2020 Air Quality Annual Progress Report (APR) for Stirling Council

In fulfilment of Part IV of the Environment Act 1995

Local Air Quality Management

April 2020

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Report Reference number	LAQM/APR/2020
Date	15/04/2020

Executive Summary: Air Quality in Our Area

Air Quality in Stirling Council

This Annual Progress Report provides an overview of air quality in the Stirling Council area. Air quality monitoring was performed at the automatic monitoring station on Craig's Roundabout in the City of Stirling (measuring nitrogen dioxide (NO_2) and particulate matter ($PM_{2.5}$ and PM_{10})) and passive monitoring for NO_2, using diffusion tubes, at 12 sites in the wider urban area.

Based on the available monitoring data for NO_2, $PM_{2.5}$ and PM_{10} there were no exceedances of the relevant Air Quality Objectives and it is considered unlikely that they will be exceeded in the near future. Therefore, it is not considered necessary to declare an AQMA in the Stirling area.

Actions to Improve Air Quality

When we breathe polluted air, pollutants get into our lungs, they can enter the bloodstream and be carried to our internal organs such as the brain. This can cause severe health problems such as asthma, cardiovascular diseases and even cancer and reduces the quality and number of years of life. Vulnerable groups, namely children, people with chronic diseases, and the elderly, are particularly sensitive to the dangerous effects of toxic air pollution and so it is critical that human health and the environment are protected.

Stirling Council have a number of initiatives and actions to improve air quality, such as, a sustainable transport strategy, a comprehensive monitoring programme and developmental control requirements. These are discussed in more detail in section 2.2.

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1. Local Air Quality Management

This report provides an overview of air quality in Stirling Council during 2019. It fulfils the requirements of Local Air Quality Management (LAQM) as set out in Part IV of the Environment Act (1995) and the relevant Policy and Technical Guidance documents.

The LAQM process places an obligation on all local authorities to regularly review and assess air quality in their areas, and to determine whether or not the air quality objectives are likely to be achieved. Where an exceedance is considered likely the local authority must declare an Air Quality Management Area (AQMA) and prepare an Air Quality Action Plan (AQAP) setting out the measures it intends to put in place in pursuit of the objectives. This Annual Progress Report (APR) is summarises the work being undertaken by Stirling Council to improve air quality and any progress that has been made.

Table 1.1 – Summary of Air Quality Objectives in Scotland

Pollutant	Air Quality Objective		Date to be achieved by
	Concentration	Measured as	
Nitrogen dioxide (NO_2)	200 µg/m^3 not to be exceeded more than 18 times a year	1-hour mean	31.12.2005
	40 µg/m^3	Annual mean	31.12.2005
Particulate Matter (PM_{10})	50 µg/m^3, not to be exceeded more than 7 times a year	24-hour mean	31.12.2010
	18 µg/m^3	Annual mean	31.12.2010
Particulate Matter ($PM_{2.5}$)	10 µg/m^3	Annual mean	31.12.2020
Sulphur dioxide (SO_2)	350 µg/m^3, not to be exceeded more than 24 times a year	1-hour mean	31.12.2004
	125 µg/m^3, not to be exceeded more than 3 times a year	24-hour mean	31.12.2004
	266 µg/m^3, not to be exceeded more than 35 times a year	15-minute mean	31.12.2005
Benzene	3.25 µg/m^3	Running annual mean	31.12.2010
1,3 Butadiene	2.25 µg/m^3	Running annual mean	31.12.2003
Carbon Monoxide	10.0 mg/m^3	Running 8-Hour mean	31.12.2003
Lead	0.25 µg/m^3	Annual Mean	31.12.2008

2. Actions to Improve Air Quality

2.1 Air Quality Management Areas

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

Stirling Council currently does not have any AQMAs and the results of past and present monitoring indicate that it will not be necessary to declare any AQMA's in the future.

2.2 Development and Initiatives

New development in the Stirling Area is a key issue affecting air quality. Where relevant, development applications are requested to submit an Air Quality Impact assessment to allow for the potential impact to be assessed and any necessary mitigation measures to be applied. Applications that primarily require this, are those that include biomass installations and increased traffic emissions e.g. major housing developments.

Stirling Councils Local Transport Strategy (LTS) establishes a long-term strategic vision for transport management, provision and services, and sets out how Stirling Council will work to promote and deliver sustainable travel and transportation. Routine reviews of the LTS, and the associated consultations, have identified that progress towards achieving many of the objectives is largely positive.

The Local Transport Strategy is delivered via a number of supporting plans including the City Transport Plan 2013; the Towns, Villages and Rural Transport Plan 2014; and the Walking and Cycling to a Healthier Stirling: Active Travel Action Plan. The Active Travel Plan focuses on encouraging walking and cycling through improving infrastructure and changing behaviours via training and promotion activities.

Stirling Councils Sustainable Development Strategy establishes a collective vision to balance the needs of its communities and businesses with the needs of the environment. The strategy establishes objectives which focus on five main areas: energy, transport, sustainable eco-systems, sustainable resource/waste management and climate change adaption. This includes reducing fuel poverty levels to zero by 2040; Stirling City Centre Emissions Free Zones by 2030; 40% natural vegetation cover by 2040; Zero Waste City by 2040; and 80% reduction in carbon emissions by 2050.

Stirling Council actively participates in and promotes the Cycle to Work Scheme and the NextBikes cycle hire scheme, encouraging staff to use sustainable methods of transport for both commuting and work purposes.

A number of Schools within the Stirling Council area deliver the Level 1 Bikeability Scotland Cycle Training, providing children with the skills, confidence and encouragement to cycle safely on the roads. Further information can be found at:

http://www.bikeabilityscotland.org/

Stirling Council have partnered with East Central Scotland Vehicles Emissions Partnership, which is a coalition of East Lothian, Falkirk, Midlothian and West Lothian Councils. The aim is to actively deal with reports from members of the public who identify idling vehicles. The remit of the Vehicles Emissions Partnership is to reduce vehicle emissions by encouraging drivers to switch off their engines and handle idling complaints. Further information can be found at:

http://switchoffandbreathe.org/about/

During 2019, Stirling Council formulated an Air Quality Strategy to include mobile air quality monitoring using Zephyr units. The Zephyr is a compact and lightweight air pollution sensor measuring NO_2, NO, O_3, PM_1, $PM_{2.5}$ and PM_{10}. Stirling Council recently purchased 11 Zephyr units and located them across urban areas of Stirling. They are rotated every 6 months based on a prioritisation matrix and will be used to monitor pollution connected with some of the larger projects within Stirling. Locations chosen can also include, main traffic junctions and close to schools to determine trends in pollutant levels during school hours with the aim of spreading awareness to local schools regarding air quality.

As part of the Sustainable Growth Agreement Actions, Stirling Council now have 14 electric vehicles (10 cars and 4 vans) within its fleet, and have installed 18 electric vehicle charging points at council buildings across the Stirling area. Stirling Council also own 55 public charging points and there are a further 41 charging points across the Stirling area which are not owned by the council.

Local Priorities and Challenges

The anticipated growth in traffic volume is seen as a priority air quality issue and the above plans were developed to manage this issue in to the future. The reports and other related documents can be viewed at:

http://my.stirling.gov.uk/services/transport-and-streets/transport-policy

How to Get Involved

A number of local and national organisations exist to promote more active and sustainable travel and members of the public can access further information or become directly involved by following the links below:

https://www.livingstreets.org.uk/who-we-are/scotland

http://www.sustrans.org.uk/scotland

http://www.stirlingcyclehub.org

http://nextbike.co.uk

Members of the public who wish to access information and advice on air quality across Scotland can do so at:

http://www.scottishairquality.co.uk/

Air quality data specific to the Stirling Council area can be found at:

http://www.scottishairquality.co.uk/latest/site-info?site_id=STRL

2.2 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 https://www.gov.scot/Publications/2015/11/5671/17.

Progress by Stirling Council against relevant actions within this strategy is demonstrated below.

2.2.1 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. Stirling Council has an Active Travel Action Plan – Walking and Cycling to a Healthier Stirling which identifies ways Stirling Council intends to build upon, and promote, existing work to increase opportunities for walking and cycling across the Stirling area.

