Falkirk Council

2015 Air Quality
Updating and Screening Assessment

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

September 2015

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Executive Summary

Falkirk Council has examined the air quality monitoring results in its area and concludes that no new Detailed Assessments are required of any pollutant.

In 2014 the Falkirk West Bridge St automatic monitoring site and the diffusion tube on the same street breached the annual NO_2 objective. There were no other diffusion tubes that breached the annual NO_2 objective. In addition, no automatic monitoring sites breached the annual or daily PM_{10} objectives.

The six SO_2 automatic monitors met all three (15-minute, hourly and daily) objectives during 2014. However, the number of exceedances at the Grangemouth MC site could be considered to be close to the 15-minute objective with 30 exceedances. There were no exceedances of the hourly or daily limit value at the monitoring sites. The 2014 results continue the objective compliance recorded both in 2013 and since the commissioning of the Tail Gas Unit at the refinery.

The benzene and 1,3 butadiene diffusion tube monitoring conducted in 2014 met the objectives. The $PM_{2.5}$ monitor at the Grangemouth AURN site recorded a concentration of 8 $\mu g/m^3$. This is within the Scottish Government's interim target value of 12 $\mu g/m^3$ and the proposed 10 $\mu g/m^3$ objective.

There have been numerous changes to the automatic monitoring network in 2014 and early 2015. These changes are a new PM_{10} and $PM_{2.5}$ analyser at the Banknock 2 site, the re-location of the Falkirk Park St enclosure and SO_2 analyser to Grangemouth Zetland Park, a new site in Bainsford utilising the former Park St NO_x and PM_{10} analysers and a new enclosure and NO_x analyser at Falkirk West Bridge St. Thus monitoring has commenced in the area of the only outstanding Detailed Assessment along Main St Bainsford.

A review of local and trunk roads resulted in three DMRB runs being conducted and no Detailed Assessments are required. No industrial processes or other sources required further consideration.

Since the 2014 Progress Report the Falkirk and Haggs action plan has been submitted and accepted. An update on the Falkirk, Haggs and Grangemouth AQMA Action Plans is provided.

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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
FIDAS	Fine Dust Analysis 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, and the recently opened Helix Park and Kelpies.

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.

Please note the LAQM process is under review by the Scottish Government. This will result in changes to the format of future reports and it is likely that the pollutants within the remit of LAQM will change.

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). Table 1.1 shows the objectives in units of micrograms per cubic metre $\mu g/m^3$ (and milligrammes per cubic metre, mg/m^3 for carbon monoxide) with the number of exceedances in each year that are permitted (where applicable).

It was announced by the Scottish Government in December 2013 that Local Authorities will be required to review $PM_{2.5}$ (particles smaller than 2.5 µm in diameter). The legislation and associated guidance has not as yet been developed. However, $PM_{2.5}$ is considered in this report at two monitoring locations. The first is Grangemouth where a $PM_{2.5}$ monitor operates as part the AURN. The second is the Banknock AQMA. This is due to the new, source apportionment related, $PM_{2.5}$ monitoring that is being conducted in the AQMA.

There can be misunderstanding between the terms 'exceedance' and a 'breach of the objective'. As an example: a monitor records a 15-minute average concentration of 300 $\mu g/m^3$ of sulphur dioxide (SO_2) at a location that is a relevant receptor. This is one 'exceedance' of the SO_2 air quality standard because the 15-minute concentration is greater than 266 $\mu g/m^3$, but it is not a breach of the objective. The latter only occurs when more than 35 exceedances are recorded (whether through monitoring or modelling) in a calendar year at a relevant receptor location. It is only a breach of an objective that can result in an Air Quality Management Area and not the occurrence of an individual or several exceedances.

It is important to note that the method of assessment that the UK Government conducts in relation to its submission to the European Union is not the same as LAQM. In addition, not all the objectives stated in Table 1.1 originate from the EU. Thus although there an AQMA may have been declared this does not automatically translate to a breach of any objectives under EU legislation.

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 ug/m^3	Running annual mean	31/12/2003
	3.25 µg/m^3	Running annual mean	31/12/2010
1,3-Butadiene	2.25 µg/m^3	Running annual mean	31/12/2003
Carbon monoxide	10.0 mg/m^3	Running 8-hour mean	31/12/2003
Lead	0.5 µg/m^3	Annual mean	31/12/2004
	0.25 µg/m^3	Annual mean	31/12/2008
Nitrogen dioxide	200 µg/m^3 not to be exceeded more than 18 times a year	1-hour mean	31/12/2005
	40 µg/m^3	Annual mean	31/12/2005
Particles (PM_{10}, gravimetric)	50 µg/m^3, not to be exceeded more than 35 times a year	24-hour mean	31/12/2004
	40 µg/m^3	Annual mean	31/12/2004
	50 µg/m^3, not to be exceeded more than 7 times a year	24-hour mean	31/12/2010
	18 µg/m^3	Annual mean	31/12/2010
Sulphur dioxide	266 µg/m^3, not to be exceeded more than 35 times a year	15-minute mean	31/12/2005
	350 µg/m^3, not to be exceeded more than 24 times a year	1-hour mean	31/12/2004
	125 µg/m^3, not to be exceeded more than 3 times a year	24-hour mean	31/12/2004

1.4 Summary of Previous Review and Assessments

A summary of Progress and Updating Screening Assessments of the last three years is provided in this Section.

2012 Updating and Screening Assessment

The executive summary of the 2012 Updating and Screening Assessment stated:

"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 SO_2 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 PM_{10} objectives in 2011. This site recorded a concentration of 18.7 µg/m^3 and was close to recording a breach of the daily objective with a 98th percentile concentration of 49 µg/m^3 (five daily exceedances were recorded). All sites met the UK / EU PM_{10} 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 PM_{10} and that the hourly NO_2 AQMA is revoked.

The NO_2 objectives were not breached at any of the automatic monitoring sites in 2011. Some diffusion tube sites breached the NO_2 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 PM_{10} 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 NO_2 or PM_{10} 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 PM_{10} 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."

2013 Progress Report

The executive summary of the 2013 Progress Report stated:

"Falkirk Council has examined its air quality monitoring results and concluded that no Detailed Assessments are required for any pollutant. In 2012 the annual nitrogen dioxide objective was breached at the Falkirk West Bridge St monitoring site. This site is within the Falkirk Town Centre Air Quality Management Area (AQMA). It is concluded that a Detailed Assessment is not required for the one tube (NA83) that recorded a concentration above the nitrogen dioxide objective but is outside of an AQMA. This is because with the distance to the nearest receptor taken into account no breach of the objective is predicted.

In January 2013 the Falkirk Town Centre AQMA was amended to include the Scottish PM_{10} objectives. This was required due to breaches of the objectives at the Falkirk West Bridge St site in previous years. In 2012 all monitoring sites met the PM_{10} objectives, although the Falkirk West Bridge St site was near to breaching both the annual and daily Scottish PM_{10} objectives.

In 2012 all three Grangemouth sites within the existing AQMA recorded a breach of the 15-minute objective. In addition, the Grangemouth Moray site recorded a breach of the daily objective. However, it is concluded that a Detailed Assessment is not required. This is primarily due to changes in emissions that will result from the commissioning of Tail Gas Treatment in 2013. It is anticipated that this will reduce the number of 15-minute exceedances such that the objective will be met. In addition, it is likely that unusual meteorological conditions experienced in 2012 contributed to the breach of the daily objective.

In 2012 many of the passive benzene diffusion tubes and the pumped diffusion tube recorded increases in annual concentrations compared to 2011. This is likely to have been due to an incident at a storage tank at the Grangemouth refinery in July 2012. It is concluded from the monitoring data that a Detailed Assessment is not required. The 1,3 butadiene monitoring results met the relevant objective in 2012.

It is not considered that any changes to emissions from existing industrial operators require further consideration. The local and trunk road traffic data that was available has been reviewed. This highlighted several roads where flows have increased and four DMRB runs were therefore conducted. The railway station at Bo'ness (a heritage railway) has again been considered. It is not considered that any of these sources require a Detailed Assessment.

A draft Action Plan has been produced for the Falkirk Town Centre and Haggs AQMAs and will now be subject to consultation. In addition, in February 2013 the ECO Stars scheme was launched in the Falkirk area."

2014 Progress Report

The executive summary of the 2014 Progress Report stated:

"Falkirk Council has examined its air quality monitoring results and concluded that a Detailed Assessment is required in the Main Street, Bainsford area. In 2013 the annual nitrogen dioxide objective was met at all automatic monitoring sites, although some exceedances were recorded at diffusion tube sites mostly located within Air Quality Management Areas.

In 2013 the Falkirk West Bridge St and Haggs monitoring sites recorded breaches of the Scottish particulate matter (PM10) annual objective. The Falkirk West Bridge St site is within the Falkirk Town Centre AQMA. The Haggs AQMA will require to be amended to include PM10.

In 2013 the three sulphur dioxide monitoring sites within the Grangemouth AQMA met the hourly and daily objectives. In contrast to previous years the 15-minute objective was achieved as well. In August 2013 Petroineos commissioned the Tail Gas Unit (TGU) on the sulphur recovery units at the Grangemouth refinery. It has been anticipated that this will reduce the number of 15-minute exceedances such that the objective will be met. There were no 15-minute exceedances recorded between the TGU commissioning and the end of 2013. However, with autumn and winter being dominated by (south) westerly weather conditions this reduction in exceedances should be treated with care.

The benzene and 1,3 butadiene diffusion tubes met the relevant objectives in 2013. The three 1,3 butadiene tubes have continued operation as it is understood that this pollutant will be retained in Local Air Quality Management. The particulate matter (PM2.5) monitor at the Grangemouth AURN site met the interim Scottish target value of 12 µg/m3. The changes to the monitoring network that have been carried out in 2013 and the anticipated changes in 2014 are discussed.

There are no changes to emissions from existing industrial operators that require further consideration. The local and trunk road traffic data that was available has been reviewed and one DMRB run was conducted. It is not considered that any of these sources require further consideration or a Detailed Assessment.

The draft Falkirk and Haggs Action Plan was submitted to the Scottish Government in August 2014. An update on Falkirk Council's four AQMAs and (draft) Action Plans is provided."

AQMAs

Falkirk Council has four active Air Quality Management Areas:

- Banknock, annual and daily Scottish PM_{10} objectives and potential breach of annual and daily UK PM_{10} objectives.
- Falkirk Town Centre, annual NO_2 objective and annual and daily Scottish PM_{10} objectives.
- Grangemouth, 15-minute SO_2 objective,
- Haggs, annual NO_2 objective.

The Grangemouth AQMA was declared for, what at the time, was considered a potential breach of the 15-minute SO_2 objective. This AQMA covers the Grangemouth area and was declared in November 2005, see Figure 1.1a. This AQMA is in relation to industrial emissions.

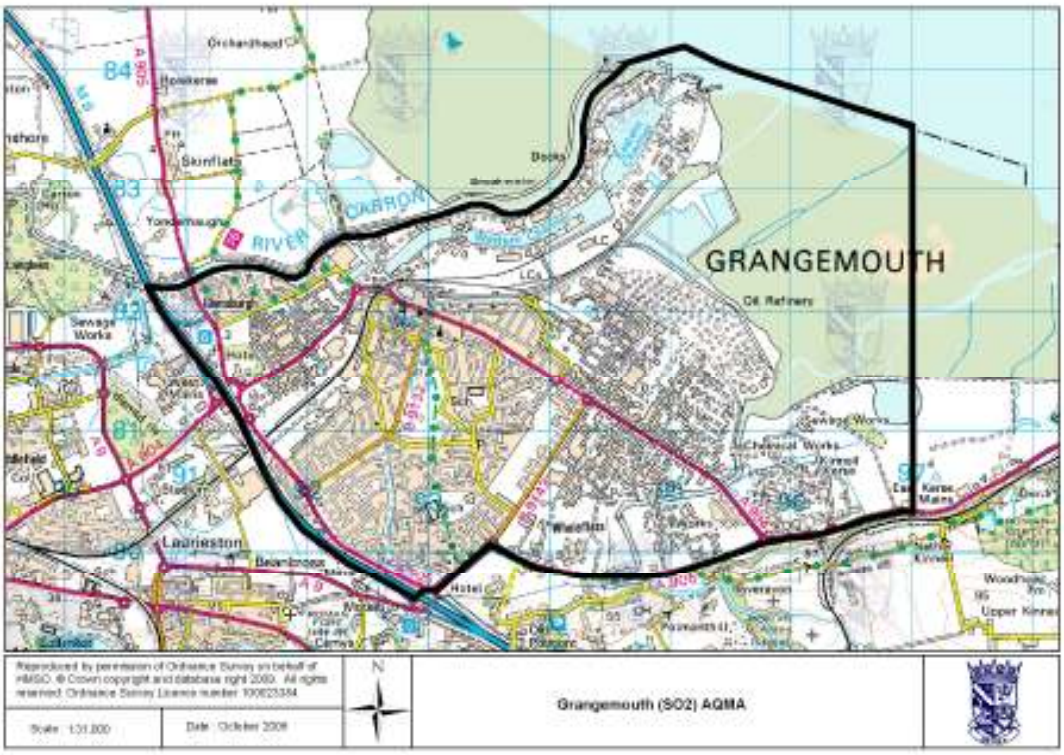
There are two AQMAs that have been declared due to a breach of the annual NO_2 objective. One covers an area of Falkirk Town Centre and the second surrounds a motorway junction in Haggs. They were both declared in March 2010, see Figures 1.1 b and c.

In January 2013 the hourly AQMA covering part of Grahams Road in Falkirk Town Centre was revoked and the Falkirk Town Centre AQMA amended to include the Scottish PM_{10} objectives.

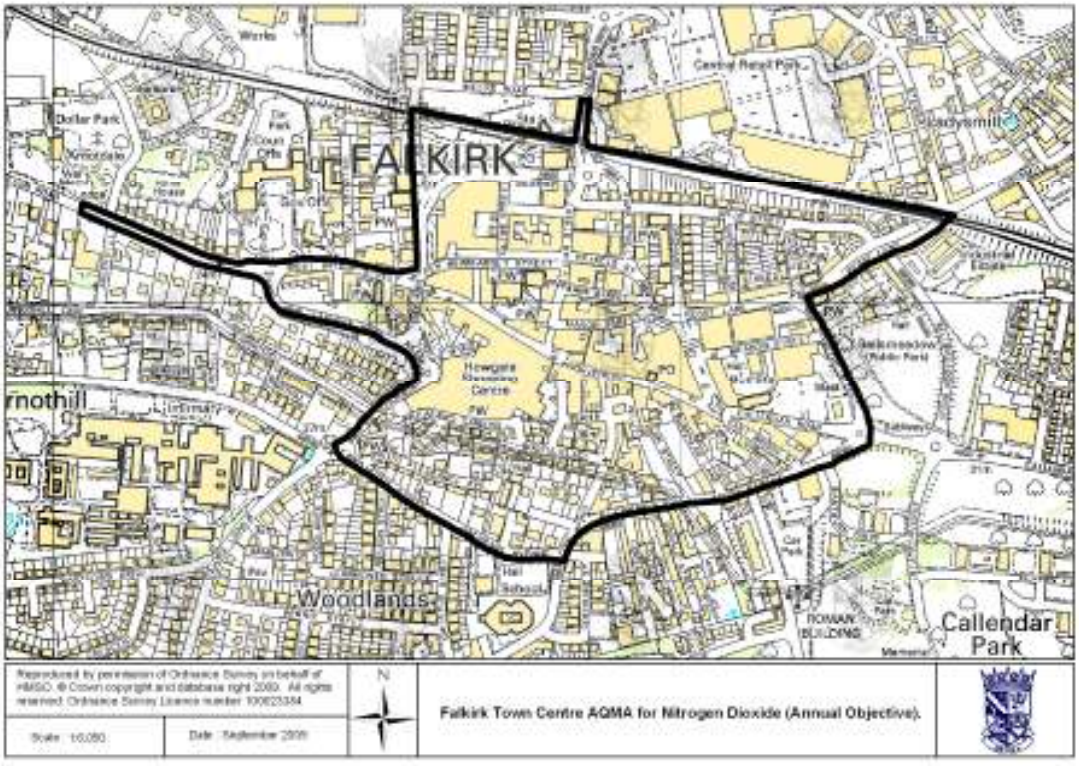
An AQMA was declared in Banknock in August 2011 in relation to breaches of the Scottish and potential breaches of the UK PM_{10} objectives, see Figure 1.1d.

An update on all AQMAs and where appropriate Action Plans is given in Section 8.

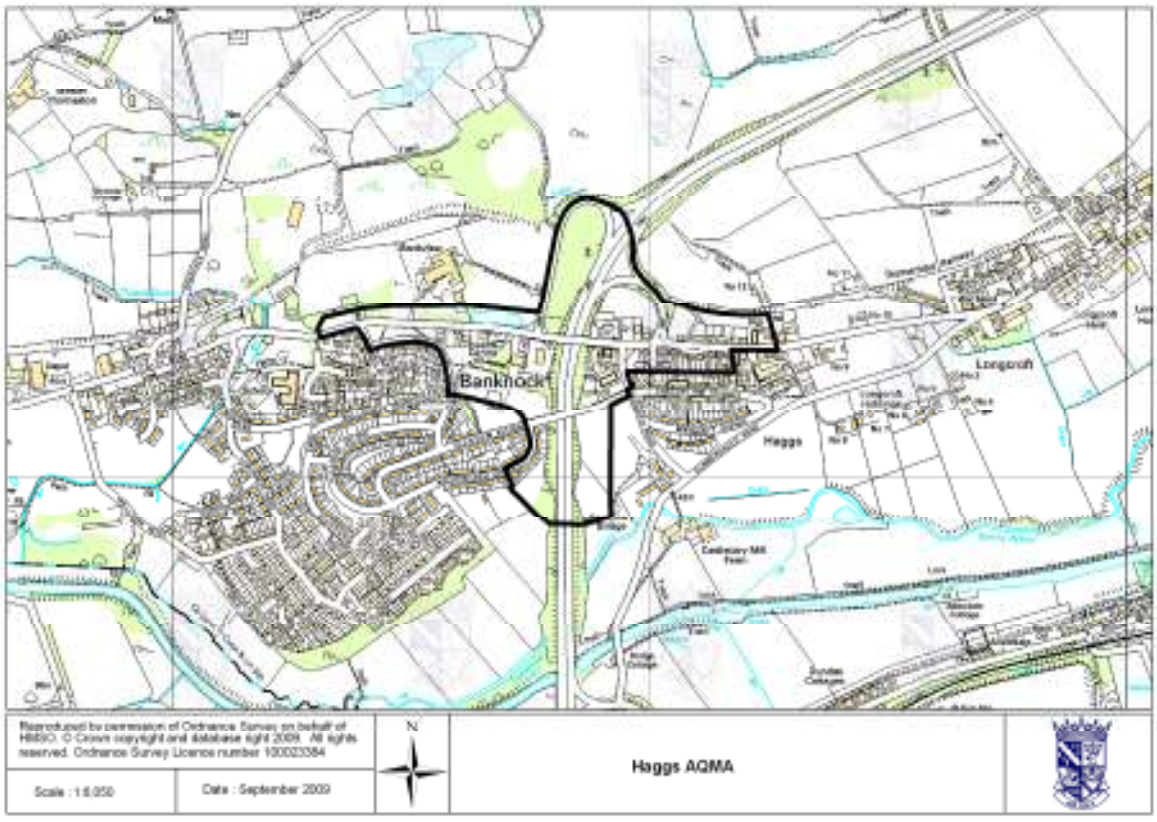
Figure 1.1 Maps of AQMA Boundaries in the Falkirk Council area.
a.) Grangemouth AQMA (15-minute SO_2), declared November 2005.



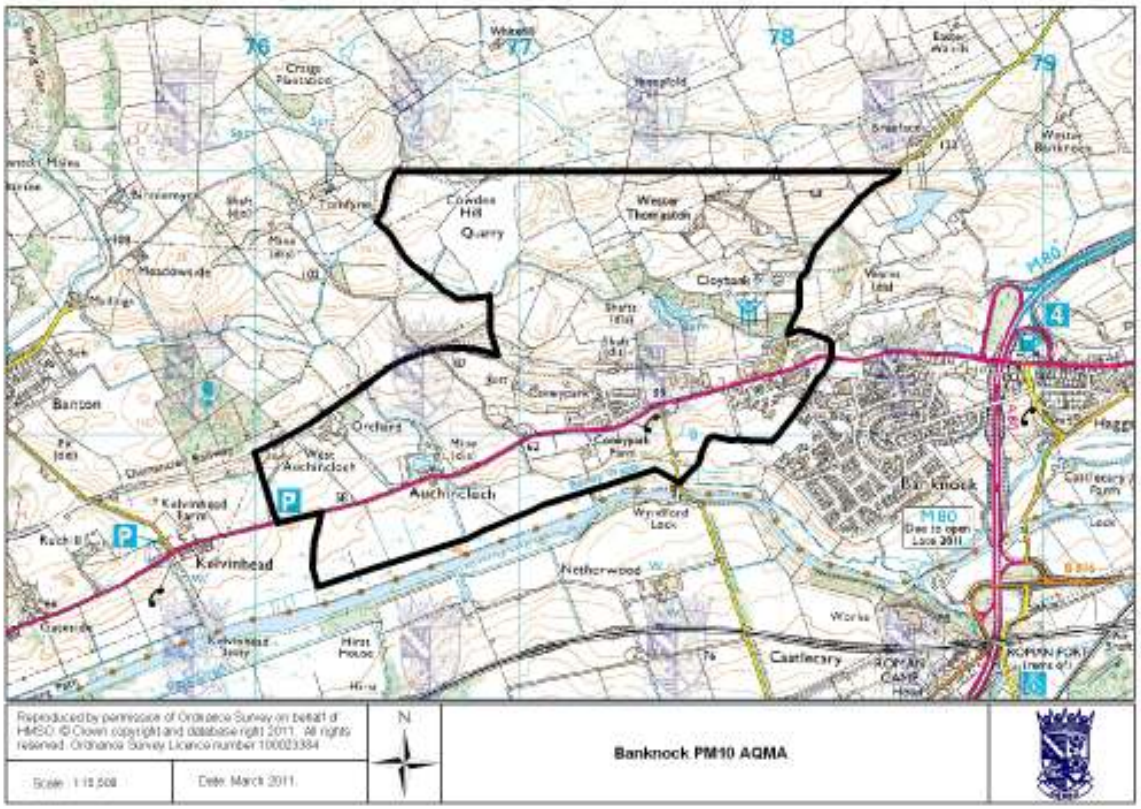
b.) Falkirk Town Centre AQMA (annual NO_2), declared March 2010.



c.) Haggs AQMA (annual NO_2), declared March 2010.



d.) Banknock AQMA (PM_{10}), declared August 2011.



2 New Monitoring Data

2.1 Summary of Monitoring Undertaken

2.1.1 Automatic Monitoring Sites

In 2014 Falkirk Council operated automatic monitoring stations at 11 locations from Banknock in the west to Bo'ness in the east. The automatic monitoring measured $PM_{2.5}$, PM_{10}, NO_2 and SO_2. Table 2.1 provides a summary of all the automatic monitoring sites.

Falkirk Council operates two sites that are affiliated to the UK Automatic Urban and Rural Network (AURN): the Grangemouth AURN site (NO_x, SO_2, PM_{10}*, $PM_{2.5}$* and a pumped benzene diffusion tube*) and the Grangemouth Moray site (NO_x only). The AURN data forms part of the UK's reporting to the EU in terms of compliance with the European objectives.

In 2014 the remaining analyser at the Grangemouth Moray site (SO_2) and six other monitoring sites (Banknock 2, Falkirk Hope St, Falkirk Park St, Falkirk West Bridge St, Grangemouth MC and Haggs) were affiliated to the Scottish Air Quality Network (SAQN). The remaining sites (Banknock 3, Bo'ness and Falkirk Grahams Road) are not affiliated to either network. The details of the network affiliation and QA / QC of each monitoring site and analyser are shown in the Appendix, Table A2.

The following changes have been made to the automatic monitoring network since the 2014 Progress Report:

- Banknock 2 (A13): The TEOM was replaced by a FIDAS 200 in February 2015. This analyser measures PM_{10} and $PM_{2.5}$. The latter is being measured primarily to assist with source identification at the site.
- Falkirk West Bridge St (A7): The enclosure and NO_x analyser were replaced in January 2015. It is anticipated that the replacement will improve the data capture of the NO_x analyser.
- Main St, Bainsford: A new enclosure has been located along this street to contribute towards the Detailed Assessment in the area. The NO_x and PM_{10} (TEOM) analyser were re-located from the former Falkirk Park St site and commenced operation in June 2015.
- Grangemouth Zetland Park: The Falkirk Park St enclosure and SO_2 analyser have been re-located to a new location in Zetland Park, Grangemouth. The analyser was commissioned in May 2015.

There are no outstanding changes to the automatic monitoring network.

* Scottish Government owned analysers.

