FIFE AIR QUALITY ANNUAL PROGRESS REPORT 2023

Fife Council

Report for: Fife Council

Ricardo ref. ED14794 Issue 2 07/08/2023

2023 Air Quality Annual Progress Report (APR) for Fife Council

In fulfilment of Part IV of the Environment Act 1995

Local Air Quality Management

August 2023

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Customer reference:
ED14794

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Report Reference Number	ED14794
Date	June 2023

Executive Summary: Air Quality in Our Area

AIR QUALITY IN FIFE

Air quality is generally good in most parts of Fife, however there are a few specific areas of concern where pollution may still be an issue and sustained action is required. The main pollutants of concern 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 2022. Fife Council (Fife) carry out monitoring of nitrogen dioxide (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 42 sites (total of 58 tubes). All NO_2 concentrations measured during 2022 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 2022 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 2022 indicates that it is unlikely that any air quality objectives relating to these pollutants were exceeded during 2022.

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.

There are currently two Air Quality Management Areas (AQMAs) for PM_{10} located within the Fife boundary, these are:

- Bonnygate, Cupar, declared in October 2008.
- Appin Crescent, Dunfermline, declared in August 2012.

During 2021, Fife revoked the NO_2 element of both AQMAs after recommendations from the Scottish Government and Scottish Environment Protection Agency (SEPA).

The Air Quality Action Plan (AQAP) for the Bonnygate, Cupar AQMA was last updated in 2021. The AQAP has been successful in reducing both NO_2 and PM_{10} concentrations within the Bonnygate area for a number of years now. During 2022 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 2021. The AQAP has been successful in reducing both NO_2 and PM_{10} concentrations within the Appin Crescent area for a number of years now. During 2022 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}.

Three AQMesh sensor units were installed in December 2017 to further understand pollutant concentrations and trends in the Appin Crescent, Dunfermline and Bonnygate, Cupar AQMAs with two units installed in Appin Crescent and one in the Bonnygate. An additional two AQMesh units were installed during 2022 at areas of concern at St Clair Street, Kirkcaldy

(June) and City Road, St Andrews (August). The 2022 data obtained from all five sites showed no exceedances of any of the NO_2, PM_{10} and $PM_{2.5}$ Air Quality Objectives.

The Air Quality Strategy for Fife (2021–2025), published in August 2021, 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 by Environmental Standards Scotland (ESS) and was identified in ESS's Improvement Report as showing good practice in relation to Air Quality Management Areas (AQMAs) and Air Quality Action Plans (AQAPs). As a consequence, Fife was asked to give evidence at a meeting of the Scottish Parliament's Net Zero, Energy and Transport Committee in relation to these matters.

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

- Revoke the PM_{10} AQMAs at Bonnygate Cupar and, Appin Crescent Dunfermline by the end of 2023. This is in accordance with the latest statutory LAQM policy and technical guidance.
- Produce an Annual Progress Report in 2024, reporting concentrations measured during 2023.
- Continue to implement the measures outlined in the action plans for Appin Crescent, Dunfermline and Bonnygate, Cupar.
- Continue to monitor NO_2, PM_{10} and $PM_{2.5}$ concentrations throughout Fife including AQMAs.
- Continue to review the NO_2 diffusion tube monitoring programme and seek to relocate any tubes where deemed appropriate

Fife received grant funding for 2022/23 for local air quality management and AQAP measures. A summary of each measure is provided throughout the report as shown in Table 1 below.

Table 1 Grant funding summary 2022/23

Measure	Summary
Nissan ENV200 electric van for Meals on Wheels	Details in Section 2.3.4
Continuation of TRL Fleet and Taxi Eco Stars schemes within Fife	Details in Section 2.3.3
AQMesh data management and reporting for existing pods	Details in Section 3.3

Measure	Summary
Clean Air Day 2022	Further information is provided in Section 2.2.6
Anti-idling campaign	Further information is provided in Section 3.4.3
Air quality and climate change co-benefits evidence base	Further information is provided in Section 3.4.2

ACTIONS TO IMPROVE AIR QUALITY

Measures outlined in the AQAPs for Bonnygate, Cupar and Appin Crescent, Dunfermline have been implemented throughout 2022. This includes the ongoing implementation of the Fife ECO Stars 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 whilst at the same time, making cost savings.

As of January 2023, the Fife Fleet scheme stands at 282 members operating 10,148 vehicles in and around Fife. Recruitment of new members continues to reflect the full spectrum of fleets operating in Fife. The requirement for all school and social work contract operators to become members of ECO Stars has resulted in a continued increase in membership numbers for the ECO Stars Taxi and Private Hire scheme. As of January 2023, the Taxi and Private Hire scheme stands at 151 members operating 623 vehicles.

Public engagement is one of the main actions taken by Fife throughout 2022. This has included the successful implementation of the Anti-Idling Campaign and also Clean Air Day educational events at Schools across Fife.

LOCAL PRIORITIES AND CHALLENGES

Fife has been awarded its grant funding from the Scottish Government for 2023-24. 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 will continue to implement the measures set out in the Bonnygate AQAP during 2023. The priorities within the designated AQMA over the forthcoming year include:

- Continue the implementation of Fife Council's travel plan including encouraging walking and cycling infrastructure and associated initiatives.
- Fife ECO Stars schemes for Fleet and Taxis operators will continue to encourage and promote 'clean fleet operations'.
- Install a new AQMesh unit on the northern side of the Bonnygate to gain additional monitoring data and further understand pollutant concentrations within the Bonnygate AQMA.

- Continue with the interrogation of monitoring data from the existing AQMesh unit on the southern side of the Bonnygate to further understand pollutant concentrations and trends within the Bonnygate AQMA.

Appin Crescent, Dunfermline:

Fife will continue to implement the measures set out in the Appin Crescent AQAP during 2023. The priorities within the designated AQMA over the forthcoming year include:

- 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'.
- Continue with the interrogation of monitoring data from the existing AQMesh units on the southern side of Appin Crescent to further understand pollutant concentrations and trends within the Appin Crescent AQMA.

In addition to the above, educational events to highlight Clean Air Day are to be delivered at four schools throughout Fife (including the Dunfermline area) as part of Clean Air Day on and around the 15th of June 2023. This follows on from the successful delivery of similar educational packages as part of Clean Air Day in the last three years. The events will include bite size air quality presentations as well as diffusion tube monitoring in the vicinity of the four selected schools and will follow on from the successful implementation of the anti-idling campaign carried out in 2022/23.

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
- Get involved in the anti-idling campaign - Switch your engine off and show you care about cleaner air! | Fife Council

Further information is available on the dedicated Fife Council air quality web pages at www.fife.gov.uk/airquality and on the what can I do about air pollution page on the Scottish Air Quality website What can I do about air pollution? (scottishairquality.scot).

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1. LOCAL AIR QUALITY MANAGEMENT

This report provides an overview of air quality in Fife during 2022. It fulfils the requirements of Local Air Quality Management (LAQM) as set out in Part IV of the Environment Act (2021) 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 below 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 since 2007. All reports can be accessed via the Fife Council website[1] and Air Quality in Scotland websites[2].

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. A further detailed assessment resulted in the amendment of the Appin Crescent AQMA to include PM_{10}. Subsequent AQAPs have been put into place.

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 were 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 aimed to improve traffic flow through Appin Crescent. It concluded that two out of the three options assessed did not provide air quality benefits however the third option (removal of a bus stop) did provide improvements.

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 presented actions that would 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.22, the result was therefore corrected for NO_2 drop off using the LAQM NO_2 fall off with distance

[1] https://www.fife.gov.uk/kb/docs/articles/environment2/environmental-health/air-quality
[2] http://www.scottishairquality.scot/news/reports?view=laqm

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 of PM_{10} and $PM_{2.5}$ were below the annual mean objectives 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, PM_{10} and $PM_{2.5}$ concentrations were below the annual mean objectives in 2017. The review of all available data relating to CO, SO_2 and benzene monitoring during 2017 indicated that it was unlikely that any AQS objectives relating to these pollutants were exceeded.

Fife 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 longer period of time. This would provide a more accurate estimate of the effect 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 the 2024 Phase 1 scenario. 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 predicted 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 predicted 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 to model emissions from road transport. Concentrations of NO_2, PM_{10} and $PM_{2.5}$ were modelled for 2016 at 3 m 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.

The 2019 APR indicated NO_2, PM_{10} and $PM_{2.5}$ concentrations were below the annual mean objectives in 2018. The review of all available data relating to CO, SO_2 and benzene monitoring during 2018 indicated that it was unlikely that any AQS objectives relating to these pollutants were exceeded. Additional indicative monitoring of NO_2, PM_{10} and $PM_{2.5}$ was carried out using AQMesh sensor units within the Bonnygate and Appin Crescent AQMAs. No exceedances were measured for any of the pollutants.

The 2020 APR indicated all NO_2, PM_{10} and $PM_{2.5}$ concentrations measured during 2019 were below the annual mean objective. Additional indicative monitoring of NO_2, PM_{10} and $PM_{2.5}$ was carried out using AQMesh sensor units within the Bonnygate and Appin Crescent AQMAs. For the Bonnygate AQMesh 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 AQMesh monitoring locations there were no exceedances measured for the NO_2, PM_{10} or $PM_{2.5}$ objectives. The review of all available data relating to CO, SO_2 and benzene monitoring during 2019 indicated that it was unlikely that any AQS objectives relating to these pollutants were exceeded.

The 2021 APR indicated that all NO_2, PM_{10} and $PM_{2.5}$ concentrations measured during 2020 were below the annual mean objective of 40 µg m^{-3}, 18 µg m^{-3} and 10 µg m^{-3} respectively. Additional indicative monitoring carried out using AQMesh sensors units within the Bonnygate and Appin Crescent AQMAs indicated that there were no exceedances measured at any of the sensor locations for the NO_2, PM_{10} or $PM_{2.5}$ objectives.

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

1.1.2 2022 Annual Progress Report

The 2022 APR utilised monitoring data collected throughout 2021. Fife 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 42 sites (total of 58 tubes). There were no diffusion tube sites which commenced or were decommissioned in 2021. All NO_2 concentrations measured during 2021 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 2021, 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. There were no exceedances measured at any of the sensor locations for the NO_2, PM_{10} or $PM_{2.5}$ objectives.

The review of all available data relating to CO, SO_2 and benzene monitoring during 2021 indicated that it was unlikely that any AQS objectives relating to these pollutants were exceeded.

The 2022 APR also provided information on the following additional projects carried out.

- The Northern Link Road Dispersion model update
- Real World Driving Emissions Study at both AQMAs
- Domestic Fuel Use Survey at both AQMAs

2. ACTIONS TO IMPROVE AIR QUALITY

2.1 AIR QUALITY MANAGEMENT AREAS

Air Quality Management Areas (AQMAs) are declared when there is an exceedance or likely exceedance of an air quality objective. After declaration, the authority must prepare publish and implement an Air Quality Action Plan (AQAP) within the shortest possible time and no later than 12 months of the date of AQMA Designation Order. The AQAP must set out measures the local authority intends to put in place in pursuit of the objectives within the shortest possible time. Measures should be provided with milestones and a final date for completion. The action plan itself should have a timescale for completion and for revocation of the AQMA. Where measures to reduce air pollution may require a longer timescale an action plan shall be reviewed and republished within five years of initial publication and then five-yearly thereafter.

A summary of AQMAs declared by Fife can be found in Table 2-1. Further information related to declared or revoked AQMAs, including maps of AQMA boundaries are available online http://www.scottishairquality.co.uk/laqm/aqma. The boundaries of the AQMA's declared by Fife 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 was formed to develop the AQAPs for both Bonnygate and Appin Crescent using the findings of the Further Assessment reports and the wide range of potential options for improving air quality. The steering group meet regularly to discuss and review the progress of the action plan measures outlined in the AQAPs.

Following the 2021 Annual Progress Report, Fife revoked both AQMA's for NO_2. Although the PM_{10} concentrations within the AQMAs were below the air quality objective these were not revoked due to the uncertainty regarding the PM_{10} concentrations reported by different PM analysers. The Scottish Government project[3] investigating PM concentrations is now complete and guidance notes[4] have been issued to the Local Authorities. After taking into consideration the study's results and amending the data appropriately Fife plan to revoke the remaining PM_{10} AQMAs by the end of this year.

Fife proposes to continue to implement both AQAPs for PM_{10} and monitor NO_2 and PM_{10} concentrations 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 which allow for concentrations of PM to be measured at locations of concern where previously it was not possible.

[3] Equivalence Study to Investigate Particulate Matter Monitoring in Scotland Using the Fidas 200 | Scottish Air Quality
[4] Local Authority Guidance Note for LAQM Reporting of Scottish PM Data | Scottish Air Quality

Table 2-1 Declared Air Quality Management Areas

AQMA Name	Pollutants and Air Quality Objectives	City/Town	Description	Action Plan
Bonnygate, Cupar	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 at 1st floor height above commercial properties.	Bonnygate Cupar, AQAP was updated in 2021
Appin Crescent, Dunfermline	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 was updated in 2021

Figure 2-1 Bonnygate, Cupar AQMA Boundary

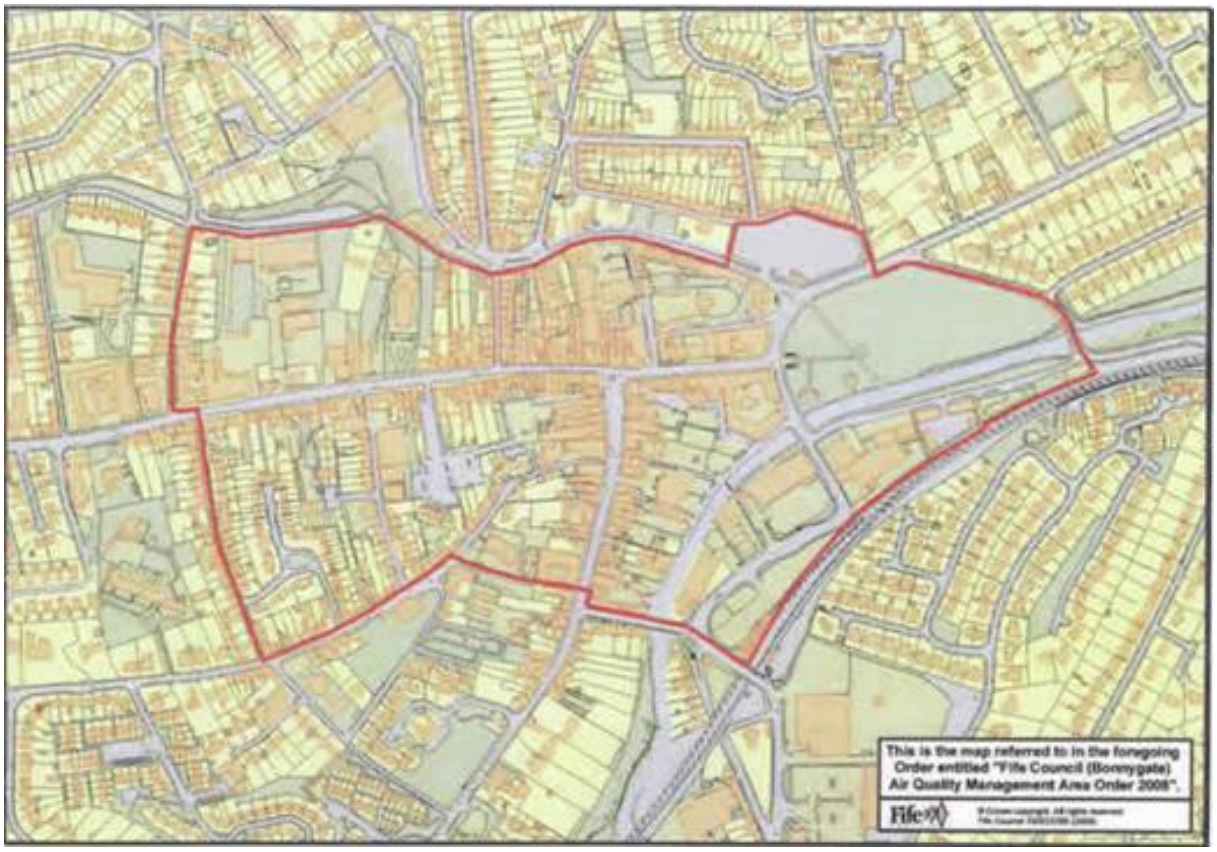
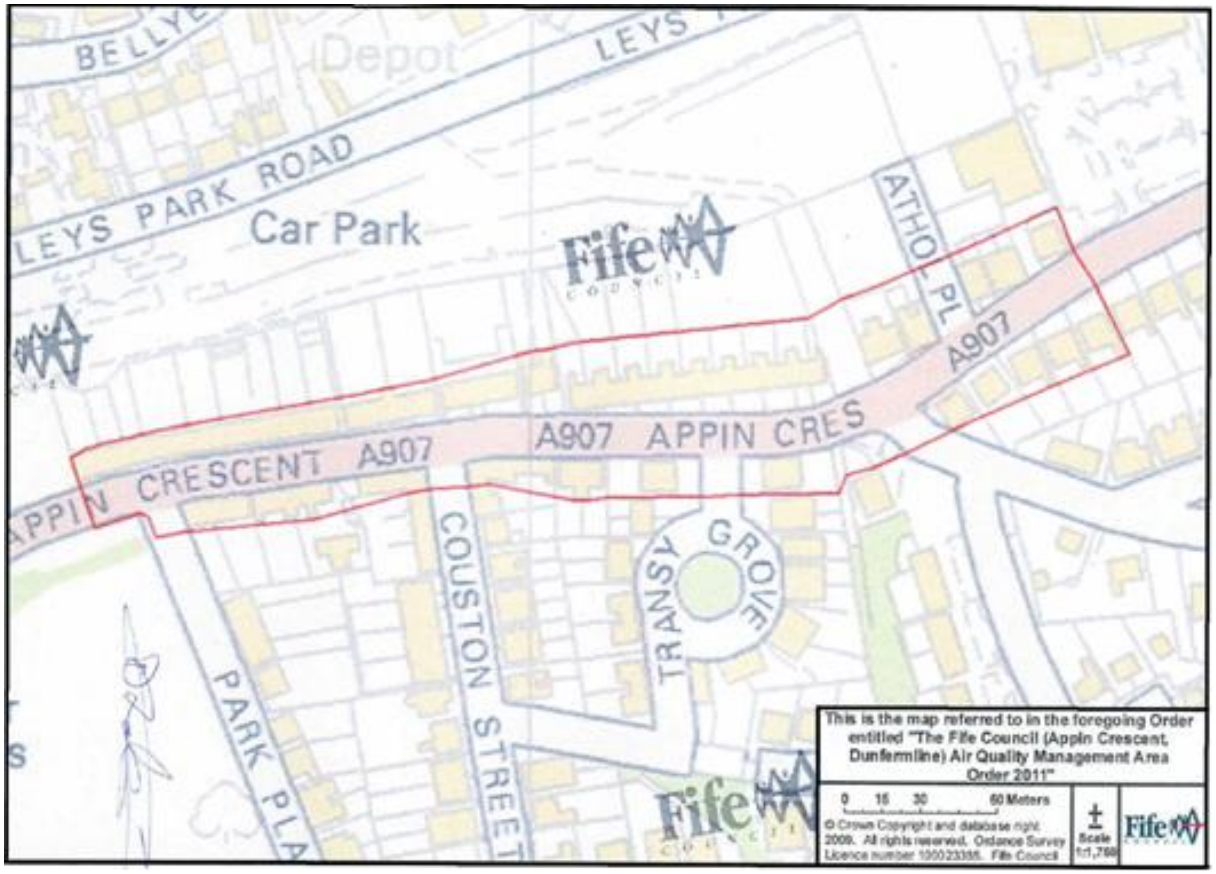


Figure 2-2 Appin Crescent, Dunfermline AQMA Boundary



2.2 CLEANER AIR FOR SCOTLAND 2

Cleaner Air for Scotland 2 – Towards a Better Place for Everyone (CAFS2) is Scotland's second air quality strategy. CAFS2 sets out how the Scottish Government and its partner organisations propose to further reduce air pollution to protect human health and fulfil Scotland's legal responsibilities over the period 2021 – 2026. CAFS2 was published in July 2021 and replaces Cleaner Air for Scotland – The Road to a Healthier Future (CAFS), which was published in 2015. CAFS2 aims to achieve the ambitious vision for Scotland "to have the best air quality in Europe". A series of actions across a range of policy areas are outlined, a summary of which is available on the Scottish Government's website[5].

Progress against relevant actions for which local authorities are the lead delivery bodies within this strategy is demonstrated below.

2.2.1 Placemaking – Plans and Policies

Local authorities with support from the Scottish Government will assess how effectively air quality is embedded in plans, policies, City Deals and other initiatives, and more generally in cross departmental working, identifying and addressing evidence, skills, awareness and operational gaps.

Fife has embedded air quality in its Fife Local Development Plan (FIFEplan), Fife Local Transport Strategy and Joint Health Protection Plan. This has been facilitated through the setting up of a Fife Core Air Quality Steering Group which consists of the relevant teams/organisations/agencies and meets quarterly to assess progress. In its Plan4Fife 2021-2024 (August 2021) specific reference is made to "Improved air quality to meet prescribed standards to reduce preventable ill-health".

The Local Development Plan (FIFEplan) and Fife Local Transport Strategy are currently under review and air quality is to be further embedded into these via consultation with Planning and Transportation colleagues. Comments from the Council's Land and Air Quality Team have already been provided for the latest versions/updates of these Plans. Fife Council's Local Transport Strategy is in the process of being finalised as of February 2023 with a view to it being adopted in the Summer of 2023. The replacement for Fife's current Local Development Plan (FIFEplan) is currently programmed to be adopted by the Council in 2027. Milestone dates are set out in the Fife Development Plan Scheme DPS12_2022.pdf (fife.gov.uk).

Fife has also promoted the use of the Place Standard tool in relation to Local Place Plans across Fife with training provided across various teams across the Council. It is currently being used by Communities & Neighbourhoods Services to help with various forms of local community-based planning.

Fife has also in partnership with NHS Fife updated its Joint Health Protection Plan (JHPP) which now covers the period 1st April 2022 to 31st March 2024 and includes specific reference to air quality in terms of the existing Bonnygate and Appin Crescent AQMAs and Fife Council's Air Quality Strategy and highlights the importance of a collaborative approach to tackling air quality issues. This collaborative approach is demonstrated by membership

[5] https://www.scottishairquality.scot/lez

of NHS Fife on the Fife Core Air Quality Steering Group and, Mossmorran and Braefoot Bay Expert Advisory Group on Air Quality.

Fife and NHS Fife have produced a MUSTER model (Meeting, Understanding, Surveillance, Toxicology, Evaluation and Reporting) risk communication tool and has produced a standard pro forma for reporting Environmental Health complaints (including those relating to air quality). Fife will also engage further with NHS Fife on health-related promotion activities such as encouraging walking and cycling in preference to the car.

2.2.2 Transport – Low Emission Zones

Local authorities working with Transport Scotland and SEPA will look at opportunities to promote zero-carbon city centres within the existing LEZs structure.

Fife has undertaken the relevant screening process and have determined that there is currently no requirement for any Low Emission Zones (LEZs) in Fife. Fife has also provided comments in relation to the proposed Low Emissions Zones (LEZs) being introduced within neighbouring local authorities (Edinburgh and Dundee).

2.2.3 Integrated Policy

Fife maximises co-benefits between air quality and related policy areas such as climate change, noise, transport, planning and agriculture amongst others to deliver enhanced benefits. Fife Council's Land and Air Quality Team is currently working with colleagues in our Climate and Zero Waste Team on Phase 1 of a Climate Change Co-Benefits Evidence Base study with Phase 2 to follow at a later date when funding allows.

Fife are also integrating air quality issues into transport and planning as outlined in the above Placemaking – Plans and Policies section. Further consideration of noise and agriculture will be the subject of future Scottish Government air quality grant submissions to undertake the relevant studies.

Additionally, the Climate Change and Zero Waste team have moved into Fife Council's Planning Service to further strengthen action in this area. This demonstrates how responding to the Climate Emergency is seen as core to the work moving forward in Fife. Fife Council's Land & Air Quality team continues to work closely with the Climate Change and Zero Waste team to ensure air quality is considered.

Fife are required to produce a Local Heat and Energy Efficiency Strategy (LHEES) and 5 year delivery plan by December 2023. This will focus on improving energy efficiency and decarbonising heat for all buildings across Fife and identifying potential heat network zones in order to help move towards Net Zero and other key targets. As part of the process a Steering Group has been established and will meet on a regular basis as the LHEES is developed and finalised. Protective Services are to be represented on this Steering Group in order to ensure that air quality (specifically indoor air quality) is adequately considered.

2.2.4 Tackling Non-Transport Emissions Sources

Fife address emissions from domestic (household) burning and agriculture, going beyond current regulatory and management approaches. We have already undertaken a domestic fuel use survey in our two AQMAs (Bonnygate, Cupar and Appin Crescent, Dunfermline) to further understand the contribution of this source and to assist in the development of best practice guidance for which we have applied for Scottish Government grant funding for

2023/24. In terms of agricultural sources, we have also applied for Scottish Government grant funding for 2023/24 to formulate a guidance leaflet aimed at making people aware of the issues associated with ammonia pollution and how to reduce the associated emissions. As agriculture is the major source of ammonia emissions in Fife the guidance will be aimed principally at the agricultural community.

Fife are also actively supporting the SGN (H100 Fife) project which aims to give residents in the Levenmouth area the opportunity to be at the leading edge of the low-carbon economy. A world-first hydrogen network is to be constructed in Buckhaven and Denbeath and will bring renewable hydrogen into around 300 homes in 2024/25 allowing residents to heat their homes and cook their food using 100% zero-carbon hydrogen (produced by a dedicated electrolysis plant, powered by a nearby offshore wind turbine). Participating customers will use hydrogen boilers, heaters and cooking appliances during the initial trial which is due to run until 2027. The project is the first of its kind to employ a direct supply of clean power to produce hydrogen for domestic heating which will put Fife at the forefront of the clean energy revolution.

The homes involved (a mix of private householders, private & social rented tenants and Council tenants) will have the above equipment installed and maintained free of charge over the course of the trial. The hydrogen will be charged at the same price as gas for all customers, enabling householders to switch to cheaper energy suppliers throughout the H100 Fife project if they wish. Householders that participate in the trial will also receive an incentive payment of £1000, paid in instalments throughout the customer's involvement in the project. As of February 2023, preparatory works for implementing the scheme are being introduced, a demonstration kitchen of hydrogen appliances has been constructed in the Fife Renewables Innovation Centre in Methil and pre-construction is underway of demonstration homes as to allow potential customers and wider stakeholders to see and try out the associated hydrogen equipment. Training will be delivered from September 2023, in partnership with Fife College, for the installers (private contractors and 5 Council engineers) who will be installing and maintaining the equipment. The hydrogen network construction is due to begin in March 2023.

Further information on the first-of-a-kind demonstration project that is leading the way in decarbonising home heating is available at https://sgn.co.uk/H100Fife and at https://h100fife.co.uk.

2.2.5 Transport – Avoiding unnecessary travel and Active Travel

Fife supports a modal shift to active travel and public transport. This will mean, amongst other objectives, providing a transport system that facilitates active travel choices, better public transport provision and constraints upon private vehicle use, especially in urban centres where pollution and congestion are most acute. Fife has a number of active travel initiatives in place which are discussed further below.

Fife will work with active travel partners to identify funding for permanent active travel infrastructure and behavioural change programmes, through grant funded programmes in line with the National Transport Strategy (NTS) Sustainable Travel Hierarchy and the Sustainable Investment Hierarchy, and where the projects are clearly aligned to the active travel outcomes framework. Relevant examples include:

- Partnership working with Sustrans to develop projects as well as seek grant funding from Sustrans to expand the shared use network across Fife
- Partnership working with SEPA to develop projects and jointly seek funding to implement
- SEStran working with community groups directly to encourage active travel, with grant funding where available

Fife will work with delivery partners to make temporary active travel infrastructure, delivered under the Space for People fund during the COVID-19 outbreak, permanent in the medium to longer term. Relevant examples include:

- St Andrews Town Centre 20mph zone has now been made permanent (as of November 2022)
- Cupar Town Centre 20mph zone has now been made permanent (as of November 2022)

Fife will work collaboratively with various partners to deliver our Active Travel vision of enabling walking, cycling and wheeling to be the most popular mode of travel for short, everyday journeys in our towns and cities. Relevant examples include:

- Encourage School Travel Plans to be developed for all schools
- Promote the “Walk Once a Week” initiative in schools to encourage active travel
- Promote Hands Up Scotland surveys in schools
- Promote Bikeability in schools, teach pupils how to cycle and develop road sense
- Undertake marketing and promotion in order to encourage use of public transport
- Community engagement to increase the active travel network across Fife

Specific details on several of the above active travel initiatives which are targeted at primary schools are provided below:

The “Walk Once a Week” Campaign is a partnership between Fife and Living Streets Scotland that continues to progress the active travel agenda in Fife Primary schools and increase the uptake of active travel. The 2022/23 period saw a maximum of 19 schools and 4,688 pupils take part. The 2021/22 period by comparison saw the same maximum number of schools take part (19) but with fewer pupils (4,207).

The Hands Up Scotland survey is a project funded by Transport Scotland and is a joint survey between Sustrans and all 32 local authorities across Scotland whereby each September schools across Scotland complete the survey by asking their pupils ‘How do you normally travel to school?’ and the results provide a valuable annual snapshot of typical school travel habits. The results for Fife primary schools in 2022 show that active travel increased from 53.9% in 2021 (46.4% walking, 3.3% cycling and 4.2% scooter/skate) to 56% in 2022 (46% walking, 4% cycling and 6% scooter/skate). A decrease in the percentage of children driven to their primary schools was noted from 23.1% in 2021 to 21% in 2022 as well as those opting to park and stride which decreased from 16.5% in 2021 to 15% in 2022 indicating that an increasing number of children were favouring active travel instead.

Cycling is promoted through encouraging active schools and is further promoted within Primary schools via the Bikeability scheme. Over 2022 the number of pupils signed up to take part across Levels 1 and 2 of Bikeability were:

- Level 1 – 2,428 pupils from 59 schools with a 100% pass rate (an increase from 1,357 pupils from 31 schools in 2021)
- Level 2 – 1,780 pupils from 44 schools with a 100% pass rate (an increase from 1,240 pupils from 28 schools in 2021)

2.2.6 Public Engagement and Behavioural Change

Fife carry out a large number of public engagement activities, including the promotion of sustainable travel choices that are aimed towards encouraging changes in behaviour that will contribute to improving local air quality. These activities aim 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.

Travel to school is still a necessity and Fife actively promote ways to make this a sustainable journey through initiatives such as WOW (Walk Once a Week), The Hands Up Scotland survey and Bikeability which are all discussed in more detail in Section 2.2.5 above.

In recent years Clean Air Day (CAD) has become a successful platform for allowing Fife to raise awareness of air quality issues while also encouraging sustainable travel options. We have successfully delivered educational initiatives and events around CAD focussing specifically on Fife primary schools and below details of the events undertaken in 2022 are provided.

For Clean Air Day 2022, Fife provided three primary schools within Dunfermline with an educational package, including materials to carry out their own monitoring studies whereby the participating primary schools were:

- Carnegie Primary
- St Margaret's RC Primary
- Duloch Primary

Prior to Clean Air Day, each school was provided with bitesize air quality presentations and a Citizen Science pack by Ricardo Energy & Environment, on behalf of Fife Council. Pupils used the information provided to determine their own monitoring locations, placing diffusion tubes in key locations they had selected around their school grounds.

On and around Clean Air Day on the 16th of June 2022, the three participating schools were also visited by EnviroTechnology Services 'Smogmobile' which is a mobile emission free air quality monitoring laboratory which allowed the children to learn more about the specialist equipment used to accurately monitor air quality (Figure 2-3). To help promote Clean Air Day branded items were provided to pupils at all three schools by Environmental Protection Scotland (EPS), Ricardo Energy & Environment and EnviroTechnology Services.

Figure 2-3 Photo of ‘Smogmobile’ with pupils from Carnegie Primary along with Councillor Jan Wincott and representatives from Ricardo Energy & Environment, EnviroTechnology Services and Environmental Protection Scotland (EPS)

During the visits the schools were encouraged to post on social media what they were involved in as part of Clean Air Day and examples of what was posted is shown in Figure 2-4.

Figure 2-4 Twitter posts from Carnegie Primary and St Margaret's Primary in relation to pupil involvement in and around Clean Air Day 2022

After Clean Air Day the schools were sent a summary presentation which allowed pupils to review what they had learned previously about air pollution and the monitoring results from their diffusion tube studies.

Positive feedback was received from Carnegie Primary with the class teacher noting:

"… it was a pleasure working with you on Tuesday and the pupils in Carnegie have been buzzing about Clean Air and monitoring air pollution all week! I've had some lovely comments from a couple of parents saying that their children - who were involved in some of those many groups who came to see you - found it really interesting and fascinating".

"It was a great event to be involved in, and from start to finish I've felt the communication has been excellent and everything has been very well organised. Would highly recommend schools take part in this initiative, our children learnt through real life meaningful contexts."

This is great feedback for Fife and shows that the event was a success. Depending on funding available there would be a hope to run similar type events in future years.

2.3 PROGRESS AND IMPACTS OF MEASURES TO ADDRESS AIR QUALITY IN FIFE COUNCIL

In order to ensure that local authorities implement the measures within an action plan by the timescales stated within that plan, the Scottish Government expects authorities to submit updates on progress through the APR process. Fife has taken forward a number of measures during the current reporting year of 2022 in pursuit of improving local air quality. Details of all measures completed, in progress or planned are set out in Table 2-2 for Bonnygate, Cupar and Table 2-3 for Appin Crescent, Dunfermline. More detail on these measures can be found in the Air Quality Action Plan relating to each AQMA, these are available on the Council's website at www.fife.gov.uk/airquality.

Key measures which have been completed or are nearing completion are listed below (including a measure previously completed and no longer listed in the associated AQAP*):

Bonnygate

- The Implementation of new Urban Traffic Management and Control system and changes to pedestrian crossings
    - Complete and monitoring on-going
- Update to the air quality strategy
    - Now covers 2021-2025 and aligns with CAFS2
- Identifying the most polluting vehicles within the AQMA
    - Undertook Real World Driving emissions study, gathered data from over 12,000 vehicles
    - Data will be used to inform decision making and policy changes within AQMA
    - Data has been used as part of the update to the existing RapidAir regional road transport air quality model for Fife
- Promote domestic combustion best practice guidance
    - Domestic Fuel Use survey undertaken in and in the vicinity of AQMA
    - Data will be used to inform decision making and policy changes within AQMA

Appin Crescent

- Changes to signage and road markings*
    - Complete and monitoring on-going
- Update to the air quality strategy
    - Now covers 2021-2025 and aligns with CAFS2
- Identifying the most polluting vehicles within the AQMA
    - Undertook Real World Driving emissions study, gathered data from nearly 13,000 vehicles
    - Data will be used to inform decision making and policy changes within AQMA
    - Data has been used as part of the update to the existing RapidAir regional road transport air quality model for Fife
- Promote domestic combustion best practice guidance
    - Domestic Fuel Use survey undertaken in and in the vicinity of AQMA
    - Data will be used to inform decision making and policy changes within AQMA

Fife expects the following measures to be further progressed over the course of the next reporting year:

- Improving links with local transport strategy/area transport plan – Due to go live in summer of 2023
- Improving Air Quality links with Local Planning and Development Framework, Provision of Information and promotion of travel options and Provision of information relating to Air Quality – The replacement for Fife's current Local Development Plan (FIFEplan) is currently programmed to be adopted by the Council in 2027. Milestone dates are set out in the Fife Development Plan Scheme DPS12_2022.pdf
- Integrate Air Quality with other Council Strategies – Work with colleagues in our Climate and Zero Waste Team to further develop the Climate Change Co-Benefits Evidence Base study which was initially started in 2022

Table 2-2 Progress on Measures to Improve Air Quality in Bonnygate

Measure No.	Measure	Category	Expected/Actual Completion Year	Measure Status	Funding Status	Key Milestone	Progress to Date	Barriers to implementation
1	Liaise with Scottish Government to encourage the consideration of national measures Implementation Phase: 2021 - 2025	Policy Guidance and Development Control	2025 (when strategy is next reviewed)	In progress	Not funded from Scottish Government Air Quality Grant	2022 (Protective Services actively involved in discussions with SEPA and Scottish Government regarding CAA and LAQM reporting) Ongoing advice to Scottish Government regarding experience of the LAQM process	Fife continues to attend and contribute to air quality seminars; training events and pollution liaison group meetings where national air quality measures are discussed. This includes recent membership of the short-term Clean Air Act and LAQM Review Act Working Group which seeks to review the provisions of the CAA 1993 with a view to ensuring alignment with LAQM Regulations. Process will also review and update templates for AQAPs, AQMA Revocations and Annual Progress Report in line with CAFS2 commitments and Environmental Standards Scotland recommendations.	None
2	Improving links with Local Transport Strategy/ Area Transport Plan Implementation Phase: 2021 - 2025	Policy guidance and development control	2025 (when strategy is next reviewed)	In progress	Not funded from Scottish Government Air Quality Grant	All years (ensuring strategy is updated as appropriate and is easily available)	Fife Air Quality Steering Group outputs continue to contribute to the development of Fife Council's Local Transport Strategy which is in the process of being finalised as of February 2023 with a view to it being adopted in the Summer of 2023. Fife will seek to incorporate travel related air quality measures into the updated Local Transport Strategy. A summary of the new LTS will be provided in the next Annual Progress Report 2024	None
3	Improving Air Quality links with Local Planning and Development Framework Implementation Phase: 2021 - 2025	Policy guidance and development control	2025 (when strategy is next reviewed)	In progress	Not funded from Scottish Government Air Quality Grant	All years (ensure guidance is updated as appropriate and is easily available)	The Low Carbon Fife Supplementary Guidance continues to form a statutory part of the Local Development Plan (FIFEplan). This guidance incorporates the Fife Air Quality Developers Guide On 13 February 2023 Scotland's fourth National Planning Framework (NPF4) was adopted by Scottish Ministers. NPF4 is now part of the statutory Development Plan for Fife and is therefore a key consideration for new development proposals. Policy 23 of NPF4 provides high-level policy protection in relation to air quality. The replacement for Fife's current Local Development Plan (FIFEplan) is currently programmed to be adopted by the Council in 2027. Milestone dates are set out in the Fife Development Plan Scheme DPS12_2022.pdf (fife.gov.uk)	None

Measure No.	Measure	Category	Expected/Actual Completion Year	Measure Status	Funding Status	Key Milestone	Progress to Date	Barriers to implementation
4	Integrate Air Quality with other Council Strategies Implementation Phase: 2021 - 2025	Policy guidance and development control	2025 (when strategy is next reviewed)	In progress	Not funded from Scottish Government Air Quality Grant	2021 (Climate Change Team moved into Planning Services therefore closer working with Protective Services now possible)	Member of the Council's Climate Change Team continue to attend future Fife Core Air Quality Steering Group meetings. The Plan for Fife, the Fife Partnership Local Outcome Improvement Plan, was produced in 2020-2021. Fife Council declared a climate emergency in 2019 and an updated plan for 2021-2024 sets out the key recovery and renewal priorities. On February 6th 2020 Fife Council's Environment and Protective Services Committee approved the Sustainable Energy Climate Action Plan - Climate Fife (2020-2030). Climate Fife includes a practical action plan. https://www.fife.gov.uk/kb/docs/articles/environment2/climate-change,-carbon-and-energy. 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)'. The Addressing the Climate Emergency (ACE) Board meets around 6 times a year, with key Climate Fife priorities being taken forward through the ACE Action Plan: • Climate Ready Buildings • Climate Resilient Communities • Climate Action Communities • Maximising Environmental Capital • Implementing Climate Fife Priorities Links to air quality are considered throughout these action plans, specifically by the Local Transport Strategy and Local Development Plan that have the potential for air quality impacts. There is close working with the Climate Change and Zero Waste Team in Fife Council's Planning Service. The Local Heat and Energy Efficiency Strategy and Delivery Plan is a new duty for Scottish Councils to plan energy efficiency and decarbonised heat of all buildings in its area. Recognising the challenges with indoor air quality Protective Services is represented on the Steering Group to provide specialist advise and input. It is hoped this work on indoor air quality can complement that proposed under the CAFS2 framework. During 2022-23 the Climate Change team has been working with Protective Services to link NAEI (National Atmospheric Emissions Inventory) data to climate actions such as decarbonised heat and transport in Fife. Work on this project is	None

Measure No.	Measure	Category	Expected/Actual Completion Year	Measure Status	Funding Status	Key Milestone	Progress to Date	Barriers to implementation
							continuing and will report back with findings in the Summer of 2023.	
5	Implementation of new Urban Traffic Management and Control system and changes to pedestrian crossings Implementation Phase: Completed and monitoring ongoing	Policy guidance and development control	2009	Complete	N/A	2009 (traffic management system introduced)	Completed and monitoring ongoing Seeking revocation of this AQMA as a result of the introduction of air quality improvements achieved at this location by this measure	None
6	Travel Plans for large Institutions and Businesses Implementation Phase: 2021 - 2025	Promoting travel alternatives	2025 (when strategy is next reviewed)	In progress	Not funded from Scottish Government Air Quality Grant	All years (ensuring active travel continues to be considered and adopted)	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.	Ensure other grant support still offered to schools and Bikeability volunteers continue to be recruited as air quality grant monies not available through this funding stream
7	Provision of Information and promotion of travel options Implementation Phase: 2021 - 2025	Promoting travel alternatives	2025 (when strategy is next reviewed)	In progress	Traffic counters funded annually using Scottish Government Air Quality Grant	All years (ensuring sustainable travel continues to be considered and adopted)	Scottish Government funding issued in 2022-23 allowed for 12 new traffic counters to be purchased and these will aid in tracking changes in vehicle use within existing AQMAs and other parts of Fife. New grant application for 2023-24 included bid for 15 traffic counters but this was unsuccessful. New bid to be submitted next year. Fife's current adopted Local Development Plan (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. The replacement for Fife's current Local Development Plan (FIFEplan) is currently programmed to be adopted by the Council in 2027. Milestone dates are set out in the Fife Development Plan Scheme DPS12_2022.pdf (fife.gov.uk)	Funding not granted 2023/24 Ensure support still offered to schools and Bikeability volunteers continue to be recruited

Measure No.	Measure	Category	Expected/Actual Completion Year	Measure Status	Funding Status	Key Milestone	Progress to Date	Barriers to implementation
							Continue to actively promote sustainable travel to school, including initiatives such as Bikeability and WOW (Walk Once a Week).	
8	Target reduced localised emissions from freight Implementation Phase: 2021 - 2025	Freight and delivery management	2025 (when strategy is next reviewed)	In progress	Funded annually using Scottish Government Air Quality Grant and Council revenue if required	All years (ensure membership continues to increase)	Scottish Government funding issued in 2022 allowed the ECO Stars scheme to continue in Fife. Continue to engage with new and existing HDV Fleet operators through the ongoing roll out and maintenance of the Fife ECO Stars scheme.	Funding important for continued implementation
9	Provision of information relating to Air Quality Implementation Phase: 2021 - 2025	Public information	2025 (when strategy is next reviewed)	In progress	Not funded from Scottish Government Air Quality Grant	All years (ensure guidance is updated as appropriate and is easily available)	The Low Carbon Fife Supplementary Guidance continues to form a statutory part of the Local Development Plan (FIFEplan). This guidance incorporates the Fife Council Air Quality Developers Guide. The replacement for Fife's current Local Development Plan (FIFEplan) is currently programmed to be adopted by the Council in 2027. Milestone dates are set out in the Fife Development Plan Scheme DPS12_2022.pdf (fife.gov.uk) In conjunction with this the Fife Council Air Quality Developers Guide has been recently amended as has the associated Fife Council Air Quality Strategy (covering the period 2021 to 2025) with both documents available online at Air quality | Fife Council	None
10	Parking Management and Control Implementation Phase: 2021 - 2025	Traffic management	2025 (when strategy is next reviewed)	In progress	Not funded from Scottish Government Air Quality Grant	All years (ensure regularly evaluated when consulted)	Continue to evaluate parking management measures/proposed changes within the Bonnygate AQMA.	None
11	Review and support proposed infrastructure changes that will contribute to delivering improvements in local air quality Implementation Phase: 2021 - 2025	Transport planning and infrastructure	2025 (when strategy is next reviewed)	In progress	Not funded from Scottish Government Air Quality Grant	All years (ensure proposed infrastructure changes taken into account and monitoring data is available for associated studies)	Continue to support proposed infrastructure changes and provide comments when consulted. This will include reviewing forthcoming planning applications associated with the proposed multi-use development to the north of Cupar and the associated relief road that will be constructed (re-alignment currently being considered). Monitoring data from within the AQMA (automatic monitoring data, diffusion tube data, AQMesh data and traffic flow data) available for any associated modelling studies required in association with such infrastructure changes.	None

Measure No.	Measure	Category	Expected/Actual Completion Year	Measure Status	Funding Status	Key Milestone	Progress to Date	Barriers to implementation
12	Target reductions in emissions from the Council fleet and contract vehicles (including driver training) Implementation Phase: 2021 - 2025	Vehicle fleet efficiency	2025 (when strategy is next reviewed)	In progress	Funded annually using various funding streams including Council revenue funding and Scottish Government Air Quality Grant and other such funding (e.g. Switched On Fleet)	All years (ensuring Fleet being upgraded especially in terms of EVs and hybrids)	Scottish Government funding issued in 2022 allowed for a new EV to be added to the Fleet. Bid for grant funding in 2023/24 for new EV was unsuccessful. To reapply in 2024/25 As of January 2023, Fife Council had 56 full electric vehicles and 19 hybrid vehicles in service (either leased or purchased). As of February 2023, the size of the Fife Council fleet decreased slightly from the 2022 figure of 1,506 vehicles and now stands at 1,497 vehicles. The amount of diesel used by the Council Fleet increased in 2021/22 to 3,470,316 litres up from 3,118,643 litres in 2021/21 indicative of a return to normal practices after the impact of COVID-19	Issues with funding available to Fleet to obtain new/replacement vehicles (including revenue) Switched On Fleet funding not available now for several years for vehicles SG AQ Grant not granted 2023/24
13	Target reductions in emissions from buses Implementation Phase: 2021 - 2025	Vehicle fleet efficiency	2025 (when strategy is next reviewed)	In progress	Funded annually using Scottish Government Air Quality Grant	All years (ensuring membership continues to increase)	Scottish Government funding issued in 2022 allowed the ECO Stars scheme to continue in Fife. Continue to encourage bus operators to recognise the importance of air quality and climate change issues through the Fife ECO Stars scheme and to continue trying to set up voluntary bus agreements through interaction with local bus operators e.g., school bus operator contracts up for renewal. As of January 2023, there are 64 bus operators within the ECO Stars scheme (one operator went out of business) but the number of vehicles covered has increased to 1,734.	Funding important for continued implementation
14	Fife ECO Stars Implementation Phase: 2021 - 2025	Vehicle fleet efficiency	2025 (when strategy is next reviewed)	In progress	Funded annually using Scottish Government Air Quality Grant and Council revenue if required	All years (ensuring membership continues to increase)	Scottish Government funding issued in 2022 allowed the ECO Stars scheme to continue in Fife. As of January 2023, the Fife Commercial Fleet Membership grew to 282 members covering 10,148 vehicles operating in Fife and beyond (note this figure includes the number of bus operators and vehicles noted above). As of January 2023, the Taxi & Private Hire Membership has increased to 151 members operating 623 vehicles. The requirement for all Fife Council school and social work contract operators to become members of ECO Stars is a key factor in the continued growth of the Taxi & Private Hire Membership scheme.	Funding important for continued implementation
15	Maintenance and utilisation of	Policy guidance and	2025 (when strategy is next reviewed)	In progress	Funded on an ad-hoc basis using Council	2022 (Regional RapidAir	Phase 1 and Phase 2 of the update of the Regional RapidAir™ Dispersion Model have now been completed.	None – updates already actioned

Measure No.	Measure	Category	Expected/Actual Completion Year	Measure Status	Funding Status	Key Milestone	Progress to Date	Barriers to implementation
	Air Quality and Planning Toolkit Implementation Phase: 2021 - 2025	development control			revenue or Scottish Government Air Quality Grant if applied for/issued	Dispersion Model updated)	Associated GIS files to be added to system to aid in considering air quality issues in the development management process.	
16	Update Air Quality Strategy for Fife Implementation Phase: 2021	Policy guidance and development control	2025 (when strategy is next reviewed)	In progress	Funded on an ad-hoc basis using Scottish Government Air Quality Grant	2021 (recent update to Fife Air Quality Strategy)	Scottish Government grant funding used to update the Fife Council Air Quality Strategy in 2020/21. AQS was approved in 2021 and now covers the period of 2021-2025. The update aligns with the Clean Air for Scotland Strategy 2 (CAFS2) and Fife Council are working through the various measures.	None – AQS recently updated
17	Promote the continued expansion of the Councils Electric Vehicle Fleet Implementation Phase: 2021 - 2025	Promoting Low Emission Transport	2025 (when strategy is next reviewed)	In progress	Funded using various funding streams including Council revenue funding and Scottish Government Air Quality Grant and other such funding (e.g., Switched On Fleet)	All years (ensuring Fleet being ungraded especially electric and hybrids)	Scottish Government funding issued in 2022 allowed for a new EV to be added to the Fleet. Bid for grant funding in 2023/24 for new EV was unsuccessful. To reapply in 2024/25. As of January 2023, Fife Council had 56 full electric vehicles and 19 hybrid vehicles in service (either leased or purchased). The number of electric and hybrid vehicles being added to the Fleet continues to increase every year with new vehicles identified and brought in on trial. Recent trial vehicle includes electric Refuse Collection Vehicle for which funding was obtained in 2022/23 for a 150kW charging station at the principal Fife Council depot (Bankhead Central)	Issues with revenue funding available to Fleet Switched On Fleet funding not available now for several years for vehicles SG AQ funding not granted 2023/24
18	Promote the continued development of the Electric Vehicle Infrastructure Implementation Phase: 2021 - 2025	Promoting Low Emission Transport	2025 (when strategy is next reviewed)	In progress	Funded on an -ad-hoc basis using Scottish Government based funding as and when chargers are required by the Council (public or work based)	All years (tracking significant changes to charging infrastructure)	As the ChargePlace Scotland site does not show all available public chargers this is no longer going to be referenced here as ZapMap offers a better reflection of the extent of public chargers across Fife. Due to the number of chargers in Fife it is not within the scope of the APR to keep track of the numbers involved but the extent of coverage on the map will be monitored over time and reported with the APR. Recent charger changes in Fife include the 150kW charging station installed at the principal Fife Council depot (Bankhead Central) which was used for trialling an electric Refuse Collection Vehicle (RCV). In addition, 8 22kW chargers have been installed at a range of sites across Fife including Oakley in the west of fife to Newport-on-Tay in the north-east of Fife.	None – changes to available funding could cause issues

