Annual Progress Report (APR)

Falkirk Council

2017 Air Quality Annual Progress Report (APR) for
Falkirk Council

In fulfilment of Part IV of the
Environment Act 1995

Local Air Quality Management

June 2017

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Report Reference number	Annual Progress Report 2017
Date	June 2017

Executive Summary: Air Quality in Our Area

Air Quality in Falkirk Council

Air quality monitoring results confirm that the NO_2 National Air Quality Standard (NAQS) Objectives were met at all seven NO_2 monitoring sites in Falkirk Council's automatic network. The Falkirk West Bridge St monitoring station recorded the highest annual mean NO_2 concentration at 37µg/m^3, but levels stayed within the objectives for the second consecutive year.

Two diffusion tubes recorded a concentration greater than the annual NO_2 objective of 40µg/m^3 in 2016 with the application of the R&A bias factor. These were diffusion tubes NA27 and NA111, both located on West Bridge St.

West Bridge St is located within the Falkirk Town Centre AQMA which was declared in 2011 in recognition of the potential to exceed NAQS objectives for NO_2 and PM_{10}. The Falkirk Town Centre Air Quality Management Action Plan was approved in June 2015 and focuses on long term actions to reduce air pollution in the area rather than short term fixes. Key measures outlined in the plan are:

- Reducing emissions from individual vehicles
- Promoting EcoStars
- Promoting alternative modes of transport
- Educate and inform the public on air quality issues

Falkirk Council has made significant progress in implementing these measures. For example there are now 12 electric vehicle charging locations through the Falkirk area with more planned in the upcoming year, an action which is helping to promote alternative modes of travel within Falkirk Council's area.

The Council are also promoting an active travel hub in the Falkirk town centre with the Forth Environmental Link looking at introducing a bike hire scheme similar to that in Stirling and Glasgow with an expected implementation date by December 2018. Full details of the progress Falkirk Council are making towards the measures outlined in its Air Quality Action Plans can be seen in Section 2.2 of this report.

Apart from the two diffusion tubes located on West Bridge St, no other diffusion tubes breached the annual NO_2 objective. Long term NO_2 monitoring data also indicates a

downward trend in NO_2 concentrations within the Falkirk area at both background and roadside sites.

The six automatic sulphur dioxide (SO_2) monitors within the Falkirk network met all three (15-minute, hourly and daily) NAQS objectives during 2016. The 2016 results continue the objective compliance recorded in 2013, 2014 and 2015. Long term SO_2 trend analysis at the Grangemouth AURN site shows a decline in SO_2 concentrations since the commissioning of the tail gas treatment (TGT) unit at INEOS Grangemouth in 2013.

The benzene and 1, 3-butadiene diffusion tube monitoring conducted in 2016 met the NAQS objectives. The $PM_{2.5}$ monitors at the Grangemouth AURN and Banknock 2 sites recorded $PM_{2.5}$ concentrations within the 10 µg/m^3 annual objective. Long term $PM_{2.5}$ monitoring at the Grangemouth AURN shows a gradual reduction in concentrations between 2011 and 2016. In addition the PM_{10} air quality objectives were met at all eight monitoring sites in 2016.

As no exceedances of National Air Quality Objectives occurred outside existing AQMAs, no new Detailed Assessment of any pollutant is required.

Actions to Improve Air Quality

Falkirk Council made a number of improvements to its air quality monitoring network during 2016. Improvements include upgrading three of the SO_2 analysers within the Grangemouth Air Quality Management Area (AQMA) and installing a FIDAS 200 particulate analyser at the West Bridge St monitoring station.

The installation of a FIDAS 200 at West Bridge St has added $PM_{2.5}$ monitoring capabilities to the Falkirk Town Centre AQMA. This action supports the development of a national $PM_{2.5}$ network, which is a priority for both local authorities and the Scottish government following the publication of the Cleaner Air for Scotland (CAFS) document. Falkirk council now monitor $PM_{2.5}$ at three locations across its area.

In addition to the above, all eleven automatic monitoring stations are now affiliated to the Scottish Air Quality Network (SAQN), following the affiliation of Main St Bainsford, Falkirk Grahams Rd and Bo'ness stations to the network in 2016. This action will improve data quality and enable members of the public to access air quality data for each of Falkirk Council's automatic sites. Members of the public will be able to see if

air pollution within the Falkirk area is low or high and make decisions regarding their health and travel plans based on this information.

In other news, the membership of our Falkirk Eco Stars scheme has surpassed 100 members, helping to improve air quality through the promotion of fuel efficient driving. In addition we are also working closely with fellow members of the East Central Scotland Vehicle Emissions Partnership, looking to align our vehicle emissions monitoring with the priorities and objectives set out in the Scottish Government's CAFS document.

Falkirk Council also continues to work closely with its partner organisations to manage local air quality. The council works closely with SEPA, INEOS and Petroineos to reduce exceedances of the SO_2 objectives within the Grangemouth AQMA.

Local Priorities and Challenges

- Education and awareness of air quality issues:

In 2017, Falkirk Council will be looking to develop our engagement with schools, through promoting air quality education resources such as the 'Learn about Air' teaching package.

- Modelling of road source emissions:

A priority for Falkirk Council will be to commission a modelling study of road source emissions in Falkirk Council's area. The scale of the project is dependent on costs and there are two options being considered. The first would be to commission a regional model of road source emissions. This will include high resolution (8m) modelling in the AQMAs and urban centres. The second option would be to scale the project down and focus on Falkirk town centre only.

Regional modelling is preferred as it will help to review and refine Falkirk Council's air quality monitoring network, ensuring all hotspots are adequately monitored and help us make decisions regarding all of our current AQMAs rather than focussing on one. This type of proactive work is a key in the delivery of the objectives outlined in the CAFS document.

The information gained through either of these options will also help inform an updated action plan for the Falkirk Town Centre AQMA.

- Replacement of obsolete AP series NO_x and SO_2 analysers:

Falkirk Hope Street has been prioritised for both a replacement NO_X and SO_2 analyser. This is because the Hope St site is both within an NO_2 AQMA and also monitors SO_2 in the Falkirk town centre. Both the current SO_2 and NO_X analysers at this site are Horiba AP models and are therefore considered obsolete.

The reason this priority is lower down than road source modelling is because the analysers marked for replacement although considered to be obsolete, are still performing well. In addition, through LAQM funding over the past 2 years, Falkirk Council has been able to replace three SO_2 analysers in the Grangemouth AQMA, which were the main priorities. Although other analysers will need to be upgraded, it is a longer term objective.

How to Get Involved

To obtain further information on air quality within the Falkirk Council area, please visit our air policy webpage at http://www.falkirk.gov.uk/services/environment/environmental-policy/air-quality/.

There are twelve automatic air quality monitoring sites across the Falkirk area. The data from all of the sites can be viewed on the Scottish Air Quality website at http://www.scottishairquality.co.uk/.

To learn more about the EcoStars Scheme fleet recognition scheme and for details of how to join if you are a commercial fleet operator please visit http://www.ecostars-uk.com/eco-stars-schemes/.

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1. Local Air Quality Management

This report provides an overview of air quality in Falkirk's Council area during 2016. It fulfils the requirements of Local Air Quality Management (LAQM) as set out in Part IV of the Environment Act (1995) 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 an exceedance is considered likely the local authority must declare an Air Quality Management Area (AQMA) and prepare an Air Quality Action Plan (AQAP) setting out the measures it intends to put in place in pursuit of the objectives. This Annual Progress Report (APR) is summarises the work being undertaken by Falkirk Council to improve air quality and any progress that has been made.

Table 1. 1 – Summary of Air Quality Objectives in Scotland

Pollutant	Air Quality Objective		Date to be achieved by
	Concentration	Measured as	
Nitrogen dioxide (NO_2)	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
Particulate Matter (PM_{10})	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
Particulate Matter ($PM_{2.5}$)	10 µg/m^3	Annual mean	31.12.2020
Sulphur dioxide (SO_2)	350 µg/m^3, not to be exceeded more than 24 times a year	1-hour mean	31.12.2004
	125 µg/m^3, not to be exceeded more than 3 times a year	24-hour mean	31.12.2004
	266 µg/m^3, not to be exceeded more than 35 times a year	15-minute mean	31.12.2005
Benzene	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	0.25 µg/m^3	Annual Mean	31.12.2008

2. Actions to Improve Air Quality

2.1 Air Quality Management Areas

Air Quality Management Areas (AQMAs) are declared when there is an exceedance or likely exceedance of an air quality objective. After declaration, the authority must prepare an Air Quality Action Plan (AQAP) within 12 months, setting out measures it intends to put in place in pursuit of the objectives.

A summary of AQMAs declared by Falkirk Council can be found in **Error! Reference source not found.**. Further information related to declared or revoked AQMAs, including maps of AQMA boundaries are available online at- http://www.scottishairquality.co.uk/laqm/aqma?id=371 full list at http://uk-air.defra.gov.uk/aqma/list>.

Falkirk Council has completed a Detailed Assessment of NO_2 and particulate (PM_{10}, $PM_{2.5}$) concentrations along Main St, Bainsford. The need for a Detailed Assessment was identified in Falkirk Council's 2014 Annual Progress Report when an exceedance of the annual mean NO_2 objective was recorded by diffusion tube monitoring on Main St, Bainsford.

The Detailed Assessment concluded that the air quality objectives were being met along Main St, Bainsford. Considering this the Council will not be declaring an Air Quality Management Area, but automatic and non-automatic monitoring will continue to ensure compliance in future years. The Main St, Bainsford Detailed Assessment can be viewed in Appendix D of this report.

Table 2. 1– Declared Air Quality Management Areas

AQMA Name	Pollutants and Air Quality Objectives	City / Town	Description	Action Plan
Falkirk Town Centre	NO_2 annual mean PM_{10} 24-hour mean and annual mean	Falkirk	An area encompassing part of Falkirk Town Centre.	Air Quality Action Management Plan (Falkirk Town Centre and Haggs) http://www.falkirk.gov.uk/services/environment/environmental-policy/air-quality/docs/air-quality/Falkirk%20and%20Haggs%20Air%20Quality%20Action%20Plan.pdf?v=201507291154
Banknock	PM_{10} 24-hour mean	Banknock	The designated area includes an area of Banknock.	Air Quality Action Management Plan (Banknock) Available on request
Haggs	NO_2 annual mean	Haggs	An area encompassing parts of Banknock and Haggs around the junction of the A803 and M80	Air Quality Action Management Plan (Falkirk Town Centre and Haggs) http://www.falkirk.gov.uk/services/environment/environmental-policy/air-quality/docs/air-quality/Falkirk%20and%20Haggs%20Air%20Quality%20Action%20Plan.pdf?v=201507291154
Grangemouth	SO_2 15 minute mean	Grangemouth	An area encompassing Grangemouth petrochemical complex and adjacent areas.	Air Quality Action Management Plan (Grangemouth) Available on request

2.2 Progress and Impact of Measures to address Air Quality in Falkirk Council's Area

Falkirk Council has taken forward a number of measures during the current reporting year of 2016 in pursuit of improving local air quality. Details of all measures completed, in progress or planned are set out in Table 2.2. More detail on these measures can be found in the air quality Action Plan relating to each AQMA. Key completed measures are:

Measure 1:

Falkirk Council sends meteorological data and provisional SO_2 data to SEPA, INEOS and Petroineos when an SO_2 exceedance is recorded at a monitoring station within the Grangemouth AQMA. 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 4:

With the addition of the Bo'ness, Falkirk Graham's Rd and Main St, Bainsford stations in 2016; all 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 the six SO_2 analysers that are used for monitoring in relation to the Grangemouth AQMA.

Measure 5

Electric vehicle (EV) charging points at council depots and points installed in public places. See table below for charging points installed by Falkirk Council:

Table 2. 2– List of EV charging points in Falkirk Council's area

Location	Type	Number of Bays	Available to Public
Municipal Buildings West Bridge Street Falkirk FK1 5RS	7kW	2	No
Abbotsford House David's Loan Falkirk FK2 7YZ	7kW	2	No
Dalgrain Depot McCafferty Way Grangemouth FK3 8EB	7kW 50kW	2 1	No
Inchyra Depot Inchyra Road Grangemouth FK3 9XB	7kW	1	No
Larbert Railway Station Foundry Loan (East) Larbert FK5 4PJ	22kW	2	Yes
Grahamston Railway Station Meeks Road Falkirk FK2 7EZ	50kW	2	Yes
Town House Street Denny FK6 5DX	22kW	2	Yes
Union Road Car Park Grangemouth FK3 8AB	22kW	2	Yes
Falkirk Stadium 4 Stadium Way Falkirk FK2 9EE	2 x 22kW 1 x 50kW	4 2	Yes

There are also chargers at Falkirk Community Hospital, Forth Valley College and Klondyke Garden Centre, although Falkirk Council has not been involved in the installation of these. The location of all charging infrastructure in the Falkirk Council area can be found at: http://www.chargeyourcar.org.uk/.

Falkirk Council also has plans for future EV infrastructure:

- Falkirk High Station (Drossie Road car park): one 22kW charger with 2 charging bays awaiting installation & commissioning.

- Falkirk High Station (Slamannan Road car park): one 7kW charger with 2 bays will be installed as part of construction of a new car park.
- Falkirk Stadium: Falkirk Council have submitted a Low Carbon Travel & Transport bid for European Regional Development Funding. If successful, the Council plan to construct 20 electric vehicle charging bays (a mix of 22kW and 50kW) under a photovoltaic canopy.

Measure 16

The Falkirk ECO Stars schemes were maintained throughout 2016. In addition ECO Stars is likely to be included in the tender specification for the Adult and Children's Services passenger transport service in 2017.

Measure 19

The vehicle emissions partnership, of which Falkirk Council is a member, organised a pilot study of remote sensing technologies to monitor vehicle emissions under 'real world' driving conditions. The pilot took place in March and April 2017. Falkirk Council is to be part of the Data Analysis Group to help decide how the information collected during the pilot can be utilised by local authorities.

Measure 20

The Council has updated the traffic signals on the B902 Grahams Road corridor to "intelligent" traffic signals which better manage the flows of traffic increasing green time along the main corridor; the knock on effect of this improves bus journey times into the town centre

Table 2. 3– Progress on Measures to Improve Air Quality

Measure No.	Measure	Category	Focus	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date
1	Improving SO_2 data access	Public Information	Supplying SO_2 monitoring data to SEPA, Petroineos and INEOS	Falkirk Council	2013	2013	AQ Objectives met in 2013, 2014 and 2015.	Anticipated reduction in SO_2 concentration/ breaches of NAQS objectives.	Data sent after exceedances, monthly summary sent.	Completed and on-going.
2	Grangemouth Working group	Policy guidance and development control	Bring together, Petroineos, INEOS, S.Gov, SEPA and Falkirk Council.	Falkirk Council	2013	2013	AQ Objectives met in 2013, 2014 and 2015.	Reduction in SO_2 due to cooperative working and agreement of priorities.	Completed. TGU full commissioned in August 2013, meeting held in November 2013. Further meeting only if breach of objective occurs.	Completed.

Measure No.	Measure	Category	Focus	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date
3	Text alert system	Public Information	Real-time notification of exceedances	Falkirk Council	2013	2013	Text alerts received by Falkirk Council, SEPA, Petroineos and INEOS when an exceedance occurs in Grangemouth AQMA	Anticipated reduction in SO_2 objective exceedances due to real time alerts of NAQS objective concentration exceedances supplied to SEPA, Petroineos and INEOS so action to rectify any plant emission issues can be taken.	Completed and on-going. Grangemouth AURN sends text alerts if a breach of SO_2 objective concentration occurs.	Completed.
4	Review monitoring network	Public Information	Grangemouth Moray SO_2 in Scottish Air Quality Network (SAQN). Monitoring conducted in Grangemouth Zetland Park.	Falkirk Council	Falkirk Park St ceased operation April 2014. Zetland Park commenced operation April 2015.	2014 and 2015	All Grangemouth automatic monitoring sites are affiliated with the SAQN.	Affiliation with the SAQN increases data capture allowing better comparison to the NAQS objectives.	Completed. In addition the Bo'ness, Falkirk Graham's Rd and Main St, Bainsford stations were affiliated to the SAQN in 2016.	Completed.

Measure No.	Measure	Category	Focus	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date
5	Electric vehicles and plug-ins	Promoting low emission transport	Cars	Falkirk Council	2012	2012 and on-going	Charging points at council depots	Anticipated reduction in NO_X and PM emissions due to increased use of electric vehicles.	12 Electric vehicle charging points located at council depots and public places across the Falkirk Council area. Falkirk Council also purchased an additional 4 electric vehicles for its fleet in 2016 making a total of 8 electric pool cars and 2 electric pool vans available for use by Council staff.	Completed and on-going
6	Eco-advanced driver training	Promoting low emission transport	All types of vehicle, fuel use and emissions	Falkirk Council	2014	2015	Offered to Council services by fleet	Anticipated reduction in NO_X and PM emissions due to promotion of efficient driving practices.	Offered to Council services by fleet.	Completed and on-going training offered.

Measure No.	Measure	Category	Focus	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date
7	Review of school bus contracts with view to raising EURO standards	Vehicle fleet efficiency	Buses	Falkirk Council	2017	2020	n/a	Anticipated reduction in NO_X and PM emissions from busses.	Meeting arranged with Public Transport Co-ordinator and procurement services to discuss the feasibility of raising the EURO standards for local and school bus contracts from 2020.	2020
8	Improvements of traffic lights at Bankside	Transport planning and infrastructure	Congestion	Falkirk Council	2013	2014	n/a	Anticipated reduction in NO_X and PM emissions due to traffic queue reduction at Bankside traffic lights.	Completed.	Completed.
9	Feasibility study of Haggs infrastructure changes	Transport planning and infrastructure	Congestion	Falkirk Council	Dependent on developer contributions and planning applications.	Dependent on developer contributions and planning applications.	n/a.	Anticipated reduction in NO_X and PM emissions.	Dependent on developer contributions and planning applications.	Dependent on developer contributions and planning applications. Future action.

Measure No.	Measure	Category	Focus	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date
10	Feasibility study of West Bridge St and Town Centre traffic management changes (speed limits, TROs etc)	Transport planning and infrastructure	Congestion	Falkirk Council	n/a	n/a	n/a	Anticipated reduction in NO_X and PM emissions.	This measure was linked to a planning application to build new council offices at Falkirk Town Centre Municipal Buildings. However, this project is no longer going ahead thus the feasibility study has been dropped. However, traffic signals along West Bridge St have been altered to improve traffic flows.	Completed
11	Take the Right Route	Promote travel alternatives	Car travel	Falkirk Council	2009	2013 and ongoing	Scheme in place and publicly advertised on Falkirk Council website.	Anticipated reduction in NO_X and PM emissions due to an increase in green travel such as walking and cycling.	Scheme rolled out in Larbert, Stenhousemuir and Grangemouth. Work on going to include Graeme High School cluster area of Falkirk.	Completed and on-going.

Measure No.	Measure	Category	Focus	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date
12	Bike hire scheme	Promote travel alternatives	Mode transfer	Falkirk Council	2016	2018	Unknown	Anticipated reduction in NO_X and PM emissions due to an increase in green travel alternatives.	Abellio currently have a bike scheme in place at Falkirk High Station. The Council are promoting an active travel hub in Falkirk town centre with the Forth Environmental Link looking at introducing a bike hire scheme similar to that in Stirling and Glasgow with an expected implementation date by December 2018.	2018

Measure No.	Measure	Category	Focus	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date
13	Soft measures e.g. travel planning (larger employers, schools), journey sharing, changes to mileage, home and mobile working.	Promote travel alternatives	Variety	Falkirk Council	2006	2014	Development of Travel Plans	Anticipated reduction in NO_X and PM emissions due to promotion of travel alternatives.	Fuel efficient and electric pool car vehicles for staff use as part of Council's travel plan Operational car sharing database for Falkirk Council area	Completed and On-going
14	Consideration of air quality in local development plan.	Policy guidance and development control	Development	Falkirk Council	2015	2015	Air quality policy statement in local development plan	Air Quality Assessment required for developments within AQMAs.	Air quality policy statement in plan.	Completed
15	Appropriate air quality monitoring in AQMAs.	Public Information	Improving data capture.	Falkirk Council	2005	2005	Good data capture (90%) in AQMAs	Good data capture will allow strict comparison of PM_{10}, $PM_{2.5}$, SO_2, NO_X concentrations against the objectives.	Monitoring maintained in AQMAs.	Completed and on-going

Measure No.	Measure	Category	Focus	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date
16	Promotion of ECO Stars	Vehicle fleet efficiency	Commercial vehicles, taxis and private hire cars.	Falkirk Council	2013	2013 and on-going	The latest Falkirk Eco Stars report shows that recruitment in Falkirk is over target with 84 members operating 4060 vehicles	Anticipated reduction in NO_X and PM emissions due to promotion of efficient driving practices.	Commercial vehicles scheme launched February 2013, extension to taxis and private hire cars commenced November 2014. Member workshop held in February 2015. ECO Stars is likely to be included in the tender specification for the Adult and Childrens Services passenger transport service in 2017.	On-going

Measure No.	Measure	Category	Focus	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date
17	Review of park and ride facilities	Transport planning and infrastructure	Cars	Falkirk Council	2017	2018	Unknown at time of writing.	Anticipated reduction in NO_X and PM emissions.	There is currently no progress in taking forward any new bus park and ride facilities. However, additional parking is being provided at both Falkirk High Station and Larbert Station to help promote and deal with demand for park and ride at railway stations. Both station parking projects should be complete by April 2018.	Completed and on-going
18	Taxi licensing	Vehicle fleet efficiency	Taxis	Falkirk Council	2013	2015	Increase in taxi services signed up to Eco Stars Scheme.	Anticipated reduction in NO_X and PM emissions due to promotion of efficient driving and vehicles.	Changes to licensing in May 2013 and Eco Stars extended to taxis and private hire cars.	On-going

Measure No.	Measure	Category	Focus	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date
19	Vehicle emissions partnership (testing and idling) - enforcement and fines rather than raising awareness.	Promoting low emission transport	Cars	Falkirk and other neighbouring authorities.	2012	2012 and on-going	Maintain membership of the partnership.	Anticipated reduction in NO_X and PM emissions through anti-idling enforcement.	The vehicle emissions partnership have organised a pilot study of remote sensing technologies to monitor vehicle emissions under 'real world' driving conditions. The pilot is to take place at various locations during March and April 2017. Falkirk Council to be part of the Data Analysis Group to help decide how this information can be utilised by LA's.	On-going subject to annual funding allocation.

Measure No.	Measure	Category	Focus	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date
20	Introduce quality bus corridors	Transport planning and infrastructure	Buses	Falkirk Council	2017	On-going depending on funding to complete the scheme/	Unknown	Anticipated reduction in NO_X and PM emissions through improved public transport.	The Council has secured areas of land along the A803 Glasgow Road corridor in Camelon. In addition to this the Council has updated the traffic signals on the B902 Grahams Road corridor to "intelligent" traffic signals which better manage the flows of traffic increasing green time along the main corridor, the knock on effect of this improves bus journey times into the town centre.	2030

2.3 Cleaner Air for Scotland

Cleaner Air for Scotland – The Road to a Healthier Future (CAFS) is a national cross-government strategy that sets out how the Scottish Government and its partner organisations propose to reduce air pollution further to protect human health and fulfil Scotland's legal responsibilities as soon as possible. A series of actions across a range of policy areas are outlined, a summary of which is available at http://www.gov.scot/Publications/2015/11/5671/17. Progress by Falkirk Council against relevant actions within this strategy is demonstrated below.

2.3.1 Transport – Avoiding travel – T1

All local authorities should ensure that they have a corporate travel plan (perhaps within a carbon management plan) which is consistent with any local air quality action plan. Falkirk Council currently do not have a corporate travel plan, however, the guiding principles are incorporated in other programs such as Take the Right Route and our fleet strategy. We foresee that given the new targets set by Scottish Government on transport, that a formalised corporate travel plan will be implemented in the near future. The Environmental Health Team will be working with colleagues in Climate Change and Sustainability to ensure local air quality is given appropriate consideration.

2.3.2 Climate Change – Effective co-ordination of climate change and air quality policies to deliver co-benefits – CC2

Scottish Government expects any Scottish local authority which has or is currently developing a Sustainable Energy Action Plan to ensure that air quality considerations are covered. Falkirk Council has developed a Sustainable Development and Climate Change Strategy 2012-2017. The plan includes air quality considerations in the green travel actions which include

2.3.3 $PM_{2.5}$ monitoring network will be established - LP2

Using funds awarded to Falkirk Council through the Scottish Government's LAQM funding support scheme. Falkirk Council was able to commission a FIDAS 200 particulate analyser for the West Bridge St monitoring site. This action adds $PM_{2.5}$ monitoring capabilities to the Falkirk Town Centre AQMA and expands our local

$PM_{2.5}$ network to three locations. It also supports the Scottish Government's aim to establish a PM2.5 monitoring network in Scotland, which is an action under CAFS.

3. Air Quality Monitoring Data and Comparison with Air Quality Objectives

3.1 Summary of Monitoring Undertaken

3.1.1 Automatic Monitoring Sites

This section sets out what monitoring has taken place and how local concentrations of the main air pollutants compare with the objectives.

Falkirk Council undertook automatic (continuous) monitoring at twelve sites during 2016 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 A.1 in Appendix A shows the details of the sites. National monitoring results are available at http://www.scottishairquality.co.uk/

Maps showing the location of the monitoring sites are provided in Figure 12 in Appendix A. Further details on how the monitors are calibrated and how the data has been adjusted are included in Appendix C.

3.1.2 Non-Automatic Monitoring Sites

Falkirk Council undertook non- automatic (passive) monitoring of NO_2 at sixty one sites during 2016.

Falkirk Council also undertook non-automatic (passive) monitoring of 1, 3-butadiene at three locations during 2016.

In addition Falkirk Council undertook non-automatic (passive) monitoring of benzene at sixteen locations. Benzene was also monitored at the Grangemouth AURN site in 2015 by pumped diffusion tube.

Table A.2 in Appendix A shows the details of the non-automatic monitoring sites. Further details on Quality Assurance/Quality Control (QA/QC) and bias adjustment for the diffusion tubes are included in Appendix C.

3.2 Individual pollutants

The air quality monitoring results presented in this section are, where relevant, adjusted for annualisation and bias. Further details on adjustments are provided in Appendix C.

3.2.1 Nitrogen Dioxide (NO_2)

Error! Reference source not found. in Appendix A compares the ratified and adjusted monitored NO_2 annual mean concentrations for the past 5 years with the air quality objective of 40µg/m^3.

Error! Reference source not found. in Appendix A compares the ratified continuous monitored NO_2 hourly mean concentrations for the past 5 years with the air quality objective of 200µg/m^3, not to be exceeded more than 18 times per year.

For NO_2 diffusion tubes, the full 2016 dataset of monthly mean values is provided in Appendix B.

The 2016 monitoring results show that all seven automatic NO_2 analysers in Falkirk Council's automatic network met both NO_2 air quality objectives. The Falkirk West Bridge St monitoring station recorded the highest annual mean NO_2 concentration at 37µg/m^3, but levels stayed within the objectives for the second consecutive year. All the results are shown in Appendix A.

Two diffusion tubes recorded a concentration greater than the annual NO_2 objective of 40 µg/m^3 in 2016 with the application of the R&A bias factor. These were diffusion tubes NA27 and NA111, both located on West Bridge St within the Falkirk Town Centre AQMA.

Diffusion tube NA27 is close to and NA111 is colocated with the Falkirk West Bridge St automatic NO_2 reference method (chemiliminescent) analsyer. As mentioned above the automatic NO_2 analyser did not record an exceedance of the objective.

Historically, diffusion tube NA27 records a higher annual concentration than the automatic analyser despite the close proximity to one another. The most likely reason is because the automatic site is set further from the kerb than NA27 and is therefore less exposed to traffic emissions.

In addition, diffusion tubes are affected by several sources of interference which can cause substantial under or overestimation (often referred to as "bias") compared to the chemiluminescent analyser (defined within Europe as the reference method) [ref 1]. Due to this NO_2 concentrations monitored using diffusoin tubes is typically of lower acuracy than that monitored by chemiluminescent analsyers.

All other NO_2 diffusion tube sites recorded concentrations below the annual NO_2 objective in 2016 with the application of the R&A bias factor, however, the following diffusion tubes recorded a concentration close to the objective (36 to 40 µg/m^3) with the application of the R&A bias factor:

- NA62 Arnot Street, Falkirk: this site is in the Falkirk Town Centre AQMA.
- NA83 Main St, Bainsford: this site is not within an AQMA.

Figures 1 to 4 in Appendix A show long term NO_2 trends at the Grangemouth AURN, Haggs, West Bridge St and Hope St automatic monitoring stations

There is a downward trend in NO_2 concentrations at the background Grangemouth AURN site between 2001 and 2016. There has also been a decrease in NO_2 concentrations at the Haggs automatic monitoring station which is a roadside site within the Haggs AQMA. The decreased concentrations here are attributed to the completion of roadworks on 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 the Hope St and West Bridge St stations, which are both urban roadside sites located within the Falkirk Town Centre AQMA, have recorded slight decreases in NO_2 concentrations since 2010.

3.2.2 Particulate Matter (PM_{10})

Error! Reference source not found. in Appendix A compares the ratified and adjusted monitored PM_{10} annual mean concentrations for the past 5 years with the air quality objective of 18µg/m^3.

Error! Reference source not found. in Appendix A compares the ratified continuous monitored PM_{10} daily mean concentrations for the past 5 years with the air quality objective of 50µg/m^3, not to be exceeded more than 7 times per year.

Falkirk Council measured PM_{10} concentrations at seven locations during 2016. The PM_{10} air quality objectives were met at all seven sites.