2.2.2 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. Stirling Council has a Sustainable Development Strategy that aims: 'to enable all people throughout the Stirling Council area to satisfy their basic needs and enjoy a good quality of life without compromising the quality of life of future generations.'

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.

Stirling Council undertook automatic (continuous) monitoring at one site during 2019. Table A.1 in Appendix A shows the details of the site. National monitoring results are available at:

http://www.scottishairquality.scot/latest/site-info?site_id=STRL&view=graphing

Maps showing the location of the monitoring site is provided in Figures A.1 and A.2. 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

Stirling Council undertook non- automatic (passive) monitoring of NO_2 at 12 sites during 2019. Figure A.2 - Detailed location of Automatic Monitor

Table A.2 in Appendix A shows the details of the sites.

A map showing the location of the monitoring sites are provided in Figure A.3. Further details on Quality Assurance/Quality Control (QA/QC) and bias adjustment for the diffusion tubes are included in Appendix C.

3.2 Individual Pollutants

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

3.2.1 Nitrogen Dioxide (NO_2)

Table B.1 in Appendix B compares the ratified and adjusted monitored NO_2 annual mean concentrations for the past 5 years with the air quality objective of 40µg/m^3.

Table B.2 compares the ratified continuous monitored NO_2 hourly mean concentrations for the past 5 years with the air quality objective of 200µg/m^3, not to be exceeded more than 18 times per year.

For diffusion tubes, the full 2019 dataset of monthly mean values is provided in Table B.6.

Figure B.1 shows the trends in annual mean NO_2 concentrations between 2015 and 2019.

The limited data recovery for the automatic monitor in 2015 makes interpretation and prediction less reliable. Since then, there has been no major issue with data recovery. The available results indicate that the above objectives have not been exceeded and are unlikely to be exceeded in the future.

On this basis an AQMQ was not considered necessary.

3.2.2 Particulate Matter (PM_{10})

Table B.3 in Appendix B compares the ratified and adjusted monitored PM_{10} annual mean concentrations for the past 5 years with the air quality objective of 18µg/m^3.

Table B.4 compares the ratified continuous monitored PM_{10} daily mean concentrations for the past 5 years with the air quality objective of 50µg/m^3, not to be exceeded more than 7 times per year.

Figure B.2 shows the trend in annual mean concentration of PM_{10} between 2015 and 2019 at Craig's Roundabout.

3.2.3 Particulate Matter ($PM_{2.5}$)

Table B.5 in Appendix B compares the ratified and adjusted monitored $PM_{2.5}$ annual mean concentrations for the past 5 years with the air quality objective of 10µg/m^3. 2019 was the first year that $PM_{2.5}$ was monitored and so there is only one figure in the table.

3.2.4 Sulphur Dioxide (SO_2)

Stirling Council does not monitor for SO_2.

3.2.5 Carbon Monoxide, Lead and 1,3-Butadiene

Stirling Council does not monitor for Carbon Monoxide, Lead or 1,3-Butadiene.

4. New Local Developments

This section discusses the new developments that could potentially have a significant impact on air quality in the Stirling area.

4.1 Road Traffic Sources

A planning application was submitted and subsequently approved during 2019 for a new link road, including a pedestrian and cycle route, through the city centre of Stirling. The air quality assessment was reviewed as part of the planning consultation process.

Results from the detailed atmospheric dispersion modelling used in the assessment predict that the annual mean concentrations of NO_2, PM_{10} and $PM_{2.5}$ to be below the respective air quality objectives at all modelled sensitive receptors. Similarly, no exceedances of the short term NO_2 and PM_{10} objectives were predicted at any of the identified sensitive locations.

It has been stipulated that prior to the commencement of construction, the applicant is to submit a construction environmental management plan (CEMP) in order to detail appropriate measures and mitigation to control fugitive dust emissions, site plant emissions and construction traffic emissions. We will monitor this site as development takes place.

Apart from the above, there are no new road traffic sources, as listed below, that would have a significant impact on air quality.

- Narrow congested streets with residential properties close to the kerb.
- Busy streets where people may spend one hour or more close to traffic.
- Roads with a high flow of buses and/or HGVs.
- Junctions.
- Bus or coach stations.

4.2 Other Transport Sources

There are no new road traffic sources, as listed below, that would have a significant impact on air quality.

- Airports.
- Locations where diesel or stream trains are regularly stationary for periods of 15 minutes or more, with potential for relevant exposure within 15m.
- Locations with a large number of movement of diesel locomotives, and potential long-term relevant exposure within 30m.
- Ports for shipping.

The Stirling Council Public Transport Co-ordinator confirmed that the total number of movements at Stirling Bus Station in the Thistle Centre was approximately 12,226 every 4 weeks, or less than 475/day. The criterion for assessment where there is relevant exposure within 10m is 2,500 movements a day. It is therefore concluded that a DMRB assessment is not required.

It should be noted that for a period of time during 2018, one of the main arterial roads (Kerse Road) within Stirling City Centre was closed in both directions due to the rail electrification works as part of the Edinburgh Glasgow Improvement Programme. The road was closed from April 16th 2018 to 19th October 2018 to enable carriageway completion and removal of temporary structures. The automatic monitor and four of the NO_2 tubes are situated within 75m of this site, however there were no substantial variations of results during this period.

4.3 Industrial Sources

It is confirmed that there are none of the following that would warrant further assessment:

- Industrial installations: new or proposed installations for which an air quality assessment has been carried out.
- Industrial installations: existing installations where emissions have increased substantially or new relevant exposure has been introduced.
- Industrial installations: new or significantly changed installations with no previous air quality assessment.

- Major fuel storage depots storing petrol.
- Poultry farms.

An application has been received for a new roadside service station near Dunblane comprising a petrol filling station, truck stop, restaurants and drive-thru. Comments have been provided and are currently awaiting response. The effect this development would have on air quality is unknown at present, but an air quality impact assessment should be undertaken. This would help to identify existing air quality in the surrounding area and to quantify the impact of the proposed development on local air quality using methodology outlined in the guidance from Environmental Protection UK and Institute of Air Quality Management for the consideration of air quality within the land-use planning and development control processes (January 2017).

At the end of 2019, an AQIA was submitted as part of an application for a proposed tomato growing facility comprising greenhouses, a river source heat pump and associated infrastructure, including an energy centre, within the Bandeath Industrial Estate, Throsk on the outskirts of Stirling city centre.

Detailed dispersion modelling was undertaken to predict the concentrations of total NO_x, NO_2, PM_{10} and SO_2 at sensitive receptor locations within the study area and it was undertaken in accordance with IAQM, EPUK and DEFRA technical guidance. From the assessment it is considered that the potential impact of the proposed development on local air quality is low risk and therefore not significant. This consultation is still out for comment and will be monitored in due course should development occur.

4.4 Commercial and Domestic Sources

The locations of previously assessed, new and proposed biomass installations are summarised in Table 4.4.1. There are no clusters of installations in 500 x 500 metre squares that could result in cumulative impacts of emissions of PM_{10}. With the exception of the Acharn Development, which has been approved and is operational, all are small scale plants with minimal potential for significant release of PM_{10} or NO_x. The applications were screened using the DEFRA review and assessment tools and further assessment was not considered necessary.