Measure No.	Measure	Category	Expected/Actual Completion Year	Measure Status	Funding Status	Key Milestone	Progress to Date	Barriers to implementation
							2022 EV Charging points in Cupar (ChargePlace Scotland sites only) had 773 public charging sessions using 14,541kW of electricity. This is up on the 2021 figure when there were 580 public charging sessions using 7,772kW of electricity. Although an increase in use was noted the figures are still well below previous years (e.g., 1,888 public sessions in 2019) showing that the charging introduced by Fife council in November 2020 has had an impact on the use with home and workplace charging likely being favoured by members of the public instead.	
19	Promote Sustainable travel initiatives Implementation Phase: 2021 - 2025	Promoting Travel Alternatives	2025 (when strategy is next reviewed)	In progress	Funded annually using Scottish Government Air Quality Grant (e.g., CAD and ECO Stars)	All years (ensuring information is up to date and promotional materials are available)	Fife Council continues to provide information via the air quality pages of the Fife Council website www.fife.gov.uk/airquality and promotional materials for initiatives carried out such as Fife ECO Stars and Clean Air Day.	Funding important for continued implementation of ECO Stars and CAD and make promotional materials available.
20	Promote domestic combustion best practice guidance Implementation Phase: 2021 - 2025	Policy Guidance and Development Control	2025 (when strategy is next reviewed or earlier if proposed Scottish Government guidance is issued)	In progress	Funded on an ad-hoc basis using Scottish Government Air Quality Grant or Council revenue	2022 (Domestic Fuel Use Survey undertaken)	A request for funding in 2023/24 has been made to the Scottish Government to produce the best practice guidance document but funding not granted. Funding will be requested again in 2024/25	SG AQ funding not granted 2023/24 for guidance leaflet
21	Develop alternative travel Infrastructure Implementation Phase: 2021 - 2025	Transport Planning and Infrastructure	2025 (when strategy is next reviewed)	In progress	Not funded through Scottish Government Air Quality Grant	All years (ensuring WoW and Bikeability still being utilised)	Fife Council continues to maintain one of the UKs comprehensive cycle networks with 350 miles of signed cycle routes. Fife Council has promoted/developed numerous initiatives such as WOW and Bikeability. The Fife Travel Plan has been set up since 1999 and continually enhance and developed. Partnerships have been developed such as with Living Streets Scotland.	Ensure other grant support still offered to schools and Bikeability volunteers continue to be recruited as air quality grant monies not available through the LAQM or AQAP funding streams
22	Promote and organise Clean Air Day Events	Public Information	2025 (when strategy is next reviewed)	In progress	Funded annually using Scottish Government Air Quality	2018-present (various CAD events undertaken)	Scottish Government grant funding used in 2022 with Clean Air Day bite size presentations provided to three Primary Schools in the Dunfermline area along with Citizen Science Packs to allow the children to undertake their own monitoring. A zero-emission mobile air quality monitoring laboratory ‘Smogmobile’ was also	Funding important for continued implementation

Measure No.	Measure	Category	Expected/Actual Completion Year	Measure Status	Funding Status	Key Milestone	Progress to Date	Barriers to implementation
	Implementation Phase: 2021 - 2025				Grant and Council revenue budget when required		used at the three schools to raise awareness and undertake monitoring. Scottish Government grant funding also used in 2022 to undertake an anti-idling campaign at several primary schools with winning designs selected for posters and a banner. These have now been printed and are in the process of being presented to the winning schools/students with posters to also be used at previously identified nuisance hotspots for engine idling to raise awareness. Scottish Government grant funding bid successful for 2023/24 with preparation works underway for 4 primary schools across Fife for 2023 CAD.	
23	Identify source apportionment to background PM Implementation Phase: 2021 - 2025	Vehicle Fleet Efficiency	2025 (when strategy is next reviewed)	In progress	Funded annually using Scottish Government Air Quality Grant or Council revenue	2021-22 (Background Particulate Matter Source Apportionment study and Domestic Fuel Use Survey)	Scottish Government grant funding used for recent Background Particulate Matter Source Apportionment study (2021). Findings from this and Domestic Fuel Use survey (2022) will aid in informing future modelling and action planning activities within the Bonnygate AQMA. Funding applied for in 2023/24 to produce a guidance leaflet but bid was unsuccessful.	SG AQ funding not granted 2023/24 for guidance leaflet
24	Utilise Sensor technology to gain a better understanding of PM concentrations within the AQMA Implementation Phase: 2021 - 2025	Traffic Management	2025 (when strategy is next reviewed)	In progress	Funded annually using Scottish Government Air Quality Grant or Council revenue budget if grant funding not issued	2018-present (period of use of AQMesh units within Bonnygate AQMA)	Scottish Government grant funding used to continue with monitoring and data analysis/reporting over 2022. The associated monitoring data is reported within this APR. Data obtained is processed and managed following guidance to ensure data quality. 2022 also saw new sensors being purchased for use in other parts of Fife.	Grant funding important for continued implementation
25	Identify most polluting vehicles within AQMA Implementation Phase: 2021 - 2025	Vehicle Fleet Efficiency	2025 (when strategy is next reviewed)	In progress	Funded annually using Council revenue budget Scottish Government Air Quality Grant if applied for/issued	2022 (Real World Driving Emissions Study undertaken within AQMA)	Over 2022/23 updates of the Regional RapidAir™ Dispersion Model have been undertaken (Phase 1 and Phase 2) and this includes utilisation of data from the March 2022 Real World Driving Emissions Study. The data from the monitoring study will also be used to inform future decision making and policy changes.	None – study already actioned

Table 2-3 Progress on Measures to Improve Air Quality in Appin Crescent

Measure No.	Measure	Category	Expected/Actual Completion Year	Measure Status	Funding Status	Key Milestone	Progress to Date	Barriers to implementation
1	Liaise with Scottish Government to encourage the consideration of national measures Implementation Phase: 2021 - 2025	Policy guidance and development control	2025 (when strategy is next reviewed)	In progress	Not funded from Scottish Government Air Quality Grant	2022 (Protective Services actively involved in discussions with SEPA and Scottish Government regarding Clean Air Act and LAQM reporting) Ongoing advice to Scottish Government regarding experience of the LAQM process.	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. This includes recent membership of the short-term Clean Air Act and LAQM Review Act Working Group which seeks to review the provisions of the Clean Air Act 1993 with a view to ensuring alignment with LAQM Regulations. Process will also review and update templates for AQAPs, AQMA Revocations and Annual Progress Report in line with CAFS2 commitments and Environmental Standards Scotland recommendations.	None
2	Improving links with Local Transport Strategy/ Area Transport Plan Implementation Phase: 2021 - 2025	Transport planning and infrastructure	2025 (when strategy is next reviewed)	In progress	Not funded from Scottish Government Air Quality Grant	All years (ensuring strategy is updated as appropriate and is easily available)	Fife Council Air Quality Steering Group outputs continue to contribute to the development of Fife Council's Local Transport Strategy which is in the process of being finalised as of February 2023 with a view to it being adopted in the summer of 2023. Fife Council will seek to incorporate travel related air quality measures into the updated Local Transport Strategy. A summary of the new LTS will be provided in the next Annual Progress Report 2024.	None
3	Improving Air Quality links with Local Planning and Development Framework Implementation Phase: 2021 - 2025	Policy guidance and development control	2025 (when strategy is next reviewed)	In progress	Not funded from Scottish Government Air Quality Grant		The Low Carbon Fife Supplementary Guidance continues to form a statutory part of the Local Development Plan (FIFEplan). This guidance incorporates the Fife Council Air Quality Developers Guide. On 13 February 2023 Scotland's fourth National Planning Framework (NPF4) was adopted by Scottish Ministers. NPF4 is now part of the statutory Development Plan for Fife and is therefore a key consideration for new development proposals. Policy 23 of NPF4 provides high-level policy protection in relation to air quality.	None

Measure No.	Measure	Category	Expected/Actual Completion Year	Measure Status	Funding Status	Key Milestone	Progress to Date	Barriers to implementation
							The replacement for Fife's current Local Development Plan (FIFEplan) is currently programmed to be adopted by the Council in 2027. Milestone dates are set out in the Fife Development Plan Scheme DPS12_2022.pdf (fife.gov.uk)	
4	Integrate Air Quality with other Council Strategies Implementation Phase: 2021 - 2025	Policy guidance and development control	2025 (when strategy is next reviewed)	In progress	Not funded from Scottish Government Air Quality Grant	2021 (Climate Change Team moved into Planning Services therefore closer working with Protective Services now possible)	Member of the Council's Climate Change Team continue to attend future Fife Core Air Quality Steering Group meetings. The Plan for Fife, the Fife Partnership Local Outcome Improvement Plan, was produced in 2020-2021. Fife Council declared a climate emergency in 2019 and an updated plan for 2021-2024 sets out the key recovery and renewal priorities. On February 6th 2020 Fife Council's Environment and Protective Services Committee approved the Sustainable Energy Climate Action Plan - Climate Fife (2020-2030). Climate Fife includes a practical action plan. https://www.fife.gov.uk/kb/docs/articles/environment2/climate-change,-carbon-and-energy. 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)'. The Addressing the Climate Emergency (ACE) Board meets around 6 times a year, with key Climate Fife priorities being taken forward through the ACE Action Plan: • Climate Ready Buildings • Climate Resilient Communities • Climate Action Communities • Maximising Environmental Capital • Implementing Climate Fife Priorities Links to air quality are considered throughout these action plans, specifically by the Local Transport Strategy and Local Development Plan that have the potential for air quality impacts. There is close working with the Climate Change and Zero Waste Team in Fife Council's Planning Service. The Local Heat and Energy Efficiency Strategy and Delivery Plan is a new duty for Scottish Councils to plan energy efficiency and decarbonised heat of all buildings in its area. Recognising the challenges with indoor air quality Protective Services is represented on the Steering Group to provide specialist advise and input. It is hoped this work on indoor air	None

Measure No.	Measure	Category	Expected/Actual Completion Year	Measure Status	Funding Status	Key Milestone	Progress to Date	Barriers to implementation
							quality can complement that proposed under the CAFS2 framework. During 2022-23 the Climate Change team has been working with Protective Services to link NAEI (National Atmospheric Emissions Inventory) data to climate actions such as decarbonised heat and transport in Fife. Work on this project is continuing and will report back with findings in the Autumn of 2023.	
5	Travel Plans for large Institutions and Businesses Implementation Phase: 2021 - 2025	Transport planning and infrastructure	2025 (when strategy is next reviewed)	In progress	Not funded from Scottish Government Air Quality Grant	All years (ensuring active travel continues to be considered and adopted)	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.	Ensure other grant support still offered to schools and Bikeability volunteers continue to be recruited as air quality grant monies not available through this funding stream
6	Provision of Information and promotion of travel options Implementation Phase: 2021 - 2025	Promoting travel alternatives	2025 (when strategy is next reviewed)	In progress	Traffic counters funded annually using Scottish Government Air Quality Grant	All years (ensuring sustainable travel continues to be considered and adopted)	Scottish Government funding issued in 2022-23 allowed for 12 new traffic counters to be purchased and these will aid in tracking changes in vehicle use within existing AQMAs and other parts of Fife. New grant application for 2023-24 included bid for 15 traffic counters but this was unsuccessful. New bid to be submitted next year. Fife's current adopted Local Development Plan (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. The replacement for Fife's current Local Development Plan (FIFEplan) is currently programmed to be adopted by the Council in 2027. Milestone dates are set out in the Fife Development Plan Scheme DPS12_2022.pdf Continue to actively promote sustainable travel to school, including initiatives such as Bikeability and WOW (Walk Once a Week).	Funding not granted 2023/24 Ensure support still offered to schools and Bikeability volunteers continue to be recruited
7	Provision of information relating to Air Quality	Public information	2025 (when strategy is next reviewed)	In progress	Not funded from Scottish Government Air Quality Grant	All years (ensure guidance is updated as appropriate and	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.	None

Measure No.	Measure	Category	Expected/Actual Completion Year	Measure Status	Funding Status	Key Milestone	Progress to Date	Barriers to implementation
	Implementation Phase: 2021 - 2025					is easily available)	The replacement for Fife's current Local Development Plan (FIFEplan) is currently programmed to be adopted by the Council in 2027. Milestone dates are set out in the Fife Development Plan Scheme DPS12_2022.pdf In conjunction with this the Fife Council Air Quality Developers Guide has been recently amended as has the associated Fife Council Air Quality Strategy (covering the period 2021 to 2025) with both documents available online at www.fife.gov.uk/airquality	
8	Target reductions in emissions from the Council fleet and contract vehicles (including driver training) Implementation Phase: 2021 - 2025	Vehicle fleet efficiency	2025 (when strategy is next reviewed)	In progress	Funded annually using various funding streams including Council revenue funding and Scottish Government Air Quality Grant and other such funding (e.g., Switched On Fleet)	All years (ensuring Fleet being upgraded especially in terms of EVs and hybrids)	Scottish Government funding issued in 2022 allowed for a new EV to be added to the Fleet. Bid for grant funding in 2023/24 for new EV was unsuccessful. To reapply in 2024/25 As of January 2023, Fife Council had 56 full electric vehicles and 19 hybrid vehicles in service (either leased or purchased). As of February 2023, the size of the Fife Council fleet decreased slightly from the 2022 figure of 1,506 vehicles and now stands at 1,497 vehicles. The amount of diesel used by the Council Fleet increased in 2021/22 to 3,470,316 litres up from 3,118,643 litres in 2021/21 indicative of a return to normal practices after the impact of COVID-19.	Issues with funding available to Fleet to obtain new/replacement vehicles (including revenue) Switched On Fleet funding not available now for several years for vehicles Scottish Government Air Quality Grant not granted 2023/24
9	Investigate the potential for establishing voluntary bus agreement Implementation Phase: 2021 - 2025	Promoting travel alternatives	2025 (when strategy is next reviewed)	In progress	Funded annually using Scottish Government Air Quality Grant	All years (ensuring membership continues to increase)	Scottish Government funding issued in 2022 allowed the ECO Stars scheme to continue in Fife. Continue to encourage bus operators to recognise the importance of air quality and climate change issues through the Fife ECO Stars scheme and to continue trying to set up voluntary bus agreements through interaction with local bus operators e.g., school bus operator contracts up for renewal. As of January 2023, there are 64 bus operators within the ECO Stars scheme (one operator went out of business) but the number of vehicles covered has increased to 1,734.	Funding important for continued implementation
10	Fife ECO Stars Implementation Phase: 2021 - 2025	Vehicle Fleet Efficiency in HGV and Taxi Fleets	2025 (when strategy is next reviewed)	In progress	Funded annually using Scottish Government Air Quality Grant and Council	All years (ensuring membership continues to increase)	Scottish Government funding issued in 2022 allowed the ECO Stars scheme to continue in Fife. As of January 2023, the Fife Commercial Fleet Membership grew to 282 members covering 10,148 vehicles operating in Fife and beyond (note this figure includes the number of bus operators and vehicles noted above).	Funding important for continued implementation

Measure No.	Measure	Category	Expected/Actual Completion Year	Measure Status	Funding Status	Key Milestone	Progress to Date	Barriers to implementation
					revenue if required		As of January 2023, the Taxi & Private Hire Membership has increased to 151 members operating 623 vehicles. The requirement for all Fife Council school and social work contract operators to become members of ECO Stars is a key factor in the continued growth of the Taxi & Private Hire Membership scheme.	
11	Maintenance and utilisation of Air Quality and Planning Toolkit Implementation Phase: 2021 - 2025	Development Control	2025 (when strategy is next reviewed)	In progress	Funded on an ad-hoc basis using Council revenue or Scottish Government Air Quality Grant if applied for/issued	2022 (Regional RapidAir Dispersion Model updated)	Phase 1 and Phase 2 of the update of the Regional RapidAir™ Dispersion Model have now been completed. Associated GIS files to be added to system to aid in considering air quality issues in the development management process.	None – updates already actioned
12	Proposed Air Dispersion modelling study of the potential Dunfermline Northern Link Road Implementation Phase: 2021 - 2025	Traffic Management	2022	Completed	Funded using Council revenue	2022 (Northern Link Road Dispersion Model updated)	Fife Council will utilise the recently updated Northern Link Road Dispersion Model to consider air quality issues in and around Dunfermline as part of the planning process. Additional sensor monitoring (AQMesh) has continued in areas of concern within the AQMA and the data was included within the updated Northern Link Road Dispersion Model and will also feed into other future modelling studies where appropriate. Northern Link Road will be constructed in phases with some sections completed by developers and others completed by Fife Council from developer transport contributions. Planning permission expected to be issued by the end of 2023 for the first phase of works associated with the Northern Link Road at the eastern side of Dunfermline near Halbeath Retail Park where a bridge crossing will be installed over the Fife Circle Railway.	None – update already actioned
13	Update Air Quality Strategy for Fife Implementation Phase: 2021	Strategy	2025 (when strategy is next reviewed)	In progress	Funded on an ad-hoc basis using Scottish Government Air Quality Grant	2021 (recent update to Fife Air Quality Strategy)	Scottish Government grant funding used to update the Fife Council Air Quality Strategy in 2020/21. AQS was approved in 2021 and now covers the period of 2021-2025. The update aligns with the Clean Air for Scotland Strategy 2 (CAFS2) and Fife Council are working through the various measures.	None – AQS recently updated
14	Promote the continued expansion of the Councils Electric Vehicle Fleet	Promoting Low Emission Transport	2025 (when strategy is next reviewed)	In progress	Funded using various funding streams including Council revenue	All years (ensuring Fleet being ungraded especially electric and hybrids)	Scottish Government funding issued in 2022 allowed for a new EV to be added to the Fleet. Bid for grant funding in 2023/24 for new EV was unsuccessful. To reapply in 2024/25. As of January 2023, Fife Council had 56 full electric vehicles and 19 hybrid vehicles in service (either leased or purchased).	Issues with revenue funding available to Fleet Switched On Fleet funding not available now for

Measure No.	Measure	Category	Expected/Actual Completion Year	Measure Status	Funding Status	Key Milestone	Progress to Date	Barriers to implementation
	Implementation Phase: 2021 - 2025				funding and Scottish Government Air Quality Grant and other such funding (e.g., Switched On Fleet)		The number of electric and hybrid vehicles being added to the Fleet continues to increase every year with new vehicles identified and brought in on trial. Recent trial vehicle includes electric Refuse Collection Vehicle for which funding was obtained in 2022/23 for a 150kW charging station at the principal Fife Council depot (Bankhead Central)	several years for vehicles Scottish Government Air Quality funding not granted 2023/24
15	Promote the continued Development of the Electric Vehicle Infrastructure Implementation Phase: 2021 - 2025	Promoting Low Emission Transport	2025 (when strategy is next reviewed)	In progress	Funded on an ad-hoc basis using Scottish Government based funding as and when chargers are required by the Council (public or work based)	All years (tracking significant changes to charging infrastructure)	As the ChargePlace Scotland site does not show all available public chargers this is no longer going to be referenced here as ZapMap offers a better reflection of the extent of public chargers across Fife. Due to the number of chargers in Fife it is not within the scope of the APR to keep track of the numbers involved but the extent of coverage on the map will be monitored over time and reported with the APR. Recent charger changes in Fife include the 150kW charging station installed at the principal Fife Council depot (Bankhead Central) which was used for trialling an electric Refuse Collection Vehicle (RCV). In addition, 8 22kW chargers have been installed at a range of sites across Fife including Oakley in the west of fife to Newport-on-Tay in the north-east of Fife. 2022 EV Charging points in Dunfermline (ChargePlace Scotland sites only) had 7,852 public charging sessions using 174,663kW of electricity. This is up on the 2021 figure when there were 5,737 public charging sessions using 61,296kW of electricity. Although an increase in use was noted the figures are still well below previous years (e.g. 9,906 public sessions in 2019) showing that the charging introduced by Fife council in November 2020 has had an impact on the use with home and workplace charging likely being favoured by members of the public instead.	None – changes to available funding could cause issues
16	Promote Sustainable travel initiatives Implementation Phase: 2021 - 2025	Promoting Travel Alternatives	2025 (when strategy is next reviewed)	In progress	Funded annually using Scottish Government Air Quality Grant (e.g., CAD and ECO Stars)	All years (ensuring information is up to date and promotional materials are available)	Fife Council continues to provide information via the air quality pages of the Fife Council website www.fife.gov.uk/airquality and promotional materials for initiatives carried out such as Fife ECO Stars and Clean Air Day.	Funding important for continued implementation of ECO Stars and CAD and make promotional materials available.
17	Promote domestic combustion	Policy Guidance and	2025 (when strategy is next reviewed or	In progress	Funded on an ad-hoc basis using Scottish	2022 (Domestic Fuel Use	A request for funding in 2023/24 has been made to the Scottish Government to produce the best practice guidance document but funding not granted.	Scottish Government Air Quality funding not

Measure No.	Measure	Category	Expected/Actual Completion Year	Measure Status	Funding Status	Key Milestone	Progress to Date	Barriers to implementation
	best practice guidance Implementation Phase: 2021 - 2025	Development Control	earlier if proposed Scottish Government guidance is issued)		Government Air Quality Grant or Council revenue	Survey undertaken)		granted 2023/24 for guidance leaflet
18	Develop alternative travel Infrastructure Implementation Phase: 2021 - 2025	Transport Planning and Infrastructure	2025 (when strategy is next reviewed)	In progress	Not funded from Scottish Government Air Quality Grant	All years (ensuring WoW and Bikeability still being utilised)	Fife Council maintains one of the UKs comprehensive cycle networks with 350 miles of signed cycle routes. Fife Council has promoted/developed numerous initiatives such as WOW and Bikeability. The Fife Travel Plan has been set up since 1999 and continually enhanced and developed. Partnerships have been developed such as with Living Streets Scotland.	Ensure other grant support still offered to schools and Bikeability volunteers continue to be recruited as air quality grant monies not available through the LAQM or AQAP funding streams
19	Promote and organise Clean Air Day Events Implementation Phase: 2021 - 2025	Public Information	2025 (when strategy is next reviewed)	In progress	Funded annually using Scottish Government Air Quality Grant and Council revenue budget when required	2018-present (various CAD events undertaken)	Scottish Government grant funding used in 2022 with Clean Air Day bite size presentations provided to three Primary Schools in the Dunfermline area along with Citizen Science Packs to allow the children to undertake their own monitoring. A zero-emission mobile air quality monitoring laboratory 'Smogmobile' was also used at the three schools to raise awareness and undertake monitoring. Scottish Government grant funding also used in 2022 to undertake an anti-idling campaign at several primary schools with winning designs selected for posters and a banner. These have now been printed and are in the process of being presented to the winning schools/students with posters to also be used at previously identified nuisance hotspots for engine idling to raise awareness. Scottish Government grant funding bid successful for 2023/24 with preparation works underway for 4 primary schools across Fife for 2023 CAD.	Funding important for continued implementation
20	Identify source apportionment to background PM Implementation Phase: 2021 - 2025	Vehicle Fleet Efficiency	2025 (when strategy is next reviewed)	In progress	Funded annually using Scottish Government Air Quality Grant or	2021-22 (Background Particulate Matter Source Apportionment study and	Scottish Government grant funding used for recent Background Particulate Matter Source Apportionment study (2021). Findings from this and Domestic Fuel Use survey (2022) will aid in informing future modelling and action planning activities within the Bonnygate AQMA. Funding applied for in 2023/24 to produce a guidance leaflet but bid was unsuccessful.	SG AQ funding not granted 2023/24 for guidance leaflet

Measure No.	Measure	Category	Expected/Actual Completion Year	Measure Status	Funding Status	Key Milestone	Progress to Date	Barriers to implementation
					Council revenue	Domestic Fuel Use Survey)		
21	Utilise Sensor technology to gain a better understanding of PM concentrations within the AQMA Implementation Phase: 2021 - 2025	Traffic Management	2025 (when strategy is next reviewed)	In progress	Funded annually using Scottish Government Air Quality Grant or Council revenue budget if grant funding not issued	2018-present (period of use of AQMesh units within Appin Crescent AQMA)	Scottish Government grant funding used to continue with monitoring and data analysis/reporting over 2022. The associated monitoring data is reported within this APR. Data obtained is processed and managed following guidance to ensure data quality. 2022 also saw new sensors being purchased for use in other parts of Fife.	Grant funding important for continued implementation
22	Identify most polluting vehicles within AQMA Implementation Phase: 2021 - 2025	Vehicle Fleet Efficiency	2025 (when strategy is next reviewed)	In progress	Funded annually using Council revenue budget or Scottish Government Air Quality Grant if applied for/issued	2022 (Real World Driving Emissions Study undertaken within AQMA)	Over 2022/23 updates of the Regional RapidAir™ Dispersion Model have been undertaken (Phase 1 and Phase 2) and this includes the utilisation of data from the March 2022 Real World Driving Emissions Study. The data from the monitoring study will also be used to inform future decision making and policy changes.	None – study already actioned

2.3.1 Progress in Bonnygate AQMA

Automatic monitoring annual mean concentrations going back to 2007 for NO_2 and PM_{10} are shown in Figure 2-5 and Figure 2-6 respectively. NO_2 concentrations at the automatic monitor within Bonnygate, Cupar have reduced by 65.4% from 52 µg m^{-3} in 2007 to 18 µg m^{-3} in 2022 and has remained well within the NO_2 annual mean objective since 2009. The NO_2 element of the AQMA was officially revoked in September 2021. However, Fife will continue to monitor NO_2 within the existing AQMA.

Since measurements started in 2007 PM_{10} concentrations have reduced by 33% from 23 µg m^{-3} to 15 µg m^{-3}. Concentrations began to increase slightly from 2017 but remained below the objective. Concentrations dropped sharply in 2020, however this is likely due to the COVID-19 lockdown restrictions. Concentrations then increased slightly in 2021 and 2022 following the easing of the COVID-19 lockdown restrictions.

Figure 2-5 NO_2 Automatic Monitoring Results 2007 to 2022 – Bonnygate, Cupar

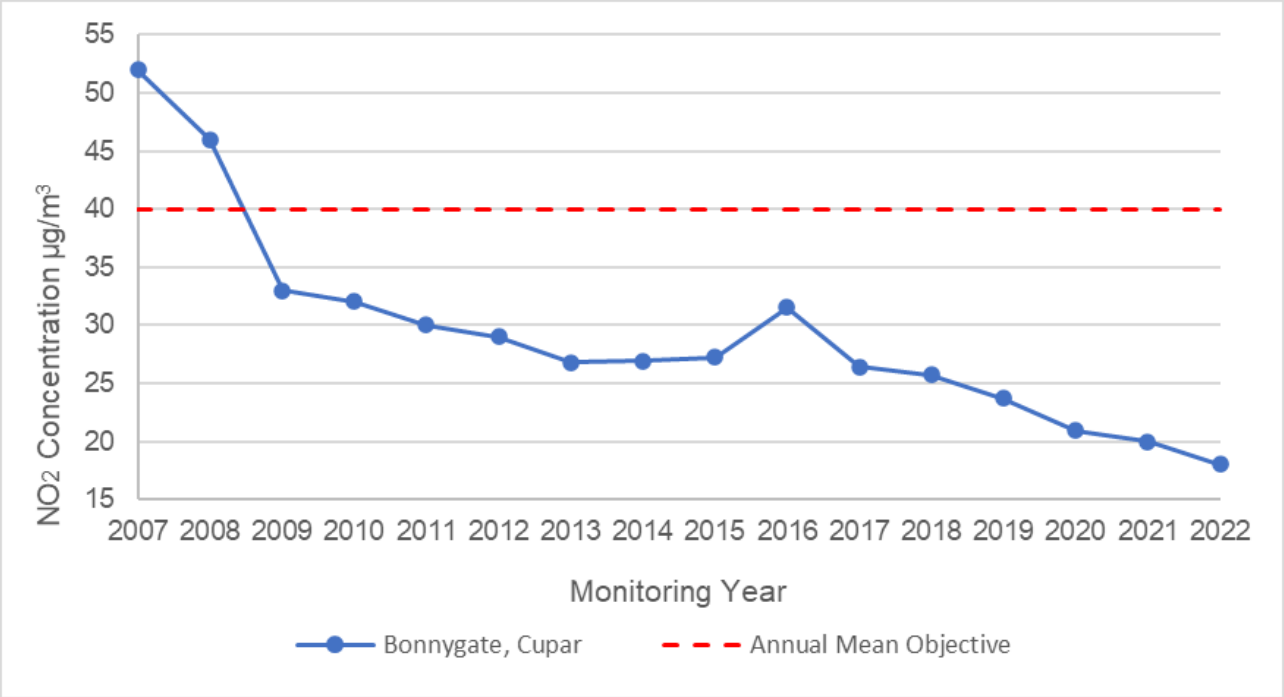
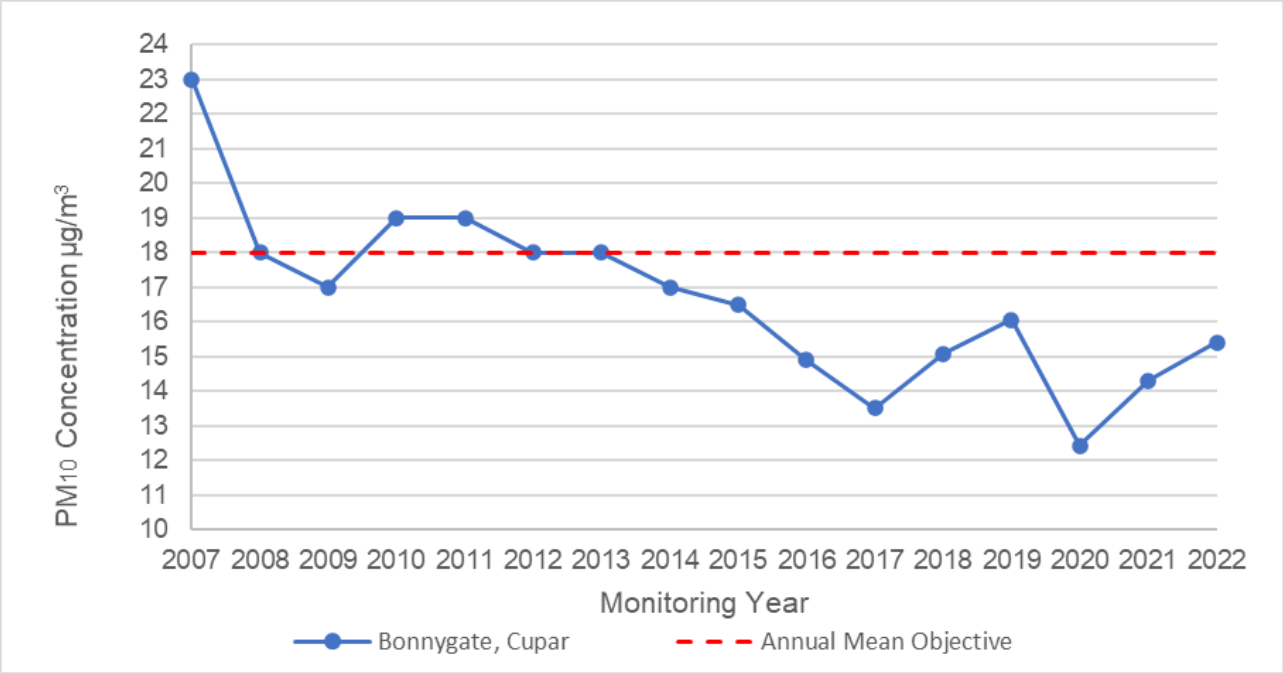


Figure 2-6 PM_{10} Automatic Monitoring Results 2007 to 2022 – Bonnygate, Cupar



2.3.2 Progress in Appin Crescent AQMA

Automatic monitoring annual mean concentrations going back to 2007 for NO_2 and PM_{10} are shown in Figure 2-7 and Figure 2-8 respectively. Since 2007, NO_2 concentrations have reduced by 51.6% from 31 µg m^{-3} in 2007 to 15 µg m^{-3} in 2022 and has remained well within the NO_2 annual mean objective since monitoring began. NO_2 concentrations have decreased steadily from 2015 until 2019 and likely because of the Action Plan measures being implemented. Concentrations dropped sharply in 2020 however this sharp decrease is likely due to the COVID-19 lockdown restrictions. 2022 data shows that NO_2 concentrations have remained low and have not returned to pre-covid concentrations. The NO_2 element of the AQMA was officially revoked in September 2021. However, Fife continue to monitor NO_2 within the existing AQMA.

PM_{10} monitoring started in 2011 and since then concentrations have reduced by 12% from 16 µg m^{-3} in 2012 to 13 µg m^{-3} in 2022. Since 2017 PM_{10} concentrations have increased slightly however staying well below the annual mean objective. Concentrations dropped sharply again in 2020, however this is again likely due to the COVID-19 lockdown restrictions. Concentrations have increased slightly over the last 2 years but are still below the elevated levels of 2015. Concentrations have remained below the annual mean objective since automatic monitoring began.

Figure 2-7 NO_2 Automatic Monitoring Results 2007 to 2022 – Appin Crescent, Dunfermline

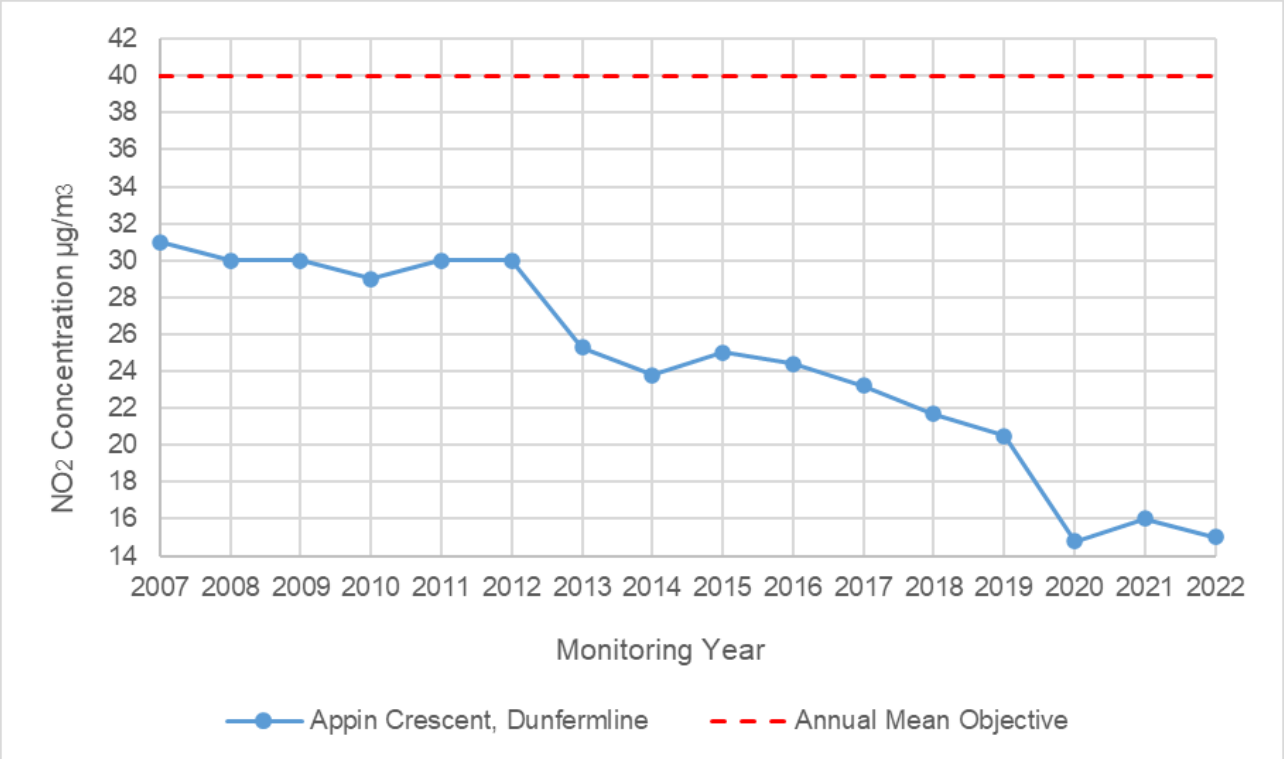
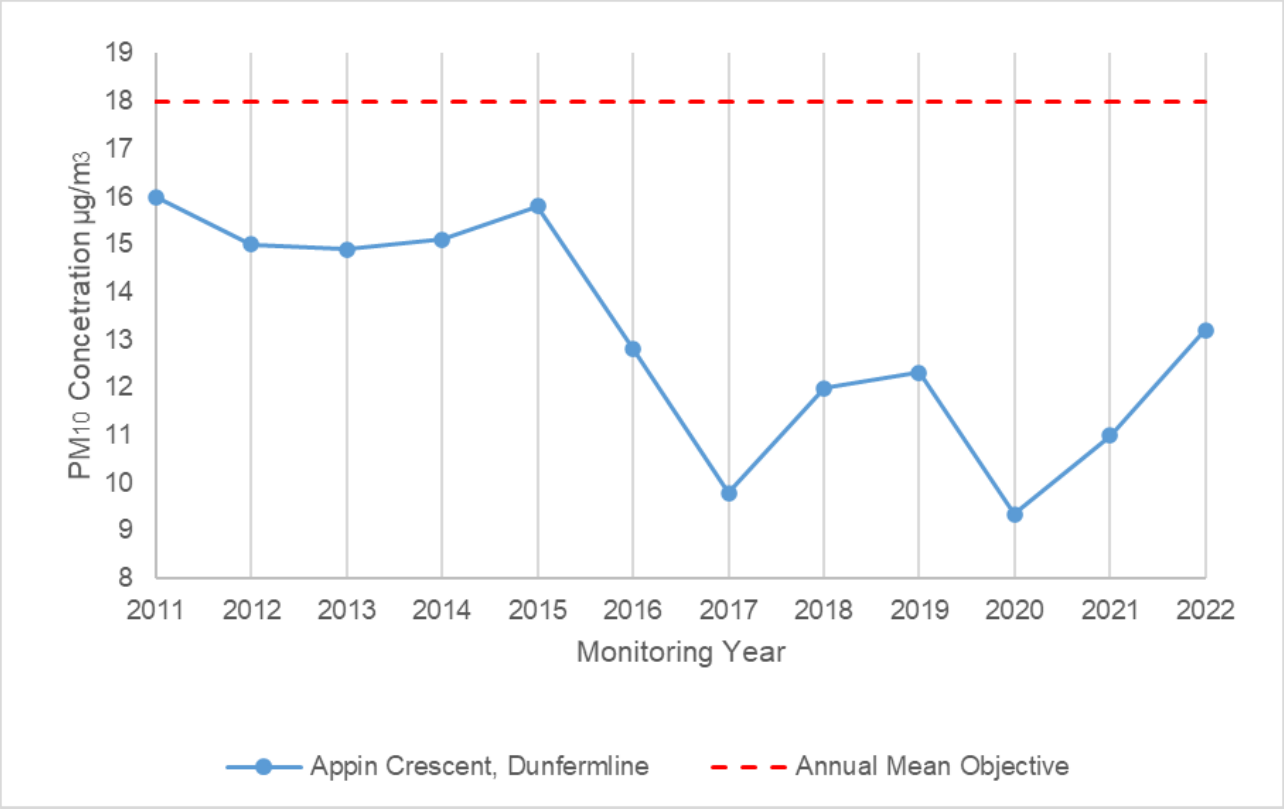


Figure 2-8 PM_{10} Automatic Monitoring Results 2011 to 2022 – Appin Crescent, Dunfermline



2.3.3 Fife ECO Stars Scheme

Fife's ECO Stars Fleet Recognition scheme and parallel ECO Stars Taxi and Private Hire scheme has continued to grow and expand membership during 2022.

Since the Fife Fleet scheme was initiated in 2014, membership has steadily increased year on year. As of January 2023, the Fife Fleet scheme stands at 282 members (up from 266 members in March 2022) made up of operators in the freight, bus and coach sectors, as well as many van fleets. Fife Fleet Recognition scheme members now operate a total of 10,148 vehicles (up from 9,704 vehicles in March 2022).

Alongside continued recruitment, there is an ongoing focus on supporting existing members by means of regularly re-engaging with individual members to hear their progress and re-assessing fleets when asked by existing members. Maintaining an ongoing relationship with members is essential in guiding their progress towards maximising fuel efficiency.

The requirement for all school and social work contract operators to become members of ECO Stars has resulted in a continued increase in membership numbers for the ECO Stars Taxi and Private Hire scheme. As of January 2023, the Taxi and Private Hire scheme stands at 151 members (up from 147 members in March 2022), operating 623 vehicles (up from 596 vehicles in March 2022).

During 2022 recent key milestone members were presented with certificates, these being Evolve Group (250th Fleet member) and A Robertson & Son Taxis (100th Taxi member) shown in Figure 2-9 and Figure 2-10.

Figure 2-9 Certificate presented to Evolve Group (250th Fleet member) by Councillor Jan Wincott (Fife Council) and Stuart McLean (TRL)

Figure 2-10 Certificate presented to A Robertson & Son (100th Taxi member) by Councillor Jan Wincott (Fife Council) and Stuart McLean (TRL)

ECO Stars continues to be supported by the Scottish Government as part of its Clean Air Strategy.

2.3.4 Targeting emissions from Council Fleet

Fife Council continues to make good progress towards increasing the number of electric and hybrid vehicles within its Fleet and the installation of publicly available charging points. These actions have direct impacts on both the Bonnygate and Appin Crescent AQMAs and work towards reducing transport emissions as detailed in the AQAPs for both areas. By the start of early January 2023 Fife Council's Fleet Operations had 56 full electric vehicles and 19 hybrid vehicles in service including a Kia Niro-E (Figure 2-11) which was obtained through Scottish Government funding and will be used by Social Work for transporting clients across Fife, including within existing AQMAs.

The funding originally offered by the Scottish Government was originally intended to purchase another Nissan ENV200 electric van for Meals on Wheels but due to issues sourcing this vehicle within the 2023/23 financial year period an alternative electric vehicle had to be sought instead.

Figure 2-11 Kia Niro-E obtained in 2022/23 using Scottish Government funding

Fife Council Fleet have been working to improve emissions/efficiency of Council refuse collection vehicles (RCVs) through the installation/upgrade of FuelSense 2.00 software within the transmissions of the Fleet of Mercedes Bens RCVs. The initial trial on two vehicles over a six-month period showed an average 8.85% fuel saving and 30 of the RCVs currently have the upgraded software installed. Another 13 RCVs in the Fleet were replaced towards the end of 2022 with new vehicles that also had the FuelSense 2.00 software installed. It is anticipated that this will bring about substantial savings in terms of fuel costs whilst also reducing emissions from the RCV fleet. Software will also be specified on any new vehicles that replacing older RCVs within the Fleet.

Fife Council Fleet have also been successful in obtaining funding for the installation of a 150kW charger at its main depot in Glenrothes in anticipation of trialling fully electric RCVs and other larger electric vehicles. The installation and commissioning of this charger was completed at the end of January 2023 (Figure 2-12) in anticipation of a Dennis Eagle eCollect RCV (Figure 2-13) which was trialled in March 2023. The vehicle was based at Bankhead Depot in Glenrothes for a week and was used for local runs (of different waste types) with the vehicle fully charged over 5 hours overnight and top-up charging also undertaken during shift swaps.

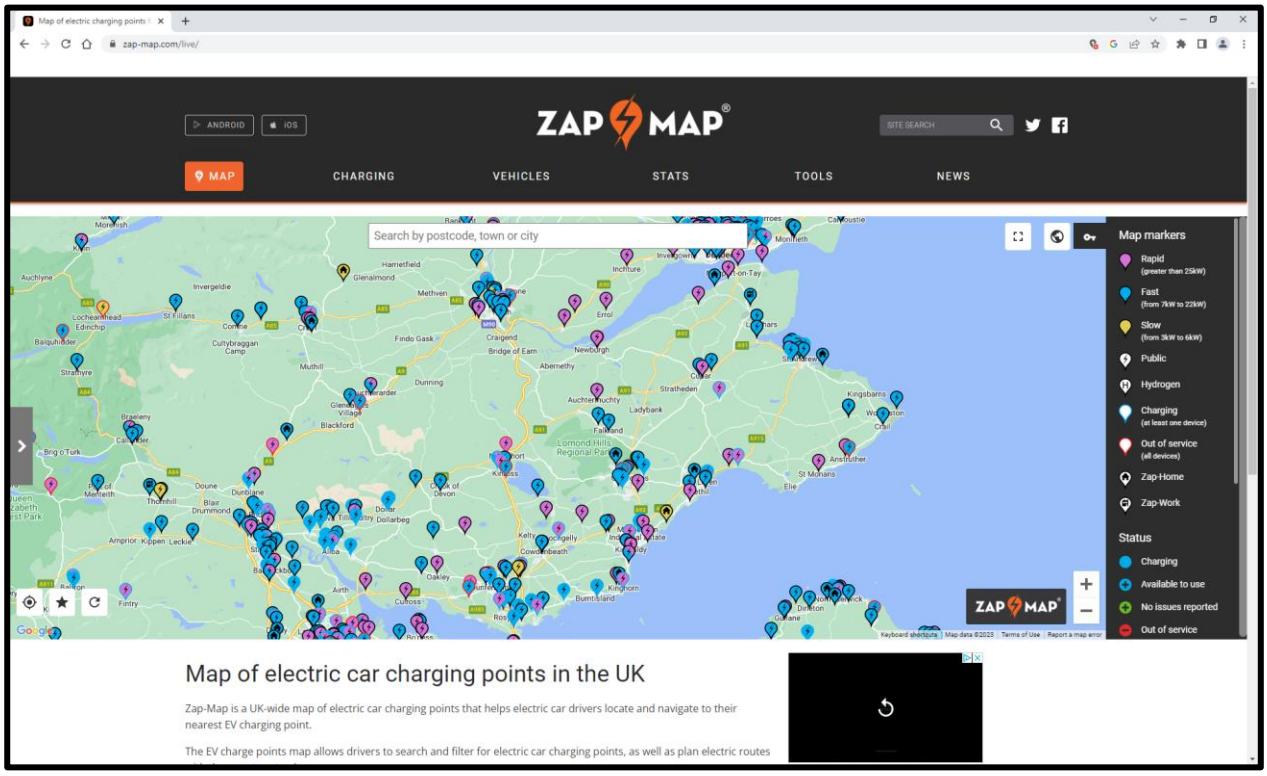
Figure 2-12 150kW charger recently installed and commissioned at Bankhead Depot, Glenrothes

Figure 2-13 Dennis Eagle eCollect refuse collection vehicle recently trialled by Fife Council

The extent of the charging infrastruture within Fife is best viewed using the interactive map on the Zapmap website (https://www.zap-map.com/live/). The live map functionality on this site can allow the user to search for the location, type, status and availability of chargers within the Fife Council area and includes ChargePlace Scotland charging sites along with other public chargers run by other operatores such as Osprey, Instavolt etc.

Due to the sheer number of charging sites within Fife it is not within the scope of the APR to keep track of the actual numbers involved but the extent of coverage of the live map functionality will be a useful indicator to track how the extent of monitoring sites extends over time. Examples of what can be viewed using the live map functionality is shown in Figure 2-14 indicating the current position of the charging network within Fife as of March 2023.

Figure 2-14 Extent of charging infrastructure within Fife as of March 2023. The sites include a range of charging speeds operated by a range of providers such as ChargePlace Scotland, Osprey and InstaVolt



Fife Councils Transportation Services worked with ChargePlace Scotland to install and commission several new 22kW public charges in 2022 whereby these new sites are listed below:

- Station Road Car Par, Auchtermuchty
- Bog Well Car Park, Ceres
- Oakley Community Centre, Oakley
- Bay Centre Car Park, Dalgety Bay
- Shore Road Car Park, Dysart
- The Temple Car Park, Lower Largo
- Tay Road Bridge Car Park, Newport-on-Tay
- Balgownie West Car Park, Culross

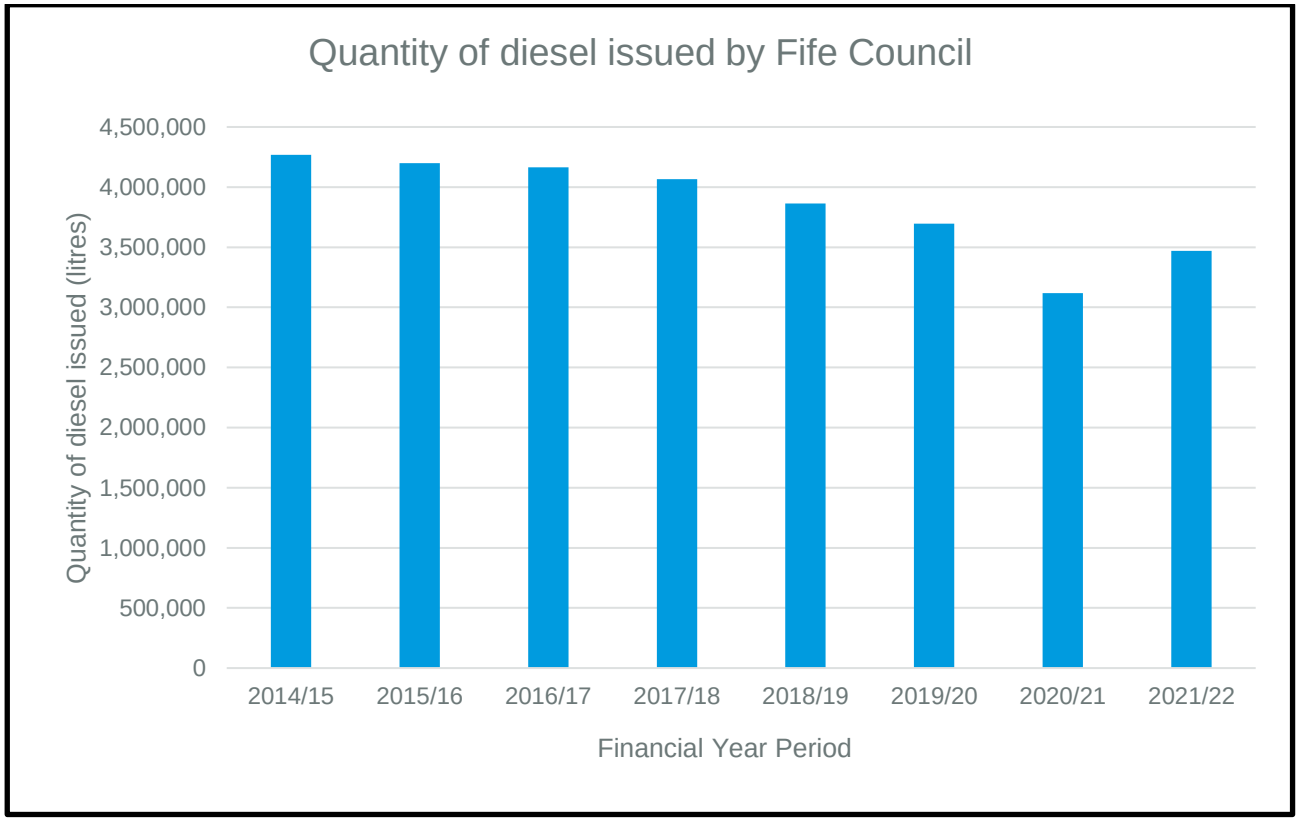
Correspondence with Transportation Services indicates that it is becoming increasingly difficult to determine the number of public charge point users owing to the number of options now available to access and utilise ChargePlace Scotland chargers so the number of charging sessions will be summarised instead in relation to Cupar and Dunfermline.

During 2022 a total of 773 public charging sessions took place at ChargePlace Scotland charging sites in Cupar using 14,541kW of electricity in total, up on 2021 when there were 580 charging sessions using 7,772kW of electricity. Whilst an increase in the number of charging sessions has been noted the figures are still down on previous years (e.g. 1,888 sessions in 2019) showing that the charging introduced by Fife Council in November 2020 has had an overall impact on the number of users accessing these chargers with home and workplace charging likely being favoured instead. Interestingly the number of charging sessions recorded in 2022 is the same as was recorded in 2016 when the amount of electricity used was significantly lower at 5,499 kW indicating that vehicles with larger battery packs, and therefore higher ranges, are now more common.

During 2022 a total of 7,852 public charging sessions took place at ChargePlace Scotland charging sites in Dunfermline using 174,663kW of electricity in total, up from 2021 when there were 5,737 charging sessions using 61,296kW of electricity. Whilst an increase in the number of charging sessions has also been noted the figures are still down on previous years (e.g. 9,906 sessions in 2019) showing that the charging introduced by Fife Council in November 2020 has had an overall impact on the number of users accessing these chargers with home and workplace charging likely being favoured instead. Again, interestingly the number of charging sessions recorded in 2022 is similar to what was recorded in 2020 (7,448 charging sessions) but the amount of electricity used was significantly lower at 121,048kW indicating that vehicles with larger battery packs, and therefore higher ranges, are now more common.