The site with the greatest annual mean PM_{10} concentration, but within the Scottish annual PM_{10} objective was the Falkirk West Bridge St site, with an annual mean concentration of 15.0 µg/m^3. Data capture was good at this location at 98% for 2016. The site is a roadside location within the Falkirk Town Centre AQMA. There were no exceedances of the daily Scottish PM_{10} objective concentration at the Falkirk West Bridge St site, which is an improvement on last years monitoring period when two exceedances were recorded.

The Banknock 2 monitoring site recorded the greatest number of daily exceedances (three), but again this is within the Scottish daily PM_{10} objective. In addition the annual PM10 concentration at this site was well below the objective at 11 µg/m^3. Investigation of the three daily exceedances of the 24-hour objective indicated that localised burning activities were the likely cause of the exceedances. The full results are shown in Appendix A.

Figures 5 and 6 in Appendix A show long-term trends of PM_{10} concentrations at the Grangemouth AURN (urban/industiral background) and Falkirk West Bridge St (roadside location) sites. The trends show a decline in PM_{10} concentrations at both monitoring sites from 2010 to 2016. This reflects well the annual concentrations recorded and reported in Appendix A.

3.2.3 Particulate Matter ($PM_{2.5}$)

Error! Reference source not found. in Appendix A compares the ratified and adjusted monitored $PM_{2.5}$ annual mean concentrations for the past 5 years with the air quality objective of 10µg/m^3.

Falkirk Council's $PM_{2.5}$ monitoring network was expanded in 2016 following the addition of a FIDAS 200 particulate analyser at West Bridge St in November 2016. $PM_{2.5}$ is now measured at three locations within the Falkirk Council area these being the Grangemouth AURN, Banknock 2 and West Bridge St sites.

During 2016 there were no exceedances of the $PM_{2.5}$ annual mean objective recorded at any of the three monitoring sites. The AURN recorded an annual mean of 6.0µg/m^3 and the Banknock site recorded an annual mean of 5.0µg/m^3. Data capture for these sites was 92% and 88% respectively. As $PM_{2.5}$ monitoring only commenced at West Bridge St in November 2016 there isn't enough data to report an accurate

annual mean, however annualisation of the two months of data collected in 2016 shows an annual mean of 6 µg/m^3 data capture was 98% for the monitoring period.

The $PM_{2.5}$ concentrations at the Grangemouth AURN site have gradually reduced from 10.9 µg/m^3 in 2011 to 6.0 µg/m^3 in 2016. See Figure 8 in Appendix A for details. This reduction may be attributed to the commissioning of the tail gas treatment (TGT) unit at the INEOS Grangemouth complex in 2013. Since the commissioning of the TGT unit, SO_2 concentrations have reduced within the Grangemouth AQMA. As sulphate species are known to contribute towards the formation of secondary $PM_{2.5,}$ a reduction in SO_2 could impact local $PM_{2.5}$ concentrations.

Long term trend analysis cannot be completed for $PM_{2.5}$ concentrations at Banknock 2 or West Bridge St as monitoring only commenced at these sites in February 2015 and November 2016 respectively. Therefore we do not yet have the five years of data that is recommended before trend analysis is completed.

To appraise compliance with the new $PM_{2.5}$ objective at locations that currently do not monitor $PM_{2.5}$ concentrations, Falkirk Council has applied locally derived correction factors of 0.45 (roadside) and 0.54 (urban background/ industrial) following guidance set out in LAQM TG (16). This methodology provides an estimation of $PM_{2.5}$ data from PM_{10} data where only one of the two metrics is available. For roadside sites the correction factor was derived using PM data from the Banknock 2 site and for the background/industrial sites the factor was derived using PM data from the Grangemouth AURN site. For further details see Table C.1 in Appendix C.

The $PM_{2.5}$ estimations indicate that all five sites where the correction factor was applied met the $PM_{2.5}$ annual mean objective in 2016. Grangemouth Municipal Chambers recorded the highest estimated annual concentration of 9.8 µg/m^3. Falkirk West Bridge St had the second highest estimated annual concentration at 8.2µg/m^3. See Table A.12 in Appendix A for a full comparison of estimated $PM_{2.5}$ annual mean concentrations against the objective.

3.2.4 Sulphur Dioxide (SO_2)

Error! Reference source not found. in Appendix A compares the ratified continuous monitored SO_2 concentrations for year 2016 with the air quality objectives for SO_2.

In 2016 Falkirk Council monitored SO_2 at six locations. Four of the locations are located in the Grangemouth (15-minute) AQMA and two sites are positioned outside of the AQMA.

There were no breaches of the SO_2 objectives (15-minute, hourly or daily) recorded at any monitoring locations during 2015.

The sites with the most exceedances of the 15-minute objective concentration (266 µg/m^3) in 2016 were Grangemouth Moray and Grangemouth Municipal Chambers. Both sites recorded twenty eight exceedances of the 15-minute objective concentration, a number below the maximum permitted by the objective (35). In addition, the Grangemouth AURN site recorded three exceedances of the objective concentration and the Falkirk Hope St site recorded two exceedances. Grangemouth Zetland Park and Bo'ness both recorded zero exceedances.

In addition, the Grangemouth Moray and Grangemouth Municipal Chambers sites both recorded exceedances of the hourly objective concentration (350 µg/m^3). Grangemouth Moray recorded one exceedance and Grangemouth Muncipal Chambers recorded three. Twenty four exceedances of the hourly objective concentration are permitted per year, so neither site breached the objective.

The Grangemouth Municipal Chambers site also recorded one exceedance of the daily objective concentration for SO_2 (125 µg/m^3). Three exceedances of the daily objective are allowed each year, thus the daily objective was not breached at this site

This is the third consecutive year that no breaches of the SO_2 objectives (15-minute, hourly or daily) have been recorded at any site in the Grangemouth AQMA. It is important to stress that although there were still exceedances of the 15- minute, hourly and daily objective concentrations, the number of exceedances were below the maximum permitted by the respective objectives.

It is worth noting here that the exceedances of the 15-minute objective recorded at the Grangemouth Moray and Grangemouth Municipal Chambers sites could be considered close to a breach of the objective with twenty eight recorded exceedances (35 allowed). Moreover, there were exceedances of the 15-minute and hourly objective concentrations recorded at Falkirk Hope St, which is a site outside the Grangemouth AQMA.

The majority of the exceedances occurred during May 2016 due to 'normal' emissions from the Grangemouth refinery. Easterly winds are more frequent during May and the weather is usually warmer than other periods of the year. This produces a typical spring/summer trend of exceedances due to emissions from the refinery, even with tail gas treatment in place.

However, on the 9th May 2016 there was an SO_2 pollution event recorded by Falkirk Council's monitoring stations which occurred due to a significant plant trip at the refinery. This event led to the exceedance of the daily objective concentration recorded at the Grangemouth Municipal Chambers site. It also caused the15-minute objective concentration to be exceeded at a monitoring location outside the Grangemouth AQMA (Falkirk Hope St).

Long term trend analysis of SO_2 concentrations within the Grangemouth AQMA shows that the number of exceedances has significantly reduced since 2013 see Figure 12 in Appendix A. This reduction is attributed to the commissioning of the TGT unit at the INEOS Grangemouth plant in 2013.

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 at the Grangemouth sites have reduced across a variety of wind directions and speeds. For example in 2012 at the Grangemouth AURN site, the polar plots indicate the highest average concentrations during particular wind conditions were greater than 80µg/m^3. In 2016 the highest average concentrations at the AURN site have reduced to 50µg/m^3. Polar roses for the Grangemouth sites are shown in Figures 10 and 11 in Appendix A.

3.2.5 Carbon Monoxide, Lead and 1, 3-Butadiene

Carbon Monoxide

No monitoring undertaken.

Lead

No monitoring undertaken.

1, 3-Butadiene

In 2016 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 A.9 in Appendix A. No changes have occurred since the submission of the previous report.

Benzene

In 2016 Falkirk Council monitored benzene at sixteen locations using passive diffusion tubes. In addition, at the Grangemouth AURN site a pumped diffusion tube operates as part of the AURN network. The results from the passive diffusion tubes are shown in Table A.10 in Appendix A with the pumped diffusion tube results shown in Table A.11 in Appendix A.

All the benzene concentrations recorded by the tubes were within the air quality objectives. All benzene diffusion tubes achieved 100% data capture. In 2016 the pumped diffusion tube at the Grangemouth AURN site recorded an annual average concentration of 0.64 µg/m^3. The concentration recorded continues to be within the relevant objectives and is a decrease compared to 2015. It is also the lowest annual concentration recorded since monitoring began in 2002.

4. New Local Developments

4.1 Road Traffic Sources

4.1.2 Narrow Congested Streets

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.

4.1.3 Busy Streets

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.

In addition, the automatic monitoring network recorded no exceedances of the hourly NO_2 objective concentration and all of the diffusion tubes recorded concentrations below 60 µg/m^3.

4.1.4 Roads with high flow of buses and/or HGVs

There are no stretches of roads in the Falkirk Council area where the percentage of HGVs is greater than 20%. Therefore no further consideration is required.

4.1.5 Junctions

Nethermains Road / Glasgow Road Junction, Denny (new roundabout accessing Mydub Farm), A88 / C116 at Letham Junction Improvements (Road Safety Scheme altering junction layout) C3 South Alloa Road – new roundabout junction accessing Kinnaird Housing development.

4.1.6 New Roads Constructed or Proposed

No changes from last year's report.

4.1.7 Roads with significantly changed traffic flows

No changes from last year's report

4.1.8 Bus or coach stations

There have been no new bus or coach stations constructed or planned for the foreseeable future.

4.2 Other Transport Sources

4.2.1 Airports

The number of airport passenger movements at Edinburgh between 2016 and 2017 has increased by +11% from 11.3 million to 12.4 [Ref 2] .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. No new airports have been constructed or are planned for the foreseeable future.

4.2.2 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.

4.2.3 Railways (diesel and steam trains)

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

4.2.4 Ports for Shipping

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

4.3 Industrial Sources

4.3.1 Industrial Installations – New/ Proposed Installations

STOR application – Scottish Power, Bonnybridge:
Falkirk Council received a planning application for a Short Term Operating Reserve (STOR) to be located on the land to north of Scottish Power, Falkirk Road, Bonnybridge. An air quality assessment was requested by Falkirk Council's Environmental Health team to assess the impact of NOx emissions from the installation on local receptors.

The air quality impact assessment considered the worst case operating scenario as outlined below:

- All 11 containers have gas engines/electrical generators; and
- All 11 engines are operating continuously, for 100% of the time.

The dispersion modelling results predicted that neither the long term nor short term NO_2 air quality objectives will be exceeded at the two receptor locations (Bogton Farm and West Carmuirs Farm) under these worse case conditions.

DKL Metals Ltd - Relocation of DK Metals Ltd facility from Avontoun to Grangemouth:
The proposed location is within the Grangemouth Air Quality Management Area (AQMA), which is declared for exceedances of the 15-min sulphur dioxide objective. Therefore, the relocation of works to Grangemouth has the potential to negatively impact on an area of existing poor air quality.

Considering the location and the nature of the proposed facility, an Air Quality Impact Assessment was requested by Falkirk Council's Environmental Health team on receipt of the planning application. The objective of the assessment was to determine the significance of the process emissions in relation to relevant Air Quality Standards.

In summary there will be no sulphur dioxide emissions as the proposed facility will use liquid petroleum gas as the principal fuel, which has no sulphur content. The site

operation has the potential to emit nitrogen oxides, carbon monoxide, particulate matter, antimony, cadmium, copper, lead and tin to the atmosphere.

SLR Consulting Ltd, on behalf of DK Metals Ltd, carried out detailed dispersion modelling using ARMOD, to quantify both the emissions from the development and to determine ground level concentrations at relevant receptor locations. The methodology used to assess the significance of the emissions was adapted from 'IPPC H1 Environmental Assessment of BAT'. This is guidance documentation produced by SEPA for the PPC application process, and is commonly used to screen out pollutants that can be considered insignificant in terms of the impact on human health and the environment.

Using the above methodology, the assessment predicted that there would be no exceedance of the National Air Quality Objectives at any of the identified sensitive receptors. Process contributions are also predicted to be 'insignificant'.

Falkirk council considered the methodology and model inputs used for the report acceptable and exceedances of relevant Air Quality Objectives are unlikely to occur as a result of planning permission being granted.

According to modelling predications 67.8% of the annual mean PM_{10} objective and 82.1% of the annual mean $PM_{2.5}$ objective is already accounted for at relevant receptors in the area. This is not solely due to the impact of this individual development, which by itself contributes less than 1% towards the annual mean objectives for each of these pollutants, but rather a cumulative effect of industrial processes in the area.

Other:

There are no new poultry farms, petrol stations or major fuel depots.

4.4 Commercial and Domestic Sources

4.4.1 Biomass Combustion Plants – Individual Installations

There are no new individual biomass combustion individual installations that require consideration.

4.4.2 Biomass Combustion Plants – Combined Sources

Falkirk Council has assessed domestic biomass or other fuel burning in previous reports. Falkirk Council has 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.

4.4.3 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

4.4.3 Combined Heat and Power Plant

Renewable Energy Combined Heat and Power (CHP) Plant, Calachem Ltd, Earls Road, Grangemouth, FK3 8XG:

Falkirk Council has received a planning application for a CHP plant to be located on Earls Rd, Grangemouth. The proposed installation will burn refuse derived fuel and thus produce emissions in the form of acid gases, particulates, dioxins and heavy

metals to air. If planning consent is granted, this facility will be regulated by SEPA under PPC regulations 2012. The PPC permit will set emissions limits and controls for the installation required under the European Waste Incineration Directive.

An air quality statement was provided in Chapter 7 of the Environmental Statement as part of the planning application process. This was supported by air dispersion modelling which predicted no exceedance of the Air Quality Standards will occur due to either emission from the plant or associated traffic.

However, the statement on air quality classed the dust emission magnitude for the development as large for all activities (earth works, construction, trackout).The risk of impacts prior to mitigation is described as medium risk for earthworks and construction and high for trackout activities. Considering this the following conditions were recommended by Environmental Health:

- Prior to work commencing, an Environmental Management Plan (EMP) must be submitted for the approval of the planning authority and all works should be carried out in accordance with the plan.

- If site generated dust is found to be impacting upon property/residents out with the site the operation responsible shall be suspended until suitable dust suppression measures are put in place.

- If either the Council's or applicant's monitoring data or modelling demonstrates a breach of the PM_{10} or $PM_{2.5}$ objectives (as set out in the Air Quality (Scotland) Regulations 2000 and Air Quality (Scotland) (Amendment) Regulations 2002) at a relevant receptor the Council is required under Local Air Quality Management to investigate the cause of the breaches. If it is shown that the applicant is causing, or significantly contributing to, a breach of the objective(s) then the applicant shall implement remedial measures to ensure that either the objectives are met and/or to reduce their contribution such that it is not significant.

4.5 New Developments with Fugitive or Uncontrolled Sources

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

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.

5. Planning Applications

5.1 Works adjacent to and within the confines of Bo'ness Road, Grangemouth

Falkirk Council received a planning application from INEOS Chemical Grangemouth Ltd seeking planning permission to close part of the A904 Bo'ness Road – Grangemouth.

An Air Quality Assessment was requested by Falkirk Council's Environmental Health team. The assessment was required to demonstrate that the increase traffic on neighbouring roads due to the Proposed Development will not have a significant impact on sensitive receptors.

The Air Quality Impact Assessment carried out by ITPEnergised on behalf of INEOS Chemical Grangemouth Ltd, demonstrated that there will not be a significant impact at sensitive receptor locations as a result of the development. The pollutants included in the assessment were NO_2 and fine particulate matter (PM_{10} and $PM_{2.5}$).

The scope of the assessment was agreed with Falkirk Council prior to commencement. Three scenarios were modelled; current baseline, future baseline without development and future baseline with development. ADMS- Roads 4 dispersion modelling software was used to predict NO_2 and fine particulate (PM_{10}, $PM_{2.5}$) concentrations at sensitive receptors for the three scenarios.

The predicted change in pollutant concentrations, in respect to baseline concentrations was assessed as 'negligible' at all receptors within the study area.

6. Conclusions and Proposed Actions

6.1 Conclusions from New Monitoring Data

Falkirk Council has examined its automatic and non-automatic monitoring results. The annual mean NO_2 objective was exceeded at two diffusion tube monitoring sites during 2016. Both sites are located on West Bridge St which is within the Falkirk Town Centre AQMA. No other exceedances of the NO_2 objectives were identified either within or out with the existing AQMA's.

In addition no exceedances of the SO_2, PM_{10}, $PM_{2.5}$, benzene or 1, 3 butadiene objectives were identified. Since no exceedances of Scottish Air Quality Objectives occurred outside existing AQMAs, no new Detailed Assessment of any pollutant is required.

For the third consecutive year, there were no exceedances of the SO_2 objectives recorded within or out with the Grangemouth AQMA. This AQMA was declared in November 2005 in relation to a potential breach of the 15-minute SO_2 objective.

In August 2013 Petroineos fully commissioned the Tail Gas Treatment (TGT) abatement unit, as an action to reduce the number of exceedances such that the 15-minute objective would be met. This reduction has materialised with all monitoring sites complying with the SO_2 objectives since 2013.

Although the SO_2 objectives are currently complied with, it is essential that the SO_2 monitors continue operation. Pollution episodes where exceedances of the 15-minute mean can be seen across the council monitoring network, typically in spring and summer months.

In 2016 the Moray and Grangemouth Municipal Chambers sites each recorded twenty eight exceedances of the 15-minute objective concentration. This could be considered close to exceeding the objective which allows for thirty five exceedances per year. Exceedances of the daily and hourly objectives were also recorded by Falkirk Council's monitoring network in 2016.

The majority of the exceedances occurred during May 2016 due to 'normal' emissions from the Grangemouth refinery. However, on the 9th May 2016 there was an SO_2 pollution event recorded by Falkirk Council's monitoring stations which occurred due to a significant plant trip at the refinery.

Despite exceedances of the objective concentrations still occurring within the Grangemouth AQMA; the number of exceedances of the 15-minute objective concentration has significantly reduced compared to before the commissioning of the Tail Gas Unit see figure 12 in Appendix A.

Local Air Quality Policy Guidance PG (S) 16 states that "There are no set criteria on which a revocation decision will be based, and the Scottish Government considers each request on a case by case basis. A minimum requirement however will normally be at least three consecutive years where the objectives of concern are being achieved".

Although SO_2 objectives have been achieved within the Grangemouth AQMA for three consecutive years; Falkirk Council considers that the Grangemouth AQMA remains justified based upon the amount of exceedances of the 15 – minute objective concentration recorded at the Moray and Municipal Chambers sites this year and also in 2014.

Monitoring data from the Grangemouth AQMA will continue to be reviewed and consultation will be sought from SEPA and other statutory consultees should the Grangemouth AQMA continue to achieve all SO_2 objectives in future reporting years.

The Falkirk Town Centre AQMA remains justified with a breach of the NO_2 objective along Falkirk West Bridge St recorded by diffusion tube monitoring in the area. Although PM_{10} concentrations appear to be gradually reducing at the Falkirk West Bridge St site.

The Haggs AQMA will be reviewed as the NO_2 and PM_{10} objectives have again be met in 2016. A detailed assessment will be required to understand whether an application to revoke is appropriate.

The roadside and background monitoring in the Banknock AQMA has shown compliance with the PM_{10} objectives for more than three consecutive years. This AQMA was declared in August 2011 when Cowdenhill quarry was identified as the primary PM_{10} source.

Cowdenhill quarry is no longer operational, however, monitoring continued in this AQMA because a new quarry, in North Lanarkshire, but using the same access road as the previous Cowdenhill quarry, was in the process of agreeing s75 / legal.

Recent discussion with North Lanarkshire Council's Environmental Health team has clarified that planning permission for the new quarry has not been granted. Therefore it is likely that Falkirk Council will look to revoke this AQMA as there is no longer a PM_{10} source in the area and concentrations are well below the objectives.

Falkirk Council's 2014 Progress Report identified elevated levels of nitrogen dioxide in the vicinity of Main Street St, Bainsford. Due to this Falkirk Council undertook a detailed assessment of NO_2, PM_{10} and $PM_{2.5}$ concentrations along Main St, Bainsford in 2016. The purpose was to provide an accurate assessment of the likelihood of the air quality objectives being exceeded at 'relevant locations' in the area.

In summary the automatic and diffusion tube monitoring work undertaken along Main St, Bainsford has indicated that the NO_2 and PM_{10} air quality objectives are being met in the area. An estimation of $PM_{2.5}$ concentrations, using a locally derived correction ratio, indicates that the annual $PM_{2.5}$ air quality objective is also being met. Therefore an AQMA will not be declared. The Detailed Assessment can be seen in Appendix D of this report.

6.2 Conclusions relating to New Local Developments

Falkirk Council has assessed new and proposed local developments in the Falkirk area and concludes that none of the developments have potential to introduce new exceedances of relevant objectives, or exacerbate existing ones.

Falkirk Council received a planning application from INEOS Chemicals Grangemouth Ltd seeking planning permission to close part of the A904 Bo'ness Road – Grangemouth. An air quality impact assessment was requested by Falkirk Council to determine the effect on local air quality of the closure of part of the A904 Bo'ness Road, leading to an increase in traffic on a section of the A905 and Inchyra Road.

The Air Quality Impact Assessment carried out by ITPEnergised on behalf of INEOS Chemical Grangemouth Ltd, demonstrated that there will not be a significant impact at sensitive receptor locations as a result of the development. The predicted change in pollutant concentrations, in respect to baseline concentrations was assessed as 'negligible' at all receptors within the study area. Therefore Environmental Health did not object to this development on the grounds of air quality concerns.

In addition, Falkirk Council have received a planning application for a Short Term Operating Reserve (STOR) to be located on the land to north of Scottish Power, Falkirk Road, Bonnybridge. The proposed development is a small-scale reserve power plant for the generation, and potentially battery storage, of electricity to provide a backup supply to the National Grid.

The intention is to export electricity from the Development to the local electrical grid at times of peak demand or when the grid requires various forms of electrical support. As the local network is not continuously in these states, it is not expected that the Development would be exporting continuously.

Dispersion modelling of NOx emissions from the proposed Development was carried out to demonstrate that the NO_2 air quality objectives would not be exceeded at receptor locations as a result of this development.

The worst case operating scenario was modelled and the results predicted that neither the long term nor short term NO_2 air quality objectives will be exceeded at the two receptor locations that were identified during the assessment.

The Environmental Health team did not object to this development but recommended the following conditions should the application be permitted:

1. The plant must comply with the relevant emission limit values set out in Annex II of the Medium Combustion Plant (MCP) Directive.
2. The plant must be fully compliant with domestic legislation which transposes the MCP Directive within the given timescale.

Lastly, a planning application was received from DKL Metals Ltd seeking planning permission for the relocation of DK Metals Ltd facility from Avontoun to Grangemouth.

The site operation has the potential to emit nitrogen oxides, carbon monoxide, particulate matter, antimony, cadmium, copper, lead and tin to the atmosphere. Considering this and the proposed location (within the Grangemouth AQMA), an Air Quality Assessment was requested by Falkirk Council's Environmental Health team on receipt of the planning application.

The objective of the assessment was to determine the significance of the process emissions in relation to relevant Air Quality Standards. SLR Consulting Ltd, on behalf of DK Metals Ltd, carried out detailed dispersion modelling using ARMOD, to quantify both the emissions from the development and to determine ground level concentrations at relevant receptor locations.

The assessment predicted that there would be no exceedance of the National Air Quality Objectives at any of the identified sensitive receptors. According to modelling predications 67.8% of the annual mean PM_{10} objective and 82.1% of the annual mean $PM_{2.5}$ objective is already accounted for at relevant receptors in the area. This is not solely due to the impact of this individual development, which by itself

contributes less than 1% towards the annual mean objectives for each of these pollutants, but rather a cumulative effect of industrial processes in the area.

6.3 Proposed Actions

Falkirk Council has examined its automatic and non-automatic monitoring results. No exceedances of the Scottish Air Quality Objectives, within or outside existing AQMAs were identified by the automatic monitoring network. However, diffusion tubes NA27 and NA111 recorded an annual NO_2 concentration above the Scottish annual objective of 40ugm-3. Both of the diffusion tubes are located within the Falkirk Town Centre AQMA; therefore no new Detailed Assessment of any pollutant is required.

The 2014 updating and screening assessment identified the need for a Detailed Assessment of PM_{10} and NO_2 concentrations along Main Street, Bainsford. Automatic monitoring commenced in June 2015. The monitoring data so far indicates that the air quality objectives for both NO_2 and PM_{10} are being met, for this reason Falkirk Council will not be declaring Main Street, Bainsford an AQMA. However we will continue with automatic monitoring in the area as diffusion tube NA83 recorded an NO_2 concentration which could be considered close to the objective in 2016 at 38ugm-3 with the application of the National Bias Adjustment Factor.

Concentrations recorded by both the Main St, Bainsford automatic station and the diffusion tubes will be regularly reviewed to ensure compliance with the objectives is maintained in future years. The detailed assessment of monitoring data for Main Street, Bainsford is presented in Appendix A.

Monitoring data for 2016 has highlighted that the Haggs and Banknock AQMA's should be reviewed in the upcoming year as both sites continue to meet the national air quality objectives. In particular the Banknock AQMA will be a priority for review as it has been established that there is no longer a PM_{10} source in the area since Cowdenhill quarry ceased operation.

If the decision to revoke the Banknock AQMA is made it is highly likely that the FIDAS particulate analyser will be moved to a more appropriate monitoring location either within the Grangemouth or Falkirk Town Centre AQMA.

In addition, a priority for Falkirk Council will be to commission a modelling study of road source emissions in Falkirk Council's area. The scale of the project is dependent on costs and there are two options being considered. The first would be to commission a regional model of road source emissions. This will include high resolution (8m) modelling in the AQMAs and urban centres. The second would be to focus on road sources impacting the Falkirk Town Centre AQMA only. The information gained through either of these options will help inform an updated action plan for the Falkirk Town Centre AQMA.

An Air Quality Progress Report as required by the Scottish Government shall be submitted in June 2018.

Appendix A: Monitoring Results

Table A. 1– Details of Automatic Monitoring Sites

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Monitoring Technique	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Inlet Height (m)
A3	Bo'ness	Urban background/ industrial	299815	681481	SO_2	N	SO_2, Horiba	Y (5 m)	22 m	1.2
A4	Falkirk Haggs	Roadside	278977	679271	NO_2, PM_{10}	Y (NO_2)	NO_x: ML, PM_{10}: TEOM.	Y (5 m)	2 m	1.2
A5	Falkirk Hope St	Roadside	288688	680218	NO_2, SO_2.	Y (NO_2 and PM_{10}.)	Horiba.	Y (1 m)	5 m	1.5
A7	Falkirk West Bridge St	Roadside	288457	680064	NO_2, PM_{10}	Y (NO_2 and PM_{10}.)	NO_x: ML, PM_{10}: TEOM.	Y (1 m)	2 m	1.2
A8	Grangemouth AURN	Urban background/ industrial	293830	681022	Benzene, NO_2, PM_{10}, $PM_{2.5}$, SO_2.	Y (SO_2)	Benzene (pumped tube), PM: FDMS. NO_x and SO_2: ML.	Y (5 m)	20 m	3.5
A9	Grangemouth Moray	Urban background/ industrial	293469	681321	NO_2, SO_2.	Y (SO_2)	NO_x: ML and SO_2: Horiba.	Y (1 m)	25 m	3.5
A10	Grangemouth Municipal Chambers	Urban background/ industrial	292816	682009	NO_2, SO_2, PM_{10}.	Y (SO_2)	NO_x and SO_2: Horiba, PM_{10}: TEOM.	Y (1 m)	40 m	3.5

A11	Grangemouth Zetland Park	Urban background/ industrial	292969	681106	SO_2	Y (SO_2)	SO_2: Horiba.	Y (1 m)	135 m	3.5
A12	Falkirk Grahams Rd	Roadside	288823	680242	PM_{10}	Y (NO_2 and PM_{10}.)	TEOM	Y (1m)	10 m	1.2
A13	Banknock 2	Roadside	277247	679027	PM_{10}	Y (PM_{10})	FIDAS	Y (7 m)	3 m	1.2
A14	Banknock 3	Urban background	277168	679254	PM_{10}	Y (PM_{10})	Osiris	Y (19 m)	17 m	1.3
A15	Main St Bainsford	Roadside	288566	681508	NO_2, PM_{10}	N	NO_x: ML, PM_{10}: TEOM.	Y (1 m)	2 m	1.2

(1) 0 if the monitoring site is at a location of exposure (e.g. installed on the façade of a residential property).

(2) N/A if not applicable.