Table 4.4.1 – Locations of Installed, Permitted and Proposed Biomass Combustion Plant within Stirling Council

Name Location	Planning Reference	Status	OS Easting	OS Northing
West Rossburn Lane Farm, Stirling, FK9 4AH	20/00142/FUL (retrospective)	Permitted 18 May 2020 Status: Operational		
Stockbridge Nursery Kilbryde and Brack Road, Doune, FK15 9ND	18/00712/FUL	Permitted 27 November 2018 Status: Unknown		
Land adjacent to North and West of 27 Whitehouse Rd, Forthside Way	16/00775/FUL	Permitted 27/02/2017 Status: Unknown	280695	693347
Carsten Mews, Drumbeg Rd, Killearn	16/00749/FUL	Permitted 15/02/2017 Status: Unknown	250499	684139
48 Glasgow Road, Blanefield	15/00644/FUL	Permitted 30/11/2015 Status: Unknown	255744	679621
Muirmill Farm, Fintry	15/00436/FUL	Permitted 02/12/2015 Status: Unknown	272876	683932
Lochend Chalets, Port of Menteith	2014/00265/DET	Operational January 2015	259156	699702
Wallace View, Stirling	15/00251/FUL	Permitted 18/06/15 Status unknown	281462	696157
Blairdrummond House, Stirling	15/00239/FUL	Permitted 15/06/2015 Operational 9/16	273189	699059
Stewarts House, 14 Main St, Fintry	15/00151/FUL	Permitted 09/06/2015 Status: Unknown	261623	686730
1 Riverside Cottages, Deanston	15/00139/FUL	Permitted 09/07/2015 Status: Unknown	271475	701710
Finnich Malise, Blanefield	15/00044/FUL	Permitted Notice: 07/04/2015 Status: Unknown	247928	685329
14 Back ’o Hill Industrial Estate	14/00768/FUL	Operational	278999	694526
Coldoch, Thornhill	14/00761/FUL	Operational 2015	269836	698062
The Stables, Burnside Farm, Bannockburn	14/00331/FUL	Permitted 22/07/2014 Status: unkown	280619	689961
Buchannan Arms Hotel Drymen	2014/0051/DET	Not Installed	247500	688393
An T Seann Sgoil, Balquidder	2014/0150/DET	Operational early 2015	253660	720902

Upper Drumbane Farm	13/00785/FUL	Permitted 30/05/2014 Status: Unknown		
Cambusmore House, Doune	13/00774/FUL	Permitted 07/02/2014 Status: unknown	265088	706218
Land 50m North Ballagan House, Strathblane	13/00690/FUL	Permitted 16/12/2013 Status; unknown		
Aucheneck Lodge, Stockiemuir Rd, by Killearn	13/00562/FUL	Permitted 08/11/2013 Status: unknown		
Gem House West Plean Industrial Estate	13/00348/FUL	Permitted 36/08/2013 Status: unknown		
Sauchie Estate, Sauchieburn,	12/00472/FUL	Permitted 21/09/2012 Status: unknown	277933	688963
Acharn Biomass Energy Plant 5.4MW	2011/0011/DET	Permitted Status: Operational	255500	731000
Fintry Sports Club, Fintry	11/00175/FUL	Permitted 16/02/2011 Status: unknown		

4.5 New Developments with Fugitive or Uncontrolled Sources

There are no new road traffic sources, as listed below, that would have a significant impact on air quality:

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

A planning application was received to extend Cambusmore quarry in Callander. An Environmental Impact Assessment was requested. The impact on air quality is to be assessed in terms of PAN 50 and the Institute of Air Quality Management Guidance on the Assessment of Mineral Dust Impacts for Planning May 2016 (v1.1).

5. Planning Applications

Stirling Councils Local Development Plan (LDP) identifies a number of sites for large scale development between 2014 and 2034. Each development site shall be assessed for its impact on air quality as it goes through the planning consultation process. Where appropriate detailed air quality impact assessments shall be required to be submitted.

A full application for a development site called Durieshill has been received. This is an application for a 3,000 house residential development, village centre, employment land, community campus and primary school located on land between Plean and the Bannockburn Interchange. The air quality assessment has been reviewed. Modelling used in the assessment indicated that there are mainly negligible impacts on NO_2, PM_{10} and $PM_{2.5}$ from the development at the 29 receptors selected, with the exception of NO_2 which has a minor impact at 4 of the 29 receptors. This application is awaiting a decision, but we will monitor this site as development takes place.

A development site called South Stirling Gateway was included in the Local Development Plan. The development proposals include affordable housing, superstore, school and a linear park. Stirling Council's Strategic Infrastructure Plan identifies a range of infrastructure projects required to support the LDP Spatial Strategy as a whole, of which development at South Stirling Gateway forms a strategic part.

It was previously noted in the 2018 Annual Progress Report that a planning application for a new crematorium in Bannockburn had been received and approved. This has now been built and is operational. SEPA have regulatory control over the facility, but it seems that the air quality objectives are not going to be breached as a result of the operation of the crematorium.

6. Conclusions and Proposed Actions

6.1 Conclusions from New Monitoring Data

Based on the data in Tables B.1 to B.5 and the graph in Figure B.1 of Appendix B, it can be seen that in 2019 there was an overall falling trend in those areas monitored for NO_2 after a slight rise in 2018. There was one site which actually bucked the trend and increased slightly during 2019 (Craig's Roundabout). With regards to PM_{10}, there was a falling trend up until 2016 but levels did increase in 2017, decreasing in 2018 and further still in 2019. This site is well below the national objectives for the parameter measured. As we have only started measuring $PM_{2.5}$, looking at the results received so far, we can anticipate that the national objective will not be exceeded anytime in the future. Based on the available monitoring data, the following conclusions can be made:

- Looking at all the air quality data throughout 2019, there are no exceedances of the relevant Air Quality Objectives and it is considered unlikely that they will be exceeded in the near future.
- On this basis it is not considered necessary to declare an AQMA within the Stirling area.

6.2 Conclusions relating to New Local Developments

In relation to new local developments, it is determined that the key issue regarding air quality is the potential for increased road traffic. It is recognised that future and pending applications (e.g. Durieshill, South Stirling Gateway, Viewforth Link Road) may increase traffic numbers and as a result negatively impact on the air quality within the Stirling Council area.

Biomass installations are also still considered a potential source of increased emissions affecting air quality. As such, biomass applications are screened using the Defra review-and-assessment tools and are not expected to have a significant impact on local air quality.

It has been highlighted that there is an increased demand for domestic households to install alternative heat and power sources into their homes. The installation of wood burning stoves may require planning permission depending if a chimney/flue has to be installed and

would protrude more than one metre. As such, the Residential Alterations and Extensions Supplementary Guidance SG12 is referred to.

6.3 Proposed Actions

Stirling Council will continue with the following actions:

- Monitor for NO_2, $PM_{2.5}$ and PM_{10} at the locations detailed in this report. Data recovery from the automatic monitor appears to be reasonably stable for 2019, to date. Results of the monitoring and other air quality assessment work will be presented in the next Annual Progress Report in 2021.
- Require air quality assessments where a development may result in significant increases in traffic as outlined in Defra Local Air Quality Guidance Management, Technical Guidance (TG16).
- Screening of biomass applications to assess the potential impact on local air quality.
- Provide information and support to Stirling Council Sustainable Development Team on future developments in the Stirling area.

To deliver the Local Transport Strategy objectives, the Sustainable Development Team developed a City Transport Plan 2013/17 – 2015/16 and a Towns, Villages and Rural Area Transport Plan 2014. This includes an Active Travel Policy (The Walking and Cycling to a Healthier Stirling: Active Travel Action Plan 2017) to encourage walking and cycling by infrastructure improvements and behaviour change (training and promotion activities). Stirling Council will also be actively participating in and promoting, the Cycle to Work Scheme and NextBikes cycle hire scheme, encouraging staff to use sustainable methods of transport for both commuting and work purposes. Statistics gathered from NextBikes show that in 2018 the total rentals reached 34,485, a significant increase from the 2017 rental total which was 17,989. The figures for 2019 are unavailable, but it would be anticipated that the number of rentals would have increased again.

The Sustainable Development Team have also been awarded £2.3 million to install more electric vehicle charging points and buy more electric fleet vehicles. This is currently in the procurement stage and so will be mentioned further in next year's annual progress report.

As part of the East Central Scotland Vehicle Emissions Partnership, Stirling will coordinate testing, idling and campaigning activities to promote better air quality in the Stirling area.

Reviews and assessment will include monitoring of: the rate of development (which will be informed by the LDP Monitoring Reports); the rate of traffic growth; the rate of modal shift from car to walking, cycling and public transport, and a measure of congestion.

Stirling Council will continuously review the location of the NO_2 tubes. The current tubes have been in the same locations for a long period of time and so it would be ideal if some of them are relocated. Relocation may help to identify new areas that may potentially exceed the objectives. New locations for the tubes have been discussed.

The new Zephyr units will be utilised further to establish areas of concern. They will also be used to give us a snapshot of what air quality is like in different parts of the City, which will be particularly helpful surrounding larger developments and projects taking place within Stirling. The equipment undergoes filter replacement every year (and a few other consumable parts), and they are tested against controls before being sold and distributed.