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?
A3. Bo'ness	Urban background / industrial.	299815	681481	SO_2	Horiba	N	Y (5 m)	22 m *	N #
A4. Falkirk Haggs	Roadside.	278977	679271	NO_2, PM_{10}	NO_x: ML, PM_{10}: TEOM.	Y (NO_2)	Y (5 m)	2 m	Y
A5. Falkirk Hope St	Roadside.	288688	680218	NO_2, SO_2.	Horiba.	Y (NO_2 and PM_{10}.)	Y (1 m)	5 m	N @ #
A6. Falkirk Park St	Roadside.	288892	680070	NO_2, SO_2, PM_{10}.	NO_x and SO_2: Horiba, PM_{10}: TEOM.	Y (NO_2 and PM_{10}.)	Y (1 m)	5 m	Y
A7. Falkirk West Bridge St	Roadside.	288457	680064	NO_2, PM_{10}	NO_x: ML, PM_{10}: TEOM.	Y (NO_2 and PM_{10}.)	Y (1 m)	2 m	Y
A8. Grangemouth AURN (Inchyra Park)	Urban background / industrial.	293830	681022	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	681321	NO_2, SO_2.	NO_x: ML and SO_2: Horiba.	Y (SO_2)	Y (1 m)	25 m	Y
A10.Grangemouth Municipal Chambers	Urban background / industrial.	292816	682009	NO_2, SO_2, PM_{10}.	NO_x and SO_2: Horiba, PM_{10}: TEOM.	Y (SO_2)	Y (1 m)	40 m	Y
A12. Falkirk Grahams Rd	Roadside.	288823	680242	PM_{10}	TEOM.	Y (NO_2 and PM_{10}.)	Y (1 m)	10 m	N
A13. Banknock 2	Roadside.	277247	679027	PM_{10}	2014: TEOM, from 2015: Fidas	Y (PM_{10})	Y (7 m)	3 m	N
A14. Banknock 3	Urban background.	277168	679254	PM_{10}	Osiris	Y (PM_{10})	Y (19 m)	17 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 AQMA or is a background monitor.

@ Distances to relevant exposure may not apply to all pollutants, due to shorter time period for SO_2.

2.1.2 Non-Automatic Monitoring Sites

In 2014 Falkirk Council monitored nitrogen dioxide at 63 locations, benzene at 16 locations and 1,3 butadiene at three locations using non-automatic methods, i.e. diffusion tubes. Table 2.2 provides details of the non-automatic monitoring sites. The diffusion tubes achieved good data capture across the year with very few tubes not achieving the annual data capture target of 75%. In addition, a pumped benzene diffusion tube (Defra / DA equipment) continued to operate at the Grangemouth AURN (A8) site as part of the AURN non-automatic hydrocarbon network. The details of the tubes used and the QA / QC of non-automatic monitoring are given in the Appendix A.

The following non-automatic site has ceased operation since the 2014 Progress Report:

- NA 47 (NO_2) Thistle Avenue, Grangemouth: background site no longer required.
- NA 70 (NO_2) Park St AQ station, Falkirk: This automatic monitoring site ceased in April 2014 therefore the diffusion tubes were discontinued.
- NA90 (NO_2) Grahams Rd bridge east, Falkirk: adequate coverage in the area with NA89 Grahams Rd / Meeks Rd.

The following non-automatic sites have commenced operation since the 2014 Progress Report.

- NA 110 (NO_2) Banknock 2 AQ station: To provide a supplementary NO_2 measurement to the Banknock PM_{10} AQMA.
- NA 111 (NO_2) Falkirk West Bridge St AQ station: This triplicate study has replaced the roadside study conducted at the Falkirk Park St site.
- NA 112 (NO_2) Philip St, Bainsford: This will act as a background site for Main St, Bainsford.

The diffusion tubes NA110 and NA111 are co-located with the automatic monitoring sites and a map of NA112 is shown in Figure 2.1.

In 2014 Falkirk Council carried out three triplicate studies. This involves three NO_2 diffusion tubes being co-located with an automatic monitoring station. This enables the diffusion tube results to be bias adjusted. This is conducted to account for the difference between results from an automatic monitor and the diffusion tubes. The first study was located at the Grangemouth MC site (NA42 / A10), an urban background site. The second study at the Falkirk Park St site (NA70 / A6), a roadside site and finally a third study at Falkirk West Bridge St (NA111 / A7). However, the Falkirk Park St monitoring site, and therefore the triplicate study, ceased in April 2014. The replacement roadside study commenced at Falkirk West Bridge St in July 2014.

The results from the three sites were submitted to the R&A bias factor for ESG Didcot, however, Falkirk Park St and West Bridge St did not contribute to this factor because of the short monitoring periods. The bias sheet from Grangemouth MC and the R&A helpdesk summary are shown in Figures A2 and A3.

The local and R&A Helpdesk bias adjustment factors suggest that the diffusion tubes over-read NO_2 compared to the automatic monitors. Falkirk Council has applied the R&A helpdesk factor to the 2014 results because there are a mixture of roadside and background sites and no valid local roadside bias factor was available in 2014. The R&A bias factor for the ESG Didcot tubes in 2014 was 0.81. Note the data submitted to the R&A Helpdesk was provisional between July and December as the data is compiled prior to ratification. The ratification of the automatic monitoring data does not usually change the bias factor significantly.

Figure 2.1 Map of the new Non-Automatic Monitoring Site (NA112, Philip St, Bainsford).

Table 2.2 Details of Non-Automatic Monitoring Sites

Site	Location	Site Type	OS Grid Ref (x, y)		Pollutants Monitored	In NO_2, benzene or 1,3 butadiene AQMA?	Relevant exposure? (m)	Distance to kerb (nearest road), m.	Worst-case Location?
NA3	Tinto Drive, Grangemouth.	Urban background.	293427	680386	Benzene, NO_2.	N	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
NA19	Kilsyth Rd, Banknock.	Roadside.	278779	679301	NO_2.	Y (NO_2).	Y (<2)	2.2	Y
NA20	Garngrew Rd, Haggs.	Urban background.	278975	679172	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	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, 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, Haggs.	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, 1,3 Butadiene, NO_2.	N	Y (<2)	0.1	Y
NA42	Municipal Chambers, Grangemouth.	Urban centre / industrial.	292817	682000	Benzene, NO_2*.	N	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 NO_2, benzene or 1,3 butadiene AQMA?	Relevant exposure? (m)	Distance to kerb (nearest road), m.	Worst-case Location?
NA44	Greenpark Drive, Polmont.	Urban background.	293436	678938	Benzene, NO_2.	N	Y (<5)	<10	N
NA48	Hayfield, Falkirk.	Urban background.	289200	681580	NO_2.	N	Y (<5)	<10	N
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.	N	Y (<5)	<2	N
NA57	Inchyra Road, Grangemouth.	Urban background / industrial.	294028	680829	Benzene, NO_2.	N	Y (<5)	<10	Y
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

Table 2.2 Details of Non-Automatic Monitoring Sites continued

Site	Location	Site Type	OS Grid Ref (x, y)		Pollutants Monitored	In NO_2, benzene or 1,3 butadiene AQMA?	Relevant exposure? (m)	Distance to kerb (nearest road), m.	Worst-case Location?
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.	289025	679991	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
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
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
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, Haggs.	Roadside.	279017	679305	NO_2.	Y (NO_2).	Y (<2)	1.6	Y

Table 2.2 Details of Non-Automatic Monitoring Sites continued

Site	Location	Site Type	OS Grid Ref (x, y)		Pollutants Monitored	In NO_2, benzene or 1,3 butadiene AQMA?	Relevant exposure? (m)	Distance to kerb (nearest road), m.	Worst-case Location?
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
NA94	A905 (Glensburgh Rd), Grangemouth.	Roadside.	291213	681927	Benzene, NO_2.	N	Y (7)	5.4	Y
NA98	Arnothill, Falkirk	Urban background.	288095	680105	NO_2.	N	Y (23)	1.6	N
NA99	St Crispins Place, Falkirk	Roadside.	288924	679675	NO_2.	Y (NO_2).	Y (7.6)	2.7	Y
NA100	Oswald St, Falkirk	Urban background.	288977	679662	NO_2.	N	Y (3.8)	1.5	N
NA101	Glensburgh Road (2), Grangemouth	Roadside.	291127	682007	NO_2.	N	Y (7)	0.9	Y
NA102	East Kerse Mains, Bo'ness	Urban background.	297968	680684	Benzene	N	N	23 (main road)	N
NA103	Merchiston Gardens	Urban background.	288270	680989	NO_2.	N	Y (12.5)	1.6	N
NA104	Powdrake Road, Grangemouth	Urban background / industrial.	293788	682054	1,3 butadiene	N	Y (40)	1.8	Y
NA105	West of Shieldhill	Rural.	288292	676889	Benzene, NO_2.	N	N	1.7	N

Table 2.2 Details of Non-Automatic Monitoring Sites continued

Site	Location	Site Type	OS Grid Ref (x, y)		Pollutants Monitored	In NO_2, benzene or 1,3 butadiene AQMA?	Relevant exposure? (m)	Distance to kerb (nearest road), m.	Worst-case Location?
NA107	Main Street (east), Bainsford	Roadside.	288640	681396	NO_2.	N	Y (4)	0.5	Y
NA108	Main Street, Camelon	Roadside.	286834	680512	NO_2.	N	Y (4)	7	Y
NA109	Carmuirs Street, Camelon	Urban background.	286786	680488	NO_2.	N	Y (4)	44	N
NA110	Banknock 2 AQ station	Roadside.	277247	679027	NO_2.	N	Y (3)	7	Y
NA111	Falkirk West Bridge St AQ station	Roadside.	288457	680064	NO_2. *	Y (NO_2).	Y (21)	3	Y
NA112	Philip Street, Bainsford	Urban background.	288505	681443	NO_2.	N	Y (4)	1	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 2014 the Falkirk West Bridge St site breached the annual NO_2 objective recording a concentration of 41.3 µg/m^3. This is a slight increase of 2.1 µg/m^3 from the 2013 monitoring result. With the data capture being only marginally below the 90% data capture requirement at 89.2% the annual result has not been annualised.

The other six NO_2 analysers in Falkirk Council's automatic network met both of the nitrogen dioxide (NO_2) objectives. The Haggs (A4) monitoring site continues to record NO_2 concentrations within the objective. There were no hourly exceedances at any of the monitoring sites and thus the hourly objective was met at all the sites. All the results are shown in Tables 2.3 and 2.4.

Figure 2.2 shows long terms trends for the Grangemouth AURN, Haggs and Falkirk West Bridge St sites. There is a slight downward trend in NO_2 concentrations at the background Grangemouth AURN site between 2001 and 2015. However, a significant decrease has been recorded at the Haggs site compared to both the peak in 2010 and the concentrations recorded in 2009. This is likely to have occurred because of the completion of the M80 and a reduced speed limit of 30 mph on the A803 which has transferred traffic from the local to trunk road network. In addition, NO_2 concentrations have reduced at background sites (eg. Grangemouth MC and Moray) since 2012.

Table 2.3 Results of Automatic Monitoring of Nitrogen Dioxide: Comparison with Annual Mean Objective (40 µg/m^3).

Site	Location	Within NO_2 AQMA?	Data Capture 2014, %	Annual Mean Concentration µg/m^3			
				2011	2012	2013	2014
A4	Falkirk Haggs	Y	93.7	34.4	35.9	34.2 *	32.1
A5	Falkirk Hope St	Y	99.8	24.1	25.1	23	23.4
A6	Falkirk Park St	Y	32.0	28.5	33.2	30.4	28 * #
A7	Falkirk West Bridge St	Y	89.2	35.9 * #	**43.4***	39.2	**41.3**
A8	Grangemouth AURN	N	95.3	15.1	16.2	14.5	16.3
A9	Grangemouth Moray	N	92	17.3	19.6	16.6	15.4
A10	Grangemouth MC	N	99.1	21.6	24.1	20.2	19.6

* Annual data capture less than 90%.

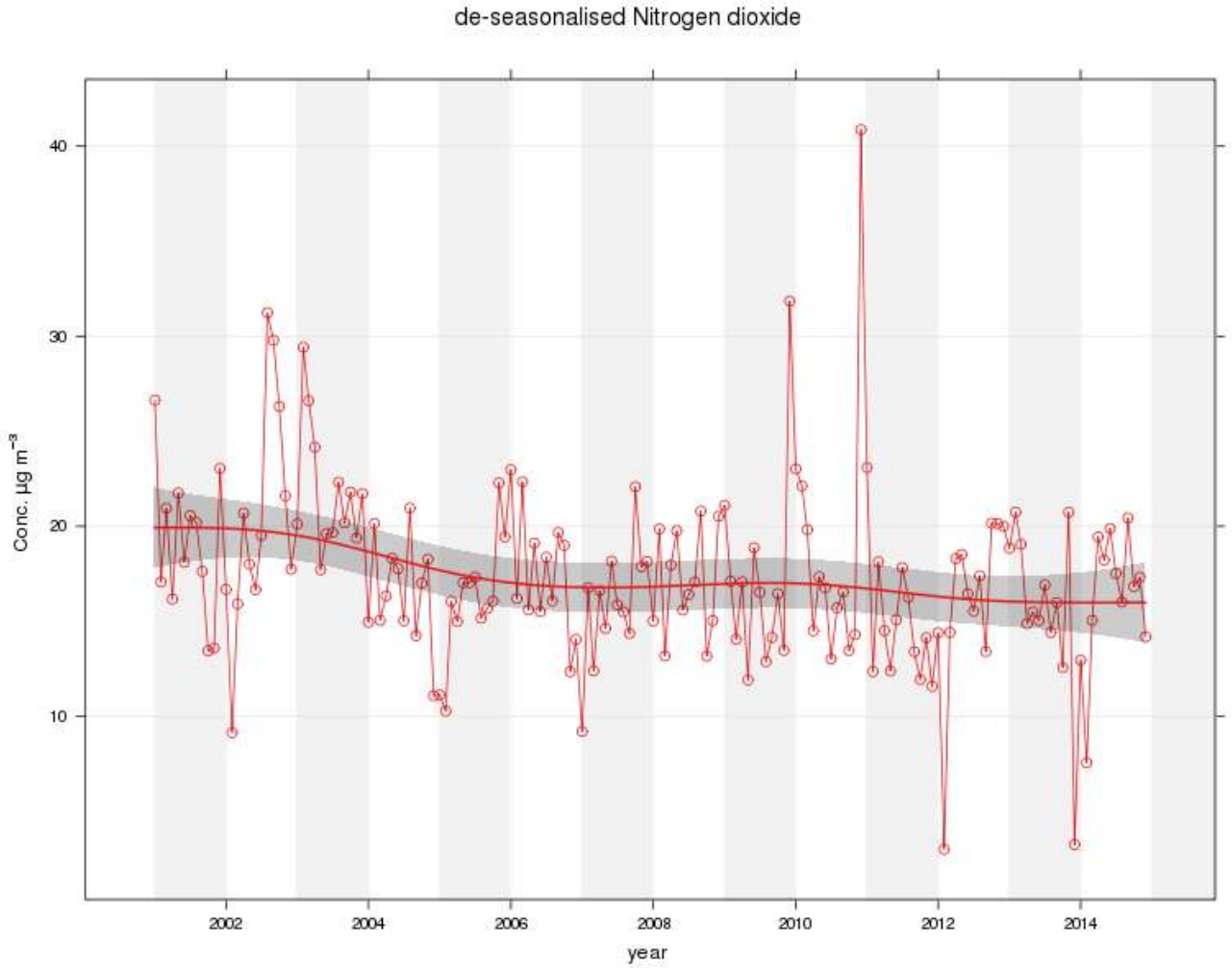
Result has been annualised.

Table 2.4 Results of Automatic Monitoring for Nitrogen Dioxide: Comparison with 1-hour mean Objective (18 exceedances of 200 µg/m^3).

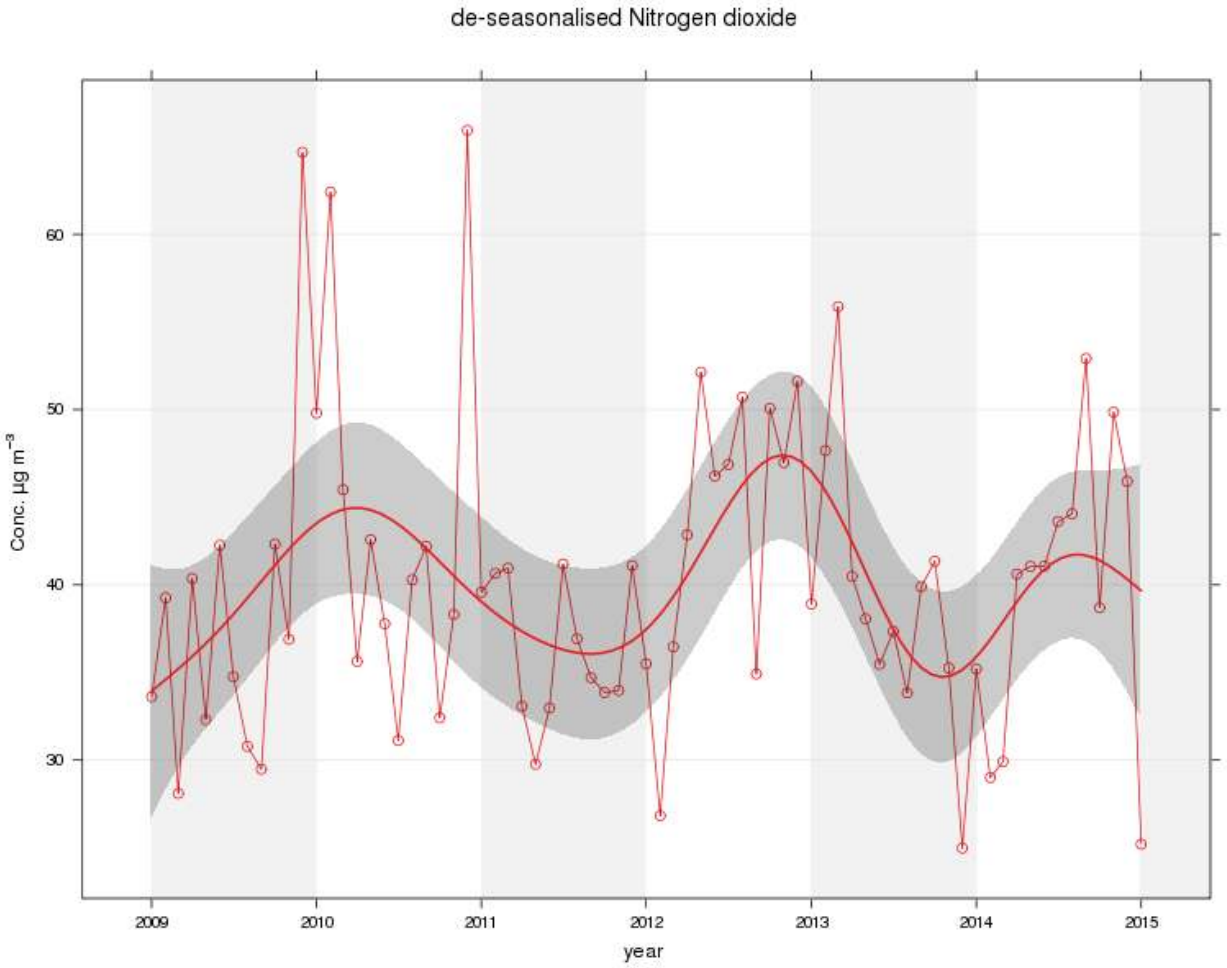
Site	Location	Within NO_2 AQMA?	Data Capture 2014, %	Number of Exceedances of Hourly Mean (200 µg/m^3), (99.8th percentile in brackets).			
				2011	2012	2013	2014
A4	Falkirk Haggs	Y	93.7	0 (142)	0 (141)	0 (138)	0 (127)
A5	Falkirk Hope St	Y	99.8	0 (111)	0 (133)	0 (94)	0 (86)
A6	Falkirk Park St	Y	32	0 (97)	0 (107)	0 (98)	0 (90)
A7	Falkirk West Bridge St	Y	89.2	0 (113) *	0 (124) *	0 (120)	0 (123)
A8	Grangemouth AURN	N	95.3	0 (78)	0 (92)	0 (80)	0 (72)
A9	Grangemouth Moray	N	92	0 (84)	0 (86)	0 (78)	0 (66)
A10	Grangemouth MC	N	99.1	0 (86)	0 (103)	0 (83)	0 (75)

* Annual data capture less than 90%.

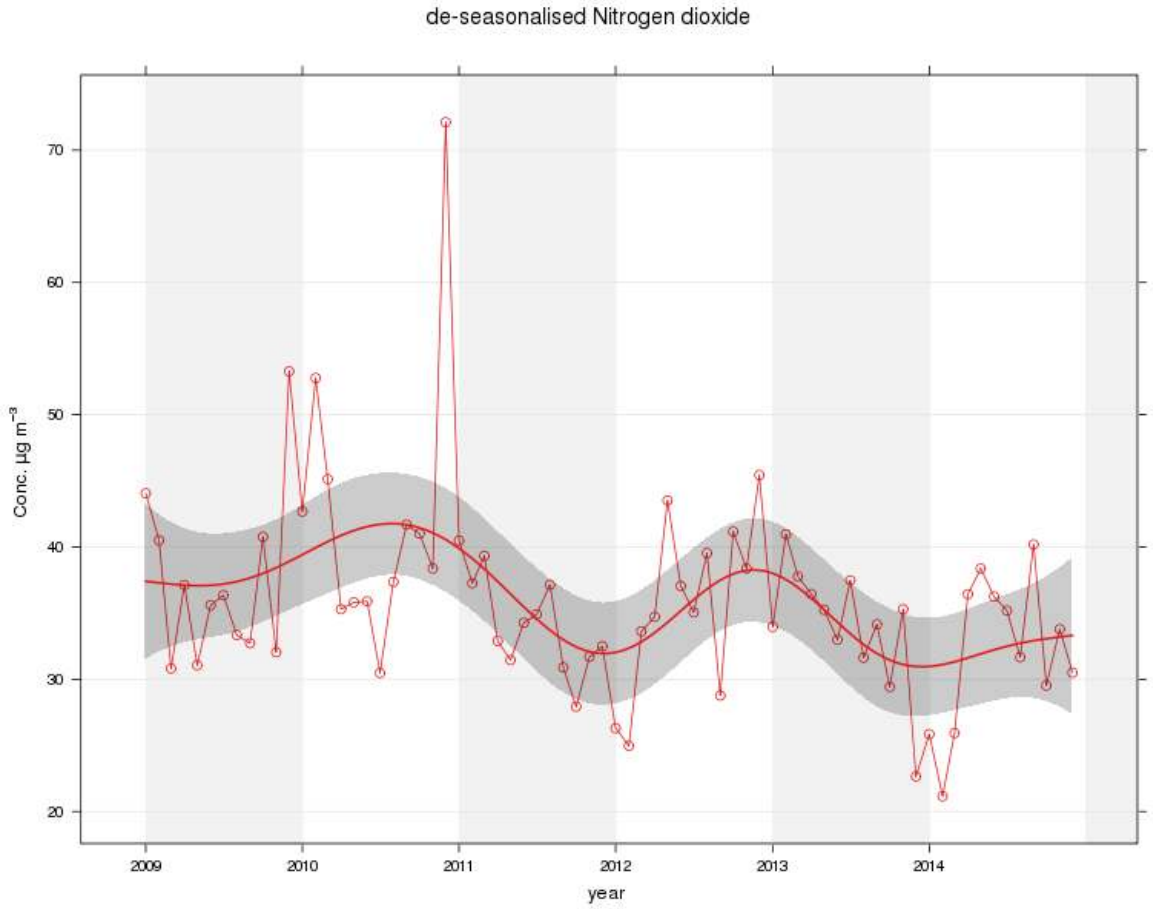
Figure 2.2 Trends in Nitrogen Dioxide Concentrations (deseasonalised) at three Automatic Monitoring Sites, a.) Grangemouth AURN, b.) Falkirk West Bridge St and c.) Haggs.
Reference 1.
a.)



b.)


de-seasonalised Nitrogen dioxide
Conc. µg m⁻³
60
50
40
30
2009
2010
2011
2012
2013
2014
2015
year

c.)


de-seasonalised Nitrogen dioxide
Conc. µg m⁻³
70
60
50
40
30
20
2009
2010
2011
2012
2013
2014
year

Diffusion Tube Monitoring Data

Table 2.6 shows the annual NO_2 concentrations in 2014 of Falkirk Council's diffusion tubes, and the previously reported results between 2011 and 2013. The diffusion tube results have been annualised for the sites that operated over the duration of 2014 but recorded data capture below 75% and those tubes that started operation part way through the year. None of the results in Table 2.6 have been distance corrected as this is carried out as appropriate. Figure 2.4 shows the results on a map across the Falkirk and Haggs AQMAs.

The following diffusion tubes recorded a concentration greater than the annual NO_2 objective of 40 µg/m^3 in 2014 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). The automatic monitoring site recorded a similar breach of the objective, all be it, with a lower concentration as it is slightly further from the kerb.

