between Airdrie and Bathgate, 1.3 km south of the Falkirk Council boundary.

4.2.1 Stationary Trains

Unfortunately information on locations where locomotives or trains are stationary for more than 15-minutes was not available from Network Rail. However, Falkirk Council is not aware of any new locations that would not have been assessed in previous reports.

There is no relevant exposure within 15 m along rail line five (Bo'ness to Kinneil railway).

Falkirk Council confirms that there are no locations where diesel or steam trains are regularly stationary for periods of 15 minutes or more, with potential for relevant exposure within 15 m.

4.2.2 Moving Trains

Line one of the list in Section 4.2 is the busiest of the rail lines in the Falkirk Council area. The 2009 U&SA did not require assessment of this line, although as a precaution a NO₂ tube was placed close to Falkirk High station. The concentration recorded in 2010 was 22 µg/m³. This is within the NO₂ objective and so the site was discontinued.

Lines two and three have fewer trains running than line one and Falkirk Council is not aware of any significant changes in the level of use. In addition, a NO_x analyser previously operated at the Falkirk Grahams Road site (A12). Although this was primarily located for road traffic emissions it was also adjacent to the Falkirk Grahamston railway station and was 6 m from the track side of line three. The line was also included in the Falkirk Town Centre Further Assessment. In addition, again primarily for road traffic emissions, a PM₁₀ monitor began operation at this location in December 2011.

As a result of the Edinburgh to Glasgow Improvement Programme (EGIP) lines 1, 2 and 3 will be electrified by 2016.

Line four runs through a mostly industrial area and appears to have no new receptors. The Bo'ness and Kinneil steam railway (line five) has four departures and arrivals in each direction during its peak timetable which only operates during July and August weekends. ^{Ref}

⁶ Line six is electric and was discussed in the 2011 Progress Report.

It is concluded that these movements do not need to be considered further.

Falkirk Council confirms that there are no locations with a large number of movements of diesel locomotives, and potential long-term relevant exposure within 30 m.

4.3 Ports (Shipping)

In 2010, 1,721 ships called at the docks, of which 27 were large (defined as 20,000-50,000 deadweight range). In 2011, 1,584 ships called at the docks. ^{Ref 7}

The number of ships calling into Grangemouth has decreased and so the docks do not need to be considered further. In addition, the docks are within the Grangemouth AQMA for SO₂ and were considered in the original Further Assessment report for this AQMA. The Grangemouth MC (A10) monitoring site (with SO₂ analyser) is also close to the docks and in 2011 this site met all three SO₂ objectives. In addition, the polar roses drawn have shown that the highest average concentrations do not occur when the wind direction originates from the direction of the docks.

Falkirk Council confirms that there are no ports or shipping that require further consideration.



5 Industrial Sources

5.1 Industrial Installations

This section considers the potential emissions from the following sources:

- 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 and poultry farms.

5.1.1 New or Proposed Installations for which an Air Quality Assessment has been carried out

The information supplied by SEPA stated that there were no new installations.

Falkirk Council confirms that there are no new or proposed industrial installations for which planning approval has been granted within its area or nearby in a neighbouring authority.

5.1.2 Existing installations where emissions have increased substantially or new relevant exposure has been introduced.

The information supplied by SEPA stated that there were no existing installations where emissions have increased substantially.

Falkirk Council confirms that there are no industrial installations with substantially increased emissions or new relevant exposure in their vicinity within its area or nearby in a neighbouring authority.

5.1.3 New or Significantly Changed Installations with No Previous Air Quality Assessment

The information supplied by SEPA stated that there were no new installations.

Falkirk Council confirms that there are no new or proposed industrial installations for which planning approval has been granted within its area or nearby in a neighbouring authority.

5.2 Major Fuel (Petrol) Storage Depots

There are major fuel (petrol) storage depots within Falkirk Council area, but these have been considered in previous reports. In addition, benzene monitoring is carried out in Grangemouth and other parts of the Falkirk Council area. As shown in Table 2.8 and 2.9 there were no breaches of the benzene objectives in 2011.

There are major fuel (petrol) storage depots within the Falkirk Council area but these have been considered in previous reports. Benzene monitoring is conducted in the Falkirk Council area and shows no exceedances of the Scottish or UK / EU objectives.

5.3 Petrol Stations

The technical guidance states that there is potential for exceedance of the 2010 annual mean objective for benzene where there is relevant exposure within 10 m of the pumps of a petrol station with an annual throughput of greater than 2000 m³ which is located close to a road with a traffic flow greater than 30,000 AADT.

One new petrol station has commenced operation at the Tesco in Camelon since the 2011 Progress Report. There is no relevant exposure within 10 m and it is not close to a road with flow of more than 30,000 AADT. Thus the site does not need considering further.

Falkirk Council confirms that there are no petrol stations within its area meeting the specified criteria that require assessment.

5.4 Poultry Farms

The information supplied by SEPA did not state that there were any changes to poultry farms.

Falkirk Council confirms that there are no poultry farms within its area meeting the specified criteria that require assessment.

The following processes have ceased operation since the 2011 Progress Report:

- Dowding and Mills (PPC/E/20072) are in the process of removing all tanks and therefore have not operated their permitted activity this year. They will apply for permit surrender when the removal of the tanks and pipe work has been completed.
- A dry cleaner, Fresh and Clean, in Polmont is now a barbers shop.

6 Commercial and Domestic Sources

This section considers the potential emissions from the following sources:

- 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.

6.1 Biomass Combustion – Individual Installations

There are currently three applications for individual biomass installations:

- 1.) (Consultation on) Application under section 36 of the Electricity Act 1989 to construct and operate a biomass renewable energy plant with a net electrical output of 100 MWe. Site to the West of Forth Ports Plc, Central Dock Road, Grangemouth. This is subject to a Planning Inquiry.
- 2.) Replacement of existing CHP plant with 25 MW biomass plant. Earl's Gate Park, Earl's Road, Grangemouth. This is at the Environmental Scoping report stage.
- 3.) Create new kilns 5 & 6 and Boilerhouse / Fuel Store at Abbotshaugh Sawmill, Falkirk, current application.

Falkirk Council confirms that there are no new biomass combustion plant in the area that have been granted planning permission.

6.2 Biomass Combustion – Combined Impacts

Falkirk Council has assessed domestic biomass or other fuel burning in previous reports. Falkirk Council has either received no significant numbers of complaints for particular areas in relation to or changes to the following:

- Complaints about nuisance dust or odour relating to burning,
- Visual signs of chimney smoke being emitted from several properties near to each other,
- Smell of burning biomass fuel,
- Known high levels of sales of biomass or other fuels via home delivery or local outlets,
- Areas known to have limited or no access to mains gas.

It is therefore proposed that no Detailed Assessment is required. A list of 'squares' (500 * 500 m) has been drawn up, discussed below, that can be used if a significant number of complaints are made for a particular area.

There are 3,168 squares (500 * 500 m) in the Falkirk Council area and of those there are 193 squares (500 * 500 m) where the **total** number of households is greater than the appropriate

threshold for households using open fires. Squares that are already close to a PM₁₀ monitor were excluded. The assessment shows that the lowest percentage of the total number of households that would be required to be using an open fire place as a primary source of heat is 9%, most squares require a much greater percentage of properties.

Falkirk Council confirms that there are no biomass combustion plant in its area that require a Detailed Assessment.

6.3 Domestic Solid-Fuel Burning

Falkirk Council has assessed domestic solid fuel burning in previous reports and is not aware of any new areas that would need consideration.

There may be improvements to emissions for this section. In areas where there is no mains gas, a change from coal or wood burning on open fires to using wood burning stoves would reduce emissions.

Falkirk Council confirms that there are no areas of significant domestic fuel use in its area.



7 Fugitive or Uncontrolled Sources

This section considers the potential emissions from the following sources:

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

Landfill sites are regulated by SEPA and they indicated no changes with respect to the pollutants covered by this report.