Table A. 2– Details of Non-Automatic Monitoring Sites

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube collocated with a Continuous Analyser?
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)	N
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	N
NA19	Kilsyth Rd, Banknock.	Roadside.	278779	679301	NO_2.	Y	Y (<2)	2.2	N
NA20	Garngrew Rd, Haggs.	Urban background.	278975	679172	NO_2.	N	Y (<5)	<10	Y
NA21	Grangemouth Rd, College.	Roadside.	290112	680500	Benzene, NO_2.	N	Y (<2)	1.8	N
NA24	Kerse Lane, Falkirk.	Roadside.	289187	680024	NO_2.	Y	Y (<2)	3	N
NA26	Weir St, Falkirk.	Urban background.	289207	680123	NO_2.	Y	Y (<5)	<10	N
NA27	West Bridge St, Falkirk.	Roadside.	288490	680055	Benzene, NO_2.	Y	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	Y (<5)	2.1	N
NA37	Denny Town House.	Urban centre.	281226	682526	Benzene, NO_2.	N	Y (<5)	<5	N

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube collocated with a Continuous Analyser?
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	N
NA42	Municipal Chambers, Grangemouth.	Urban centre / industrial.	292817	682000	Benzene, NO_2*.	N	Y (<5)	<10	Y
NA44	Greenpark Drive, Polmont.	Urban background.	293436	678938	Benzene, NO_2.	N	Y (<5)	<10	N
NA47	Thistle Avenue, Grangemouth.	Roadside.	292000	680300	NO_2.	N	Y (<2)	1.3	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	Y (<5)	<10	N
NA51	Mary St, Laurieston.	Roadside.	290965	679490	NO_2.	N	Y (1)	4.5	N
NA52	Main St, Larbert.	Roadside.	285866	682356	NO_2.	N	Y (<2)	4.4	N
NA53	Denny Cross.	Roadside.	281211	682727	NO_2.	N	Y (<2)	0.8	N
NA55	Inchyra Station	Urban background / industrial.	293830	681022	Benzene, 1, 3-butadiene.	N	Y (<5)	<2	Y
NA57	Inchyra Road, Grangemouth.	Urban background / industrial.	294028	680829	Benzene, NO_2.	N	Y (<5)	<10	N
NA58	Callendar Rd, Falkirk.	Roadside.	289667	679724	NO_2.	N	Y (<2)	0.5	N

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube collocated with a Continuous Analyser?
NA59	Carron Rd, Bainsford.	Roadside.	288392	681931	NO_2.	N	Y (<2)	1.2	N
NA60	Ronades Rd, Carron.	Roadside.	288133	681587	NO_2.	N	Y (<2)	1.6	N
NA61	Canal Rd, Falkirk.	Roadside.	287976	680656	NO_2.	Y	Y (<2)	1.5	N
NA62	Arnot St, Falkirk.	Roadside.	289125	679705	NO_2.	Y	Y (<2)	1.2	N
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	N
NA65	Redding Rd, Redding.	Roadside.	291356	678644	NO_2.	N	Y (<2)	0.6	N
NA67	Queen St, Falkirk.	Urban background.	289430	680433	NO_2.	Y	Y (<5)	<10	N
NA68	Bellevue St, Falkirk.	Roadside.	289234	679945	NO_2.	Y	Y (<2)	1.7	N
NA69	Kerse Lane, Falkirk.	Roadside.	289025	679991	NO_2.	Y	Y (<2)	2.3	N
NA70	Park St AQ station, Falkirk.	Roadside.	288892	680070	NO_2.*	Y	Y (<2)	4.7	N
NA71	Park St, Falkirk.	Roadside.	288910	680112	NO_2.	Y	Y (<2)	1.5	N

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube collocated with a Continuous Analyser?
NA72	Vicar St, Falkirk.	Roadside.	288824	680120	NO_2.	Y	Y (<2)	1.5	N
NA73	West Bridge St RHS, Falkirk.	Roadside.	288467	680048	NO_2.	Y	Y (<2)	0.3	N
NA76	Tyrst Road, Stenhousemuir.	Roadside.	286851	683229	NO_2.	N	Y (<2)	<2	N
NA77	Kinnaird Village.	Roadside.	286490	683775	Benzene, NO_2.	N	Y (<2)	3.9	N
NA78	Glen Brae, Falkirk.	Roadside.	288525	678991	NO_2.	N	Y (<2)	2.6	N
NA80	Cow Wynd, Falkirk.	Roadside.	288765	679456	Benzene, NO_2.	N	Y (<2)	1.8	N
NA81	Grahams Rd, Falkirk.	Roadside.	288834	680898	Benzene, NO_2.	N	Y (<2)	0.5	N
NA82	Castings Ave, Falkirk.	Roadside.	288858	681036	NO_2.	N	Y (<2)	<2	N
NA83	Main St, Bainsford.	Roadside.	288614	681415	NO_2.	Y	Y (<2)	0.5	N
NA85	Auchinloch Dr, Banknock.	Roadside.	278752	679049	NO_2.	Y	Y (<2)	<2	N
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	Y (<2)	1.6	N

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube collocated with a Continuous Analyser?
NA88	Ure Crescent, Bonnybridge.	Roadside.	282444	681074	NO_2.	N	Y (<2)	1.7 (16 to M876)	N
NA89	Grahams Rd/Meeks Rd, Falkirk.	Roadside.	288853	680328	NO_2.	Y	Y (<2)	2.2	N
NA90	Grahams Rd bridge east, Falkirk.	Roadside.	288855	680234	NO_2.	Y	Y (<2)	2.2	N
NA94	A905 (Glensburgh Rd), Grangemouth.	Roadside.	291213	681927	Benzene, NO_2.	N	Y (7 m)	5.4	N
NA98	Arnothill, Falkirk	Urban background.	288095	680105	NO_2.	Y	Y (23 m)	1.6	N
NA99	St Crispins Place, Falkirk	Roadside.	288924	679675	NO_2.	Y	Y (7.6 m)	2.7	N
NA100	Oswald St, Falkirk	Urban background.	288977	679662	NO_2.	N	Y (3.8 m)	1.5	N
NA101	Glensburgh Road (2), Grangemouth	Roadside.	291127	682007	NO_2.	N	Y (7 m)	0.9	N
NA102	Easy Kearse Mains, Bo'ness	Urban background.	297968	680684	Benzene	N	N	23 m (main road)	N
NA104	Powdrake Road, Grangemouth	Urban background / industrial.	293788	682054	1,3- butadiene	N	Y (40 m)	1.8	N
NA105	West of Shieldhill	Rural.	288292	676889	Benzene, NO_2.	N	N	1.7	N
NA106	Stirling Road, North Broomage	Roadside.	284975	683532	NO_2.	N	Y (4 m)	19	N

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube collocated with a Continuous Analyser?
NA107	Main Street (east), Bainsford	Roadside.	288640	681396	NO_2	N	Y (4 m)	0.5	N

(1) 0 if the monitoring site is at a location of exposure (e.g. installed on/adjacent to the façade of a residential property). N/A if not applicable.

Table A. 3– Annual Mean NO_2 Monitoring Results

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2016 (%) (2)	NO_2 Annual Mean Concentration ($\mu g/m^3$) (3)				
					2012	2013	2014	2015	2016
A4	Falkirk Haggs	Automatic	83	83	35	34	32	30	33
A5	Falkirk Hope St	Automatic	98	98	25	23	23	21	23
A7	Falkirk West Bridge St	Automatic	84	84	**43**	39	**41**	37	37
A8	Grangemouth AURN	Automatic	92	92	16	14	16	14	16
A9	Grangemouth Moray	Automatic	95	95	19	16	15	15	18
A10	Grangemouth MC	Automatic	82	82	24	20	19	18	21
A15	Main St Bainsford	Automatic	87	87	n/m	n/m	n/m	15	24
NA3	Tinto Drive, Grangemouth.	Diffusion Tube	100.0	100.0	21	21	19	20	19
NA5	Copper Top pub, Camelon.	Diffusion Tube	100.0	100.0	31	28	27	27	25
NA7	Irving Parish Church, Camelon.	Diffusion Tube	91.7	91.7	19	19	18	17	16
NA9	Bellsdyke Rd, Larbert.	Diffusion Tube	100.0	100.0	25	26	29	26	25
NA19	Kilsyth Rd, Banknock.	Diffusion Tube	91.7	91.7	36	36	36	26	33
NA20	Garngrew Rd, Haggs.	Diffusion Tube	91.7	91.7	27	24	22	23	24
NA21	Grangemouth Rd, College.	Diffusion Tube	91.7	91.7	30	28	28	28	28
NA24	Kerse Lane, Falkirk.	Diffusion Tube	83.3	83.3	37	**42**	37	38	35
NA26	Weir St, Falkirk.	Diffusion Tube	100.0	100.0	22	21	18	17	18
NA27	West Bridge St, Falkirk.	Diffusion Tube	91.7	91.7	**61**	**53**	**45**	**47**	**48**
NA29	Wellside Place, Falkirk.	Diffusion Tube	91.7	91.7	20	18	17	15	17
NA36	Kerr Crescent, Haggs.	Diffusion Tube	100.0	100.0	**42**	**40**	38	37	38

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2016 (%) (2)	NO_2 Annual Mean Concentration ($\mu g/m^3$) (3)				
					2012	2013	2014	2015	2016
NA37	Denny Town House.	Diffusion Tube	91.7	91.7	20	19	20	18	17
NA38	Larbert Village Primary School.	Diffusion Tube	100.0	100.0	20	19	18	16	17
NA41	Seaview Place, Bo'ness.	Diffusion Tube	91.7	91.7	24	22	21	21	21
NA42	Municipal Chambers, Grangemouth.	Diffusion Tube	100	100	21	20	19	20	20
NA44	Greenpark Drive, Polmont.	Diffusion Tube	75.0	75.0	17	16	16	12	12
NA48	Hayfield, Falkirk.	Diffusion Tube	100.0	100.0	21	21	20	19	19
NA50	Upper Newmarket St, Falkirk.	Diffusion Tube	100.0	100.0	30	30	27	22	24
NA51	Mary St, Laurieston.	Diffusion Tube	100.0	100.0	27	24	25	19	25
NA52	Main St, Larbert.	Diffusion Tube	100.0	100.0	28	26	21	24	24
NA53	Denny Cross.	Diffusion Tube	100.0	100.0	34	33	31	28	29
NA57	Inchyra Road, Grangemouth.	Diffusion Tube	100.0	100.0	27	26	26	20	23
NA58	Callendar Rd, Falkirk.	Diffusion Tube	91.7	91.7	23	22	21	21	20
NA59	Carron Rd, Bainsford.	Diffusion Tube	75.0	75.0	31	28	26	29	26
NA60	Ronades Rd, Carron.	Diffusion Tube	100.0	100.0	29	29	27	24	26
NA61	Canal Rd, Falkirk.	Diffusion Tube	100.0	100.0	25	26	25	24	24
NA62	Arnot St, Falkirk.	Diffusion Tube	100.0	100.0	39	36	38	39	39
NA63	Camelon Rd, Falkirk.	Diffusion Tube	100.0	100.0	**41**	38	36	36	36
NA64	New Hallglen Rd, Falkirk.	Diffusion Tube	100.0	100.0	20	20	18	18	18
NA65	Redding Rd, Redding.	Diffusion Tube	100.0	100.0	25	24	18	27	26
NA67	Queen St, Falkirk.	Diffusion Tube	100.0	100.0	31	31	28	25	29
NA68	Bellevue St, Falkirk.	Diffusion Tube	100.0	100.0	35	31	29	35	31
NA69	Kerse Lane, Falkirk.	Diffusion Tube	91.7	91.7	38	33	35	30	34
NA70	Park St AQ station,	Diffusion Tube	91.7	91.7	30	28	28	n/m	34

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) [1]	Valid Data Capture 2016 (%) [2]	NO_2 Annual Mean Concentration ($\mu g/m^3$) [3]				
					2012	2013	2014	2015	2016
	Falkirk.								
NA71	Park St, Falkirk.	Diffusion Tube	91.7	91.7	38	35	33	35	29
NA72	Vicar St, Falkirk.	Diffusion Tube	100.0	100.0	33	33	32	30	32
NA73	West Bridge St RHS, Falkirk.	Diffusion Tube	100.0	100.0	34	35	33	31	22
NA76	Tyrst Road, Stenhousemuir.	Diffusion Tube	91.7	91.7	24	20	23	23	22
NA77	Kinnaird Village.	Diffusion Tube	83.3	83.3	25	24	22	23	33
NA78	Glen Brae, Falkirk.	Diffusion Tube	100.0	100.0	31	30	30	32	31
NA80	Cow Wynd, Falkirk.	Diffusion Tube	91.7	91.7	31	29	30	32	27
NA81	Grahams Rd, Falkirk.	Diffusion Tube	100.0	100.0	32	32	29	26	19
NA82	Castings Ave, Falkirk.	Diffusion Tube	83.3	83.3	22	20	18	20	38
NA83	Main St, Bainsford.	Diffusion Tube	91.7	91.7	**41**	37	34	35	21
NA85	Auchinloch Dr, Banknock.	Diffusion Tube	100.0	100.0	25	23	21	20	16
NA86	Wolfe Rd, Falkirk.	Diffusion Tube	83.3	83.3	19	19	15	18	32
NA87	M80 slip south, Haggs.	Diffusion Tube	100.0	100.0	33	32	32	32	30
NA88	Ure Crescent, Bonnybridge.	Diffusion Tube	100.0	100.0	33	30	29	29	30
NA89	Grahams Rd/Meeks Rd, Falkirk.	Diffusion Tube	91.7	91.7	34	34	30	31	32
NA94	A905 (Glensburgh Rd), Grangemouth.	Diffusion Tube	83.3	83.3	38	36	31	24	21
NA98	Arnothill, Falkirk	Diffusion Tube	91.7	91.7	26	25	22	15	26
NA99	St Crispins Place, Falkirk	Diffusion Tube	66.7	66.7	29	26	25	22	21
NA100	Oswald St, Falkirk	Diffusion Tube	91.7	91.7	22	21	20	16	23
NA101	Glensburgh Road (2), Grangemouth	Diffusion Tube	0.0	0.0	26	24	24	17	n/m
NA105	West of Shieldhill	Diffusion Tube	91.7	91.7	10	10	9	10	8

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2016 (%) (2)	NO_2 Annual Mean Concentration ($\mu g/m^3$) (3)				
					2012	2013	2014	2015	2016
NA107	Main Street (east), Bainsford	Diffusion Tube	83.3	83.3	n/m	31	30	28	30
NA108	Main Street, Camelon	Diffusion Tube	75.0	75.0	n/m	n/m	23	18	23
NA109	Carmuirs Street, Camelon	Diffusion Tube	83.3	83.3	n/m	n/m	18	14	16
NA110	Banknock 2 AQ station	Diffusion Tube	91.7	91.7	n/m	n/m	18	19	19
NA111	Falkirk West Bridge St AQ station	Diffusion Tube	91.7	91.7	n/m	n/m	33	33	**43**
NA112	Philip Street, Bainsford	Diffusion Tube	100	100	n/m	n/m	16	16	17

Notes: Exceedences of the NO_2 annual mean objective of 40µg/m3 are shown in **bold**.

NO_2 annual means exceeding 60µg/m^3, indicating a potential exceedence of the NO_2 1-hour mean objective are shown in **bold and underlined.**

(1) data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

(2) data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

(3) Means for diffusion tubes have been corrected for bias. All means have been "annualised" as per LAQM.TG(16) if valid data capture for the full calendar year is less than 75%. See Appendix C for details.

Table A. 4– 1-Hour Mean NO_2 Monitoring Results

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2015 (%) (2)	NO_2 1-Hour Means > 200µg/m^3 (3)				
					2012	2013	2014	2015	2016
A4 Falkirk Haggs	Roadside	Automatic	83	83	0	0	0	0	0 (119)
A5 Hope St	Urban Background	Automatic	98	98	0	0	0	0	0
A7 Falkirk West Bride St	Roadside.	Automatic	84	84	0 (124)	0	0	0 (115)	0 (107)
A8 Grangemouth AURN	Urban background / industrial.	Automatic	92	92	0	0	0	0	0
A9 Grangemouth Moray	Urban background / industrial.	Automatic	95	95	0	0	0	0	0
A10 Grangemouth MC	Urban background / industrial.	Automatic	82	82	0	0	0	0 (86)	0 (72)
A15 Main St Bainsford	Roadside	Automatic	87	87	n/m	n/m	n/m	0 (45)	0 (94)

Notes: Exceedences of the NO_2 1-hour mean objective (200µg/m^3 not to be exceeded more than 18 times/year) are shown in **bold.**

(1) data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

(2) data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

(3) If the period of valid data is less than 85%, the 99.8th percentile of 1-hour means is provided in brackets.

Figure 1 – Grangemouth AURN long term NO_2 concentrations

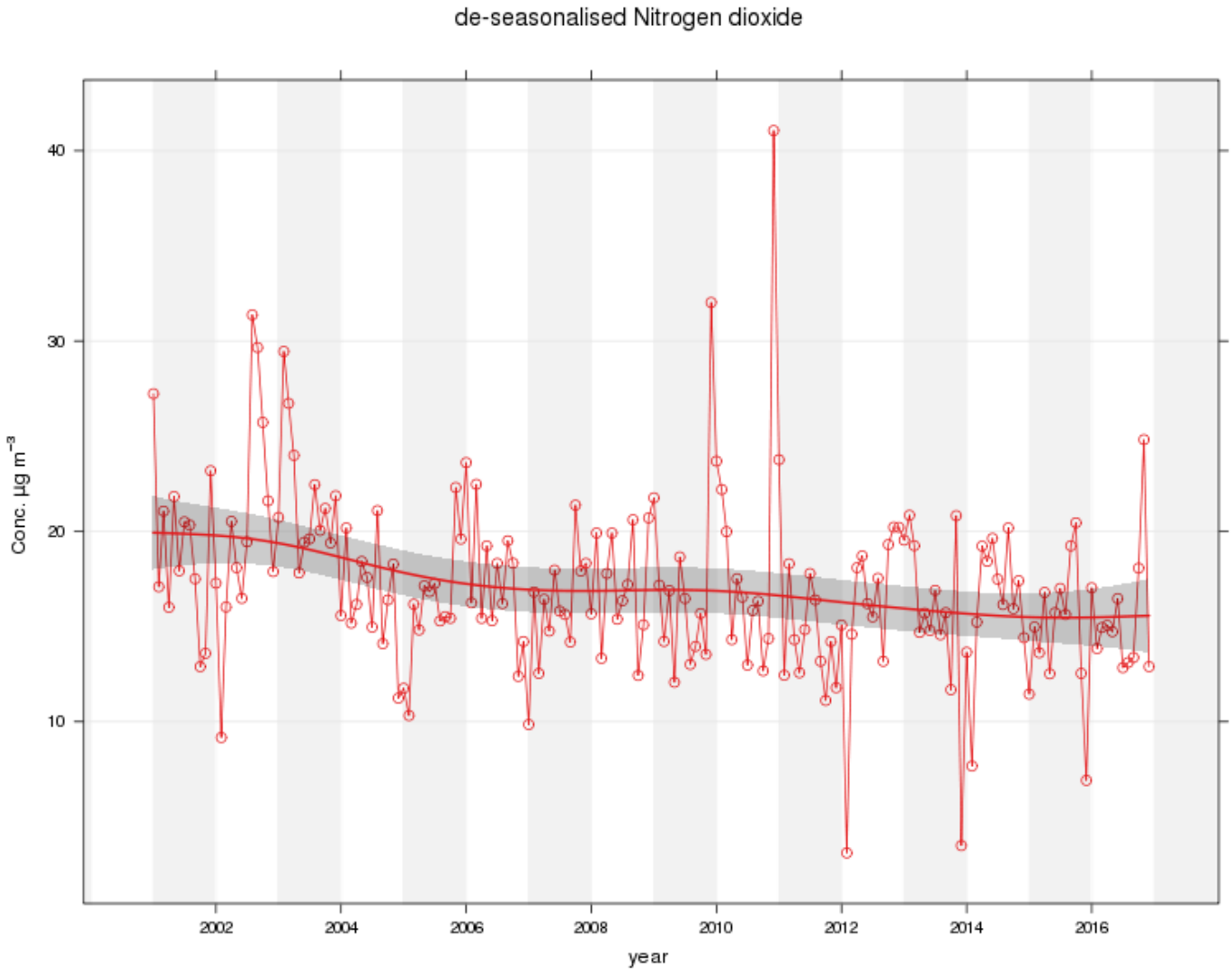


Figure 2 – Falkirk Haggs long term NO_2 concentrations

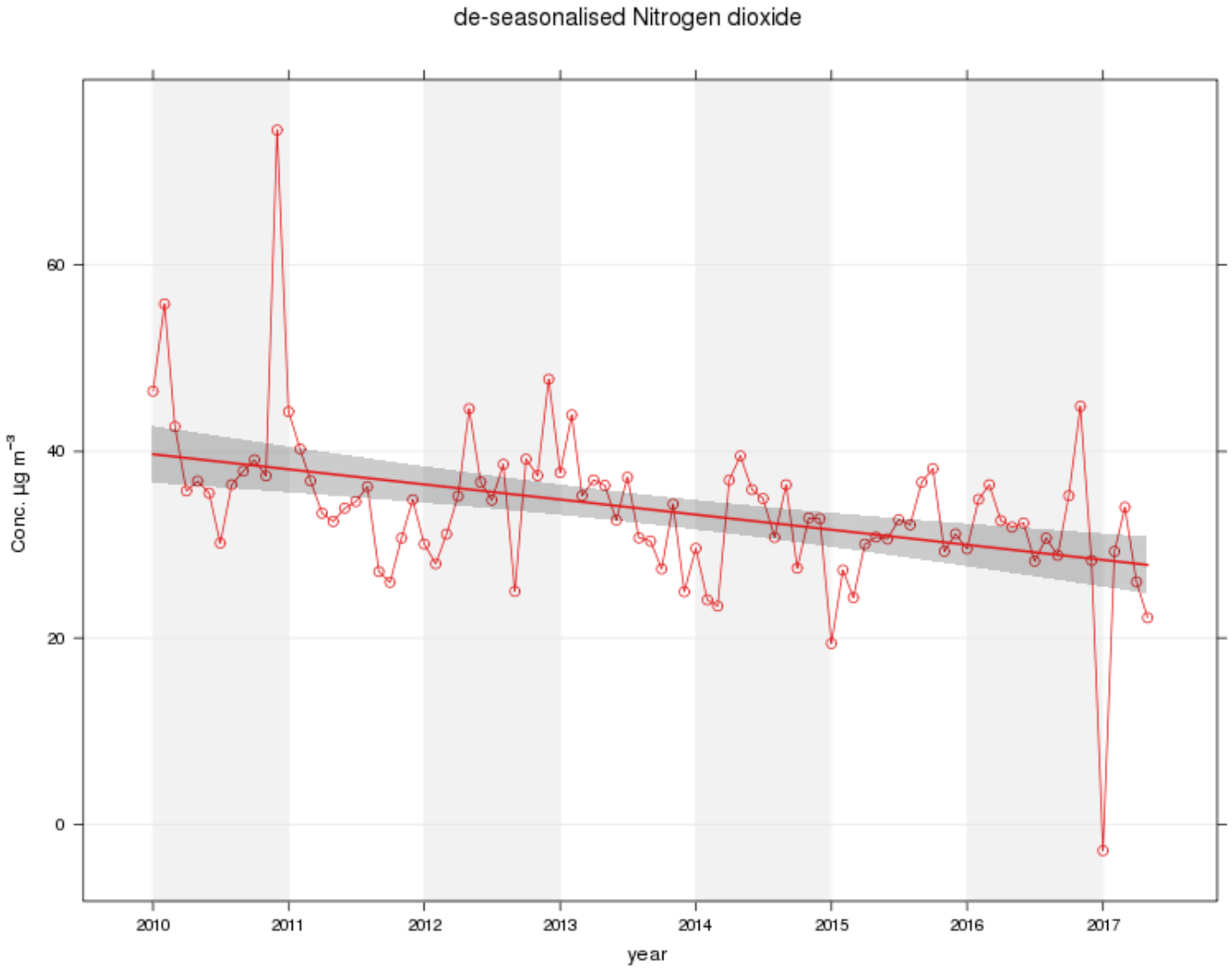


Figure 3 – Falkirk Hope St long term NO_2 concentrations

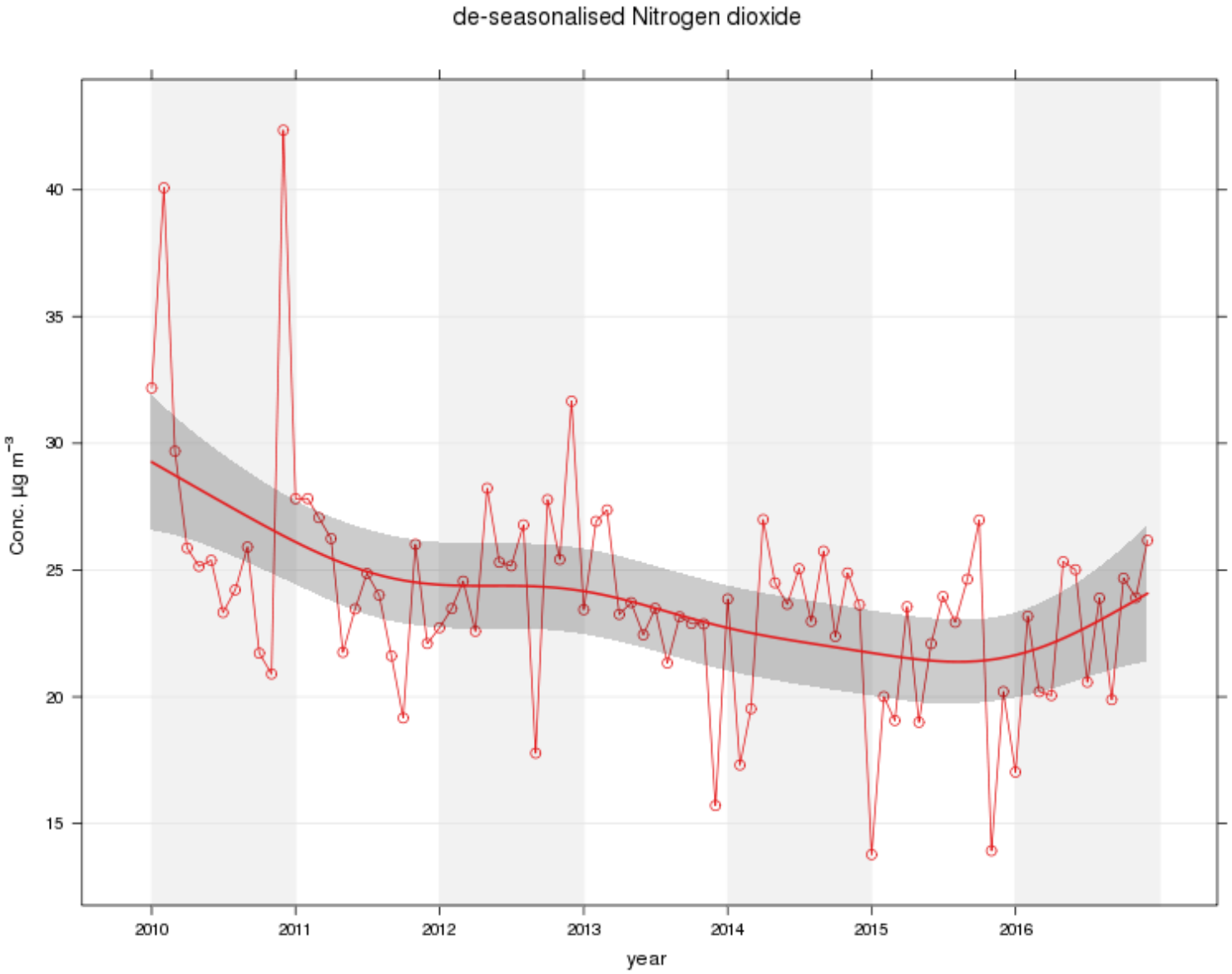


Figure 4 - Falkirk West Bridge St long term NO_2 concentrations

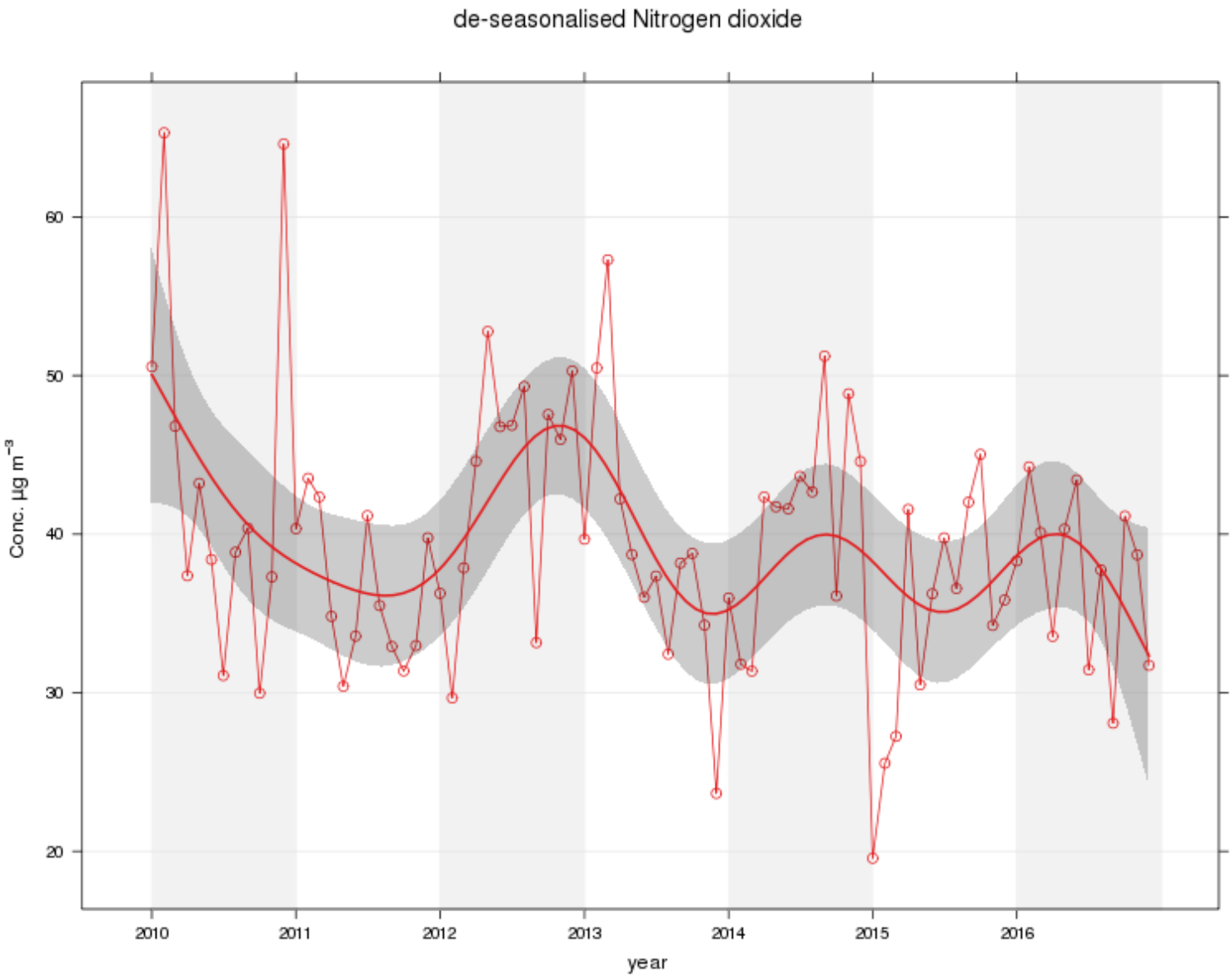


Table A. 5– Annual Mean PM_{10} Monitoring Results

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2016 (%) (2)	PM_{10} Annual Mean Concentration ($\mu g/m^3$) (3)				
				2012	2013	2014	2015	2016
A4	Falkirk Haggs	96	96	15.9	**18.3**	16.5	15	14
A7	Falkirk West Bridge St	98	98	17.8	**19.5**	17.7	15	15
A8	Grangemouth AURN	95	95	14.1	14	12.4	12.2	11
A10	Grangemouth Municipal Chambers	90	90	14.7	15	14.6	13	13
A12	Falkirk Graham's Road	95	95	16	16.3	13.2	11.8	13
A13	Banknock 2	83	83	16	16.3	13.2	11	11
A14	Banknock 3	n/m	n/m	12.7	14.6	15	8.2	n/m
A15	Main St Bainsford	41	41	n/m	n/m	n/m	12.8	10

Notes: Exceedences of the PM_{10} annual mean objective of 18µg/m^3 are shown in **bold.**

(1) data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

(2) data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

(3) All means have been "annualised" as per LAQM.TG(16), valid data capture for the full calendar year is less than 75%. See Appendix C for details.

