Fife Air Quality Annual Progress Report 2020

Fife Council

Report for Fife Council
ED10032

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

In fulfilment of Part IV of the
Environment Act 1995

Local Air Quality Management

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Executive summary

Air Quality in Fife

Air quality is generally good in most parts of Fife, but there are a few specific areas within town centres where hotspots of pollution have been identified and action is required. The main pollutants of concern in these hotspot areas are nitrogen dioxide (NO_2) and fine particulate matter (PM_{10} and $PM_{2.5}$) mainly sourced from road vehicle emissions. This Annual Progress Report has been undertaken to fulfil Fife Council's duty to annually review and assess air quality. The report provides the latest monitoring results and discusses the implications for air quality management in the Fife area.

The Annual Progress Report utilises monitoring data collected throughout 2019. Fife Council carry out monitoring of NO_2 at four automatic stations in Cupar, Dunfermline, Kirkcaldy and Rosyth. Non-automatic monitoring of NO_2 was carried out using diffusion tubes at 55 sites (total of 71 tubes). During 2019, two additional monitoring locations commenced monitoring, one was relocated slightly, and two monitoring sites were removed as these were duplicate sites. In addition monitoring also ceased at 11 sites due to continuously low readings over recent years. All NO_2 concentrations measured during 2019 were below the annual mean objective of 40 µg m^{-3}.

PM_{10} and $PM_{2.5}$ is measured at the four automatic sites within Fife at Cupar, Dunfermline, Kirkcaldy and Rosyth. During 2019 all concentrations were below the annual mean objective of 18 µg m^{-3} for PM_{10} and 10 µg m^{-3} for $PM_{2.5}$.

The review of all available data relating to carbon monoxide (CO), sulphur dioxide (SO_2) and benzene monitoring during 2019 indicates that it is unlikely that any air quality objectives relating to these pollutants were exceeded during 2019.

The review of all other local developments has not identified any locations where there may be a risk of the air quality objectives being exceeded and so no additional air quality assessment is recommended at this time.

Fife Council have carried out the National Low Emission Framework (NLEF) screening process for the Bonnygate, Cupar and Appin Crescent, Dunfermline AQMAs. The result of these screening assessments concluded that there will be no need to implement Low Emission Zones (LEZs) within Fife.

There are currently two AQMAs for NO_2 and PM_{10} located within the Fife Council boundary, these are:

- Bonnygate, Cupar, declared in October 2008.
- Appin Crescent, Dunfermline, declared in November 2011 for NO_2 and August 2012 for PM_{10}.

The AQAP for the Bonnygate, Cupar AQMA was last updated in 2015 and has been successful in reducing both NO_2 and PM_{10} concentrations within the Bonnygate area. During 2019 all annual mean concentrations were below the objective level of 40 µg m^{-3} for NO_2 and 18 µg m^{-3} for PM_{10}.

The AQAP for Appin Crescent, Dunfermline was last updated in 2015. The AQAP aims to reduce NO_2 and PM_{10} concentrations within Appin Crescent. Initially an AQMA was declared in November 2011 for NO_2 only, however this was amended in August 2012 to include PM_{10}. During 2019 all annual mean concentrations were below the objectives for NO_2 and PM_{10}.

Three AQMesh sensor units were installed in December 2017 to seek to further understand pollutant concentrations and trends in the Appin Crescent, Dunfermline AQMA and Bonnygate, Cupar AQMA. Data is managed and processed by Ricardo Energy and Environment (Ricardo) who carry out the appropriate Quality Assurance/Quality Control (QA/QC) procedures. For the Bonnygate, Cupar monitoring location, the data showed that there were no exceedances of the NO_2 objectives, however there were exceedances of PM_{10} (both annual and daily objectives) and $PM_{2.5}$ objectives during 2019. For the two Appin Crescent Dunfermline locations there were no exceedances measured for the NO_2, PM_{10} or $PM_{2.5}$ objectives.

The Air Quality Strategy for Fife (2015–2020) was developed from the guidance of the Scottish Government and aims not only to raise awareness of air quality issues but also to promote some of the existing best practice work that the Council has undertaken within existing AQMAs to other parts of Fife. It recognises that no one single authority or Council service can have all the solutions and consequently a collaborative approach with key partners and stakeholders is considered essential in order to bring about improvements in air quality. An Air Quality Steering Group (including various Council services, SEPA, NHS Fife and representatives of local communities) aims to meet regularly to ensure that the aims and objectives of Fife's Air Quality Strategy and Air Quality Action Plans are being progressed. Progress in implementing the aims and objectives of Fife's Air Quality Strategy was acknowledged at the COSLA excellence awards in 2017 where Fife Council received a bronze award in the category of "Tackling Inequalities and Improving Health".

Following the review of all available data it is recommended that Fife Council carry out the following actions:

- Continue to monitor NO_2, PM_{10} and $PM_{2.5}$ concentrations throughout Fife.
- Produce an Annual Progress Report in 2021, reporting concentrations measured during 2020.
- Continue to implement the measures outlined in the action plans for Appin Crescent, Dunfermline and Bonnygate, Cupar.

Actions to Improve Air Quality

Measures outlined in the AQAPs for Bonnygate, Cupar and Appin Crescent, Dunfermline have been implemented throughout 2019. This includes the ongoing implementation of the Fife ECOStars scheme which is a free, voluntary scheme that provides recognition, guidance and advice on operational best practice to operators of goods vehicles, buses and coaches, taxis and private hire vehicles. It is being rolled out in Fife to help fleet operators improve efficiency, reduce fuel consumption and reduce emissions - all helping to improve local air quality and at the same time, make cost savings.

As of May 2020, there were 210 fleet operator members, who operate more than 8,200 vehicles in and around Fife. Recruitment of new members continues to reflect the full spectrum of fleets operating in Fife, with van fleets such as MGB Services and McLays in addition to hauliers operating heavy goods vehicles, such as Seacliff Haulage. We have seen an increase in bus and coach operators from other Local Authority areas joining as they are regularly travelling in, around and through Fife. The scheme is also of interest to national operators, with Scottish Fire and Rescue joining this year.

Ongoing support of the membership can result in star rating upgrades where good practice has been implemented, having a positive effect on air quality in Fife. One example is local company Growforth, who have upgraded their fleet and invested in driver training following recommendations made after their initial ECOStars assessment, resulting in a 3 to 4 star upgrade.

Fife Council has also updated its air quality guidance note for developers to reflect latest policy and technical guidance and it is expected that this guidance note will facilitate dealing with planning applications with air quality issues. This guidance note is available at the dedicated Fife Council air quality web pages at www.fife.gov.uk/airquality.

Local Priorities and Challenges

Fife Council has been awarded its grant funding from the Scottish Government for 2020-21. The funding will be used to carry out the following air quality initiatives and studies, which aim to work towards and further enhance the measures set out in the action plans for Bonnygate, Cupar and Appin Crescent, Dunfermline:

Bonnygate, Cupar:
Fife Council will continue to implement the measures set out in the Bonnygate AQAP during 2020. Fife Council's priorities within the designated AQMA over the forthcoming year include:

- Review and update the current AQAP to align with the updated Air Quality Strategy (see below) and the recently completed NLEF LEZ screening undertaken for Bonnygate, Cupar;
- Update Fife Council's Air Quality Strategy to cover 2021 to 2025;
- Continue the implementation of Fife Council's travel plan including encouraging walking and cycling infrastructure and initiatives;
- Fife ECOStars schemes for Fleet and Taxis operators will continue to encourage and promote 'clean fleet operations';
- To further raise awareness of air quality an educational package to highlight Clean Air Day will be delivered to a local primary school associated with the Bonnygate AQMA catchment area during October 2020;
- Although Scottish Government funding was not obtained to interrogate monitoring data from the AQMesh unit in the Bonnygate over 2020 Fife Council is committed to continue to undertake this to further understand pollutant concentrations and trends within the Bonnygate AQMA.

Appin Crescent, Dunfermline:
Fife Council will continue to implement the measures set out in the Appin Crescent AQAP during 2020. Fife Council's priorities within the designated AQMA over the forthcoming year include:

- Review and update the current AQAP to align with the updated Air Quality Strategy (see below) and the recently completed NLEF LEZ screening for Appin Crescent, Dunfermline;
- Updating the Council's Air Quality Strategy to cover 2021 to 2025;
- Continue the implementation of Fife Council's travel plan including encouraging walking and cycling infrastructure and initiatives;
- Fife ECO Stars schemes for Fleet and Taxis operators will continue to encourage and promote 'clean fleet operations';
- To further raise awareness of air quality an educational package to highlight Clean Air Day will be delivered to a local primary school associated with the Appin Crescent AQMA catchment area during October 2020;
- Although Scottish Government funding was not obtained to interrogate monitoring data from the two AQMesh units in Appin Crescent over 2020 Fife Council is committed to continue to undertake this to further understand pollutant concentrations and trends within the Appin Crescent AQMA.

In addition to the above the educational package to highlight Clean Air Day will also be delivered within a local primary school in the Cowdenbeath/Lochgelly catchment areas during October 2020 given the current political interest associated with Mossmorran.

How to Get Involved

Members of the public can find information related to air quality on the Fife Council website. Actions that members of the public can take to help reduce air pollution include:

- Car sharing
- Reducing car journeys by choosing to walk, cycle or take public transport instead
- Maintain and look after your vehicle properly
- Consider switching to an electric vehicle

Further information is available on the dedicated Fife Council air quality web pages at www.fife.gov.uk/airquality.

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1 Local Air Quality Management

This report provides an overview of air quality in Fife 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) summarises the work being undertaken by Fife Council to improve air quality and any progress that has been made. Table 1-1 summarises the Air Quality Objectives applicable to Scotland.

Table 1-1 Summary of Air Quality Objectives in Scotland

AQ Objective-Pollutant	Concentration	Measured as	Date to be achieved by
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

1.1 Summary of Previous Review and Assessment

1.1.1 Previous Review and Assessment Reports

Fife Council have carried out a number of reviews and assessments in relation to air quality over recent years. The 2007 APR and 2008 APR concluded that a detailed assessment should be carried out for Bonnygate, Cupar (NO_2), Appin Crescent, Dunfermline (PM_{10}) and Admiralty Road, Rosyth (PM_{10}). These reports concluded that an AQMA should be declared for NO_2 and PM_{10} at Bonnygate, Cupar and increased monitoring should be carried out at Appin Crescent, Dunfermline. This monitoring was increased and an additional assessment in 2010 suggested an AQMA should be declared in Appin Crescent for NO_2. Since these AQMAs were declared Air Quality Action Plans have been adopted for these areas to address the air quality issues and the Appin Crescent AQMA was also been amended to include PM_{10} as well as NO_2.

There were a few diffusion tube sites which showed exceedances in Appin Crescent, Dunfermline; Admiralty Road, Rosyth and St Clair Street, Kirkcaldy during 2010. The 2013 APR concluded that an AQMA was not required at Admiralty Road, Rosyth at that time.

A traffic management options appraisal was carried out in 2014 at Appin Crescent to assess if changes to the traffic management would have a significant impact. This was not the case. The Cupar Streetscene dispersion model was also carried out in 2014 to assess the traffic management changes proposed for Cupar. Two options were deemed to have a positive impact and were implemented in 2014. The 2014 APR concluded that the traffic management changes in Cupar were a success and concentrations in the Bonnygate AQMA had reduced.

A modelling assessment was carried out in 2015 to determine the effects of the Cupar North Development Zone and Relief Road. The report concluded that the results for each approach are very similar but when considering the cumulative impacts of the development without the relief road it is recommended that mitigation measures are considered to counteract the impact of additional development traffic.

An additional Appin Crescent traffic management appraisal was carried out in 2015 to investigate the potential impact of traffic management scenarios which aim to improve traffic flow through Appin Crescent.

The 2016 APR indicated exceedances within the current Appin Crescent AQMA at Appin Crescent (2) and Appin Crescent (6 ABC). The Air Quality Action Plan for Appin Crescent presents actions that will be implemented to address these exceedances. No exceedances were measured in the Cupar AQMA.

The 2017 APR highlighted a marginal exceedance within St Andrews as the result of new monitoring deployed within the town centre which commenced in 2016. This monitoring location was however some distance from the nearest receptor. In accordance with TG.16, the result was therefore corrected for NO_2 drop off using the LAQM NO_2 fall off with distance calculator. This resulted in an annual mean concentration of 33 µg m^{-3} at the nearest receptor which is below the objective. Measured 2016 concentrations were below the PM_{10} and $PM_{2.5}$ annual mean objectives with no exceedances of the annual mean or daily mean objective at all sites.

The review of all available data relating to carbon monoxide (CO), sulphur dioxide (SO_2) and benzene monitoring during 2016 indicated that it is unlikely that any AQS objectives relating to these pollutants were exceeded during 2016. A review of industrial sources reported that Longannet Power Station ceased operation in March 2016.

The 2018 APR indicated NO_2 concentrations measured during 2017 were below the annual mean objective of 40 µg m^{-3}. PM_{10} and $PM_{2.5}$ concentrations were below the annual mean objective of 18 µg m^{-3} for PM_{10} and 10 µg m^{-3} for $PM_{2.5}$. The review of all available data relating to carbon monoxide (CO), sulphur dioxide (SO_2) and benzene monitoring during 2017 indicated that it was unlikely that any AQS objectives relating to these pollutants were exceeded during 2017.

Fife Council carried out a number of surveys in 2018 including an emissions tracer survey and a mobile air quality survey in St Andrews measuring NO_2, PM_{10} and $PM_{2.5}$. The emissions tracer survey sampled

a section of the Council vehicle fleet to determine if fleet renewals would yield tangible air quality benefits in the AQMAs and areas of concern. A number of locations with high GPS count points and emissions were established in Kirkcaldy, Methil and Glenrothes, which coincide with the location of Council depot facilities. Fife Council will look to potentially extend the survey to include all fleet vehicles and over a long period of time. This would provide a more accurate estimate of the affect the fleet has on overall emissions levels.

The aim of the mobile monitoring was to demonstrate how air pollution concentrations vary within St Andrews and in turn to review the current NO_2 diffusion tube monitoring locations. Hotspots were identified along Links Crescent and North Street (A917) and along City Road. Increased concentrations were also measured along South Street and Bell Street for NO_2, PM_{10} and $PM_{2.5}$ confirming that the main source of pollution is likely to be road traffic.

An updated air quality impact assessment was carried out in 2018 for the Cupar North Development Zone and Relief Road. Two future 'with development' traffic scenarios were assessed by comparison with future baseline conditions for both annual mean NO_2 and PM_{10} concentrations: Phase 1 2024 (when 600 residential units are in use just prior to opening of the relief road) and completed development 2030 (when all residential and mixed use aspects of development are complete, and the Cupar Relief road is operational). No exceedances of the 40 µg m^{-3} NO_2 annual mean objective were predicted in 2024 Phase 1. The annual mean NO_2 concentrations were not predicted to be in excess of the annual mean objective in the Bonnygate AQMA. PM_{10} exceedances of the 18 µg m^{-3} Scottish annual mean objective were predicated at three 1st floor and two ground floor height receptors where relevant human exposure might be present. The model results indicated that additional emissions from vehicle trips generated by the Cupar North Development would contribute to what could be considered a significant increase in annual mean PM_{10} concentrations within the Bonnygate AQMA in 2024, prior to the relief road becoming operational.

No exceedances of the 40 µg m^{-3} NO_2 annual mean objective were predicted in the 2030 completed development scenario. The predicted impact was classified as either beneficial or negligible at all receptors. PM_{10} exceedances of the 18 µg m^{-3} Scottish annual mean objective were predicated at three 1st floor and two ground floor height receptors where relevant human exposure might be present. The model results indicate that the relief road will have a beneficial effect on PM_{10} concentrations within the Bonnygate AQMA; the reduction will not however be sufficient to achieve compliance with the 18 µg m^{-3} Scottish PM_{10} annual mean objective.

Ricardo prepared a regional scale dispersion model on behalf of Fife Council to model emissions from road transport. Concentrations of NO_2, PM_{10} and $PM_{2.5}$ were modelled for 2016 at 3m resolution over the whole of the Council area using a novel modelling framework (RapidAir) developed by Ricardo. The concentrations predicted from RapidAir were validated against roadside measurements made in Fife where emissions data was available. In addition, local validations were carried out for each of the main towns in Fife for NO_2 (Cupar, Dunfermline, Kirkcaldy, Rosyth and St Andrews) and the remaining tubes locations in combination.

Further information on any of these reviews and assessments can be found by contacting Fife Council directly at air.quality@fife.gov.uk or looking on the website for a copy www.fife.gov.uk/airquality

1.1.2 2019 Annual Progress Report

The 2019 APR utilised monitoring data collected throughout 2018. Fife Council carried out monitoring of NO_2 at four automatic stations in Cupar, Dunfermline, Kirkcaldy and Rosyth. Non-automatic monitoring of NO_2 was carried out using diffusion tubes at 62 sites (total of 80 tubes). During 2018 no new monitoring commenced. Appin Crescent 1 was relocated from 80 Appin Crescent to 76 Appin Crescent early in 2018 due to permission issues and 57 Halbeath Road was removed at the end of 2018 due to low readings. This has been replaced with a new site at North Street, St Andrews, following the mobile monitoring study which was undertaken. All NO_2 concentrations measured during 2018 were below the annual mean objective of 40 µg m^{-3}.

PM_{10} and $PM_{2.5}$ was measured at the four automatic sites within Fife at Cupar, Dunfermline, Kirkcaldy and Rosyth. During 2018 all concentrations were below the annual mean objective of 18 µg m^{-3} for PM_{10} and 10 µg m^{-3} for $PM_{2.5}$.

Additional indicative monitoring of NO_2, PM_{10} and $PM_{2.5}$ was carried out using AQMesh sensors units within the Bonnygate and Appin Crescent AQMAs. No exceedances were measured for any of the pollutants.

The review of all available data relating to carbon monoxide (CO), sulphur dioxide (SO_2) and benzene monitoring during 2018 indicated that it was unlikely that any AQS objectives relating to these pollutants were exceeded during 2018.

2 Actions to Improve Air Quality

2.1 Air Quality Management Areas

A summary of the AQMAs declared by Fife Council can be found in Table 2-1. Further information related to declared or revoked AQMAs, including maps of AQMA boundaries are available online at http://www.scottishairquality.co.uk/laqm/aqma. The boundaries of the AQMA's declared by Fife Council are shown in Figure 2.1 (Bonnygate, Cupar) and Figure 2.2 (Appin Crescent, Dunfermline). A steering group including key representatives from relevant services of Fife Council was formed to develop the draft AQAPs for both Bonnygate and Appin Crescent. The steering group considered the findings of the Further Assessment reports and the wide range of potential options for improving air quality within the AQMAs. The steering group aims to meet regularly to discuss the progress of the action plan measures outlined in the AQAPs.

Following a review of the 2019 Annual Progress Report, SEPA and the Scottish Government both recommended that Fife Council strongly consider revoking both AQMA's. Whilst concentrations of NO_2 and PM_{10} recorded within both AQMAs have improved significantly and now meet the Scottish air quality objectives for both pollutants, due to the current uncertainty regarding PM_{10} concentrations reported by different analysers and the Particular Matter concentrations indicated by the Bonnygate AQMesh monitoring in 2019, Fife Council do not propose to implement the revocation procedure for either AQMA at this time.

Fife Council instead proposes to continue to implement both AQAPs and monitor concentrations of NO_2 and PM_{10} within the AQMAs to ensure that the Scottish air quality objectives continue to be achieved, and public health continues to be protected. This will include the continued consideration of monitoring data collected by the AQMesh sensors within Bonnygate and Appin Crescent which allow for concentrations of PM_{10} to be measured at locations where previously not possible. Fife Council will review the 2020 monitoring data obtained for both AQMAs in the 2021 APR and will also take guidance from the current Particulate Matter Measurement study that has recently been commissioned by the Scottish Government before a decision is made regarding the potential revocation of both AQMAs.

Table 2-1 Declared Air Quality Management Areas

AQMA Name	Pollutants and Air Quality Objectives	City/Town	Description	Action Plan
Cupar, Bonnygate	NO_2 annual mean PM_{10} annual mean	Cupar	An area comprising of Bonnygate (A91), Crossgate (A914) and St Catherine Street (A91). There are a number of residential properties within the area close to the road at1st floor height above commercial properties.	Bonnygate Cupar, AQAP can be accessed at: http://publications.fifedirect.org.uk/c64_FifeCouncilBonnygateAQAPUpdate20156.pdf
Appin Crescent, Dunfermline	NO_2 annual mean PM_{10} annual mean	Dunfermline	An area comprising of Appin Crescent, Dunfermline. There are a number of residential properties within the area close to the road at both ground level and 1st floor height.	Appin Crescent, AQAP can be accessed at: http://publications.fifedirect.org.uk/c64_FifeCouncilAppinCrescentAQAPUpdate20151.pdf

Figure 2.1 Bonnygate, Cupar AQMA Boundary

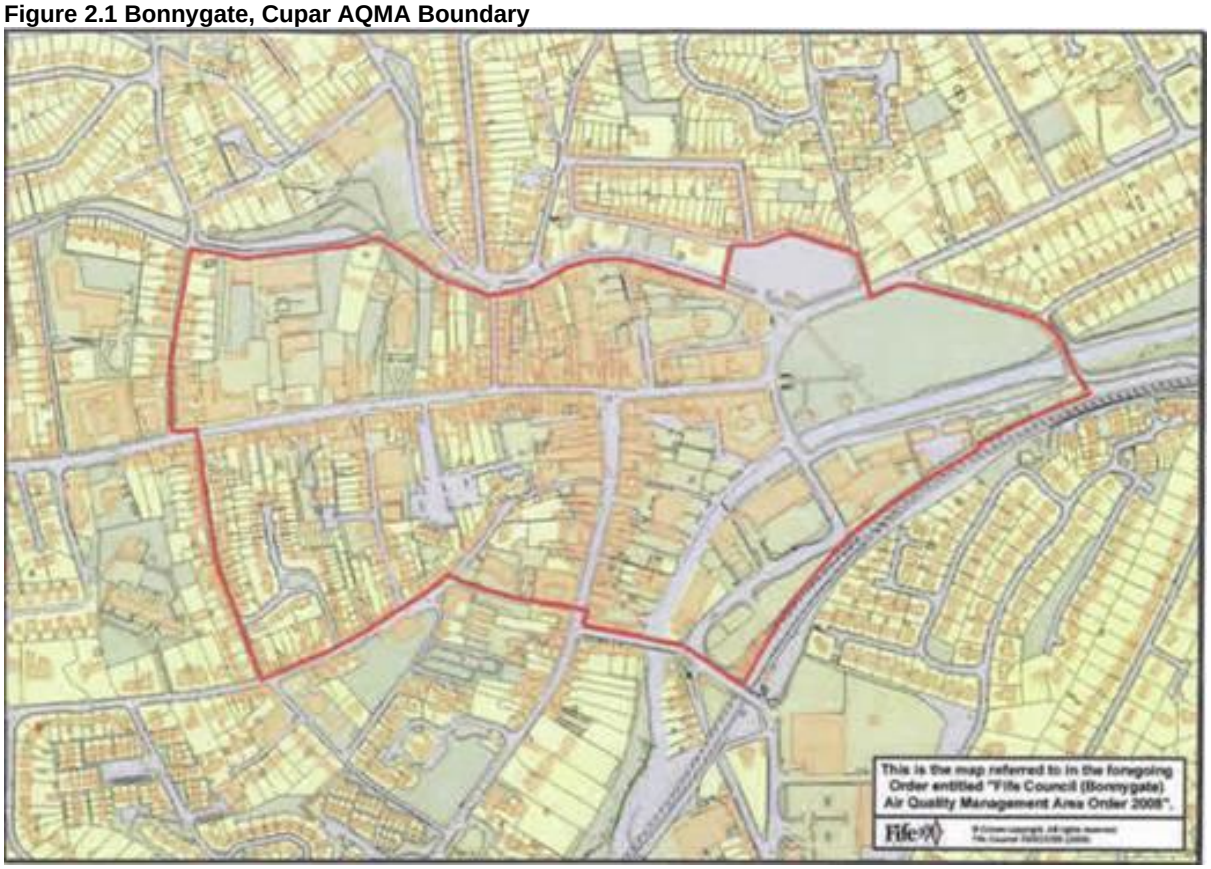
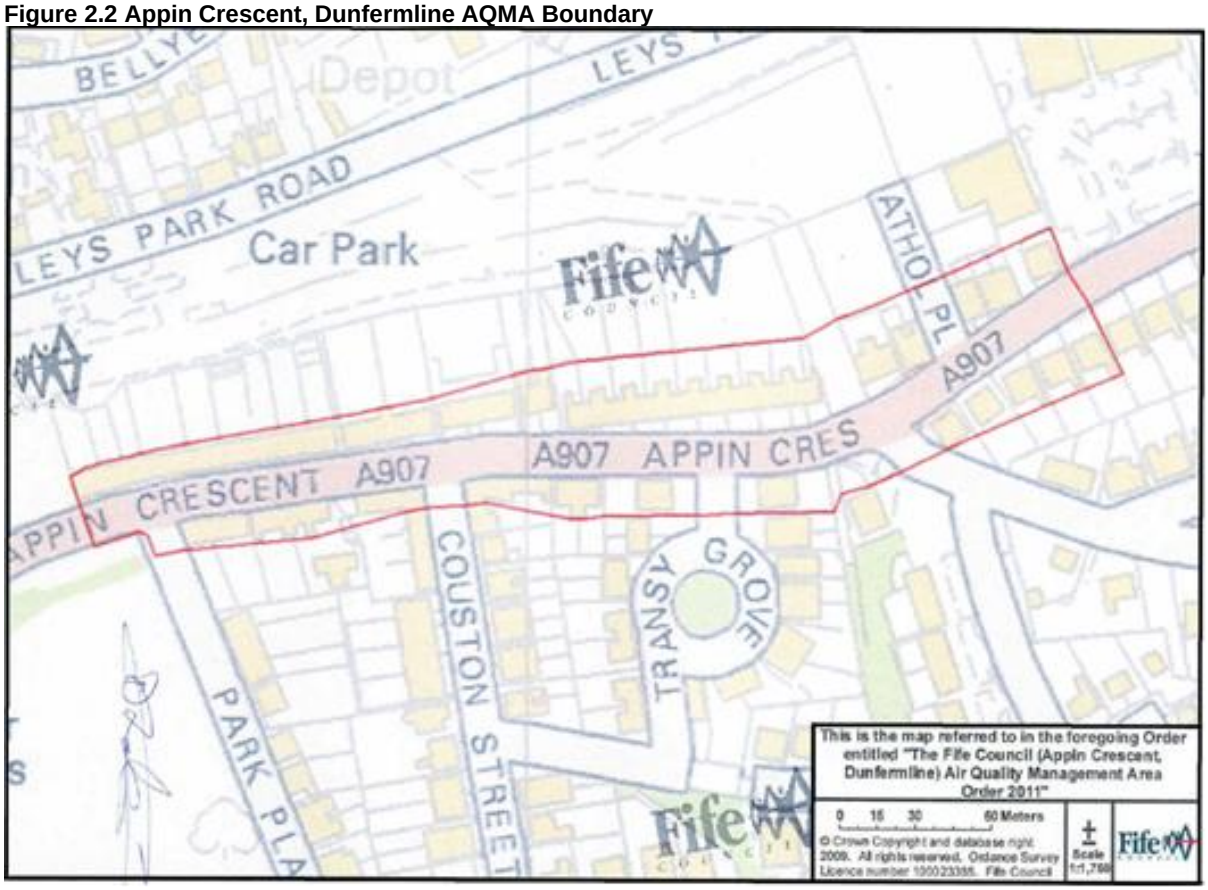


Figure 2.2 Appin Crescent, Dunfermline AQMA Boundary



2.2 Progress and Impact of Action Plan Measures

The Bonnygate AQAP aims to work towards reducing transport emissions of NOx and PM_{10} in the AQMA by approximately 53% and 33% respectively; using a wide range of measures such as road and traffic signalling improvements combined with other measures, for example behaviour-change.

The Appin Crescent AQAP aims to work towards reducing transport emissions of NOx and PM_{10} in the AQMA by approximately 18% and 40% respectively; and as with the Bonnygate AQAP will involve a combination of road layout and traffic signalling improvements combined with many other measures.

In April 2015 a review and update of both the Appin Crescent and Bonnygate Air Quality Action Plans was completed by Fife Council. A brief summary of the new measures incorporated into both action plans as a result of the AQAP review are provided in Table 2-2 and Table 2-3. Further details of the AQAP's and their progress are detailed in Table 2-6 and Table 2-7. Fife Council plan to update both AQAPs in 2020 which will allow new measures to be considered for implementation. These AQAP updates will align with the updated Air Quality Strategy (also due to be updated in 2020) as well as the recently completed NLEF LEZ screenings undertaken for both AQMAs.

Table 2-2 New measures included within the Bonnygate Air Quality Action Plan (2015)

No.	Measure	Timescale
1	Fife ECO Stars	Short Term
2	Fife Council Air Quality Strategy 2015-2020	Short Term
3	Air Quality and Planning Toolkit	Short Term

Table 2-3 New measures included within the Appin Crescent Air Quality Action Plan (2015)

No.	Measure	Timescale
1	Fife ECO Stars	Short Term
2	Fife Council Air Quality Strategy 2015-2020	Short Term
3	Air Quality and Planning Toolkit	Short Term
4	Cost-Benefit-Analysis of options to improve air quality within Appin Crescent	Short Term
5	Proposed air dispersion modelling study of the potential Dunfermline Northern Link Road	Short Term

2.2.1 Completed Measures

Fife Council has taken forward a number of measures during the current reporting year of 2019 in pursuit of improving local air quality. Details of all measures completed, in progress or planned are set out in Table 2-6 for Bonnygate, Cupar and Table 2-7 for Appin Crescent, Dunfermline. The tables summarise progress to date on each of the measures within the AQAP. More details on these measures can be found in the relevant AQAP and Fife Council's Air Quality Strategy 2015-2020.

Key completed measures include the installation of new traffic management systems within Bonnygate, Cupar which began in 2009. This included a new pedestrian crossing on the Bonnygate and a new twin mini roundabout system implemented at St Catherine Street/East Bridge to ease the flow of traffic through Cupar, thus reducing congestion.

Within the Appin Crescent AQMA, revised lane markings and signage were introduced in March 2013. These measures have resulted in a reduction in NO_2 concentrations on the south side of Appin Crescent. The AQAP outlines the consideration of a bypass and a feasibility study was commissioned to determine if this would be an option to reduce pollutant concentrations within Appin Crescent. The feasibility study suggested that the proposed bypass would achieve the reduction required in pollutant concentrations to reach the statutory annual mean objectives. However, no funding is currently available for this option and Fife Council are considering alternative traffic management options that will result in similar reductions whilst being more cost effective and practicable to apply.

As progress on the action plan measures for Cupar and Dunfermline continues to advance, a number of measures have now been completed - these are summarised in Table 2-4. Similarly, as the action plan measures have been advanced, certain measures have been discounted from further consideration. Details on discounted measures are summarised in Table 2-5.

Table 2-4 Completed AQAP Measures

No.	Measure	Comments
	Bonnygate, Cupar	
4	Implementation of new Urban Traffic Management and Control system and changes to pedestrian crossings	New pedestrian crossing installed at Bonnygate and twin mini roundabout scheme implemented at St Catherine Street/East Bridge.
	Appin Crescent, Dunfermline	
2	Feasibility study	Feasibility studies (2015 and 2016) and a Cost Benefit Analysis report in 2016 have been produced and considered by the AQ Steering Group. It has been concluded from these studies that the options considered to date are not cost effective, feasible or acceptable as defined in AQAP evaluation criteria. Focus is now on the delivery of the Northern Link Road to the north of Dunfermline in terms of seeking air quality improvements in the Appin Crescent AQMA.
6	Traffic Management optimisation (dependent on feasibility study)	
15	Cost-benefit analysis of traffic management options to improve air quality within Appin Crescent.	

2.2.2 Discounted Measures

Table 2-5 Discounted AQAP Measures

No.	Measure	Justification
	Bonnygate, Cupar	
8	AQMA Awareness Signs	Measure has been discounted based on the grounds of cost effectiveness, practicability feasibility and acceptability to members of the public.
	Appin Crescent, Dunfermline	
12	Consideration of development of Appin Crescent bypass (Dependent upon feasibility study)	Based on the findings of the feasibility study, the Air Quality Steering Group considers that this option is not as cost effective, practicable and feasible relative to the introduction of the Northern Link Road in Dunfermline

Table 2-6 Progress on Measures to Improve Air Quality- Bonnygate, Cupar

Measure No.	Measure	Category	Focus	Lead Authority	Planning Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date (May 2020)
1	Improving links with Local Transport Strategy/ Area Transport Plan Implementation Phase: Ongoing	Policy guidance and development control	Measures to ensure the air quality in the AQMA is improved where possible and to avoid future problems are implemented via the Local Transport Strategy.	Fife Council	As outlined in the aims and objectives of Council's Air Quality Strategy 2015-20	Reference to Bonnygate AQMA and measures included in Air Quality Action Plan. Integration of plan with Local Transport Strategy.	Low	Fife Council continues to attend and contribute to air quality seminars, training events and pollution liaison group meetings where national air quality measures are discussed.
2	Improving Air Quality Links with local Planning and Development Framework Implementation Phase: Ongoing	Policy guidance and development control	Local planning considerations aim to mitigate the cumulative negative air quality impacts of new development	Fife Council	Fife Council Air Quality Steering Group outputs are contributing to the development of Fife Council Local Transport Strategy/Area Transport Plan and are to be incorporated in future revisions of these strategies/plans.	Ensure that development proposals with the potential to exert an impact on the Bonnygate AQMA are assessed for air quality impacts and where necessary, appropriate mitigation measures considered.	Medium	The Low Carbon Fife Supplementary Guidance was adopted in January 2019 and now forms a statutory part of the Local Development Plan (FIFEplan). This guidance incorporates the Fife Council Air Quality Developers Guide. Initial stages of reviewing the Local Development Plan (FIFEplan) are due to begin towards the end of 2020. In conjunction with this the Fife Council Air Quality Developers Guide is in the process of being amended as is the Fife Council Air Quality Strategy (to cover 2021 to 2025).
3	Integrate AQ with other Council Strategies Implementation Phase: Ongoing	Policy guidance and development control	Encourage opportunity for contributions towards improving local air quality and minimising negative impacts from existing and future Council strategies. Increase awareness of local air quality	Fife Council	As outlined in the aims and objectives of Council's Air Quality Strategy 2015-20	Continue and enhance joint working between Council Services and other Partnership Organisations to encourage potential air quality implications of existing and future Council strategies. Implementation of the relevant AQS objectives	Low	Submission of AQ grant application for 2020-2021 includes submissions for climate change related measures. The Scottish Government 'expect any Scottish local authority which has or is currently developing a Sustainable Energy [Climate] Action Plan to ensure that air quality considerations are covered, (Clean Air for Scotland – The Road to a Healthier Future 2015, P21)'. On February 6th 2020 Fife Council's Environment and Protective Services Committee approved the Sustainable Energy Climate Action Plan - Climate Fife. https://climatechange.fife.scot Climate Fife includes a practical action plan for mitigation activities and a Risk and Vulnerability Assessment to outline the challenge for adaption action. To expedite the work, and to reflect the climate emergency, a 12-month emergency action plan has been prepared to March 2021. Climate Fife is a Fife wide plan. Reducing carbon emission and adapting to unavoidable climate change are also therefore priorities for the Fife Partnership. A review is underway to bring forward more action on the climate emergency into the Plan for Fife - the Local Outcome Improvement Plan. Air Quality and linked low carbon emissions actions are covered under the Sustainable Transport theme in the Climate Fife Action Plan. Additionally, Fife Council is to bring a revised Carbon Management Plan to committee, April 2020. Fife Councils Land & Air Quality Team continues to work closely with the Council's Climate Change team to ensure air quality is considered.
4	Implementation of new Urban Traffic Management and Control system and changes to	Policy guidance and development control	Improve efficiency of transit through Cupar Town Centre and reduce emissions from road traffic sources within the	Fife Council	2009	Pollutant reduction in AQMA. AQ monitor will continue to confirm the effectiveness of the measures.	Decline in NO_2 and PM_{10} concentrations within Bonnygate, monitoring to continue until trend has emerged. Pollutant concentrations can vary annually due to	Completed and monitoring ongoing

Measure No.	Measure	Category	Focus	Lead Authority	Planning Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date (May 2020)
	pedestrian crossings Implementation Phase: Completed and monitoring ongoing		Bonnygate street canyon. Installation of traffic management system.				meteorological influences.	
5	Travel Plans for Large Institutions and Businesses Implementation Phase: Ongoing	Promoting travel alternatives	To encourage a shift to more sustainable forms of travel or reducing the need for travel.	Fife Council	As outlined in the aims and objectives of Council's Air Quality Strategy 2015-20	Continue the implementation of Fife Council's travel plan. Undertake Council Travel surveys	Low	Transportation department continuing to support schools in updating and developing School specific travel plans. Continue to actively promote sustainable travel to school, including initiatives such as Bikeability and WOW (Walk Once a Week). Continue the implementation of Fife Council's Travel Plan.
6	Promotion of Travel Choices Implementation Phase: Ongoing	Promoting travel alternatives	Discourage long stay commuter parking as part of the Fife Council's Parking Strategy. To increase awareness of travel choices and encourage changes in behaviour that will contribute to improving local air quality.	Fife Council	As outlined in the aims and objectives of Councils Air Quality Strategy 2015-20	To improve integration between cycling, walking and public transport. To continue to liaise with Scottish Government in the production of KPIs for this action plan measure.	Low	Grant application for 2020-21 includes 9 new traffic counters with 9 obtained in 2019-20 through grant funding also. These traffic counters will aid in tracking changes in vehicle use. Adopted FIFEplan policy 11 requires new development to encourage and facilitate the use of sustainable transport appropriate to the development, promoting in the following order of priority: walking, cycling, public transport, cars. Initial stages of reviewing the Local Development Plan (FIFEplan) are due to begin towards the end of 2020. Continue to actively promote sustainable travel to school, including initiatives such as Bikeability and WOW (Walk Once a Week).
7	Target reduced localised emissions from freight. Implementation Phase: Ongoing	Freight and delivery management	Improve efficiency of transit through the AQMA and facilitate reduced emissions.	Fife Council	As outlined in the aims and objectives of Councils Air Quality Strategy 2015-20	Pollution reduction in AQMA	Medium	Continue to engage with HDV Fleet operators through the ongoing roll out of the Fife ECO Stars scheme.
8	AQMA Awareness Signs Implementation Phase: N/A	Public information	To increase awareness of the Bonnygate AQMA and encourage behavioural change.	Fife Council	N/A	Authorisation, design, procurement and installation	Low	Measure has been discounted based on the grounds of cost effectiveness, practicability, feasibility and acceptability to members of the public.
9	Provision of Information relating to Air Quality Implementation Phase: Ongoing	Public information	To increase awareness of local air quality issues and encourage changes in behaviour that will contribute to improving local air quality.	Fife Council	As outlined in the aims and objectives of Council's Air Quality Strategy 2015-20	Production of booklet – travel pack Publication of LAQM reports	Low	This information is covered by the Low Carbon Fife Supplementary Guidance which was adopted in January 2019 and now forms a statutory part of the Local Development Plan (FIFEplan). This guidance incorporates the Fife Council Air Quality Developers Guide. Initial stages of reviewing the Local Development Plan (FIFEplan) are due to begin towards the end of 2020. In conjunction with this the Fife Council Air Quality Developers Guide is in the process of being amended as is the Fife Council Air Quality Strategy (to cover 2021 to 2025).

Measure No.	Measure	Category	Focus	Lead Authority	Planning Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date (May 2020)
10	Parking Management and Control Implementation Phase: Short – Medium Term	Traffic management	Reduce traffic by discouraging long stay parking and associated commuting movements. Minimise impacts of commercial deliveries on traffic movement.	Fife Council	As outlined in the aims and objectives of Council's Air Quality Strategy 2015-20	Pollutant reduction in AQMA	Low	Continue to evaluate parking management measures within the Bonnygate AQMA.
11	Promotion pf Cycling and Walking Implementation Phase: Ongoing	Promoting travel alternatives	To encourage a shift away from the use of private motor vehicles for travelling to more sustainable forms of transport or reducing the need for travel.	Fife Council	As outlined in the aims and objectives of Council's Air Quality Strategy	Number/length of cycling and walking routes developed.	Low	Adopted FIFEplan policy 11 requires new development to encourage and facilitate the use of sustainable transport appropriate to the development, promoting in the following order of priority: walking, cycling, public transport, cars. Initial stages of reviewing the Local Development Plan (FIFEplan) are due to begin towards the end of 2020. Continue to actively promote sustainable travel to school, including initiatives such as Bikeability and WOW (Walk Once a Week).
12	Review and support proposed infrastructure changes that will contribute to delivering improvements in local air quality Implementation Phase: Long Term/Ongoing	Transport planning and infrastructure	Support Council proposals for infrastructure changes that will facilitate improvements in vehicle movements within Cupar. (Confirm that proposals will be subject to suitable environmental assessments).	Fife Council	As outlined in the aims and objectives of Council's Air Quality Strategy	Pollutant Reduction in AQMA	High	Results from AQMesh pod installed on the southern side of the Bonnygate in December 2017 to be reported within this 2020 APR.
13	Target reductions in emissions from the Council fleet and contract vehicles (including driver training) Implementation Phase: Ongoing	Vehicle fleet efficiency	Target reduced emissions from Council fleet vehicles and Council contract fleet vehicles operating within the Cupar AQMA.	Fife Council	As outlined in the aims and objectives of Council's Air Quality Strategy 2015-20	Fife Council tender specification outlines that all new vehicles must have the latest gas recyclable exhaust and catalyst systems fitted. Number of vehicles in fleet. Number of electric and hydrogen powered vehicles in fleet.	Medium	By the end of 2019 Fife Council had 36 full electric vehicles and 19 hybrid vehicles in service (either leased or purchased). The size of the Fife Council fleet decreased slightly in 2019 and now stands at 1,544. Total diesel use for 2018/19 was 3,864,122 litres (a reduction of 201,533 from the previous year). Correspondence with Fleet advises that this has been as a result of a reduction in the number of larger sized Fleet items.
14	Target reductions in emissions from buses Implementation Phase: Ongoing	Vehicle fleet efficiency	Target reduced emissions from buses operating within the Bonnygate AQMA.	Fife Council	As outlined in the aims and objectives of Council's Air Quality Strategy 2015-20	Establish a bus quality partnership Increase in fleet using alternative fuel	Medium	Continue to encourage bus operators to recognise the importance of air quality and climate change issues through the Fife ECO Stars scheme and to explore the potential to set up voluntary bus agreements through interaction with local bus operators through the ongoing Fife ECO Stars recruitment process. As of February 2020 there are now 23 bus operators within the ECO Stars scheme covering 707 vehicles.

Measure No.	Measure	Category	Focus	Lead Authority	Planning Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date (May 2020)
15	Fife ECO Stars Implementation Phase: Ongoing	Vehicle fleet efficiency	Encourage operators of buses, coaches, HGVs and LDVs to sign up to voluntary scheme which encourages and promotes 'clean operators'	Fife Council	As outlined in the aims and objectives of Council's Air Quality Strategy 2015-20	Develop and promote Fife ECO Stars, a new green recognition scheme aiming to tackle air pollution from transport.	Medium	In 2019 the Fife Commercial Membership grew to 210 members covering over 8,200 vehicles operating in Fife & beyond. The Taxi & Private Hire Membership has increased by over 50% with figures now standing at 67 operators and 365 vehicles.
16	Air Quality and Planning Toolkit Implementation Phase: Short Term 2020	Policy guidance and development control	Facilitate the consideration of the potential air quality impacts of developments across Fife, but notably near existing AQMAs	Fife Council	As outlined in the aims and objectives of Council's Air Quality Strategy 2015-20	Develop a GIS based dispersion modelling toolkit to assist planners and other local authority officers in the consideration of the air quality issues in the development management process.	Medium	The Regional RapidAir™ Dispersion Model was recently updated with local validations carried out for each of the main towns in Fife for NO_2 (Cupar, Dunfermline, Rosyth, Kirkcaldy and St Andrews). This allows the Council to consider air quality issues in the development management process.
17	Air Quality Strategy 2015-2020 Implementation Phase: Ongoing 2020	Policy guidance and development control	Increase awareness of local air quality issues and promote good practice in reducing emissions of air quality pollutants.	Fife Council	As outlined in the aims and objectives of Council's Air Quality Strategy 2015-20	Develop and adopt an Air Quality Strategy that aims to raise awareness of air quality issues and to promote some of the existing best practice work that the Council has undertaken within existing AQMAs to other parts of Fife.	High	See measures 1-16. These are considered to be consistent with the aims/objectives of Scottish Government Cleaner Air Quality Strategy for Scotland 2015 including the List of Actions in Chapter 14 of this document. Fife Council's Air Quality Strategy will be updated in 2020 to cover the 2021 to 2025 period. This update will align with the Bonnygate AQAP update which will also take place in 2020 and the results of the NLEF LEZ screening process for Bonnygate.

Table 2-7 Progress on measures to Improve Air Quality- Appin Crescent, Dunfermline

Measure No.	Measure	Category	Focus	Lead Authority	Planning Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date (May 2020)
1	Liaise with Scottish Government to encourage the consideration of national measures Implementation Phase: Ongoing	Policy guidance and development control	Increase focus on background concentrations of PM and encourage national action	Fife Council	As outlined in the aims and objectives of Council's Air Quality Strategy 2015-20	Maintain contact with the Scottish Government regarding the adoption of national air quality measures.	Low KPI's to be developed in liaison with Scottish Government	Fife Council continues to attend and contribute to air quality seminars, training events and pollution liaison group meetings where national air quality measures are discussed.
2	Feasibility study Implementation Phase: Completed	Transport planning and infrastructure	To adopt a strategic approach to air quality in Appin Crescent and undertake a detailed assessment of the feasibility and impacts of proposed infrastructure and traffic management measures.	Fife Council	As outlined in the aims and objectives of Council's Air Quality Strategy 2015-20	Undertake a feasibility study to assess the potential impact of local infrastructure developments and traffic management optimisation on air quality in Appin Crescent.	Low to Medium	Completed
3	Improving links with Local Transport Strategy/ Area Transport Plan Implementation Phase: Ongoing	Transport planning and infrastructure	Measures to ensure the current poor air quality in the AQMA is improved where possible and to avoid future problems are implemented via the Local Transport Strategy.	Fife Council	As outlined in the aims and objectives of Council's Air Quality Strategy 2015-20	Reference to Appin Crescent AQMA and measures included in Air Quality Action Plan. Integration of plan with Local Transport Strategy.	Low	Fife Council Air Quality Steering Group outputs continue to contribute to the development of Fife Council's Local Transport Strategy/Area Transport Plan and are to be incorporated in future revisions of these strategies/plans.
4	Improving Air Quality links with Local Planning and Development Framework Implementation Phase: Ongoing	Policy guidance and development control	Local planning considerations aim to mitigate the cumulative negative air quality impacts of new development	Fife Council	As outlined in the aims and objectives of Council's Air Quality Strategy 2015-20	Integration of Appin Crescent AQAP with future versions of Local Plan. Maintain and make available - air quality guidance notes for developers.	Medium	The Low Carbon Fife Supplementary Guidance was adopted in January 2019 and now forms a statutory part of the Local Development Plan (FIFEplan). This guidance incorporates the Fife Council Air Quality Developers Guide. Initial stages of reviewing the Local Development Plan (FIFEplan) are due to begin towards the end of 2020. In conjunction with this the Fife Council Air Quality Developers Guide is in the process of being amended as is the Fife Council Air Quality Strategy (to cover 2021 to 2025).
5	Integrate Air Quality with other Council Strategies Implementation Phase: Ongoing	Policy guidance and development control	Encourage opportunity for contributions towards improving local air quality and minimising negative impacts from existing and future Council strategies. Increase awareness of local air quality.	Fife Council	As outlined in the aims and objectives of Council's Air Quality Strategy 2015-20	Maintain regular and ongoing communication between members of the Appin Crescent AQAP steering group.	Low	Submission of AQ grant application for 2020-2021 includes submissions for climate change related measures. The Scottish Government '*expect any Scottish local authority which has or is currently developing a Sustainable Energy [Climate] Action Plan to ensure that air quality considerations are covered, (Clean Air for Scotland – The Road to a Healthier Future 2015, P21)'.* On February 6th 2020 Fife Council's Environment and Protective Services Committee approved the Sustainable Energy Climate Action Plan - Climate Fife. https://climatechange.fife.scot

Measure No.	Measure	Category	Focus	Lead Authority	Planning Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date (May 2020)
								Climate Fife includes a practical action plan for mitigation activities and a Risk and Vulnerability Assessment to outline the challenge for adaption action. To expedite the work, and to reflect the climate emergency, a 12-month emergency action plan has been prepared to March 2021. Climate Fife is a Fife wide plan. Reducing carbon emission and adapting to unavoidable climate change are also therefore priorities for the Fife Partnership. A review is underway to bring forward more action on the climate emergency into the Plan for Fife - the Local Outcome Improvement Plan. Air Quality and linked low carbon emissions actions are covered under the Sustainable Transport theme in the Climate Fife Action Plan. Additionally, Fife Council is to bring a revised Carbon Management Plan to committee, April 2020. Fife Councils Land & Air Quality Team continues to work closely with the Council's Climate Change team to ensure air quality is considered.
6	Traffic Management optimization (dependant on feasibility study) Implementation Phase: Completed	Traffic management	Reduce traffic queuing within the AQMA through the optimisation of the Traffic management system.	Fife Council	As outlined in the aims and objectives of Council's Air Quality Strategy 2015-20	Optimisation of the traffic management system at Appin Crescent and the surrounding network. Progress of this action is dependent on the conclusions of the feasibility study.	High	Completed
7	Travel Plans for large Institutions and Businesses Implementation Phase: Ongoing	Transport planning and infrastructure	To encourage a shift to more sustainable forms of travel or reducing the need for travel.	Fife Council	As outlined in the aims and objectives of Council's Air Quality Strategy 2015-20	Continue the implementation of Fife Council's travel plan Undertake Council travel surveys	Low	Transportation department continuing to support schools in updating and developing School specific travel plans. Continue to actively promote sustainable travel to school, including initiatives such as Bikeability and WOW (Walk Once a Week). Continue the implementation of Fife Council's Travel Plan.
8	Provision of Information and promotion of travel options Implementation Phase: Ongoing	Promoting travel alternatives	To increase awareness of travel choices and encourage changes in behaviour that will contribute to improving local air quality.	Fife Council	As outlined in the aims and objectives of Council's Air Quality Strategy 2015-20	To improve integration between cycling, walking and public transport. Produce Travel Choices facility for Dunfermline. Undertaking Travel Marketing in Dunfermline.	Low	Grant application for 2020-21 includes 9 new traffic counters with 9 obtained in 2019-20 through grant funding also. These traffic counters will aid in tracking changes in vehicle use. Adopted FIFEplan policy 11 requires new development to encourage and facilitate the use of sustainable transport appropriate to the development, promoting in the following order of priority: walking, cycling, public transport, cars. Initial stages of reviewing the Local Development Plan (FIFEplan) are due to begin towards the end of 2020. Continue to actively promote sustainable travel to school, including initiatives such as Bikeability and WOW (Walk Once a Week).
9	Provision of information relating to Air Quality	Public information	To increase awareness of local air quality issues and encourage changes in behaviour that will	Fife Council	As outlined in the aims and objectives of Council's Air Quality Strategy 2015-20	Continue to make information relating to local air quality management available through the Council website.	Low	This information is covered by the Low Carbon Fife Supplementary Guidance which was adopted in January 2019 and now forms a statutory part of the Local Development Plan (FIFEplan). This guidance incorporates the Fife Council Air Quality Developers Guide.

