



Falkirk Council

2018 Air Quality Annual Progress Report (APR) for
Falkirk Council

In fulfilment of Part IV of the
Environment Act 1995

Local Air Quality Management

June 2018

Local Authority Officer	John Millar
Department	Environmental Health
Address	Abbotsford House, Davids Loan, Falkirk, FK2 7YZ
Telephone	01324 504873
E-mail	JohnA.Millar@falkirk.gov.uk
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Executive Summary: Air Quality in Our Area

Air Quality in Falkirk Council

The 2017 Falkirk Council air quality monitoring results for all pollutants measured have shown an improvement from the 2016 results through reduced exceedance concentration levels.

Specifically, the Nitrogen Dioxide (NO₂) National Air Quality Standard (NAQS) objectives were achieved at all seven automatic monitoring sites within the Falkirk Council automatic network. The highest annual mean NO₂ concentration of 36µg/m³ was recorded at the Falkirk West Bridge Street site. In 2016 the highest annual mean NO₂ concentration was recorded at the Falkirk West Bridge St site with a level of 37µg/m³.

In 2017, there were no NO₂ diffusion tubes which recorded a concentration greater than the annual NAQS objective of 40µg/m³. This is another significant improvement from 2016 as results at two sites (NA27 Falkirk West Bridge St and NA111 Falkirk West Bridge St Air Quality station) had breached this limit. Long term NO₂ monitoring data also indicates a downward trend in concentrations at both background and roadside sites which is again, regarded as an overall improvement.

Falkirk West Bridge St is located within the Falkirk Town Centre Air Quality Management Area (AQMA) which was declared in 2011 in recognition of the potential to exceed NAQS objectives for NO₂ and Particulate Matter (PM₁₀). The Falkirk Town Centre Air Quality Management Action Plan (AQAP) was approved in June 2015 and focuses on long-term key point 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 the EcoStars Fleet Recognition Scheme
- Promoting alternative and sustainable modes of transport
- To educate and inform the public on air quality issues

In 2017, Falkirk Council has made significant progress in implementing these measures. For example, there are now 27 electric vehicle (EV) charging bays throughout the Falkirk area with more planned in the upcoming year, an action which

is helping to promote alternative modes of travel and help to achieve measures included in the Sustainable Development and Climate Change Strategy 2012 - 2017.

Plans for future upgrades of the EV charge network include:

- Replacing the 50kW charger at Meeks Road, along with a 22kW charger at Larbert Station;
- A Low Carbon Vehicle Hub at Falkirk Stadium (Plans for approx. 20 vehicle charging bays – 22kW and 50kW) under a photovoltaic canopy.

The Falkirk Council vehicle fleet currently includes twelve electric cars and three electric vans. There are plans to increase this EV fleet in the future.

The Council are also 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. Full details of the progress Falkirk Council are making towards the measures outlined in their Air Quality Action Plans can be seen in Section 2.2 of this report.

In 2017, the six automatic sulphur dioxide (SO₂) analysers within the Falkirk monitoring network met all three (15-minute, hourly and daily) NAQS objectives.

There were exceedances (15min SO₂ Objective: 266µg/m³) recorded at both the Grangemouth Moray site (Annual total: 10) and Grangemouth Municipal Chambers (4) but these were within the NAQS annual limit. This was proven to be a substantial improvement from 2016 where Grangemouth Moray and Grangemouth Municipal Chambers sites both recorded 28 exceedances (total: 56) of this annual total objective.

The 2017 SO₂ results continue the objective compliance recorded in 2013, 2014 and 2015, and 2016. Long term SO₂ trend analysis at the Grangemouth AURN site shows a decline in SO₂ concentrations since the commissioning of the tail gas treatment (TGT) unit at INEOS Grangemouth in 2013.

Falkirk Council measured PM₁₀ concentrations at eight locations during 2017. The Scottish NAQS objectives for PM₁₀ were met at all eight locations.

The two sites with the highest annual mean PM₁₀ concentration (but within the Scottish NAQS PM₁₀ objective) was: A13–Banknock 2 (Roadside, 13µg/m³) and A15–Main St, Bainsford (Roadside, 13µg/m³).

Over a five year period (from 2013 until 2017), all eight sites have recorded PM₁₀ (annual mean) long term reductions.

The Banknock 2 monitoring site recorded the greatest number of PM₁₀ daily exceedances (7) which was substantial increase from 4 recorded in 2015, this is within the Scottish NAQS limit ($>50\mu\text{g}/\text{m}^3$, not to be exceeded more than 7 times per year).

Over a five year period (from 2013 until 2017), three sites have recorded PM₁₀ (24-hour mean) reductions: A4–Falkirk Haggs (Roadside), A7–West Bridge Street, Falkirk (Roadside) and A12–Grahams Road, Falkirk (Roadside). Two sites have recorded increased PM₁₀ (24hr mean) results: A8–Grangemouth AURN (Urban Background/Industrial) and A13–Banknock 2. Two sites has remained at the same PM₁₀ (24hr mean) level: A10–Grangemouth Municipal Chambers and A15–Main St, Bainsford.

The benzene and 1, 3-butadiene diffusion tube monitoring conducted in 2017 met the NAQS (annual running mean) objectives for each pollutant respectively.

During 2017, all three PM_{2.5} automatic sites recorded the same annual mean concentration (within the Scottish NAQS PM_{2.5} objective) of $6\mu\text{g}/\text{m}^3$. Data capture was reasonable for the Falkirk West Bridge St site at 88% and good for the Grangemouth AURN and Banknock 2 sites, these were 95% and 99% respectively.

The PM_{2.5} concentrations recorded at the Grangemouth AURN site have gradually reduced over longer-term from $9.2\mu\text{g}/\text{m}^3$ in 2012 to $6\mu\text{g}/\text{m}^3$ in 2016 and 2017. 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, SO₂ concentrations have reduced within the Grangemouth AQMA. Sulphate species are known to contribute towards the formation of secondary PM_{2.5}, a reduction in SO₂ could impact on local PM_{2.5} concentrations.

As no exceedances of NAQS 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 equipment during 2017. Improvements include upgrading communications throughout the network such as the installation of a new datalogging / comms unit at the Grangemouth AURN site along with a new modem system at the Falkirk West Bridge St site. This allows improved data capture rates, security and connectivity throughout.

It is anticipated that DEFRA will be upgrading the PM₁₀ and PM_{2.5} TEOM analysers within the Grangemouth AURN site in 2018. Beta Attenuation Monitors (BAMS) will be the replacement analyser type. Upgrade information will be provided in the 2019 Annual Progress Report.

In 2017, the membership of Falkirk EcoStars Fleet Recognition scheme now has 160 vehicle operators. This scheme helps to improve air quality through the promotion of fuel efficient driving within the Council area. In addition we are also working closely with fellow members of the East Central Scotland Vehicle Emissions Partnership (ECSVEP), looking to align our vehicle emissions monitoring with the priorities and objectives set out in the Scottish Government's Cleaner Air for Scotland (CAFS) document. Funding has been provided to continue the operation of the Falkirk EcoStars scheme (Fleet Operators and Taxis) during 2017 / 2018.

Falkirk Council also continues to work closely with its partner organisations to manage local air quality issues. The council works closely with SEPA, INEOS and Petroineos to reduce exceedances of the SO₂ objectives within the Grangemouth AQMA.

Local Priorities and Challenges

Education and Awareness of Air Quality Issues

In 2018, Falkirk Council will be looking to develop our engagement with local schools, through promoting air quality education resources such as the 'Learn about Air' teaching package, the Clean Air Day and working closer with the Transport Planning department on how to promote alternative / sustainable local transport solutions.

Grangemouth Industry Modelling Study

The Scottish Government has approved a comprehensive 2018 pollution modelling study and assessment within the Grangemouth AQMA area / Industrial area. This

would help inform future monitoring requirements and management of the Grangemouth AQMA. This will also be beneficial in improved understanding of the current pollution sources / industry and how these will be changing into the future.

Air Quality Station – Proposed Equipment Transfer / Decommissioning

Plans are being drafted for transferring the Falkirk, Grahams Road PM₁₀ TEOM analyser to the nearby Hope St site in order to provide an improved roadside Falkirk town centre monitoring location. This would involve a full decommissioning of the current Grahams Road site thus reducing monitoring stations from twelve to eleven but will maintain the same monitoring capability.

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 eleven automatic air quality monitoring sites across the Falkirk Council area. The monitoring data from all of the sites can be viewed on the Scottish Air Quality website at:

<http://www.scottishairquality.co.uk/latest/summary?view=la>

To learn more about the EcoStars Fleet Recognition Scheme and for details of how to join if you are a commercial fleet operator please visit:

<https://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 Council's area during 2017. 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) summarises the work being undertaken by Falkirk Council to improve air quality and any progress that has been made.

Table 1.1 – Summary of National Air Quality Strategy 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 (AQMA) 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 AQMA declared by Falkirk Council can be found in Table 2.1

Further information related to declared or revoked AQMA, including maps of AQMA boundaries are available online at https://uk-air.defra.gov.uk/aqma/local-authorities?la_id=371 – see full list at <http://uk-air.defra.gov.uk/aqma/list>

Falkirk Council plans to undertake a full assessment of the Grangemouth AQMA during 2018 complimented by an extensive air quality modelling exercise of industrial sources. This will inform future monitoring requirements and management of air quality within this industrial region. The Scottish Government has provided support for this assessment.

A review and assessment is planned to be undertaken on the Banknock AQMA during 2018.

A review and assessment of the Falkirk Town Centre and Haggs AQMA will be undertaken in 2019.

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 an area of Falkirk Town Centre.	Air Quality Action Management Plan (Falkirk Town Centre and Hags) 2015 Air Quality Management Action Plan (Falkirk Town Centre and Hags) June 2015
Banknock	PM ₁₀ 24-hour mean and annual mean	Banknock	An area encompassing an area within Banknock, Falkirk.	Air Quality Action Management Plan (Banknock)
Hags	NO ₂ annual mean	Hags	An area that connects Banknock and Hags around the road junction of the A803 and M80	Air Quality Management Plan (Falkirk Town Centre and Hags) 2015 Air Quality Management Action Plan (Falkirk Town Centre and Hags) June 2015
Grangemouth	SO ₂ 15-min mean	Grangemouth	An area encompassing the Grangemouth industry areas, shipping port and adjacent residential areas	Air Quality Management Plan (Grangemouth) 2010 Available on request

2.2 Progress and Impact of Measures to Address Air Quality in Falkirk Council Area

Falkirk Council has taken forward a number of measures during the current reporting year of 2017 in pursuit of improving local air quality. Details of all measures completed, in progress or planned are set out in Table 2.3. More detail on these improvement measures can be found in the relevant AQAP relating to each AQMA.

Key completed measures are:

Measure 1: Improving Grangemouth SO₂ Data Access

Falkirk Council regularly sends provisional SO₂ and associated meteorological data to SEPA, INEOS, Petronineos and other interested parties when an SO₂ exceedance is recorded at an air quality monitoring station within the Grangemouth AQMA. In addition a monthly summary is sent and annual running totals are produced.

Measure 3: Text Alert System (Upgrade)

A text alert system had previously been installed in 2013 to provide local contacts (SEPA, INEOS, Petroineos etc.) with air quality information when breaches of NAQS objectives were occurring - this system was linked to individual analysers. A new system will be commissioned in 2018 to work in tandem with the Falkirk Council data collection software and can be used for any pollutant measured (rather than just SO₂). It will also have the functionality of producing email alerts to users in addition to texts.

Measure 5: Electric Vehicles (EV) and Plug-ins

Electric Vehicle charging points at Council depots and points installed at public places throughout the region can be shown in the Table 2.2.

Table 2.2 Electric Vehicle Charging Points at Council Depots / Public Places in Falkirk

Location	Type	Number of Bays	Available to Public
Municipal Buildings West Bridge Street Falkirk FK1 5RS	7kW	4 (Increased from 2 in 2016)	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	4 (Increased from 1 in 2016)	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 many EV charge points located at various locations throughout the Falkirk Council area – these can be viewed using the following web link:

<http://www.chargeyourcar.org.uk/>

Progress in 2017 of EV charging infrastructure:

- A new 22kW charger has been installed at Drossie Road (Falkirk High Station) and a 7kW charger installed at Slamannan Road (Falkirk High Station)
- Abellio have installed a 7kW charger in the main Falkirk High Station car park

- Scottish Canals have installed a charger at the Falkirk Wheel

Plans for future upgrades of the EV charge network include:

- Replacing the 50kW charger at Meeks Road, along with a 22kW charger at Larbert Station
- A Low Carbon Vehicle Hub at Falkirk Stadium (Approx. 20 vehicle charging bays – 22kW and 50kW) under a photovoltaic canopy

The Falkirk Council vehicle fleet includes twelve electric cars and three electric vans. There are plans to increase this fleet in the future.

Measure 11: Take the Right Route / School Travel Pack / Walk to School

During 2017, the Take the Right Route advertising was applied to billboards, bus/cycle shelters, print and digital media. This included: three online campaigns, four wrapped buses, two bus backs, three hoardings / branded steps / north stand sign at Falkirk Football Club to raise awareness. There has also been promotion of sustainable transport methods at schools in Falkirk during 2017 – this included updating the School Travel Pack Plan and Walk to School program. These schemes reached 50 primary schools and 14,593 pupils across the Falkirk Council area.

Measure 15: Appropriate Air Quality Monitoring in AQMAs

Falkirk Council made a number of improvements to its air quality monitoring network equipment during 2017. Improvements include upgrading communications throughout the network such as the installation of a new datalogging / comms unit at the Grangemouth AURN site along with a new modem system at the Falkirk West Bridge St site to allow improved data capture rates, security and connectivity throughout.

Measure 16: Promotion of Ecostars

Falkirk Council continued to subscribe to the EcoStars Fleet Recognition scheme during 2017. Reference to EcoStars is now included in the tender specification for Falkirk Council Adult and Children's Service passenger transport services.

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	Comments
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 Grangemouth SO ₂ exceedances-monthly summary sent with ongoing totals.	Completed and on-going.	Comments relating to target pollution reductions (link to AQAP for more details)
2	Grangemouth Working Group	Policy guidance and development control	Bringing 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 fully commissioned in August 2013, meeting held in November 2013. Further meeting only if breach of objective occurs.	Completed.	

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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	Comments
3	Text Alert System	Public Information	Real-time notification of exceedances by SMS / Email	Falkirk Council	2013	2013	Text alerts received by Falkirk Council, SEPA, Petroineos and INEOS when an exceedance occurs within the 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 in 2013 / Upgraded in 2018	Rather than a text alert system linked to individual analysers this system has been upgraded in 2018 to incorporate the Council's data collection system and can be used for any measured pollutant.
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.	

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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	Comments
5	Electric Vehicles and Plug-ins	Promoting low emission transport	Cars / Fleet	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.	In 2017 the Electric vehicle charging point bays increased to 27. These are located at council depots and public places across the Falkirk Council area. Falkirk Council also purchased an additional 5 electric vehicles for its fleet in 2017 making a total of 12 electric pool cars and 3 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.	

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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	Comments
7	Review of School Bus Contracts with View to Raising EURO Engine Standards	Vehicle fleet efficiency	Buses	Falkirk Council	2017	2020	n/a	Anticipated reduction in NO _x and PM emissions from buses.	Meetings to be arranged in 2018 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.	

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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	Comments
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	

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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	Comments
11	Take the Right Route / Walk to School & School Travel Plan Pack	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.	In 2017 Take the Right Route continually promoted across the Falkirk Council area with on street interviews, 3 online campaigns, bus advertising and leaflets distributed .	Completed and on-going.	

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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	Comments
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	

Falkirk Council

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	Comments
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	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 / Improved data logging and communication equipment installed during 2017.	Completed and on-going	

Falkirk Council

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	Comments
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.	During 2017, reference to EcoStars is now included in the tender specification for Falkirk Council Adult and Children's Service passenger transport. Member meetings were held regularly during 2017.	On-going	

Falkirk Council

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	Comments
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	

Falkirk Council

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	Comments
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 ESVEP continues to assist in promoting anti idling and the reporting of smoky vehicles in the Falkirk Council area. Improvements of the associated 'Switch Off and Breathe' website has taken place.	On-going subject to annual funding allocation.	

Falkirk Council

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	Comments
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 has a local transport strategy published in 2014 entitled 'Falkirk Council Local Transport Strategy'. This strategy sets out the Council's overall transport vision. This includes objectives directly related to providing sustainable transport options such as encouraging more travel by foot / bicycle / rail, and ensuring new transport infrastructure is delivered to support sustainable travel choices.

Falkirk Council has an active travel scheme which promotes alternative transport methods to the car within the local community. Projects completed in 2017 include:

- Take the Right Route: utilising three online marketing campaigns, extensive local bus / paper / business advertising, social media presence with market research feedback concluded
- Falkirk Green Travel Map: Raising awareness of Falkirk Council's cycle / footways with 4500 maps distributed to local residents in 2017
- Provision of public static bike pumps: 10 static bike pumps located at locations across the regions cycle network
- School Travel Plan Pack: Information pack distributed to 16 schools across Falkirk. Raising awareness throughout the school network
- Active travel hub: increased health benefits of active travel within eth workplace. Projects completed during 2017 include: 16 Pop-Up Hubs/Active Travel Surgeries, 10 Dr Bike Sessions, 16 Ebike demos/led rides, 6 bike maintenance sessions

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 a Sustainable Development and Climate Change Strategy 2012 - 2017. The strategy makes reference to air quality considerations throughout. Plans are being considered to update this in 2018.

Falkirk Council will be producing a Local Heat and Energy Efficiency Strategy and Local Climate Impacts Profile in 2018. Additional information and further updates on these strategies will be provided in the LAQM Progress report 2019.

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 2017. 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 Appendix A, Figure 23. 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 NO₂ at sixty one sites during 2017.

Falkirk Council also undertook non- automatic (passive) monitoring of 1,3-Butadiene at three sites during 2017.

In addition, Falkirk Council also undertook non-automatic (passive) monitoring of benzene at sixteen sites during 2017.

Table A.2 in Appendix A shows the details of the 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 (NO₂)

Table A.3 in Appendix A compares the ratified and adjusted monitored NO₂ annual mean concentrations for the past 5 years with the air quality objective of 40µg/m³.

For diffusion tubes, the full 2017 dataset of monthly mean values is provided in Appendix B.

Table A.4 in Appendix A compares the ratified continuous monitored NO₂ hourly mean concentrations for the past 5 years with the air quality objective of 200µg/m³, not to be exceeded more than 18 times per year.

NO₂ Automatic Analyser Fixed Station Results

The 2017 monitoring results (as displayed in table A.3 and A.4) show that all seven automatic NO₂ analysers in Falkirk Council's network met both NO₂ National Air Quality Strategy objectives. The highest NO₂ annual mean result in 2017 was recorded at the Falkirk West Bridge Street site (36µg/m³). The lowest result was recorded at the Grangemouth AURN site (14 µg/m³). There has been an overall reduction in NO₂ levels at all sites since 2016. The last exceedance in relation to NO₂ annual mean was recorded in 2014 at the Falkirk West Bridge St site (41 µg/m³).

Over a five year period (from 2013 until 2017), four sites have recorded NO₂ reductions: A4–Haggs, A5–Hope St, A7–Falkirk West Bridge St and A10–Grangemouth Municipal Chambers. Two sites have recorded increased NO₂ levels: A9–Grangemouth Moray and A15–Main St, Bainsford. One site has remained at the same NO₂ level: A8–Grangemouth AURN.

Long term NO₂ trend graphs are shown in Appendix A, Figures 1 to 6. There is an overall downward trend in NO₂ (Annual Mean) concentrations at the following sites: A4–Haggs (Figure 1), A5–Hope St (Figure 2), A3–Falkirk West Bridge St (Figure 3) and A10–Grangemouth Municipal Chambers.

Likely contributing factors to the reduction in NO₂ at the above sites include roadwork upgrades on the M80 (Haggs) coupled with a 30mph speed limit introduction on the A803 which has allowed traffic to flow from the local to trunk road network. Increased

uptake of hybrid and electric vehicles may have also contributed to the overall NO₂ reduction.

NO₂ Diffusion Tube Results

The 2017 NO₂ diffusion tube monitoring results (as displayed in table A.3) show that all sixty one (non-automatic) NO₂ diffusion tubes in Falkirk Council's network met the NO₂ (annual mean) National Air Quality Strategy objectives.

Two diffusion tubes were close to the 40µg/m³ limit and the highest recorded during 2017 were: NA24-Kerse Lane, Falkirk (39µg/m³) and NA27-West Bridge Street, Falkirk (38µg/m³). These sites are both roadside locations within the Falkirk Town Centre AQMA. Diffusion tube NA27 is colocated with the West Bridge Street, Falkirk fixed monitoring station. This site contains an automatic NO₂ reference method (Chemiluminescence) analyser which has recorded a result of 36µg/m³ during 2017 which is comparable and representative (within the NAQS objective limit).

Historically, diffusion tube NA27–West Bridge Street, Falkirk records a higher concentration than the automatic analyser despite the close proximity to one another. The most likely reason is that the automatic site is located further from the kerb than NA27 and is therefore less exposed to traffic emissions.

The lowest NO₂ annual mean diffusion tube results were found at the following locations: NA105–West of Shieldhill (Rural, 7µg/m³) and NA64–New Hallglen Road, Falkirk (Roadside, 14µg/m³).

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 automatic chemiluminescence NO₂ analyser (defined within Europe as the reference method)^{ref 1}. Due to this, NO₂ concentrations recorded using diffusion tubes is typically of lower accuracy than that recorded by reference automatic (chemiluminescence) NO₂ analysers.

3.2.2 Particulate Matter (PM₁₀)

Table A.5 in Appendix A compares the ratified and adjusted monitored PM₁₀ annual mean concentrations for the past 5 years with the air quality objective of 18µg/m³.

Table A.6 in Appendix A compares the ratified continuous monitored PM₁₀ daily mean concentrations for the past 5 years with the air quality objective of 50µg/m³, not to be exceeded more than 7 times per year.

Falkirk Council measured PM₁₀ concentrations at eight locations during 2017. The Scottish NAQS objectives for PM₁₀ were met at all eight locations.

The two sites with the highest recorded annual mean PM₁₀ concentration (but within the Scottish NAQS PM₁₀ objective) were: A13–Banknock 2 (Roadside, 13µg/m³) and A15–Main St, Bainsford (Roadside, 13µg/m³). Data capture was good for these two locations, these were 99% and 94% respectively.

The two sites with the lowest annual mean PM₁₀ concentration was: A14–Banknock 3 (Urban Background, 7µg/m³) and A8–Grangemouth AURN (Urban Background / Industrial, 9µg/m³). Data capture was poor for the Banknock site at 17% but good for the Grangemouth AURN site at 95%.

Over a five year period (from 2013 until 2017), all eight sites have recorded PM₁₀ (annual mean) reductions. A selection of long-term trend graphs which shows these PM₁₀ reductions can be viewed in Appendix A, Figures 7 to 11.

The Banknock 2 monitoring site recorded the greatest number of daily exceedances (7) which was substantial increase from 4 recorded in 2015, this is within the Scottish NAQS limit (>50 µg/m³, not to be exceeded more than 7 times / year). Further investigation into the daily exceedances of the 24-hr Scottish NAQS objective indicated that localised fuel burning activities were the likely cause of the exceedances. The full results are shown in Appendix A, Table A.6.

Over a five year period (from 2013 until 2017), three sites have recorded PM₁₀ (24-hr mean) reductions: A4–Falkirk Haggs (Roadside), A7–West Bridge Street, Falkirk (Roadside) and A12–Grahams Road, Falkirk (Roadside). Two sites have recorded increased PM₁₀ (24-hr mean) results: A8–Grangemouth AURN (Urban Background / Industrial) and A13–Banknock 2. Two sites has remained at the same PM₁₀ (24hr mean) level: A10 Grangemouth Municipal Chambers and A15 Main St, Bainsford.

3.2.3 Particulate Matter (PM_{2.5})

Table A.7 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/m³.

PM_{2.5} is measured at three locations within the Falkirk Council area these are: A7 – Falkirk West Bridge St (Roadside), A8 – Grangemouth AURN (Urban Background / Industrial) and A13 – Banknock 2 (Roadside).

During 2017 there were no exceedences of the PM_{2.5} Scottish NAQS objective (10µg/m³) at any of the three monitoring sites.

All three sites recorded the same annual mean PM_{2.5} concentration (within the Scottish NAQS PM_{2.5} objective) of 6µg/m³. Data capture was reasonable for Falkirk West Bridge St at 88% and good for the Grangemouth AURN and Banknock 2 sites, these were 95% and 99% respectively.

The PM_{2.5} concentrations at the Grangemouth AURN site have gradually reduced from 9.2µg/m³ in 2012 to 6.0 µg/m³ in 2016 and 2017. See Figure 13 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, SO₂ 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 SO₂ could also impact local PM_{2.5} concentrations.

Long-term trend analysis has been completed on all three sites for PM_{2.5} and can be shown in Appendix A, Figures 12 to 14. In general terms, there has been a long-term reduction in PM_{2.5} levels at the Grangemouth AURN site since 2013 however levels have remained stable at 6µg/m³ for the Falkirk West Bridge Street and Banknock 2 sites since they were commissioned (2015 onwards).

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 0.6 (urban - roadside), 0.67 (urban background/ industrial) and 0.46 (non-urban roadside) following guidance set out in LAQM TG (16). This methodology provides an estimation of PM_{2.5} data from PM₁₀ data where only one of the two metrics is available. For urban roadside sites the correction factor was derived using PM data from the Falkirk West Bridge Street site, for the background/industrial sites the factor was derived using PM data from the Grangemouth AURN site and for non-urban roadside sites the correction factor was derived using PM data from the Banknock 2 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 2017. Grangemouth Municipal Chambers recorded the highest estimated annual PM_{2.5} concentration of 8µg/m³. Main St, Bainsford had the second highest estimated annual concentration at

7.8µg/m³. 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 (SO₂)

Table A.8 in Appendix A compares the ratified continuous monitored SO₂ concentrations for 2017 with the air quality NAQS objectives for SO₂.

In 2017 Falkirk Council monitored SO₂ at six locations. Four of the sites are located within the Grangemouth (15-minute) AQMA and two of the sites are located outwith the AQMA.

There were no breaches of the SO₂ objectives (15-minute, hourly or daily) recorded at any of the Falkirk Council monitoring locations during 2017.

For 2017, the sites recording the highest exceedances of the 15-minute objective concentration (266µg/m³) were A9–Grangemouth Moray (10) and A10-Grangemouth Municipal Chambers (4). No other exceedances were recorded at any of the other sites during 2017.

During 2017, there were no exceedances of the hourly objective concentration (350µg/m³) and daily objective concentration (125µg/m³).

This is the fourth consecutive year that no breaches of the SO₂ 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 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 would not be considered close to a breach of the objective with 10 and 4 exceedances recorded (35 allowed) at each site respectively.

The majority of the exceedances occurred during May and July 2017. 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 Grangemouth refinery, even with tail gas treatment in place.

Long-term trend analysis of SO₂ concentrations within the Grangemouth AQMA shows that the number of exceedances has 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.

It is anticipated that the Grangemouth AQMA will be assessed during 2018

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 2013 at the Grangemouth AURN site, the polar plots indicate the highest average concentrations during particular wind conditions were greater than $90\mu\text{g}/\text{m}^3$ (as shown in Figure 22, B) Grangemouth AURN: 2013–2017) . In 2017 the highest average concentrations at the AURN site have reduced to $45\mu\text{g}/\text{m}^3$ (as shown in Figure 22, A) Grangemouth AURN: 2017). Polar roses for the Grangemouth sites are shown in Figure 22, A) to F) 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 2017 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 2017 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. Only four of the sixteen benzene diffusion tubes achieved 100% data

capture (NA21, NA27, NA37 and NA42) with nine tubes achieving 91% (NA3, NA38, NA41, NA55, NA57, NA77, NA80, NA81, and NA94), two achieving 83% (NA102 and NA105) and one site achieving a low 50% data capture rate (NA44).

In 2017 the pumped diffusion tube at the Grangemouth AURN site recorded an annual average concentration of $0.65\mu\text{g}/\text{m}^3$. The concentration recorded continues to be within the relevant objectives and is a slight increase compared to 2016 ($0.64\mu\text{g}/\text{m}^3$).

4. New Local Developments

4.1 Road Traffic Sources

4.1.2 Narrow Congested Streets

There have been no changes from last year's annual progress report. 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 has not identified any streets where pedestrians may spend 1 hour or more in close proximity to road traffic.

For info: the Falkirk Council automatic monitoring network recorded no exceedances of the hourly NO₂ National Air Quality Strategy Objective concentration and all of the NO₂ non-automatic diffusion tubes (across the Falkirk Council network) recorded annual concentrations below 40µg/m³.