Skene Group disposed of their interest in Cowdenhill quarry during 2011 with operations ceasing in July 2011. An environmental scoping report has been issued for a new quarry, which will include an assessment of air quality. This quarry will be in proximity to the previous Cowdenhill quarry and will be located in the North Lanarkshire Council area, it will however use the existing access road that passes through the Falkirk Council area. The proposals state that this access road will be upgraded.

The TEOM installation in the AQMA (Banknock 2) has been delayed due to issues with the electrical supply and storm damage to the enclosure. The monitor installation will still go ahead bearing in mind the proposed new quarry; with the application of the VCM this will give a reference equivalent measurement of PM₁₀.

Falkirk Council is not aware of any other changes to unmade haulage roads on industrial sites, waste transfer stations or other potential sources of fugitive particulate emissions.

Falkirk Council confirms that there are no new potential sources of fugitive particulate matter emissions in its area.

8 AQMA and Action Plan Updates

Grangemouth AQMA (SO₂ 15-minute) Action Plan

In 2011 Falkirk Council monitored sulphur dioxide at seven locations, the results are shown in Table 2.9. The Grangemouth AURN and Grangemouth Moray sites continued to breach the 15-minute objective, while the daily and hourly objectives were met. All other monitoring sites met all three objectives. This is consistent with results from previous years. No exceedance has been recorded at the four monitoring sites outside the AQMA since December 2010.

It is understood that the Tail Gas Treatment abatement equipment being installed by INEOS (as discussed in the 2010 and 2011 Progress Reports) will now be fully commissioned by the end of 2012 rather than by the previously reported June 2013. It is anticipated that this work will reduce the number of exceedances in the Grangemouth AQMA such that the 15-minute objective is met.

In addition, Falkirk Council understands that Flue Gas Desulphurisation has been running on two of the units at Longannet Power Station since the end of 2010 with full commissioning by the end of November 2012. A third unit is due for commissioning by the end of August 2013.

The Grangemouth AQMA Action Plan included four measures and an update of these is provided in this section.

Measure 1:

Seven of Falkirk Council's automatic monitoring stations are affiliated to either the AURN or the Scottish Air Quality Network with the data displayed on the appropriate website. This includes five of the seven SO₂ analysers that are used for monitoring in relation to the Grangemouth AQMA. The data from the Bo'ness and Polmont sites are available on request.

Falkirk Council sends meteorological data and provisional SO₂ to SEPA and INEOS when an SO₂ exceedance is recorded at a monitoring station. In addition, a monthly summary is sent. The monthly summary includes data for each site, a list of the exceedances and as necessary polar roses or other analysis.

Measure 2:

A working group meeting will be organised post-commissioning of the Tail Gas Treatment unit.

Measure 3:

Falkirk Council's text alert system has been implemented and is being maintained. The Scottish Air Quality Network has recently launched an air quality alert system for the public (<http://www.scottishairquality.co.uk/know-and-respond/>). Falkirk Council will continue to run its system as it is pollutant specific for each site.

Measure 4:

The Abbotsford House site ceased operation on the 16th April 2010. This unit was relocated to Polmont and commenced operation in September 2010. The Polmont site is likely to cease operation at the end of September 2012. This is because only one exceedance, well within the 35 allowed by the objective, has been recorded since monitoring started.

The three main monitoring sites are located in Grangemouth. The sites in Bo'ness and Falkirk provide suitable background data. An assessment will also take place as to whether operating two SO₂ analysers at both Falkirk Hope and Park St can continue to be justified. The 15-minute objective continues to be met outside the Grangemouth AQMA. No exceedances (for any objective) have been recorded outside the AQMA between December 2010 and May 2012.

Falkirk Town Centre (NO₂ hourly and annual) AQMA

The draft Action Plan is nearing completion and will be consulted upon in due course.

The Falkirk Town Centre and Haggs Further Assessments have now been accepted by the Scottish Government. The Falkirk Town Centre Further Assessment and monitoring have shown the AQMA declared for the hourly NO₂ objective is not required and can be revoked, but that PM₁₀ (Scottish objectives only) should be added to the AQMA declared for the annual NO₂ objective. These changes will be proposed to elected Members at the next available opportunity (no meetings have been scheduled recently due to the local elections).

Haggs (NO₂ annual) AQMA

This work is running in conjunction with the Falkirk Town Centre AQMA work.

A PM₁₀ TEOM monitor is due for installation at the Haggs monitoring site following the Further Assessment.

Banknock (PM₁₀ daily and annual) AQMA

This AQMA was declared in August 2011 for a breach of the Scottish objectives and a potential breach of the UK objectives.

In 2011 the Scottish and UK objectives were met at the Banknock 1 monitoring site, whether a 1.14 or 1.3 factor was applied to the Osiris monitoring data. The number of daily exceedances recorded in 2011 was three and this compares to 18 recorded in 2010 (with a 1.3 factor applied four in 2011 and 30 in 2010). The 2011 annual concentration was 15.2 µg/m³ compared to 20.7 µg/m³ in 2010 (with a 1.3 factor the concentration was 17.3 µg/m³ in 2011 compared to 23.7 µg/m³ in 2010). The Banknock 1 data has not been annually adjusted due to the likely local sources influencing this site.

Skene Group disposed of their interest in Cowdenhill Quarry during 2011 with operations ceasing in July 2011. An environmental scoping report, which included air quality, has been issued for a new quarry. The new quarry will be in proximity to the previous Cowdenhill

quarry but located in the North Lanarkshire Council area. The proposals state that the existing access road, running through the Falkirk Council area, will be used, but also that the access road will be upgraded.

The installation of a TEOM PM₁₀ monitor (Banknock 2) will provide, via the volatile correction method, reference equivalent results. The installation in the area has been delayed due to electrical supply issues and storm damage to the enclosure, but will still go ahead.

The Further Assessment report work has begun, with the modelling initially focusing on the years of 2010 and 2011. As the quarry ceased operation in July 2011 this will provide a useful baseline situation for the report. Future scenarios will also be modelled, but this element cannot progress until the future situation is confirmed.



9 Conclusions and Proposed Actions

9.1 Conclusions from New Monitoring Data

Falkirk Council has examined its automatic and non-automatic monitoring results. The Grangemouth AURN and Grangemouth Moray automatic sites, both within the Grangemouth SO₂ AQMA, breached the 15-minute objective in 2011. The hourly and daily objectives were met at these two sites. The SO₂ monitoring sites outside the Grangemouth AQMA continue to meet all three objectives.

All sites except the Falkirk West Bridge St site met the Scottish PM₁₀ objectives in 2011. This site recorded a concentration of 18.7 µg/m³ and was close to recording a breach of the daily objective with a 98th percentile concentration of 49 µg/m³ (five daily exceedances were recorded). All sites met the UK / EU PM₁₀ objectives in 2011. As discussed in the Further Assessment report for Falkirk Town Centre and subsequent communications with the Scottish Government it will be proposed to elected Members that the Falkirk Town Centre AQMA declaration is amended to include PM₁₀, but that the hourly NO₂ AQMA is revoked.

The NO₂ objectives were not breached at the automatic monitoring sites in 2011. Some diffusion tube sites breached the NO₂ annual objective in 2011 but most were in the Falkirk Town Centre or Hags AQMAs. One tube, NA83, did record a breach of the objective with the R&A factor applied. However, with the more appropriate local roadside factor (Falkirk Park St) an exceedance was not recorded at the nearest receptor.

All benzene and 1,3 butadiene diffusion tubes met the objectives in 2011 along with the pumped diffusion tube (benzene) at the Grangemouth AURN site. The Grangemouth AURN site met the PM_{2.5} EU target and limit values as well as the Scottish target value in 2011.

9.2 Conclusions from Assessment of Sources

Falkirk Council has conducted a review of potential sources of the seven pollutants. Eleven DMRB runs were conducted due to changes in road traffic levels, none of the results showed a likely breach of the NO₂ or PM₁₀ objectives. Emissions from other transport sources did not require further consideration.