Appendix A: Monitoring Sites

Table A.1 – Details of Automatic Monitoring Site

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)
Craig's Roundabout	Roadside	279944	693005	$PM_{2.5}$, PM_{10}	N	Palas Fidas	10m	3m	2.2
Craig's Roundabout	Roadside	279944	693005	NO_x	N	Serinus	10m	3m	2.2

(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.

Figure A.1 - General Location of Automatic Monitoring Site

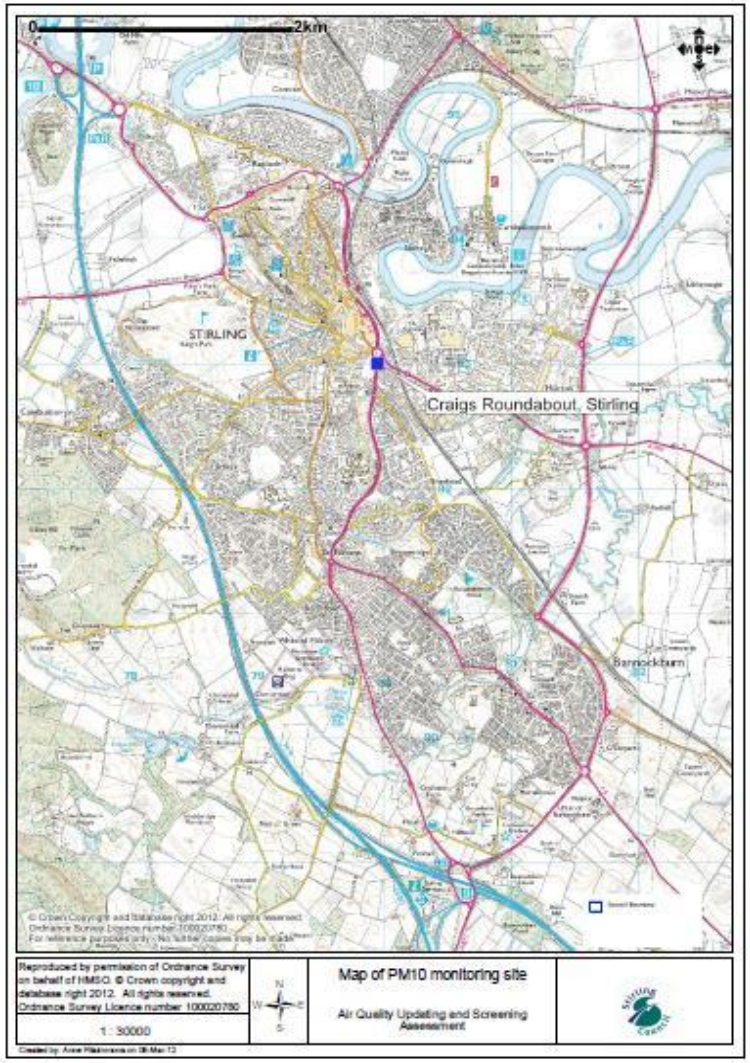


Figure A.2 - Detailed location of Automatic Monitor

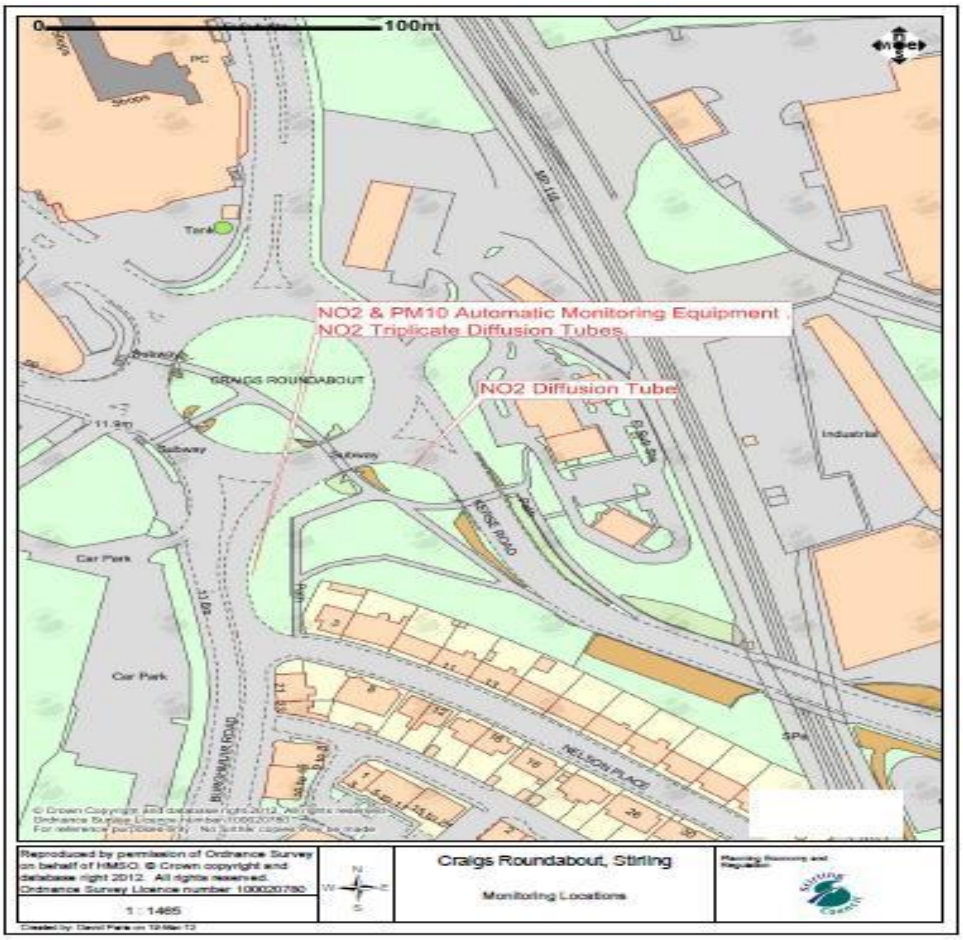


Table A.2 – Details of Non-Automatic Monitoring Sites

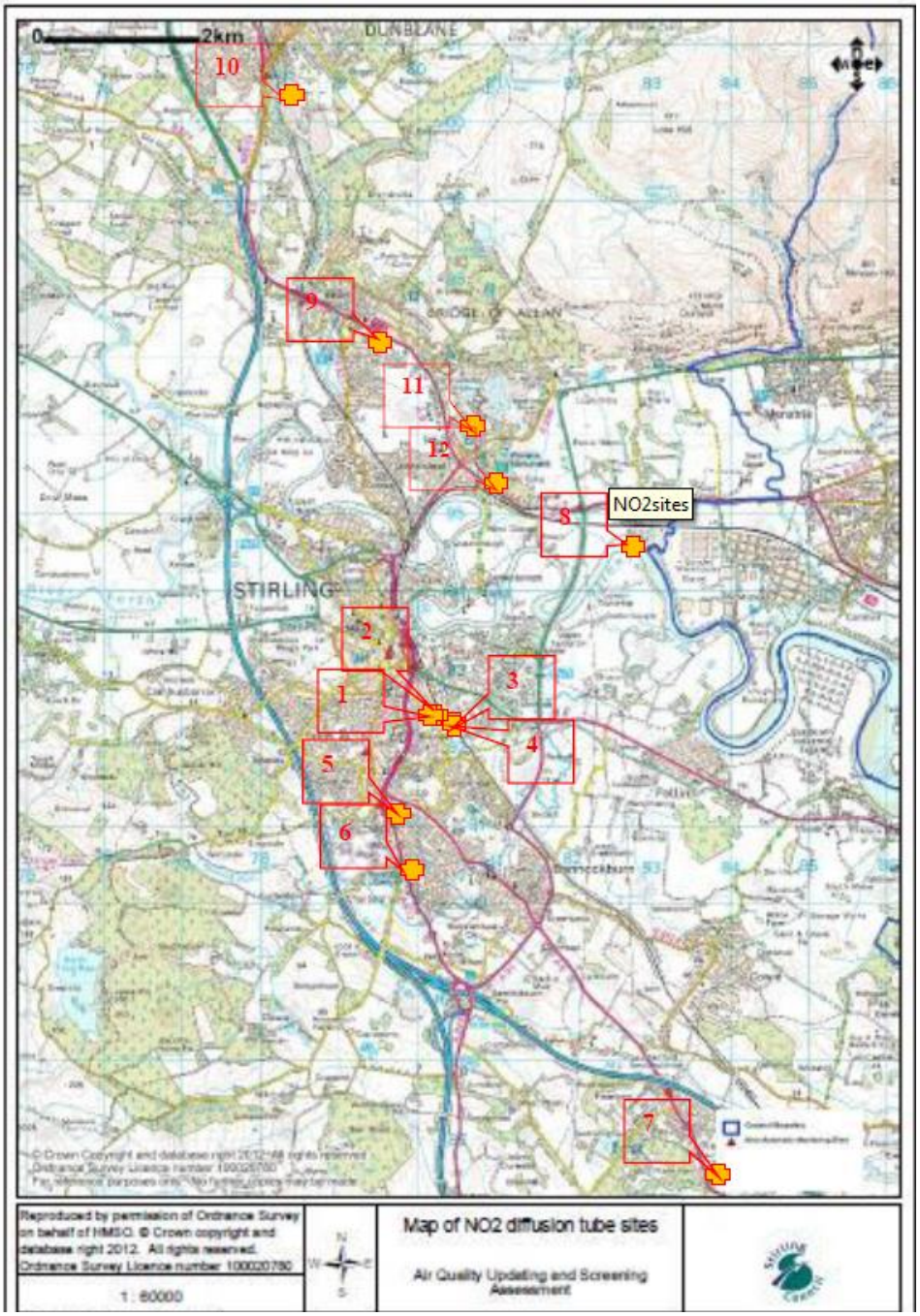
Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) [1]	Distance to kerb of nearest road (m) [2]	Tube co-located with a Continuous Analyser?
1	Dumbarton Road, Stirling	Kerbside	279655	693240	NO_2	N	2	0.5	N
2	Port Street, Stirling	Kerbside	279634	693160	NO_2	N	2	0.5	N
3	Craig's Roundabout no. 1	Roadside	279987	693043	NO_2	N	10	2	N
4 A,B,C	Craig's Roundabout no. 2 (automatic analyser)	Roadside	279944	693005	NO_2	N	10	3	Y
5	Lennox Avenue, Stirling	Urban background	279354	691933	NO_2	N	4	1.5	N
6	Barnsdale Road, Stirling	Roadside	279520	691252	NO_2	N	18	1.5	N
7	Main Street, Plean	Roadside	283222	687582	NO_2	N	6	1.5	N
8	Alloa Road	Roadside	282075	695057	NO_2	N	9	2	N

	Roundabout								
9	Henderson Street, Bridge of Allan	Roadside	279177	697497	NO_2	N	7	1.5	N
10	Stirling Road, Dunblane	Roadside	278081	700580	NO_2	N	8	1.5	N
11	Stirling University	Roadside	280346	696339	NO_2	N	>50	2	N
12	Airthrey Road	Roadside	280505	695719	NO_2	N	3	2	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.

Figure A.3 - Location of Diffusion Tube Sites



Appendix B: Monitoring Results

Table B.1 – Annual Mean NO_2 Monitoring Results

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) [1]	Valid Data Capture 2019 (%) [2]	NO_2 Annual Mean Concentration (µg/m^3) [3]				
					2015	2016	2017	2018	2019
Craigs Rbt	Roadside	Automatic	89.21	89.21	See C.1.2	23	22	23	20
1	Kerbside	Diffusion Tube	100	100	30.5	28.7	24.0	24.1	20.4
2	Kerbside	Diffusion Tube	100	100	28.8	23.2	24.1	21.7	19.7
3	Roadside	Diffusion Tube	100	100	31.5	27.2	25.1	20.5	22.0
4A	Roadside	Diffusion Tube	100	100	27.6	21.0	23.4	21.3	19.7
4B	Roadside	Diffusion Tube	100	100	27.4	21.2	20.5	21.2	20.3
4C	Roadside	Diffusion Tube	91.7	91.7	27.9	21.7	21.1	18.9	18.9
5	Roadside	Diffusion Tube	100	100	14.7	11.3	10.2	11.5	10.3
6	Roadside	Diffusion Tube	100	100	19.1	15.2	15.7	16.5	14.0
7	Roadside	Diffusion Tube	100	100	20.9	17.5	16.0	16.4	13.8
8	Roadside	Diffusion Tube	100	100	31.5	25.4	23.5	26.8	22.3
9	Roadside	Diffusion Tube	75	75	29.5	20.8	21.2	22.7	17.6
10	Roadside	Diffusion Tube	100	100	19.6	16.0	16.1	15.4	11.6
11	Roadside	Diffusion Tube	100	100	26.7	21.9	19.4	19.0	16.3
12	Roadside	Diffusion Tube	100	100	28.4	22.9	21.9	22.4	16.7

Notes: Exceedances of the NO_2 annual mean objective of 40µg/m^3 are shown in **bold**.

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