4.1.4 Roads with a High Flow or Buses and / or HGVs

No changes from last year's annual progress report. There are no sections of roads in the Falkirk Council area where the percentage of HGVs using these are greater than 20%. Therefore no consideration is required.

4.1.5 Junctions

There were no new road junctions constructed during 2017 within the Falkirk Council area.

4.1.6 New Roads Constructed or Proposed

There were no new roads constructed or proposed during 2017 within the Falkirk Council area.

4.1.7 Roads with Significantly Changed Traffic Flows

There were no roads with significantly changed traffic flows during 2017 within the Falkirk Council area.

4.1.8 Bus or Coach Stations

There have been no changes from last year's annual progress report. There are no new bus or coach stations constructed or planned for the foreseeable future within the Falkirk Council area

4.2 Other Transport Sources

4.2.1 Airports

The nearest major airport to the Falkirk Council area is Edinburgh. Airport passenger movements between January 2016 and 2017 have increased by 12% from 699,441 in 2016 to 781,072^{ref 2} in 2017. This airport does not need considering further as it is greater than 1km from the Falkirk Council boundary.

Falkirk Council is not aware of any significant changes to Cumbernauld airport. This is small airport situated near to the Falkirk Council boundary.

No other new airports are constructed or planned for the foreseeable future.

4.2.2 Stationary trains

Falkirk Council has not identified any new locations where locomotives or trains are stationary for more than 15-minutes that would not have been assessed in previous annual progress 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. The Grangemouth Port is the nearest major port within Falkirk Council area and this has been operating for many years.

4.3 Industrial Sources

Industrial Installations – New / Proposed Installations

New Energy Plant Application – Ineos

During September 2017, Falkirk Council received a planning application for a proposed development of a new energy plant (and associated works) at Ineos, Grangemouth. The proposed new energy plant is required to provide a replacement source of steam and gas-fired electrical power generation to the Grangemouth Complex.

The proposed development plans to increase the conversion efficiency of fuel gas to steam and result in an overall reduction in the steam generating capacity at the Grangemouth Complex. Within the planning application the proposed development would comprise three boilers. Under normal operating conditions only two of the boilers would be in use.

The main pollutants emitted would be NO_x and SO₂, however the short-term and long-term environmental concentrations of NO_x, NO₂, CO, SO₂, PM₁₀ and PM_{2.5} from the proposed operation were predicted using the dispersion model AERMOD.

As noted in Chapter 6 (Air Quality and Climate) of the Environmental Impact Assessment, the proposed development is located within the Grangemouth AQMA encompassing the Grangemouth petrochemical complex and adjacent areas, declared for exceedance of the SO₂ 15-minute mean Air Quality Objective (AQO).

In accordance with Falkirk Council's RW07 Policy, a detailed assessment of the potential impacts on this AQMA and the wider environment has been undertaken.

The report concludes that the proposed development would have a negligible (beneficial) effect on air quality with regards to human health which is not significant. For protected conservation areas, there are existing issues in terms of potential nitrogen loading, however the proposed development will have an additional (beneficial) impact which is not significant.

If planning consent is granted, this facility will fall within the remit of the Pollution Prevention and Control (Scotland) Regulations 2012 – Part A permit and will require a variation of the existing PPC permit which SEPA will be responsible for regulating the facility.

4.4 Commercial and Domestic Sources

4.4.1 Biomass Combustion Plants

There are no new individual biomass combustion 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 number 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 in close proximity to each other
- Significant odours 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 has not identified 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:

<http://www.falkirk.gov.uk/services/environment/environmental-policy/air-quality/smoke-control-areas.aspx>

4.4.4 Combined Heat and Power Plant

Combined Heat and Power (CHP) Renewable Energy Plant - CalaChem, Earls Gate, Grangemouth

An air quality assessment has been received in relation a planning application for a proposed Combined Heat and Power (CHP) Renewable Energy Plant at CalaChem, Earls Gate, Grangemouth. The proposed installation will burn refuse derived fuel (RDF) and is intended to replace the existing gas fired energy plant which is operated by CalaChem. This plant supplies heat and electricity to the CalaChem site and other heat users on the Earls Gate park.

The proposed facility will produce primarily emissions of NO_x, SO₂, heavy metals, dioxins and furans as well as other substances. The proposed facility will have five gas boilers, but only two of these will be required when the CHP Plant is operational. The additional three gas fired boilers will only be required when the CHP plant is offline to ensure a constant steam supply to users. Two scenarios were considered within the modelling assessment:

1. Typical operations: the operation of the CHP plant and two gas fired boilers
2. CHP offline – five gas fired boilers.

In addition to stack emission dispersion modelling an odour assessment was included.

The conclusions from the air quality assessment were as follows:

- Emissions from the proposed facility would not cause a breach of the air quality assessment levels (AQAL)
- The maximum predicted impact can be screened out as 'insignificant' using a series of highly conservative assumptions for most pollutants. For those which cannot be screened out as insignificant it can be concluded that the impact is 'not significant'
- The impact of the short term sulphur dioxide emissions in the AQMA can be screened out as 'insignificant'
- The dispersion modelling has shown that the maximum impact will be significantly lower than the odour criterion therefore there should be no

reasonable cause of annoyance due to odour releases from the odour control stack

4.5 New Developments with Fugitive or Uncontrolled Sources

Landfill sites are regulated by SEPA licences and no changes with respect to the pollutants covered in 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 Proposed Residential and Commercial Development – Gilston Farm near Polmont – Odour and Dust Risk Assessments – December 2017

Falkirk Council received an odour and dust assessment for the proposed residential and commercial development at Gilston Farm near Polmont in December 2017. The proposed development is for a mixed-use development comprising residential accommodation and commercial / retail / hotel facilities. The assessment was submitted to demonstrate that dust and odour has been assessed from the proposed development.

The dust and odour assessment report was carried out by ITP Energised on behalf of Acies Group. The report demonstrates that the potential odour impact has been assessed as negligible at the closest medium sensitivity receptors (office use) and 'slight adverse' at the closest high sensitivity receptors (residential use). Overall the predicted odour impact at all receptors within the proposed development is considered as 'not significant'.

The risk of dust impacts has been assessed as 'negligible' and 'not significant'. Mitigation options were presented to reduce the potential odour impacts to negligible at all receptors which concluded the report

5.2 Whitecross Mixed-Use Redevelopment at Former Manuel Brickworks Site at Whitecross, Falkirk – Air Quality Assessment – December 2017

Falkirk Council received an air quality assessment for the proposed mixed-use redevelopment (comprising up to 1500 units) of the former Manuel Brickworks Site at Whitecross, Falkirk in December 2017.

The air quality assessment was carried out by Surface Property on behalf of CWC Group.

This report was submitted to assess the following:

- Dust generation during construction of the development
- Potential impacts of the development on existing and new residential receptors
- The Design Manual for Roads and Bridges (DMRB) screening method used to assess traffic for baseline year 2017 and a future year of 2024

The assessment focuses on the main pollutants relating to road traffic – NO₂ and PM₁₀.

The qualitative assessment of the construction dust effects within the air quality assessment has shown that the Air Quality Objective for PM₁₀ will not be exceeded. The assessment also scoped out demolition effects and effects on ecological receptors. It concluded high risk from earthworks, construction and track out on dust soiling and low risk from earthworks, construction, and trackout on human health receptors. With the implementation of best practice mitigation measures no significant effects were predicted from the report's conclusions

The DMRB screening assessment demonstrated that background air quality in 2024 when the development is operational will not exceed Air Quality Objectives for NO₂ or PM₁₀ at existing or new receptors.

Overall the development was predicted to have a negligible impact on the surrounding environment, including existing residential properties along Myrehead Road, Haining.

6. Conclusions and Proposed Actions

6.1 Conclusions from New Monitoring Data

Falkirk Council has assessed its automatic and non-automatic 2017 monitoring results.

All seven automatic NO₂ analysers in Falkirk Council's network met both NO₂ NAQS objectives. There has been an overall reduction in NO₂ levels at all sites since 2016. There is an overall downward trend in NO₂ (Annual Mean) Concentrations at four of the seven sites.

All sixty one NO₂ diffusion tubes in Falkirk Council's network met the NO₂ (annual mean) National Air Quality Strategy objectives. Two diffusion tubes were close to the 40µg/m³ limit and were the highest recorded were: NA24-Kerse Lane, Falkirk (39µg/m³) and NA27-West Bridge Street, Falkirk (38µg/m³). These are both roadside locations within the Falkirk Town Centre AQMA. There were two NO₂ diffusion exceedances in 2016 both located at Falkirk West Bridge Street.

Falkirk Council measured PM₁₀ concentrations at eight locations during 2017. The Scottish NAQS objectives for PM₁₀ were met at all eight locations.

The two sites with the highest annual mean PM₁₀ concentration (but within the Scottish NAQS PM₁₀ objective) was: A13–Banknock 2 (Roadside, 13µg/m³) and A15–Main St, Bainsford (Roadside, 13µg/m³). Over a five year period (from 2013 until 2017), all eight sites have recorded PM₁₀ (annual mean) reductions.

During 2017 there were no exceedences of the PM_{2.5} Scottish NAQS objective (10µg/m³) at any of the three monitoring sites. All three sites recorded the same annual mean PM_{2.5} concentration (within the Scottish NAQS PM_{2.5} objective) of 6µg/m³.

There were no breaches of the SO₂ objectives (15-minute, hourly or daily) recorded at any of the Falkirk Council monitoring locations during 2017.

For 2017, the sites recording the highest exceedances of the 15-minute objective concentration (266µg/m³) were A9–Grangemouth Moray (10) and A10-Grangemouth Municipal Chambers (4). No other exceedances were recorded at any of the other sites during 2017.

During 2017, there were no exceedances of the hourly objective concentration ($350\mu\text{g}/\text{m}^3$) and daily objective concentration ($125\mu\text{g}/\text{m}^3$).

This is the fourth 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 objective concentrations, the number of exceedances were below the maximum permitted by the respective objectives.

Long term trend analysis of SO_2 concentrations within the Grangemouth AQMA shows that the number of exceedances has reduced since 2013. Although the SO_2 objectives are currently complied with, it is essential that the SO_2 analysers in Falkirk Council network in the Grangemouth area continue operation. Pollution episodes where exceedances of the 15-min mean can be seen across the Council monitoring network, typically in the spring and summer months.

In 2017 Falkirk Council monitored 1, 3-butadiene at three locations and sixteen locations using passive diffusion tubes, all the results were within the objective. The pumped diffusion tube at the Grangemouth AURN continues to be within the relevant objectives and is a slight increase compared to 2016 ($0.64\mu\text{g}/\text{m}^3$).

Local Air Quality Policy PG (S) 16^{ref3} 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 NAQS objectives have been achieved within the Grangemouth AQMA for four consecutive years; Falkirk Council considers the AQMA remains justified based upon continual exceedances of the 15min objective concentration recorded at the Grangemouth Moray and Municipal Chambers sites for the past three consecutive years.

It is to be noted that an assessment of the Grangemouth AQMA (in conjunction with a comprehensive pollution modelling study) will be completed in 2018.

The Falkirk Town Centre AQMA remains justified as although NO_2 NAQS objectives were met, there were two NO_2 diffusion tubes results that were close to this objective limit ($40\mu\text{g}/\text{m}^3$), these were NA24-Kerse Lane, Falkirk ($39\mu\text{g}/\text{m}^3$) and NA27-West

Bridge Street, Falkirk ($38\mu\text{g}/\text{m}^3$). The PM_{10} annual mean and 24-hour concentrations continue to be reducing and meeting the objectives.

The Haggs AQMA will be reviewed in 2018 as the NO_2 and PM_{10} NAQS objectives have been met for four consecutive years. A detailed assessment will be completed in 2018 to understand whether an application to revoke is appropriate.

The roadside and background monitoring within the Banknock AQMA has shown compliance with the PM_{10} objectives for more than 4 years. This AQMA was declared in August 2011 when Cowdenhill quarry was identified as the primary PM_{10} source. It is anticipated that the quarry related planning applications in this area will be concluded in late 2018 which will inform an assessment of the AQMA.

Main St, Bainsford met all NAQS objectives for NO_2 , PM_{10} and $\text{PM}_{2.5}$ (annualised estimation) in 2017. Falkirk Council undertook a detailed assessment of NO_2 , PM_{10} and $\text{PM}_{2.5}$ in Main St, Bainsford in 2016. Falkirk Council will continue to assess the monitoring results within this area and provide an updated detailed assessment in 2019 which will inform future management of the air quality in relation to a potential AQMA process.

6.2 Conclusions relating to New Local Developments

Falkirk Council has assessed new and proposed local developments in the Falkirk area during 2017 and concludes that none of the developments have the potential to introduce new exceedances of relevant levels, or exacerbate existing ones.

An air quality assessment was received in relation a planning application for proposed Combined Heat and Power Renewable Energy Plant at CalaChem, Earls Gate, Grangemouth. The proposed installation will burn refuse derived fuel (RDF) and is intended to replace the existing gas fired energy plant which is operated by CalaChem which supplies heat and electricity to the CalaChem site and other heat users on the Earls Gate park.

The conclusions from the air quality assessment were as follows:

- Emissions from the proposed facility do not cause a breach of the air quality assessment levels (AQAL)
- The maximum predicted impact can be screened out as 'insignificant' using a series of highly conservative assumptions for most pollutants. For those which cannot be screened out as insignificant it can be concluded that the impact is 'not significant'
- The impact of the short term sulphur dioxide emissions in the AQMA can be screened out as 'insignificant'
- The dispersion modelling has shown that the maximum impact will be significantly lower than the odour criterion therefore there should be no reasonable cause of annoyance due to odour releases from the odour control stack

Falkirk Council Environmental Health was satisfied with the outcomes of the air quality and odour modelling assessment. The site (if planning permission is granted) will be under the control of a SEPA PPC permit.

Falkirk Council received an odour and dust assessment for the proposed residential and commercial development at Gilston Farm near Polmont. The proposed development is for a mixed-use development comprising residential accommodation and commercial / retail / hotel facilities. The assessment was submitted to demonstrate that dust and odour has been assessed from the proposed development.

The dust and odour assessment that was carried out by ITP Energised on behalf of Acies Group demonstrated that the potential odour impact had been assessed as negligible at the closest medium sensitivity receptors (office use) and 'slight adverse' at the closest high sensitivity receptors (residential use). Overall the predicted odour impacts at all receptors within the proposed development was considered 'not significant'.

The risk of dust impacts is assessed as 'negligible' and 'not significant'. Mitigation options are presented to reduce the potential odour impacts to negligible at all receptors.

Falkirk Council assessed this report and found that the dust emission magnitude has been rated as 'large' for earthworks, construction and 'medium' for trackout phases – this would give cause for concern under dry weather conditions particularly close to existing nearby local sensitive receptors if planning permission was granted for the development. However, using guidance for the management of these dust emissions from the stated IAQM 2014 includes minimum mitigating measures for their management that would be deemed acceptable. Falkirk Council also recommended monitoring of these mitigation measures to ensure they are being adhered to.

Falkirk Council received an air quality assessment for the proposed mixed-use redevelopment (comprising up to 1500 units) of the former Manuel Brickworks Site at Whitecross, Falkirk in December 2017.

The air quality assessment was carried out by Surface Property on behalf of CWC Group.

This report was submitted to assess the following:

- Dust generation during construction of the development
- Potential impacts of the development on existing and new residential receptors
- The Design Manual for Roads and Bridges (DMRB) screening method used to assess traffic for baseline year 2017 and a future year of 2024

The assessment focuses on the main pollutants relating to road traffic – NO₂ and PM₁₀.

The qualitative assessment of the construction dust effects has shown that the Air Quality Objective for PM₁₀ will not be exceeded. The assessment also scoped out demolition effects and effects on ecological receptors. It concluded high risk from earthworks, construction and track out on dust soiling and low risk from earthworks, construction, and trackout on human health receptors. With the implementation of best practice mitigation measures no significant effects were predicted.

The DMRB screening assessment demonstrated that background air quality in 2024 when the development is operational will not exceed Air Quality Objectives for NO₂ or PM₁₀ at existing or new receptors.

Overall the development was predicted to have a negligible impact on the surrounding environment, including existing residential properties along Myrehead Road, Haining.

Falkirk Council reviewed the report and asked for further detail in relation to the following aspects:

- Inclusion of a statement of what the actual development proposes e.g. number of houses, any associated roads, any other building types within development etc.
- Some further explanation why the DMRB screening method has been used for pollution modelling purposes in this assessment over other packages such as ADMS roads? Perhaps use statement taken from DEFRA TG16
- 'An assessment of construction dust effects has been undertaken' – reference as to where this can be found within the assessment document would be beneficial
- A statement on the air quality assessment's author and their relevant qualifications would be useful in accordance with the Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations (2017 (SI 2017/571)
- Some more information required to be added in table 2.1 – for example NO₂ – 200µg/m³ - not to be exceeded more than 18 times a year – 1hr mean

Details can be found here: <http://www.scottishairquality.co.uk/air-quality/standards>

- It would be useful to include the PM_{2.5} objectives but also include the associated statement directly below the table stating that it is not included in this assessment.

West Lothian Council also provided the following comment this report as the proposed development is in close proximity to their Council boundary:

“The AADT in that section is not clear. It does not give an indication of what the increase in AADT will be in Linlithgow. Would you be able to place an objection on the grounds of insufficient information for this data?”

An updated revision of the air quality report with the above recommended requirements is yet to be received by the Falkirk Council Environmental Health team.

6.3 Proposed Actions

Falkirk Council has examined its automatic and non-automatic monitoring results. No exceedances of the Scottish NAQS objectives, within or outside existing AQMAs were identified by the automatic monitoring network. However, diffusion tubes NA24 and NA27 recorded an annual NO₂ concentration close to the Scottish NAQS annual objective of 40µg/m³. 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 PM₁₀ and NO₂ concentrations along Main Street, Bainsford. Automatic monitoring commenced in June 2015. The monitoring data so far indicates that the air quality objectives for both NO₂ and PM₁₀ are being met, for this reason Falkirk Council will not be declaring Main Street, Bainsford an AQMA. The diffusion tubes located in this area recorded results in 2017 within the NAQS objective (NA107 – Main St, Bainsford, 26µg/m³ and NA112 Phillip St, Bainsford, 16µg/m³). 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.

Monitoring data for 2017 has highlighted that the Haggs and Banknock AQMA's should be reviewed in 2018 as both sites continue to meet the NAQS objectives. In particular the Haggs AQMA will be a priority for review as the Banknock AQMA is subject to planning applications in relation to quarry activities in this area. It is anticipated that these will be concluded in late 2018

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 review of the Grangemouth AQMA and inclusion of modelling study of pollution sources within the industrial area. The information gained through either of these options will help inform an updated action plan for the Grangemouth AQMA.

An Air Quality Progress Report as required by the Scottish Government shall be submitted in June 2019.

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, APSA 370, UV Fluorescence	5	22	1.2
A4	Falkirk Haggs	Roadside	278977	679271	NO ₂ , PM ₁₀	Y (NO ₂)	NO _x : Casella MLME, Chemiluminescence. PM ₁₀ : R&P TEOM	5	2	1.2
A5	Falkirk Hope St	Roadside	288688	680218	NO ₂ , SO ₂	Y (NO ₂ and PM ₁₀)	SO ₂ : Horiba, APSA 360, UV Fluorescence. NO _x : Horiba APNA 360, Chemiluminescence.	1	5	1.5
A7	Falkirk West Bridge St	Roadside	288457	680064	NO ₂ , PM ₁₀	Y (NO ₂ and PM ₁₀)	NO _x : API Teledyne, T200, Chemiluminescence. PM ₁₀ : PALAS FIDAS 200 (Optical, light-scattering)	1	2	1.2
A8	Grangemouth AURN	Urban Background / Industrial	293830	681022	Benzene, NO ₂ , SO ₂ , PM ₁₀ and PM _{2.5}	Y (SO ₂)	Benzene: Pumped absorption tube. SO ₂ : Casella MLME, UV Fluorescence. NO _x : Casella, MLME, Chemiluminescence. PM _{10+2.5} : R&P, TEOM FDMS.	5	20	3.5
A9	Grangemouth Moray	Urban Background / Industrial	293469	681321	NO ₂ , SO ₂	Y (SO ₂)	SO ₂ : Horiba, APSA 370, UV Fluorescence. NO _x : Casella, MLME, Chemiluminescence.	1	25	3.5

Falkirk Council

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)
A10	Grangemouth Municipal Chambers	Urban Background / Industrial	292816	682009	NO ₂ , SO ₂ and PM ₁₀	Y (SO ₂)	SO ₂ : Horiba, APSA 370, UV Fluorescence. NO _x : Horiba APNA 360, Chemiluminescence. PM ₁₀ : R&P, TEOM.	1	40	3.5
A11	Grangemouth Zetland Park	Urban Background / Industrial	292969	681106	SO ₂	Y (SO ₂)	SO ₂ : Horiba, APSA 370, UV Fluorescence.	1	135	3.5
A12	Falkirk Grahams Rd	Roadside	288823	680242	PM ₁₀	Y (NO ₂ and PM ₁₀)	PM ₁₀ : R&P, TEOM	1	10	1.2
A13	Banknock 2	Roadside	277247	679027	PM ₁₀	Y (PM ₁₀)	PALAS FIDAS 200 (Optical, light-scattering)	7	3	1.2
A14	Banknock 3	Urban Background	277168	679254	PM ₁₀	Y (PM ₁₀)	Turnkey Osiris (Optical, light-scattering)	19	17	1.3
A15	Main St, Bainsford	Roadside	288566	681508	NO ₂ , PM ₁₀	N	NO _x : Horiba APNA 360, Chemiluminescence. PM ₁₀ : R&P, TEOM	1	2	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	<5	2.6	N
NA5	Copper Top pub, Camelon	Roadside	287332	680333	NO ₂	N	<2	0.6 (traffic island)	N
NA7	Irving Parish Church, Camelon	Urban background	287324	680442	NO ₂	N	<5	1.4	N
NA9	Bellsdyke Rd, Larbert	Roadside	286048	683542	NO ₂	N	<2	0.7	N
NA19	Kilsyth Rd, Banknock	Roadside	278779	679301	NO ₂	Y	<2	2.2	N
NA20	Garngrew Rd, Haggs	Urban background	278957	679172	NO ₂	N	<5	1.5	N
NA21	Grangemouth Rd, Falkirk College	Roadside	290112	680500	Benzene, NO ₂	N	<2	1.8	N
NA24	Kerse Lane, Falkirk	Roadside	289189	680018	NO ₂	Y	<2	3	N
NA26	Weir St, Falkirk	Urban background	289207	680123	NO ₂	Y	<5	1.7	N
NA27	West Bridge St, Falkirk	Roadside	288490	680055	Benzene, NO ₂	Y	<2	0.5	Y
NA29	Wellside Place, Falkirk	Urban background	288467	680220	NO ₂	N	<5	1.6	N
NA36	Kerr Crescent, Haggs	Roadside	278985	679273	NO ₂	Y	<5	2.1	N
NA37	Denny Town House	Urban centre	281226	682526	Benzene, NO ₂	N	<5	8.9	N
NA38	Larbert Village Primary School	Urban background	285937	682309	Benzene, NO ₂	N	<5	2.3	N
NA41	Seaview Place, Bo'ness	Roadside	299722	681594	Benzene, 1,3 Butadiene, NO ₂	N	<2	0.1	N
NA42	Municipal Chambers, Grangemouth	Urban centre / Industrial	292817	682000	Benzene, NO ₂	N	<5	37.5	Y

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?
NA44	Harvey Avenue, Polmont	Urban background	293720	678911	Benzene, NO ₂	N	<5	1.6	N
NA48	Hayfield, Falkirk.	Urban background	289197	681564	NO ₂	N	<5	3.1	N
NA50	Upper Newmarket St, Falkirk	Urban background	288671	680047	NO ₂	Y	<5	9	N
NA51	Mary St, Laurieston	Roadside	290965	679490	NO ₂ .	N	1	4.5	N
NA52	Main St, Larbert	Roadside	285866	682356	NO ₂	N	<2	4.4	N
NA53	Denny Cross	Roadside	281211	682727	NO ₂	N	<2	0.8	N
NA55	Inchyra Air Quality Station, Grangemouth	Urban background / industrial	293830	681022	Benzene, 1, 3-butadiene	N	<5	5	Y
NA57	Inchyra Road, Grangemouth	Urban background / industrial	294028	680829	Benzene, NO ₂	N	<5	1.2	N
NA58	Callendar Rd, Falkirk	Roadside	290194	679624	NO ₂	N	<2	0.5	N
NA59	Carron Rd, Bainsford	Roadside	288392	681931	NO ₂	N	<2	1.2	N
NA60	Ronades Rd, Carron	Roadside	288133	681587	NO ₂	N	<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	<2	1.2	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?
NA63	Camelon Rd, Falkirk	Urban background	288055	680134	NO ₂	On AQMA boundary NO ₂	<5	1.4	N
NA64	New Hallglen Rd, Falkirk	Roadside	288807	678422	NO ₂	N	<2	1.7	N
NA65	Redding Rd, Redding	Roadside	291356	678644	NO ₂	N	<2	0.6	N
NA67	Queen St, Falkirk	Urban background	289430	680433	NO ₂	N	<5	1.8	N
NA68	Bellevue St, Falkirk	Roadside	289234	679945	NO ₂	Y	<2	1.7	N
NA69	Kerse Lane, Falkirk	Roadside	289025	679991	NO ₂	Y	<2	2.3	N
NA71	Park St, Falkirk	Roadside	288910	680112	NO ₂	Y	<2	1.5	N
NA72	Vicar St, Falkirk	Roadside	288824	680120	NO ₂	Y	<2	1.5	N
NA73	West Bridge St RHS, Falkirk	Roadside	288467	680048	NO ₂	Y	<2	0.3	N
NA76	Tryst Road, Stenhousemuir	Roadside	286851	683229	NO ₂	N	<2	1.8	N
NA77	Kinnaird Village	Roadside	286490	683775	Benzene, NO ₂	N	<2	3.9	N
NA78	Glen Brae, Falkirk	Roadside	288525	678991	NO ₂	N	<2	2.6	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?
NA80	Cow Wynd, Falkirk	Roadside	288765	679456	Benzene, NO ₂	N	<2	1.8	N
NA81	Grahams Rd, Falkirk	Roadside	288817	680911	Benzene, NO ₂	N	<2	0.5	N
NA82	Castings Ave, Falkirk	Roadside	288858	681036	NO ₂	N	<2	1	N
NA83	Main St, Bainsford	Roadside	288614	681415	NO ₂	N	<2	0.5	N
NA85	Auchinloch Dr, Banknock	Roadside	278752	679049	NO ₂	Y	<2	0.8	N
NA86	Wolfe Rd, Falkirk	Urban background	289667	679871	NO ₂	N	<2	2	N
NA87	M80 slip south, Hags	Roadside	279017	679305	NO ₂	Y	<2	1.6	N
NA88	Ure Crescent, Bonnybridge	Roadside	282444	681074	NO ₂	N	<2	1.7 (16 to M876)	N
NA89	Grahams Rd / Meeks Rd, Falkirk	Roadside	288856	680336	NO ₂	Y	<2	2.2	N
NA94	A905 (Glensburgh Rd), Grangemouth	Roadside	291213	681927	Benzene, NO ₂	N	7	5.4	N
NA98	Arnothill, Falkirk	Urban background	288080	680073	NO ₂	N	23	1.6	N
NA99	St Crispins Place, Falkirk	Roadside	288924	679675	NO ₂	Y	7.6	2.7	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?
NA100	Oswald St, Falkirk	Urban background	288977	679662	NO ₂	N	3.8	1.5	N
NA101	Glensburgh Road (2), Grangemouth	Roadside	291127	682007	NO ₂	N	7	0.9	N
NA104	Powdrake Road, Grangemouth	Urban background / industrial	293817	682028	1,3- butadiene	N	40	1.8	N
NA105	West of Shieldhill	Rural	288279	676875	Benzene, NO ₂	N	Background rural site	1.7	N
NA107	Main Street (east), Bainsford	Roadside	288640	681396	NO ₂	N	4	0.5	N
NA108	Main St, Camelon	Roadside	286834	680512	NO ₂	N	12.2	2.2	N
NA109	Carmuirs St, Camelon	Urban background	286786	680488	NO ₂	N	45	40	N
NA110	Banknock 2 Air Quality Station	Roadside	277247	679027	NO ₂	Y	5.2	2.6	N
NA111	Falkirk West Bridge St Air Quality Station	Urban centre	288457	680064	NO ₂	Y	4.3	2.3	Y
NA112	Phillip St, Bainsford	Urban background	288505	681443	NO ₂	N	5.4	1.1	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).

(2) N/A if not applicable.