The following diffusion tubes recorded a concentration close to the objective (36 to 40 µg/m^3) in 2014 with the application of the R&A bias factor:

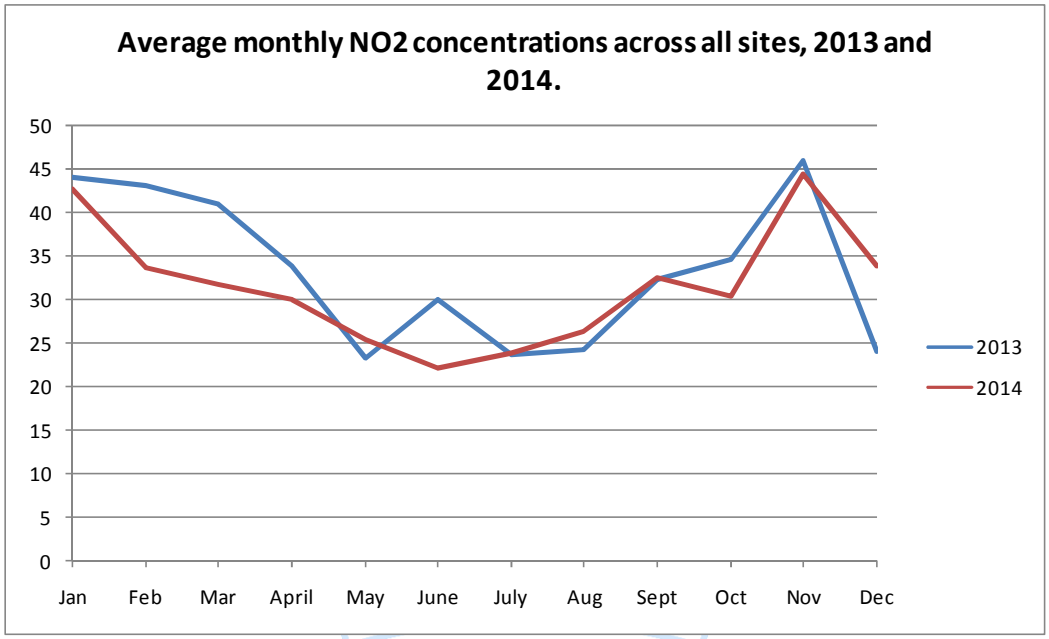
- NA19 Kilsyth Road, Banknock: this site is in the Haggs AQMA.
- NA24 Kerse Lane, Falkirk: this site is in the Falkirk Town Centre AQMA.
- NA36 Kerr Crescent, Haggs: this site in the Haggs AQMA.
- NA62 Arnot Street, Falkirk: this site is in the Falkirk Town Centre AQMA.
- NA63 Camelon Road, Falkirk: this site in on the boundary of the Falkirk Town Centre AQMA.
- NA68 Bellevue St, Falkirk: this site is in the Falkirk Town Centre AQMA.

There is no local roadside bias factor in 2014 to adjust the diffusion tube results because of the closure of the Falkirk Park St monitoring site. A new triplicate study commenced at Falkirk West Bridge St in July 2014 but with less than nine months of diffusion tube data a bias factor cannot be calculated.

The diffusion tube monitoring indicates that NO_2 concentrations have decreased compared to 2013. A comparison in Figure 2.3 of the monthly average concentrations across all of Falkirk's diffusion tubes, with respective bias factors applied, indicate that levels were substantially lower during 2014 between January and April and in June in comparison to 2013. During the other months concentrations were only slightly different across the two years.

Note in April 2014 the contractor that supplies and analyses the 1,3 butadiene tubes changed from Environmental Scientifics Group to Gradko and in April 2015 a similar change occurred with the NO_2 and benzene diffusion tubes.

Figure 2.3 Monthly average NO_2 concentrations at all diffusion tube sites in 2013 and 2014.



The concentrations recorded by the diffusion tubes have, on average, decreased between 2011 and 2014 (Table 2.5). Although site dependent the decrease is not as strongly reflected at some of the automatic monitoring sites.

The R&A factor was greater than the local roadside site factor (0.76 local road and 0.84 R&A) in 2011, while in 2012 and 2013 the local roadside factor was greater than the R&A (0.86 and 0.87 local road compared to 0.79 and 0.80 R&A). This may explain why the NO_2 diffusion tubes show a greater decrease between 2011 and 2014. However, the decrease is less substantial when considering 2012 to 2014 data and this decline ties in with more automatic monitoring sites.

There is no local roadside bias factor in 2014 due to the closure of the Falkirk Park St monitoring site. A triplicate study at Falkirk West Bridge St commenced in July 2014 but nine months of data is required to calculate a bias factor. This will be available in 2015 and will ensure that any roadside tubes that are close to the objective can be considered with a local roadside factor and the R&A factor.

Table 2.5 Average NO_2 concentrations across all NO_2 diffusion tubes.

Average NO2, µg/m3, concentrations across all sites.				
Type of site	**2011 (0.84)**	**2012 (0.79)**	**2013 (0.80)**	**2014 (0.81)**
All	30.5	28.7	27.3	25.7
Road and kerbside	33.0	31.6	29.9	28.3
Non-road/kerbside	23.1	21.9	21.1	19.4

Table 2.6 Results of Nitrogen Dioxide Diffusion Tubes in 2014.

Site	Location	Within NO_2 AQMA?	Data Capture for Monitoring Period, %	Data Capture 2014, %	Annual mean concentrations, µg/m^3			
					2011 (0.84)	2012 (0.79)	2013 (0.80)	2014 (0.81)
NA3	Tinto Drive, Grangemouth.	N	n/a	100	21	21	21	19
NA5	Copper Top pub, Camelon.	N	n/a	100	31	31	28	27
NA7	Irving Parish Church, Camelon.	N	n/a	100	21	19	19	18
NA9	Bellsdyke Rd, Larbert.	N	n/a	100	28	25	26	29
NA19	Kilsyth Rd, Banknock.	Y	n/a	67	33 *	36	36	36
NA20	Garngrew Rd, Haggs.	N	n/a	75	25	27	24	22
NA21	Grangemouth Rd, College.	N	n/a	92	33	30	28	28
NA24	Kerse Lane, Falkirk.	Y	n/a	100	40	37	**42**	37
NA26	Weir St, Falkirk.	Y	n/a	100	22	22	21	18
NA27	West Bridge St, Falkirk.	Y	n/a	100	**51**	**61**	**53**	**45**
NA29	Wellside Place, Falkirk.	N	n/a	100	21	20	18	17
NA36	Kerr Crescent, Haggs.	Y	n/a	100	**47**	**42**	**40**	38
NA37	Denny Town House.	N	n/a	100	20	20	19	20
NA38	Larbert Village Primary School.	N	n/a	100	21	20	19	18
NA41	Seaview Place, Bo'ness.	N	n/a	100	25	24	22	21
NA42	Municipal Chambers, Grangemouth.	N	n/a	100	22	21	20	19
NA44	Greenpark Drive, Polmont.	N	n/a	92	17 *	17	16	16

Table 2.6 Results of Nitrogen Dioxide Diffusion Tubes in 2014 continued

Site	Location	Within NO_2 AQMA?	Data Capture for Monitoring Period, %	Data Capture 2014, %	Annual mean concentrations, µg/m^3			
					2011 (0.84)	2012 (0.79)	2013 (0.80)	2014 (0.81)
NA48	Hayfield, Falkirk.	N	n/a	100	22	21	21	20
NA50	Upper Newmarket St, Falkirk.	Y	n/a	100	26	30	30	27
NA51	Mary St, Laurieston.	N	n/a	100	30	27	24	25
NA52	Main St, Larbert.	N	n/a	100	30	28	26	21
NA53	Denny Cross.	N	n/a	100	33	34	33	31
NA57	Inchyra Road, Grangemouth.	N	n/a	100	28	27	26	26
NA58	Callendar Rd, Falkirk.	N	n/a	100	23	23	22	21
NA59	Carron Rd, Bainsford.	N	n/a	100	32	31	28	26
NA60	Ronades Rd, Carron.	N	n/a	100	31	29	29	27
NA61	Canal Rd, Falkirk.	N	n/a	92	30	25	26	25
NA62	Arnot St, Falkirk.	Y	n/a	100	**43**	39	36	38
NA63	Camelon Rd, Falkirk.	On boundary NO_2.	n/a	100	**42**	**41**	38	36
NA64	New Hallglen Rd, Falkirk.	N	n/a	100	20	20	20	18
NA65	Redding Rd, Redding.	N	n/a	92	24	25	24	18
NA67	Queen St, Falkirk.	N	n/a	100	33	31	31	28
NA68	Bellevue St, Falkirk.	Y	n/a	100	36	35	31	29
NA69	Kerse Lane, Falkirk.	Y	n/a	100	35	38	33	35
NA70	Park St AQ station, Falkirk.	Y	100	33	32	30	28	28

Table 2.6 Results of Nitrogen Dioxide Diffusion Tubes in 2014 continued

Site	Location	Within NO_2 AQMA?	Data Capture for Monitoring Period, %	Data Capture 2014, %	Annual mean concentrations, µg/m^3			
					2011 (0.84)	2012 (0.79)	2013 (0.80)	2014 (0.81)
NA71	Park St, Falkirk.	Y	n/a	92	**41**	38	35	33
NA72	Vicar St, Falkirk.	Y	n/a	100	34	33	33	32
NA73	West Bridge St RHS, Falkirk.	Y	n/a	92	37	34	35	33
NA76	Tyrst Road, Stenhousemuir.	N	n/a	100	24	24	20	23
NA77	Kinnaird Village.	N	n/a	92	31	25	24	22
NA78	Glen Brae, Falkirk.	N	n/a	100	32	31	30	30
NA80	Cow Wynd, Falkirk.	N	n/a	75	33	31	29	30
NA81	Grahams Rd, Falkirk.	N	n/a	92	34	32	32	29
NA82	Castings Ave, Falkirk.	N	n/a	100	23	22	20	18
NA83	Main St, Bainsford.	N	n/a	100	**44**	**41**	37	34
NA85	Auchinloch Dr, Banknock.	Y	n/a	100	25	25	23	21
NA86	Wolfe Rd, Falkirk.	N	n/a	100	18	19	19	15
NA87	M80 slip south, Haggs.	Y	n/a	100	36	33	32	32
NA88	Ure Crescent, Bonnybridge.	N	n/a	100	36	33	30	29
NA89	Grahams Rd/Meeks Rd, Falkirk.	N	n/a	83	37	34	34	30
NA94	A905 (Glensburgh Rd), Grangemouth.	N	n/a	92	37 *	38	36	31

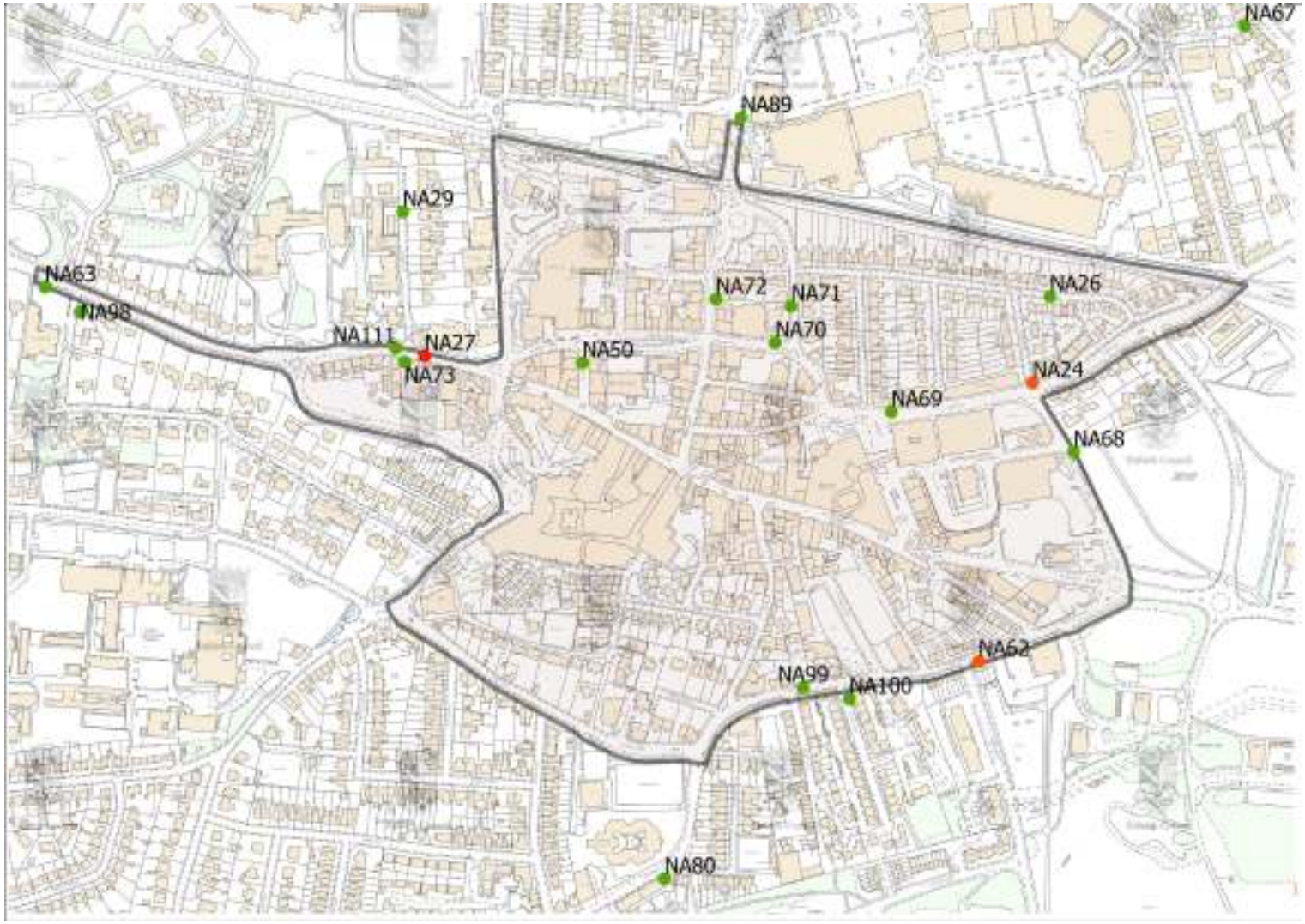
Table 2.6 Results of Nitrogen Dioxide Diffusion Tubes in 2014 continued

Site	Location	Within NO_2 AQMA?	Data Capture for Monitoring Period, %	Data Capture 2014, %	Annual mean concentrations, µg/m^3			
					2011 (0.84)	2012 (0.79)	2013 (0.80)	2014 (0.81)
NA98	Arnothill, Falkirk	N	n/a	67	26 *	26	25	22
NA99	St Crispins Place, Falkirk	Y	n/a	100	34 *	29	26	25
NA100	Oswald St, Falkirk	N	n/a	92	22 *	22	21	20
NA101	Glensburgh Road (2), Grangemouth	N	n/a	92	28 *	26	24	24
NA103	Merchiston Gardens	N	n/a	75	22 *	21	19	16
NA105	West of Shieldhill	N	n/a	100	11 *	10	10	9
NA107	Main Street (east), Bainsford	N	n/a	100	n/m	n/m	31	30
NA108	Main Street, Camelon	N	n/a	100	n/m	n/m	n/m	23
NA109	Carmuirs Street, Camelon	N	n/a	92	n/m	n/m	n/m	18 *
NA110	Banknock 2 AQ station	N	100	75	n/m	n/m	n/m	18 *
NA111	Falkirk West Bridge St AQ station	Y	80	40	n/m	n/m	n/m	33 *
NA112	Philip Street, Bainsford	N	100	17	n/m	n/m	n/m	16 *

* Annual adjusted.

Figure 2.4 NO_2 diffusion tube monitoring results in a.) Falkirk Town Centre and b.) Haggs AQMAs. Green less than 36 µg/m^3, orange 36 to 40 µg/m^3 and red greater than 40 µg/m^3.

a.)



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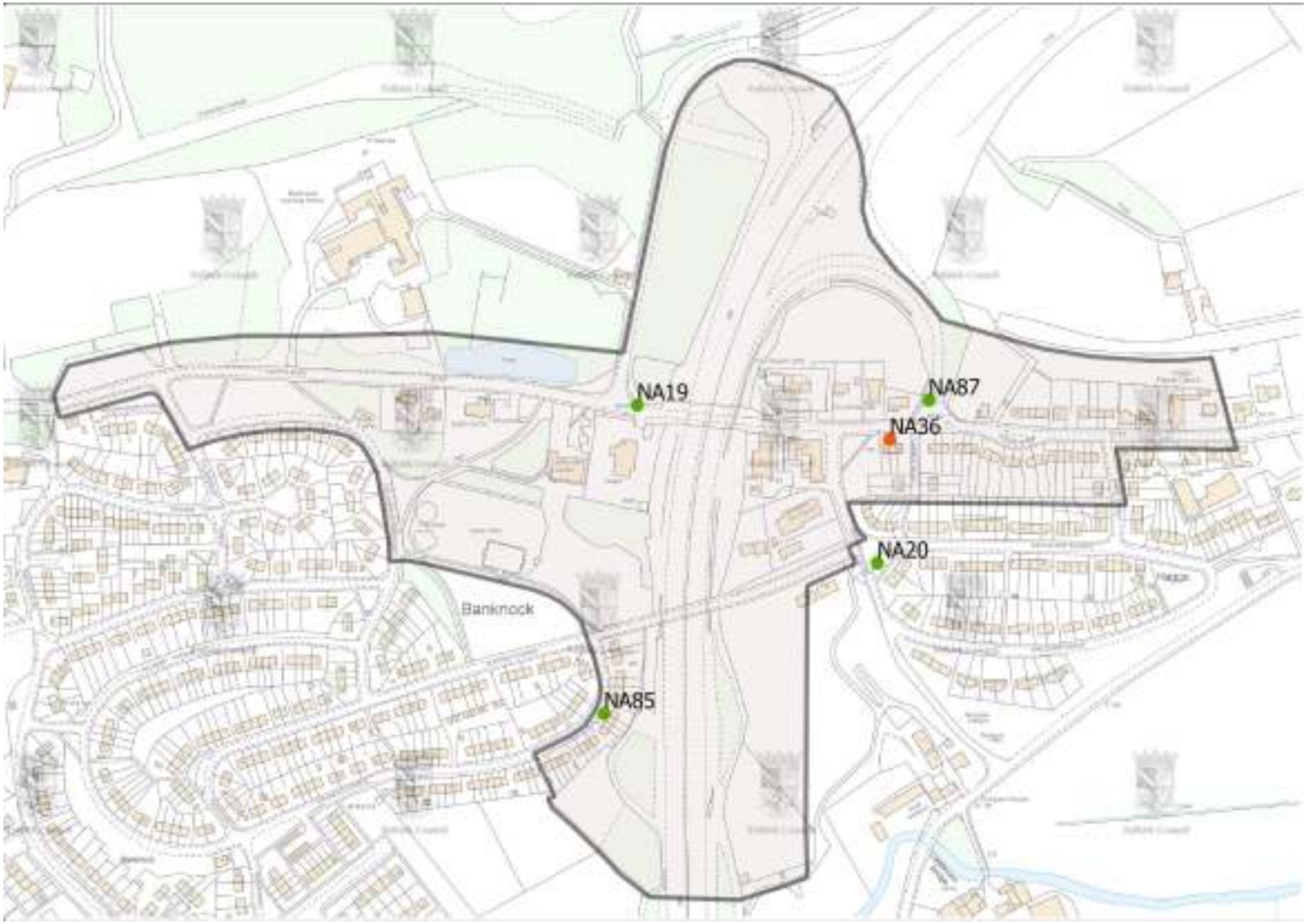


2.2.2 PM_{10}

Falkirk Council measured PM_{10} concentrations at eight locations in 2014. The site with the greatest concentration, but within the Scottish annual PM_{10} objective, was the Falkirk West Bridge St site with an annual average concentration of 17.7 µg/m^3. However, the site was slightly below the data capture target with 85% achieved in 2014. Two daily exceedances were recorded at the Falkirk West Bridge St site with the 98th percentile below the limit value at 40 µg/m^3.

The Banknock 2 monitoring site recorded the greatest number of daily exceedances (three), but again this is within the Scottish daily PM_{10} objective. Thus the two sites within the Banknock AQMA (Banknock 2 and 3) met the Scottish PM_{10} objectives in 2014.

All other sites met the Scottish PM_{10} objectives in 2014. The UK / EU objectives were met at all sites in 2014. The full results are shown in Tables 2.7 and 2.8. The Banknock AQMA will remain in place because the Tomfyne quarry has been given planning permission but is subject to s75 and legal agreements before operations can commence.

It is noted that the Scottish Government has proposed in its draft Low Emissions Strategy that the particulate matter objectives are aligned with the World Health Organisation standards. The result of this would be an increase of the annual PM_{10} objective from 18 to 20 µg/m^3 but a reduction of the $PM_{2.5}$ objective from 12 to 10 µg/m^3. In addition, it was proposed that $PM_{2.5}$ is included in Local Air Quality Management.

It is thus proposed that the Haggs AQMA is not amended to include PM_{10}. The concentration recorded in 2014 was 16.5 µg/m^3 (a decrease from the marginal breach in 2013 of 18.3 µg/m^3) and thus the site achieved both the existing 18 and potential future 20 µg/m^3 objectives. It is quite likely that the TEOM at the Haggs site will be converted to monitor $PM_{2.5}$ in the future.

Figure 2.5 shows long-term trends of PM_{10} concentrations at the Grangemouth AURN site and Falkirk West Bridge St site. The trend in PM_{10} at the Grangemouth AURN site should be treated with slight caution as there have been changes to the correction factor used and the monitoring technique used. However, there is long-term decline at the monitoring site although the concentrations have levelled out since early 2009.

The Falkirk West Bridge St monitoring site has recorded a decline in concentrations between its installation in September 2009 and December 2014. This reflects well the annual concentrations recorded and reported in Tables 2.7 and 2.8.

Table 2.7 Results of Automatic Monitoring of PM_{10}: Comparison with Annual Mean Objectives (18 and 40 µg/m^3)

Site	Site Type	Within PM_{10} AQMA?	Data Capture for Monitoring Period, %	Data Capture 2014, %	Reference Equivalent ?	Annual mean concentration, µg/m^3			
						2011	2012	2013	2014
A4: Falkirk Haggs	Roadside	N	n/a	96.9	Y, VCM	n/m	15.9* #	**18.3**	16.5
A6. Falkirk Park St	Roadside.	Y	n/a	31.8	Y, VCM	15.6	14.6	15.2	14.8 * #
A7. Falkirk West Bridge St	Roadside.	Y	n/a	85	Y, VCM	**18.7 * #**	17.8	**19.5**	17.7 *
A8. Grangemouth AURN	Urban background / industrial.	N	n/a	95.8	Y, FDMS	14.1	14.1	14 * #	12.4
A10.Grangemouth Municipal Chambers	Urban background / industrial.	N	n/a	93.2	Y, VCM	15.1 * #	14.7 * #	15 * #	14.6
A12. Falkirk Grahams Rd	Roadside	Y	n/a	94.3	Y, VCM	n/m	16	16.3	13.2
A13. Banknock 2	Roadside	Y	n/a	98	Y, VCM	n/m	12.7 * #	14.6	15
A14. Banknock 3	Urban background	Y	n/a	82.1	N, 1.14 Osiris	n/m	n/m	12.3 * #	10.6 *

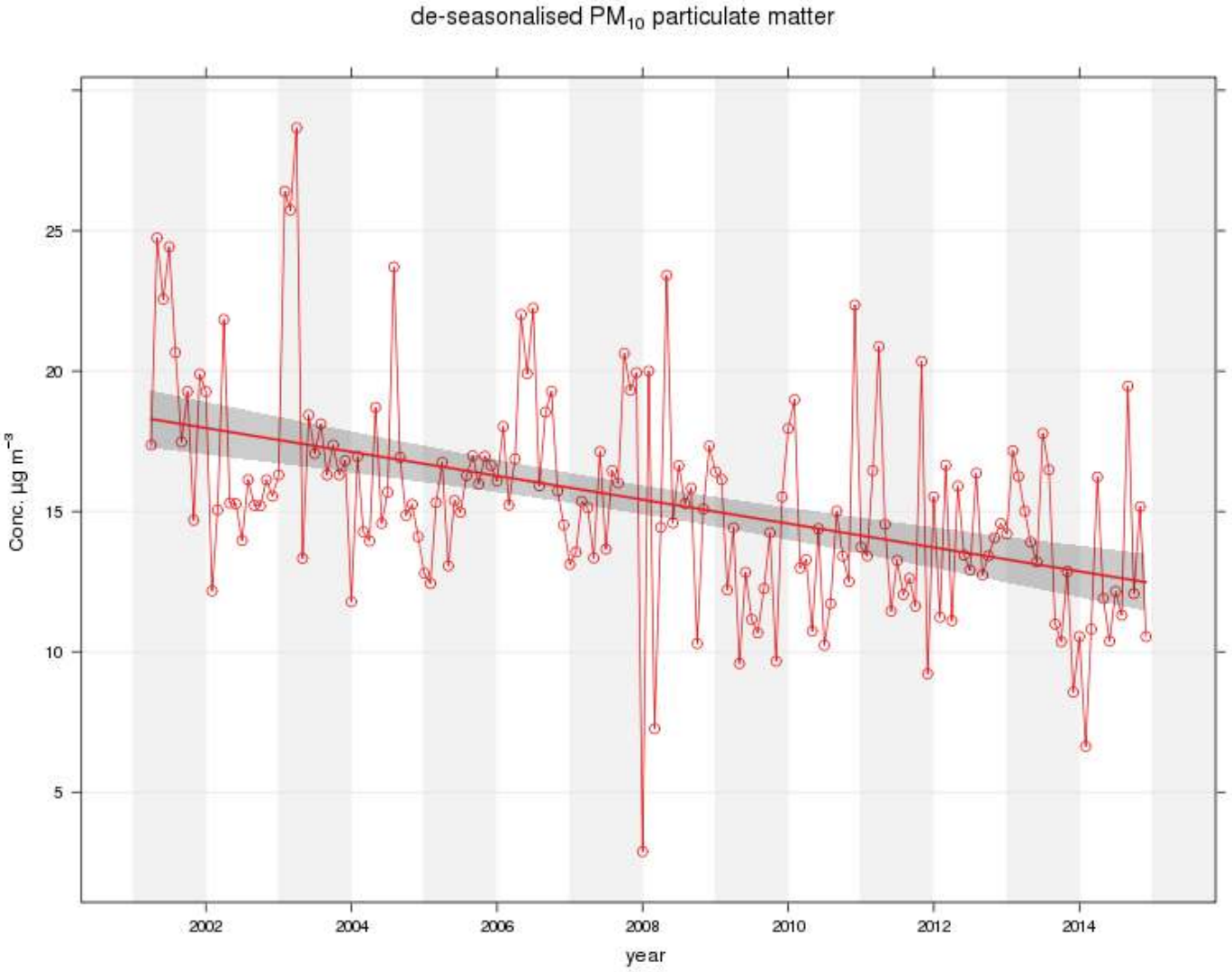
* Annual data capture less than 90%.