There were no significant changes to industrial emissions although three biomass operations are proposed (but have not been granted planning permission as yet). The changes to quarry operations in the Banknock PM₁₀ AQMA have been noted with monitoring continuing in the area and the Further Assessment underway. It is concluded that cumulative effects of small biomass boilers do not need to be considered further.

The review found no requirement for a Detailed Assessments for any pollutant.

9.3 Proposed Actions

The 2012 U&SA has found no requirement for a Detailed Assessments for any pollutant based on monitoring data and screening criteria.

Falkirk Council shall continue to assess and monitor SO₂ concentrations in the Grangemouth AQMA. There will be a particular focus on the number of exceedances at the Grangemouth sites following the installation and commissioning of Tail Gas Treatment towards the end of 2012.

The Polmont analyser is likely to cease operation in September 2012 which will be followed by a review of the two Falkirk analysers (Hope St and Park St).

At the earliest opportunity it will be proposed to elected Members that the Falkirk Town Centre AQMA will be amended to include PM₁₀ and that the hourly NO₂ AQMA be revoked. There have been no committee meetings recently due to the local elections. Falkirk Town Centre and Hags AQMA Action Plans will also be submitted.

If required by the Scottish Government Falkirk Council will submit a Progress Report in 2013.



10 References

General:

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<http://www.scottishairquality.co.uk/openair/openair.php>
b. D.Carslaw and K.Ropkins, Openair: Open-source tools for the analysis of air pollution data. R package version 2.14.1 and Openair 0.5-18.
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<http://www.dft.gov.uk/traffic-counts/area.php?region=Scotland&la=Falkirk>
5. Civil Aviation Authority, UK Airport Statistics
<http://www.caa.co.uk/default.aspx?catid=80&pagetype=88&pageid=3&sqlid=3#Data>
6. Scottish Railway Preservation Society, timetable for Bo'ness and Kinneil Railway,
<http://www.srps.org.uk/railway/timetable.htm>
7. Personal communication, Forth Ports.
8. UK-AIR and Scottish Air Quality Network:
http://www.airquality.co.uk/verification_and_ratification.php and
http://www.scottishairquality.co.uk/verification_and_ratification.php
9. UK-AIR website, data selector: http://uk-air.defra.gov.uk/data/data_selector

All websites were accessible in May 2012.

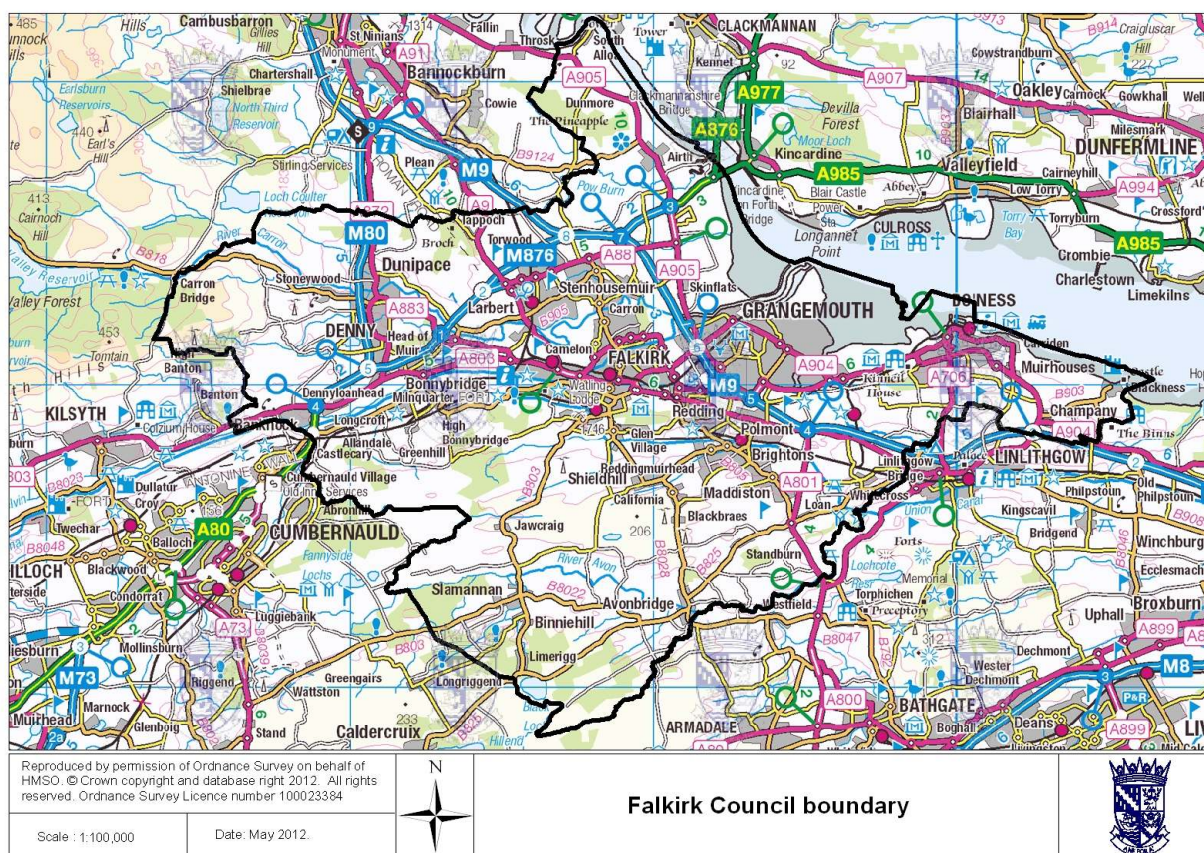
Appendices

Appendix A: Falkirk Council boundary and QA/QC of monitoring data.

Appendix B: DMRB Calculations.

Appendix A: Falkirk Council boundary and QA/QC of monitoring data

Figure A1 The boundary of the Falkirk Council area.



Factors from Local Co-location Studies

The nitrogen dioxide, benzene and 1,3 butadiene tubes used by Falkirk Council are supplied and analysed by Environmental Scientifics Group (formerly called Harwell Scientifics). The method used for the NO₂ tubes is 50% acetone and 50% tri-ethanolamine. The tubes used for benzene are Chromosorb ATD (atomic thermal desorption) tubes and for 1,3 butadiene are molecular sieve ATD tubes.

Falkirk Council carried out two triplicate studies for NO₂, the first was at the Grangemouth Municipal Chambers (site NA42 / A10), an urban background site. The second was at the Falkirk Park St (NA70 / A6), a roadside site, spreadsheets with the calculations are shown in

Figure A3. The automatic monitoring data used for the two sites was ratified for January to June 2011 and provisional for remainder of the year.