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

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

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

Table B.2 – 1-Hour Mean NO_2 Monitoring Results

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2019 (%) (2)	NO_2 1-Hour Means > 200µg/m^3 (3)				
					2015	2016	2017	2018	2019
Craig's Rbt	Roadside	Automatic	90	90	0	0	0	0	0

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

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

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

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

Table B.3 – Annual Mean PM_{10} Monitoring Results

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2019 (%) (2)	PM_{10} Annual Mean Concentration (µg/m³) (3)				
				2015	2016	2017	2018	2019
Craigs Rbt	Roadside	99	99	15	13	13	14	11

Notes: Exceedances of the PM_{10} 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 B.4 – 24-Hour Mean PM_{10} Monitoring Results

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2019 (%) (2)	PM_{10} 24-Hour Means > 50µg/m^3 (3)				
				2015	2016	2017	2018	2019
Craigs Rbt	Roadside	99	99	0	0	0	0	0

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

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

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

(3) If the period of valid data is less than 85%, the 98.1st percentile of 24-hour means is provided in brackets.

Table B.5 – Annual Mean $PM_{2.5}$ Monitoring Results

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2019 (%) (2)	$PM_{2.5}$ Annual Mean Concentration ($\mu g/m^3$) (3)				
				2015	2016	2017	2018	2019
Craigs Rbt	Roadside	76	76	N/A	N/A	N/A	N/A	5.6

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

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

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

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

Table B.6 – NO_2 Monthly Diffusion Tube Results for 2019

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)
Dumbarton Road, Stirling	34.0	27.0	22.1	19.9	14.2	18.6	20.2	20.9	24.3	29.8	31	25.7	24.0	20.4
Port Street, Stirling	37.0	29.6	22.4	16.8	18.0	14.7	17.7	23.0	21.1	26.3	27.6	23.6	23.2	19.7
Craigs Rbt, Stirling	31.1	30.6	16.8	29.5	27.3	22.0	15.6	19.8	23.0	31.0	34.5	29.2	25.9	22.0
Craigs Rbt, Stirling	33.0	27.4	missing	missing	17.2	15.4	14.3	18.8	21.7	28.6	27.9	27.1	23.1	19.7
Craigs Rbt, Stirling	29.2	48.1	missing	missing	14.1	15.2	14.7	18.1	19.3	27.7	24.6	27.6	23.9	20.3
Craigs Rbt, Stirling	33.8	31.2	missing	missing	16.9	14.3	22.1	19.1	19.5	26.0	22.3	17.6	22.3	18.9
Lennox Ave, Stirling	22.2	14.2	7.6	10.0	8.7	7.8	8.7	7.5	12.2	16.0	17.7	12.4	12.1	10.3
Barnsdale Rd, Stirling	24.1	22.4	13.7	16.3	10.9	missing	12.3	12.2	15.1	17.4	21.5	15.5	16.5	14.0
Main St, Plean	25.1	19.0	12.6	16.5	14.3	11.5	8.7	12.4	15.7	19.8	23.3	15.5	16.2	13.8
Alloa Rd Rbt, Stirling	29.4	31.3	23.2	32.0	23.5	21.4	contaminated	20.6	24.8	28.7	28	25.5	26.2	22.3