Table 2.8 Results of Automatic Monitoring for PM_{10}: Comparison with 24-hour mean Objectives (7 and 35 exceedances of 50 µg/m^3)

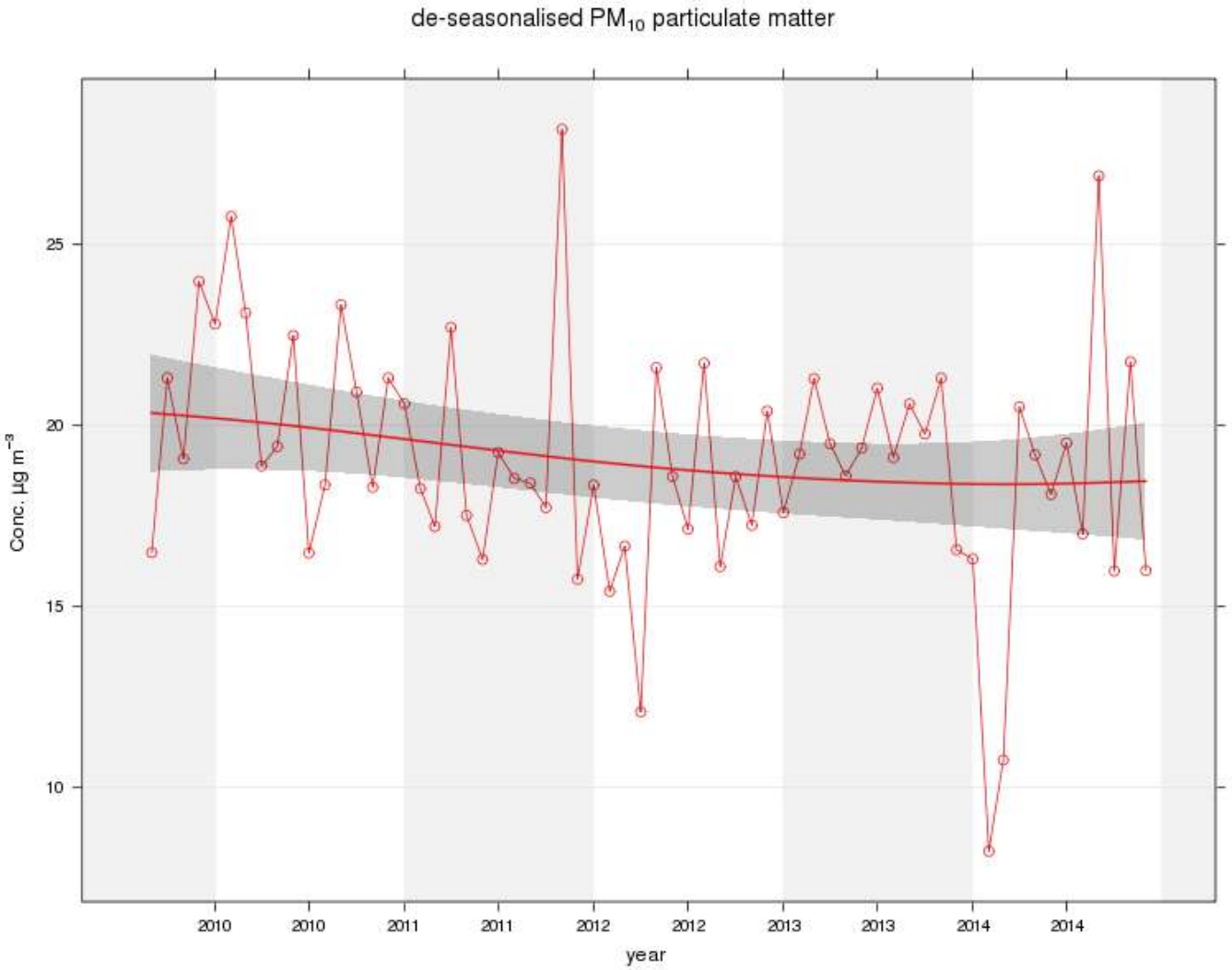
Site	Site Type	Within PM_{10} AQMA?	Data Capture for Monitoring Period %	Data Capture 2014, %	Reference Equivalent?	Number of Daily Exceedances of 50 µg/m^3 (98th percentile)			
						2011	2012	2013	2014
A4: Falkirk Haggs	Roadside	N	n/a	96.9	Y, VCM	n/m	0 (45) *	4 (46)	1 (38)
A6. Falkirk Park St	Roadside.	Y	n/a	31.8	Y, VCM	2 (38)	2 (38)	1 (34)	0 (34) *
A7. Falkirk West Bridge St	Roadside.	Y	n/a	85	Y, VCM	5 (49) *	6 (46)	4 (49)	2 (40) *
A8. Grangemouth AURN	Urban background / industrial.	N	n/a	95.8	Y, FDMS	2 (38)	2 (37)	0 (34) *	0 (32)
A10.Grangemouth Municipal Chambers	Urban background / industrial.	N	n/a	93.2	Y, VCM	0 (40)	2 (41) *	0 (32)*	0 (34)
A12. Falkirk Grahams Rd	Roadside	Y	n/a	94.3	Y, VCM	n/m	4 (44)	3 (38)	0 (32)
A13. Banknock 2	Roadside	Y	n/a	98	Y, VCM	n/m	0 (18) *	0 (33)	3 (40)
A14. Banknock 3	Urban background	Y	n/a	82.1	N, 1.14 Osiris	n/m	n/m	0 (22) *	0 (24) *

* Annual data capture less than 90%.

Figure 2.5 Trends in PM_{10} Concentrations at a.) Grangemouth AURN and b.) Falkirk West Bridge St. a.)



b.)


de-seasonalised PM10 particulate matter
Conc. µg m-3
25
20
15
10
2010
2010
2011
2011
2012
2012
2013
2013
2014
2014
year

2.2.3 Sulphur Dioxide

In 2014 Falkirk Council monitored sulphur dioxide at six locations with the results shown in Table 2.9. The 15-minute objective was met at all six monitoring sites in 2014 with the daily and hourly standards (and therefore objectives) met. The monitoring results are consistent with the 2013 results and since the commissioning of the Tail Gas Unit at the refinery. All six monitoring sites achieved 90% data capture during their operational periods. The Falkirk Park St site achieved 99.4% period data capture but due to its closure only 17.4% annual data capture.

As reported in the 2014 Progress Report the Tail Gas Treatment abatement unit was commissioned by Petroineos in August 2013. In addition, Flue Gas Desulphurisation has been operating on three of the four units at Longannet Power Station since December 2013.

In Table 2.9 and Figures 2.6 to 2.8 the SO_2 monitoring data is presented in a variety of ways; a table of exceedances, graphs and polar plots. It is clear that since the commissioning of the TGU in August 2013 there has been a step change in the SO_2 levels recorded in the Grangemouth AQMA. The number of 15-minute exceedances has reduced with no 'high' (> 533 µg/m^3) concentrations and no hourly or daily exceedances recorded since commissioning. In addition, the monthly average concentrations have decreased, particularly at the Moray site. However, there were 30 fifteen minute exceedances recorded at Grangemouth MC in 2014. In addition, the 99.9th percentile concentration was 262 µg/m^3 at MC which is close to the air quality objective concentration of 266 µg/m^3.

In the 2014 Progress Report it was reported that no exceedances were recorded following the full commissioning of the TGU. However, this was cautioned by the autumn months of 2013 being dominated by westerly and south-westerly wind conditions. Since the end of 2013 a wider variety of meteorological conditions have been recorded which permits a more representative analysis.

The polar plots suggest that the reduction in the number of exceedances goes beyond any changes that could relate to only short-term meteorological conditions. In general, the average concentrations have reduced across a variety of wind directions and speeds at all three sites in Grangemouth. In 2012 the polar plots indicate the highest average concentrations during particular wind conditions were greater than 200 µg/m^3. In 2014 the highest average concentrations have reduced to 80 µg/m^3.

Similarly the percentile concentrations (99.9th percentile to represent the 15-minute objective) have decreased at the three monitoring sites and most noticeably at the Moray site. However, the percentile plot of MC indicates that the peak concentrations have increased under very specific meteorological conditions (just east of a south-east wind direction with speed of 1 to 2 m/s). This is compensated by the extent of the conditions causing exceedances reducing compared to 2012. It is also possible that the full range of meteorological conditions that previously caused exceedances at the Moray site have not

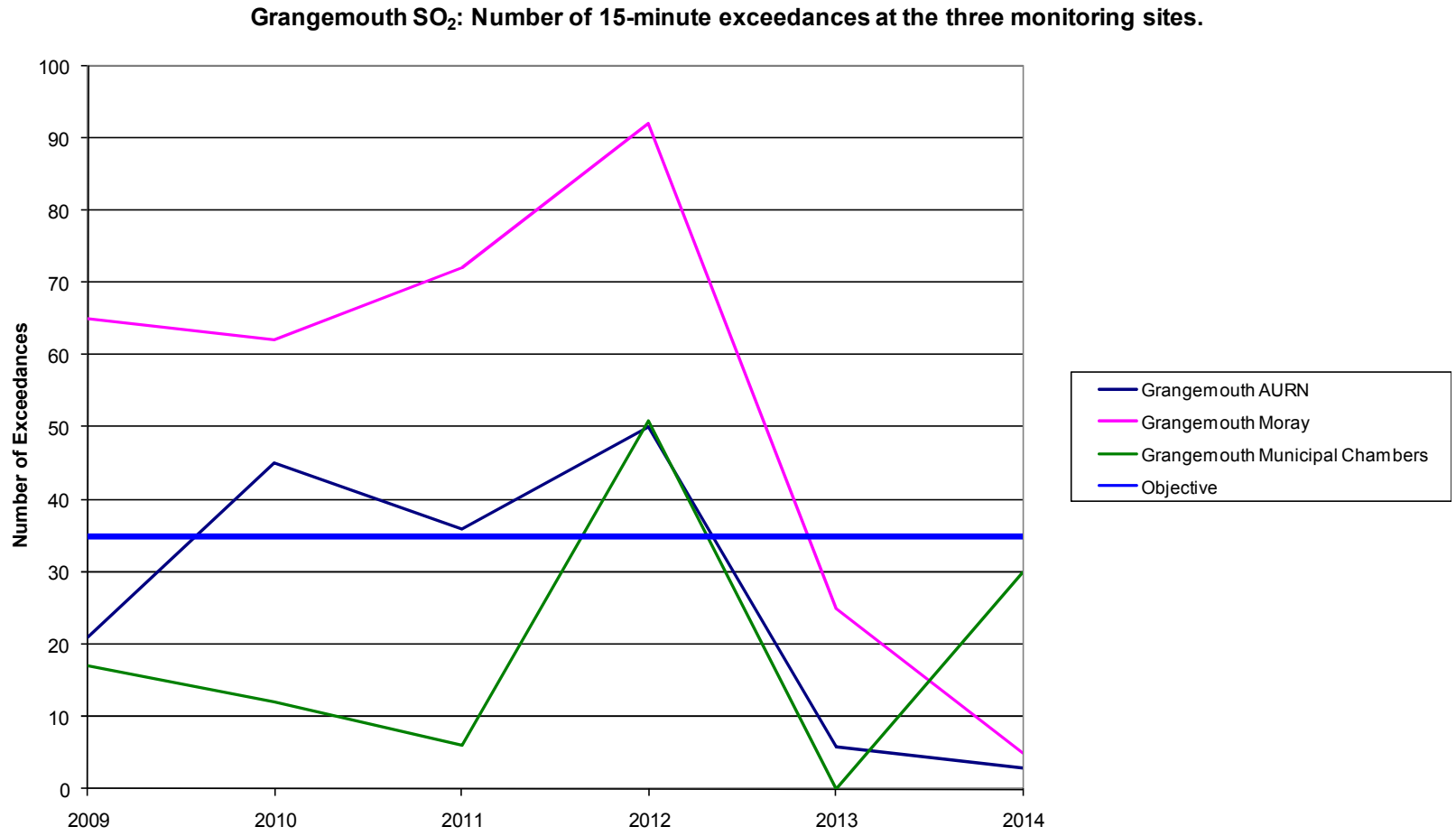
been experienced (north-easterly, 5 to 10 m/s). A comparison with 2013 is not made because the TGU was commissioned part-way through the year and the autumn dominated by south-westerly winds.

Table 2.9 Results of Automatic Monitoring of SO_2: Comparison with Objectives.

Site	Location	Within SO_2 AQMA?	Annual Data Capture 2014, %.	Number of exceedances and (appropriate percentiles, μg/m^3).		
				15-minute objective	1-hour objective	24-hour objective
A3	Bo'ness	N	95.9	0 (82)	0 (53)	0 (14)
A5	Falkirk Hope St	N	99.3	0 (81)	0 (53)	0 (19)
A6	Falkirk Park St	N	17.4	0 (19)	0 (12)	0 (3)
A8	Grangemouth AURN	Y (15-min)	96.6	3 (144)	0 (89)	0 (29)
A9	Grangemouth Moray	Y (15-min)	99.2	5 (174)	0 (101)	0 (34)
A10	Grangemouth Municipal Chambers	Y (15-min)	99.4	30 (262)	0 (176)	0 (63)

Note: Although Falkirk Park St annual data capture was low the period data capture was 99.4%.

Figure 2.6 a.) Number of exceedances at the three SO_2 monitoring sites in the Grangemouth AQMA between 2009 and 2014.



b.) Monthly concentrations at the Grangemouth Moray site between 2007 and 2014.

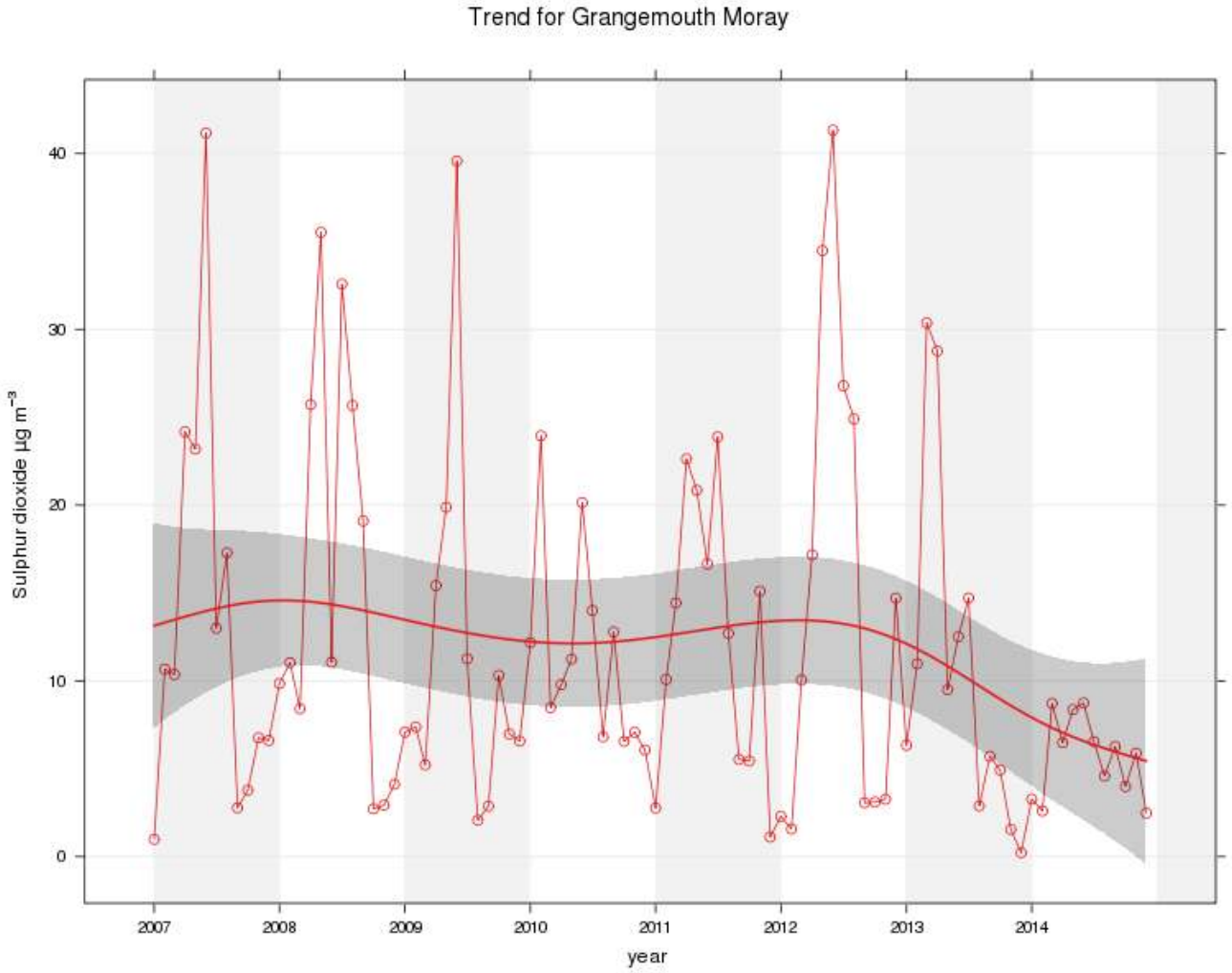


Figure 2.7 Polar Plots of SO_2 Concentrations in the Grangemouth AQMA in 2014.

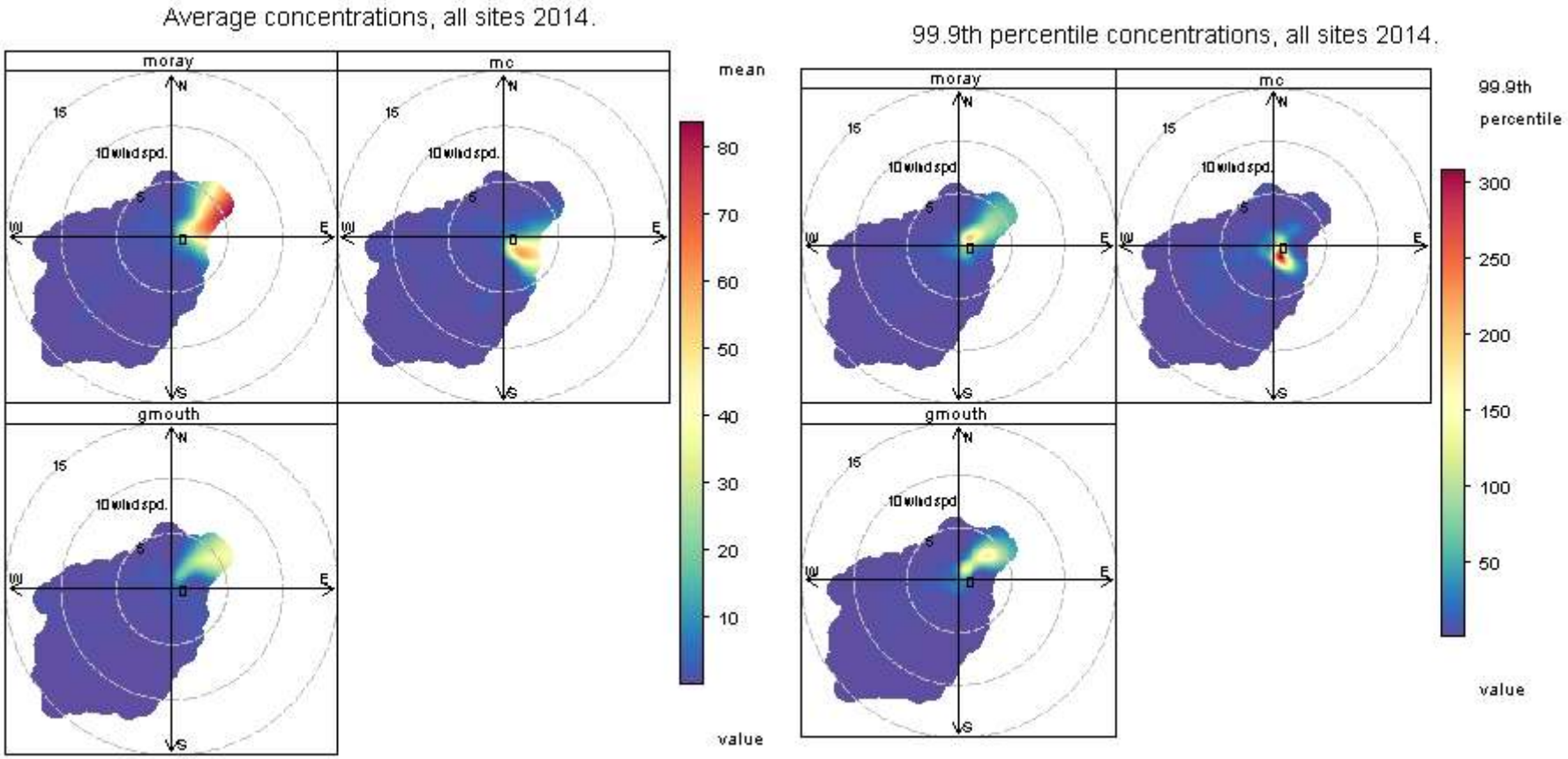
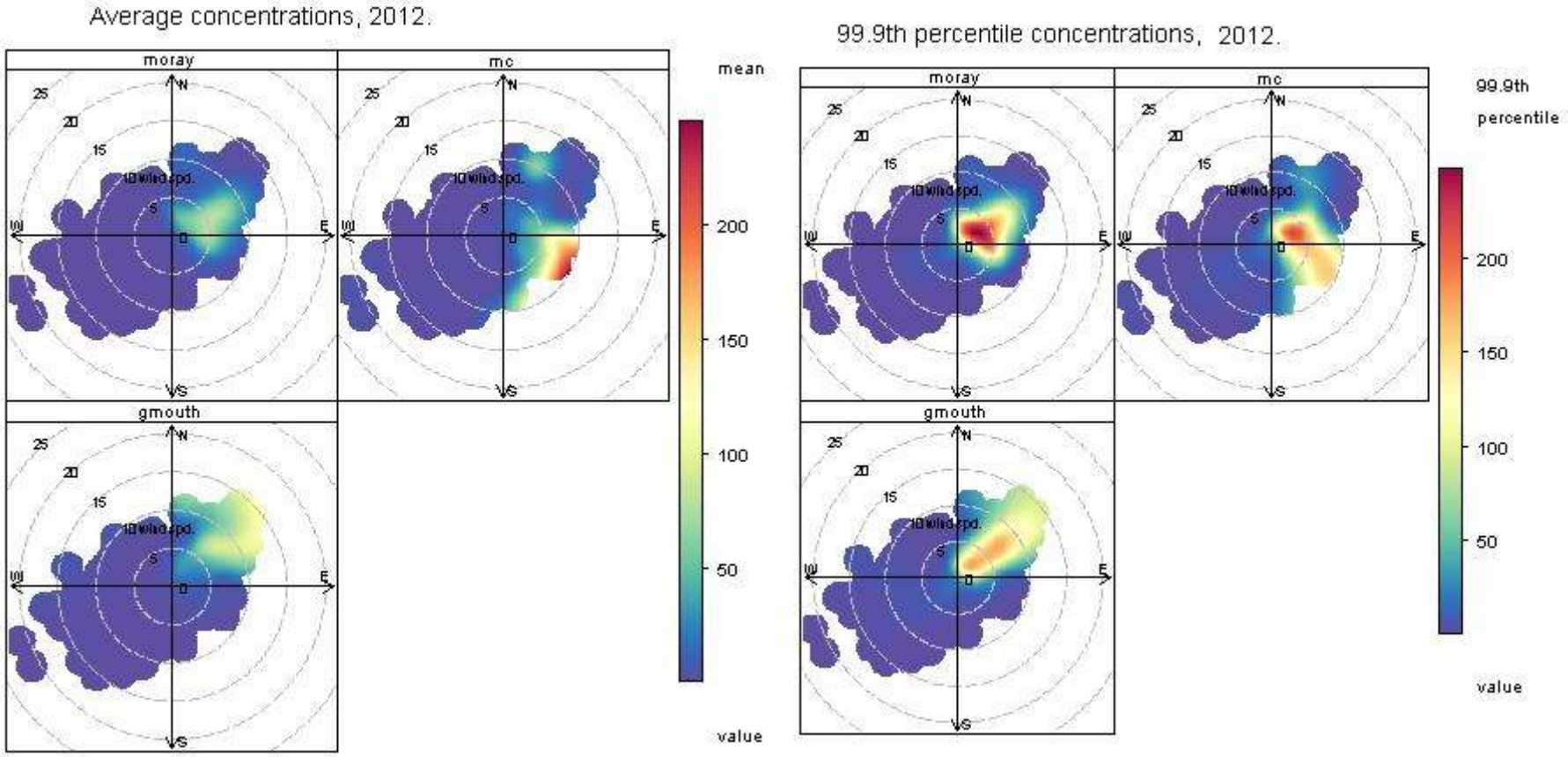


Figure 2.8 Polar Plots of SO_2 Concentrations in the Grangemouth AQMA in 2012.