Table A.3 – Annual Mean NO₂ Monitoring Results

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) ⁽¹⁾	Valid Data Capture 2017 (%) ⁽²⁾	NO ₂ Annual Mean Concentration (µg/m ³) ⁽³⁾				
					2013	2014	2015	2016	2017
A4	Falkirk Haggs	Automatic	76	76	34	32	30	33	28
A5	Falkirk Hope St	Automatic	83	83	23	23	21	23	19
A7	Falkirk West Bridge St	Automatic	94	94	39	41	37	37	36
A8	Grangemouth AURN	Automatic	96	96	14	16	14	16	14
A9	Grangemouth Moray	Automatic	85	85	16	15	15	18	17
A10	Grangemouth Municipal Chambers	Automatic	98	98	20	19	18	21	17
A15	Main St, Bainsford	Automatic	89	89	n/m	n/m	15	24	23
NA3	Tinto Drive, Grangemouth	Diffusion Tube	100	100	21	19	20	19	18
NA5	Copper Top pub, Camelon	Diffusion Tube	91	91	28	27	27	25	24
NA7	Irving Parish Church, Camelon	Diffusion Tube	100	100	19	18	17	16	15
NA9	Bellsdyke Rd, Larbert	Diffusion Tube	100	100	26	29	26	25	24
NA19	Kilsyth Rd, Banknock	Diffusion Tube	100	100	36	36	26	33	26
NA20	Garngrew Rd, Haggs	Diffusion Tube	100	100	24	22	23	24	22

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) ⁽¹⁾	Valid Data Capture 2017 (%) ⁽²⁾	NO ₂ Annual Mean Concentration (µg/m ³) ⁽³⁾				
					2013	2014	2015	2016	2017
NA21	Grangemouth Rd, College	Diffusion Tube	100	100	28	28	28	28	28
NA24	Kerse Lane, Falkirk	Diffusion Tube	100	100	42	37	38	35	39
NA26	Weir St, Falkirk	Diffusion Tube	91	91	21	18	17	18	17
NA27	West Bridge St, Falkirk	Diffusion Tube	100	100	53	45	47	48	38
NA29	Wellside Place, Falkirk	Diffusion Tube	100	100	18	17	15	17	17
NA36	Kerr Crescent, Haggs	Diffusion Tube	91	91	40	38	37	38	35
NA37	Denny Town House	Diffusion Tube	100	100	19	20	18	17	15
NA38	Larbert Village Primary School	Diffusion Tube	100	100	19	18	16	17	15
NA41	Seaview Place, Bo'ness	Diffusion Tube	100	100	22	21	21	21	20
NA42	Municipal Chambers, Grangemouth	Diffusion Tube	100	100	20	19	20	20	17
NA44	Greenpark Drive, Polmont	Diffusion Tube	75	75	16	16	12	12	16
NA48	Hayfield, Falkirk	Diffusion Tube	100	100	21	20	19	19	16
NA50	Upper Newmarket St, Falkirk	Diffusion Tube	83	83	30	27	22	24	20
NA51	Mary St, Laurieston	Diffusion Tube	100	100	24	25	19	25	22
NA52	Main St, Larbert	Diffusion Tube	100	100	26	21	24	24	21
NA53	Denny Cross	Diffusion Tube	91	91	33	31	28	29	23

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) ⁽¹⁾	Valid Data Capture 2017 (%) ⁽²⁾	NO ₂ Annual Mean Concentration (µg/m ³) ⁽³⁾				
					2013	2014	2015	2016	2017
NA57	Inchyra Road, Grangemouth	Diffusion Tube	100	100	26	26	20	23	19
NA58	Callendar Rd, Falkirk	Diffusion Tube	75	75	22	21	21	20	22
NA59	Carron Rd, Bainsford	Diffusion Tube	75	75	28	26	29	26	28
NA60	Ronades Rd, Carron	Diffusion Tube	100	100	29	27	24	26	23
NA61	Canal Rd, Falkirk	Diffusion Tube	100	100	26	25	24	24	20
NA62	Arnot St, Falkirk	Diffusion Tube	100	100	36	38	39	39	34
NA63	Camelon Rd, Falkirk	Diffusion Tube	91	91	38	36	36	36	33
NA64	New Hallglen Rd, Falkirk	Diffusion Tube	100	100	20	18	18	18	14
NA65	Redding Rd, Redding	Diffusion Tube	100	100	24	18	27	26	23
NA67	Queen St, Falkirk	Diffusion Tube	100	100	31	28	25	29	27
NA68	Bellevue St, Falkirk	Diffusion Tube	100	100	31	29	35	31	27
NA69	Kerse Lane, Falkirk	Diffusion Tube	100	100	33	35	30	34	30
NA71	Park St, Falkirk.	Diffusion Tube	100	100	35	33	35	29	30
NA72	Vicar St, Falkirk.	Diffusion Tube	91	91	33	32	30	32	25
NA73	West Bridge St RHS, Falkirk	Diffusion Tube	100	100	35	33	31	22	28
NA76	Tryst Road, Stenhousemuir	Diffusion Tube	91	91	20	23	23	22	19
NA77	Kinnaird Village	Diffusion Tube	83	83	24	22	23	33	21

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) ⁽¹⁾	Valid Data Capture 2017 (%) ⁽²⁾	NO ₂ Annual Mean Concentration (µg/m ³) ⁽³⁾				
					2013	2014	2015	2016	2017
NA78	Glen Brae, Falkirk	Diffusion Tube	91	91	30	30	32	31	28
NA80	Cow Wynd, Falkirk	Diffusion Tube	100	100	29	30	32	27	29
NA81	Grahams Rd, Falkirk	Diffusion Tube	100	100	32	29	26	19	28
NA82	Castings Ave, Falkirk	Diffusion Tube	100	100	20	18	20	38	17
NA83	Main St, Bainsford	Diffusion Tube	75	75	37	34	35	21	31
NA85	Auchinloch Dr, Banknock	Diffusion Tube	100	100	23	21	20	16	17
NA86	Wolfe Rd, Falkirk	Diffusion Tube	100	100	19	15	18	32	15
NA87	M80 slip south, Haggis	Diffusion Tube	91	91	32	32	32	30	27
NA88	Ure Crescent, Bonnybridge	Diffusion Tube	100	100	30	29	29	30	28
NA89	Grahams Rd/Meeks Rd, Falkirk	Diffusion Tube	100	100	34	30	31	32	28
NA94	A905 (Glensburgh Rd), Grangemouth	Diffusion Tube	91	91	36	31	24	21	30
NA98	Arnohill, Falkirk	Diffusion Tube	66	66	25	22	15	26	19
NA99	St Crispins Place, Falkirk	Diffusion Tube	100	100	26	25	22	21	24
NA100	Oswald St, Falkirk	Diffusion Tube	66	66	21	20	16	23	19
NA101	Glensburgh Road (2),	Diffusion Tube	100	100	24	24	17	n/m	22

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) ⁽¹⁾	Valid Data Capture 2017 (%) ⁽²⁾	NO ₂ Annual Mean Concentration (µg/m ³) ⁽³⁾				
					2013	2014	2015	2016	2017
	Grangemouth								
NA105	West of Shieldhill	Diffusion Tube	100	100	10	9	10	8	7
NA107	Main Street (east), Bainsford	Diffusion Tube	100	100	31	30	28	30	26
NA108	Main Street, Camelon	Diffusion Tube	75	75	n/m	23	18	23	22
NA109	Carmuir Street, Camelon	Diffusion Tube	100	100	n/m	18	14	16	15
NA110	Banknock 2 AQ station	Diffusion Tube	100	100	n/m	18	19	19	16
NA111	Falkirk West Bridge St AQ station	Diffusion Tube	100	100	n/m	33	33	43	36
NA112	Philip Street, Bainsford	Diffusion Tube	100	100	n/m	16	16	17	16

Notes: Exceedences of the NO₂ annual mean objective of 40µg/m³ are shown in **bold**.

NO₂ annual means exceeding 60µg/m³, indicating a potential exceedance of the NO₂ 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 NO₂ Monitoring Results

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) ⁽¹⁾	Valid Data Capture 2017 (%) ⁽²⁾	NO ₂ 1-Hour Means > 200µg/m ³ ⁽³⁾				
					2013	2014	2015	2016	2017
A4 Falkirk Haggs	Roadside	Automatic	76	76	0	0	0	0 (119)	0 (107)
A5 Hope St	Urban Background	Automatic	83	83	0	0	0	0	0 (82)
A7 Falkirk West Bride St	Roadside	Automatic	94	94	0	0	0 (115)	0 (107)	0
A8 Grangemouth AURN	Urban background / industrial	Automatic	96	96	0	0	0	0	0
A9 Grangemouth Moray	Urban background / industrial	Automatic	85	85	0	0	0	0	0
A10 Grangemouth Municipal Chambers	Urban background / industrial	Automatic	98	98	0	0	0 (86)	0 (72)	0
A15 Main St, Bainsford	Roadside	Automatic	89	89	n/m	n/m	0 (45)	0 (94)	0

Notes: Exceedences of the NO₂ 1-hour mean objective (200µg/m³ 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.

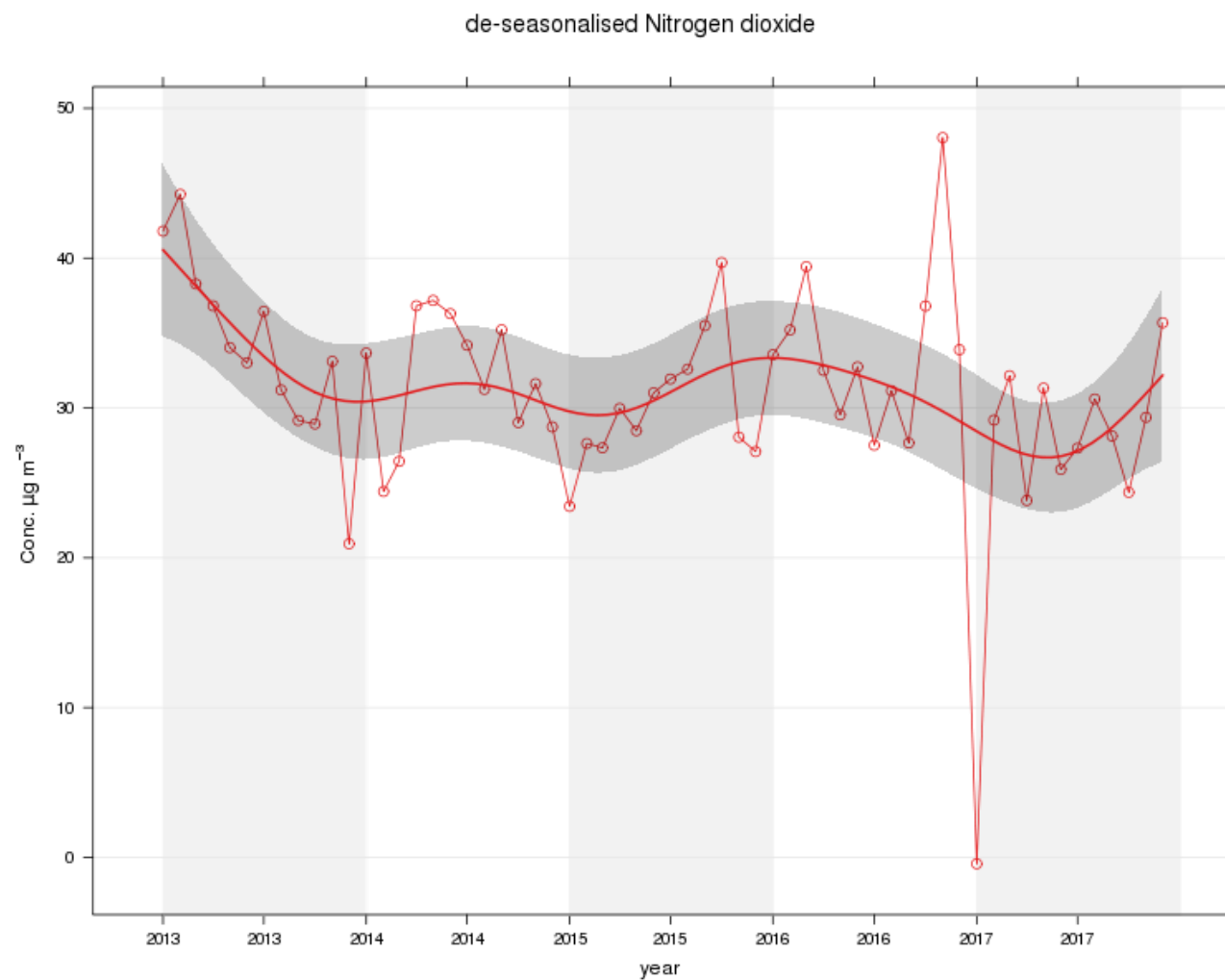
Figure 1 – A4 Falkirk Haggs Long Term NO₂ Concentrations

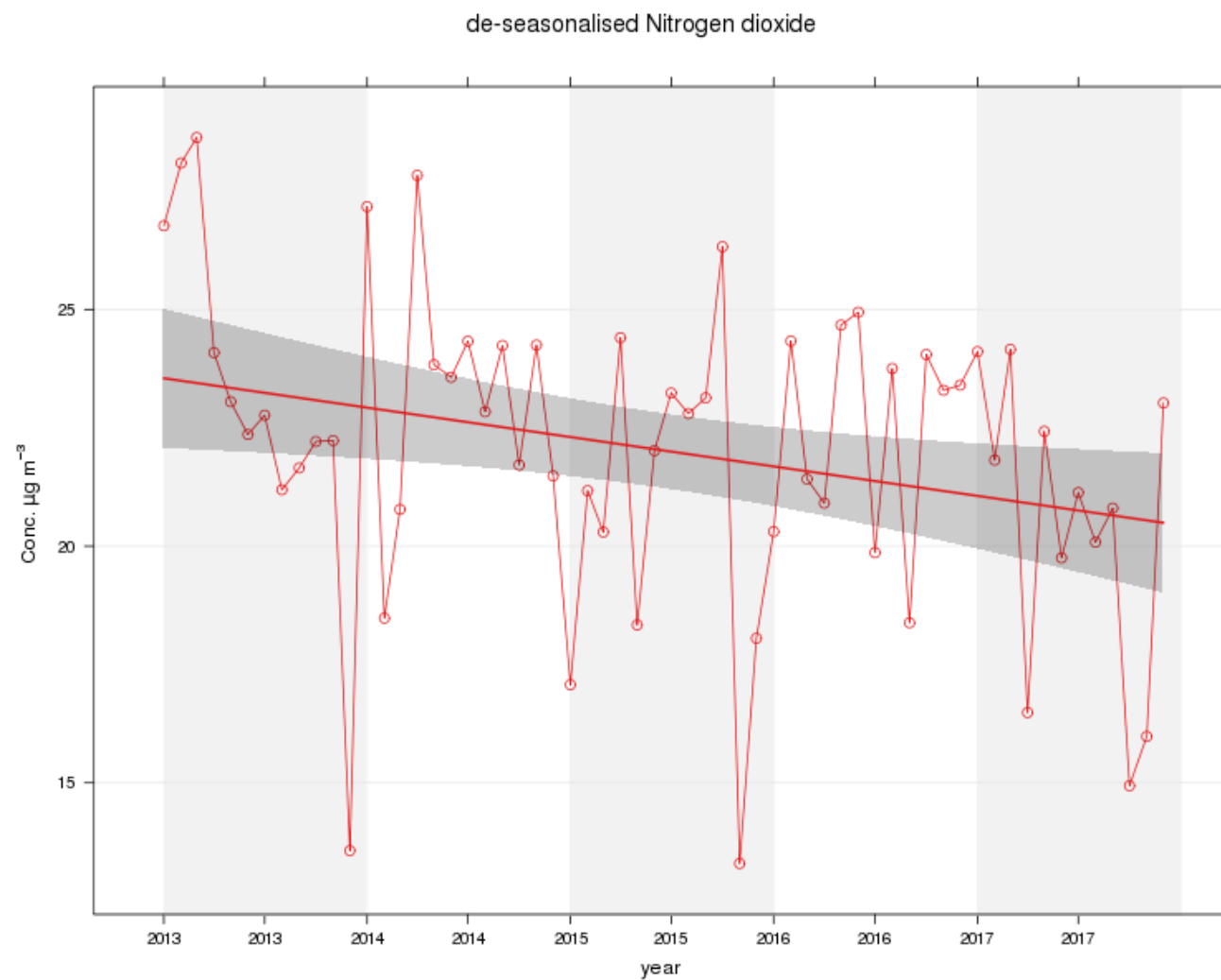
Figure 2 – A5 Falkirk Hope St Long Term NO₂ Concentrations

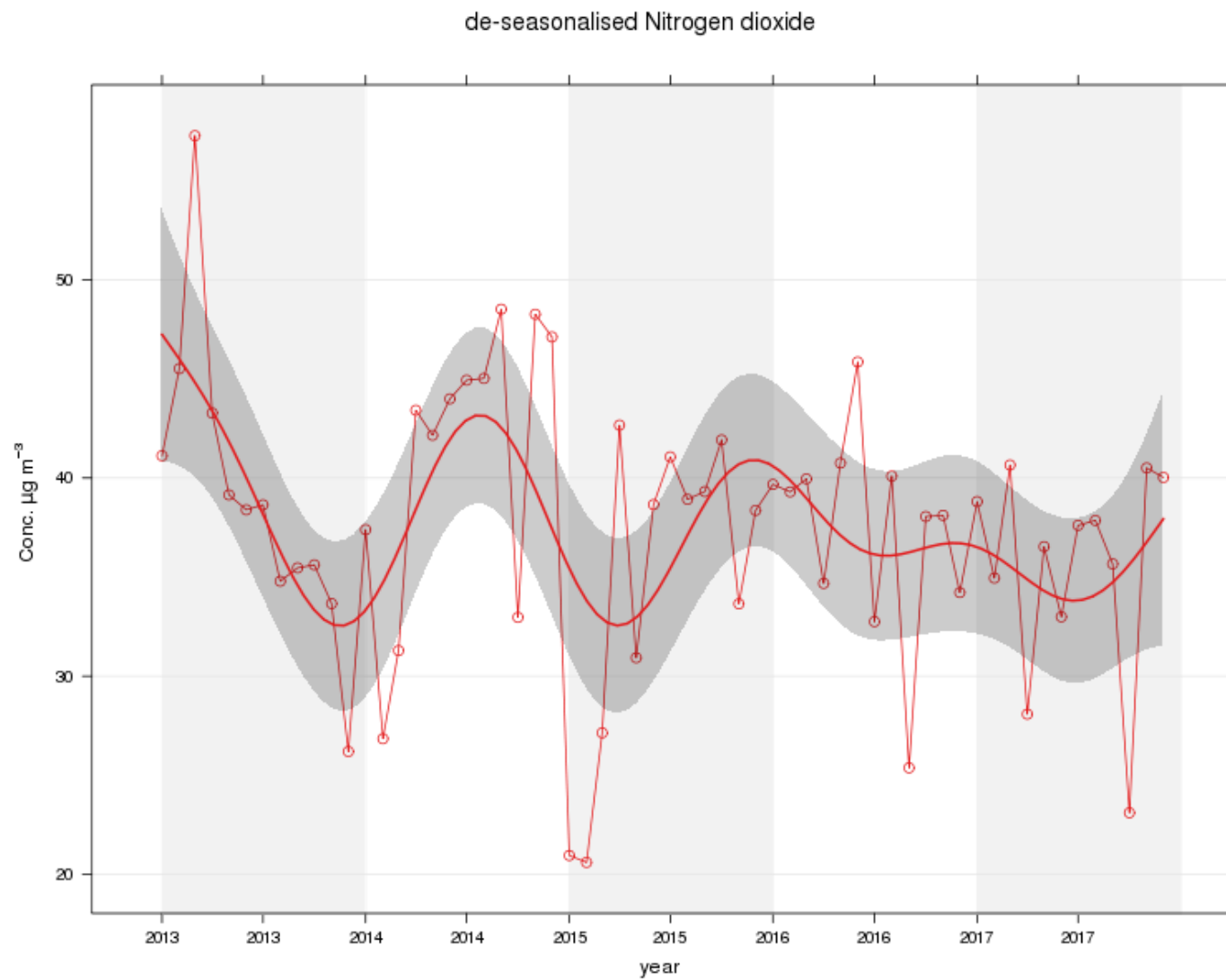
Figure 3 – A7 Falkirk West Bridge St Long Term NO₂ Concentrations

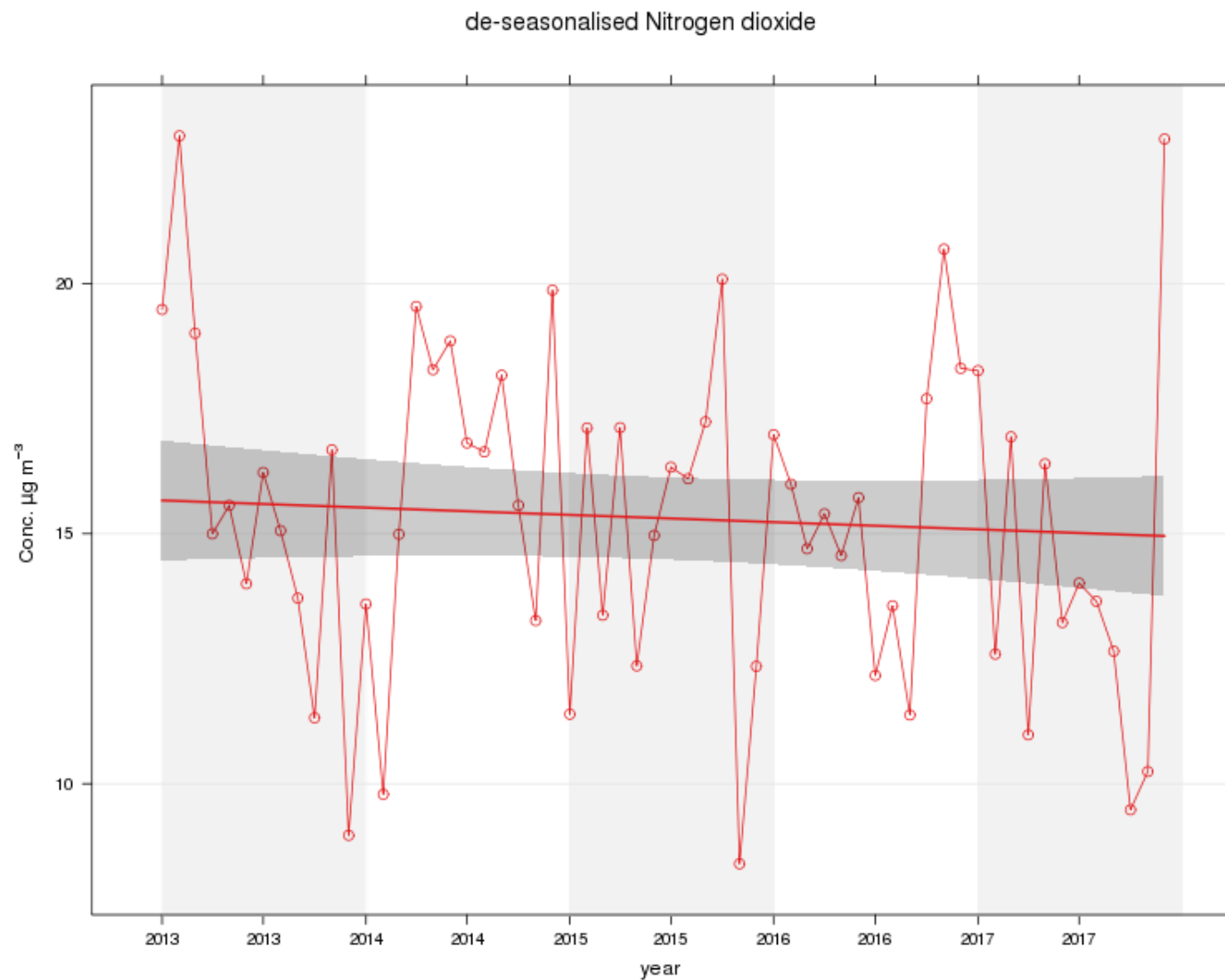
Figure 4 – A8 Grangemouth AURN Long Term NO₂ Concentrations

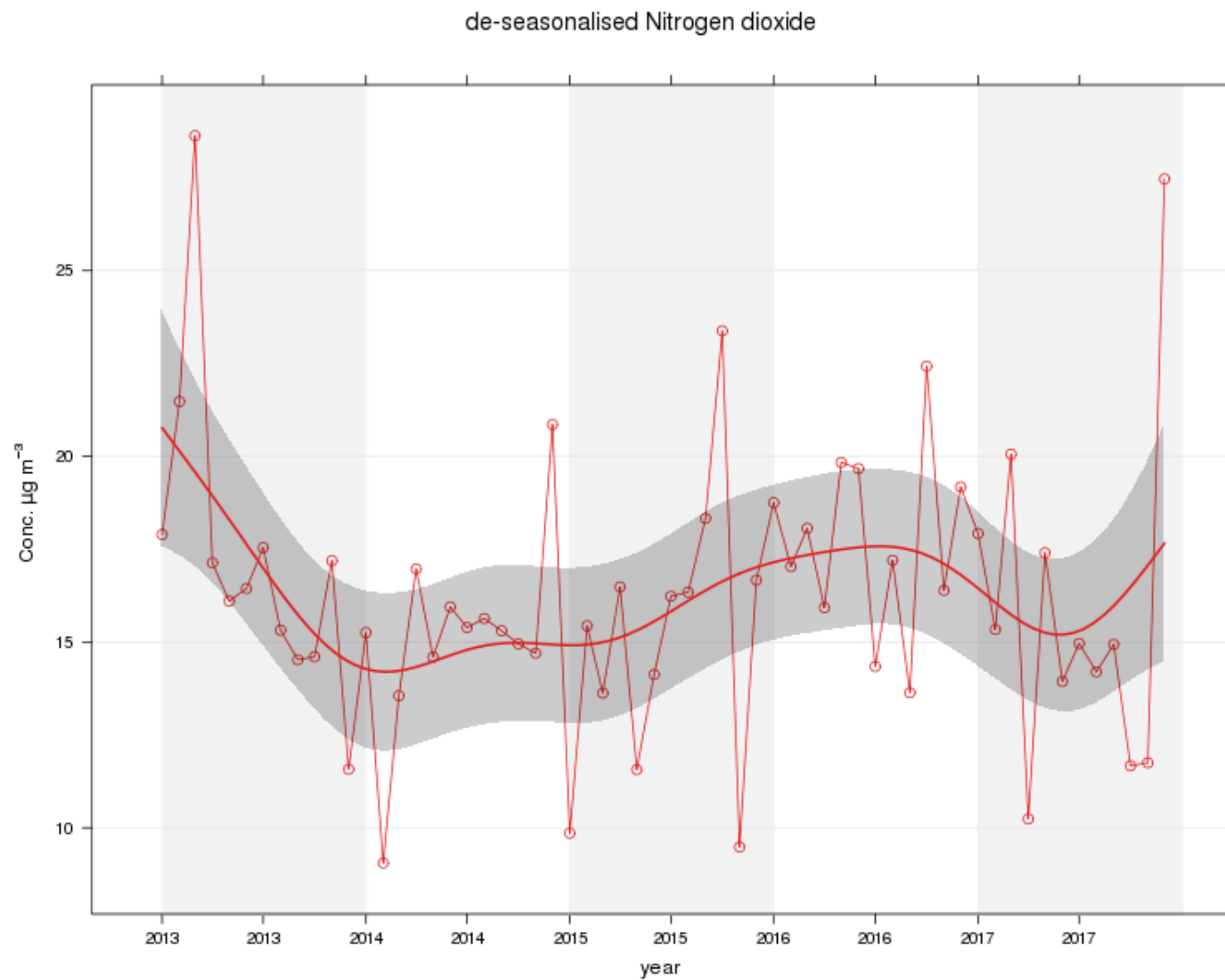
Figure 5 – A9 Grangemouth Moray Long Term NO₂ Concentrations

