FIFE AIR QUALITY ANNUAL PROGRESS REPORT 2024

Fife Council

Report for: Fife Council

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2024 Air Quality Annual Progress Report (APR) for Fife Council

In fulfilment of Part IV of the Environment Act 1995

Local Air Quality Management

June 2024

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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 2023. 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 44 sites (total of 52 tubes). All NO_2 concentrations measured during 2023 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 2023 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 2023 indicates that it is unlikely that any air quality objectives relating to these pollutants were exceeded during 2023.

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.

The Air Quality Action Plans (AQAPs) for both Bonnygate, Cupar and Appin Crescent Dunfermline AQMAs (both last updated in 2021), have been successful in reducing both NO_2 and PM_{10} concentrations for several years now. During 2023 monitoring within the AQMAs showed that concentrations were below all objectives level for NO_2 and PM_{10}.

Fife's Air Quality Management Areas (AQMAs) at Bonnygate, Cupar and Appin Crescent, Dunfermline Air Quality Management Areas (AQMAs) are now both fully revoked. The NO_2 element was revoked in September 2021 and the PM_{10} element was revoked in December 2023.

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 (AQMAs) using three AQMesh sensors. During June 2022, August 2022 and April 2023 Fife Council enhanced their sensor network by installing an additional three sensors at areas of concern to further assess air pollution in these areas. These were St Clair Street, Kirkcaldy, City Road, St Andrews and Bonnygate North, Cupar. With the addition of the Bonnygate North site, it should be noted that the site "Bonnygate" referenced in previous reports will henceforth be referred to as "Bonnygate South". The 2023 data obtained from all six AQMesh units 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).

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

- Produce an Annual Progress Report in 2025, reporting concentrations measured during 2024.
- Continue to implement the ongoing 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 previous AQMAs.
- Continue to review the NO_2 diffusion tube monitoring programme and seek to relocate any tubes where deemed appropriate.
- Update the Fife Air Quality Strategy to take into consideration revoked AQMAs and cover 5 more years.

Fife received grant funding for 2023/24 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 2023/24

Measure	Summary
Provision of three new NOx analysers to replace ageing equipment at Cupar, Dunfermline and Kirkcaldy and new air conditioning unit in Kirkcaldy	Details in Appendix D
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
Clean Air Day 2023	Further information is provided in Section 2.2.6
Blue Green Network	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 2023. 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.

Public engagement is one of the main actions taken by Fife throughout 2023. This has included the continued implementation of the Anti-Idling Campaign and also Clean Air Day educational events at several schools across Fife.

LOCAL PRIORITIES AND CHALLENGES

Fife has been awarded its grant funding from the Scottish Government for 2024-25. The funding will be used in conjunction with existing resources 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. Fife will continue to implement the ongoing measures set out in the Bonnygate and Appin Crescent AQAPs during 2024 following the recent AQMA revocations. The priorities within the areas 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'.
- Continue with the interrogation of monitoring data from the existing AQMesh units within Bonnygate, Cupar and Appin Crescent, Dunfermline to further understand pollutant concentrations and trends.

In addition to the above, educational events to highlight Clean Air Day are due to be delivered at several schools throughout Fife as part of Clean Air Day on and around the 20th of June 2024. This follows on from the successful delivery of similar educational packages as part of Clean Air Day over recent years. The events will include bite size air quality presentations as well as air quality monitoring in the vicinity of the 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 2023. It fulfils the requirements of Local Air Quality Management (LAQM) as set out in Part IV of the Environment Act (1995), as amended by 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

AQ Objective-Pollutant	Concentration	Measured as	Date to be achieved by
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 assessments 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 for both AQMAs.

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 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.

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

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 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 tube locations in combination.

NO_2, PM_{10} and $PM_{2.5}$ concentrations were below the annual mean objectives in 2018, 2019, 2020 and 2021. The review of all available data relating to CO, SO_2 and benzene monitoring indicated that it was unlikely that any AQS objectives relating to these pollutants were exceeded between 2018 and 2021. 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 in 2018, no exceedances were measured for any of the pollutants. In 2019 AQMesh monitoring data indicated that there were exceedances of the PM_{10} (both annual and daily objectives) and $PM_{2.5}$ objectives during 2019 at Bonnygate but no NO_2 exceedances. There were no exceedances of the NO_2, PM_{10} or $PM_{2.5}$ objectives at Appin Crescent during 2019. AQMesh data indicated that there were no exceedances measured at any of the sensor locations for the NO_2, PM_{10} or $PM_{2.5}$ objectives in 2020 or 2021.