Measure No.	Measure	Category	Focus	Lead Authority	Planning Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date (May 2020)
	Implementation Phase: Ongoing		contribute to improving local air quality.					Initial stages of reviewing the Local Development Plan (FIFEplan) are due to begin towards the end of 2020. In conjunction with this the Fife Council Air Quality Developers Guide is in the process of being amended as is the Fife Council Air Quality Strategy (to cover 2021 to 2025).
10	Target reductions in emissions from the Council fleet and contract vehicles (including driver training) Implementation Phase: Ongoing	Vehicle fleet efficiency	Target reduced emissions from Council fleet vehicles and Council contract fleet vehicles.	Fife Council	As outlined in the aims and objectives of Council's Air Quality Strategy 2015-20	Monitor and assess viable options for alternative fuels, technologies and fuel additives. Fife Council tender specification outlines that all new vehicles must have exhaust trap and filtration systems. Number of vehicles in Council fleet Number of electric and hydrogen powered vehicles in Council fleet	Medium	By the end of 2019 Fife Council had 36 full electric vehicles and 19 hybrid vehicles in service (either leased or purchased). The size of the Fife Council fleet decreased slightly in 2019 and now stands at 1,544. Total diesel use for 2018/19 was 3,864,122 litres (a reduction of 201,533 from the previous year). Correspondence with Fleet advises that this has been as a result of a reduction in the number of larger sized Fleet items.
11	Investigate the potential for establishing voluntary bus agreements Implementation Phase: Ongoing	Promoting travel alternatives	Target reduced emissions from buses operating within the Appin Crescent AQMA.	Fife Council	As outlined in the aims and objectives of Council's Air Quality Strategy 2015-20	Liaise with bus operators regarding emissions from the bus fleet and improvements to bus service infrastructure. Bus quality agreement similar to P&R at Ferrytoll, link to Forth Road Bridge Replacement crossing.	Low	Continue to encourage bus operators to recognise the importance of air quality and climate change issues through the Fife ECO Stars scheme and to explore the potential to set up voluntary bus agreements through interaction with local bus operators through the ongoing Fife ECO Stars recruitment process. As of February 2020 there are now 23 bus operators within the ECO Stars scheme covering 707 vehicles.
12	Consideration of development of Appin Crescent bypass (Dependent upon feasibility study) Implementation Phase: Completed	Transport planning and infrastructure	If determined to be feasible, the development of a bypass at Appin Crescent may be a potential option to facilitate a reduction the traffic volume passing through the AQMA and consequently, contribute to lower emissions.	Fife Council	As outlined in the aims and objectives of Council's Air Quality Strategy 2015-20.	Development of an Appin Crescent bypass.	High	Completed
13	Fife ECO Stars Implementation Phase: Ongoing	Vehicle Fleet Efficiency in HGV and Taxi Fleets	Encouraging local fleet operators to introduce fleet management systems that improve air quality	Fife Council	As outlined in the aims and objectives of Council's Air Quality Strategy 2015-20	Number of ECO Stars members	Medium	In 2019 the Fife Commercial Membership grew to 210 members covering over 8,200 vehicles operating in Fife & beyond. The Taxi & Private Hire Membership has increased by over 50% with figures now standing at 67 operators and 365 vehicles.
14	Air Quality and Planning Toolkit Implementation Phase: Ongoing 2020	Development Control	Ensure future development does not compromise achievement of statutory air quality objectives	Fife Council	As outlined in the aims and objectives of Council's Air Quality Strategy 2015-20	Develop a GIS based dispersion modelling toolkit to assist planners and other local authority officers in the consideration of the air quality issues in the development management process.	Medium	The Regional RapidAir™ Dispersion Model was recently updated with local validations carried out for each of the main towns in Fife for NO_2 (Cupar, Dunfermline, Rosyth, Kirkcaldy and St Andrews). This allows the Council to consider air quality issues in the development management process.

Measure No.	Measure	Category	Focus	Lead Authority	Planning Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date (May 2020)
15	Cost-benefit analysis of traffic management options to improve air quality within Appin Crescent Implementation Phase: Completed	Traffic Management	Evaluation of short to medium term traffic management measures to improve air quality	Fife Council	As outlined in the aims and objectives of Council's Air Quality Strategy 2015-20	CBA analysis outcomes of two traffic management options	Low to Medium	Completed
16	Proposed Air Dispersion modelling study of the potential Dunfermline Northern Link Road Implementation Phase: Ongoing 2020 (Initial dispersion modelling report produced in 2016 and updated to reflect latest road vehicle emissions factors in 2017).	Traffic Management	Estimate the impact of the proposed northern link road and the proposed Dunfermline strategic land allocation (SLA) zones	Fife Council	As outlined in the aims and objectives of Council's Air Quality Strategy 2015-20	Carry out Air Quality dispersion modelling to quantify the impacts of the proposed Northern Link.	High	Results from the two AQMesh pods installed on the southern side of Appin Crescent in December 2017 to be reported within this 2020 APR.
17	Air Quality Strategy for Fife Implementation Phase: Ongoing 2020	Strategy	As outlined in the aims / objectives contained in the Air Quality Strategy Report 2015-2020	Fife Council	As outlined in the aims and objectives of Council's Air Quality Strategy 2015-20	Pollutant reduction in AQMAs KPIs are currently being developed by the Scottish Government as outlined in the Cleaner Air Quality Strategy for Scotland and are anticipated to be finalised in the First Annual Progress Report for this Strategy. Following the introduction of these KPIs, Fife Council will incorporate these into the action planning process.	High	See measures 1-16. These are considered to be consistent with the aims/objectives of Scottish Government Cleaner Air Quality Strategy for Scotland 2015 including the List of Actions in Chapter 14 of this document. Fife Council's Air Quality Strategy will be updated in 2020 to cover the 2021 to 2025 period. This update will align with the Appin Crescent AQAP update which will also take place in 2020 and the results of the NLEF LEZ screening process for Appin Crescent.

2.2.3 Progress in Bonnygate AQMA

NO_2 concentrations at the automatic monitor within Bonnygate, Cupar have been declining steadily since 2007. Between 2015 and 2016 concentrations increased slightly before declining again until 2019. NO_2 concentrations at the automatic monitoring station remain well within the NO_2 annual mean objective. Since 2007 NO_2 concentrations have reduced by 54% from 52 µg m^{-3} to 23.7 µg m^{-3}.

PM_{10} concentrations have steadily declined between 2007 and 2009. In 2010 concentrations increased and remained consistent in 2011, before reducing slightly in 2012. Since 2012 concentrations had been reducing steadily until 2017 where they have increased in 2018 and 2019. Since 2012 concentrations have remained below the AQS annual mean objective. Since measurements stared in 2007 PM_{10} concentrations have reduced by 37% from 23 µg m^{-3} to 14.6 µg m^{-3}.

Automatic monitoring annual mean concentrations going back to 2007 for NO_2 and PM_{10} are shown in Figure 2.3 and Figure 2.4 respectively.

Figure 2.3 NO_2 Automatic Monitoring Results 2007-2019 – Bonnygate, Cupar

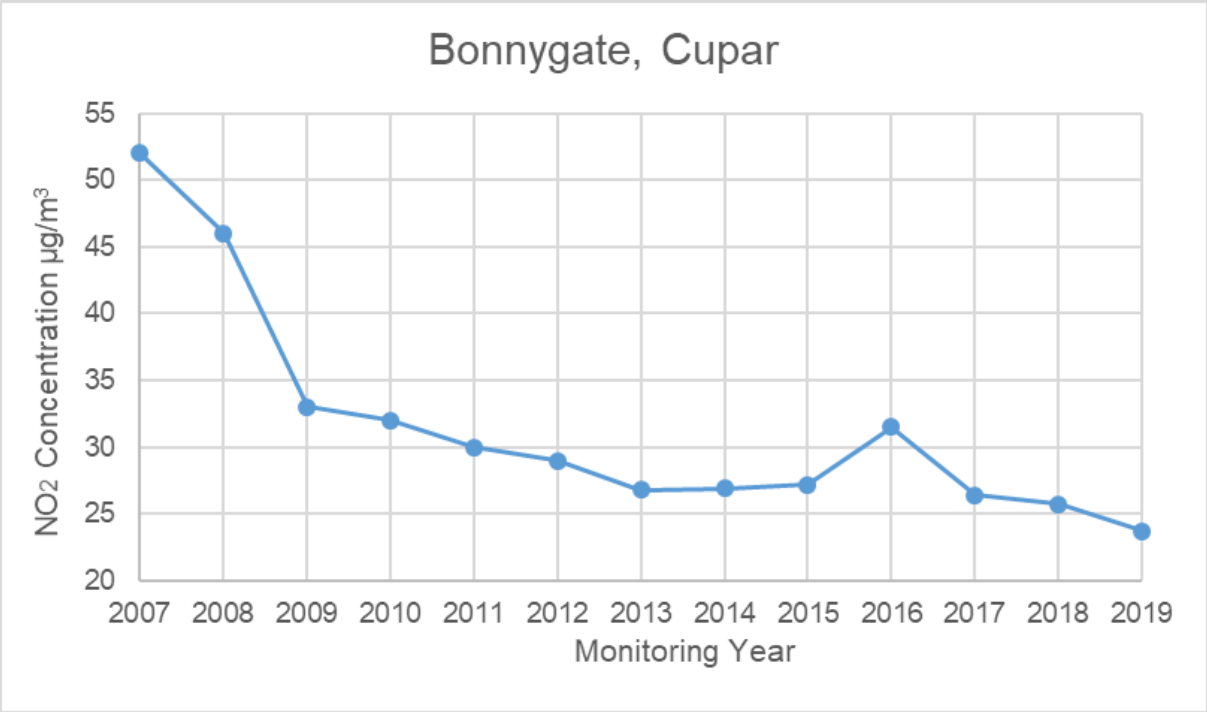
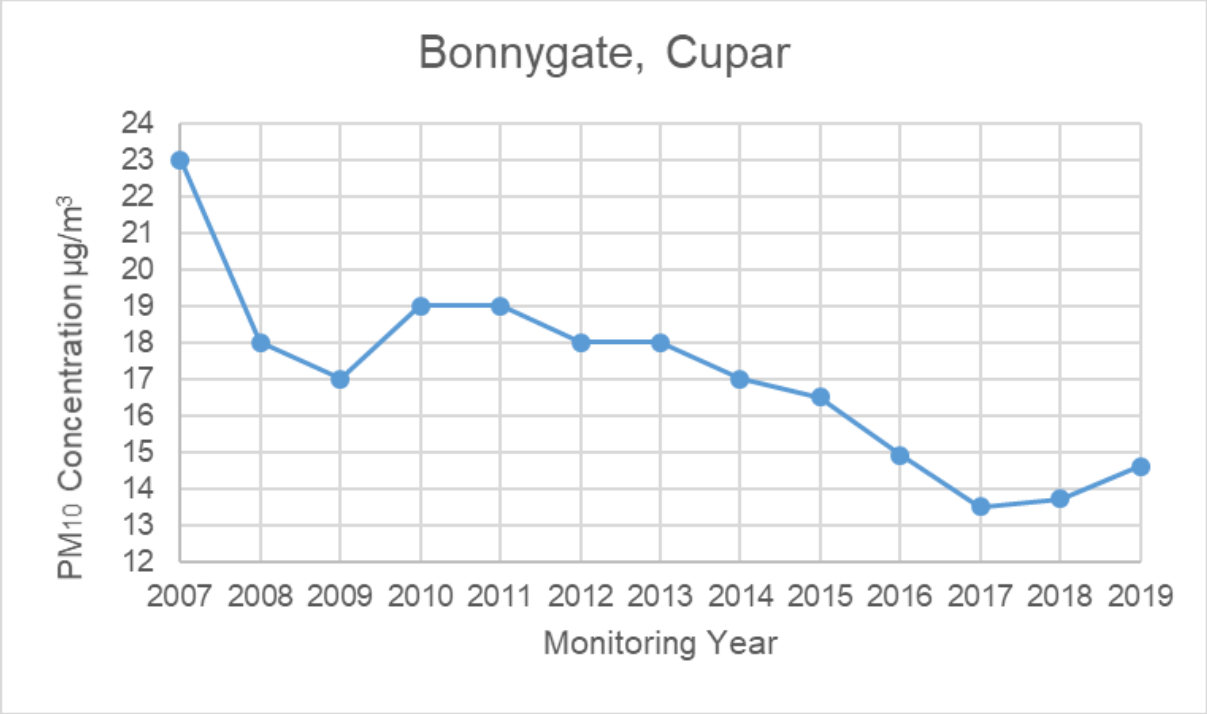


Figure 2.4 PM_{10} Automatic Monitoring Results 2007-2019 – Bonnygate, Cupar



2.2.4 Progress on Appin Crescent AQMA

NO_2 concentrations within Appin Crescent steadily decreased between 2007 and 2010; they increased slightly in 2011 and stayed consistent in 2012. Between 2012 and 2014 NO_2 concentrations dropped significantly. After a minor increase in 2015 concentrations continued to decrease steadily from 2015 until 2019 likely as a result of the Action Plan measures being implemented. Since 2007 NO_2 concentrations have reduced by 34% from 31 µg m^{-3} to 20.5 µg m^{-3}.

PM_{10} concentrations increased from 2008 to 2010, before declining gradually until 2013. From 2013 until 2015 concentrations increased slightly before reducing significantly between 2015 and 2017. Since 2017 PM_{10} concentrations have increased slightly. Concentrations have remained below the annual mean objective, with the exception of 2010. PM_{10} monitoring started in 2008 since then concentrations have reduced by 25% from 16 µg m^{-3} to 11.2 µg m^{-3}.

Automatic monitoring annual mean concentrations going back to 2007 for NO_2 and PM_{10} are shown in in Figure 2.5 and Figure 2.6 respectively.

Figure 2.5 NO_2 Automatic Monitoring Results 2007-2019 – Appin Crescent, Dunfermline

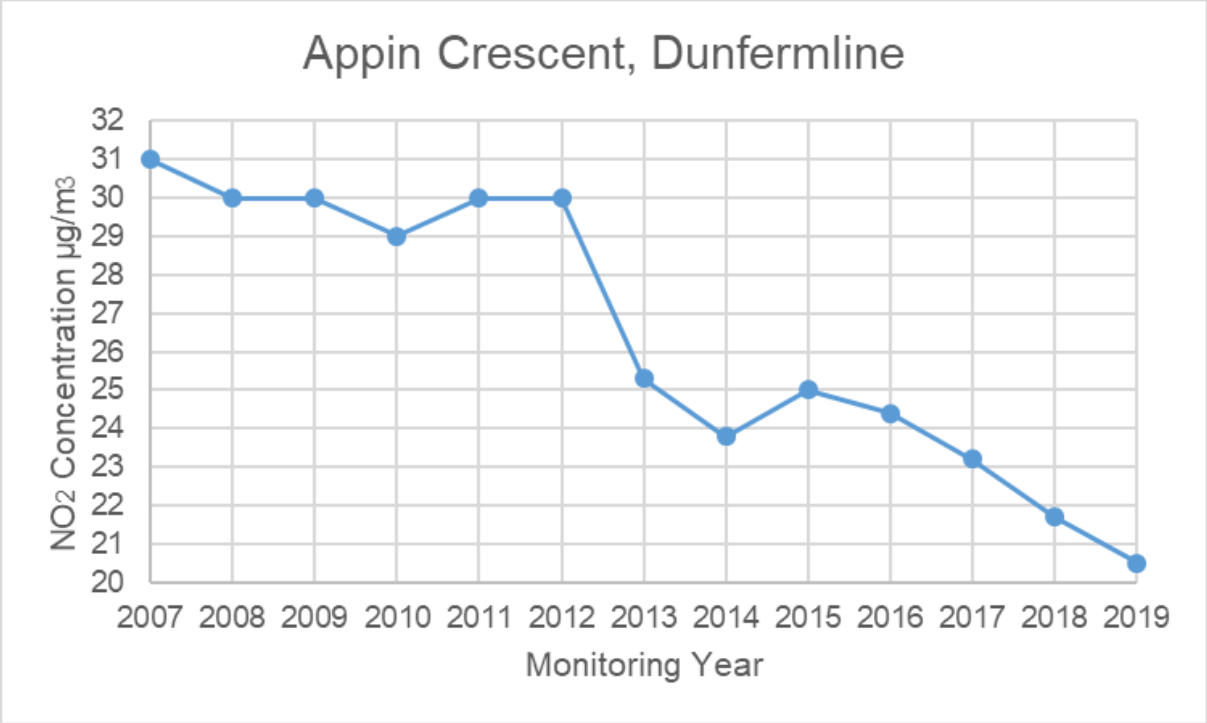
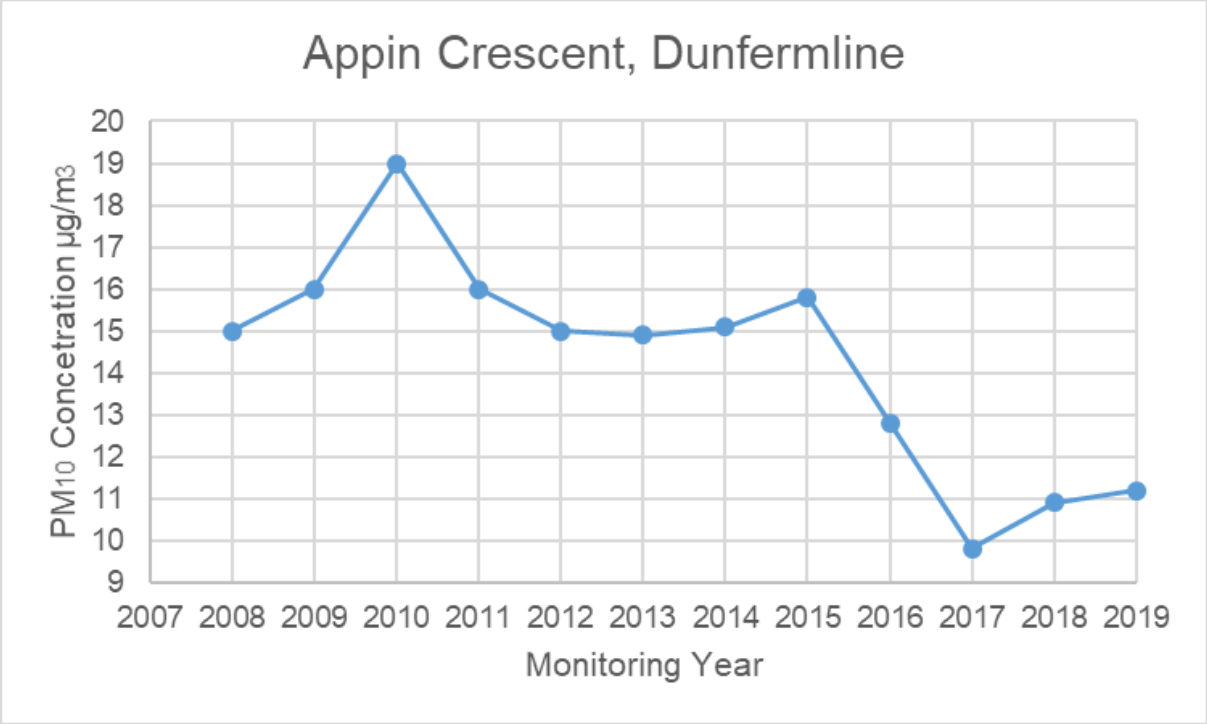


Figure 2.6 PM_{10} Automatic Monitoring Results 2007-2019 – Appin Crescent, Dunfermline



2.2.5 Fife ECO Stars Scheme

Fife's ECOStars Fleet Recognition scheme continues to recruit strongly. Having completed its 6th year, the scheme strikes a balance between recruitment of new operator members and ongoing support of the existing membership, providing advice on good operational performance and clean vehicles. This year has seen an increase in the number of operators considering ULEV.

The scheme has grown to 210 fleet operator members, who operate more than 8200 vehicles in and around Fife.

Recruitment of new members continues to reflect the full spectrum of fleets operating in Fife, with van fleets such as MGB Services and McLays in addition to hauliers operating heavy goods vehicles, such as Seacliff Haulage. We have seen an increase in bus and coach operators from other LA areas joining as they are regularly travelling in, around and through Fife. The scheme is also of interest to national operators, with Scottish Fire and Rescue joining this year.

Ongoing support of the membership can result in star rating upgrades where good practice has been implemented, having a positive effect on air quality in Fife. One example is local company Growforth, who have upgraded their fleet and invested in driver training following recommendations made after their initial ECOStars assessment, resulting in a 3 to 4 star upgrade.

The parallel ECOStars Taxi and Private Hire scheme has more than doubled the number of operators to 67 members, covering 365 vehicles. The increase of membership as a requirement for social work contracts had a positive impact on recruitment efforts.

ECOStars continues to be supported by the Scottish Government as part of its clean air strategy, and TRL also keep the scheme profile high by attending local forums such as the SESTran Logistics and Freight Forum.

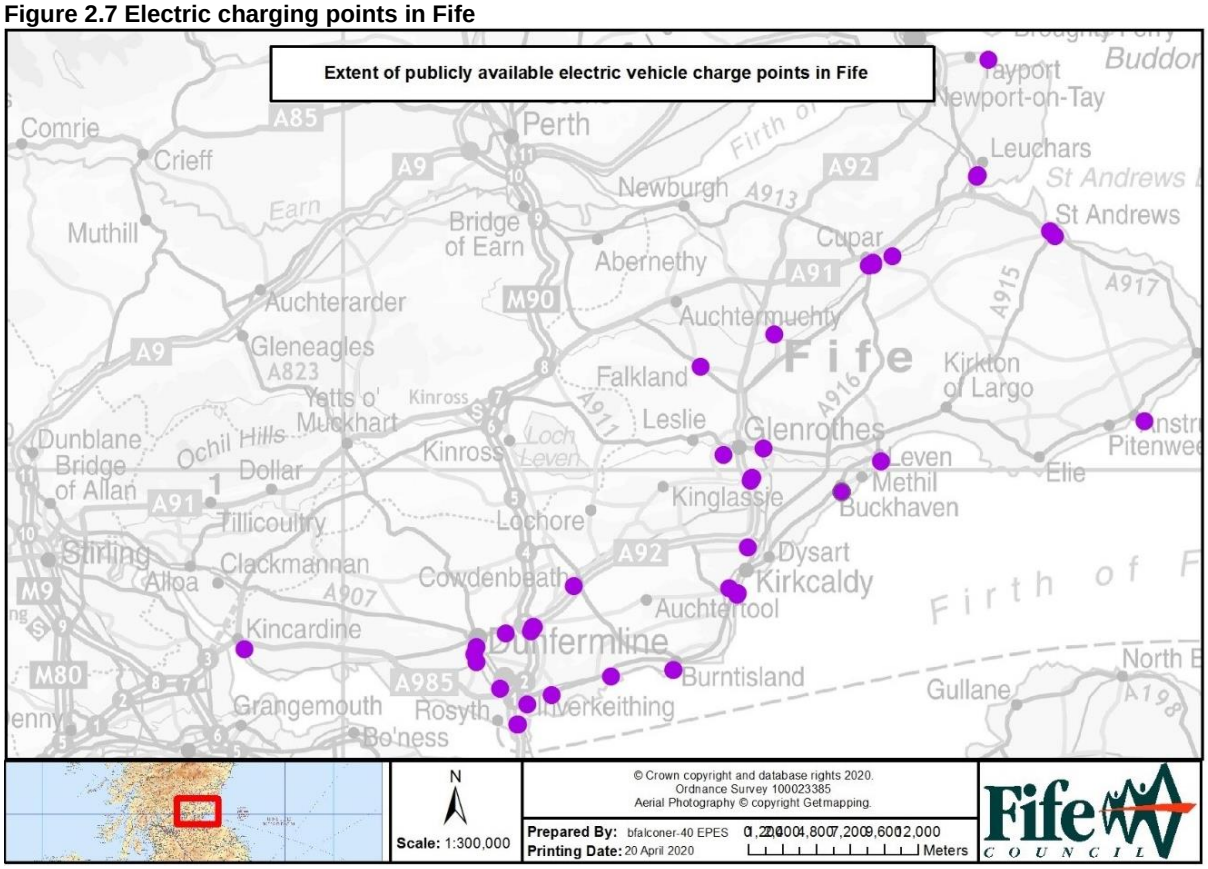
2.2.6 Targeting emissions from Council Fleet

Fife Council continues to make good progress towards increasing the number of electric vehicles and publicly available charging points in Fife. This action has direct impacts on both the Bonnygate and Appin Crescent AQMAs and works towards reducing transport emissions as detailed in the AQAPs for both areas. By the end of 2019 Fife Council's Fleet Operations had 36 full electric vehicles and 19 hybrid vehicles in service. In addition, several new publicly available charge points had been added to the network during 2019 including:

- Halbeath Park & Ride, Dunfermline – Six 7kW chargers, one 22kW charger and two 50kW rapid chargers;
- Halbeath Depot – One 50kW rapid charger;
- College Street car park, Buckhaven – One 22kW charger;
- Links Place car park, Burntisland – One 22kW charger, and;
- Leuchars Railway Station – One 7kW charger

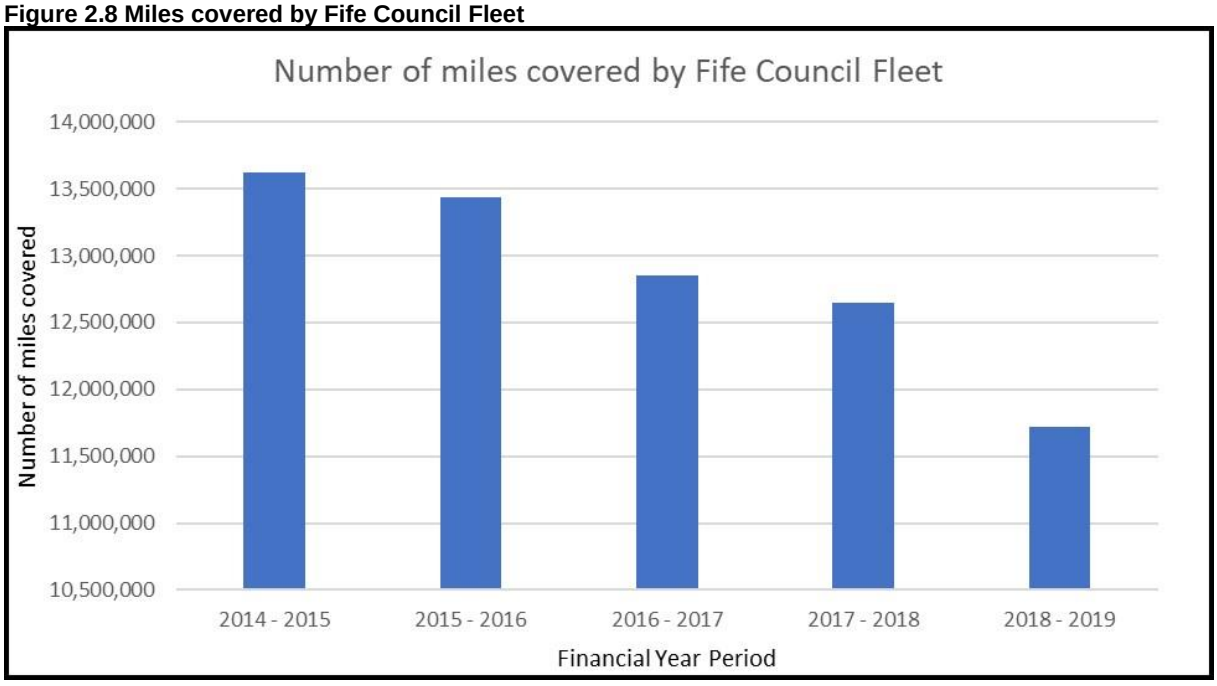
The full extent of the number of charging point locations across Fife can be seen in Figure 2.7. With specific reference to Cupar, there were 253 charge point users in 2019 (up from 184 in 2018 and 141 in 2017) and in terms of Dunfermline there were 1,143 charge point users in 2019 (up from 724 in 2018 and 619 in 2017) showing an ever increasing use of electric vehicles within these areas of interest (current AQMAs).

Figure 2.7 Electric charging points in Fife



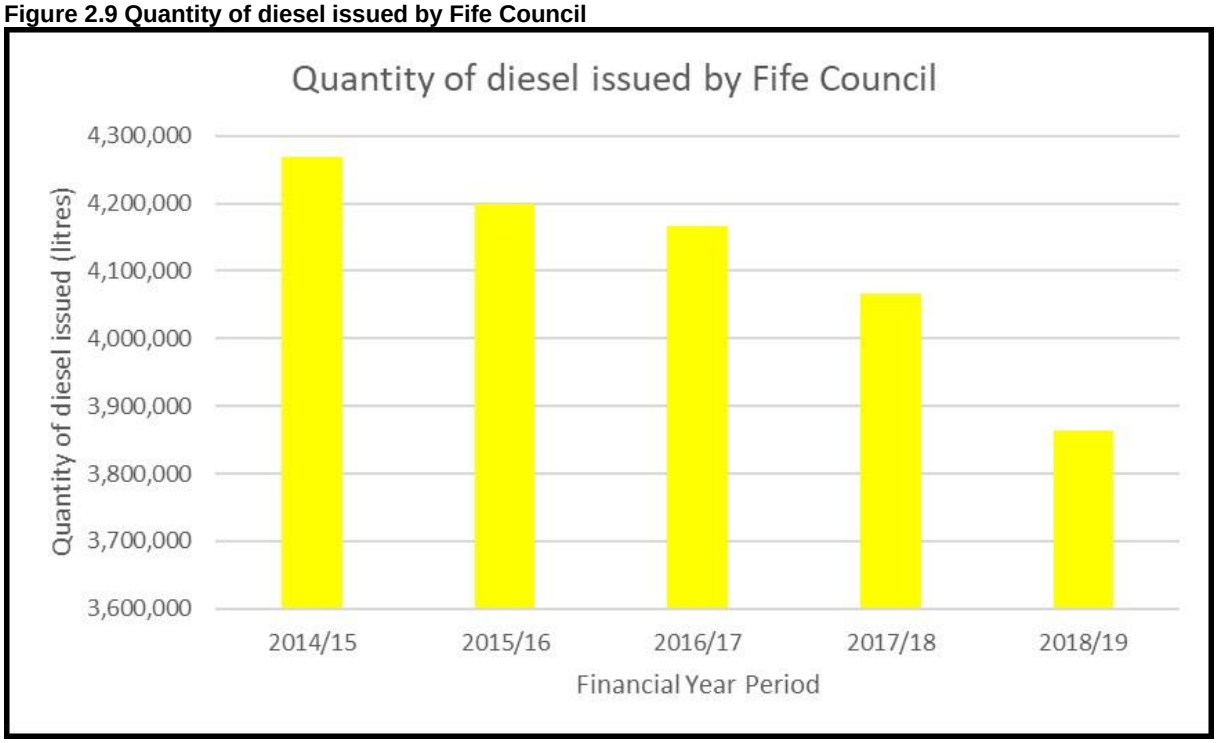
Associated with the increase in electric vehicles within the Council Fleet is an overall reduction in the overall Fleet size. Since 2011/12 the Fleet Demand Challenge Approach adopted by the Council has reduced the Fleet size by over 360 vehicles and has resulted in an associated reduction in the overall mileage covered. The mileage covered by the Council Fleet has reduced from 13,624,727 miles in 2014/15 to 11,715,613 miles in 2018/19 (Figure 2.8). This is an overall reduction of 1,909,114 miles over this time period.

Figure 2.8 Miles covered by Fife Council Fleet



Associated with the reduction in mileage covered is a significant reduction in the diesel used by the Fleet. The amount of diesel used by the Council Fleet has reduced from 4,269,548 litres in 2014/15 to 3,864,122 litres in 2018/19 (Figure 2.9). This is an overall reduction of 405,426 litres and equates to a CO_2 reduction of 1,065 tonnes.

Figure 2.9 Quantity of diesel issued by Fife Council



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 Fife 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." **(CAFS T1 2015)**

Fife Council was the first Local Authority in Scotland to write a travel plan back in 1999 and to monitor how things are changing; an Employee Travel Survey is carried out every two years. The Fife Council Travel Plan promotes sustainable travel with a hierarchy of walking, cycling, public transport and car share which is consistent with the key aims and objectives of Fife Council's Air Quality Strategy 2015-20 and the Appin Crescent (Dunfermline) and Bonnygate (Cupar) Air Quality Action Plans (updated 2015).

Fife Council have several initiatives in place, which include:

- TripshareFife.com - allowing you to find people travelling to similar locations to car share with: https://liftshare.com/uk/community/fifetripshare
- Cycle to Work Scheme – providing you an opportunity to purchase a new bike and/or safety accessory and pay direct from your salary, saving money and spreading the cost.
- Working with Schools to assist them in producing school travel plans.
- WOW (Walk Once a Week)
- Bikeability – providing cycle training to primary school children P4 -7 (Discussed below in Section 2.2.5)

The "Walk Once a Week" Campaign has continued over 2019 (and into 2020) and is now in its fifth year. WOW is a partnership between Fife Council and Living Streets Scotland that continues to progress the active travel agenda in Fife Primary schools and increase the uptake of active travel. Levels of active travel remain well above average amongst the WOW schools in Fife with 85% of pupils (as of March 2020) utilising active travel measures to get to school (through walking, park & stride or using a bike or scooter). This compares with a 70% average across all other Fife schools.

Throughout the academic year, the Living Streets' Walk of Fame competition encourages schools across Scotland to join in and track as many active journeys as they can via the WOW Travel Tracker. The Walk of Fame is a fun and engaging way for schools to reach even higher levels of active travel and demonstrate how much they have embedded WOW as they try and get into the national top ten of the most active schools.

During the October 2019 Scotland Walk of Fame for International Walk to School Month Fife Council schools features regularly in the top 10 results with Auchtertool Primary winning prizes in the second week of the competition (for schools under 250 pupils). Other schools to feature in the top ten in this category included Milesmark Primary (Dunfermline) and St Agatha's Primary (Leven). Fife schools also featured in the top ten for schools in the over 250 pupils category in the form of Capshard Primary (Kirkcaldy) and Commercial Primary (Dunfermline).

Throughout December Fife schools also featured well in the Festive Walk of Fame with several making it into the top ten. On day 2 of the challenge Auchtertool Primary was first, Milesmark Primary (Dunfermline) second and Crossgates Primary third in the up to 250 pupils category. In the over 250 pupils category Commercial Primary (Dunfermline) was first and Capshard Primary (Kirkcaldy) was fourth.

In March 2020 the Scotland Walk of Fame for World Book Day took place and Fife schools featured in the top 10 every day of the week. On World Book Day (5th March) Milesmark Primary (Dunfermline) finished first in the under 250 pupils category and won the prize of a set of books for the school library.

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

The Scottish Government 'expect any Scottish local authority which has or is currently developing a Sustainable Energy [Climate] Action Plan to ensure that air quality considerations are covered, (Clean Air for Scotland – The Road to a Healthier Future 2015, P21)'.

On 6th February 2020 Fife Council's Environment and Protective Services Committee approved the Sustainable Energy Climate Action Plan - Climate Fife. [https://climatechange.fife.scot].

Climate Fife includes a practical action plan for mitigation activities and a Risk and Vulnerability Assessment to outline the challenge for adaption action. To expedite the work, and to reflect the climate emergency, a 12-month emergency action plan has been prepared to March 2021.

Climate Fife is a Fife wide plan. Reducing carbon emission and adapting to unavoidable climate change are also therefore priorities for the Fife Partnership. A review is underway to bring forward more action on the climate emergency into the Plan for Fife - the Local Outcome Improvement Plan.

Air Quality and linked low carbon emissions actions are covered under the Sustainable Transport theme in the Climate Fife Action Plan. Additionally, Fife Council is to bring a revised Carbon Management Plan to committee, April 2020.

Fife Councils Land & Air Quality Team continues to work closely with the Council's Climate Change team to ensure air quality is considered.

2.3.3 NHS Boards and their Local Authority Partners will include reference to air quality and health in JHPP-H2

"NHS boards and their local authority partners will include reference to air quality and health in the next revision of their Joint Health Protection Plans, which should identify and address specific local priority issues." **(CAFS H2 2015)**

Fife Council has in partnership with NHS Fife updated its Joint Health Protection Plan (JHPP) for 2018-2020 whereby this includes specific reference to air quality in terms of the existing Bonnygate and Appin Crescent AQMAs, Fife Council's Air Quality Strategy 2015-20 and highlights the importance of a collaborative approach to tackling air quality issues. The Joint Health Protection Plan (JHPP) will be updated during 2020 as well as the Bonnygate and Appin Crescent AQAPs and Fife Council's Air Quality Strategy.

2.3.4 Planning Authorities – Planning authorities to review the Local Development Plan-P2

"Expect planning authorities to review the Local Development Plan and revise at the next scheduled update to ensure policies are consistent with CAFS objectives and any local authority air quality action plans." ***(CAFS P2 2015)***

The Low Carbon Fife Supplementary Guidance was adopted in January 2019 and now forms a statutory part of the Local Development Plan (FIFEplan) which was adopted in September 2017. This guidance incorporates the air quality development guidelines which are designed to assist developers in considering and meeting the relevant air quality requirements. Initial stages of reviewing the Local Development Plan (FIFEplan) are due to begin towards the end of 2020.

2.3.5 Cycling Action Plan-T3

"We will work with partners to deliver our shared vision in the Cycling Action Plan for Scotland that by 2020, 10% of everyday journeys will be made by bike." **(CAFS T3 2015)**

Fife has one of the UK's most comprehensive cycling networks. Over 350 miles of sign posted cycle network includes a variety of leisure and commuting routes. Terrain varies from off road disused railway tracks to routes in forests and from networks in towns and networks in quiet country lanes.

Cycling is promoted through encouraging active schools. In schools across Fife the latest figures (Hands Up Travel To School) show that 3% of children travel to nursery and primary school by cycling. Cycling is further promoted within schools via the Bikeability scheme. Up to March 2020 the number of pupils signed up to take part across Levels 1, 2 and 3 were:

- Level 1 – 1424 pupils from 44 schools (836 pupils have completed)
- Level 2 – 955 pupils from 32 schools (300 have completed)
- Level 3 – 0 pupils (6 pupils have previously completed)

In addition CTA training is now being offered to all schools within Fife and delivered at the requested schools. Up to March 2020 the number of pupils signed up to take part was:

- 30 pupils from 5 schools

2.3.6 Work with key partners to investigate the use of hydrogen as a transport fuel-T10

"Work with key partners to investigate the use of hydrogen as a transport fuel, as well as exploring wider environmental and economic opportunities of using hydrogen for energy applications – especially in promoting renewables, energy balancing and storage." **(CAFS T10 2015)**

Hydrogen and fuel cell (HFC) technologies can provide services throughout Scotland's energy system and is becoming widely recognised as a key catalyst to decarbonising Scotland's energy production and use, with an emphasis on an integrated approach to transport as well as heat and power.

One of Scotland's leading forces behind making this a reality is Fife through its pioneering Levenmouth Community Energy Project, a collaborative initiative which is being led by Bright Green Hydrogen and supported by a number of partners including Fife Council and Toshiba.

Part of this project also involved Levenmouth becoming home to one of Europe's largest fleet of hydrogen dual-fuel vehicles (17 vehicles), seven of which are operated by Fife Council. The fleet includes 10 electric-powered Renault Kangoo vans with H2 fuel cell range extender which will be 100% zero emissions if charged using the Hydrogen Office's 100% green electric vehicle charging station. The project also includes five Ford Transit vehicles and two Refuse Collection Vehicles (RCVs) that were converted to run on a diesel and hydrogen mixture and are operated by Fife Council.

Recent correspondence with the Councils Fleet Services indicates that the seven Council operated vehicles discussed above are now running on diesel only as there is currently no more funding available for Bright Green Hydrogen and as such there have been issues with the supply of hydrogen for vehicle refuelling purposes.

Alternative uses for the hydrogen are however continuing to be explored in terms of it potentially being used to heat local homes. Funding has now been secured by SGN to progress the feasibility of zero carbon hydrogen generation from offshore wind in Fife in the Levenmouth area. An associated project (Hydrogen 100) aims to lay the foundations for this change while giving residents in the local area the opportunity to be at the leading edge of the low-carbon economy. If these proposals (H100) are approved by Ofgem SGN will build a world-first hydrogen network in Levenmounth. In the project's first phase, the network will heat around 300 local homes using green hydrogen generated from offshore wind.

Further information on the project is available at: https://sgn.co.uk/H100Fife and https://www.investinfife.co.uk/blogs/news/1190/redir/

2.3.7 Freight Quality Partnerships-T12

"Encourage each local authority with an AQMA to create a Freight Quality Partnership (or utilise an existing RTP Freight Quality Partnership) and consider appropriate measures for local air quality improvement by 2017." **(CAFS T12 2015)**

Fife Council continues to explore the potential to develop Freight Quality Partnerships through the on-going implementation of the Fife ECO Stars Fleet and Taxi schemes which includes the running of future workshop events with key stakeholders.

2.4 National Low Emission Framework (NLEF) Stage 1 Screening Appraisal for Fife Council

The NLEF[1], which is now part of the review and assessment process for LAQM reporting in Scotland, contributes to the Cleaner Air for Scotland strategy by aiming to improve local air quality in areas where air quality objectives are exceeded, or likely to be exceeded, primarily due to emissions from transport.

The NLEF is directly linked to Air Quality Action Planning (AQAP) for local authorities with Air Quality Management Areas (AQMAs) and will help to identify actions to improve local air quality within AQMAs. The NLEF appraisal takes the form of a two-stage process, as summarised in Table 2-8:

Table 2-8 NLEF Appraisal Process

Stage		Outcome	Actions Required
1	Screening	• decision on whether to proceed to stage two assessment	• screening process to identify actions that will benefit air quality within the AQMA • screening evidence should form part of the Annual Progress Report, with the decision agreed by Scottish Government and SEPA
2	Assessment	• decision to proceed with introduction of LEZ or identification of alternative transport-related measures required to improve air quality • Stage two assessment report agreed by Scottish Government and SEPA	• NMF approach to support assessment of sources of pollution and options • quantitative impact assessment (based on predicted change in pollutant concentrations) • consideration of consequential impacts (e.g. congestion, export of pollution)

The NLEF Stage 1 Screening Appraisal for Fife Council is detailed in Table 2-9. It is the opinion of Fife Council that the proposed measures adopted thus far are sufficient and there is therefore no need to proceed to a Stage 2 Assessment.

Since the declaration of the Appin Crescent AQMA in 2011, amended AQMA in 2012, and the adoption of the AQAP in 2012, concentrations of NO_2 and PM_{10} recorded within Appin Crescent have declined significantly. Measured concentrations of both pollutants in recent years have been well below the annual mean objectives, and through the continued implementation of further measures included within the AQAP, the Council are helping to ensure the continued improvement of air quality within the AQMA, and ongoing compliance with the air quality objectives. Fife Council will continue to review air quality monitoring data together with guidance from the Scottish Government and evaluate the appropriateness of revoking the Appin Crescent AQMA.

In respect to the consideration for the requirement for a Low Emission Zone, Fife Council has considered the following aspects in relation to Appin Crescent :

- Fife Council has achieved significant improvements in concentrations of NO_2 and PM_{10} within the Appin Crescent AQMA through the targeted implementation of its AQAP and seeks to bring about continued improvement in air quality through ongoing implementation of measures listed in the AQAP;
- Monitored concentrations of both NO_2 and PM_{10} within the Appin Crescent AQMA now meet the air quality objectives;
- The spatial nature of the historic exceedances of NO_2 and PM_{10} identified in Appin Crescent are restricted in nature;
- A significant reduction in vehicle traffic through the AQMA has been achieved; and

[1] https://www.gov.scot/publications/national-low-emission-framework/pages/2/

- The Appin Crescent (A907) represents a key trunk road connecting Dunfermline to the M90 and the rest of Fife. Any vehicle restrictions enforced on this road could have significant impacts on public mobility, and/or result in the diversion of vehicles onto alternative, smaller residential roads.

Since the declaration of the Bonnygate, Cupar AQMA in 2008 and the adoption of the AQAP in 2010, concentrations of NO_2 and PM_{10} recorded within Bonnygate have declined significantly. Measured concentrations of both pollutants in recent years have been well below the annual mean objectives, and through the continued implementation of further measures included within the AQAP, the Council are helping to ensure the continued improvement of air quality within the AQMA, and ongoing compliance with the air quality objectives. Fife Council will continue to review air quality monitoring data together with guidance from the Scottish Government and evaluate the appropriateness of revoking the Bonnygate AQMA.

In respect to the consideration for the requirement for a Low Emission Zone, Fife Council has considered the following aspects in relation to Bonnygate:

- Fife Council has achieved significant improvements in concentrations of NO_2 and PM_{10} within the Bonnygate AQMA through the targeted implementation of its AQAP and seeks to bring about continued improvement in air quality through ongoing implementation of measures listed in the AQAP.
- Monitored concentrations of both NO_2 and PM_{10} within the Bonnygate AQMA now meet the air quality objectives .
- The spatial nature of the historic exceedances of NO_2 and PM_{10} identified in Bonnygate are restricted in nature;
- The Bonnygate (A91) represents a key trunk road connecting Stirlingshire, Clackmannanshire, Perthshire and Fife. Any vehicle restrictions enforced on this road could have significant impacts on public mobility, and/or result in the diversion of vehicles onto alternative, smaller residential roads.

Consequently, it is Fife Council's opinion that a Low Emission Zone is neither required or a suitable option for improving ambient air quality in the Appin Crescent or Bonnygate AQMAs.

It is Fife Council's view that the measures and actions undertaken by the Council have brought about cost-effective improvements in air quality as rapidly as possible and as such, the Council do not propose to proceed to Stage 2 NLEF assessments for either of the AQMAs.

Table 2-9 NLEF Stage 1 Screening Appraisal

No.	NLEF Stage 1 Screening Appraisal Question	Appraisal Response
1	What is the name of the declared AQMA(s)?	Appin Crescent, Dunfermline Bonnygate, Cupar
2	What pollutants are the AQMA(s) declared for?	Nitrogen Dioxide (NO_2) and Particulate Matter (PM_{10})
3	What are the main sources of air pollution, or other factors, contributing to the declaration of the AQMA? *(If the main source is not transport–related no further screening is required).*	Traffic sources
4	Are the declared AQMA(s) (and therefore area(s) of exceedance) restricted in nature geographically to a small area for which a Low Emission Zone (LEZ) would not be appropriate or proportionate (e.g. single streets, road junctions, small town centre)?	Yes – Appin Crescent is restricted to a single street only Yes – Bonnygate is restricted to only a few streets
5	Do the monitored concentrations within the AQMA(s) meet the air quality objective(s)? If yes, for how long has compliance been achieved? If not, what are the extent of the exceedances?	Yes – since 2013 With a slight exceedance (43 µg m^{-3}) being recorded at Appin Crescent 6(A,B,C) in 2015 With a slight exceedance (41 µg m^{-3}) being recorded at Bonnygate B4 in 2016
6	What is the current trend for pollutant concentrations within the AQMA(s) (state the trend for each pollutant declared)?	NO_2 and PM_{10} are both decreasing at Appin Crescent and Bonnygate
7	Are there any major planned developments which could impact air quality within or surrounding the AQMA(s)?	Not at Appin Crescent At Bonnygate a new development comprising of the demolition of derelict buildings and the construction of 24 affordable housing units and 1 retail unit is proposed for the gap site at 26 to 32 Boonygate. An Air Quality Impact Assessment will be required to support the application to assess the potential to exert a detrimental impact on air quality. However, at the time of writing, no impact assessment has yet been received
8	What are the current trends for vehicle movements within the AQMA and surrounding areas?	Traffic count data recorded at Appin Crescent shows a decline in traffic over the past 10 years. Between 2009 and 2019, total traffic flow (Eastbound and Westbound) have reduced by up to 10% for both the working week and full week averages. The morning

		and afternoon peak traffic flows have also reduced on average by 4% and 8-11%, respectively. The data for Bonnygate shows a variable trend in average weekly vehicle numbers within the AQMA. Average vehicle numbers over the working week and the full week increased between 2004 and 2006 before falling fairly steadily until 2013, with a slight increase in 2012. Traffic volume has shown a slight increase between 2013 to 2019 except for a notable dip in 2018, likely due to the closure of a connecting road. A similar trend is evident in peak traffic counts. Total traffic flow (Eastbound and Westbound) in 2019 has been shown to be up by 7 to 9% on average compared to 2009. For peak morning traffic, the vehicle count increased by 4% (5 day) and 12% (7 day) compared to 2009 and increased by 6 to 7% for afternoon traffic.
9	Provide evidence showing how the AQAP (and associated plans, programmes and strategies) will deliver significant improvements towards achieving the air quality objective(s) in as short a timescale as possible?	Since the declaration of the Appin Crescent AQMA in 2011, amended AQMA in 2012, and the adoption of the AQAP in 2012, concentrations of NO_2 and PM_{10} recorded within Appin Crescent have declined significantly. Measured concentrations of both pollutants in recent years have been well below the annual mean objectives, and through the continued implementation of further measures included within the AQAP, the Council are helping to ensure the continued improvement of air quality within the AQMA, and ongoing compliance with the air quality objectives. Fife Council will continue to review air quality monitoring data together with guidance from the Scottish Government and evaluate the appropriateness of revoking the Appin Crescent AQMA. Since the declaration of the Bonnygate, Cupar AQMA in 2008 and the adoption of the AQAP in 2010, concentrations of NO_2 and PM_{10} recorded within Bonnygate have declined significantly. Measured concentrations of both pollutants in recent years have been well below the annual mean objectives, and through the continued implementation of further measures included within the AQAP, the Council are helping to ensure the continued improvement of air quality within the AQMA, and ongoing compliance with the air quality objectives. Fife Council will continue to review air quality monitoring data together with guidance from the Scottish Government and evaluate the appropriateness of revoking the Bonnygate AQMA.