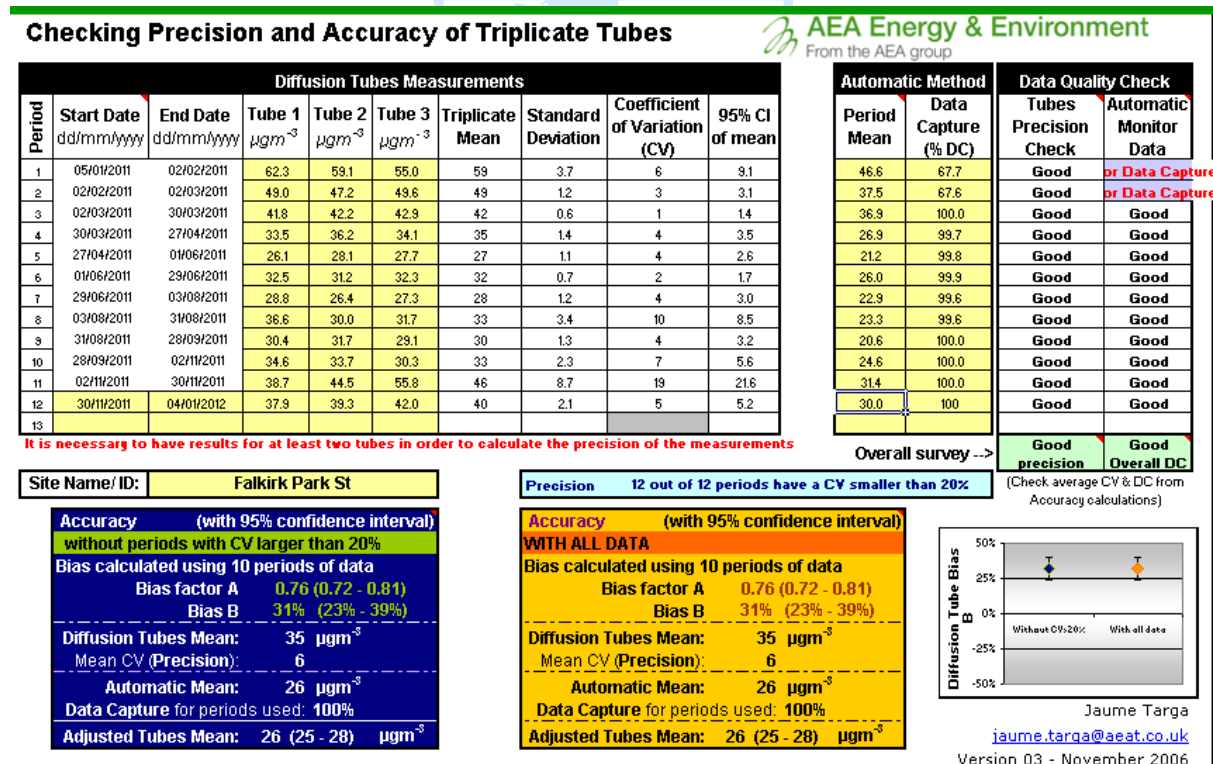
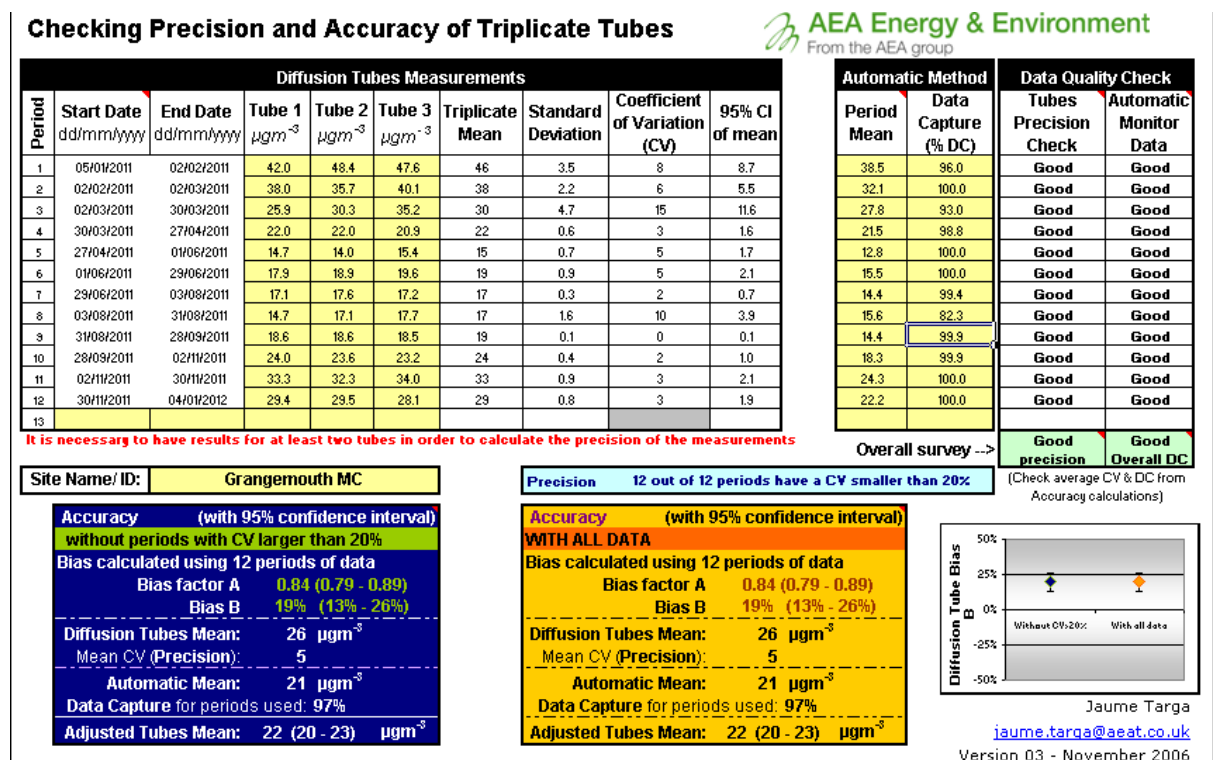
The bias factor for the Grangemouth MC site (A10) was 0.84 and for the Falkirk Park St site (A6) was 0.76. This is in contrast to 2010 where the background and roadside factors were similar and 2011 represent the more usual situation for these two sites. The bias adjustment factor from the R&A Helpdesk database for 2011 is 0.84. The two local studies carried out by Falkirk Council contributed to this factor, the background site is the same as the R&A factor but the local roadside factor is lower than this value.

The overall automatic data capture and overall provision was good for both sites. The R&A factor has been used for NO₂ concentrations in this report as the tubes are located at a variety of site types. However, it should be noted that this gives a conservative result (i.e. an over-reading) for the roadside diffusion tubes as this factor is greater than the Park St factor. This should be borne in mind for the roadside tubes.

Discussion of Choice of Factor to Use

The local and R&A Helpdesk bias adjustment factors suggest that the diffusion tubes over-read NO₂ compared to the automatic monitors. Falkirk Council has used the R&A helpdesk factor for the 2011 results as there are a mixture of roadside and background sites. However, it should be noted that when this factor is used for the roadside sites this gives a conservative (i.e. over records) result for these diffusion tubes. This is because the R&A factor is noticeably higher than the Park St factor, 0.77 vs 0.84, see Appendix for calculations. This is discussed further in respect of roadside tubes that are close to the objective.

Figure A2 NO₂ bias adjustment factors for Grangemouth MC (A10) and Falkirk Park St (A6).



PM₁₀ Monitoring Adjustment

All TEOM data for data from 2008 onwards has been adjusted using the King's College London Volatile Correction Method (VCM). For the sites affiliated to the Scottish Air Quality Network in 2011 this was carried out by AEA as part of the Scottish Government's contract for the SAQN.

The Grangemouth AURN site has had an FDMS since April 2009 and so no correction factor has been applied to this data, prior to this there was a TEOM on site. The VCM has been applied to 2008 and 2009 data by King's College under contract to Defra.

The Banknock 1 Osiris data has had an adjustment factor of 1.3 and 1.14 applied. The Osiris output is a 15-minute average, these have been converted to an hourly and daily average using Enview software.

Short-term to Long-term Data Adjustment

Short-term to long-term adjustment has not been conducted for the Banknock 1 monitoring results given the potential for local sources to be impacting the monitoring results.

Monitoring results have been adjusted for the appropriate diffusion tubes and automatic analysers where data capture was below 90%, details are shown in Tables A1.

Table A1 Short-term to long-term adjustments.