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 2023 Annual Progress Report

The 2023 APR utilised monitoring data collected throughout 2022. Fife carried out NO_2 automatic monitoring at four sites in Cupar, Dunfermline, Kirkcaldy and Rosyth. Non-automatic monitoring of NO_2 was carried out at 42 sites (total of 58 diffusion tubes). Three diffusion tube sites were decommissioned at the beginning of 2022 due to low readings and were replaced by three new sites selected due to public complaints and/or a suitable level of traffic flow. All NO_2 concentrations measured during 2022 were below the annual mean objective of 40 µg m^{-3}.

PM_{10} and $PM_{2.5}$ was measured at four automatic sites in Cupar, Dunfermline, Kirkcaldy and Rosyth. 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 sensor units within Cupar, Dunfermline, Kirkcaldy and St Andrews. Two additional AQMesh sensor units were installed at Kirkcaldy (June) and St Andrews (August) during 2022. The 2022 data obtained from all five sites showed no exceedances of any of the NO_2, PM_{10} and $PM_{2.5}$ objectives.

A review of all available data relating to CO, SO_2 and benzene monitoring during 2022 indicated that it was unlikely that any air quality strategy objectives relating to these pollutants were exceeded.

2. ACTIONS TO IMPROVE AIR QUALITY

2.1 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 timescale and no later than 12 months of the date of the 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 timescale. 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.

Fife currently does not have any active AQMAs. During 2023 Fife made the decision to seek revocation of the PM_{10} element of both AQMAs following the release of the guidance note[3] issued by the Scottish Government in 2023 relating to the Pilot Research Study[4] to Investigate Monitoring Techniques in Scotland. The NO_2 element of the AQMAs was revoked in 2021.

A summary of AQMAs revoked by Fife can be found in Table 2-1. Further information related to revoked AQMAs, including maps of AQMA boundaries are available online https://www.scottishairquality.scot/laqm/aqma. The boundaries of the AQMA's recently revoked 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 met regularly throughout 2023 to discuss and review the progress of the action plan measures outlined in the AQAPs.

Fife proposes to continue to monitor NO_2 and PM_{10} concentrations within the former 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 monitoring was not possible.

[3] Local Authority Guidance Note for LAQM Reporting of Scottish PM Data | Scottish Air Quality

[4] Equivalence Study to Investigate Particulate Matter Monitoring in Scotland Using the Fidas 200 | Scottish Air Quality

Table 2-1 Revoked Air Quality Management Areas

AQMA Name	Pollutants and Air Quality Objectives	City/Town	Description	Revocation Date
Bonnygate, Cupar	NO_2 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.	September 2021
	PM_{10} annual mean			December 2023
Appin Crescent, Dunfermline	NO_2 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.	September 2021
	PM_{10} annual mean			December 2023