Associated with the increased uptake of electric and hybrid vehicles within the Council Fleet is an overall reduction in the size of the Council Fleet and a reduction in the quantity of diesel being used. Since 2011/12 the Fleet Demand Challenge Approach has reduced the Fleet size by 385 vehicles (up to the 2021/22 period). The amount of diesel used by the Council Fleet increased in 2021/22 to 3,470,316 litres up from 3,118,643 litres in 2020/21 (Figure 2-15 indicative of a return towards normal working practices after the impact of COVID-19.

Figure 2-15 Quantity of diesel issued by Fife Council



3. AIR QUALITY MONITORING DATA AND COMPARISON WITH AIR QUALITY OBJECTIVES

3.1 SUMMARY OF MONITORING UNDERTAKEN

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

3.1.1 Automatic Monitoring Sites

Fife Council undertook automatic (continuous) monitoring at four sites during 2022, which measure NO_2, PM_{10}, and $PM_{2.5}$ concentrations. These automatic monitors are located at 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, only PM_{10} and $PM_{2.5}$ are considered within the LAQM assessment and reporting process, and it is only these that are reported within this APR.

The PM equivalence study[3] carried out by the Scottish Government identified that when publishing data that was monitored using the FIDAS 200 technique, correction factors for PM_{10} (divide by 0.909) and $PM_{2.5}$ (multiply by 1.06) should be applied. The Scottish Government guidance[4] states that these corrections should be applied when reporting data within the LAQM reporting regime.

Maps showing the location of the monitoring sites are provided in Figure 3-1 to Figure 3-5. Further details on how the monitors are calibrated and how the data has been adjusted 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 2022 have been summarised in the INEOS Grangemouth Oil Refinery Annual Community Air Quality Monitoring Report[6].

3.1.2 Non-Automatic Monitoring Sites

Fife Council undertook non-automatic (passive) monitoring of NO_2 at 42 sites during 2022, using 58 diffusion tubes in total. 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 three diffusion tube sites decommissioned at the beginning of 2022 due to historically low readings – 3A Junction Road, Kirkcaldy; 6B Bonnygate West, Cupar and 11 Halbeath Road, Dunfermline. These were replaced by Oriel Road, Kirkcaldy; Pratt Street, Kirkcaldy and Chapel Level, Kirkcaldy which were selected due to public complaints and/or a suitable level of traffic flow (data for all three sites showed

[6] Community Air Quality Monitoring Report, Ambient Atmospheric Survey in the vicinity of Grangemouth – 2022, INEOS March 2023

over 10,000 vehicle movements per days and are therefore worthy of consideration). Table A.2 in Appendix A shows the details of the diffusion tube sites.

Maps showing the location of the monitoring sites 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 Quality Assurance/Quality Control (QA/QC) and bias adjustment for the diffusion tubes are included in Appendix C.

Figure 3-1 Location of automatic monitor and NO_2 diffusion tubes – Bonnygate, Cupar AQMA

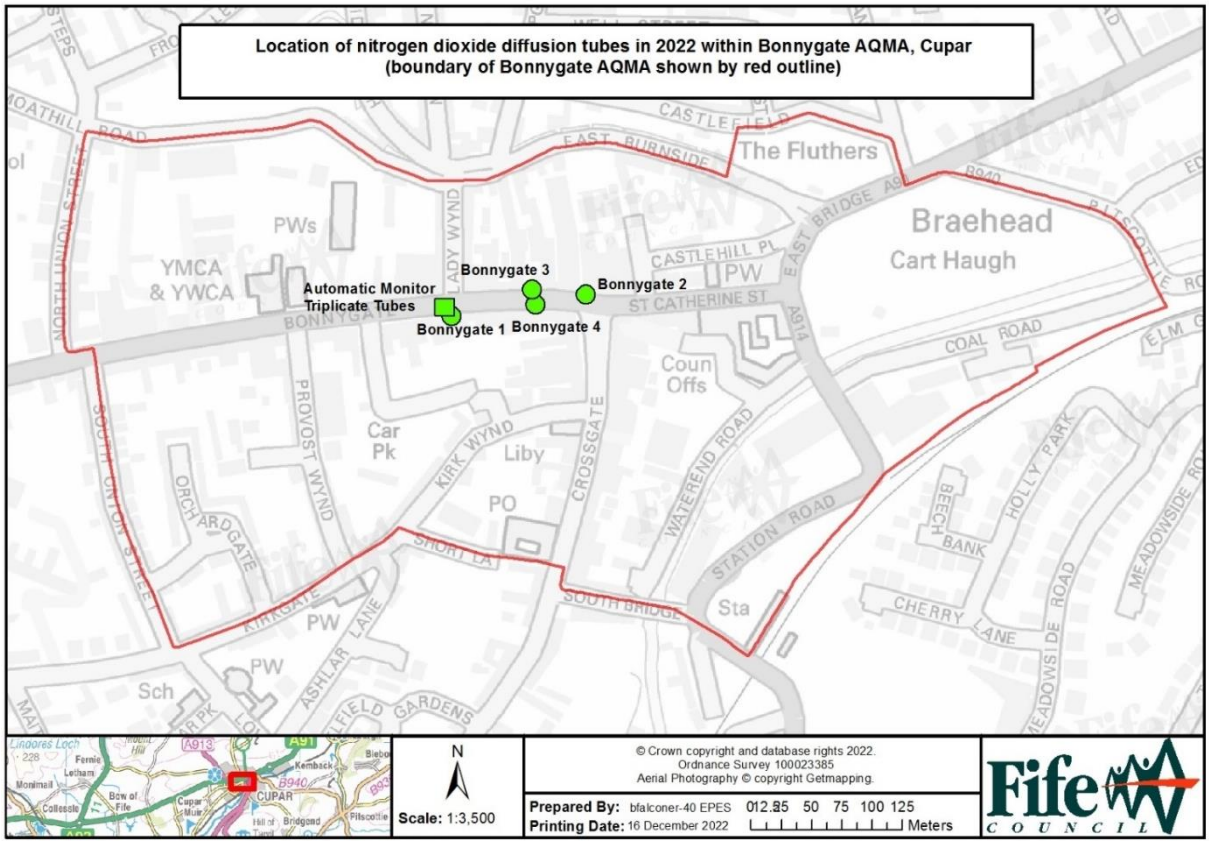


Figure 3-2 Location of automatic monitor and NO_2 diffusion tubes - Appin Crescent, Dunfermline AQMA

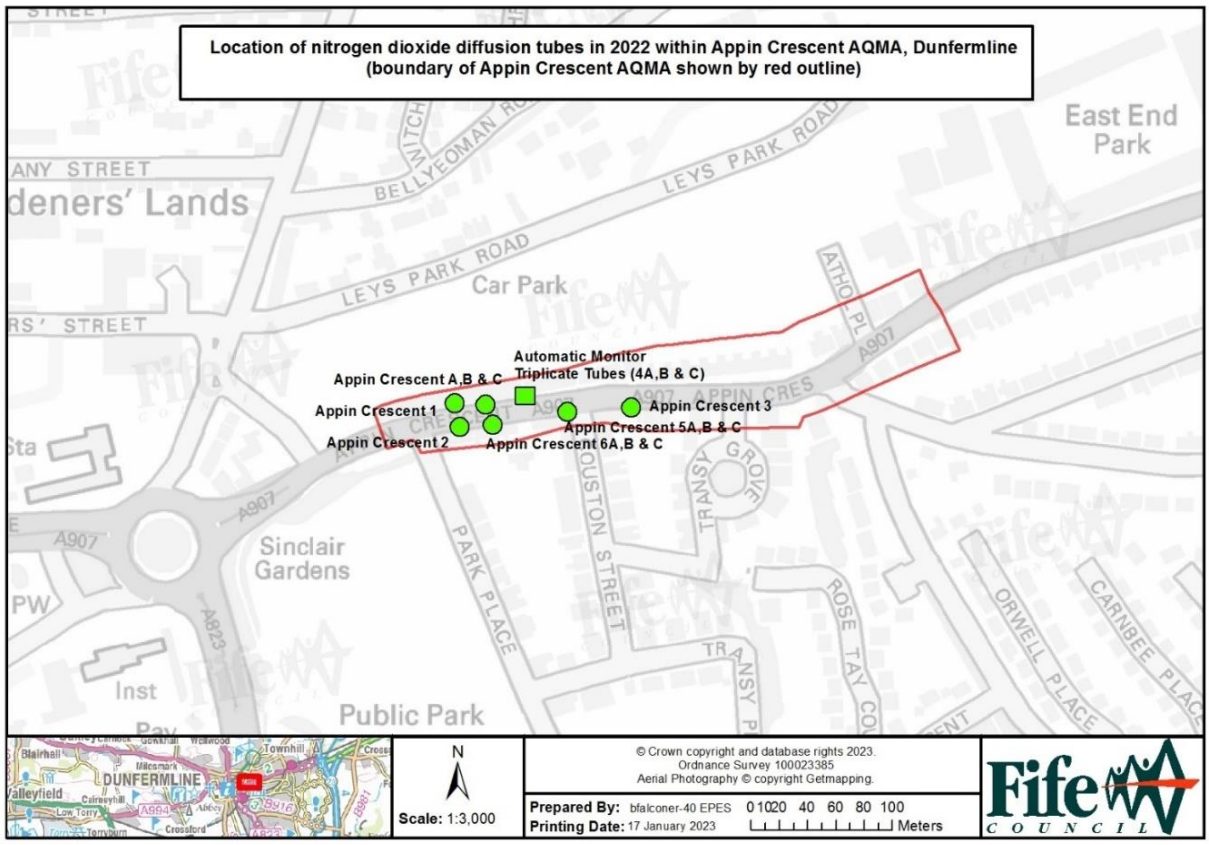


Figure 3-3 Location of automatic monitor and NO_2 diffusion tubes – St Clair Street, Kirkcaldy

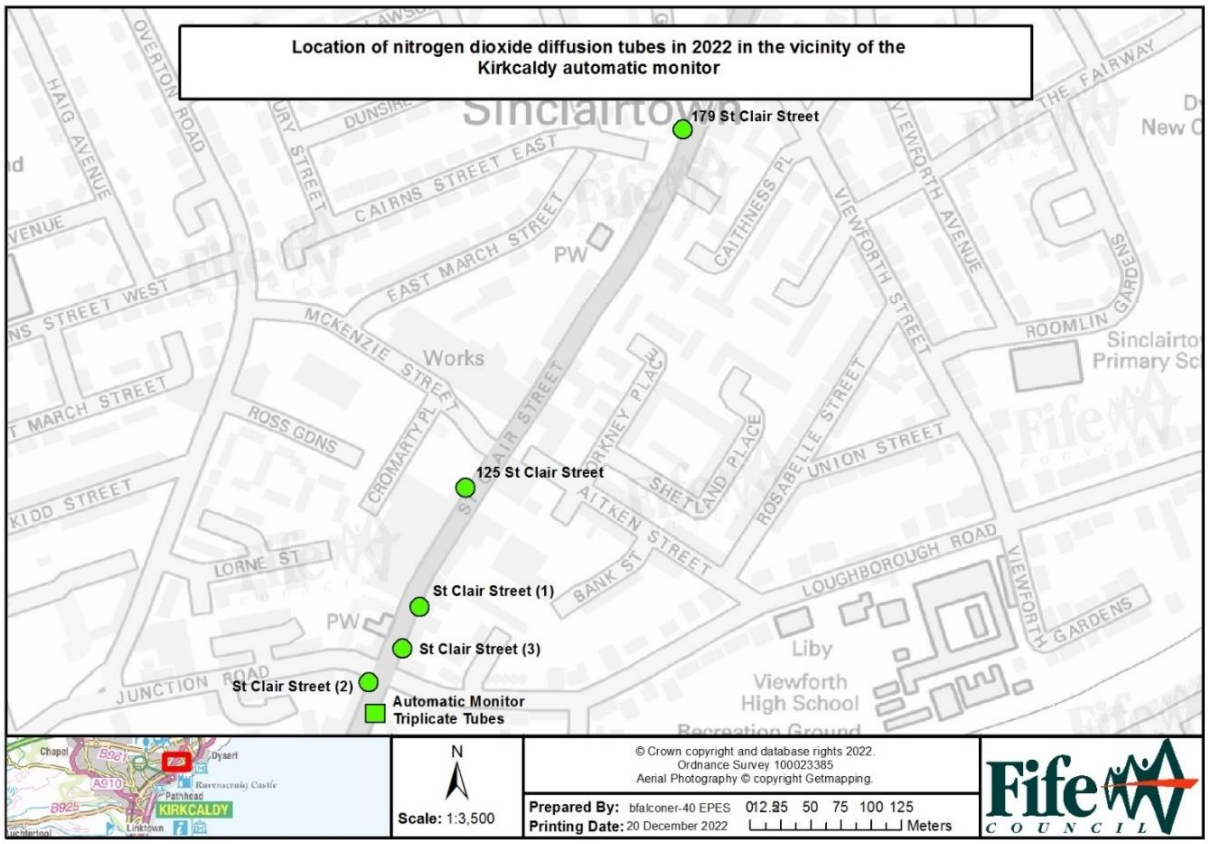


Figure 3-4 Location of automatic monitor and NO_2 diffusion tubes – Admiralty Road, Rosyth

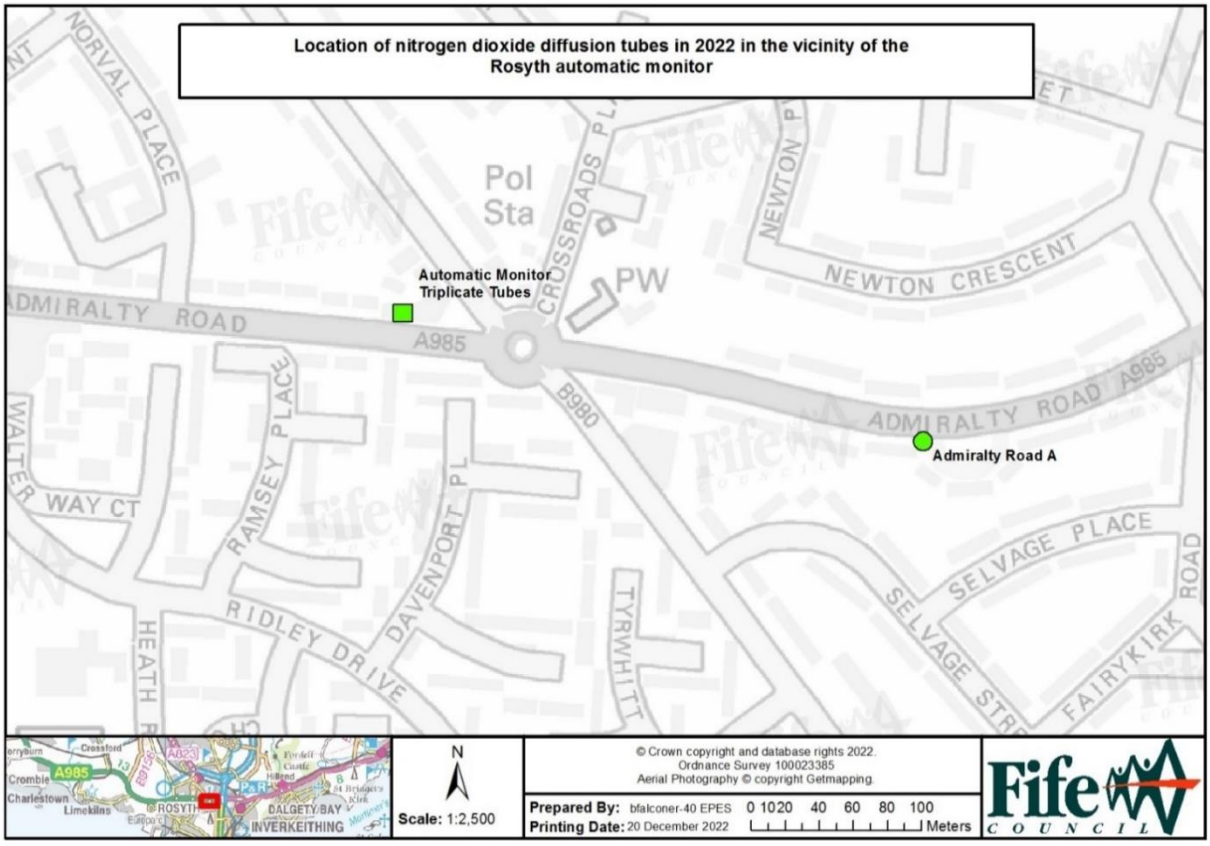
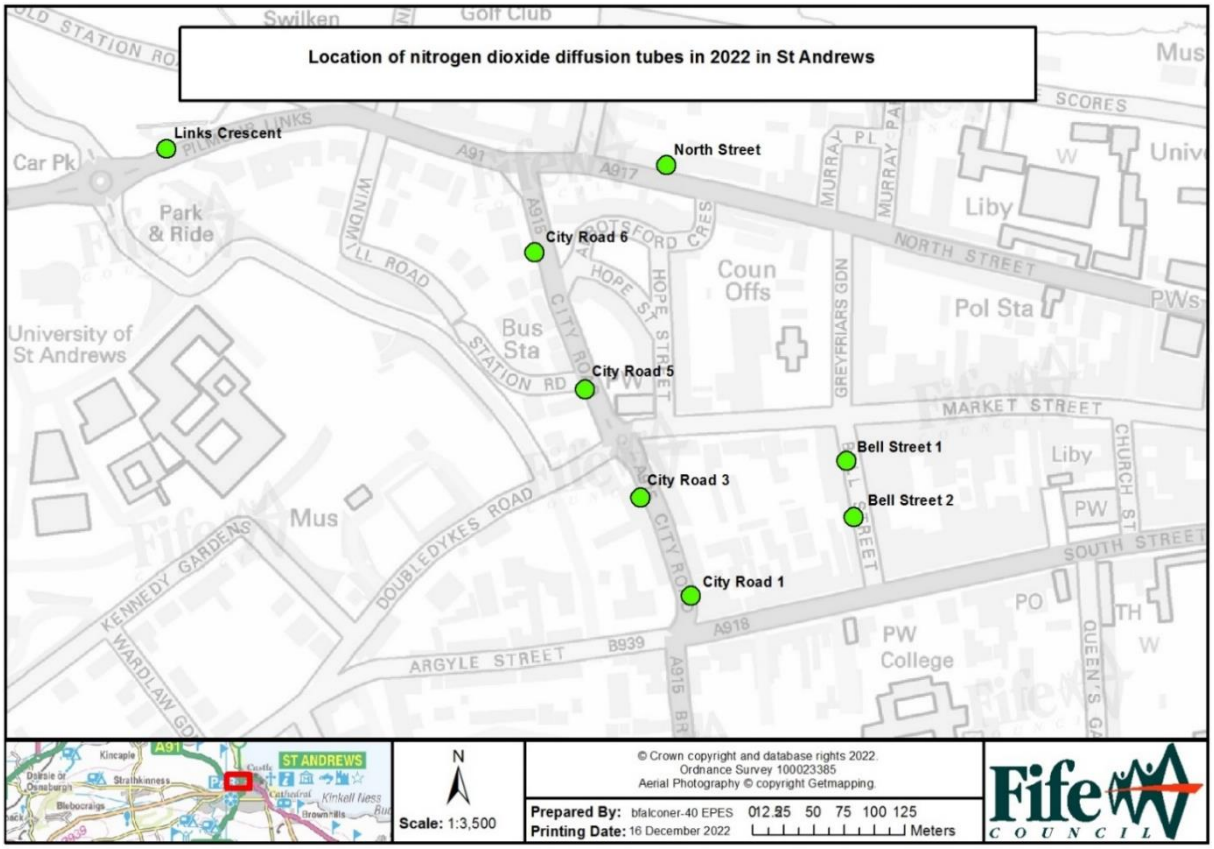


Figure 3-5 Location of nitrogen dioxide diffusion tubes – St Andrews



3.1.3 Other Monitoring Activities

Fife Council undertook AQMesh senor monitoring of NO_2, PM_{10} and $PM_{2.5}$ at five sites during 2022. In December 2017 two pods were installed in the Appin Crescent AQMA, and one pod was installed in the Bonnygate AQMA. An additional two pods were installed during 2022 at areas of concern at St Clair Street, Kirkcaldy (June) and City Road, St Andrews (August).

The two pods at Appin Crescent AQMA were co-located with diffusion tubes Appin Crescent 5 A,B,C and Appin Crescent 6 A,B,C. The Cupar AQMesh was co-located with diffusion tube Bonnygate 4. City Road, St Andrews AQMesh was co-located with City Road 6 but was then moved on the 19th of December 2022 to the location stated in Figure 3-8. The St Clair Street, Kirkcaldy AQMesh was not co-located with a diffusion tube site (due to the downpipe not being in good condition) but was located 13 meters south-west of the St Clair Street 2 diffusion tube site. Maps showing the location of the AQMesh pod sites are provided in Figure 3-6 to Figure 3-9.

Figure 3-6 Location of AQMesh pods - Appin Crescent, Dunfermline AQMA

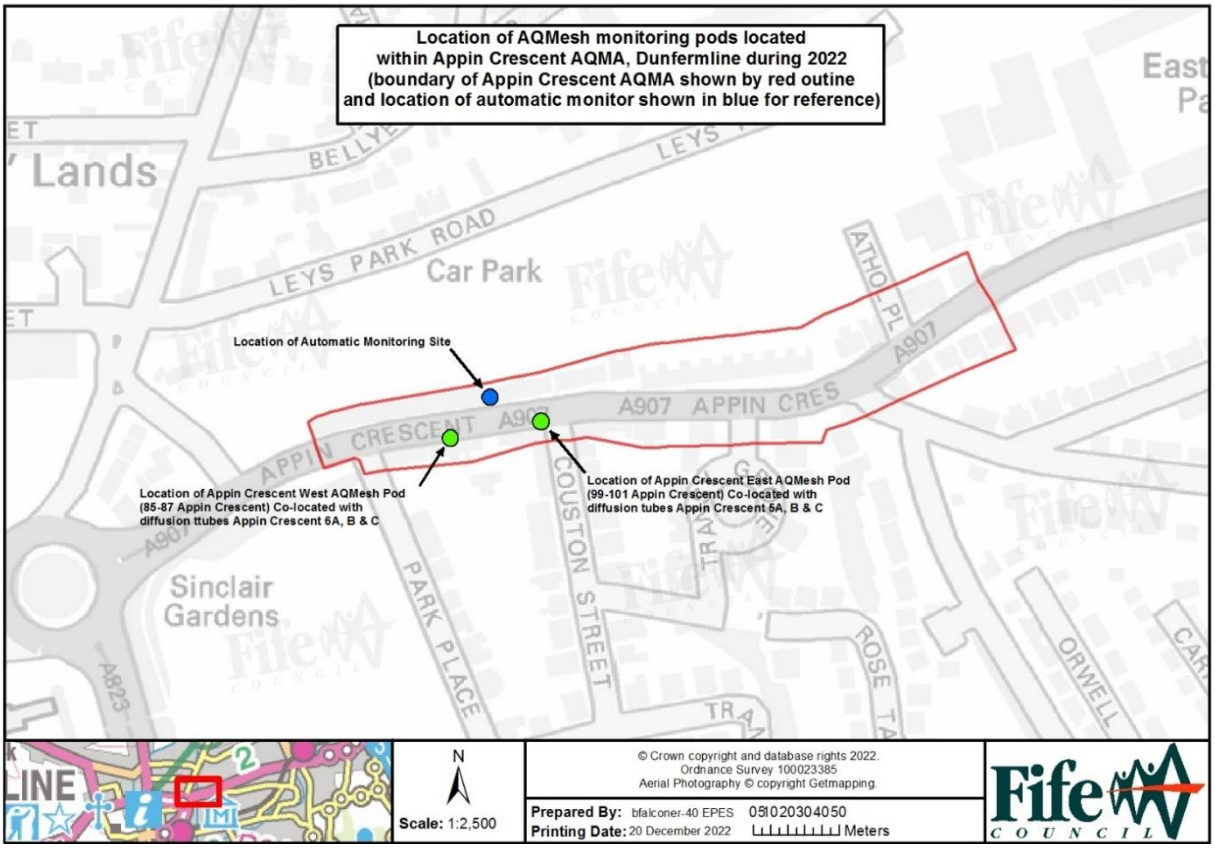


Figure 3-7 Location of AQMesh pod – Bonnygate, Cupar AQMA

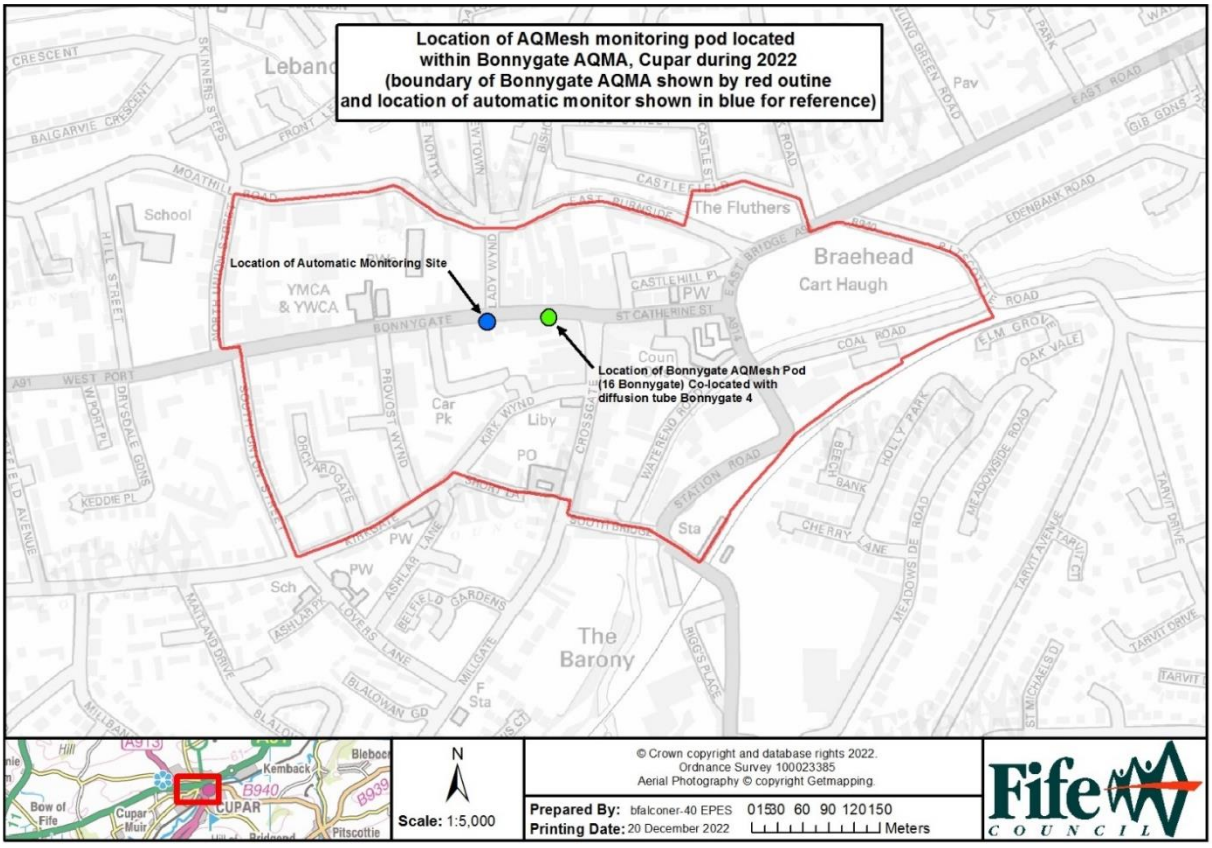


Figure 3-8 Location of AQMesh pod – St Andrews

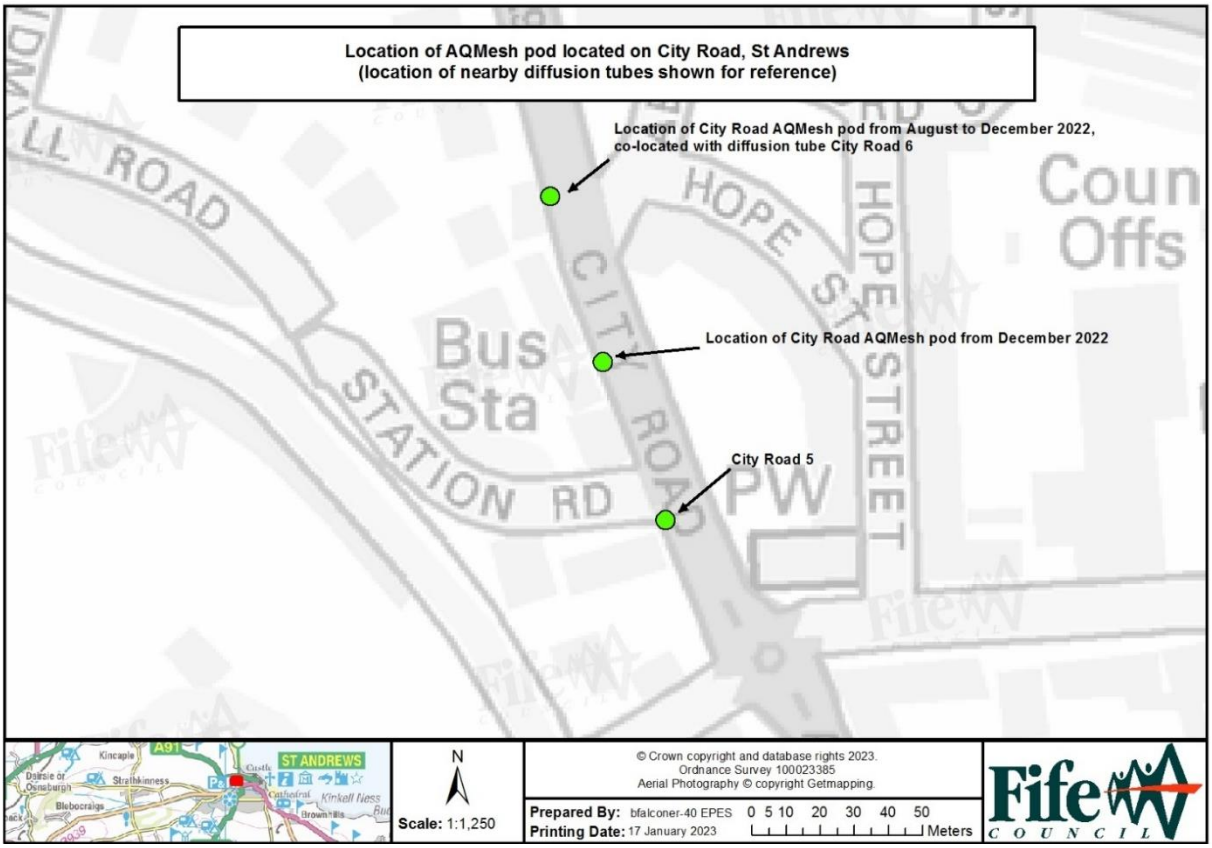
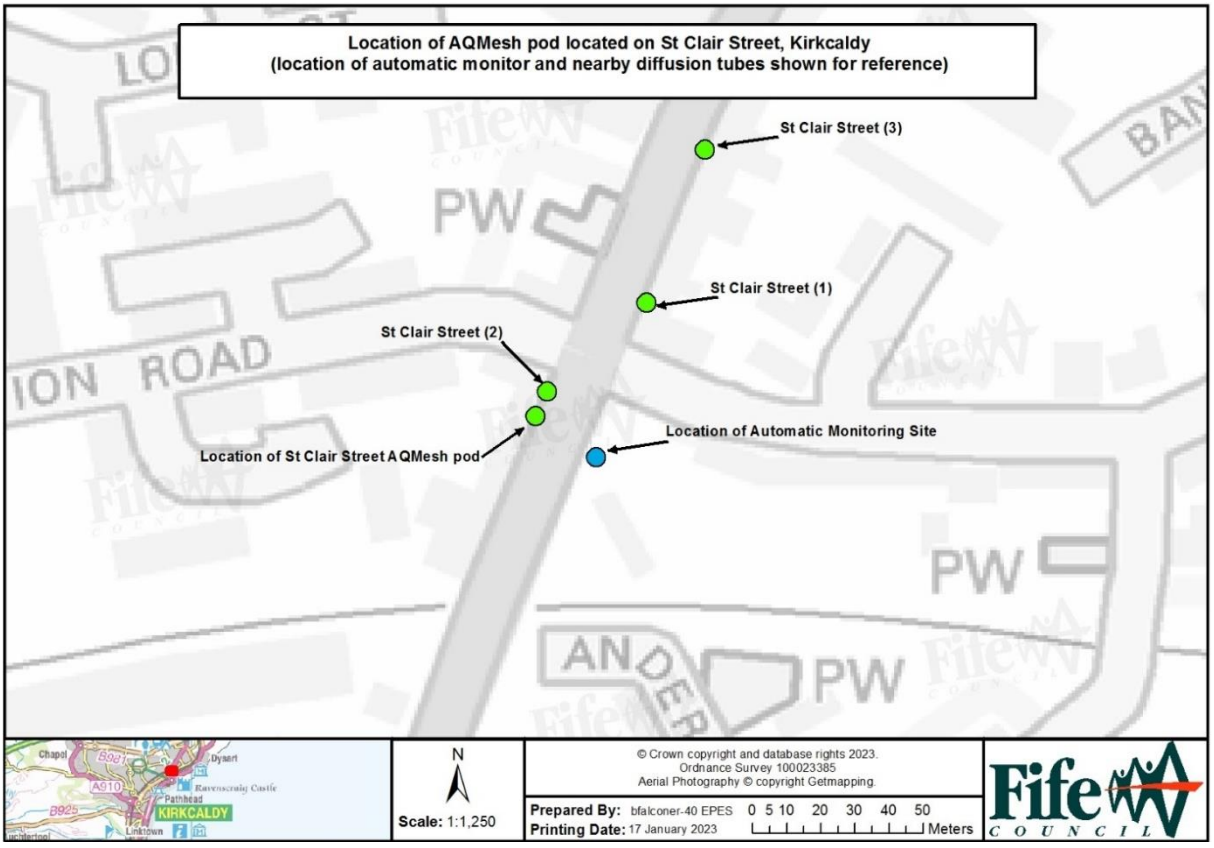


Figure 3-9 Location of AQMesh pod – Kirkcaldy



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.

A dynamic style report containing embedded statistical data for Fife can be found here: https://www.scottishairquality.scot/assets/reports/372/Fife_annual_2022.html. The key areas have been extracted and included below however further detail can be found online. The embedded data allows the reader a level of interaction with some of the report findings, providing additional insight. This approach enables a more easily navigated and streamlined report providing an engaging and intuitive reader experience. The analysis has been carried out for the pollutants NO_2, PM_{10} and $PM_{2.5}$ using the Openair analysis tool. Further figures are provided 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:

- **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 plots have been created for all four automatic monitoring sites in Fife for the period 1st January – 31st December 2022. 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.
- **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 as higher wind speeds come from a specific direction.
- **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.
- **Back trajectory Analysis Plots –** The back trajectory plots show data from the HYSPLIT model (NOAA HYSPLIT[7]) run in the analysis mode. This shows the air mass back trajectories for the period covered by this report. Two different kinds of plot are shown. One statistically groups the trajectories into similar clusters and shows the proportion of time during the report period that each represents. This is

[7] https://www.arl.noaa.gov/hysplit/hysplit

useful to get an overview of air mass origins during the report period. Plots in Trajectories associated with top ten most polluted days provide information on the trajectory direction associated with the top 10 measured concentrations.

3.2.1 Nitrogen Dioxide (NO_2)

3.2.1.1 Automatic Monitoring Data

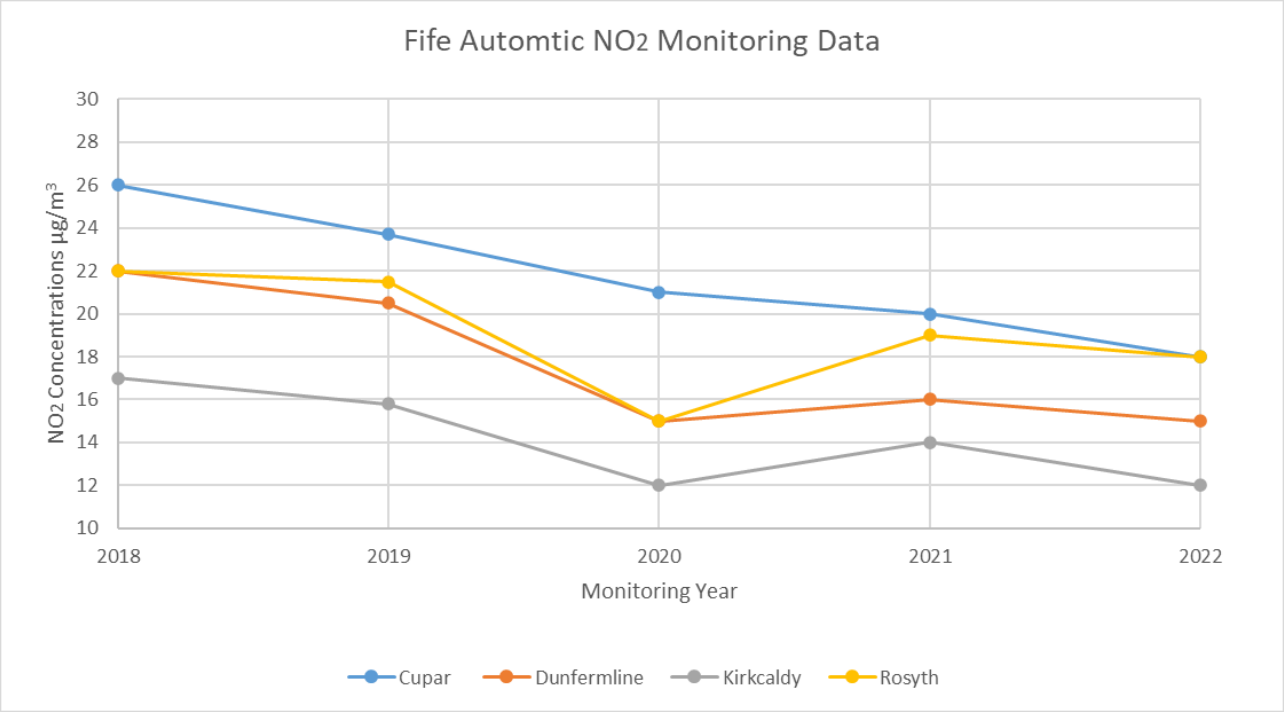
Table A.3 in Appendix A compares the ratified NO_2 annual mean concentrations for the four automatic sites for the past five years with the air quality objective of 40 µg m^{-3}.

Table A.4 in Appendix A compares the ratified automatic monitored NO_2 hourly mean concentrations for the past five years with the air quality objective of 200 µg m^{-3}, not to be exceeded more than 18 times per year.

Figure 3-10 provides the monitoring results for 2022 and the previous four years.

All four automatic monitoring sites did not record any exceedances of the AQS NO_2 annual or 1-hour mean objectives during 2022 and have been consistently well below the objectives for the past five years.

Figure 3-10 Fife automatic monitoring sites NO_2 annual mean concentrations (µg m^{-3})



Over the last five years NO_2 concentrations have been declining steadily between 2018 and 2019. In 2020 the sharp drop in concentrations has been attributed to the COVID-19 pandemic and associated travel restrictions which resulted in a significant decrease in vehicle traffic. In 2021 concentrations increased again as the COVID-19 lockdown and restrictions eased. However, as can be seen concentrations in 2022 were found to be lower than in 2021 and remain lower then pre-covid concentrations at all sites. Longer NO_2 trends at the two AQMAs can be seen in Figure 2-5 and Figure 2-7 above. The trend of decreasing concentrations seen at Cupar and Dunfermline suggest that the Action Plan measures introduced along with other external events have had a positive impact on NO_2 pollution concentrations. Following this the NO_2 element of the AQMA was revoked in 2021.

Three AQMesh sensor units have been monitoring NO_2 since December 2017 to further understand the pollutant concentrations and trends in the Appin Crescent and Bonnygate, AQMAs. AQMesh data indicated that no exceedances of both the annual and 1-hour mean objectives were measured during 2022.

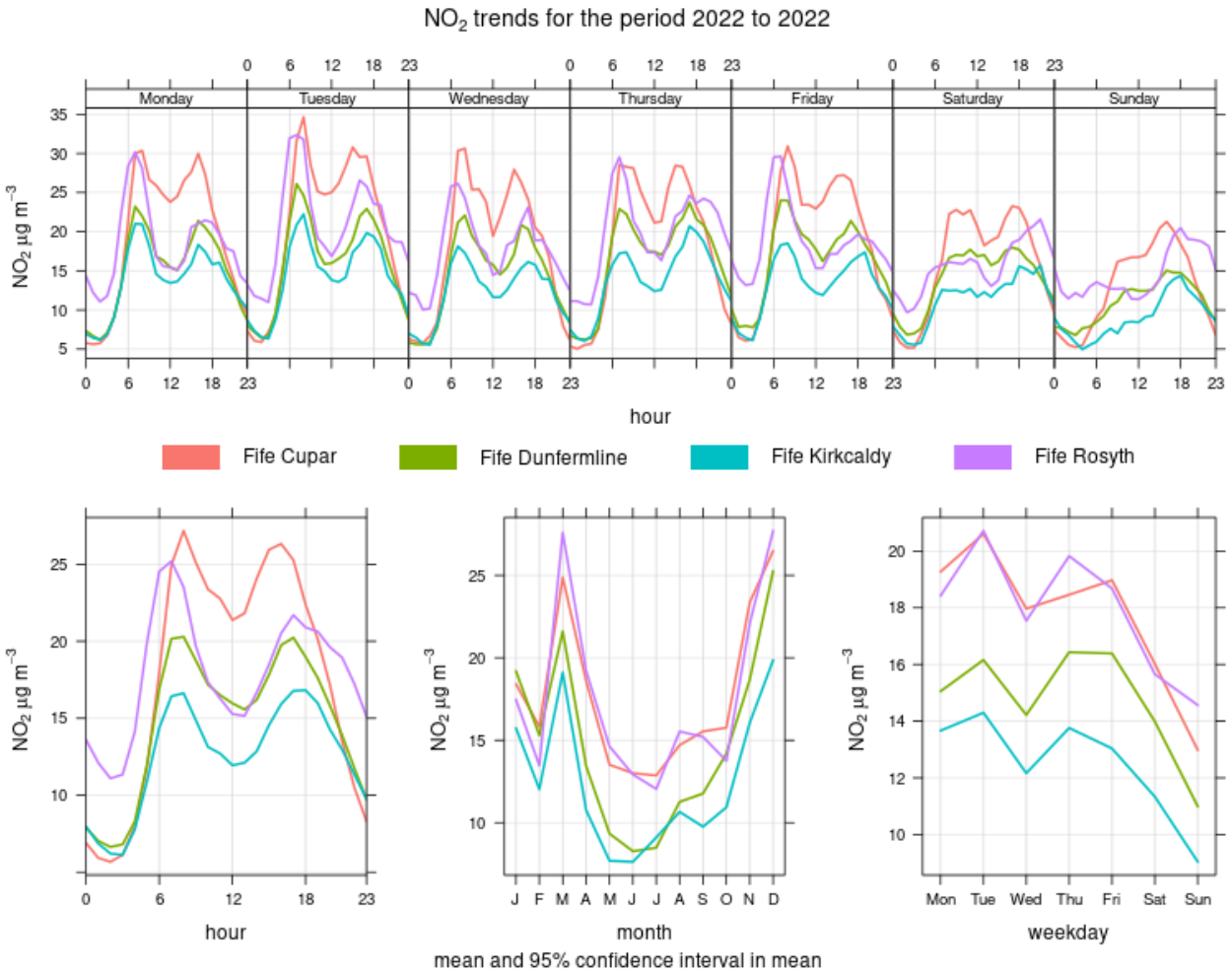
A further two AQMesh sensor units were installed in June and August 2022 at areas of concern, these being St Clair Street, Kirkcaldy and City Road, St Andrews. Annualised 2022 data from these sites again indicated that no exceedances of both annual and 1-hour mean objectives were measured during 2022 at these locations.

More information and detailed analysis of the AQMesh sensor monitoring carried out is provided in Section 3.3 and Appendix E.

3.2.1.2 NO_2 Trends Analysis 2022

Figure 3-11 compares the time variation plots for NO_2 in 2022 at each of the automatic monitoring stations; Cupar, Dunfermline, Kirkcaldy and Rosyth. All four sites have very similar time variations on data throughout the year, with Cupar generally being the highest and Kirkcaldy the lowest. However, it should be noted that Cupar is located at kerbside (less than 0.5 metres from the kerb) rather than roadside (between 0.5 and 5 metres from the kerb) like the three other sites. This proximity to the source will contribute to the higher concentrations as NO_2 drops off significantly the further you are from the source. The highest concentrations are measured between Monday to Friday with rush hour periods (approximately 8am and 5pm) showing highest concentrations. This indicates 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 poorer pollution dispersion conditions.

Figure 3-11 NO_2 Time Variation for Fife



Figures F.1-4 in Appendix F show the NO_2 time series plots for each monitoring site independently.

Figures F.13-16 show NO_2 calendar plots for each of the monitoring stations across Fife. Calendar plots provides an easily identifiable illustration of what days had the highest concentrations. For 2022 these plot shows that higher concentrations were in November and December. This is different to 2021 when it was January and February that the concentrations were higher. Its however not clear how much this was affected by lockdown restrictions.

Figures F.25-28 show NO_2 polar plots at each of the monitoring stations. This report will focus on the Polar plots analysis for the AQMAs at Cupar (left) and Dunfermline (right) shown in Figure 3-12. 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 generally low. For Cupar, the plot indicates that concentrations were highest in 2022 when the wind was from the east. Whereas for Dunfermline the concentrations were highest when wind speed was low and coming from the west.

Figure 3-12 Polar plots of NO_2 concentrations by wind speed and direction

3.2.1.3 Diffusion Tube Monitoring Data

Table A.3 in Appendix A compares the bias adjusted monitored NO_2 annual mean concentrations for the past five years with the air quality objective of 40 µg m^{-3}.

For diffusion tubes, the full 2022 dataset of monthly mean values is provided in Appendix B.

The diffusion tube data has been bias corrected using the local bias adjustment factor, or a combined factor for areas out with the areas covered by automatic monitors. The following local bias adjustments were calculated for this report – further details are provided in Appendix C:

- Cupar = 0.71
- Dunfermline = 0.70
- Kirkcaldy = 0.62
- Rosyth = 0.87
- Average of Local = 0.71

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.

Details of the diffusion tube bias adjustment are found within Appendix C of this report. Diffusion tube results from 2018 to 2022 are presented in Appendix A, Table A.3. Diffusion tube trend graphs are provided for the different areas of interest within Fife, these are presented in Figure A.1 to Figure A.7.

The 2022 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 2022 was 25 µg m^{-3} at Appin Crescent 6 ABC. The highest annual mean measured at Bonnygate, Cupar during 2022 was 24 µg m^{-3} at Bonnygate B4.

3.2.2 Particulate Matter (PM_{10})

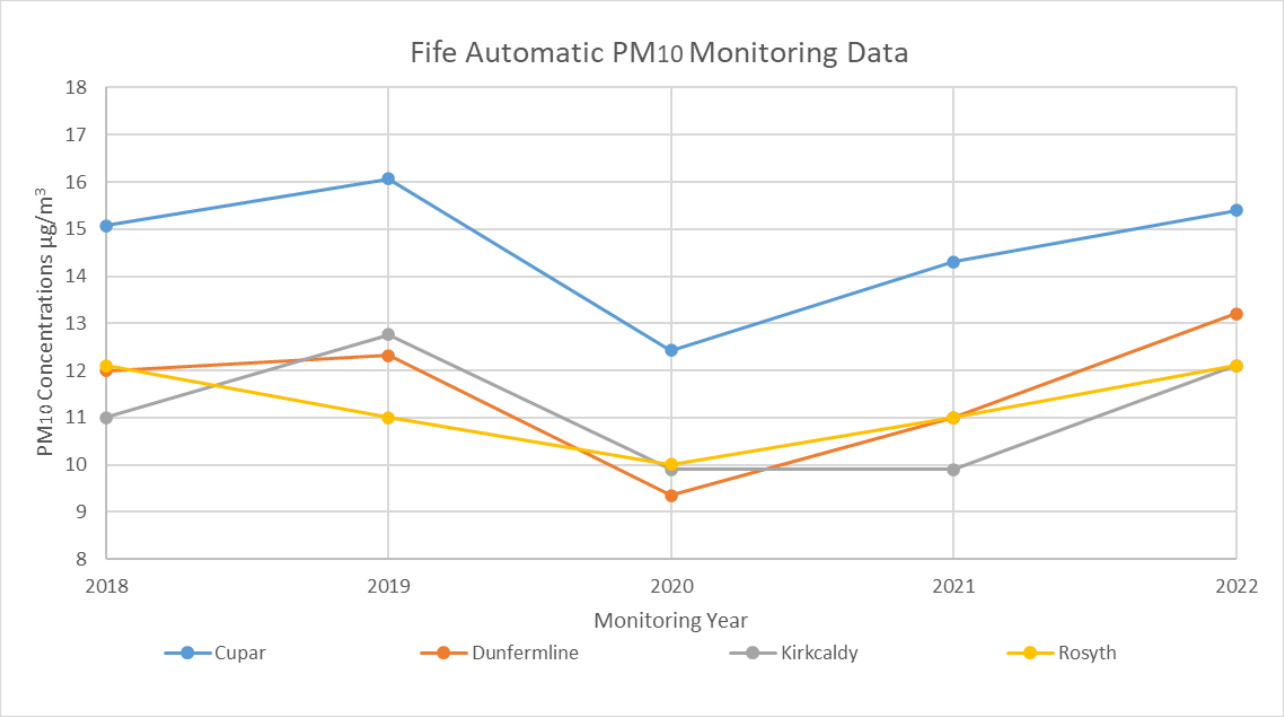
Table A.5 in Appendix A compares the ratified PM_{10} annual mean concentrations for the past five years with the air quality objective of 18 µg m^{-3}. The data provided (including historic years) has been corrected following the Scottish Government guidance[4] which states that PM_{10} data should be divided by 0.909.

Table A.6 in Appendix A compares the ratified continuous monitored PM_{10} daily mean concentrations for the past five years with the air quality objective of 50 µg m^{-3}, not to be exceeded more than seven times per year.

Figure 3-13 provides the PM_{10} monitoring results for 2022 and the previous four years.

All four automatic monitoring sites did not record an exceedance of the PM_{10} annual or 24-hour mean statutory objectives during 2022 and have been consistently below the objectives for the past five years.

Figure 3-13 Fife automatic monitoring sites PM_{10} annual mean concentrations (µg m^{-3})



With the exception of the drop in concentrations seen at all sites in 2020 (attributed to the Covid-19 restrictions), PM10 concentrations have varied very little over the last 5 years. Longer PM_{10} trends at the two AQMAs can be seen in Figure 2-6 and Figure 2-8 above. Concentrations at all sites over the last 2 years have increased back to pre-covid levels.

As previously stated, three AQMesh sensor units have been monitoring PM_{10} since December 2017 within the Appin Crescent and Bonnygate AQMAs. An additional two sensor units measuring PM_{10} were installed during 2022 at St Clair Street, Kirkcaldy and City Road, St Andrews.