2.2.4 Benzene

In 2014 Falkirk Council monitored benzene at 16 locations using passive diffusion tubes. In addition, at the Grangemouth AURN (A8) site a pump diffusion tube operates as part of the AURN network. The results from the pump diffusion tube are shown in Table 2.10 with the passive diffusion tube results in Table 2.11.

All the benzene concentrations recorded by the tubes were within the air quality objectives. All benzene diffusion tubes achieved data capture greater then 75%. A pumped diffusion tube is generally considered to be more accurate than a passive diffusion tube. In 2014 the pumped diffusion tube at the Grangemouth AURN site recorded an annual average concentration of 0.99 µg/m^3. Please note that October to December 2014 data has not been finalised. The concentration recorded continues to be within the relevant objectives and is a decrease compared to 2013. It is also the lowest annual concentration recorded since monitoring began in 2002.

Table 2.10 Results of pumped benzene diffusion tube.

Site	Location	Data capture, 2014, %.	Annual mean concentration, µg/m^3				
			2010	2011	2012	2013	2014
A8	Grangemouth AURN	100	1.42	1.26	1.97	1.13	0.99

Table 2.11 Results of passive benzene diffusion tubes.

Site	Location	Within benzene AQMA?	Data capture, 2014, %.	Annual mean concentration, µg/m^3				
				2011	2012	2012 #	2013	2014
NA3	Tinto Drive,Grangemouth	N	100	1.22	1.23	n/a	1.39	1.30
NA21	Grangemouth Road, College	N	75	0.92	1.91	1.73	1.25	1.13
NA27	West Bridge Street, Falkirk	N	83	1.49	2.09	1.78	1.52	2.39
NA37	Denny Town House	N	92	0.87	1.38	n/a	1.16	1.09
NA38	Larbert Village Primary School	N	100	1.36	1.37	1.32	0.85	1.04
NA41	Seaview Place, Bo'ness	N	83	2.19	2.14	2.05	1.84	1.97
NA42	Municipal Chambers, Grangemouth	N	75	0.91	1.62	1.41	1.59	1.25
NA44	Greenpark Drive, Polmont	N	83	0.84	1.49	1.21	1.16	1.34
NA55	Inchyra Station	N	83	1.42	**3.29**	3.04	1.38	1.32
NA57	Inchyra Road, Grangemouth	N	83	1.31	2.39	n/a	1.33	1.96
NA77	Kinnaird Village	N	92	0.63	1.32	n/a	1.12	1.04
NA80	Cow Wynd, Falkirk	N	92	1.11	1.75	1.52	1.53	1.33
NA81	Grahams Road, Falkirk	N	100	1.04	1.37	n/a	1.47	1.25
NA94	A905 (Glensburgh Rd), Grangemouth	N	100	0.77	1.67	n/a	1.71	1.13
NA102	East Kerse Mains, Bo'ness	N	92	0.69	1.76	n/a	1.35	1.26
NA105	West of Shieldhill	N	92	0.91	1.26	1.1	0.69	0.74

Note: April 2014 results not covered by UKAS accreditation due to high QC results.

Falkirk Council has considered INEOS' community monitoring results. In 2014 all the sites met the Scottish benzene objective. [Ref 2]

2.2.5 Other Pollutants Monitored

1,3 Butadiene

In 2014 Falkirk Council monitored 1,3 butadiene at three locations using passive diffusion tubes. All the results were within the objective and are shown in Table 2.12. All annual concentrations were within the objective. The annual concentrations have decreased since 2013. This is due to the detection limits reducing following a change in contractor (ESG to Gradko) supplying and analysing the tubes from April 2014.

Table 2.12 Results from 1,3 butadiene diffusion tubes.

Site ID	Location	Within 1,3 butadiene AQMA?	Data capture in 2014, %.	Annual mean concentrations (µg/m^3)			
				2011	2012	2013	2014
NA41	Seaview Place, Bo'ness	N	100	0.85	1.19	1.25	0.42
NA55	Inchyra Station, Grangemouth	N	91.7	0.85	1.19	1.25	0.48
NA104	Powdrake Road, Grangemouth	N	91.7	1.16	1.19	1.25	0.47

$PM_{2.5}$

A Scottish Government owned $PM_{2.5}$ FDMS-TEOM commenced operation at the Grangemouth AURN (A8) site in December 2008. The Scottish Government has announced that it wishes local authorities to review and assess $PM_{2.5}$. This is in addition to PM_{10} and will result in a $PM_{2.5}$ objective being placed into legislation. Therefore in-line with previous reports the $PM_{2.5}$ results from the Grangemouth AURN (A8) site are included but considered in slightly more detail.

The Grangemouth $PM_{2.5}$ results are shown in Table 2.13. The concentration recorded in 2014 at the Grangemouth AURN (A8) site was 8.0 µg/m^3. This concentration is below the Scottish Government's interim target value of 12 µg/m^3. It is also lower than the World Health Organisation standard, which the Scottish Government has proposed to adopt, of 10 µg/m^3. In 2014 the annual concentration recorded was the lowest since monitoring began in December 2008. The $PM_{2.5}$ concentrations in Grangemouth has gradually reduced from 10.9 µg/m^3 in 2011 to 8.0 µg/m^3 in 2014. However, as shown in Figure 2.9 this follows a slow increase in concentrations between 2008 and 2011.

In addition, $PM_{2.5}$ monitoring commenced in Banknock in February 2015 with the installation of a FIDAS 200. The measurement of $PM_{2.5}$ at this monitoring site is primarily focused on assisting with source identification in the area. However, if a 10 µg/m^3 objective is placed into

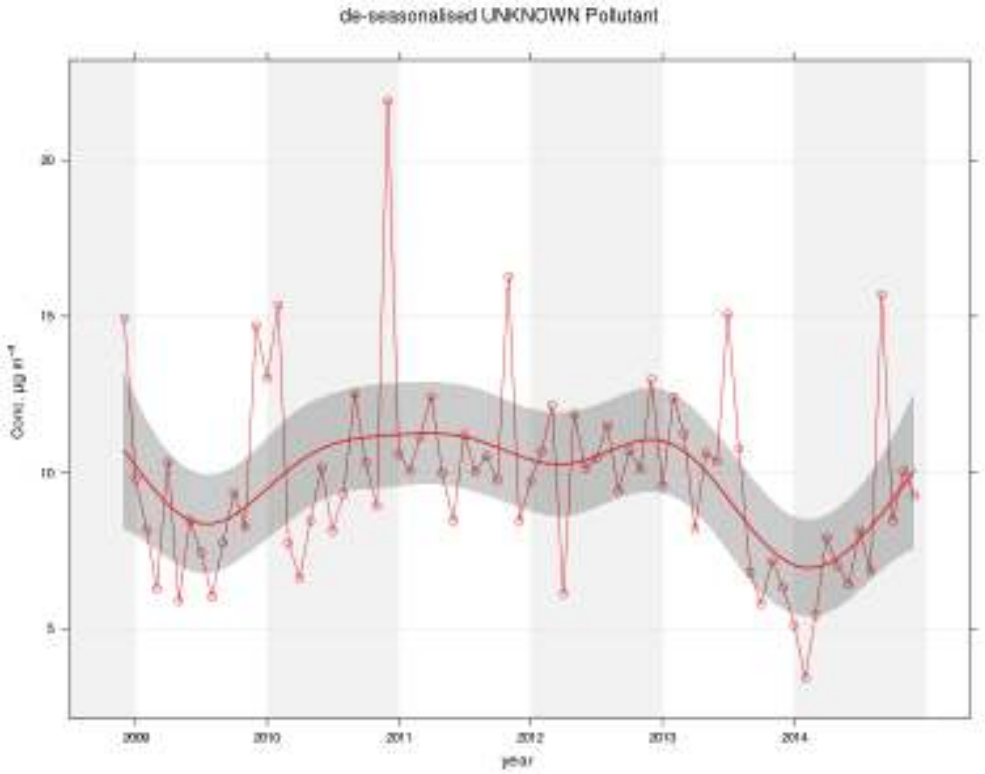
legislation the unit will serve a secondary purpose and naturally the data will be compared against the objective.

Table 2.13 Results from $PM_{2.5}$ monitoring.

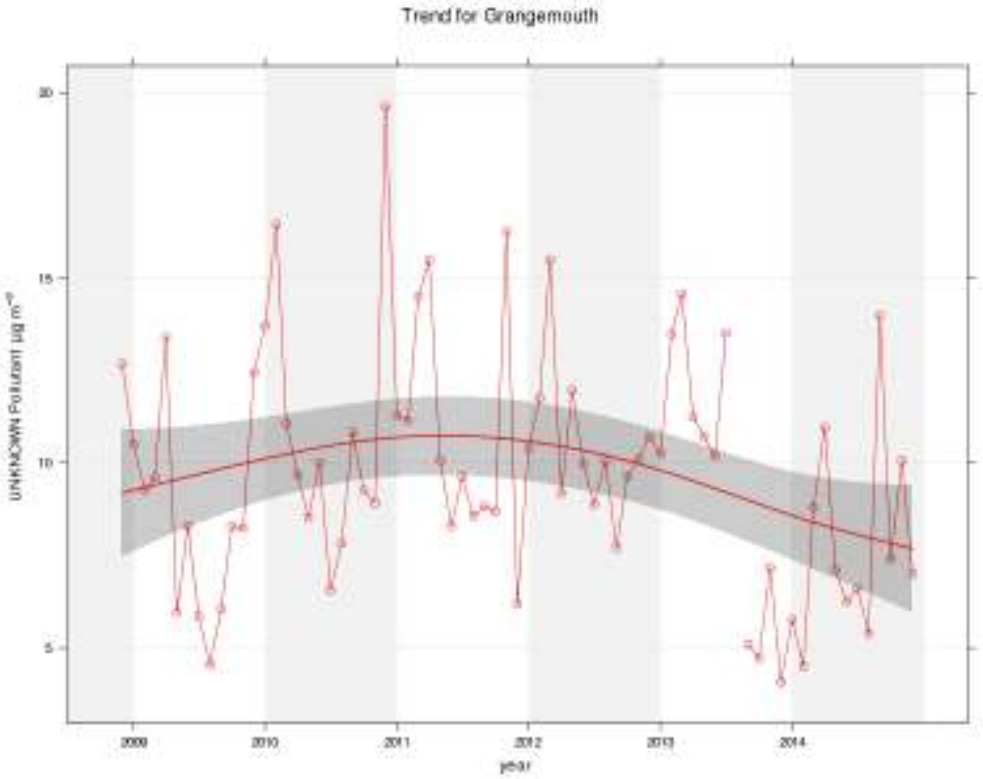
Site ID	Location	Data Capture in 2014, %	Annual mean concentration (µg/m^3)			
			2011	2012	2013	2014
A8	Grangemouth AURN	92.4	10.9	10.5	9.2	8.0

Figure 2.9 a.) Deseasonalised and b.) absolute $PM_{2.5}$ concentrations at Grangemouth between December 2008 and December 2014.

a.)



b.)


Trend for Grangemouth
UNKNOWN Pollutant µg m⁻³
20
15
10
5
2009
2010
2011
2012
2013
2014
year

Summary of Compliance with AQS Objectives

Falkirk Council has examined its 2014 automatic and non-automatic monitoring results. The Falkirk West Bridge St automatic monitoring site and the diffusion tube on the same street breached the annual NO_2 objective. No other diffusion tubes breached the annual NO_2 objective. No monitoring sites breached the annual or daily PM_{10} objectives.

The six SO_2 automatic monitors met all three (15-minute, hourly and daily) objectives. However, the number of exceedances at the Grangemouth MC site was close to the 15-minute objective with 30 exceedances. There were no exceedances of the hourly or daily limit value.

The benzene and 1,3 butadiene diffusion tube monitoring conducted in 2014 met the objectives.

The $PM_{2.5}$ monitor at the Grangemouth AURN site recorded a concentration of 8 µg/m^3. This level is within the Scottish Government's interim target value of 12 µg/m^3 and the proposed 10 µg/m^3 objective. $PM_{2.5}$ monitoring commenced monitoring at the Banknock 2 site in February 2015 to primarily assist with source identification.

No carbon monoxide or lead monitoring is conducted in the Falkirk Council area.

There are no outstanding changes to the automatic monitoring network.

3 Road Traffic Sources

This section 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.

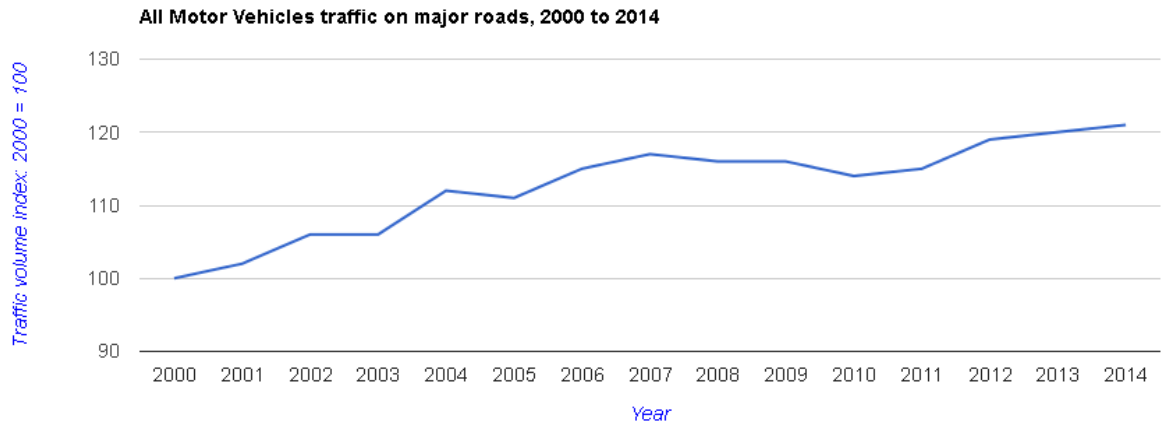
This section will review any changes to the following since the 2014 Progress Report:

- 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 NO_2 and PM_{10}. Emissions of benzene, 1,3 butadiene and carbon monoxide from road traffic are now insignificant.

Figure 3.1 shows that the total amount of road traffic, by vehicle miles with 2000 as a base year, on Falkirk Council's roads reached an initial peak in 2007 and then declined through to 2010. An increase through to 2012 was experienced which then levelled off in 2013 and 2014. Using the year 2000 as a base year of 100, 2007 was equal to 117 with 2014 equal to 121.

Figure 3.1 All motor vehicles traffic on major roads in Falkirk Council area, 2000 to 2014



Reference 3

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.

There are no 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.

In addition, the automatic monitoring network recorded no exceedances of the hourly objective concentration and all of the diffusion tubes recorded concentrations below 60 $\mu g/m^3$.

Falkirk Council is not aware of any links where there are any new locations where people may spend 1-hour or more in proximity to traffic.

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).

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 tighter Scottish PM_{10} objective a DMRB run is required where either the background concentration of PM_{10} is greater than 15 µg/m^3 and the AADT greater than 5,000 or where a 10% increase in flow has been recorded. Thus the focus is on links that have experienced a 10% increase in flow with an AADT of 5,000 or greater.

The following links have been considered with a DMRB run with results shown in Table 3.1:

- A803 Glenfuir Road to Rosebank roundabout.
- A803 Bridge St to the Bypass Road Dennyloanhead.
- B9132 Abbots Road between Newhouse Road to Bo'ness Road.

Table 3.1 Results of the DMRB runs.

Road	NO_2 annual mean, µg/m^3	PM_{10} annual mean, µg/m^3
A803 Glenfuir road to Rosebank roundabout	28.8	16.9
A803 Bridge St to the Bypass Road Dennyloanhead	28.4	16.3
B9132 Abbots Road, Newhouse Road to Bo'ness Rd	25.6	14.5

The following diffusion tube shall be relocated:

- Inchyra Road (NA57): the relevant receptor is slightly greater than 10 m from the kerb. However, diffusion tube (NA57) shall be re-located so that it represents these receptors on the southern section of the road close to junction 5 of the M9.

Transport Planning have reported that there are increased levels of congestion at the junction of the M876 and M80. This follows the M80 upgrade and the reduction of the speed limit on the A803 to 30 mph. There are no receptors within 50 m of the kerb and thus it need not be considered any further.

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 slip-road at junction 6 from the M9 onto Glensburgh Road in Grangemouth has been re-designed and signalised. In addition, the subsequent roundabout has been signalised. In Figure 3.2 two photos show the previous and new layout. The construction works were completed in April 2014.

The new layout has moved traffic away from the diffusion tube NA94 on Glensburgh Road (and hence the nearby receptor). This is because the vast majority of the traffic travels straight through the junction in the new second and third lanes. The new layout then allows left-turning traffic to be served by a dedicated near-side lane that is subject to reduced congestion.

In 2013 the annual mean NO_2 concentration at diffusion tube NA94 was 36 µg/m^3 and in 2014 the concentration reduced to 31 µg/m^3. The diffusion tube monitoring will continue at the site. However, the results indicate that there has been a reduction in concentrations of NO_2 in the vicinity of this site. It is likely that the re-designed junction has contributed to a reduction in NO_2 concentrations in the area. This is because the distance between the tube (and thus receptor) and dominant emissions source (road traffic) has increased and congestion has reduced.

Figure 3.2 Photos of a.) the old and b.) new road layout along Glensburgh Road, Grangemouth.

a.) Old road layout.

b.) New road layout.

Falkirk Council has assessed the major new roads meeting the criteria in Section A.5 of Box 5.3 in TG(09). The diffusion tube monitoring at site NA94 will continue but concentrations have decreased noticeably between 2013 and 2014 following the junction re-design.

3.6 Roads with Significantly Changed Traffic Flows

For Scottish authorities the guidance relating to Section 3.4 requires assessment of roads where traffic levels have increased by 10% or more for PM_{10}. The guidance in this section requires an increase of 25% but includes NO_2. The DMRB runs conducted in Section 3.4, where the requirement was for a link to have a 10% increase, included NO_2 and so does not need to be considered again.

Please see conclusion of 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.

However, nine new Euro V hybrid buses commenced operation in the Falkirk Council area in November 2014. The First Group buses are running on their number 3 and 4 routes which operate between the Falkirk wheel and Grangemouth and a photograph is shown in Figure 3.3. The routes include Falkirk Town Centre and specifically West Bridge Street. The hybrid element of the vehicles powers the electrical requirements of the bus. This reduces the load on the engine and is a contrast to other hybrids where the electrical power is used to fully or partly drive the vehicle.

Figure 3.3 A photograph of First Group's hybrid bus during its launch.

Reference 4

Subsequently First Group has announced another order of 385 new vehicles across its UK operations. It is understood that 26 of the new vehicles (Figure 3.4) will operate in the Falkirk area along with a further 15 'nearly new' vehicles that are cascaded from other operations. All the new vehicles supplied to Scotland will be Euro VI. Once the vehicles are operating further details will be provided in next year's air quality report.

Figure 3.4 The photograph accompanying First Group's announcement of their new vehicle order.

Reference 5.

Falkirk Council confirms that there are no changes to any bus or coach stations in the area.

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

The number of airport passenger movements at Edinburgh between 2013 and 2014 has increased by 3.8% from 9.775 million to 10.159 million. [Ref 6] The airport does not need considering further as it is greater than 1 km from the Falkirk Council boundary.

Falkirk Council is not aware of any significant changes to Cumbernauld airport. This 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 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 line 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 Falkirk 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 electrified line between Airdrie and Bathgate, 1.3 km south of the Falkirk Council boundary.

4.2.1 Stationary Trains

Falkirk Council is not aware of any new locations where locomotives or trains are stationary for more than 15-minutes that would not have been assessed in previous reports.

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 rail lines listed in Section 4.2 is the busiest in the Falkirk Council area. The 2009 U&SA report did not require assessment of this line, although as a precaution a NO_2 tube was placed close to Falkirk High station. The site recorded a concentration of 22 µg/m^3 in 2010. This is within the NO_2 objective and so the site was discontinued.

As a result of the Edinburgh to Glasgow Improvement Programme (EGIP) line 1 will be electrified by 2016 and lines 2 and 3 by 2018. The current construction and delivery timetable is:

- 2012 to 2014: Extensive bridge clearance works.
- May 2014: Electrification of Cumbernauld to Glasgow line.
- June 2014: Completion of re-developed Haymarket Station.
- July 2014: Opening of new station building at Cumbernauld.
- May 2015: Completion of Haymarket to Inverkeithing signalling renewal.
- April 2016: Last of 61 bridge clearance projects complete.
- October 2016: Completion of intermediate station platform extensions (including Falkirk High, Polmont and Linlithgow.)
- December 2016: Completion of Edinburgh Waverley platform extensions.
- December 2016: Introduction of first Edinburgh to Glasgow electric services.
- December 2016: Completion of Edinburgh Gateway railway station.
- December 2017: All electric fleet operating on Edinburgh to Glasgow services.
- December 2018: Introduction of electric services on Stirling / Alloa / Dunblane lines (this includes services through Falkirk Grahamston).
- December 2018: Introduction of 8 car services and 42 minute journey time between Edinburgh and Glasgow.

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 PM_{10} monitor began operation at this location in December 2011 and met the objectives in 2014.

Line four runs through a mostly industrial area and has no new receptors. The Bo'ness and Kinneil steam railway (line five) continues to operate four departures and arrivals in each direction during its peak timetable. This timetable only operates on July and August weekends. This line was re-assessed in the 2013 Progress Report. [Ref 7] 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 2013, 1,202 ships called at the docks, and in 2014 1,196 ships called at the docks. [Ref 8]

The number of ships calling into Grangemouth has decreased and thus the docks do not need to be considered further. In addition, the docks are within the SO_2 Grangemouth AQMA and were considered in the original Further Assessment report. The Grangemouth MC (A10) monitoring site (with SO_2 analyser) is close to the docks and in 2014 this site met all three SO_2 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.

PPC/E/0020072, Sulzer Dowding & Mills Engineering, Larbert. This site has mothballed their process and is applying to surrender as they do not intend to operate in the future. The site had permit emission conditions relating to emissions of NO_x.

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 currently carried out in Grangemouth and other parts of the Falkirk Council area. As shown in Tables 2.10 and 2.11 there were no breaches of the benzene objectives in 2014.

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 the results indicate no exceedances of the Scottish or UK / EU objectives.

5.3 Petrol Stations

The technical guidance states that there is potential to exceed the 2010 annual mean benzene objective where there is relevant exposure within 10 m of the pumps of a petrol station with an annual throughput of greater than 2000 m^3 which is located close to a road with a traffic flow greater than 30,000 AADT.

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

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 or new installations.

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

Additional information about industrial emissions in the Falkirk Council area
It was announced by INEOS in March 2014 that the ethylene cracker (G4) and butadiene plant (BE3) have closed.
http://www.ineos.com/news/ineos-group/grangemouth-milestones/?business=INEOS+Group

As widely report in the media (http://www.bbc.co.uk/news/uk-scotland-edinburgh-east-fife-33970594) it has been announced by Scottish Power that Longannet Power Station will close in March 2016. This will be considered by any future assessments of sulphur dioxide in the Grangemouth AQMA and the impact, if any, will be accounted for by the Grangemouth AQMA SO_2 monitors.

In February 2015 the Scottish Government announced a moratorium on granting consents for unconventional oil and gas developments in Scotland. The moratorium is to continue until work including a full public health assessment and a review current planning and environmental guidance is conducted. The reporters of an application in the Falkirk area (PPA-240-2032 (Planning Permission Appeal), Land located 230 m south of Powdrake farmhouse, Powdrake Road, near Airth, Plean and Letham Moss, Falkirk) have therefore suspended their work on this appeal. In respect of this application it is noted that Defra have proposed that benzene will be removed as part of Local Air Quality Management in England. The Scottish Government has yet to announce the pollutant details of any revised LAQM process in Scotland.

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 no new individual biomass combustion individual installations that require consideration.

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 about 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.

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.

A map of the smoke control areas in the Falkirk Council area is available to view on the Falkirk Council website at www.falkirk.gov.uk/airquality and is shown in Figure 6.1.

Figure 6.1 A map of the merged smoke control areas in the Falkirk Council area.

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 has the potential to 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 no changes with respect to the pollutants covered by this report have been indicated by SEPA.

The new quarry in the vicinity of the Banknock AQMA is discussed in Section 8.

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, Action Plan and Other Strategy or Policy Updates

Grangemouth AQMA (SO_2 15-minute) AQMA and Action Plan

In 2014 Falkirk Council monitored sulphur dioxide at six locations and the results were shown in Table 2.9. The three sites in the AQMA (Grangemouth AURN, Moray and Municipal Chambers) met the 15-minute objective. In addition, the daily and hourly objectives were met. The monitoring sites outside the AQMA met all three objectives.