Falkirk West Bridge St (A7)	Site Type	Annual Mean (2011), $\mu\text{g}/\text{m}^3$	Period Mean, $\mu\text{g}/\text{m}^3$	Ratio
Grangemouth AURN	Urban background.	15.1	15.3	0.99
Grangemouth Moray	Urban background.	17.3	18.3	0.95
Edinburgh St. Leonards	Urban background	24.8	26.8	0.93
			Average	0.95

Falkirk Grahams Road (A12)	Site Type	Annual Mean (2011), $\mu\text{g}/\text{m}^3$	Period Mean, $\mu\text{g}/\text{m}^3$	Ratio
Grangemouth AURN	Urban background.	15.1	14.5	1.04
Grangemouth Moray	Urban background.	17.3	17.1	1.01
Edinburgh St. Leonards	Urban background	24.8	25.4	0.97
			Average	1.01

NA19 (Kilsyth Rd, Banknock)	Site Type	Annual Mean (2011), $\mu\text{g}/\text{m}^3$	Period Mean, $\mu\text{g}/\text{m}^3$	Ratio
Grangemouth AURN	Urban background.	15.1	15.2	0.99
Grangemouth Moray	Urban background.	17.3	17.7	0.98
Edinburgh St. Leonards	Urban background	24.8	25.7	0.96
			Average	0.98

NA44 (Greenpark Drive, Polmont)	Site Type	Annual Mean (2011), $\mu\text{g}/\text{m}^3$	Period Mean, $\mu\text{g}/\text{m}^3$	Ratio
Grangemouth AURN	Urban background.	15.1	14.0	1.08
Grangemouth Moray	Urban background.	17.3	16.4	1.06
Edinburgh St. Leonards	Urban background	24.8	24.8	1.00
			Average	1.04

NA94 (A905, Glensburgh Rd)	Site Type	Annual Mean (2011), $\mu\text{g}/\text{m}^3$	Period Mean, $\mu\text{g}/\text{m}^3$	Ratio
Grangemouth AURN	Urban background.	15.1	15.2	0.99
Grangemouth Moray	Urban background.	17.3	17.7	0.98
Edinburgh St. Leonards	Urban background	24.8	25.7	0.96
			Average	0.98

NA98 (Arnothill, Falkirk)	Site Type	Annual Mean (2011), $\mu\text{g}/\text{m}^3$	Period Mean, $\mu\text{g}/\text{m}^3$	Ratio
Grangemouth AURN	Urban background.	15.1	12.5	1.21
Grangemouth Moray	Urban background.	17.3	14.3	1.21
Edinburgh St. Leonards	Urban background	24.8	20.9	1.18
			Average	1.20

NA99 (St. Crispins Place, Falkirk)	Site Type	Annual Mean (2011), $\mu\text{g}/\text{m}^3$	Period Mean, $\mu\text{g}/\text{m}^3$	Ratio
Grangemouth AURN	Urban background.	15.1	11.9	1.27
Grangemouth Moray	Urban background.	17.3	13.9	1.24
Edinburgh St. Leonards	Urban background	24.8	20.3	1.22
			Average	1.25

NA100 (Oswald St, Falkirk)	Site Type	Annual Mean (2011), $\mu\text{g}/\text{m}^3$	Period Mean, $\mu\text{g}/\text{m}^3$	Ratio
Grangemouth AURN	Urban background.	15.1	12.5	1.21
Grangemouth Moray	Urban background.	17.3	14.3	1.21
Edinburgh St. Leonards	Urban background	24.8	20.9	1.18
			Average	1.20

NA101 (Glensburgh Rd 2, Grangemouth)	Site Type	Annual Mean (2011), $\mu\text{g}/\text{m}^3$	Period Mean, $\mu\text{g}/\text{m}^3$	Ratio
Grangemouth AURN	Urban background.	15.1	12.5	1.21
Grangemouth Moray	Urban background.	17.3	14.3	1.21
Edinburgh St. Leonards	Urban background	24.8	20.9	1.18
			Average	1.20

NA103 (Merchiston Gardens)	Site Type	Annual Mean (2011), $\mu\text{g}/\text{m}^3$	Period Mean, $\mu\text{g}/\text{m}^3$	Ratio
Grangemouth AURN	Urban background.	15.1	19.5	0.77
Grangemouth Moray	Urban background.	17.3	19.5	0.89
Edinburgh St. Leonards	Urban background	24.8	24.8	1.00
			Average	0.89

NA105 (West of Shieldhill)	Site Type	Annual Mean (2011), $\mu\text{g}/\text{m}^3$	Period Mean, $\mu\text{g}/\text{m}^3$	Ratio
Grangemouth AURN	Urban background.	15.1	19.5	0.77
Grangemouth Moray	Urban background.	17.3	19.5	0.89
Edinburgh St. Leonards	Urban background	24.8	24.8	1.00
			Average	0.89

QA/QC Automatic Monitoring

Table A2 Details of the QA/QC for 2011 for the automatic monitoring stations.

QA / QC for 2011.		
Site	Analyser	Network
A2. Banknock 1	PM ₁₀ (Osiris)	Local #
A3. Bo'ness	SO ₂	Local *
A4. Falkirk Haggs	NO _x	SAQN
A5. Falkirk Hope St	NO _x	SAQN
	PM ₁₀ (TEOM)	SAQN
	SO ₂	SAQN
A6. Falkirk Park St	NO _x	SAQN
	PM ₁₀ (TEOM)	SAQN
	SO ₂	SAQN
A7. Falkirk West Bridge St	NO _x	SAQN
	PM ₁₀ (TEOM)	SAQN
A8. Grangemouth AURN (Inchyra)	NO _x	AURN
	PM ₁₀ (TEOM-FDMS)	AURN
	PM _{2.5} (TEOM-FDMS)	AURN
	SO ₂	AURN
A9. Grangemouth Moray	NO _x	AURN
	PM ₁₀ (TEOM)	SAQN
	SO ₂	SAQN
A10. Grangemouth Municipal Chambers	NO _x	SAQN
	PM ₁₀ (TEOM)	SAQN
	SO ₂	SAQN
A11. Polmont	SO ₂	Local *
A12. Falkirk Grahams Rd	NO _x	Local *
	PM ₁₀ (TEOM)	Local *

Local sites (*):

- Suspicious data or data recorded when a fault is occurring is automatically marked invalid by software. Data is also manually checked and marked invalid if it is suspicious.
- All NO_x and SO₂ analysers receive fortnightly zero and span checks and filter changes.
- All LSO site visits are carried out by Falkirk Council staff who are audited to AURN standard.
- Receive a service every six months.
- Are covered by a contract for emergency callout.
- Zero and span scaling is carried out on the data in-house based on the fortnightly site visits and additionally for the Horiba sites the auto-calibrations occurring every three days. Span adjustments are based on the concentration that is stated on the gas cylinders. No independent check is made of the cylinder concentrations, though cylinders are replaced if contamination is suspected.

Local sites (#):

- Data is downloaded at site and a flow check is carried out on a fortnightly basis.
- A filter change is carried out on an approximate four weekly basis, although this is dependent on the weather and filter loading. The filters are retained for analysis.
- Some minor adjustment of the times for the data has taken place. This is because between a flow check or filter change and the next midnight hour, the Osiris records data in 15-minute blocks at say 12, 27, 42, 57 mins past the hour rather than the usual 15, 30, 45 and 00. This should have little effect on the results and permits the data to fit into the Council's monitoring database which it otherwise would not.
- All LSO site visits are carried out by Falkirk Council staff who are audited to AURN standard.
- The Osiris is serviced on an annual basis and covered by a service agreement for any breakdowns, both are completed off-site.
- A 1.3 / 1.14 correction factor has been applied to the PM₁₀ data for Banknock 1. It was confirmed with King's College London that the VCM could not be applied to Osiris data.

AURN and Scottish AQ network sites:

- All NO_x and SO₂ analysers receive fortnightly zero and span checks and filter changes. Note the AURN sites receive a fortnightly NO₂ span check for NO_x converter efficiency but the SAQN sites do not.
 - TEOM heads are cleaned and the filter changed on a four weekly basis or more frequently if the filter loading goes above 90%.
 - TEOM-FDMS heads are cleaned and filters changed as directed by AURN CMCU (i.e. at 90% loading).
 - All LSO site visits are carried out by Falkirk Council staff who are audited to AURN standard.
 - Are covered by a contract for emergency callout and receive a service every six months.
- QA/QC is to either AURN / 'national' standards ^{Ref 8}.

- Falkirk Council also checks the data on its systems and is in communication with AEA to ensure the best data quality. Unscaled data is supplied by Falkirk Council to AEA for the Scottish AQ Network sites on a six monthly basis to improve data capture.
- For the time that a monitor is affiliated to the AURN or SAQN, data has been downloaded from either the UK-AIR website or the Scottish Air Quality Network.