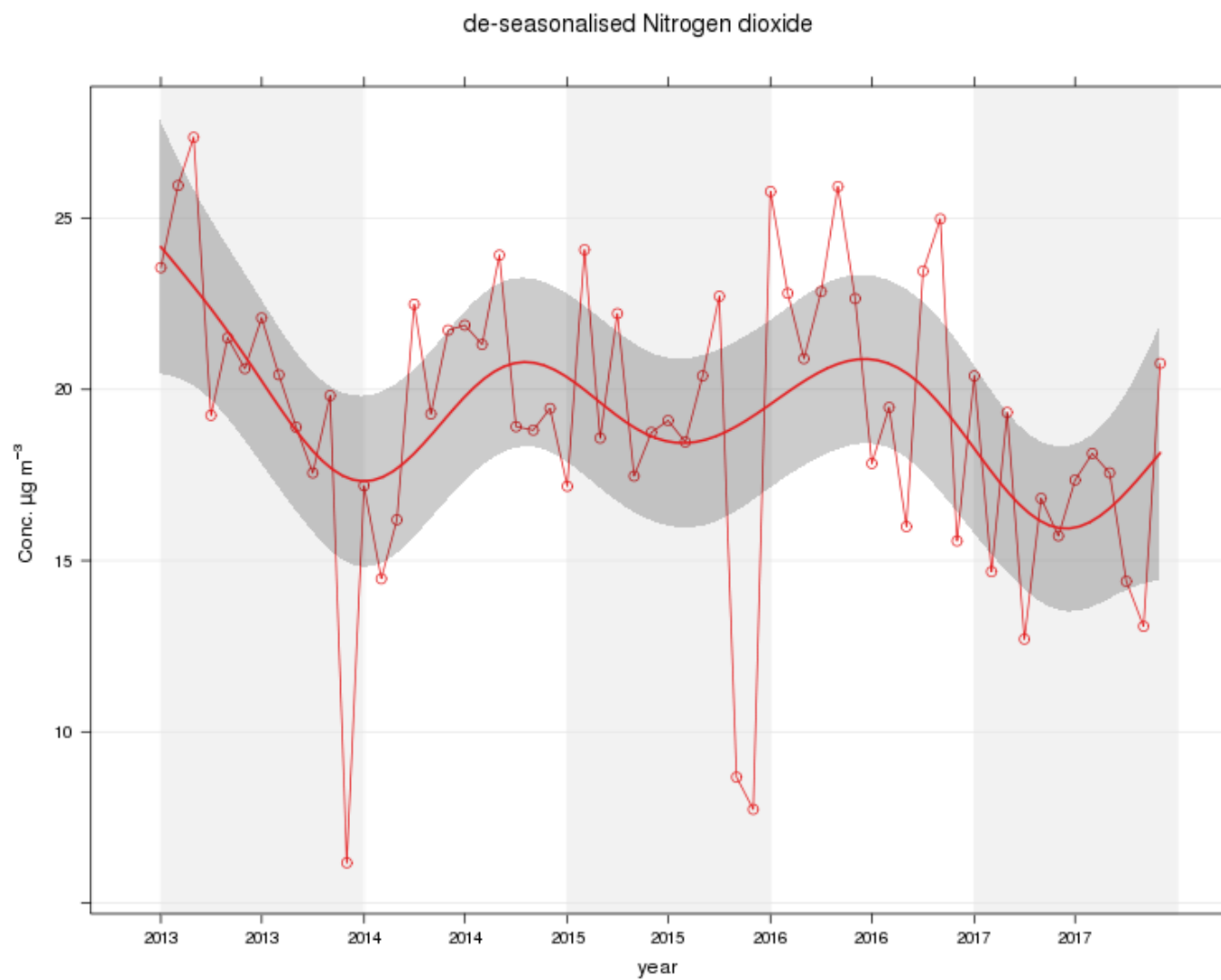
Figure 6 – A9 Grangemouth Municipal Chambers Long Term NO₂ Concentrations

Table A.5 – Annual Mean PM₁₀ Monitoring Results

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) ⁽¹⁾	Valid Data Capture 2017 (%) ⁽²⁾	PM ₁₀ Annual Mean Concentration (µg/m ³) ⁽³⁾				
				2013	2014	2015	2016	2017
A4	Falkirk Haggs	95	95	18.3	16.5	15	14	12
A7	Falkirk West Bridge St	88	88	19.5	17.7	15	15	10
A8	Grangemouth AURN	95	95	14	12.4	12.2	11	9
A10	Grangemouth Municipal Chambers	85	85	15	14.6	13	13	12
A12	Falkirk Grahams Road	98	98	16.3	13.2	11.8	13	12
A13	Banknock 2	99	99	16.3	13.2	11	11	13
A14	Banknock 3	17	17	14.6	15	8.2	n/m	7
A15	Main St, Bainsford	94	94	n/m	n/m	12.8	10	13

Notes: Exceedences of the PM₁₀ annual mean objective of 18µg/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) 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 PM₁₀ Monitoring Results

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) ⁽¹⁾	Valid Data Capture 2017 (%) ⁽²⁾	PM ₁₀ 24-Hour Means > 50µg/m ³ ⁽³⁾				
				2013	2014	2015	2016	2017
A4	Falkirk Haggs	95	95	4	1	1	0	0
A7	Falkirk West Bridge St	88	88	4	2 (40)	2 (29)	0	0
A8	Grangemouth AURN	95	95	0 (34)	0	1 (21)	0	1
A10	Grangemouth Municipal Chambers	85	85	0 (32)	0	0	0	0
A12	Falkirk Grahams Road	98	98	3	0	0 (18)	0	0
A13	Banknock 2	99	99	0	3	4	n/m	7
A14	Banknock 3	17	17	0 (22)	0 (24)	1	3	0
A15	Main St, Bainsford	94	94	n/m	n/m	0 (16)	0 (16)	0

Notes: Exceedences of the PM₁₀ 24-hour mean objective (50µg/m³ 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 98.1st percentile of 24-hour means is provided in brackets.

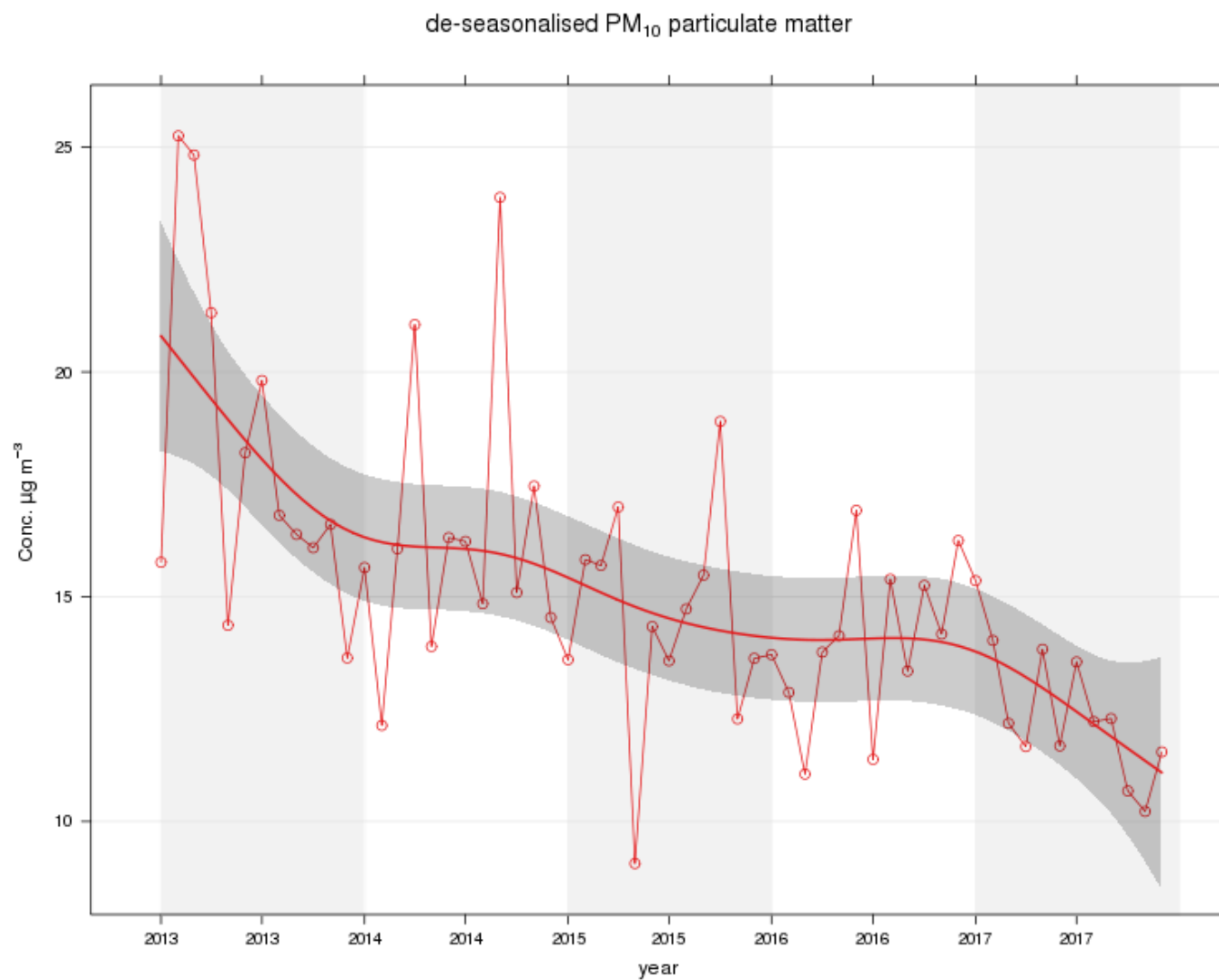
Figure 7 – A4 Falkirk Haggs Long Term PM₁₀ Concentrations

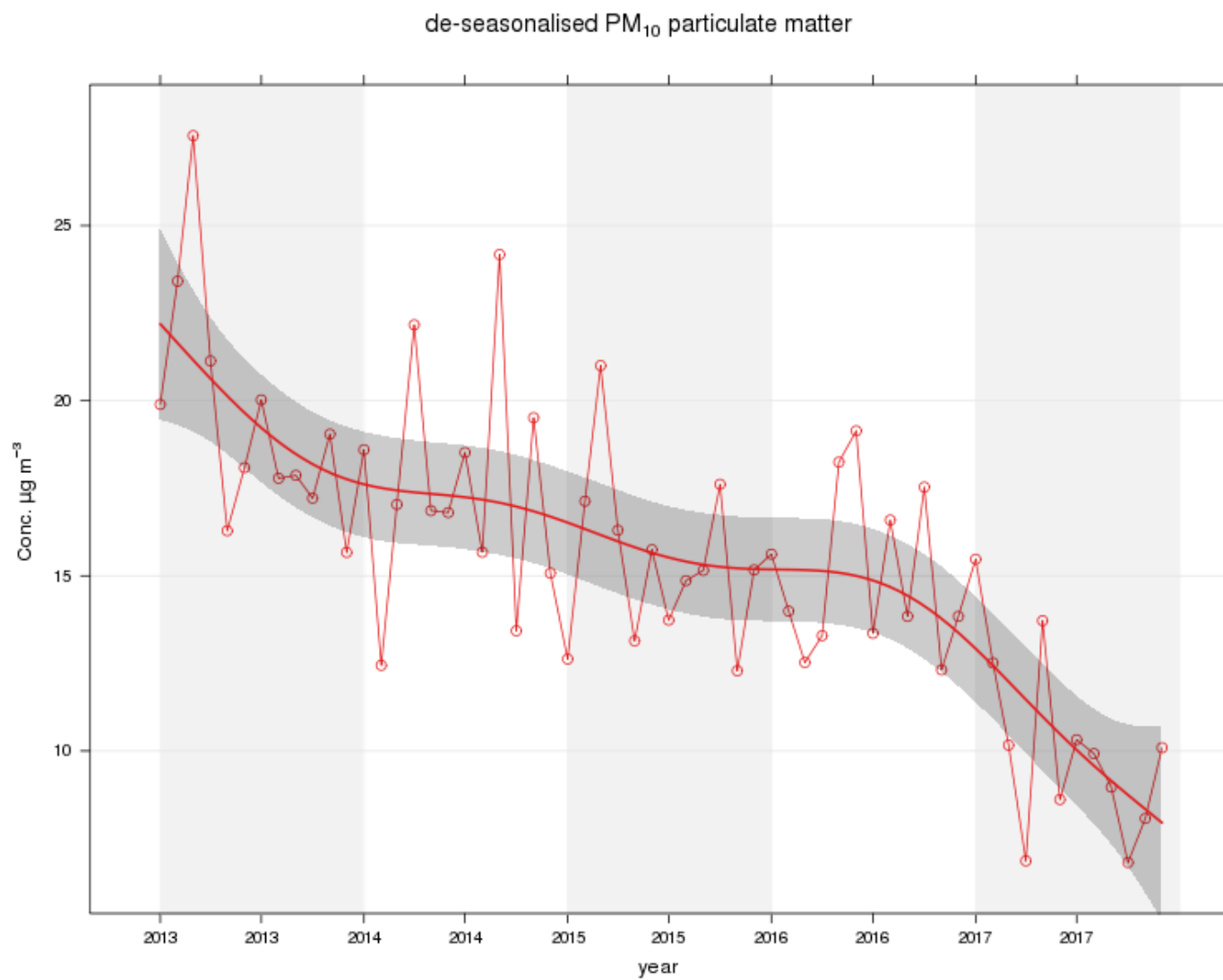
Figure 8 – A7 Falkirk West Bridge St Long Term PM₁₀ Concentrations

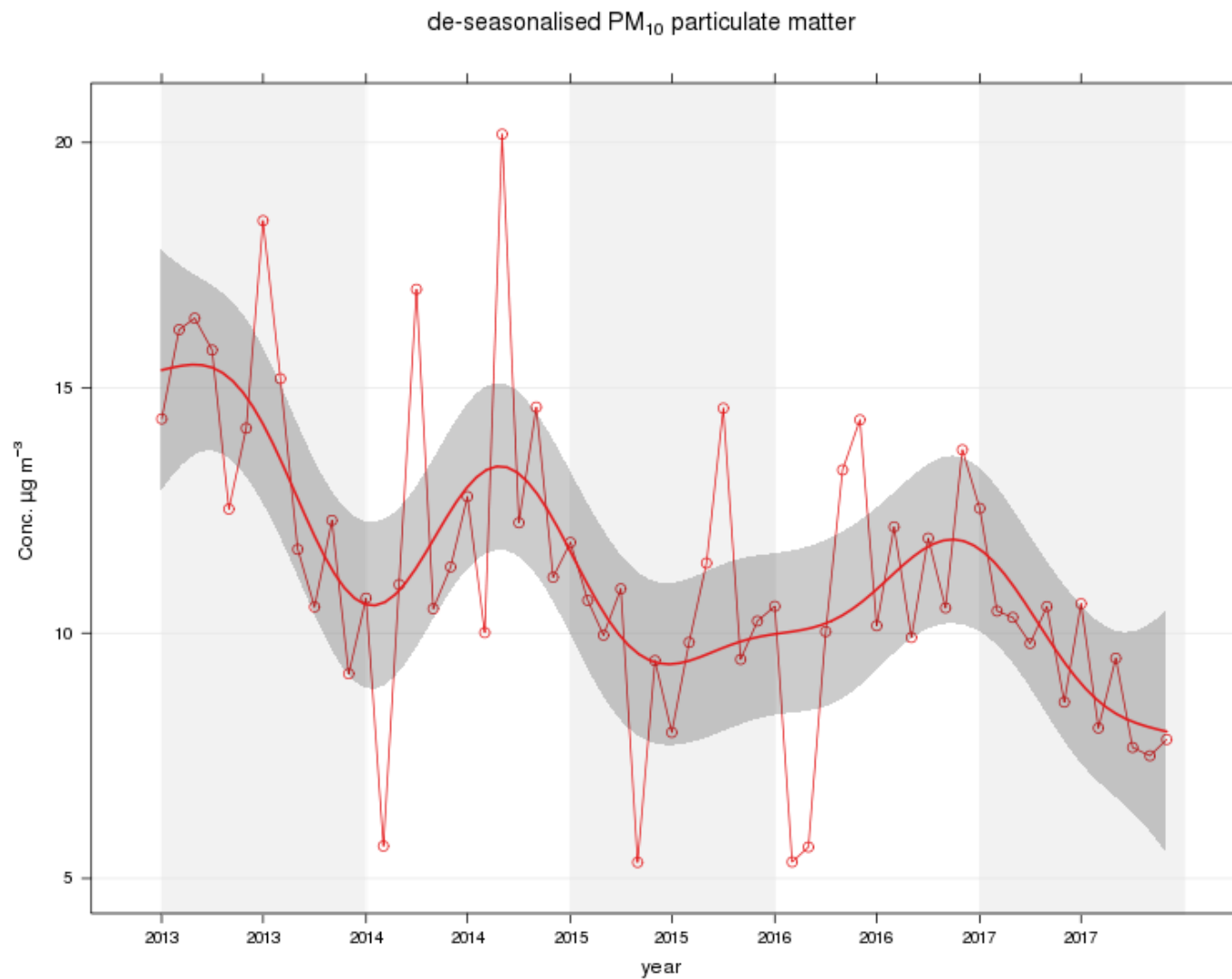
Figure 9 – A8 Grangemouth AURN Long Term PM₁₀ Concentrations

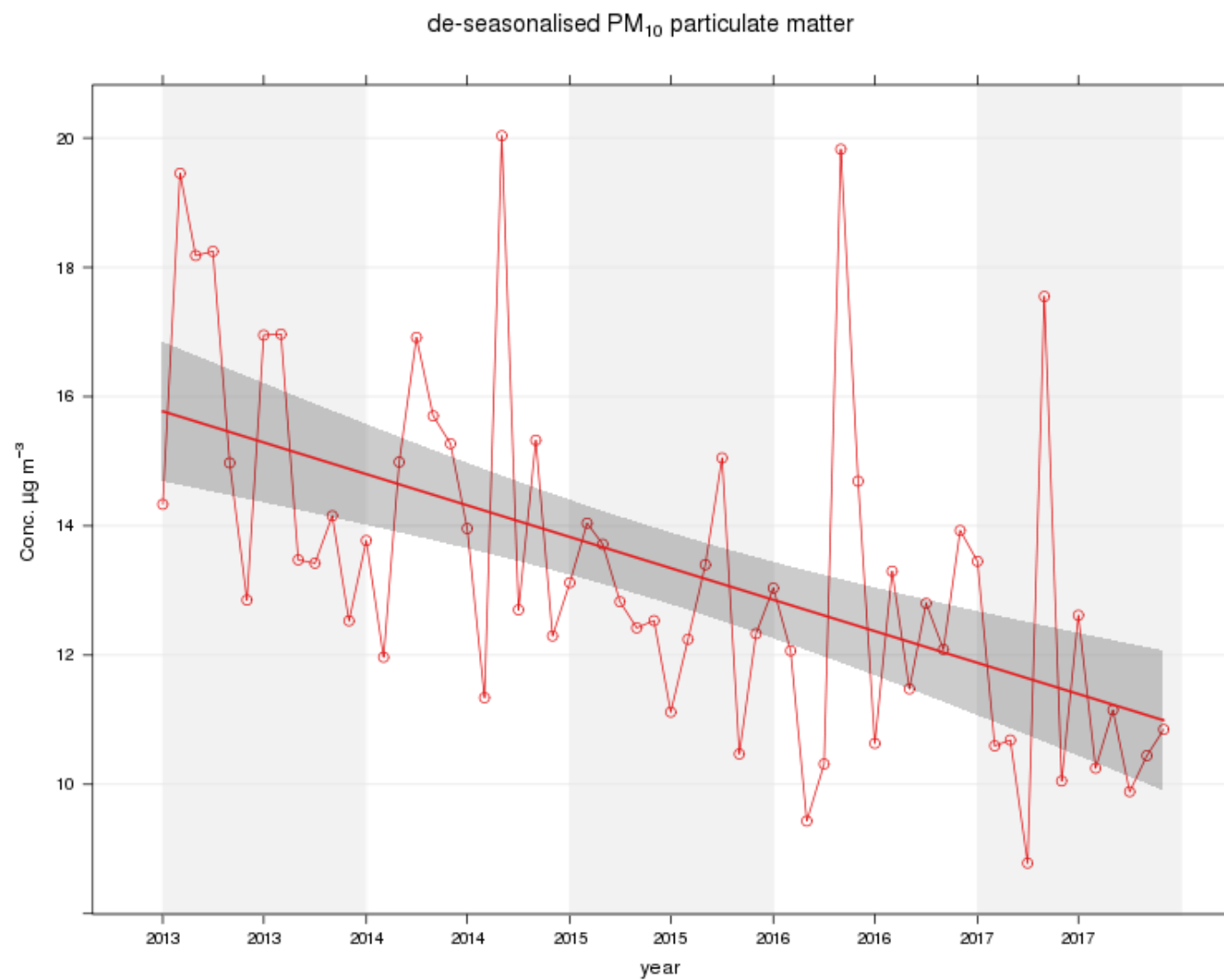
Figure 10 – A10 Grangemouth Municipal Chambers Long Term PM₁₀ Concentrations

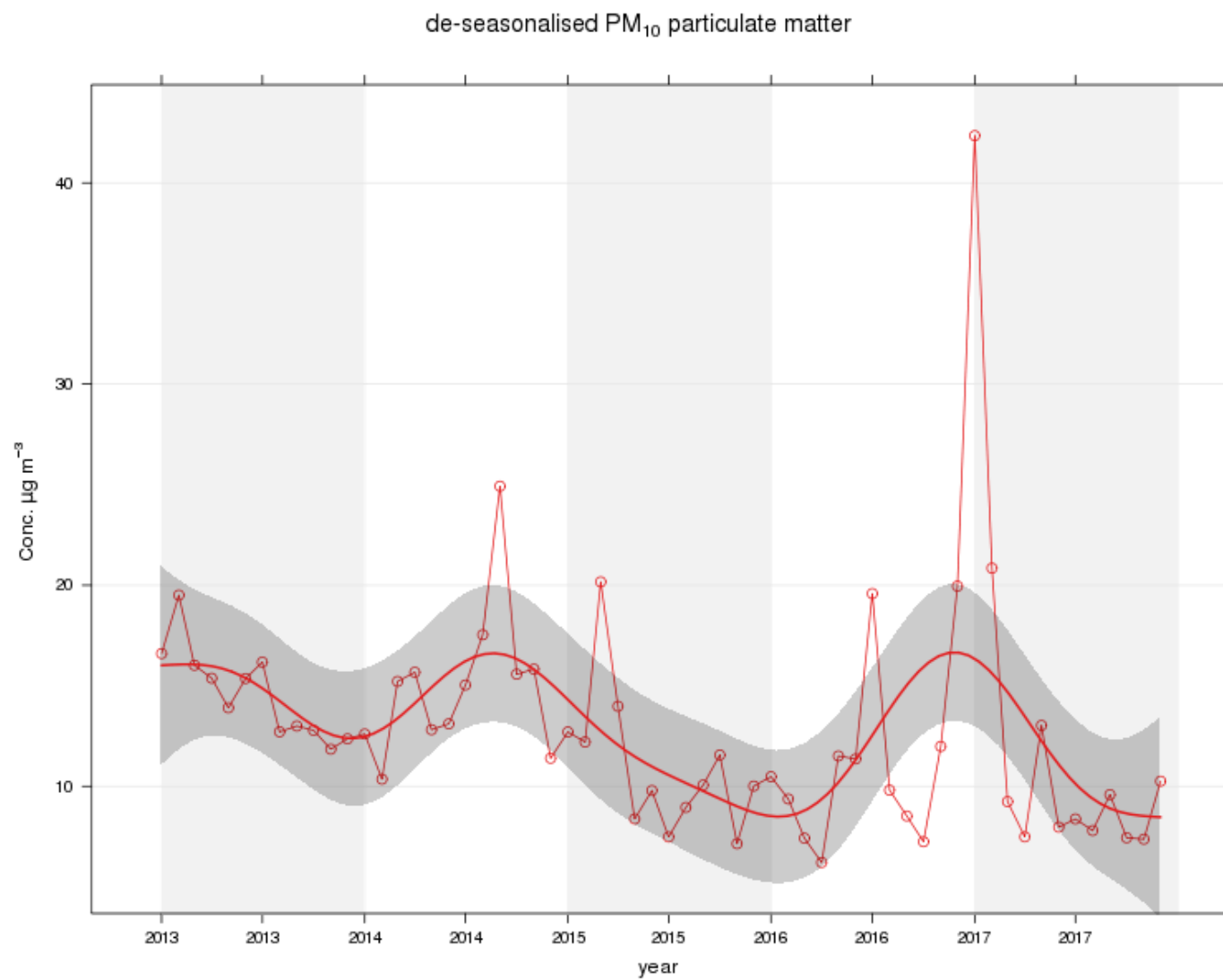
Figure 11 – A13 Banknock 2 Long Term PM₁₀ Concentrations

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

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) ⁽¹⁾	Valid Data Capture 2017 (%) ⁽²⁾	PM _{2.5} Annual Mean Concentration (µg/m ³) ⁽³⁾				
				2013	2014	2015	2016	2017
A7	Falkirk West Bridge St	88	88	n/m	n/m	n/m	6	6
A8	Grangemouth AURN	95	95	9.2	8.0	9.2	6	6
A13	Banknock 2	99	99	n/m	n/m	6	5	6

Notes: Exceedences of the PM₁₀ annual mean objective of 10µg/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) 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.