Table A. 6– 24-Hour Mean PM_{10} Monitoring Results

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2016 (%) (2)	PM_{10} 24-Hour Means > 50µg/m^3 (3)				
				2012	2013	2014	2015	2016
A4	Falkirk Haggs	96	96	0 (45)	4	1	1	0
A7	Falkirk West Bridge St	98	98	6	4	2 (40)	2 (29)	0
A8	Grangemouth AURN	95	95	2	0 (34)	0	1 (21)	0
A10	Grangemouth Municipal Chambers	90	90	2 (41)	0 (32)	0	0	0
A12	Falkirk Graham's Road	95	95	4	3	0	0 (18)	0
A13	Banknock 2	n/m	n/m	0 (18)	0	3	4	n/m
A14	Banknock 3	83	83	n/m	0 (22)	0 (24)	1	3
A15	Main St Bainsford	41	41	n/m	n/m	n/m	0 (16)	0 (16)

Notes: Exceedences of the PM_{10} 24-hour mean objective (50µg/m^3 not to be exceeded more than 7 times/year) are shown in **bold.**

(1) data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

(2) data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

(3) If the period of valid data is less than 85%, the 90.4th percentile of 24-hour means is provided in brackets.

Figure 5 – Grangemouth AURN long term PM_{10} concentrations

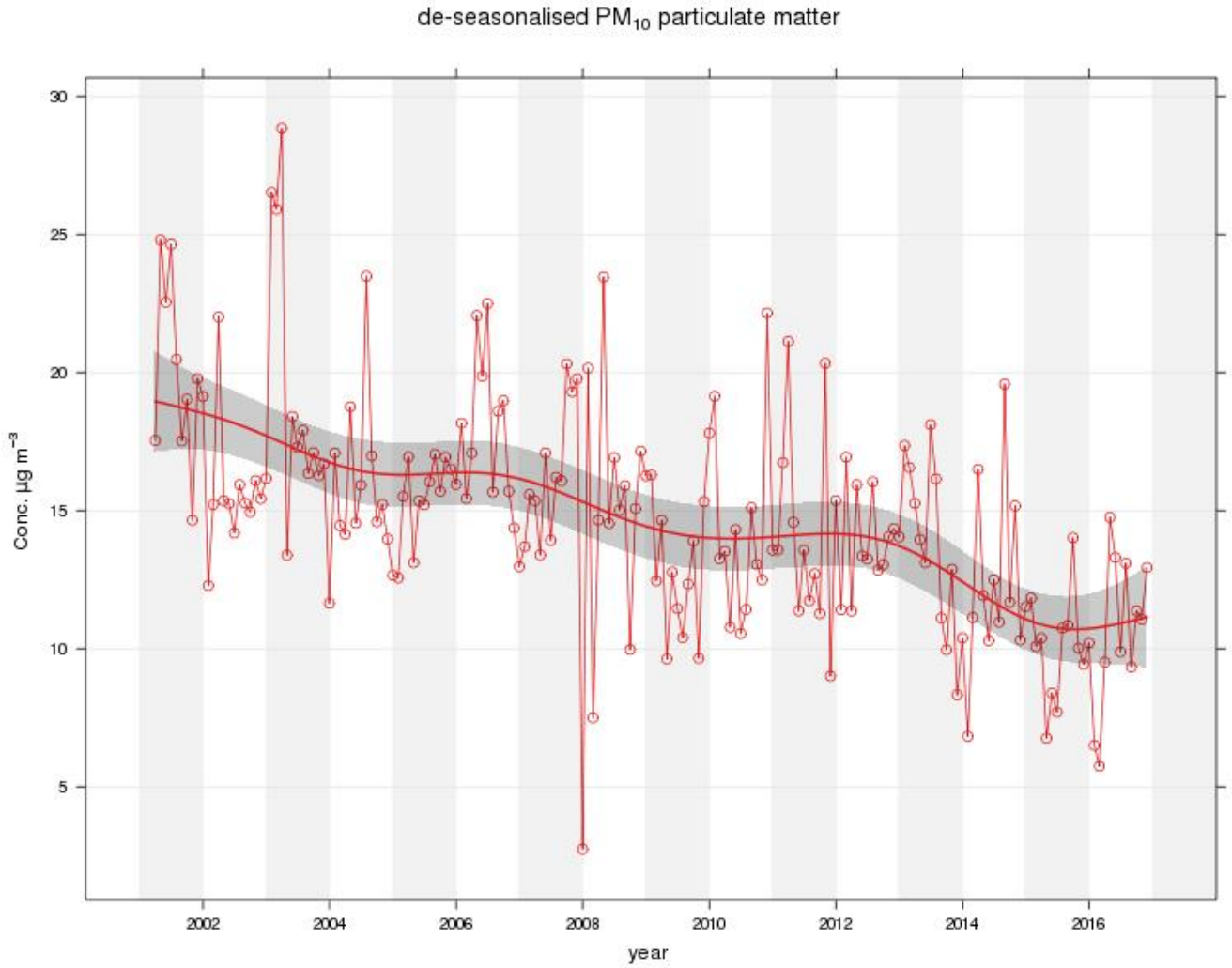


Figure 6 – West Bridge St long term PM_{10} concentrations

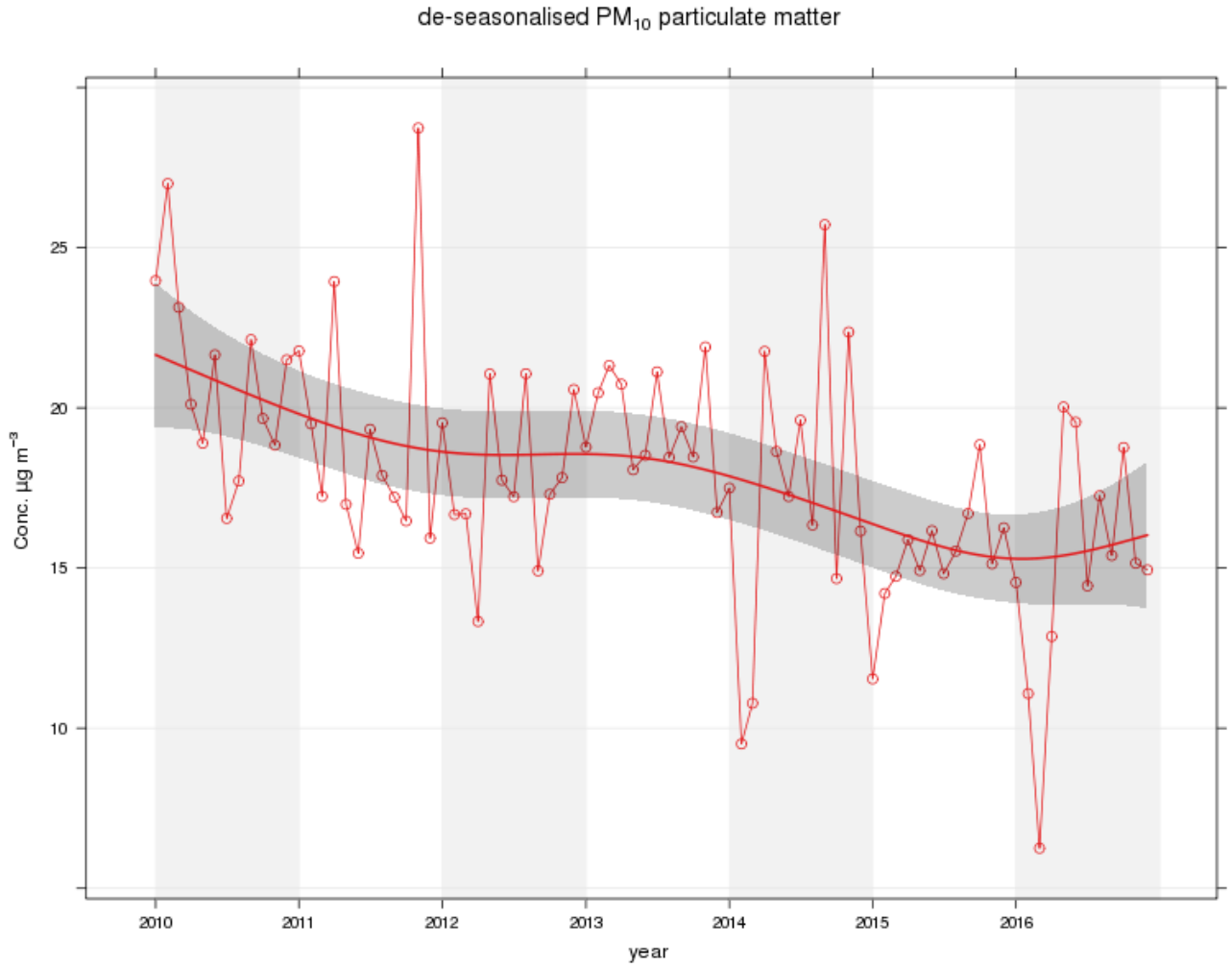


Figure 7– Falkirk Graham's Rd PM_{10} concentrations

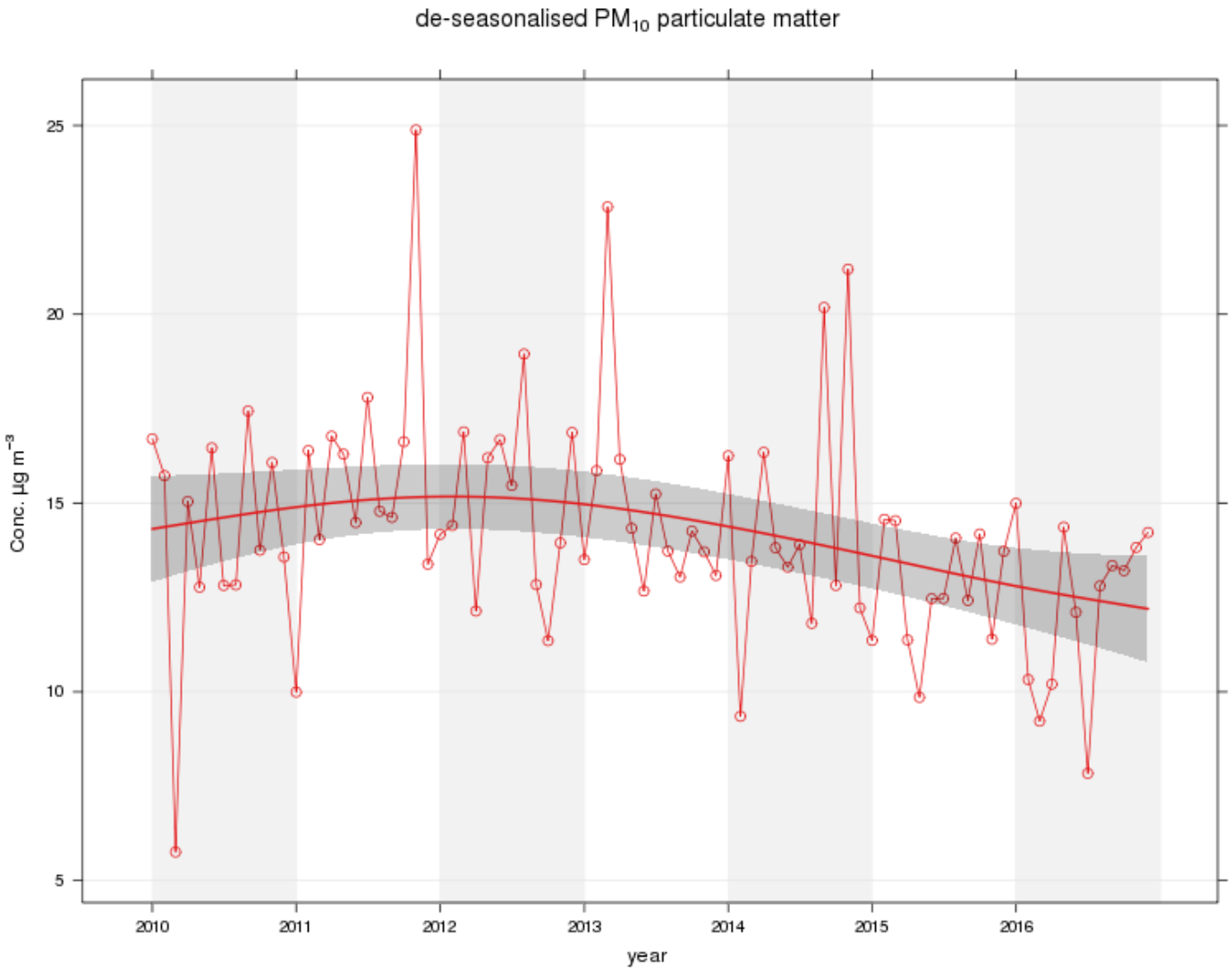


Table A. 7– Annual Mean $PM_{2.5}$ Monitoring Results

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2015 (%) (2)	$PM_{2.5}$ Annual Mean Concentration ($\mu g/m^3$) (3)				
				2012	2013	2014	2015	2016
A7	West Bridge St	98	14	**n/m**	n/m	n/m	n/m	6
A8	Grangemouth AURN	92	92	**10.5**	9.2	8.0	9.2	6
A13	Banknock 3	88	88	n/m	n/m	n/m	6.0	5

Notes: Exceedences of the PM_{10} annual mean objective of $10\mu g/m^3$ are shown in **bold.**

(1) data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

(2) data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

(3) All means have been "annualised" as per LAQM.TG(16), valid data capture for the full calendar year is less than 75%. See Appendix C for details.

Figure 8 – Grangemouth AURN long term $PM_{2.5}$ concentrations

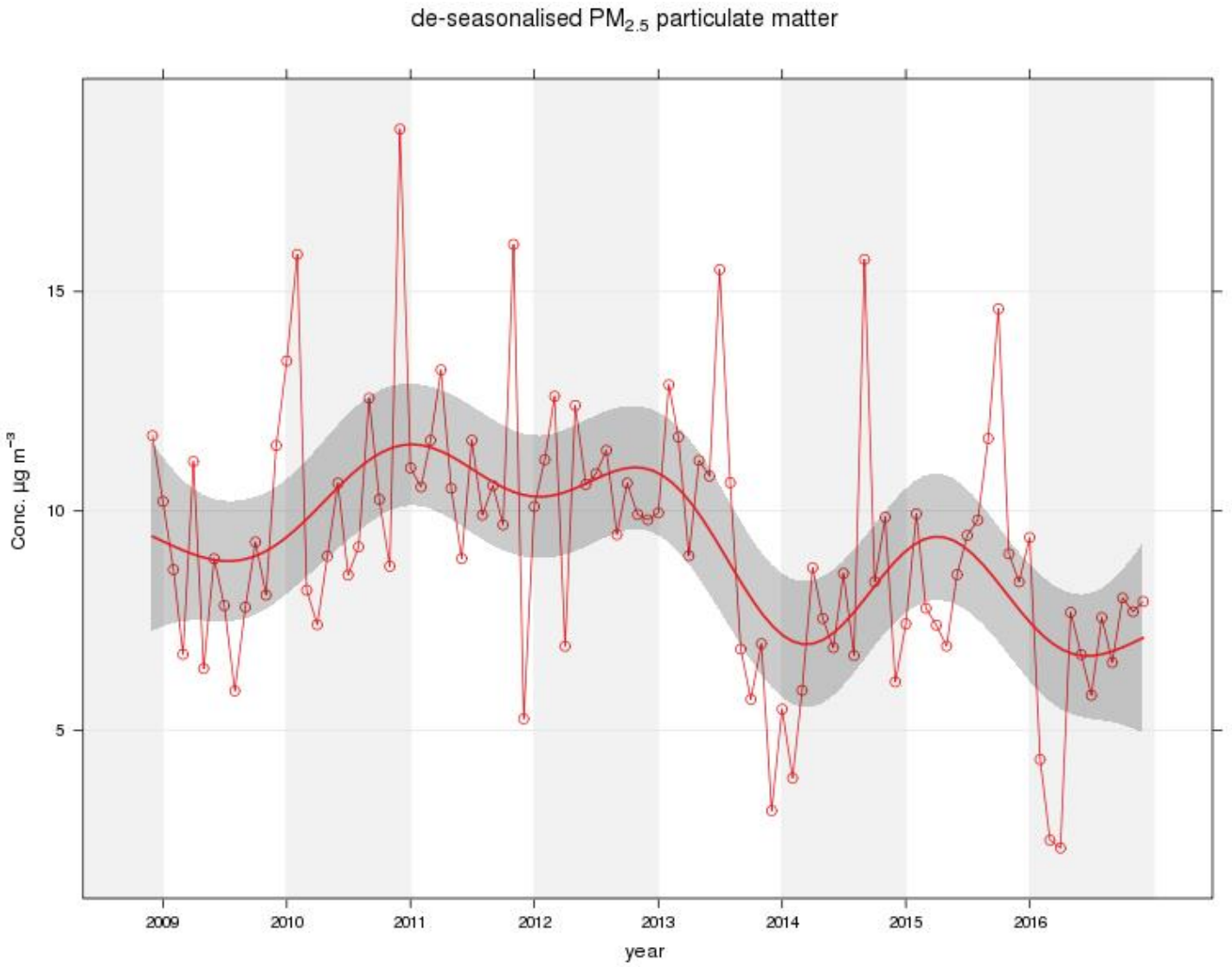


Table A. 8– SO_2 Monitoring Results

Site ID	Site Type	Valid Data Capture for monitoring Period (%) (1)	Valid Data Capture 2016 (%) (2)	Number of Exceedences (percentile in bracket) (3)		
				15-minute Objective (266 µg/m^3)	1-hour Objective (350 µg/m^3)	24-hour Objective (125 µg/m^3)
A3	Bo'ness	67	67	0 (16)	0 (15)	0 (9)
A5	Falkirk Hope St	98	98	2	0	0
A8	Grangemouth AURN	96	96	3	0	0
A9	Grangemouth Moray	96	96	28	1	0
A10	Grangemouth Municipal Chambers	86	86	28	3	1
A11	Grangemouth Zetland Park	99	99	0	0	0

Notes: Exceedences of the SO_2 objectives are shown in **bold** (15-min mean = 35 allowed a year, 1-hour mean = 24 allowed a year, 24-hour mean = 3 allowed a year)

(1) data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

(2) data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%)

(3) If the period of valid data is less than 85%, the relevant percentiles are provided in brackets.

Figure 9 – Grangemouth sites long term SO_2 concentrations

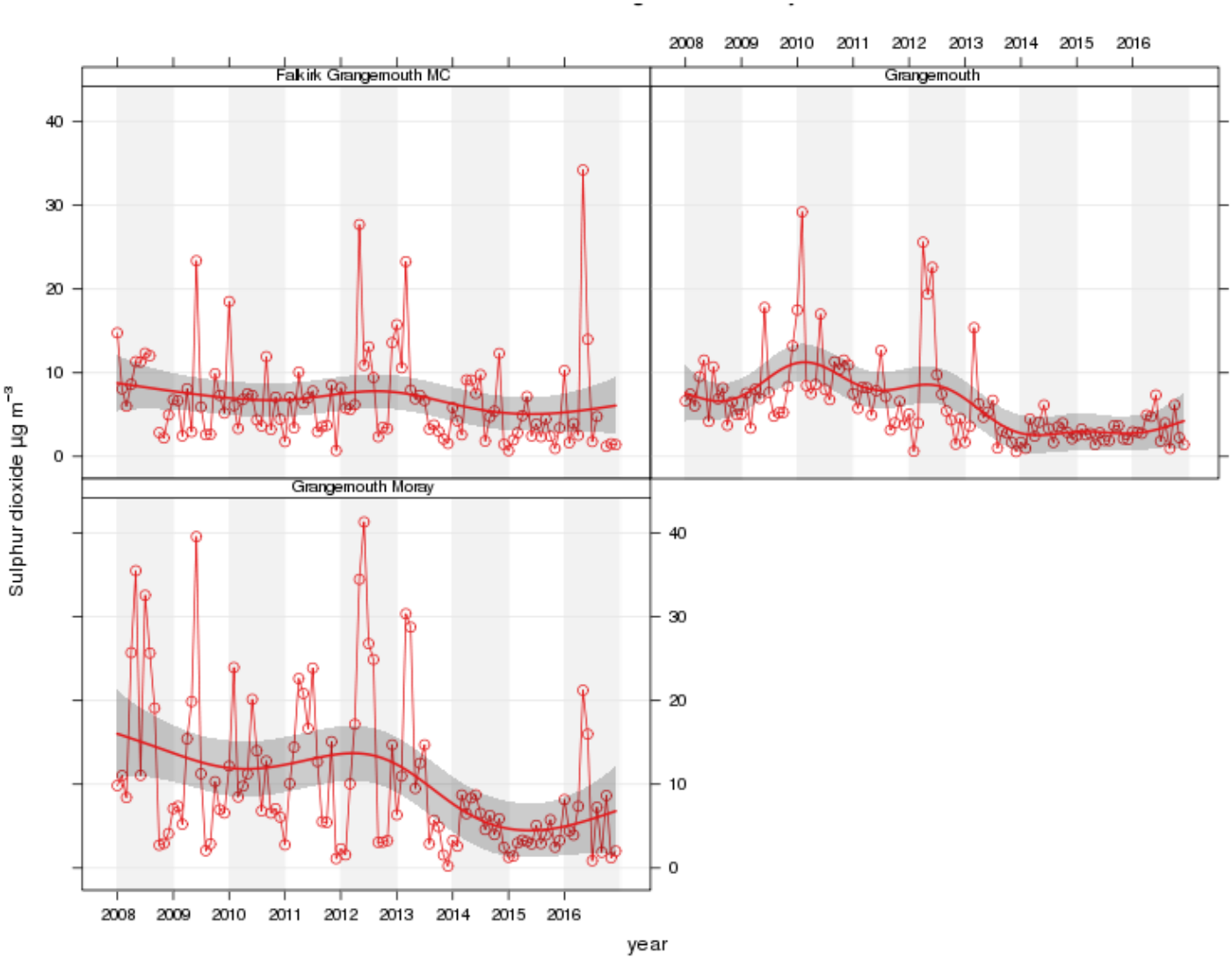
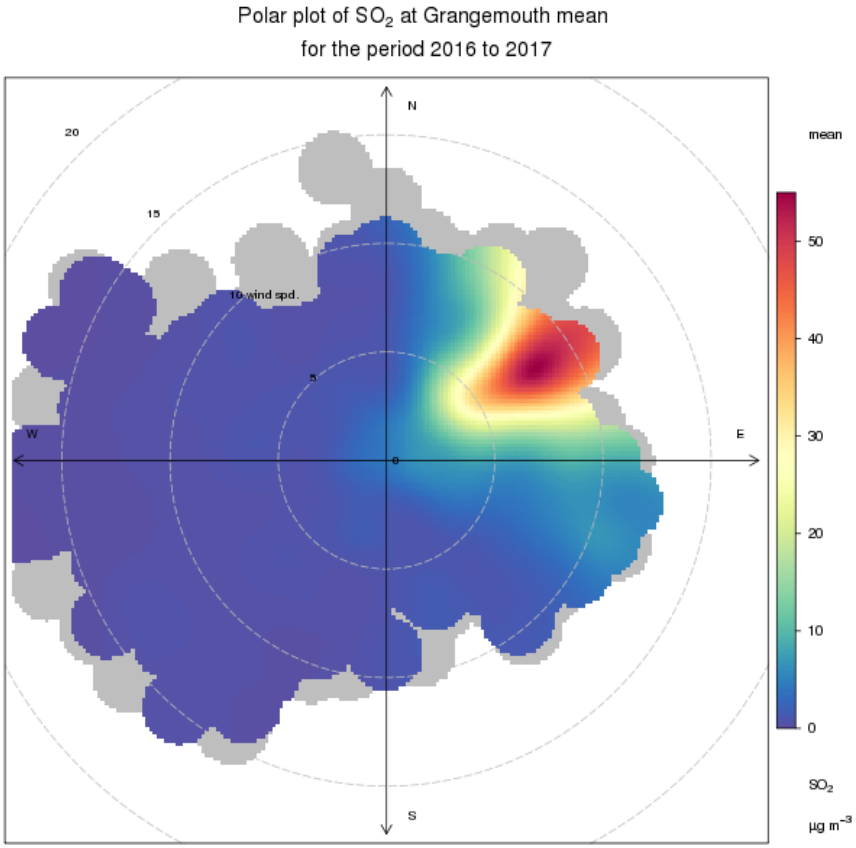
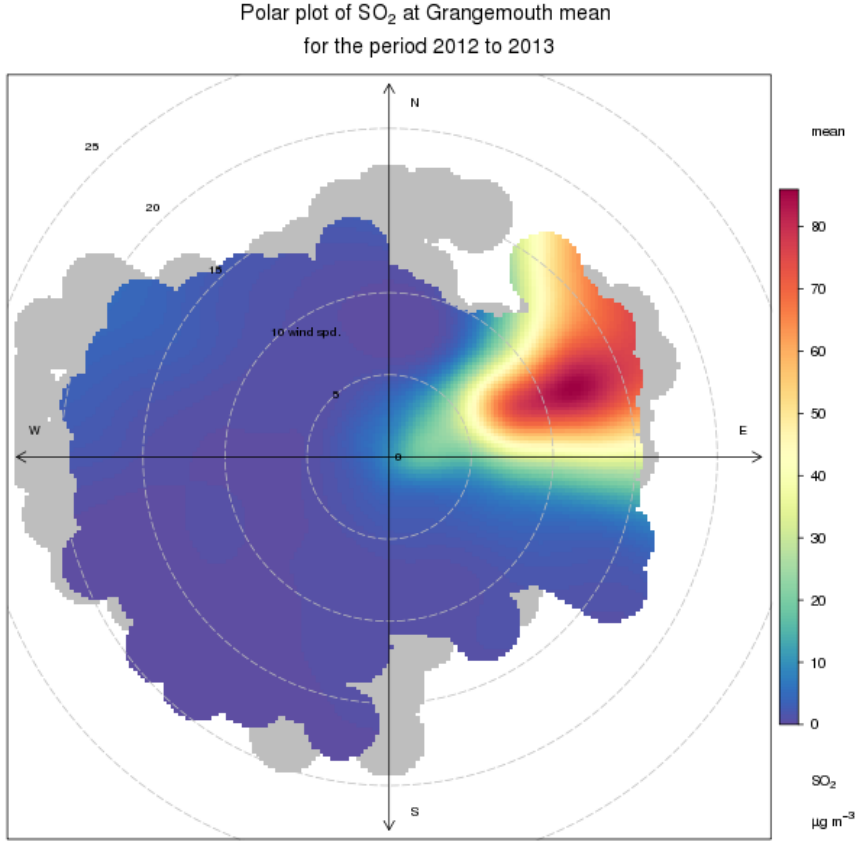