QA/QC Diffusion Tube Monitoring

The full set of monthly diffusion tube results are shown in Figure A3 and A4.

ESG (formerly Harwell Scientifics) have satisfactorily passed all the WASP (Workplace Analysis Scheme for Proficiency) scheme tests since 2009. They follow their internal standard operating procedure that meets the guidelines set out in Defra's 'Diffusion Tubes For Ambient NO₂ Monitoring: Practical Guidance.' ESG recorded 'good' precision throughout 2011.

Tube results are checked on a monthly basis and reviewed at the end of the year. Results under 4 µg/m³ are not included. If a tube is found on the ground or with a spider in etc, an assessment is made at the end of the year as to whether the result seems appropriate for that site and the time of year.

The full pumped benzene diffusion tube results are shown in Table A3. ^{Ref 9}

Table A3 Pumped diffusion tube (Grangemouth AURN) results in full.

Start Date	End Date	Benzene	Status
30/12/2010	11/01/2011	0.89	R µg/m ³
11/01/2011	25/01/2011	1.41	R µg/m ³
25/01/2011	08/02/2011	0.92	R µg/m ³
08/02/2011	22/02/2011	2.36	R µg/m ³
22/02/2011	09/03/2011	0.75	R µg/m ³
09/03/2011	23/03/2011	1.25	R µg/m ³
23/03/2011	05/04/2011	1.1	R µg/m ³
05/04/2011	19/04/2011	1.31	R µg/m ³
19/04/2011	03/05/2011	3.5	R µg/m ³
03/05/2011	17/05/2011	1.47	R µg/m ³
17/05/2011	31/05/2011	0.32	R µg/m ³
31/05/2011	14/06/2011	1.09	R µg/m ³
14/06/2011	28/06/2011	1.25	R µg/m ³
28/06/2011	12/07/2011	1.41	R µg/m ³
12/07/2011	26/07/2011	0.83	R µg/m ³
26/07/2011	09/08/2011	2.15	R µg/m ³
09/08/2011	23/08/2011	1.4	R µg/m ³
23/08/2011	07/09/2011	1.51	R µg/m ³
07/09/2011	21/09/2011	0.68	R µg/m ³
21/09/2011	04/10/2011	1.25	R µg/m ³
04/10/2011	18/10/2011	0.44	R µg/m ³
18/10/2011	01/11/2011	0.55	R µg/m ³
01/11/2011	16/11/2011	3.04	P µg/m ³

Table A4 a, b and c Benzene, 1,3 butadiene and nitrogen dioxide results in full.

Benzene results 2011		Grid Reference		January	February	March	April	May	June	July	August	September	October	November	December	Annual average	Annual data
Site number	Location	x	y	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	µg/m ³	capture, %
3	Tinto Drive, Grangemouth	293427	680386	-	-	-	-	-	-	-	-	-	-	-	-	0.38	16.7
21	Grangemouth Road, College	290112	680500	0.17	0.32	0.3	0.32	0.31	0.33	-	0.27	0.35	0.28	0.1	0.36	0.28	91.7
24	Kerse Lane, Falkirk	288195	680040	0.25	0.37	0.36	0.43	0.39	0.78	-	0.56	0.25	0.12	0.78	-	0.35	33.3
27	West Bridge Street, Falkirk	288470	680040	0.41	0.38	0.51	0.41	0.39	0.23	-	0.17	0.097	0.23	0.5	0.29	0.46	83.3
37	Denny Town House	281227	682725	0.38	0.24	0.18	0.28	0.36	0.66	-	0.11	0.097	0.23	0.1	0.21	0.27	91.7
38	Larbert Village Primary School	285960	682400	-	1.7	0.29	0.3	0.34	0.2	-	0.43	0.46	0.25	3.4	0.47	0.68	83.3
41	Seaview Place, Boness	299720	681600	0.45	0.51	0.92	0.26	0.077	0.2	-	0.12	0.23	0.29	0.51	0.57	0.28	91.7
42	Municipal Chambers, Grangemouth	292800	682000	0.25	0.26	0.23	0.38	0.091	0.14	-	0.16	0.1	0.17	0.36	0.21	0.26	84
44	Greenpark Drive, Polmont	293550	678860	0.24	0.16	0.67	0.27	0.25	0.25	-	0.097	0.15	0.17	0.36	0.21	0.26	91.7
46	West Bridge Street traffic lights, Falkirk	288543	680045	0.18	0.24	0.38	0.35	0.36	0.25	-	0.097	0.15	0.17	0.36	0.21	0.26	84
49	Lennox Terrace, Grangemouth	293600	680250	0.27	0.23	0.3	0.35	0.39	0.33	-	0.23	0.25	0.26	-	-	0.24	75.0
55	Inchyra Station	293833	681014	0.1	0.66	0.27	0.5	0.41	0.43	-	0.45	0.18	0.28	1.4	0.12	0.44	91.7
57	Inchyra Road, Grangemouth	292800	682000	0.35	0.59	0.43	0.36	0.59	0.74	-	0.47	0.14	0.31	0.1	0.36	0.40	131
66	Holehouse, Slamannan	289450	672035	0.19	0.13	0.18	0.097	0.077	1.2	-	0.1	0.097	0.15	-	-	0.25	0.80
74	Hope St AQ station	288678	680218	0.34	0.49	0.42	0.38	0.14	0.23	-	0.097	0.23	0.3	-	-	0.29	75.0
77	Kinnaird Village	286490	683775	0.17	0.22	0.33	0.18	0.17	0.21	-	0.1	0.17	-	0.1	0.29	0.19	63.3
80	Cow Wynd	288765	679456	0.35	0.54	0.54	0.34	0.15	0.8	-	0.13	0.23	0.15	0.1	0.42	0.34	111
81	Grahams Road, Falkirk	288834	680898	0.21	0.43	0.42	0.38	0.17	0.25	-	0.31	0.23	0.34	-	0.46	0.32	104
87	M80 slip south, Heggs	279017	679305	0.18	0.36	-	0.29	0.23	0.11	-	-	0.19	-	-	-	0.23	74
94	A905 (Glenburgh Rd), Grangemouth	291213	681927	0.2	0.39	0.35	0.23	0.33	0.13	-	0.12	0.097	0.25	0.24	0.28	0.24	50.0
95	Rae St, Stenhousemuir (2)	286778	683175	0.15	0.2	0.25	0.54	0.31	0.85	-	0.15	-	0.25	-	-	0.34	110
102	East Kerse Mains, Boness	297968	680684	-	-	-	-	0.1	0.33	-	0.25	0.15	0.15	0.28	0.22	0.21	66.7
105	West of Shieldmill	288284	676881	-	-	-	-	-	-	-	-	-	-	0.32	0.24	0.28	58.3

1,3 butadiene results 2011

1,3 butadiene results 2011		Grid Ref		January	February	March	April	May	June	July	August	September	October	November	December	Annual Average	Annual data
Site No	Address	x	y	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	µg/m ³	capture, %
27	West Bridge Street, Falkirk	288470	680040	0.2	0.19	0.57	0.42	0.33	0.19	-	0.57	0.19	0.46	0.59	0.44	0.35	75.0
41	Seaview Place, Boness	299720	681600	0.2	0.19	0.57	0.42	0.33	0.19	-	0.57	0.19	0.46	0.59	0.44	0.35	91.7
42	Municipal Chambers, Grangemouth	292817	682000	-	0.19	0.57	0.42	0.33	0.19	-	0.57	0.19	1.7	-	-	0.52	66.7
49	Lennox Terrace, Grangemouth	293600	680250	0.2	0.19	0.57	0.42	0.33	0.19	-	0.57	0.19	0.46	-	-	0.35	75.0
55	Inchyra Station, Grangemouth	293833	681014	0.2	0.19	0.57	0.42	0.33	0.19	-	0.57	0.19	0.46	0.59	0.44	0.38	85
57	Inchyra Road, Grangemouth	292800	682000	0.2	0.19	0.57	0.42	0.33	0.19	-	0.57	0.19	0.46	-	-	0.35	75.0
104	Powdrake Road, Grangemouth	293788	682054	-	-	-	-	-	-	-	-	-	-	0.59	0.44	0.52	16.7