3 Air Quality Monitoring Data and Comparison with Air Quality Objectives

3.1 Summary of Monitoring Undertaken

This section sets out the monitoring that has taken place within Fife during 2019 and how local concentrations of the main air pollutants compare with the relevant objectives.

3.1.1 Automatic Monitoring Sites

Fife Council undertook automatic (continuous) monitoring at four sites during 2019, which measure NO_2, PM_{10}, and $PM_{2.5}$ concentrations. These are Cupar, Dunfermline, Kirkcaldy, and Rosyth. Table A.1 in Appendix A provides the site details for all automatic monitoring locations. National monitoring results are also available at: http://www.scottishairquality.scot/data/data-selector.

All PM_{10} analysers were upgraded to FIDAS during 2016 and included monitoring of $PM_{2.5}$, PM_1 and total suspended particles (TSP). However, results for 2019 have only been reported for PM_{10} and $PM_{2.5}$.

Maps showing the location of the automatic monitoring sites in 2019 are provided in Figure 3.1 to Figure 3.5. Further details on the QA/QC of the automatic monitoring sites are included in Appendix C.

Short-period CO monitoring has also been undertaken by Fife Council's Transportation Department. Concentrations of 1,3 butadiene, benzene, nitrogen dioxide and sulphur dioxide measured independently in 2019 will be provided in the INEOS Grangemonth Oil Refinery Annual Community Air Quality Monitoring Report once made available to Fife Council.

3.1.2 Non-Automatic Monitoring Sites

Fife Council operates an extensive NO_2 diffusion tube monitoring survey with sites in East, West and Central Fife. In total there are 55 NO_2 diffusion tube monitoring sites throughout the Fife area. Of these, eight sites are triplicate sites, with four of these triplicate sites being co-located with the automatic analysers at Cupar, Dunfermline, Kirkcaldy and Rosyth.

There were two additional diffusion tube sites which commenced in 2019 at 102 Baldridgeburn, Dunfermline and 30 North Street, St Andrews. Bonnygate B2, Cupar was relocated slightly to the east due to numerous no returns. City Road 2, St Andrews and Bonnygate B3B, Cupar were removed as these were duplicate tubes. An additional 11 sites ceased monitoring after June 2019, due to continuously low readings over recent years. These were:

- Queensway, Glenrothes
- High Street, Leslie
- Cupar Road, Auchtermuchty
- Crossgate, Cupar
- Ladywynd, Cupar
- City Road 4, St Andrews
- North Approach Road A, Kincardine
- North Approach Road B, Kincardine
- 229 Admiralty Road, Rosyth
- 129 Admiralty Road, Rosyth
- 42 Chalmers Street, Dunfermline

Table A.2 in Appendix A shows the details of all diffusion tube sites included sites that ceased monitoring during 2019. Maps showing the location of the nitrogen dioxide diffusion tubes are provided

in Figure 3.1 to Figure 3.5. These focus on the main monitoring areas of Cupar, Dunfermline, Kirkcaldy, Rosyth and St Andrews. Further details on QA/QC and bias adjustment for the diffusion tubes are included in Appendix C. Monitoring ceased at a total of 13 sites throughout Fife during 2019 and therefore these sites required to be annualised in accordance with TG.16, details are provided in Appendix D.

Figure 3.1 Nitrogen dioxide diffusion tube locations – Bonnygate, Cupar AQMA

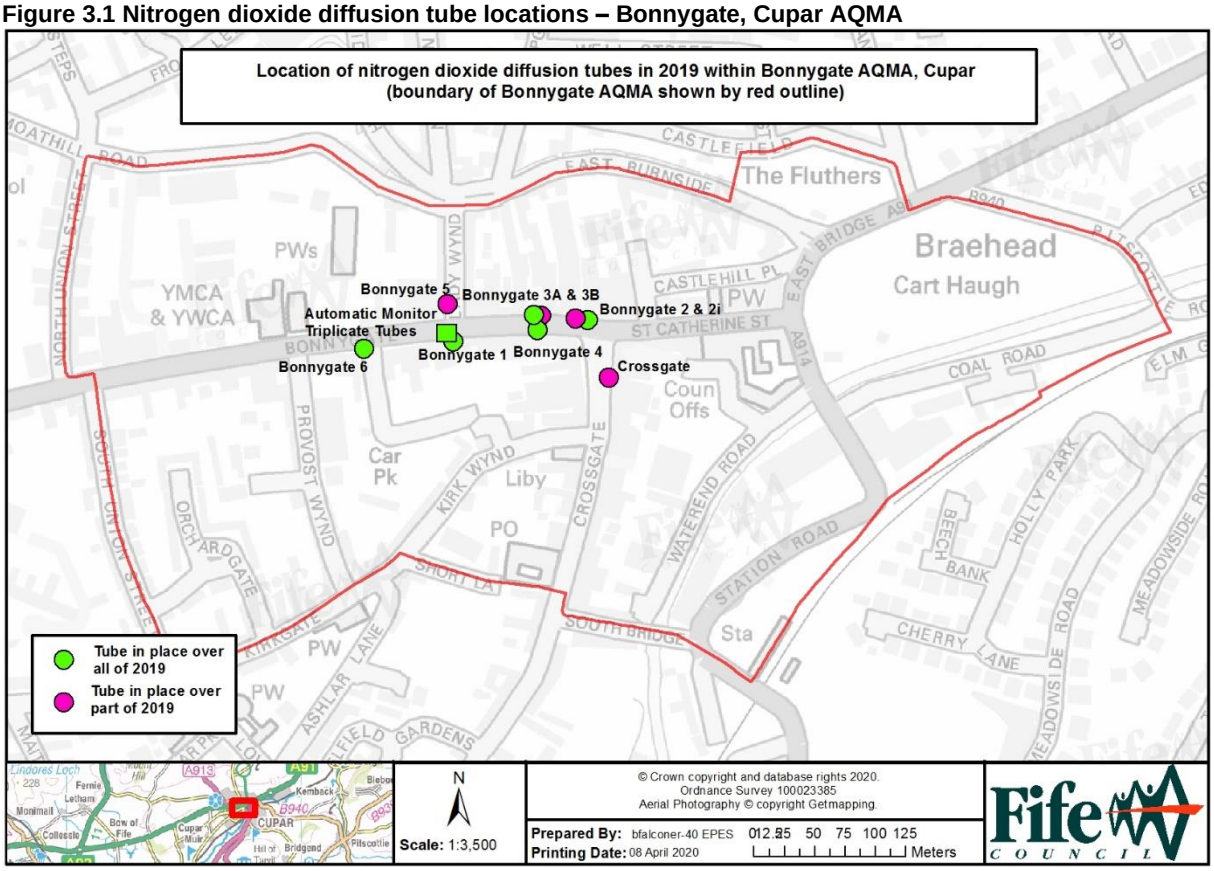


Figure 3.2 Nitrogen dioxide diffusion tube locations - Appin Crescent, Dunfermline AQMA

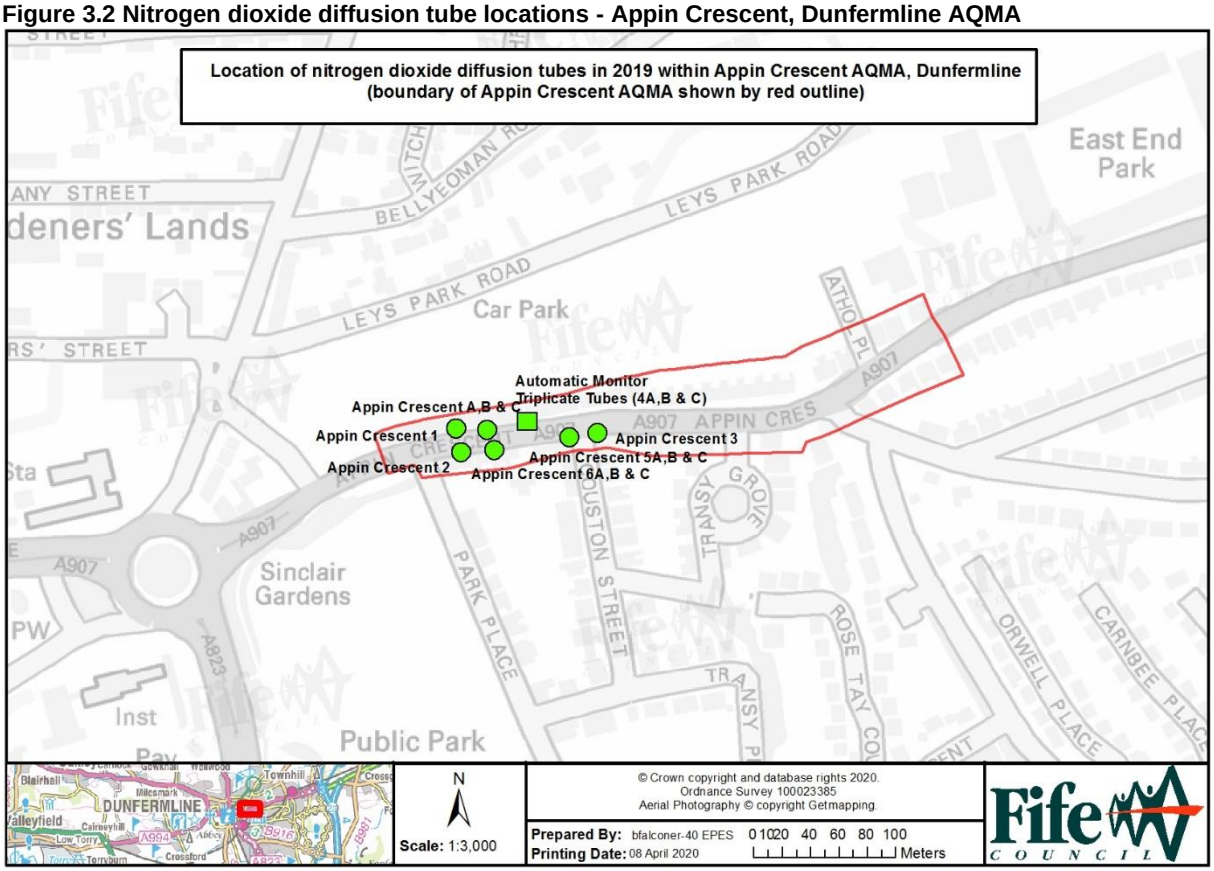


Figure 3.3 Nitrogen dioxide diffusion tube locations - Kirkcaldy

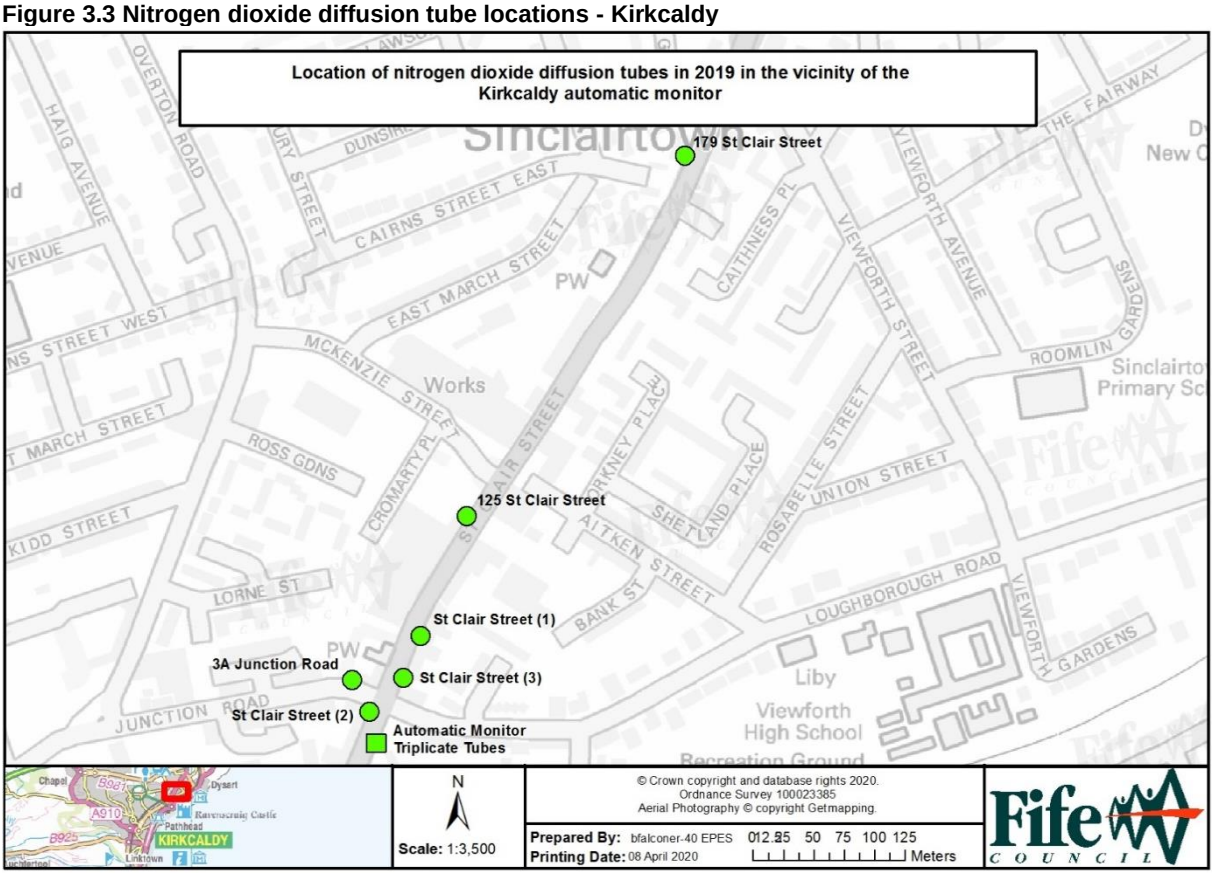


Figure 3.4 Nitrogen dioxide diffusion tube locations – Rosyth

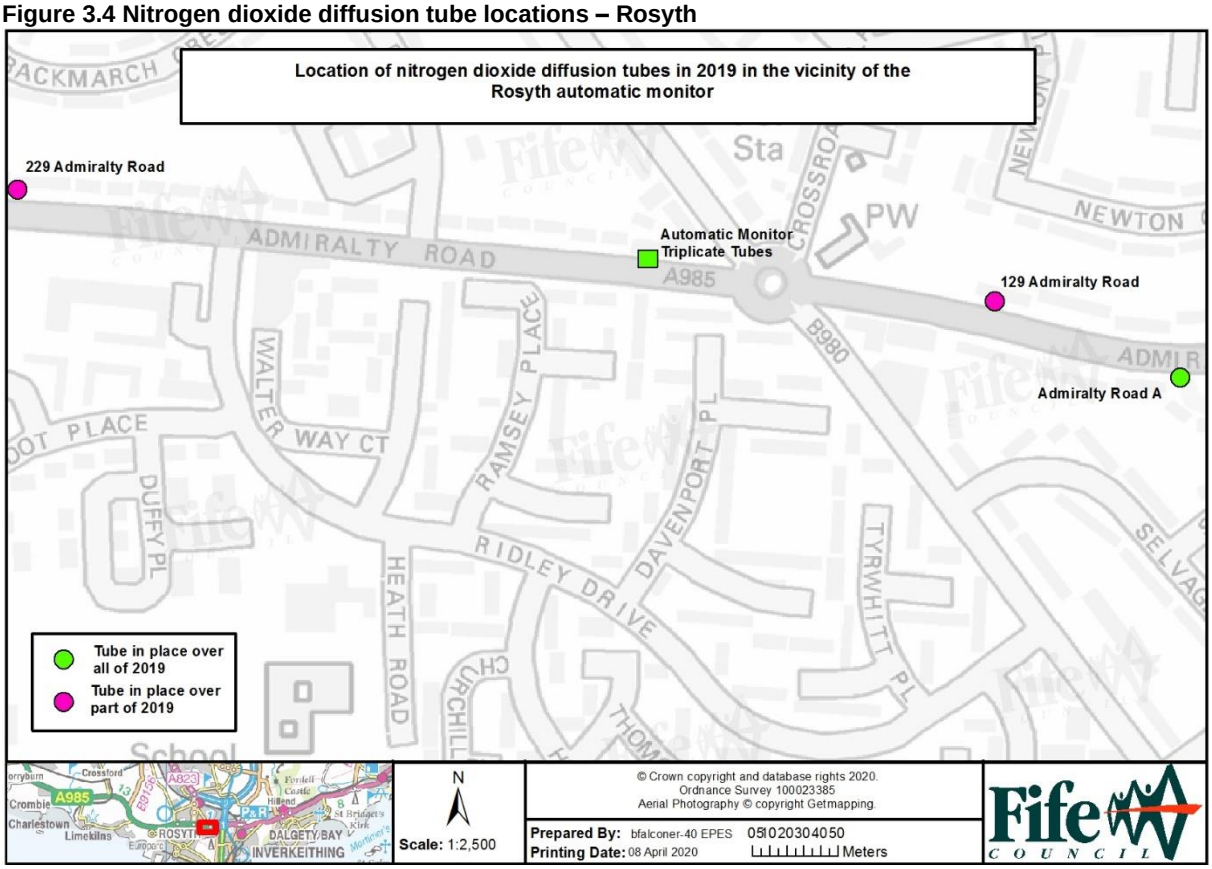
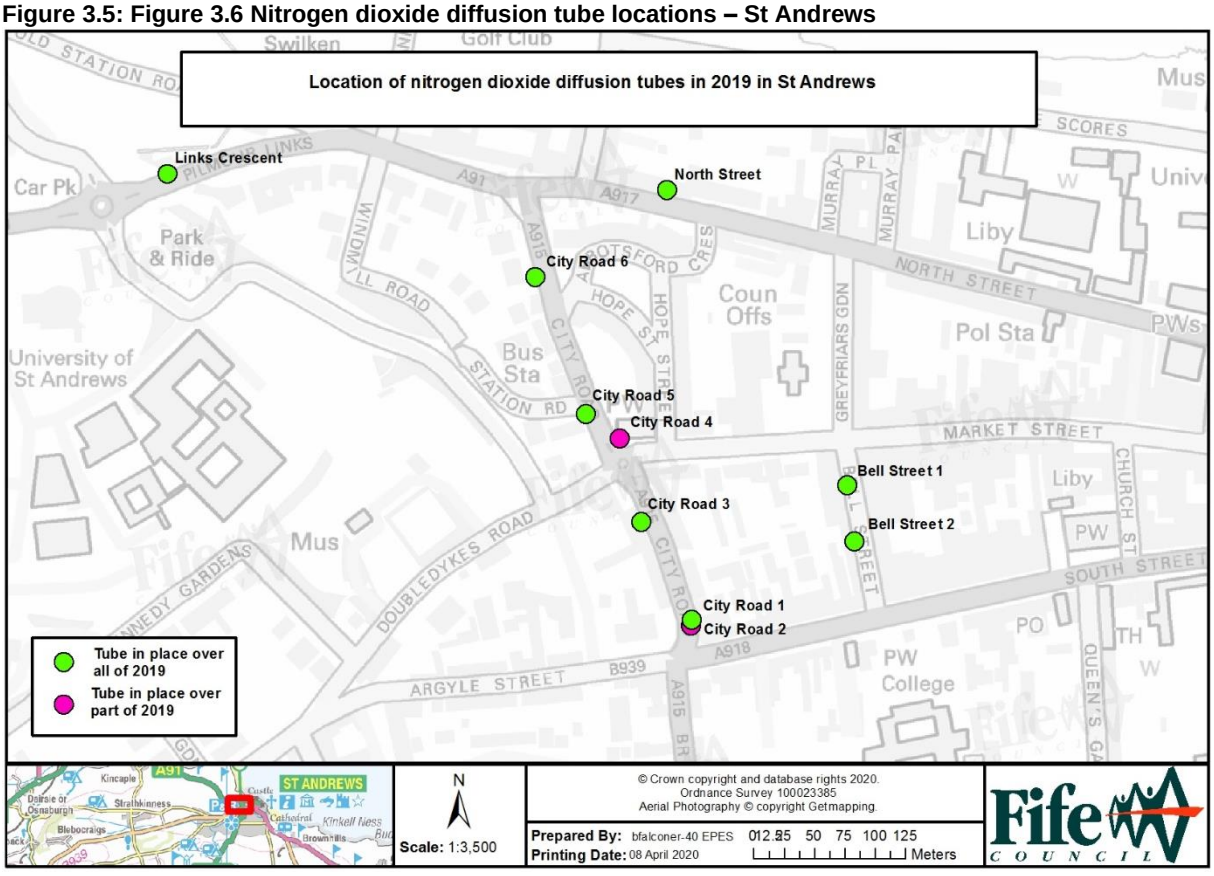


Figure 3.5: Figure 3.6 Nitrogen dioxide diffusion tube locations – St Andrews



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.

Additional trend analysis has been carried out in this section for the pollutants NO_2, PM_{10} and $PM_{2.5}$ using the Openair analysis tool and is provided in its entirety in Appendix H . This type of analysis helps the Council inform future policy making.

Openair is an innovative tool to analyse, interpret and understand air pollution data using "R". R is a free and open source programming language designed for the analysis of data. The Openair tool can perform complex and innovative analysis of current and archived air pollutant data allowing powerful data visualisation and interrogation. For this report Fife Council has utilised the following analysis tools;

- **Polar Plots** – This tool produces polar plots of pollutant concentrations by wind speed and wind direction. Polar plots are useful to gain a quick graphical representation of the relationship between pollutant concentrations and the meteorological conditions. This can be useful in identifying potential sources of pollution affecting the location, for example particle suspension is increased at higher wind speeds.
- **Time variation** - This tool produces four separate panes combined into a single plot: The plotted output shows the average variation by day of the week and hour of the day combined (the top-most pane), hour of the day (diurnal variation, shown in the lower left pane), month of the year (seasonal variation in the lower middle pane) and day of week (lower right pane) of one or more variables or at one or multiple sites over a user selected time range. The variation of a pollutant by time of day and day of week can reveal useful information concerning the likely sources at a particular site.
- **Calendar Plots** – This tool provides a way of visualising trends in daily pollutant concentrations across a year in the familiar form of a calendar. Concentrations are represented with a colour scale and the meteorological conditions can be represented using arrows giving the vector averaged wind direction, scaled according to the wind speed based on modelled wind speed and direction from data from the UK air quality forecast. In this way pollution episodes can be identified by date and sources potentially indicated by the combination of pollutant and meteorological conditions.

3.2.1 Nitrogen Dioxide (NO_2)

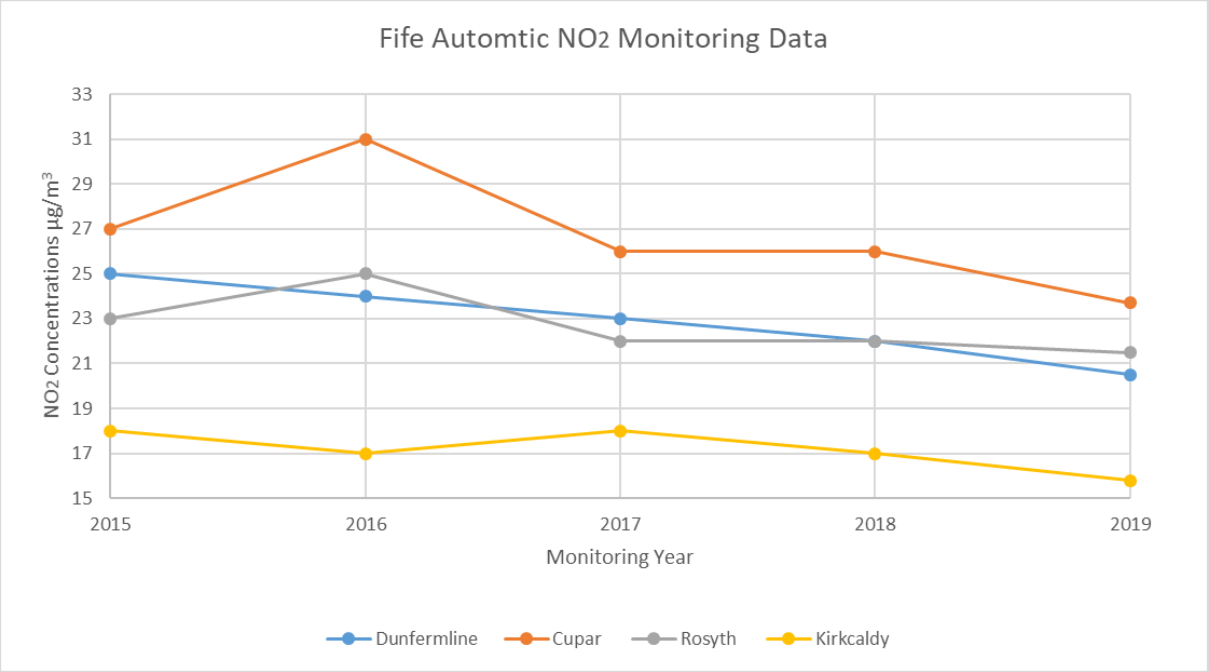
3.2.1.1 Automatic Monitoring Data

Table 3-1 and Figure 3.6 provides the monitoring results for 2019 and the previous five years. All four automatic monitoring sites did not record any exceedances of the AQS NO_2 annual or 1-hour mean objectives (refer to Table A.4) during 2019 and have been consistently well below the objectives for the past five years.

Table 3-1 Annual Mean NO_2 Monitoring Results (µg m-3)

Site Name	Site Type	Valid Data Capture 2019 (%)	2015	2016	2017	2018	2019
Cupar	Kerbside	99%	27	31	26	26	24
Dunfermline	Roadside	98%	25	24	23	22	21
Kirkcaldy	Roadside	98%	18	17	18	17	16
Rosyth	Roadside	100%	23	25	22	22	22

Figure 3.6 Fife automatic monitoring sites NO2 annual mean concentrations 2015-2019 (µg m-3)



Over the last five years NO_2 concentrations increased slightly at Cupar and Rosyth in 2016 before declining again from 2017 onwards. Dunfermline has been declining gradually since 2015. While Kirkcaldy seen a slight increasing 2017 before declining until 2019. Longer NO_2 trends at the two AQMAs can be seen in Figure 2.3 and Figure 2.5 above. The trend of decreasing concentrations seen at Cupar and Dunfermline suggest that the action plan measures introduced have had a positive impact.

Three AQMesh units have been monitoring since December 2017 to seek to further understand the pollutant concentrations and trends in the Appin Crescent, Dunfermline AQMA and Bonnygate, Cupar AQMA. Data is managed and processed by Ricardo who carry out appropriate QA/QC. The data showed that no NO_2 exceedances were measured during 2019. Analysis of the monitoring data from these units is provided in Section 3.3.1.

3.2.1.2 Diffusion Tube Monitoring Data

The annual diffusion tube data is presented in Appendix A, Table A.3. The data has been bias corrected using the local bias adjustment factor, or a combined factor for areas outwith the areas covered by automatic monitors. The following local bias adjustments were calculated – further details are provided in Appendix C:

- Cupar = 0.76
- Dunfermline = 0.75
- Kirkcaldy = 0.62
- Rosyth = 0.83
- Average of Local = 0.74

The local bias adjustment factor was applied to all diffusion tubes within the areas covered by the automatic monitors while the average of the local bias adjustment factors was used for all other sites for consistency. The local bias calculations are outlined in the data QA/QC in Appendix C. The full 2019 dataset of monthly mean values is provided in Appendix B.

Details of the diffusion tube bias adjustment are found within Appendix C of this report. Diffusion tube results from 2015 to 2019 are presented in Appendix A, Table A.3. Diffusion tube trends graphs are provided for the different areas of interest within Fife, these are presented in Appendix A, Figure A.1 to Figure A.8. The 2019 diffusion tube results indicate that there were no exceedances of the annual mean

objective at any monitoring locations, including locations within Dunfermline and Cupar which have exceeded in previous years. The highest annual mean concentration measured in Appin Crescent, Dunfermline during 2019 was 33.8 µg m^{-3} at Appin Crescent 6(A,B,C). The highest annual mean measured at Bonnygate, Cupar during 2018 was 32.4 µg m^{-3} at Bonnygate 4B.

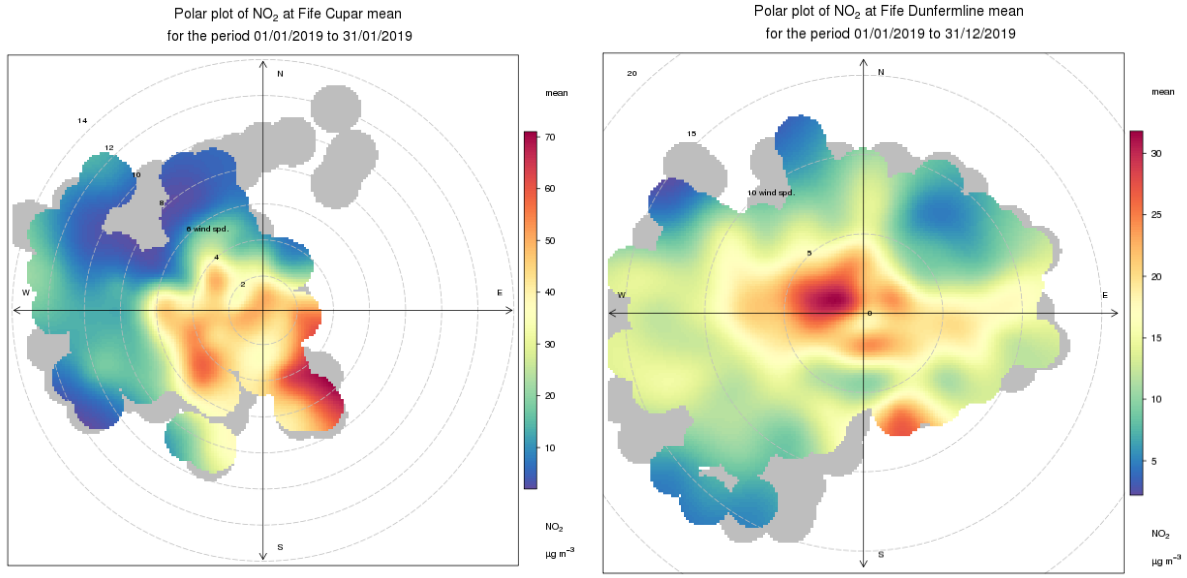
3.2.1.3 NO_2 Trends Analysis 2019

Figures H.1-4 in Appendix H illustrates the time variation plots for NO_2 in 2019 at each of the automatic monitoring stations; Cupar, Dunfermline, Kirkcaldy and Rosyth. All four sites have very similar time variations in data throughout the year. The highest concentrations are measured between Monday to Friday with rush hour periods (approximately at 8am and 5pm) showing highest concentrations. Again, showing traffic to be the main source of NO_2 for all sites. Concentrations at all four sites significantly drop at the weekend. There is a strong seasonal variation at all sites with winter months seeing significantly higher concentrations than in summer months. This is likely due to a decrease in traffic during summer months and winter conditions providing poor pollution dispersion conditions.

Figures H.1-4 also show polar plots at each of the monitoring stations. This report will focus on the Polar plots analysis for the AQMAs at Cupar and Dunfermline shown in Figure 3.7. Both plots indicate a broadly east-west signal which is consistent with parallel winds through the street canyon. It also shows that concentrations are highest when wind speeds are low.

It should be noted that the meteorological conditions in the Openair tool on the Scottish Government website are modelled, so there may be some bias in the data and subsequent analysis. However, these polar plots are very similar to last years'. Further Polar plots and OpenAir analysis can be found in Appendix H.

Figure 3.7 Polar plots of NO_2 concentrations by wind speed and direction



Figures H.5-8 show calendar plots of the date and the wind speed and direction respectively for each of the monitoring stations across Fife. Calendar plots show elevated concentrations. As with the time variation figures it can be seen that the lowest concentrations are in summer with higher concentrations throughout the winter months specifically January and February for all sites.

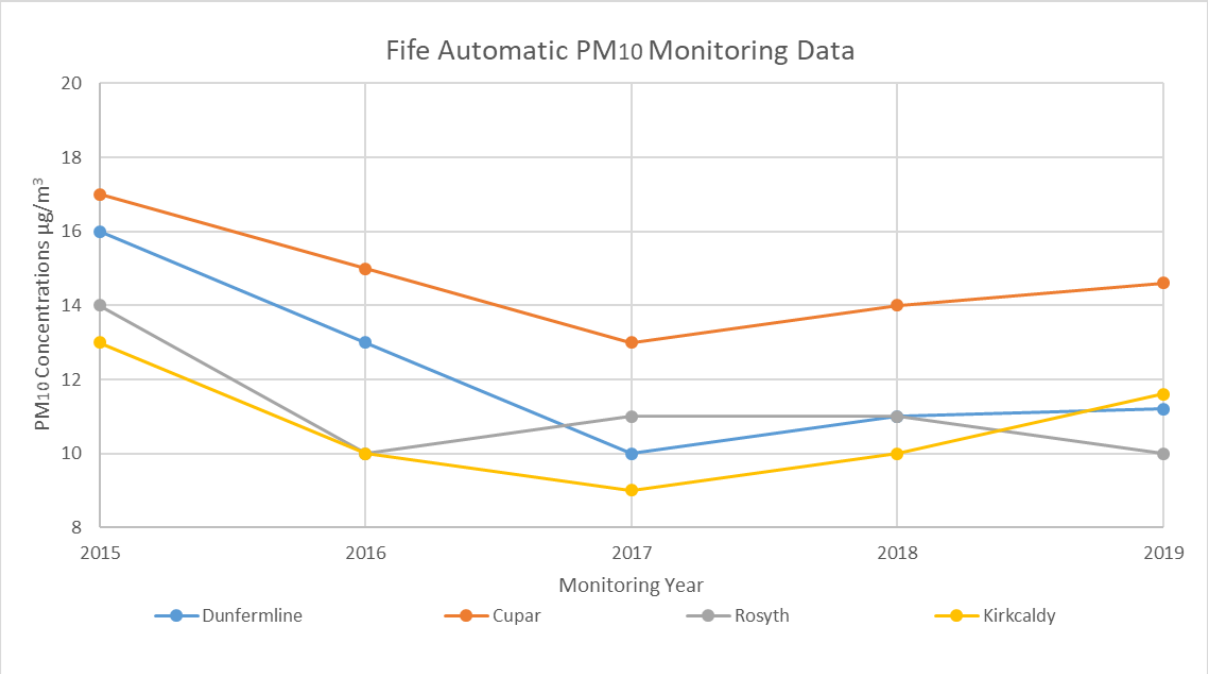
3.2.2 Particulate Matter (PM_{10})

Table 3-2 and Figure 3.8 provides the PM_{10} monitoring results for 2019 and the previous five years. All four automatic monitoring sites did not record an exceedance of the PM_{10} annual or 24-hour mean statutory objectives (refer to Table A.5) during 2019 and have been consistently below the objectives for the past five years.

Table 3-2 Annual Mean PM_{10} Monitoring Results (µg m^{-3})

Site Name	Valid Data Capture 2019 (%)	2015	2016	2017	2018	2019
Cupar	99%	17	15	13	14	15
Dunfermline	100%	16	13	10	11	11
Kirkcaldy	92%	13	10	9	10	12
Rosyth	91%	14	10	11	11	10

Figure 3.8 Fife automatic monitoring sites PM_{10} annual mean concentrations 2015-2019 (µg m^{-3})



Over the past five years PM_{10} concentrations have declined significantly at both Dunfermline and Cupar. Longer PM_{10} trends at the two AQMAs can be seen in Figure 2.4 and Figure 2.6 above. The decline in concentrations coincide with implementation of certain AQAP measures and highlights that the action plans can be effective in helping to reduce pollution concentrations in AQMAs. Over the past few years concentrations at all sites have stayed effectively stable within 1 or 2 µg m^{-3}.

Three AQMesh units have been monitoring since December 2017 to further understand pollutant concentrations and trends in the two AQMAs. The 2019 PM_{10} data showed that the annual and daily objectives were not exceeded at Appin Crescent, Dunfermline. However, both the annual and daily objectives were exceeded for PM_{10} at Bonnygate, Cupar. The annual mean concentration was 21 µg m^{-3}, (annualised to 24 µg m^{-3}). There were also 12 daily mean exceeds of 50 µg m^{-3} at Bonnygate during the first three months of the year.

3.2.2.1 PM_{10} Trend Analysis 2019

Figures H.9-12 in Appendix H illustrates the time variation plots for PM_{10} in 2019 at each of the automatic monitoring stations. All four sites have very similar time variations in data throughout the year. The highest concentrations at Cupar and Rosyth are measured between Monday to Friday similar to NO2 concentrations. However, the other 3 locations don't show a significant variation between weekdays and the weekend. This suggests that traffic at Cupar has a great effect on concentrations than the other locations. In addition, Dunfermline shows highest concentrations on a Saturday morning, whilst Kirkcaldy shows highest concentrations on a Monday morning compared to other days during the week. There is again strong seasonal variation at all sites with winter months seeing significantly higher concentrations than in summer months.

Figures H.9-12 also show polar plots at each of the monitoring stations. All plots indicate that concentrations are highest when coming from the East or South East. This can suggest that Particulate Matter concentrations in Fife are influenced by transboundary pollution.

Figures H.13-16 show calendar plots of the date and the wind speed and direction respectively for each of the monitoring stations across Fife. Calendar plots show elevated concentrations. Concentrations are relatively low throughout the year with elevated concentrations in April at all sites. The elevated data in April indicated by the calendar plots again highlights the influence transboundary pollution had in Fife during 2019 as it indicates when the transboundary pollution episode effected Scotland on the 24th April 2019. For more information on this event go to:
http://www.scottishairquality.scot/news/index?id=595

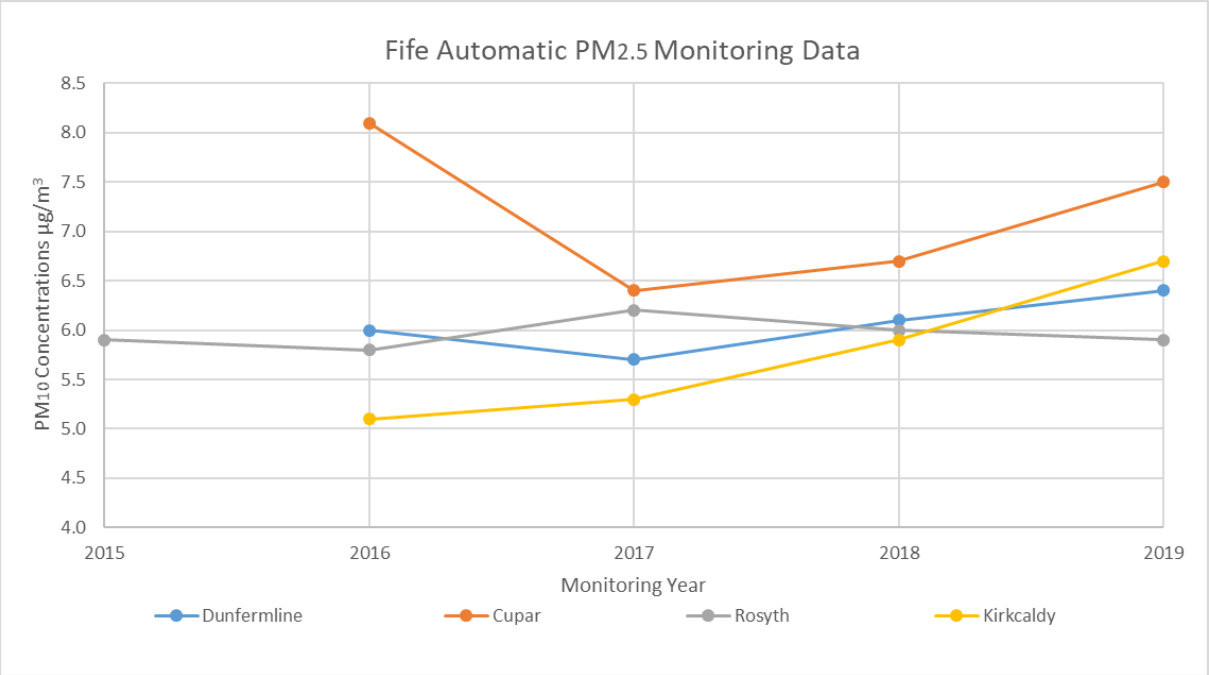
3.2.3 Particulate Matter ($PM_{2.5}$)

Table 3-3 and Figure 3.9 provides the $PM_{2.5}$ monitoring results for 2019 and the previous five years. All four automatic monitoring sites did not record an exceedance of $PM_{2.5}$ annual mean objective during 2019 and have been consistently below the objectives for the past five years.

Table 3-3 Annual Mean $PM_{2.5}$ Monitoring Results (µg m^{-3})

Site Name	Valid Data Capture 2019 (%)	2015	2016	2017	2018	2019
Cupar	99%	-	8	6	7	8
Dunfermline	100%	-	6	6	6	6
Kirkcaldy	92%	-	5	5	6	7
Rosyth	91%	6	6	6	6	6

Figure 3.9 Fife automatic monitoring sites $PM_{2.5}$ annual mean concentrations 2015-2019 (µg m^{-3})



Overall $PM_{2.5}$ concentrations have increased slightly or stayed the same since monitoring commenced. The most significant increase has been seen at Kirkcaldy however staying well within the AQS objective.

Three AQMesh units have been monitoring since December 2017 to further understand pollutant concentrations and trends in the two AQMAs. The 2019 $PM_{2.5}$ data showed that the annual objective was not exceeded at Appin Crescent, Dunfermline. However, the annual objective was exceeded for

$PM_{2.5}$ at Bonnygate, Cupar. The measured annual mean concentration was 10 µg m^{-3}, annualised to 11 µg m^{-3}.

3.2.3.1 $PM_{2.5}$ Trend Analysis 2019

Figures H.17-20 in Appendix H illustrates the time variation plots for $PM_{2.5}$ in 2019 at each of the automatic monitoring stations. All four sites have very similar time variations in data throughout the year. Concentrations are relatively consistent across the full week. Diurnal variations show that concentrations at all sites appear to increase during the night. There is also a strong seasonal variation at all sites with winter months seeing significantly higher concentrations than in summer months. This along with the diurnal plot suggests that traffic is not the main source of $PM_{2.5}$ at all sites and more likely domestic fuel burning.

Figures H.17-20 also show $PM_{2.5}$ polar plots at each of the monitoring stations. All plots indicate that concentrations are highest when coming from the East or South East same as for PM_{10}.

3.2.4 Sulphur Dioxide (SO_2)

Fife Council does not undertake any SO_2 monitoring.

3.2.5 Benzene

There are currently two benzene monitoring programmes carried out within the Fife Council boundary:

- Monitoring in the area of the Grangemouth oil refinery on behalf of INEOS,
- Monitoring along the Fife coastline on behalf of INEOS (associated with Houndpoint).

INEOS Grangemouth Benzene Monitoring
At the time of writing, The INEOS Grangemouth annual monitoring report 2019 and therefore the Benzene monitoring has not yet been published. A summary will be added to this report once it is available.

INEOS Houndpoint Benzene Monitoring
INEOS FPS Ltd. commissioned National Physical Laboratory (NPL) to monitor the ambient air hydrocarbon levels at 12 locations on the Forth Estuary coastline during 2019 (3rd January 2019 to 2nd January 2020) Nine locations on the Estuary North shore between North Queensferry and West Wemyss (including 4 locations between Dalgety Bay and Burntisland) were used, and 3 locations on the Estuary South shore between South Queensferry and Whitehouse Point were used.

The ambient air samples were collected over 2 week periods using passive diffusive tubes. These samples were analysed for iso-butane, n-butane, iso-pentane, n-pentane, n-hexane, n-heptane, benzene, toluene, xylene and total hydrocarbons (C4-C10). These hydrocarbons may be emitted from a variety of sources around the Forth Estuary including INEOS operations at Hound Point Terminal, road traffic, and other industrial sites such as the operations of ExxonMobil and Shell at Braefoot Bay and Mossmorran.

The results of this monitoring indicate that the average concentrations of benzene over the 12 month period were low with the annual means at each location ranging from 0.2 to 0.3 parts per billion volume to volume (ppb v/v). This is below the current annual Air Quality (Scotland) Strategy objective of 1 ppb v/v.

The concentrations of other hydrocarbons were also low, but there are no Air Quality (Scotland) Strategy objectives for these substances.

- The substance present in the greatest concentrations at most locations was n-butane for which annual mean concentrations ranged from 1.8 to 9.4 ppb v/v.
- The annual mean concentrations of other individual substances ranged from <0.3 to 4.2 ppb v/v.

- The annual mean concentrations of total hydrocarbons (C4 to C10) at different locations ranged from 7 to 26 ppb v/v.

INEOS FPS Ltd., and the previous Houndpoint Terminal operator, have commissioned monitoring along the Forth Estuary coastline for many years and there has been an overall reduction in the levels of hydrocarbons, including benzene, present in the ambient air over the last decade. The concentrations at any one locality are highly dependent on the weather. The measurements made in 2019 indicate that concentrations of most of the monitored substances have reduced when compared to those measured in 2018 at most of the locations.

3.2.6 Carbon Monoxide, Lead and 1,3-Butadiene

As in previous years, short periods of CO monitoring have been undertaken by Fife Council's Transportation Services at a number of roadside locations. Measurements were undertaken with Marksman 660 street monitors. The results are summarised in Table 3-4.

Whilst none of these monitoring periods are sufficiently long to permit full assessment of CO concentrations over a full annual period for 2019, they all indicate that concentrations are likely to be below the AQS objective of 10 mg m^{-3} for the running 8-hour mean concentration.

Table 3-4 CO Monitoring Fife Transportation Services

Site Number/Location	Monitoring Period	Max 8-Hour Concentration (ppm)
Dunfermline, Bothwell Gardens (Site 3)	24/04/19 to 30/04/19	0.21
	19/07/19 to 25/07/19	1.20
	12/10/19 to 18/10/19	0.45
Leven, Glenlyon Road/ Windygates Road (Site 7)	10/05/19 to 16/05/19	0.34
	01/08/19 to 07/08/19	0.24
	01/02/20 to 07/02/20	0.41
Dunfermline, Carnegie Drive/Pilmuir Street (Site 13)	24/04/19 to 30/04/19	0.53
	19/07/19 to 25/07/19	0.84
	12/10/19 to 18/10/19	0.61
Kirkcaldy, Dunnikier Road/Victoria Road (Site 16)	07/06/19 to 13/06/19	0.90
	02/09/19 to 08/09/19	0.91
	Faulty equipment	No data
Rosyth, Admiralty Road/ Queensferry Road (Site 24)	07/06/19 to 13/06/19	0.23
	02/09/19 to 08/09/19	0.55
	Faulty equipment	No data
Cupar, Bonnygate (Site 34)	10/05/19 to 16/05/19	0.68
	01/08/19 to 07/08/19	0.85
	01/02/20 to 07/02/20	0.74
Dunfermline, Appin Crescent (Site 35)	24/04/19 to 30/04/19	1.06
	19/07/19 to 25/07/19	0.48
	12/10/19 to 18/10/19	1.04
Kirkcaldy, St Clair Street/Junction Road (Site 36)	07/06/19 to 13/06/19	0.29
	02/09/19 to 08/09/19	0.33
	05/03/20 to 11/03/20	0.65
A909 Mossmorran (Site 37)	24/04/19 to 30/04/19	0.21
	19/07/19 to 25/07/19	0.65
	12/10/19 to 18/10/19	0.45
St Andrews, Bell Street (Site 39)	10/05/19 to 16/05/19	1.24
	01/08/19 to 07/08/19	1.88
	01/02/20 to 07/02/20	1.68

Site Number/Location	Monitoring Period	Max 8-Hour Concentration (ppm)
St Andrews, City Road (Site 40)	10/05/19 to 16/05/19	1.24
	13/08/19 to 19/08/19	0.90
	18/02/20 to 24/02/20	0.56
St Andrews, St Mary' Place (Site 41)	23/05/19 to 29/05/19	0.18
	13/08/19 to 19/08/19	0.55
	18/02/20 to 24/02/20	1.30
St Andrews, Lamond Drive (Site 42)	23/05/19 to 29/05/19	0.43
	13/08/19 to 19/08/19	0.49
	18/02/20 to 24/02/20	0.45

Other hydrocarbons:
Monitored concentrations of propane, n-butane, iso-butane, n-pentane, hexane, heptane, octane, nonane, decane, propylene, toluene, o-xylene, m & p-xylene, styrene and total C4 to C10 hydrocarbons are measured by INEOS as part of their annual reporting requirements at Grangemouth and Houndpoint. At the time of writing, the INEOS Grangemouth annual monitoring report 2019 has not yet been published. A summary will be added to this report once it is available. The results associated with Houndpoint have been discussed above in the Benzene section.

At the time of writing, The Mossmorran and Braefoot Bay Independent Air Quality Monitoring Review Annual Report 2020 has not yet been published. A summary will be added to this report once it is available.

3.2.7 Summary of Compliance with AQS Objectives

New monitoring data measured in 2019 identified no exceedances of the AQS annual mean objective for NO_2 at any of the automatic or non-automatic monitoring locations in Fife. The highest annual mean concentration measured in Appin Crescent, Dunfermline during 2019 was 33.8 µg m^{-3} at Appin Crescent 6(A,B,C). The highest annual mean concentration in Bonnygate, Cupar during 2019 was 32.4 µg m^{-3} at Bonnygate 4B.

All the automatic monitoring sites in Fife measured PM_{10} concentrations below the annual and daily mean objectives during 2019. Bonnygate, Cupar and Appin Crescent, Dunfermline have both already been declared AQMAs for NO_2 and PM_{10}. PM_{10} concentrations within these locations have remained below the annual mean objective consistently since 2014.

Fife Council has examined the results from monitoring in the Fife Council area. Concentrations within the Appin Crescent, Dunfermline AQMA and Bonnygate Cupar AQMA are within the air quality objectives.

In light of the 2019 monitoring results, Fife Council should continue to monitor at locations throughout Fife. Following a review of concentrations Fife Council intend to amend non-automatic monitoring locations as appropriate. The monitoring data for 2020 will be reported in the next Annual Progress Report (2021) which will evaluate the most recent monitoring data.

3.3 Additional Monitoring studies undertaken in 2019

There were no additional air quality studies carried out in 2019 to help Fife Council to get a better understanding of air quality within the region. However, Fife continued with the AQMesh sensor monitoring studies.

3.3.1 AQMesh Sensor Monitoring Study

In December 2017, Fife Council began an AQMesh sensor monitoring study to gain a better understanding of air pollution concentrations in the Bonnygate, Cupar and Appin Crescent, Dunfermline AQMAs. Fife Council then contracted Ricardo to manage and QA/QC the data from this study. This report provides a summary of the data from this study from 1st January – 31st December 2019.