Henderson St, BOA	18.0	28.3	17.0	20.7	17.6	17.9	17.4	missing	17.1	21.9	24.1	27.3	20.7	17.6
Stirling Rd, Dunblane	1.2	18.7	13.8	11.4	11.5	11.9	8.7	11.2	14.9	21.4	20.3	18.2	13.6	11.6
Stirling University	24.6	21.8	23.0	17.1	19.4	14.1	14.8	15.0	20.1	21.4	22.6	16.5	19.2	16.3
Airthrey Road	27.3	20.6	19.7	15.9	17.6	13.9	16.5	16.6	21.4	23.4	25.1	18.3	19.7	16.7

(1) See Appendix C for details on bias adjustment

Figure B.1 Trends in Annual Mean Concentration of NO_2 at Diffusion Tube Sites 2015-2019

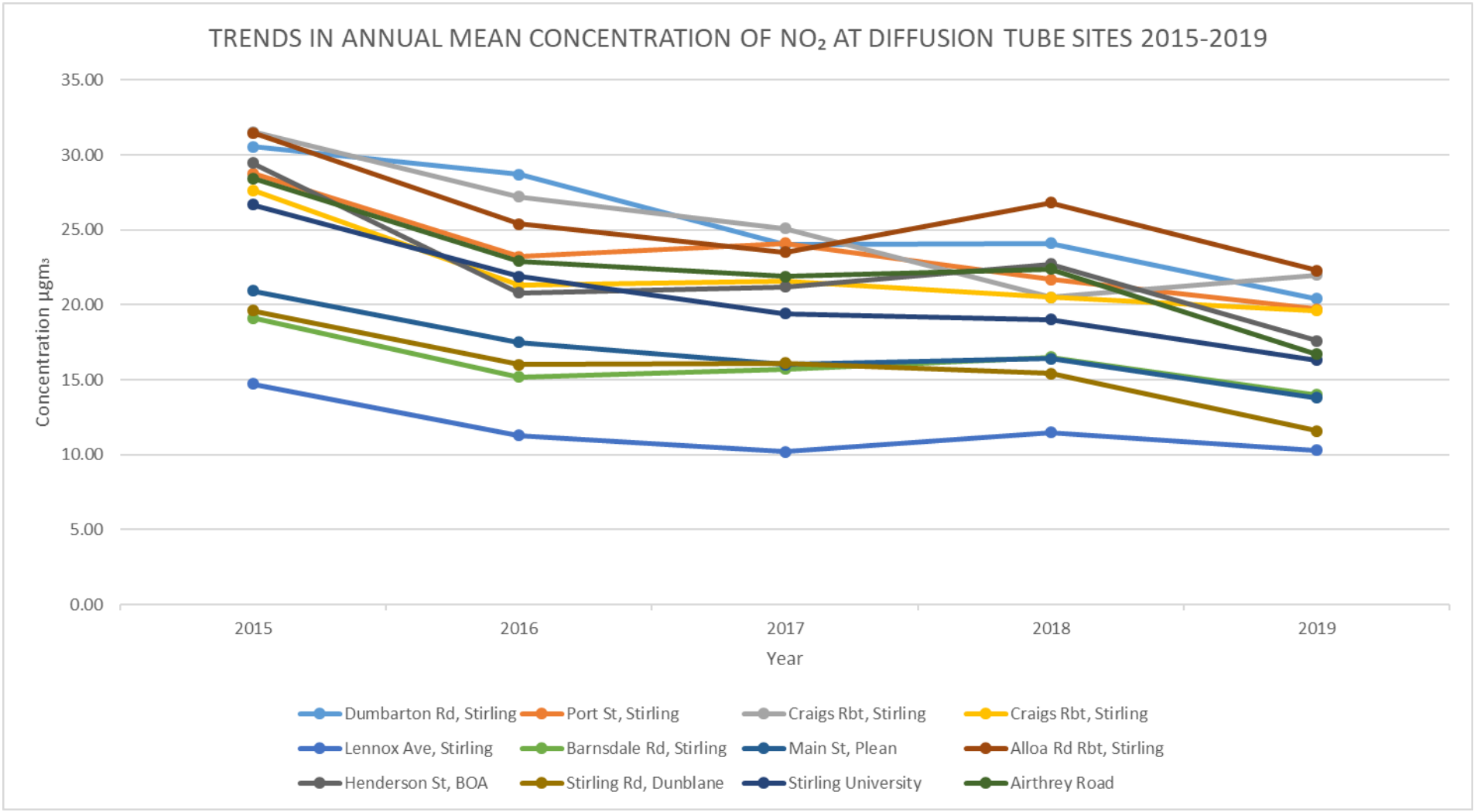
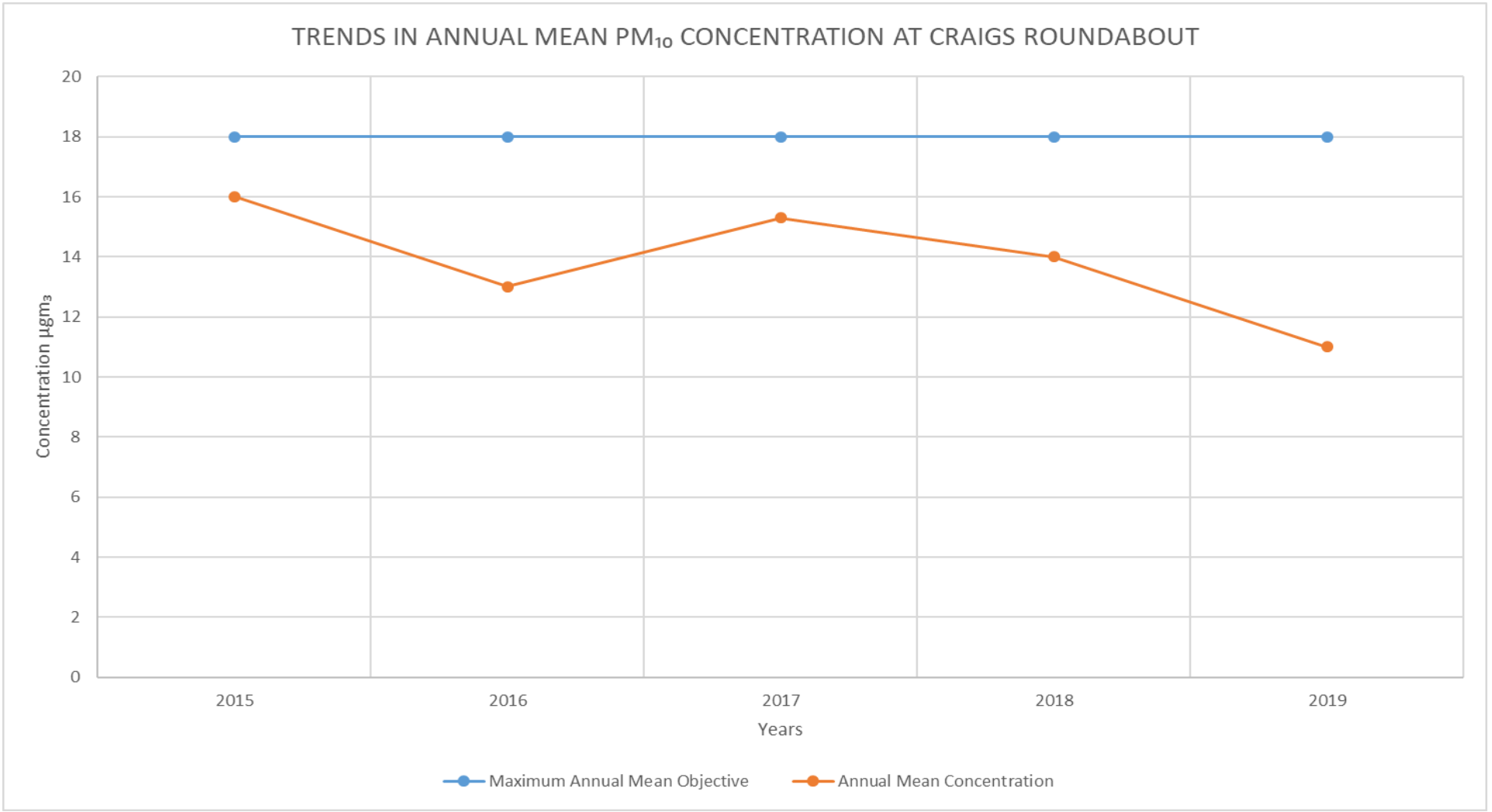


Figure B.2 Trends in Annual Mean PM_{10} Concentration at Craigs Roundabout 2015-2019



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

C.1 Automatic Site

Stirling Council operates an automatic monitoring station at Craig's Roundabout. The station houses a Serinus NO_x automatic analyser and a Palas Fidas analyser for $PM_{2.5}$ and PM_{10}. Data recorded by the station is analysed by Ricardo Energy and Environment.