Site No	Address	Grid ref. x	Grid ref. y	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Average	Part St bias 2011	RSA bias 2011 (March 2012)	Data capture, %
3	Tinto Drive, Grangemouth	293427	680386	29.8	41.6	33.5	19.4	14.6	18.7	18.7	19.6	19.1	23.7	38.4	27.5	25	20	21	100.0
5	Copper Top Pub, Camelon	287332	680333	57.6	51.3	35	31.9	29.9	29.4	26.2	29.5	33.2	40.1	43.7	38.8	37	29	31	100.0
7	Living Parish Church, Camelon	287324	680442	40.4	49.5	31.7	18.2	14.9	16.3	16.7	17.1	16.1	28.4	31.6	28.2	26	20	21	100.0
9	Balslawn Road, Larbert	288048	683542	50	49	43.7	26.5	19	23.2	19.1	26.5	29.1	33.7	43.4	40.5	34	26	28	100.0
11	Marine Road, Larbert	288052	683542	43.7	48	43.7	26.5	19	23.2	19.1	26.5	29.1	33.7	43.4	40.5	34	26	28	100.0
13	Green Hill, Camelon	287662	679622	57.8	55.1	41.3	33.8	27.6	30.4	28.5	32	31.8	39.6	52.1	-	38	29	32	83.3
15	Green Hill, Camelon	287662	679622	57.8	55.1	41.3	33.8	27.6	30.4	28.5	32	31.8	39.6	52.1	-	38	29	32	83.3
19	Kilwh Road, Banknock	278770	679301	62.7	48.1	43.9	41.4	7.5	42.8	42.8	31.9	18.9	33.5	52.1	-	40	31	34	66.7
20	Grangemouth Road, Hags	278770	679155	62.7	46.5	39.5	24.1	19.6	20.4	18.1	31.9	23.9	28.9	39.8	36.5	30	23	25	100.0
21	Grangemouth Road, Collee	290112	680500	59.5	50.6	47.1	25	29.1	30	24.4	30.5	33.2	41.4	56.1	41.6	39	30	33	100.0
24	Kerse Lane, Falkirk	299187	680024	68.8	-	44.6	47.8	36.8	44.2	37.8	41.3	45.1	53.4	55.2	-	48	37	40	83.3
26	West Street, Falkirk	289207	680123	44.5	38.8	34.4	56	16.4	17.7	17.7	17.4	17.8	22	33.3	28.6	26	20	22	100.0
27	West Bridge Street, Falkirk	289490	680095	81.5	80.4	71.7	56	43.7	56	57.3	52.3	39.9	54.9	75.4	-	61	47	51	91.7
29	Wellside Place, Falkirk	288466	680220	39.5	37.7	32.1	19.6	15.9	16.5	19.1	17.2	16.3	21.8	37.1	22.2	25	19	21	100.0
36	Ken Crescent, Hags	278965	679273	85.4	78.2	66.7	50.6	43.6	46.4	44.7	45.4	43.9	52.9	58.7	54.3	56	43	47	100.0
37	Denny Town House	281228	682526	24.5	37.2	21.6	-	-	16.7	18.1	16.7	18.1	23.6	33.3	-	24	19	20	83.3
38	Larbert Village Primary School	289330	682316	47.8	38.1	34	16.7	14.9	14.9	14.9	15.8	16.5	19.8	33.7	34.4	25	20	21	83.3
41	Stewart Place, Boreas	289722	681594	49.1	43.9	26	25.8	21	24.3	23.9	24.3	19.6	28.5	32.3	-	25	20	21	100.0
42	Municipal Chambers, Grangemouth	292817	682000	42	38	25.9	22	14.7	17.9	17.6	14.7	18.6	24	33.3	29.4	26	20	22	100.0
43	Greenpark Drive, Polmont	293436	678838	28.6	-	31.2	20.6	15.4	19.6	17.2	17.7	18.5	23.2	34	28.1	-	19	15	66.7
44	N. Distributor Road, Bainsford	288444	681178	75.6	76.9	67.3	40	39.8	40.8	46.1	39	37.5	44.4	-	-	51	39	43	83.3
45	Thistle Avenue, Grangemouth	292000	680300	50.7	43.3	39.3	26.9	19.7	22.5	19.3	23.3	22.3	27.6	32.5	-	30	23	25	91.7
48	Hayfield, Falkirk	292000	681580	42.8	37.5	26.8	20.4	17.6	18.2	18.8	18.4	18.5	22.8	40.9	29.8	26	20	22	100.0
49	Lennox Terrace, Grangemouth	293600	680250	45.4	38.7	33.2	23.9	18.6	20	20.8	20.7	20.9	25.5	-	-	27	21	22	83.3
50	Upper Newmarket Street	288671	680047	33.9	41.4	36.6	28.7	25.6	29.7	-	22.8	22.7	26.7	45	26.6	31	24	26	91.7
51	Marv Street, Laurieston	290965	679490	51.3	48	45.4	33.7	-	28.3	26.1	25.8	28.2	30	35.1	-	35	27	30	83.3
52	Main Street, Larbert	289566	682356	56.4	48.4	44.7	32.9	22.7	27.7	23	25.9	30.4	34.9	40.5	40.4	36	27	30	100.0
53	Denny Cross	282727	682727	33.4	57.5	48.8	34.9	33	34.4	34.5	29.8	30.6	40.5	53.7	33.8	39	30	33	100.0
55	Indyva Station	283528	681023	42	39.3	24.1	18.7	13.9	14.5	15.2	12.2	18.3	14.3	10.7	32	25	26	83.3	
56	Indyva Station	283528	681023	42	39.3	24.1	18.7	13.9	14.5	15.2	12.2	18.3	14.3	10.7	32	25	26	83.3	
58	Collier Road, Falkirk	294667	679724	43.9	37.2	39.5	26.7	18.5	21.2	15.2	20.8	19	24.7	32.1	32.7	28	21	23	100.0
59	Carroll Road, Bainsford	288392	681931	60.2	53.4	49.1	31.4	27.7	27.8	26.4	30.7	27.8	37.2	49.1	39.8	38	29	32	100.0
60	Ronades Road, Carron	288133	681587	56.9	60.1	42.8	32.2	26	25.1	25.9	26.6	29.6	40.4	-	-	37	28	31	83.3
61	Canal Rd, Falkirk	287976	680656	54.9	51.6	40.6	32.5	20.2	25.4	25.3	26	-	32.9	41.7	42	36	28	30	91.7
62	Arnd Street, Falkirk	289125	679705	74.8	67.8	64.9	46.4	39.2	40.8	32.9	41.7	40.7	53.3	62.1	54.7	52	40	43	100.0
63	Camelon Road, Falkirk	288055	680134	60.8	57.4	62.3	49.6	37.2	42.8	39.7	42.5	43.4	52.3	60.3	-	50	38	42	91.7
64	New Hallen Road, Hallden	288807	678422	41.3	38	33.8	21.5	16.1	17.2	18.8	18.9	13.7	19.5	35.1	18.6	24	18	20	100.0
65	Redding Road, Redding	291356	679644	47.7	38.3	-	22	18.1	-	22.2	26.5	19.1	27	40.1	28.3	29	22	24	83.3
66	Holthouse, Slamanian	289450	672035	25.5	21.8	11.3	8.9	5.9	8.1	7.8	7.6	6.3	10.4	-	-	11	9	10	83.3
67	Queen Street, Falkirk	289430	680433	59.5	48.4	45.5	32.2	24.5	37.3	32	33.9	27.9	32.7	39.9	-	39	30	33	83.3
68	Belvue Street, Falkirk	289234	679445	82.2	66.5	63.2	40.6	37.5	37.5	24.4	32.5	35.1	42.9	53.2	49.8	40	30	33	100.0
69	Rene Lane, Falkirk	294522	679950	64.3	56.8	44.6	37.4	24	32.5	28.6	32.6	30.7	34.6	44.5	32.5	42	32	38	100.0
70	Park Street AQ station, Falkirk	288892	680070	56.3	47.2	42.2	38.2	28.1	31.2	26.4	30.7	30.7	33.9	43.6	30.9	38	29	32	100.0
71	Park Street, Falkirk	288910	680112	74.4	63	60.6	45.3	37.4	42.7	32.3	31.7	24.1	30.3	55.8	42	48	37	41	100.0
72	Park Street, Falkirk	288924	680120	60.3	47.3	52.3	38.3	25.8	36	33.4	32.4	30.8	36.1	59.4	40.2	40	31	34	100.0
73	West Bridge Street, RHS, Falkirk	288467	680048	55.5	54.1	53	39.8	36.5	42.3	31.8	35	35.8	43.1	59.4	45.9	44	34	37	100.0
74	Hope street/AQ station	286688	680216	51	51	37.3	32	22.6	23.9	21.3	24.2	21.9	34.2	-	-	32	25	27	83.3
76	Tryst Road, Stenhousemur	286851	683229	54.6	42.3	38.9	23.8	17	19.6	17.1	20	22.2	25.2	32.7	32.9	29	22	24	100.0
77	Tryst Road, Stenhousemur	286490	683775	53	51	50.7	29.2	-	-	19.7	23.3	22.8	35.2	47.6	-	37	28	31	75.0
78	Kinnaird Village	288525	679991	55.3	24.2	51.6	37	31.2	35.3	33.4	34.2	33.4	36.1	41.1	40	38	29	32	100.0
79	Glen Baie, Falkirk	288491	679327	45.3	46.6	40.4	25.5	-	-	-	-	-	-	-	-	39	30	33	33.3
80	Garrows Road, Falkirk	288491	679327	45.3	46.6	40.4	25.5	-	-	-	-	-	-	-	-	39	30	33	33.3
81	Cow Wind, Falkirk	288765	679456	56.2	54.2	50	37.1	28.6	31.6	25.6	29	33.9	42.6	45.8	40.3	40	30	33	100.0
82	Grahams Road, Falkirk	288534	680398	58.5	57.7	50.6	36.1	28.3	31.7	33.7	31.3	28.3	35.6	50.6	-	40	31	34	91.7
83	Castle Ave, Falkirk	288598	681036	46.5	43.9	25.8	21.4	15.6	17.8	16.4	19	19.1	26.8	40.9	32	27	21	23	100.0
84	Man Street, Boreas	288444	680444	32.2	27.1	21.5	14.3	34.5	40.3	35.3	40	45.3	53.9	55.6	53	26	18	20	100.0
85	Auchinloch Drive, Banknock	301324	680592	52.3	27.1	21.5	14.3	34.5	40.3	35.3	40	45.3	53.9	55.6	53	26	18	20	100.0
86	Wolfe Rd, Falkirk	279017	679049	52.3	43.9	35.2	28.8	18.3	22.5	21.1	20.7	18.5	26.1	39.1	28.5	26	23	26	100.0
87	M80 slip south, Hags	289667	679871	41.1	28	28.1	19.1	12.5	14.1	13.7	14.8	13.4	16.8	26.7	24.9	21	16	18	100.0
88	Grims Road, Hags	279017	679305	45.9	56	41.1	38.4	-	40.4	-	34.4	39.2	39.5	50.8	38.3	42	33	36	83.3
89	Grims Road, Hags	282444	681074	68.6	-	52.8	44.5	27.7	36.9	31.8	37.1	35.4	-	45.9	-	42	33	36	75.0
90	Grahams Rd/Weeks Rd, Falkirk	288653	680328	63.8	59.9	52.9	41.5	34.4	36	32	33.1	36.7	44.7	43.5	-	44	33	37	91.7
91	Grahams Rd bridge east, Falkirk	288655	680234	43.2	58.5	55.6	42.4	31.3	38.2	-	38.2	37	46.6	54.7	-	45	34	37	83.3
92	Grahams Rd bridge west, Falkirk	288655	680291	54.6	-	-	34	-	32.3	27.4	30.3	28.3	36.8	-	-	35	27	29	58.3
93	Cochrane Avenue, Falkirk	288743	679606	42.2	41.5	43.9	29.4	-	-	-	-	-	-	-	-	39	30	33	33.3
94	A907 (Glenburgh Rd), Grangemouth	281213	681927	26.8	35.7	26.7	17.1	11.9	12.9	12.9	13.6	17.7	-	-	-	45	35	38	66.7
95	Rose St, Stenhousemur (2)	280778	683175	34.9	35.7	28.1	17.1	11.9	12.9	12.9	13.6	17.7	-	-	-	45	35	38	66.7
96	Southburn Road, Denny	286230	681263	56.3	48.1	32.1	22.6	28.3	19.6	27.1	25.8	36.8	45.4	-	-	34	26	28	83.3
97	Shirehall, Falkirk	286230	681263	56.3	48.1	32.1	22.6	28.3	19.6	27.1	25.8	36.8	45.4	-	-	34	26	28	83.3
98	St Crispian Place, Falkirk	2																	