3.3.1.1 Methodology

In terms of this study, the pollutants of concern that the AQMesh sensor systems is monitoring are NO_2, PM_{10} and $PM_{2.5}$. The AQMesh is an air quality sensor system which is designed to measure real time readings at a resolution as low as 1-minute averages and at locations which have previously been inaccessible to conventional monitoring equipment. For gaseous pollutants the AQMesh uses electrochemical sensors to measure concentrations. For Particulate Matter (PM_{10} and $PM_{2.5}$) it uses an optical particle counter (https://www.aqmesh.com/).

It should be noted that AQMesh pods have not been assessed through the UK equivalence programme (e.g. MCERTS) and so do not currently have a formal equivalence designation. Once the stated quality control processes have been applied, the data should be used for indication purposes only when comparing to the relevant air quality standards.

For this study the AQMesh pods were set to measure 15-minute averages. Two pods were installed at the Appin Crescent AQMA and one at the Bonnygate AQMA. The locations are illustrated in Figure 3.10 and Figure 3.11. These locations had not previously been monitored for Particulate Matter due to accessibility reasons. NO_2 is currently measured at these locations using diffusion tubes, which provide indicative annual averages of NO_2. Photographs of the installed AQMesh units are also shown below in Figure 3.12.

Ricardo used their dedicated data management system (MODUS) to manage and process all data from the AQMesh pods. MODUS is a state-of-the-art, modular platform for robust, reliable and effective management of air quality data. MODUS is the same data management system that is used by the Scottish Air Quality Database (http://www.scottishairquality.scot/), the UK national network (AURN - https://uk-air.defra.gov.uk/interactive-map) Air Quality England Network (http://www.airqualityengland.co.uk/), as well as several other national and international air quality networks.

Ricardo's data management system provided:

- Automatic importing of data from the AQMesh.
- Management and processing of raw data.
- Screening and scaling of raw data.
- Statistical analysis.

QA/QC was applied to this data in line with advice published by AQEG on the Defra UK air website (https://uk-air.defra.gov.uk/library/aqeg/pollution-sensors.php) and included:

- Co-location of the AQMesh sensors at the nearest automatic site for at least one week every 3 months.
- Co-location of the AQMesh sensor after it has been removed from site for repair.
- Where appropriate, the application of correction factors to the raw data using the co-location data acquired.

During processing of the co-location data, orthogonal regression analysis was carried out to help calculate a correction factor. Examples of this analysis is provided in Appendix F of this report. For AQMesh data processing, correction factors are worked out for each individual co-location exercise then either applied as a ramp to the next co-location point (the value of the factor incrementally going up or down each day dependant on the next correction factor value and the amount of time between the co-location exercises), or as a straight line (the value of the correction factor stays the same for each day) if there is a stop in data before the usable co-location caused by something happening to the sensor during sampling which could affect its sensitivity.

As well as the orthogonal regression analysis, Ricardo also carried out data comparison exercises to ascertain whether the data from the AQ Mesh sensors were representative. Comparisons were made with the local automatic monitoring sites at Bonnygate and Appin Crescent. Both sites use FIDAS analysers to monitor Particulate Matter. Data comparison plots are provided in Appendix F of this report. If poor data was identified from both the orthogonal and comparison analysis this data was removed from the dataset. As with automatic data in the SAQD and AURN networks if erroneous data was identified during the ratification of the data this was also removed from the dataset.

It should be reiterated that the AQMesh sensor is an indicative method of monitoring used by Fife Council to identify air pollution areas of concern where it has previously not been possible to carry out monitoring.

Figure 3.10 Appin Crescent, Dunfermline AQMesh sensor locations

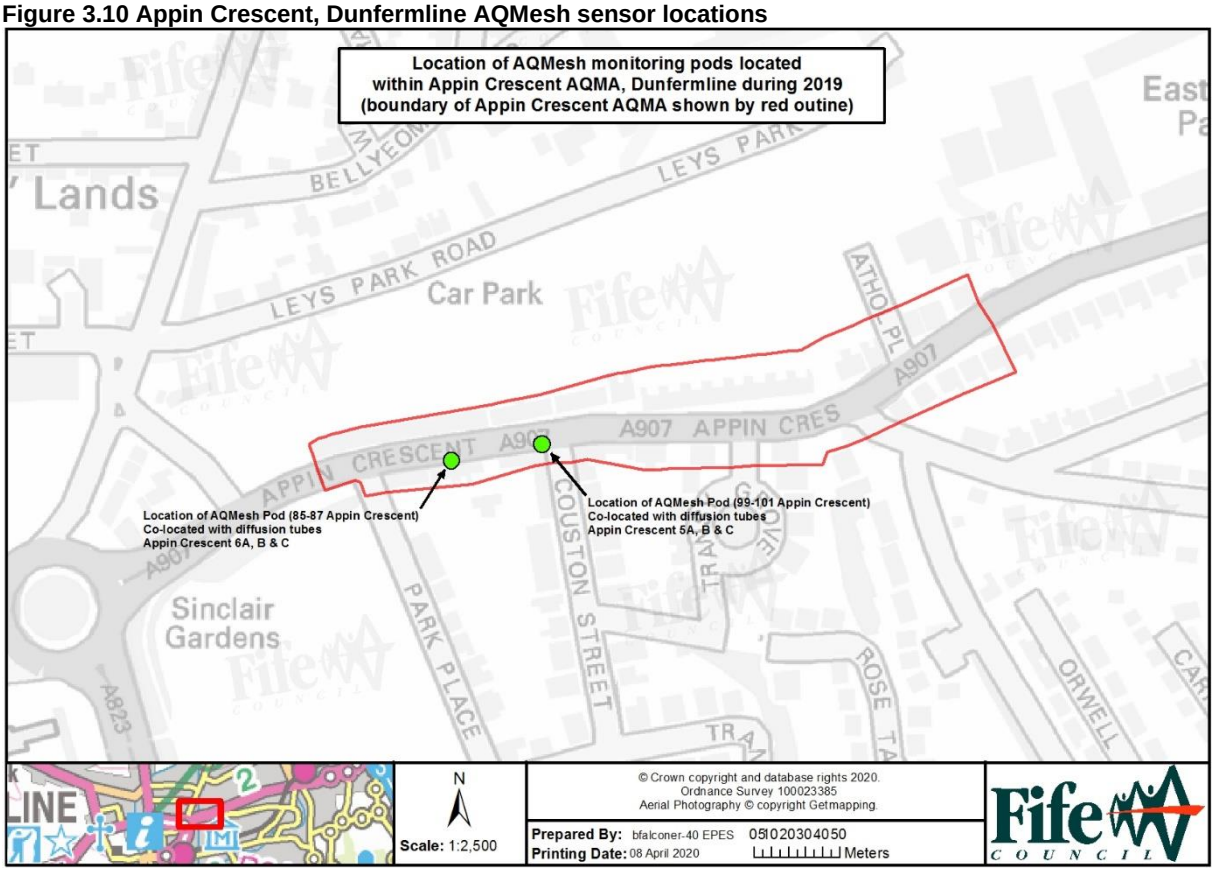


Figure 3.11 Bonnygate, Cupar AQMesh sensor location

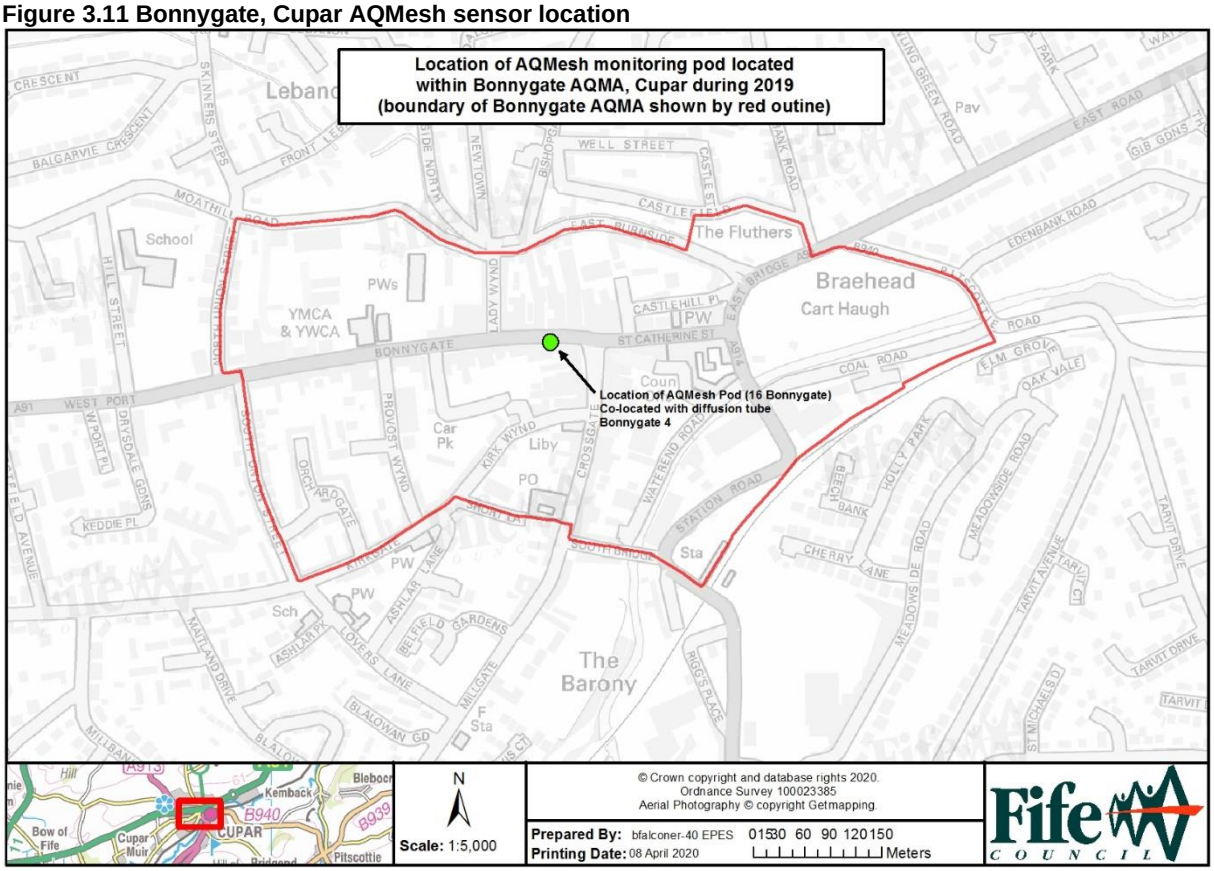


Figure 3.12 Photos of the Fife AQMesh Monitoring Locations

Bonnygate AQMesh sensor
(co-located with diffusion tube Bonnygate B4)

Appin Crescent West AQMesh sensor
(co-located with triplicate diffusion tubes
Appin Crescent 6A,B & C)

Appin Crescent East AQMesh sensor
(co-located with triplicate diffusion
Appin Crescent 5A,B & C)

3.3.1.2 Data

Table 3-5, Table 3-6 and Table 3-7 provide a summary of statistics for the concentrations measured by the AQMesh sensors from 1st January to the 31st December 2019. Table 3-8 and Table 3-9 provide a summary of statistics for the automatic monitoring sites located in Bonnygate, Cupar and Appin Crescent, Dunfermline for the same time period. More detailed Air Pollution reports from the AQMesh sensors and automatic sites can be found in the Appendix G of this report. For a direct comparison against annual mean objectives a data capture rate of 75% is required for the year. To compensate for low data capture rates at the three AQMesh Sensors the period mean concentration has been annualised using the calculation described in Box 7.9 of the LAQM Technical guidance (TG16). Annualisation workings can be found in Appendix D.

As can be seen, none of the pollutants measured by AQMesh sensors located at Appin Crescent measured concentrations that exceeded the annual mean objectives for NO_2 (40 µg m^{-3}), PM_{10} (18 µg m^{-3}) or $PM_{2.5}$ (10 µg m^{-3}). In addition, neither sites measured any exceedances of the NO_2 hourly mean objective (200 µg m^{-3} not to be exceeded more than 18 times a year). Though there were exceedances of the Daily Mean PM_{10} Objective at both Appin Crescent West and East they were below the objective of no more than 7 exceedances of 50 µg m^{-3} allowed per year. It is important to note however, that the data capture at Appin Crescent East is 50.1%. The low data capture rate was due to malfunctions with the AQMesh sensor.

As can be seen from Table 3-5, Fife Bonnygate AQMesh sensor did not measure exceedances of both the annual and hourly NO_2 objectives. However, the annual objectives were exceeded for both PM_{10} and $PM_{2.5}$ with measured concentrations of 21 µg m^{-3} (annualised to 23.7 µg m^{-3}) and 10 µg m^{-3} (annualised to 11 µg m^{-3}) respectively. The PM_{10} daily mean objective was also exceeded at Bonnygate with 12 daily exceedances of 50 µg m^{-3} during 2019. All 12 exceedances of the PM_{10} daily mean objective occurred during the first three month of 2019.

When comparing the AQMesh sensors with the nearby automatic sites, the statistics show that at both Bonnygate and Appin Crescent, averaged concentrations were found to be higher at the AQMesh pod locations than that measured at the automatic sites for all pollutants. The exception being PM_{10} concentrations at Appin Crescent West.

The AQMesh pods were co-located with diffusion tubes (as illustrated in Figure 3.10 and Figure 3.11 and shown in the associated photographs, Figure 3.12). Table 3-10 provides the bias corrected annual concentrations for these diffusion tubes. For the Bonnygate and Appin Crescent West locations the Diffusion Tubes measured higher NO_2 concentrations than the AQMesh. For Appin Crescent East the Diffusion Tube measured 1 µg m^{-3} less than the AQMesh sensor.

Table 3-5 Fife Bonnygate AQ Mesh monitoring Statistics 1st January to 31st December 2019

	V High (No. of Days)	High (No. of Days)	Mod (No. of Days)	Low (No. of Days)	Max. Hourly Conc.	Max. Daily Conc.	Max. Running 8 Hour Mean	Max. Running 24 Hour Mean	Period Mean Conc.	Annualised Mean Conc.	Period Data Capture (%)
NO (µg m^{-3})	0	0	0	0	601	212	354	222	58	n/a	85.5
NO_2 (µg m^{-3})	0	0	0	306	141	59	102	59	30	n/a	83.0
PM_{10} (µg m^{-3})	1	1	10	243	499	119	213	133	21	23.7	70.3
$PM_{2.5}$ (µg m^{-3})	0	3	8	240	200	60	85	62	10	11	69.2

Table 3-6 Fife Appin Crescent West AQ Mesh monitoring Statistics 1st January to 31st December 2019

	V High (No. of Days)	High (No. of Days)	Mod (No. of Days)	Low (No. of Days)	Max. Hourly Conc.	Max. Daily Conc.	Max. Running 8 Hour Mean	Max. Running 24 Hour Mean	Period Mean Conc.	Annualised Mean Conc.	Period Data Capture (%)
NO (µg m^{-3})	0	0	0	0	337	56	115	71	14	n/a	72.5
NO_2 (µg m^{-3})	0	0	0	263	155	71	108	77	24	25	71.5
PM_{10} (µg m^{-3})	0	0	2	260	260	71	127	93	11	11	72.4
$PM_{2.5}$ (µg m^{-3})	0	0	0	248	104	34	64	49	7	7	68.6

Table 3-7 Fife Appin Crescent East AQ Mesh monitoring Statistics 1st January to 31st December 2019

	V High (No. of Days)	High (No. of Days)	Mod (No. of Days)	Low (No. of Days)	Max. Hourly Conc.	Max. Daily Conc.	Max. Running 8 Hour Mean	Max. Running 24 Hour Mean	Period Mean Conc.	Annualised Mean Conc.	Period Data Capture (%)
NO (µg m^{-3})	0	0	0	0	341	107	181	120	28	n/a	50.1
NO_2 (µg m^{-3})	0	0	0	185	193	87	124	93	31	33	50.1
PM_{10} (µg m^{-3})	0	0	4	177	469	63	121	64	15	13	50.1
$PM_{2.5}$ (µg m^{-3})	0	0	2	179	61	41	56	43	9	7	50.1

Table 3-8 Fife Cupar Automatic monitoring site statistics 1st January to 31st December 2019

	V High (No. of Days)	High (No. of Days)	Mod (No. of Days)	Low (No. of Days)	Max. Hourly Conc.	Max. Daily Conc.	Max. Running 8 Hour Mean	Max. Running 24 Hour Mean	Period Mean Conc.	Period Data Capture (%)
NO ($\mu g/m^3$)	0	0	0	0	376	129	226	157	25	99.7
NO_2 ($\mu g/m^3$)	0	0	0	365	127	64	91	68	24	99.3
PM_{10} ($\mu g/m^3$)	0	1	1	360	172	92	116	93	15	98.9
$PM_{2.5}$ ($\mu g/m^3$)	0	0	2	360	55	37	46	39	8	99.0

Table 3-9 Fife Dunfermline Automatic monitoring site statistics 1st January to 31st December 2019

	V High (No. of Days)	High (No. of Days)	Mod (No. of Days)	Low (No. of Days)	Max. Hourly Conc.	Max. Daily Conc.	Max. Running 8 Hour Mean	Max. Running 24 Hour Mean	Period Mean Conc.	Period Data Capture (%)
NO (µg/m³)	0	0	0	0	252	72	126	81	11	97.6
NO_2 (µg/m³)	0	0	0	358	101	58	79	63	21	97.6
PM_{10} (µg/m³)	0	0	3	362	459	70	135	71	11	99.7
$PM_{2.5}$ (µg/m³)	0	0	1	364	56	39	51	40	6	99.7

Table 3-10 Co-located Diffusion tube annual concentrations

Diffusion Tube Name	Annual Concentration for 2019 (µg/m³)
Bonnygate 4B	32
Appin Crescent 5A,B,C (co-located with AQMesh East)	30
Appin Crescent 6A,B,C (co-located with AQMesh West)	34

3.3.1.3 Diurnal Variation Analysis

Diurnal variation analysis shows the hourly average concentrations (in parts per billion) for each hour of the day over the monitoring period in question (1st January 2019 to 31st December 2019). This section compares the respective AQMesh and automatic monitoring (Cupar and Dunfermline) site diurnal variation data. Diurnal analysis was not carried out for Appin Crescent East due to the low data capture rate as this can be heavily skewed by seasonal differences.

As can be seen in Figure 3.13 and Figure 3.14, for both Bonnygate, Cupar and Appin Crescent West, Dunfermline monitoring locations, the AQMesh monitoring sites followed a very similar diurnal profile to the automatic sites. Both locations highlight the traffic rush hour periods which as expected shows that the main source of the NO_2 in these areas are vehicle emissions. Both Cupar and Dunfermline locations also show that the AQMesh monitoring sites measured concentrations significantly higher than the automatic sites when the main emission source is active.

Figure 3.13 NO_2 Diurnal Variation Plot for Fife Bonnygate AQMesh sensor and Fife Cupar automatic monitor 2019

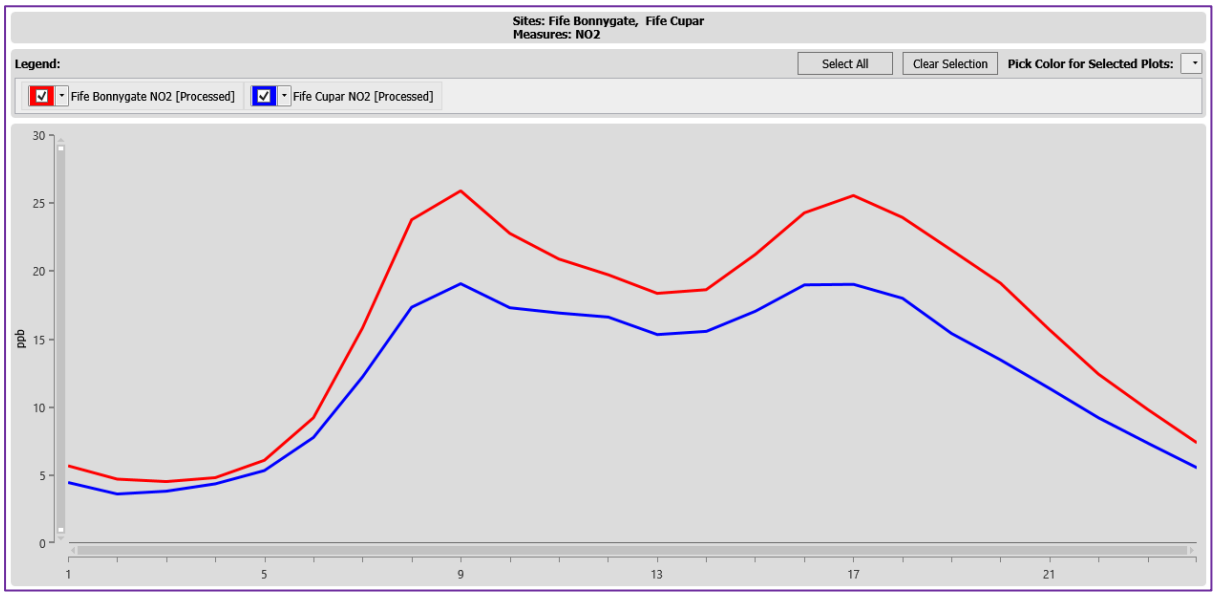


Figure 3.14 NO_2 Diurnal Variation Plot for Fife Appin Crescent West AQMesh sensor and Fife Dunfermline automatic monitor 2019

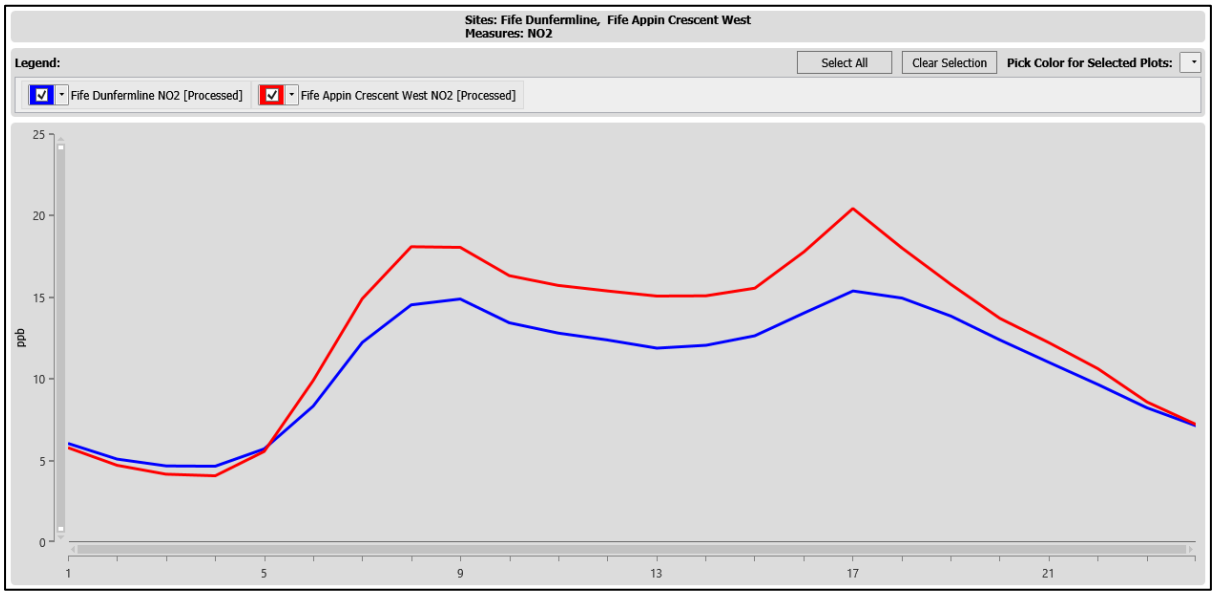


Figure 3.15 illustrates the PM_{10} diurnal variation data from the Fife Bonnygate AQMesh and the Fife Cupar automatic site for 2019. As can be seen, both have a similar profile however there is more of a camel's hump affect at the AQMesh site suggesting vehicles have a greater affect at this location. It is also clear that the AQMesh is consistently and significantly measuring higher concentrations than at the automatic monitoring site.

Figure 3.16 illustrates the $PM_{2.5}$ diurnal variation data from Fife Bonnygate AQMesh and the Fife Cupar automatic site for 2019. A similar profile is seen for $PM_{2.5}$ as it is for PM_{10}. Where again the AQMesh is consistently and significantly measuring higher concentrations than at the automatic monitoring site but not to the same extent as for PM_{10}.

Figure 3.17 and Figure 3.18 illustrates the PM_{10} and $PM_{2.5}$ (respectively) diurnal variation data for Fife Appin Crescent West AQMesh sensor and the Fife Dunfermline automatic site for 2019. As can be seen, the AQMesh profile is different to the Dunfermline automatic site. They are also different to the NO_2 profiles in Figure 3.14. This suggests that traffic has a less contributing factor to PM_{10} and $PM_{2.5}$

concentration at this location. Generally, concentrations are higher at Fife Dunfermline from 09:00 onwards compared to the Appin Crescent West AQMesh sensor for both PM_{10} and $PM_{2.5}$.

Figure 3.15 PM_{10} Diurnal Variation Plot for Fife Bonnygate AQMesh sensor and Fife Cupar automatic monitor 2019

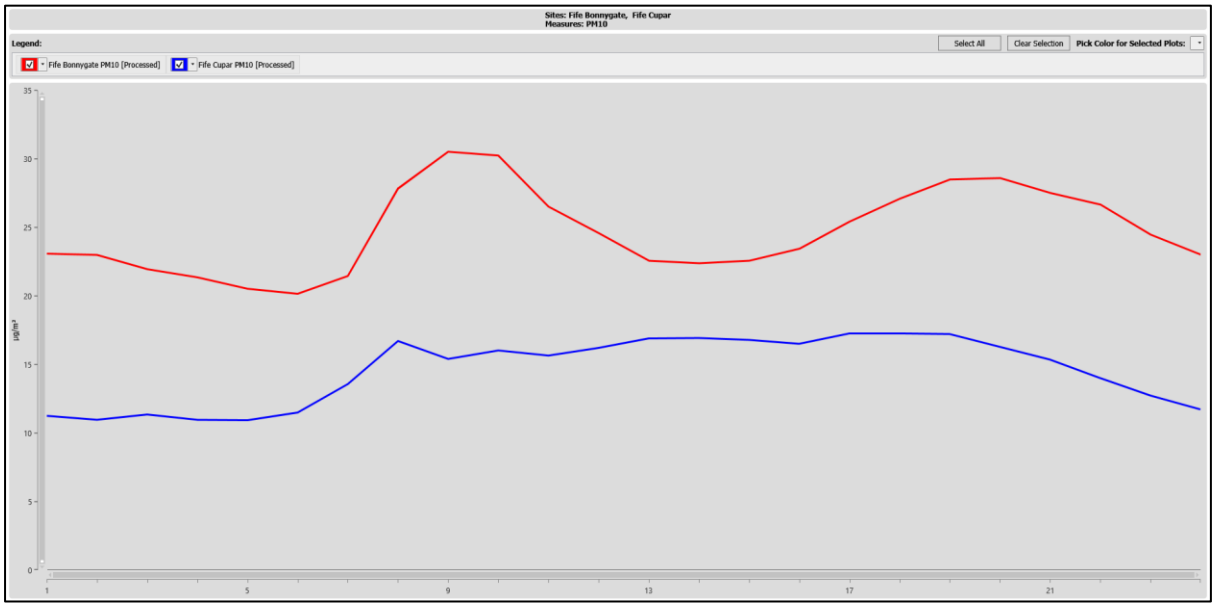


Figure 3.16 $PM_{2.5}$ Diurnal Variation Plot for Fife Bonnygate AQMesh sensor and Fife Cupar automatic monitor 2019

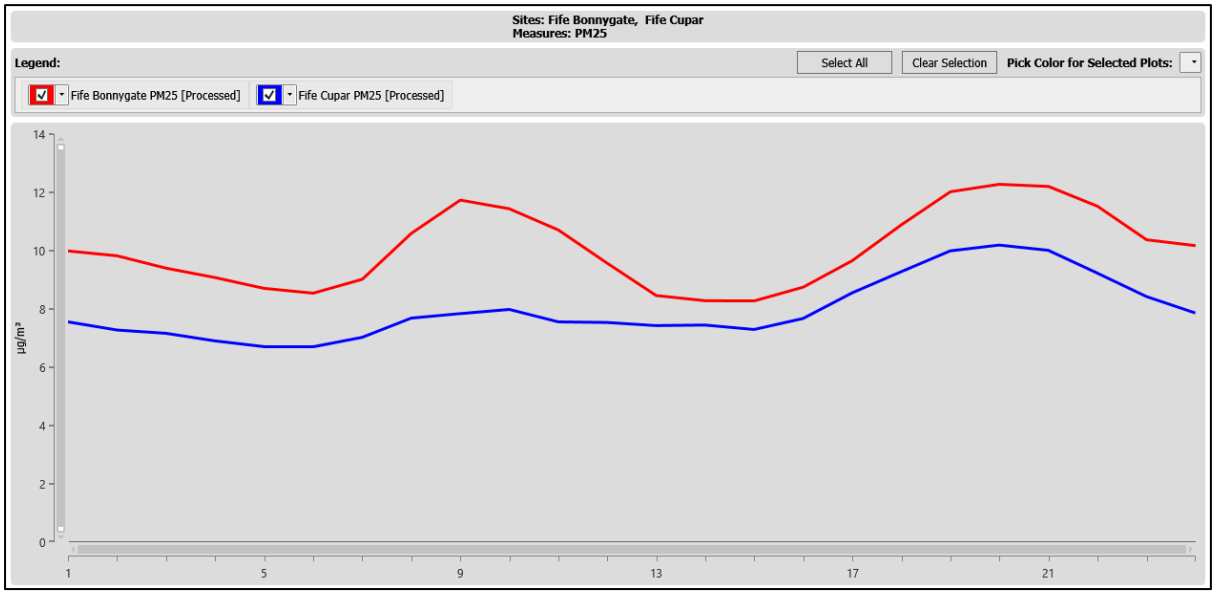


Figure 3.17 PM_{10} Diurnal Variation Plot for Fife Appin Crescent West AQMesh sensors and Fife Dunfermline automatic monitor 2019

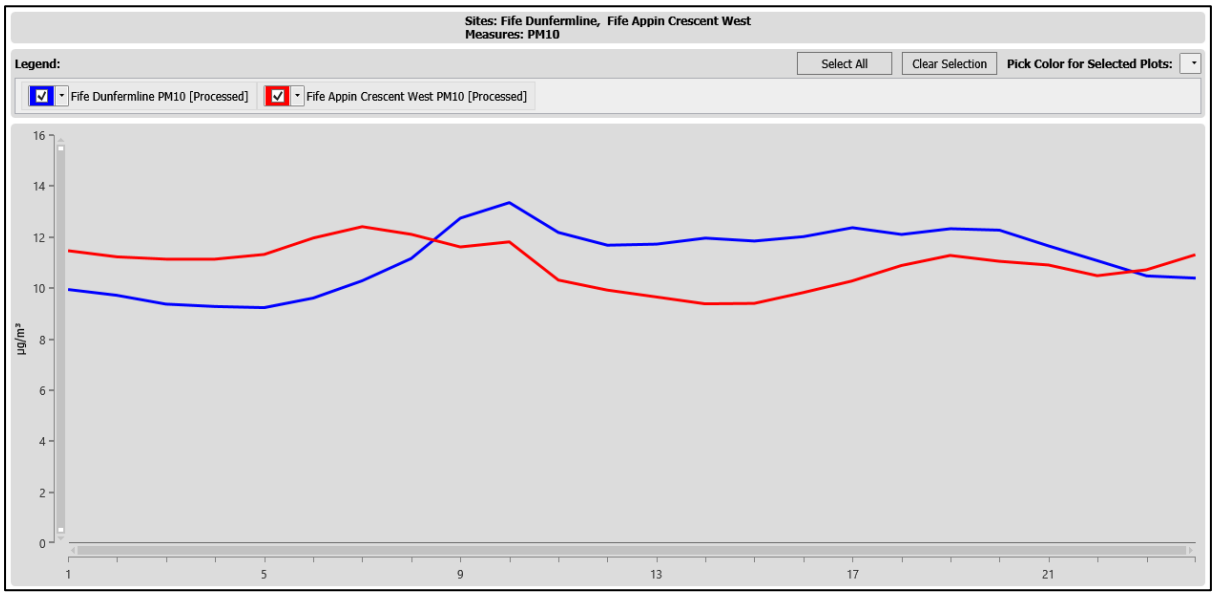
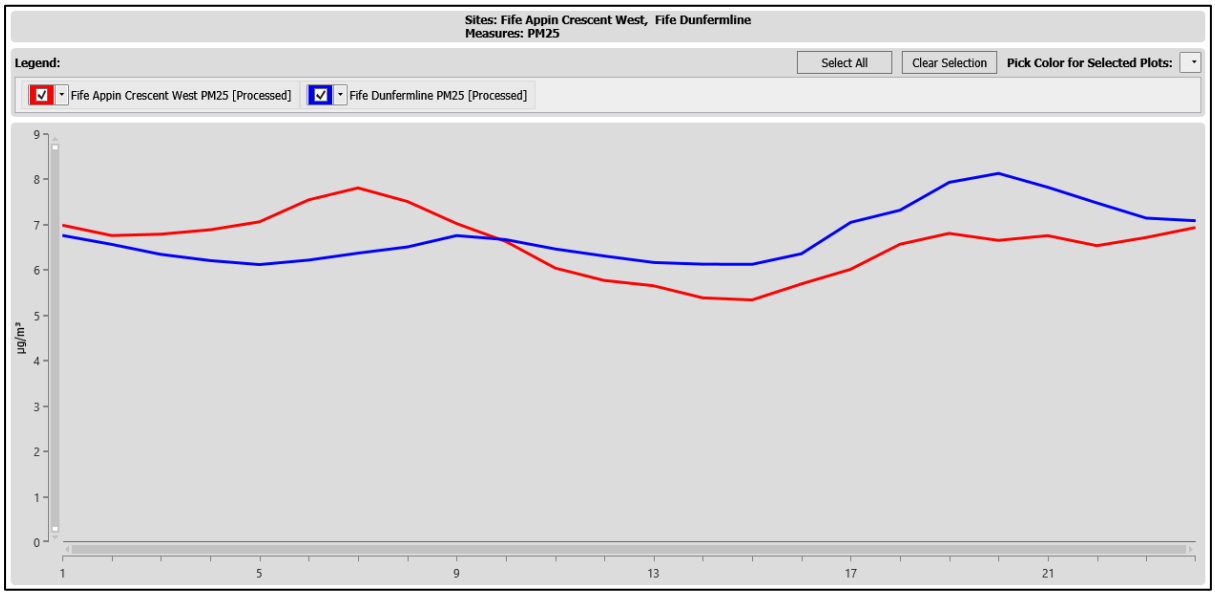


Figure 3.18 $PM_{2.5}$ Diurnal Variation Plot for Fife Appin Crescent West AQMesh sensors and Fife Dunfermline automatic monitor 2019



4 New Local Developments

4.1 Road Traffic Sources

There have been no major changes or additions to the existing local and trunk road network in 2019.

4.2 Other Transport Sources

Fife Council confirms that there are no new Transportation sources that have not been adequately considered in previous rounds of Review and Assessment.

4.3 Industrial Sources

SEPA confirms that there is one new industrial source that may have significant impact on the local air quality in Fife. The Westfield Energy Recovery facility (ERF) will be situated on the former Westfield Open Cast Coal site near Kinglassie. This Energy from Waste plant will incinerate 250,000 Tonnes per annum of non-hazardous waste and will be regulated against the requirements of Chapter IV of IED and the BAT Conclusions on Waste Incineration published on 3 December 2020. Westfield ERF is not expected to be operational before 2023. The permit application, ref. PPC/A/1181922, is nearing the final stages of determination.

4.4 Poultry Farms

Fife Council confirms that there are no new poultry farms that have not been adequately considered in previous rounds of Review and Assessment.

4.5 Commercial and Domestic Sources

SEPA confirms there is a new petrol station at Dalgety Bay, PPC/B/1184681, which was issued with a PVR permit in Sept 2019, however it is understood that the building of this facility is on hold.

4.6 New Developments with Fugitive or Uncontrolled Sources

SEPA have advised that the following amendments to Part A and Part B processes have been made during 2019:

- PPC/A/1013494 Mossmorran Complex

  There have been a number of changes to plant and operation at the Mossmorran Complex, permit ref. PPC/A/1013494, since June 2019 in relation to combustion, however none of these are expected to cause a change in air quality.

  ExxonMobil shutdown in August 2019 and Shell reduced throughput. During this period ground flaring and occasional elevated flaring occurred. During the shut-down temporary boilers were installed to provide steam which would otherwise have been provided by the site boilers. In order to facilitate start-up of the plant further temporary boilers were installed to enable the permanent site boilers to be commissioned prior to operation and replace one of the site boilers which required further repair.

- PPC/A/1096556 RWE Markinch Biomass Plant

  At RWE Markinch Biomass plant, PPC/A/1096556, they installed Glenrothes Energy Centre in 2018, this became operational in early 2019 and involved the following changes:

  - Removal from the permit of the 3 existing 26.4 MWth input gas-fired steam-raising boilers covered by Chapter 1 Section 1.1 Part A in Part 1 of Schedule 1 of the Pollution

Prevention and Control (Scotland) Regulations 2012 (PPC 2012). These were mothballed when Tullis Russell closed and have been removed from site.

- Insertion of three new 4.25 MWth input gas-fired hot water boilers covered by Chapter 1 Section 1.1 Part B (d) of Part 1 of Schedule 1 of PPC 2012 - this implements the Medium Combustion Plant Directive (MCPD) in Scotland. The three new boilers discharge to atmosphere via a common 12 metre stack. It is understood there is space to put in a 4th boiler if demand increases in the future but there is currently no plan to do this (this would also discharge at the same location).These boilers are expected to operate intermittently only to ensure continued supply of hot water to the Glenrothes District Heating Network when the CHP is shut-down.

There is not anticipated to be any change to emissions from the main stack Emission Point A1 because of this variation as this will not result in any increase in current throughputs etc.

Please note that since the lockdown due to Covid-19 RWE is currently running at a reduced rate due to reduced waste-wood fuel inputs and may shutdown in the summer if there is a shortage of fuel until commercial sources of waste wood are re-established – we would expect this to be a temporary position in 2020 only and am not aware of any changes in emissions to air associated with this at present. This may mean increased running of the 4.25 MWth boilers.

During 2019, the following processes ceased operation:

- PPC/A/101657 NOBLE FOODS LIMITED (poultry), Letham Farm, Leven, Fife KY8 5NN, permit ref.
- PPC/B/1004481 ESA McIntosh-Havelock (timber), Mitchelston Ind Est, Kirkcaldy.

SEPA have advised that there may be unmade haulage roads on industrial sites, specifically at the Westfield ERF site as it is developed; this will be detailed in the relevant Planning Permission. There will be no unmade roads at the site following completion of construction.

5 Planning Applications

5.1 Applications

The relevant planning guidance controls how Fife Council will manage potential air quality impacts from proposed developments. During 2019 the Land & Air Quality Team commented on numerous planning applications in relation to air quality matters with these ranging from proposed wood burning stoves and biomass boilers to large scale residential developments where an Air Quality Impact Assessment (AQIA) was required in support of the application. The types of comments made by the team are summarised in the table below:

Table 5-1 Summarised air quality related planning application comments

Comment	Number of planning applications
AQIA advised/submitted for applications located within AQMA's	1
AQIA advised/submitted for applications located outwith AQMA's	60
Biomass boiler/wood burning stove questionnaire provided for completion/submitted (required for details of emissions, fuel type to be used etc)	19
General information provided (e.g. agreeing scope of AQIA, further information required, retain air quality condition(s) etc)	27

From the numerous planning applications submitted the main ones worthy of comment are detailed below as these are either located within, or in the vicinity of, an existing AQMA:

17/03292/FULL – Erection of new buildings and conversion, part demolition, extension and refurbishment of existing buildings to form residential units and ancillary commercial floorspace (Classes 1, 2, sui generis take away and sui generis licensed premises and Class 10) with associated infrastructure, parking, landscaping, and access at Pilmuir Works, Dunfermline

Given the scale of the proposed development and the site's proximity to the Appin Crescent AQMA it was advised that an Air Quality Impact Assessment be undertaken. The applicant was advised to consult latest guidance to determine the level of assessment as well as consider the potential impacts on the AQMA. The submitted assessment concluded that there would be no adverse effects on local air quality conditions.

18/00590/FULL – Erection of 16 flatted dwellings and 14 dwelling houses with associated landscaping, parking and vehicular access at 60 Grieve Street, Dunfermline

Given the scale of the proposed development and the site's proximity to the Appin Crescent AQMA it was advised that an Air Quality Impact Assessment be undertaken. The applicant was advised to consult latest guidance to determine the level of assessment as well as consider the potential impacts on the AQMA. The submitted assessment concluded that there would be no adverse effects on local air quality conditions.

19/03018/PREAPP Pre-application advice for erection of 49 affordable houses at Land to North of Pitscottie Road, Cupar

Given the nature of the proposed development and the site's proximity to the Bonnygate AQMA it was advised that potential air quality issues should be considered. At the time of writing no further information had been received.

19/03448/PREAPP – Demolition of derelict buildings and erection of 24 affordable housing units and 1 retail unit and associated infrastructure works at development site 26-32 Bonnygate, Cupar, Fife

Given the scale of the proposed development (and its location within an existing AQMA) an Air Quality Impact Assessment will be required in terms of any future planning applications. The air quality consultant has contacted us for advice and a detailed assessment is expected given the nature and location of the proposed development. At the time of writing this AQIA has not yet been received.

6 Conclusions and Proposed Actions

6.1 Conclusions from New Monitoring data

Nitrogen Dioxide

The 2020 APR has considered the available monitoring data measured during 2019. During 2019 non-automatic, diffusion tube monitoring was undertaken at 55 locations within Fife. There were no exceedances of the NO_2 annual mean objective at any automatic or non-automatic monitoring locations during 2019. The highest annual mean concentration measured in Appin Crescent, Dunfermline during 2019 was 33.8 µg m^{-3} at Appin Crescent 6(A,B,C). The highest annual mean concentration measured in Bonnygate, Cupar during 2019 was 32.4 µg m^{-3} at Bonnygate 4B.

During 2019 Bonnygate B2, Cupar was relocated slightly to the east due to numerous no returns, being renamed Bonnygate B2i, Cupar. 102 Baldridgeburn, Dunfermline and 30 North Street, St Andrews commenced monitoring in 2019. City Road 2, St Andrews and Bonnygate B3B, Cupar were removed as these were duplicate tubes. In addition 11 sites ceased monitoring after June 2019, due to continuously low readings over several years. The annual mean concentrations for these sites have been annualised in accordance with TG.16, further details are provided in Appendix D.

Three AQMesh sensors were installed in December 2017 to seek to further understand pollutant concentrations and trends in the Appin Crescent, Dunfermline AQMA (two monitoring locations) and Bonnygate, Cupar AQMA (one monitoring location). Data is managed and processed by Ricardo who carry out appropriate QA/QC. The data from all three sites showed that no exceedances were measured during 2019 for NO_2.

Particulate Matter

PM_{10} concentrations are measured at four locations in Fife at Cupar; Dunfermline Kirkcaldy and Rosyth. Measured 2019 concentrations were below the PM_{10} annual mean objective with no exceedances of the annual or daily mean objective at all sites.

During 2019 $PM_{2.5}$ was measured at four automatic monitoring sites in Cupar; Dunfermline Kirkcaldy and Rosyth. Measured 2019 concentrations were below the $PM_{2.5}$ annual mean objective at all sites.

AQMesh Sensors located at two monitoring locations within Appin Crescent, Dunfermline measured no exceedances of the annual or daily mean (PM_{10} only) objectives for both PM_{10} and $PM_{2.5}$.

The one AQMesh Sensor monitoring location within Bonnygate Cupar measured exceedances of the annual mean objective for both PM_{10} and $PM_{2.5}$ with concentrations of 24 µg m^{-3} and 11 µg m^{-3} respectively. The PM_{10} daily mean objective was also exceeded with 12 daily exceedances of 50 µg m^{-3} during 2019. All 12 exceedances of the PM_{10} daily mean objective occurred during the first three month of 2019.

Sulphur Dioxide

No SO_2 concentrations were measured in Fife during 2019. Historical SO_2 monitoring data from the Longannet power station site is available in previous year's APR report for Fife Council.

Carbon Monoxide

Short-term monitoring undertaken by Fife Council's Transportation Services department during 2019 indicates that the AQS objective for CO is unlikely to have been exceeded during 2019.

1,3 Butadiene and Benzene

At the time of writing, the INEOS Grangemouth annual monitoring report has not yet been published. A summary will be added to this report once it is available.

A summary of the monitoring data from INEOS Houndpoint states that concentrations of most of the monitored substances in 2019 have reduced when compared to those measured in 2018 at most of the locations.

At the time of writing, The Mossmorran and Braefoot Bay Independent Air Quality Monitoring Review Annual Report 2020 has not yet been published. A summary will be added to this report once it is available.

6.2 Conclusions Relating to New Developments

Fife Council have not identified any New Local Developments out with the applications previously considered and assessed by Fife Council where there may be a risk of the air quality objectives being exceeded. Therefore, no additional air quality assessment is recommended at this time.

6.3 Proposed Actions

Following the review of all available data it is recommended that Fife Council carry out the following actions:

1. Submit the next Air Quality Progress Report in June 2021
2. Review the current NO_2 diffusion tube monitoring programme and seek to relocate any tubes where deemed appropriate (i.e. where continuously low readings have been recorded)
3. Continue to implement the measures outlined in the action plans for Appin Crescent, Dunfermline and Bonnygate, Cupar
4. Continue to measure pollution in both AQMAs using AQMesh Sensor units to obtain a better understanding of concentrations in locations previously not monitored.
5. Await the outcomes of the Particulate Matter Measurement Study recently commissioned by the Scottish Government due to the current uncertainty regarding PM_{10} concentrations reported by different analyser types. The outcomes of this exercise will help guide future decision making regarding the possible revocation of the current AQMAs.

Fife Confirms it will undertake these recommended actions.

Appendices

Appendix A: Monitoring Results
Appendix B: Full Monthly Diffusion Tube Results for 2019
Appendix C: Data QA/QC
Appendix D: Annualisation of Data
Appendix E: Technical Specification of Automatic Monitoring Equipment
Appendix F: Example Co-location Data Orthogonal Regression Analysis
Appendix G: Air Pollution reports from the AQ Mesh sensors
Appendix H: Openair Analysis Plots

Appendix A – Monitoring Results

Table A.1 - Details of Automatic Monitoring Sites

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)
Cupar	Kerbside	337403	714571	NO_2, PM_{10}, $PM_{2.5}$	Y	NO_x Analyser (Chemiluminescence), FIDAS (since December 2016)	N (1m)	<0.5m	1.9m
Dunfermline	Roadside	309926	687722	NO_2, PM_{10}, $PM_{2.5}$	Y	NO_x Analyser (Chemiluminescence), FIDAS (since September 2016)	Y (1m)	4m	2m
Kirkcaldy	Roadside	329143	692986	NO_2, PM_{10} $PM_{2.5}$	N	NO_x Analyser (Chemiluminescence), FIDAS (since April 2016)	N (10m)	5m	2m
Rosyth	Roadside	311755	683503	NO_2, PM_{10} $PM_{2.5}$	N	NO_x Analyser (Chemiluminescence) FIDAS (since July 2015)	Y (1.5m)	6m	2.1m

Table A. 2 - Details of Non-Automatic Monitoring

Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Relevant Exposure? (m) [1]	Distance to kerb of nearest road (m) [2]	Tube collocated with a Continuous Analyser?
Central Area								
Queensway, Glenrothes	K	327849	701114	NO_2	N	N (17.0)	1	N
High Street, Leslie	R(F)	325111	701806	NO_2	N	Y	3	N
Glenlyon Road, Levenmouth	K	337357	701318	NO_2	N	N (26.8)	1	N
Asda Roundabout, Kirkcaldy	K	328742	694045	NO_2	N	N (28.0)	1	N
Victoria Road, Kirkcaldy	R(F)	328144	692315	NO_2	N	Y	2.5	N
Dunnikier Road, Kirkcaldy	R(F)	328152	692352	NO_2	N	Y	3.4	N
3A Junction Road, Kirkcaldy	R(F)	329123	693029	NO_2	N	Y	1.5	N
St Clair Street 1, Kirkcaldy	R	329157	693030	NO_2	N	N (2.0)	1.3	N
St Clair Street 2, Kirkcaldy	R	329131	693008	NO_2	N	N (2.0)	1.8	N
St Clair Street 3 (MS), Kirkcaldy	R(F)	329174	693069	NO_2	N	Y	2	N
125 St Clair Street, Kirkcaldy	R(F)	329208	693163	NO_2	N	Y	1.5	N
179A St Clair Street, Kirkcaldy	R(F)	329310	693326	NO_2	N	Y	1.5	N
St Clair Street ROMON (A,B,C,)* Kirkcaldy	R	329143	692986	NO_2	N	N (10.0)	5	Y

Hendry Road Kirkcaldy	R	327437	692270	NO_2	N	N (16.0)	1.7	N
				East Area				
Cupar Road, Auchtermuchty	R(F)	324186	711800	NO_2	N	Y	1.8	N
Bell Street 1, St Andrews	R(F)	350712	716691	NO_2	N	Y	1.6	N
Bell Street 2, St Andrews	R(F)	350721	716646	NO_2	N	Y	2.1	N
City Road 1, St Andrews	R	350590	716570	NO_2	N	N (1.0)	1.5	Y
City Road 2, St Andrews	R	350590	716570	NO_2	N	N (1.0)	1.5	Y
City Road 3, St Andrews	R	350538	716682	NO_2	N	N (14.0)	1.5	N
City Road 4, St Andrews	R	350523	716725	NO_2	N	N (26.0)	2.2	N
City Road 5, St Andrews	R	350499	716748	NO_2	N	N (5.0)	1.9	N
City Road 6, St Andrews	R	350470	716826	NO_2	N	N (5.0)	2.2	N
Links Crescent, St Andrews	R(F)	350156	716947	NO_2	N	Y	3	N
North Street, St Andrews	R	350519	716935	NO_2	N	N (3.0)	2.2	N
Bonnygate B1, Cupar	R(F)	337409	714570	NO_2	Y	Y	5.3	N
Bonnygate B2, Cupar	R(F)	337507	714584	NO_2	Y	Y	1.7	N
Bonnygate B2i, Cupar	R(F)	337519	714583	NO_2	Y	Y	1.7	N
Bonnygate 3A, Cupar	R(F)	337480	714586	NO_2	Y	Y	1.6	Y

Bonnygate 3B, Cupar	R(F)	337480	714586	NO_2	Y	Y	1.6	Y
Bonnygate 4B, Cupar	R(F)	337467	714576	NO_2	Y	Y	1.9	N
Ladywynd B5, Cupar	R(F)	337405	714596	NO_2	Y	Y	1	N
Bonnygate West B6, Cupar	R	337333	714559	NO_2	Y	N (4.0)	3	N
Crossgate, Cupar	K	337536	714537	NO_2	Y	N (3.0)	0.5	N
Bonnygate, Cupar, Monitor A, B, C*	K	337403	714571	NO_2	Y	N (4.8)	0.6	Y
West Area								
High Street, Cowdenbeath	K	316527	691742	NO_2	N	N (3.5)	0.5	N
North Approach Road (A, B), Kincardine	K	293182	687527	NO_2	N	N (11.0)	0.5	N
Admiralty Road A, Rosyth	R(F)	312069	683431	NO_2	N	Y	9	N
129 Admiralty Road, Rosyth	R (F)	311960	683477	NO_2	N	Y	12	N
229 Admiralty Road, Rosyth	R (F)	311384	683543	NO_2	N	Y	11	N
Admiralty Road (A,B,C) ROMON*	R(F)	311755	683503	NO_2	N	Y	6.5	Y
Appin Crescent 1, Dunfermline	R(F)	309888	687719	NO_2	Y	Y	6.5	N
Appin Crescent 2, Dunfermline	R(F)	309883	687701	NO_2	Y	Y	1.5	N
Appin Crescent 3, Dunfermline	R(F)	309975	687716	NO_2	Y	Y	1.8	N
Appin Crescent 4(A)(B)(C), Dunfermline*	R(F)	309926	687722	NO_2	Y	Y	3.9	Y

Appin Crescent 5(A)(B)(C) Dunfermline*	R(F)	309957	687714	NO_2	Y	Y	1.5	N
Appin Crescent 6(A)(B)(C) Dunfermline*	R(F)	309904	687704	NO_2	Y	Y	1.5	N
Appin Crescent (A)(B)(C), Dunfermline*	R	309900	687716	NO_2	Y	N (5.1)	1.6	N
Carnegie Drive (A,B,C), Dunfermline*	R(F)	309023	687632	NO_2	N	Y	2.3	N
11 Halbeath Road, Dunfermline	R (F)	310245	687784	NO_2	N	Y	14	N
Pilmuir Road, Dunfermline	R	309143	687774	NO_2	N	Y	2	N
Mill Street, Dunfermline	R	308888	687968	NO_2	N	Y	2	N
42 Chalmers Street, Dunfermline	R	308808	687555	NO_2	N	Y	1.8	N
Rumblingwell, Dunfermline	R	307898	688224	NO_2	N	N (6.3)	1.7	N
102 Baldridgeburn, Dunfermline	K	308447	688068	NO_2	N	N (3.0)	0.5	N

Y= if the monitoring site is at a location of exposure (e.g. installed on/adjacent to the façade of a residential property).
*Triplicate sites
K = Kerbside, 0-1, from the kerb of a busy road.
R =Roadside,1-5m from the kerb. R (F) = Façade of buildings on street
UB = Urban background, >50m from any busy road.