C.1.1 Quality Assurance /Quality Control of automatic monitoring site

The automatic monitoring equipment is audited every 6 months by Ricardo Energy and Environment and a routine service and breakdown call out service is contracted to Air Monitors. Local Site Operator (LSO) calibrations were also performed.

C.1.2 Data Capture Issues

In August 2015, we were informed, retrospectively, that the NO_2 data indicated a possible problem with 'internal sampling' at the automatic monitor and the data was rejected up to 8 August 2015.

From the 4th to 28th September 2017 the analyser broke down and no data was collected during this period. The data capture rate for this month was only 22%. In May 2017 there was also a loss of data with the capture rate at 69%.

In May 2018 there was a failure in a part of the NOx analyser – this was not resolved until mid-June 2018 with a consequent loss of data. This equipment was end of life and was replaced at the end of March 2019.

During May and June 2019 there were data capture issues associated with NO_2. The data capture rate was reduced to 61% and 60% respectively.

C.2 Non-Automatic Monitoring Sites

Non-automatic monitoring is carried out for NO_2 only. There are twelve monitoring sites, seven of which are located within Stirling City Centre. Of these, a set of three tubes are co-located with the automatic analyser at Craig's Roundabout to enable a local bias-adjustment factor to be calculated.

The tubes are provided and analysed by Edinburgh Scientific Services using 50% TEA in Acetone and are changed on a monthly basis by Stirling Council personnel. A map of the diffusion tube locations is shown in Figure A.3 of Appendix A.

C.2.1 Data Capture Issues

No NO_2 data was captured across all 12 of the non-automatic monitoring sites in January and February of 2016. After submission of the NO_2 tubes, it was found that no monitoring data had been captured. Following correspondence with Edinburgh Scientific Services, it was identified that the wrong monitoring tubes had been provided to Stirling Council. This matter was rectified as soon as possible, allowing data to be captured from March onwards.

From July to September 2018 monitoring tubes were missing from Henderson Street, Bridge of Allan. The suspected reason was due to hanging baskets having been placed in close proximity to the tubes and possibly knocking them off. There were no further issues with this site location.

In November 2018 three sites recorded extremely high concentrations (> 70µg/m³). This is unexplained, but the data was written off as erroneous and omitted from the annual mean.

During March and April 2019, the three co-located tubes at the automatic monitor were reported missing due to an unknown reason and so no data was collected at this site for those two months. This doesn't appeared to have had a significant impact on the data collected overall.

C.2.2 Bias Correction Factor

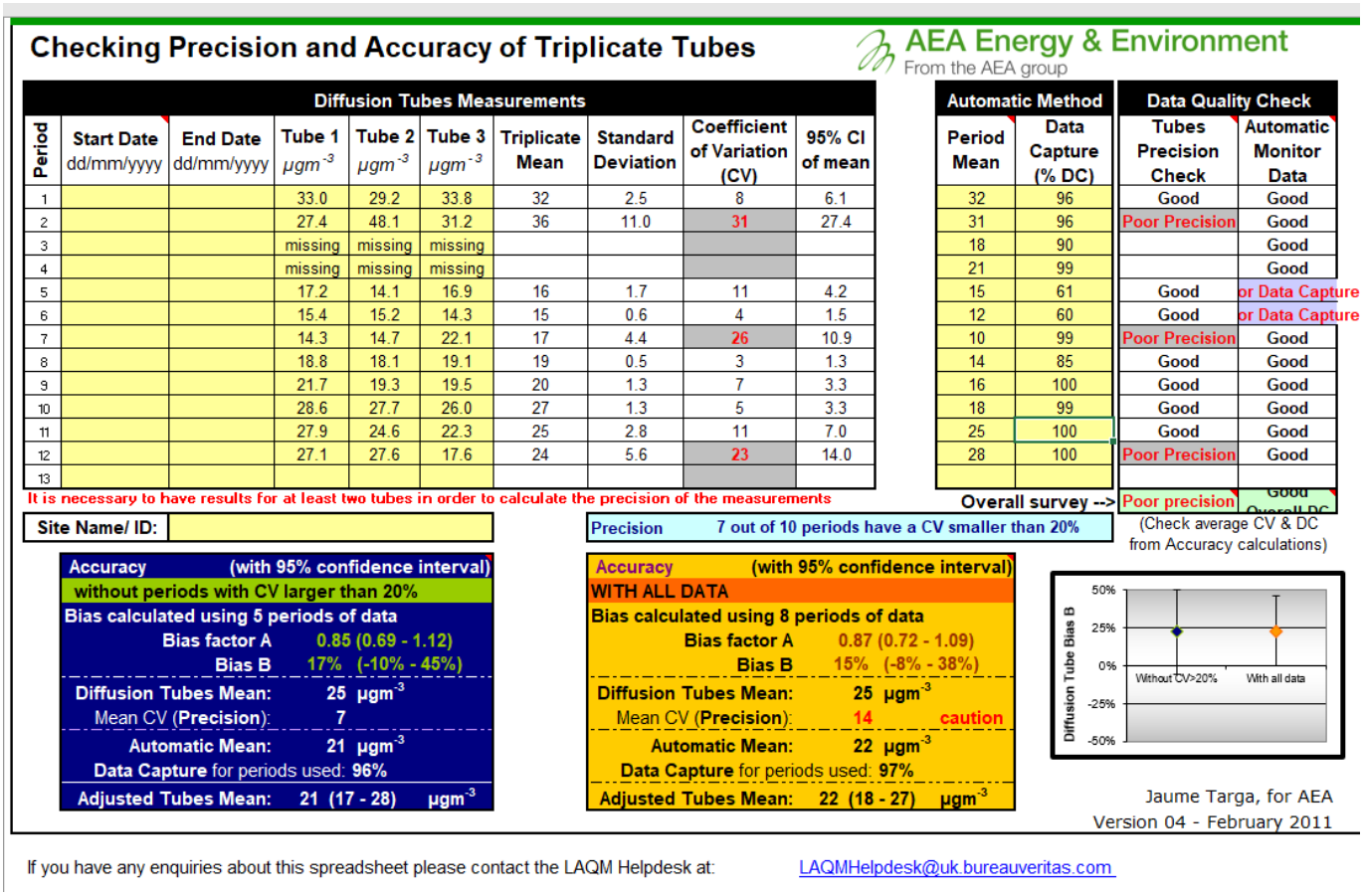
C.2.2.1 – 2019

A bias adjustment factor was applied to the annual mean NO_2 concentrations for 2019. The factor of 0.85 was obtained from the National Diffusion Tube Bias Adjustment Factor Spreadsheet version 03/19 which can be viewed at:

https://laqm.defra.gov.uk/bias-adjustment-factors/national-bias.html

The output from the Local Bias Adjustment Spreadsheet is shown in Table C.2.1 below.