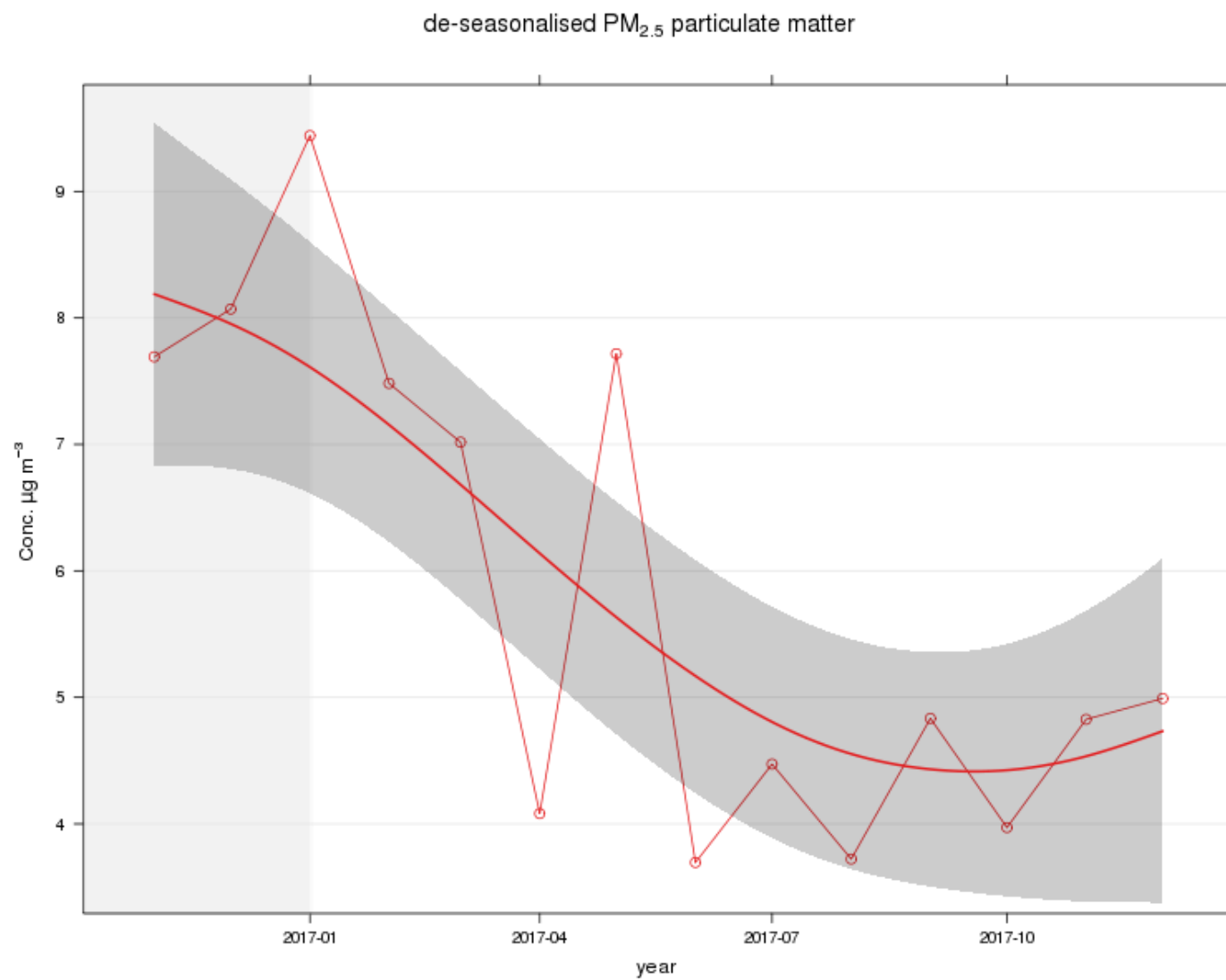
Figure 12 – A7 Falkirk West Bridge St Long Term PM_{2.5} Concentrations

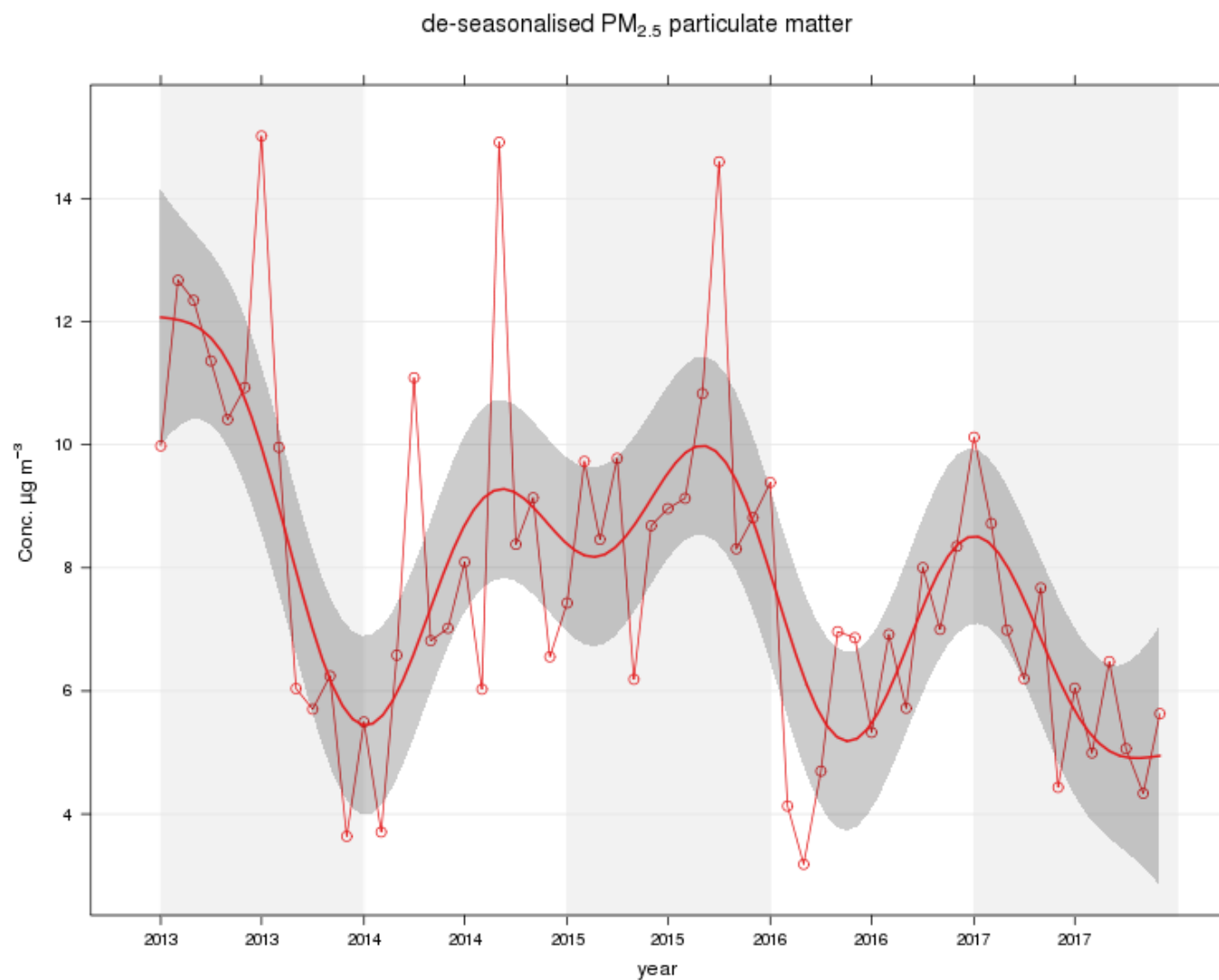
Figure 13 – A8 Grangemouth AURN Long Term PM_{2.5} Concentrations

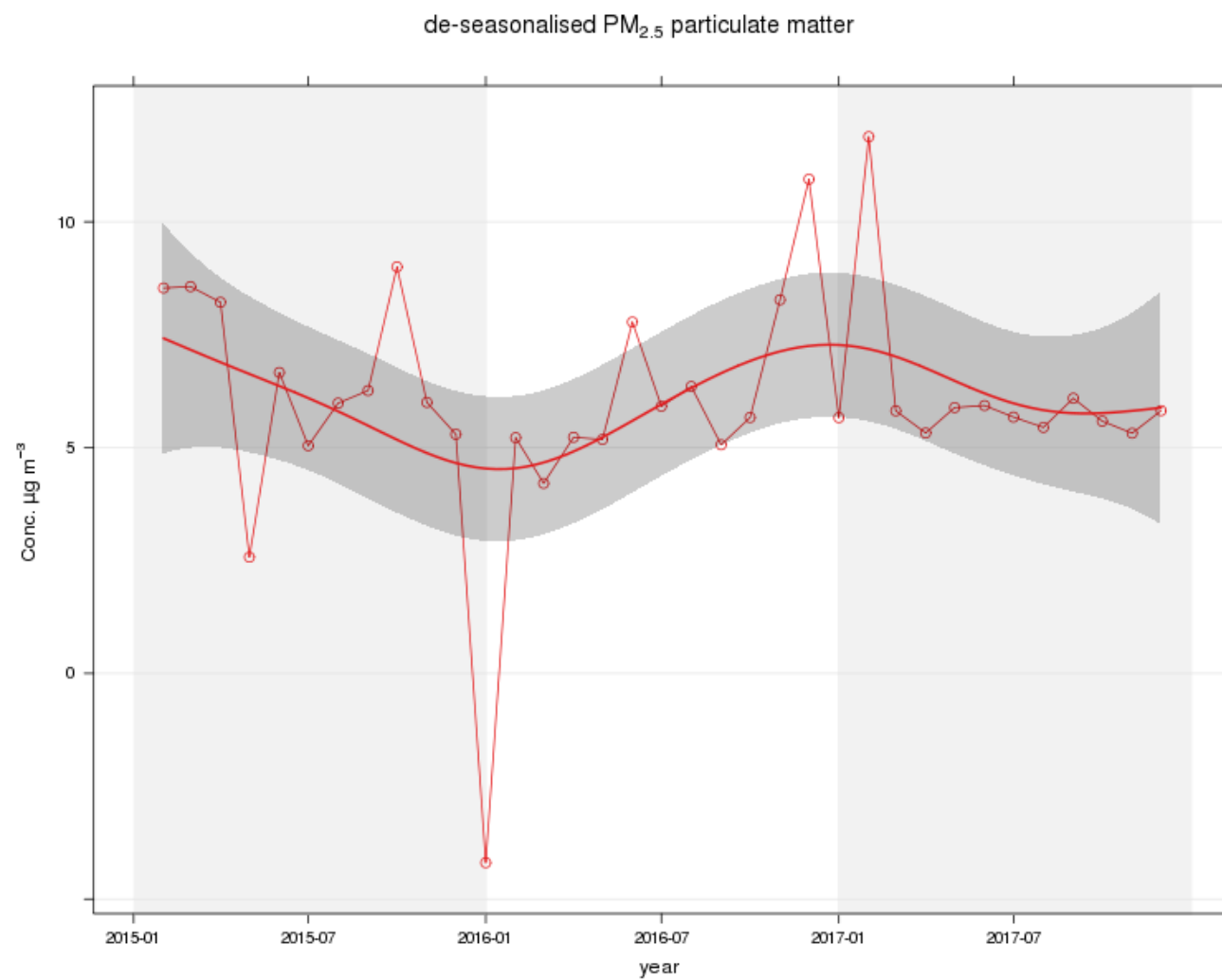
Figure 14 – A13 Banknock 2 Long Term PM_{2.5} Concentrations

Table A.8 – SO₂ Monitoring Results

Site ID	Site Type	Valid Data Capture for monitoring Period (%) ⁽¹⁾	Valid Data Capture 2017 (%) ⁽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	92	92	0	0	0
A5	Falkirk Hope St	89	89	0	0	0
A8	Grangemouth AURN	95	95	0	0	0
A9	Grangemouth Moray	89	89	10	0	0
A10	Grangemouth Municipal Chambers	97	97	4	0	0
A11	Grangemouth Zetland Park	91	91	0	0	0

Notes: Exceedences of the SO₂ 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.

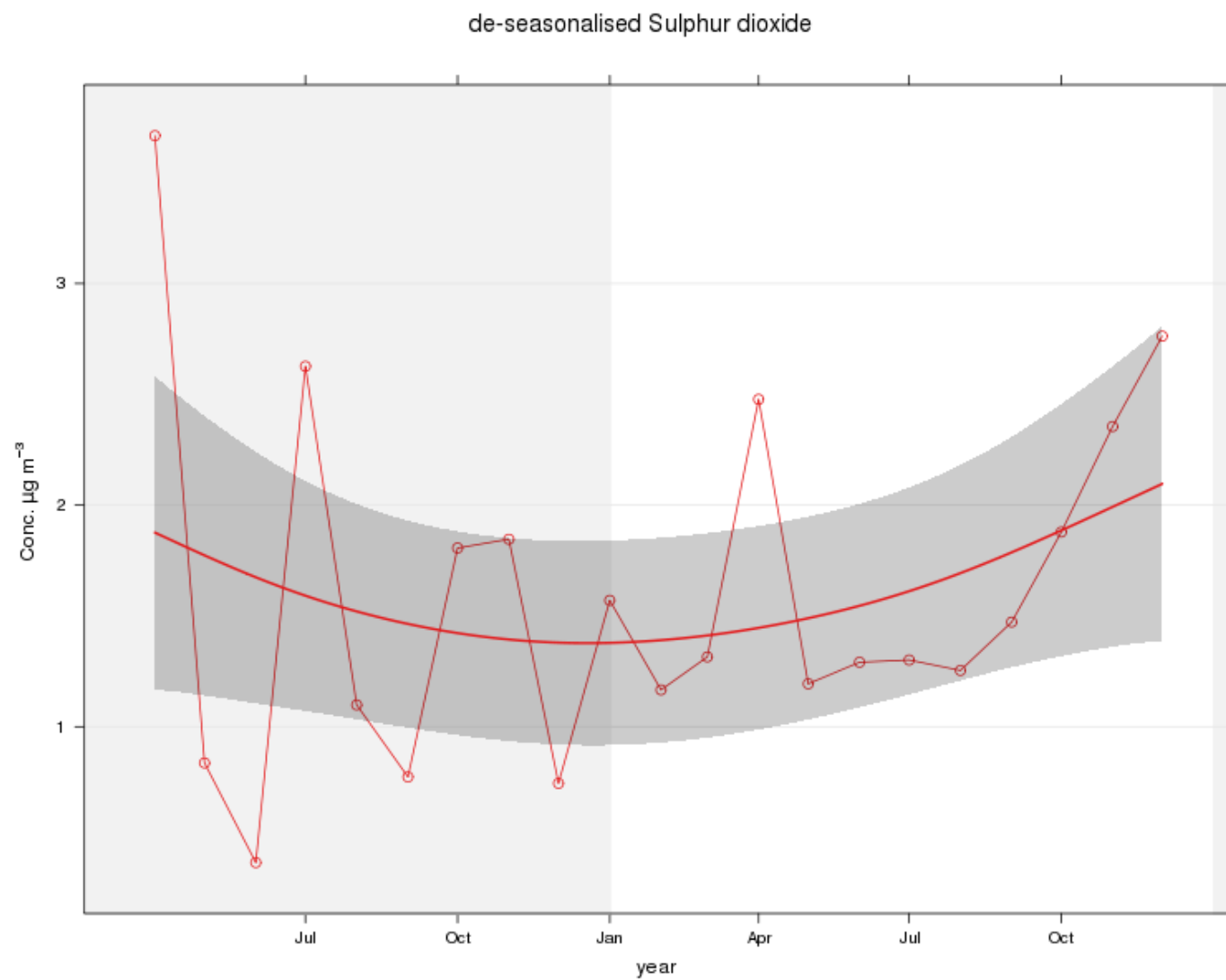
Figure 15 – A3 Bo'ness Long Term SO₂ Concentrations

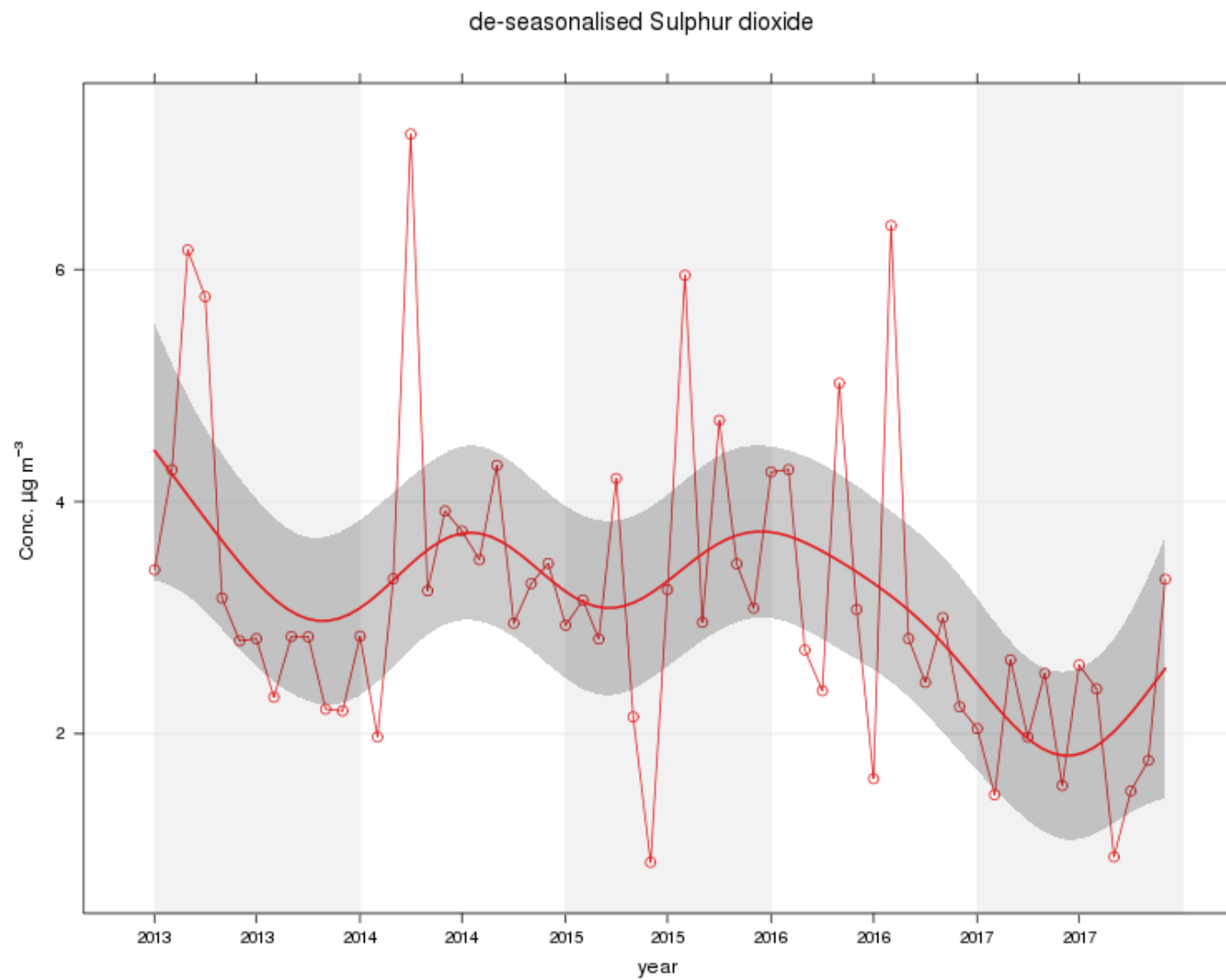
Figure 16 – A8 Falkirk Hope St Long Term SO₂ Concentrations

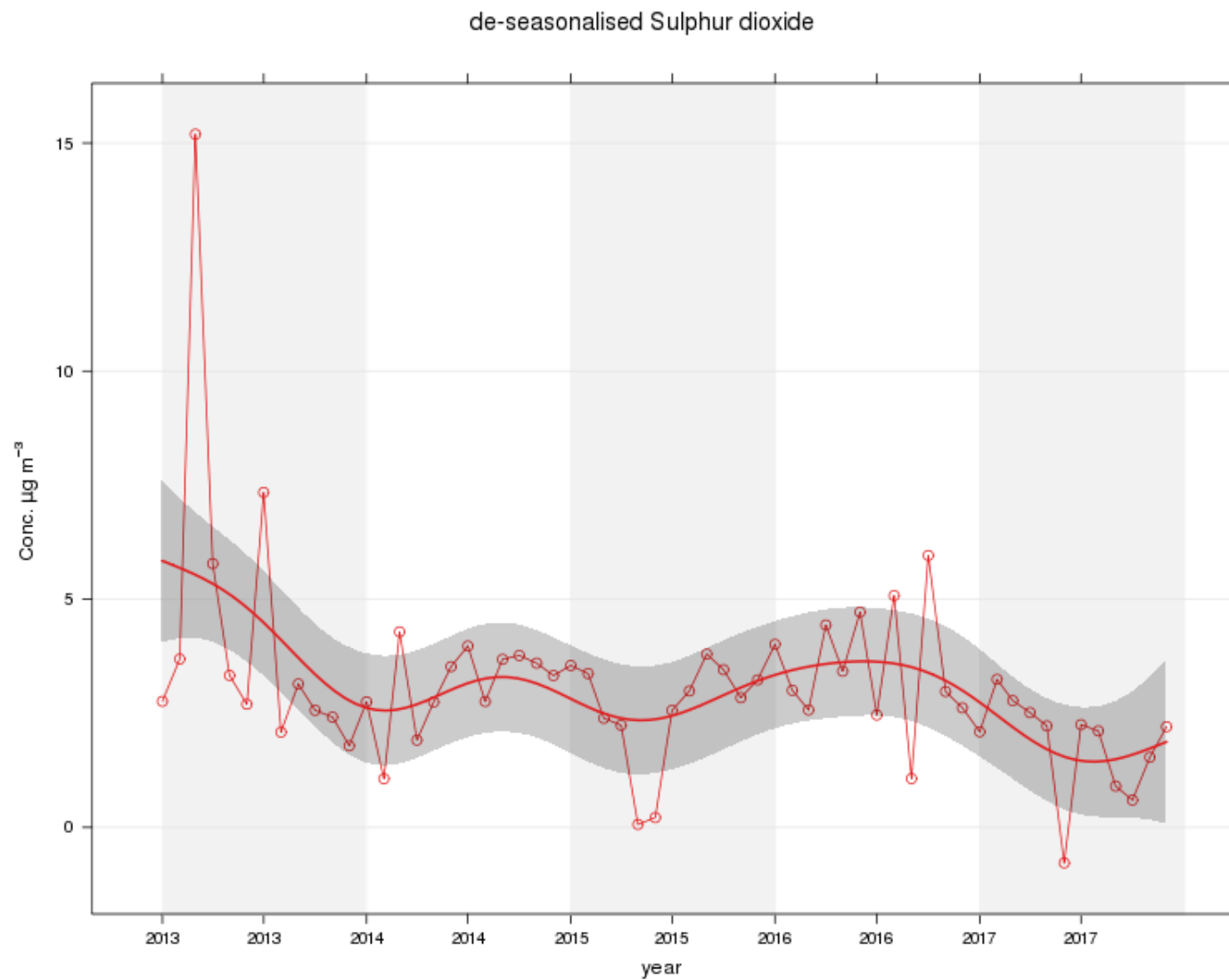
Figure 17 – A5 Grangemouth AURN Long Term SO₂ Concentrations

Figure 18 – A9 Grangemouth Moray Long Term SO₂ Concentrations

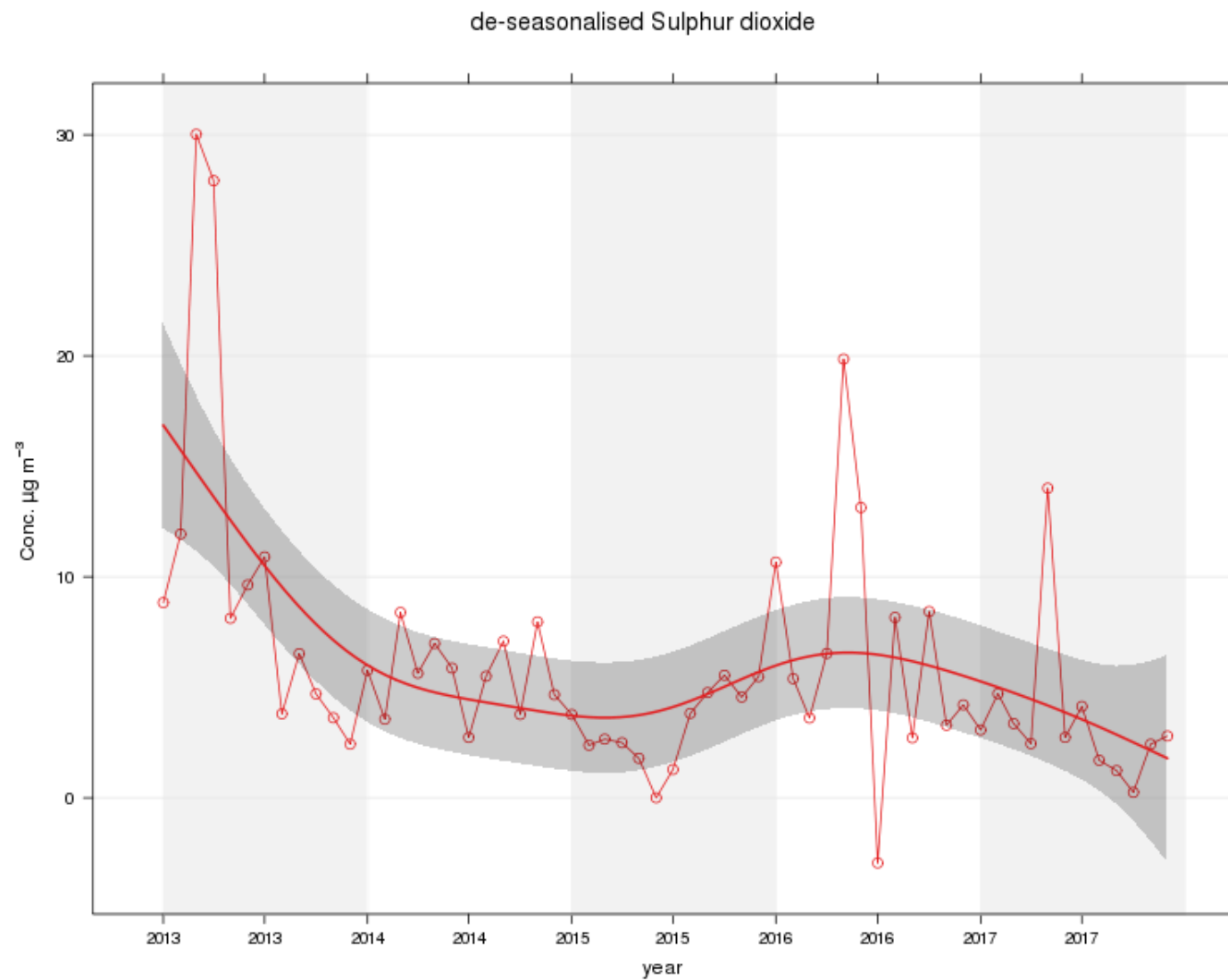


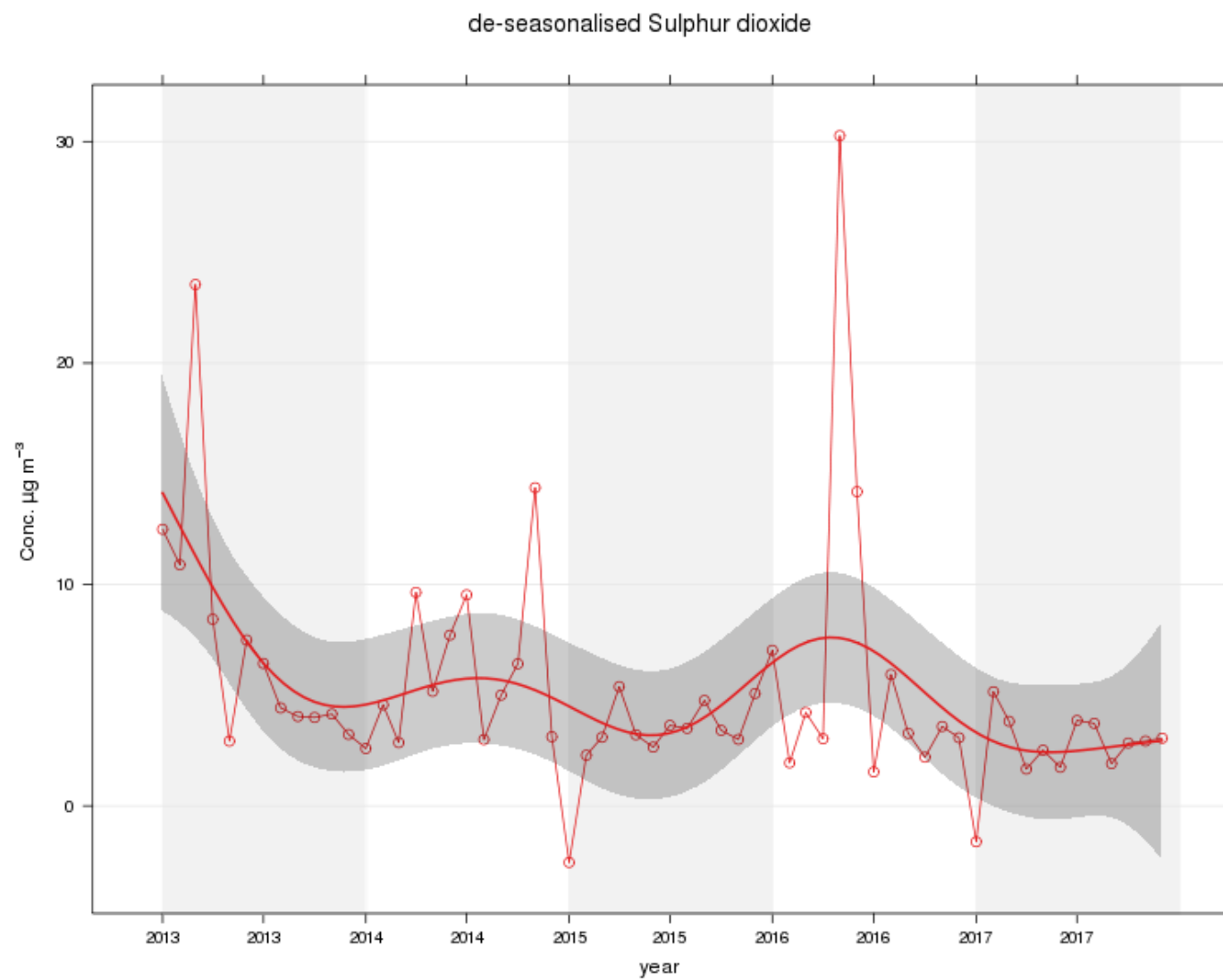
Figure 19 – A10 Grangemouth Municipal Chambers Long Term SO₂ Concentrations