Table A. 1 - Annual mean NO_2 Monitoring Results – Non-Automatic sites (µg m^{-3})

Site Name	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2019 (%) (2)	2015	2016	2017	2018	2019 BIAS Adjusted
Central Area								
Queensway, Glenrothes	K	100	42	18	20	17	18	17*
High Street, Leslie	R(F)	100	42	19	20	17	17	16*
Glenlyon Road, Levenmouth	K	N/A	100	25	26	24	24	23
Asda Roundabout, Kirkcaldy	K	N/A	100	26	28	24	27	22
Victoria Road, Kirkcaldy	R(F)	N/A	83	26	25	23	25	23
Dunnikier Road, Kirkcaldy	R(F)	N/A	83	25	26	21	23	22
3A Junction Road, Kirkcaldy	R(F)	N/A	100	26	27	22	23	19*
St Clair Street 1, Kirkcaldy	R(F)	N/A	100	31	32	33	30	25
St Clair Street 2, Kirkcaldy	R(F)	N/A	100	37	37	34	33	29
St Clair Street 3 (MS), Kirkcaldy	R(F)	N/A	100	27	28	25	26	23
125 St Clair Street, Kirkcaldy	R(F)	N/A	100	32	32	29	28	23
179A St Clair Street, Kirkcaldy	R(F)	N/A	100	27	28	26	25	22
St Clair Street ROMON (A,B,C) Kirkcaldy	R	N/A	100	19	20	19	17	16*
Hendry Road, Kirkcaldy	R	N/A	100	-	-	26	24	21
East Area								
Cupar Road, Auchtermuchty	R(F)	100	42	22	25	21	20	17*
Bell Street 1, St Andrews	R(F)	N/A	100	32	30	27	28	27
Bell Street 2, St Andrews	R(F)	N/A	100	21	26	24	23	22
City Road 1, St Andrews	R	N/A	100	23	24	20	22	22
City Road 2, St Andrews	R	100	42	23	24	20	22	20*
City Road 3, St Andrews	R	N/A	100	-	25	22	23	22
City Road 4, St Andrews	R	100	42	-	23	18	18	15*
City Road 5, St Andrews	R	N/A	100	-	29	23	22	18*
City Road 6, St Andrews	R	N/A	92	-	33	31	31	27

Site Name	Site Type	Valid Data Capture for Monitoring Period (%) [1]	Valid Data Capture 2019 (%) [2]	2015	2016	2017	2018	2019 BIAS Adjusted
Links Crescent, St Andrews	R(F)	100	100	-	-	19	21	19*
North Street, St Andrews	R	100	100	-	-	-	-	21
Bonnygate B1, Cupar	R(F)	N/A	100	27	25	24	25	24
Bonnygate B2, Cupar	R(F)	33	8	29	32	28	28	-
Bonnygate B2i, Cupar	R(F)	100	75	-	-	-	-	23*
Bonnygate 3A, Cupar	R(F)	N/A	100	39	37	31	31	31
Bonnygate 3B, Cupar	R(F)	100	42	39	37	31	31	30
Bonnygate 4B, Cupar	R(F)	N/A	100	36	**41**	33	34	32
Ladywynd B5, Cupar	R(F)	100	42	16	15	14	15	14*
Bonnygate West B6, Cupar	R(F)	100	100	-	-	20	18	18*
Crossgate, Cupar	K	100	42	21	20	18	18	17*
Bonnygate, Cupar, Monitor A, B, C	K	N/A	100	27	27	26	27	23
West Area								
High Street, Cowdenbeath	K	N/A	100	19	21	18	20	19*
North Approach Road A, Kincardine	K	80	33	16	16	16	15	14*
North Approach Road B, Kincardine	K	80	33	16	16	16	15	14*
Admiralty Road A, Rosyth	R(F)	N/A	100	28	29	26	25	27
129 Admiralty Road, Rosyth	R (F)	100	42	22	24	21	22	20
229 Admiralty Road, Rosyth	R (F)	100	42	20	21	19	19	20
Admiralty Road (A,B,C) ROMON	R(F)	N/A	100	23	25	22	22	22
Appin Crescent 1, Dunfermline	R(F)	N/A	100	27	25	25	25	26
Appin Crescent 2, Dunfermline	R(F)	N/A	100	40	38	34	34	31
Appin Crescent 3, Dunfermline	R(F)	N/A	100	35	32	29	28	28

Site Name	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2019 (%) (2)	2015	2016	2017	2018	2019 BIAS Adjusted
Appin Crescent 4(A)(B)(C), Dunfermline	R(F)	N/A	100	25	24	23	21	21
Appin Crescent 5(A)(B)(C), Dunfermline	R(F)	N/A	92	39	35	35	31	30
Appin Crescent 6(A)(B)(C), Dunfermline	R(F)	N/A	92	**43**	39	37	35	34
Appin Crescent (A)(B)(C), Dunfermline	R	N/A	83	32	31	29	27	27
Carnegie Drive (A,B,C), Dunfermline	R(F)	N/A	100	30	30	26	27	26
11 Halbeath Road, Dunfermline	R (F)	N/A	100	18	17	16	15	15*
Pilmuir Road, Dunfermline	R	N/A	92	24	26	23	24	23
Mill Street, Dunfermline	R	N/A	100	28	30	30	30	30
42 Chalmers Street	R	100	42	-	21	19	19	18*
Rumblingwell, Dunfermline	R	N/A	100	22	22	22	21	21
102 Baldridgeburn, Dunfermline	K	71	42	-	-	-	-	33

Notes:

Exceedances of the NO_2 annual mean objective of 40 µg m^{-3} are shown in **bold**.

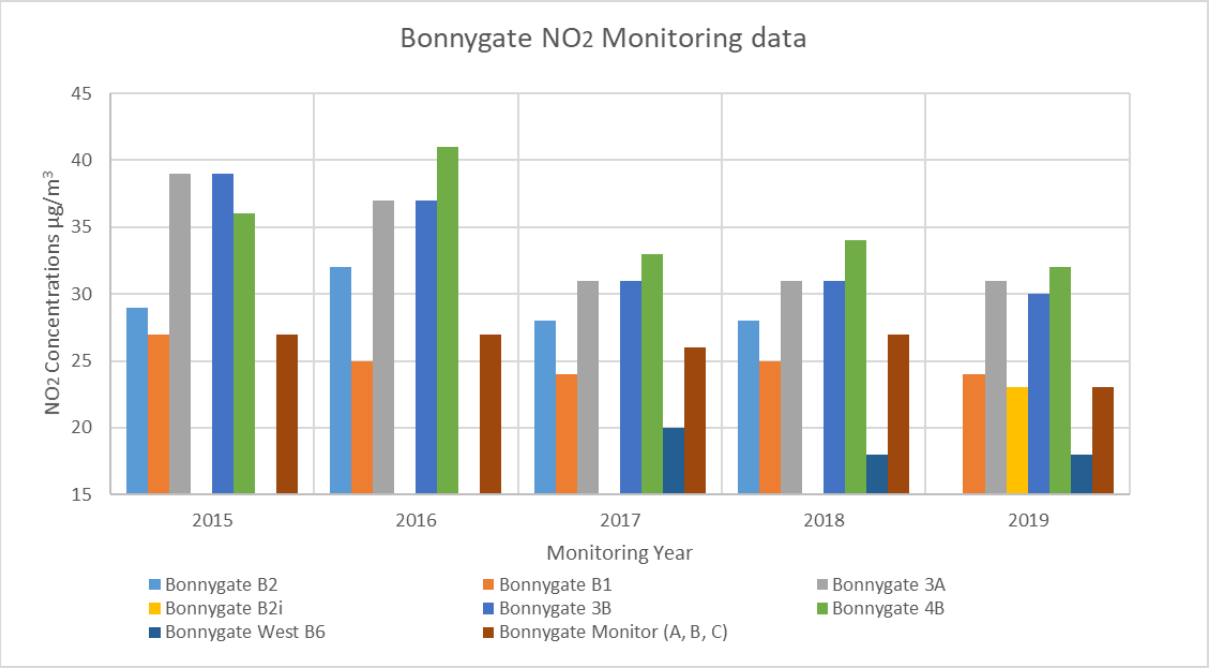
(1) Data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

(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) 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

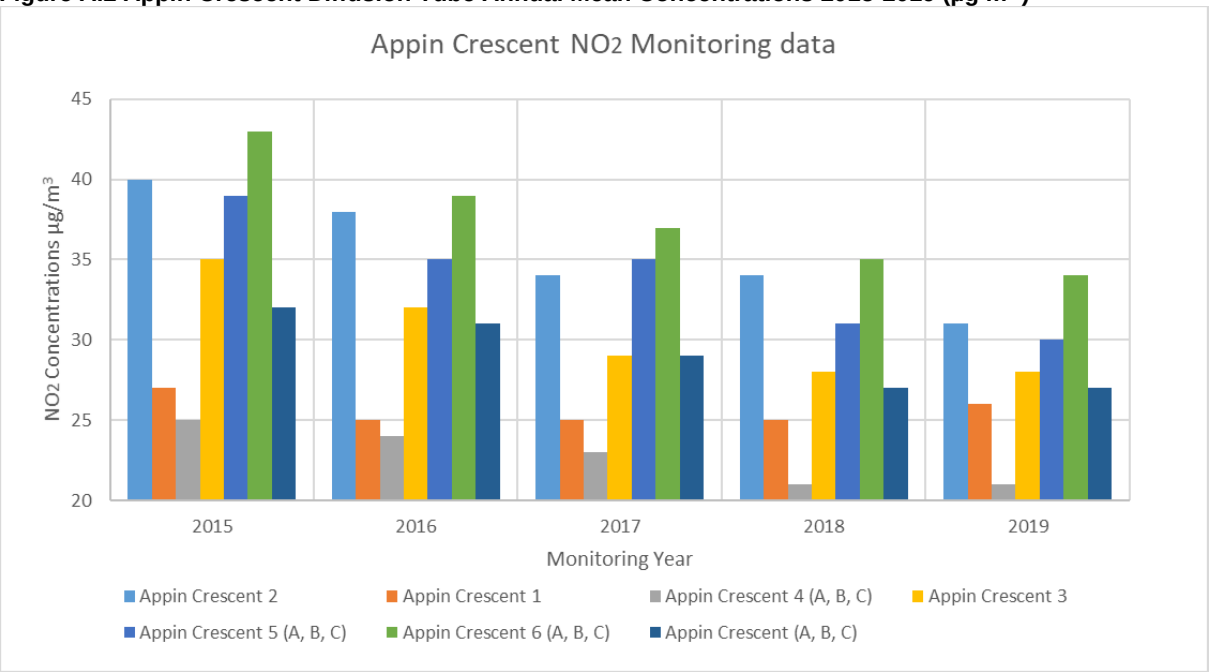
*****Annualised in accordance with TG.16. Full details in Appendix C.

Figure A.1 Bonnygate Diffusion Tube Annual Mean Concentrations 2015-2019 (µg m^{-3})



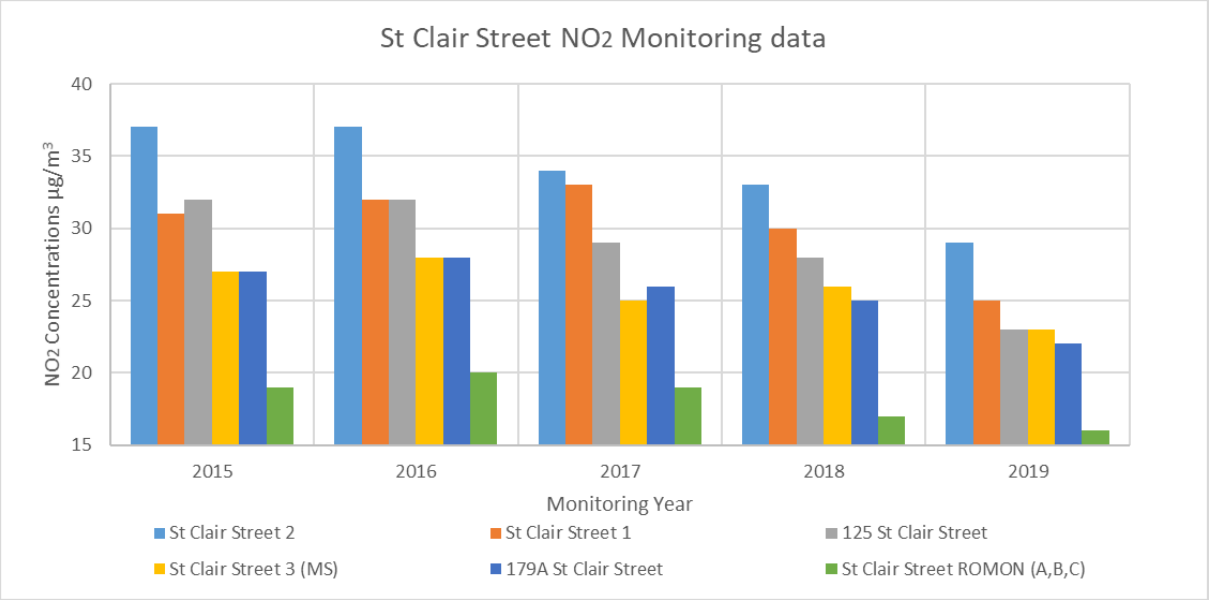
NO_2 annual mean concentrations for the Bonnygate area are presented in Figure A.1. Concentrations increased at all sites between 2015 and 2016. Before decreasing slightly from 2016 to 2019.

Figure A.2 Appin Crescent Diffusion Tube Annual Mean Concentrations 2015-2019 (µg m^{-3})



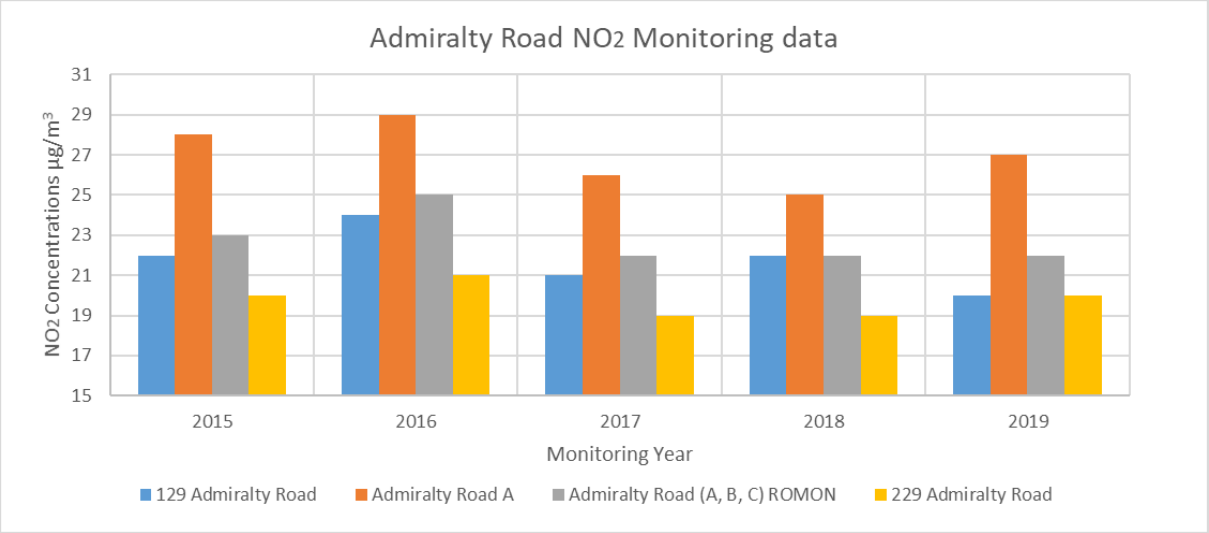
NO_2 annual mean concentrations for the Appin Crescent area are presented in Figure A.2. Since 2015 concentrations have declined steadily at all sites. With the exception of 2016 where there was a slight increase at all monitoring sites.

Figure A.3 St Clair Street Diffusion Tube Annual Mean Concentrations 2015-2019 (µg m^{-3})



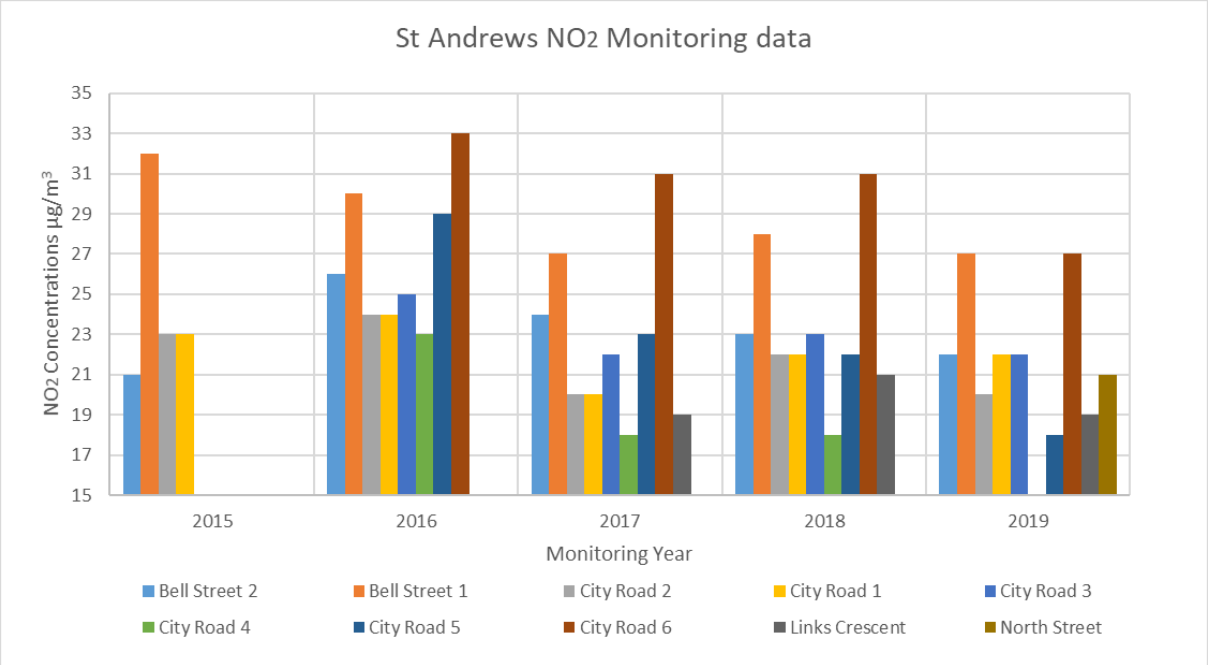
NO_2 annual mean concentrations for the St Clair Street area are presented in Figure A.3. Concentrations stayed fairly consistent between 2015 and 2016, the stared to decline steadily from 2016 to 2019.

Figure A.4 Admiralty Road Diffusion Tube Annual Mean Concentrations 2015-2019 (µg m^{-3})



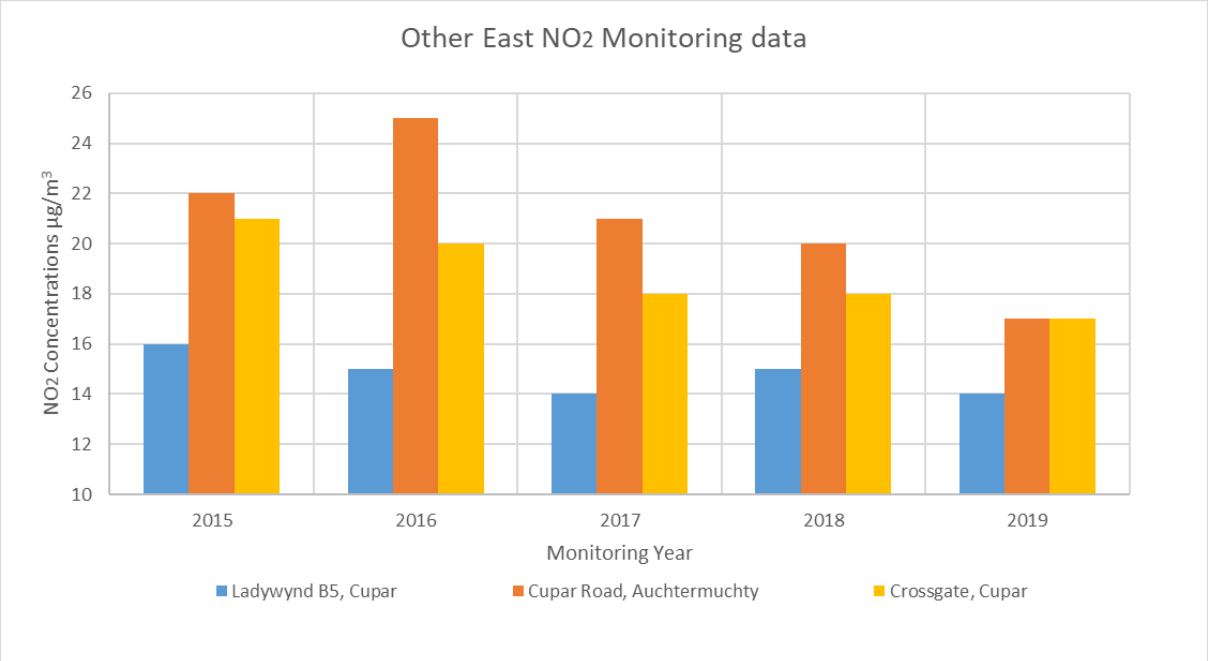
NO_2 annual mean concentrations for the Admiralty Road area are presented in Figure A.4. Concentrations increased slightly in 2016, then gradually declined between 2016 and 2019, with the exception of Admiralty Road A increasing slightly in 2019.

Figure A.5 St Andrews Diffusion Tube Annual Mean Concentrations 2015-2019 (µg m^{-3})



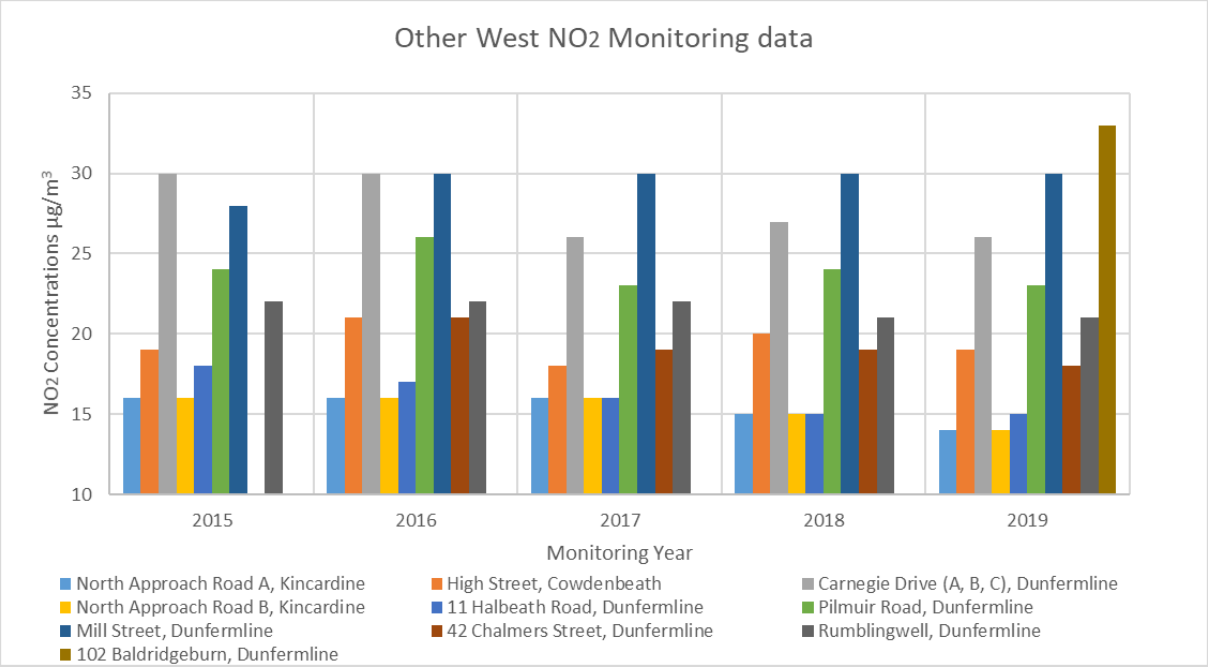
NO_2 annual mean concentrations for the St Andrews area are presented in Figure A.5. Between 2015 and 2016 concentrations declined. An additional four monitoring sites were introduced in 2016 however these sites declined along with the initial sites until 2019. With the exception of Bell Street 1 with increased slightly in 2018 before declining again in 2019.

Figure A.6 Other East Diffusion Tube Annual Mean Concentrations 2015-2019 (µg m^{-3})



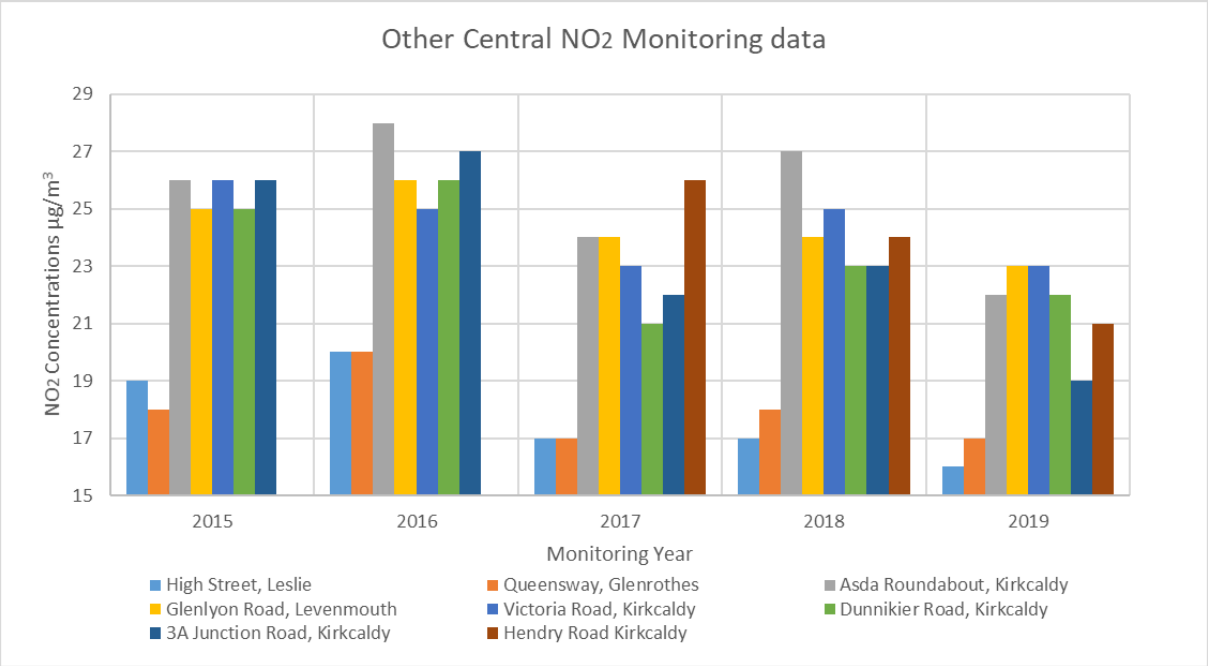
NO_2 annual mean concentrations for other east areas in Fife are presented in Figure A.6. Concentrations increased slightly in 2016 at Cupar Road and Crossgate, then declined steadily until 2019, with the exception of Ladywynd increasing in 2018 before decreasing again in 2019.

Figure A.7 Other West Diffusion Tube Annual Mean Concentrations 2015-2019 (µg m^{-3})



NO_2 annual mean concentrations for the other west areas in Fife are presented in Figure A.7. Concentrations increased slightly in 2016 before steadily declining until 2019. 102 Baldridgeburn was added in 2019.

Figure A.8 Other Central Diffusion Tube Annual Mean Concentrations 2015-2019 (µg m^{-3})



NO_2 annual mean concentrations for the other central areas in Fife are presented in Figure A.8. Concentrations have jumped around across the central Fife area increasing in 2016 before declining again in 2017. There were slight increases again in 2018 before a more significant decline in 2019 at all monitoring sites.

Table A. 2 - 1-Hour Mean NO_2 Monitoring Results (NO_2 1-Hour Means > 200 µg m^{-3})

Site Name	Monitoring Type	Valid Data Capture 2019 (%) (1)	2015(2)	2016(2)	2017(2)	2018(2)	2019(2)
Cupar	Automatic	99.2%	0	0	0	0	0
Dunfermline	Automatic	97.5%	0	0	0	0	0
Kirkcaldy	Automatic	98.4%	0	0	0	0	0
Rosyth	Automatic	99.7%	0	0	0	0	0

Notes:

(1) 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%).

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

Table A.5 – 24- Hour Mean PM_{10} Monitoring Results (PM_{10} 24-Hour Means > 50 µg m^{-3})

Site Name	Valid Data Capture 2019 (%) (1)	2015(2)	2016(2)	2017(2)	2018(2)	2019(2)
Cupar	99%	2 (27)	0	1	1	0
Dunfermline	100%	2 (25)	1	0	0	0
Kirkcaldy	92%	2	0	0	0	0
Rosyth	91.5%	3 (24)	1	1	0	0

Notes:

(1) 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%).

(2) If the period of valid data is less than 90%, the 98.1th percentile of 24-hour means is provided in brackets.

Appendix B – Full Monthly Diffusion Tube Results for 2019

Table B. 1- NO_2 Monthly Diffusion Tube Results for 2019 (µg m^{-3})

Site Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean Raw	Annual Mean Bias Adjusted (1)
Central Area														
Queensway, Glenrothes	34.5	26.5	21.2	27.7	23.0	Monitoring ceased							26.6	17.1
High Street, Leslie	34.0	24.1	21.6	26.2	21.2	Monitoring ceased							25.4	16.4
Glenlyon Road, Levenmouth	45.4	34.8	32.2	29.9	28.0	28.1	22.9	25.0	30.2	32.8	38.8	29.6	31.5	23.1
Asda Roundabout, Kirkcaldy	41.5	41.1	30.6	42.1	29.5	31.0	28.0	26.9	27.4	33.6	37.7	36.4	33.8	22.3
Victoria Road, Kirkcaldy	46.7	-	33.4	37.3	31.0	31.2	28.6	30.0	33.9	33.7	39.2	-	34.5	22.8
Dunnikier Road, Kirkcaldy	44.9	39.7	-	-	30.8	31.2	27.3	24.6	25.2	30.5	41.7	30.6	32.7	21.5
3A Junction Road, Kirkcaldy	37.2	32.5	23.2	33.5	28.7	24.9	25.7	23.2	25.9	29.2	33.7	27.5	28.8	19.0
St Clair Street 1, Kirkcaldy	41.9	42.5	30.7	48.9	36.4	39.4	35.3	30.4	33.2	37.1	45.0	34.6	38.0	25.0
St Clair Street 2, Kirkcaldy	61.3	54.9	48.7	33.6	36.4	37.0	34.6	43.8	40.2	36.2	51.2	48.2	43.8	28.9
St Clair Street 3 (MS), Kirkcaldy	38.4	39.3	28.5	40.6	32.3	34.6	31.1	29.1	28.7	35.2	42.2	31.6	34.3	22.6
125 St Clair Street, Kirkcaldy	49.2	46.4	35.5	24.1	27.7	26.9	33.4	34.9	34.3	33.1	34.6	41.0	35.1	23.2
179A St Clair Street, Kirkcaldy	51.8	40.0	35.7	19.8	27.5	24.2	25.1	29.4	33.7	33.4	39.6	39.9	33.3	22.0
St Clair Street ROMON (A), Kirkcaldy	36.2	31.7	25.0	18.8	18.5	19.6	18.0	19.8	21.9	25.1	32.7	27.4		
St Clair Street ROMON (B), Kirkcaldy	38.9	31.7	25.8	17.6	19.5	18.4	18.2	20.0	20.9	22.5	35.1	29.5	24.8	16.4
St Clair Street ROMON (C), Kirkcaldy	40.0	30.2	25.1	18.9	18.3	17.3	18.7	19.9	22.0	27.7	33.5	29.1		
Hendry Road Kirkcaldy	43.0	38.7	33.6	27.0	30.6	26.3	27.3	27.8	31.0	27.6	36.3	32.6	31.8	21.0
East Area														

Cupar Road, Auchtermuchty	35.0	25.5	24.4	22.2	23.5	Monitoring ceased							26.1	16.9
Bell Street 1, St Andrews	46.0	47.9	33.6	43.5	34.5	30.7	28.4	26.9	33.1	35.8	44.3	30.5	36.3	26.7
Bell Street 2, St Andrews	44.5	40.9	30.9	32.2	26.8	22.9	22.5	20.5	27.4	30.0	37.6	28.9	30.4	22.4
City Road 1, St Andrews	33.3	29.8	21.3	42.4	27.2	25.6	26.3	21.3	27.0	33.1	42.7	22.3	29.4	21.6
City Road 2, St Andrews	32.7	29.0	21.7	40.9	30.0	Monitoring ceased							30.9	20.0
City Road 3, St Andrews	40.9	33.6	28.3	30.6	26.3	25	23.1	24.3	26.7	30.7	34.7	35.2	30.0	22.0
City Road 4, St Andrews	26.4	24.3	15.9	27	20.9	Monitoring ceased							22.9	14.8
City Road 5, St Andrews	34.1	28.5	22.2	27.1	21.1	19.3	19.6	20.6	22.4	26.5	31.7	26.7	25.0	18.4
City Road 6, St Andrews	50.9	44.6	34.8	36.7	35.5	35.3	-	33.6	36.6	14.9	43.8	33.1	36.3	26.7
Links Crescent, St Andrews	32.6	30.3	27.4	28.5	25.1	24.5	22.2	22.6	24.3	26.5	30.8	21.7	26.4	19.4
North Street, St Andrews	38.0	34.0	27.3	27.7	23.6	22.1	22.4	25.3	26.4	26.6	34.3	27.0	27.9	20.5
Bonnygate B1, Cupar	40.7	35.5	25.7	36.9	29.6	27.3	25.2	23.8	27.1	33.9	40.0	29.4	31.3	23.8
Bonnygate B2, Cupar	49.6	-	-	Monitoring ceased									49.6	
Bonnygate B2i, Cupar	-	-	-	35.9	34.8	29.3	28.6	28.8	33.4	41.6	46.1	37.4	35.1	23.2
Bonnygate 3A, Cupar	52.6	44.4	29.8	43.8	44.3	38.1	34.8	32.5	38.6	47.4	51.2	35.7	41.1	31.2
Bonnygate 3B, Cupar	53.4	44.3	36.6	50.1	39.7	Monitoring ceased							44.8	30.0
Bonnygate 4B, Cupar	55.5	48.5	40.6	48.6	40.1	37.5	36.2	35.9	37.7	44.4	46.0	40.9	42.7	32.4
Ladywynd B5 Cupar	28.3	24.9	17.2	19.7	14.7	Monitoring ceased							21.0	14.0
Bonnygate West B6, Cupar	35.7	30.5	23.9	21.1	17.0	25.2	16.4	18.0	20.2	24.9	30.6	26.9	24.2	18.4
Crossgate, Cupar	35.7	30.5	23.9	21.1	17.0	25.2	16.4	18.0	20.2	24.9	30.6	26.9	24.2	16.8
Bonnygate Monitor BA, Cupar	37.0	32.5	28.4	37.1	26.9	25.2	24.6	23.1	26.6	33.0	41.2	29.1		
Bonnygate Monitor BB, Cupar	43.4	33.4	26.5	36.4	27.6	25.7	23.5	23.3	26.7	31.6	39.0	29.8	30.5	23.1
Bonnygate Monitor BC, Cupar	40.6	35.8	28.2	36.1	26.5	25.5	23.8	22.9	27.9	30.5	38.3	28.6		
West Area														
High Street, Cowdenbeath	38.1	35.2	22.5	30.2	22.5	22.0	19.6	19.5	20.9	28.4	35.5	22.5	26.4	19.4

North Approach Road A, Kincardine	36.5	24.3	18.2	15.9	-	Monitoring ceased							23.7	14.3
North Approach Road B, Kincardine	35.9	23.2	17.9	17.1	-	Monitoring ceased							23.5	14.1
Admiralty Road A, Rosyth	46.6	37.1	28.3	33.2	25.9	25.8	22.9	25.5	28.3	32.8	40.9	33.5	31.7	26.7
129 Admiralty Road, Rosyth	39.2	26.2	22.2	27.2	22.8	Monitoring ceased							27.5	20.4
229 Admiralty Road, Rosyth	36.4	39.4	21.2	22.8	17.0	Monitoring ceased							27.4	20.3
Admiralty Road A ROMON	40.4	28.2	21.7	23.0	21.9	16.0	22.2	21.5	27.5	26.8	31.4	25.1	25.8	21.7
Admiralty Road B ROMON	39.5	28.3	21.8	24.8	21.0	18.0	22	22.4	26.5	27	32.5	26.3		
Admiralty Road C ROMON	40.5	27.6	21.5	25.6	21.6	20.5	21.5	23.5	26	27.0	35.2	23.9		
Appin Crescent 1, Dunfermline	52.5	37.8	38.7	32.9	28.4	26.3	22.3	25.3	29.8	32.1	44.1	42.3	34.4	26.1
Appin Crescent 2, Dunfermline	60.5	47.4	41.4	40.6	36.3	31.8	32.4	37.5	36.4	40.2	42.4	47.8	41.2	31.3
Appin Crescent 3, Dunfermline	54.2	43.0	36.5	41.1	31.5	28.6	29.2	28.8	32.1	33.5	43.3	45.2	37.3	28.3
Appin Crescent 4A, Dunfermline	40.3	33.2	28.5	26.6	21.1	20.8	19.2	20.8	23.7	27.4	30.1	30.2	27.3	20.7
Appin Crescent 4B, Dunfermline	42.3	32.7	31.0	28.6	21.6	19.7	18.2	20.2	24.5	26.9	32.6	32.0		
Appin Crescent 4C, Dunfermline	44.4	33.2	30.3	26.2	21.5	21.1	18.2	20.5	23.3	26.0	33.0	31.4		
Appin Crescent 5A, Dunfermline	63.6	52.2	49.7	36.3	29.6	29.2	30.0	34.2	35.6	38.6	45.0	50.2	40.1	30.5
Appin Crescent 5B, Dunfermline	64.3	-	45.9	36.1	31.8	30.7	28.1	31.6	34.9	37.2	41.0	48.4		
Appin Crescent 5C, Dunfermline	65.0	51.8	43.9	30.8	34.1	32.9	30.3	31.1	34.7	36.1	-	48.8		
Appin Crescent 6A, Dunfermline	58.0	56.5	45.4	43.2	36.3	34.6	33.9	37.4	-	40.5	43.5	50.3	44.5	33.8
Appin Crescent 6B, Dunfermline	68.7	58.8	45.7	44.1	36.9	36.0	31.8	38.6	36.4	37.1	43.0	52.4		
Appin Crescent 6C, Dunfermline	60.1	59.8	47.3	43.9	38.2	36.3	36.5	38.9	38.8	40.6	53.4	54.3		
Appin Crescent A, Dunfermline	52.9	40.6	41.5	-	-	27.0	20.6	30.9	34.7	38.4	45.8	36.7	35.9	27.3
Appin Crescent B, Dunfermline	54.5	43.6	37.9	31.8	25.1	23.0	24.2	29.0	29.8	30.2	46	39.4		
Appin Crescent C, Dunfermline	59.6	45.2	45.2	33.7	28.7	26.0	22.2	26.9	33.2	36.0	39.3	42.4		
Carnegie Drive A, Dunfermline	42.6	37.9	28.5	42.6	30.8	33.8	31.1	29.7	28.8	31.0	37.2	34.0		

Carnegie Drive B, Dunfermline	41.0	38.2	28.5	42.6	31.6	31.9	32.7	30.3	29.5	33.3	37.9	32.9	34.1	25.9
Carnegie Drive C, Dunfermline	38.5	36.9	29.4	41.4	32.5	30.5	31.5	31.5	30.5	33.3	37.1	34.3		
11 Halbeath Road, Dunfermline	31.5	25.1	19.5	16.9	14.6	10.8	13.7	14.4	16.5	18.9	25.6	25.6	19.4	14.8
Pilmuir Road, Dunfermline	63.7	37.4	39.3	34.6	33.9	33.4	33.4	33.8	38.5	42.2	46.5	39.3	39.7	22.6
Mill Street, Dunfermline	36.8	33.6	20.5	24.0	20.7	Monitoring ceased							27.1	30.1
42 Chalmers Street, Dunfermline	43.1	31.7	27.9	26.5	24.4	23.8	21.2	21.7	24.2	26.0	29.6	30.8	27.6	18.2
Rumblingwell, Dunfermline	-	-	-	-	-	20.1	20.4	-	-	23.5	31.9	31.0	25.4	21.0
102 Baldridgeburn Dunfermline	31.5	25.1	19.5	16.9	14.6	10.8	13.7	14.4	16.5	18.9	25.6	25.6	19.4	33.0

1. See Appendix C for details on bias adjustment
2. 2019 data annualised, from period mean concentrations as described in TG(16)

Appendix C – Data QA/QC

Diffusion Tube Bias Adjustment Factors

Diffusion tubes may over or under predict NO_2 concentrations when compared to the reference method chemiluminescent analyser. This difference in measurement is described as bias. Accuracy in results can be adjusted in order to account for this. Results are adjusted using a calculated bias adjustment factor.

The diffusion tubes deployed by Fife Council were supplied and analysed by SOCOTEC using a preparation mixture of 20% triethanolamine (TEA) in water.

Figures C1-C4 show the locally derived adjustment factors. Overall the locally derived adjustment factor was 0.74. The local bias adjustment was applied to all diffusion tubes within the area. While the average of the local was used for all other sites for consistency.