Table C.2.2.1 Local Bias Adjustment Output



Checking Precision and Accuracy of Triplicate Tubes

AEA Energy & Environment
From the AEA group

Diffusion Tubes Measurements

Period	Start Date dd/mm/yyyy	End Date dd/mm/yyyy	Tube 1 µgm-3	Tube 2 µgm-3	Tube 3 µgm-3	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean
1			33.0	29.2	33.8	32	2.5	8	6.1
2			27.4	48.1	31.2	36	11.0	31	27.4
3			missing	missing	missing				
4			missing	missing	missing				
5			17.2	14.1	16.9	16	1.7	11	4.2
6			15.4	15.2	14.3	15	0.6	4	1.5
7			14.3	14.7	22.1	17	4.4	26	10.9
8			18.8	18.1	19.1	19	0.5	3	1.3
9			21.7	19.3	19.5	20	1.3	7	3.3
10			28.6	27.7	26.0	27	1.3	5	3.3
11			27.9	24.6	22.3	25	2.8	11	7.0
12			27.1	27.6	17.6	24	5.6	23	14.0
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
32	96	Good	Good
31	96	Poor Precision	Good
18	90		Good
21	99		Good
15	61	Good	or Data Capture
12	60	Good	or Data Capture
10	99	Poor Precision	Good
14	85	Good	Good
16	100	Good	Good
18	99	Good	Good
25	100	Good	Good
28	100	Poor Precision	Good
Overall survey -->		Poor precision	Good

(Check average CV & DC from Accuracy calculations)

Site Name/ ID:

Precision 7 out of 10 periods have a CV smaller than 20%

Accuracy (with 95% confidence interval)
without periods with CV larger than 20%
Bias calculated using 5 periods of data
Bias factor A 0.85 (0.69 - 1.12)
Bias B 17% (-10% - 45%)
Diffusion Tubes Mean: 25 µgm-3
Mean CV (Precision): 7
Automatic Mean: 21 µgm-3
Data Capture for periods used: 96%
Adjusted Tubes Mean: 21 (17 - 28) µgm-3

Accuracy (with 95% confidence interval)
WITH ALL DATA
Bias calculated using 8 periods of data
Bias factor A 0.87 (0.72 - 1.09)
Bias B 15% (-8% - 38%)
Diffusion Tubes Mean: 25 µgm-3
Mean CV (Precision): 14 caution
Automatic Mean: 22 µgm-3
Data Capture for periods used: 97%
Adjusted Tubes Mean: 22 (18 - 27) µgm-3

Jaume Targa, for AEA
Version 04 - February 2011

If you have any enquiries about this spreadsheet please contact the LAQM Helpdesk at: LAQMHelpdesk@uk.bureauveritas.com

C.2.2.2 – 2018

A bias adjustment factor was applied to the annual mean NO_2 concentrations for 2018. The factor of 0.91 was obtained from the National Diffusion Tube Bias Adjustment Factor Spreadsheet version 03/18 which can be viewed at:

https://laqm.defra.gov.uk/bias-adjustment-factors/national-bias.html

C.2.2.3 - 2017

A bias adjustment factor was applied to the annual mean NO_2 concentrations for 2017. The factor of 0.91 was obtained from the National Diffusion Tube Bias Adjustment Factor Spreadsheet version 06/17 which can be downloaded at:

https://laqm.defra.gov.uk/bias-adjustment-factors/national-bias.html

C.2.2.4 - 2016

A bias adjustment factor was applied to the annual mean NO_2 concentrations for 2016. The factor of 0.87 was obtained from the National Diffusion Tube Bias Adjustment Factor Spreadsheet version 06/17 which can be downloaded at:

https://laqm.defra.gov.uk/bias-adjustment-factors/national-bias.html

C.2.2.5 - 2015

Based on the results for 2015 the locally derived bias adjustment factor was calculated using the above tool as 1.04 and the national figure was reported as 0.76.

The data capture for the automatic monitor during 2015 was also limited (34.4%), however, the figure of 1.04 was used as it is more consistent with previous figures and also conservative.

C.3 –Annualising of Means Monitoring Data

Where the valid data capture for the full calendar year is less than 75%, the means have been “annualised” as per Box 7.9 and 7.10 of the LAQM TG (16).

Figure C.3.1 – Annualising Continuous Monitoring Data

Box 7.9 – Example: Annualising Continuous Monitoring Data

It has only been possible to carry out a monitoring survey at site for six months between July and December 2015. The measured mean concentration **M** for this period is 30.2µg/m3. How can this be used to estimate the annual mean for this location?

 Identify two to four nearby, long-term, continuous monitoring sites, ideally those forming part of the national network. The data capture for each of these sites should ideally be at least 85%. These sites should be background (Urban Background, Suburban or Rural) sites to avoid any very local effects that may occur at Urban Centre, Roadside or Kerbside sites, and should, wherever possible lie within a radius of about 50 miles. If no background sites are available, and the site to be annualised is itself a Urban Centre, Roadside or Kerbside site, then it is permissible to annualise using roadside or kerbside sites rather than background sites, though this should be clearly stated in the annual report.

- Obtain the annual means, **Am**, for the calendar year for these sites.
- Work out the period means, **Pm**, for the period of interest, in this case July to December 2015.
- Calculate the ratio, **R**, of the annual mean to the period mean (**Am/Pm**) for each of the sites.
- Calculate the average of these ratios, **Ra**. This is then the annualisation factor.
- Multiply the measured period mean concentration **M** by this annualisation factor **Ra** to give the estimate of the annual mean for 2015.

For this example the best estimate of the annual mean for site S in 2015 will be **M × Ra = 30.2 × 0.944 = 28.5µg/m3.**

Background Site	Annual mean 2015 (Am)	Period Mean 2015 (Pm)	Ratio (Am/Pm)
A	28.6	29.7	0.963
B	22.0	22.8	0.965
C	26.9	28.9	0.931
D	23.7	25.9	0.915
Average (Ra)			**0.944**

If the short-term period covers, for instance, February to June 2016, and the work is being carried out in August 2016, then an annual mean for 2016 will not be available. The calculation can then be carried out using the ratio to the 2015 annual mean, but the result is then an estimate of the 2015 annual mean at the short-term site. The 2016 bias correction factor would also not be available, and so it would be necessary to use the 2015 factor instead.

Figure C.3.2 – Annualising No_2 Diffusion Tube Monitoring Data

Box 7.10 – Example: Annualising NO2 Diffusion Tube Monitoring Data

A diffusion tube site (D1) has 8 months' worth of data and so it is necessary to annualise. A continuous background site (B1) has greater than 85% data capture for the year. The tubes were set out in accordance with the recommended calendar for 2015. If there are many locations to be annualised then it can be quicker to average the background site data to the same calendar as the diffusion tubes. The results are given in the below table. In addition, the results are given for the background site for those months that D1 data are available (Column B1 when D1 is Available).

Start Date	End Date	B1	D1	B1 when D1 is Available
7 January 2015	4 February 2015	15.6	38.4	15.6
4 February 2015	4 March 2015	38.3		
4 March 2015	1 April 2015	22.7	43.1	22.7
1 April 2015	29 April 2015	22.2		
29 April 2015	27 May 2015	24.9	51.3	24.9
27 May 2015	1 July 2015	20.8		
1 July 2015	29 July 2015	18.1	31.3	18.1
29 July 2015	26 August 2015	16.1	26.8	16.1
26 August 2015	30 September 2015	25.5	41.0	25.5
30 September 2015	28 October 2015	21.1		
28 October 2015	2 December 2015	28.1	29.8	28.1
2 December 2015	6 January 2016	32.0	39.8	32.0
Average		**23.8**	**37.7**	**22.9**

The annual mean (**Am**) of B1 is 23.8µg/m3. The period mean (**Pm)**, of B1 is 22.9µg/m3. The ratio **R** of the annual mean to the period mean (**Am/Pm**) is 1.04. This process should be repeated for all continuous background sites. If no continuous monitoring sites are available, then diffusion tube sites from background locations with 12 months' data may be used. In either case, the more background sites that can be identified the better. Calculate the average of these ratios **Ra**. This is then the annualisation factor.

The measured period mean concentration **M** is 37.7µg/m3. Multiply by this annualisation factor Ra to give the estimate of the annual mean for 2015. Assuming that all other background sites yielded an annualisation factor of 1.04, then Ra in this example is 1.04; and the annualised average of **D1 = M × Ra = 37.7 ×1.04 = 39.2µg/m3.**

If the periods that the tubes were out varied beyond the 4 to 5 week recommendation, then it may be necessary to do a time weighted average rather than simple average in order to calculate M, Am and Pm.

Glossary of Terms

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

References

(1) 2018 Air Quality Annual Progress Report for Stirling Council

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