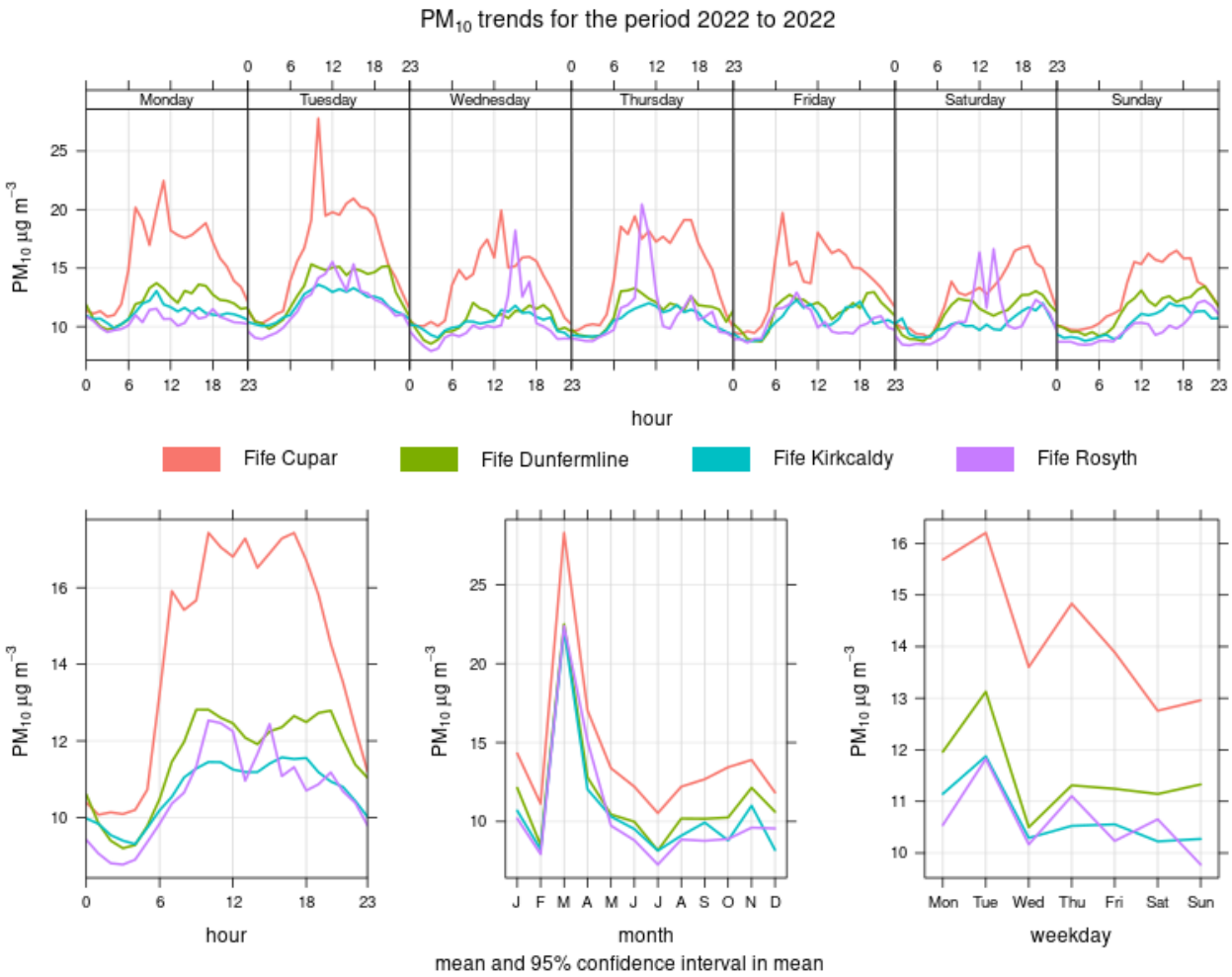
2022 data indicated that no exceedances of both the annual and 24-hour mean objectives were measured during 2022 at all sites.

More detailed analysis of the AQMesh sensor monitoring data from these units in Section 3.3 and Appendix E.

3.2.2.1 PM_{10} Trends Anlysis 2022

Figure 3-14 compares the time variation plots for PM_{10} in 2022 at each of the automatic monitoring stations. All four sites have similar time variations in data throughout the year, with Cupar significantly standing out as having the highest concentrations. The highest concentrations at all sites are measured between Monday to Friday (similar to NO_2 but not to the same extent). The analysis suggests that traffic at Cupar has a greater effect on concentrations than the other locations however, this is probably due to the location of the site (kerbside rather than roadside). It does however show the contribution traffic has to PM_{10} at kerbside locations. It is also notable that Rosyth appears to have a localised source of PM_{10} which affects the site on Wednesdays, Thursdays and Saturdays during the day. The monthly analysis also illustrates the affect transboundary pollution has on PM_{10} concentrations in March and April. Scotland is often affected by easterly winds from the continent during this period that brings over transboundary particulate matter from continental Europe. In addition, more localised farming activity can also cause increased particulate matter concentrations.

Figure 3-14 PM_{10} Time Variation for Fife



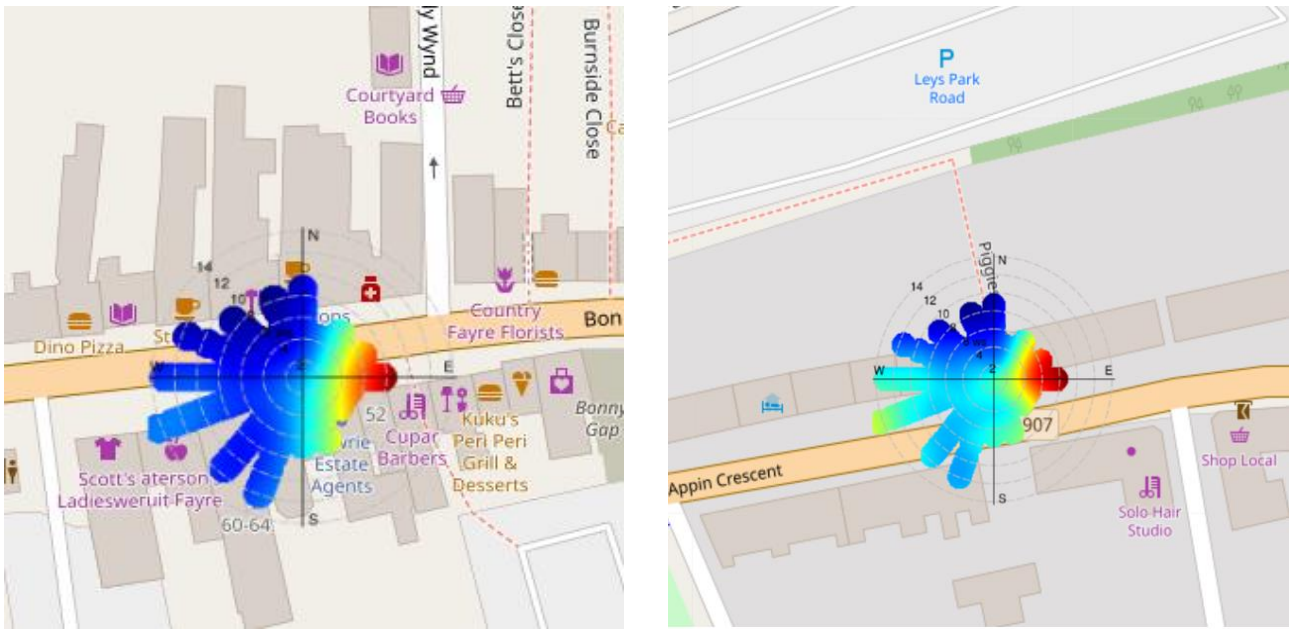
Figures F.5-8 in Appendix F show the PM_{10} time series plots for each monitoring site individually.

Figures F.17-20 show PM_{10} calendar plots for each of the monitoring stations across Fife. It shows that concentrations are relatively consistent throughout the year at all sites with the

exception of March and April when transboundary particulate matter affects Scotland as a whole.

Figures F.29-32 show PM_{10} polar plots at each of the monitoring stations. Polar plots analysis for the AQMAs at Cupar (left) and Dunfermline (right) are shown in Figure 3-15. All plots indicate that concentrations are highest with high wind speeds coming from the southwest. This can suggest that Particulate Matter concentrations in Fife are influenced by transboundary pollution. The signal seen with lower wind speed from the east indicate more local emission sources.

Figure 3-15 Polar plots of PM_{10} concentrations by wind speed and direction



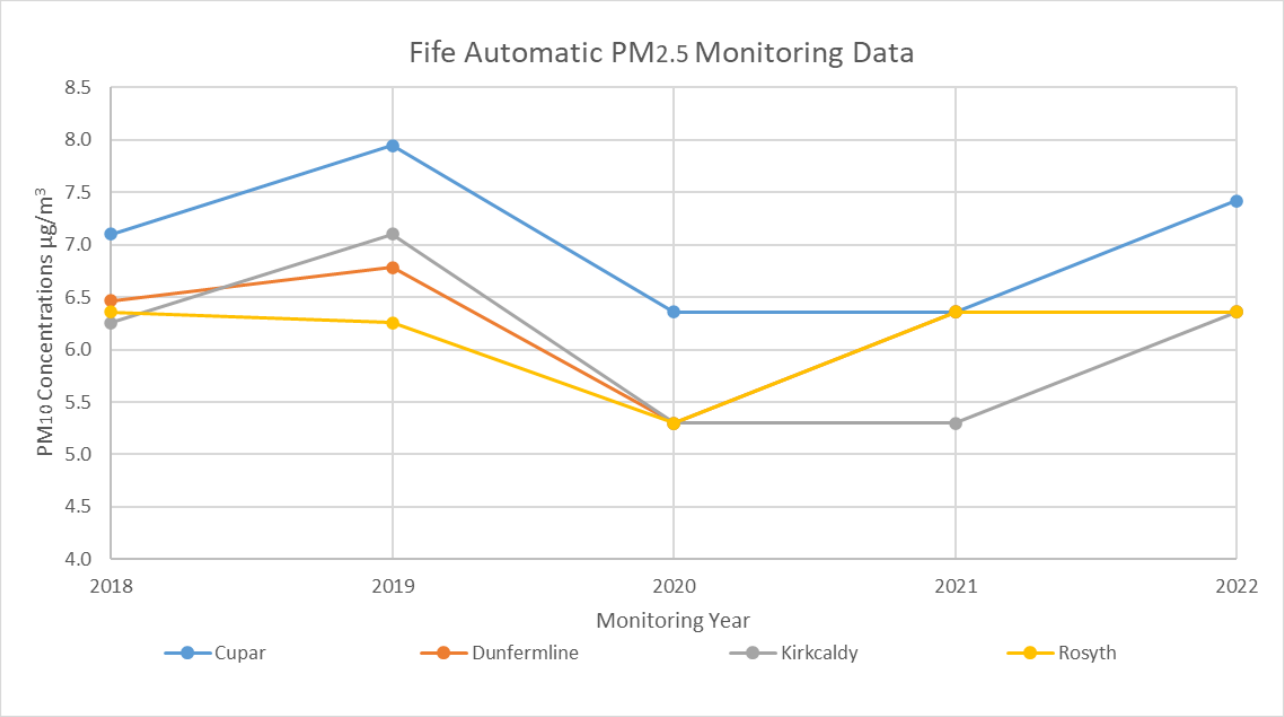
3.2.3 Particulate Matter ($PM_{2.5}$)

Table A.7 in Appendix A compares the ratified $PM_{2.5}$ annual mean concentrations for the past five years with the air quality objective of 10 µg m^{-3}. This data has been corrected following the Scottish Government guidance[4] which states that $PM_{2.5}$ data should be multiplied by 1.06.

Figure 3-16 provides the $PM_{2.5}$ monitoring results for 2022 and the previous four years.

All four automatic monitoring sites did not record an exceedance of $PM_{2.5}$ annual mean objective during 2022 and have been consistently below the objectives for the past five years.

Figure 3-16 Fife automatic monitoring sites $PM_{2.5}$ annual mean concentrations (µg m^{-3})



Overall $PM_{2.5}$ concentrations have remained unchanged (with 1 or 2 µgm^{-3}) since monitoring commenced. There was a decline across all sites between 2019 and 2020 however this is again likely due to the COVID-19 lockdown restrictions.

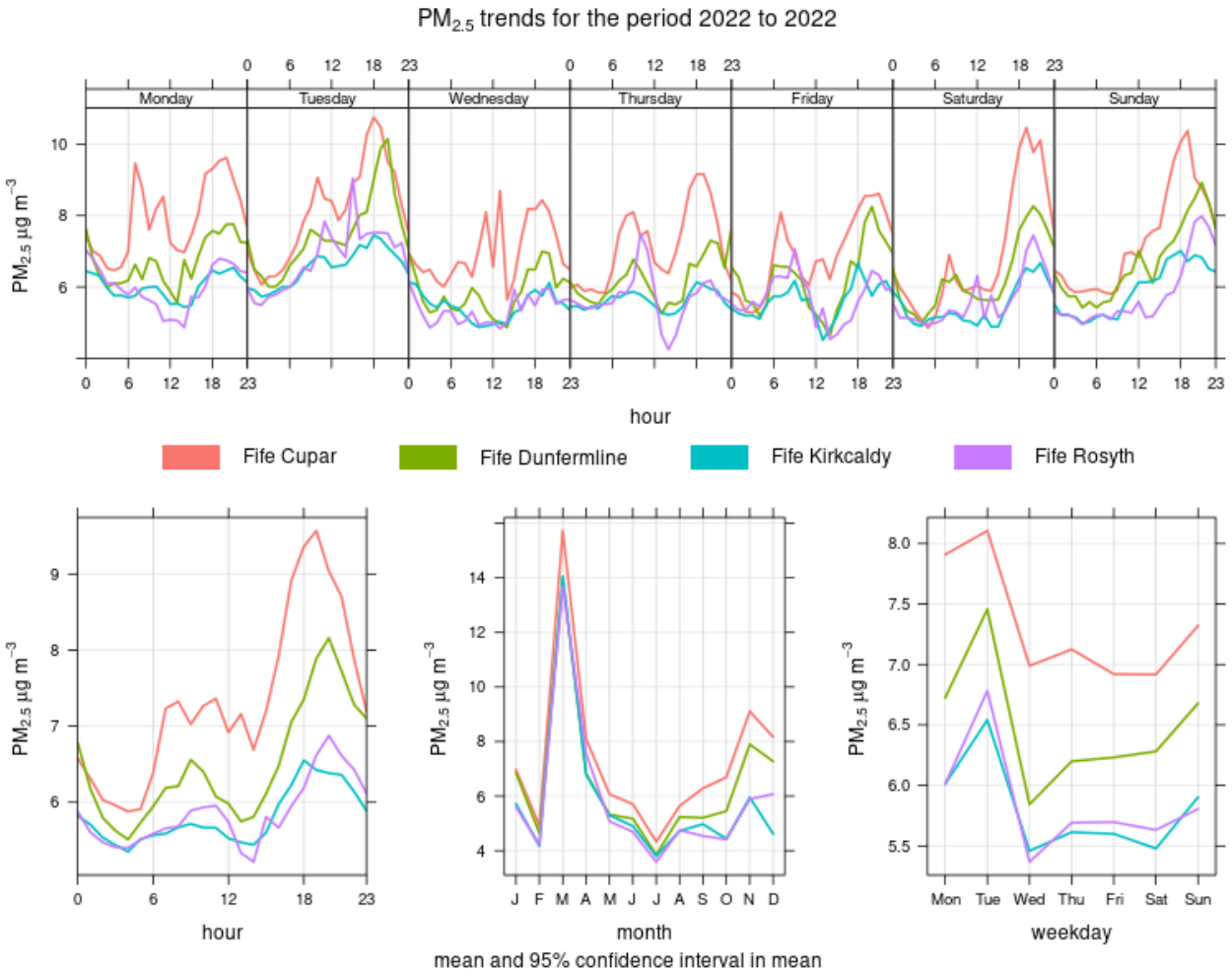
As previously stated, three AQMesh sensor units have been monitoring $PM_{2.5}$ since December 2017 at the Appin Crescent and Bonnygate AQMAs. An additional two sensor units measuring $PM_{2.5}$ were installed during 2022 at St Clair Street, Kirkcaldy and City Road, St Andrews. 2022 data indicated that no exceedances of the annual mean objectives were measured during 2022.

More detailed analysis of the AQMesh sensor monitoring data from these units is provided in Section 3.3 and Appendix E.

3.2.3.1 $PM_{2.5}$ Trends Analysis 2021

Figure 3-17 compares the time variation plots for $PM_{2.5}$ in 2022 at each of the automatic monitoring stations. All four sites have very similar time variations in data throughout the year with Cupar again standing out as consistently having the highest concentrations. This again could be related to the Cupar being a kerbside site. Analysis shows that concentrations are relatively consistent across the full week. Diurnal variations show that concentrations at all sites appear to increase during the night. This along with the diurnal plots indicates that traffic is not the only source of $PM_{2.5}$ at all sites, with domestic fuel burning also being a potential source. As with the PM_{10}, the monthly time variation analysis illustrates the affects transboundary particulate matter has on $PM_{2.5}$ concentrations across all sites.

Figure 3-17 $PM_{2.5}$ Time Variation for Fife

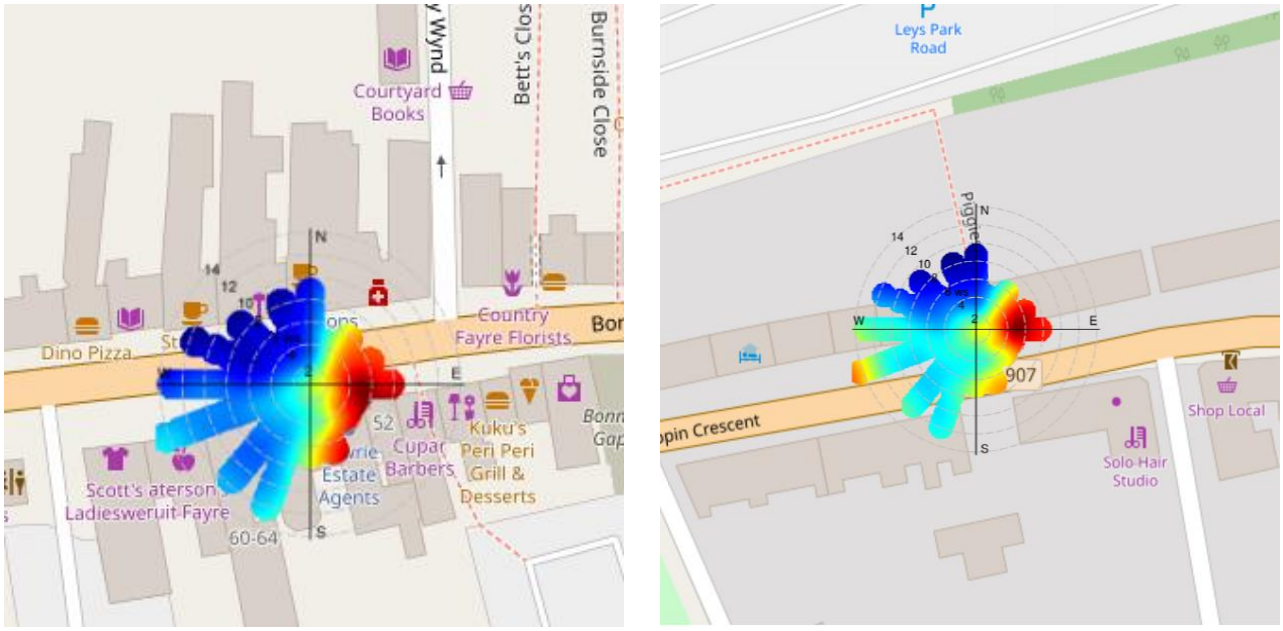


Figures F.9-12 in Appendix F show the $PM_{2.5}$ time series plots for each monitoring site individually.

Figures F.21-24 show $PM_{2.5}$ calendar plots for each of the automatic monitoring stations across Fife. Calendar plots show elevated concentrations. Concentrations are consistent throughout the year with the exception of March when transboundary particulate matter affects Scotland as a whole.

Figures F.33-36 show $PM_{2.5}$ polar plots at each of the monitoring stations. Polar plots analysis for the AQMAs at Cupar (left) and Dunfermline (right) shown in Figure 3-18. As with PM_{10}, the plots indicate a transboundary component with a signal seen with winds from the east.

Figure 3-18 Polar plots of $PM_{2.5}$ concentrations by wind speed and direction



3.2.4 Sulphur Dioxide (SO_2)

Fife Council does not undertake any SO_2 monitoring as previous review and assessment has not identified the need for this.

3.2.5 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 3-1.

Whilst none of these monitoring periods are sufficiently long to permit full assessment of CO concentrations over a full annual period for 2022, 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 3-1 CO Monitoring Fife Transportation Services

Site Number/Location	Monitoring Period	Max 8-Hour Concentration (ppm)
Site 3 - Bothwell Gardens, Dunfermline	14/04/22 to 20/04/22	0.49
	02/07/22 to 08/07/22	2.5
	14/10/22 to 20/10/22	2.43
Site 7 - Glenlyon Road, Leven	26/05/22 to 01/06/22	0.59
	05/08/22 to 11/08/22	1.01
	08/02/23 to 14/02/23	1.53
Site 13 - Carnegie Drive, Dunfermline	23/04/22 to 29/04/22	1.9
	14/07/22 to 20/07/22	2.24
	14/10/22 to 20/10/22	0.09

Site Number/Location	Monitoring Period	Max 8-Hour Concentration (ppm)
Site 16 - Kirkcaldy, Victoria Rd / Dunnikier Rd T/L's	09/06/22 to 15/06/22	0.45
	25/10/22 to 31/10/22	0.33
	02/03/23 to 08/03/23	0.69
Site 24 - Rosyth, Admiralty Rd/Queensferry Rd R/A	21/06/22 to 27/06/22	0.54
	31/08/22 to 06/09/22	0.56
	02/03/23 to 08/03/23	0.2
Site 34 - Bonnygate, Cupar	26/05/22 to 01/06/22	0.25
	05/08/22 to 11/08/22	0.75
	08/02/23 to 14/02/23	0.63
Site 35 - Appin Crescent, Dunfermline	23/04/22 to 29/04/22	0.54
	14/07/22 to 20/07/22	0.63
	14/10/22 to 21/07/22	0.28
Site 36 - Kirkcaldy, St Clair St/Junction Rd T/L's	09/06/22 to 15/06/22	0.39
	24/09/22 to 30/09/22	0.91
	02/03/23 to 08/03/23	0.26
Site 37 - Mossmorran	14/04/24 to 20/04/22	0.49
	02/07/22 to 08/07/22	0.66
	25/10/22 to 31/10/22	0.5
Site 38 - Bell Street, St Andrews	13/05/22 to 19/05/22	0.49
	17/08/22 to 23/08/22	0.15
	30/01/23 to 05/02/23	0.16
Site 40 - City Road, St Andrews	13/05/22 to 19/05/22	0.48
	17/08/22 to 23/08/22	2.3
	30/01/23 to 05/02/23	0.6

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. Measured annual average concentrations for 2022 were found to be lower than the set air quality limit for these substances. The INEOS Grangemouth[6] annual community air monitoring report for 2022 states that there were no significant changes in the annual average concentrations for all hydrocarbon components across all locations, when compared with historical data. The results associated with INEOS Houndpoint are discussed below in the Benzene section.

At the time of writing, The Mossmorran and Braefoot Bay Independent Air Quality Monitoring Review Annual Report 2022 has not yet been published. It is anticipated that this will be finalised later this year by IOM and the findings incorporated into a revised version of this Annual Progress Report and a Summary Report included in the Appendix.

The Mossmorran and Braefoot Bay Expert Advisory Group on Air Quality (AQ EAG) believe that providing a Summary Report along with the full version of the report would be beneficial in terms of simplifying the overall findings for members of the public and elected members. By means of an example the Summary Report for 2021[8] can be seen in Appendix G and shows there were no adverse effects on air quality from activities undertaken at the Mossmorran complex in 2021.

3.2.6 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

Benzene monitoring is presented for INOES Grangemouth oil refinery in their annual monitoring report for 2022[6]. This report concludes that the annual average concentrations of Benzene are below the Air Quality (Scotland) Regulations 2000 air quality objective of 3.25 µg m^{-3} (1ppb).

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 2022 (31st December 2021 to 30th December 2022). Nine locations on the Estuary North shore between North Queensferry and West Wemyss (including four locations between Dalgety Bay and Burntisland) were used, and three locations on the Estuary South shore between South Queensferry and Whitehouse Point were used. Benzene monitoring is presented for INEOS Houndpoint in their annual monitoring report for 2022[9].

The ambient air samples were collected over two-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 0.1 to 0.2 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 monitoring also concluded that;

[8] IOM-Mossmorran-AQ-2021-summary-report.pdf (fife.gov.uk)
[9] Ambient atmospheric survey for hydrocarbons in the vicinity of Hound Point annual survey for 2022, INEOS – March 2023

- The concentrations of all 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 all locations was n-butane for which annual mean concentrations ranged from 1.7 to 6.9 ppb v/v.
- Concentrations of n-heptane, toluene and xylene were all below the limit of detection (LOD) of <0.3 ppb v/v at all locations with the exception of n-heptane at one location at 0.7 ppb v/v.
- The annual mean concentrations of other individual substances ranged from <0.3 (LOD) to 2.6 ppb v/v.
- The annual mean concentrations of total hydrocarbons (C4 to C10) at different locations ranged from 7 to 19 ppb v/v.

INEOS FPS Ltd., and the previous Hound Point 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 2022 indicate that concentrations of the lower molecular weight monitored substances have reduced when compared to those measured in 2021 at most of the locations.

3.2.7 Summary of Compliance with AQS Objectives

Monitoring data measured in 2022 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 2022 was 25 µg m^{-3} at Appin Crescent 6 ABC. The highest annual mean concentration measured in Bonnygate, Cupar during 2022 was 24 µg m^{-3} at Bonnygate B4.

All the automatic monitoring sites in Fife measured PM_{10} and $PM_{2.5}$ concentrations below the annual and daily mean objectives during 2022. Bonnygate, Cupar and Appin Crescent, Dunfermline have both been declared AQMAs for PM_{10}. PM_{10} concentrations within these locations have remained below the annual mean objective consistently since 2014.

In light of the 2022 monitoring results, Fife Council will 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 2023 will be reported in the next Annual Progress Report (2024) which will evaluate the most recent monitoring data.

3.3 ADDITIONAL AQMESH SENSOR MONITORING STUDY

A shortened version (Appendix removed due to size) of the data analysis report for Fife Council's five AQMesh air quality monitoring sensor sites from 1st January – 31st December 2022 is provided in Appendix E. A full version of the AQMesh report can be obtained on request.

In 2022, none of Fife's five AQMesh sensor sites measured exceedances for any of the Scottish AQ objectives for pollutants NO_2, PM_{10} and $PM_{2.5}$.

When comparing the Appin Crescent East and West AQMesh sensors with the nearby automatic site in the Dunfermline AQMA, the statistics show that:

- NO_2 annual mean concentrations for both Appin Crescent AQMesh pods have consistently been higher than that measured at the automatic site since monitoring began in 2018. As concentrations have reduced, the difference between sensor and automatic concentrations has also decreased.
- Both PM_{10} and $PM_{2.5}$ concentrations are very similar when comparing sensors and the automatic site in 2022 and have been since monitoring began. In 2018 and 2019, concentrations at both Appin Crescent AQMesh pods were higher than at the automatic site, but since 2020 concentrations have been below the automatic site.

When comparing the Bonnygate AQMesh sensor with the nearby automatic site in the Cupar AQMA, the statistics show that:

- Bonnygate AQMesh NO_2 annual mean concentrations have been higher than the Cupar automatic site annual mean concentrations since monitoring began in 2018, with the exception of 2020 when the annual mean concentrations were the same. For both sensor and automatic sites, 2022 levels of NO_2 are still well below that measured in 2018 and 2019.
- PM_{10} and $PM_{2.5}$ concentrations for the AQMesh pod in Bonnygate have been very similar since monitoring began in 2018, except for 2019, when both PM_{10} and $PM_{2.5}$ were higher at the AQMesh pod than the automatic site.

When comparing St Clair Street, Kirkcaldy AQMesh sensor with the nearby Fife Kirkcaldy automatic site the statistics show that:

- Data for all three pollutants are comparable within 1 or 2 μgm^{-3} with the sensor site being slightly higher for NO_2 and $PM_{2.5}$ (but still within prescribed air quality objectives)

When considering City Road, St Andrews AQMesh sensor data, there is no automatic site comparison to make due to there being no automatic monitoring carried out in St Andrews. However, 2022 City Road data indicates that concentrations are well below the Scottish AQ objectives for pollutants NO_2, PM_{10} and $PM_{2.5}$. When comparing sensor data with the previous 5 years of the collocated diffusion tube, the sensor site was slightly higher, however well below 2018 and 2019.

All AQMesh pods were co-located with diffusion tubes (or as close to as possible). For all five locations, the diffusion tubes measured higher NO_2 concentrations than the AQMesh. The differences are however relatively insignificant due to the low concentrations measured and the associated differences (between 1 to 4 μgm^{-3}).

Diurnal variation analysis indicates:

- The Bonnygate AQMesh site is more affected by traffic emissions than the Cupar automatic site. Comparing 2019 with 2022 diurnals also indicates that traffic emissions are returning back to pre-Covid-19 patterns, however, 2022 mean concentrations are still lower than 2019.
- In 2022, both Appin Crescent AQMesh sites measured higher NO_2 concentrations than the Dunfermline automatic site throughout the day. Analysis suggests that the Appin Crescent West AQMesh site is more affected by traffic emissions during the day than both the Appin Crescent East and the Dunfermline automatic sites.

- The only distinguishable diurnal variation for PM_{10} is at the Cupar automatic site. Analysis could suggest that traffic contributes more to PM_{10} concentrations at the Cupar automatic site location than at the Bonnygate AQMesh location.
- Diurnal analysis suggests that traffic has little contributing factor to PM_{10} concentrations at Appin Crescent locations.
- There is no obvious variation in $PM_{2.5}$ for all years at both Appin Crescent and Bonnygate which indicates that traffic contributes little to $PM_{2.5}$ concentration in both areas.

3.4 ADDITIONAL STUDIES

Three additional studies were carried out by Ricardo Energy & Environment on behalf of Fife Council. These include an update to the regional dispersion model, a climate change study and an anti-idling campaign.

3.4.1 Update to the Regional Dispersion Model

In 2018, Fife Council previously commissioned Ricardo Energy and Environment to produce a RapidAir regional road transport air quality model for Fife for a base year of 2016 (developed from traffic count data that was the most up to date data available at the time of modelling). In 2022 and early 2023 the RapidAir regional air quality model was updated (in two phases) to a more recent year, this being 2019 (the last full calendar year without the impacts of the Covid pandemic).

During this process the following was undertaken:

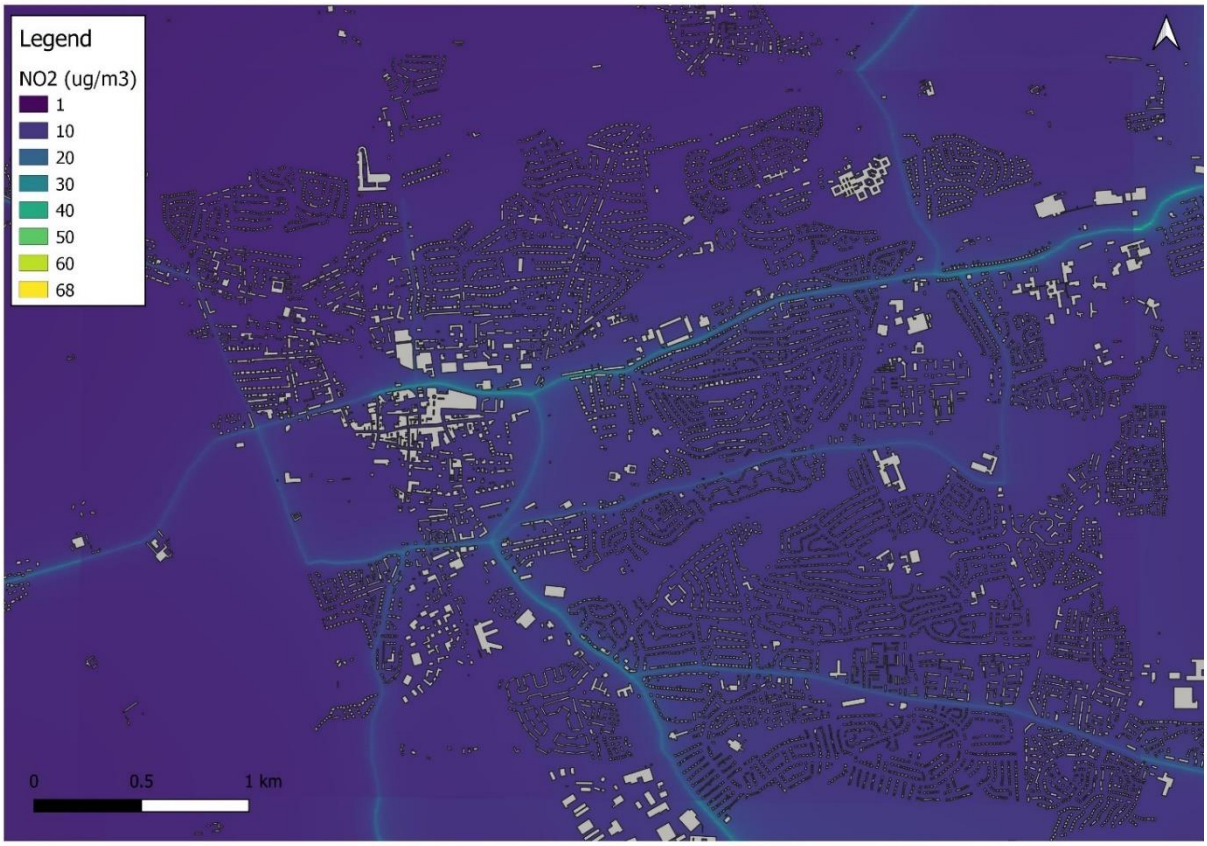
- Updating of the existing regional air quality model with more recent traffic count observations from 2019;
- Updating of the existing regional air quality model with recent real world vehicle emission measurements undertaken within the Bonnygate and Appin Crescent AQMAs in 2022; and
- Verification of the updated regional model at all urban locations within Fife using verified 2019 measurement data (from automatic sites and diffusion tubes).

Concentrations of NO_2, PM_{10} and $PM_{2.5}$ were modelled at a 3m resolution and have been provided to Fife Council as a GIS pack. This data will be incorporated into the Councils GIS system and will be used to consider air quality issues as part of the development management process whilst also aiding in future decision making.

Examples of the graphical outputs provided by RapidAir are shown below in terms of the mapped concentrations of the NO_2 annual mean at Cupar (Figure 3-19) and Dunfermline (Figure 3-20) in 2019.

Figure 3-19 NO_2 annual mean RapidAir output at Cupar

Figure 3-20 NO_2 annual mean RapidAir output at Dunfermline



3.4.2 Climate Change Co-benefits Study

During 2022/2023, an Air Quality and Climate Change co-benefits study is being undertaken by Ricardo Energy & Environment on behalf of Fife Council. The study has utilised the Scenario Modelling Tool, developed by Ricardo on behalf of the UK Department of Environment, Food and Rural Affairs and underpinned by emissions data from the National Atmospheric Emission Inventory and Greenhouse Gas Emissions Inventory. The source sectors focused on in the study were building and energy, transport and waste management.

The provisional findings of the study concluded that many of the measures being considered by Fife Council to reduce greenhouse gas emissions and reduce climate impacts will have a positive impact on emissions of air quality pollutants across the authority area. Despite this, careful consideration of the impacts of measures is required as uptake rates are approved to ensure that positive impacts are achieved in terms of both emissions of greenhouse gases and air pollutants. The study also identified gaps in the data needed to support future analyses. This study is on-going and due to finish in July 2023.

3.4.3 Anti-idling Campaign

During 2022/23 Fife Council ran an Anti-Idling campaign called ‘Switch your engine off and show you care about cleaner air!’ to highlight how idling vehicle engines contribute to air pollution and impact our health and the environment.

Fife’s primary school children have been learning about air pollution and vehicle idling and thinking about the impact on their health, their family’s health and how it affects their local environment. Pupils at various schools across Fife took part in a poster and banner competition with winning entries being selected by a competition judging panel.

The outcome of the campaign saw the winning designs being used in the manufacturing of the following items:

- Winning Banner - 2 copies of the winning banner design for Mountfleurie Primary School (Figure 3-21)
- Winning Posters – Correx A3 Posters of the winning poster designs for Dunnikier Primary School and Lynburn Primary School (Figure 3-22 and Figure 3-23)
- ‘We care about clean air’ Cloud Static Cling Stickers – will be distributed to participating schools, offered to ECO Stars members and the Fife Council Fleet.
- ‘We care about clean air’ foam cloud which will be used at photo opportunities with businesses who are part of the ECO Stars scheme. The board can also be used for future Air Quality based events such as Clean Air Day.

The Fife Council communications Team will set up social media posts across April and May 2023, leading up to Clean Air Day on 15th June 2023 and these will be visible on the Fife Council social media platforms including the Fife Council Facebook Page and Twitter. From June 2023 onwards it is also proposed to meet with members of Fife ECO Stars for photo opportunities with the foam cloud, which will also be promoted on social media with the relevant businesses tagged.

50 copies of each of the winning posters have been manufactured in total and while some copies have been distributed to the winning schools (Dunnikier Primary and Lynburn Primary) the remaining copies will be installed at areas where idling complaints have been

received and photographs showing these locations with the posters on display will be provided in the 2024 APR.

Figure 3-21 Winning Banner presented to Mountfleurie Primary School pupils and Headteacher by Councillor Jan Wincott

Figure 3-22 Winning Poster presented to Dunnikier Primary School pupil by Councillor Jan Wincott

Figure 3-23 Winning Poster presented to Lynburn Primary School pupil and teacher by Councillor Jan Wincott

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 2022.

4.2 OTHER TRANSPORT SOURCES

Fife Council confirms that there are no new roads, junctions, bus stations or railway sources that have been identified that meet the associated criteria for further consideration.

4.3 INDUSTRIAL SOURCES

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

SEPA has recently issued a new permit in Methil for PTG Treatments Limited (PPC/A/SEPA2021-7032). SEPA have also varied conditions of two permits one Leven for the James Donaldson Group Limited (PPC/E/0030184) and one in Rosyth for Rosyth Royal Dockyard Limited (PPC/B/1110524).

4.4 COMMERCIAL AND DOMESTIC SOURCES

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

4.5 NEW DEVELOPMENTS WITH FUGITIVE OR UNCONTROLLED SOURCES

Fife Council confirms that there are no new developments with fugitive or uncontrolled sources that have not been adequately considered in previous rounds of Review and Assessment.

5. PLANNING APPLICATIONS

5.1 APPLICATIONS

The relevant planning guidance controls how Fife Council will manage potential air quality impacts from proposed developments. During 2022 the Land & Air Quality Team commented on numerous planning applications in relation to air quality matters mostly focused on residential and mixed-use developments. The types of comments made by the team are summarised in Table 5-1:

Table 5-1 Summarised air quality related planning application comments

Comment	Number of planning applications
AQIA advised and/or submitted for applications located out with AQMA's	35
AQIA advised and/or submitted for applications located within AQMA's	0
Biomass boiler/wood burning Stove questionnaire requested and/or submitted	10
General information provided (e.g., agreeing scope of AQIA, further info required, retain air quality condition(s) etc)	17

Applications of note include the following:

22/00966/FULL – Erection of 15 dwellinghouses (Class 9) and 30 flatted dwellings (extra care) (Sui Generis) with associated access and landscaping and infrastructure at Council Park Depot, Leys Park Road, Dunfermline

Given the nature and scale of the development and its proximity to the Appin Crescent AQMA, it was advised that a suitable air quality impact assessment be undertaken. The Airshed's letter report, 'Air Quality Impact Assessment for Proposed Residential Development – Bellyeoman Road Dunfermline', dated 29 June 2022, concluded that a quantitative assessment was not required. Application conditioned in October 2022 with no associated air quality conditions.

22/00990/PPP – Planning permission in principle for a Mixed Use Development comprising Residential (Class 9 and Sui Generis); Student Accommodation (Class 8); Delicatessen and Restaurant (Class 3); Local Convenience (Class 1); Assembly and Leisure (Class 11); Urban Park; Landscaping; and, all Associated Infrastructure including SUDS Basin, Roads, Accesses and Footways at former Madras College, Kilrymont Road, St Andrews, KY16 8DE

The AirShed Air Quality Impact Assessment submitted in support of the application and based on the results from the assessment, local air quality within the proposed development site is likely to comply with all statutory Limit Values and Objectives. Application conditioned

in December 2023 with a condition advising that should the proposed size/scale of the development change the existing AQIA should be reassessed and resubmitted for approval.

22/01021/FULL – Residential development of 212 units, including 46 affordable units, with associated infrastructure including two vehicular access points, roads, landscaping, playpark and SuDS at Land to South of Hill View, Kinglassie

ITP Energised's report, 'Air Quality Impact Assessment', report reference 4557, dated 7 March 2022, concludes that the overall effect of the proposed development on local air quality at human receptors is assessed as not significant. Application not yet decided (as of February 2023)

22/01039/FULL – Erection of 42 Flatted dwellings and associated works (demolition of existing building) at Former Dunfermline Local Office, Walmer Drive, Dunfermline

Given the nature and scale of the development and its proximity to the Appin Crescent AQMA, it was advised that a suitable air quality impact assessment be undertaken. Application not yet decided (as of February 2023)

22/01336/PREAPP – Pre-application for mixed use development of residential (approximately 500-550 units) (including affordable housing), tourism/leisure uses and public woodland park at Castlandhill House, Ferry Toll Road, Rosyth

Given the nature and scale of the development, it was advised that a suitable air quality impact assessment be undertaken. PREAPP response issued in August 2022 advised that a AQIA will be expected in terms of PPP submission requirements for the site.

22/01344/FULL – Erection of 70 residential units with associated works including formation of accesses, open space, drainage infrastructure and landscaping at Land North and South of A994 Conscience Bridge, Cairneyhill

AECOM's report, 'Air Quality Assessment', dated March 2022, concludes that the air quality impacts associated with the proposed development are not considered to be significant. Application not yet decided (as of February 2023)

22/01914/FULL – Erection of 80 residential units with associated engineering, infrastructure, landscaping and open space at Land to North Of 10 to 22 Cameron Crescent, Windygates

Campion Homes' report, 'Air Quality Assessment', dated July 2021, concludes that air quality impacts can be considered to be insignificant. Application not yet decided (as of February 2023)

22/02521/PREAPP – Erection of 29 dwellinghouses at Land To The Rear Of 28 To 50 Main Street, Springfield

Given the nature and scale of the development, it was advised that a suitable air quality impact assessment be undertaken. PREAPP response issued in November 2022 advised that a AQIA will be expected in terms of future planning submissions for the site.

22/03629/FULL – Erection of 36 dwellinghouses (Class 9) and alterations to existing farm building to form 2 dwellinghouses (Class 9) and alterations to existing dwellinghouse and formation of access at 50 James Street, Pittenweem, Anstruther

Given the nature and scale of the development, it was advised that a suitable air quality impact assessment be undertaken. Application not yet decided (as of February 2023)

22/04086/PPP – Proposed redevelopment of former Prestonhill Quarry to create a mixed use development including approximately 180 residential units (including affordable housing), holiday lodges, café/bistro, associated access, open space, landscaping, SuDS and other infrastructure at Prestonhill Quarry, Preston Crescent, Inverkeithing

The Airshed's report, Air Quality Impact Assessment – Prestonhill Quarry Inverkeithing, dated 11 May 2021, advised that a full assessment could not be completed at the time of writing due to Covid-19 restrictions in place. However, The Airshed advise that impacts associated with the proposed development will be assessed in detail once the masterplan has been finalised and the baseline road traffic survey has been completed. Application not yet decided (as of February 2023)

22/03416/FULL – Change of use of land to operational railway and construction of railway station and associated development at Land To The West Of Levenmouth Swimming Pool Promenade Leven Fife

The Atkins 'Air Quality Assessment' dated 7 Sept 2022 determined that expected traffic flows for the proposed development do not exceed relevant air quality assessment screening criteria and as such further assessment of air quality effects at areas of human exposure was not required. Application not yet decided (as of February 2023). This particular application involves co-ordination with a much wider scheme of works aimed towards improving opportunities for active travel and connectivity including SEPA's Levenmouth Programme, Fife Council's Levenmouth Reconnected project and Network Rail's Levenmouth Railway reopening.

6. CONCLUSIONS AND PROPOSED ACTIONS

6.1 CONCLUSIONS FROM NEW MONITORING DATA

The 2023 APR has considered the available monitoring data measured during 2022.

Nitrogen Dioxide

During 2022, NO_2 is measured at four sites using automatic monitors; Cupar, Dunfermline, Kirkcaldy and Rosyth. Non-automatic, diffusion tube monitoring was undertaken at 42 locations within Fife (covering 58 diffusion tubes in total). There were no exceedances of the NO_2 annual mean objective at any automatic or non-automatic monitoring locations during 2022. The highest annual mean concentration measured in Appin Crescent, Dunfermline during 2022 was 25 µg m^{-3} at Appin Crescent 6 ABC. The highest annual mean concentration measured in Bonnygate, Cupar during 2022 was 24 µg m^{-3} at Bonnygate B4. There were three diffusion tube sites decommissioned at the beginning of 2022 due to historically low readings – 3A Junction Road, Kirkcaldy; 6B Bonnygate West, Cupar and 11 Halbeath Road, Dunfermline. These were replaced by Oriel Road, Kirkcaldy; Pratt Stret, Kirkcaldy and Chapel Level, Kirkcaldy which were selected due to public complaints and/or a suitable level of traffic flow (data for all three sites showed over 10,000 vehicle movements per days and are therefore worthy of consideration).

AQMesh Sensor monitoring carried out at five locations in Fife (Appin Crescent, Dunfermline (2 locations); Bonnygate, Cupar; City Road, St Andrews and St Clair Street, Kirkcaldy) measured no exceedances of the annual or daily mean objectives for NO_2. Data is managed and processed by Ricardo who carry out appropriate QA/QC.

Particulate Matter

PM_{10} and $PM_{2.5}$ concentrations are measured using Reference equivalent techniques at four locations in Fife; Cupar, Dunfermline, Kirkcaldy and Rosyth. 2022 measured concentrations of both PM_{10} and $PM_{2.5}$ did not exceed any of the annual or daily mean objectives for both PM_{10} and $PM_{2.5}$.

AQMesh Sensor monitoring carried out at five locations in Fife (Appin Crescent, Dunfermline (2 locations); Bonnygate, Cupar; City Road, St Andrews and St Clair Street, Kirkcaldy) measured no exceedances of the annual or daily mean objectives for both PM_{10} and $PM_{2.5}$.

Sulphur Dioxide

No SO_2 concentrations were measured in Fife during 2022. 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 2022 indicates that the AQS objective for CO is unlikely to have been exceeded during 2022.

Benzene and 1,3 Butadiene

Benzene and 1,3 Butadiene monitoring carried out in the area of the INEOS Grangemouth refinery show that it is unlikely that the AQS objective for these pollutants have been exceeded within the Fife Council boundary.

A summary of the monitoring data from INEOS Houndpoint states that concentrations of the monitored substances have reduced when compared to those measured in 2021 at most of the locations.

At the time of writing, The Mossmorran and Braefoot Bay Independent Air Quality Monitoring Review Annual Report 2022 has not yet been published. It is anticipated that this will be finalised later this year by IOM and the findings incorporated into a revised version of this Annual Progress Report and a Summary Report included in the Appendix.

The Mossmorran and Braefoot Bay Expert Advisory Group on Air Quality (AQ EAG) believe that providing a summary report along with the full version of the report would be beneficial in terms of simplifying the overall findings for members of the public and elected members. By means of an example the Summary Report for 2021[8] can be seen in Appendix G and shows there were no adverse effects on air quality from activities undertaken at the Mossmorran complex in 2021.

6.2 CONCLUSIONS RELATING TO NEW LOCAL 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 Fife Council will carry out the following actions:

1. Revoke the PM_{10} AQMAs at Bonnygate Cupar and, Appin Crescent Dunfermline by the end of 2023.This is in accordance with the latest statutory LAQM Policy and Technical Guidance documentation.
2. Produce an Annual Progress Report in 2024, reporting concentrations measured during 2023.
3. Continue to implement the measures outlined in the action plans for Appin Crescent, Dunfermline and Bonnygate, Cupar.
4. Continue to monitor NO_2, PM_{10} and $PM_{2.5}$ concentrations throughout Fife including AQMAs.
5. Continue to review the NO_2 diffusion tube monitoring programme and seek to relocate any tubes where deemed appropriate.

6.4 GRANTS AWARDED

Over April and May 2023 Fife Council was provided with the grant funding allocation from the Scottish Government for local air quality management and AQAP related measures/projects over 2023/24. The awarded funding (Table 6-1) will cover key areas including:

Table 6-1 Grant funding allocation 2023/24

LAQM	AQAP
Provision of three new NO_x analysers to replace aging equipment at Cupar, Dunfermline and Kirkcaldy (EnviroTechnology Services)	Continuation of TRL Fleet and Taxi ECO Stars schemes within Fife
Provision of new air conditioning unit at Kirkcaldy to replace faulty unit (EnviroTechnology Services)	AQMesh data management and reporting over 2023 for existing pods located within Bonnygate and Appin Crescent AQMAs as well as those in Kirkcaldy and St Andrews (Ricardo)
	CAD 2023 – Education packages and citizen science packs to be used at four schools across Fife (including Dunfermline area)* *Funding provided for three schools, Council revenue funding to be used for fourth school
	Green Blue Network – GIS data to be provided showing areas of concern via a numerical ranking system. Fife Council seeks to replicate the air purification section of the Edinburgh Green Blue Network Report by undertaking this work

A summary of progress on the above items will be provided in the 2024 APR.

Last year funding was provided for several local air quality management and AQAP measures, summaries of which are provided in Table 6-2 below in terms of the use of the funding and the associated outcomes along with where in the APR additional information is available:

Table 6-2 Grant funding summary 2022/23

Measure	Summary
Nissan ENV200 electric van for Meals on Wheels	Due to issues sourcing an electric van within the 2023/23 financial year period an alternative electric vehicle was obtained with the funding instead used to obtain a Kia NiroE which is being used by Social Work as detailed in Section 2.3.4
Continuation of TRL Fleet and Taxi ECO Stars schemes within Fife	Funding was used to ensure TRL continued to recruit new members while also liaising with existing members. Key milestone Fleet and Taxi members were also identified and issued with certificates as detailed in Section 2.3.3

Measure	Summary
AQMesh data management and reporting for existing pods	Funding used to ensure data from existing AQMesh pods (within AQMAs) was appropriately managed, quality assured, quality controlled and reported. In addition, Council revenue funding was used to ensure the same was undertaken for recently obtained additional AQMesh pods which are located in other areas of concern (Kirkcaldy and St Andrews) as detailed in Section 3.3
Clean Air Day 2022	Funding used to provide three schools in the Dunfermline area with educational packages, including materials to carry out their own monitoring. On and around CAD (16th June 2022) the schools were also visited by EnviroTechnology Services 'Smogmobile' which is a mobile emission free air quality monitoring laboratory which allowed the children to learn more about the specialist equipment used to accurately monitor air quality. Further information is provided in Section 2.2.6
Anti-idling campaign	Funding used to run an anti-idling campaign in which several schools took part and winning designs were selected for posters and a banner. These have now been printed and presented to the winning schools/students with posters to also be used at previously identified nuisance hotspots for engine idling in order to raise awareness. Further information is provided in Section 3.4.3
Air quality and climate change co-benefits evidence base	Funding used to undertake a study which has provisionally concluded that many of the measures being considered by Fife Council to reduce greenhouse gas emissions and reduce climate impacts will have a positive impact on emissions of air quality within the Fife area. The study also identified gaps in the data needed to support future analyses with additional work to be undertaken over 2023 as part of the funded project. Further information is provided in Section 3.4.2

APPENDICES

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? Which 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}, $PM_{2.5}$	YES Bonnygate	NO_x Analyser (Chemiluminescence), FIDAS (since December 2016)	N (1m)	<0.5m	1.9m
Dunfermline	Roadside	309926	687722	NO_2, PM_{10}, $PM_{2.5}$	YES Appin Crescent	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

Notes:

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

(2) N/A if not applicable.