Figure C. 1 Local Bias adjustment spreadsheet- Cupar

Checking Precision and Accuracy of Triplicate Tubes

AEA Energy & Environment
From the AEA group

Diffusion Tubes Measurements										Automatic Method		Data Quality Check	
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	Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
1	07/01/2019	04/02/2019	37.0	43.4	40.6	40	3.2	8	8.0	36.2	100	Good	Good
2	04/02/2019	04/03/2019	32.5	33.4	35.8	34	1.7	5	4.2	29.8	100	Good	Good
3	04/03/2019	01/04/2019	28.4	26.5	28.2	28	1.0	4	2.6	20.8	100	Good	Good
4	01/04/2019	29/04/2019	37.1	36.4	36.1	37	0.5	1	1.3	27.2	99	Good	Good
5	29/04/2019	04/06/2019	26.9	27.6	26.5	27	0.6	2	1.4	19.8	100	Good	Good
6	04/06/2019	02/07/2019	25.2	25.7	25.5	25	0.3	1	0.6	15.7	99	Good	Good
7	02/07/2019	06/08/2019	24.6	23.5	23.8	24	0.6	2	1.4	14.8	99	Good	Good
8	06/08/2019	03/09/2019	23.1	23.3	22.9	23	0.2	1	0.5	16.0	99	Good	Good
9	03/09/2019	03/10/2019	26.6	26.7	27.9	27	0.7	3	1.8	18.7	99	Good	Good
10	03/10/2019	07/11/2019	33.0	31.6	30.5	32	1.3	4	3.1	24.1	98	Good	Good
11	07/11/2019	02/12/2019	41.2	39.0	38.3	40	1.5	4	3.8	33.6	100	Good	Good
12	02/12/2019	10/01/2020	29.1	29.8	28.6	29	0.6	2	1.5	22.3	99	Good	Good
13													
											Overall survey -->	Good precision	Good Overall DC

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

(Check average CV & DC from Accuracy calculations)

Site Name/ ID: Cupar

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

Accuracy (with 95% confidence interval) without periods with CV larger than 20%		Accuracy (with 95% confidence interval) WITH ALL DATA	
Bias calculated using 12 periods of data		Bias calculated using 12 periods of data	
Bias factor A	0.76 (0.71 - 0.83)	Bias factor A	0.76 (0.71 - 0.83)
Bias B	31% (20% - 41%)	Bias B	31% (20% - 41%)
Diffusion Tubes Mean:	30 µgm^{-3}	Diffusion Tubes Mean:	30 µgm^{-3}
Mean CV (Precision):	3	Mean CV (Precision):	3
Automatic Mean:	23 µgm^{-3}	Automatic Mean:	23 µgm^{-3}
Data Capture for periods used:	99%	Data Capture for periods used:	99%
Adjusted Tubes Mean:	23 (22 - 25) µgm^{-3}	Adjusted Tubes Mean:	23 (22 - 25) µgm^{-3}

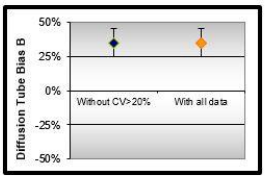


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Figure C. 2 Local Bias Adjustment Factor spreadsheet- Dunfermline

Checking Precision and Accuracy of Triplicate Tubes

AEA Energy & Environment
From the AEA group

Diffusion Tubes Measurements										Automatic Method		Data Quality Check	
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	Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
1	10/01/2019	07/02/2019	40.3	42.3	44.4	42	2.1	5	5.1	35.2	100	Good	Good
2	07/02/2019	07/03/2019	33.2	32.7	33.2	33	0.3	1	0.7	26.3	100	Good	Good
3	07/03/2019	04/04/2019	28.5	31.0	30.3	30	1.3	4	3.2	21.0	100	Good	Good
4	04/04/2019	02/05/2019	26.6	28.6	26.2	27	1.3	5	3.2	19.7	99	Good	Good
5	02/05/2019	06/06/2019	21.1	21.6	21.5	21	0.3	1	0.7	20.1	78	Good	Good
6	06/06/2019	04/07/2019	20.8	19.7	21.1	21	0.7	4	1.8	11.8	99	Good	Good
7	04/07/2019	07/08/2019	19.2	18.2	18.2	19	0.6	3	1.4	11.9	100	Good	Good
8	07/08/2019	02/09/2019	20.8	20.2	20.5	21	0.3	1	0.7	13.4	100	Good	Good
9	02/09/2019	01/10/2019	23.7	24.5	23.3	24	0.6	3	1.5	15.5	100	Good	Good
10	01/10/2019	05/11/2019	27.4	26.9	26.0	27	0.7	3	1.8	17.6	100	Good	Good
11	05/11/2019	05/12/2019	30.1	32.6	33.0	32	1.6	5	3.9	31.0	99	Good	Good
12	05/12/2019	08/01/2020	30.2	32.0	31.4	31	0.9	3	2.3	22.3	100	Good	Good
13													
											Overall survey -->	Good precision	Good Overall DC

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

(Check average CV & DC from Accuracy calculations)

Site Name/ ID:	Dunfermline

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

Accuracy (with 95% confidence interval) without periods with CV larger than 20%	
Bias calculated using 12 periods of data	
Bias factor A	0.75 (0.68 - 0.84)
Bias B	33% (20% - 47%)
Diffusion Tubes Mean:	27 μgm^{-3}
Mean CV (Precision):	3
Automatic Mean:	20 μgm^{-3}
Data Capture for periods used:	98%
Adjusted Tubes Mean:	20 (19 - 23) μgm^{-3}

Accuracy (with 95% confidence interval) WITH ALL DATA	
Bias calculated using 12 periods of data	
Bias factor A	0.75 (0.68 - 0.84)
Bias B	33% (20% - 47%)
Diffusion Tubes Mean:	27 μgm^{-3}
Mean CV (Precision):	3
Automatic Mean:	20 μgm^{-3}
Data Capture for periods used:	98%
Adjusted Tubes Mean:	20 (19 - 23) μgm^{-3}

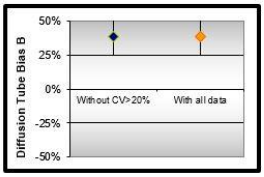

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Figure C. 3 Local Bias Adjustment Factor spreadsheet- Kirkcaldy

Checking Precision and Accuracy of Triplicate Tubes

AEA Energy & Environment
From the AEA group

Diffusion Tubes Measurements										Automatic Method		Data Quality Check	
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	Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
1	07/01/2019	04/02/2019	36.2	38.9	40.0	38	2.0	5	4.9	28.3	100	Good	Good
2	04/02/2019	04/03/2019	31.7	31.7	30.2	31	0.9	3	2.2	21.8	100	Good	Good
3	04/03/2019	01/04/2019	25.0	25.8	25.1	25	0.4	2	1.1	15.8	100	Good	Good
4	01/04/2019	29/04/2019	18.8	17.6	18.9	18	0.7	4	1.8	12.7	96	Good	Good
5	29/04/2019	03/06/2019	18.5	19.5	18.3	19	0.6	3	1.6	12.5	100	Good	Good
6	03/06/2019	01/07/2019	19.6	18.4	17.3	18	1.2	6	2.9	10.5	99	Good	Good
7	01/07/2019	05/08/2019	18.0	18.2	18.7	18	0.4	2	0.9	9.8	89	Good	Good
8	05/08/2019	02/09/2019	19.8	20.0	19.9	20	0.1	1	0.2	12.4	100	Good	Good
9	02/09/2019	30/09/2019	21.9	20.9	22.0	22	0.6	3	1.5	13.0	100	Good	Good
10	30/09/2019	04/11/2019	25.1	22.5	27.7	25	2.6	10	6.5	15.1	100	Good	Good
11	04/11/2019	02/12/2019	32.7	35.1	33.5	34	1.2	4	3.0	23.1	100	Good	Good
12	02/12/2019	07/01/2020	27.4	29.5	29.1	29	1.1	4	2.8	10.7	100	Good	Good
13													
											Overall survey -->	Good precision	Good Overall DC

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

(Check average CV & DC from Accuracy calculations)

Site Name/ ID:	Kirkcaldy

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

Accuracy (with 95% confidence interval) without periods with CV larger than 20%	
Bias calculated using 12 periods of data	
Bias factor A	0.62 (0.55 - 0.72)
Bias B	60% (38% - 83%)
Diffusion Tubes Mean:	25 μgm^{-3}
Mean CV (Precision):	4
Automatic Mean:	15 μgm^{-3}
Data Capture for periods used:	99%
Adjusted Tubes Mean:	15 (14 - 18) μgm^{-3}

Accuracy (with 95% confidence interval) WITH ALL DATA	
Bias calculated using 12 periods of data	
Bias factor A	0.62 (0.55 - 0.72)
Bias B	60% (38% - 83%)
Diffusion Tubes Mean:	25 μgm^{-3}
Mean CV (Precision):	4
Automatic Mean:	15 μgm^{-3}
Data Capture for periods used:	99%
Adjusted Tubes Mean:	15 (14 - 18) μgm^{-3}

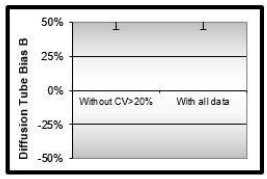

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Figure C. 4 Local Bias Adjustment Factor Spreadsheet – Rosyth

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	10/01/2019	07/02/2019	40.4	39.5	40.5	40	0.6	1	1.4
2	07/02/2019	07/03/2019	28.2	28.3	27.6	28	0.4	1	0.9
3	07/03/2019	04/04/2019	21.7	21.8	21.5	22	0.2	1	0.4
4	04/04/2019	02/05/2019	23.0	24.8	25.6	24	1.3	5	3.3
5	02/05/2019	06/06/2019	21.9	21.0	21.6	22	0.5	2	1.1
6	06/06/2019	04/07/2019	16.0	18.0	20.5	18	2.3	12	5.6
7	04/07/2019	07/08/2019	22.2	22.0	21.5	22	0.4	2	0.9
8	07/08/2019	02/09/2019	21.5	22.4	23.5	22	1.0	4	2.5
9	02/09/2019	01/10/2019	27.5	26.5	26.0	27	0.8	3	1.9
10	01/10/2019	05/11/2019	26.8	27.0	27.0	27	0.1	0	0.3
11	05/11/2019	05/12/2019	31.4	32.5	35.2	33	2.0	6	4.9
12	05/12/2019	08/01/2020	25.1	26.3	23.9	25	1.2	5	3.0
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
36.1	100	Good	Good
26.1	100	Good	Good
18.4	100	Good	Good
20.6	99	Good	Good
18.1	100	Good	Good
14.6	99	Good	Good
16.5	100	Good	Good
16.5	100	Good	Good
19.1	99	Good	Good
20.1	100	Good	Good
32.1	100	Good	Good
19.4	100	Good	Good
Overall survey -->		Good precision	Good Overall DC

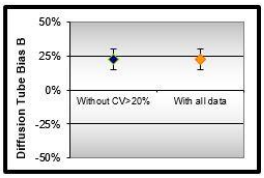
(Check average CV & DC from Accuracy calculations)

Site Name/ ID: Rosyth

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

Accuracy (with 95% confidence interval) without periods with CV larger than 20%
Bias calculated using 12 periods of data
Bias factor A 0.83 (0.78 - 0.89)
Bias B 20% (13% - 28%)
Diffusion Tubes Mean: 26 μgm^{-3}
Mean CV (Precision): 4
Automatic Mean: 21 μgm^{-3}
Data Capture for periods used: 100%
Adjusted Tubes Mean: 21 (20 - 23) μgm^{-3}

Accuracy (with 95% confidence interval) WITH ALL DATA
Bias calculated using 12 periods of data
Bias factor A 0.83 (0.78 - 0.89)
Bias B 20% (13% - 28%)
Diffusion Tubes Mean: 26 μgm^{-3}
Mean CV (Precision): 4
Automatic Mean: 21 μgm^{-3}
Data Capture for periods used: 100%
Adjusted Tubes Mean: 21 (20 - 23) μgm^{-3}



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QA/QC of Automatic Monitoring

The QA/QC procedures follow the requirements of the Technical Guidance (TG.16) and are equivalent to those used at UK levels for the National Network (AURN) monitoring sites. This gives a high degree of confidence in the data obtained, both for measured concentrations at the automatic sites and for establishing robust bias correction factors for diffusion tubes.

In order to satisfy the requirement in the Technical Guidance (TG.16), the following QA/QC procedures were implemented:

- 3-weekly calibrations of the NOx analyser;
- 6-monthly audits and servicing of the monitoring site;
- Data ratification.

Calibrations of the NOx analyser were carried out using certified compressed gas standards (ISO17025). This ensured that the calibration gas was traceable to national and international standards. FIDAS diagnostics were recorded and cal dust performed.

Audits of the monitoring sites consisted of a number of performance checks to identify any faults with the equipment. The calibration cylinder was also checked against another gas standard in order to confirm the gas concentration. Any identified faults during the audit were forwarded on to the service unit for repair.

The final stage of the QA/QC process was to ratify the data. During ratification, all calibration, audit and service data are collected, and the data are scaled appropriately. Any suspect data identified are deleted therefore ensuring that the data are of a high quality.

Diffusion Tube QA/QC Process

Diffusion tubes used by Fife Council are now supplied and analysed by SOCOTEC. The tube preparation method is 20% TEA in water. SOCOTEC is a participant in the centralised QA/QC services provided by Defra and the devolved administrations. These services compromise of:

- Promotion of the independent AIR-PT scheme, operated by LGC Standards and supported by the health and Safety Laboratory, with yearly assessment against agreed performance criteria. AIR-PT combines two long running PT schemes: LGC Standards STACKS PT scheme and HSL Workplace Analysis Scheme for Proficiency (WASP) PT scheme.
- Provision of quality control standard solutions, free of charge to laboratories that prepare and analyse NO_2 diffusion tubes used by Local Authorities for LAQM purposes.

Bias Correction for Diffusion Tubes

Diffusion tube samplers are a simple and cost effective method of measuring NO_2. However, they are classed as an indicative method and are known to have a systematic bias compared to more accurate results obtained from calibrated automatic analysers. The local bias factor is calculated using sites where a triplicate set of diffusion tubes are co-located with a chemiluminescence analyser. The national bias adjustment factor is derived using the national database co-location studies.

Fife Council has four co-location sites that have been used to calculate the local bias adjustment factor. The local bias adjustment factor for each individual location was calculated using the “LAQM Tool” described in LAQM TG(16). The results are shown in Table C.1 below. The average of the local bias adjustment factors is 0.74.

For this report, in order to keep results comparable, the local bias adjustment was applied to all diffusion tubes within the area. While the average of the local was used for all other sites for consistency.

The survey consists of tubes exposed over a range of settings, which differ from the co-location site, e.g. the co-location site in a very exposed setting and the tubes being assessed are on building façade in a canyon-like street.

Table C. 1 Local BIAS adjustment factors

Source	Bias Adjustment Factors 2018
Cupar	0.76
Dunfermline	0.75
Kirkcaldy	0.62
Rosyth	0.83
Average Local Bias factor	0.74

Appendix D – Annualisation of Data

Data capture for the following sites was less than 75%, therefore the data was annualised in accordance with TG(16) as per Box 7.9.

- Queensway Glenrothes – 42%. Periods of valid data = 07/01/19-03/06/19
- High Street Leslie – 42%. Periods of valid data = 07/01/19-03/06/19
- Cupar Road Auchtermuchty – 42%. Periods of valid data = 07/01/19-04/06/19
- City Road 2 St Andrews – 42%. Periods of valid data = 07/01/19-04/06/19
- City Road 4 St Andrews – 42%. Periods of valid data = 07/01/19-04/06/19
- Bonnygate B2i Cupar – 75%. Periods of valid data = 01/04/19-10-0119
- Bonnygate 3B Cupar – 42%. Periods of valid data = 07/0119-04/06/19
- Ladywynd B5 Cupar – 42%. Periods of valid data = 07/01/19-04/06/19
- Crossgate Cupar – 42%. Periods of valid data = 07/01/19-04/06/19
- N. Approach Road A Kincardine – 33%. Periods of valid data = 10/01/19-02/05/19
- N. Approach Road B Kincardine – 33%. Periods of valid data = 10/01/19-02/05/19
- 129 Admiralty Road Rosyth – 42%. Periods of valid data = 10/01/19-06/06/19
- 229 Admiralty Road Rosyth – 42%. Periods of valid data = 10/0119-06/06/19
- Chalmers Street Dunfermline – 42%. Periods of valid data = 10/01/19-06/06/19
- 102 Baldridgeburn Dunfermline – 42%. Periods of valid data = 06/06/19-07/08/19, 01/10/19-08/01/20

Table D. 1 Annualisation of NO_2 Diffusion Tubes for Central Area

Automatic Site	Automatic Site Annual Mean 2019 (AM) (Central)	Automatic Site Period Mean 2019 (PM) *(Queensway Glenrothes)*	Automatic Site Period Mean 2019 (PM) *(High Street Leslie)*
Bush Estate	5.2	5.9	5.9
Dundee Mains Loan	10.5	11.9	11.9
Edinburgh St Leonards	19.4	22.4	22.4
Average Ratio (Am/Pm) – Queensway Glenrothes		**0.88**	
Average Ratio (Am/Pm) – High Street Leslie		**0.88**	
Queensway Glenrothes – Annual Mean (µg m^{-3})		**23.3**	

Queensway Glenrothes – Annual Mean (µg m^{-3}) – BIAS Adjusted	**17.1**
High Street Leslie – Annual Mean (µg m^{-3})	**22.3**
High Street Leslie – Annual Mean (µg m^{-3}) – BIAS Adjusted	**16.4**

Table D. 2 Annualisation of NO_2 Diffusion Tubes for East Area

Automatic Site	Automatic Site Annual Mean 2019 (AM) (East)	Automatic Site Period Mean 2019 (PM) *(Cupar Road Auchtermuchty)*	Automatic Site Period Mean 2019 (PM) *(City Road 2 St Andrews)*	Automatic Site Period Mean 2019 (PM) *(City Road 4 St Andrews)*	Automatic Site Period Mean 2019 (PM) *(Bonnygate B2i Cupar)*	Automatic Site Period Mean 2019 (PM) *(Bonnygate 3B Cupar)*	Automatic Site Period Mean 2019 (PM) *(Ladywynd B5 Cupar)*	Automatic Site Period Mean 2019 (PM) *(Crossgate Cupar)*
Bush Estate	5.2	5.9	5.9	5.9	5.1	5.9	5.9	5.9
Dundee Mains Loan	10.6	11.8	11.8	11.8	9.7	11.8	11.8	11.8
Edinburgh St Leonards	19.4	22.3	22.3	22.3	17.5	22.3	22.3	22.3
Average Ratio (Am/Pm) – Cupar Road Auchtermuchty						0.88		
Average Ratio (Am/Pm) – City Road 2 St Andrews						0.88		
Average Ratio (Am/Pm) – City Road 4 St Andrews						0.88		
Average Ratio (Am/Pm) – Bonnygate B2i Cupar						1.07		
Average Ratio (Am/Pm) – Bonnygate 3B Cupar						0.88		
Average Ratio (Am/Pm) – Ladywynd B5 Cupar						0.88		
Average Ratio (Am/Pm) – Crossgate Cupar						0.88		
Cupar Road Auchtermuchty – Annual Mean (µg m^{-3})						**23.0**		
Cupar Road Auchtermuchty – Annual Mean (µg m^{-3}) – BIAS Adjusted						**16.9**		
City Road 2 St Andrews – Annual Mean (µg m^{-3})						**27.2**		
City Road 2 St Andrews – Annual Mean (µg m^{-3}) – BIAS Adjusted						**20.0**		
City Road 4 St Andrews – Annual Mean (µg m^{-3})						**20.2**		
City Road 4 St Andrews – Annual Mean (µg m^{-3}) – BIAS Adjusted						**14.8**		
Bonnygate B2i Cupar – Annual Mean (µg m^{-3})						**37.5**		

Bonnygate B2i Cupar – Annual Mean (µg m^{-3}) – BIAS Adjusted	**28.5**
Bonnygate 3B Cupar – Annual Mean (µg m^{-3})	**39.5**
Bonnygate 3B Cupar – Annual Mean (µg m^{-3}) – BIAS Adjusted	**30.0**
Ladywynd B5 Cupar – Annual Mean (µg m^{-3})	**18.5**
Ladywynd B5 Cupar – Annual Mean (µg m^{-3}) – BIAS Adjusted	**14.0**
Crossgate Cupar – Annual Mean (µg m^{-3})	**22.1**
Crossgate Cupar – Annual Mean (µg m^{-3}) – BIAS Adjusted	**16.8**

Table D. 3 Annualisation of NO_2 Diffusion Tubes for West Area

Automatic Site	Automatic Site Annual mean 2019 (Am) (West)	Automatic Site Period Mean 2019 (Pm) *(N. Approach Road A Kincardine)*	Automatic Site Period Mean 2019 (Pm) *(N. Approach Road B Kincardine)*	Automatic Site Period Mean 2019 (Pm) *(129 Admiralty Road Rosyth)*	Automatic Site Period Mean 2019 (Pm) *(229 Admiralty Road Rosyth)*	Automatic Site Period Mean 2019 (Pm) *(Chalmers Street Dunfermline)*	Automatic Site Period Mean 2019 (Pm) *(102 Baldridgeburn Dunfermline)*
Bush Estate	5.1	6.1	6.1	5.9	5.9	5.9	5.1
Dundee Mains Loan	10.5	13.2	13.2	11.7	11.7	11.7	6.1
Edinburgh St Leonards	19.2	23.5	23.5	21.9	21.9	21.9	8.0
Average Ratio (Am/Pm) – N. Approach Road A Kincardine				0.82			
Average Ratio (Am/Pm) – N. Approach Road B Kincardine				0.82			
Average Ratio (Am/Pm) – 129 Admiralty Road Rosyth				0.88			
Average Ratio (Am/Pm) – 229 Admiralty Road Rosyth				0.88			
Average Ratio (Am/Pm) – Chalmers Street Dunfermline				0.88			
Average Ratio (Am/Pm) – 102 Baldridgeburn Dunfermline				1.71			
N. Approach Road A Kincardine – Annual Mean (µg m^{-3})				**19.4**			
N. Approach Road A Kincardine – Annual Mean (µg m^{-3}) – BIAS Adjusted				**14.3**			
N. Approach Road B Kincardine – Annual Mean (µg m^{-3})				**19.2**			
N. Approach Road B Kincardine – Annual Mean (µg m^{-3}) – BIAS Adjusted				**14.1**			
129 Admiralty Road Rosyth – Annual Mean (µg m^{-3})				**24.3**			

129 Admiralty Road Rosyth – Annual Mean (µg m^{-3}) – BIAS Adjusted	**20.2**
229 Admiralty Road Rosyth – Annual Mean (µg m^{-3})	**24.2**
229 Admiralty Road Rosyth – Annual Mean (µg m^{-3}) – BIAS Adjusted	**20.1**
Chalmers Street Dunfermline – Annual Mean (µg m^{-3})	**23.9**
Chalmers Street Dunfermline – Annual Mean (µg m^{-3}) – BIAS Adjusted	**18.0**
102 Baldridgeburn Dunfermline – Annual Mean (µg m^{-3})	**43.4**
102 Baldridgeburn Dunfermline – Annual Mean (µg m^{-3}) – BIAS Adjusted	**32.5**

Figure D.4 Fife Bonnygate AQMesh Sensor Annualisation PM_{10}

Site	PM_{10} Annual Mean	PM_{10} Period Mean	Ratio
Cupar	15	13.13	1.14
Dundee Mains Loan	9	8.11	1.11
Perth Muirton	9	7.88	1.14
		Average	1.13
		Bonnygate Annual Mean Conc	21
		Bonnygate Annualised Conc	23.7

Figure D.5 Fife Bonnygate AQMesh Sensor Annualisation $PM_{2.5}$

Site	$PM_{2.5}$ Annual Mean	$PM_{2.5}$ Period Mean	Ratio
Cupar	8	7.15	1.12
Dundee Mains Loan	6	4.97	1.21
Perth Muirton	5	4.72	1.06
		Average	1.13
		Bonnygate Annual Mean Conc	10
		Bonnygate Annualised Conc	11.3

Table D. 6 Fife Appin Crescent East AQMesh Sensor Annualisation NO_2

Site	NO_2 Annual Mean	NO_2 Period Mean	Ratio
Fife Dunfermline	21	25.4	0.83
Dundee Mains Loan	11	7.3	1.5
Edinburgh St Leonards	21	24.9	0.84
		Average	1.05
		Appin East Annual Mean Conc	31
		Appin East Annualised Conc	32.8

Table D. 7 Fife Appin Crescent East AQMesh Sensor Annualisation PM_{10}

Site	PM_{10} Annual Mean	PM_{10} Period Mean	Ratio
Fife Dunfermline	11	13.3	0.83
Dundee Mains Loan	9	10.8	0.82
Edinburgh St Leonards	11	13.0	0.85
		Average	0.84
		Appin East Annual Mean Conc	15
		Appin East Annualised Conc	12.5

Table D. 8 Fife Appin Crescent East AQMesh Sensor Annualisation $PM_{2.5}$

Site	$PM_{2.5}$ Annual Mean	$PM_{2.5}$ Period Mean	Ratio
Fife Dunfermline	6	8.1	0.74
Dundee Mains Loan	6	6.8	0.89
Edinburgh St Leonards	6	7.7	0.78
		Average	0.80
		Appin East Annual Mean Conc	9
		Appin East Annualised Conc	7.2

Table D. 9 Fife Appin Crescent West AQMesh Sensor Annualisation NO_2

Site	NO_2 Annual Mean	NO_2 Period Mean	Ratio
Fife Dunfermline	21	19.2	1.09
Dundee Mains Loan	11	10.7	1.02
Edinburgh St Leonards	11	19.9	1.06
		Average	1.06
		Appin West Annual Mean Conc	24
		Appin West Annualised Conc	25.4

Table D. 10 Fife Appin Crescent West AQMesh Sensor Annualisation PM_{10}

Site	PM_{10} Annual Mean	PM_{10} Period Mean	Ratio
Fife Dunfermline	11	10.7	0.99
Dundee Mains Loan	9	9.1	1.03
Edinburgh St Leonards	11	10.94	1.01
		Average	1.01
		Appin West Annual Mean Conc	11
		Appin West Annualised Conc	11

Table D. 11 Fife Appin Crescent West AQMesh Sensor Annualisation $PM_{2.5}$

Site	$PM_{2.5}$ Annual Mean	$PM_{2.5}$ Period Mean	Ratio
Fife Dunfermline	6	6.1	0.98
Dundee Mains Loan	6	5.5	1.08
Edinburgh St Leonards	6	6.2	0.97
		Average	1.01
		Appin West Annual Mean Conc	7
		Appin West Annualised Conc	7

Appendix E – Technical Specification of Automatic Monitoring Equipment

Figure E. 1 Appin Crescent, Dunfermline

Station Name:	Appin Crescent, Dunfermline
Easting:	309926
Northing:	687722
Distance to kerb and road name/number	3m + (A907)
Site Classification:	Roadside
Manifold type and height:	Single Teflon tube, inlet height 2m
Network affiliation:	Scottish Air Quality Database
Quality control procedures:	UKAS calibration by Ricardo with Air Liquide gas cylinder
Pollutants measured on site:	PM_{10}, $PM_{2.5}$, PM_1, TSP, NOx, NO, NO_2
Instrument manufacturer:	FIDAS 200 Thermo i-series
Calibration procedure and frequency:	2 weekly manual calibrations
Site service arrangements:	6-monthly service by air monitors
Co-located passive sampler	Triplicate NO_2 tubes installed

Figure E. 2 Bonnygate, Cupar

Station Name:	Bonnygate, Cupar
Easting:	337403
Northing:	714571
Site Classification:	Kerbside (<1m from Kerb)
Distance to kerb and road name/number	0.5m to Bonnygate (A91)
Distance to nearest junction and joining road name/number	Opposite the junction with Ladywynd
Start date of monitoring	19 December 2005
Manifold type and height:	Single Teflon tube, Inlet height 1.9m
Network affiliation:	Scottish Air Quality Database
Quality control procedures:	UKAS calibration by Ricardo with Air Liquide gas cylinder
Pollutants measured on site:	PM_{10}, $PM_{2.5}$, PM_1, TSP, NOx, NO, NO_2
Instrument manufacturer:	FIDAS 200 Thermo i-series
Calibration procedure and frequency:	2-weekly manual calibration
Site service arrangements:	6-monthly service by Air Monitors
Co-located passive sampler	Triplicate NO_2 tubes installed

Figure E. 3 Admiralty Road, Rosyth

Station Name:	Admiralty Road, Rosyth
Easting:	311755
Northing:	683503
Site Classification:	Roadside
Distance to kerb and road name/number	6m (A985(T))
Start date of monitoring	March 2008
Manifold type and height:	Single Teflon tube, Inlet height 2.1m
Network affiliation:	Scottish Air Quality Database
Quality control procedures:	UKAS calibration by Ricardo with Air Liquide gas cylinder
Pollutants measured on site:	PM_{10}, $PM_{2.5}$, PM_1, TSP, NOx, NO, NO_2
Instrument manufacturer:	FIDAS 200 NOx – Thermo 42i
Calibration procedure and frequency:	2-weekly manual calibrations.
Site service arrangements:	6-monthly service by air monitors
Co-located passive sampler	Triplicate NO_2 tubes installed

Figure E. 4 St Clair Street, Kirkcaldy

Station Name:	St Clair Street, Kirkcaldy
Easting:	329143
Northing:	692986
Site Classification:	Roadside
Distance to kerb and road name/number	4.8m, Saint Clair Street/A921
Start date of monitoring	February 2011
Manifold type and height:	Single Teflon tube, Inlet height 2m
Network affiliation:	Scottish Air Quality Database
Quality control procedures:	UKAS calibration by Ricardo with Air Liquide gas cylinder
Pollutants measured on site:	PM_{10}, $PM_{2.5}$, PM_1, TSP, NOx, NO, NO_2
Instrument manufacturer:	FIDAS 200 NOx – Thermo 42i
Calibration procedure and frequency:	2-weekly manual calibration
Site service arrangements:	6-monthly service by air monitors
Co-located passive sampler	Triplicate NO_2 tubes installed

Appendix F – Example Co-location Data Orthogonal Regression Analysis

Figure F.1 Example of co-location data orthogonal regression analysis: Dunfermline

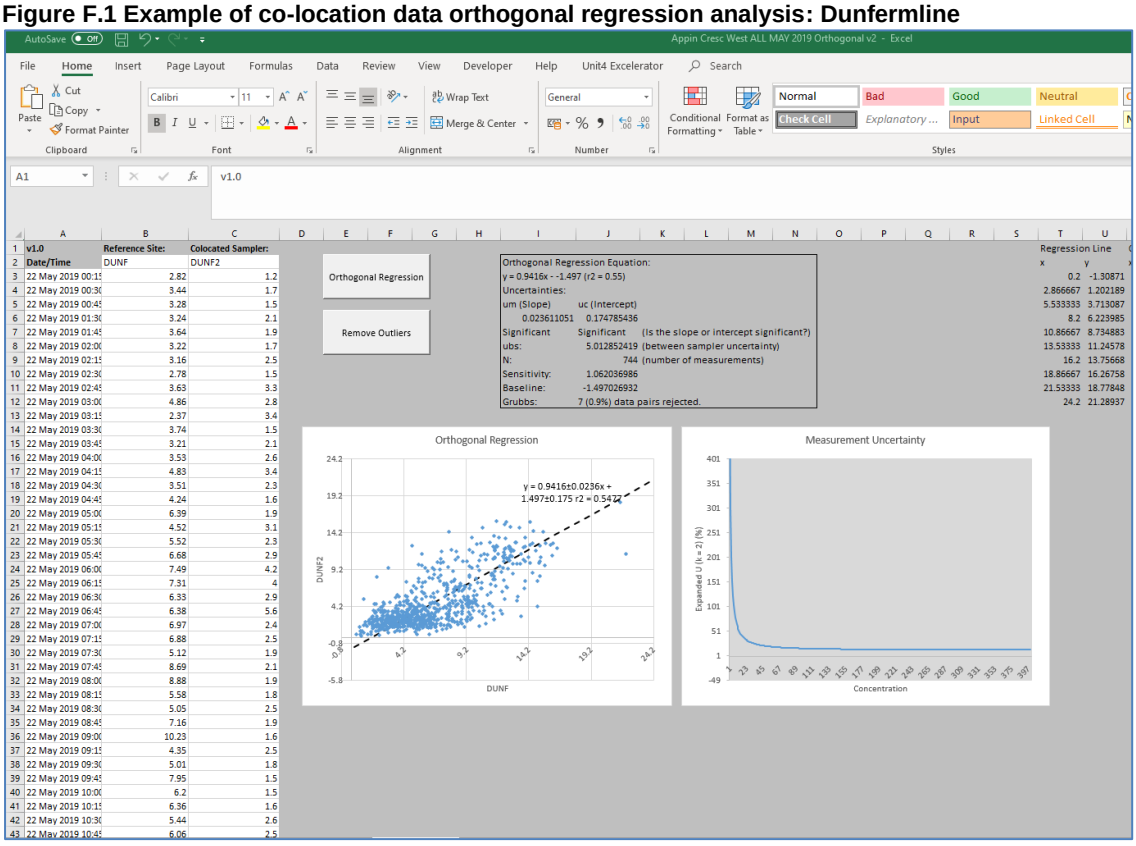


Figure F.2 Example of co-location data orthogonal regression analysis: Cupar

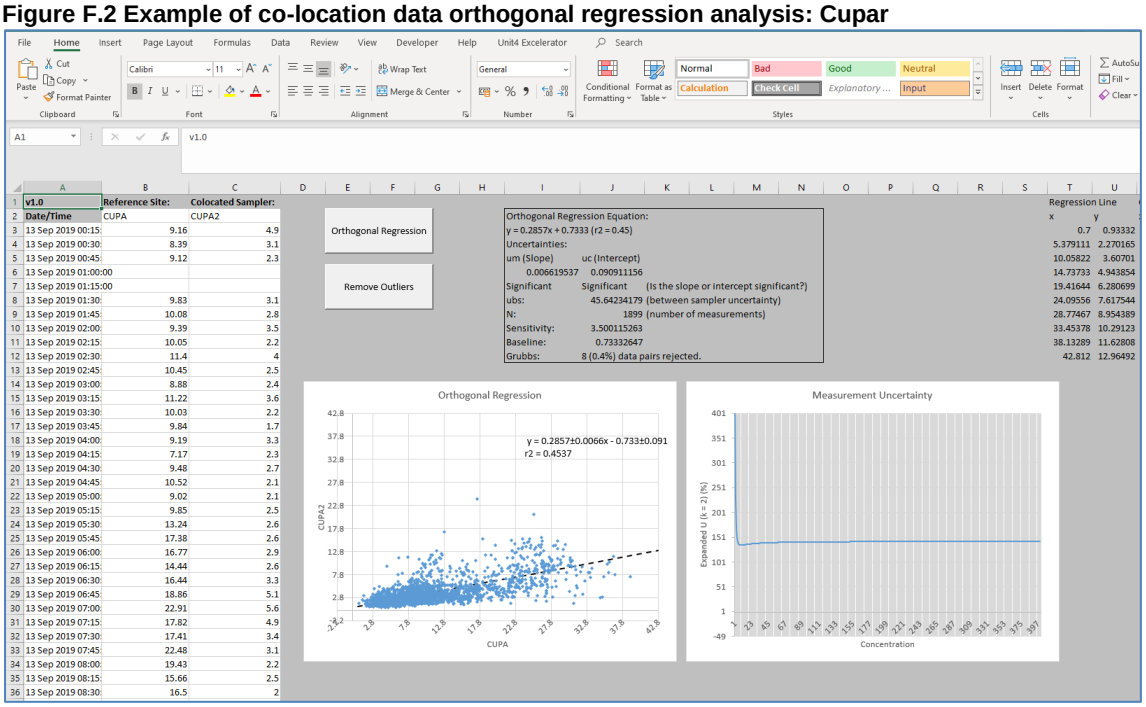


Figure F.3 $PM_{2.5}$ Data comparison: Cupar and Bonnygate

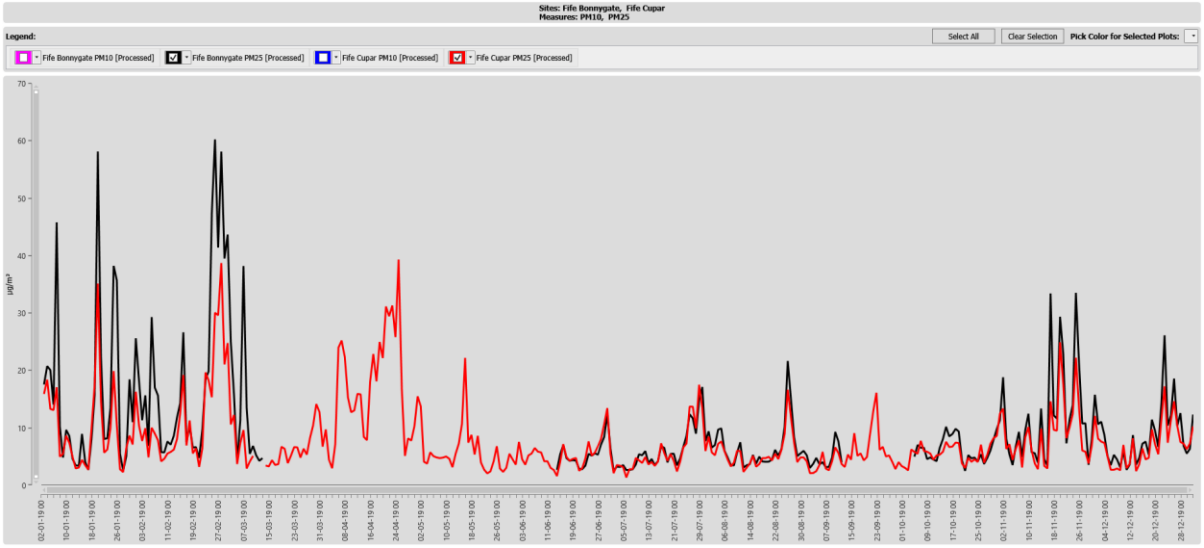


Figure F.4 PM_{10} Data comparison: Cupar and Bonnygate

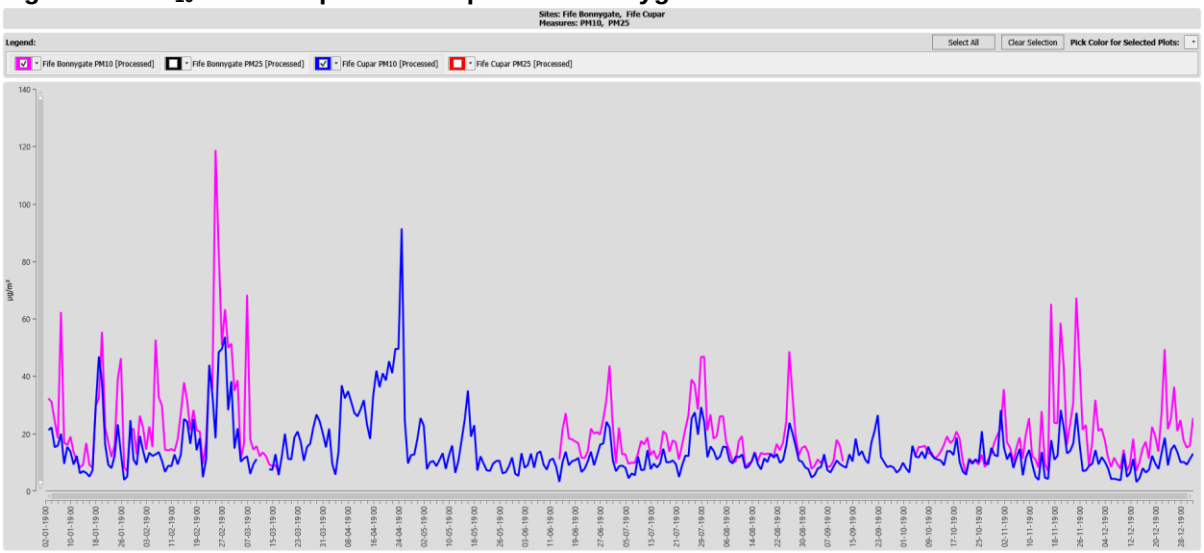


Figure F.5 $PM_{2.5}$ Data comparison: Dunfermline and Appin Crescent West

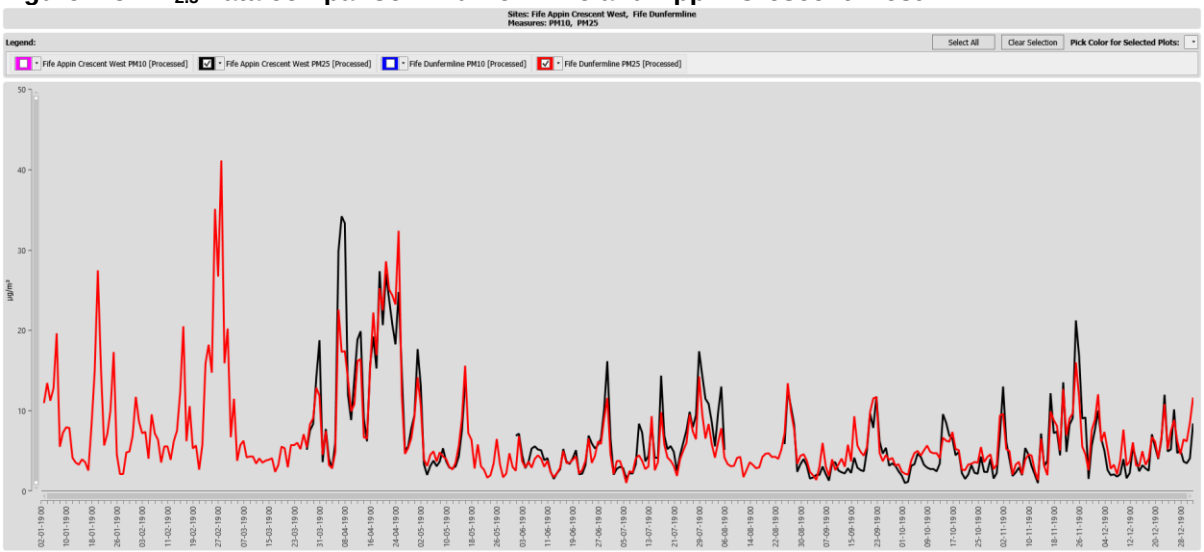


Figure F.6 PM_{10} Data comparison: Dunfermline and Appin Crescent West

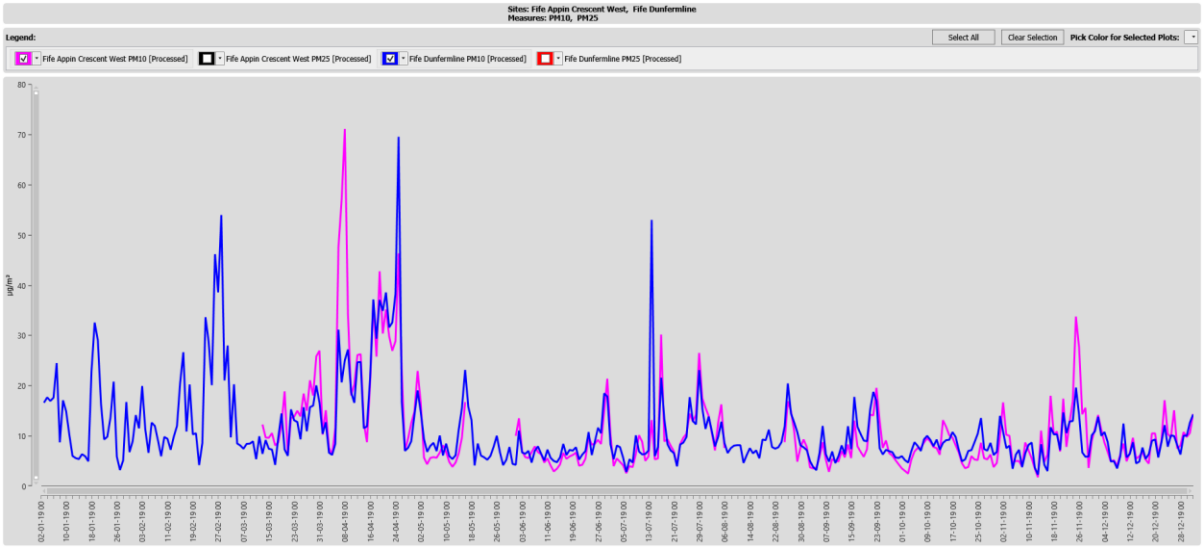


Figure F.7 $PM_{2.5}$ Data comparison: Dunfermline and Appin Crescent East

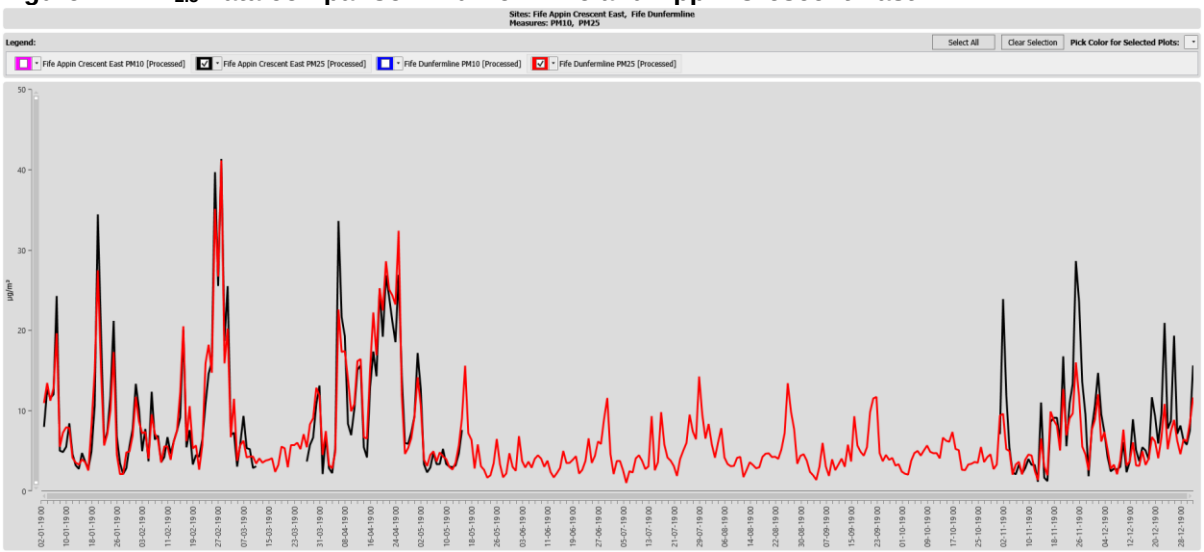
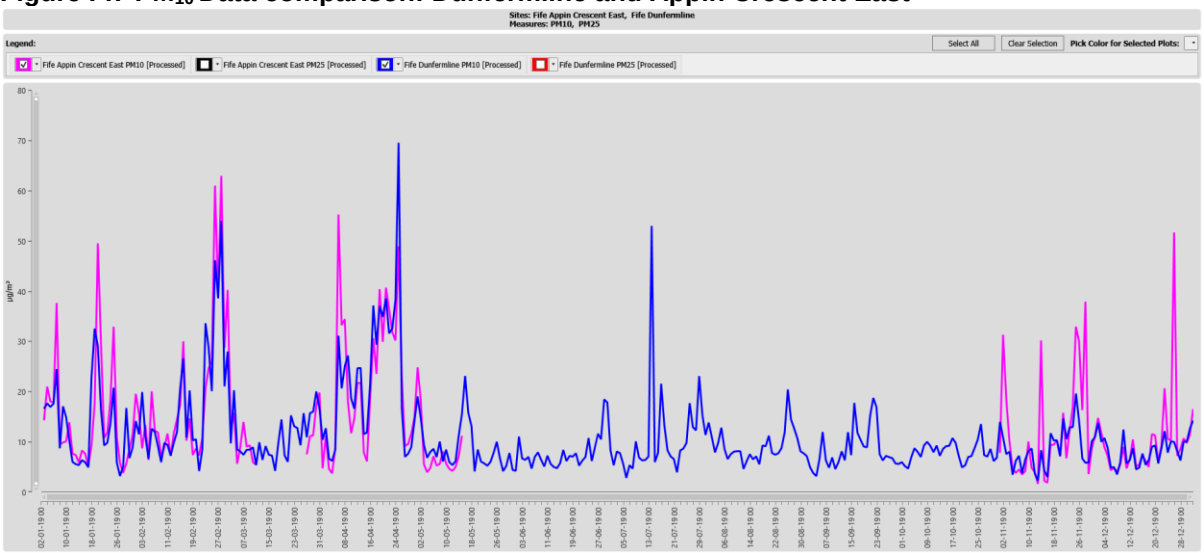


Figure F.7 PM_{10} Data comparison: Dunfermline and Appin Crescent East

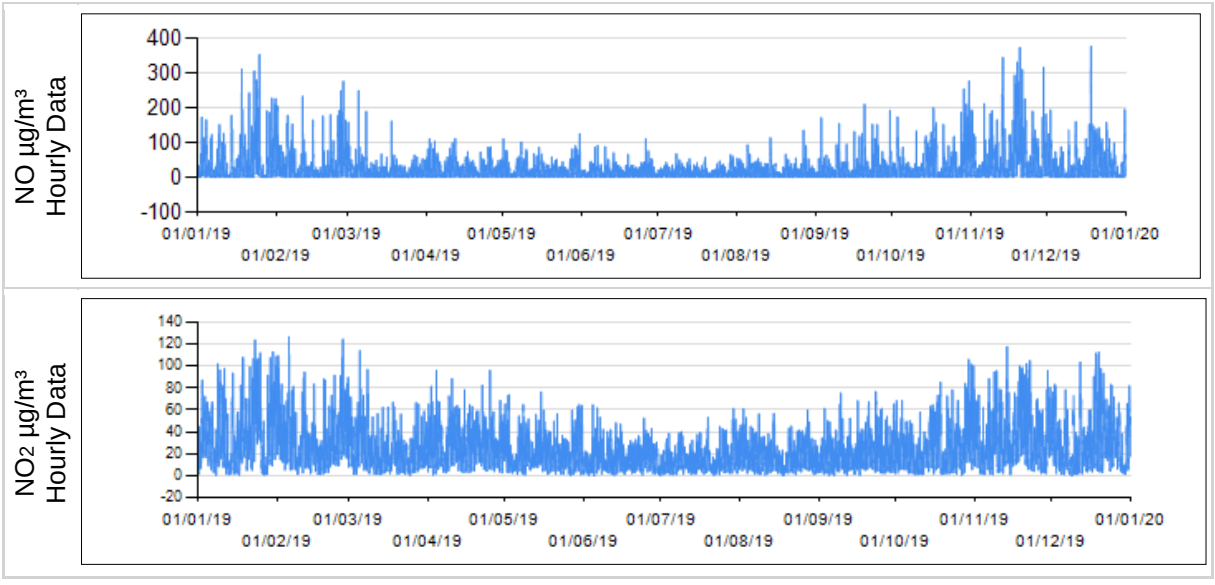


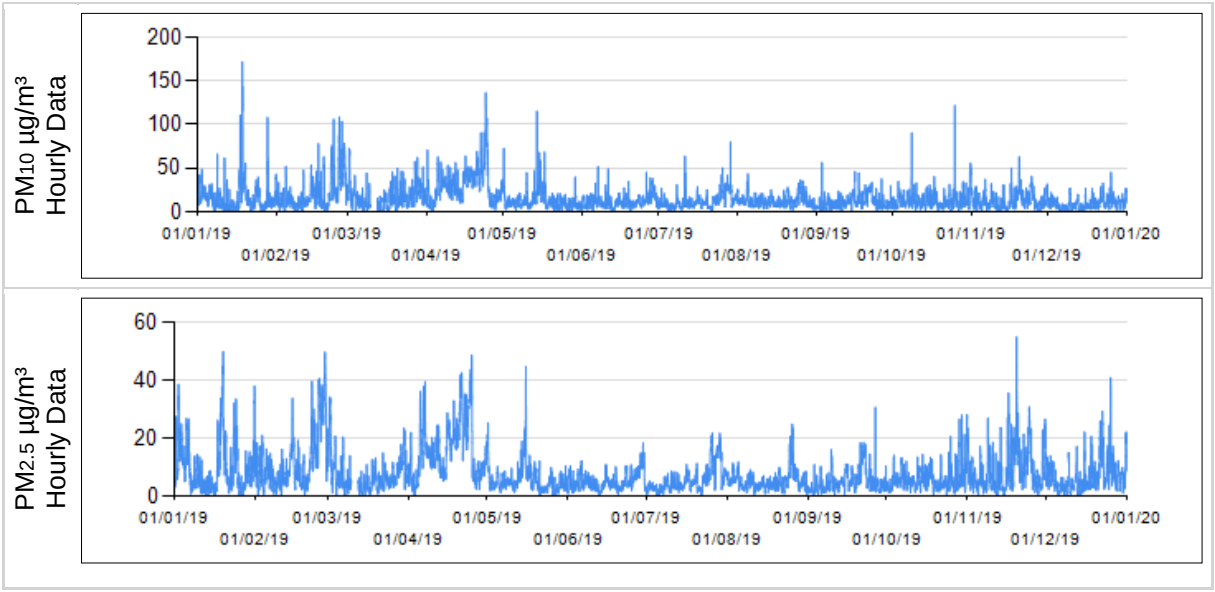
Appendix G – Air Pollution reports

Fife Cupar
01/01/2019 to 31/12/2019
These data have been fully ratified
Correction Factor for Gravimetric Equivalence applied

	V High (No. of Days)	High (No. of Days)	Mod (No. of Days)	Low (No. of Days)	Max. Hourly Conc.	Max. Daily Conc.	Max. Running 8 Hour Mean	Max. Running 24 Hour Mean	Period Mean Conc.	Period Data Capture (%)
NO (µg/m³)	0	0	0	0	376	129	226	157	25	99.7
NO_2 (µg/m³)	0	0	0	365	127	64	91	68	24	99.3
PM_{10} (µg/m³)	0	1	1	360	172	92	116	93	15	98.9
$PM_{2.5}$ (µg/m³)	0	0	2	360	55	37	46	39	8	99.0

	Air Quality Objective	Exceedances	Days
NO_2	Hourly mean > 200 µg/m³	No	0
NO_2	Period mean > annual mean obj 40 µg/m³	No	
PM_{10}	Daily mean > 50 µg/m³	2	2
PM_{10}	Period mean > annual mean obj 18 µg/m³ (Scotland)	No	
PM_{10}	Period mean > annual mean obj 40 µg/m³	No	
$PM_{2.5}$	Period mean > annual mean obj 10 µg/m³ (Scotland)	No	
$PM_{2.5}$	Period mean > annual mean obj 20 µg/m³ (EU)	No	
$PM_{2.5}$	Period mean > annual mean obj 25 µg/m³ (UK)	No	
Note: When comparing site measurements against the air quality objectives data capture should meet or exceed 90% across a calendar year.			