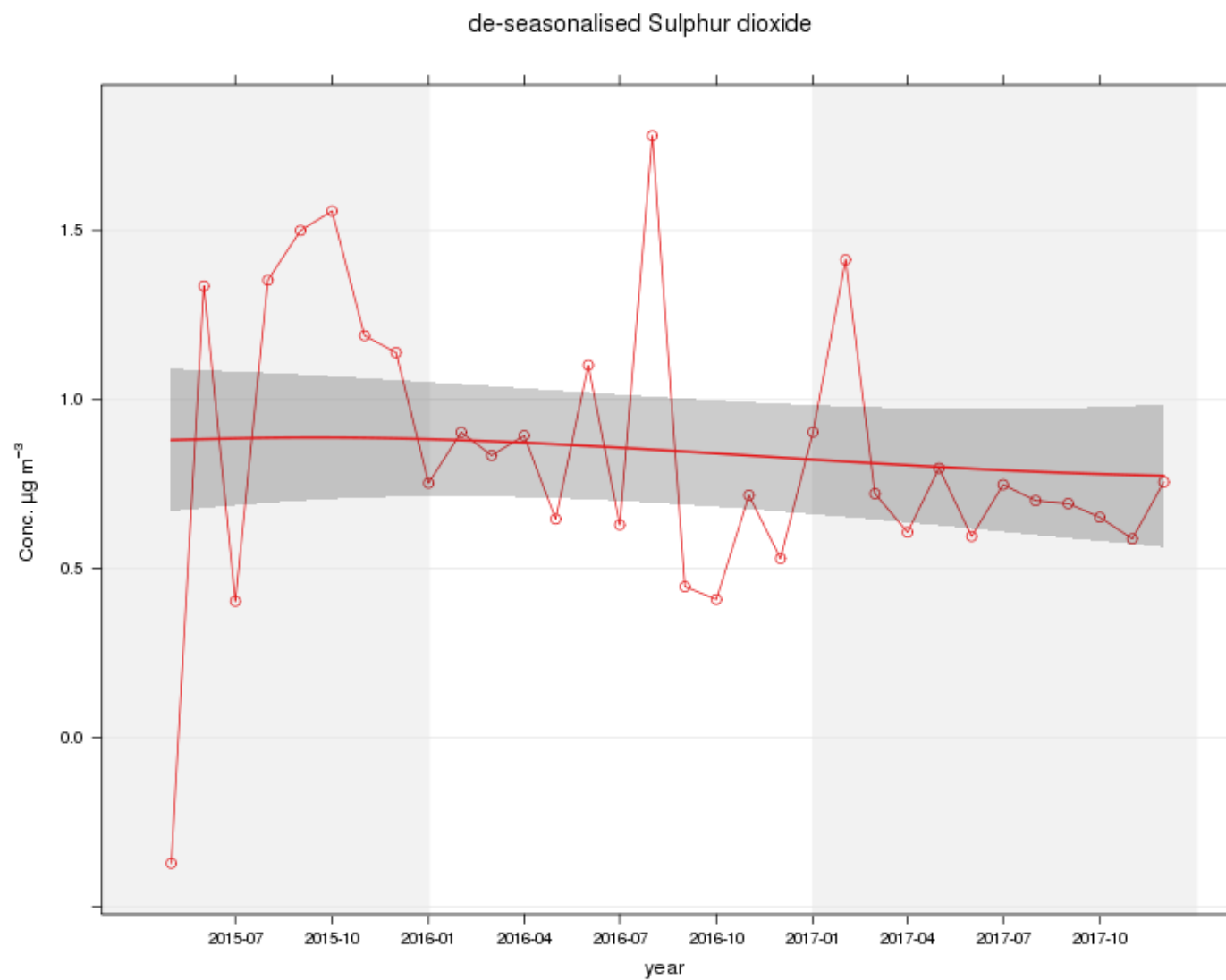
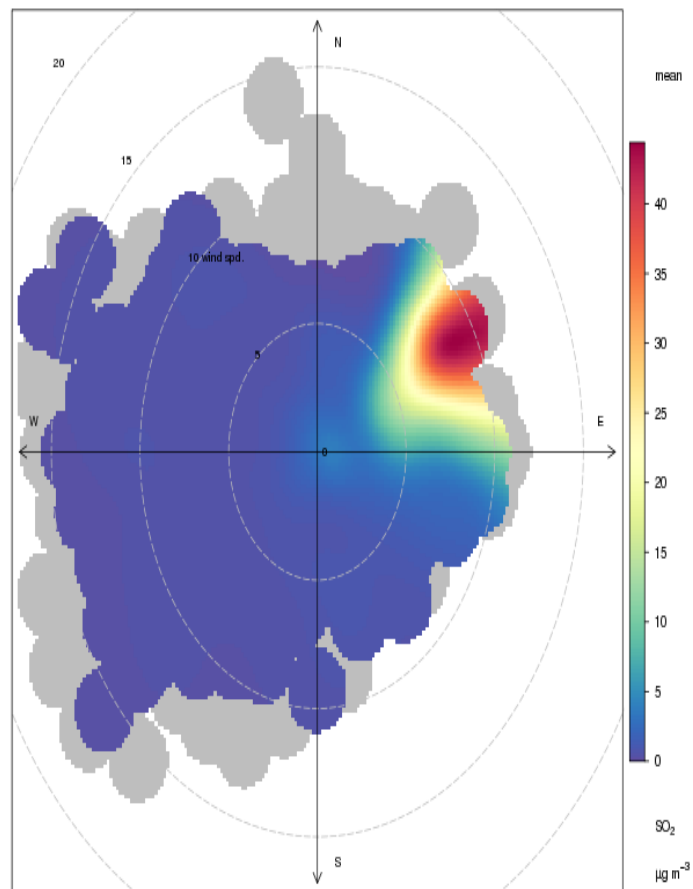
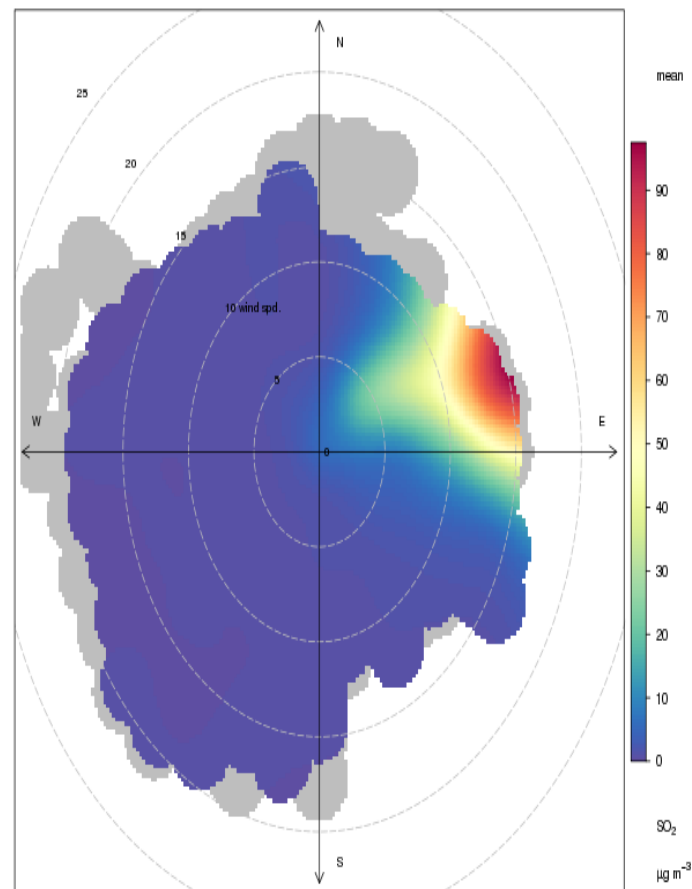
Figure 20 – A11 Grangemouth Zetland Park Long Term SO₂ Concentrations

Figure 21 – Polar plots of average SO₂ concentrations in the Grangemouth sites

A) Grangemouth AURN: 2017

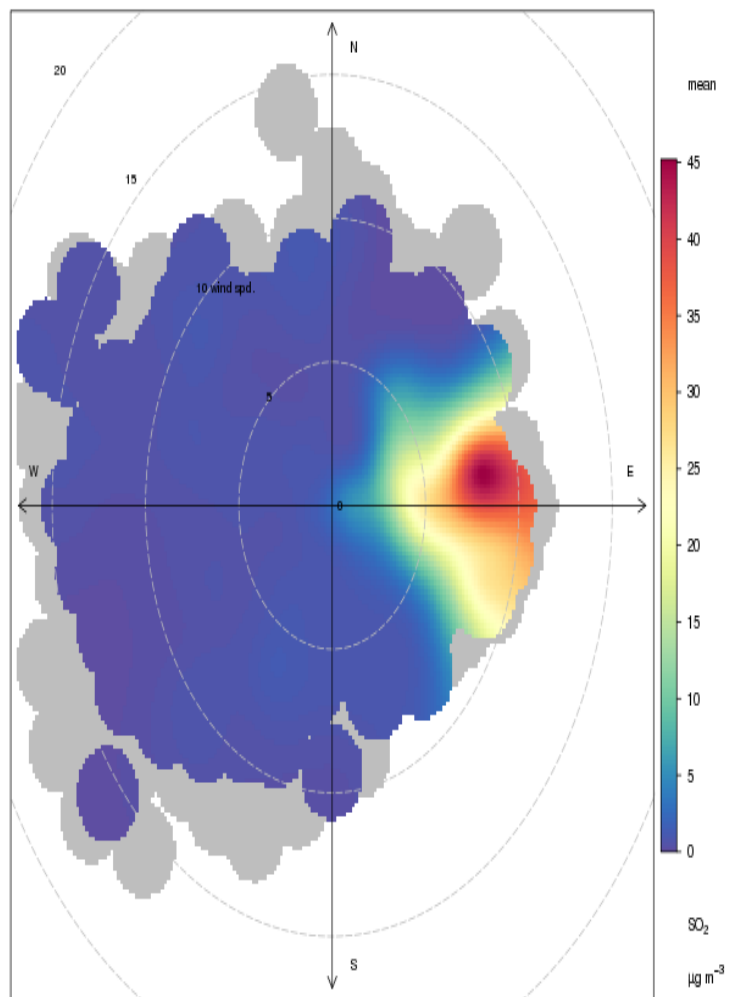
Polar plot of SO₂ at Grangemouth mean
for the period 2017 to 2017

B) Grangemouth AURN: 2013 – 2017

Polar plot of SO₂ at Grangemouth mean
for the period 2013 to 2017

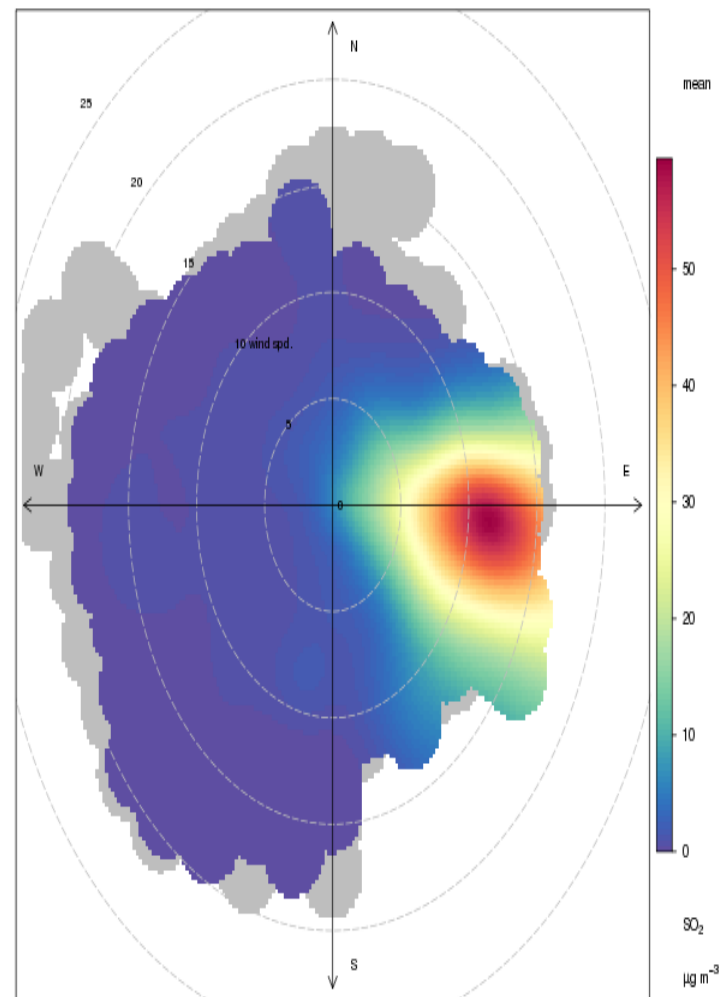
C) Grangemouth Moray: 2017

Polar plot of SO₂ at Grangemouth Moray mean
for the period 2017 to 2017

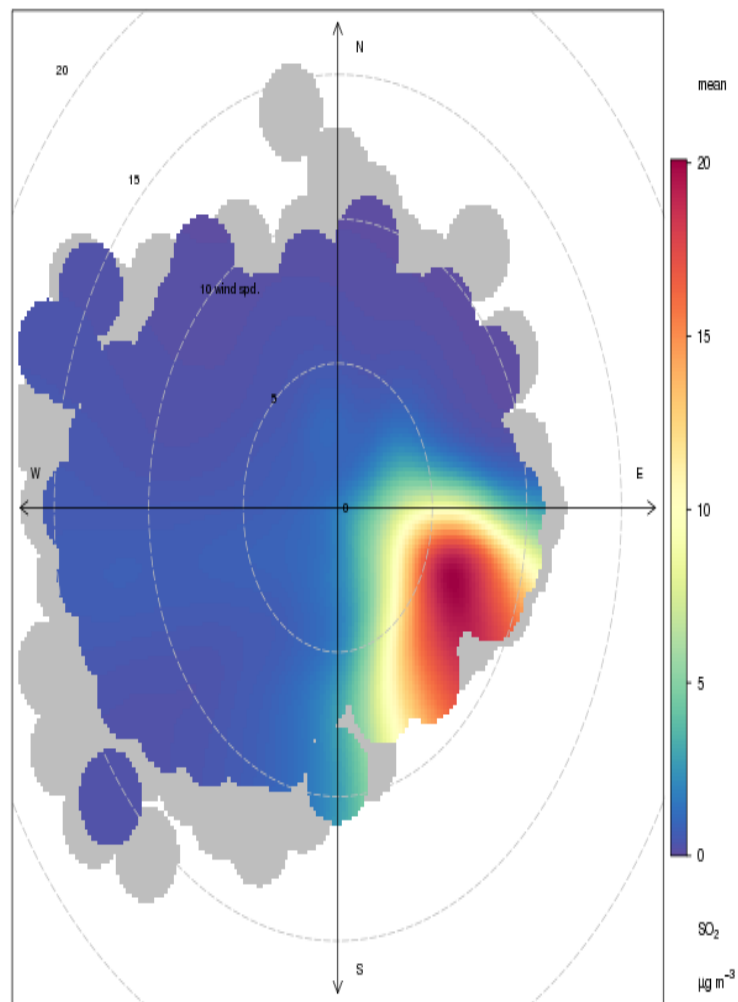


D) Grangemouth Moray: 2013 – 2017

Polar plot of SO₂ at Grangemouth Moray mean
for the period 2013 to 2017



E) Grangemouth Municipal Chambers: 2017
Polar plot of SO₂ at Falkirk Grangemouth MC mean
for the period 2017 to 2017



F) Grangemouth Municipal Chambers: 2013 – 2017
Polar plot of SO₂ at Falkirk Grangemouth MC mean
for the period 2013 to 2017

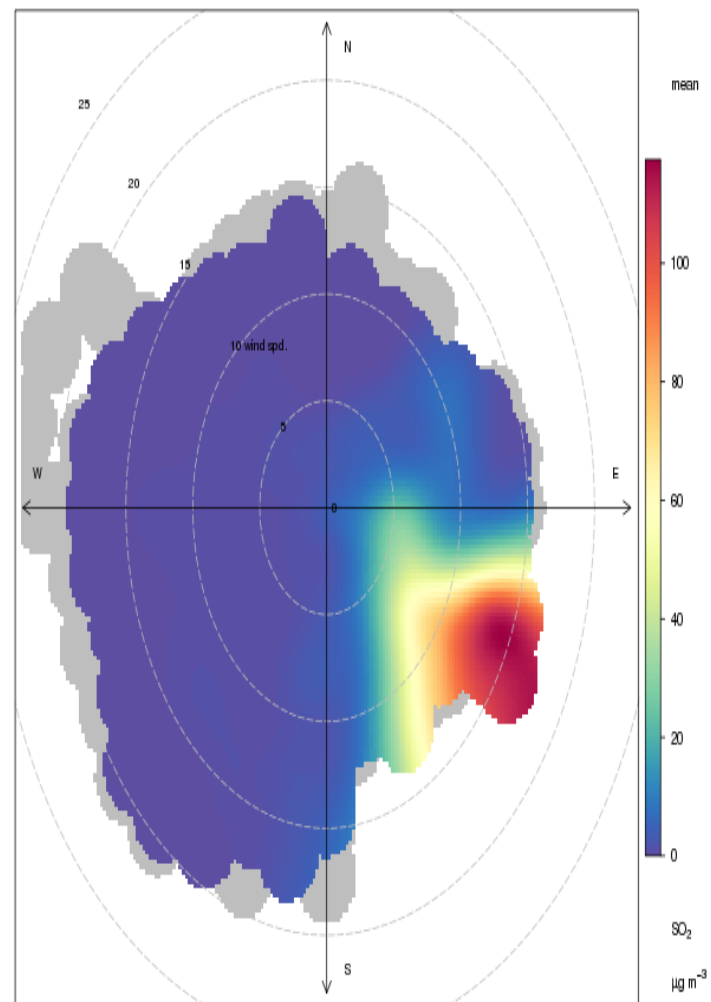


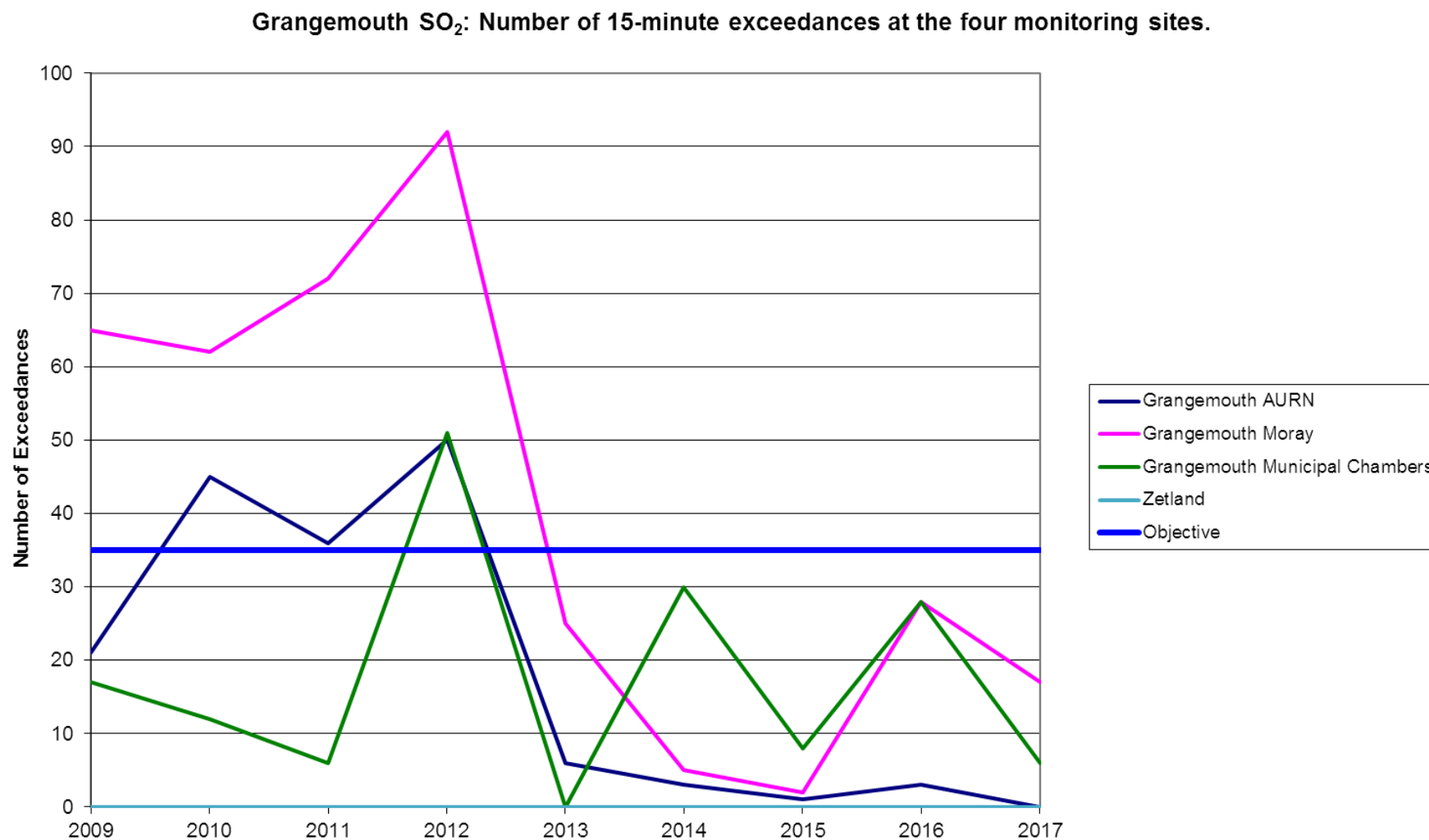
Figure 22 – Exceedances of the 15minute air quality objective concentration at the Grangemouth sites 2013 – 2017

Table A. 9 – 1, 3 Butadiene Annual Mean Diffusion Tube Results for 2017

Site ID	Location	Within 1, 3 butadiene AQMA?	Data capture in 2017, %.(1)	Annual mean concentrations (µg/m3)				
				2013	2014	2015	2016	2017
NA41	Seaview Place, Bo'ness	N	91.7	1.25	0.42	0.11	0.10	0.1
NA55	Inchyra Station, Grangemouth	N	91.7	1.25	0.48	0.09	0.10	0.07
NA104	Powdrake Road, Grangemouth	N	100	1.25	0.47	0.13	0.11	0.1

Note: Exceedences of the 1, 3- butadiene running annual mean objective of 2.25µg/m³ are shown in **bold**.

Table A. 10 – Benzene Annual Mean Diffusion Tube Results for 2017

Site ID	Location	Within Benzene AQMA?	Data capture in 2017, %.(1)	Annual mean concentrations (µg/m ³)				
				2013	2014	2015	2016	2017
NA3	Tinto Drive, Grangemouth	N	91.7	1.39	1.3	1.16	0.51	0.58
NA21	Grangemouth Road, Falkirk College	N	100	1.25	1.13	0.72	0.46	0.56
NA27	West Bridge Street, Falkirk	N	100	1.52	2.39	0.69	0.78	0.68
NA37	Denny Town House	N	100	1.16	1.09	0.59	0.58	0.56
NA38	Larbert Village Primary School	N	91.7	0.85	1.04	0.55	0.51	1.01
NA41	Seaview Place, Bo'ness	N	91.7	1.84	1.97	0.91	1.11	0.82
NA42	Municipal Chambers, Grangemouth	N	100	1.59	1.25	0.69	0.79	0.47
NA44	Harvey Avenue, Polmont	N	50	1.16	1.34	0.56	0.48	0.39
NA55	Inchyra AQ Station, Grangemouth	N	91.7	1.38	1.32	0.5	0.46	0.52
NA57	Inchyra Road, Grangemouth	N	91.7	1.33	1.96	0.69	0.90	0.57
NA77	Kinnaird Village	N	91.7	1.12	1.04	0.65	0.44	0.51
NA80	Cow Wynd, Falkirk	N	91.7	1.53	1.33	0.81	0.56	0.57
NA81	Grahams Road, Falkirk	N	91.7	1.47	1.25	0.88	0.95	0.7
NA94	A905 (Glensburgh Rd), Grangemouth	N	91.7	1.71	1.13	0.68	0.78	0.64
NA102	East Kerse Mains, Bo'ness	N	83.3	1.35	1.26	0.61	0.49	0.44
NA105	West of Shieldhill	N	83.3	0.69	0.74	0.34	0.19	0.69

Note: Exceedences of the Benzene running annual mean objective of 3.25µg/m³ are shown in **bold**.

Table A. 11 – Pumped Benzene Annual Mean Results for 2017

Site ID	Location	Within Benzene AQMA?	Data capture in 2017, % (1)	Annual mean concentrations (µg/m ³)				
				2013	2014	2015	2016	2017
A8	Grangemouth AURN	N	100	1.13	0.99	0.73	0.64	0.65

Note: Exceedences of the Benzene running annual mean objective of 3.25µg/m³ are shown in **bold**.

Table A. 12 – Estimated Annual Mean PM_{2.5} Results 2017

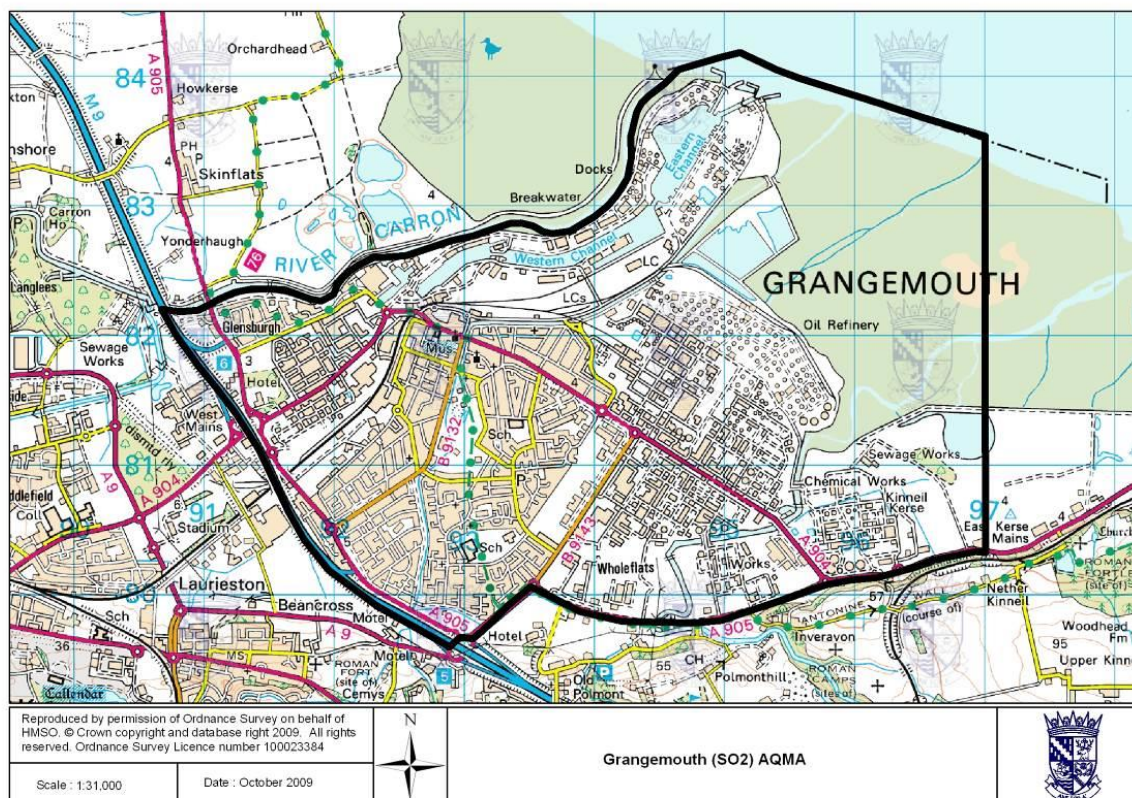
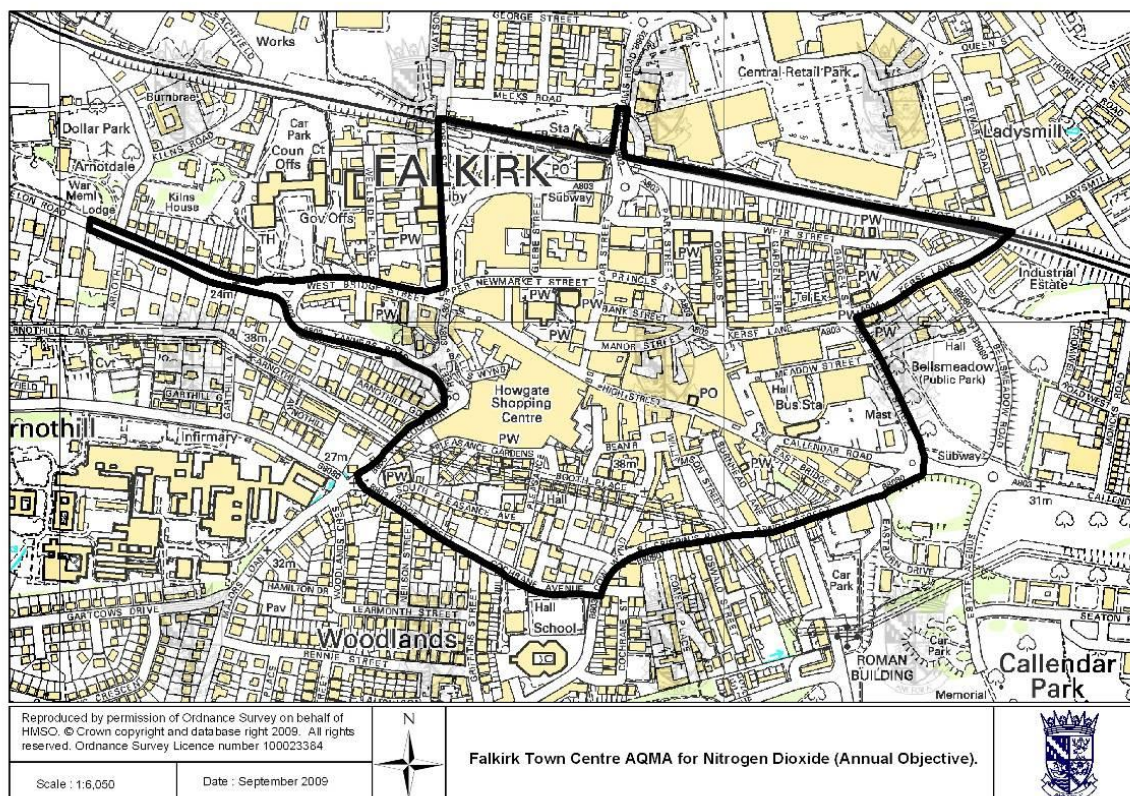
Site ID	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture in 2017 (%) (2)	Correction Factor	Estimated PM _{2.5} Annual Mean Concentration (µg/m ³) (3)				
					2013	2014	2015	2016	2017
A4 Falkirk Haggs	Roadside (Non-urban)	95	95	0.46	8.45	7.62	6.92	6.46	5.54
A10 Grangemouth Municipal Chambers	Urban Background/Industrial	85	85	0.67	10.00	9.73	8.67	8.67	8.00
A12 Falkirk Graham's Road	Roadside (Urban)	98	98	0.60	9.78	7.92	7.08	7.80	7.20
A14 Banknock 3	Roadside (Non-urban)	17	17	0.46	6.74	6.92	3.78	n/m	3.05
A15 Main St Bainsford	Roadside (Urban)	94	94	0.60	n/m	n/m	7.68	6.00	7.80

Note: Exceedences of the PM_{2.5} annual mean objective of 10µg/m³ are shown in **bold**.