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

Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA? Which AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube co-located with a Continuous Analyser?	Tube Height (m)
Central Area									
St Clair Street 1, Kirkcaldy	Roadside	329157	693030	NO_2	No	No (2.0)	1.3	No	2.2-2.5
St Clair Street 2, Kirkcaldy	Roadside	329131	693008	NO_2	No	No (2.0)	1.8	No	2.2-2.5
St Clair Street 3, Kirkcaldy	Roadside (Façade)	329174	693069	NO_2	No	Yes	2	No	2.2-2.5
125 St Clair Street, Kirkcaldy	Roadside (Façade)	329208	693163	NO_2	No	Yes	1.5	No	2.2-2.5
179A St Clair Street, Kirkcaldy	Roadside (Façade)	329310	693326	NO_2	No	Yes	1.5	No	2.2-2.5
St Clair Street Romon A, B, C, Kirkcaldy	Roadside	329143	692986	NO_2	No	No (10.0)	5	Yes	2.2-2.5
Glenlyon, Leven	Kerbside	337357	701318	NO_2	No	No (26.8)	1	No	2.2-2.5
ASDA Roundabout, Kirkcaldy	Kerbside	328742	694045	NO_2	No	No (28.0)	1	No	2.2-2.5
Victoria Road, Kirkcaldy	Roadside (Façade)	328144	692315	NO_2	No	Yes	2.5	No	2.2-2.5
Dunnikier Road, Kirkcaldy	Roadside (Façade)	328152	692352	NO_2	No	Yes	3.4	No	2.2-2.5
Henry Road, Kirkcaldy	Roadside	327437	692270	NO_2	No	No (16.0)	1.7	No	2.2-2.5
Chapel Level, Kirkcaldy	Roadside	325526	694027	NO_2	No	No (10m)	10	No	2.2-2.5m
Oriel Road, Kirkcaldy	Roadside	327239	691669	NO_2	No	No (5m)	2	No	2.2-2.5m
Pratt Street, Kirkcaldy	Roadside	327415	690432	NO_2	No	No (2m)	2	No	2.2-2.5m

Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA? Which AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube co-located with a Continuous Analyser?	Tube Height (m)
East Area									
City Road 1, St Andrews	Roadside	350590	716570	NO_2	No	No (1.0)	1.5	Yes	2.2-2.5
Bell Street 1, St Andrews	Roadside (Façade)	350712	716691	NO_2	No	Yes	1.6	No	2.2-2.5
Bell Street 2, St Andrews	Roadside (Façade)	350721	716646	NO_2	No	Yes	2.1	No	2.2-2.5
City Road 3, St Andrews	Roadside	350538	716682	NO_2	No	No (14.0)	1.5	No	2.2-2.5
City Road 5, St Andrews	Roadside	350499	716748	NO_2	No	No (5.0)	1.9	No	2.2-2.5
City Road 6, St Andrews	Roadside	350470	716826	NO_2	No	No (5.0)	2.2	No	2.2-2.5
Links Crescent, St Andrews	Roadside (Façade)	350156	716947	NO_2	No	Yes	3	No	2.2-2.5
North Street, St Andrews	Roadside	350519	716935	NO_2	No	No (3.0)	2.2	No	2.2-2.5
Bonnygate B1, Cupar	Roadside (Façade)	337409	714570	NO_2	Yes, Bonnygate	Yes	5.3	No	2.2-2.5
Bonnygate B2, Cupar	Roadside (Façade)	337507	714584	NO_2	Yes, Bonnygate	Yes	1.7	No	2.2-2.5
Bonnygate B4, Cupar	Roadside (Façade)	337467	714576	NO_2	Yes, Bonnygate	Yes	1.9	No	2.2-2.5
Bonnygate B3, Cupar	Roadside (Façade)	337480	714586	NO_2	Yes, Bonnygate	Yes	1.6	Yes	2.2-2.5
Bonnygate Monitor A, B, C, Cupar	Kerbside	337403	714571	NO_2	Yes, Bonnygate	No (4.8)	0.6	Yes	2.2-2.5
West Area									
High Street, Cowdenbeath	Kerbside	316527	691742	NO_2	No	No (3.5)	0.5	No	2.2-2.5
Admiralty Road A, Rosyth	Roadside (Façade)	312069	683431	NO_2	No	Yes	9	No	2.2-2.5

Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA? Which AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube co-located with a Continuous Analyser?	Tube Height (m)
Admiralty Road ROMON A, B, C, Rosyth	Roadside (Façade)	311755	683503	NO_2	No	Yes	6.5	Yes	2.2-2.5
Carnegie Drive A, B, C, Dunfermline	Roadside (Façade)	309023	687632	NO_2	No	Yes	2.3	No	2.2-2.5
Pilmuir Street, Dunfermline	Roadside	309143	687774	NO_2	No	Yes	2	No	2.2-2.5
Mill Street, Dunfermline	Roadside	308888	687968	NO_2	No	Yes	2	No	2.2-2.5
Rumblingwell, Dunfermline	Roadside	307898	688224	NO_2	No	No (6.3)	1.7	No	2.2-2.5
102 Baldridgeburn, Dunfermline	Kerbside	308447	688068	NO_2	No	No (3.0)	0.5	No	2.2-2.5
Appin Crescent 1, Dunfermline	Roadside (Façade)	309888	687719	NO_2	Yes, Appin Crescent	Yes	6.5	No	2.2-2.5
Appin Crescent 2, Dunfermline	Roadside (Façade)	309883	687701	NO_2	Yes, Appin Crescent	Yes	1.5	No	2.2-2.5
Appin Crescent 3, Dunfermline	Roadside (Façade)	309975	687716	NO_2	Yes, Appin Crescent	Yes	1.8	No	2.2-2.5
Appin Crescent A, B, C, Dunfermline	Roadside	309900	687716	NO_2	Yes, Appin Crescent	No (5.1)	1.6	No	2.2-2.5
Appin Crescent 4A, 4B, 4C, Dunfermline	Roadside (Façade)	309926	687722	NO_2	Yes, Appin Crescent	Yes	3.9	Yes	2.2-2.5
Appin Crescent 5A, 5B, 5C, Dunfermline	Roadside (Façade)	309957	687714	NO_2	Yes, Appin Crescent	Yes	1.5	No	2.2-2.5
Appin Crescent 6A 6B, 6C, Dunfermline	Roadside (Façade)	309904	687704	NO_2	Yes, Appin Crescent	Yes	1.5	No	2.2-2.5

Notes:

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

(2) N/A if not applicable.

* 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.

Table A.3 – Annual Mean NO_2 Monitoring Results (µg m^{-3})

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2022 (%) (2)	2018	2019	2020	2021	2022
Cupar	Kerbside	Automatic	100	98	26	24	21	20	18
Dunfermline	Roadside	Automatic	100	98	22	21	15	16	15
Kirkcaldy	Roadside	Automatic	100	100	17	16	12	14	12
Rosyth	Roadside	Automatic	100	95	22	22	15	19	18
Central Area									
St Clair Street 1, Kirkcaldy	Roadside	Diffusion Tube	100	100	30	25	18	21	19
St Clair Street 2, Kirkcaldy	Roadside	Diffusion Tube	100	100	33	29	23	23	21
St Clair Street 3, Kirkcaldy	Roadside (Façade)	Diffusion Tube	100	100	26	23	16	19	17
125 St Clair Street, Kirkcaldy	Roadside (Façade)	Diffusion Tube	100	100	28	23	18	20	19
179A St Clair Street, Kirkcaldy	Roadside (Façade)	Diffusion Tube	100	100	25	22	18	18	17
St Clair Street Romon A, B, C, Kirkcaldy	Roadside	Diffusion Tube	100	91.67	17	16	13	14	12
Glenlyon, Leven	Kerbside	Diffusion Tube	100	100	24	23	16	20	18
ASDA Roundabout, Kirkcaldy	Kerbside	Diffusion Tube	100	100	27	22	16	19	17
Victoria Road, Kirkcaldy	Roadside (Façade)	Diffusion Tube	100	75	25	23	16	22	17
Dunnikier Road, Kirkcaldy	Roadside (Façade)	Diffusion Tube	100	91.67	23	22	16	18	15
Henry Road, Kirkcaldy	Roadside	Diffusion Tube	100	100	24	21	16	19	17
Chapel Level, Kirkcaldy	Roadside	Diffusion Tube	100	100	-	-	-	-	11
Oriel Road, Kirkcaldy	Roadside	Diffusion Tube	100	100	-	-	-	-	11
Pratt Street, Kirkcaldy	Roadside	Diffusion Tube	100	100	-	-	-	-	11
East Area									
City Road 1, St Andrews	Roadside	Diffusion Tube	100	91.67	22	22	13	16	14
Bell Street 1, St Andrews	Roadside (Façade)	Diffusion Tube	100	91.67	28	27	14	15	16

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) [1]	Valid Data Capture 2022 (%) [2]	2018	2019	2020	2021	2022
Bell Street 2, St Andrews	Roadside (Façade)	Diffusion Tube	100	100	23	22	13	14	14
City Road 3, St Andrews	Roadside	Diffusion Tube	100	100	23	22	16	17	16
City Road 5, St Andrews	Roadside	Diffusion Tube	100	100	22	18	13	15	14
City Road 6, St Andrews	Roadside	Diffusion Tube	100	91.67	31	27	21	24	21
Links Crescent, St Andrews	Roadside (Façade)	Diffusion Tube	100	100	21	19	14	16	15
North Street, St Andrews	Roadside	Diffusion Tube	100	100	-	21	13	17	16
Bonnygate B1, Cupar	Roadside (Façade)	Diffusion Tube	100	100	25	24	18	21	17
Bonnygate B2, Cupar	Roadside (Façade)	Diffusion Tube	100	100	-	23	21	23	20
Bonnygate B4, Cupar	Roadside (Façade)	Diffusion Tube	100	91.67	34	32	22	27	24
Bonnygate B3, Cupar	Roadside (Façade)	Diffusion Tube	100	100	31	32	20	27	22
Bonnygate Monitor A, B, C, Cupar	Kerbside	Diffusion Tube	100	100	27	23	16	19	17
West Area									
High Street, Cowdenbeath	Kerbside	Diffusion Tube	100	100	20	19	14	16	14
Admiralty Road A, Rosyth	Roadside (Façade)	Diffusion Tube	100	100	25	27	20	23	22
Admiralty Road ROMON A, B, C, Rosyth	Roadside (Façade)	Diffusion Tube	100	100	22	22	17	19	18
Carnegie Drive A, B, C, Dunfermline	Roadside (Façade)	Diffusion Tube	100	100	27	26	18	22	19
Pilmuir Street, Dunfermline	Roadside	Diffusion Tube	100	100	24	23	17	17	16
Mill Street, Dunfermline	Roadside	Diffusion Tube	100	100	30	30	22	25	23
Rumblingwell, Dunfermline	Roadside	Diffusion Tube	100	100	21	21	15	16	14
102 Baldridgeburn, Dunfermline	Kerbside	Diffusion Tube	100	100	-	33	16	17	16

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2022 (%) (2)	2018	2019	2020	2021	2022
Appin Crescent 1, Dunfermline	Roadside (Façade)	Diffusion Tube	100	100	25	26	19	21	19
Appin Crescent 2, Dunfermline	Roadside (Façade)	Diffusion Tube	100	100	34	31	24	26	24
Appin Crescent 3, Dunfermline	Roadside (Façade)	Diffusion Tube	100	100	28	28	21	26	24
Appin Crescent A, B, C, Dunfermline	Roadside	Diffusion Tube	100	100	27	27	20	21	20
Appin Crescent 4A, 4B, 4C, Dunfermline	Roadside (Façade)	Diffusion Tube	100	100	21	21	15	16	15
Appin Crescent 5A, 5B, 5C, Dunfermline	Roadside (Façade)	Diffusion Tube	100	100	31	30	23	24	23
Appin Crescent 6A 6B, 6C, Dunfermline	Roadside (Façade)	Diffusion Tube	100	100	35	34	24	26	25

Notes:

Means for diffusion tubes have been corrected for bias. See Appendix C for details.

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

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%).

Table A.4 – 1-Hour Mean NO_2 Monitoring Results, Number of 1-Hour Means > 200 µg m^{-3} (not to be exceeded more than 18 times/year)

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2021 (%) (2)	2018	2019	2020	2021	2022
Cupar	Kerbside	Automatic	100	98	0	0	0	0	0
Dunfermline	Roadside	Automatic	100	98	0	0	0	0	0
Kirkcaldy	Roadside	Automatic	100	100	0	0	0	0	0
Rosyth	Roadside	Automatic	100	95	0	0	0	0	0

Notes:

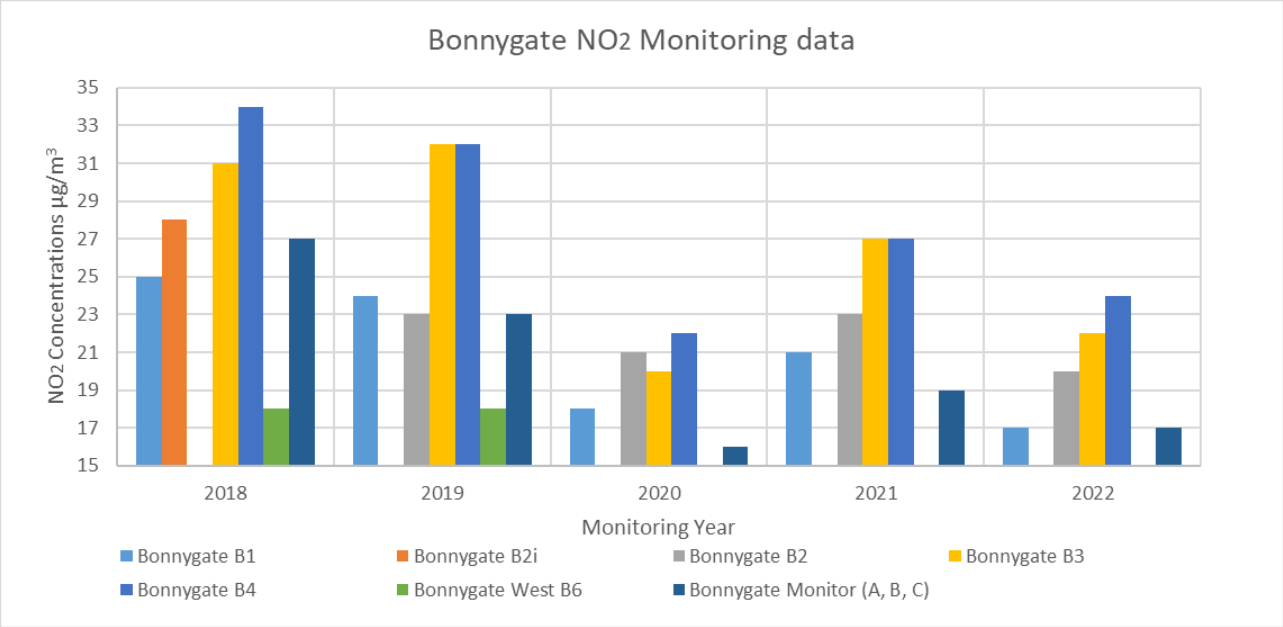
Exceedances of the NO_2 1-hour mean objective (200 µg m^{-3} not to be exceeded more than 18 times/year) are shown in bold.

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

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

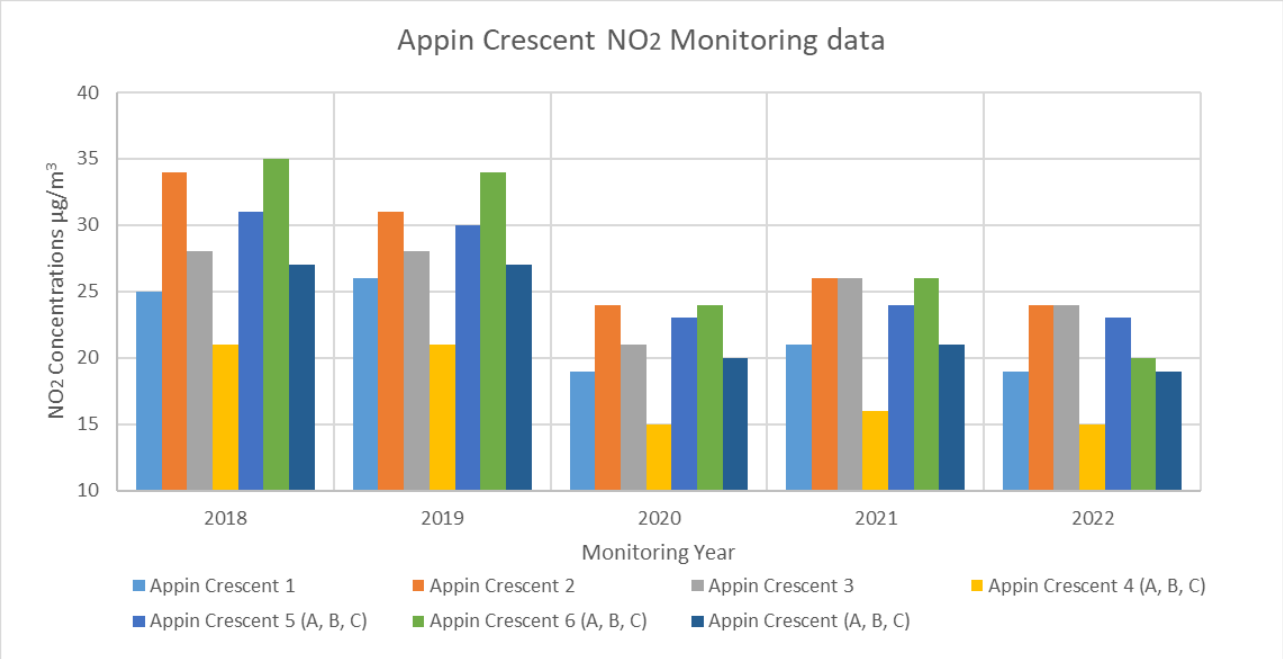
(2) Data capture for the full calendar year (e.g., if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

Figure A-1 Bonnygate Diffusion Tube Annual Mean Concentrations 2018-2022 (µg m^{-3})



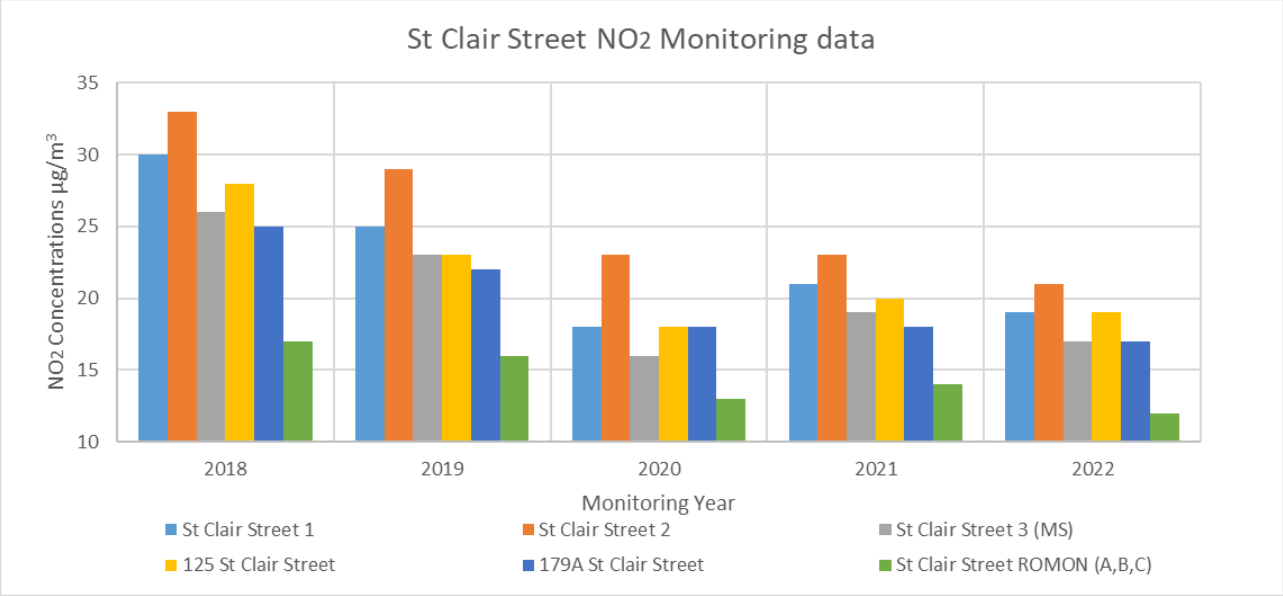
NO_2 annual mean concentrations for the Bonnygate area are presented in Figure A-1. Concentrations decreased at all sites between 2018 and 2020. Concentrations increased in 2021, likely due to COVID-19 lockdown and restrictions easing, however they remain below 2019. Concentrations continue to decrease in 2022 but remain lower than 2019.

Figure A-2 Appin Crescent Diffusion Tube Annual Mean Concentrations 2018-2022 (µg m^{-3})



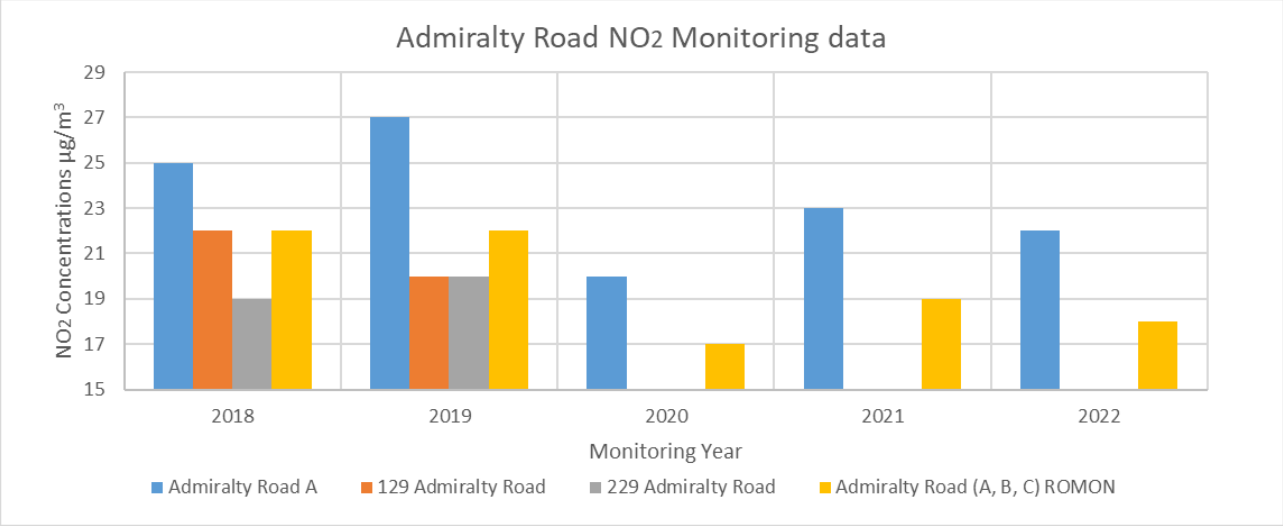
NO_2 annual mean concentrations for the Appin Crescent area are presented in Figure A-2. All sites seen a decline in concentrations between 2018 and 2020. Concentrations increased in 2021 compared to 2020, likely due to COVID-19 lockdown and restrictions easing. Concentrations decreased in 2022 and are similar to 2020.

Figure A-3 St Clair Street Diffusion Tube Annual Mean Concentrations 2018-2022 (µg m^{-3})



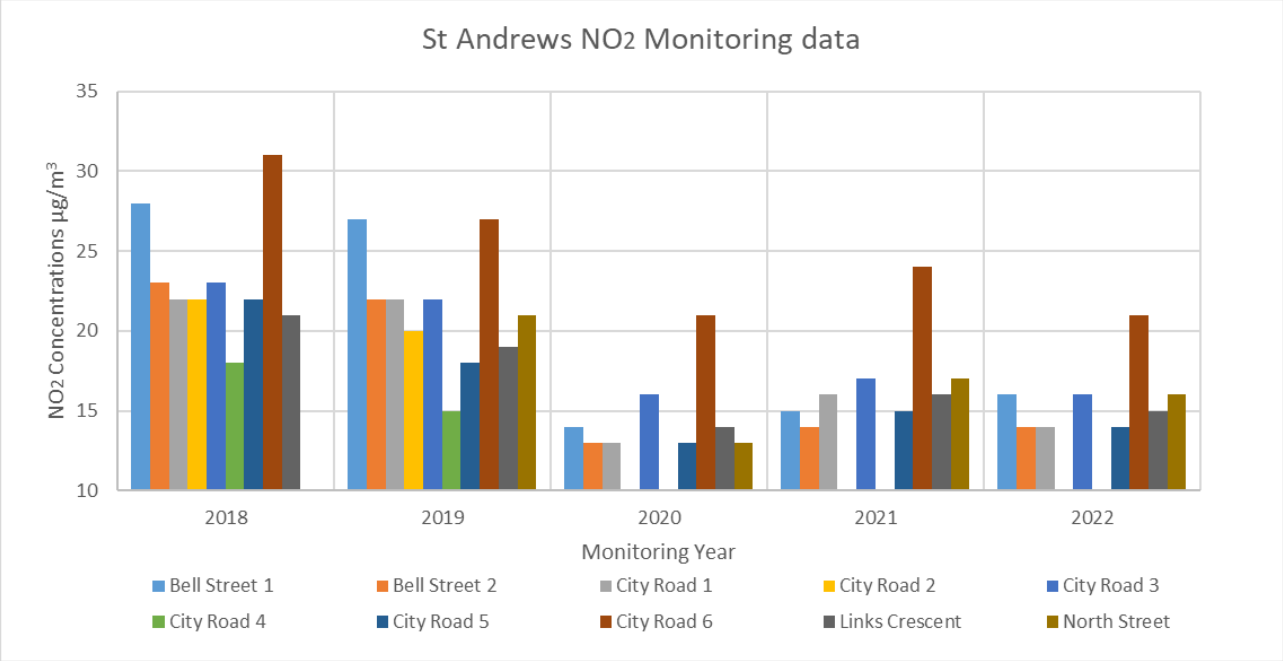
NO_2 annual mean concentrations for the St Clair Street area are presented in Figure A-3. Concentrations declined gradually between 2018 and 2020. Following the easing of COVID-19 lockdown and restrictions concentrations increased slightly in 2021 before decreasing again in 2022.

Figure A-4 Admiralty Road Diffusion Tube Annual Mean Concentrations 2018-2022 (µg m^{-3})



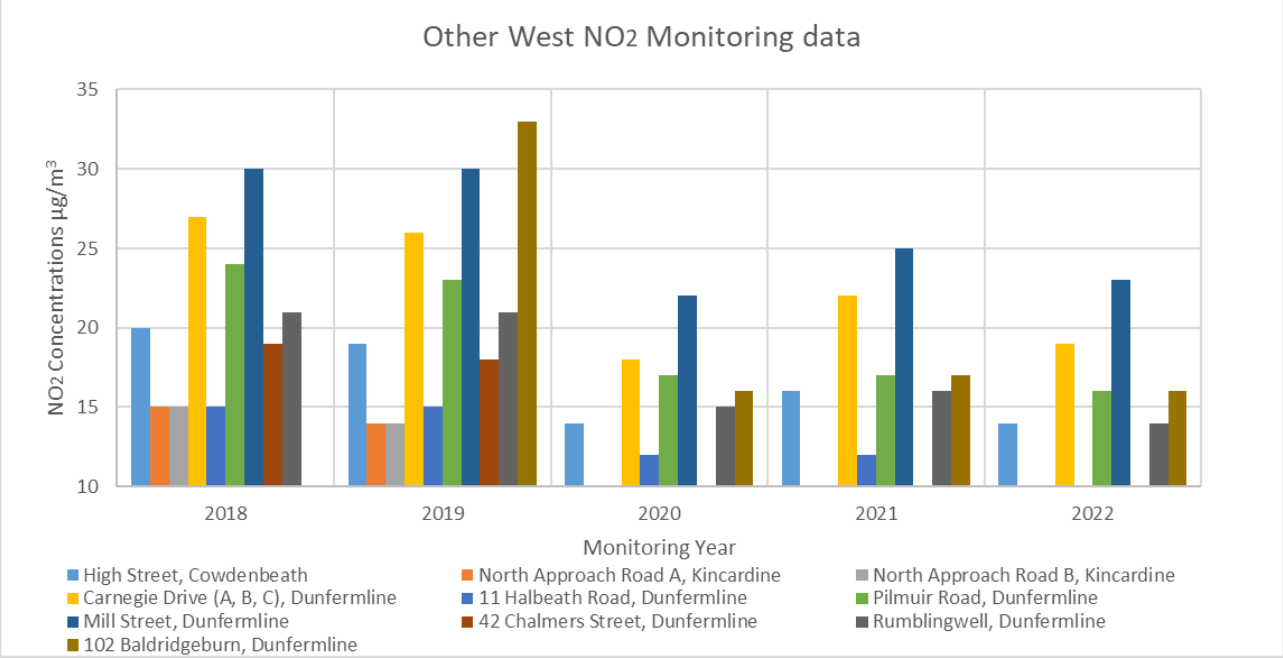
NO_2 annual mean concentrations for the Admiralty Road area are presented in Figure A-4. Concentrations increased slightly between 2018 and 2019, then gradually dropped in 2020. A few sites were decommissioned after 2019. Concentrations then increased in 2021 following the easing of COVID-19 lockdown and restrictions. 2022 concentrations decreased compared to 2021 but remain higher than 2020.

Figure A-5 St Andrews Diffusion Tube Annual Mean Concentrations 2018-2022 (µg m^{-3})



NO_2 annual mean concentrations for the St Andrews area are presented in Figure A-5. Between 2018 and 2020 concentrations declined. Two monitoring sites were decommissioned in 2020 and concentrations decreased at all sites. Concentrations increased in 2021 compared to 2020 following the easing of COVID-19 lockdown and restrictions, before decreasing slightly in 2022, although they remain below 2019 levels.

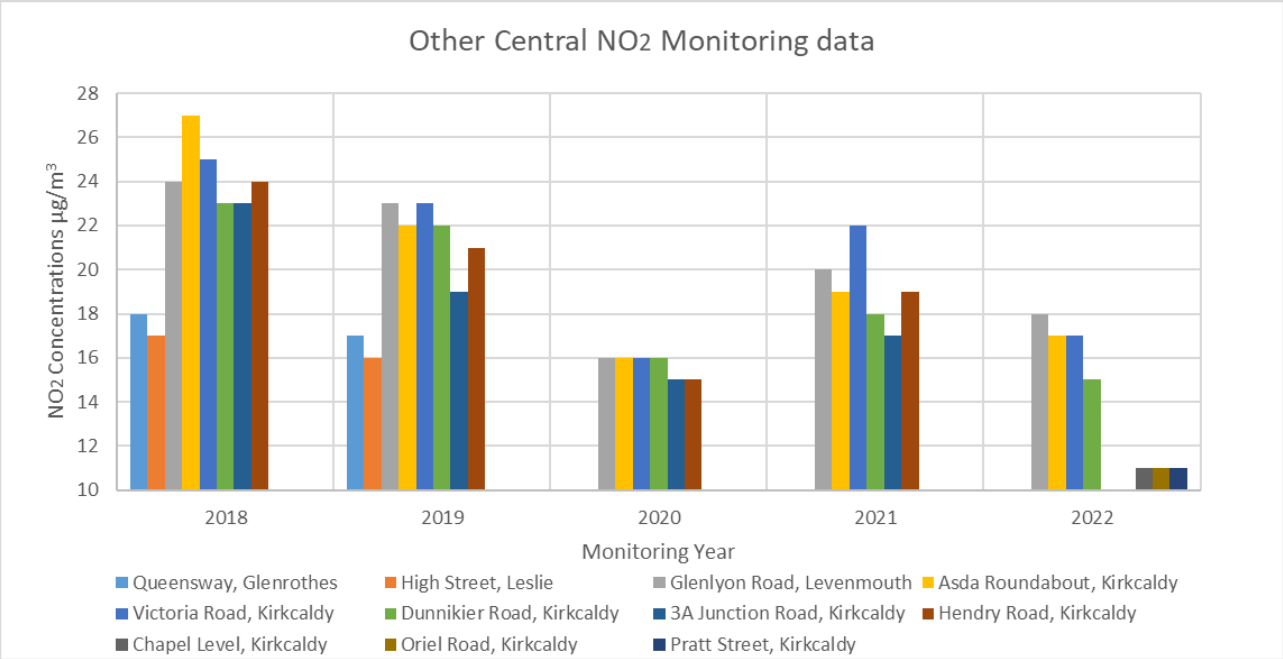
Figure A-6 Other West Diffusion Tube Annual Mean Concentrations 2018-2022 (µg m^{-3})



NO_2 annual mean concentrations for the other west areas in Fife are presented in Figure A-6. Concentrations remained consistent between 2018 and 2019 before declining in 2020. Three sites were removed in 2020. All sites increased slightly in 2021 following COVID-19

lockdown and restrictions easing. One site was removed in 2022 and concentrations reduced.

Figure A-7 Other Central Diffusion Tube Annual Mean Concentrations 2018-2022 (µg m^{-3})



NO_2 annual mean concentrations for the other central areas in Fife are presented in Figure A-7. Concentrations have declined between 2018 to 2020 at all monitoring sites. Two sites were decommissioned in 2020. Concentrations increased in 2021 compared to 2020 following the easing of COVID-19 lockdown and restrictions. A further two sites were decommissioned in 2022 and three were added. Concentrations decreased compared to 2021 but remain higher than 2020.

Table A.5 – Annual Mean PM_{10} Monitoring Results (µg m^{-3})

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2022 (%) (2)	2018	2018 Corrected#	2019	2019 Corrected#	2020	2020 Corrected#	2021	2021 Corrected#	2022	2022 Corrected#
Cupar	Kerbside	100	100	13.7	15.1	14.6	16.1	11.3	12.4	13.0	14.3	14.0	15.4
Dunfermline	Roadside	100	100	10.9	12.0	11.2	12.3	8.5	9.4	9.6	10.6	12.0	13.2
Kirkcaldy	Roadside	100	100	10.3	11.3	11.6	12.8	9.0	9.9	9.4	10.3	11.0	12.1
Rosyth	Roadside	100	100	10.5	11.6	10.00	11.0	9.1	10.0	9.9	10.9	11.0	12.1

Notes:

Exceedances of the PM_{10} annual mean objective of 18 µg m^{-3} are shown in bold.

* All means have been "annualised" as per LAQM.TG(22), valid data capture for the full calendar year is less than 75%. See Appendix C for details.

All means have been corrected using factors (PM_{10} divided by 0.909) identified by the "Scottish Government Equivalence Study To Investigate Particulate Matter Monitoring In Scotland Using The Fidas 200"[4]

(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%).

Table A.6 – 24-Hour Mean PM_{10} Monitoring Results, Number of PM_{10} 24-Hour Means > 50 µg m^{-3}

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2021 (%) (2)	2018	2019	2020	2021	2022
Cupar	Kerbside	100	100	1	0	0	0	0
Dunfermline	Roadside	100	100	0	0	0	0	0
Kirkcaldy	Roadside	100	100	0	0	0	0	0
Rosyth	Roadside	100	100	0	0	0	0	0

Notes:

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

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

All data have been corrected using factors (PM_{10} divided by 0.909) identified by the "Scottish Government Equivalence Study To Investigate Particulate Matter Monitoring In Scotland Using The Fidas 200"[4]

(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%).

Table A.7 – Annual Mean $PM_{2.5}$ Monitoring Results (µg m^{-3})

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2022 (%) (2)	2018	2018 Corrected#	2019	2019 Corrected#	2020	2020 Corrected#	2021	2021 Corrected#	2022	2022 Corrected#
Cupar	Kerbside	100	100	6.7	7.1	7.5	8.0	5.6	5.9	6.3	6.7	7.0	7.4
Dunfermline	Roadside	100	100	6.1	6.5	6.4	6.8	4.8	5.1	5.5	5.8	6.0	6.4
Kirkcaldy	Roadside	100	100	5.9	6.3	6.7	7.1	5.0	5.3	5.3	5.6	6.0	6.4
Rosyth	Roadside	100	100	6.0	6.4	5.9	6.3	5.1	5.4	5.5	5.8	6.0	6.4

Notes:

Exceedances of the $PM_{2.5}$ annual mean objective of 10 µg m^{-3} are shown in bold.

* All means have been "annualised" as per LAQM.TG(22), valid data capture for the full calendar year is less than 75%. See Appendix C for details.

All means have been corrected using factors ($PM_{2.5}$ multiplied by 1.06) identified by the "Scottish Government Equivalence Study To Investigate Particulate Matter Monitoring In Scotland Using The Fidas 200"[4]

(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%).

Appendix B Full Monthly Diffusion Tube Results for 2022

Table B.1 – NO_2 2022 Monthly Diffusion Tube Results (µg m^{-3})

Site ID	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean: Raw Data	Annual Mean: Bias Adjusted (1)
Central														
St Clair Street 1, Kirkcaldy	29.8	23.2	41.1	36.7	30.7	25.4	25.8	27.6	31.1	26.7	32.8	31.6	30.2	18.7
St Clair Street 2, Kirkcaldy	49.4	41.8	41.2	27.5	25.7	29.3	28.1	32.2	26.3	31.4	35.9	35.6	33.7	20.9
St Clair Street 3, Kirkcaldy	26.1	21.4	38.4	34.2	25.1	22.7	22.4	25.2	24.9	25.7	34.7	27.4	27.4	17.0
125 St Clair Street, Kirkcaldy	43.0	32.8	39.8	24.9	23.1	23.1	23.7	28.5	24.1	29.1	31.0	37.6	30.1	18.6
179A St Clair Street, Kirkcaldy	39.1	30.9	34.2	22.2	21.8	21.7	20.0	26.2	23.2	26.2	29.6	35.6	27.6	17.1
St Clair Street Romon A, Kirkcaldy	29.7	21.5	25.0	17.3	15.5	15.5	15.8	17.0	15.9	17.8	21.7	28.8	20.1	12.4
St Clair Street Romon B, Kirkcaldy	25.9	20.1	26.1	19.5	16.9	14.5	15.6	17.7	16.1	17.2	23.3	30.3		
St Clair Street Romon C, Kirkcaldy	29.3	20.7	24.6	17.5	16.9	12.6	15.3	No return	15.4	17.9	21.7	26.4		
Glenlyon, Leven	32.4	26.1	33.3	24.9	21.0	17.5	18.8	23.4	20.2	23.2	25.8	29.9	24.7	17.6
ASDA Roundabout, Kirkcaldy	27.3	23.6	36.2	30.1	21.4	22.2	21.0	23.5	22.6	25.7	33.5	28.2	27.0	16.7
Victoria Road, Kirkcaldy	34.7	24.7	43.1	32.3	No return	23.0	24.5	28.8	No return	No return	30.2	29.5	27.5	17.1

Site ID	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean: Raw Data	Annual Mean: Bias Adjusted (1)
Dunnikier Road, Kirkcaldy	26.7	20.3	35.7	29.6	20.7	19.9	18.9	22.5	25.6	23.9	No return	34.1	23.6	14.7
Henry Road, Kirkcaldy	33.2	30.1	34.3	26.9	27.4	21.1	26.8	28.5	24.8	29.4	24.9	24.6	27.7	17.2
Chapel Level, Kirkcaldy	23.1	16.1	24.7	15.3	15.1	13.5	15.1	16.9	17.1	16.9	18.1	25.7	18.1	11.2
Oriel Road, Kirkcaldy	20.9	14.5	26.8	20.6	13.5	12.4	15.1	16.0	15.2	15.2	22.4	23.9	18.0	11.2
Pratt Street, Kirkcaldy	21.5	17.6	24.8	17.8	12.4	12.9	15.0	15.4	14.9	15.4	20.9	21.8	17.5	10.9
East														
City Road 1, St Andrews	15.1	15.6	28.5	27.0	19.0	16.0	15.5	21.7	21.6	16.1	25.0	No return	20.1	14.4
Bell Street 1, St Andrews	24.1	25.4	31.9	26.8	No return	18.0	20.3	20.4	20.1	19.3	23.3	23.4	23.0	16.4
Bell Street 2, St Andrews	22.8	19.6	26.1	23.1	20.5	14.5	17.8	18.9	17.2	16.3	19.8	20.6	19.8	14.1
City Road 3, St Andrews	26.9	23.3	25.6	23.8	20.5	19.6	21.7	21.6	22.1	19.3	26.7	24.1	22.9	16.4
City Road 5, St Andrews	19.1	18.3	30.2	22.0	18.0	17.3	19.3	17.4	18.4	20.4	21.0	20.5	20.2	14.4
City Road 6, St Andrews	28.9	25.9	37.0	25.3	27.6	26.6	28.6	35.7	32.7	No return	25.8	30.3	29.5	21.1
Links Crescent, St Andrews	19.6	17.9	26.3	22.9	19.6	17.2	20.1	21.2	20.7	17.9	22.0	20.2	20.5	14.6
North Street, St Andrews	25.5	23.4	29.4	24.4	21.3	17.6	18.9	24.6	18.9	19.8	23.8	22.3	22.5	16.1

Site ID	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean: Raw Data	Annual Mean: Bias Adjusted (1)
Bonnygate B1, Cupar	27.9	23.2	34.2	27.7	21.3	18.5	18.1	22.2	22.8	19.8	23.7	30.9	24.2	17.2
Bonnygate B2, Cupar	34.5	29.6	34.4	28.1	25.4	19.4	20.3	28.4	25.4	18.7	31.1	34.5	27.5	19.5
Bonnygate B4, Cupar	37.4	33.6	44.5	34.8	29.4	No return	28.2	32.2	30.0	24.8	36.2	38.7	33.6	23.9
Bonnygate B3, Cupar	30.2	27.6	39.3	38.8	28.5	22.3	24.0	30.8	33.9	20.4	33.5	36.0	30.4	21.6
Bonnygate Monitor A, Cupar	27.2	23.7	31.6	26.9	18.0	17.8	19.8	23.0	22.3	20.4	34.0	32.6		
Bonnygate Monitor B, Cupar	26.1	22.3	32.9	26.3	17.8	17.3	19.5	23.3	18.5	21.2	29.8	29.8	24.2	17.2
Bonnygate Monitor C, Cupar	27.4	21.1	31.7	26.5	21.5	18.8	17.7	22.3	21.6	21.4	27.7	31.6		
West														
High Street, Cowdenbeath	19.1	12.8	28.0	24.1	15.0	13.4	15.5	16.9	21.4	18.4	21.5	26.2	19.4	13.8
Admiralty Road A, Rosyth	29.7	25.5	35.4	27.2	14.7	17.8	20.6	23.9	27.4	22.4	29.2	32.6	25.5	22.2
Admiralty Road ROMAN A, Rosyth	23.3	19.2	31.7	20.5	13.7	14.1	16.3	20.0	20.0	16.7	24.6	29.5		
Admiralty Road ROMAN B, Rosyth	22.2	18.1	28.6	20.1	13.5	13.9	13.1	19.8	18.2	18.0	24.8	26.4	20.3	17.7
Admiralty Road ROMAN C, Rosyth	20.5	20.6	31.6	20.2	12.7	13.0	17.4	19.7	20.4	15.9	24.2	28.5		
Carnegie Drive A, Dunfermline	25.7	23.0	34.8	31.3	19.2	22.6	25.1	26.7	26.3	26.7	32.8	31.8	27.7	19.4

Site ID	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean: Raw Data	Annual Mean: Bias Adjusted (1)
Carnegie Drive B, Dunfermline	27.3	22.6	37.0	30.7	23.3	24.6	25.1	26.6	26.0	26.3	34.9	34.1		
Carnegie Drive C, Dunfermline	26.6	22.2	36.0	31.2	22.8	22.8	24.9	27.2	25.9	25.9	34.4	32.1		
Pilmuir Street, Dunfermline	28.3	23.7	30.7	22.4	17.1	21.4	17.4	20.8	20.6	23.3	24.1	29.6	23.3	16.3
Mill Street, Dunfermline	36.6	31.2	40.7	30.5	26.0	26.2	27.4	33.0	32.8	29.9	41.4	41.9	33.1	23.2
Rumblingwell, Dunfermline	26.7	20.8	26.2	19.8	16.1	15.2	13.9	18.8	17.3	20.6	23.9	25.1	20.4	14.3
102 Baldridgeburn, Dunfermline	29.3	22.6	29.0	22.6	17.0	15.5	16.9	19.9	19.9	19.4	26.6	37.9	23.1	16.1
Appin Crescent 1, Dunfermline	39.9	34.3	35.7	25.9	19.3	22.9	21.4	24.5	20.7	27.0	27.1	34.8	27.8	19.5
Appin Crescent 2, Dunfermline	44.3	34.1	47.1	29.7	28.0	25.0	25.0	31.0	29.2	30.5	39.1	48.2	34.3	24.0
Appin Crescent 3, Dunfermline	45.1	36.4	47.4	33.1	25.4	22.9	25.1	29.7	26.3	32.4	44.7	43.6	34.3	24.0
Appin Crescent A, Dunfermline	38.1	31.1	36.8	27.8	20.6	19.7	20.5	24.4	24.8	27.2	37.4	37.0		
Appin Crescent B, Dunfermline	39.7	33.3	38.4	27.1	22.3	20.4	20.9	25.2	24.9	27.8	32.7	41.0	28.8	20.2
Appin Crescent C, Dunfermline	37.7	32.5	39.4	28.1	20.8	21.1	22.0	24.1	23.0	27.3	21.4	40.4		
Appin Crescent 4A, Dunfermline	29.0	23.8	29.9	20.2	15.7	14.1	15.8	17.0	17.5	21.0	23.2	29.1	21.1	14.8

Site ID	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean: Raw Data	Annual Mean: Bias Adjusted (1)
Appin Crescent 4B, Dunfermline	28.7	24.1	31.8	18.9	15.1	14.1	16.8	18.2	17.5	19.4	24.2	28.8		
Appin Crescent 4C, Dunfermline	26.1	23.5	28.8	18.9	14.9	13.9	13.3	17.3	16.3	21.8	24.0	27.9		
Appin Crescent 5A, Dunfermline	48.2	40.5	37.6	28.6	24.7	24.3	26.0	28.4	25.7	39.9	35.0	40.8	32.5	22.7
Appin Crescent 5B, Dunfermline	42.8	40.1	42.8	27.7	27.4	23.8	27.1	25.8	26.7	30.8	34.0	43.4		
Appin Crescent 5C, Dunfermline	42.3	39.1	39.7	29.2	26.0	22.8	24.6	28.3	24.2	29.7	30.2	40.4		
Appin Crescent 6A, Dunfermline	45.6	34.5	47.5	32.0	26.8	25.7	25.1	30.5	27.0	30.0	40.2	40.2	35.1	24.6
Appin Crescent 6B, Dunfermline	45.6	35.3	44.6	29.8	28.7	25.4	27.9	30.3	28.3	35.0	36.9	44.3		
Appin Crescent 6C, Dunfermline	46.7	37.0	43.5	36.5	52.0	25.6	29.1	32.0	31.9	25.3	40.6	47.2		

Notes:

(1) See Appendix C for details on bias adjustment

Appendix C Air Quality Monitoring Data QA/QC

New or Changed Sources Identified Within Fife Council During 2022

Fife Council has not identified any new sources relating to air quality within the reporting year of 2022.

Additional Air Quality Works Undertaken by Fife Council During 2022

Fife Council has not completed any additional works within the reporting year of 2022.

QA/QC of Diffusion Tube Monitoring

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.

Diffusion Tube Annualisation

All diffusion tube monitoring locations within Fife Council recorded data capture of 75% therefore it was not required to annualise any monitoring data. In addition, any sites with a data capture below 25% do not require annualisation.

Diffusion Tube Bias Adjustment Factors

Fife Council have applied a local bias adjustment factor to the 2022 monitoring data. A summary of bias adjustment factors used by Fife Council over the past five years is presented in Table C.1.

Table C.1 – Bias Adjustment Factor

Year	Local or National	If National, Version of National Spreadsheet	Average Adjustment Factor
2022	Local	-	0.71
2021	Local	-	0.75
2020	Local	-	0.68
2019	Local	-	0.74
2018	Local	-	0.78

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. These are Cupar – Bonnygate, Dunfermline – Appin Crescent, Kirkcaldy – St Clair Street and Rosyth – Admiralty Road. The local bias adjustment factor for each individual location was calculated using the "LAQM Tool" described in LAQM TG(22). The results are shown in Table C.2 and summarised in Table C.3 below. The average of the local bias adjustment factors is 0.71.