Appendix B: DMRB Calculations

Table A5 Background concentrations used in DMRB runs.

Link	2011 background concentration, $\mu\text{g}/\text{m}^3$		
	NO_x	NO_2	PM_{10}
A872/04 Stirling Street, Dunipace	26.7	16.1	12.8
A904/08 Earls Road, Grangemouth	34.2	21.6	15.1
A9/02 Stirling Road	21.9	13.5	13.1
A9/05 Stirling Road Torwood	25.4	15.4	13.7
B805/05, jct with B810 Shieldhill to B810 Polmont.	28.1	16.6	12.9
B810/02 Station Road, Polmont	27.2	16.1	12.6
A803 Main Street, Camelon	38.3	21.7	13.4
A803 Glasgow Road, Camelon	38.3	21.5	15.3
M876, M80 to Checkbar	37.2	21.4	13.6
M876 North Broomage to Hill of Kinnaird	18.8	11.8	13.5
B902 Bainsford	n/a (tube in place)	n/a (tube in place)	13.7

Table A6 Other input data to the DMRB runs.

Link	%HGV	Mean speed, mph	85th percentile speed, mph	Mean speed, kph	85th percentile speed, kph	Distance (closest) receptor to centre link, m	AADT
A872/04 Stirling Street, Dunipace	4.1%	41.7	n/a	67.1	n/a	6	11,350
A904/08 Earls Road, Grangemouth	4.6%	28	n/a	45.1	n/a	8	13,370
A9/02 Stirling Road	7.9%	41.7	n/a	67.1	n/a	10	10,600
A9/05 Stirling Road Torwood	7.3%	43.9	n/a	70.7	n/a	13	8,942
B805/05, jct with B810 Shieldhill to B810 Polmont.	2.6%	28.2	n/a	45.4	n/a	6	12,536
B810/02 Station Road, Polmont	2.9%	28.7	n/a	46.2	n/a	7	13,265
A803 Main Street, Camelon	3.6%	25.1	n/a	40.4	n/a	11	16,276
A803 Glasgow Road, Camelon	3.6%	29.4	n/a	47.3	n/a	11	15,529
M876, M80 to Checkbar	15.4%	n/a	59.5	n/a	95.8	31	32,293
M876 North Broomage to Hill of Kinnaird	14.5%	n/a	59.5	n/a	95.8	35	25,664
B902 Bainsford	5% (estimate)	n/a	26.6	n/a	42.5	9	15,977

Verification

Table A7 Verification for DMRB runs.

Verification	Background NO ₂	Monitored NO ₂	Modelled NO ₂	NO ₂ difference, %
A803 Coppertop and tube NA5.	21.7	31.3	27.8	-11.2
M876, M80 to Checkbar and tube NA88	20.5	35.5	32.4	-8.7

The DMRB modelled component of PM₁₀ was adjusted by the NO_x ratio from a verified site. DMRB runs took account of the NO_x to NO₂ conversion method (April 2009).