Figure 10 – Polar plots of average SO_2 concentrations Grangemouth sites

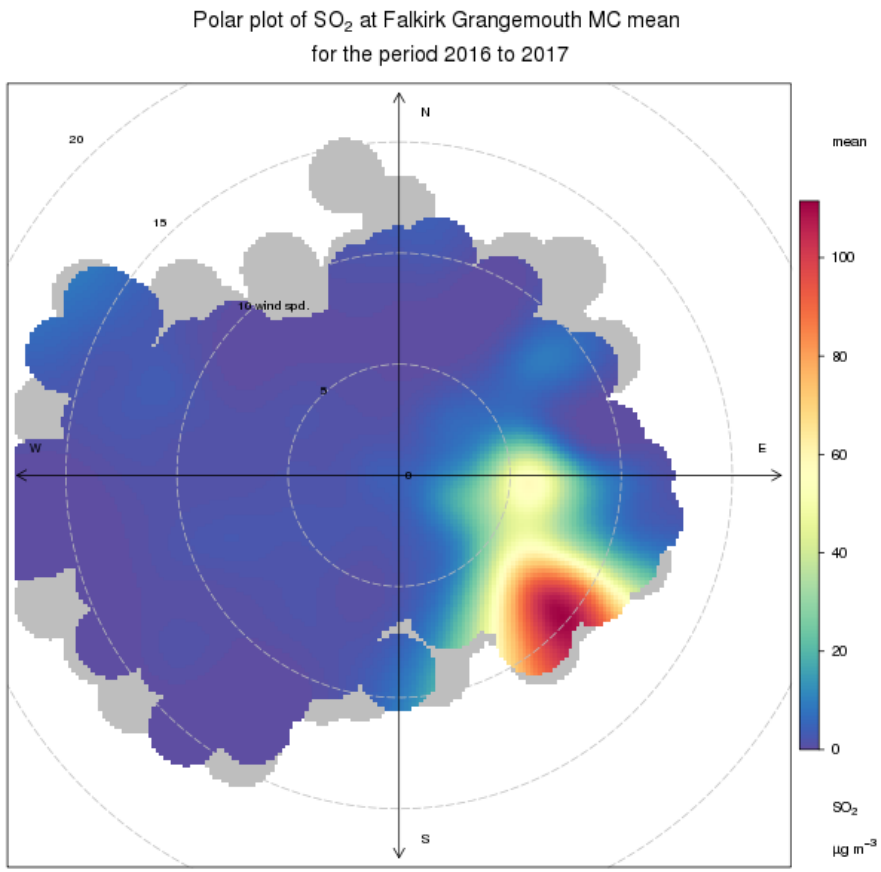
A) Grangemouth AURN 2015



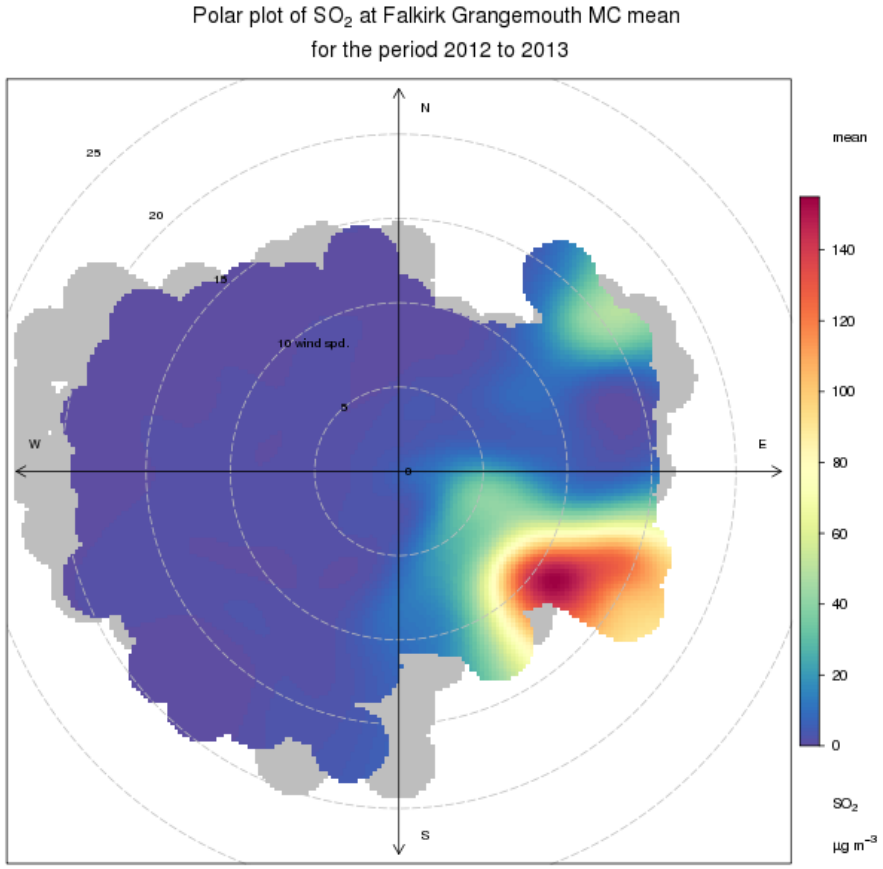
B) Grangemouth AURN 2012



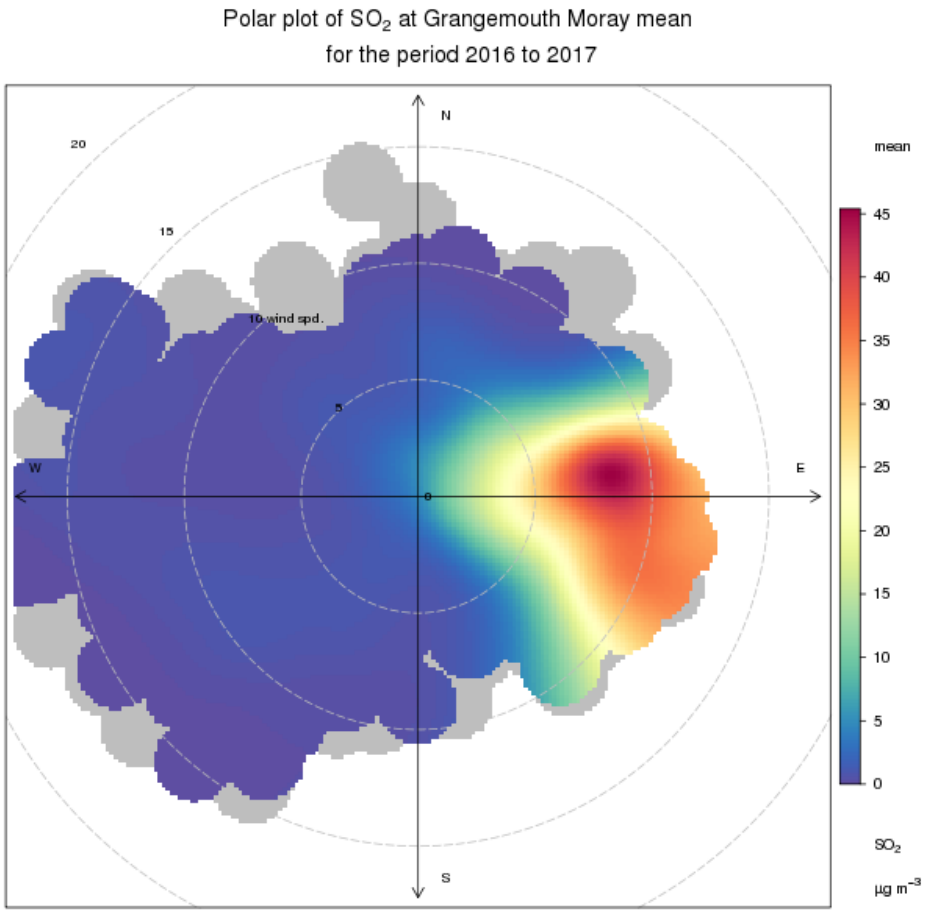
C) Grangemouth MC 2016



D) Grangemouth MC 2012



E) Grangemouth Moray 2016



F) Grangemouth Moray 2012

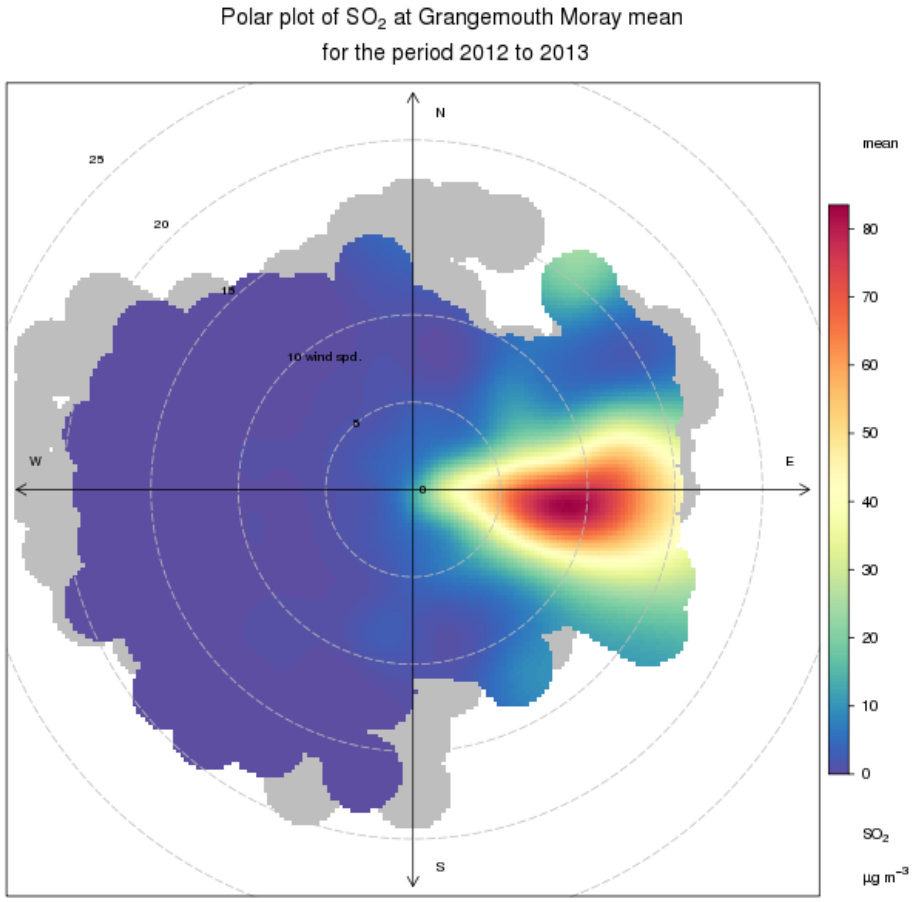


Figure 11 - Polar plots of SO_2 concentrations at Moray by season

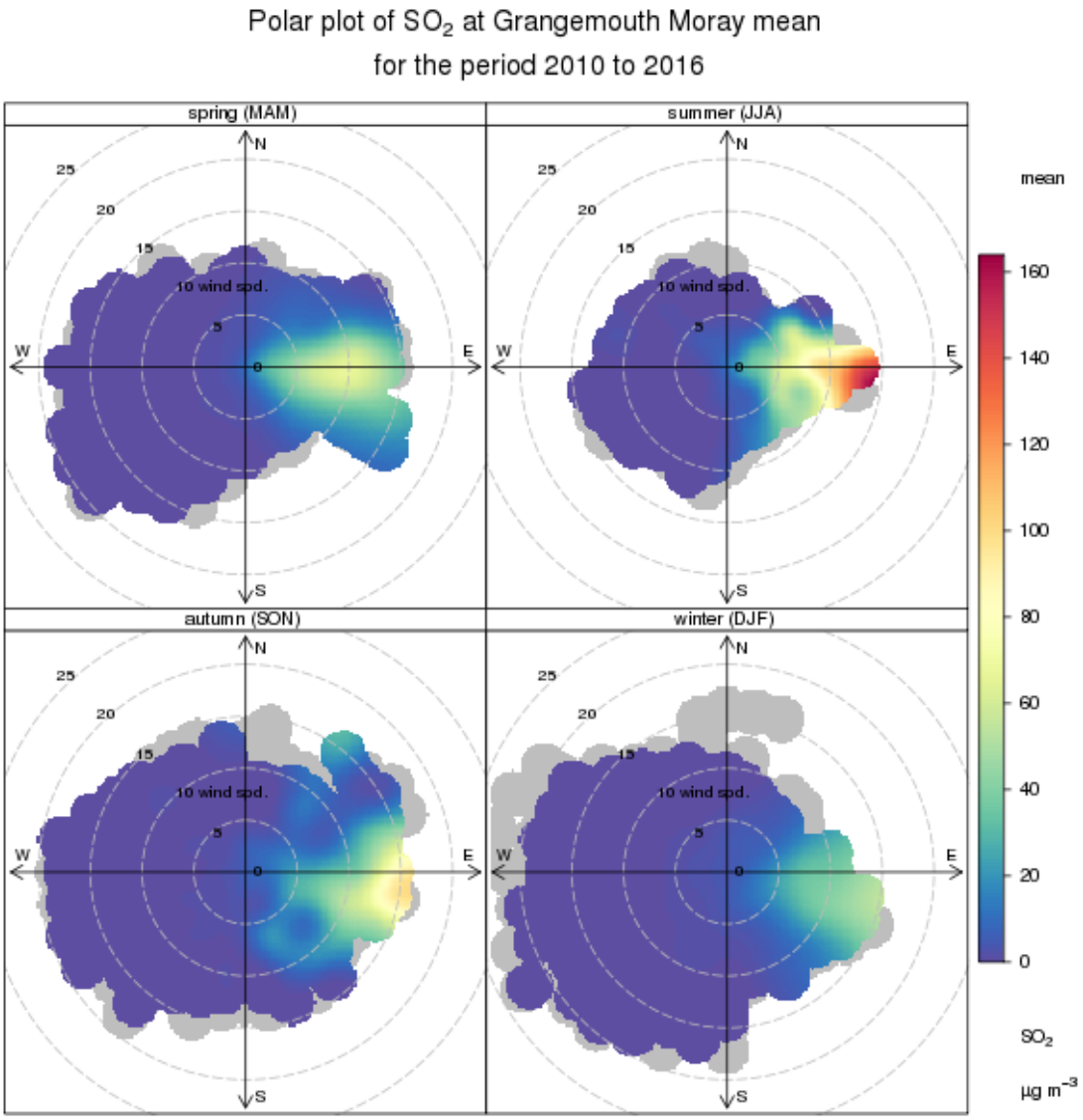


Figure 12: Exceedances of the 15 minute objective concentration at Grangemouth sites 2009 - 2016

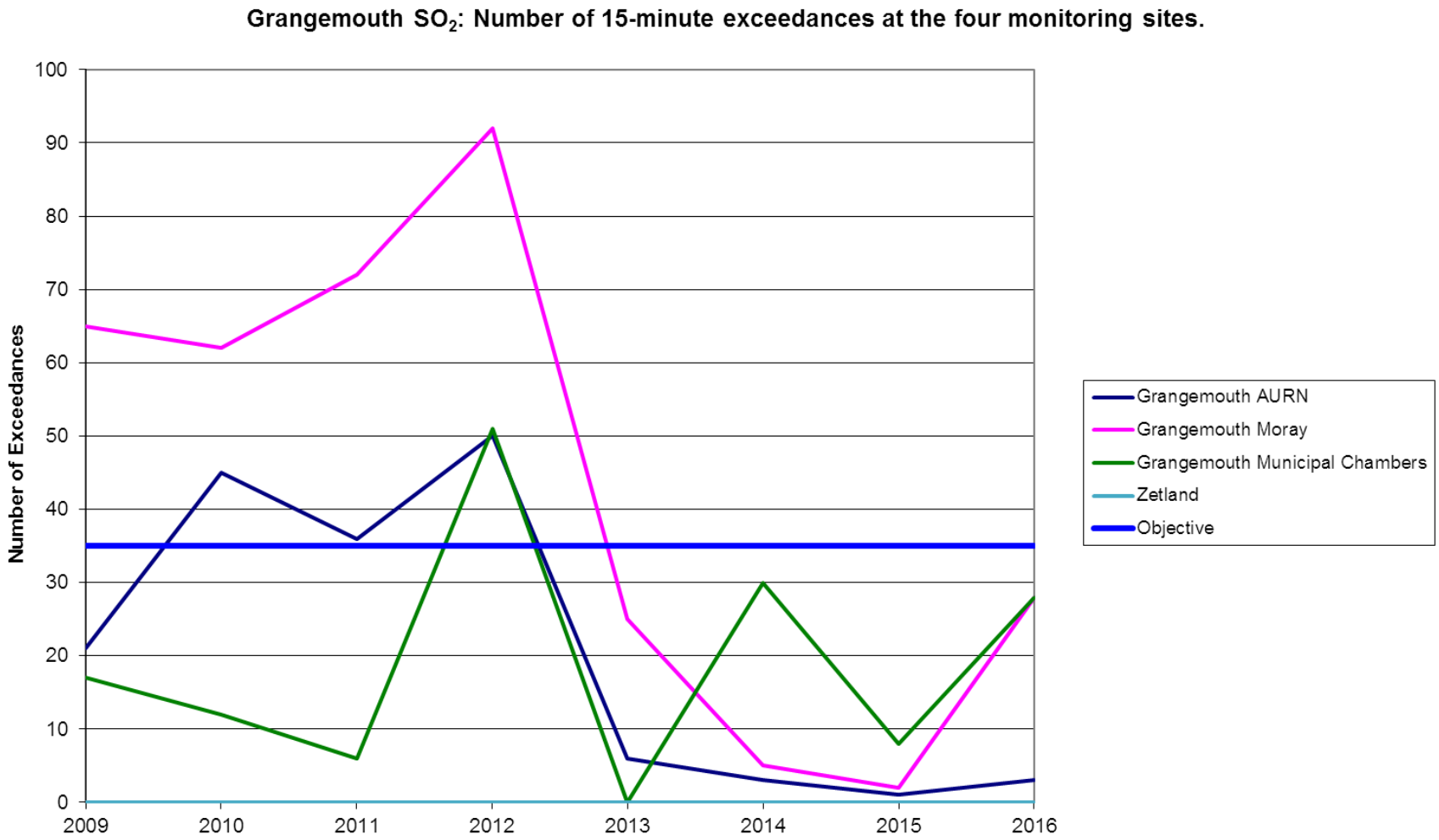


Table A. 9 – 1, 3-Butadiene Annual Mean Diffusion Tube Results for 2016

Site ID	Location	Within 1,3 butadiene AQMA?	Data capture in 2016, %.(1)	Annual mean concentrations (µg/m3)				
				2012	2013	2014	2015	2016
NA41	Seaview Place, Bo'ness	N	100.0	1.19	1.25	0.42	0.11	0.10
NA55	Inchyra Station, Grangemouth	N	100.0	1.19	1.25	0.48	0.09	0.10
NA104	Powdrake Road, Grangemouth	N	100.0	1.19	1.25	0.47	0.13	0.11

Notes: Exceedences of the 1, 3- butadiene running annual mean objective of 2.25µg/m^3 are shown in **bold.**

Table A. 10 – Benzene Annual Mean Diffusion Tube Results for 2016

Site	Location	Within benzene AQMA?	Data capture, 2016, %.	Annual mean concentration, µg/m^3				
				2012	2013	2014	2015	2016
NA3	Tinto Drive,Grangemouth	N	91.7	1.23	1.39	1.3	1.16	0.51
NA21	Grangemouth Road, College	N	91.7	1.91	1.25	1.13	0.72	0.46
NA27	West Bridge Street, Falkirk	N	91.7	2.09	1.52	2.39	0.69	0.78
NA37	Denny Town House	N	91.7	1.38	1.16	1.09	0.59	0.58
NA38	Larbert Village Primary School	N	100.0	1.37	0.85	1.04	0.55	0.51
NA41	Seaview Place, Bo'ness	N	100.0	2.14	1.84	1.97	0.91	1.11
NA42	Municipal Chambers, Grangemouth	N	100.0	1.62	1.59	1.25	0.69	0.79
NA44	Greenpark Drive, Polmont	N	83.3	1.49	1.16	1.34	0.56	0.48
NA55	Inchyra Station	N	100.0	**3.29**	1.38	1.32	0.5	0.46
NA57	Inchyra Road, Grangemouth	N	100.0	2.39	1.33	1.96	0.69	0.90
NA77	Kinnaird Village	N	91.7	1.32	1.12	1.04	0.65	0.44
NA80	Cow Wynd, Falkirk	N	100.0	1.75	1.53	1.33	0.81	0.56
NA81	Grahams Road, Falkirk	N	100.0	1.37	1.47	1.25	0.88	0.95
NA94	A905 (Glensburgh Rd), Grangemouth	N	91.7	1.67	1.71	1.13	0.68	0.78
NA102	East Kerse Mains, Bo'ness	N	91.7	1.76	1.35	1.26	0.61	0.49
NA105	West of Shieldhill	N	100.0	1.26	0.69	0.74	0.34	0.19

Notes: Exceedences of the benzene running annual mean objective of 3.25µg/m^3 are shown in **bold**

Table A. 11 – Pumped Benzene Annual Mean Results for 2016

Site	Location	Within benzene AQMA?	Data capture, 2016, %.	Annual mean concentration, µg/m^3				
				2012	2013	2014	2015	2016
A8	Grangemouth AURN	N	100	1.97	1.13	0.99	0.73	0.64

Notes: Exceedences of the benzene running annual mean objective of 3.25µg/m^3 are shown in **bold.**

Table A. 12 – Estimated Annual Mean $PM_{2.5}$ Results 2016

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2016 (%) (2)	Correction Factor	Estimated PM2.5 Annual Mean Concentration (µg/m3) (3)				
					2012	2013	2014	2015	2016
A4 Falkirk Haggs	Roadside	96	96	0.54	9.88	8.91	8.91	8.1	7.63
A7 Falkirk West Bridge St	Roadside	98	98	0.54	9.61	**10.5**	9.55	8.1	8.18
A10 Grangemouth Municipal Chambers	Urban Background/ Industrial	90	90	0.75	**11.02**	**11.25**	**10.95**	9.75	9.80
A12 Falkirk Graham's Road	Roadside	95	95	0.54	8.64	8.80	7.12	6.37	7.09
A15 Main St Bainsford	Roadside	41	41	0.54	n/m	n/m	n/m	6.91	5.45

Notes: Exceedences of the $PM_{2.5}$ annual mean objective of 10µg/m^3 are shown in **bold.**

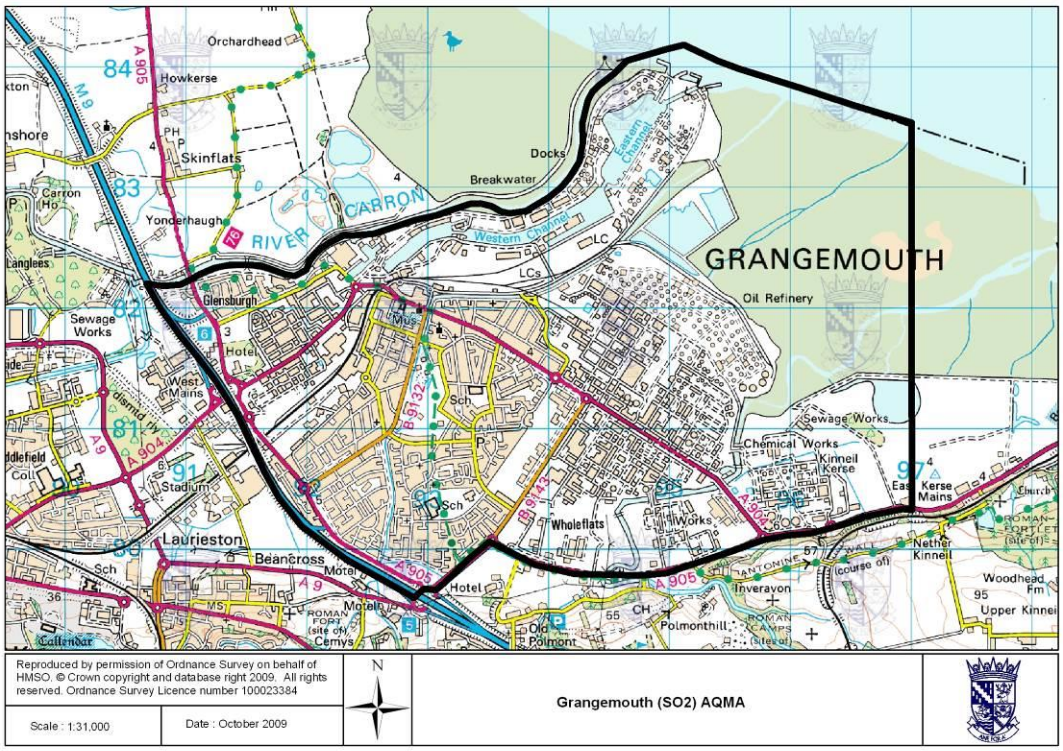
(1) data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

(2) data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

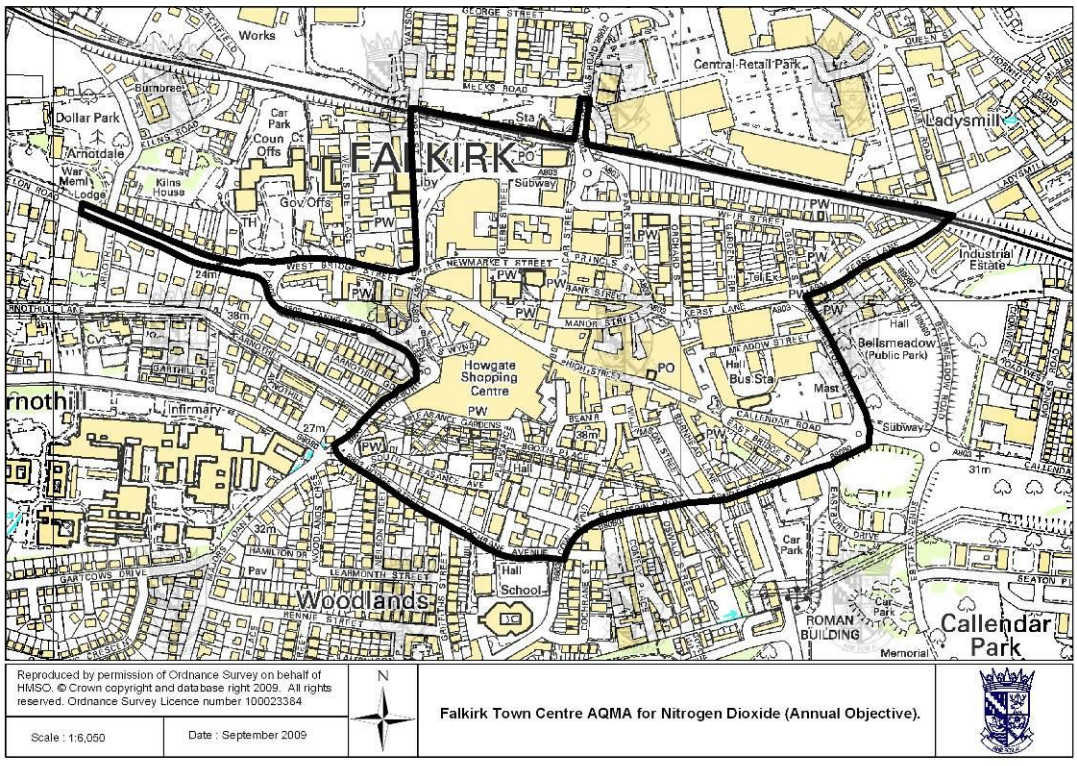
(3) All means have been estimated using a local correction factor as per LAQM.TG(16),See Appendix C for details.

Figure 13– Maps of AQMA Boundaries in the Falkirk Council area.

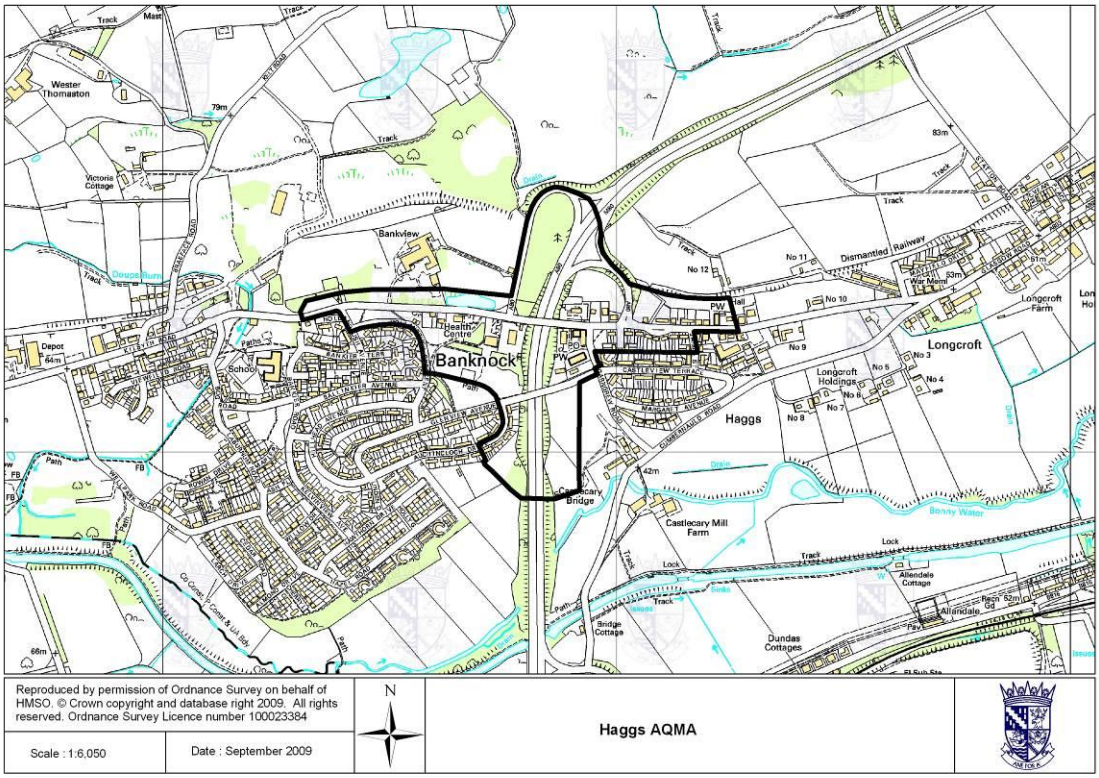
a) Grangemouth AQMA (15-minute SO_2), declared November 2005.