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

Table C.2 Local Bias Adjustment

	Local Bias Adjustment – Cupar	Local Bias Adjustment – Dunfermline	Local Bias Adjustment – Kirkcaldy	Local Bias Adjustment – Rosyth
Periods used to calculate bias	12	12	12	12
Bias Factor A	0.71 (0.67 – 0.77)	0.70 (0.65 – 0.76)	0.62 (0.57 – 0.68)	0.87 (0.80 – 0.96)
Bias Factor B	40% (30% – 50%)	43% (31% – 54%)	61% (47% –75%)	14% (4% –25%)
Diffusion Tube Mean (µg m^{-3})	24	21	20	21
Mean CV (Precision)	5	4	5	5
Automatic Mean (µg m^{-3})	17	15	12	18
Data Capture	98%	98%	100%	99%
Adjusted Tube Mean (µg m^{-3})	17 (16 – 19)	15 (14 – 16)	12 (11 – 14)	18 (17 – 20)

Table C.3 Local Bias Adjustment Summary

Source	Bias Adjustment Factors 2022
Cupar	0.71
Dunfermline	0.70
Kirkcaldy	0.62
Rosyth	0.87
Average Local Bias factor	0.71

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

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	Automatic Method: Period Mean	Automatic Method: Data Capture (% DC)	Data Quality Check: Tubes Precision Check	Data Quality Check: Automatic Monitor Data
1	05/01/2022	01/02/2022	27.2	26.1	27.4	27	0.7	3	1.7	20.1	99	Good	Good
2	01/02/2022	01/03/2022	23.7	22.3	21.1	22	1.3	6	3.2	16.3	99	Good	Good
3	01/03/2022	28/03/2022	31.6	32.9	31.7	32	0.7	2	1.8	17.9	97	Good	Good
4	28/03/2022	03/05/2022	26.9	26.3	26.5	27	0.3	1	0.8	19	98	Good	Good
5	03/05/2022	07/06/2022	18.0	17.8	21.5	19	2.1	11	5.2	13	98	Good	Good
6	07/06/2022	05/07/2022	17.8	17.3	18.8	18	0.8	4	1.9	12	98	Good	Good
7	05/07/2022	03/08/2022	19.8	19.5	17.7	19	1.1	6	2.8	13	98	Good	Good
8	03/08/2022	31/08/2022	23.0	23.3	22.3	23	0.5	2	1.3	15	98	Good	Good
9	31/08/2022	28/09/2022	22.3	18.5	21.6	21	2.0	10	5.0	16	98	Good	Good
10	28/09/2022	01/11/2022	20.4	21.2	21.4	21	0.5	3	1.3	16	99	Good	Good
11	01/11/2022	29/11/2022	34.0	29.8	27.7	31	3.2	11	8.0	22.6	98	Good	Good
12	29/11/2022	05/01/2023	32.6	29.8	31.6	31	1.4	5	3.5	26.8	97	Good	Good
13													

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

Overall survey --> Good Good

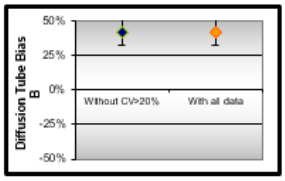
Site Name/ ID: Cupar - Bonnygate

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

(Check average CV & DC from Accuracy calculations)

Accuracy (with 95% confidence interval) without periods with CV larger than 20%
Bias calculated using 12 periods of data
Bias factor A: 0.71 (0.67 - 0.77)
Bias B: 40% (30% - 50%)
Diffusion Tubes Mean: 24 µgm^{-3}
Mean CV (Precision): 5
Automatic Mean: 17 µgm^{-3}
Data Capture for periods used: 98%
Adjusted Tubes Mean: 17 (16 - 19) µgm^{-3}

Accuracy (with 95% confidence interval) WITH ALL DATA
Bias calculated using 12 periods of data
Bias factor A: 0.71 (0.67 - 0.77)
Bias B: 40% (30% - 50%)
Diffusion Tubes Mean: 24 µgm^{-3}
Mean CV (Precision): 5
Automatic Mean: 17 µgm^{-3}
Data Capture for periods used: 98%
Adjusted Tubes Mean: 17 (16 - 19) µgm^{-3}



Jaume Targa, for AEA
Version 04 - February 2011

Figure C-2 Local bias adjustment spreadsheet - Dunfermline

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	Automatic Method: Period Mean	Automatic Method: Data Capture (% DC)	Data Quality Check: Tubes Precision Check	Data Quality Check: Automatic Monitor Data
1	05/01/2022	31/01/2022	29.0	28.7	26.1	28	1.6	6	4.0	20.8	98	Good	Good
2	31/01/2022	01/03/2022	23.8	24.1	23.5	24	0.3	1	0.7	15.7	98	Good	Good
3	01/03/2022	28/03/2022	29.9	31.8	28.8	30	1.5	5	3.8	22.6	98	Good	Good
4	28/03/2022	03/05/2022	20.2	18.9	18.9	19	0.8	4	1.9	13.3	99	Good	Good
5	03/05/2022	06/06/2022	15.7	15.1	14.9	15	0.4	3	1.0	9	99	Good	Good
6	06/06/2022	06/07/2022	14.1	14.1	13.9	14	0.1	1	0.3	8	98	Good	Good
7	06/07/2022	01/08/2022	15.8	16.8	13.3	15	1.8	12	4.5	9	99	Good	Good
8	01/08/2022	29/08/2022	17.0	18.2	17.3	18	0.6	4	1.6	11	99	Good	Good
9	29/08/2022	26/09/2022	17.5	17.5	16.3	17	0.7	4	1.7	12	99	Good	Good
10	26/09/2022	31/10/2022	21.0	19.4	21.8	21	1.2	6	3.0	14	98	Good	Good
11	31/10/2022	28/11/2022	23.2	24.2	24.0	24	0.5	2	1.3	17.2	98	Good	Good
12	28/11/2022	06/01/2023	29.1	28.8	27.9	29	0.6	2	1.6	25.5	98	Good	Good
13													

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

Overall survey --> Good Good

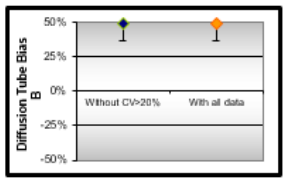
Site Name/ ID: Dunfermline - Appin Crescent

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

(Check average CV & DC from Accuracy calculations)

Accuracy (with 95% confidence interval) without periods with CV larger than 20%
Bias calculated using 12 periods of data
Bias factor A: 0.7 (0.65 - 0.76)
Bias B: 43% (31% - 54%)
Diffusion Tubes Mean: 21 µgm^{-3}
Mean CV (Precision): 4
Automatic Mean: 15 µgm^{-3}
Data Capture for periods used: 98%
Adjusted Tubes Mean: 15 (14 - 16) µgm^{-3}

Accuracy (with 95% confidence interval) WITH ALL DATA
Bias calculated using 12 periods of data
Bias factor A: 0.7 (0.65 - 0.76)
Bias B: 43% (31% - 54%)
Diffusion Tubes Mean: 21 µgm^{-3}
Mean CV (Precision): 4
Automatic Mean: 15 µgm^{-3}
Data Capture for periods used: 98%
Adjusted Tubes Mean: 15 (14 - 16) µgm^{-3}



Jaume Targa, for AEA
Version 04 - February 2011

Figure C-3 Local bias adjustment 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	04/01/2022	31/01/2022	29.7	25.9	29.3	28	2.1	7	5.2	16.6	100	Good	Good
2	31/01/2022	28/02/2022	21.5	20.1	20.7	21	0.7	3	1.7	11.9	100	Good	Good
3	28/02/2022	28/03/2022	25.0	26.1	24.6	25	0.8	3	1.9	19.7	100	Good	Good
4	28/03/2022	03/05/2022	17.3	19.5	17.5	18	1.2	7	3.0	11	100	Good	Good
5	03/05/2022	06/06/2022	15.5	16.9	16.9	16	0.8	5	2.0	7	100	Good	Good
6	06/06/2022	04/07/2022	15.5	14.5	12.6	14	1.5	10	3.7	8	100	Good	Good
7	04/07/2022	01/08/2022	15.8	15.6	15.3	16	0.3	2	0.6	9	100	Good	Good
8	01/08/2022	29/08/2022	17.0	17.7		17	0.5	3	4.4	11	100	Good	Good
9	29/08/2022	26/09/2022	15.9	16.1	15.4	16	0.4	2	0.9	10	100	Good	Good
10	26/09/2022	31/10/2022	17.8	17.2	17.9	18	0.4	2	0.9	11	100	Good	Good
11	31/10/2022	28/11/2022	21.7	23.3	21.7	22	0.9	4	2.3	13.8	100	Good	Good
12	28/11/2022	05/01/2023	28.8	30.3	26.4	29	2.0	7	4.9	20.1	100	Good	Good
13													
												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

Overall survey -->

(Check average CV & DC from Accuracy calculations)

Site Name/ ID: Kirkcaldy - St Clair Street

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 (0.57 - 0.68)

Bias B: 61% (47% - 75%)

Diffusion Tubes Mean: 20 µgm^{-3}

Mean CV (Precision): 5

Automatic Mean: 12 µgm^{-3}

Data Capture for periods used: 100%

Adjusted Tubes Mean: 12 (11 - 14) µgm^{-3}

Accuracy (with 95% confidence interval) WITH ALL DATA

Bias calculated using 12 periods of data

Bias factor A: 0.62 (0.57 - 0.68)

Bias B: 61% (47% - 75%)

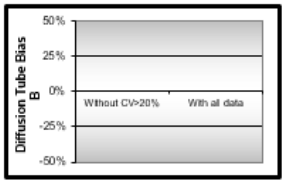
Diffusion Tubes Mean: 20 µgm^{-3}

Mean CV (Precision): 5

Automatic Mean: 12 µgm^{-3}

Data Capture for periods used: 100%

Adjusted Tubes Mean: 12 (11 - 14) µgm^{-3}



Jaume Targa, for AEA
Version 04 - February 2011

Figure C-4 Local bias adjustment spreadsheet - Rosyth

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	05/01/2022	31/01/2022	23.3	22.2	20.5	22	1.4	6	3.5	18.6	98	Good	Good
2	31/01/2022	01/03/2022	19.2	18.1	20.6	19	1.3	6	3.1	14	99	Good	Good
3	01/03/2022	28/03/2022	31.7	28.6	31.6	31	1.8	6	4.4	28.4	98	Good	Good
4	28/03/2022	03/05/2022	20.5	20.1	20.2	20	0.2	1	0.5	19.1	99	Good	Good
5	03/05/2022	06/06/2022	13.7	13.5	12.7	13	0.5	4	1.3	16	99	Good	Good
6	06/06/2022	06/07/2022	14.1	13.9	13.0	14	0.6	4	1.5	10	49	Good	or Data Capture
7	06/07/2022	01/08/2022	16.3	13.1	17.4	16	2.2	14	5.5	12	99	Good	Good
8	01/08/2022	29/08/2022	20.0	19.8	19.7	20	0.2	1	0.4	15	100	Good	Good
9	29/08/2022	26/09/2022	20.0	18.2	20.4	20	1.2	6	2.9	15	99	Good	Good
10	26/09/2022	31/10/2022	16.7	18.0	15.9	17	1.1	6	2.6	14	100	Good	Good
11	31/10/2022	28/11/2022	24.6	24.8	24.2	25	0.3	1	0.8	19.6	100	Good	Good
12	28/11/2022	06/01/2023	29.5	26.4	28.5	28	1.6	6	4.0	28.8	100	Good	Good
13													
												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

Overall survey -->

(Check average CV & DC from Accuracy calculations)

Site Name/ ID: Rosyth - Admirality Road

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 11 periods of data

Bias factor A: 0.87 (0.8 - 0.96)

Bias B: 14% (4% - 25%)

Diffusion Tubes Mean: 21 µgm^{-3}

Mean CV (Precision): 5

Automatic Mean: 18 µgm^{-3}

Data Capture for periods used: 99%

Adjusted Tubes Mean: 18 (17 - 20) µgm^{-3}

Accuracy (with 95% confidence interval) WITH ALL DATA

Bias calculated using 11 periods of data

Bias factor A: 0.87 (0.8 - 0.96)

Bias B: 14% (4% - 25%)

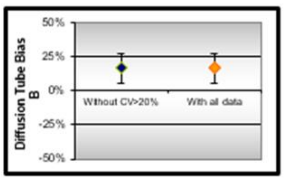
Diffusion Tubes Mean: 21 µgm^{-3}

Mean CV (Precision): 5

Automatic Mean: 18 µgm^{-3}

Data Capture for periods used: 99%

Adjusted Tubes Mean: 18 (17 - 20) µgm^{-3}



Jaume Targa, for AEA
Version 04 - February 2011

NO_2 Fall-off with Distance from the Road

No diffusion tube NO_2 monitoring locations within Fife Council required distance correction during 2022.

QA/QC of Automatic Monitoring

The QA/QC procedures follow the requirements of the Technical Guidance (TG.22) 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.22), 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.

The Local Site Operator (LSO) duties are carried out by EnviroTechnology on behalf of Fife. 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. The SAQD (Ricardo) are responsible for the data management. 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.

Monitoring data presented within the APR is ratified. Live and historic data is available on the Scottish Air Quality Website: https://www.scottishairquality.scot/data.

PM_{10} and $PM_{2.5}$ Monitoring Adjustment

PM_{10} and $PM_{2.5}$ monitoring is completed within Fife Council. The PM equivalence study[3] carried out by the Scottish Government identified that when monitoring using the FIDAS 200 technique correction factors for PM_{10} and $PM_{2.5}$ should be applied. The Scottish Government guidance[4] states that corrections should be applied when reporting data within the LAQM reporting regime. The correction factors should be applied to the data collected within the SAQD. PM_{10} data should be divided by 0.909 and $PM_{2.5}$ data should be multiplied by 1.06.

Automatic Monitoring Annualisation

All automatic monitoring locations within Fife Council recorded data capture of greater than 75% therefore it was not required to annualise any monitoring data. In addition, any sites with a data capture below 25% do not require annualisation.

NO_2 Fall-off with Distance from the Road

No automatic NO_2 monitoring locations within Fife Council required distance correction during 2022.

Appendix D Technical Specification of Automatic Monitoring Equipment

Figure D-1 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:	Manual certified calibration by EnviroTechnology Services with 6-monthly audits by Ricardo
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:	3-weekly manual calibration by EnviroTechnology Services
Site service arrangements:	6-monthly detailed service by EnviroTechnology Services
Co-located passive sampler	Triplicate NO_2 tubes installed

Figure D-2 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:	Manual certified calibration by EnviroTechnology Services with 6-monthly audits by Ricardo
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:	3-weekly manual calibration by EnviroTechnology Services
Site service arrangements:	6-monthly detailed service by EnviroTechnology Services
Co-located passive sampler	Triplicate NO_2 tubes installed

Figure D-3 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:	Manual certified calibration by EnviroTechnology Services with 6-monthly audits by Ricardo
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:	3-weekly manual calibration by EnviroTechnology Services
Site service arrangements:	6-monthly detailed service by EnviroTechnology Services
Co-located passive sampler	Triplicate NO_2 tubes installed

Figure D-4 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:	Manual certified calibration by EnviroTechnology Services with 6-mothly audits by Ricardo
Pollutants measured on site:	PM_{10}, $PM_{2.5}$, PM_1, TSP, NOx, NO, NO_2
Instrument manufacturer:	FIDAS 200 NOx – Thermo 42i (Jan to Sept) Teledyne API T200 (Sept onwards)
Calibration procedure and frequency:	3-weekly manual calibration by EnviroTechnology Services
Site service arrangements:	6-monthly detailed service by EnviroTechnology Services
Co-located passive sampler	Triplicate NO_2 tubes installed

Appendix E AQMesh monitoring Data Management and Processing 2022

Introduction

In November 2017, Fife Council began a sensor monitoring study to gain a better understanding of air pollution concentrations in the Bonnygate, Cupar and Appin Crescent, Dunfermline Air Quality Management Areas (AQMA) using three AQMesh sensor pods. During June 2022, Fife Council enhanced their sensor network by installing an additional two sensor pods at areas of concern to further assess air pollution in these areas. These were St Clair Street, Kirkcaldy and City Road, St Andrews.

Fife Council contracted Ricardo Energy and Environment (Ricardo) to manage, quality assure and quality control (QA/QC) the data from this study. This report provides a summary of the data from the Fife Council air quality sensor network from 1st January – 31st December 2022.

Methodology

The pollutants of concern that the AQMesh sensor systems are monitoring in this study are nitrogen dioxide (NO_2) and particulate matter (PM_{10} and $PM_{2.5}$). The AQMesh is an air quality sensor system which is able 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 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 formally assessed through the United Kingdom (UK) equivalence programme (e.g., Environment Agency's Monitoring Certification Scheme (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 any relevant air quality standards. For this study, all five AQMesh pods were set to measure 15-minute averages.

The locations of the pods are illustrated in Figures E-1 to E-4. For Bonnygate, Appin Crescent, and City Road locations, the AQMesh were collocated with existing diffusion tube locations. For the St Clair Street location, the AQMesh pod was located 13 metres south-west from the existing diffusion tube at St Clair Street 2, as it was not feasible to co-locate at the nearby St Clair Street (2). It should also be noted that the City Road location was changed on the 19th of December 2022. This was due to the solar panel used to power the AQMesh not being exposed to enough sunlight. The change in location is illustrated in Figure E-4. Due to the lateness in the year when the change occurred and the relatively near site of the new location, the 2022 analysis has not separated the data out.

For all AQMesh locations, particulate matter was not measured prior to installation due to accessibility reasons. NO_2 has been measured at locations (where collocated) using diffusion tubes, which provide indicative annual average concentrations of NO_2.

Photographs of the installed AQMesh units are also shown below in Figure E-5 and E-6.

Figure E-1: Bonnygate, Cupar AQMesh sensor location

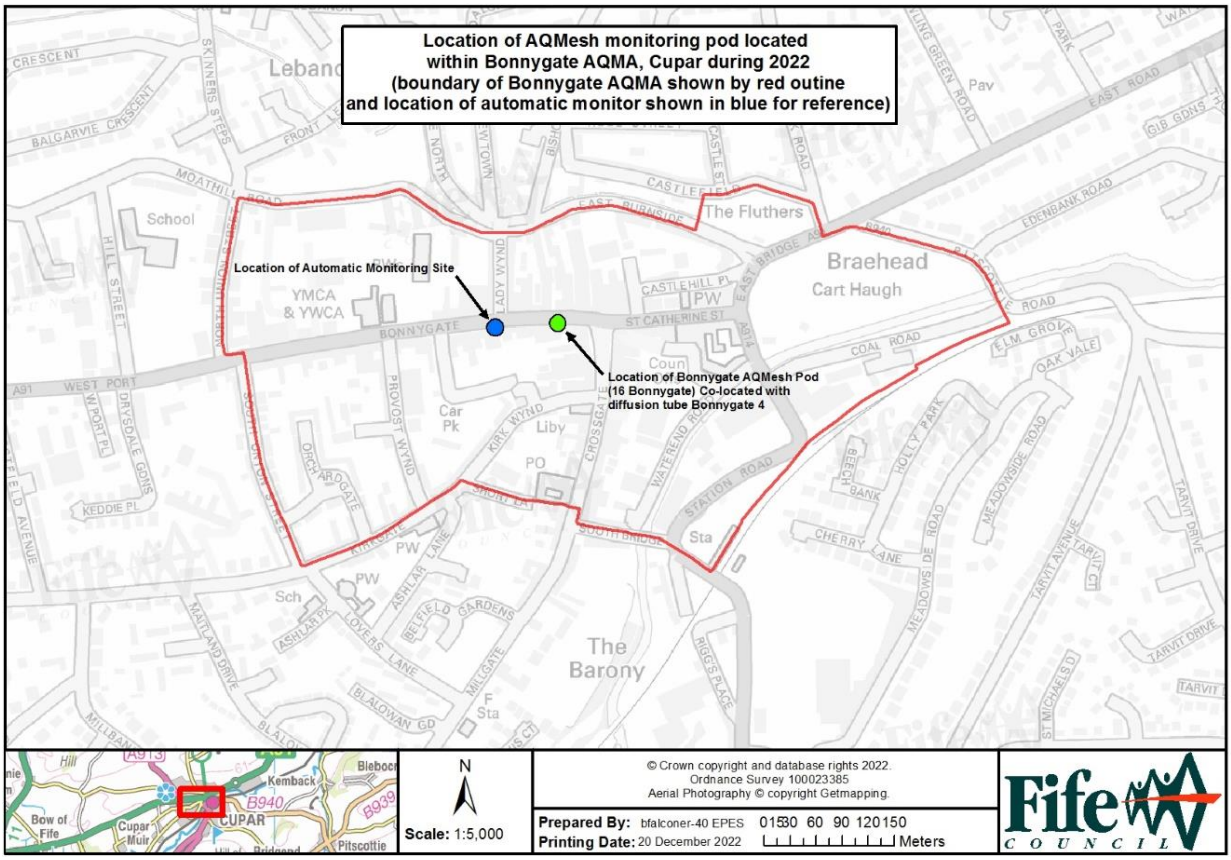


Figure E-2: Appin Crescent, Dunfermline AQMesh sensor locations

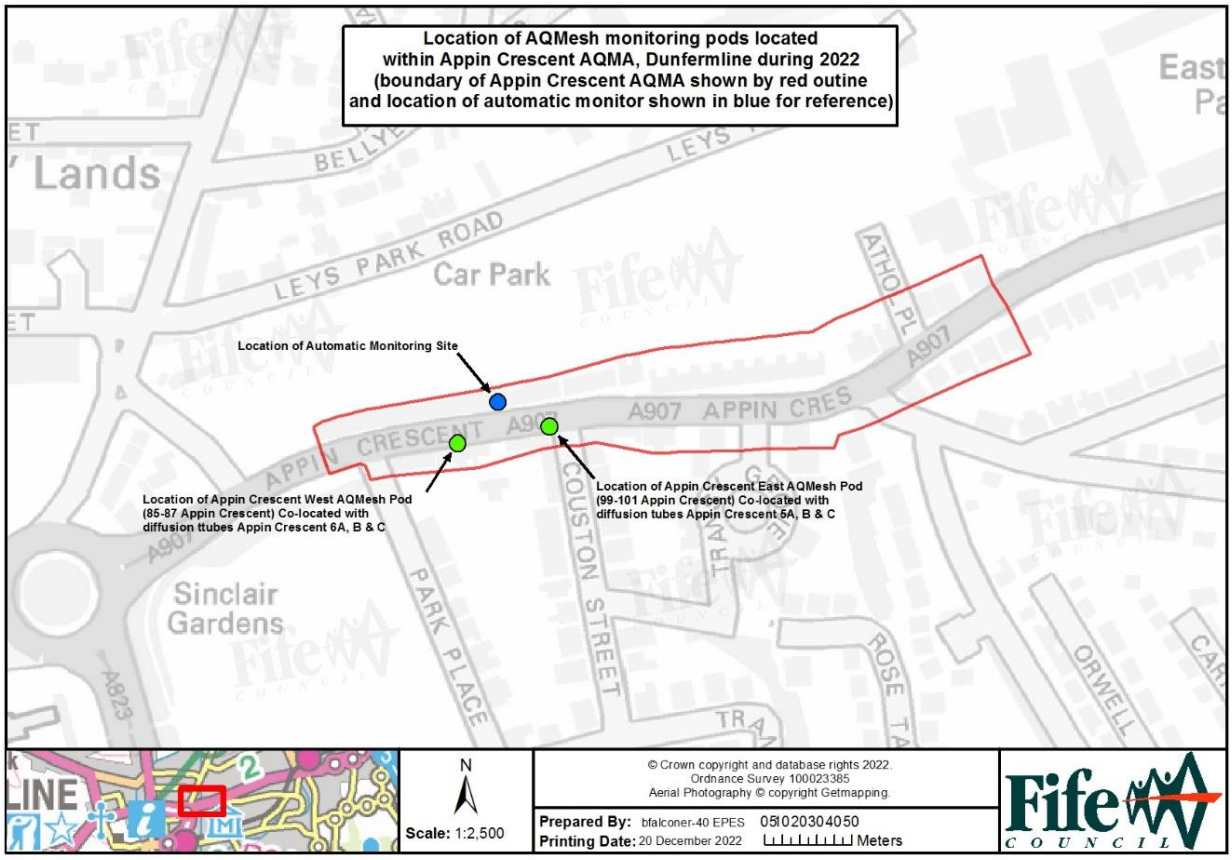


Figure E-3: St Clair St Kirkcaldy AQMesh sensor location

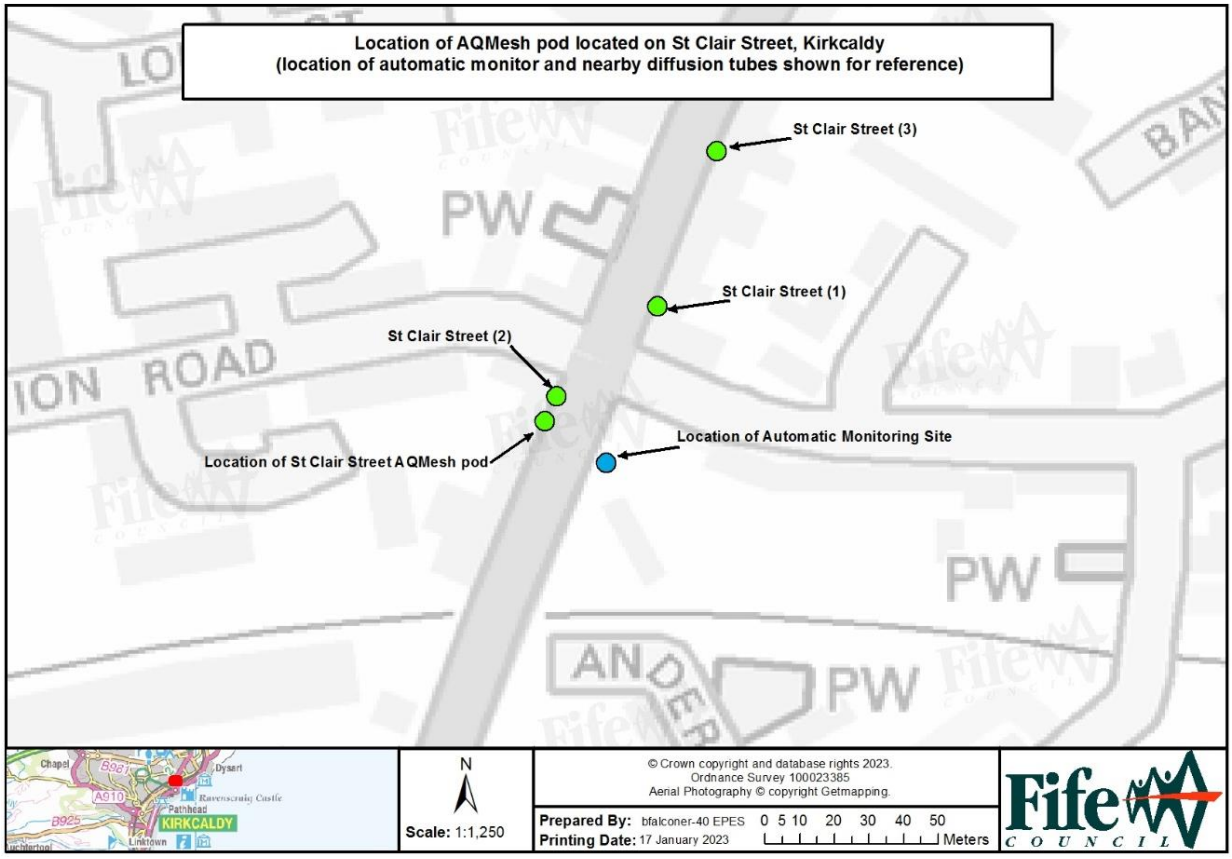


Figure E-4: City Road St Andrews AQMesh sensor location

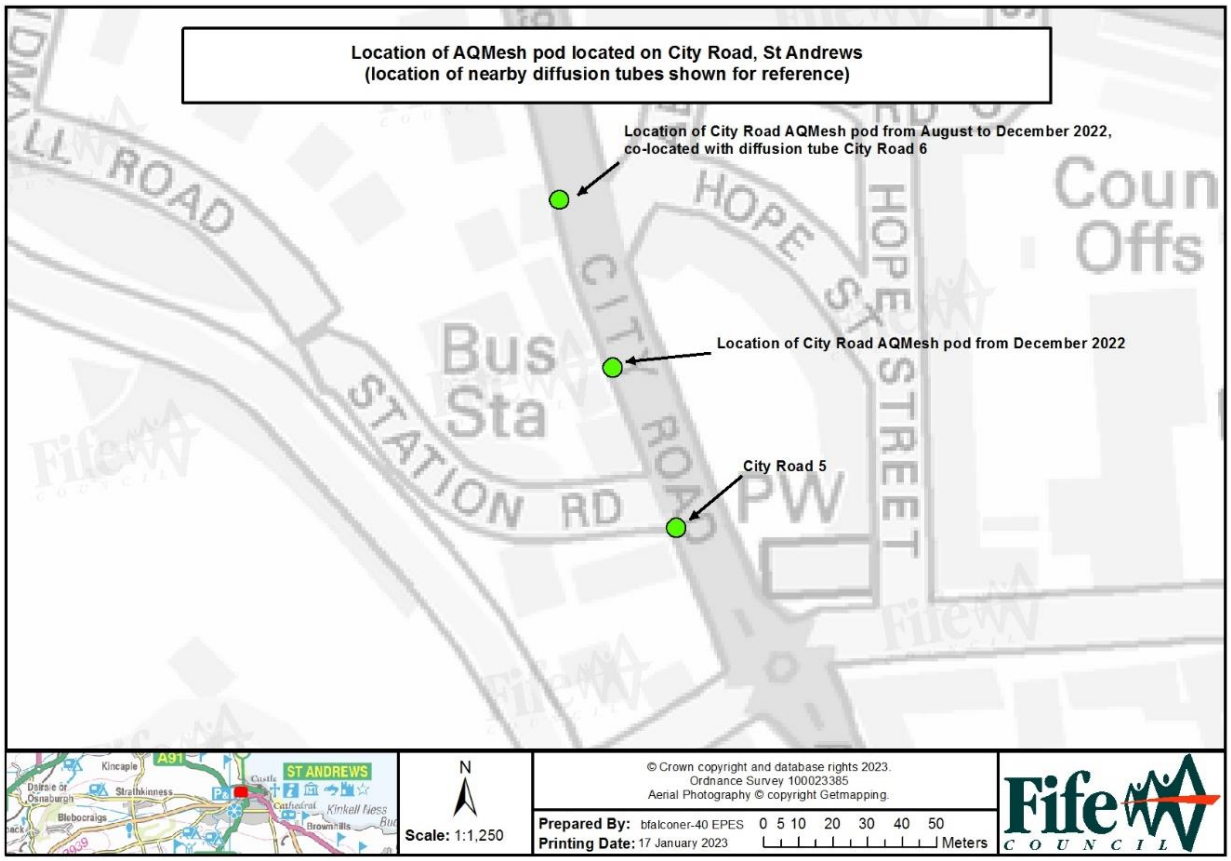


Figure E-5: Photos of the Fife AQMesh Monitoring Locations (Bonnygate and Appin Crescent)

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)

Figure E-6: Photos of the Fife AQMesh Monitoring Locations (St Clair Street and City Road)

St Clair Street AQMesh Sensor

City Road AQMesh Sensor (collocated with diffusion tube City Road 6)

New City Road AQMesh Sensor

Data Management and QA/QC

Ricardo used their dedicated data management system (MODUS) to manage and process all data from the five 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, the UK national network (AURN) and Air Quality England, 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 Air Quality Expert Group (AQEG) on the Defra UK air website included:

- Co-location of the AQMesh sensors at the nearest automatic site for at least one week every three months.
- Co-location of the AQ Mesh 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. It should be noted that co-location data is not always used to process the data. Where it has been identified that the data from co-locations is erroneous (for example correlation between automatic and sensor data is poor or when calculated sensitivities are unrealistic causing data to become an outlier when compared) then the data ratifier may choose to disregard. A co-location study can be affected by a number of factors including the range of concentrations measured and the performance of the instruments. This is taken into account during the data ratification process.

Changes to the AQMesh sensor systems during 2022

The following significant changes were made to the AQMesh Sensor systems during 2022.

- All AQMesh – 8th March 2022 – Firmware upgrade to v3.37.405
- Appin Crescent East/West & Bonnygate – 17th/18th March 2022 – Firmware downgraded to v3.24.328
- City Road – 19th December – Moved location as stated previously

Data and Analysis

Tables E.1 to E.5 provide a summary of statistics for the concentrations measured by the AQMesh sensors from 1st January 2022 to the 31st December 2022. Tables E.6 to E.8 provide a summary of statistics for the automatic monitoring sites located in Cupar, Dunfermline and Kirkcaldy for the same time period. Automatic monitoring is not carried out in St Andrews. It should be noted that the tables also provide SAQD corrected data for PM_{10} and $PM_{2.5}$ as recommended by Scottish Government (May 2023)[4]. Annualisation calculations were also carried out using LAQM Technical Guidance (TG22)[10] for both St Andrews and Kirkcaldy sites due to the low data capture for 2022.

[10] https://www.scottishairquality.scot/technical-guidance/local-air-quality-management-new-technical-guidance-tg22

As can be seen in Tables E.1 to E.5, none of Fife's AQMesh sensor sites measured exceedances for any of the Scottish AQ objectives for pollutants NO_2, PM_{10} and $PM_{2.5}$ in 2022. This is similar to previous years for Appin Crescent and Bonnygate AQMesh sites, with exception to Bonnygate in 2019, where exceedances were measured for annual (PM_{10} and $PM_{2.5}$) and daily (PM_{10} only) mean objectives. Pollution concentrations across all pollutants measured at all sites were low throughout 2020 and 2021, in comparison to 2018 and 2019. This is especially the case for NO_2. This has been attributed to the Covid-19 restrictions and the associated varying ranges of travel restrictions and guidance throughout 2020 and 2021.

Figures E-7 to E-10 provide a visual representation of annual mean concentrations compared to AQ objectives since AQMesh monitoring began, and also illustrates the difference between the automatic site and AQMesh sensor site location concentrations.

When comparing the Appin Crescent East and West AQMesh sensors with the nearby automatic site in Dunfermline, the statistics show that NO_2 annual mean concentrations for both Appin Crescent AQMesh pods have been consistently higher than that measured at the automatic site. It also shows that concentrations of NO_2 have remained significantly lower than that measured in 2018 and 2019.

When comparing PM_{10} the Appin Crescent AQMesh sensor data with the automatic site, 2022 concentrations are basically the same and have also seen similar increases from the lows of 2020 and 2021. Concentrations at the sensor sites are still below the relative highs of 2018. For $PM_{2.5}$, concentrations have not varied much across the years. However, concentrations have increased from the slight drop seen in 2020 and 2021.

A similar situation is seen with the Bonnygate AQMesh, in that the NO_2 annual mean concentrations (though still well below the annual mean objective) have been consistently higher than the Cupar automatic site annual mean concentrations, with the exception of 2020 when the annual mean concentrations were the same. For both sensor and automatic sites, 2022 levels of NO_2 are still well below that measure in 2018 and 2019.

For PM_{10} concentrations for the AQMesh pod in Bonnygate have been very similar since monitoring began in 2018, with the exception of 2019, when PM_{10} was higher (37%) at the AQMesh pod than the automatic site. Over the last two years concentrations have been higher at the automatic site than the sensor site. For $PM_{2.5}$, concentrations are around the same (within 1 or 2 µg m^{-3}) and have not significantly changed at both sites, with again the exception and outlier being 2019.

Figure E-9 compares St Clair Street, Kirkcaldy sensor data for 2022 with automatic data from the last 5 years. As can be seen, data for all three pollutants are comparable within 1 or 2 µg m^{-3} with the sensor site being slightly higher for NO_2 and $PM_{2.5}$.

Figure E-10 compares the City Road, St Andrews 2022 sensor data with the last 5 years of its collocated diffusion tube (City Road 6) site data, as automatic monitoring isn't currently and has not previously been carried out in St Andrews. For 2022 the sensor site was slightly higher than City Road 6 however still well below the annual mean objective and below the peak years of 2018 and 2019. PM_{10} and $PM_{2.5}$ have not previously been measured in St Andrews using reference equivalent measure techniques for the time period in question.

The AQMesh pods were co-located with diffusion tubes (as illustrated in Figures E-1 to E-4 and shown in the associated photographs in Figure E-5 and Figure E-6). As previously stated, St Clair Street AQMesh is not precisely co-located with St Clair Street 2 as defined

in the LAQM Technical Guidance due to it being located 13 meters south-west. However, for this analysis we are considering them as such. Table E.9 provides the bias corrected annual mean concentrations for these diffusion tubes. For the Bonnygate and Appin Crescent locations the diffusion tubes measured higher NO_2 concentrations than the AQMesh sensor, which is similar to previous year's measurements. St Clair Street 2 and City Road 6 diffusion tubes also measured higher than the sensors. The differences are however relatively insignificant due to the low concentrations measured and the associated differences (between 1 to 4 µg m^{-3}).

Table E.1 Fife Bonnygate AQMesh monitoring Statistics 1st January to 31st December 2022

	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_2 (µg m^{-3})	0	0	0	316	119	62	113	65	23	85.7
PM_{10} (µg m^{-3})	0	0	0	307	294	38	62	41	12	84.9
$PM_{2.5}$ (µg m^{-3})	0	0	0	306	133	28	36	29	6	84.6

Table E.2 Fife Appin Crescent West AQMesh monitoring Statistics 1st January to 31st December 2022

	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_2 (µg m^{-3})	0	0	0	314	127	58	93	60	21	84.9
PM_{10} (µg m^{-3})	0	0	1	302	179	59	104	77	12	84.2
$PM_{2.5}$ (µg m^{-3})	0	0	0	303	75	28	48	36	6	84.2

Table E.3 Fife Appin Crescent East AQMesh monitoring Statistics 1st January to 31st December 2022

	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_2 (µg m^{-3})	0	0	0	314	109	62	96	66	18	84.9
PM_{10} (µg m^{-3})	0	0	2	302	139	74	117	94	12	84.2
$PM_{2.5}$ (µg m^{-3})	0	0	1	288	76	39	63	51	6	80.6

Table E.4 Fife Kirkcaldy St Clair St AQMesh monitoring Statistics 1st January to 31st December 2022

	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 Data	Period Data Capture (%)
NO_2 (µg m^{-3})	0	0	0	193	131	60	96	60	18	18.9	46
PM_{10} (µg m^{-3})	0	0	0	112	82	30	47	38	12	11.9	28
$PM_{2.5}$ (µg m^{-3})	0	0	0	107	49	29	40	32	7	7.7	27

Table E.5 Fife St Andrew City Road AQMesh monitoring Statistics 1st January to 31st December 2022

	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 Data	Period Data Capture (%)
NO_2 (µg m^{-3})	0	0	0	118	114	39	66	40	18	21.1	31
PM_{10} (µg m^{-3})	0	0	0	113	58	42	49	42	9	9.3	31
$PM_{2.5}$ (µg m^{-3})	0	0	1	112	57	41	49	41	6	6.6	31

Table E.6 Fife St Andrew City Road AQMesh monitoring Statistics 1st January to 31st December 2022

	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.	SAQD Corrected Data	Period Data Capture (%)
NO_2 (µg/m³)	0	0	0	365	129	48	71	50	18	n/a	98.0
PM_{10} (µg/m³)	0	0	4	360	451	74	98	75	14	15.7	99.6
$PM_{2.5}$ (µg/m³)	0	0	2	362	141	48	58	51	7	7.8	99.6

Table E.7 Fife Dunfermline Automatic monitoring site statistics 1st January to 31st December 2022

	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.	SAQD Corrected Data	Period Data Capture (%)
NO_2 (µg/m³)	0	0	0	365	84	58	74	64	15	n/a	98.4
PM_{10} (µg/m³)	0	0	2	363	105	67	81	69	12	12.7	99.7
$PM_{2.5}$ (µg/m³)	0	0	2	363	62	47	51	48	6	6.9	99.7

Table E.8 Fife Kirkcaldy Automatic monitoring site statistics 1st January to 31st December 2022

	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.	SAQD Corrected Data	Period Data Capture (%)
NO_2 (µg/m³)	0	0	0	365	95	43	73	50	12	n/a	99.9
PM_{10} (µg/m³)	0	0	2	363	88	64	70	64	11	11.8	99.8
$PM_{2.5}$ (µg/m³)	0	0	2	363	67	48	52	49	6	6.1	99.8

Figure E-7 Appin Crescent AQMesh and Automatic monitoring annual mean concentrations compared to AQ Objectives since AQMesh monitoring began (2018)

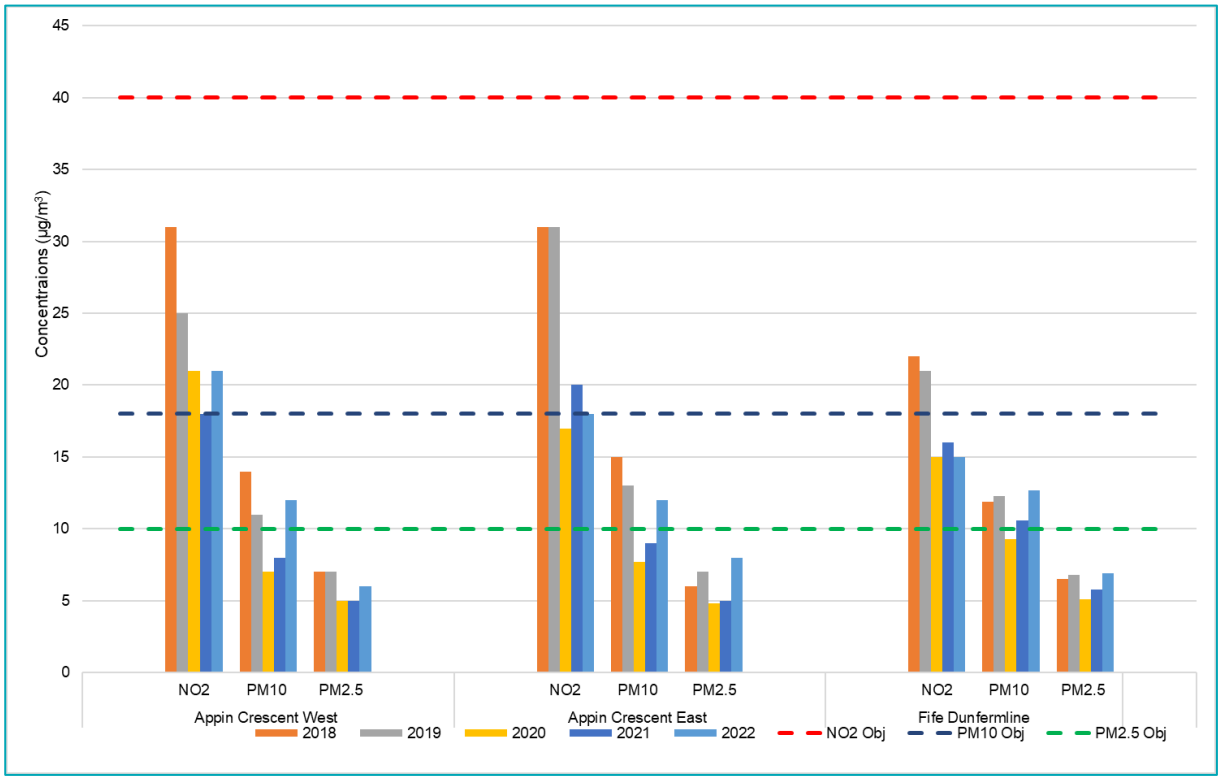


Figure E-8 Bonnygate Annual mean concentrations compared to AQ Objectives since AQMesh monitoring began (2018)

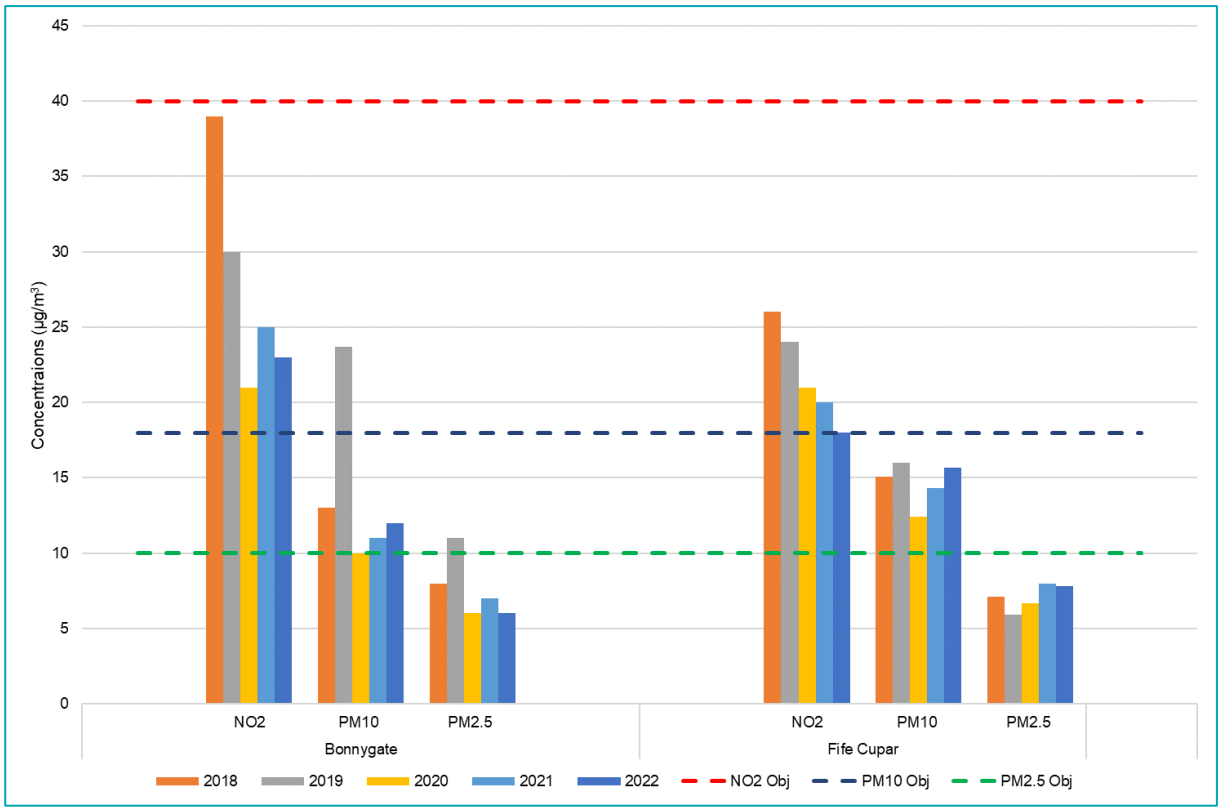


Figure E-9 Kirkcaldy St Clair St Annual mean concentrations compared to AQ Objectives since AQMesh monitoring began (2022)

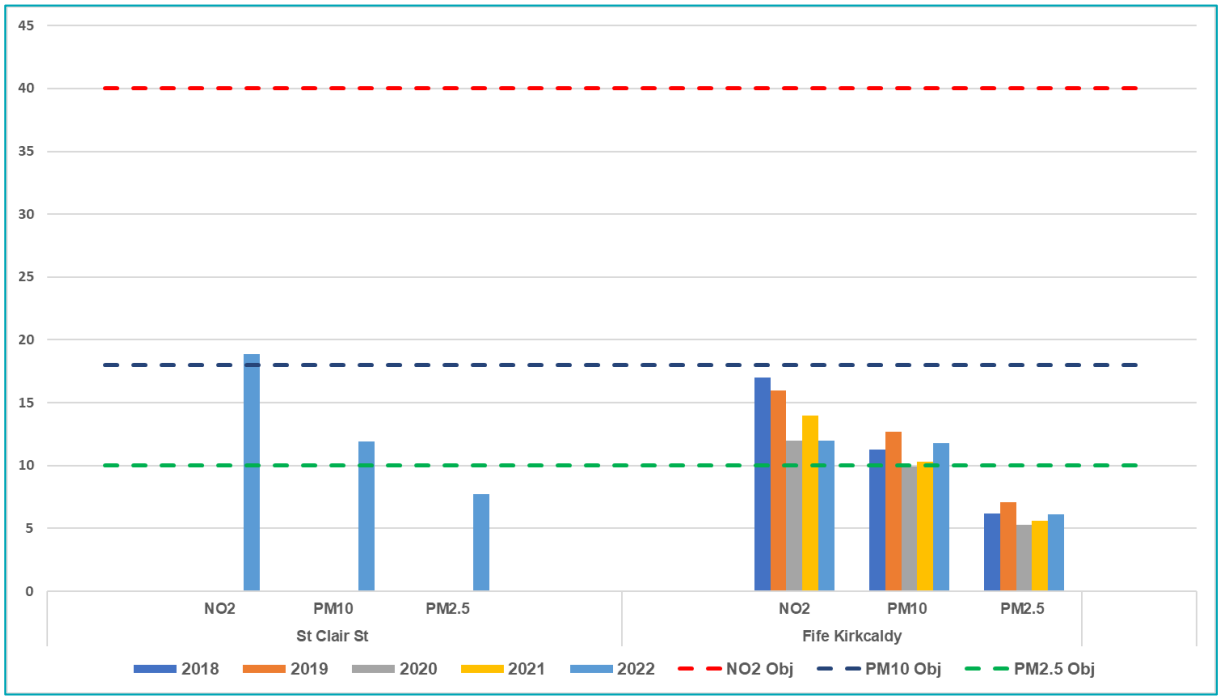


Figure E-10 St Andrews City Road Annual mean concentrations compared to AQ Objectives since AQMesh monitoring began (2022)

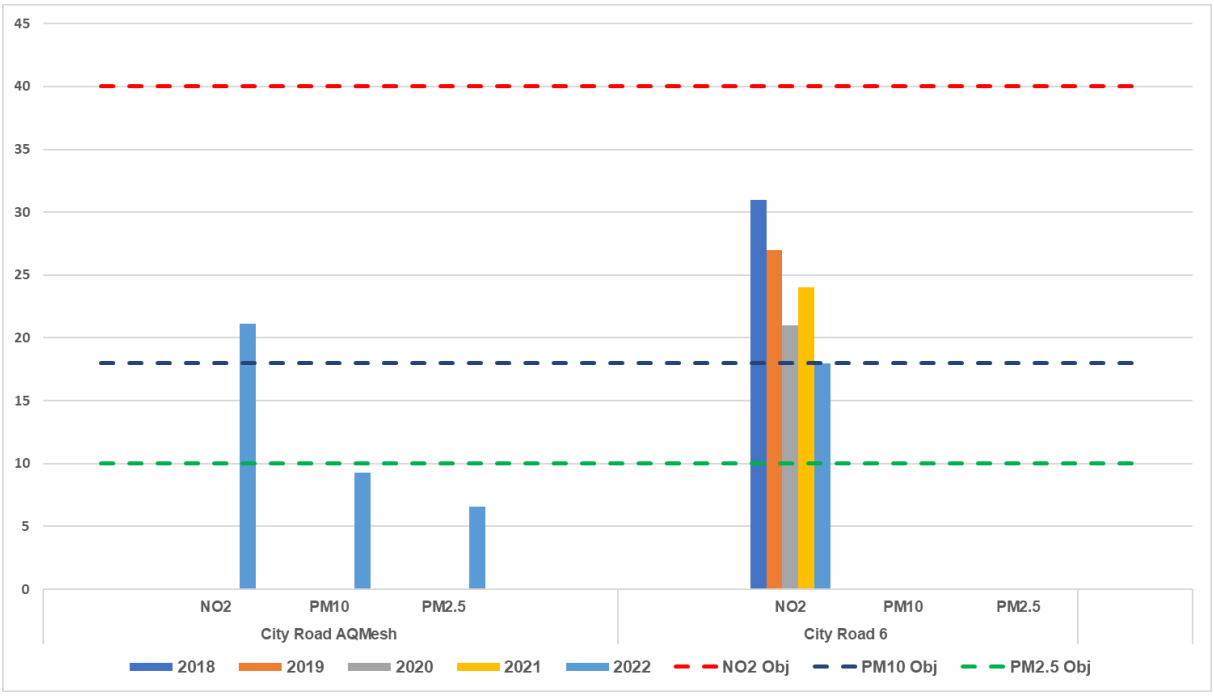


Table E.9 Co-located diffusion tube annual concentrations

Diffusion Tube Name	2022 Annual Concentration (µg/m³)	2022 Co-located AQMesh Annual Concentration (µg/m³)
Bonnygate B4	24	23
Appin Crescent 5A, B, C (co-located with AQMesh East)	23	18
Appin Crescent 6A, B, C (co-located with AQMesh West)	25	21
St Clair Street 2*	21	19
City Road 6+	21	18

* AQMesh located 13 meters south-west of the diffusion tube site
+ Moved to its current location, illustrated in Figure E-4, on the 19th December 2022

Diurnal Variation Analysis

Diurnal variation analysis shows the hourly average concentrations for each hour of the day over the monitoring period in question (1st January 2022 to 31st December 2022). This section compares the respective AQMesh sensor and automatic monitoring site (Fife Cupar and Fife Dunfermline) diurnal variation data. Locations of the automatic monitoring sites are provided in Figure E- and Figure E-. Diurnal analysis was not carried out for both Kirkcaldy St Clair Street and St Andrew City Road AQMesh due to the low data capture across the year. It is recommended that at least 75% data capture is achieved before analysis can accurately be carried out. It should be noted that this analysis is carried out using ppb (parts per billion) units rather than µg m^{-3} for NO_2.

Figure E-11 to E-14 compares automatic and AQMesh sites NO_2 diurnal analysis for 2019 and 2022. 2022 data is compared to 2019 instead of 2020 and 2021 because both 2020 and 2021 are considered outlier years due to the affects the Covid-19 pandemic and the associated travel restrictions had on air pollution concentrations.

When comparing the Bonnygate Cupar and Fife Cupar sites the diurnal profile for NO_2, both profiles clearly identify the traffic rush hour periods however the sensor site is significantly higher than the automatic indicating that the Bonnygate AQMesh site is more affected by traffic NO_2 emissions than the Cupar automatic site throughout the day. When comparing 2022 with 2019, the profile shape is very similar with the only differences being that the rush hour peaks are less prominent (especially for the evening rush hour peak) in 2022, and the peak concentrations are significantly lower. This indicates that traffic (being the main source of NO_2 for these locations) is not contributing the same emissions of NO_2 in 2022 as it did in 2019.