The 2014 monitoring results are reasonably consistent with the 2013 monitoring results. No breach of the 15-minute objective was recorded in 2013 and 2014. All monitoring sites achieved 90% data capture. However, there were 25 exceedances recorded at Moray in 2013 and 30 exceedances recorded at Municipal Chambers in 2014. Thus it can be considered that the number of 15-minute exceedances remains close to the objective. There have been no 15-minute exceedances recorded at a monitoring site outside the AQMA since August 2012.

A smooth trend plot of concentrations and polar roses were shown in Figures 2.6 to 2.8. These graphs and the number of recorded exceedances show a reduction in sulphur dioxide levels and an improvement in air quality in the AQMA since the commissioning of the Tail Gas Unit in August 2013.

The original AQMA declaration related to a potential breach of the 15-minute objective. However, between 2007 and 2012 a breach of the objective was recorded. It is thus considered that this AQMA has changed from being a clear breach of the objective (between 2007 and 2012) to its original declaration, that is, there is potential for the objective to be breached. It is considered that the Grangemouth AQMA remains justified because the number of exceedances, in 2014 particularly, was close to the objective. However, the strength of this justification has significantly weakened since the commissioning of the Tail Gas Unit.

The Grangemouth Zetland Park has been positioned to support any AQMA amendment or revocation. The Grangemouth AQMA Action Plan included four measures and an update of these is provided in this section.

Measure 1:

Eight 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 six SO_2 analysers that are used for monitoring in relation to the Grangemouth AQMA. The data from the Bo'ness site is available on request.

Falkirk Council sends meteorological data and provisional SO_2 to SEPA, INEOS and Petroineos when an SO_2 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:
As discussed in the 2014 Progress Report a working group meeting was held in November 2013 as it was post-commissioning of the Tail Gas Treatment unit.

It was agreed by the working group that another meeting would only occur if there was another breach of the sulphur dioxide objectives.

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 and site specific.

Measure 4:
The monitoring site changes that have been implemented since the declaration of the AQMA are:

- The Grangemouth Moray site commenced operation in September 2006 with the SO_2 analyser. This analyser and site continues to operate.
- The Abbotsford House site ceased operation on the 16th April 2010. The unit was relocated to Polmont and commenced operation in September 2010 and ceased operation at in September 2012. During this period there was only one 15-minute exceedance recorded during the period of monitoring.
- Following the commissioning of the Tail Gas Unit in August 2013 the justification and viability of operating two SO_2 analysers in Falkirk was considered. The 15-minute objective continues to be met outside the Grangemouth AQMA. With few exceedances recorded outside the Grangemouth AQMA and zero since August 2012 it was considered that one of the Falkirk SO2 sites should cease operation. The Falkirk Hope St site has been in operation longer than Falkirk Park St and is a fixed site. The Falkirk Park is a mobile unit and a re-location was to benefit the Falkirk Townscape Heritage Initiative. It was considered that Falkirk Park St was no longer required for either the road traffic or Grangemouth AQMA work. Therefore the Falkirk Park St site ceased operation in April 2014.
- The Falkirk Park St enclosure was re-located to Zetland Park in Grangemouth. The SO_2 analyser was commissioned in May 2015. The NO_x and PM_{10} analysers have been utilised at the new Main Street, Bainsford, monitoring site.
- Falkirk Council is observing developments of small SO2 'sensors'. It is unlikely that these will replace the reference monitoring that is conducted at the automatic sites. However, they may be useful in providing indicative measurements in additional areas and may aid location of any future monitoring sites.
- It is likely that by March 2016 the Grangemouth Moray and Bo'ness SO_2 analysers, which are more than 15 years old, will be replaced because spare parts will no longer

be manufactured. The replacement will thus ensure that monitoring can continue into the future. It is anticipated that other analysers will be replaced in due course. The exception is the Grangemouth AURN analyser which was replaced in 2012 as part of a Defra funded AURN replacement programme.

Table 8.1 Update on Grangemouth AQMA Action Plan measures

Measure Number	Measure	Focus	Lead authority	Progress to date	Progress in last 12 months	Estimated completion date	Comments relating to emission reductions
1	Improving data access	Supplying monitoring data to SEPA, Petroineos and INEOS.	Falkirk Council	Data sent after exceedances, monthly summary sent.	Same as Progress to date.	Ongoing.	See comments in this Section.
2	Working group.	Bring together FVHB, Petroineos, INEOS, S.Govt, SEPA and Falkirk Council.	Falkirk Council	TGU full commissioned in August 2013, meeting held in November 2013.	Same as Progress to date.	Completed. Meeting only if breach of objective occurs.	Objectives met in 2013 and 2014.
3	Text alert system.	Real-time notification of exceedances.	Falkirk Council	Implemented.	Maintenance of system. Considering upgrade of comms to GPRS.	Completed and ongoing. Grangemouth AURN sends e-mails.	n/a
4	Monitoring network.	Review monitoring network.	Falkirk Council	Grangemouth Moray SO_2 in SAQN. Monitoring conducted in Polmont and Grangemouth Zetland Park.	Falkirk Park St ceased operation April 2014. Zetland Park to commence April 2015. Observing development of SO2 'sensors'.	Ongoing	See comments in this and Section 2.

Falkirk Town Centre (NO_2 hourly and annual) AQMA

The draft Falkirk Town Centre and Haggs air quality Action Plan was submitted in August 2014 to the Scottish Government and SEPA. The final copy of the Action Plan has now been submitted and accepted.

Table 8.2 provides a general update on the air quality Action Plan measures which further detail on some of the measures described in this section.

Measure 3: Falkirk Council has produced an Eco driving leaflet which is available to view on Falkirk Council's website: http://www.falkirk.gov.uk/services/roads-parking-transport/transport/docs/car-pooling/Guide%20to%20Eco-Driving.pdf?v=201406020913
This includes a paragraph relating to diesel vehicles and air quality:
"Diesel cars emit less CO2 than their petrol equivalents, but produce more 'air quality' emissions, such as nitrogen oxides (NOx) and particulates, which towns and cities and affect our health. If you considering buying a diesel car, choose one with a diesel particulate filter to reduce particulate matter emissions".

Measure 5: The possibility of including ECO Stars in the assessment of tendered bus service contracts has been discussed with the Public Transport Co-ordinator. In addition, it is likely that operators will be invited to provide bids in relation to the provision of newer buses. However, the use of new vehicles will need to be balanced against the additional cost incurred (mostly due to reduction in fixed capital). The tendered network is currently under a review and new contracts will be considered during 2016.

Measure 6: The improvements to the three set of traffic lights along the Main Street, Bainsford and Grahams Road route into Falkirk have been completed and one of lights is shown in Figure 8.1

Figure 8.1 Picture of traffic lights at the Main St, Bainsford and Bankside junction.

Measure 14: In June 2015 Falkirk Council adopted its Local Development Plan which includes a policy on Air Quality. RW07 states:

"The Council will seek to contribute to the improvement of air quality. Impacts on air quality will be taken into account in assessing development proposals, particularly within Air Quality Management Areas (AQMAs). An Air Quality Assessment may be required for developments that are within AQMAs or where the proposed development may cause or significantly contribute towards a breach of National Air Quality Standards. Development proposals that result in either a breach of National Air Quality Standards or a significant increase in concentrations within an existing AQMA will not be permitted unless there are over-riding issues of national or local importance."

Measure 15: Falkirk Council continues to monitor NO_x and PM_{10} in its AQMAs. As described in Section 2 the Falkirk West Bridge St NO_x analyser and enclosure were replaced in January 2015. The Hope St site continues to monitor NO_x, the Grahams Road site PM_{10} and the Haggs site measures NO_x and PM_{10}.

Measure 16: In February 2013 the Falkirk ECO Stars scheme was launched at the Falkirk Stadium (www.falkirk.gov.uk/ecostars). ECO Stars is an environmental fleet management recognition scheme for vans, lorries, buses and coaches. The scheme assesses individual vehicles and overall fleet operations to recognise levels of environmental performance. It provides advice and guidance on how to improve fuel efficiency and reduce operating costs. It also aims to raise awareness among operators of commercial vehicles of the important role they can play in helping to improve local air quality (particularly in the Council's Air Quality Management Areas) and other environmental issues by enhancing their fleet performance. The scheme is voluntary and free to join and open to operators of buses, coaches, vans and trucks. In the UK the ECO Stars scheme also operates in six other Scottish local authority

areas and in South Yorkshire, Thurrock, Nottinghamshire, Mid-Devon and York. The Falkirk scheme has 71 members who operate 3,743 vehicles that are either based in or operate through the Falkirk Council area.

In November 2014 an extension of the ECO Stars scheme to permit taxis and private hire cars was approved. The recruitment of members is underway and a launch event expected in late 2015.

Measure 18: In May 2013 Falkirk Council agreed to the following Licensing changes to taxis and private hire car requirements: “that the current policy on the age of vehicles is changed to reduce the age at which a vehicle can first enter the fleet from 6 years to 3 years but that this is done progressively by a reduction of 1 year each year starting on 1 April 2014 and that the current policy requiring that each new operator licence is in respect of a wheelchair accessible vehicle be modified to the requirement being for a wheelchair accessible vehicle or for a hybrid or electric vehicle;”

“that a training requirement is introduced in regard to drivers standards for new taxi and private hire drivers only (with the option for the Civic Licensing Committee to attach the condition in other cases where it considers it necessary) and that officers are instructed to bring proposals on the content of the training requirement following discussion with training providers to a future Committee;”.

This has been followed by the extension of the ECO Stars scheme to permit taxis and private hire vehicles to become members of the scheme. These two actions therefore achieve a balance between legislative requirements and voluntary actions by operators to reduce their emissions.

Measure 19: Falkirk Council is part of a vehicle emissions partnership that aims to educate drivers' with the aim of reducing harmful vehicle emissions.

Smoke and fumes that come from vehicle exhausts are harmful to health. To report 'smoky' or idling vehicles contact the hotline number 01845 451888 or text 'idle' to 60777, and leave the following details:

- Location
- Registration number
- Owner details (if known)
- Date and time
- And for idling, how long the vehicle remained stationary with its engine running.

The aim of vehicle emission testing is to emphasise the importance of well-maintained, clean and efficient vehicles which are cheaper to run, and will emit less pollution.

As well as carrying out the tests, the testing team can give practical advice on how to improve vehicle efficiency and reduce harmful emissions while saving on running costs. Anyone can come along and get their vehicles checked free of charge.

The dates for the 2015 vehicle testing season at Central Retail Park, Falkirk are:

- March 24, 25, 26, 27, 28, 29
- April 21, 22, 23, 24
- May 19, 20, 21, 22
- June 16, 17, 18, 19
- July 28, 29, 30, 31
- August 01, 02, 25, 26, 27, 28
- September 22, 23, 24, 25
- October 20, 21, 22, 23.

Table 8.2 Update on Falkirk and Haggs Action Plan Measures

Measure Number	Description	Focus	Lead Authority	Progress	Completion date	Comments
1	Council vehicles, advance date of older vehicles	Vans	Falkirk Council	20% fleet will be replaced in 2014/15 and 2015/16.	Ongoing	Overall small number vehicles but large mileage in council area.
2	Electric vehicles and plug-ins	Cars	Falkirk Council	Charging points at council depots and points beginning to be installed in public places.	Ongoing	
3	Eco-advanced driver training	All types of vehicle, fuel use and emissions	Falkirk Council	Offered to Council services by fleet.	Ongoing	
4	Support local fuel stations to provide alternative / green fuels chargers etc	All types of vehicle and emissions	Falkirk Council	None	Unknown	Unknown
5	Review of school bus contracts with view to raising EURO standards	Buses	Falkirk Council	Discussions with Public Transport Co-ordinator about summer procurement of services.	Ongoing	Buses only. Newer vehicles will require greater funding.
6	Improvements of traffic lights at Bankside	Congestion	Falkirk Council	Completed	2014	
7	Feasibility study of Haggs infrastructure changes	Congestion	Falkirk Council	Dependent on developer contributions and planning applications.	Dependent on developer contributions and planning applications.	Unknown
8	Feasibility study of West Bridge St and Town Centre traffic managemenr changes (speed limits, TROs etc)	Congestion	Falkirk Council	Dependent on planning applications.	2017	
9	Take the Right Route	Car travel	Falkirk Council	Scheme rolled out in Larbert and Stenhousemuir.	Ongoing	
10	Council service based work travel plan	Mode transfer	Falkirk Council			
11	Introduce quality bus corridors	Buses	Falkirk Council	Future action.	n/a	Unknown
12	Bike hire scheme	Mode transfer	Falkirk Council	None	None	Unknown

Measure Number	Description	Focus	Lead Authority	Progress	Completion date	Comments
13	Soft measures e.g. travel planning (larger employers, schools), journey sharing, changes to mileage, home and mobile working.	Variety	Falkirk Council	Tied in with Take the Right Route.	Tied in with Take the Right Route.	Ongoing
14	Consideration of air quality in local development plan.	Development	Falkirk Council	Draft policy statement in plan.	Local Plan under assessment.	2015
15	Appropriate air quality monitoring in AQMAs.	n/a	Falkirk Council	Monitoring maintained in AQMAs.	Ongoing	Increasingly subject to financial pressures.
16	Promotion of ECO Stars	Commercial vehicles, taxis and private hire cars.	Falkirk Council	Commercial vehicles scheme launched February 2013, extension to taxis and private hire cars commenced November 2014. Member workshop held in February 2015.	Ongoing	A voluntary scheme.
17	Review of park and ride facilties	Cars	Sestran	None	Unknown	
18	Taxi licensing	Taxis	Falkirk Council	Changes to licensing in May 2013 and Ecostars extended to taxis and private hire cars.	Ongoing	
19	Vehicle emissions partnership (testing and idling) - enforcement and fines rather than raising awareness.	Cars	Falkirk and other neighbouring authorities.	Falkirk central retail park testing schedule set for 2015.	Ongoing subject to annual funding allocation.	In partnership with the three Lothian authorities.
20	Introduction of car clubs.	Cars	Developers	None	Unknown	

Haggs (NO_2 annual) AQMA

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

In December 2013 PM_{10} (TEOM) monitoring commenced at the Haggs (A4) monitoring site. In the Scottish Government's low emission draft emissions strategy published in January 2015 it was stated that there will be a review of the particulate matter objectives. This will include PM_{10} and $PM_{2.5}$. The proposal is to consider the adoption of the World Health Organisation standards with changes for PM_{10} to 20 µg/m^3 and for $PM_{2.5}$ to 10 µg/m^3. In 2014 the PM_{10} monitoring results at the Haggs site monitoring met the current objective of 18 µg/m^3.

These two developments since the 2014 Progress Report have led Falkirk Council to conclude that the Haggs AQMA does not require amending to include PM_{10}. The existing monitoring will continue at the Haggs site. However, an adaption to $PM_{2.5}$ is under consideration if the LAQM process is revised.

Banknock (PM_{10} 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 February 2015 the TEOM at the Falkirk Banknock / Banknock 2 monitoring site was replaced with a FIDAS 200 unit. This will enable PM_{10} monitoring to continue into the future and has enabled the co-measurement of $PM_{2.5}$. The latter is primarily focused on future source identification rather than objective compliance. The Banknock 3 (Osiris) unit continues to operate at a background location which is 230 m from the A803 road.

The Banknock AQMA will remain in place at this time because the Tomfyne quarry has been given planning permission although it is subject to s75 and legal agreements before operations can commence. The revocation of the AQMA will be considered if the objectives continue to be met after the quarry is operating.

Local Transport Strategy

Falkirk Council has published its 2014 and onwards Local Transport Strategy. The key elements that relate to air quality are:

"Since the last LTS in 2006, there have been significant transport achievements in the Falkirk Council area. Just over £25 million has been spent on transport capital projects during this period that has enabled, among other things:

- Implemented A904 Grangemouth Road Crossing Facilities
- Implemented upgrading of Bo'ness Town Centre to benefit pedestrian environment
- Implemented Braes paths improvements resulting from community consultation
- Implemented Bo'ness / Blackness paths improvements from community consultation (excluding Blackness- Bo'ness shore route)
- Developed local networks suitable for walking around every settlement in the Falkirk Council area

• Bowtrees Roundabout to Bowtrees Cottage Cycle/ Footpath
• Provide Cycle Parking facilities at shopping centres, health and leisure centres
• First stage pilot project under auspices of Take the Right Route
• Improved multi user route access to Camelon and Larbert railway stations
• Produced Supplementary Planning Guidance for Developers to develop Travel Plans
• Operational car sharing database for Falkirk Council area
• Complete School Travel Assessments at all 56 Schools in Falkirk Council Area
• Install cycle parking and playground markings at 7 schools
• 20 mph signing installed at all schools
• Continuing development of the cycle network within and between settlements;
• Production and adoption of a Core Paths Plan;
• Ongoing work with local schools and employers to implement travel plan initiatives;
• Extension of Larbert Station car park
• Ongoing support of tendered bus services;
• Producing the detailed design of A801 Avon Gorge Improvement scheme;
• Ongoing maintenance of the Council's road, footway, bridges and structures stock;
• Production of a Road Maintenance Plan;
• Ongoing detailed structural inspection of the street lighting stock;
• Completion of the A9 / Icehouse Brae Junction Improvement, Laurieston;
• Construction of Phase 1 of the Denny Eastern Access Road, and;
• Construction of the M876 Glenbervie Slip Roads junctions.

The two air quality policies in the Local Transport Strategy are:
"AQ1 The Council will continue to monitor and analyse air quality data throughout the Council area in compliance with the requirements of the Environment Act 1995 and subsequent regulations.

AQ2 The Council will work with partner agencies, to implement transport initiatives to assist in improving air quality and to work towards achieving the air quality objectives through the measures that will (in due course) be outlined in the air quality Action Plans."

Carbon Management Plan

According to a report to the Falkirk Council Executive on the 24th February 2015:

"The Carbon Management Plan underwent an internal audit in 2013/14. Based on recommendations from the audit, the terms of reference of the Corporate Sustainability Group and the Carbon Management Group were revised, in order to improve reporting and clarify roles in terms of governance, leadership and management. All recommendations were subsequently implemented.

In April 2013 a new dedicated Climate Change Team was established. The team facilitates and reports to the Corporate Sustainability Group on wider climate change and sustainability issues and reports to the Carbon Management Group on carbon reduction issues. In 2013 the Climate Change Team started working with Services' Departmental Management Teams to help them understand and take responsibility for managing their CO2 emissions.

Reducing the Council's Own Greenhouse Gas Emissions:
As a public body, Falkirk Council has a duty to contribute to the national target of cutting Scotland's carbon dioxide emissions by 42% by 2020. Falkirk Council's strategy for reducing its carbon dioxide emissions (CO2) is set out in the Carbon Management Plan 2011-2015. The strategy uses a baseline year of 2005/06 with a target of reducing CO2 emissions by 20% by 2015.

2005/06 Baseline CO_2 tonnes	2010 /11	2011 /12	2012 /13	2013 /14	% change 05/06- 13/14
40,915	*44,596*	*43,824*	*47,734*	*46,177*	*+13%*

The table above shows that the Council's emissions continue to rise. Total CO2 emissions from Falkirk Council have increased by approximately 13% over the last 8 years. This is despite a continued programme of efficiencies in terms of building energy, fleet and staff travel reduction. The quality of data relating to building energy increased greatly from 2010/11, however, the three year period since then also shows continued growth. The reasons behind the growth since 2005/06 are largely building energy related and are a combination of:

• Improved accuracy and robustness of data (some meters had not been included and this led to under-recording of energy use.)
• Replacement of secondary schools by higher energy consuming community hubs with swimming pools.
• Continued gradual extension of the Council's built estate
• Continued gradual increase of energy use in office buildings
• Advanced age and structural condition of buildings e.g. leisure centres
• Increased computer and electronic equipment usage

The continued increase in CO2 emissions comes despite many of the planned and additional carbon reduction actions being successfully delivered. This report focuses on the period 2013/14 and actions delivered within that period alone include:
• LED lighting project at Callendar House
• Leisure centre efficiency programmes on lighting, pool insulation and pump efficiencies
• Fitting of tracking units to Council owned fleet and mechanical equipment
• Household food collection programmes, which target particularly potent greenhouse gases
(Full details can be found in sections 2.6 and 2.7 of the appended report).
2.6 Proposed actions on CO2 reduction are many and varied, including:
• Approving and implementing a heating management approach
• Rationalising the property portfolio
• Optimising use of the built estate
• Use of fleet computer technology to optimise route planning and fleet use
• Drive forward and support a programme of energy efficiency projects

A considerable effort is being put into the Council's property portfolio. The new HQ building will be more efficient than most current buildings and will allow for the disposal of less suitable stock. Other initiatives such as a new heating management approach will assist with this. There will also be a targeted investment in the remaining buildings.

Reducing Emissions From the Local Authority Area:
By signing Scotland's Climate Change Declaration, Falkirk Council agreed to work with others in our local community to address climate change issues across the wider Council area. Estimates of carbon emissions for the Falkirk Council area (source Department for Energy and Climate Change), show that compared with other Scottish local authority areas, Falkirk Council's has one of the highest tonnages of CO2 per person. This reflects the concentration of industry at Grangemouth. This is countered by the contribution of many of the Council's policies and activities such as:
• Falkirk Local Development Plan - requirements for low and zero carbon buildings support of renewable energy technology where appropriate.
• Local Housing Strategy – substantial funds were secured in 2013/14 for home energy initiatives, helping to reduce household fuel bills, cut carbon emissions and create jobs.
• National Heat Networking Project – collated data relating to Falkirk Council estate to inform future projects aligning excess heat supply and demand for both business and domestic use.

Adapting to a Changing Climate:
As a public body, Falkirk Council has a duty to contribute to national programmes to help Scotland to adapt to the impacts of a changing climate. In the period 2013/14, the potential impact of severe weather events was incorporated into the Corporate Risk Register. Work also started on a Council-wide, risk based strategy to address this. The Emergency Planning Unit continued to support two Community Councils as they developed their own Community Emergency Plans. Civil contingencies and emergency preparedness procedures continued to be constantly revised and updated.

Working in Partnership:
In 2013/14, Falkirk Council continued to work in a wide variety of partnerships that contributed to climate change and sustainability efforts. This includes sharing resource efficiency best practice through the Community Planning Sustainability Group, protection of wildlife and landscape through biodiversity related partnerships as well as partnership working with housing associations to address fuel efficiency in homes. Contingency planning and emergency preparedness planning ensured that community planning partners and local businesses were engaged and had access to support."

9 Conclusions and Proposed Actions

9.1 Conclusions from New Monitoring Data

Falkirk Council has examined its automatic and non-automatic monitoring results. It is concluded that:

- No new Detailed Assessments of any pollutant is required. Automatic monitoring has commenced along Main St in Bainsford to support the outstanding Detailed Assessment in the area.
- The number of exceedances in the Grangemouth AQMA has reduced compared to before the commissioning of the Tail Gas Unit. However, in 2014 the number of exceedances of the 15-minute objective concentration recorded at the Grangemouth MC (A10) site could be considered to be close to the objective. The Grangemouth AQMA remains justified based upon the 2014 Grangemouth MC results. However, the strength of this justification has significantly weakened compared to when breaches of the objective were being recorded (between 2007 and 2012).
- The Falkirk Town Centre AQMA remains justified with a breach of the NO_2 objective along Falkirk West Bridge St. Although PM_{10} concentrations appear to be reducing at the Falkirk West Bridge St (A7) site.
- The Haggs AQMA remains under review and the monitoring has again met the NO_2 objectives and the PM_{10} objectives in 2014.
- The roadside and background monitoring in the Banknock AQMA is operating in the area. Any decision on the status of the AQMA will be made once the new Tomfyne quarry begins operation.

9.2 Conclusions from Assessment of Sources

Falkirk Council has conducted a review of potential sources of the seven pollutants. Emissions from other transport sources, industrial and other sources did not require further consideration. The review found no requirement for any new Detailed Assessments of any pollutant.

9.3 Proposed Actions

The 2015 U&SA report has found no requirement to conduct a Detailed Assessment of any pollutant at any location in the Falkirk Council area.

Falkirk Council will continue to assess and monitor SO_2 concentrations in the Grangemouth AQMA and NO_2 and PM_{10} in the Haggs AQMA. To ensure that SO_2 monitoring can continue the replacement of two analysers, likely to be at Bo'ness and Grangemouth Moray, shall be investigated.

The automatic monitoring NO_x and PM_{10} on Main St Bainsford commenced in June 2015 in relation to the Detailed Assessment along this street. The automatic and non-automatic results will be considered after one-year of monitoring as part of the Detailed Assessment.

A 2016 air quality report as required by the Scottish Government shall be submitted.