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.

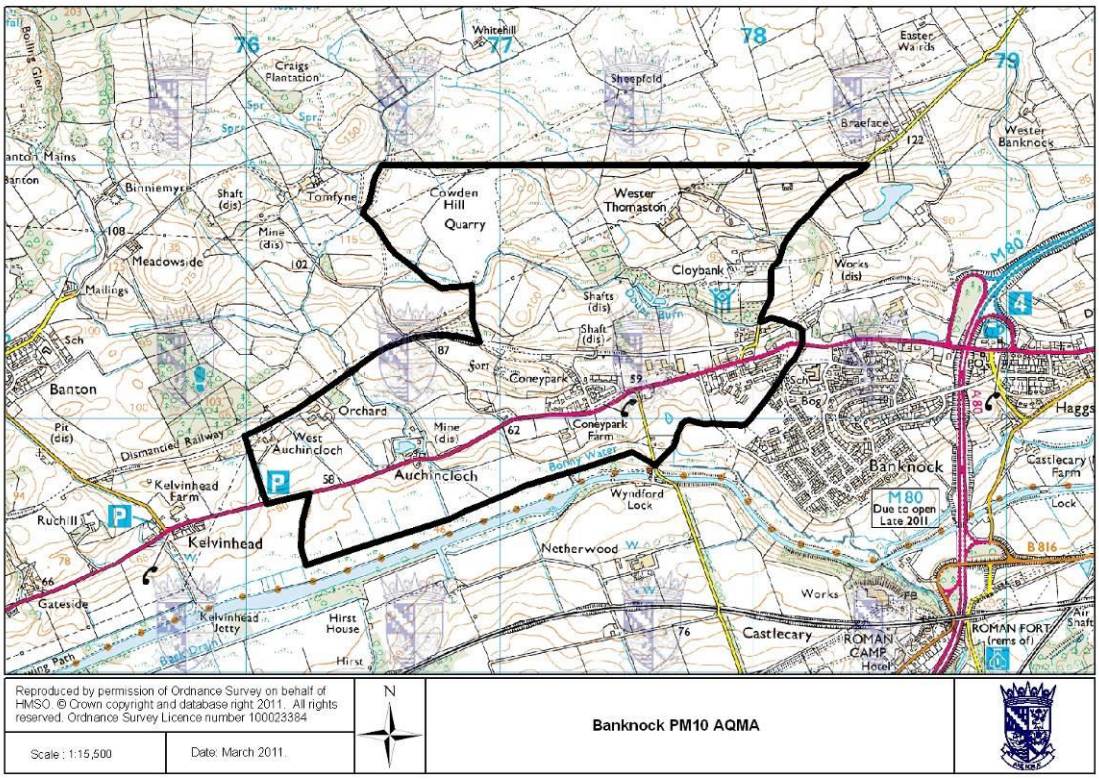
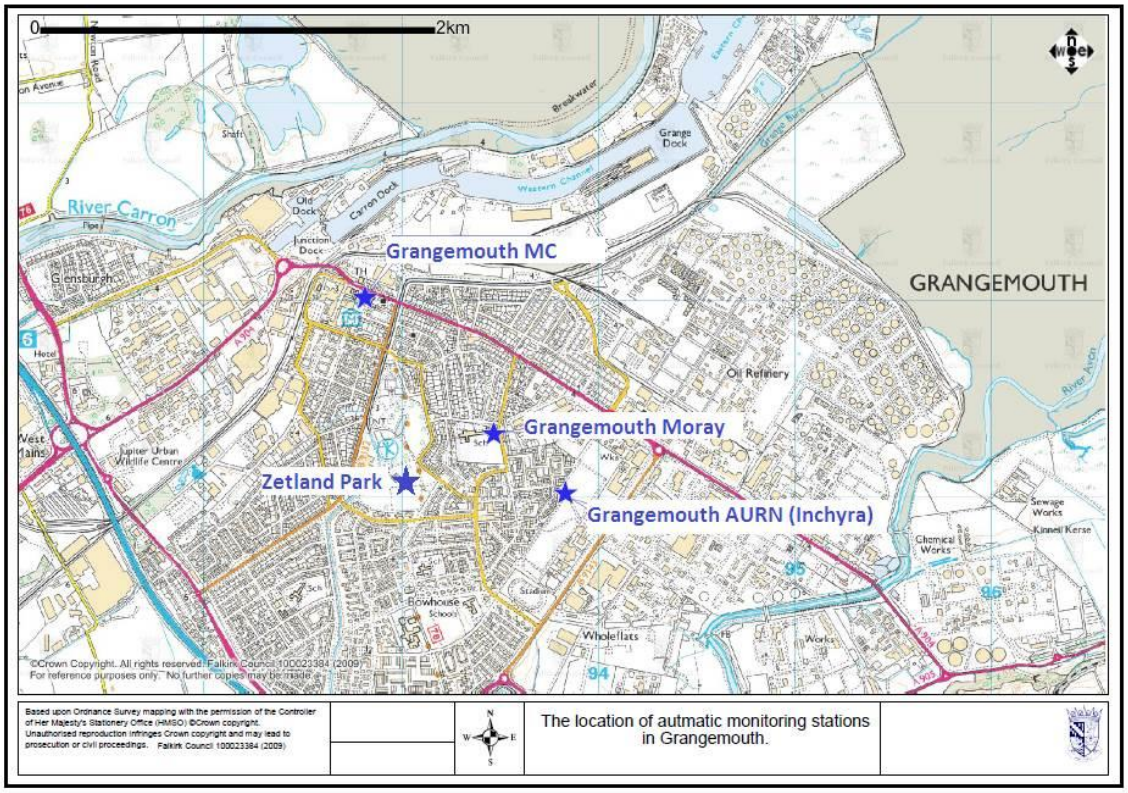
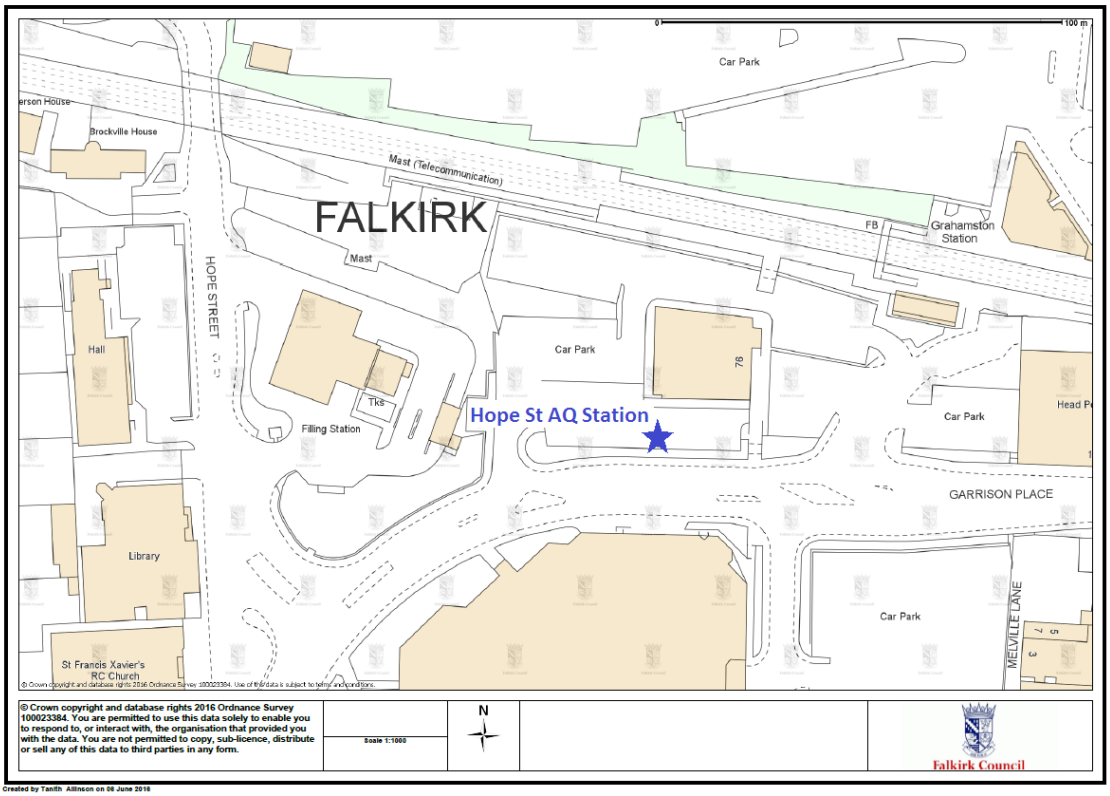


Figure 14 – Maps Showing Automatic Monitoring Locations

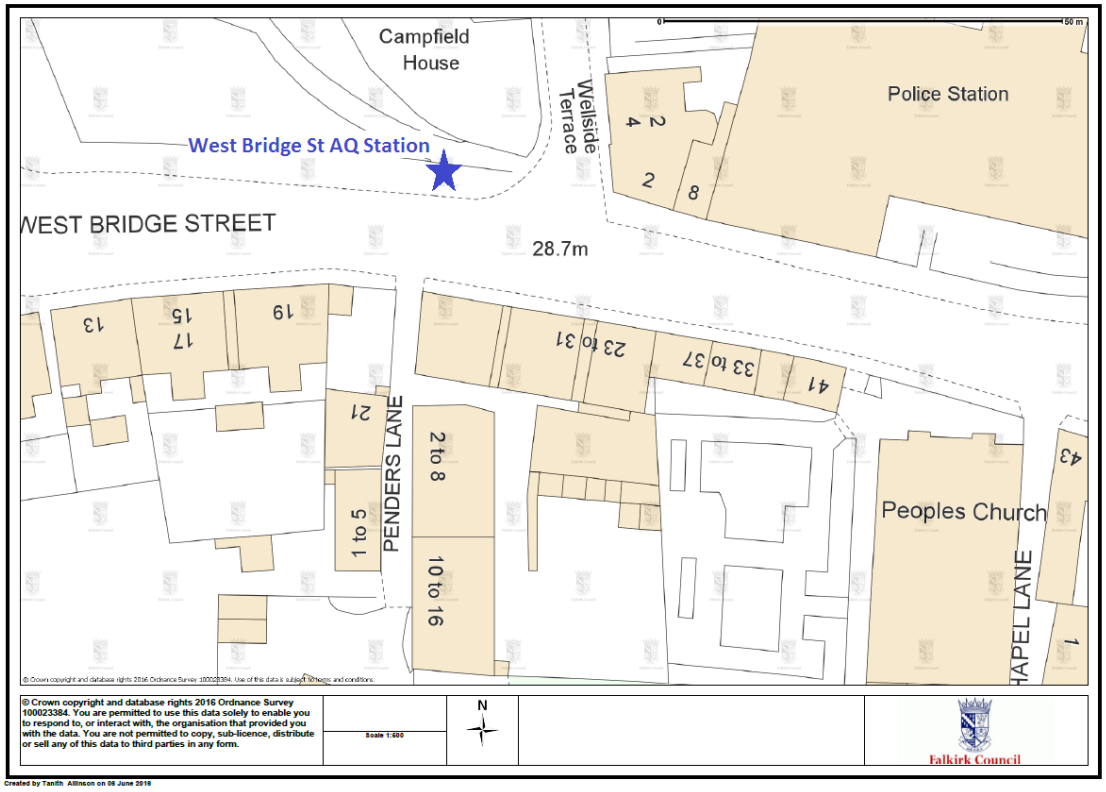
a) Grangemouth AQ Stations



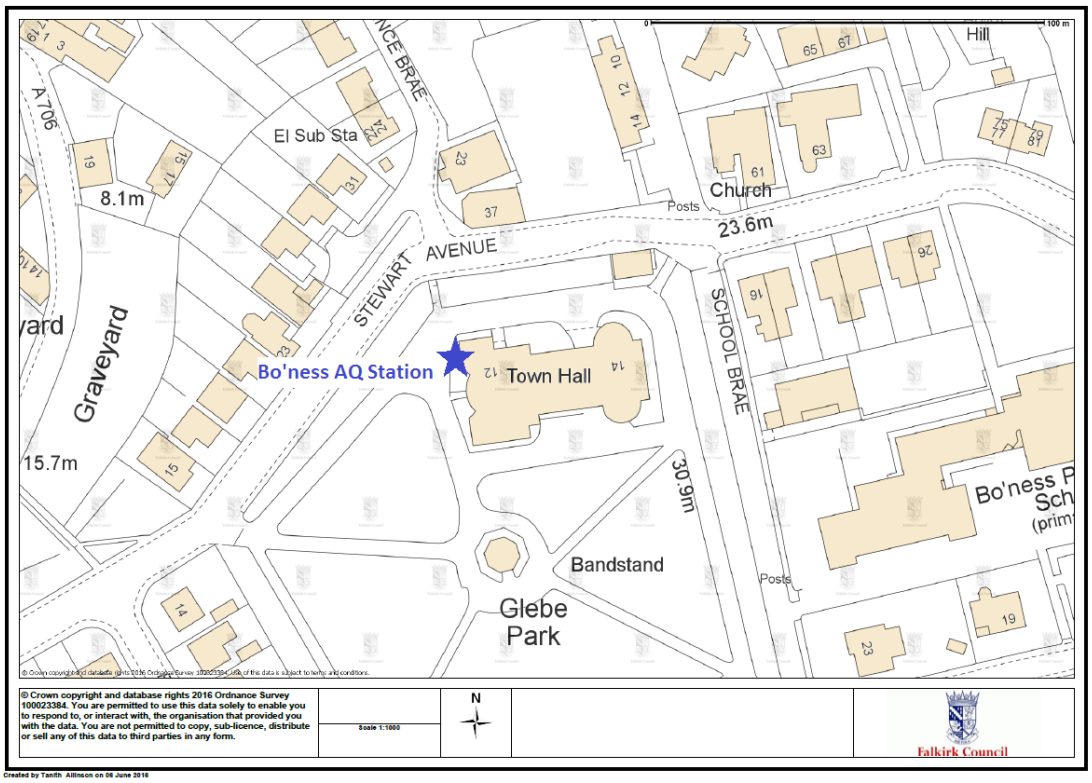
b) Falkirk Hope St AQ Station



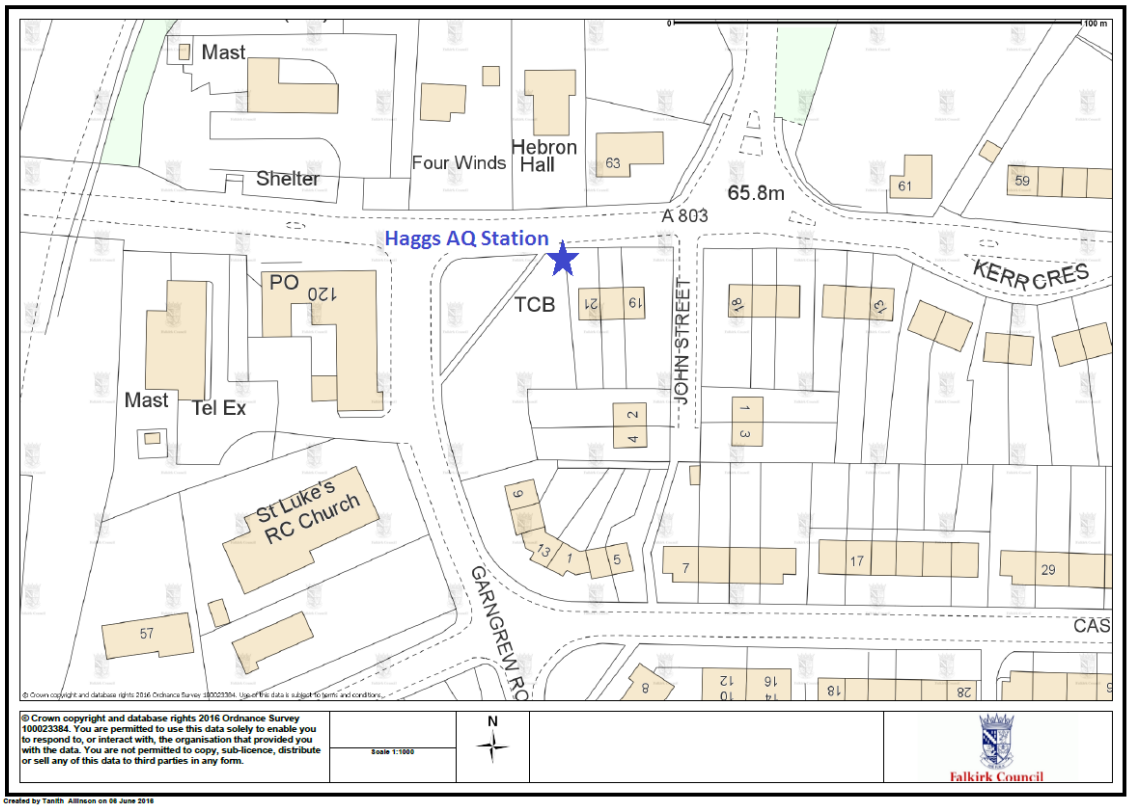
c) Falkirk West Bridge St AQ Station



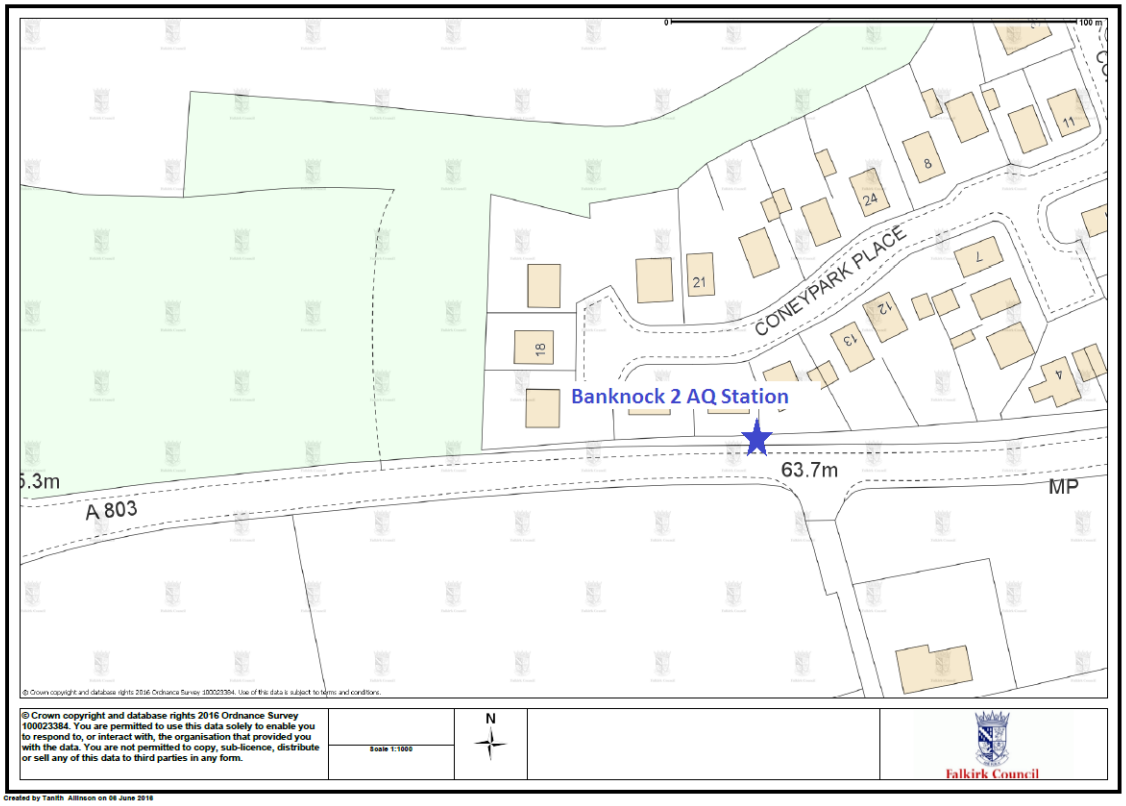
d) Bo'ness AQ Station



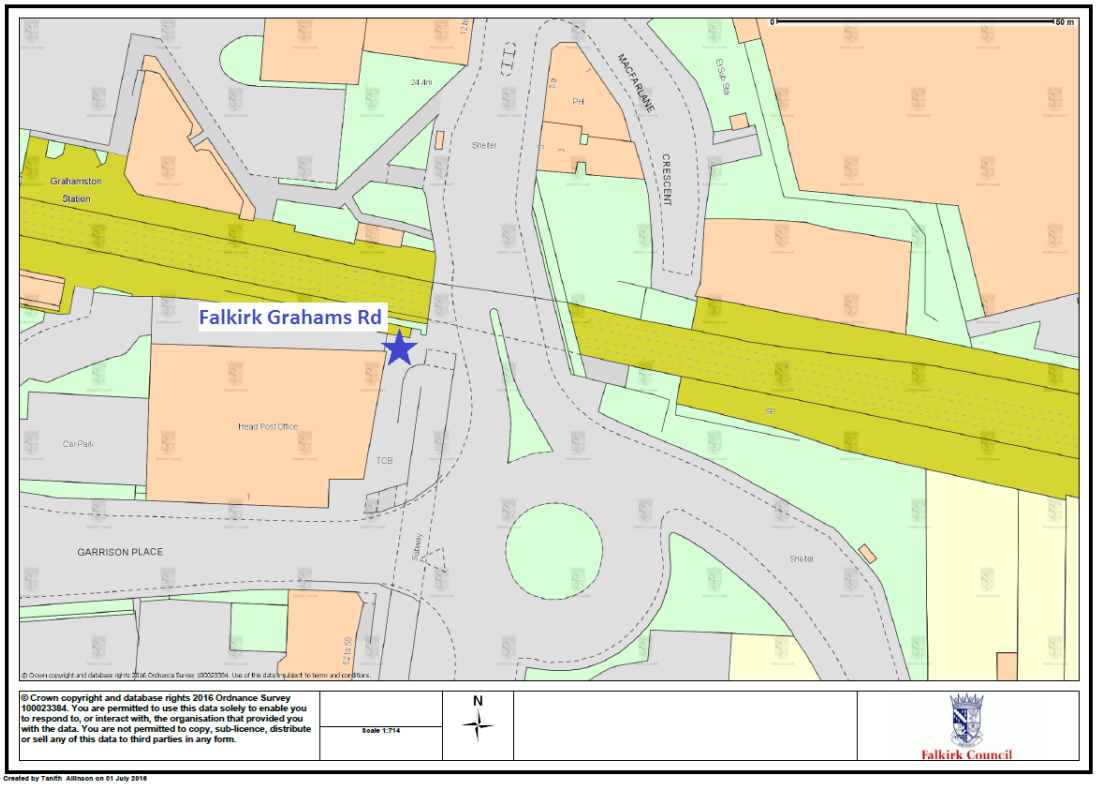
e) Falkirk Haggs AQ Station



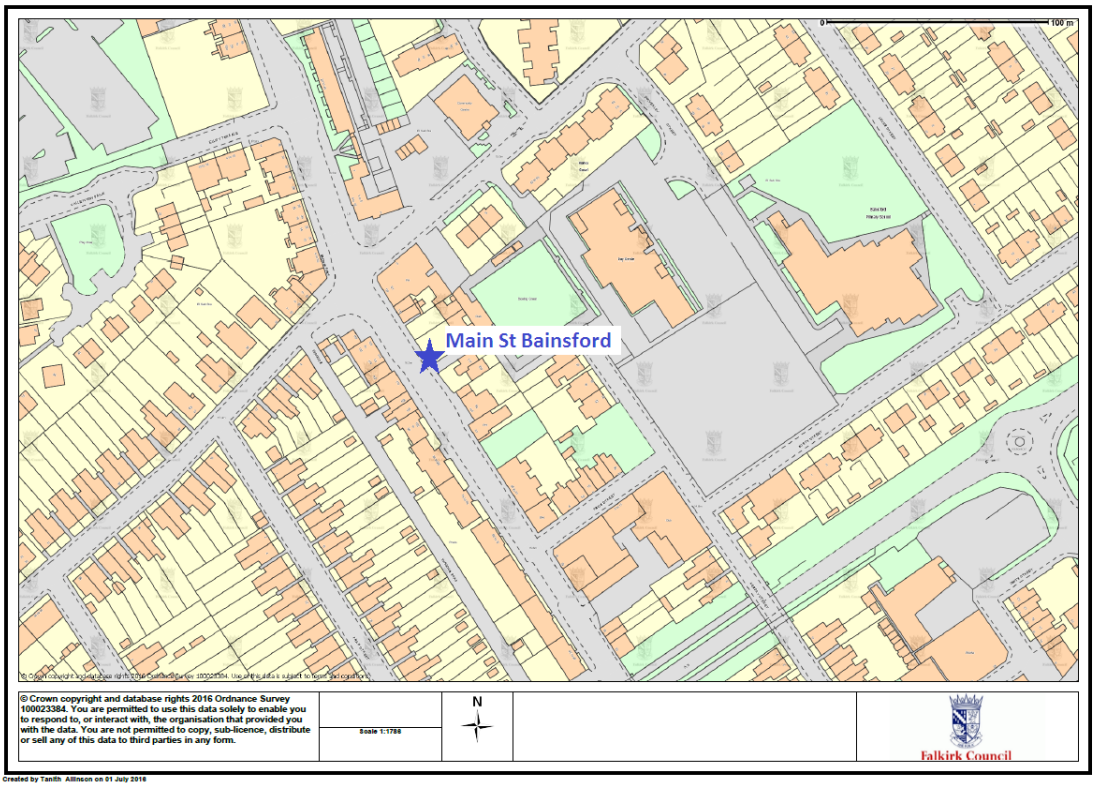
f) Banknock 2 AQ Station



g) Falkirk Grahams Rd AQ Station



h) Main St Bainsford



Appendix B: Full Monthly Diffusion Tube Results for 2016

Table B.1 – NO_2 Monthly Diffusion Tube Results for 2016

Site ID	NO_2 Mean Concentrations ($\mu g/m^3$)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean	
													Raw Data	Bias Adjusted (1)
3	24.43	19.60	16.19	16.49	13.76	15.36	11.50	12.96	15.98	20.64	31.91	26.30	**19**	**19**
5	31.54	26.33	20.19	18.67	20.82	20.83	17.72	21.80	22.30	28.65	34.90	30.98	**25**	**25**
7	19.32	19.94	13.12	12.30	12.82	12.66	9.60	12.66	12.90	21.53	24.30	--	**16**	**16**
9	28.89	27.98	25.47	19.19	17.02	18.24	17.20	19.25	20.79	24.22	36.71	35.50	**25**	**25**
19	34.15	31.26	30.91	32.47	30.60	35.31	17.45	-	25.90	37.13	39.14	34.05	**32**	**33**
20	28.16	27.97	21.92	18.52	16.22	-	16.37	15.93	18.77	23.74	31.44	30.10	**23**	**24**
21	28.07	30.97	19.38	20.56	27.08	28.08	22.10	22.19	26.51	30.58	35.67	-	**27**	**28**
24	-	36.78	38.27	30.51	26.30	28.87	33.75	30.92	33.99	33.97	47.17	-	**34**	**35**
26	23.35	19.64	11.48	14.06	13.84	15.34	9.84	14.40	16.56	21.90	26.52	22.31	**18**	**18**
27	44.74	41.56	40.03	42.47	41.30	49.09	27.13	38.60	-	61.05	68.00	58.36	**47**	**48**
29	21.12	19.44	15.34	12.73	13.92	15.76	8.25	11.78	11.46	21.10	23.51	-	**16**	**17**
36	40.20	45.01	33.89	30.95	31.66	35.96	30.63	30.61	26.69	38.85	45.65	44.20	**37**	**38**
37	19.77	18.70	14.06	12.50	14.47	15.79	10.52	11.38	-	20.15	22.48	21.52	**17**	**17**
38	19.81	20.10	15.50	10.80	13.34	12.50	9.41	11.23	13.14	18.35	26.76	22.35	**17**	**17**
41	21.31	20.08	15.89	20.02	16.81	17.84	-	16.74	18.59	21.93	29.89	26.26	**21**	**21**
42	23.21	22.34	18.42	15.02	18.57	16.36	11.12	13.45	14.85	21.54	29.55	22.86	**19**	**20**
44	-	16.53	13.47	12.35	9.19	10.33	8.08	9.21	11.85	15.03	-	-	**12**	**12**
48	22.48	21.06	16.73	14.16	15.46	18.58	10.99	13.33	13.41	22.68	27.07	22.92	**19**	**19**
50	24.84	21.54	20.56	23.56	24.79	28.66	12.89	19.19	19.68	31.72	29.52	22.09	**23**	**24**
51	28.89	24.84	23.03	21.33	17.38	18.18	18.37	18.04	25.13	24.26	33.24	32.15	**24**	**25**
52	28.65	26.94	24.77	18.65	18.92	19.96	15.77	15.85	20.51	24.86	33.88	31.02	**24**	**24**
53	30.38	28.95	26.20	26.13	31.72	34.21	15.91	19.92	22.41	33.94	33.66	28.37	**28**	**29**
57	31.45	21.68	20.15	19.41	17.04	17.33	14.85	15.69	21.11	21.70	33.05	35.02	**23**	**23**
58	29.26	21.76	20.80	16.53	13.65	16.79	11.56	15.39	16.24	22.98	28.05	-	**20**	**20**