For Appin Crescent, as with Bonnygate, the diurnal profiles are very similar with the rush hour periods identified and both sensor sites being significantly higher than the automatic site throughout the day (with West being higher than East). When comparing 2022 with 2019, again the evening rush hour peak is not as prominent and peak concentrations are lower in 2022, however not to the same extent as seen in Bonnygate. In fact, Appin Crescent West peak concentrations in 2022 are almost the same as in 2019 whereas the automatic site is still significantly lower. This is illustrated by the increase in gap between the Appin Crescent West and automatic diurnal plots in 2022. There is no diurnal profile for Appin Crescent East in 2019 due to low data capture.

Figure E-11 NO_2 Diurnal Variation Plot for Fife Bonnygate AQMesh sensor and Fife Cupar automatic monitor 2022

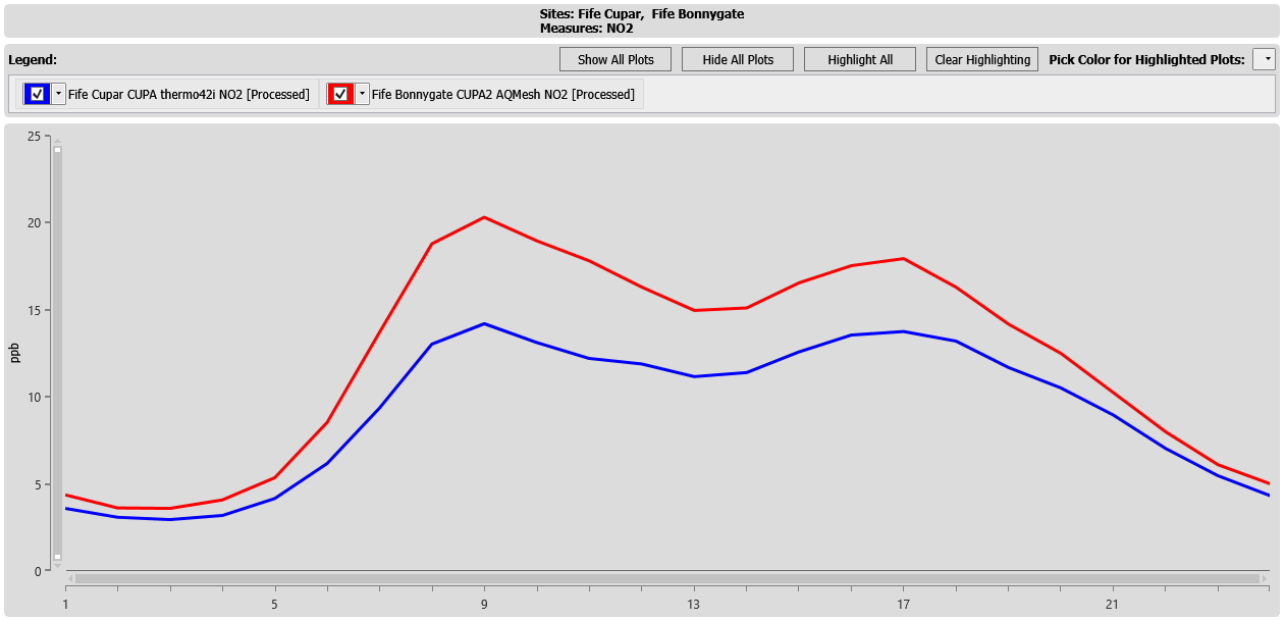


Figure E-12 NO_2 Diurnal Variation Plot for Fife Bonnygate AQMesh sensor and Fife Cupar automatic monitor 2019

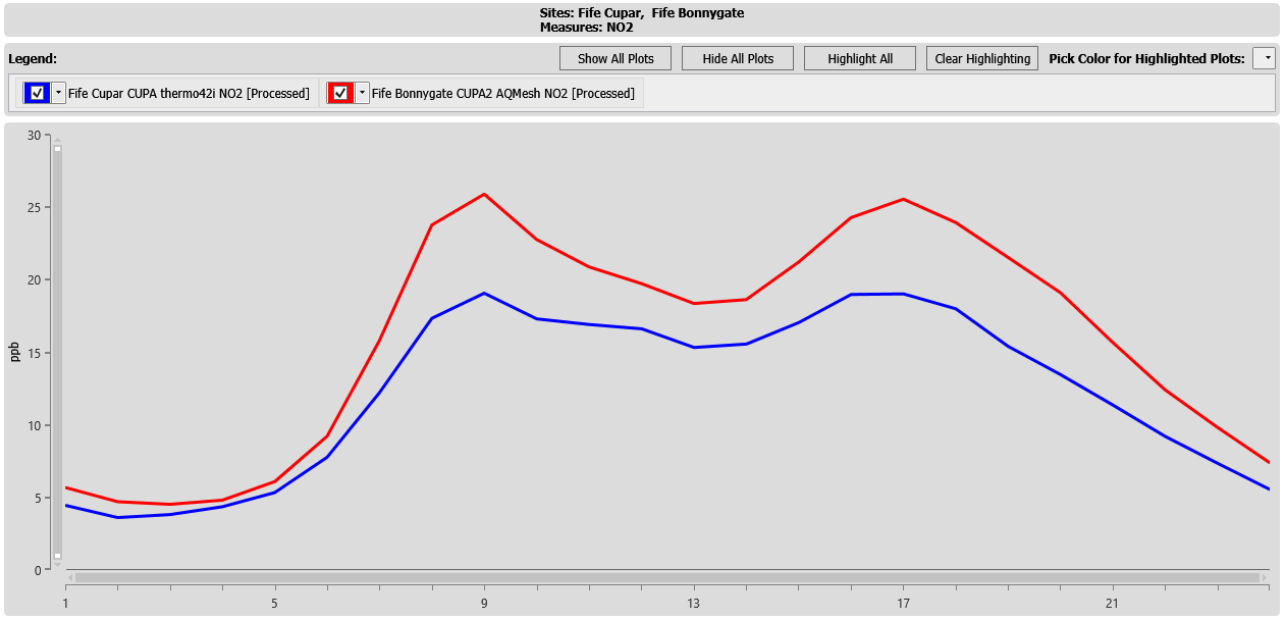


Figure E-13 NO_2 Diurnal Variation Plot for Fife Appin Crescent East and West AQMesh sensor and Fife Dunfermline automatic monitor 2022

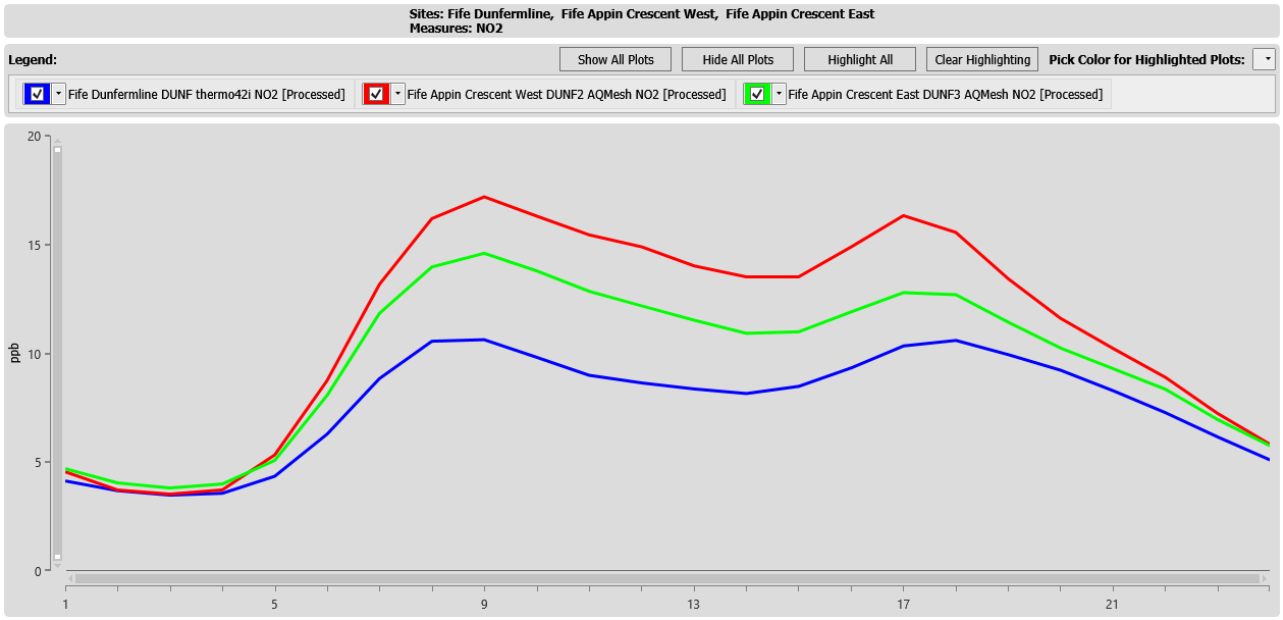
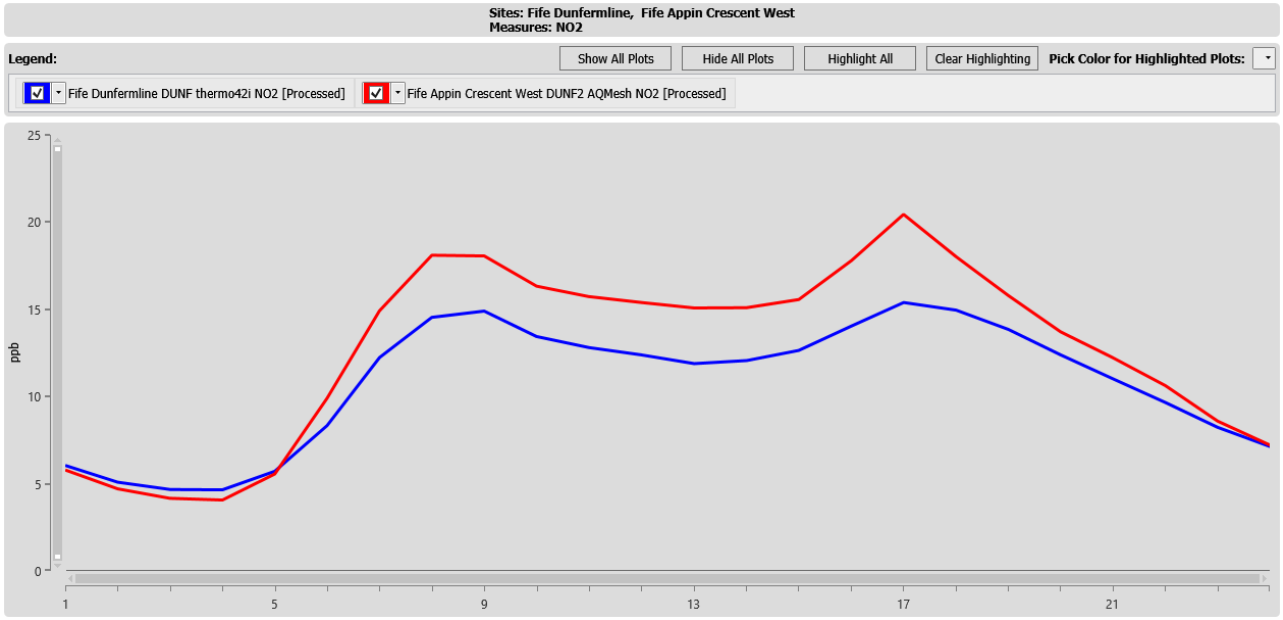


Figure E-14 NO_2 Diurnal Variation Plot for West AQMesh sensor and Fife Dunfermline automatic monitor 2019 (NB: low data capture for Fife Appin Crescent East, therefore not included)



Figures E-15 to E-21 compares automatic and AQMesh sites PM_{10} and $PM_{2.5}$ diurnal analyses for 2022 and 2019.

Figures E-15 and E-17 compares Bonnygate PM_{10} and $PM_{2.5}$ diurnal variation data for 2022 and 2019. Looking at 2022 PM_{10} data, you can see a significant difference in profiles between the sensor and the automatic sites, especially between 7am and 7pm. The automatic site indicates a step change in concentration between these times whereas with the AQMesh sensor does not, with the increase being more gradual and to a lesser extent in terms of concentrations measured. This analysis could indicate that traffic contributes more to PM_{10} concentrations at the Cupar automatic site than at the Bonnygate AQMesh

location. However due to the greater number of Particulate Matter sources and its transboundary nature, there is significantly more uncertainty attributed to this hypothesis compared to when considering NO_2 diurnal analysis. When comparing the 2022 with 2019 diurnal profiles there is an obvious difference. Where the automatic site is higher in 2022 than the sensor site this is not the case in 2019 where the sensor is consistently higher throughout. The profile of the sensor site is also different with defined “humps” between 7am and 12pm and again, but to a lesser extent, from 5pm to 11pm. General, concentrations are also significantly higher for the sensor site in 2019 whereas the automatic site is very similar to 2022 if slightly lower during the peaks period. This and other data analysis suggests that the 2019 data is an outlier from the norm. For this reason, an additional diurnal plot has been provided for 2018 in Figure E-17. This shows similarities to 2022 in terms of peak concentrations and diurnal variation, again indicating that 2019 PM_{10} dataset is an anomaly.

For $PM_{2.5}$ there is no real trend in the diurnal plot suggesting little influence from local emission sources. The automatic site is consistently higher than the sensor throughout. When compared to 2019, this switches with the sensor higher than the automatic site, as seen with PM_{10}. When compared to 2018, the 2019 profile is the same in terms of the sensor being higher than the automatic site. The 2018 peak concentrations are however more similar to 2022.

Figure E-15 PM_{10} and $PM_{2.5}$ Diurnal Variation Plot for Fife Bonnygate AQMesh sensor and Fife Cupar automatic monitor 2022

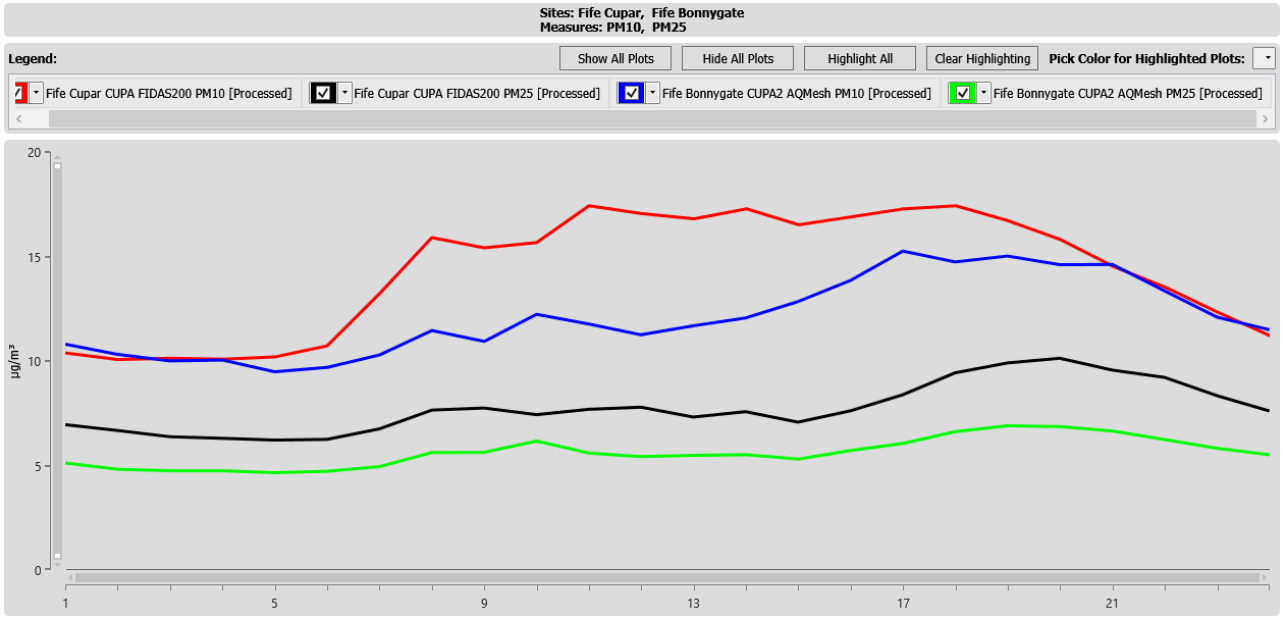


Figure E-16 PM_{10} and $PM_{2.5}$ Diurnal Variation Plot for Fife Bonnygate AQMesh sensor and Fife Cupar automatic monitor 2019

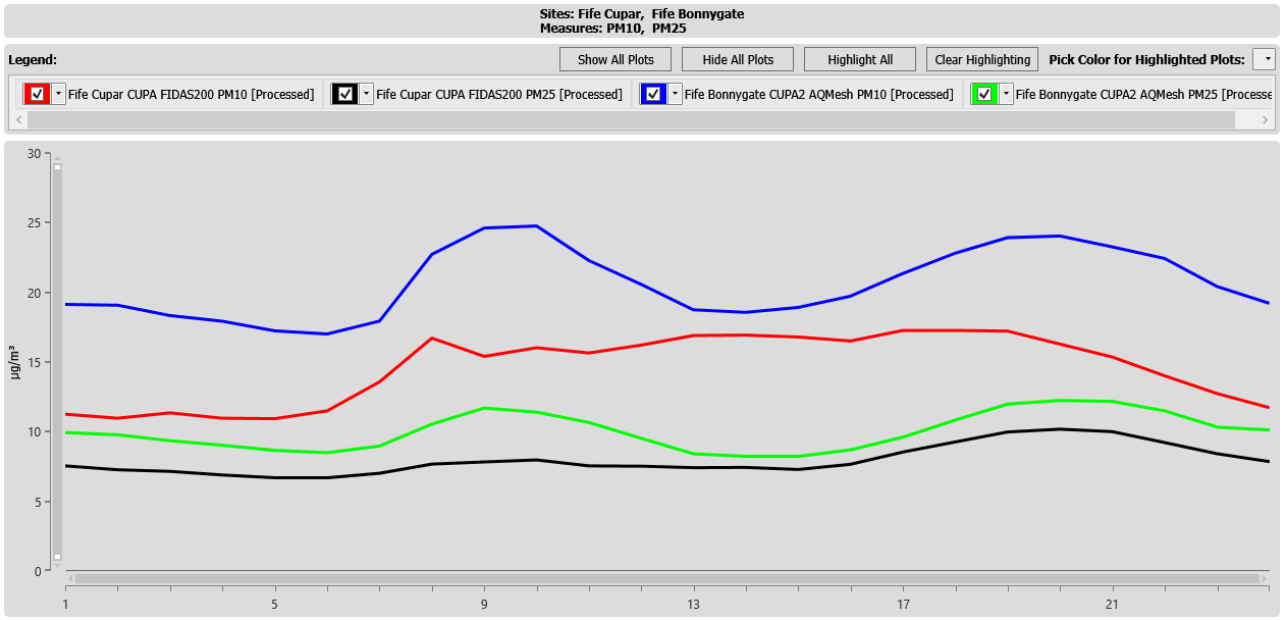
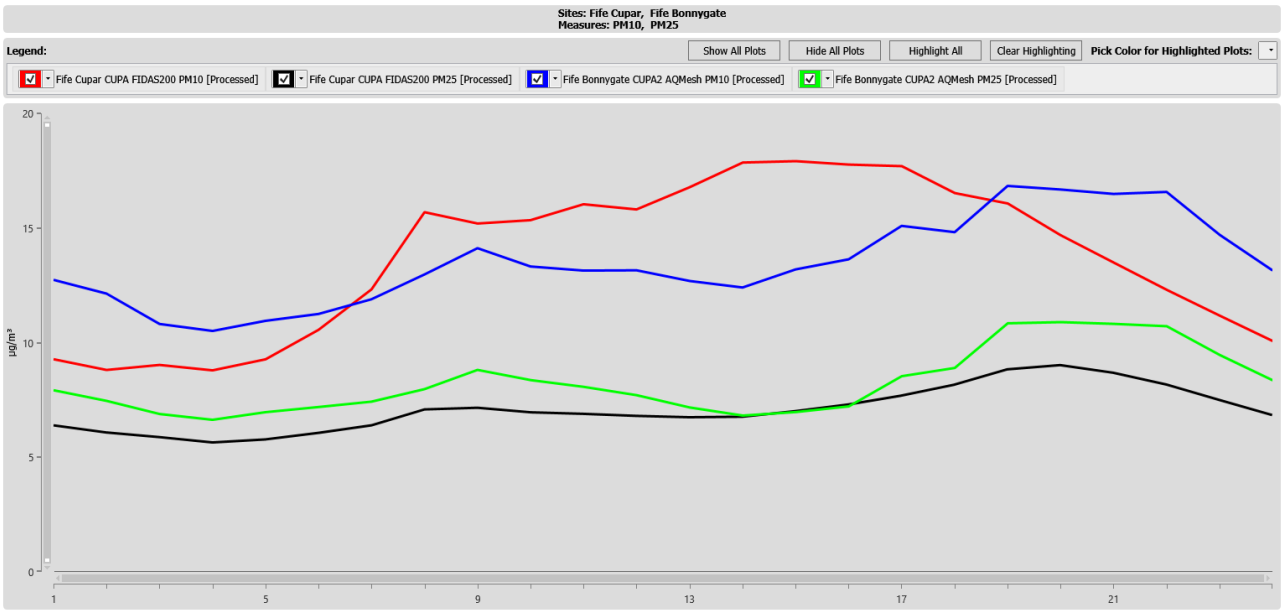


Figure E-17 PM_{10} and $PM_{2.5}$ Diurnal Variation Plot for Fife Bonnygate AQMesh sensor and Fife Cupar automatic monitor 2018



Figures E-18 to E-21 illustrate the PM_{10} and $PM_{2.5}$ diurnal variation data for Fife Appin Crescent West and East AQMesh sensors, and the Fife Dunfermline automatic site for 2022 and 2019.

As can be seen (Figures E-18 and E-19) for all years, PM_{10} diurnal analysis shows little variation throughout the day indicating that traffic has little influence on concentrations. The automatic site does appear to become slightly elevated around 7am, however it remains like this until around 9pm which does not correlate with the NO_2 diurnal analysis (which we know is associated to traffic emissions). This alternatively may indicate PM_{10} concentration contributions from domestic household emissions.

For $PM_{2.5}$ (Figures E-20 and E-21), the diurnal variation analysis shows very little change at all sites and for all years. This analysis suggests that traffic has little contributing factor to PM_{10} and $PM_{2.5}$ concentrations at all of these locations.

Figure E-18 PM_{10} Diurnal Variation Plot for Fife Appin Crescent East and West AQMesh sensors and Fife Dunfermline automatic monitor 2022

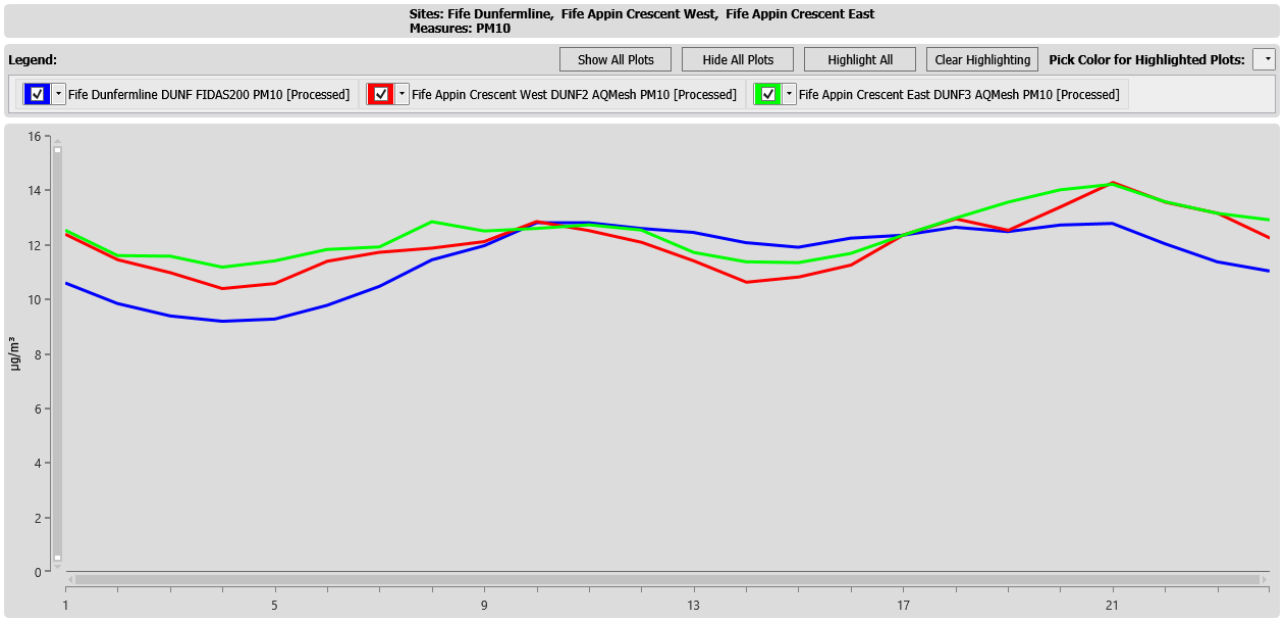


Figure E-19 PM_{10} Diurnal Variation Plot for Fife Appin Crescent West AQMesh sensors and Fife Dunfermline automatic monitor 2019 (low data capture for Fife Appin Crescent East, not included)

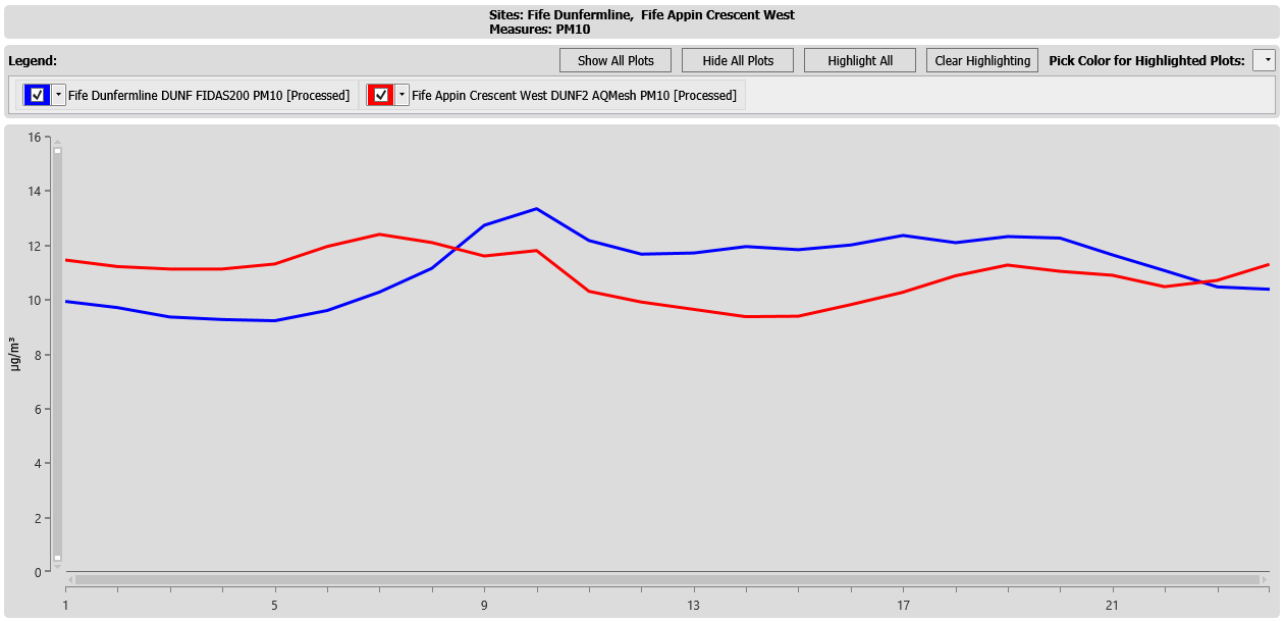


Figure E-20 $PM_{2.5}$ Diurnal Variation Plot for Fife Appin Crescent East and West AQMesh sensors and Fife Dunfermline automatic monitor 2022

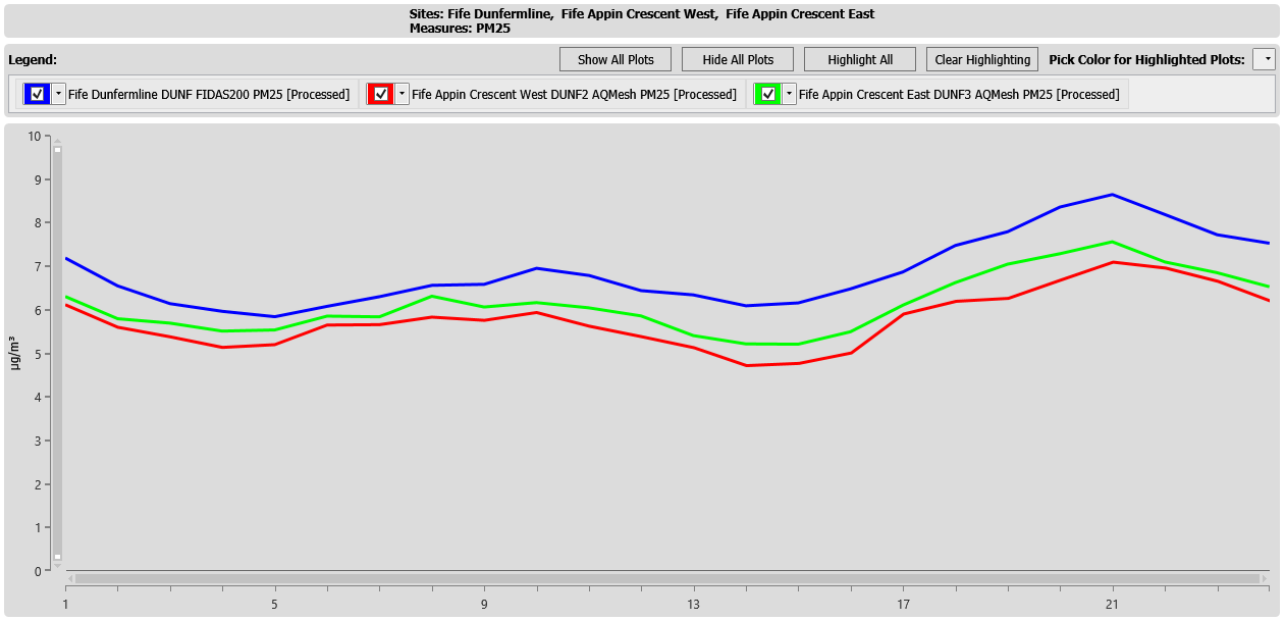
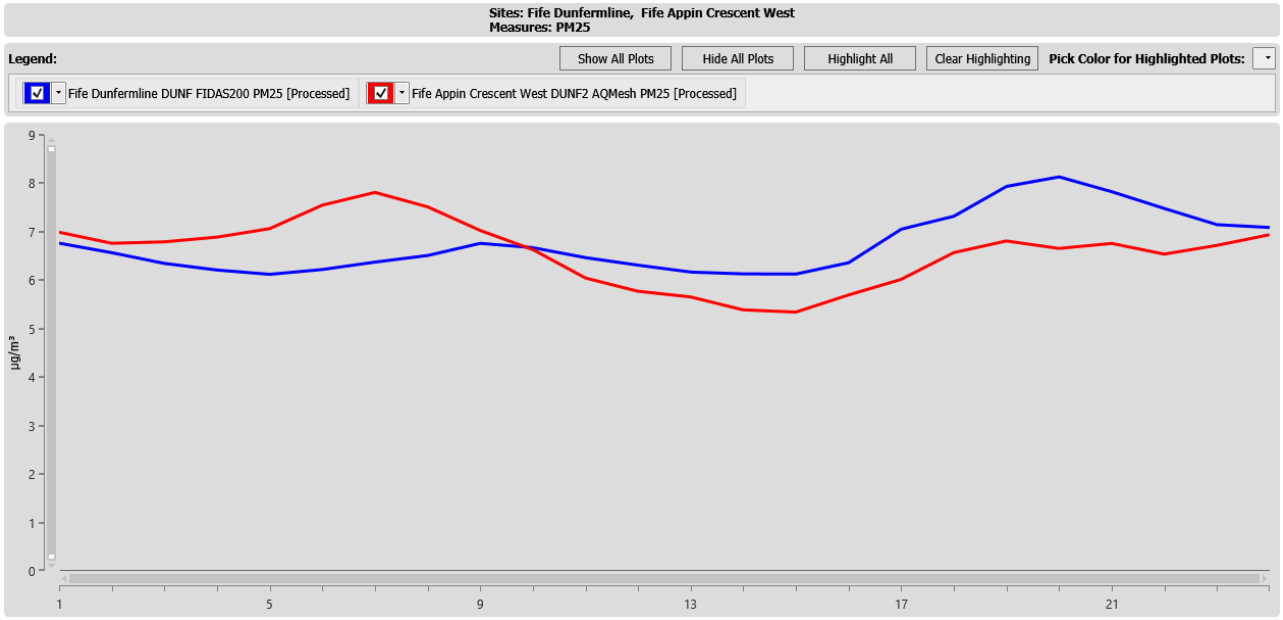


Figure E-21 $PM_{2.5}$ Diurnal Variation Plot for Fife Appin Crescent West AQMesh sensors and Fife Dunfermline automatic monitor 2019 (low data capture for Fife Appin Crescent East, not included)



Summary

This report provides data analysis of Fife Council's five AQMesh air quality monitoring sensor sites from 1st January – 31st December 2022, measuring particulate matter (PM_{10} and $PM_{2.5}$) and nitrogen dioxide (NO_2).

In 2022, none of Fife's AQMesh sensor sites measured exceedances for any of the Scottish AQ objectives for pollutants NO_2, PM_{10} and $PM_{2.5}$.

When comparing the Appin Crescent East and West AQMesh sensors with the nearby automatic site in the Dunfermline AQMA, the statistics show that:

- NO_2 annual mean concentrations for both Appin Crescent AQMesh pods have consistently been higher than measured at the automatic site since monitoring began in 2018. As concentrations have reduced, the difference between sensor and automatic concentrations has also decreased.
- Both PM_{10} and $PM_{2.5}$ concentrations are very similar when comparing sensors and the automatic site in 2022 and have been since monitoring began. In 2018 and 2019, concentrations at both Appin Crescent AQMesh pods were higher than at the automatic site, but since 2020 concentrations have been below the automatic site.

When comparing the Bonnygate AQMesh sensor with the nearby automatic site in the Cupar AQMA, the statistics show that:

- Bonnygate AQMesh NO_2 annual mean concentrations have been higher than the Cupar automatic site annual mean concentrations since monitoring began in 2018, with the exception of 2020 when the annual mean concentrations were the same. For both sensor and automatic sites, 2022 levels of NO_2 are still well below that measured in 2018 and 2019.
- PM_{10} and $PM_{2.5}$ concentrations for the AQMesh pod in Bonnygate have been very similar since monitoring began in 2018, except for 2019, when both PM_{10} and $PM_{2.5}$ were higher at the AQMesh pod than the automatic site.

When Comparing St Clair Street Kirkcaldy AQMesh sensor with the nearby Fife Kirkcaldy automatic site the statistics show that:

- Data for all three pollutants are comparable within 1 or 2 µg m^{-3} with the sensor site being slightly higher for NO_2 and $PM_{2.5}$.

When considering City Road St Andrews AQMesh Sensor data, there is no automatic site comparison to make due to there being no automatic monitoring carried out in St Andrews. However, 2022 City Road data indicates that concentrations are well below the Scottish AQ objectives for pollutants NO_2, PM_{10} and $PM_{2.5}$. When comparing sensor data with the previous 5 years of the collocated diffusion tube, the sensor site was slightly higher, however well below 2018 and 2019.

All AQMesh pods were co-located with diffusion tubes (or as close to as possible). For all five locations, the diffusion tubes measured higher NO_2 concentrations than the AQMesh. The differences are however relatively insignificant due to the low concentrations measured and the associated differences (between 1 to 4 µg m^{-3}).

Diurnal variation analysis indicates:

- The Bonnygate AQMesh site is more affected by traffic emissions than the Cupar automatic site. Comparing 2019 with 2022 diurnals also indicates that traffic emissions are returning back to pre-Covid-19 patterns, however, 2022 mean concentrations are still lower than 2019.
- In 2022, both Appin Crescent AQMesh sites measured higher NO_2 concentrations than the Dunfermline automatic site throughout the day. Analysis suggests that the Appin Crescent West AQMesh site is more affected by traffic emissions during the day than both the Appin Crescent East and the Dunfermline automatic sites.
- The only distinguishable diurnal variation for PM_{10} is at the Cupar automatic site. Analysis could suggest that traffic contributes more to PM_{10} concentrations at the Cupar automatic site location than at the Bonnygate AQMesh location.
- Diurnal analysis suggests that traffic has little contributing factor to PM_{10} concentrations at Appin Crescent locations.
- There is no obvious variation in $PM_{2.5}$ for all years at both Appin Crescent and Bonnygate which indicates that traffic contributes little to $PM_{2.5}$ concentration in both areas.

Appendix F Dynamic Report

A dynamic style report containing embedded statistical data for Fife can be found here: https://www.scottishairquality.scot/assets/reports/372/Fife_annual_2022.html. The key areas have been extracted and included below however further detail can be found online. The embedded data allows the reader a level of interaction with some of the report findings, providing additional insight. This approach enables a more easily navigated and streamlined report providing an engaging and intuitive reader experience. The analysis has been carried out for the pollutants NO_2, PM_{10} and $PM_{2.5}$ using the Openair analysis tool. 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;

- **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 plots have been created for all four automatic monitoring sites in Fife for the period 1st January – 31st December 2022. 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.
- **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 come from a specific direction.
- **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.
- **Back trajectory Analysis Plots** – The back trajectory plots show data from the HYSPLIT model (NOAA HYSPLIT) run in the analysis mode. This shows the air mass back trajectories for the period covered by this report. Two different kinds of plot are shown. One statistically groups the trajectories into similar clusters and shows the proportion of time during the report period that each represents. This is useful to get an overview of air mass origins during the report period. Plots in Trajectories associated with top ten most polluted days provide information on the trajectory direction associated with the top 10 measured concentrations.

Table F.1 Summary statistics for NO_2 (µg m^{-3})

Site	Mean	Data capture	Hourly max	Daily max	Low	Moderate	High	Hours exceeding	99.8th Percentile	98th Percentile	95th Percentile	50th Percentile
Fife Cupar	17.7	98.00%	128.9	48.1	365	0	0	0	85.5	57.3	46.5	13.8
Fife Dunfermline	14.7	98.40%	84.3	58.4	365	0	0	0	68.8	49.2	38.7	11.5
Fife Kirkcaldy	12.5	99.90%	94.9	42.6	365	0	0	0	70.8	46.1	34.5	9.5
Fife Rosyth	17.9	94.80%	118.1	56.8	350	0	0	0	81.6	62.4	49.9	13.1

Table F.2 Summary statistics for PM_{10} (µg m^{-3})

Site	Mean	Data capture	Hourly max	Max 24-hour mean	Low	Moderate	High	Days exceeding	98th Percentile daily	90th Percentile daily	98th Percentile hourly	95th Percentile hourly	50th Percentile hourly
Fife Cupar	14.3	100%	450.5	73.9	360	4	0	4	37.9	23.7	49.3	35.2	11.2
Fife Dunfermline	11.5	100%	104.7	67.3	363	2	0	2	31	18	38	26.9	9.4
Fife Kirkcaldy	10.7	100%	87.9	63.9	363	2	0	2	30.3	17.1	37	25.5	8.6
Fife Rosyth	10.6	100%	438.2	67.7	361	4	0	4	31.3	17.4	38.6	24.4	8.2

Table F.3 Summary statistics for $PM_{2.5}$ (µg m^{-3})

Site	Mean	Data capture	Max 24-hour mean	Low	Moderate	High
Fife Cupar	7.3	100%	48.2	362	2	0
Fife Dunfermline	6.5	100%	47.4	363	2	0
Fife Kirkcaldy	5.8	100%	48.1	363	2	0
Fife Rosyth	5.9	100%	47.1	363	2	0

Table F-4 SAQD Specific FIDAS corrected data Summary statistics for PM_{10} (µg m^{-3}) for LAQM Reporting

Site	Year	Mean	Mean Corrected	Hourly max	Hourly max Corrected	Max 24-hour	Max 24-hour Corrected
Fife Cupar	2018	13.7	15.1	219.8	241.7	61.4	67.5
Fife Cupar	2019	14.6	16	171.9	189.2	91.6	100.7
Fife Cupar	2020	11.3	12.4	203	223.3	43.3	47.6
Fife Cupar	2021	13	14.3	115.2	126.7	39.6	43.5
Fife Cupar	2022	14.3	15.7	450.5	495.6	73.9	81.3
Fife Dunfermline	2018	10.9	11.9	168	184.8	32.7	36
Fife Dunfermline	2019	11.2	12.3	459.3	505.3	69.6	76.5
Fife Dunfermline	2020	8.5	9.3	67.7	74.5	25.2	27.7
Fife Dunfermline	2021	9.6	10.6	320.4	352.5	46.9	51.6
Fife Dunfermline	2022	11.5	12.7	104.7	115.2	67.3	74.1
Fife Kirkcaldy	2018	10.3	11.3	115.8	127.4	43.5	47.8
Fife Kirkcaldy	2019	11.6	12.7	496.5	546.2	77.9	85.7
Fife Kirkcaldy	2020	9	9.9	60.5	66.6	26.2	28.8
Fife Kirkcaldy	2021	9.4	10.3	101.6	111.8	27.8	30.5
Fife Kirkcaldy	2022	10.7	11.8	87.9	96.7	63.9	70.3
Fife Rosyth	2018	10.5	11.6	70.5	77.6	43.4	47.7
Fife Rosyth	2019	10	11	139.9	153.9	69.4	76.3
Fife Rosyth	2020	9.1	10	299.2	329.2	41.5	45.7
Fife Rosyth	2021	10	11.1	126	138.6	29.4	32.4
Fife Rosyth	2022	10.6	11.7	438.2	482.1	67.7	74.5

Table F-5 SAQD Specific FIDAS corrected data Summary statistics for $PM_{2.5}$ (µg m^{-3}) for LAQM Reporting

Site	Year	Mean	Mean Corrected	Max 24-hour mean	Max 24-hour Corrected
Fife Cupar	2018	6.7	7.1	27.3	28.9
Fife Cupar	2020	5.6	5.9	21.3	22.6
Fife Cupar	2021	6.3	6.7	24	25.4
Fife Dunfermline	2018	6.1	6.5	24.7	26.2
Fife Dunfermline	2020	4.8	5.1	19.1	20.2
Fife Dunfermline	2022	6.5	6.9	47.4	50.2
Fife Kirkcaldy	2018	5.8	6.2	27	28.7
Fife Kirkcaldy	2019	6.7	7.1	39.1	41.5
Fife Kirkcaldy	2020	5	5.3	17.6	18.7
Fife Kirkcaldy	2022	5.8	6.1	48.1	51
Fife Rosyth	2020	5.1	5.4	32.9	34.8
Fife Rosyth	2022	5.9	6.2	47.1	49.9
Fife Cupar	2019	7.5	8	37.1	39.3
Fife Cupar	2022	7.3	7.8	48.2	51.1
Fife Dunfermline	2019	6.4	6.8	38.8	41.1
Fife Dunfermline	2021	5.5	5.8	24.6	26.1
Fife Kirkcaldy	2021	5.3	5.6	21.1	22.4
Fife Rosyth	2018	6	6.4	26.4	28
Fife Rosyth	2019	5.9	6.2	33.8	35.8
Fife Rosyth	2021	5.6	6	18.5	19.6