Figure 2-1 Bonnygate, Cupar AQMA Boundary

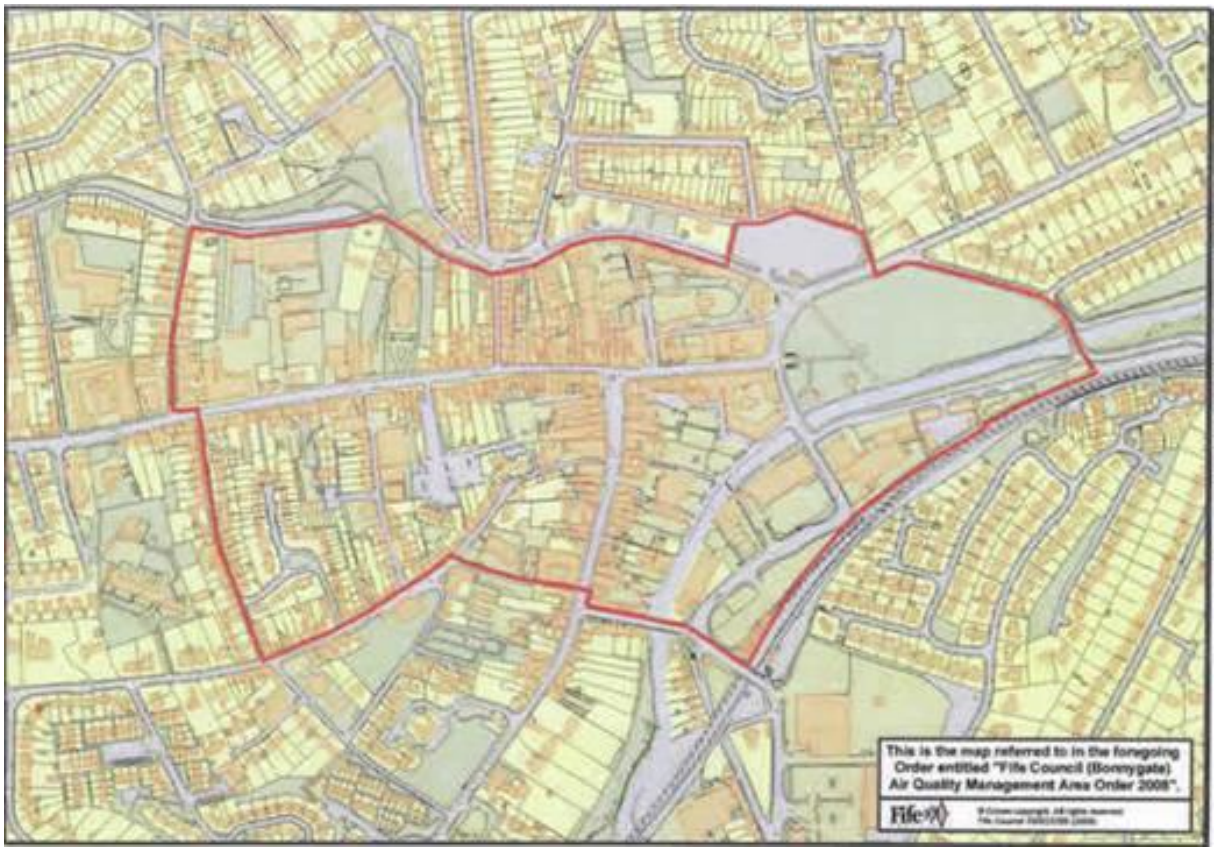
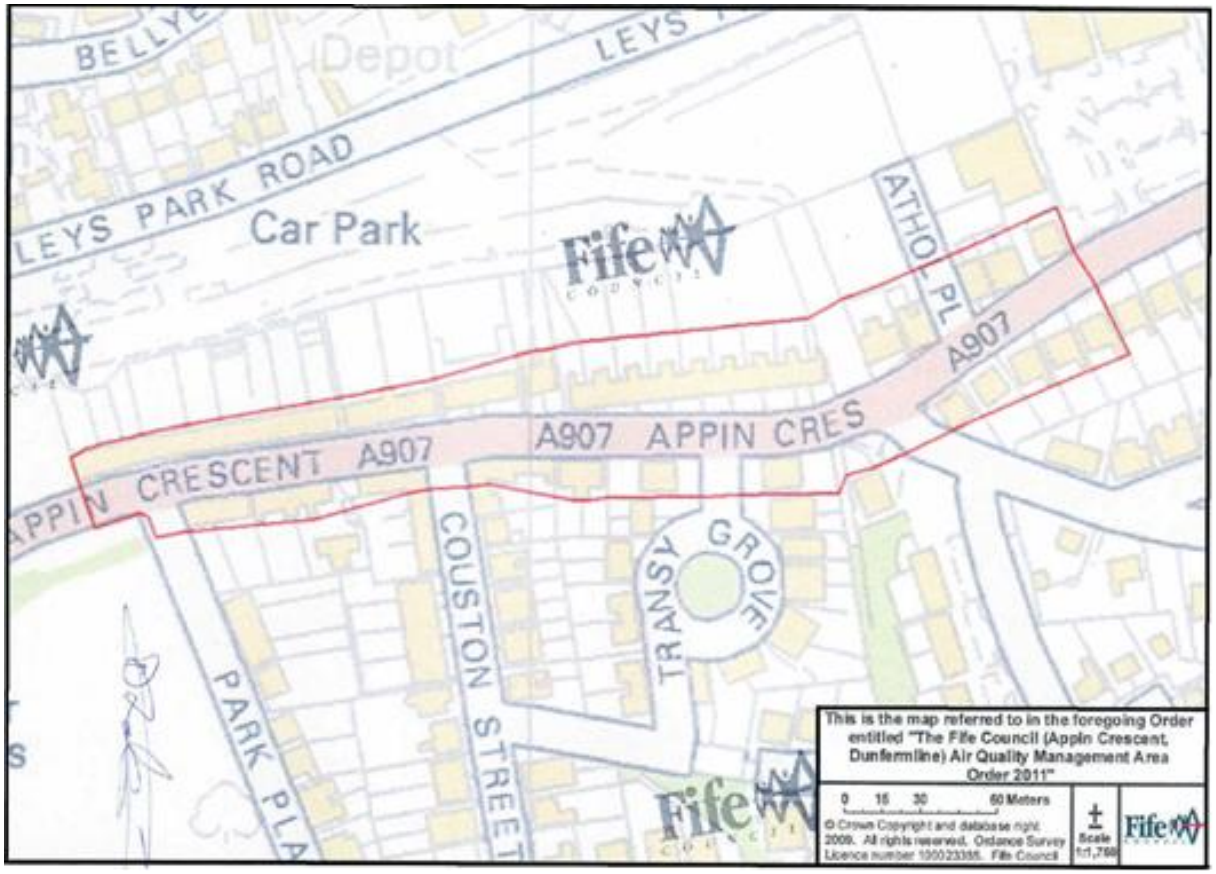