10 References

General:

Technical Guidance LAQM.TG(09), Defra and Devolved Administrations, February 2009 and subsequent web updates.
http://www.defra.gov.uk/environment/quality/air/air-quality/laqm/

Specific:

1. a. Openair via Scottish Air Quality Network, 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.
2. Personal communication, INEOS Community Air Monitoring Report Ambient Atmospheric Survey in the Vicinity of Grangemouth - 2014.
3. Department for Transport, Falkirk Council area Traffic Counts. http://www.dft.gov.uk/traffic-counts/area.php?region=Scotland&la=Falkirk
4. Falkirk Football Club, First Bus Launch, http://www.falkirkfc.co.uk/housty-parks-the-bus-with-first-bluebird/
5. Bus and Coach website: http://www.busandcoach.com/news/articles/euro-6-and-virtual-electrics-feature-in-first-s-777million-order/
6. Civil Aviation Authority, UK Airport Statistics http://www.caa.co.uk/default.aspx?catid=80&pagetype=88&pageid=3&sglid=3#Data
7. Scottish Railway Preservation Society, timetable for Bo'ness and Kinneil Railway, http://www.srps.org.uk/railway/timetable.htm
8. Personal communication, Forth Ports.
9. Scottish Air Quality Network: http://www.scottishairquality.co.uk/verification_and_ratification.php

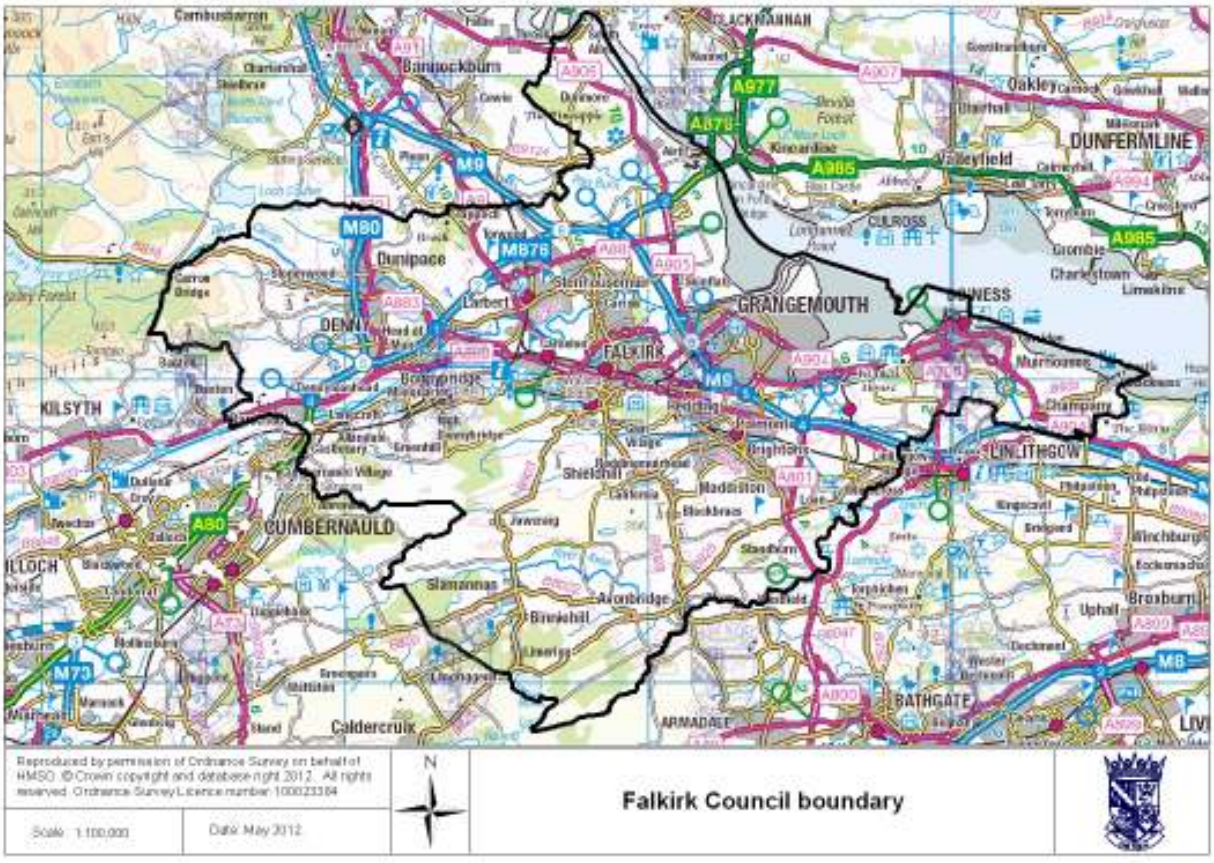
All websites were accessible in June 2015.

11 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

In 2014 the nitrogen dioxide, benzene and 1,3 butadiene tubes used by Falkirk Council were supplied and analysed by Environmental Scientifics Group in Didcot (formerly called Harwell Scientifics). The method used for the NO_2 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.

In 2014 Falkirk Council carried out three triplicate studies. This involves three NO_2 diffusion tubes being co-located with an automatic monitoring station. This enables the diffusion tube results to be bias adjusted. This is conducted to account for the difference between results from an automatic monitor and the diffusion tubes. The first study was located at the Grangemouth MC site (NA42 / A10), an urban background site. The second study at the Falkirk Park St site (NA70 / A6), a roadside site and finally a third study at Falkirk West Bridge St (NA111 / A7). However, the Falkirk Park St monitoring site, and therefore the

triplicate study, ceased in April 2014. The replacement roadside study commenced at Falkirk West Bridge St in July 2014.

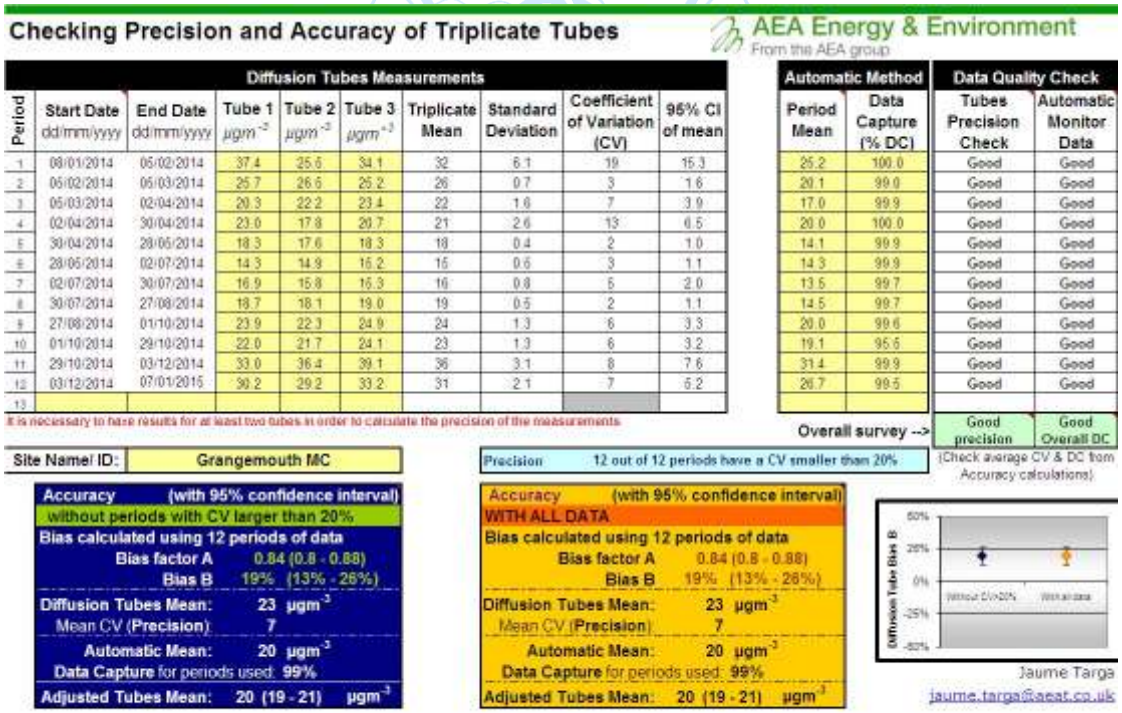
The results from the three sites were submitted to the R&A bias factor for ESG Didcot, however, Falkirk Park St and West Bridge St did not contribute to this factor because of the short monitoring periods. The bias sheet from Grangemouth MC and the R&A helpdesk summary are shown in Figures A2 and A3.

The local and R&A Helpdesk bias adjustment factors suggest that the diffusion tubes over-read NO_2 compared to the automatic monitors. Falkirk Council has applied the R&A helpdesk factor to the 2014 results because there are a mixture of roadside and background sites and no valid local roadside bias factor was available in 2014. The R&A bias factor for the ESG Didcot tubes in 2014 was 0.81. Note the data submitted to the R&A Helpdesk was provisional between July and December as the data is compiled prior to ratification. The ratification of the automatic monitoring data does not usually change the bias factor significantly.

Discussion of Choice of Factor to Use

The local and R&A Helpdesk bias adjustment factors suggest that the diffusion tubes over-read NO_2 compared to the automatic monitors. Falkirk Council has used the R&A helpdesk factor to adjust the 2014 results. This is because there was only a local background site available in 2014 with neither of the roadside studies in operation for more than nine months.

Figure A2 NO_2 bias adjustment factor at Grangemouth MC (A10) and the R&A bias sheet.



Checking Precision and Accuracy of Triplicate Tubes

AEA Energy & Environment
From the AEA group

Diffusion Tubes Measurements

Period	Start Date dd/mm/yyyy	End Date dd/mm/yyyy	Tube 1 µgm^{-3}	Tube 2 µgm^{-3}	Tube 3 µgm^{-3}	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean
1	08/01/2014	05/02/2014	37.4	25.6	34.1	32	6.1	19	15.3
2	05/02/2014	05/03/2014	25.7	26.6	26.2	26	0.7	3	1.6
3	05/03/2014	02/04/2014	20.3	22.2	23.4	22	1.6	7	3.9
4	02/04/2014	30/04/2014	23.0	17.8	20.7	21	2.6	13	6.5
5	30/04/2014	28/05/2014	18.3	17.6	18.3	18	0.4	2	1.0
6	28/05/2014	02/07/2014	14.3	14.9	16.2	15	0.6	3	1.1
7	02/07/2014	30/07/2014	16.9	15.8	16.3	16	0.8	5	2.0
8	30/07/2014	27/08/2014	18.7	18.1	19.0	19	0.5	2	1.1
9	27/08/2014	01/10/2014	23.9	22.3	24.9	24	1.3	6	3.3
10	01/10/2014	29/10/2014	22.0	21.7	24.1	23	1.3	6	3.2
11	29/10/2014	03/12/2014	33.0	36.4	39.1	36	3.1	8	7.6
12	03/12/2014	07/01/2015	30.2	29.2	33.2	31	2.1	7	5.2
13									

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

Automatic Method		Data Quality Check	
Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
25.2	100.0	Good	Good
20.1	99.0	Good	Good
17.0	99.9	Good	Good
20.0	100.0	Good	Good
14.1	99.9	Good	Good
14.3	99.9	Good	Good
13.5	99.7	Good	Good
14.5	99.7	Good	Good
20.0	99.6	Good	Good
19.1	95.5	Good	Good
31.4	99.9	Good	Good
26.7	99.5	Good	Good
Overall survey -->		Good precision	Good Overall DC

(Check average CV & DC from Accuracy calculations)

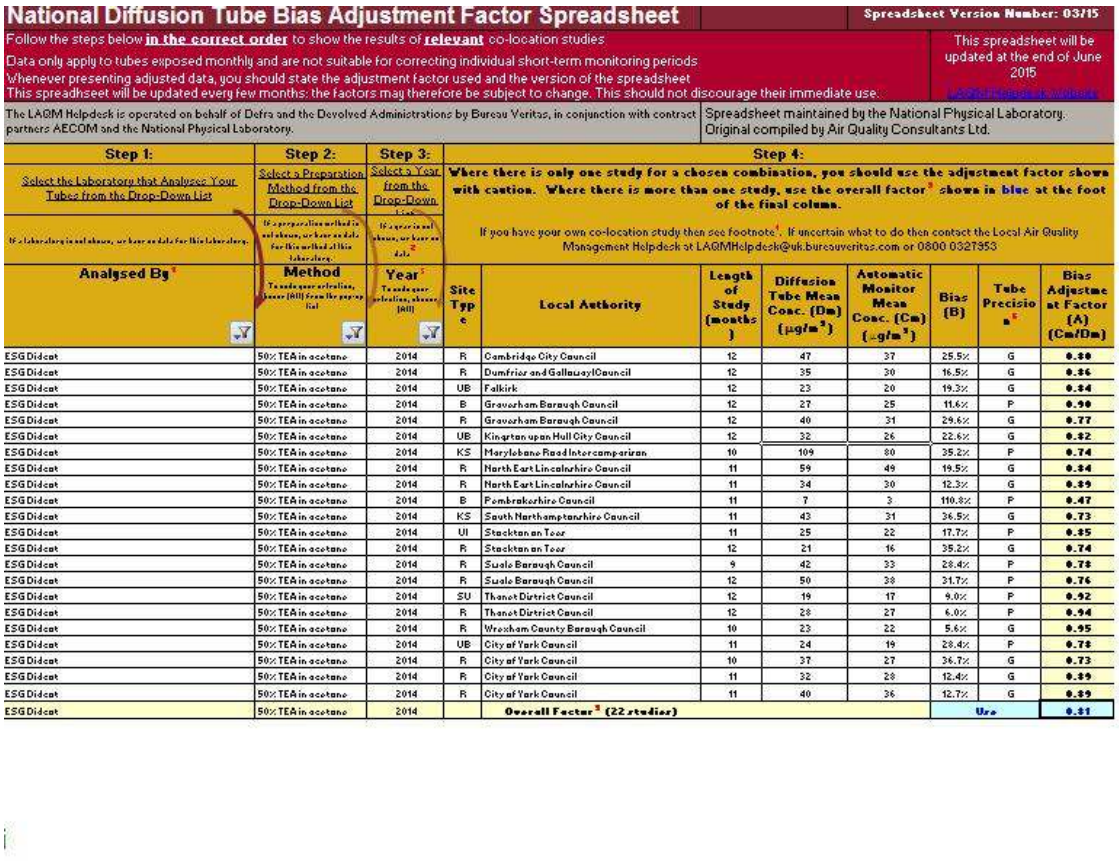
Site Name/ ID: Grangemouth MC

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

Accuracy (with 95% confidence interval) without periods with CV larger than 20%
Bias calculated using 12 periods of data
Bias factor A 0.84 (0.8 - 0.88)
Bias B 19% (13% - 26%)
Diffusion Tubes Mean: 23 µgm^{-3}
Mean CV (Precision): 7
Automatic Mean: 20 µgm^{-3}
Data Capture for periods used: 99%
Adjusted Tubes Mean: 20 (19 - 21) µgm^{-3}

Accuracy (with 95% confidence interval) WITH ALL DATA
Bias calculated using 12 periods of data
Bias factor A 0.84 (0.8 - 0.88)
Bias B 19% (13% - 26%)
Diffusion Tubes Mean: 23 µgm^{-3}
Mean CV (Precision): 7
Automatic Mean: 20 µgm^{-3}
Data Capture for periods used: 99%
Adjusted Tubes Mean: 20 (19 - 21) µgm^{-3}

Jaume Targa
jaume.targa@aeat.co.uk



National Diffusion Tube Bias Adjustment Factor Spreadsheet — Spreadsheet Version Number: 03/15

Follow the steps below **in the correct order** to show the results of **relevant** co-location studies

Data only apply to tubes exposed monthly and are not suitable for correcting individual short-term monitoring periods

Whenever presenting adjusted data, you should state the adjustment factor used and the version of the spreadsheet

This spreadsheet will be updated every few months: the factors may therefore be subject to change. This should not discourage their immediate use.

This spreadsheet will be updated at the end of June 2015

The LAQM Helpdesk is operated on behalf of Defra and the Devolved Administrations by Bureau Veritas, in conjunction with contract partners AECOM and the National Physical Laboratory.

Spreadsheet maintained by the National Physical Laboratory. Original compiled by Air Quality Consultants Ltd.

Step 1: Select the Laboratory that Analyses Your Tubes from the Drop-Down List

Step 2: Select a Preparation Method from the Drop-Down List

Step 3: Select a Year from the Drop-Down List

Step 4: Where there is only one study for a chosen combination, you should use the adjustment factor shown with caution. Where there is more than one study, use the overall factor[3] shown in blue at the foot of the final column.

If you have your own co-location study then see footnote[4]. If uncertain what to do then contact the Local Air Quality Management Helpdesk at LAQMHelpdesk@uk.bureauveritas.com or 0800 0327953

Analysed By[1]	Method	Year[2]	Site Type	Local Authority	Length of Study (months)	Diffusion Tube Mean Conc. (Dm) (µg/m³)	Automatic Monitor Mean Conc. (Cm) (µg/m³)	Bias (B)	Tube Precision[5]	Bias Adjustment Factor (A) (Cm/Dm)
ESG Didcot	50% TEA in acetone	2014	R	Cambridge City Council	12	47	37	25.5%	G	0.80
ESG Didcot	50% TEA in acetone	2014	R	Dumfries and Galloway Council	12	35	30	16.5%	G	0.86
ESG Didcot	50% TEA in acetone	2014	UB	Falkirk	12	23	20	19.3%	G	0.84
ESG Didcot	50% TEA in acetone	2014	B	Gravesham Borough Council	12	27	25	11.6%	P	0.90
ESG Didcot	50% TEA in acetone	2014	R	Gravesham Borough Council	12	40	31	29.6%	G	0.77
ESG Didcot	50% TEA in acetone	2014	UB	Kingston upon Hull City Council	12	32	26	22.6%	G	0.82
ESG Didcot	50% TEA in acetone	2014	KS	Marylebone Road Intercomparison	10	109	80	35.2%	P	0.74
ESG Didcot	50% TEA in acetone	2014	R	North East Lincolnshire Council	11	59	49	19.5%	G	0.84
ESG Didcot	50% TEA in acetone	2014	R	North East Lincolnshire Council	11	34	30	12.3%	G	0.89
ESG Didcot	50% TEA in acetone	2014	B	Pembrokeshire Council	11	7	3	110.8%	P	0.47
ESG Didcot	50% TEA in acetone	2014	KS	South Northamptonshire Council	11	43	31	36.5%	G	0.73
ESG Didcot	50% TEA in acetone	2014	UI	Stockton on Tees	11	25	22	17.7%	P	0.85
ESG Didcot	50% TEA in acetone	2014	R	Stockton on Tees	12	21	16	35.2%	G	0.74
ESG Didcot	50% TEA in acetone	2014	R	Swale Borough Council	9	42	33	28.4%	P	0.78
ESG Didcot	50% TEA in acetone	2014	R	Swale Borough Council	12	50	38	31.7%	P	0.76
ESG Didcot	50% TEA in acetone	2014	SU	Thanet District Council	12	19	17	9.0%	P	0.92
ESG Didcot	50% TEA in acetone	2014	R	Thanet District Council	12	28	27	6.0%	P	0.94
ESG Didcot	50% TEA in acetone	2014	R	Wrexham County Borough Council	10	23	22	5.6%	G	0.95
ESG Didcot	50% TEA in acetone	2014	UB	City of York Council	11	24	19	28.4%	P	0.78
ESG Didcot	50% TEA in acetone	2014	R	City of York Council	10	37	27	36.7%	G	0.73
ESG Didcot	50% TEA in acetone	2014	R	City of York Council	11	32	28	12.4%	G	0.89
ESG Didcot	50% TEA in acetone	2014	R	City of York Council	11	40	36	12.7%	G	0.89
ESG Didcot	50% TEA in acetone	2014		Overall Factor[3] (22 studies)				Use		0.81

Figure A3: Precision of ESG Didcot, 50% TEA/Acetone diffusion tubes in 2014.

2014	G
2014	G
2014	G
2014	G
2014	G
2014	G
2014	G
2014	G
2014	G
2014	G
2014	G
2014	G
2014	G
2014	P
2014	P
2014	P
2014	P
2014	P
2014	P
2014	P
2014	P
2014	P

PM_{10} Monitoring Adjustment

All TEOM data from 2008 onwards has been adjusted using the King's College London Volatile Correction Method (VCM). This was carried out by Ricardo-AEA for the sites affiliated to the Scottish Air Quality Network in 2014 as part of the Scottish Government's contract.

The PM_{10} monitor at the Grangemouth AURN site has been a FDMS since April 2009 and so no correction factor has been applied to this data. The VCM has been applied to the 2008 and 2009 TEOM data by King's College under contract to Defra.

The Banknock 3 Osiris data has been adjusted by a factor of 1.14. 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 3 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 substantially below 90%, details are shown in Table A1.

Table A1 Short-term to long-term adjustments.

A6: Falkirk Park St	Site Type	Annual Mean (2014), µg/m^3	Data capture 2014, %	Period Mean, µg/m^3	Ratio
Grangemouth AURN	Urban background.	16.3	95.3	17.1	0.95
Grangemouth Moray	Urban background.	15.4	92	16.0	0.96
				Average	0.96

NA70: Falkirk Park St	Site Type	Annual Mean (2014), µg/m^3	Data capture 2014, %	Period Mean, µg/m^3	Ratio
Grangemouth AURN	Urban background.	16.3	95.3	17.2	0.95
Grangemouth Moray	Urban background.	15.4	92	16.2	0.95
				Average	0.95

NA110: Banknock 2 AQ Station	Site Type	Annual Mean (2014), µg/m^3	Data capture 2014, %	Period Mean, µg/m^3	Ratio
Grangemouth AURN	Urban background.	16.3	95.3	16.0	1.02
Grangemouth Moray	Urban background.	15.4	92	15.0	1.03
				Average	1.02

NA111: Falkirk West Bridge St	Site Type	Annual Mean (2014), µg/m^3	Data capture 2014, %	Period Mean, µg/m^3	Ratio
Grangemouth AURN	Urban background.	16.3	95.3	16.5	0.99
Grangemouth Moray	Urban background.	15.4	92	15.8	0.97
				Average	0.98

NA112: Philip St Bainsford	Site Type	Annual Mean (2014), µg/m^3	Data capture 2014, %	Period Mean, µg/m^3	Ratio
Grangemouth AURN	Urban background.	16.3	95.3	22.6	0.72
Grangemouth Moray	Urban background.	15.4	92	22.0	0.70
				Average	0.71

QA/QC Automatic Monitoring

Table A2 Details of the QA/QC at the automatic monitoring stations in 2014.

QA / QC in 2014.		
Site	**Analyser**	**Network**
A3. Bo'ness	SO_2	Local *
A4. Falkirk Haggs	NO_x	SAQN
	PM10 (TEOM)	SAQN
A5. Falkirk Hope St	NO_x	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
	SO_2	SAQN
A10. Grangemouth Municipal Chambers	NO_x	SAQN
	PM_{10} (TEOM)	SAQN
	SO_2	SAQN
A12. Falkirk Grahams Rd	PM_{10} (TEOM)	Local *
A13. Banknock 2	PM_{10} (TEOM)	SAQN
A14. Banknock 3	PM_{10} (Osiris)	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 SO_2 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 standards.
- Analysers are covered by a contract for emergency callout and receive a service every six months.
- 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.
- As with the other sites all LSO site visits are carried out by Falkirk Council staff who are audited to AURN standards.
- The Osiris is serviced on an annual basis and covered by a service agreement for any breakdowns, both are completed off-site.
- A 1.14 correction factor has been applied to the Banknock 3 (Osiris) PM_{10} data.

AURN and Scottish AQ network sites:

- All NO_x and SO_2 analysers receive fortnightly zero and span checks and filter changes.
- 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 that are audited to AURN standard.
- Analysers are covered by a contract for emergency callout and receive a service every six months.
- QA/QC is to AURN / 'national' standards [Ref 9].
- Falkirk Council also checks the data on its systems and is in communication with Ricardo-AEA to ensure the best data quality. Unscaled data is supplied by Falkirk Council to Ricardo-AEA for the Scottish AQ Network sites on a six monthly basis to improve data capture.

The UKAS certificates of the analysers within the Scottish Air Quality Network (but excluding AURN) are shown in Figure A4.

Figure A4 Certificate of calibration of the Scottish Air Quality Network monitoring sites

RICARDO-AEA

CERTIFICATE OF CALIBRATION

18 Blythswood Square, Glasgow, G2 4AD
Telephone 01235 753642

0401

Approved Signatories: D. Hector S. Stratton

Signed:

Date of Issue: 1st April 2015

Certificate Number: 3119

Page 1 of 4

Customer Name and Address: Scottish Government
Water, Air, Soils and Flooding Division
Environmental Quality Directorate
Scottish Government
Victoria Quay
Edinburgh
EH6 6QQ

Description: Calibration factors for Falkirk City Council's Hope Street, Park Street, Grangemouth Municipal Chambers, Haggs, Banknock, Grangemouth Moray School, and West Bridge Street air monitoring stations.