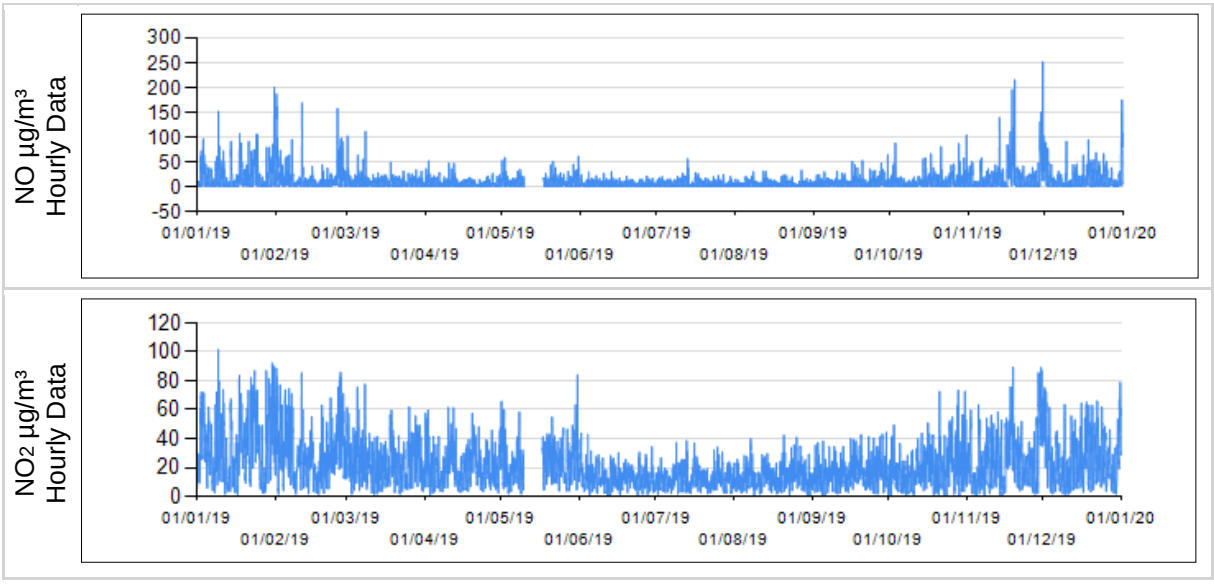


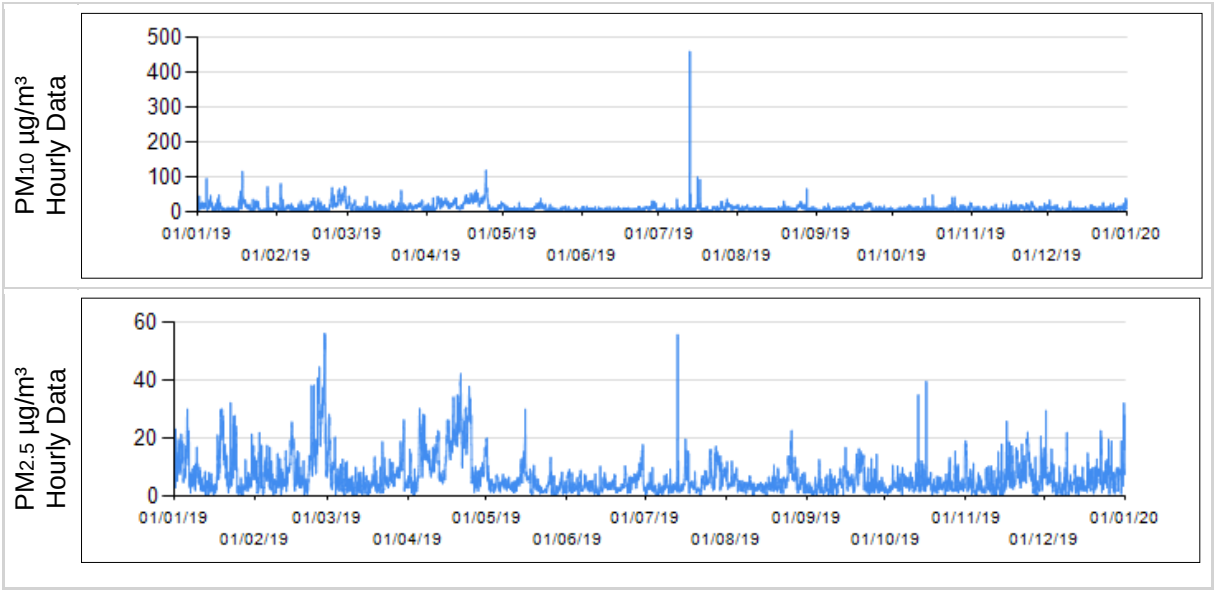

PM10 µg/m³ Hourly Data
200
150
100
50
0
01/01/19
01/02/19
01/03/19
01/04/19
01/05/19
01/06/19
01/07/19
01/08/19
01/09/19
01/10/19
01/11/19
01/12/19
01/01/20
PM2.5 µg/m³ Hourly Data
60
40
20
0
01/01/19
01/02/19
01/03/19
01/04/19
01/05/19
01/06/19
01/07/19
01/08/19
01/09/19
01/10/19
01/11/19
01/12/19
01/01/20

Fife Dunfermline
01/01/2019 to 31/12/2019
These data have been fully ratified
Correction Factor for Gravimetric Equivalence applied

	V High (No. of Days)	High (No. of Days)	Mod (No. of Days)	Low (No. of Days)	Max. Hourly Conc.	Max. Daily Conc.	Max. Running 8 Hour Mean	Max. Running 24 Hour Mean	Period Mean Conc.	Period Data Capture (%)
NO (µg/m³)	0	0	0	0	252	72	126	81	11	97.6
NO_2 (µg/m³)	0	0	0	358	101	58	79	63	21	97.6
PM_{10} (µg/m³)	0	0	3	362	459	70	135	71	11	99.7
$PM_{2.5}$ (µg/m³)	0	0	1	364	56	39	51	40	6	99.7

	Air Quality Objective	Exceedances	Days
NO_2	Hourly mean > 200 µg/m³	No	0
NO_2	Period mean > annual mean obj 40 µg/m³	No	
PM_{10}	Daily mean > 50 µg/m³	3	3
PM_{10}	Period mean > annual mean obj 18 µg/m³ (Scotland)	No	
PM_{10}	Period mean > annual mean obj 40 µg/m³	No	
$PM_{2.5}$	Period mean > annual mean obj 10 µg/m³ (Scotland)	No	
$PM_{2.5}$	Period mean > annual mean obj 20 µg/m³ (EU)	No	
$PM_{2.5}$	Period mean > annual mean obj 25 µg/m³ (UK)	No	
Note: When comparing site measurements against the air quality objectives data capture should meet or exceed 90% across a calendar year.			

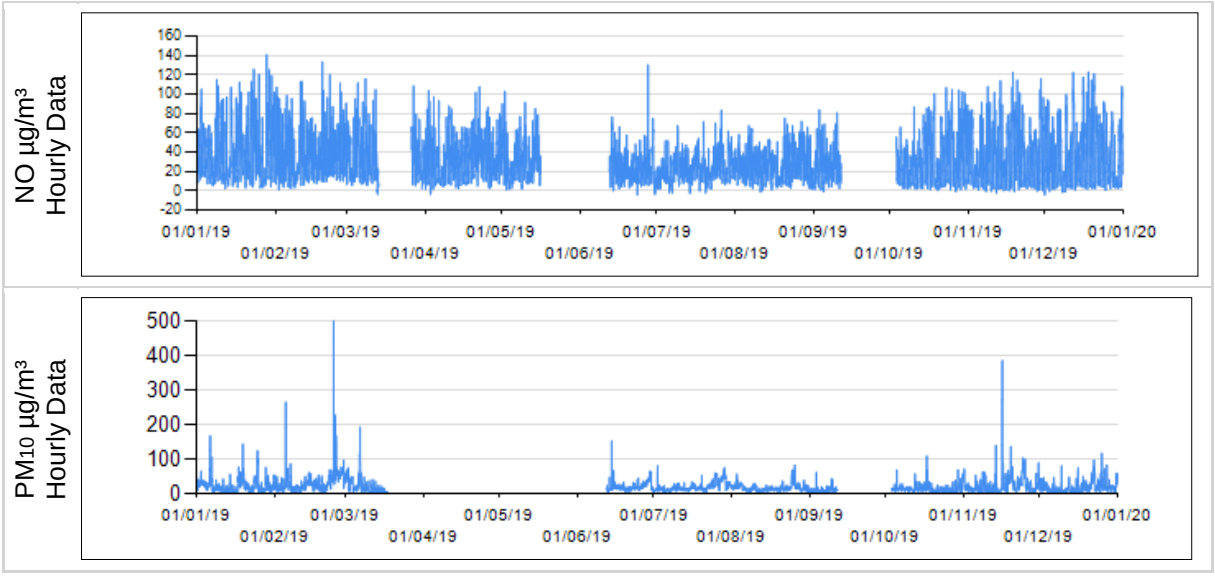


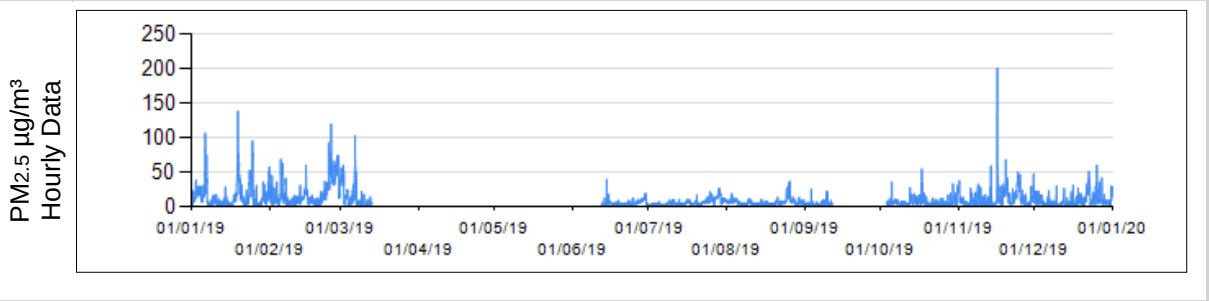

PM10 µg/m³ Hourly Data
500
400
300
200
100
0
01/01/19
01/02/19
01/03/19
01/04/19
01/05/19
01/06/19
01/07/19
01/08/19
01/09/19
01/10/19
01/11/19
01/12/19
01/01/20
PM2.5 µg/m³ Hourly Data
60
40
20
0
01/01/19
01/02/19
01/03/19
01/04/19
01/05/19
01/06/19
01/07/19
01/08/19
01/09/19
01/10/19
01/11/19
01/12/19
01/01/20

Fife Bonnygate
01/01/2019 to 31/12/2019
Ad-hoc monitoring job with AQMesh
These data have been fully ratified
Correction Factor for Gravimetric Equivalence applied

	V High (No. of Days)	High (No. of Days)	Mod (No. of Days)	Low (No. of Days)	Max. Hourly Conc.	Max. Daily Conc.	Max. Running 8 Hour Mean	Max. Running 24 Hour Mean	Period Mean Conc.	Annualised Mean Conc.	Period Data Capture (%)
NO (µg/m³)	0	0	0	0	601	212	354	222	58	n/a	85.5
NO_2 (µg/m³)	0	0	0	306	141	59	102	59	30	n/a	83.0
PM_{10} (µg/m³)	1	1	10	243	499	119	213	133	21	23.7	70.3
$PM_{2.5}$ (µg/m³)	0	3	8	240	200	60	85	62	10	11	69.2

	Air Quality Objective	Exceedances	Days
NO_2	Hourly mean > 200 µg/m³	None	0
NO_2	Period mean > annual mean obj 40 µg/m³	No	
PM_{10}	Daily mean > 50 µg/m³	12	12
PM_{10}	Period mean > annual mean obj 18 µg/m³ (Scotland)	Yes	
PM_{10}	Period mean > annual mean obj 40 µg/m³	No	
$PM_{2.5}$	Period mean > annual mean obj 10 µg/m³ (Scotland)	Yes	
$PM_{2.5}$	Period mean > annual mean obj 20 µg/m³ (EU)	No	
$PM_{2.5}$	Period mean > annual mean obj 25 µg/m³ (UK)	No	
Note: When comparing site measurements against the air quality objectives data capture should meet or exceed 90% across a calendar year.			

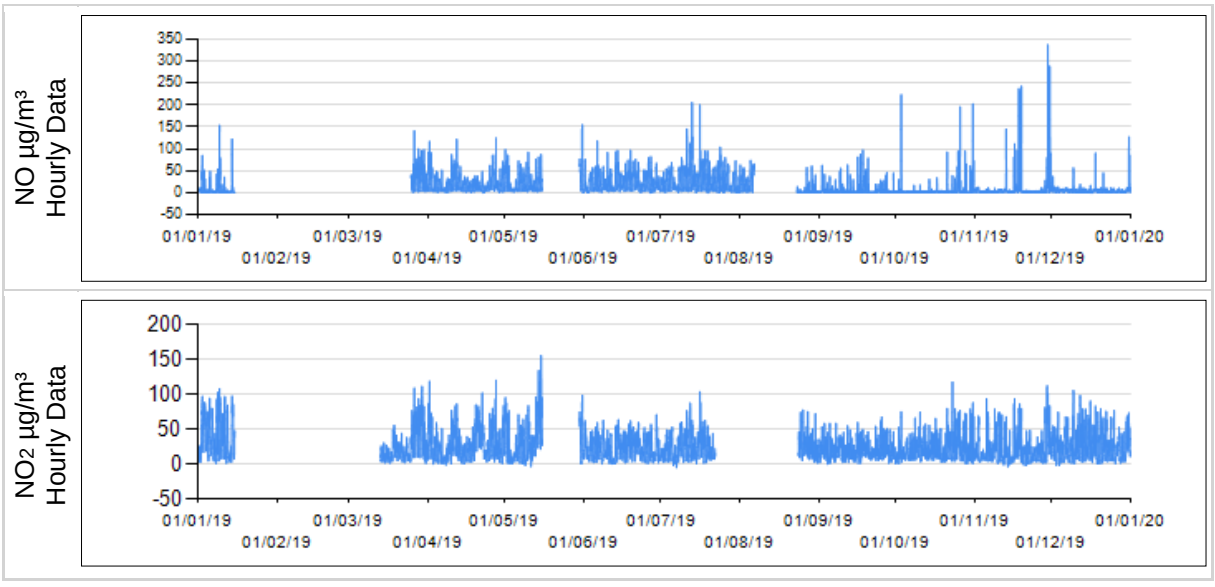


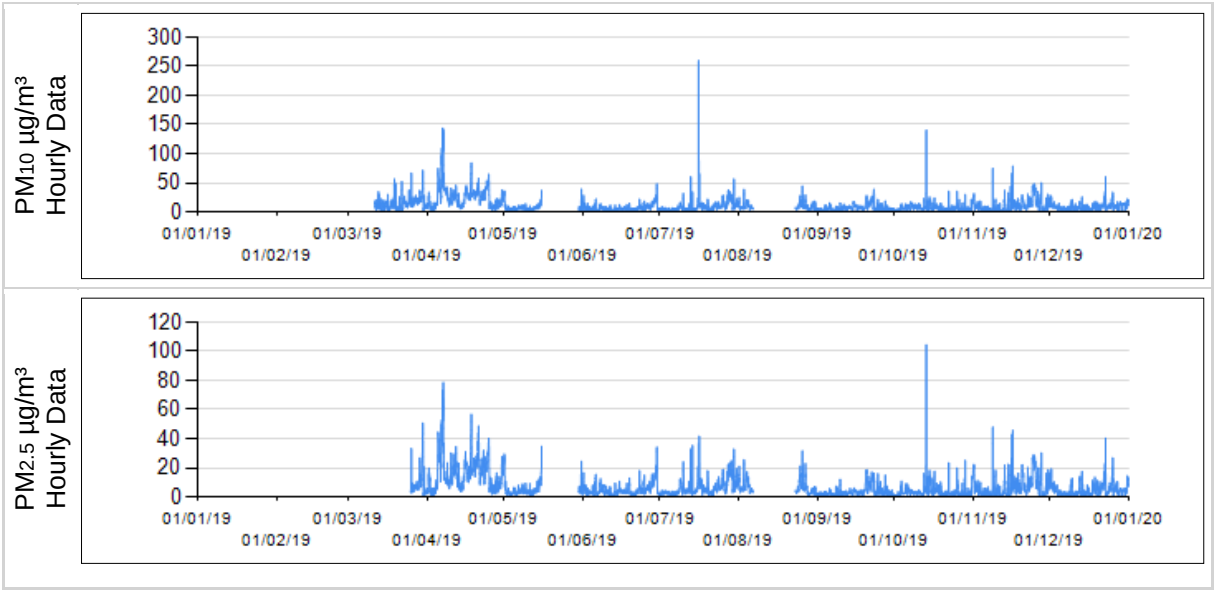

PM2.5 µg/m³
Hourly Data
250
200
150
100
50
0
01/01/19
01/02/19
01/03/19
01/04/19
01/05/19
01/06/19
01/07/19
01/08/19
01/09/19
01/10/19
01/11/19
01/12/19
01/01/20

Fife Appin Crescent West
01/01/2019 to 31/12/2019
Ad-hoc monitoring job with AQMesh
These data have been fully ratified

	V High (No. of Days)	High (No. of Days)	Mod (No. of Days)	Low (No. of Days)	Max. Hourly Conc.	Max. Daily Conc.	Max. Running 8 Hour Mean	Max. Running 24 Hour Mean	Period Mean Conc.	Annualised Mean Conc.	Period Data Capture (%)
NO (µg/m³)	0	0	0	0	337	56	115	71	14	n/a	72.5
NO_2 (µg/m³)	0	0	0	263	155	71	108	77	24	25	71.5
PM_{10} (µg/m³)	0	0	2	260	260	71	127	93	11	11	72.4
$PM_{2.5}$ (µg/m³)	0	0	0	248	104	34	64	49	7	7	68.6

	Air Quality Objective	Exceedances	Days
NO_2	Hourly mean > 200 µg/m³	No	0
NO_2	Period mean > annual mean obj 40 µg/m³	No	
PM_{10}	Daily mean > 50 µg/m³	2	2
PM_{10}	Period mean > annual mean obj 40 µg/m³	No	
$PM_{2.5}$	Period mean > annual mean obj 10 µg/m³ (Scotland)	No	
$PM_{2.5}$	Period mean > annual mean obj 20 µg/m³ (EU)	No	
$PM_{2.5}$	Period mean > annual mean obj 25 µg/m³ (UK)	No	
Note: When comparing site measurements against the air quality objectives data capture should meet or exceed 90% across a calendar year.			

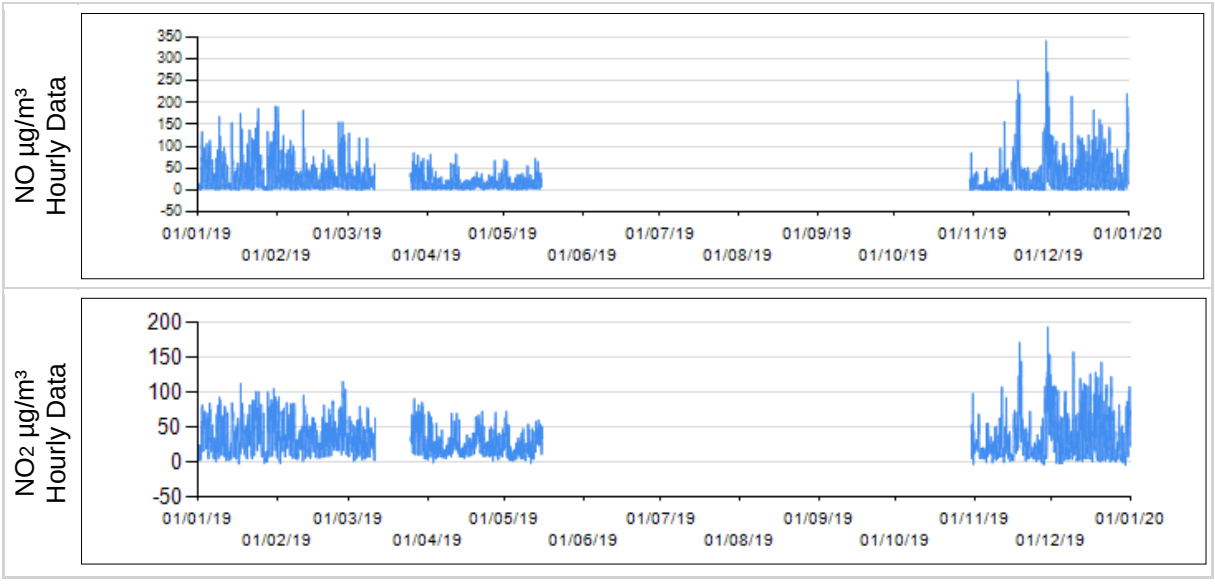


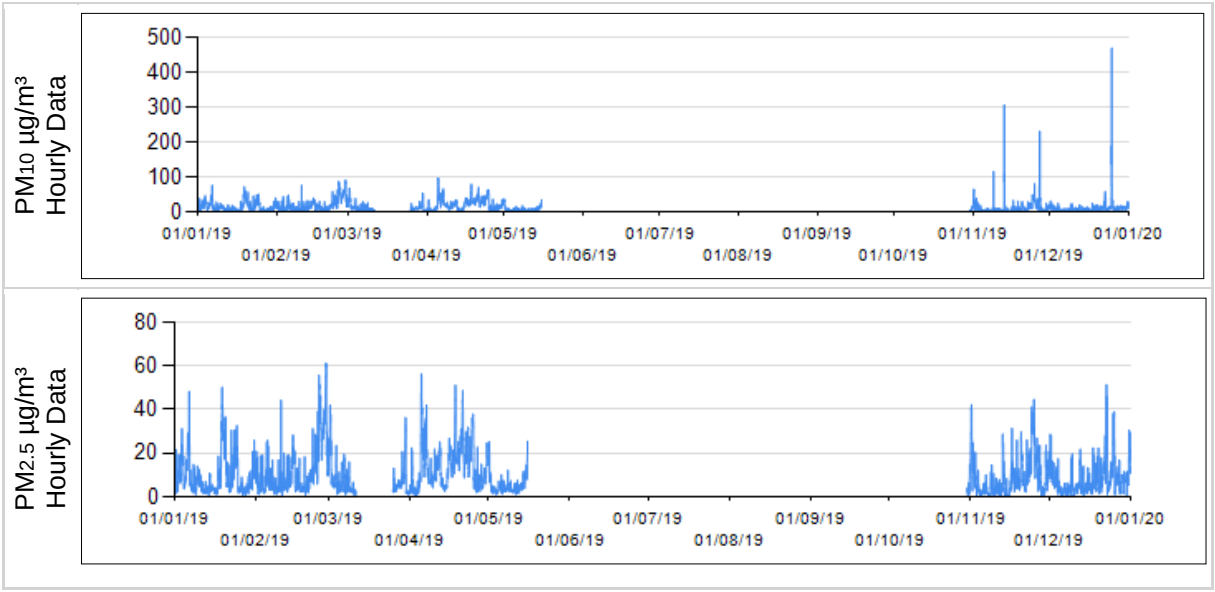

PM10 µg/m³ Hourly Data
300
250
200
150
100
50
0
01/01/19
01/02/19
01/03/19
01/04/19
01/05/19
01/06/19
01/07/19
01/08/19
01/09/19
01/10/19
01/11/19
01/12/19
01/01/20
PM2.5 µg/m³ Hourly Data
120
100
80
60
40
20
0
01/01/19
01/02/19
01/03/19
01/04/19
01/05/19
01/06/19
01/07/19
01/08/19
01/09/19
01/10/19
01/11/19
01/12/19
01/01/20

Fife Appin Crescent East
01/01/2019 to 31/12/2019
Ad-hoc monitoring job with AQMesh
These data have been fully ratified

	V High (No. of Days)	High (No. of Days)	Mod (No. of Days)	Low (No. of Days)	Max. Hourly Conc.	Max. Daily Conc.	Max. Running 8 Hour Mean	Max. Running 24 Hour Mean	Period Mean Conc.	Annualised Mean Conc.	Period Data Capture (%)
NO (µg/m³)	0	0	0	0	341	107	181	120	28	n/a	50.1
NO2 (µg/m³)	0	0	0	185	193	87	124	93	31	33	50.1
PM10 (µg/m³)	0	0	4	177	469	63	121	64	15	13	50.1
PM2.5 (µg/m³)	0	0	2	179	61	41	56	43	9	7	50.1

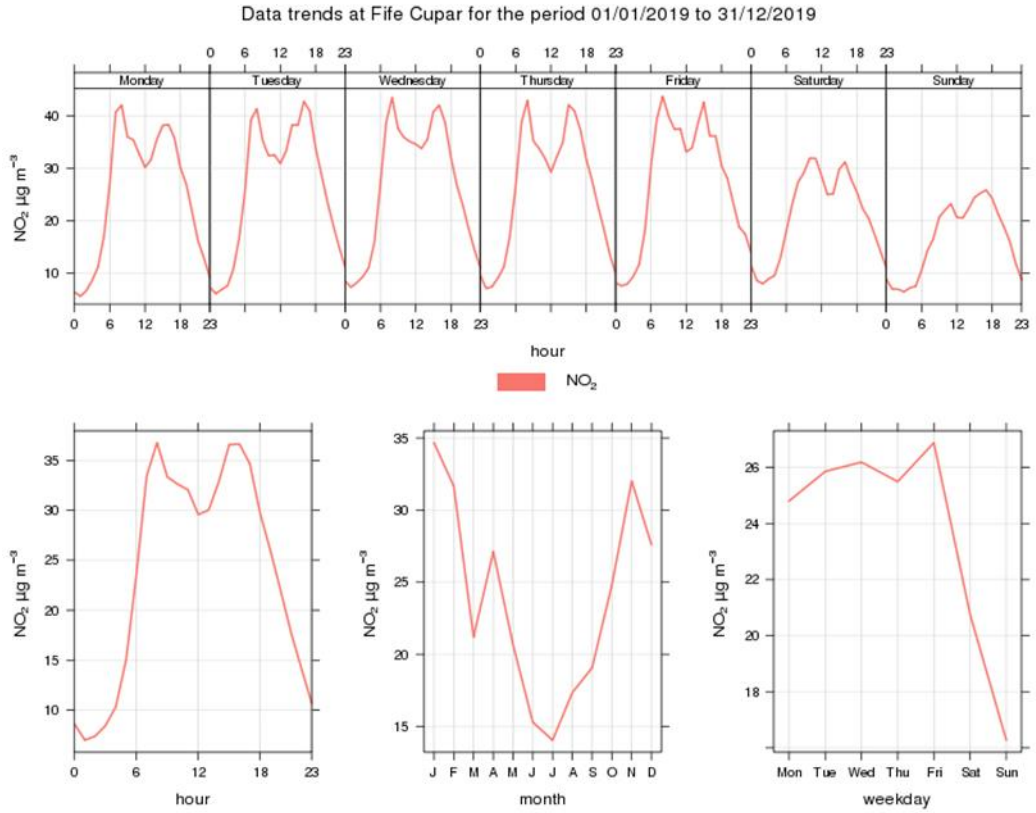
	Air Quality Objective	Exceedances	Days
NO2	Hourly mean > 200 µg/m³	No	0
NO2	Period mean > annual mean obj 40 µg/m³	No	
PM10	Daily mean > 50 µg/m³	4	4
PM10	Period mean > annual mean obj 40 µg/m³	No	
PM2.5	Period mean > annual mean obj 10 µg/m³ (Scotland)	No	
PM2.5	Period mean > annual mean obj 20 µg/m³ (EU)	No	
PM2.5	Period mean > annual mean obj 25 µg/m³ (UK)	No	
Note: When comparing site measurements against the air quality objectives data capture should meet or exceed 90% across a calendar year.			




PM10 µg/m³ Hourly Data
500
400
300
200
100
0
01/01/19
01/02/19
01/03/19
01/04/19
01/05/19
01/06/19
01/07/19
01/08/19
01/09/19
01/10/19
01/11/19
01/12/19
01/01/20
PM2.5 µg/m³ Hourly Data
80
60
40
20
0
01/01/19
01/02/19
01/03/19
01/04/19
01/05/19
01/06/19
01/07/19
01/08/19
01/09/19
01/10/19
01/11/19
01/12/19
01/01/20

Appendix H – Openair Analysis

Figure H.1: Fife Cupar NO_2 Openair Analysis



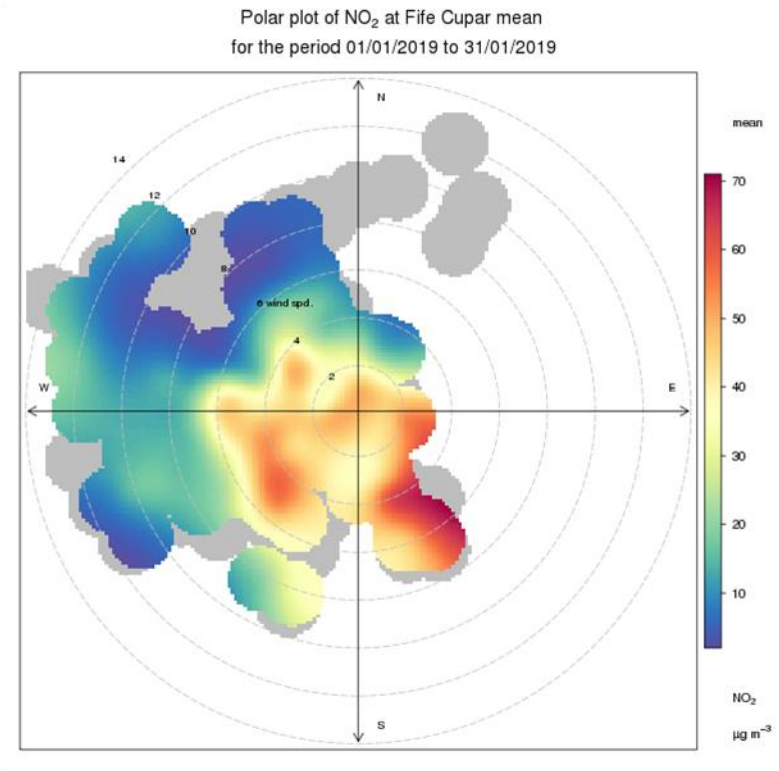
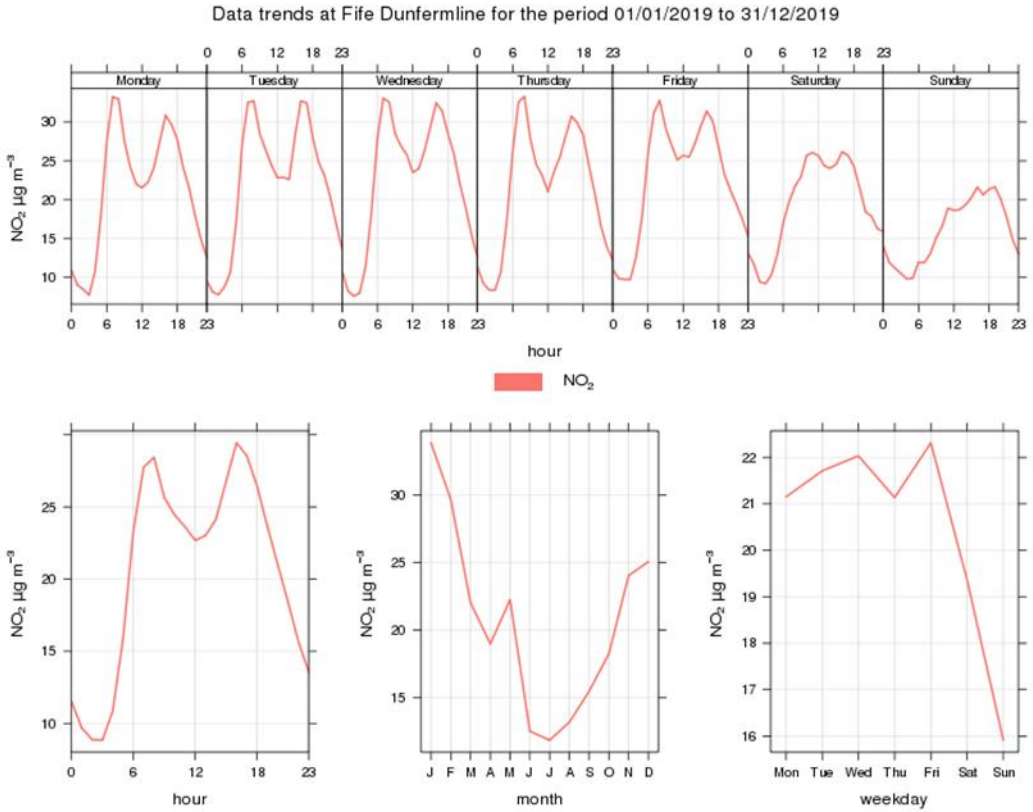


Figure H.2: Fife Dunfermline NO_2 Openair Analysis



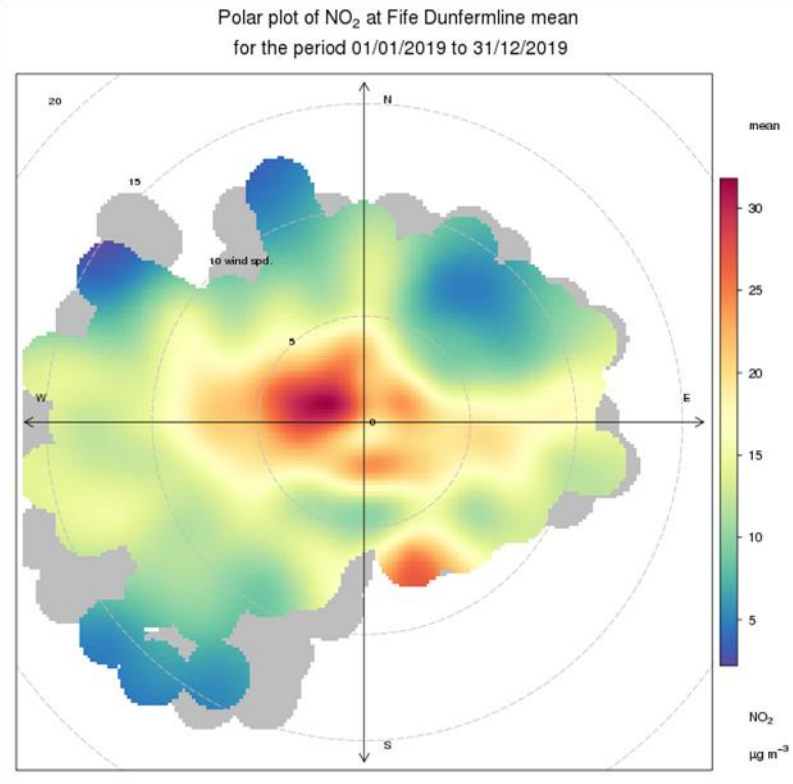
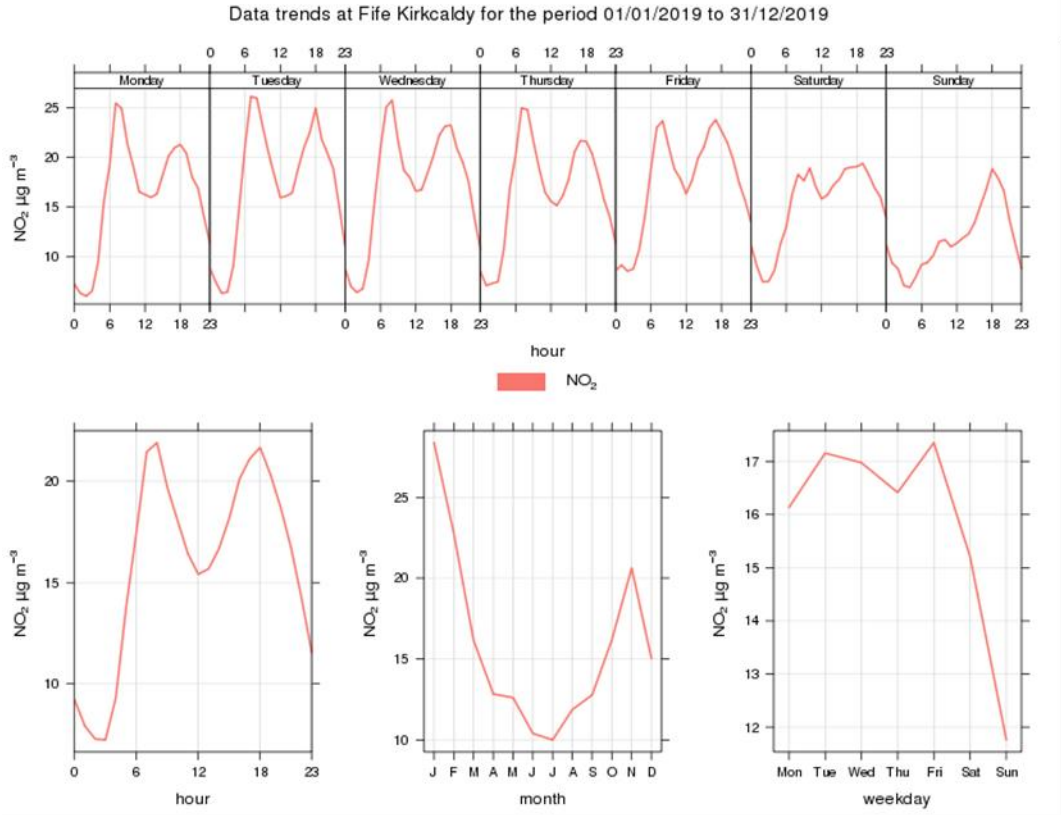


Figure H.3: Fife Kirkcaldy NO_2 Openair Analysis



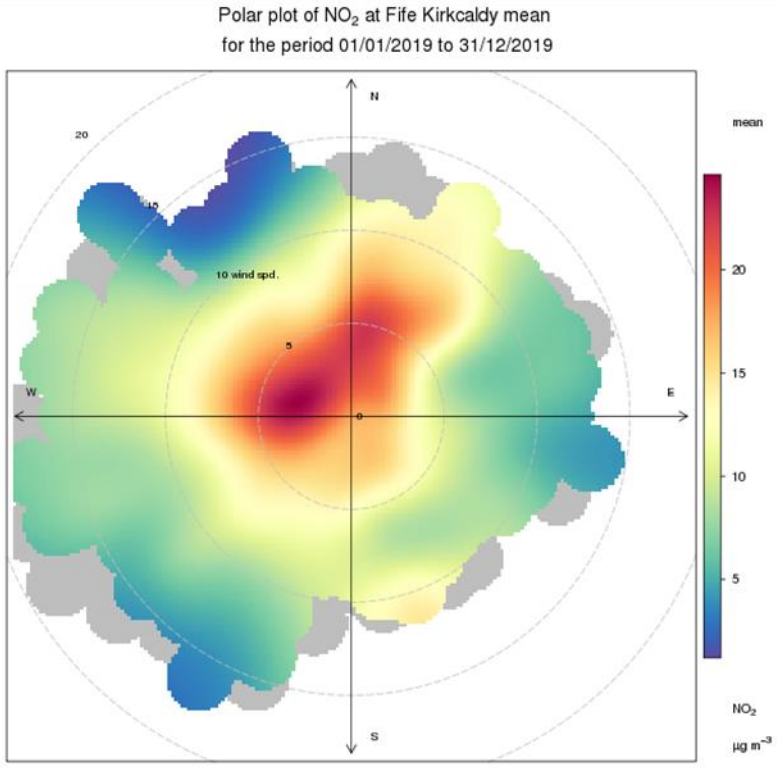


Figure H.4: Fife Rosyth NO_2 Openair Analysis

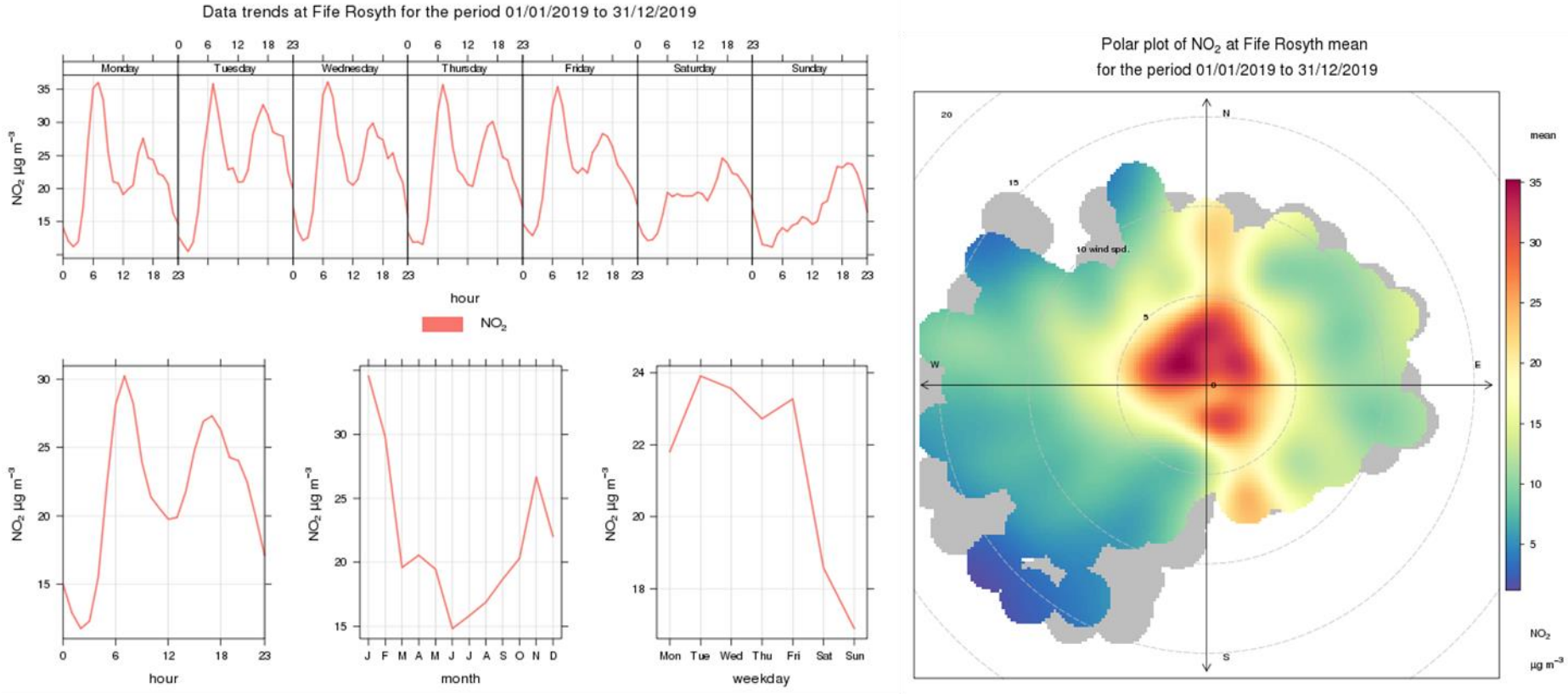


Figure H.5: Fife Cupar NO_2 Calendar Plot – Date and Wind

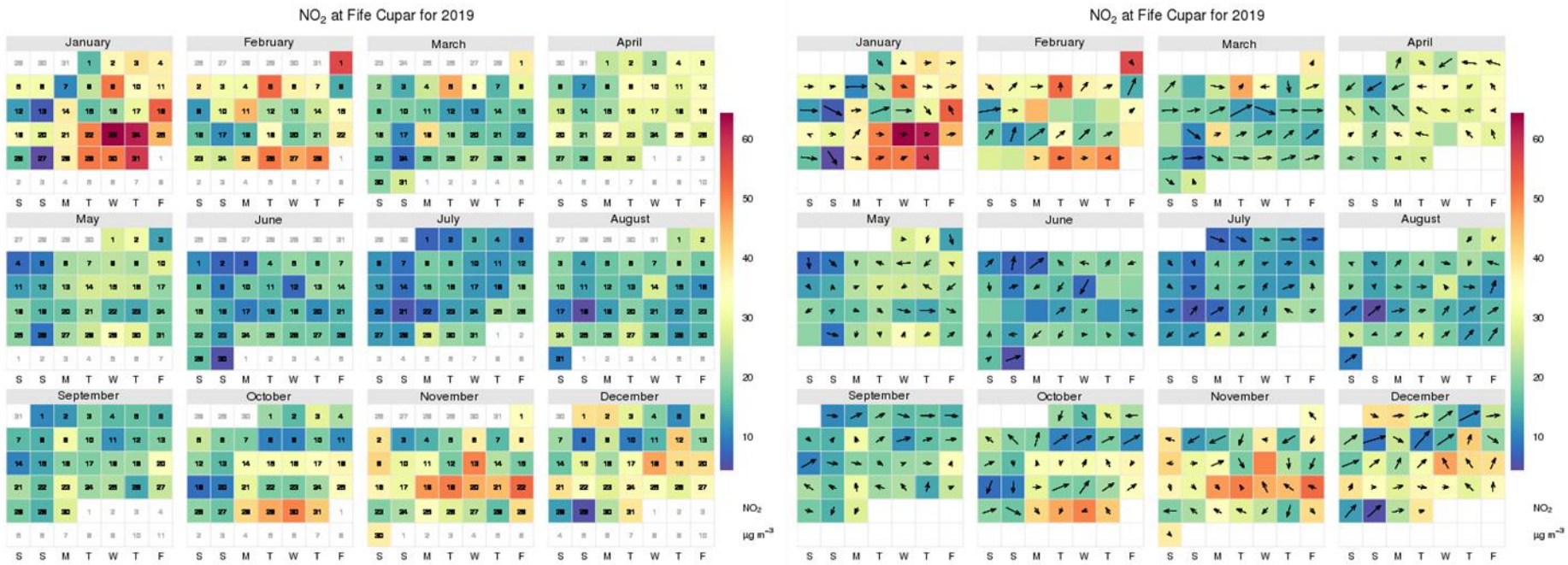


Figure H.6: Fife Dunfermline NO_2 Calendar Plot – Date and Wind

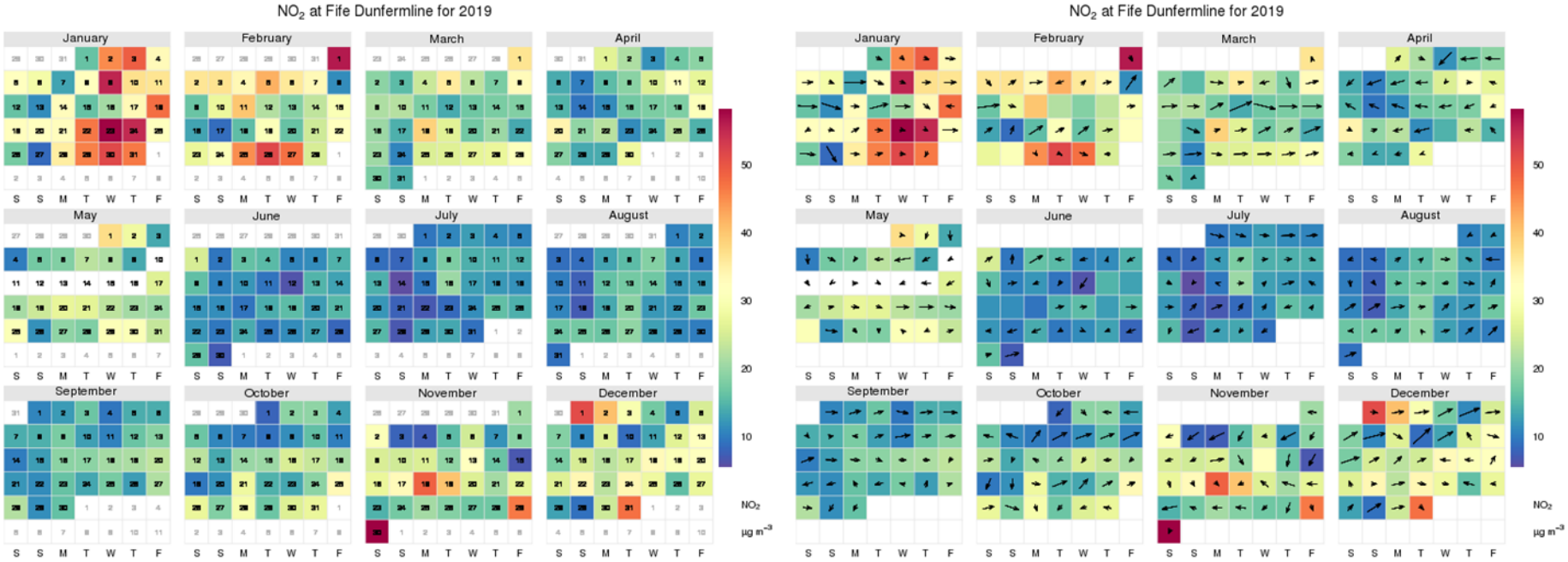


Figure H.7: Fife Kirkcaldy NO_2 Calendar Plot – Date and Wind

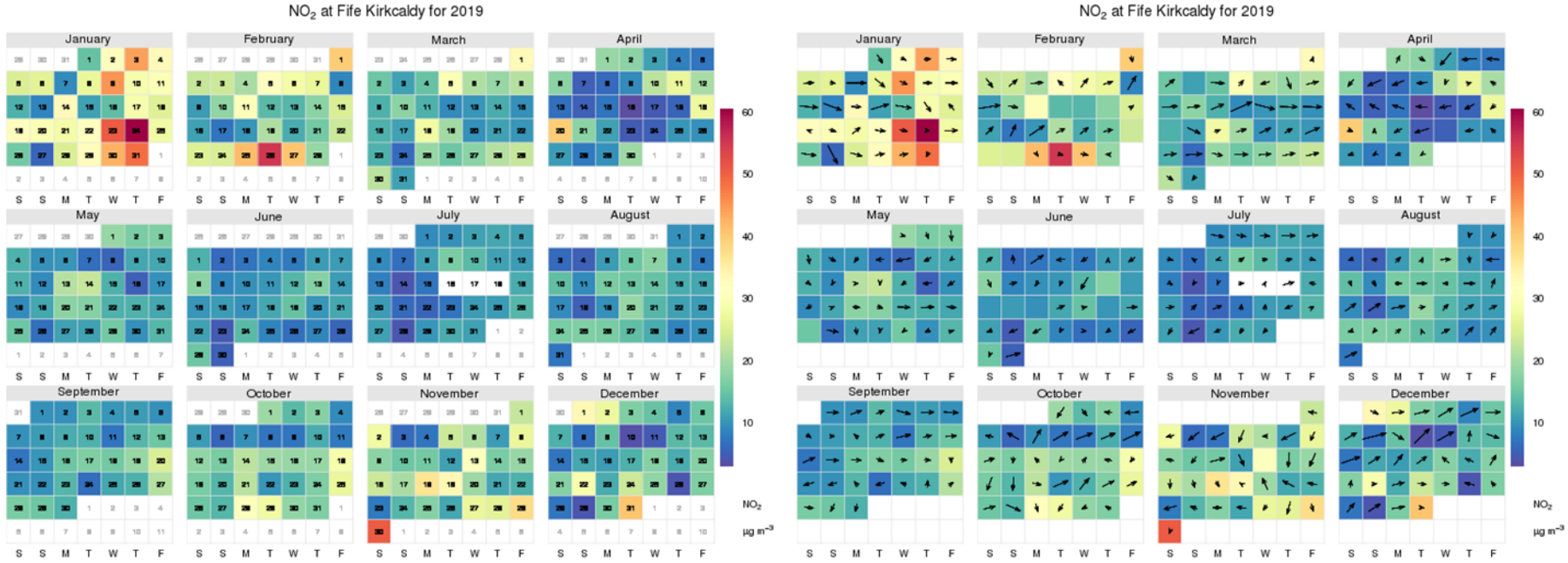


Figure H.8: Fife Rosyth NO_2 Calendar Plot – Date and Wind

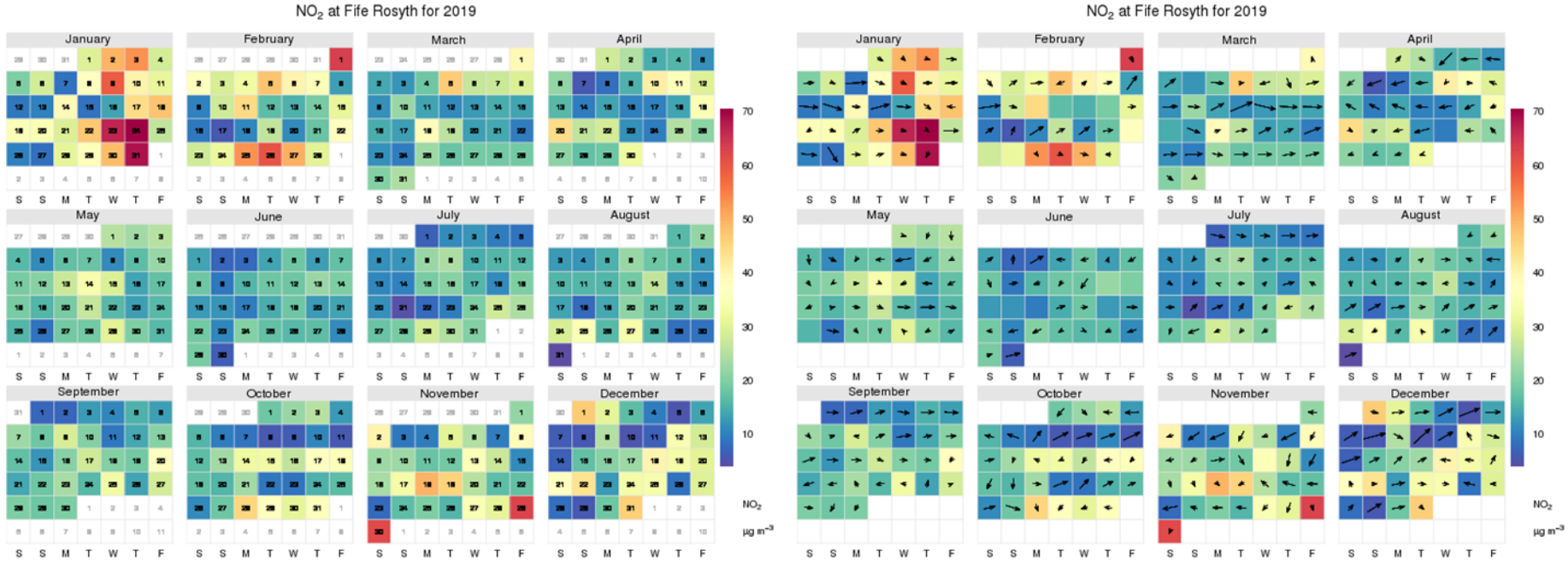
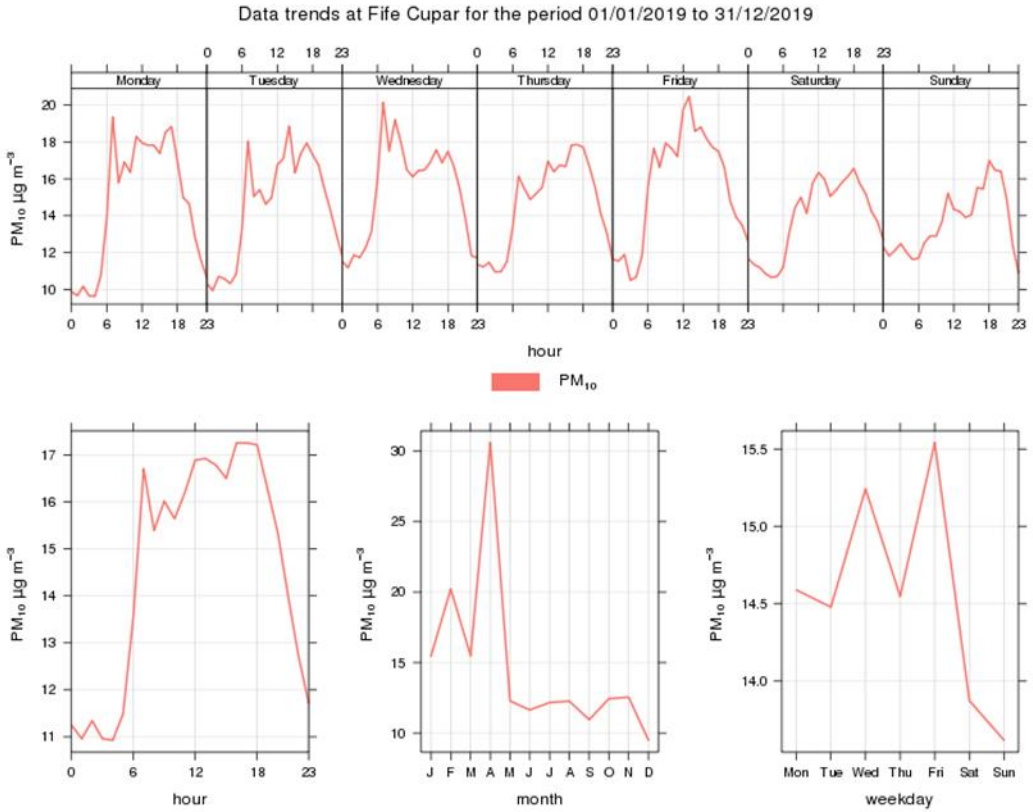