Figure 2-2 Appin Crescent, Dunfermline AQMA Boundary



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 by Fife 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 regularly 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 Transport Strategy for Fife 2023-2033 was approved by the Fife Council Cabinet Committee on 30th November 2023 and sets out our vision and priorities for transport in Fife over that ten-year period. One of the key aims is to work with others to decarbonise the transport sector by encouraging sustainable travel and enabling the roll-out of zero-emission vehicles (including the development of a Public EV Strategy & Expansion Plan).

https://www.fife.gov.uk/__data/assets/pdf_file/0020/450155/Local-Transport-Strategy-for-Fife-2023-2033.pdf

Scotland's fourth National Planning Framework (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 is currently programmed to be adopted by the Council in 2027. The first stage involves preparation of an Evidence Report which will go through a Gatecheck process to establish an information baseline for preparing the Proposed Local Development Plan. The Evidence Report, which will include an Environmental Scoping Report, will be considered by Full Council Committee on 21st March 2024 before submission to Gatecheck in April 2024. Milestone dates are set out in the latest update of the Fife Development Plan Scheme (2023) Fife Development Scheme 2023.

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

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

being used by Communities & Neighbourhoods Services to help with various forms of local community-based planning.

In partnership with NHS Fife, Fife has also 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 previously 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 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 Protective Services is currently working with colleagues in our Climate and Zero Waste Team to finalise 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.

In December 2023 Fife Council approved the Fife Local Heat and Energy Efficiency Strategy (LHEES) and Delivery Plan. This new duty for Scottish Local Authorities is 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 advice and input. Air quality is included in the priorities for the plan and work is currently being undertaken to understand the impact of actions on air quality.

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 previously undertaken a domestic fuel use survey in our two (now recently revoked) AQMAs (Bonnygate, Cupar and Appin Crescent, Dunfermline) to further understand the contribution of this source. The Scottish Government are considering domestic burning under CAFS2 and we await further information in this regard should formal guidance be provided by the Scottish Government. In the meantime we are currently investigating the potential for general guidance to be made available on the various Fife Council social media platforms for members of the public.

In terms of agricultural sources, we have previously applied (unsuccessfully) for funding to formulate a guidance leaflet aimed at making landowners aware of the issues associated with ammonia pollution and how to reduce the associated emissions. The Scottish Government are also considering ammonia emissions under CAFS2 and we await further information in this regard also before potentially exploring other funding options in order to progress.

Fife are also actively supporting the Scottish Gas Network (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 the summer of 2025 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 April 2024 the construction phase of the project continues with over 65% of the new 8.2km hydrogen network now installed. In addition the construction of the hydrogen demonstration homes is now complete with these now being fitted with appliances in preparation for opening up to participants. The construction of the hydrogen production and storage facility at Fife Energy Park is also progressing well and is nearing completion.

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 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.