Figure F-1 Cupar NO_2 time series

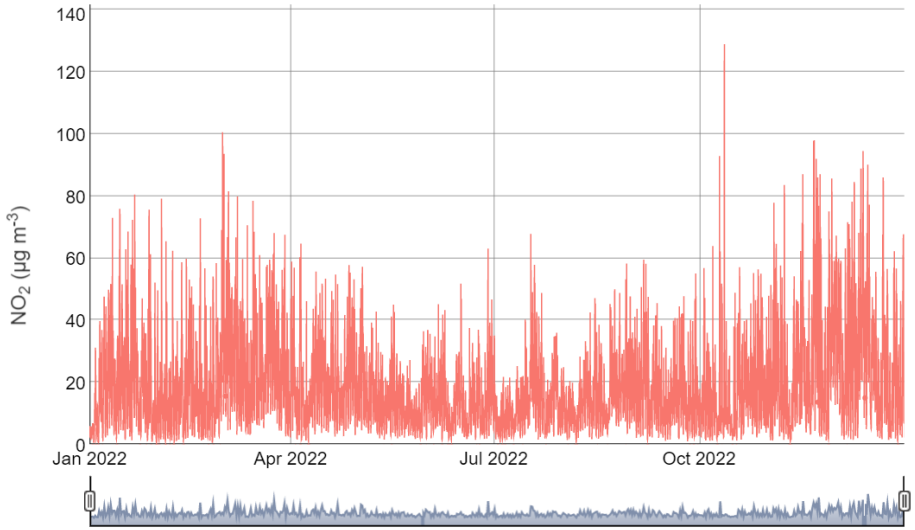


Figure F-2 Dunfermline NO_2 time series

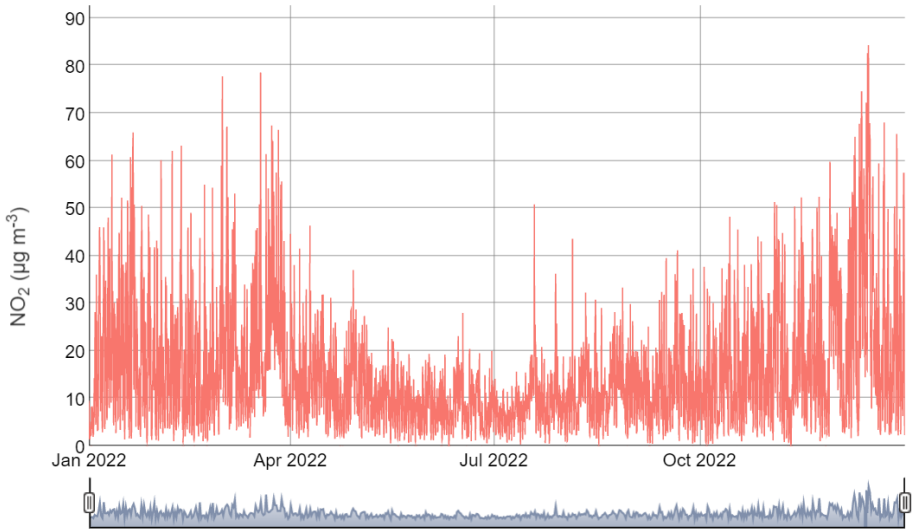


Figure F-3 Kirkcaldy NO_2 time series

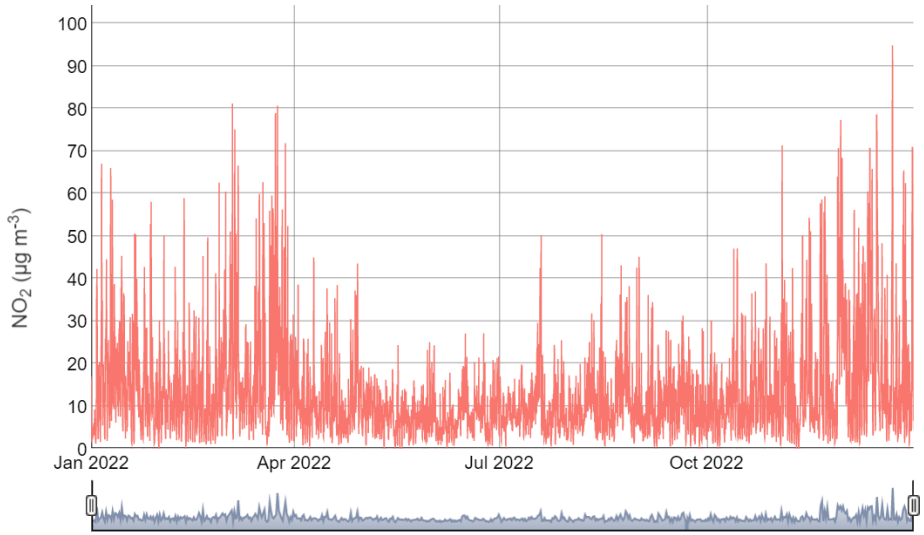


Figure F-4 Rosyth NO_2 time series

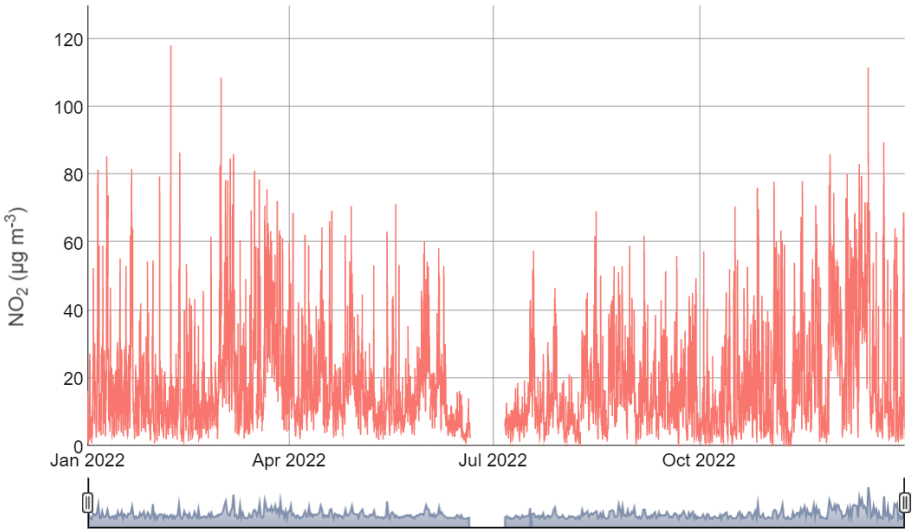


Figure F-5 Cupar PM_{10} time series

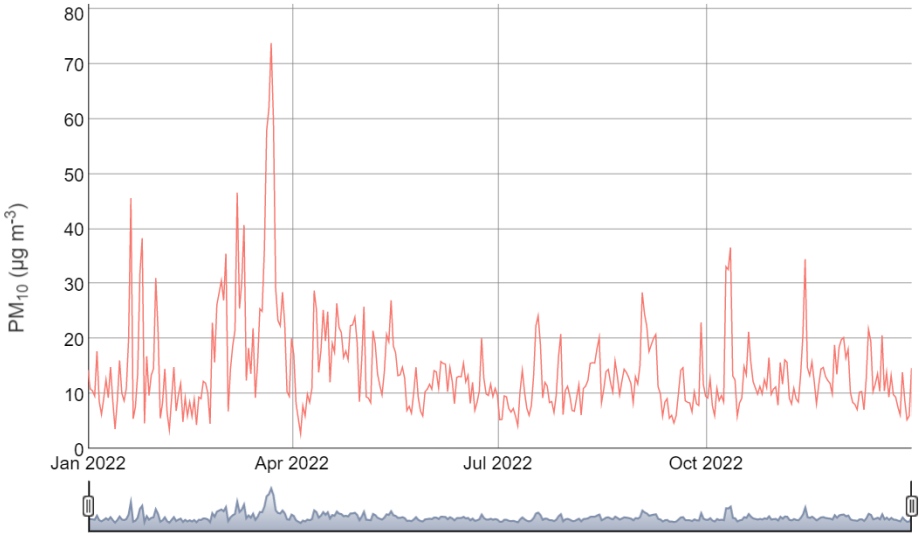


Figure F-6 Dunfermline PM_{10} time series

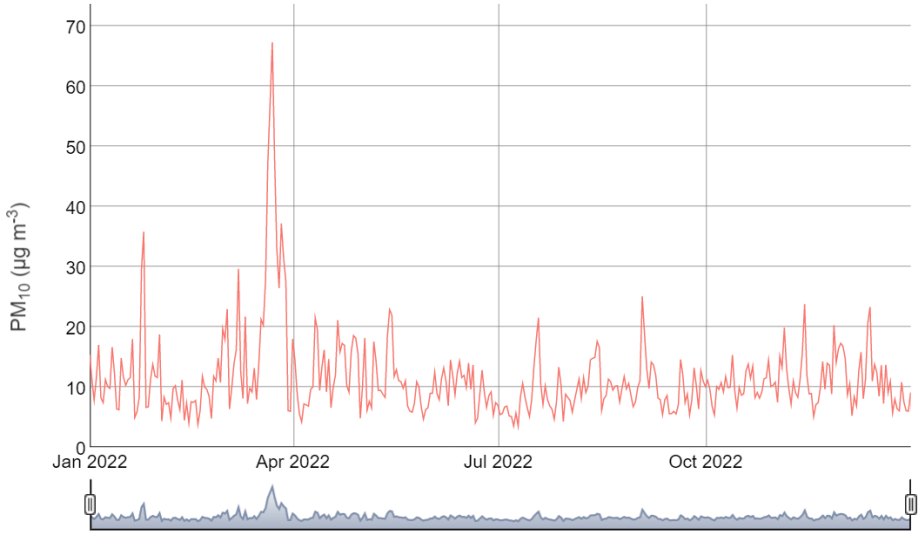


Figure F-7 Kirkcaldy PM_{10} time series

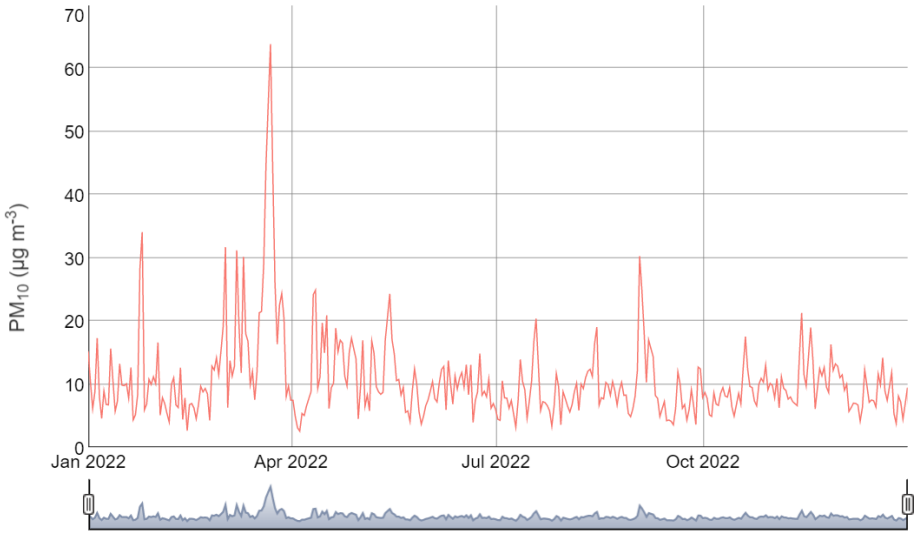


Figure F-8 Rosyth PM_{10} time series

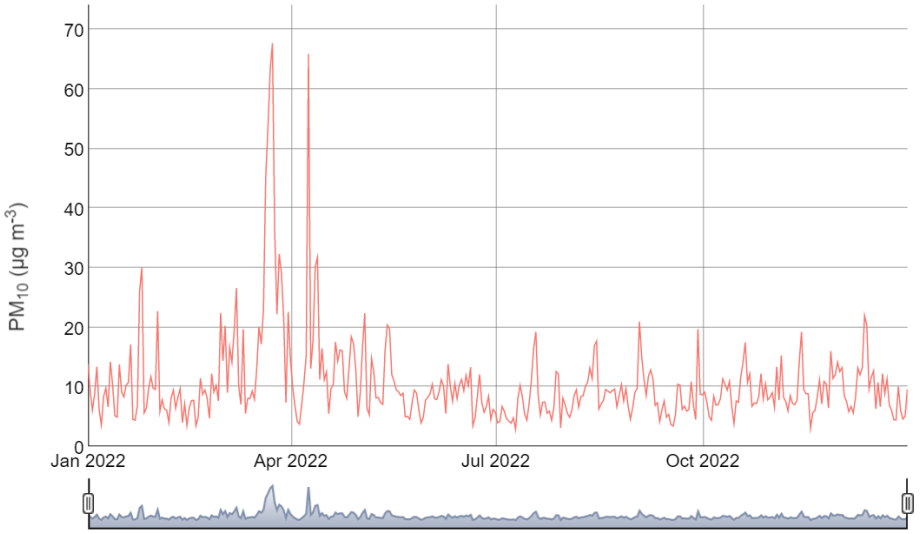


Figure F-9 Cupar $PM_{2.5}$ time series

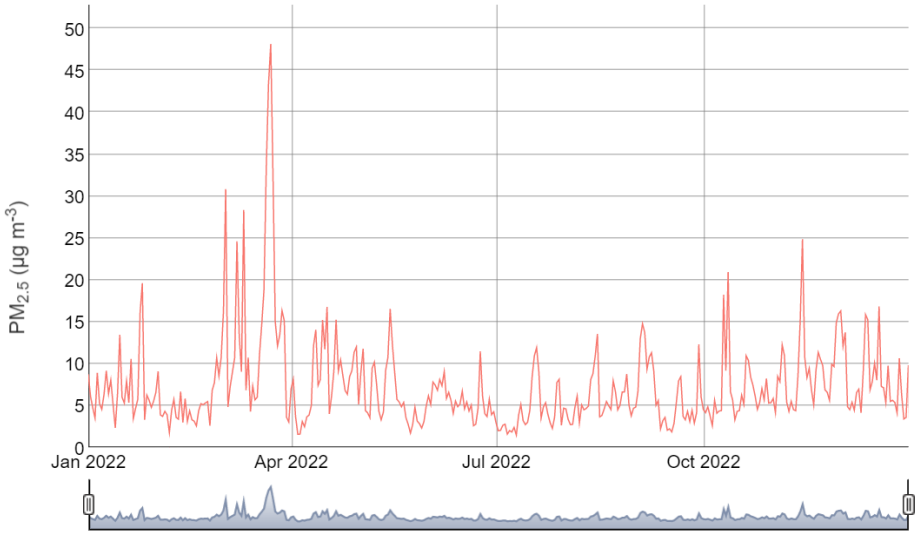


Figure F-10 Dunfermline $PM_{2.5}$ time series

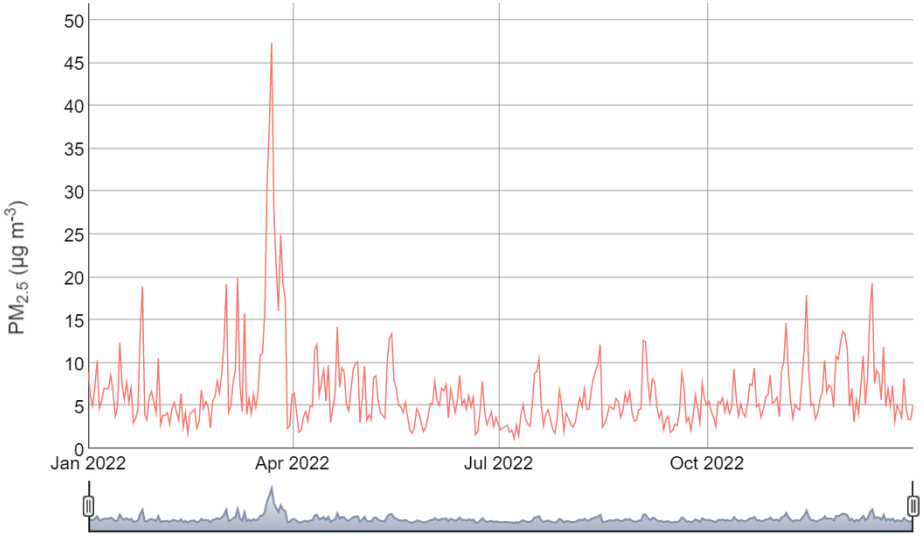


Figure F-11 Kirkcaldy $PM_{2.5}$ time series

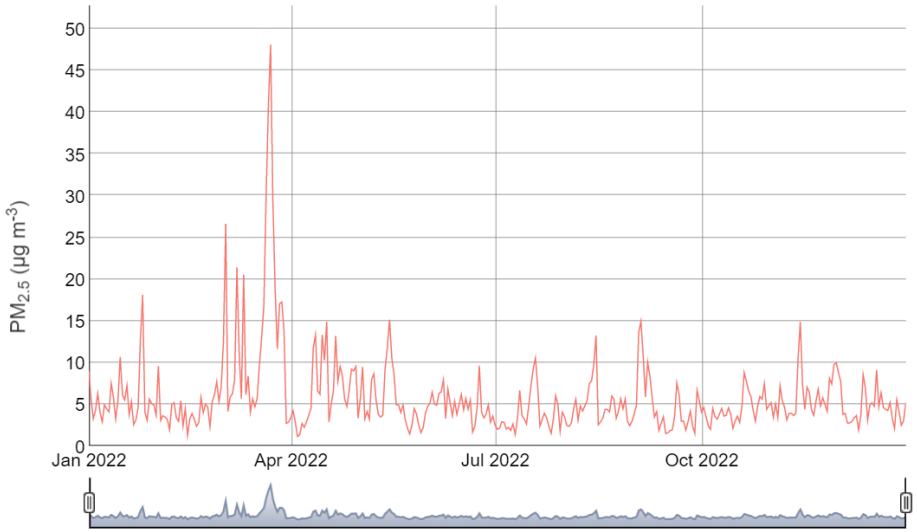


Figure F-12 Rosyth $PM_{2.5}$ time series

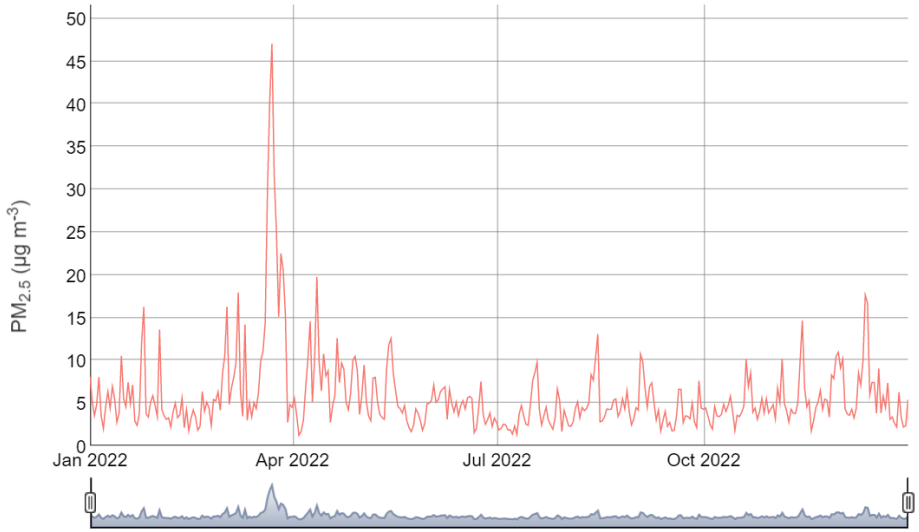


Figure F-13 Cupar NO_2 calendar plots

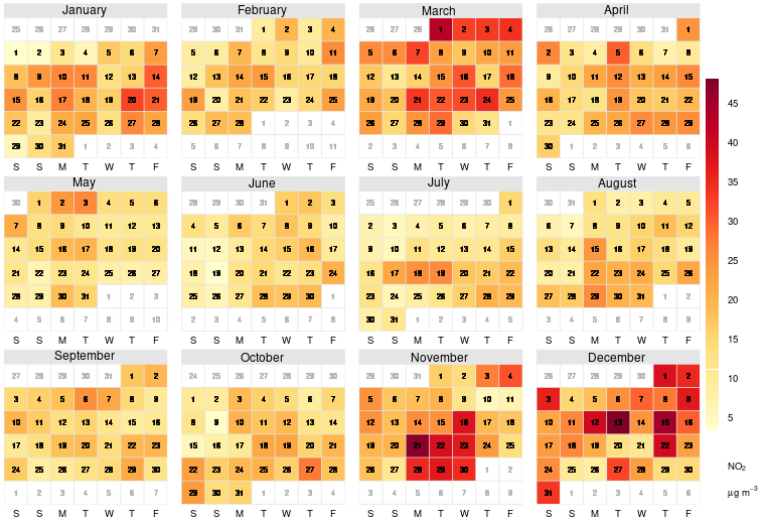


Figure F-14 Dunfermline NO_2 calendar plots

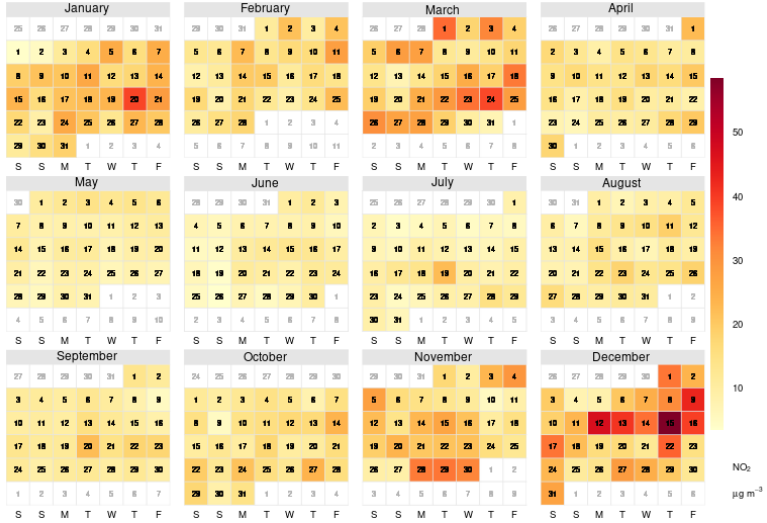


Figure F-15 Kirkcaldy NO_2 calendar plots

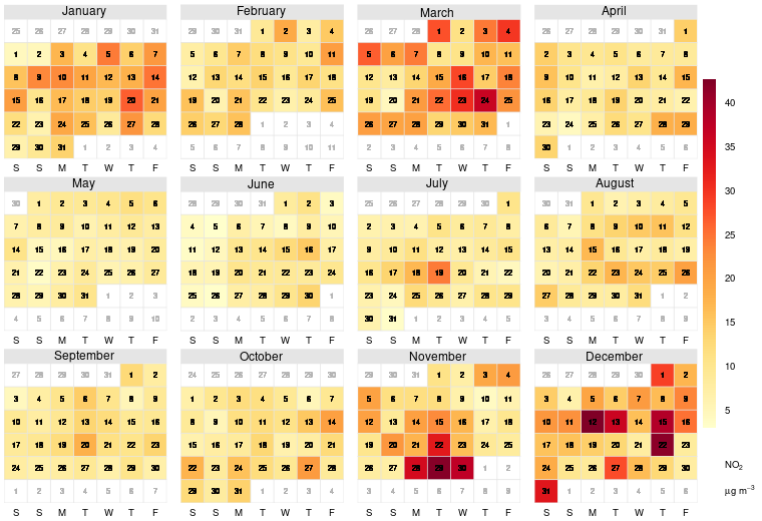


Figure F-16 Rosyth NO_2 calendar plots

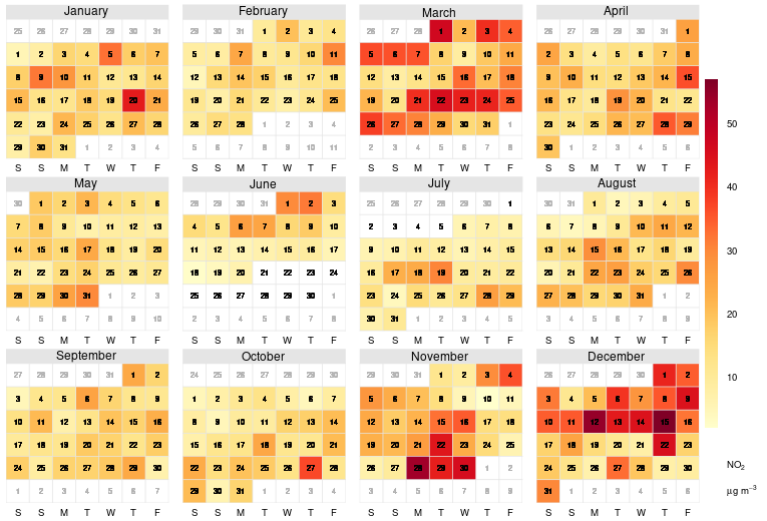


Figure F-17 Cupar PM_{10} calendar plots

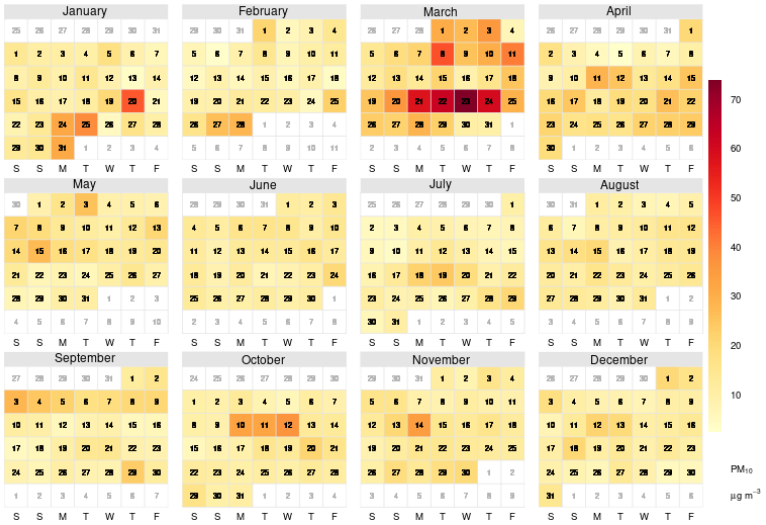


Figure F-18 Dunfermline PM_{10} calendar plots

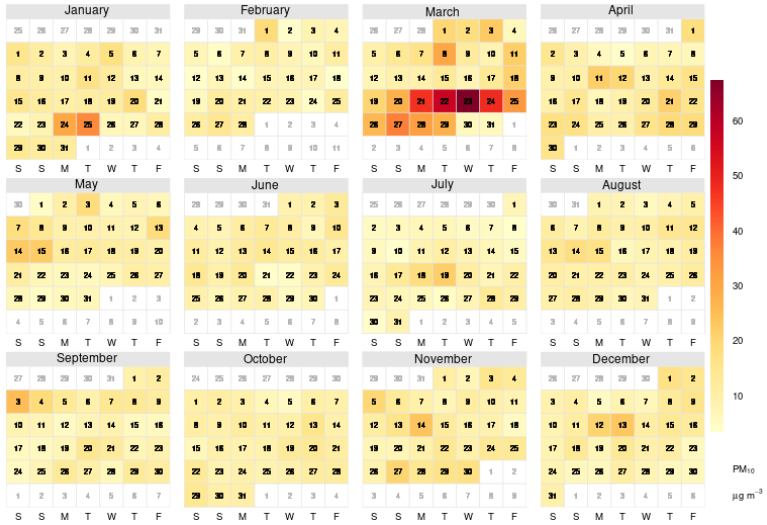


Figure F-19 Kirkcaldy PM_{10} calendar plots

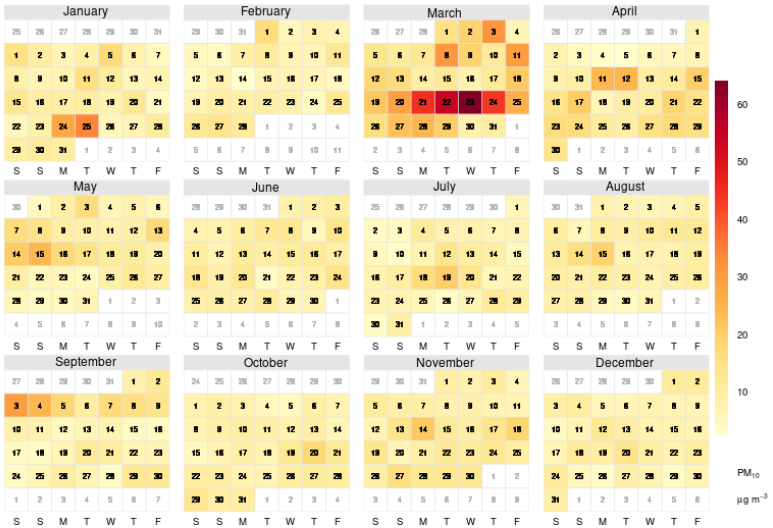


Figure F-20 Rosyth PM_{10} calendar plots

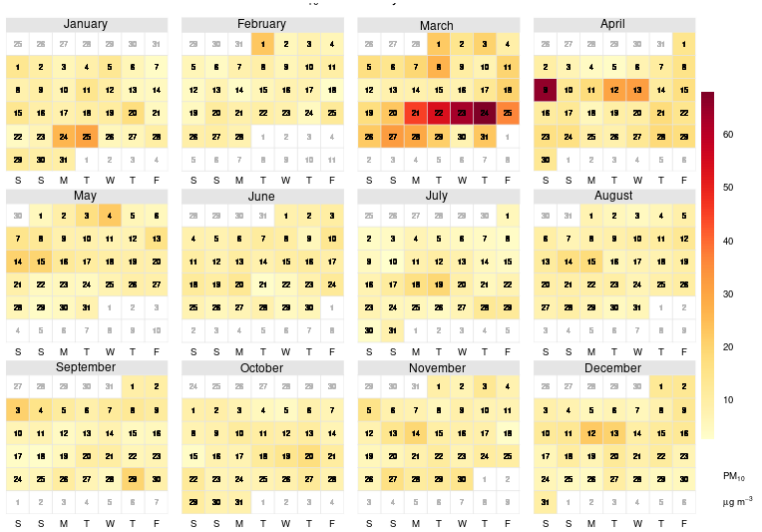


Figure F-21 Cupar $PM_{2.5}$ calendar plots

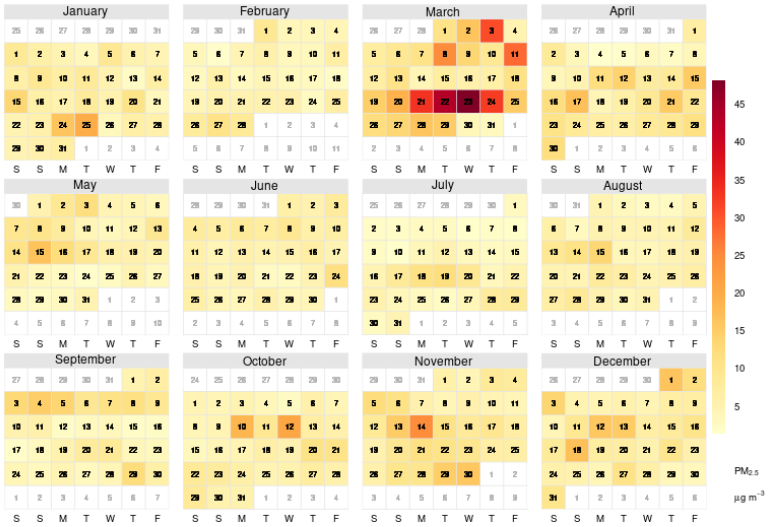


Figure F-22 Dunfermline $PM_{2.5}$ calendar plots

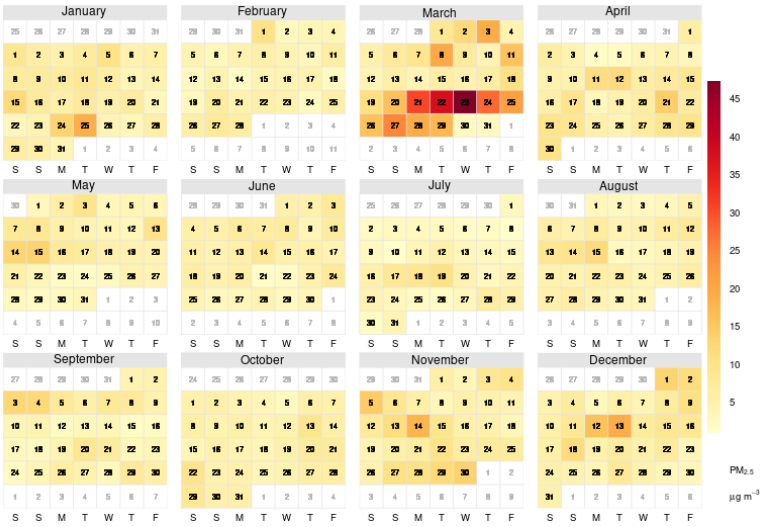


Figure F-23 Kirkcaldy $PM_{2.5}$ calendar plots

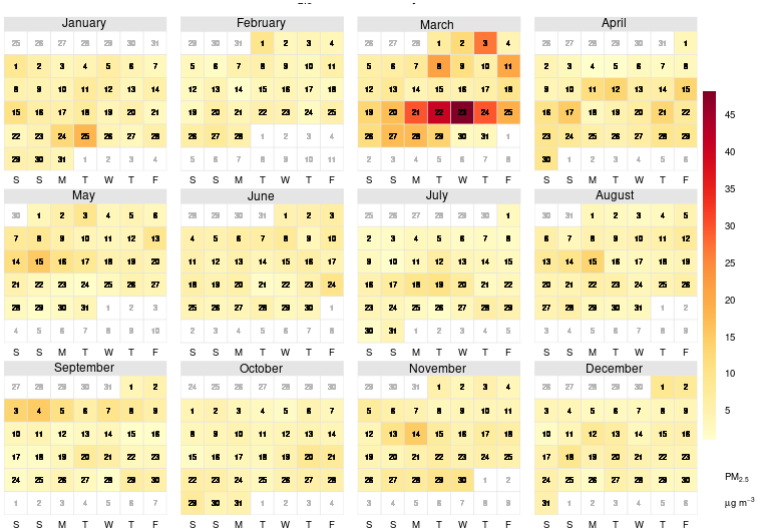


Figure F-24 Rosyth $PM_{2.5}$ calendar plots

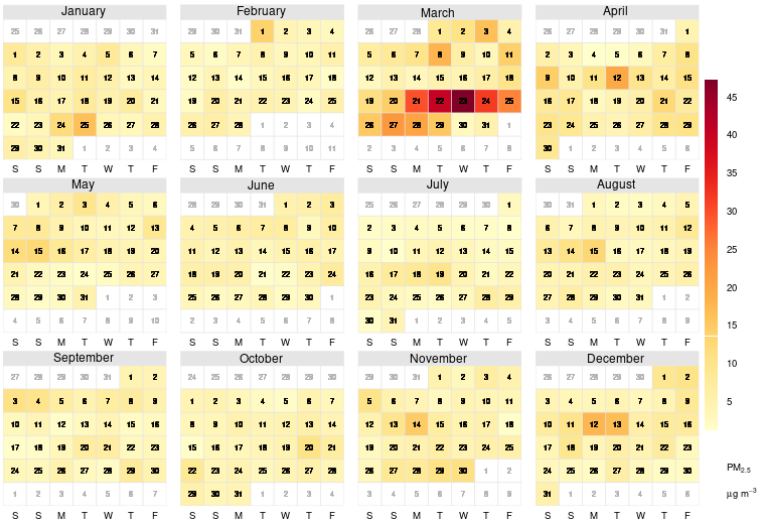


Figure F-25 Cupar NO_2 polar plot

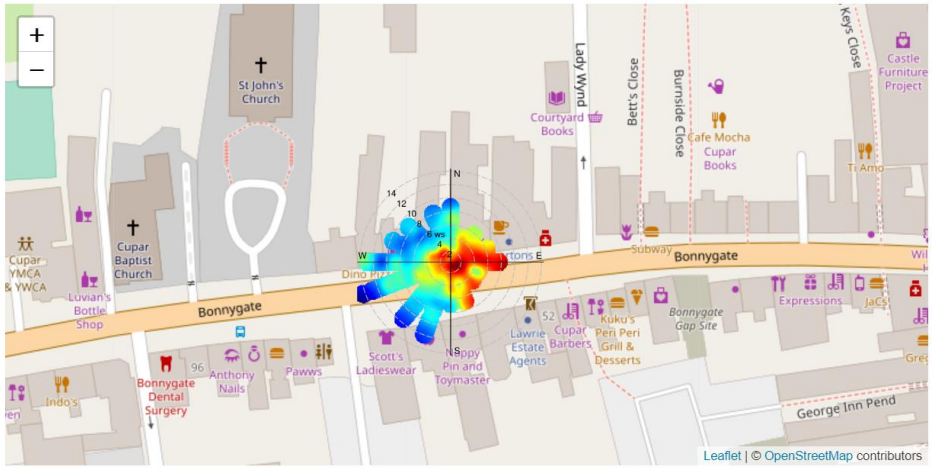


Figure F-26 Dunfermline NO_2 polar plot

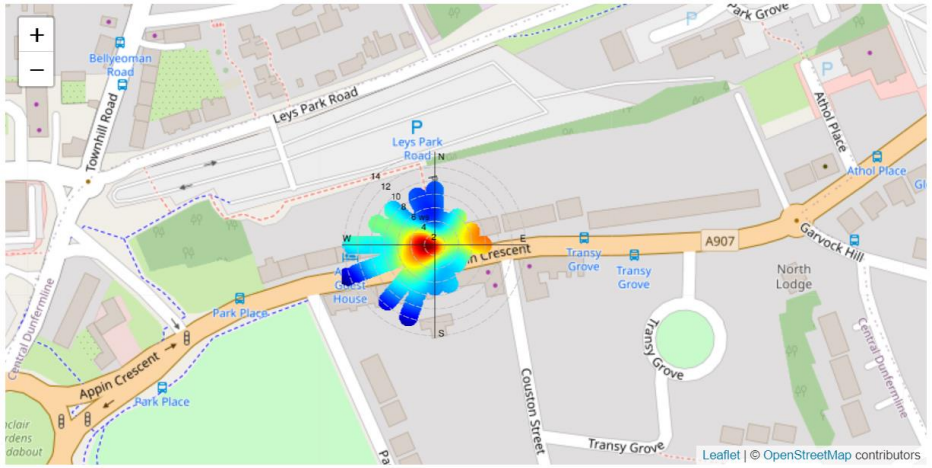


Figure F-27 Kirkcaldy NO_2 polar plot

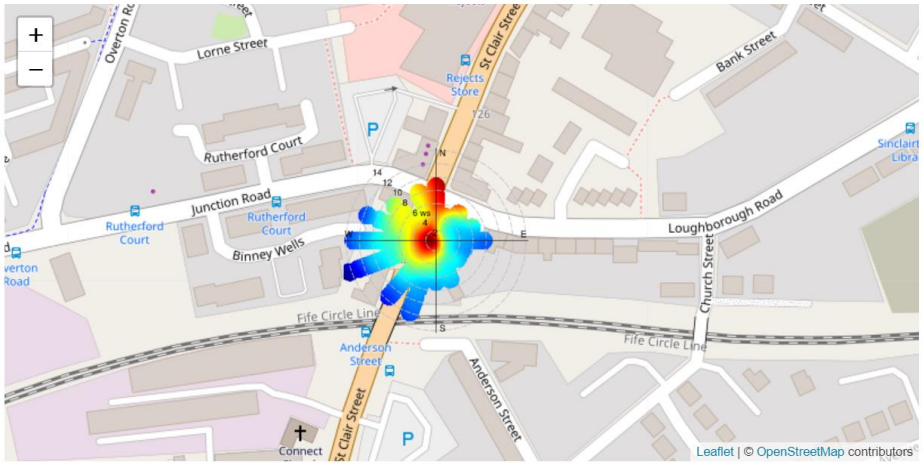


Figure F-28 Rosyth NO_2 polar plot

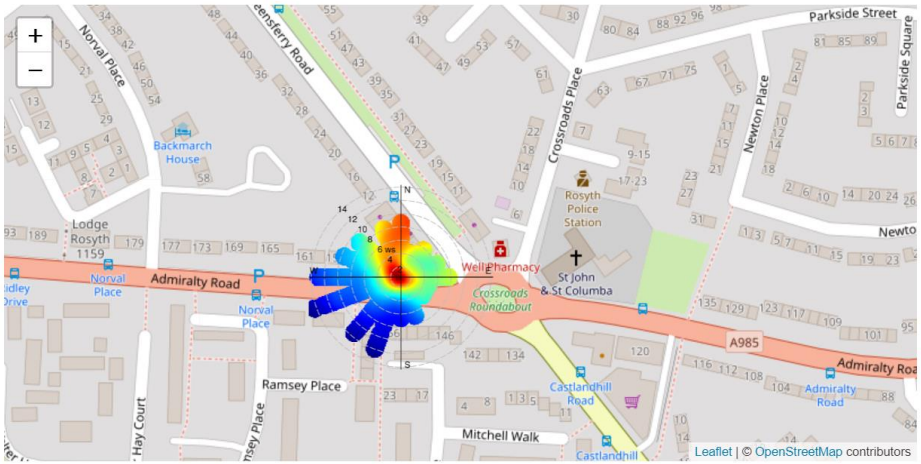


Figure F-29 Cupar PM_{10} polar plot

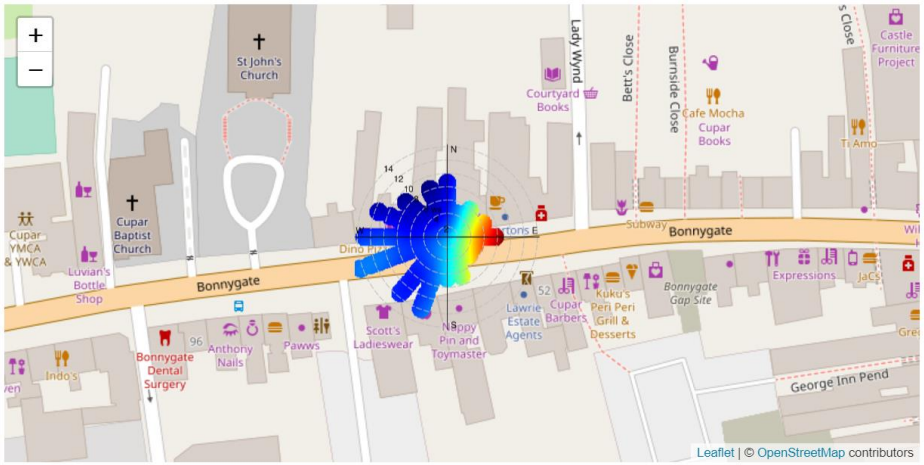


Figure F-30 Dunfermline PM_{10} polar plot

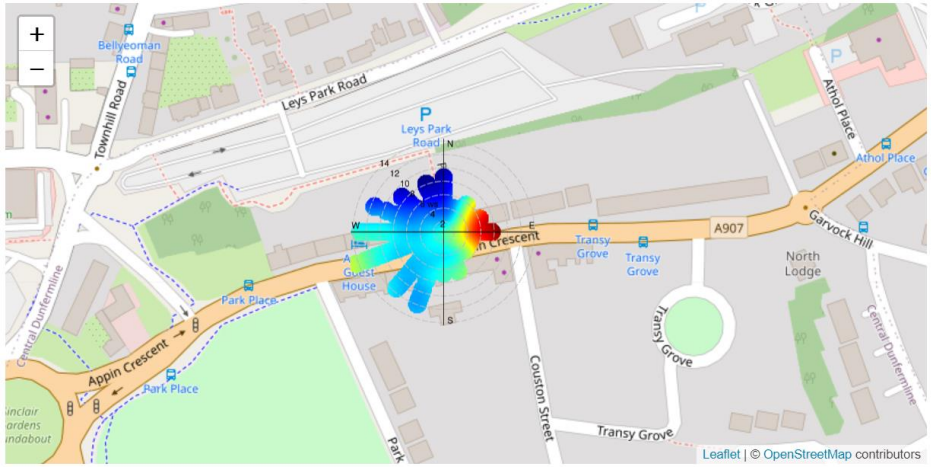


Figure F-31 Kirkcaldy PM_{10} polar plot

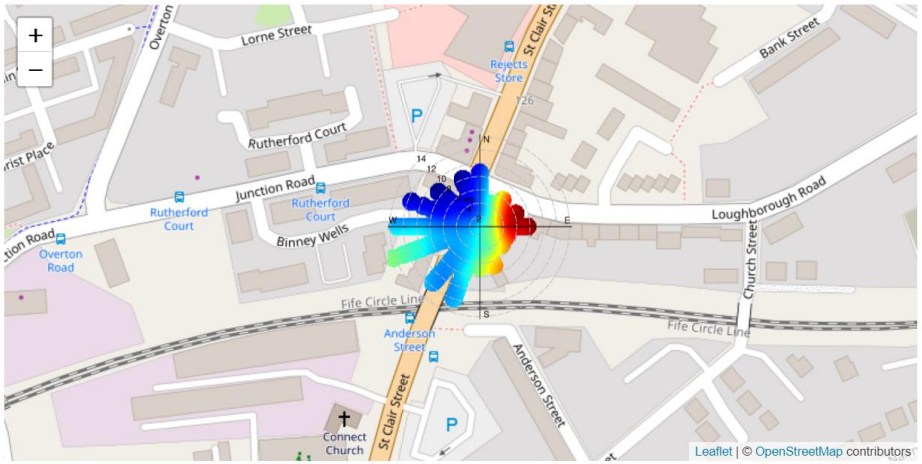


Figure F-32 Rosyth PM_{10} polar plot

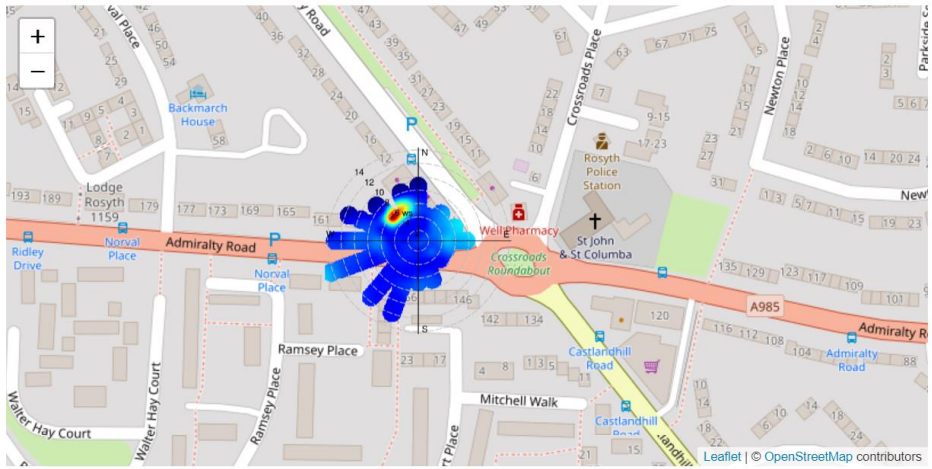


Figure F-33 Cupar $PM_{2.5}$ polar plot

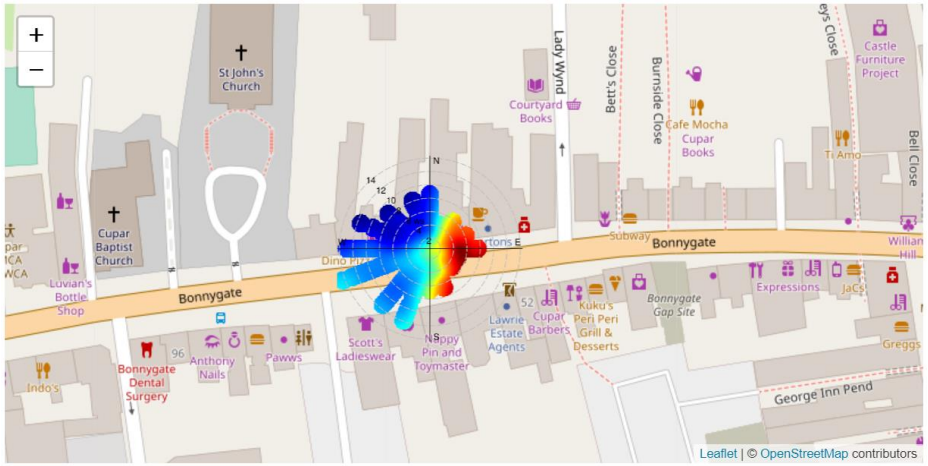


Figure F-34 Dunfermline $PM_{2.5}$ polar plot

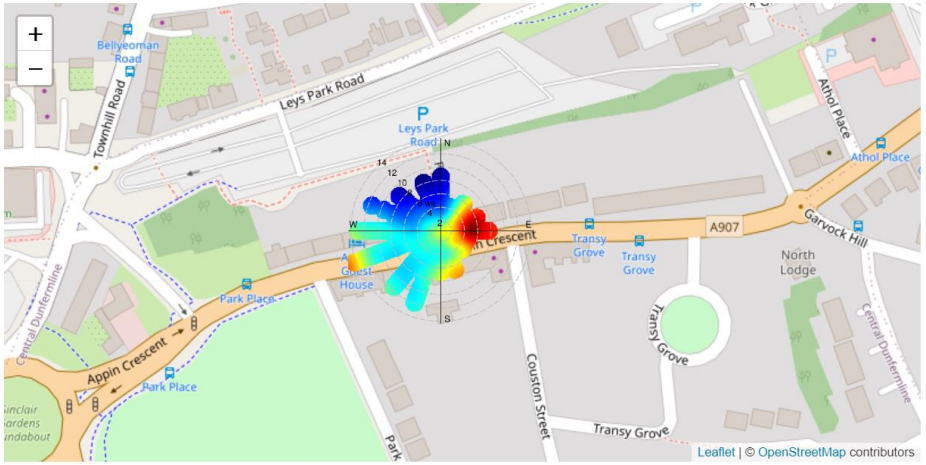


Figure F-35 Kirkcaldy $PM_{2.5}$ polar plot

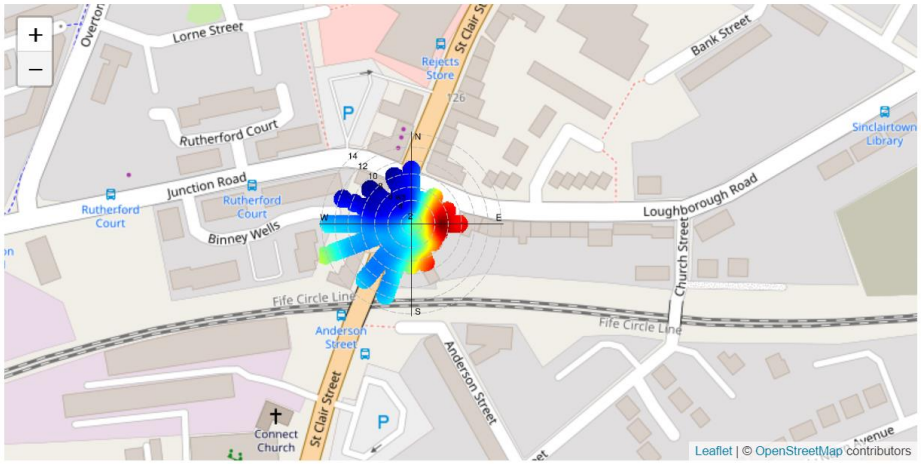


Figure F-36 Rosyth $PM_{2.5}$ polar plot

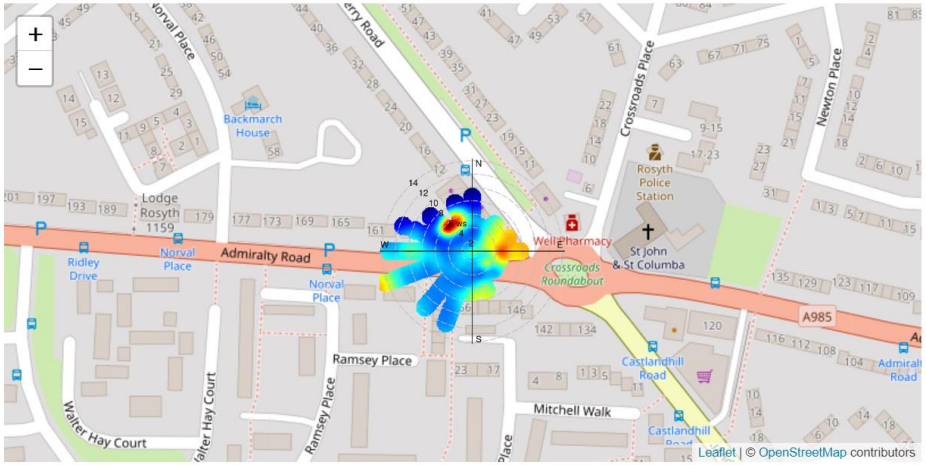


Figure F-37 Trajectory Clusters

Figure F-38 Trajectory plot for top ten highest daily NO_2 concentration

Figure F-39 Trajectory plot for top ten highest daily PM_{10} concentration

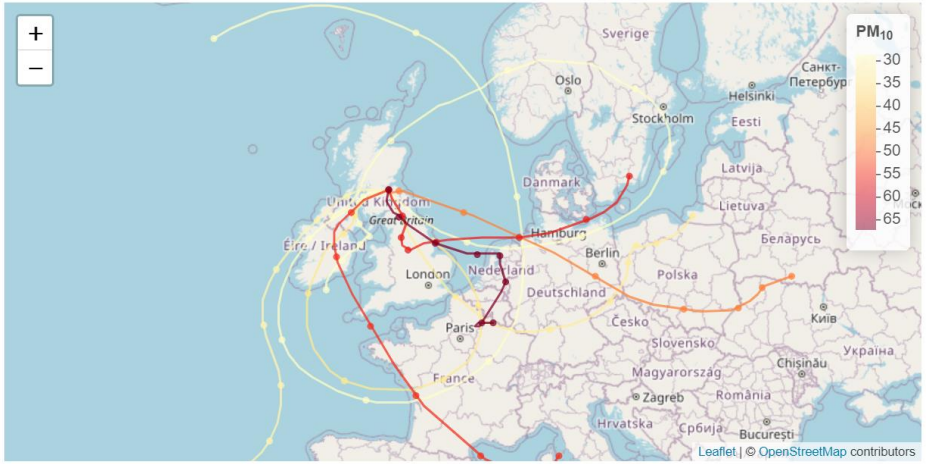
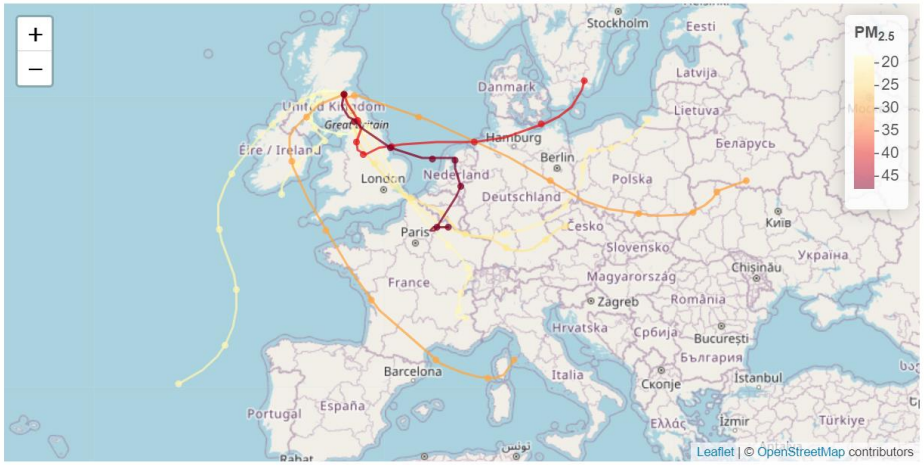


Figure F-40 Trajectory plot for top ten highest daily $PM_{2.5}$ concentration



Appendix G The Mossmorran and Braefoot Bay Independent Air Quality Monitoring Review Annual Report Summary 2021[8]

IOM

Air Quality Around Mossmorran and Braefoot Bay 2021 – Summary Report

Image courtesy of SEPA

What is air quality like around Mossmorran and Braefoot Bay and has it been affected by the industries in the area?

Monitoring has revealed no adverse effects on air quality from activities undertaken at the Mossmorran Complex, which includes ExxonMobil's Fife Ethylene Plant (FEP) and Shell UK Fife NGL plant, in 2021. Levels of air pollutants remain within the objectives set by the Scottish Government to protect human health.

This conclusion comes from evaluating data collected by SEPA and Fife Council at their air monitoring stations, along with additional data provided by INEOS along the Forth Estuary. SEPA's monitoring sites were chosen to reflect the location of residential communities, and included a downwind site to represent the most impacted direction from the Mossmorran Complex.

The quality of the air in the area is determined by measuring the amount of pollutants that are present. These pollutants can come from different sources or activities, including vehicles, industries, wood-burning and gas stoves. The measurements were compared to air quality objectives, which are set by the government to make sure the air we breathe is safe.

Pollutant	SEPA (4 monitoring sites)	Fife Council (4 monitoring sites)	INEOS
PM_{10}*	Highest annual mean found at Little Raith: 11.9 µg m^{-3}	Highest annual mean found at Cupar: 13.0 µg m^{-3}	N/A
$PM_{2.5}$*	Highest annual mean found at Little Raith: 6.3 µg m^{-3}	Highest annual mean found at Cupar: 6.3 µg m^{-3}	N/A
NO_2**	Highest annual mean found at Little Raith: 4.1 µg m^{-3}	Highest annual mean found at Cupar: 20 µg m^{-3}	N/A
SO_2**	Little Raith: 32.5 µg m^{-3} (highest 15 minute mean)	N/A	N/A
CO#	Little Raith: 1.7 mg m^{-3} (highest running 8 hour mean)	N/A	N/A
Benzene##	N/A	N/A	1 to 0.4 ppb

*PM_{10} and $PM_{2.5}$ are two different sizes of particulate matter. These are tiny particles which go deep into the lungs, affecting health in many ways.

** NO_2 is nitrogen dioxide and SO_2 is sulphur dioxide, which are gases that can affect lung health.

Carbon monoxide is a colourless, odourless gas. It can affect how well your blood carries oxygen.

Benzene is a vapour, which has been associated with cancer.

In the table above, the highest average value out of all the monitoring sites is provided. The square colours indicate whether any air quality objectives were exceeded. Green means the objective for that pollutant was not exceeded. No pollutant objectives were exceeded. N/A indicates that no data were available. For more information on air quality objectives please see **www.scottishairquality.scot/air-quality/standards**.

How do emissions from the industries at Mossmorran and Braefoot Bay affect air quality?

Operations at ExxonMobil's Fife Ethylene Plant (FEP) and Shell UK Fife NGL plant at Mossmorran and Braefoot Bay can produce air pollutants. The emissions of air pollutants are regulated by the Scottish Environment Protection Agency (SEPA). All air quality monitoring stations found that air quality remained good throughout the year.

Who evaluates air quality related to the Mossmorran and Braefoot Bay area?

The Mossmorran & Braefoot Bay Expert Advisory Group on Air Quality (AQ EAG) advises Fife Council on whether there are any air quality and related health impacts arising from operations at the Mossmorran Complex and the Braefoot Bay Marine terminal facilities.

The AQ EAG reviews air quality data collected from various sources, including air monitoring data from Fife Council, SEPA, INEOS, and emissions monitoring by ExxonMobil and Shell, as required by their permit.

The AQ EAG also considers the potential impact that any major plant changes could have on air quality and liaises with representatives from community councils and the local health service.

This summary and the full report are independently developed by the Institute of Occupational Medicine (IOM) for the AQ EAG as required under the planning permits for FEP and FNGL, and financed by the site operators. This summary has been approved by the Mossmorran and Braefoot Bay Community and Safety Liaison Committee's Expert Advisory Group on Communications. Fife Council covers costs of the administration of the Committee and constituent groups including the AQ EAG.

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For more information on the AQ EAG's reports, see **www.fife.gov.uk/kb/docs/articles/environment2/environmental-health/mossmorran-and-braefoot-bay**

GLOSSARY OF TERMS

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

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