Figure H.9: Fife Cupar PM_{10} Openair Analysis



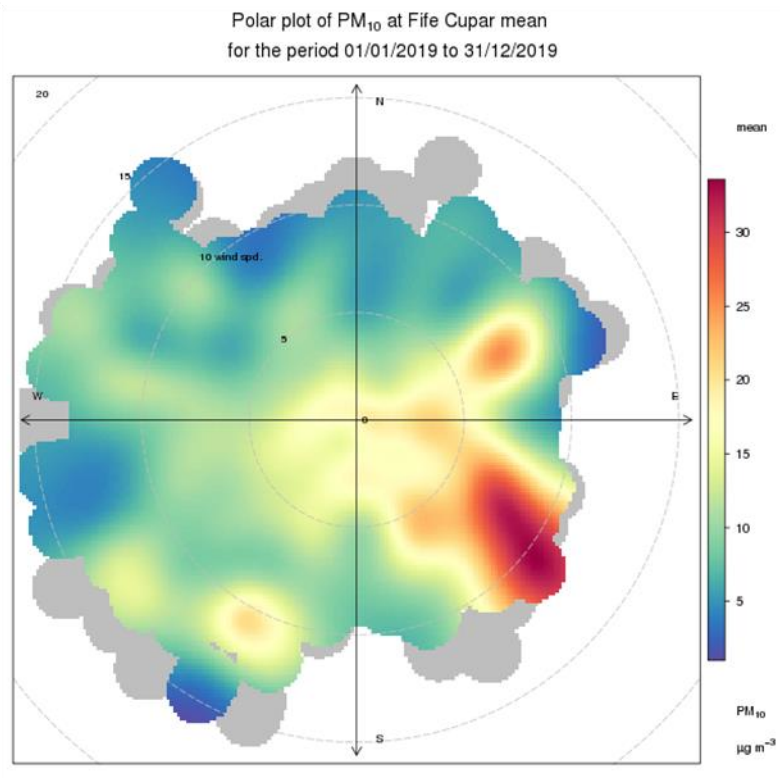
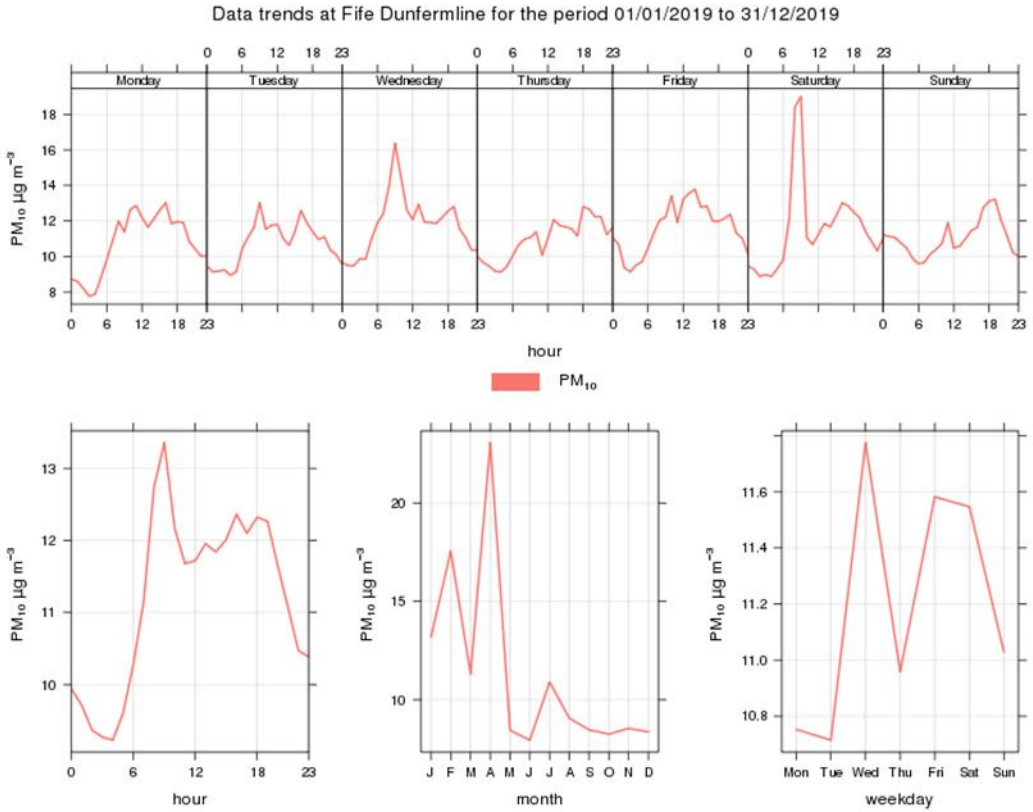


Figure H.10: Fife Dunfermline PM_{10} Openair Analysis



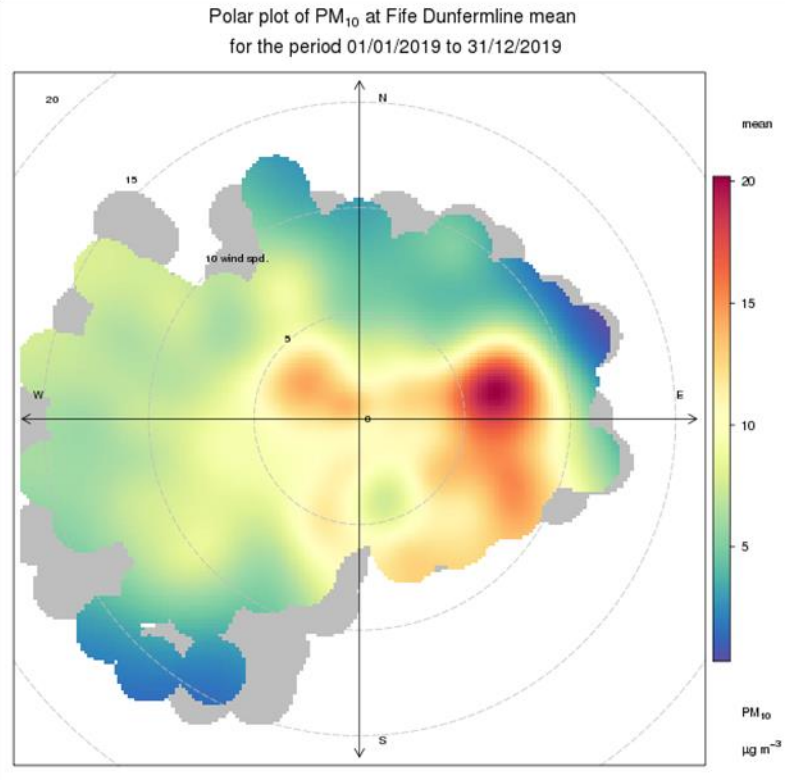
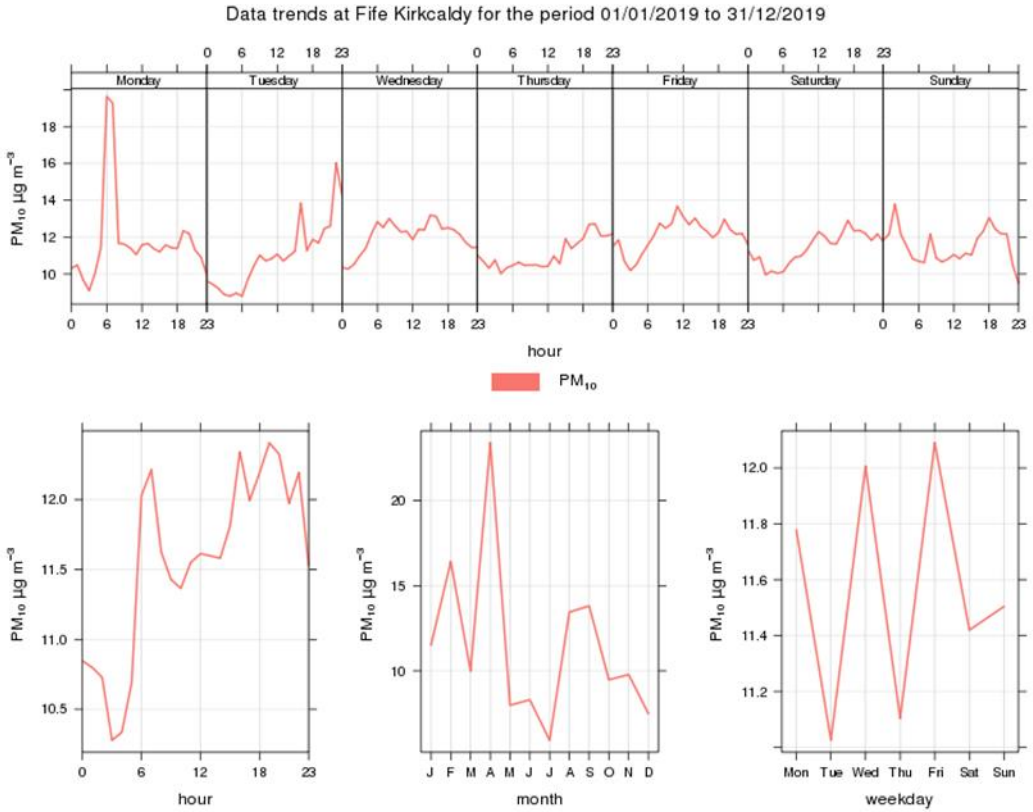


Figure H.11: Fife Kirkaldy PM_{10} Openair Analysis



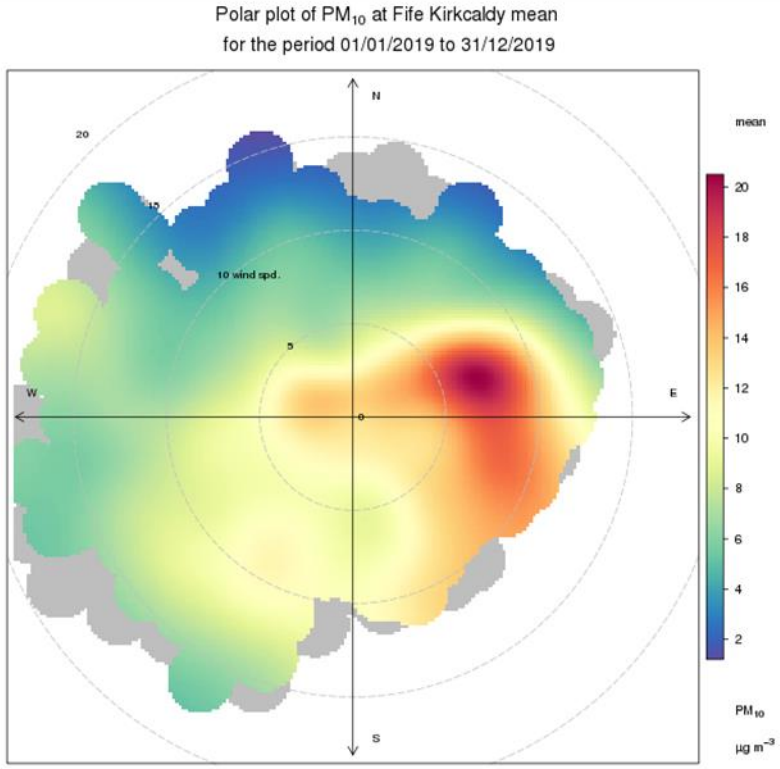


Figure H.12: Fife Rosyth PM_{10} Openair Analysis

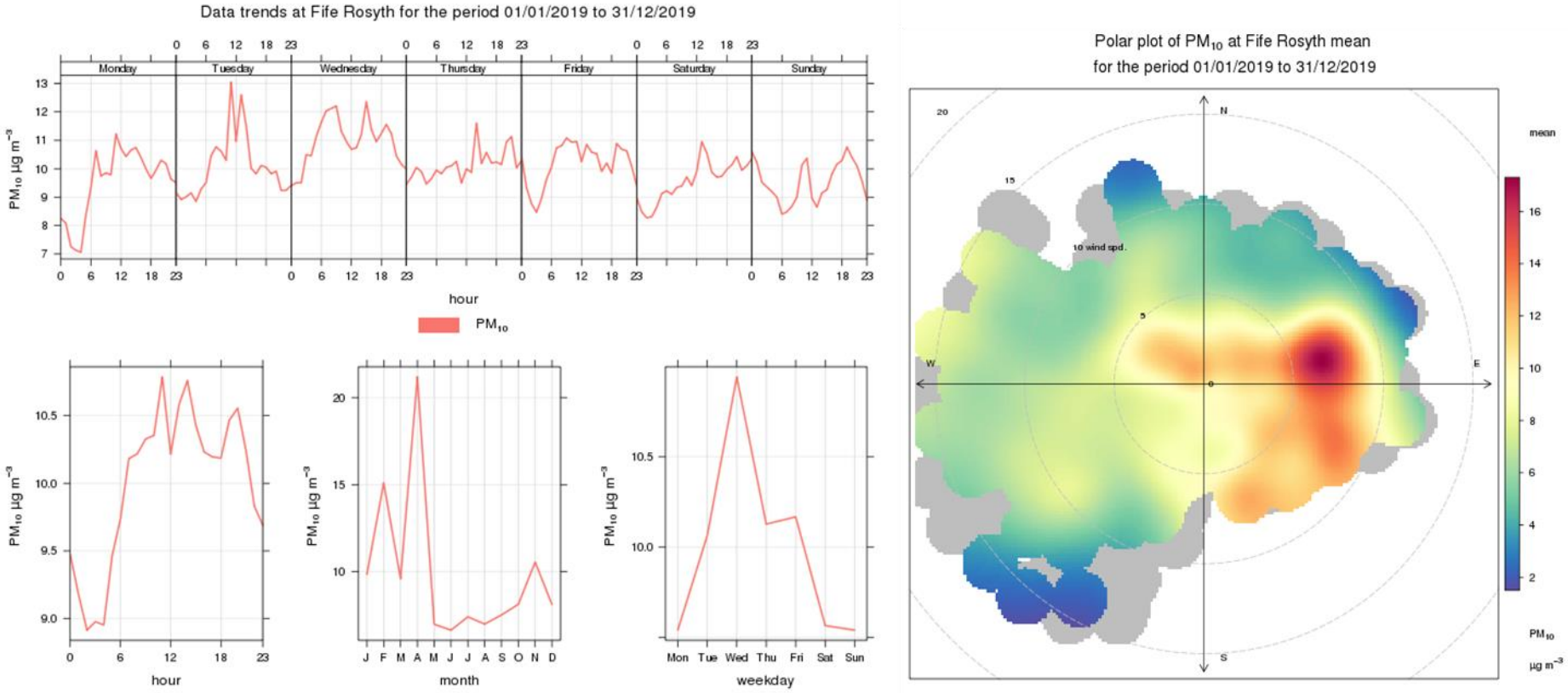


Figure H.13: Fife Cupar PM_{10} Calendar Plot – Date and Wind

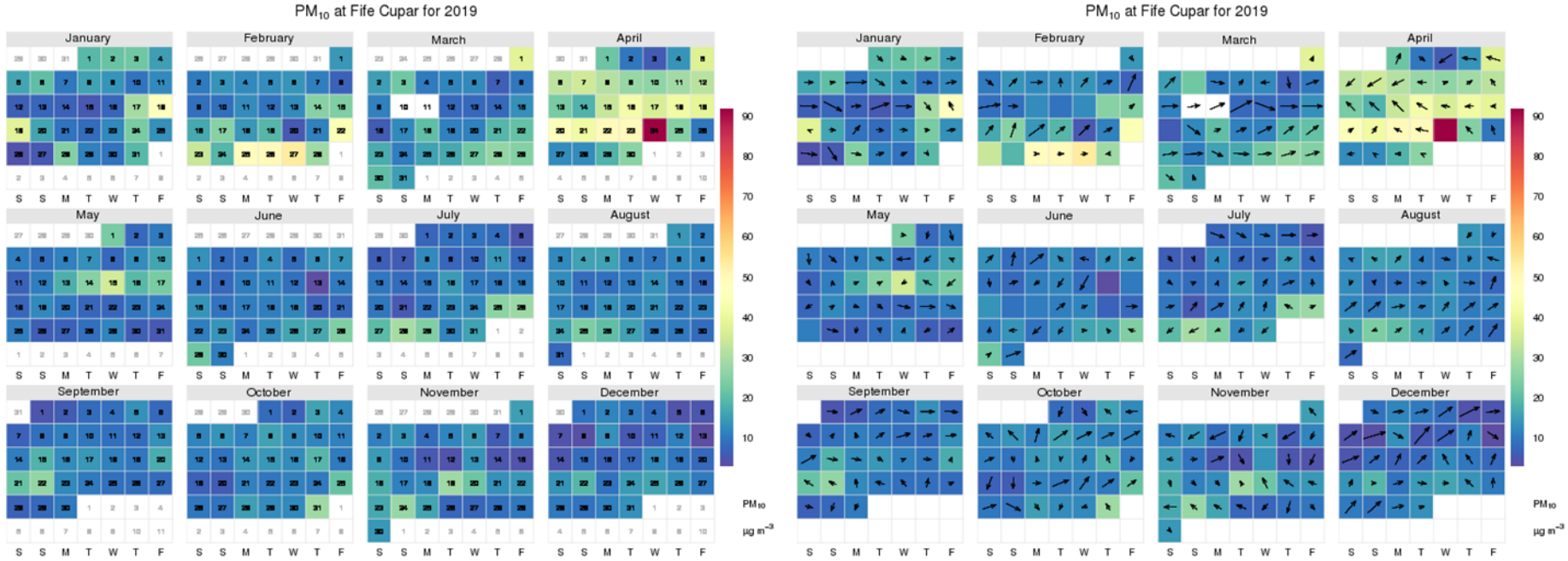


Figure H.14: Fife Dunfermline PM_{10} Calendar Plot – Date and Wind

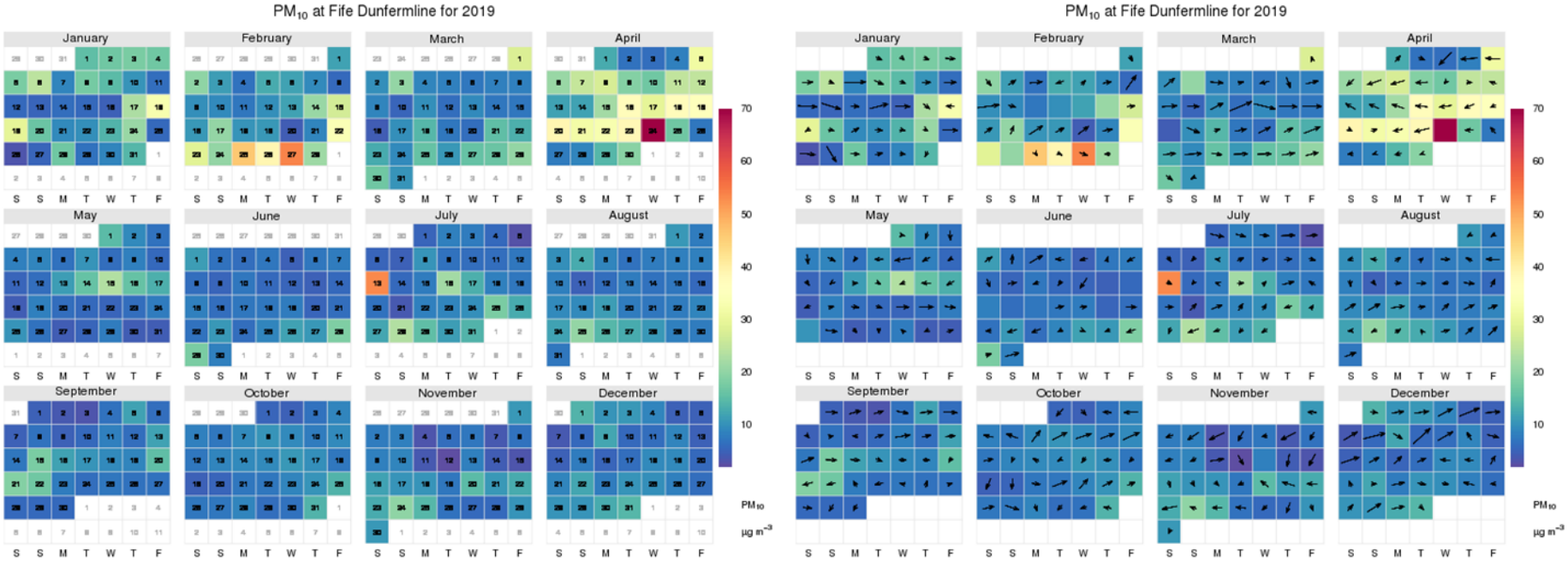


Figure H.15: Fife Kirkcaldy PM_{10} Calendar Plot – Date and Wind

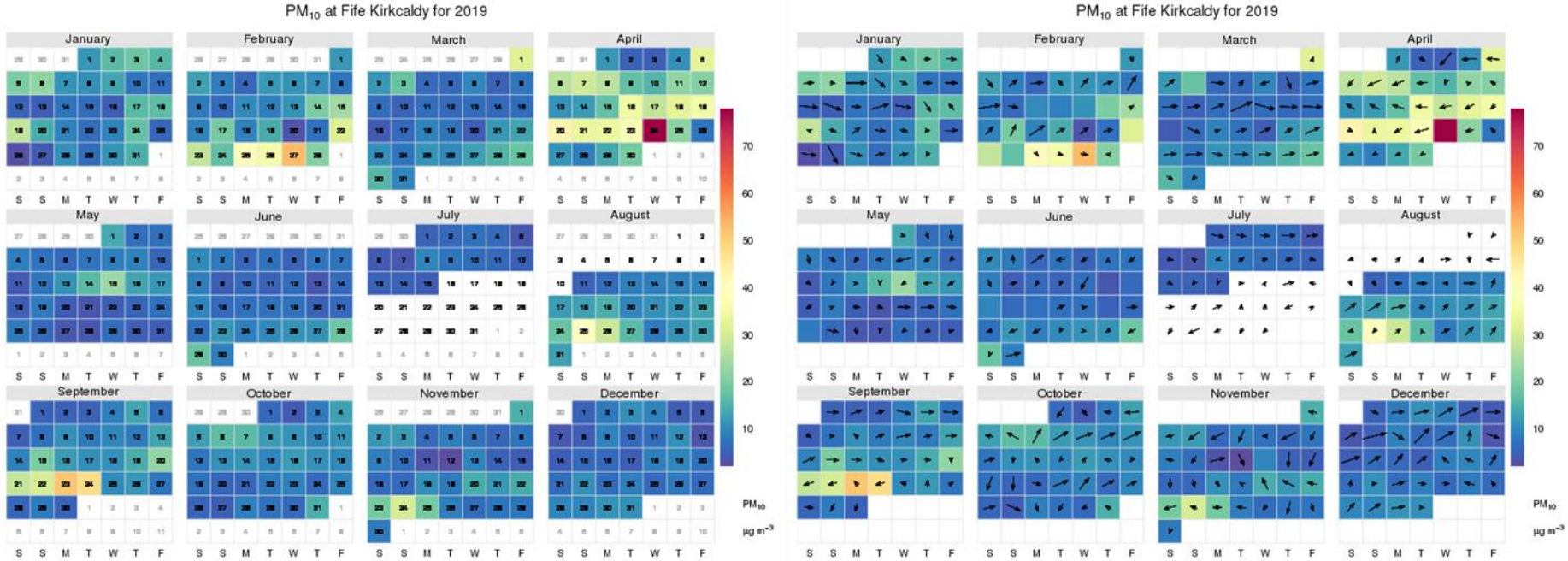


Figure H.16: Fife Rosyth PM_{10} Calendar Plot – Date and Wind

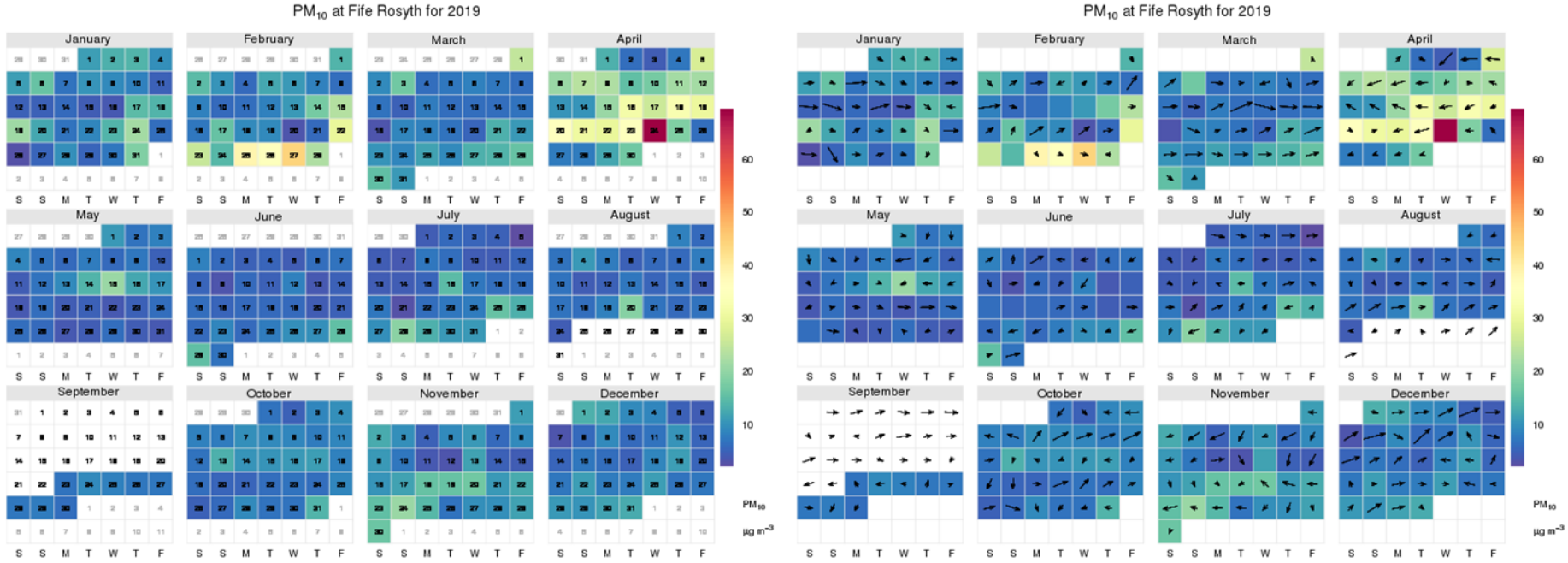
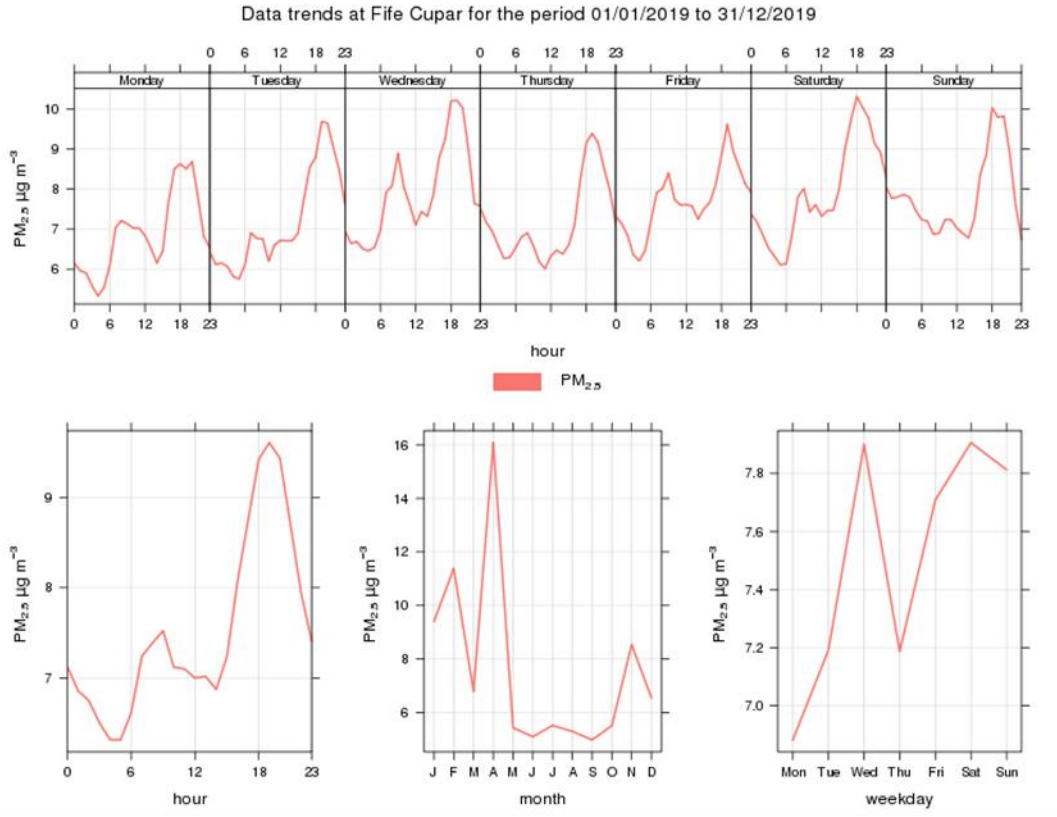


Figure H.17: Fife Cupar $PM_{2.5}$ Openair Analysis



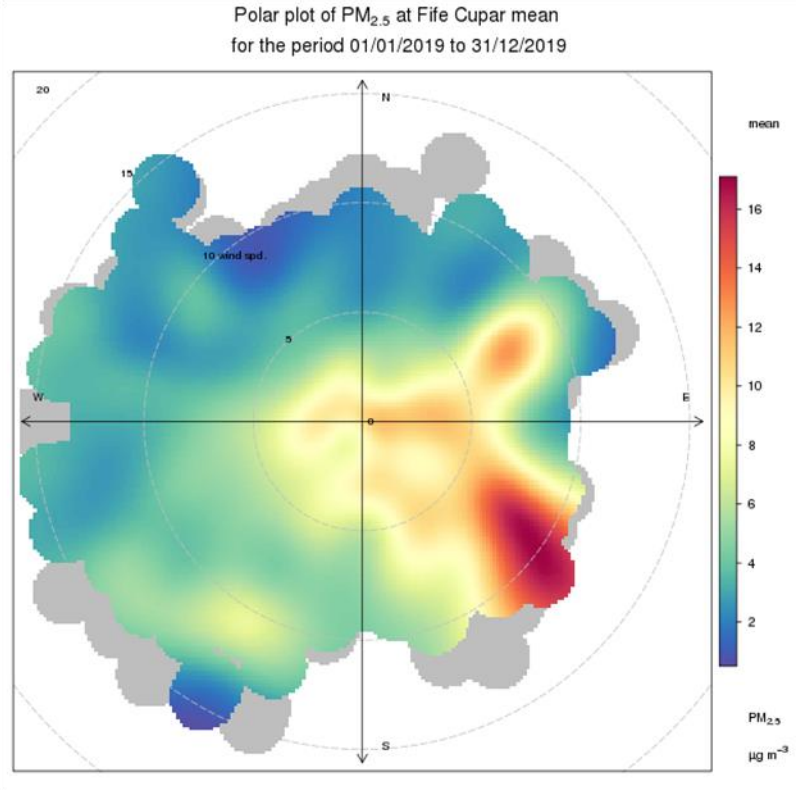
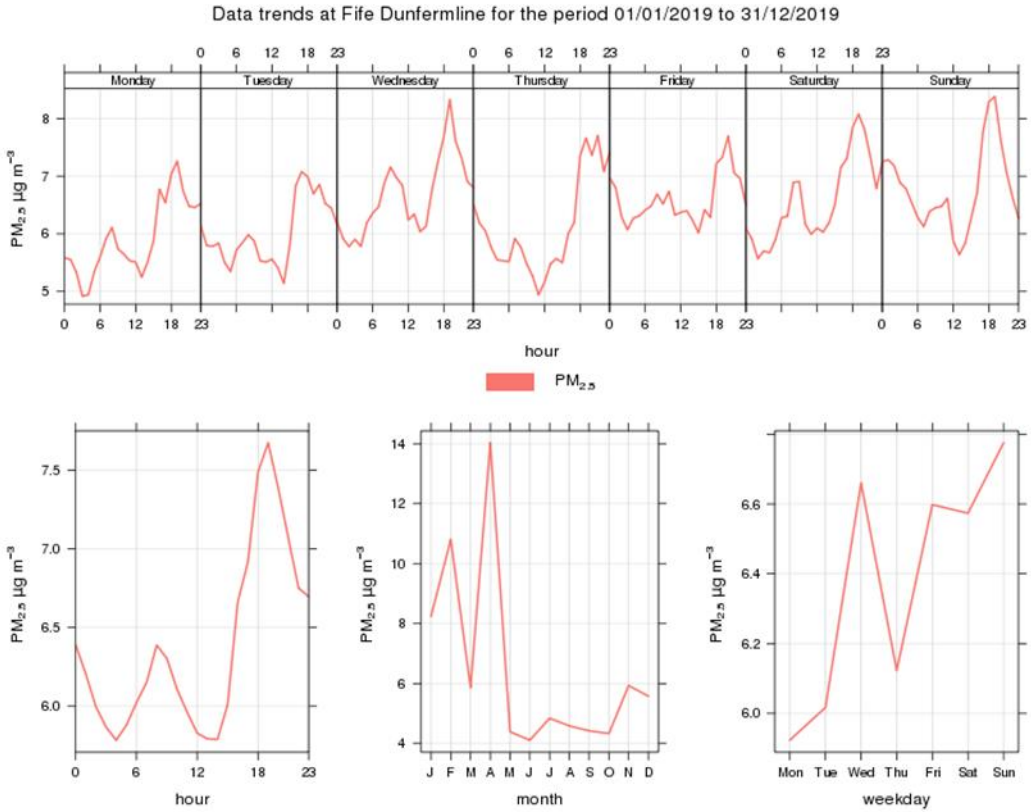


Figure H.18: Fife Dunfermline $PM_{2.5}$ Openair Analysis



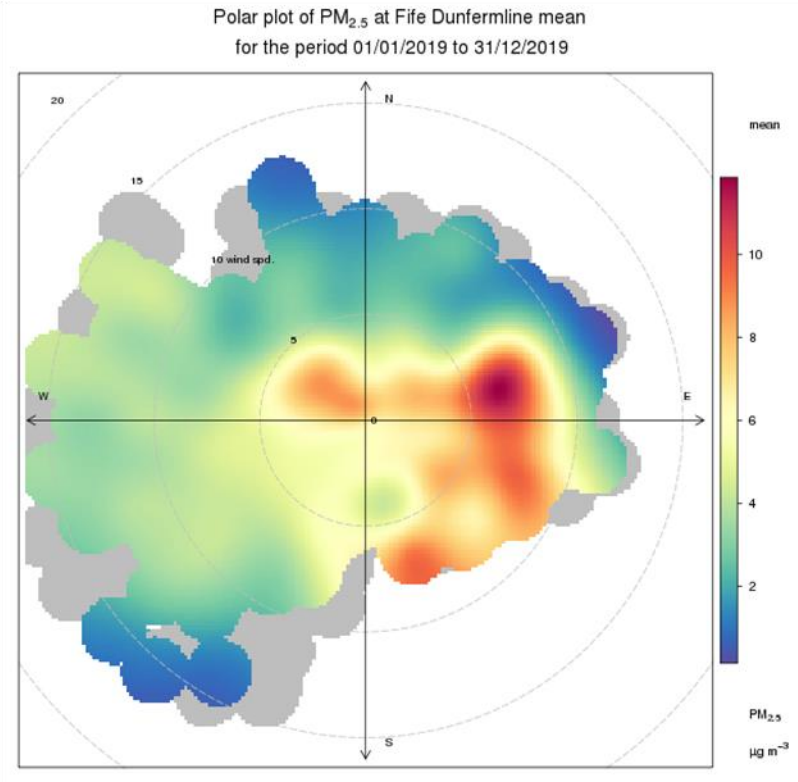
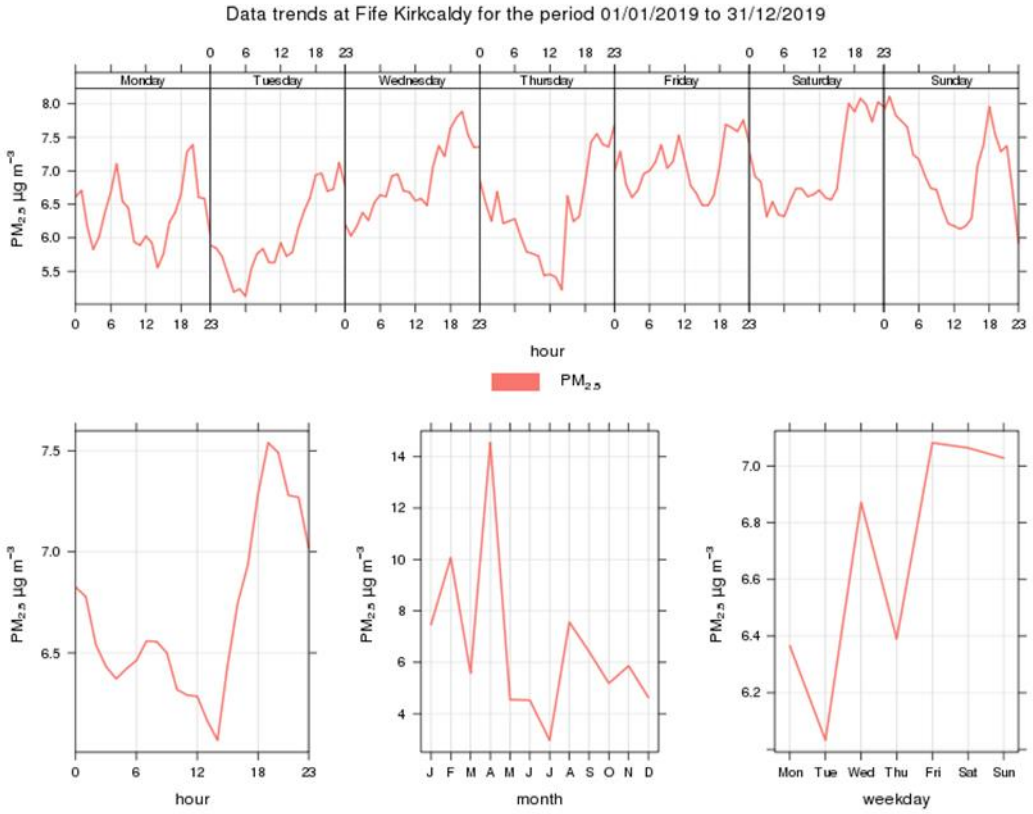


Figure H.19: Fife Kirkcaldy $PM_{2.5}$ Openair Analysis



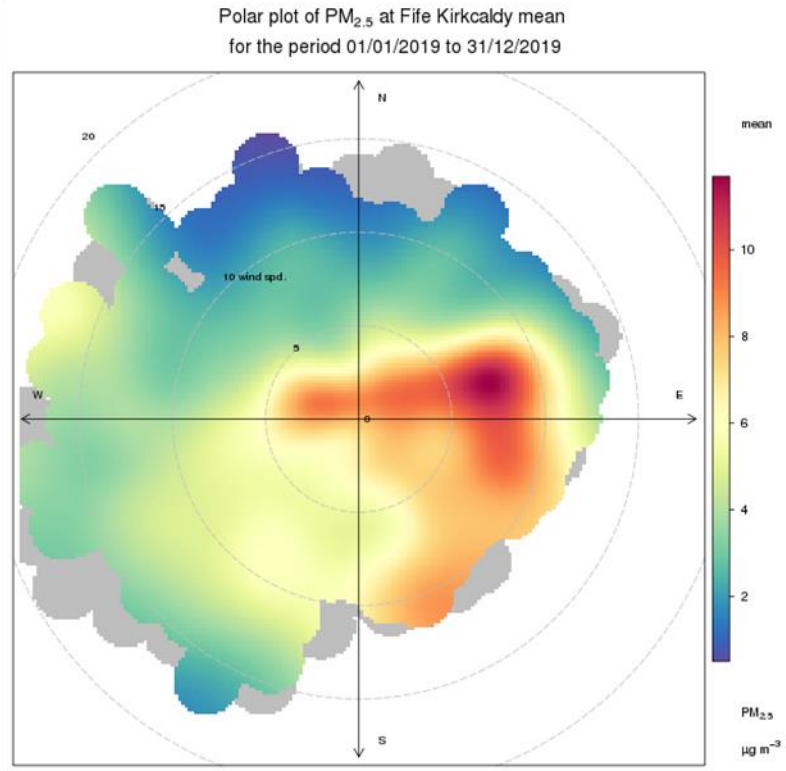
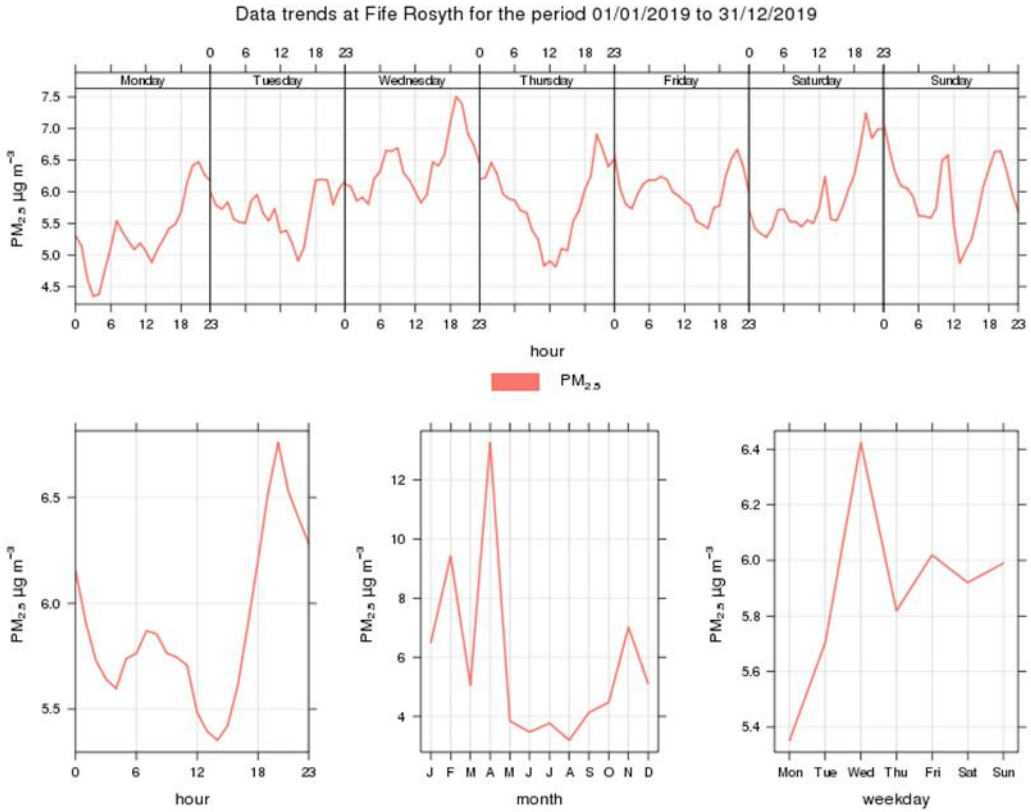
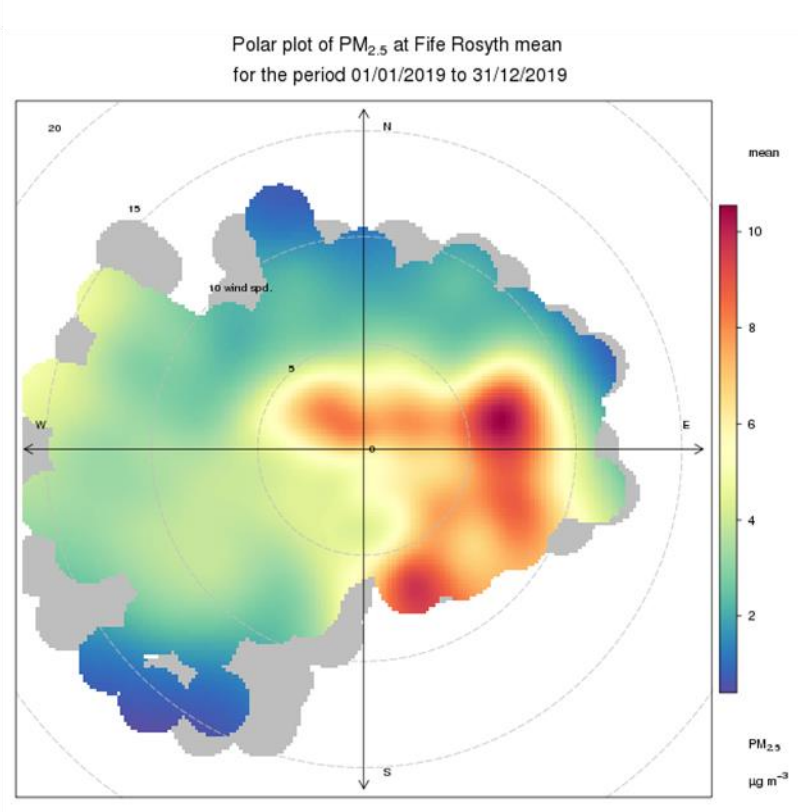


Figure H.20: Fife Rosyth $PM_{2.5}$ Openair Analysis





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
AQS	Air Quality Strategy
AURN	Automatic Urban and Rural Network (UK air quality monitoring network)
CO	Carbon Monoxide
Defra	Department for Environment, Food and Rural Affairs
DMRB	Design Manual for Roads and Bridges – Air Quality screening tool produced by Highways England
FMDS	Filter Dynamics Measurement System
LAQM	Local Air Quality Management
LEZ	Low Emissions Zone
NLEF	National Low Emission Framework
NO_2	Nitrogen Dioxide
NOx	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 2.5 µm or less
QA/QC	Quality Assurance and Quality Control
SO_2	Sulphur Dioxide

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