Site / Date Test Carried Out	Species	Analyser Serial No.	Zero Response[1]	Uncertainties ppb	Calibration Factor[2]	Uncertainties %	Converter eff. (%)[3]
Hope Street 11th August 2014	NO_x	890704	0.5	2.5	1.0442	3.5	99.6
	NO	0214	0.6	2.5	1.0561	3.5	
	SO_2	890617056	0.4	2.5	1.0098	3.4	
Grangemouth Municipal Chambers 12th August 2014	NO_x	8906170204	1.1	2.5	1.0170	3.5	99.6
	NO		1.1	2.5	1.0368	3.5	
	SO_2	8904140505	1.4	2.6	1.1396	4.0	
Haggs 12th August 2014	NO_x	1401925	-0.2	2.5	1.0449	3.5	98.9
	NO		-0.3	2.5	1.0426	3.5	

Site / Date Test Carried Out	Species	Analyser Serial No.	Zero Response[1]	Uncertainties ppb	Calibration Factor[2]	Uncertainties %	Converter eff. (%)[3]
West Bridge Street 11th August 2014	NO_x	MI2820-M1094	0.1	2.6	1.1750	3.5	100.4
	NO		0.4	2.6	1.1796	3.5	
Grangemouth Moray School 4th August 2014	SO_2	103005	3.0	2.5	0.8985	3.1	

Site / Date Test Carried Out	Species	Analyser Serial No.	Parameter	Specified Value	Measured Value	Deviation %	Uncertainty %
Banknock 12th August 2014	TEOM PM_{10}	22763	Main Flow[4]	3.00	3.10	3.4	±2.2
			Aux Flow[4]	13.67			±2.2
			Total Flow	16.67	16.29	-2.3	±2.2
			k_0[5]	12650	12467	-1.4	±1.0
Haggs 12th August 2014	TEOM PM_{10}	23170	Main Flow[4]	3.00	3.04	1.4	±2.2
			Aux Flow[4]	13.67			±2.2
			Total Flow	16.67	16.31	-2.2	±2.2
			k_0[5]	13865	14082	1.6	±1.0
Grangemouth Municipal Chambers 12th August 2014	TEOM PM_{10}	22697	Main Flow[4]	3.00	3.00	0.1	±2.2
			Aux Flow[4]	13.67			±2.2
			Total Flow	16.67	16.14	-3.2	±2.2
			k_0[5]	13841	13694	-1.1	±1.0
West Bridge Street 11th August 2014	TEOM PM_{10}	27493	Main Flow[4]	3.00	3.08	2.6	±2.2
			Aux Flow[4]	13.67			±2.2
			Total Flow	16.67	16.41	-1.6	±2.2
			k_0[5]	13101	13321	1.7	±1.0

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ilac-MRA UKAS CALIBRATION

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CERTIFICATE OF CALIBRATION

18 Blythswood Square, Glasgow, G2 4AD
Telephone 01235 753642

Approved Signatories: D. Hector S. Stratton

Signed:

Date of Issue: 1st April 2015

Certificate Number: 3120

Customer Name and Address:

Scottish Government
Water, Air, Soils and Flooding Division
Environmental Quality Directorate
Scottish Government
Victoria Quay
Edinburgh
EH6 6QQ

Description: Calibration factors for Falkirk City Council's Hope Street, Park Street, Grangemouth Municipal Chambers, Haggs, Banknock, Grangemouth Moray School, and West Bridge Street air monitoring stations.

Site / Date Test Carried Out	Species	Analyser Serial No.	Zero Response[1]	Uncertainties ppb	Calibration Factor[2]	Uncertainties %	Converter eff. (%)[3]
Hope Street 20th February 2015	NO_x	890704	3.7	2.5	0.9927	3.5	99.5
	NO	0214	1.5	2.5	0.9949	3.5	
	SO_2	890617056	0.9	2.5	0.9148	3.3	
Grangemouth Municipal Chambers 20th February 2015	NO_x	8906170204	0.2	2.6	1.0894	3.5	99.1
	NO		0.3	2.5	1.0662	3.5	
	SO_2	8904140505	1.0	2.5	0.9238	3.2	
Haggs 18th February 2015	NO_x	1401925	0.0	2.7	1.0326	3.5	98.2
	NO		-1.0	2.5	1.0219	3.5	

Site / Date Test Carried Out	Species	Analyser Serial No.	Zero Response [1]	Uncertainties ppb	Calibration Factor[2]	Uncertainties %	Converter eff. (%)[3]
West Bridge Street 31st March 2015	NO_x	MI2820-M1094	4.6	2.5	1.0027	3.5	100.0
	NO		5.4	2.5	1.0030	3.5	
Grangemouth Moray School 26th January 2015	SO_2	103005	2.5	2.5	0.8993	3.2	

Site / Date Test Carried Out	Species	Analyser Serial No.	Parameter	Specified Value	Measured Value	Deviation %	Uncertainty %
Haggs 18th February 2015	TEOM PM_{10}	23170	Main Flow[4]	3.00	2.99	-0.5	±2.2
			Aux Flow[4]	13.67			±2.2
			Total Flow	16.67	16.10	-3.4	±2.2
			k_0[5]	13865	13967	0.7	±1.0
Grangemouth Municipal Chambers 20th February 2015	TEOM PM_{10}	22697	Main Flow[4]	3.00	3.05	1.6	±2.2
			Aux Flow[4]	13.67			±2.2
			Total Flow	16.67	16.35	-1.9	±2.2
			k_0[5]	13941	13795	-0.3	±1.0
West Bridge Street 31st March 2015	TEOM PM_{10}	27493	Main Flow[4]	3.00	2.92	-2.5	±2.2
			Aux Flow[4]	13.67			±2.2
			Total Flow	16.67	16.55	-0.7	±2.2
			k_0[5]	13101	12724	-2.9	±1.0

The gaseous ambient analysers listed above have been tested for zero response, calibration factor, linearity and converter efficiency (NO_x analysers only) by documented methods. The factors have been calculated using certified gas standards. The particulate analysers listed above have been tested for sample flow rates and k_0 (where appropriate) by documented methods. Note that the test results are valid on the day of test only, as analyser drift over time cannot be quantified. All results for gaseous species are given in ppb (parts per billion) mole fractions or ppm (parts per million) mole fractions.

[1]The zero response is the zero reading on the data logging system of the analyser when audit zero gas was introduced to the analysers under test.

[2]The calibration factor is the multiplying factor required to scale the reading on the data logging system of the analyser into reported concentration units (ppb for NO, NO_x, SO_2, O_3 and ppm for CO. Where 1 ppm = 1000 ppb). It should be used in conjunction with the zero response. A corrected concentration is calculated using the following equation:

Concentration = F (Output - Zero Response)

Where F = Calibration Factor provided on this certificate
Output = Reading on the data logging system of the analyser
Zero Response = Zero Response provided on this certificate

[3]Converter eff. is the measured efficiency of the NO_2 to NO converter within the oxides of nitrogen analyser under test.

[4]The measured main flow rate (where applicable) is the flow rate through the sensor unit of the TEOM particulate analyser under test. The measured aux flow rate (where applicable) is the flow rate through the bypass tubing of the TEOM particulate analyser under test. The measured total flow rate is the total flow rate through the particulate analyser under test. Units of flow are l.min-1. Where flow rates are highlighted in bold, it indicates that measurements were not made at the analyser sample inlet. These measurements therefore may not accurately reflect analyser performance in normal operation.

[5]The calculated k0 value (TEOM analysers only) is the calculated k0 spring constant based on tests undertaken with filters of known weight. The % deviation indicates the closeness of the calculated result to the manufacturer's specified k0 value.

The calibration results shaded are those that fall within our scope of accreditation, all other results on this certificate are not UKAS accredited, but have been included for completeness.

QA/QC Diffusion Tube Monitoring

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 NO_2 Monitoring: Practical Guidance.' ESG recorded 'good' precision throughout the first half of 2014 but poor in the second half.

The full pumped benzene diffusion tube results are shown in Table A3.

The full set of monthly diffusion tube results are shown in Table A4.

Tube results are checked on a monthly basis and reviewed at the end of the year. Results under 4 $\mu g/m^3$ are generally 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.

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

Grangemouth AURN				
Start Date	End Date	Benzene	Units	Status
23/12/2013	14/01/2014	0.78	µg/m^3	Verified
14/01/2014	21/01/2014	2	µg/m^3	Verified
21/01/2014	03/02/2014	1.75	µg/m^3	Verified
03/02/2014	17/02/2014	1.63	µg/m^3	Verified
17/02/2014	04/03/2014	1.18	µg/m^3	Verified
04/03/2014	18/03/2014	0.8	µg/m^3	Verified
18/03/2014	01/04/2014	1.28	µg/m^3	Verified
01/04/2014	15/04/2014	1.38	µg/m^3	Verified
15/04/2014	29/04/2014	0.6	µg/m^3	Verified
29/04/2014	13/05/2014	0.36	µg/m^3	Verified
13/05/2014	27/05/2014	0.91	µg/m^3	Verified
27/05/2014	10/06/2014	1.48	µg/m^3	Verified
10/06/2014	24/06/2014	0.55	µg/m^3	Verified
24/06/2014	08/07/2014	0.8	µg/m^3	Verified
08/07/2014	23/07/2014	0.82	µg/m^3	Verified
23/07/2014	05/08/2014	0.83	µg/m^3	Verified
05/08/2014	19/08/2014	0.7	µg/m^3	Verified
19/08/2014	02/09/2014	0.5	µg/m^3	Verified
02/09/2014	16/09/2014	1.21	µg/m^3	Verified
16/09/2014	30/09/2014	0.55	µg/m^3	Verified
30/09/2014	14/10/2014	0.77	µg/m^3	Preliminary Verified
14/10/2014	28/10/2014	0.54	µg/m^3	Preliminary Verified
28/10/2014	11/11/2014	0.97	µg/m^3	Preliminary Verified
11/11/2014	25/11/2014	1.53	µg/m^3	Preliminary Verified
25/11/2014	10/12/2014	1.42	µg/m^3	Preliminary Verified
10/12/2014	23/12/2014	0.42	µg/m^3	Preliminary Verified
23/12/2014	06/01/2015	0.98	µg/m^3	Preliminary Verified

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

a.)

Benzene results 2014

Site number	Location	Grid Reference x	Grid Reference y	January ppb	February ppb	March ppb	April ppb	May ppb	June ppb	July ppb	August ppb	September ppb	October ppb	November ppb	December ppb	Annual average ppb	Annual average ug/m^3	Annual data capture,
3	Tinto Drive,Grangemouth	293427	680386	0.88	0.36	0.41	*0.58*	0.37	0.15	0.17	0.22	0.34	0.31	0.5	0.5	0.40	1.30	100.0
21	Grangemouth Road, College	290112	680500	0.35	0.32	0.35	*0.36*	0.3	-	0.17	-	0.38	0.39	-	0.5	0.35	1.13	75.0
27	West Bridge Street, Falkirk	288470	680040	-	0.47	0.52	*3.7*	0.45	0.16	0.25	0.28	0.29	0.63	-	0.6	0.74	2.39	83.3
37	Denny Town House	281227	682725	0.32	-	0.26	*0.81*	0.27	0.15	0.23	0.17	0.26	0.33	0.6	0.3	0.34	1.09	91.7
38	Larbert Village Primary School	285930	682318	0.37	0.27	0.54	*0.41*	0.25	0.15	0.17	0.17	0.26	0.34	0.5	0.4	0.32	1.04	100.0
41	Seaview Place, Bo'ness	299720	681600	0.6	1.2	0.47	*0.63*	0.58	0.15	-	-	0.39	0.44	1	0.6	0.61	1.97	83.3
42	Municipal Chambers, Grangemouth	292800	682000	0.4	-	0.32	-	0.32	-	0.18	0.19	0.32	0.42	0.8	0.5	0.38	1.25	75.0
44	Greenpark Drive, Polmont	293550	678860	0.33	0.27	0.31	*1.3*	0.26	0.15	0.17	-	-	0.32	0.6	0.4	0.41	1.34	83.3
55	Inchyra Station	293833	681014	0.42	0.38	0.51	*0.56*	-	0.2	0.21	-	0.57	0.31	0.5	0.4	0.41	1.32	83.3
57	Inchyra Road, Grangemouth	294028	680829	0.7	0.46	0.8	*0.84*	1.2	0.26	-	0.27	-	0.39	0.7	0.4	0.60	1.96	83.3
77	Kinnaird Village	286490	683775	0.54	0.27	0.27	*0.42*	0.32	0.15	-	0.17	0.44	0.25	0.3	0.4	0.32	1.04	91.7
80	Cow Wynd	288765	679456	0.42	0.41	0.38	*0.55*	0.34	-	0.21	0.17	0.5	0.42	0.6	0.5	0.41	1.33	91.7
81	Grahams Road, Falkirk	288834	680898	0.54	0.46	0.38	*0.49*	0.43	0.19	0.17	0.17	0.51	0.29	0.6	0.4	0.39	1.25	100.0
94	A905 (Glensburgh Rd), Grangemouth	291213	681927	0.4	0.33	0.33	*0.49*	0.44	0.15	0.24	0.17	0.32	0.3	0.6	0.4	0.35	1.13	100.0
102	East Kerse Mains, Bo'ness	297968	680684	0.28	0.31	0.32	*0.47*	0.28	0.15	0.17	1.1	0.26	0.24	0.7	-	0.39	1.26	91.7
105	West of Shieldhill	288284	676881	0.23	0.21	0.25	*0.33*	0.18	0.15	0.17	-	0.35	0.24	0.2	0.2	0.23	0.74	91.7

b.)

1,3 butadiene results 2014

Site No	Address	Grid Ref x	Grid Ref y	January ppb	February ppb	March ppb	April ppb	May ppb	June ppb	July ppb	August ppb	September ppb	October ppb	November ppb	December ppb	Annual Average ppb	Annual Average µg/m^3	Annual data
41	Seaview Place, Bo'ness	299720	681600	0.6	0.6	0.6	0.08	0.07	0.07	0.05	0.07	0.06	0.02	0.02	0.02	0.19	0.42	100.0
55	Inchyra Station, Grangemouth	293833	681014	0.6	0.6	0.6	-	0.13	0.13	0.06	0.03	0.07	0.02	0.07	0.03	0.21	0.48	91.7
104	Powdrake Road, Grangemouth	293788	682054	0.6	0.6	0.6	0.12	0.02	0.02	0.08	-	0.06	0.05	0.13	0.02	0.21	0.47	91.7

c.)

Site No	Address	Grid ref, x	Grid ref, y	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
3	Tinto Drive, Grangemouth	293427	680386	30.1	28.8	24.6	18.6	14.5	15.7	24.3	18.7	21.1	26.1	30.6	30.9
5	Copper Top Pub, Camelon	287332	680333	41.6	35.9	34	45.2	25.3	15.7	24.8	28.2	32.2	34.6	53	32.4
7	Irving Parish Church, Camelon	287324	680442	37.8	21.8	21.7	19.9	15.6	13.5	13.6	15.1	22.6	18	33.1	28.9
9	Bellsdyke Road, Larbert	286048	683542	39	42.2	41	28	26.5	22	28.3	35	37.8	37.2	51.7	44.1
19	Kilsyth Road, Banknock	278779	679301	49.3	43.5	45	-	42.2	39.3	-	-	41.9	39.1	53.1	-
20	Garngrew Road, Haggs	278957	679169	41.2	-	25.6	25.2	24	-	21.6	23.9	28.8	29.8	-	26.8
21	Grangemouth Road, College	290112	680500	40.6	35.6	34.9	33.7	28	-	23.6	27.1	38.3	35.1	42.6	40.3
24	Kerse Lane, Falkirk	289189	680018	47.8	53.4	49.1	47.4	43.1	39.9	15.7	50.4	56.2	40.2	57.9	50.7
26	Weir Street, Falkirk	289207	680123	36.6	27	15.9	22.7	18.3	11.9	16.2	17.2	19.8	23.8	33.2	26.2
27	West Bridge Street, Falkirk	288490	680055	73.6	58	57.6	62.8	54.7	48	29.7	56	68.1	43.2	66.8	41.8
29	Wellside Place, Falkirk	288465	680220	27.1	23.1	23.6	23.1	14.9	15.4	17.3	16	23.8	15.9	36.5	21.8
36	Kerr Crescent, Haggs	278985	679273	49.6	50.8	49.7	53.8	40	36.5	43.1	44.2	48	40.1	58.2	54.9
37	Denny Town House	281226	682526	42.5	23.9	23.8	21.7	17.4	15.1	15.6	17.2	23.8	20.8	40.2	28.2
38	Larbert Village Primary School	285930	682318	34.2	22.6	21.1	20.8	14.4	13.3	13.2	16.1	22.6	22.1	33.6	26.7
41	Seaview Place, Bo'ness	299722	681594	37.4	27.1	26.4	22.6	20.3	19.1	18.6	19.2	25.5	24.3	38.8	29.7
42	Municipal Chambers, Grangemouth	292817	682000	37.4	25.7	20.3	23	18.3	14.3	16.9	18.7	23.9	22	33	30.2
42				25.5	26.5	22.2	17.8	17.6	14.9	15.8	18.1	22.3	21.7	36.4	29.2
42				34.1	25.2	23.4	20.7	18.3	15.2	15.3	19	24.9	24.1	39.1	33.2
44	Greenpark Drive, Polmont	293436	678938	32.3	20.8	19.3	18.3	12.3	10.3	8.7	-	19.7	19.2	28.5	24.5
48	Hayfield, Falkirk	289200	681580	37.4	26.7	26.4	25.7	16.4	16.8	17.5	16.7	22.2	24.2	41.1	24.6
50	Upper Newmarket Street	288671	680047	31.8	31.2	31	41	27.7	32.2	26.5	31.2	39.7	30.4	42.2	28.3
51	Mary Street, Laurieston	290965	679490	35.7	32.4	28	28.8	29.6	25	27.6	27.9	33	27.5	39.3	30
52	Main Street, Larbert	285866	682356	44.7	27.8	25.5	23.3	20.9	17.1	19	20.1	25.3	26.1	37.6	29.7
53	Denny Cross	281211	682727	59.1	34	40.4	42	34.9	29.7	29.6	29.2	34.5	35.4	57.7	33.6
57	Inchyra Road, Grangemouth	294028	680829	37.5	35.6	32.2	25.7	22.4	18.6	50.6	21.6	30.3	33	45.1	31.6
58	Callendar Road, Falkirk	289667	679724	42.4	25.7	25.8	25.1	20.9	17.7	15.6	19	24	25.6	38.9	27.4
59	Carron Road, Bainsford	288392	681931	39.6	36.9	32.1	30.9	22.4	23.4	22.3	28.6	35.3	27.1	50	41.2
60	Ronades Road, Carron	288133	681587	40.6	39	34.3	31.4	25.8	19.8	24.4	24.8	34.7	37.5	53.2	28.4
61	Canal Rd, Falkirk	287976	680656	44.7	35.9	30.6	31.1	24	24	21.1	25.7	32.3	32.1	39.2	-
62	Arnot Street, Falkirk	289125	679705	56.7	53.6	50.9	42.2	40.9	36.3	37.7	36.4	48	46	63.8	46
63	Camelon Road, Falkirk	288055	680134	58.7	50.4	47.4	43.7	38.3	26.6	33.4	38.8	46.5	43.1	59.3	54.1
64	New Hallglen Road, Hallglen	288807	678422	36.7	22	25.6	18.8	21.1	13.9	16.4	19	25.5	21.5	32.6	19.6
65	Redding Road, Redding	291356	678644	34.9	22.4	20.5	14.3	13.4	13.8	11.3	14.3	21.5	-	43	35.5
67	Queen Street, Falkirk	289430	680433	46.5	36.7	40.3	34.5	27.3	22.4	23.9	29.9	29.5	30	49.4	39.2
68	Belluvue Street Falkirk	289234	679945	49.3	43.1	41.5	17.9	23.5	25.4	22	35.8	39.6	37.7	49.2	46.8
69	Kerse Lane, Falkirk	289025	679991	54.7	40.2	44.1	36.4	36.9	29.9	42.8	39.2	47.3	41.9	58.7	39.6
70	Park Street AQ station, Falkirk	288892	680070	44.3	36.5	36.7	32.3	-	-	-	-	-	-	-	-
70				46.2	35.3	37.4	34.1	-	-	-	-	-	-	-	-
70				43.9	33.8	33.9	33	-	-	-	-	-	-	-	-
71	Park Street, Falkirk	288910	680112	44.6	47.1	43.3	39.8	27.7	36.7	32.8	-	38.4	39.4	55.6	38
72	Vicar Street, Falkirk	288824	680120	53.4	40.6	39.7	56.2	33.3	25.5	25.9	28.8	39.5	36.4	56.5	43.4
73	West Bridge Street, RHS,Falkirk	288467	680048	57.9	48.1	48.4	42.9	35.6	33.2	32	33.3	42.3	39.7	-	39
76	Tryst Road, Stenhousemuir	286851	683229	48.4	35.4	25.2	24.7	19.6	15	18.6	21.4	26.6	26.2	38.8	39.3
77	Kinnaird Village	286490	683775	42.4	32.3	-	26.1	20.6	14.9	20.4	22.1	25.6	27.8	39.5	31.3
78	Glen Brae, Falkirk	288525	678991	49.1	39.2	37.8	39.7	34.1	24.2	27.6	29.8	38.9	38.5	48.8	43.9
80	Cow Wynd, Falkirk	288765	679456	51.3	-	-	-	30.1	28.3	31.9	34.6	41	31.5	45.3	36.3
81	Grahams Road, Falkirk	288834	680898	54.2	38.1	33.8	33.8	28	27.7	-	24.4	37.8	30.4	54.3	34.2
82	Castings Ave, Falkirk	288858	681036	38.8	27.7	22.2	15.9	15	9	15.4	14.8	23.9	21.8	37	29.5
83	Main Street, Bainsford	288614	681415	52.3	53.3	38.4	45.2	30.7	22.1	34.2	31.7	46.8	46.7	56.4	51.1
85	Auchincloch Drive, Banknock	278752	679049	44.8	26.9	24.2	30.2	25.8	15.7	12.8	18.2	25	22.5	40.1	27.6
86	Wolfe Rd, Falkirk	289667	679871	28.1	18.1	21.8	19.3	14.7	10	12.6	12.7	18.5	18.8	33.3	21.4
87	M80 slip south, Haggs	279017	679305	40.4	47.8	35.6	37.5	33.2	30.3	35.5	35.8	40	37.7	51.9	44.3
88	Ure Crescent, Bonnybridge	282444	681074	45.7	36.6	31.2	29.3	28.2	23.9	26.6	34.7	37.7	33.5	47.5	47.4
89	Grahams Rd/Meeks Rd, Falkirk	288853	680328	41.6	40.3	-	-	35.7	29	31.1	35	39	37.1	45	30.7
94	A905 (Glensburgh Rd), Grangemouth	291213	681927	53.8	34.4	38.2	36.5	30.7	26	30.5	38.4	42.5	41.6	46.8	-
98	Arnothill, Falkirk	288095	680105	-	-	28.1	30.5	-	23	22.6	21.9	27.6	25.6	36.3	-
99	St Crispins Place, Falkirk	288924	679675	41.4	26.5	26.2	33.6	28	24	26.6	28.8	35.4	25.3	41.2	33.5
100	Oswald St, Falkirk	288977	679662	31.2	19.3	25.6	22.1	22.9	21	18.7	21.3	27	-	25.4	30.6
101	Glensburgh Road, Grangemouth (2)	291127	682007	46.2	30.7	29.2	25.3	22.3	-	20.9	22.8	28.4	27.7	45.8	29
103	Merchiston Gardens	288270	680989	35.6	22.5	21.1	18.4	16.1	9.3	15.7	16.9	21.9	-	-	-
105	West of Shieldhill	288292	676889	17.5	10.1	11.2	8.2	7.6	7	7.5	7.2	11	9.2	18.5	11.6
107	Main Street (east), Bainsford	288640	681396	52.9	38.2	38.6	35.2	30	29.6	26.9	30.3	39	30.3	50.2	37.8
108	Main Street, Camelon	286834	680512	37.5	26.4	27.1	26.3	25.9	24.5	21.4	26.6	31.3	25	45.7	21.9
109	Carmuirs Street, Camelon	286786	680488	35.9	20.2	22.3	20.8	15.7	-	14	17.9	20	23	32.6	21.1
110	Banknock 2 AQ station	277247	679027	-	-	-	21.1	19.5	16.2	18.9	17.9	23.4	18.9	31.8	32.2
111	Falkirk West Bridge St AQ station	288457	680064	-	-	-	-	-	-	38.4	39.9	31	41.6	61.1	43
111				-	-	-	-	-	-	37.1	-	49.2	38.2	58.1	-
111				-	-	-	-	-	-	33.9	36.8	-	31.8	48.8	-
112	Philip Street, Bainsford	288505	681443	-	-	-	-	-	-	-	-	-	-	38.9	17.9

Appendix B: DMRB Calculations

Table A5 Background concentrations used in DMRB runs.

Link	2014 background concentration, µg/m^3		
	NO_x	NO_2	PM_{10}
A803 Glenfuir road to Rosebank roundabout	20.4	15.5	13.57
A803 Bridge St to the Bypass Road Dennyloanhead	23.8	17.2	13.66
B9132 Abbots Road (Newhouse Road to Bo'ness Rd)	22.8	15.5	12.83

Table A6 Other input data to the DMRB runs.

Link	%HGV	Mean speed, kph	Distance (closest) receptor to centre link, m	AADT
A803 Glenfuir road to Rosebank roundabout	5%	40	6.3	22,117
A803 Bridge St to the Bypass Road Dennyloanhead	5%	40	4.0	9,457
B9132 Abbots Road (Newhouse Road to Bo'ness Rd)	5%	40	8.0	8,996

Verification

Table A7 Verification for DMRB runs.

Verification	Background NO_2	Monitored NO_2	Modelled NO_2	NO_2 difference, %
NA77 Kinnaird Village	12.6	28	15.9	-43.1

The DMRB modelled component of PM_{10} was adjusted by the NO_x ratio from a verified site. DMRB runs took account of the NO_x to NO_2 conversion method (April 2009).