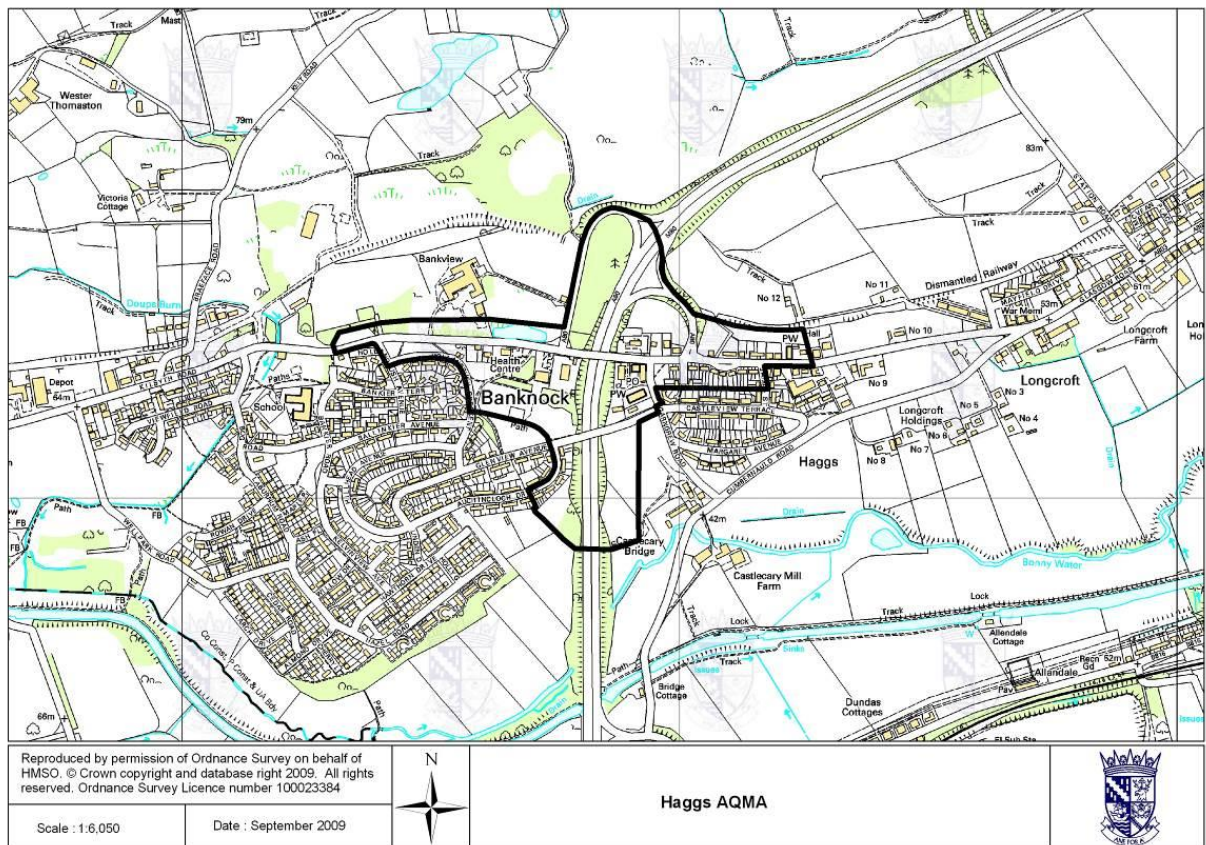
(1) Data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

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

Figure 23 – Maps of AQMA Boundaries in the Falkirk Council areaA) Grangemouth AQMA (SO₂ 15-min mean), declared November 2005B) Falkirk Town Centre AQMA (NO₂ Annual Mean, PM₁₀ annual and 24-hour mean), declared March 2010

C) Hags AQMA (NO₂ annual mean), declared March 2010



D) Banknock AQMA (PM₁₀ 24-hour mean), declared August 2011

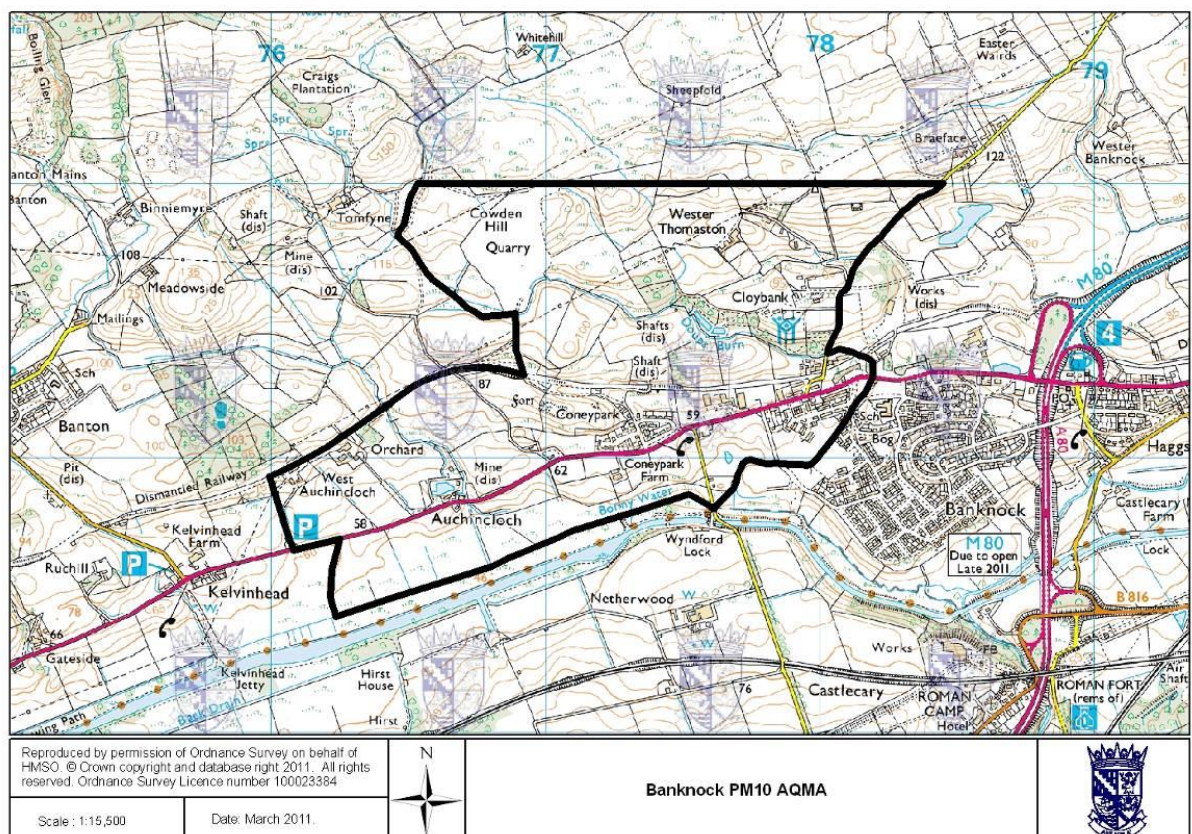
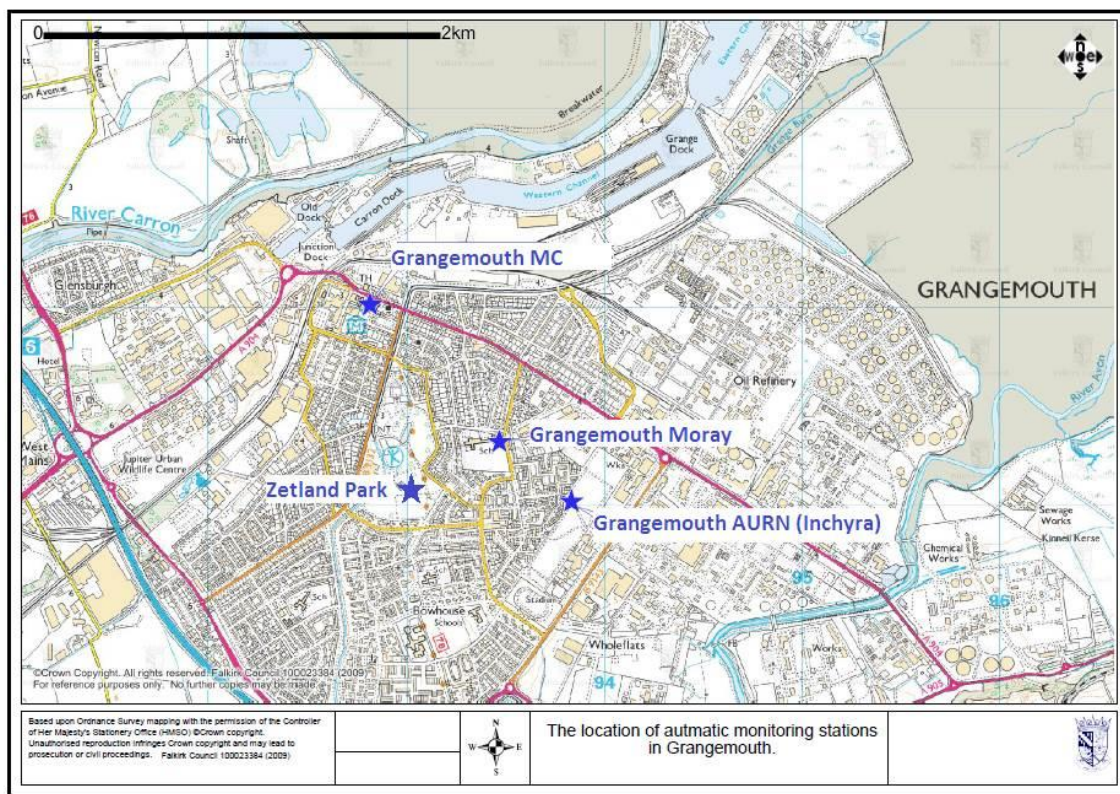
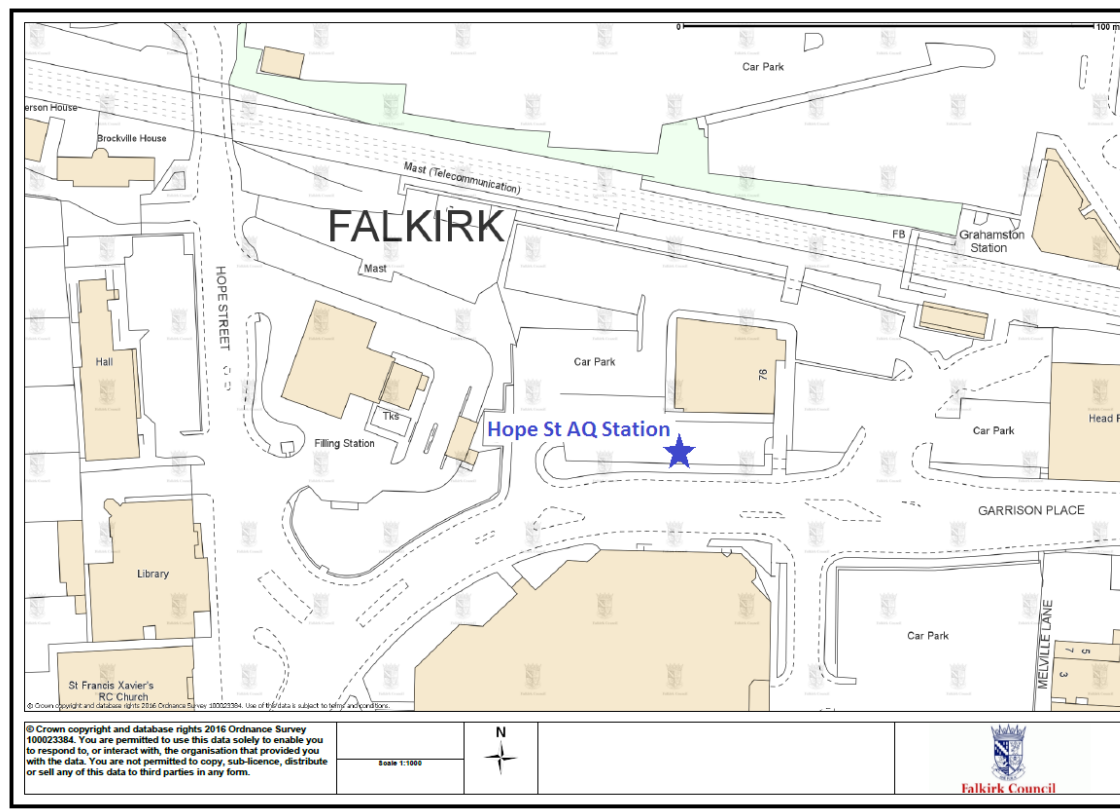


Figure 24 – Maps Showing Automatic Monitoring Locations

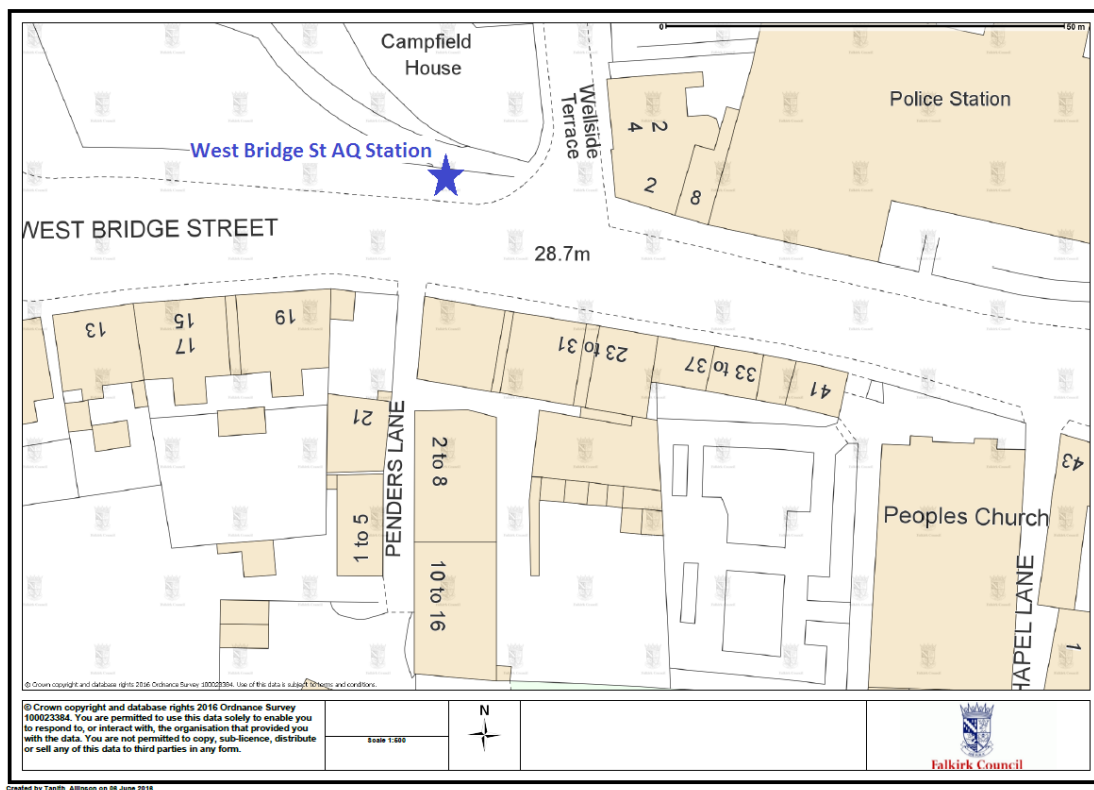
A) Grangemouth Air Quality (AQ) Stations



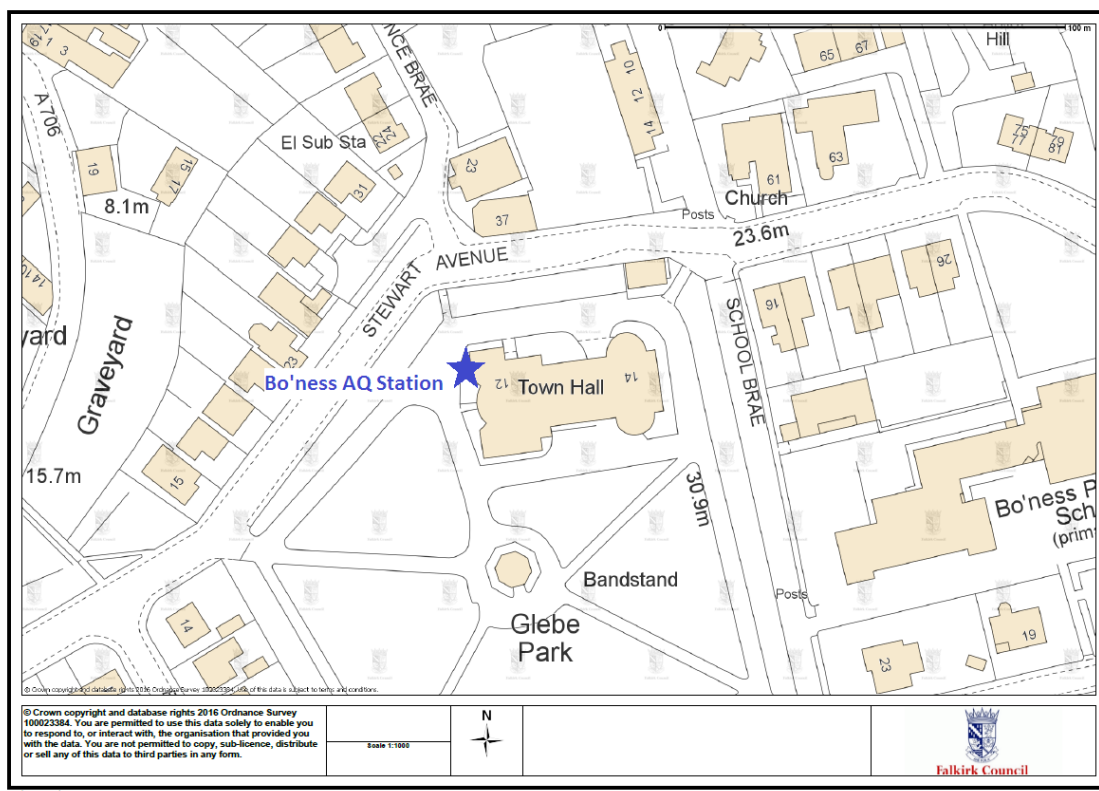
B) Falkirk Hope St AQ Station



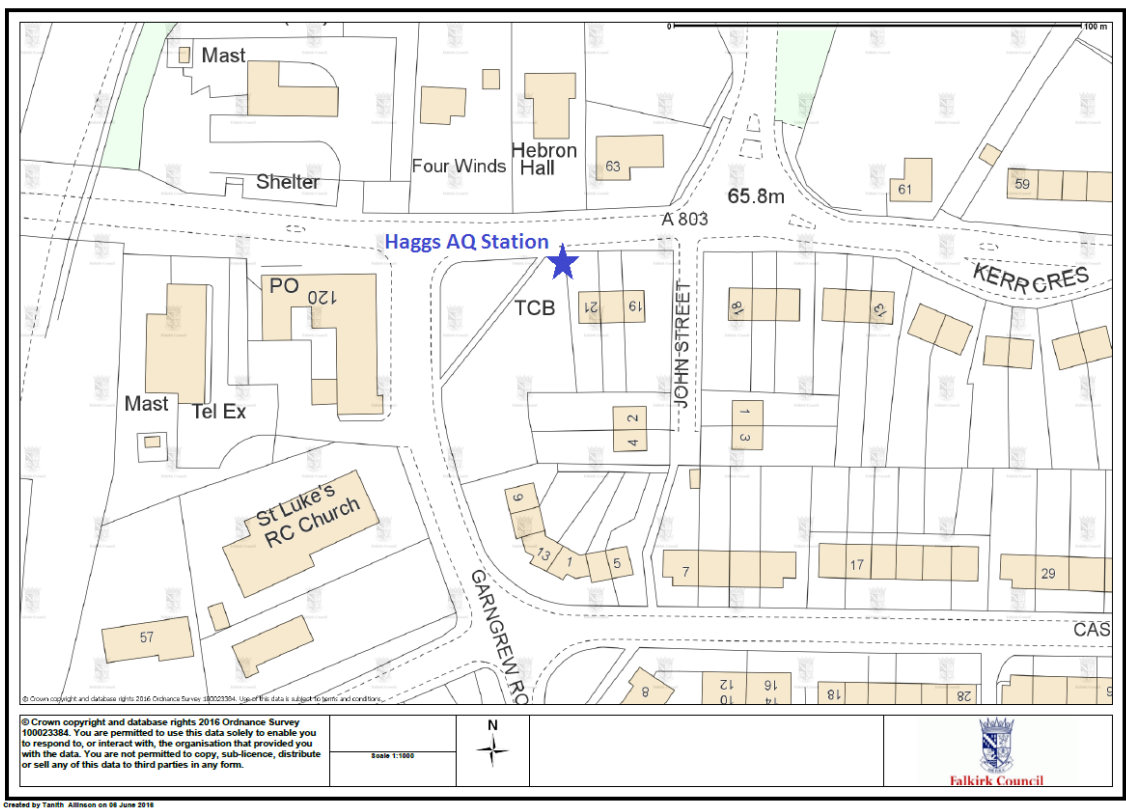
C) Falkirk West Bridge St AQ Station



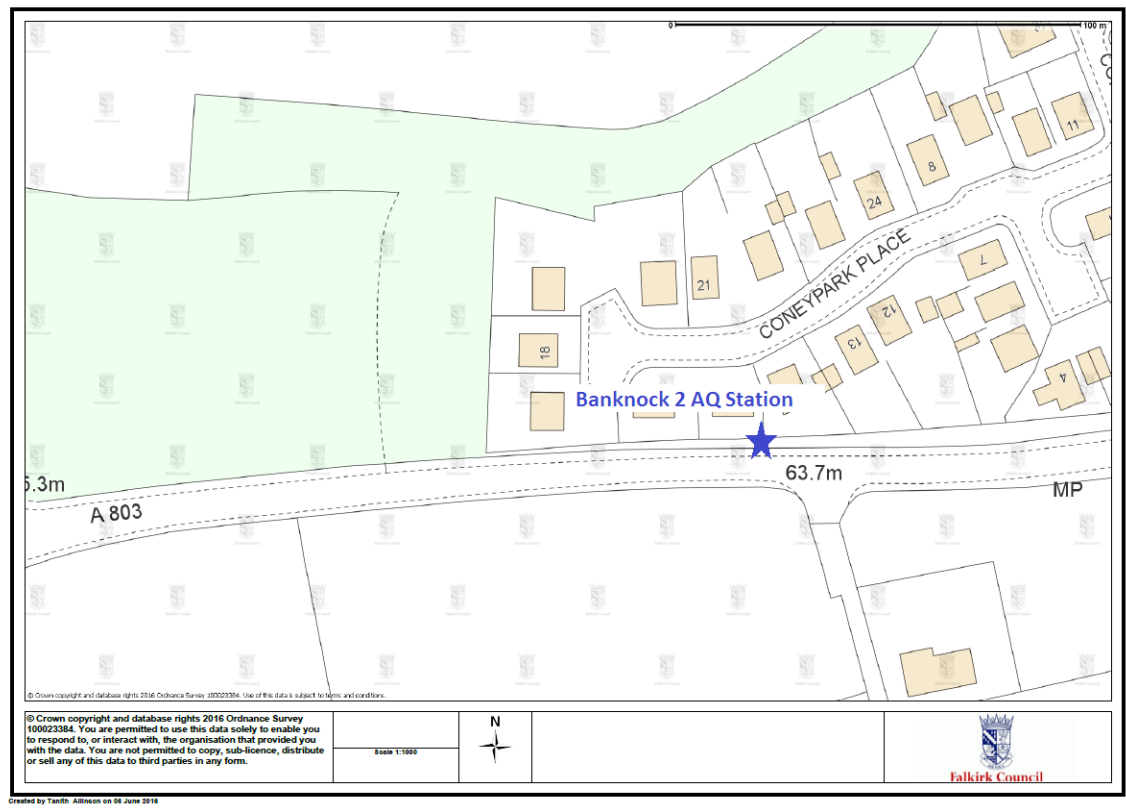
D) Bo'ness AQ Station



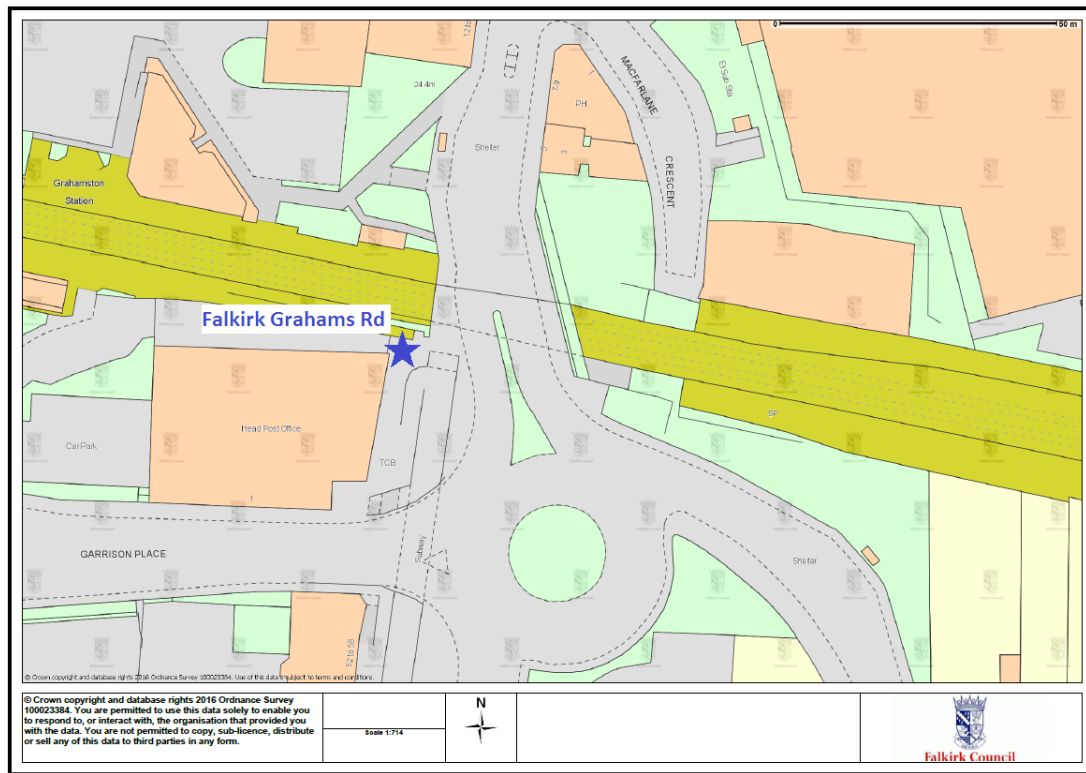
E) Falkirk Hags AQ Station



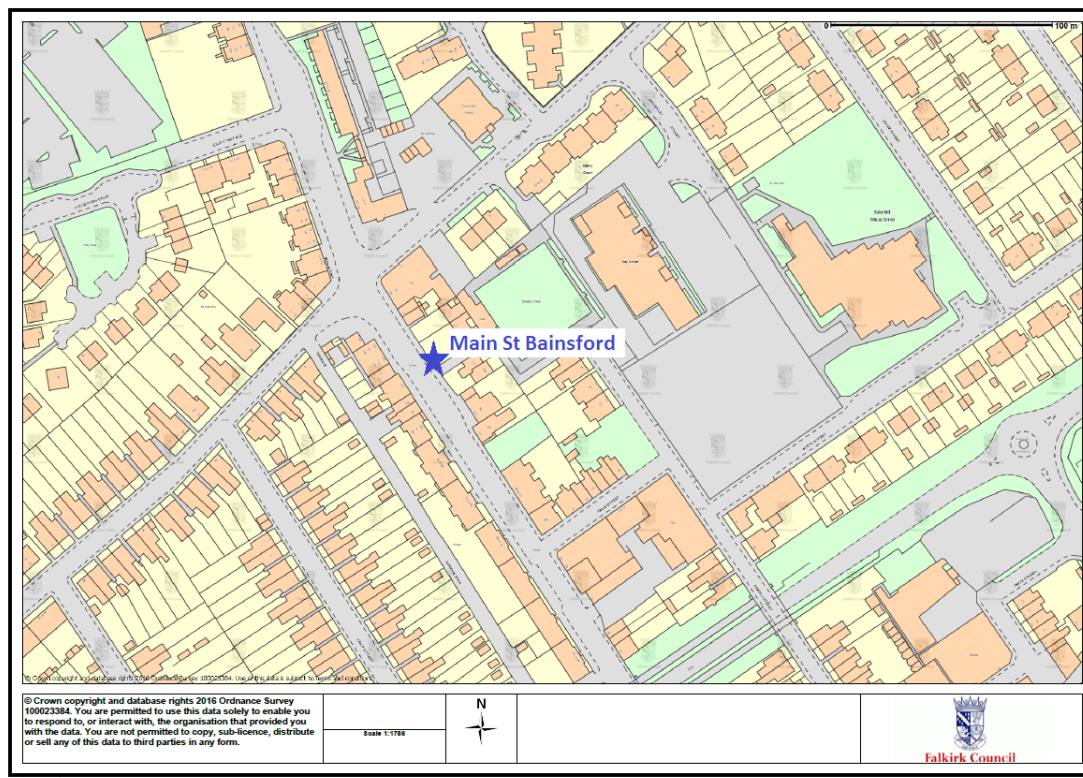
F) Banknock 2 AQ Station



G) Falkirk Grahams Rd AQ Station



H) Main St, Bainsford, Falkirk AQ Station



Appendix B: Full Monthly Diffusion Tube Results for 2017

Table B.1 – NO₂ Monthly Diffusion Tube Results for 2017

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⁾
NA3	32.43	21.49	22.14	14.41	14.38	11.42	11.89	13.96	16.29	16.96	23.19	31.90	19	18
NA5	36.34	26.84	26.59	-	21.63	18.07	17.55	20.22	24.64	25.97	30.38	37.74	26	24
NA7	27.98	18.93	19.96	9.77	12.94	10.72	9.83	9.48	16.28	16.01	18.94	22.01	16	15
NA9	31.00	28.16	31.76	23.48	18.72	18.81	16.92	18.29	23.31	24.00	33.53	35.68	25	24
NA19	31.01	37.90	32.73	20.41	26.64	17.52	23.11	20.88	27.20	25.76	30.86	38.30	28	26
NA20	32.89	23.91	27.55	16.89	15.07	14.75	16.85	20.65	22.15	23.14	30.28	34.73	23	22
NA21	74.46	30.76	31.05	17.89	22.62	19.17	18.14	20.56	25.00	24.63	31.48	43.31	30	28
NA24	95.05	35.99	41.38	37.94	31.29	28.62	24.86	31.85	35.67	35.79	44.23	57.27	42	39
NA26	26.31	22.53	-	13.45	14.06	11.20	14.19	14.35	16.32	17.54	20.66	30.44	18	17
NA27	49.49	50.38	49.80	35.96	40.88	32.99	33.88	33.00	40.78	32.81	42.26	46.84	41	38
NA29	49.39	23.60	18.37	9.31	11.69	9.79	12.36	10.99	18.96	15.45	20.21	25.00	19	17
NA36	46.03	39.40	45.07	32.21	29.72	-	28.19	33.56	34.45	35.96	39.68	46.47	37	35
NA37	22.28	21.39	17.40	12.08	15.56	10.34	10.93	12.58	17.27	14.43	17.47	23.44	16	15
NA38	24.35	19.48	21.46	10.32	10.97	9.62	0.11	13.04	15.37	15.98	21.41	31.49	16	15
NA41	27.95	22.97	22.78	17.91	16.94	15.44	15.09	16.51	19.15	20.63	27.42	35.51	22	20
NA42 (3 Tubes)	28.13	20.57	21.74	12.47	14.19	10.76	12.44	14.14	15.27	16.58	24.50	27.99	18	17
	30.01	20.30	20.55	11.12	12.57	11.49	11.53	12.59	15.88	16.24	23.96	26.49		