Site ID	NO_2 Mean Concentrations (µg/m^3)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean	
													Raw Data	Bias Adjusted (1)
59	33.58	29.01	29.04	25.97	23.30	23.57	21.07	21.93	23.28	-	-	-	**26**	**26**
60	30.27	28.88	22.71	18.57	21.71	21.47	16.06	19.38	22.98	27.61	37.63	29.88	**25**	**26**
61	29.31	25.47	21.98	18.60	19.00	20.73	15.54	17.39	20.40	27.83	34.42	29.24	**24**	**24**
62	42.45	41.24	38.52	31.13	33.57	31.10	28.78	31.22	35.31	39.68	47.12	43.63	**38**	**39**
63	45.69	39.55	32.35	28.71	30.64	30.48	25.45	29.41	30.78	38.94	46.09	40.36	**35**	**36**
64	23.94	17.82	15.69	14.56	15.17	17.56	8.75	10.44	14.76	22.52	23.07	21.82	**17**	**18**
65	34.59	26.55	20.24	18.14	16.05	23.12	17.52	20.83	22.23	30.32	35.97	30.77	**25**	**26**
67	29.99	31.46	27.20	26.61	23.14	22.74	19.10	23.65	24.19	29.46	37.29	38.79	**28**	**29**
68	34.06	32.94	31.97	24.25	24.07	18.50	27.13	27.28	27.75	25.93	44.25	35.39	**30**	**31**
69	-	35.01	31.24	35.16	29.64	39.35	21.62	30.18	30.43	40.31	36.50	36.22	**33**	**34**
71	37.43	38.72	32.52	25.94	24.03	25.20	25.31	25.89	-	32.80	45.71	41.26	**33**	**34**
72	31.92	30.76	26.55	24.31	26.07	29.37	18.99	22.45	26.87	33.85	35.42	-	**28**	**29**
73	35.88	33.32	25.96	24.67	31.28	30.94	19.88	22.81	28.77	34.64	39.71	33.88	**31**	**32**
76	27.34	29.92	20.44	14.32	17.30	13.39	14.39	14.40	17.60	18.94	32.81	27.84	**21**	**22**
77	26.06	28.24	22.98	16.03	16.09	16.65	14.86	16.97	17.93	23.65	34.79	-	**22**	**22**
78	28.17	31.78	-	26.77	29.20	26.22	29.05	-	32.25	35.94	40.09	36.62	**32**	**33**
80	33.32	36.94	28.94	22.70	23.98	21.67	25.70	24.08	30.36	28.24	41.87	41.18	**31**	**31**
81	34.15	25.14	25.61	26.13	23.04	26.82	17.53	22.20	26.49	30.37	-	33.17	**26**	**27**
82	24.99	23.60	16.10	11.86	12.56	15.19	10.34	12.42	17.56	20.31	27.71	22.65	**18**	**19**
83	41.34	47.44	36.05	31.17	30.61	-	27.87	27.89	-	33.80	47.56	42.69	**37**	**38**
85	24.33	21.09	18.22	17.71	16.71		10.25	14.67	16.13	30.16	24.96	23.79	**20**	**21**
86	20.10	14.14	12.70	12.63	10.55	12.48	8.61	11.60	12.78	17.44	24.94	21.31	**15**	**16**
87	29.25	30.86	28.29	23.78	-	-	25.51	26.67	30.59	31.39	37.91	35.57	**31**	**32**
88	32.82	34.96	25.44	26.98	23.49	23.18	22.48	25.47	22.47	29.93	41.44	35.40	**29**	**30**
89	31.22	31.44	27.92	25.17	22.97	24.23	22.76	24.45	27.12	32.23	39.93	35.61	**29**	**30**
94	-	31.86	16.10	25.61	29.79	24.41	23.18	23.74	36.45	34.38	46.70	44.46	**31**	**32**
98	23.29	22.14	19.64	17.50	18.44	-	11.30	15.47	-	26.17	21.63	23.20	**20**	**21**
99	24.11	31.19	28.42	20.61	17.75	21.12	18.15	21.46	23.29	27.61	39.41	-	**25**	**26**
100	22.52	23.29	-	18.46	-	18.17	11.88	-	17.36	24.48	28.26	-	**21**	**21**

Site ID	NO_2 Mean Concentrations ($\mu g/m^3$)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean	
													Raw Data	Bias Adjusted (1)
101	27.54	28.92	17.91	18.25	21.04	23.43	13.56	14.77	19.56	25.36	33.67	9.23	**23**	**23**
105	13.28	8.51	6.91	7.69	4.54	8.07	3.87	6.06	5.24	9.87	12.53	11.78	**8**	**8**
107	36.98	36.56	24.80	28.13	24.89		18.59	22.38	22.67	34.52	42.69	34.39	**29**	**30**
108	24.61	21.92	21.29	19.04	19.94			19.22	18.56	27.87	27.57		**23**	**23**
109	21.83	-	14.35	14.20	11.30	16.74	7.99	12.31	12.61	22.72	23.02	20.87	**16**	**16**
110	21.54	21.93	19.27	13.20	15.25	14.12	13.01	13.71	18.16	17.33	25.92	22.38	**18**	**19**
111	40.27	41.62	33.78	39.98	37.57	42.54	25.31	34.74	30.07	43.25	51.64	41.14	**42**	**43**
112	22.17	20.19	14.61	12.62	12.89	14.64	8.52	11.22	11.84	20.39	26.85	21.69	**17**	**17**

(1) See Appendix C for details on bias adjustment

Appendix C: Supporting Technical Information / Air Quality Monitoring Data QA/QC

Diffusion Tube Monitoring QA/QC

In 2016 the nitrogen dioxide, benzene and 1, 3-butadiene tubes used by Falkirk Council were supplied and analysed by Gradko International. 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.

Nitrogen Dioxide Diffusion Tubes

The NO_2 diffusion tube analysis in 2016 was carried out by to Gradko. International Ltd. Gradko follows the DEFRA guidance for the preparation and analysis of the NO_2 diffusion tubes. All the results for the amount of nitrogen dioxide present on the tube are within the scope of their UKAS accreditation

The full set of monthly NO_2 diffusion tube results are shown in Table 15 in Appendix B.

1, 3-Butadiene Diffusion Tubes

Gradko International Ltd performed the quantitative analysis of 1, 3-butadiene on diffusion tubes by TD-GCMS. Analysis has been carried out in accordance with in-house method GLM 13 under UKAS fixed scope accreditation.

The full set of monthly 1, 3-butadiene diffusion tube results are shown in Table 16 in Appendix B.

Benzene Diffusion Tubes

Gradko. International Ltd analysed Falkirk Council's benzene diffusion tubes by ATD-GC-MS. All results are within the scope of their UKAS accreditation.

Diffusion Tube Bias Adjustment Factor

The national diffusion tube bias adjustment factor spread sheet as shown in Figure 13 was used to calculate the bias adjustment factor applied to the Falkirk NO_2 diffusion tube data. Falkirk Council has applied the R&A helpdesk factor to the

2016 results because there are a mixture of roadside and background sites. The R&A bias factor for the ESG Didcot tubes in 2016 was 1.03.

Figure 15 - National Diffusion Tube Bias Adjustment Factor Spread Sheet

National Diffusion Tube Bias Adjustment Factor Spreadsheet

Spreadsheet Version Number: 03/17 V2

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 spreadhseet 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 2017

LAQM Helpdesk Website

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:	Step 2:	Step 3:	Step 4:								
Select the Laboratory that Analyses Your Tubes from the Drop-Down List	Select a Preparation Method from the Drop-Down List	Select a Year from the Drop-Down List	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 a laboratory is not shown, we have no data for this laboratory.	If a preparation method is not shown, we have no data for this method at this laboratory.	If a year is not shown, we have no data[2]	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 To undo your selection, choose (All) from the pop-up list	Year[2] To undo your selection, choose (All)	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)
Gradko	50% TEA in acetone	2016	R	LB Newham	12	36	44	-18.0%	G	**1.22**
Gradko	50% TEA in acetone	2016	UB	London Borough of Camden	12	42	43	-1.3%	G	**1.01**
Gradko	50% TEA in acetone	2016	R	London Borough of Richmond upon Thames	12	36	36	2.4%	G	**0.98**
Gradko	50% TEA in acetone	2016	B	London Borough of Richmond upon Thames	11	24	26	-7.6%	G	**1.08**
Gradko	50% TEA in acetone	2016	R	Royal Borough of Greenwich	11	51	45	13.3%	G	**0.88**
Gradko	50% TEA in acetone	2016	SU	Royal Borough of Greenwich	12	20	21	-5.9%	G	**1.06**
Gradko	50% TEA in acetone	2016	R	Royal Borough of Greenwich	11	45	45	0.9%	G	**0.99**
Gradko	50% TEA in acetone	2016	R	Royal Borough of Greenwich	12	69	61	13.1%	G	**0.88**
Gradko	50% TEA in acetone	2016	R	Royal Borough of Greenwich	9	40	41	-2.6%	G	**1.03**
Gradko	50% TEA in acetone	2016	R	Royal Borough of Greenwich	12	41	38	8.4%	P	**0.92**
Gradko	50% TEA in acetone	2016	R	West Berkshire Council	12	38	42	-8.9%	G	**1.10**
Gradko	50% TEA in acetone	2016	R	East Hampshire District Council	12	21	23	-6.2%	G	**1.07**
Gradko	50% TEA in acetone	2016	B	City of London	12	38	42	-8.6%	G	**1.09**
Gradko	50% TEA in acetone	2016	R	City of London	12	83	90	-8.7%	G	**1.10**
Gradko	50% TEA in acetone	2016	UI	Middlesbrough	12	17	18	-7.7%	G	**1.08**
Gradko	50% TEA in acetone	2016	KS	Marylebone Road Intercomparison	11	80	78	2.3%	G	**0.98**
Gradko	50% TEA in acetone	2016		**Overall Factor[3] (16 studies)**				**Use**		**1.03**

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 2015 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 the data after this date. The VCM has been applied to the 2008 and 2009 AURN TEOM data by King's College under contract to Defra.

The PM_{10} monitor at the Banknock 2 site has been a FIDAS since February 2015 so no correction factor has been applied to the data after this date.

Estimating $PM_{2.5}$ from PM_{10} Measurements

LAQM TG (16) describes two methodologies for estimating $PM_{2.5}$ from PM_{10} measurements. Method one is to apply a locally derived correction ratio calculated from local sites measuring both PM_{10} and $PM_{2.5}$. The second is to apply a nationally derived correction ratio of 0.7. The national correction ratio should only be used where no appropriate local sites measuring both PM_{10} and $PM_{2.5}$ are available. The locally derived correction ratio should only be used at sites of the same classification.

In 2016, Falkirk Council had two local sites monitoring both PM_{10} and $PM_{2.5}$ these being the Banknock 2 site and the Grangemouth AURN site. The Falkirk West Bridge St automatic station was upgraded to include PM2.5 monitoring capabilities through the commissioning of a FIDAS analyser, however monitoring did not commence until November 2016 thus it is not suitable to obtain a correction factor from this site as only two months of data is available for 2016.

Using guidance in LAQM TG (16) the $PM_{2.5}$/ PM_{10} ratios were calculated for the Grangemouth AURN and Banknock 2 sites. The ratio derived from the Banknock 2 data was applied to sites classified as roadside and the ratio derived from the AURN data was applied to sites classified as urban background/industrial.

The local correction ratios were used to estimate $PM_{2.5}$ from PM_{10} measurements at the following sites; Falkirk Haggs, Falkirk West Bridge St, Grangemouth Municipal Chambers, Falkirk Graham's Road, Banknock 3 and Main St Bainsford.

Results can be seen in Table A.12 in Appendix A. Table C.1 shows how the local ratios have been derived.

Table C. 1- Locally Derived $PM_{2.5}$/ PM_{10} Correction Ratio

Site	Site Type	Annual Average PM_{10} (µg/m3), 2016	Annual Average $PM_{2.5}$ (µg/m3), 2016	Ratio
A13 Banknock 2	Roadside	11	5	0.45
A8 AURN	Urban Background/ Industrial	11	6	0.55

Short term to long term adjustments

The annual average PM_{10} concentration for the Main St Bainsford site has been annualised. This site achieved a data capture below 75% for PM_{10} in 2016. Grangemouth Municipal Chambers and Grangemouth AURN were used as a background sites to calculate the adjustment ratio following guidance set out in Box 7.9 of the LAQM TG (16). Details are shown in Table C.2.

Table C. 2– PM_{10} short term to long term adjustment factor – Main St Bainsford

Main St Bainsford	Site Type	Annual Mean (2016), µg/m^3	Data capture 2016, %	Period Mean, µg/m^3	Ratio
Grangemouth MC	Urban background/ Industrial	15	91	14	1.07
AURN	Urban background/ Industrial	11	95	9	1.22
				Average	**1.15**

QA/QC Automatic Monitoring

Table C. 3 – Details of the QA/QC at the automatic monitoring stations in 2016

QA / QC in 2016		
Site	**Analyser**	**Network**
A3. Bo'ness	SO_2	SAQN
A4. Falkirk Haggs	NO_x	SAQN
	PM10 (TEOM)	SAQN
A5. Falkirk Hope St	NO_x	SAQN
	SO_2	SAQN
A7. Falkirk West Bridge St	NO_x	SAQN
	$PM_{10,}$ $PM_{2.5}$ (FIDAS)	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
A11. Grangemouth Zetland Park	SO2	SAQN
A12. Falkirk Grahams Rd	PM_{10} (TEOM)	SAQN
A13. Banknock 2	$PM_{10,}$ $PM_{2.5}$ (FIDAS)	SAQN
A14. Banknock 3	PM_{10} (Osiris)	Local
A15 Main St Bainsford	NO_x	SAQN
	PM_{10} (TEOM)	SAQN

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.
- As with the other sites all LSO site visits are carried out by Falkirk Council staffs 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.

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
- 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.

Glossary of Terms

Abbreviation	Description
AQAP	Air Quality Action Plan - A detailed description of measures, outcomes, achievement dates and implementation methods, showing how the LA intends to achieve air quality limit values'
AQMA	Air Quality Management Area – An area where air pollutant concentrations exceed / are likely to exceed the relevant air quality objectives. AQMAs are declared for specific pollutants and objectives
APR	Air quality Annual Progress Report
AURN	Automatic Urban and Rural Network (UK air quality monitoring network)
Defra	Department for Environment, Food and Rural Affairs
DMRB	Design Manual for Roads and Bridges – Air quality screening tool produced by Highways England
FDMS	Filter Dynamics Measurement System
LAQM	Local Air Quality Management
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxides
PM_{10}	Airborne particulate matter with an aerodynamic diameter of 10µm (micrometres or microns) or less
$PM_{2.5}$	Airborne particulate matter with an aerodynamic diameter of 2.5µm or less
QA/QC	Quality Assurance and Quality Control
SO_2	Sulphur Dioxide

References

1. Technical Guidance LAQM.TG (16), Defra and Devolved Administrations, April 2016.
2. Civil Aviation Authority, UK Airport Statistics http://www.caa.co.uk/default.aspx?catid=80&pagetype=88&pageid=3&sglid=3#Data
3. Policy Guidance LAQM.PG (S) 16, Defra and Devolved Administrations, March 2016.

Appendix D: Supporting Technical Information – Main St, Bainsford Detailed Assessment

Falkirk Council

Detailed Assessment of Nitrogen Dioxide and Particulate Matter on Main Street, Bainsford

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

2017

Local Authority Officer	Tanith Allinson
Department	Environmental Health
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Report Ref:	Detailed Assessment, Main St Bainsford
Status	Final
Date	2017

Executive Summary

Falkirk Council's 2014 Progress Report identified elevated levels of nitrogen dioxide (NO_2) in the vicinity of Main Street St, Bainsford. The elevated levels were recorded by diffusion tube monitoring in the area. In June 2015 an automatic monitoring station was installed on Main St, Bainsford housing both an NO_2 and PM_{10} analyser. A PM_{10} analyser was installed as in Falkirk Council's experience if there is a risk that the NO_2 objective is being breached due to road traffic emissions, then that risk also applies to PM_{10}.

In addition, since 2016 Local Authorities have been required to review and assess $PM_{2.5}$ concentrations as part of the Local Air Quality Management (LAQM) regime. Currently there is no $PM_{2.5}$ monitoring at Main St, Bainsford therefore in order to demonstrate compliance against the objective; $PM_{2.5}$ concentrations were estimated using a locally derived correction ratio.

The automatic monitoring station was installed to provide real-time monitoring data recorded using reference method analysers which record more accurate results compared to diffusion tubes. This report presents the results of this additional automatic monitoring as well as results from diffusion tube monitoring. The purpose is to provide an accurate assessment of the likelihood of the air quality objectives being exceeded at 'relevant locations' in the area. The report has been prepared in accordance with the Local Air Quality Management Technical Guidance Note LAQM.TG (16).

In summary the automatic and diffusion tube monitoring work undertaken along Main St, Bainsford has indicated that the NO_2 and PM_{10} air quality objectives are being met in the area. An estimation of $PM_{2.5}$ concentrations, using a locally derived correction ratio, indicates that the annual $PM_{2.5}$ air quality objective is being met.

Based on this assessment of the monitoring data, the following conclusions are made:

- As the monitoring data has indicated that the NO_2 and PM_{10} air quality objectives are being met; an AQMA will not be declared along Main St, Bainsford.

- Falkirk Council will continue monitoring NO_2 and PM_{10} at the current monitoring locations in order to ensure that any future changes in air quality are detected.
- Subject to funding the Council will consider upgrading the TEOM PM_{10} analyser to include $PM_{2.5}$ monitoring capabilities to the Main St, Bainsford automatic station.
- Future monitoring results from the Main St, Bainsford automatic stations and diffusion tubes will be reviewed and reported through the LAQM Annual Progress Reports.

Any comments or queries regarding this document should be addressed to: Tanith Allinson (Air Quality Specialist) tanith.allinson@falkirk.gov.uk.

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1. Introduction

1.1 Description of Local Authority Area

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

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

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

1.2 Purpose of a Detailed Assessment

The Local Air Quality Management regime requires that where a Progress Report or Updating and Screening Assessment (U&SA) report identifies a risk that an objective may be breached at a relevant receptor location; a Detailed Assessment must be carried out. A Detailed Assessment considers the area at risk of breaching an objective in greater detail. The assessment can be conducted through more comprehensive monitoring, e.g. an automatic monitor, and / or it may be conducted using dispersion modelling. The nature of the assessment will depend on the resources available and the likely nature of the emissions.

The 2014 Progress Report concluded that a Detailed Assessment was required in the Main Street, Bainsford area. This was due to elevated concentrations of nitrogen dioxide (NO_2) continuing to be recorded at a diffusion tube along the street (NA 83). Particles were included because in Falkirk's experience if there is a risk of the NO_2 objective due to road traffic emissions being breached then that risk also applies to PM_{10} and $PM_{2.5}$.

If a Detailed Assessment concludes that an objective is breached at a relevant receptor then the report will recommend that an Air Quality Management Area (AQMA) is required.

1.3 Air Quality Objectives

The air quality objectives applicable to LAQM in Scotland are set out in the Air Quality (Scotland) Regulations 2000, the Air Quality (Scotland) Amendment Regulations 2002 and the Air Quality (Scotland) Amendment Regulations 2016 and are shown in Table 1.1. This table shows the objectives in units of microgrammes per cubic metre, μg/m^3 (except for carbon monoxide which is in milligrammes per cubic metre, mg/m^3) with the number of exceedances in each year that are permitted (where applicable).

Table D1. 1 Air Quality Objectives included in Regulations for the purpose of Local Air Quality Management in Scotland.

Pollutant	Air Quality Objective		Date to be achieved by
	Concentration	Measured as	
Nitrogen dioxide (NO_2)	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
Particulate Matter (PM_{10})	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
Particulate Matter ($PM_{2.5}$)	10 μg/m^3	Annual mean	31.12.2020
Sulphur dioxide (SO_2)	350 μg/m^3, not to be exceeded more than 24 times a year	1-hour mean	31.12.2004
	125 μg/m^3, not to be exceeded more than 3 times a year	24-hour mean	31.12.2004
	266 μg/m^3, not to be exceeded more than 35 times a year	15-minute mean	31.12.2005
Benzene	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	0.25 μg/m^3	Annual Mean	31.12.2008

There can be a misunderstanding between the terms ‘exceedance’ and a ‘breach of the objective’. As an example: a monitor records a 15-minute average concentration of 300 μg/m^3. This, for SO_2, is an ‘exceedance’ of the air quality

standard because the 15-minute concentration is greater than 266 µg/m^3. However, it is not a breach of the objective. This only occurs when more than 35 exceedances are recorded, whether through monitoring or modelling, at a specific location that is representative of a relevant receptor in a calendar year. 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 and Scottish Governments are required to use to assess air quality in relation to their submissions 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 may be an AQMA this does not automatically translate to a breach of any objectives under EU legislation.

1.4 Existing AQMAs

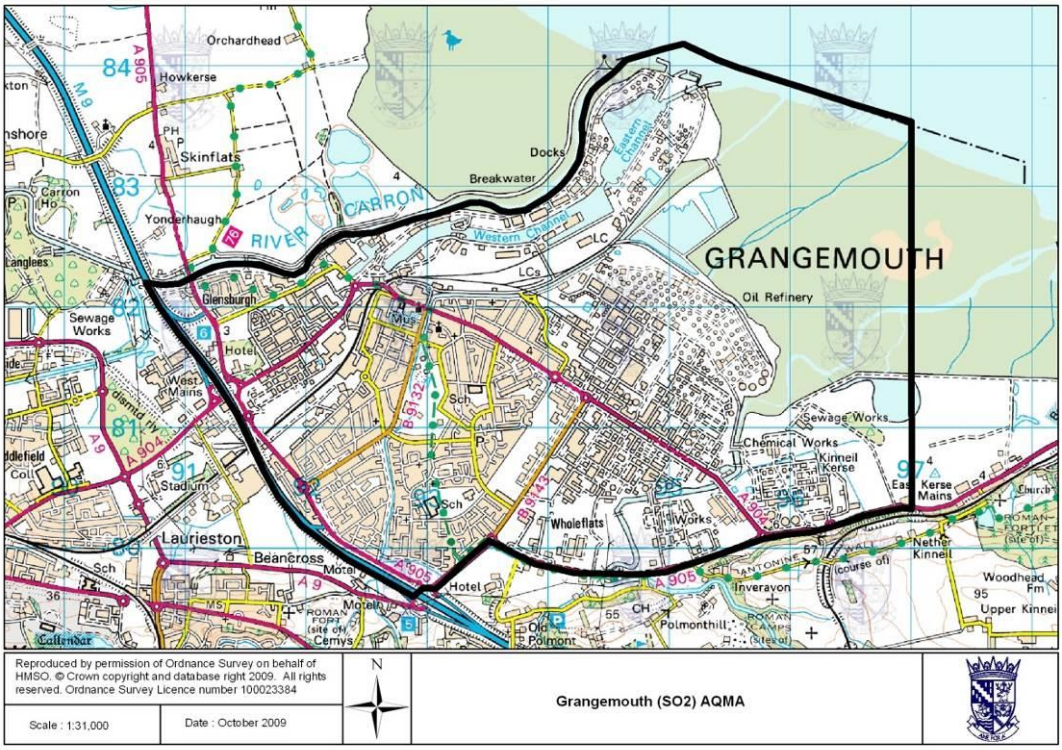
Falkirk Council has four active Air Quality Management Areas. The Grangemouth AQMA was declared for a potential breach of the 15-minute SO_2 objective. This AQMA covers the Grangemouth area and was declared in November 2005, see Figure 1.1a. This AQMA is in relation to industrial emissions.

There are two AQMAs have been declared for 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 1.1b 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 was amended to include the Scottish PM_{10} objectives.

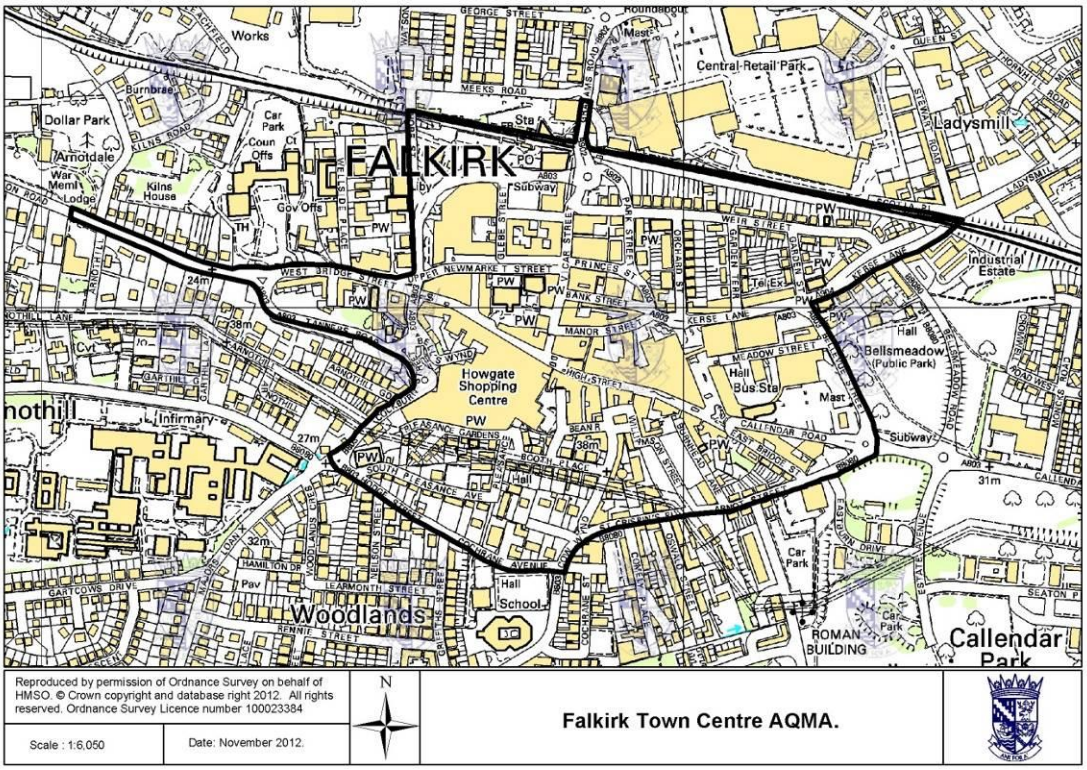
An AQMA was declared in the Banknock area in August 2011 in relation to breaches of the Scottish and potential breaches of the UK PM_{10} objectives see Figure 1.1d.

Figure 1. 1: Four maps showing the boundaries of Falkirk Council's AQMAs.

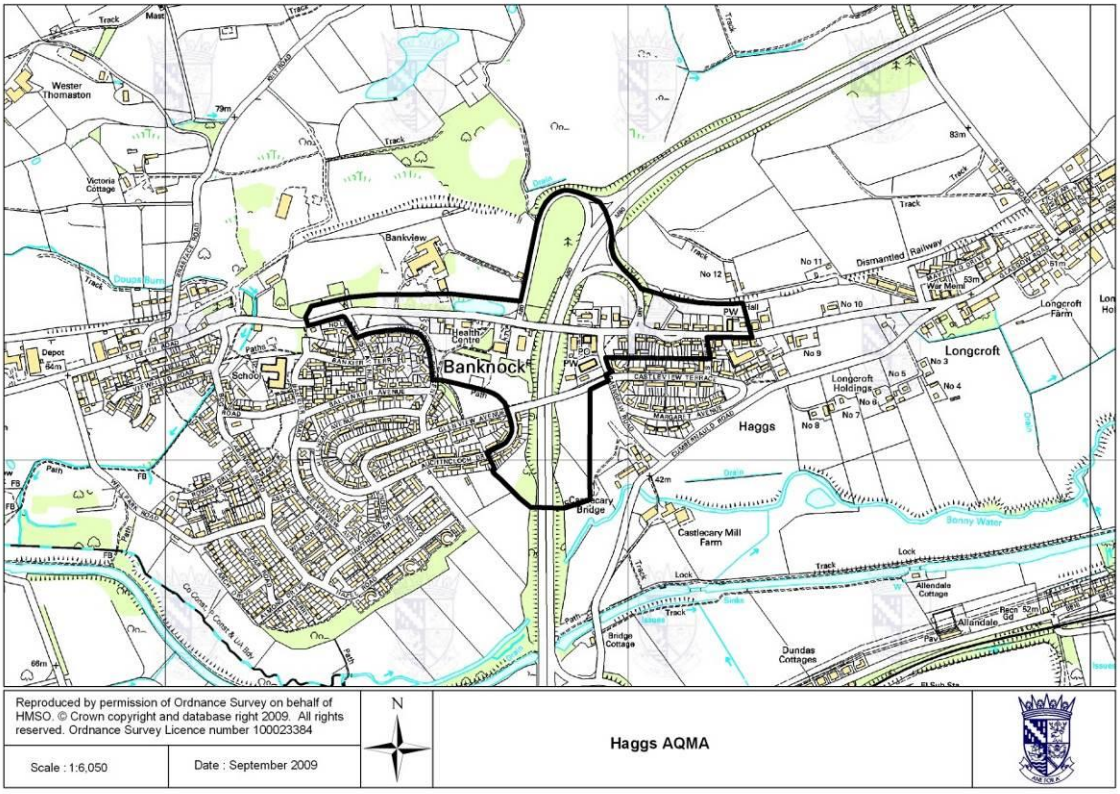
a.) Grangemouth AQMA (15-minute SO_2).