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⁾
NA42	30.59	20.90	18.97	12.80	13.02	10.53	11.65	13.28	15.36	16.59	23.20	29.43	18	17
NA44	-	-	20.13	-	10.11	12.25	12.52	14.20	15.73	18.44	23.41	28.21	17	16
NA48	25.48	19.12	22.03	10.82	14.27	11.55	12.93	13.49	15.55	15.34	20.93	26.73	17	16
NA50	26.31	25.21	25.90	-	-	16.23	13.87	16.79	21.68	20.90	22.01	28.08	22	20
NA51	31.81	27.08	27.79	18.86	19.82	17.41	15.60	18.00	23.04	22.79	28.15	33.91	24	22
NA52	33.45	27.96	24.56	16.88	19.39	15.67	11.08	20.35	22.72	20.66	27.23	33.97	23	21
NA53	27.29	37.06	28.69	17.26	25.79	16.79	-	19.36	24.12	23.66	23.30	32.81	25	23
NA57	24.98	23.27	24.74	15.67	14.26	13.39	13.25	14.39	18.74	17.87	23.95	37.33	20	19
NA58	26.50	25.57	-	-	29.32	15.30	-	12.84	20.86	20.88	29.34	34.55	24	22
NA59	83.93	17.28	-	-	22.12	17.77	17.57	20.47	24.66	24.71	-	41.86	30	28
NA60	35.55	28.16	27.90	19.37	19.20	16.83	16.83	19.09	24.19	23.74	32.28	38.08	25	23
NA61	34.72	26.25	25.55	14.17	15.90	16.66	15.89	19.04	21.95	20.86	13.85	32.69	21	20
NA62	49.52	41.39	42.58	32.04	31.40	29.95	25.91	32.40	33.87	36.02	39.77	47.81	37	34
NA63	45.53	40.38	40.03	30.58	30.46	25.61	-	26.05	28.63	34.66	40.99	48.36	36	33
NA64	21.63	20.37	16.82	10.55	12.26	10.18	12.42	10.42	14.65	11.97	15.96	22.31	15	14
NA65	33.80	29.61	27.74	21.12	19.75	17.42	18.39	18.80	22.97	21.36	26.01	37.69	25	23
NA67	26.10	32.70	32.97	25.38	26.35	20.48	20.14	24.21	26.29	27.28	33.85	46.49	29	27
NA68	33.39	29.28	34.89	23.68	22.40	24.23	20.47	20.43	28.80	30.24	37.85	44.12	29	27
NA69	37.40	37.77	37.70	28.09	27.64	24.74	24.63	25.25	32.01	28.22	31.69	47.48	32	30

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⁾
NA71	44.13	33.75	35.29	30.24	24.95	24.34	22.83	28.13	29.86	30.58	37.15	49.68	33	30
NA72	-	32.55	29.07	19.89	25.27	24.75	16.32	22.75	27.99	26.54	32.95	42.64	27	25
NA73	36.13	36.19	31.93	22.05	33.49	24.81	25.77	26.52	28.76	27.95	30.37	38.79	30	28
NA76	32.59	-	23.09	15.78	18.45	12.69	10.91	16.19	19.88	18.95	28.49	27.68	20	19
NA77	27.20	23.92	25.09	-	-	14.86	13.01	17.64	22.51	20.33	27.18	30.60	22	21
NA78	40.36	35.12	30.55	13.48	26.24	23.99	24.76	29.27	31.49	-	35.62	38.88	30	28
NA80	46.28	35.45	35.05	25.04	22.99	21.53	20.84	28.10	28.81	30.04	37.33	42.49	31	29
NA81	34.78	36.17	33.66	28.40	23.41	20.24	22.46	22.93	40.64	26.08	29.77	41.36	30	28
NA82	24.61	24.66	20.50	13.02	14.25	10.79	9.47	13.37	14.39	15.24	20.63	35.20	18	17
NA83	40.87	38.47	40.85	31.22	-	28.45	11.72	30.21	33.30	-	-	44.61	33	31
NA85	21.97	24.39	23.13	9.23	19.92	11.81	15.50	13.78	17.83	15.85	18.18	27.72	18	17
NA86	25.49	18.78	21.09	16.61	14.31	9.71	9.72	9.95	13.58	14.04	20.26	25.21	17	15
NA87	36.66	33.85	30.71	22.30	27.78	23.47	22.76	-	29.53	28.09	32.52	31.33	29	27
NA88	36.33	32.04	35.96	31.59	21.10	24.69	20.61	25.48	27.52	29.02	28.40	43.14	30	28
NA89	35.88	32.27	32.07	24.12	26.00	22.58	21.77	25.44	30.82	28.40	34.09	43.56	30	28
NA94	30.14	36.14	36.44	31.50	-	25.03	21.05	27.84	31.79	31.43	41.05	37.71	32	30
NA98	25.08	24.31	-	11.66	19.80	-	-	-	16.55	16.62	20.40	26.38	20	19
NA99	37.80	30.76	29.30	20.98	22.13	18.26	18.05	19.26	23.13	24.34	32.33	32.32	26	24
NA100	31.78	24.10	25.48	16.61	16.44	14.03	-	-	16.39	15.91	-	-	20	19

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⁾
NA101	42.50	25.22	24.64	17.30	22.27	14.76	15.34	15.93	19.82	20.05	27.22	35.46	23	22
NA105	13.00	10.89	7.82	5.19	5.38	5.72	6.45	5.85	6.42	7.28	9.87	12.77	8	7
NA107	42.28	34.77	31.36	20.74	29.16	18.58	15.55	21.62	27.34	24.75	31.63	37.75	28	26
NA108	54.25	-	22.12	12.26	-	17.43	17.35	19.94	-	19.55	21.28	28.06	24	22
NA109	22.86	22.08	21.41	9.08	12.54	10.34	13.11	11.73	14.93	13.54	17.26	23.18	16	15
NA110	25.62	19.87	18.85	12.58	11.94	11.62	11.65	14.05	16.52	16.19	21.49	22.97	17	16
NA111 (3 tubes)	44.58	43.48	50.18	32.84	35.80	29.25	33.99	30.25	35.64	31.00	41.90	49.35	39	36
	51.24	45.94	45.52	34.32	36.06	27.29	32.71	30.53	36.57	34.01	42.46	44.51		
	45.34	48.43	44.17	32.99	39.88	31.15	30.53	30.15	35.75	35.71	41.41	52.65		
NA112	25.66	21.31	18.20	9.65	26.18	9.57	11.19	11.34	16.05	14.07	17.48	28.30	17	16

(1) See Appendix C for details on bias adjustment

Table B.2 – 1, 3-Butadiene Monthly Diffusion Tube Results for 2017

Site ID	1,3-Butadiene Mean Concentrations													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean	Annual Mean
	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	µg/m ³
41	0.12	0.03	0.12	-	0.03	0.03	0.03	0.02	0.03	0	0.05	0.02	0.04	0.10
55	0.05	0.04	0.04	0.03	0.07	0.02	0.02	0.02	0.02	-	0.02	0.02	0.03	0.07
104	0.04	0.08	0.1	0.03	0.04	0.02	0.06	0.02	0.02	0.06	0.02	0.02	0.04	0.10

Table B.3 –Benzene Monthly Diffusion Tube Results for 2017

Site ID	Benzene Mean Concentrations													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean	Annual Mean
	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	µg/m ³
3	0.25	0.27	0.23	0.18	0.24	0.11	0.11	0.07	0.15	0.16	0.18	-	0.18	0.58
21	0.23	0.31	0.2	0.15	0.16	0.12	0.13	0.11	0.19	0.16	0.25	0.06	0.17	0.56
27	0.14	0.4	0.27	0.21	0.21	0.15	0.19	0.17	0.21	0.24	0.27	0.06	0.21	0.68
37	0.24	0.16	0.2	0.14	0.17	0.14	0.2	0.14	0.2	0.17	0.18	0.13	0.17	0.56
38	0.23	2.01	0.18	0.14	0.1	0.09	0.1	0.19	0.13	0.1	0.15	-	0.31	1.01
41	0.39	0.47	0.07	-	0.2	0.17	0.16	0.19	0.22	0.22	0.25	0.43	0.25	0.82
42	0.31	0.13	0.01	0.17	0.22	0.13	0.13	0.09	0.3	0.15	0.05	0.06	0.15	0.47
44	-	-	-	-	-	0.14	0.11	0.09	0.19	0.13	-	0.06	0.12	0.39
55	0.24	0.29	0.19	0.12	-	0.1	0.18	0.08	0.17	0.12	0.2	0.06	0.16	0.52
57	0.19	-	0.2	0.2	0.19	0.12	0.14	0.31	0.18	0.17	0.17	0.06	0.18	0.57
77	0.07	0.27	0.18	0.27	0.13	0.07	0.11	0.12	0.18	-	0.14	0.17	0.16	0.51
80	0.27	0.35	-	0.12	0.16	0.11	0.12	0.11	0.17	0.13	0.17	0.21	0.17	0.57
81	0.26	0.43	0.29	0.22	-	0.18	0.16	0.15	0.23	0.16	0.05	0.24	0.22	0.70
94	0.24	0.35	0.22	0.18	0.11	0.17	0.16	0.11	0.23	0.2	0.2	-	0.20	0.64
102	0.16	0.07	0.16	0.14	0.15	0.11	0.11	0.09	-	-	0.14	0.22	0.14	0.44
105	0.13	1.28	0.11	0.12	0.11	0.07	0.06	0.07	0.07	-	-	0.1	0.21	0.69

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

Diffusion Tube Monitoring QA/QC

In 2017 the nitrogen dioxide (NO₂), benzene and 1, 3-butadiene tubes deployed by Falkirk Council were supplied and analysed by Gradko International Ltd. The analysis method used for the NO₂ tubes is 50% tri-ethanolamine (TEA) and 50% acetone. The benzene tubes type is Chromosorb ATD (atomic thermal desorption) and for 1, 3-butadiene the tube type is Carboxpack X (ATD) with analysis using TD-GCMS.

Nitrogen Dioxide Diffusion Tubes

The NO₂ diffusion tube analysis in 2017 was carried out by to Gradko International Ltd. Gradko follows the DEFRA guidance for the preparation and analysis of the NO₂ diffusion tubes. All the results for the amount of NO₂ present on the tube are within the scope of their UKAS accreditation

The full set of monthly NO₂ diffusion tube results are shown in Table B.1 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 B.2 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. The full set of monthly Benzene diffusion tube results are shown in Table B.3 in Appendix B.

NO₂ Diffusion Tube Bias Adjustment Factor (Local and National)

In accordance with LAQM TG16, a locally derived Bias Adjustment Factor has been calculated for the 2017 NO₂ diffusion tube results based on the following two co-location sites: NA42 Grangemouth Municipal Chambers and NA111 Falkirk West Bridge Street. The local results have been submitted to the LAQM Helpdesk to contribute to the national bias factor.

The results of the locally derived bias adjustment factor spreadsheets are shown in Figure 25 A) and B).

The national diffusion tube bias adjustment factor spreadsheet is displayed in Figure 26 for comparison purposes. The overall National bias factor in 2017 was 1.01.

A comparison in summary form of the local and national bias factor summary is shown in table C1.

Table C1 – Comparison of Local vs National Bias Factor Summary

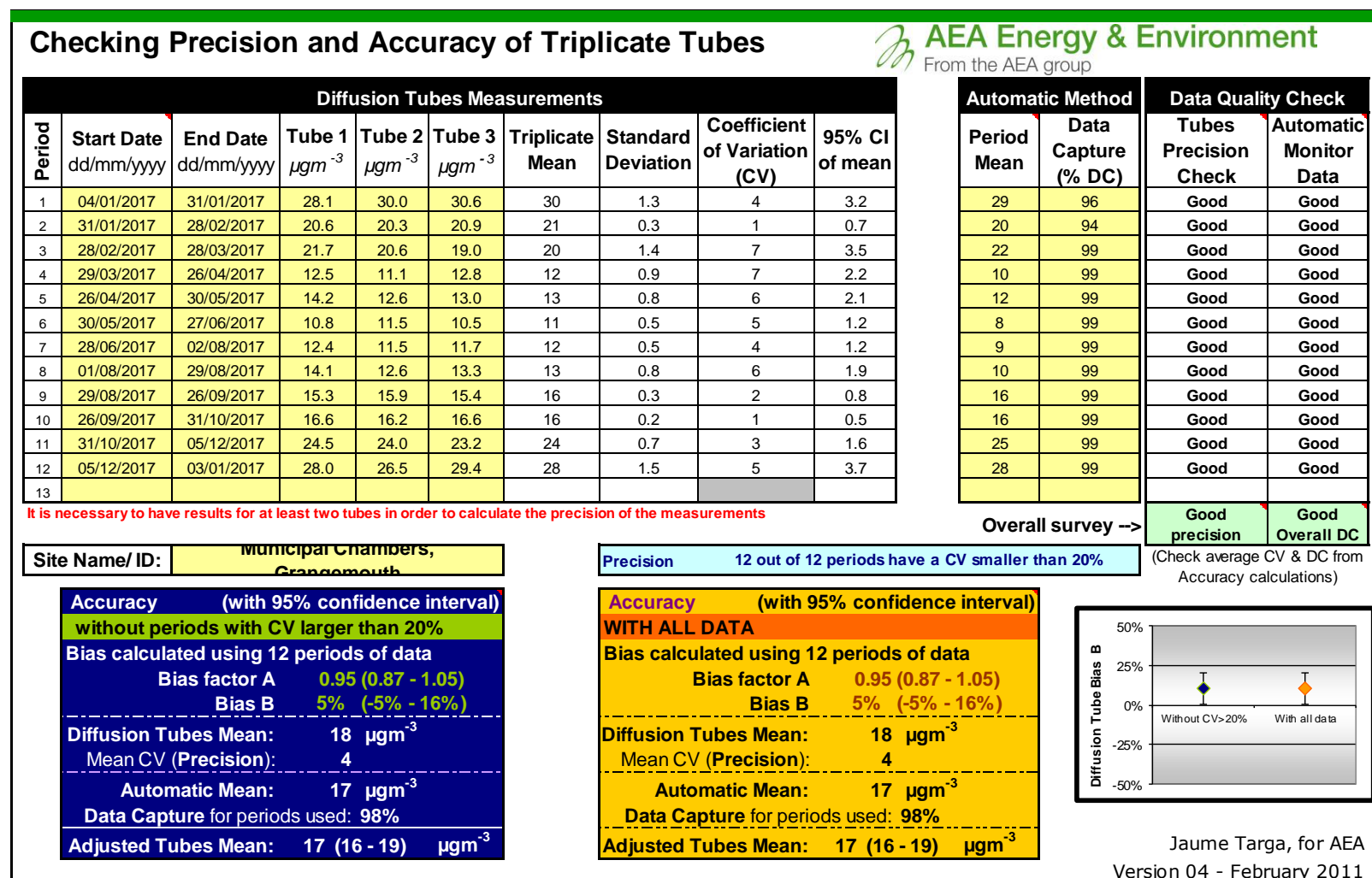
2017 Falkirk Council NO₂ Diffusion Tubes	
Local Bias Adjustment Factor	0.93
National Bias Adjustment Factor	1.01
Difference	0.08

In accordance with LAQM TG16 Box 7.11 – data quality checks of the local bias adjustment spreadsheet have been assessed as ‘good’ for both colocation sites. Falkirk Council have a full years’ worth of colocation data at representative locations (Grangemouth Municipal Chambers: Urban background / Industrial – typical off-street urban location that is likely to measure traffic and industrial emissions and West Bridge Street: roadside – traffic related, elevated NO₂ levels at typical daytime peak traffic periods).

Using the above reasons it has been decided to apply the locally derived bias adjustment factor for the 2017 NO₂ diffusion tube results.

Figure 25 – NO₂ Locally Derived Bias Adjustment Factor Spreadsheets

A) Grangemouth Municipal Chambers



B) Falkirk West Bridge Street

Checking Precision and Accuracy of Triplicate Tubes



Diffusion Tubes Measurements									
Period	Start Date dd/mm/yyyy	End Date dd/mm/yyyy	Tube 1 μgm^{-3}	Tube 2 μgm^{-3}	Tube 3 μgm^{-3}	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean
1	05/01/2017	01/02/2017	44.6	51.2	45.3	47	3.6	8	9.1
2	01/02/2017	01/03/2017	43.5	45.9	48.4	46	2.5	5	6.1
3	01/03/2017	29/03/2017	50.2	45.5	44.2	47	3.2	7	7.8
4	29/03/2017	26/04/2017	32.8	34.3	33.0	33	0.8	2	2.0
5	26/04/2017	31/05/2017	35.8	36.1	39.9	37	2.3	6	5.7
6	31/05/2017	28/06/2017	29.3	27.3	31.2	29	1.9	7	4.8
7	28/06/2017	02/08/2017	34.0	32.7	30.5	32	1.7	5	4.3
8	02/08/2017	30/08/2017	30.3	30.5	30.2	30	0.2	1	0.5
9	30/08/2017	27/09/2017	35.6	36.6	35.8	36	0.5	1	1.3
10	27/09/2017	01/11/2017	31.0	34.0	35.7	34	2.4	7	5.9
11	01/11/2017	06/12/2017	41.9	42.5	41.4	42	0.5	1	1.3
12	06/12/2017	04/01/2018	49.4	44.5	52.7	49	4.1	8	10.2
13									

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

Automatic Method		Data Quality Check	
Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
48	91	Good	Good
44	99	Good	Good
46	95	Good	Good
29	99	Good	Good
34	99	Good	Good
24	94	Good	Good
29	99	Good	Good
27	99	Good	Good
36	92	Good	Good
26	64	Good	or Data Capture
34	97	Good	Good
44	41	Good	or Data Capture
Overall survey -->		Good precision	Poor Overall DC

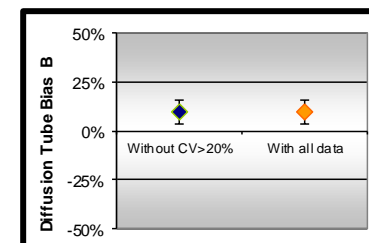
(Check average CV & DC from Accuracy calculations)

Site Name/ ID:	Falkirk West Bridge Street
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Accuracy (with 95% confidence interval)	
without periods with CV larger than 20%	
Bias calculated using 10 periods of data	
Bias factor A	0.92 (0.87 - 0.98)
Bias B	8% (2% - 15%)
Diffusion Tubes Mean:	38 μgm^{-3}
Mean CV (Precision):	4
Automatic Mean:	35 μgm^{-3}
Data Capture for periods used:	96%
Adjusted Tubes Mean:	35 (33 - 37) μgm^{-3}

Precision	12 out of 12 periods have a CV smaller than 20%
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Accuracy (with 95% confidence interval)	
WITH ALL DATA	
Bias calculated using 10 periods of data	
Bias factor A	0.92 (0.87 - 0.98)
Bias B	8% (2% - 15%)
Diffusion Tubes Mean:	38 μgm^{-3}
Mean CV (Precision):	4
Automatic Mean:	35 μgm^{-3}
Data Capture for periods used:	96%
Adjusted Tubes Mean:	35 (33 - 37) μgm^{-3}



Jaume Targa, for AEA
Version 04 - February 2011

C) Calculation of Two Colocation Results: Grangemouth Municipal Chambers and Falkirk West Bridge St

	FWBS (%)	GMC (%)	Average (%)	2 Locations Factor	Inverse to give local Bias Adjustment Factor
Bias Factor B	8	5	7	1.07	0.93

Figure 26 – NO₂ National Derived Bias Adjustment Factor Spreadsheet

National Diffusion Tube Bias Adjustment Factor Spreadsheet							Spreadsheet Version Number: 09/17			
<p>Follow the steps below in the correct order to show the results of relevant co-location studies</p> <p>Data only apply to tubes exposed monthly and are not suitable for correcting individual short-term monitoring periods</p> <p>Whenever presenting adjusted data, you should state the adjustment factor used and the version of the spreadsheet</p> <p>This spreadsheet will be updated every few months: the factors may therefore be subject to change. This should not discourage their immediate use.</p>							<p>This spreadsheet will be updated at the end of March 2018</p> <p>LAQM Helpdesk Website</p>			
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.	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 <small>To make your selection, choose (All) from the pop-up list</small>	Year ² <small>To make your selection, choose (All)</small>	Site Type	Local Authority	Length of Study (months)	Diffusion Tube Mean Conc. (Dm) (µg/m ³)	Automatic Monitor Mean Conc. (Cm) (µg/m ³)	Bias (B)	Tube Precision ³	Bias Adjustment Factor (A) (Cm/Dm)
Gradko	50% TEA in Acetone	2016	R	LB Newham	12	36	42	-14.6%	G	1.17
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	UB	Middlesbrough	12	17	18	-7.8%	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	SU	Redcar and Cleveland Borough Council	10	13	12	12.0%	G	0.89
Gradko	50% TEA in acetone	2016	R	London Borough of Croydon	11	53	47	14.1%	G	0.88
GRADKO	50% TEA in acetone	2016	UB	Norwich City Council	10	13	15	-11.9%	G	1.14
Gradko	50% TEA in acetone	2016		Overall Factor³ (19 studies)					Use	1.01

PM₁₀ 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 for the sites affiliated to the Scottish Air Quality Network in 2015 as part of the Scottish Government's contract.

The PM₁₀ 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 PM₁₀ 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 PM₁₀ Measurements

LAQM TG (16) describes two methodologies for estimating PM_{2.5} from PM₁₀ measurements. Method one is to apply a locally derived correction ratio calculated from local sites measuring both PM₁₀ 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 PM₁₀ and PM_{2.5} are available. The locally derived correction ratio should only be used at sites of the same classification.

In 2017, Falkirk Council had three local sites monitoring both PM₁₀ and PM_{2.5} these being the Banknock 2, the Grangemouth AURN and Falkirk West Bridge St sites. The Falkirk West Bridge St automatic station was upgraded to include PM_{2.5} monitoring capabilities through the commissioning of a FIDAS analyser in November 2016. A sufficient volume of monitoring data has been collected since this installation date.

Using guidance in LAQM TG (16) the PM_{2.5}/ PM₁₀ ratios were calculated for the Banknock 2, Grangemouth AURN and Falkirk West Bridge St sites. The ratio derived from the Banknock 2 data was applied to sites classified as roadside (non-urban), the ratio derived from the AURN data was applied to sites classified as urban background/industrial and the ratio derived from the Falkirk West Bridge St data was applied to sites classified as roadside (urban).

The local correction ratios were used to estimate PM_{2.5} from PM₁₀ measurements at the following sites; Falkirk Haggs, Grangemouth Municipal Chambers, Falkirk

Graham's Road, Banknock 3 and Main St Bainsford. Results are shown in Table A.12 in Appendix A. Table C.1 displays how the local ratios have been derived.

Table C. 2 – Locally Derived PM_{2.5} / PM₁₀ Correction Ratio

Site	Site Type	Annual Average PM ₁₀ (µg/m ³), 2017	Annual Average PM _{2.5} (µg/m ³), 2017	Ratio
A7 Falkirk West Bridge St	Roadside (Urban)	10	6	0.6
A8 AURN	Urban Background / Industrial	9	6	0.67
A13 Banknock 2	Roadside (Non-urban)	13	9	0.46

Short term to long term adjustments

The annual average PM₁₀ concentration for the Banknock 3 site has been annualised. This site achieved a data capture below 75% for PM₁₀ in 2017. Grangemouth Municipal Chambers and Grangemouth AURN were used as 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. 3 – PM₁₀ short term to long term adjustment factor – Banknock 3

Banknock 3 (Urban Background)	Site Type	Annual Mean 2017, µg/m ³	Data capture 2017, %	Period Mean, µg/m ³	Ratio
Banknock 2	Roadside	13	99	11.55	1.13
Haggs	Roadside	12	95	12.05	1
				Average	1.06

QA/QC Automatic Monitoring

Table C. 4 – Details of the QA/QC at the automatic monitoring stations in 2017

QA / QC in 2017		
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	SO ₂	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 staff who are audited to AURN standards.
- The Osiris is serviced on an annual basis and covered by a service agreement for any breakdowns, both are completed off-site.

AURN and Scottish AQ network sites:

- All NO_x and SO₂ 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 who 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 to ensure the best data quality. Unscaled data is supplied by Falkirk Council to Ricardo 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
ECSVEP	East Central Scotland Vehicle Emissions Partnership
EIA	Environmental Impact Assessment
FDMS	Filter Dynamics Measurement System
LAQM	Local Air Quality Management
NAQS	National Air Quality Strategy
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
RDF	Refuse Derived Fuel
SO ₂	Sulphur Dioxide
TEOM	Tapered Element Oscillating Microbalance

References

1. Technical Guidance LAQM.TG (16), Defra and Devolved Administrations, February 2018.
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.