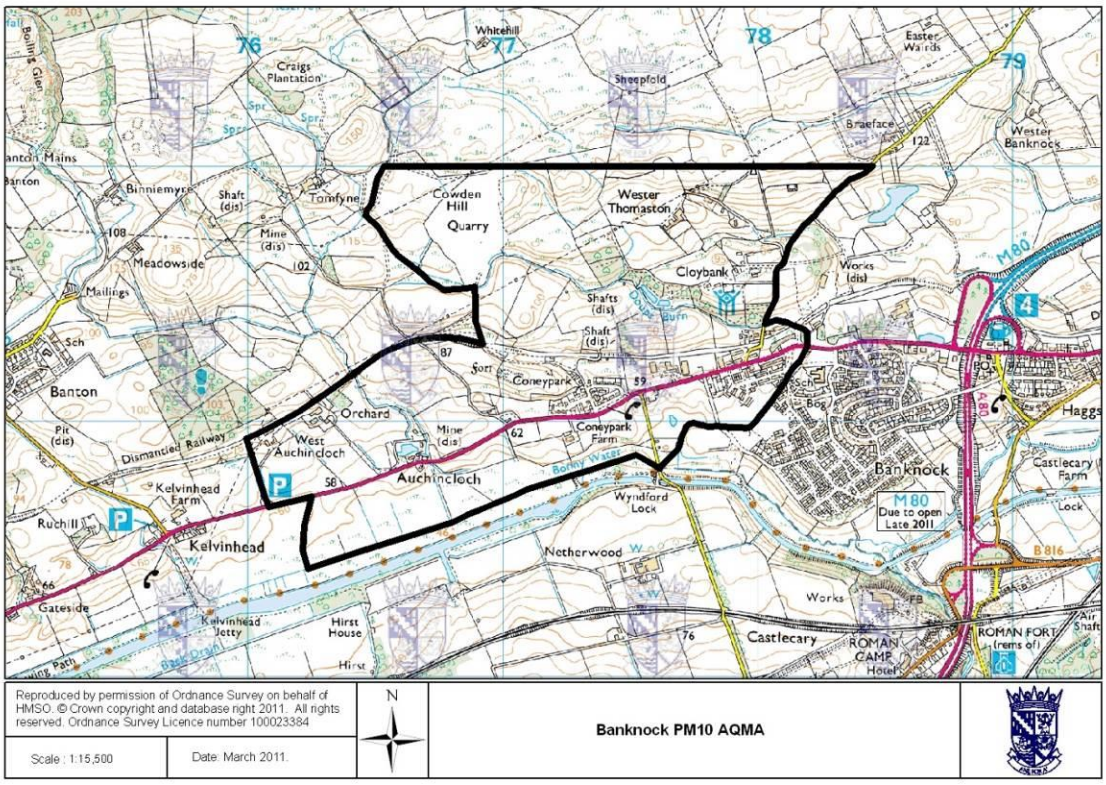
b.) Falkirk Town Centre AQMA (annual NO_2 and annual and daily PM_{10}).



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



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



2. Method of Assessment

2.1 Summary of Monitoring Data

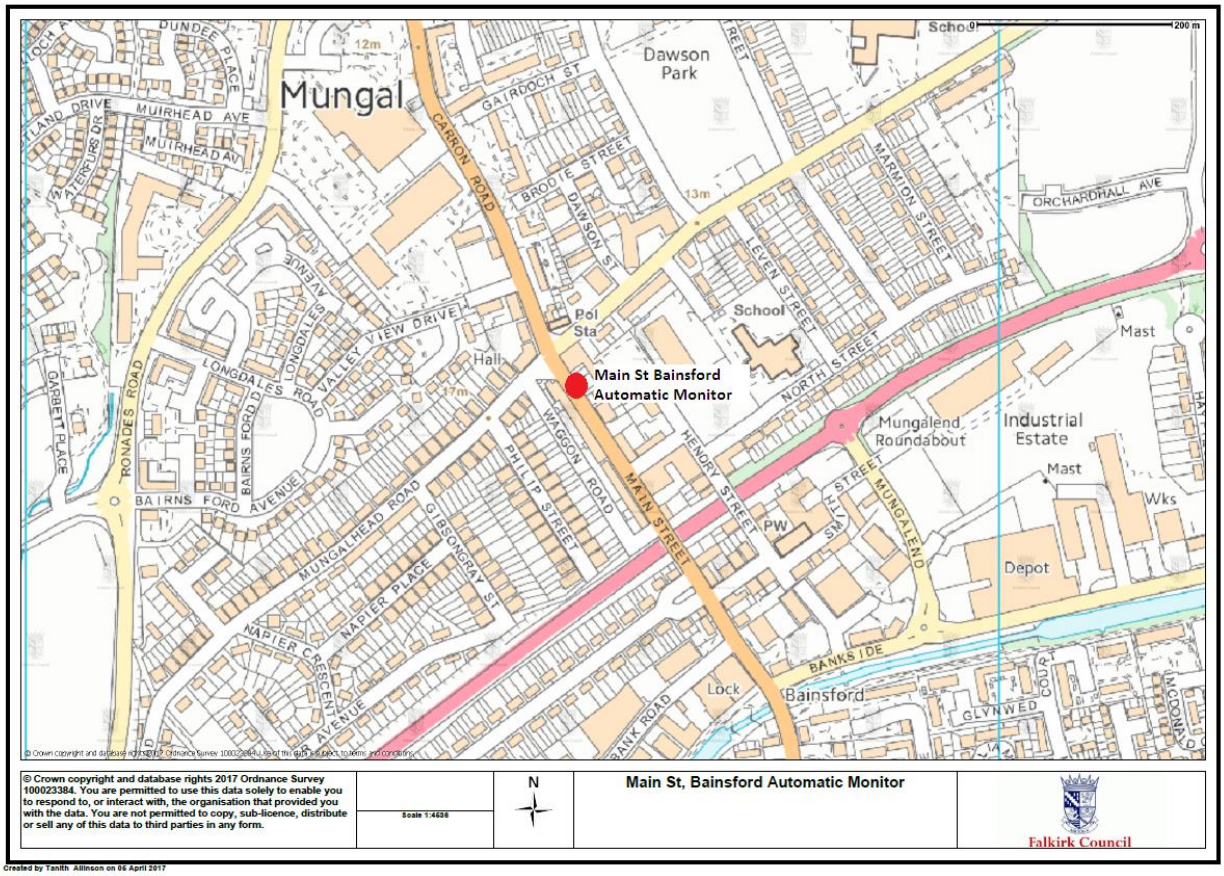
2.1.1 Automatic Air Quality Monitoring

Falkirk Council operates automatic monitoring stations at 12 locations from Banknock in the west to Bo'ness in the east. The automatic monitoring measures $PM_{2.5}$, PM_{10}, NO_2 and SO_2.

On the 10th of June 2015, automatic monitoring commenced at one location on Main St Bainsford. The station was installed to measure NO_2 and PM_{10} concentrations as part of this detailed assessment. The station houses the following equipment:

- NO_x analyser: Horiba APNA 360
- PM_{10}: R&P TEOM 1400AB

Figure 2. 1: Map showing the Main St Bainsford automatic site location



As with any monitoring site some compromise has been made with the location of the Main Street Bainsford station. There are high voltage power lines under a lot of the footpaths in the area, the unit could not interfere with the visibility splay of the pedestrian crossing or the signalised junction and could not be located in front of some residential properties due to view obstruction.

For the purposes of LAQM, regulations state that exceedances of the objectives should be assessed in relation to "the quality of the air at locations which are situated outside of buildings or other natural or man-made structures, above or below ground, and where members of the public are regularly present" [Ref 1]. Falkirk Council considers the location of the Main St, Bainsford automatic monitoring equipment to be in an area of public exposure relevant to the averaging periods for the NO_2, PM_{10} and $PM_{2.5}$ objectives. The location also compliments the diffusion tube monitoring network in the area.

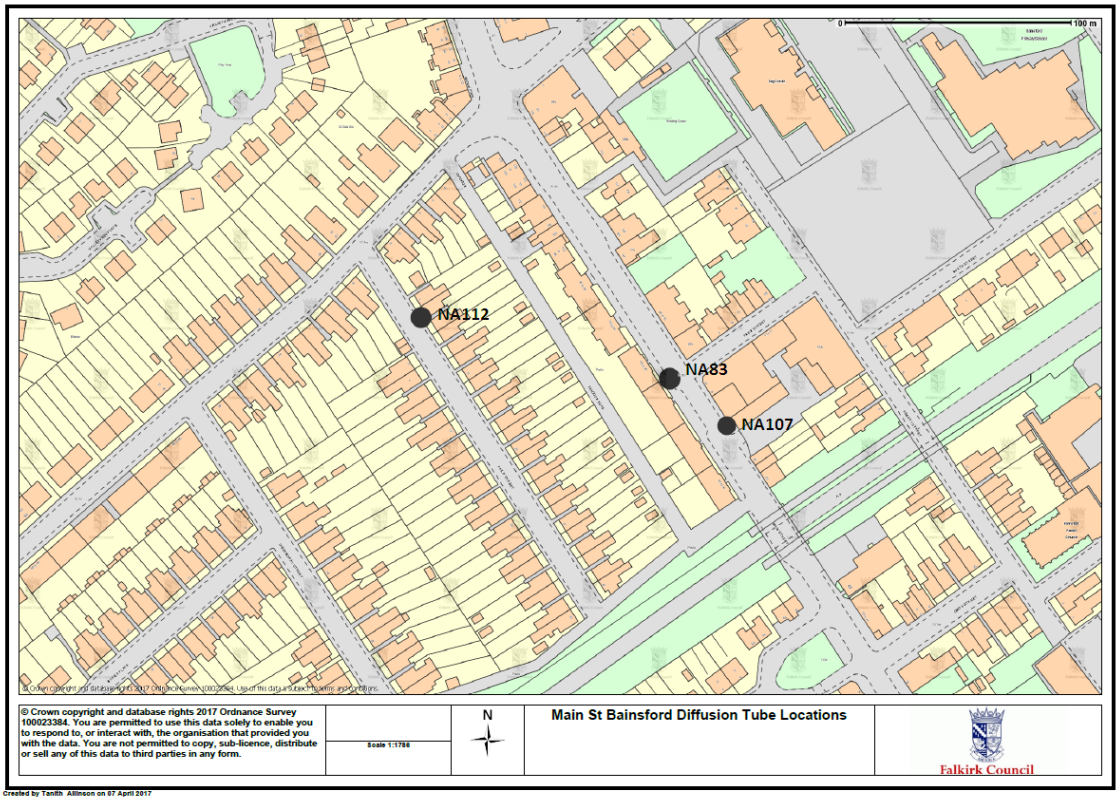
2.1.2 Non-Automatic Monitoring

Falkirk Council monitors nitrogen dioxide at 65 locations, benzene at 16 locations and 1,3 butadiene at three locations using non-automatic methods (i.e. diffusion tubes). The details of the type of tubes used and the QA / QC of non-automatic monitoring are given in Appendix 1. The following non-automatic sites are relevant to the area under consideration:

- NA83 Main Street, Bainsford,
- NA107 Main Street, Bainsford (E),
- NA112 Philip Street, Bainsford.

Falkirk Council has used the R&A helpdesk factor to adjust the diffusion tube results as there are a mixture of roadside and background sites.

Figure 2. 2: A map of the non-automatic monitoring sites in the vicinity of Main St, Bainsford.



3. Comparison of Monitoring Results with Air Quality Objectives

3.1 Nitrogen Dioxide

Automatic NO_2 monitoring commenced at Main St Bainsford in June 2015. However, data capture from June – December 2015 was poor at just 27%. This was due to the Air Quality Specialist post being vacant for a number of months during the study period, combined with a change in telemetry system which resulted in data being lost.

Due to the low data capture during the initial monitoring period, this assessment considers data recorded from 01st January 2016 onwards. Table 2.1 compares the monitored NO_2 annual mean concentrations for 2016 with the air quality objective of 40µg/m^3.Table 2.2 compares the monitored NO_2 hourly mean concentrations with the air quality objective of 200µg/m^3, not to be exceeded more than 18 times per year.

The monitoring results show that the NO_2 air quality objectives were met at the automatic monitoring station on Main St, Bainsford and at all three diffusion locations relevant to the study area (NA83, NA107 and NA112). Data capture for the automatic analyser in 2016 was good at 91%.

None of the diffusion tubes recorded an annual NO_2 concentration above the 40µg/m^3 objective with the application of the relevant R&A bias factor. However, location NA83 recorded a concentration of 38µg/m^3 which could be considered close to the objective concentration.

From the diffusion tube monitoring results it is clear that concentrations are elevated on the west side compared to the east side of the street. In 2016 diffusion tube NA107 located on the east side of the street recorded an annual average concentration that was 8µg/m^3 lower than that recorded at NA83 located on the west side. This trend can also be seen in other monitoring years. The pre-dominate wind direction is south-westerly which suggests that an element of a street canyon effect is occurring along Main St.

Diffusion tubes NA83 and NA107 both achieved 83% data capture in 2016 and diffusion tube NA112 achieved 100% data capture.

Table D3. 1 - Monitored NO_2 annual mean concentrations for 2016

Site ID	Monitoring Type	Valid Data Capture for Monitoring Period (%)(1)	Valid Data Capture (%)(2)	NO_2 Annual Mean Concentration (µg/m^3) (3)
Main St, Bainsford	Automatic	91	91	25
Main St (East), Bainsford (NA107)	Diffusion Tube	83	83	30
Main St, Bainsford (NA83)	Diffusion Tube	83	83	38
Philip St, Bainsford (NA112)	Diffusion Tube	100	100	16

Notes: Exceedences of the NO_2 annual mean objective of 40µg/m3 are shown in **bold**.

(1) data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

(2) data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

(3) Means for diffusion tubes have been corrected for bias. All means have been "annualised" as per LAQM.TG(16) if valid data capture for the full calendar year is less than 75%. See Appendix C for details.

Table D3. 2 - Monitored NO_2 24 hour mean concentrations for 2016

Site ID	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture (%) (2)	NO_2 1-Hour Means > 200µg/m^3 (3)
Main St, Bainsford	Automatic	91	91	1

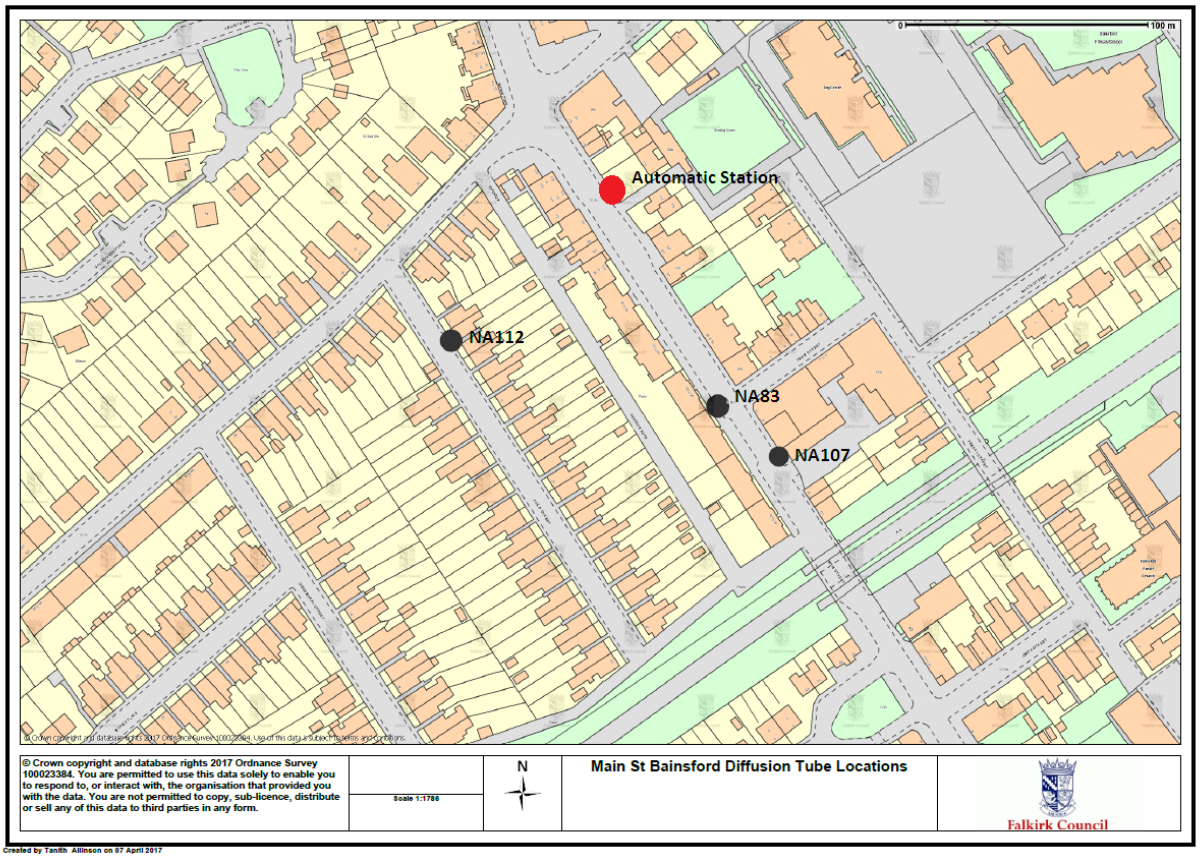
Notes: Exceedences of the NO_2 1-hour mean objective (200µg/m^3 not to be exceeded more than 18 times/year) are shown in **bold.**

(1) data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

(2) data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

(3) If the period of valid data is less than 90%, the 99.8th percentile of 1-hour means is provided in brackets.

Figure 2. 3 - A map of the automatic and non-automatic NO_2 monitoring sites in the vicinity of Main St, Bainsford.



3.2 PM_{10} Automatic Monitoring Data

The PM_{10} analyser commenced operation at Main St, Bainsford in June 2015; however there have been difficulties in regards to data capture. This is due to the breakdown of the PM_{10} analyser from June – November 2016.

Due to the poor data capture resulting from issues with the analyser, this assessment considers the seven months of data recorded November 2016 to June 2017. The data has been annualised in accordance with LAQM TG (16) guidance for comparison against the annual mean objective for PM_{10}. See Appendix A for details of the annualisation method. Data capture for the monitoring period was good at 100%.

Table 2.4 compares the ratified continuous monitored PM_{10} daily mean concentrations for the monitoring period with the air quality objective of 50µg/m^3, not to be exceeded more than 7 times per year.

Monitoring results indicate that both the annual and daily PM_{10} objectives applicable to Scotland were met at the automatic monitoring station. The monitored PM_{10} concentration (9µg/m^3) was well below the annual mean objective concentration (18µg/m^3) during the monitoring period. The daily objective concentration (50µg/m^3) was exceeded once during monitoring, which is well below the seven permitted by the objective.

Table D3. 3 - Monitored PM_{10} annual mean concentrations for monitoring period November 2016 - June 2017.

Site ID	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture (%) (2)	PM_{10} Annual Mean Concentration (µg/m^3) (3)
Main St Bainsford	100	58	9

Notes: Exceedences of the PM_{10} annual mean objective of 18µg/m^3 are shown in **bold.**

(1) data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

(2) data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

(3) All means have been "annualised" as per LAQM.TG(16), valid data capture for the full calendar year is less than 75%. See Appendix C for details.

Table D3. 4 - Monitored PM_{10} 24 hour mean concentrations for monitoring period November 2016 – June 2017.

Site ID	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture (%) (2)	PM_{10} 24-Hour Means > 50µg/m^3 (3)
Main St Bainsford	100	58	1 (29)

Notes: Exceedences of the PM_{10} 24-hour mean objective (50µg/m^3 not to be exceeded more than 7 times/year) are shown in **bold.**

(1) data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

(2) data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

(3) If the period of valid data is less than 90%, the 90.4th percentile of 24-hour means is provided in brackets.

3.3 Estimated $PM_{2.5}$ Concentrations

To appraise compliance with the Scottish $PM_{2.5}$ annual objective at Main St, Bainsford, which does not currently monitor $PM_{2.5}$, Falkirk Council has applied a locally derived correction ratio of 0.54 to the Main St, Bainsford PM_{10} data following guidance set out in LAQM TG (16).

The $PM_{2.5}$ estimation indicates that Main St, Bainsford met the $PM_{2.5}$ annual mean objective (10µg/m^3) during the monitoring period for this assessment. For full details of the methodology used see Appendix A.

Table D3. 5 - Estimated Annual Mean $PM_{2.5}$ Concentration

Site ID	Site Type	Correction Ratio	Estimated PM2.5 Annual Mean Concentration (µg/m3) (1)
Main St Bainsford	Roadside	0.54	5

Notes: Exceedences of the $PM_{2.5}$ annual mean objective of 10µg/m^3 are shown in **bold.**

(1) All means have been estimated using a local correction factor as per LAQM.TG(16),See Appendix A for details.

4. Conclusions and Proposed Actions

4.1 Conclusions

Falkirk Council has examined the monitoring results recorded in the Main St, Bainsford area and has concluded that:

- There are no breaches of the annual or hourly nitrogen dioxide objectives.
- There are no breaches of the annual or daily particulate matter (PM_{10}) objectives.
- There are no estimated breaches of the annual $PM_{2.5}$ objective.

4.2 Proposed Actions

Falkirk Council proposes to carry out the following actions:

- Continue to operate the automatic NO_x and PM_{10} analysers at their current location on Main St, Bainsford for at least another 12 months to confirm the objectives are being met.
- Continue to monitor NO_2 via diffusion tube in the area.
- Results of the continued monitoring will be assessed in the Annual Progress Report 2017.

5. References

1. Technical Guidance LAQM.TG (16), Defra and Devolved Administrations, April 2016.

2. Policy Guidance LAQM.PG (S) 16, Defra and Devolved Administrations, March 2016.

Appendix 1: QA / QC of Data

Diffusion Tube Monitoring QA/QC

The nitrogen dioxide diffusion tubes used by Falkirk Council were supplied and analysed by Gradko International. The method used for the NO_2 tubes is 50% acetone and 50% tri-ethanolamine.

Nitrogen Dioxide Diffusion Tubes

The NO_2 diffusion tube analysis was carried out by to Gradko. International Ltd. Gradko follows the DEFRA guidance for the preparation and analysis of the NO_2 diffusion tubes. All the results for the amount of nitrogen dioxide present on the tube are within the scope of their UKAS accreditation

The full set of monthly NO_2 diffusion tube results relevant to this assessment are shown in Table A.1.1 in Appendix 1.

Diffusion Tube Bias Adjustment Factor

The national diffusion tube bias adjustment factor spread sheet as shown in Figure A.1 was used to calculate the bias adjustment factor applied to the Falkirk NO_2 diffusion tube data. Falkirk Council has applied the R&A helpdesk factor to the 2016 results because there are a mixture of roadside and background sites. The R&A bias factor for the ESG Didcot tubes in 2016 was 1.03.

Figure A1. 1 - National Diffusion Tube Bias Factor Spread sheet 2016

National Diffusion Tube Bias Adjustment Factor Spreadsheet

Spreadsheet Version Number: 03/17 V2

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 spreadhseet 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 2017

LAQM Helpdesk Website

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

If a laboratory is not shown, we have no data for this laboratory.

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

If a preparation method is not shown, we have no data for this method at this laboratory.

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

If a year is not shown, we have no data[2]

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 (To undo your selection, choose (All) from the pop-up list)	Year[5] (To undo your selection, choose (All))	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[6]	Bias Adjustment Factor (A) (Cm/Dm)
Gradko	50% TEA in acetone	2016	R	LB Newham	12	36	44	-18.0%	G	**1.22**
Gradko	50% TEA in acetone	2016	UB	London Borough of Camden	12	42	43	-1.3%	G	**1.01**
Gradko	50% TEA in acetone	2016	R	London Borough of Richmond upon Thames	12	36	36	2.4%	G	**0.98**
Gradko	50% TEA in acetone	2016	B	London Borough of Richmond upon Thames	11	24	26	-7.6%	G	**1.08**
Gradko	50% TEA in acetone	2016	R	Royal Borough of Greenwich	11	51	45	13.3%	G	**0.88**
Gradko	50% TEA in acetone	2016	SU	Royal Borough of Greenwich	12	20	21	-5.9%	G	**1.06**
Gradko	50% TEA in acetone	2016	R	Royal Borough of Greenwich	11	45	45	0.9%	G	**0.99**
Gradko	50% TEA in acetone	2016	R	Royal Borough of Greenwich	12	69	61	13.1%	G	**0.88**
Gradko	50% TEA in acetone	2016	R	Royal Borough of Greenwich	9	40	41	-2.6%	G	**1.03**
Gradko	50% TEA in acetone	2016	R	Royal Borough of Greenwich	12	41	38	8.4%	P	**0.92**
Gradko	50% TEA in acetone	2016	R	West Berkshire Council	12	38	42	-8.9%	G	**1.10**
Gradko	50% TEA in acetone	2016	R	East Hampshire District Council	12	21	23	-6.2%	G	**1.07**
Gradko	50% TEA in acetone	2016	B	City of London	12	38	42	-8.6%	G	**1.09**
Gradko	50% TEA in acetone	2016	R	City of London	12	83	90	-8.7%	G	**1.10**
Gradko	50% TEA in acetone	2016	UI	Middlesbrough	12	17	18	-7.7%	G	**1.08**
Gradko	50% TEA in acetone	2016	KS	Marylebone Road Intercomparison	11	80	78	2.3%	G	**0.98**
Gradko	50% TEA in acetone	2016		**Overall Factor[3] (16 studies)**				**Use**		**1.03**

Table A1. 1 - NO_2 Monthly Diffusion Tube Results for Main St, Bainsford 2016

Site ID	NO_2 Mean Concentrations ($\mu g/m^3$)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean	
													Raw Data	Bias Adjusted
83	41.34	47.44	36.05	31.17	30.61	-	27.87	27.89	-	33.80	47.56	42.69	**37**	**38**
107	36.98	36.56	24.80	28.13	24.89		18.59	22.38	22.67	34.52	42.69	34.39	**29**	**30**
112	22.17	20.19	14.61	12.62	12.89	14.64	8.52	11.22	11.84	20.39	26.85	21.69	**17**	**17**

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 Main St Bainsford TEOM data as the site is affiliated to the Scottish Air Quality Network.

Estimating $PM_{2.5}$ from PM_{10} Measurements

LAQM TG (16) describes two methodologies for estimating $PM_{2.5}$ from PM_{10} measurements. Method one is to apply a locally derived correction ratio calculated from local sites measuring both PM_{10} and $PM_{2.5}$. The second is to apply a nationally derived correction ratio of 0.7. The national correction ratio should only be used where no appropriate local sites measuring both PM_{10} and $PM_{2.5}$ are available.

Falkirk Council has three local sites monitoring both PM_{10} and $PM_{2.5}$, these being the Banknock 2 site, Grangemouth AURN and Falkirk West Bridge St. The locally derived correction ratio should only be used at sites of the same classification, as Main St, Bainsford is classified as a roadside site, only Banknock 2 and Falkirk West Bridge St are suitable for obtaining a local correction factor, as these are also classified as roadside sites.

As Falkirk West Bridge only began monitoring $PM_{2.5}$ in November 2016, it is not suitable to derive a local correction factor as there is not enough data to calculate an annual mean; therefore Banknock 2 was used to estimate $PM_{2.5}$ from PM_{10} measurements at Main St Bainsford. See table A1.2 for details.

Table A1. 2 – Locally Derived $PM_{2.5}$/ PM_{10} Correction Factors

Site	Site Type	Annual Average PM10 (µg/m3)	Annual Average PM 2.5 (µg/m3)	Ratio
A15 Banknock 2	Roadside	11	5	0.45

Short term to long term adjustments

The annual average PM_{10} concentration for the Main St Bainsford site has been annualised. A full year of monitoring data was not available for this Detailed Assessment due to technical issues with the analyser as discussed earlier. Therefore the site achieved a data capture below 75% for PM_{10} for the calendar year. Grangemouth Municipal Chambers and Grangemouth AURN were used as a background sites to calculate the adjustment ratio following guidance set out in Box 7.9 of the LAQM TG (16). Details are shown in Table A1.2.

The NO_2 analyser at Main St, Bainsford achieved a data capture above the 75% for the calendar year and therefore the annual average NO_2 concentration was not annualised.

Table A1. 3 - PM_{10} short term to long term adjustments

Main St Bainsford	Site Type	Annual Mean (2016), µg/m^3	Data capture 2016, %	Monitoring Period Mean, µg/m^3	Ratio
Grangemouth MC	Urban background/ Industrial	15	91	14	1.07
AURN	Urban background/ Industrial	11	95	13	0.85
				Average	**0.96**

QA / QC of Automatic Monitoring Data

The Main St Bainsford automatic monitoring site within the Scottish Air Quality Network; therefore the following QA / QC of the data apply:

- 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
- 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.

Glossary of Terms

Abbreviation	Description
AQAP	Air Quality Action Plan - A detailed description of measures, outcomes, achievement dates and implementation methods, showing how the LA intends to achieve air quality limit values'
AQMA	Air Quality Management Area – An area where air pollutant concentrations exceed / are likely to exceed the relevant air quality objectives. AQMAs are declared for specific pollutants and objectives
APR	Air quality Annual Progress Report
AURN	Automatic Urban and Rural Network (UK air quality monitoring network)
Defra	Department for Environment, Food and Rural Affairs
FDMS	Filter Dynamics Measurement System
FIDAS	Fine Dust Analysis System
LAQM	Local Air Quality Management
LSO	Local Site Operator
NO_2	Nitrogen Dioxide
PM_{10}	Airborne particulate matter with an aerodynamic diameter of 10µm (micrometres or microns) or less
$PM_{2.5}$	Airborne particulate matter with an aerodynamic diameter of 2.5µm or less
QA/QC	Quality Assurance and Quality Control
SO_2	Sulphur Dioxide
SAQN	Scottish Air Quality Network
SEPA	Scottish Environmental Protection Agency
TEOM	Tapered Element Oscillating Microbalance
VCM	Volatile Correction Model