Within the Dunfermline area a ‘Greenspace Strategy’ has been developed and is a new community owned organisation that will support various local projects and groups. There are 10 interlinked themes within the strategy which includes energy, health and wellbeing as well as active travel. With regards to active travel within Dunfermline a Walking and Cycling Index 2023 has been published (as of March 2024) and includes the results of a survey undertaken by Sustrans to identify the extent of active travel within Dunfermline and these results will be updated on an annual basis. The survey results for 2023 show that 48% of residents walk or wheel at least 5 days a week (wheeling relates to the use of wheeled mobility aids) with 9% of residents cycling at least once a week. As part of the ‘Greenspace Strategy’ a local group in Dunfermline is also in the process of creating a Cycling Action Plan for the city, aiming to make Dunfermline an easy place to cycle to, from and around.

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

During 2023/24 Fife Council trialled its own new travel tracker (Fresh Air Frankie Travel Tracker) which collects data daily on how pupils travel to school and it is hoped that this will be rolled out to all Fife primary schools in the next academic year (2024/25). The data obtained so far since the trial was introduced in October 2023 are shown in Table 2-2 and highlights a high uptake considering the survey period mainly covers the winter months.

Table 2-2 Travel Tracker (Fresh Air Frankie Travel Tracker) Results

Month	Number of schools taking part	Active travel	Non-Active travel
October	11	59%	41%
November	8	60%	40%
December	8	60%	40%
January	11	56%	44%
February	9	60%	40%

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 2023/24 period saw a maximum of 9 schools and 2,377 pupils take part. The 2022/23 period by comparison saw a greater number of schools take part (19) with a higher number of pupils (4,688).

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 2023 show that active travel increased slightly from 56% in 2022 (46% walking, 4% cycling and 6% scooter/skate) to 57% in 2023 (44% walking, 6% cycling and 7% scooter/skate). A decrease in the percentage of children driven to their primary schools was noted from 21% in 2022 to 20% in 2023 as well as those opting to park and stride which decreased from 15% in 2022 to 14% in 2023 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 2023 the number of pupils signed up to take part across Levels 1 and 2 of Bikeability were:

- Level 1 – 1,334 pupils took part from 31 schools (19% of schools across Fife delivered the scheme) with a 37% pass rate (500 pupils passed). In comparison 2,428 pupils from 59 schools took part in 2022 with a 100% pass rate.
- Level 2 – 908 pupils took part from 25 schools (16% of schools across Fife delivered the scheme) with a 22% pass rate (200 pupils passed). In comparison 1,780 pupils from 44 schools took part in 2022 with a 100% pass rate.

Colleagues in Transportation have advised that schools started off with a high commitment to take part in Bikeability but due to the teachers strikes over 2023 a significant number dropped out hence the lower numbers noted above.

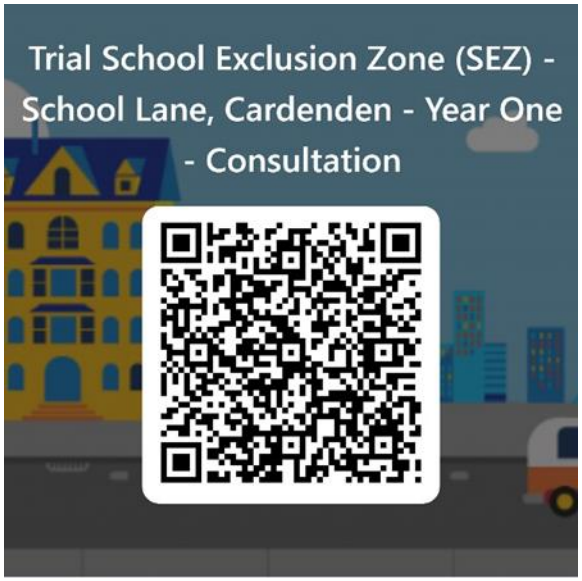
In November 2022 ‘School Exclusion Zones’ were trialled at three schools across Fife over a scheduled 18-month period (due to end in May 2024), whereby the schools involved were:

- Denend Primary, Cardenden
- Pitcoudie Primary, Glenrothes

- St Marie's RC, Kirkcaldy

The objectives of the SEZs included improving road safety outside the schools and encouraging more active travel to and from school. As the trial is now nearing completion (as of April 2024) parents and children from the three schools involved have been asked to provide comments by means of an online consultation (example consultation method shown in Figure 2-3). The feedback provided will be used to determine if these trial SEZs will be made permanent and if further SEZs will be rolled out to other schools across Fife. A report is due to go to Fife Council's Cabinet Committee in May 2024 in relation to the findings of the trial following which a decision on how to proceed will be made.

Figure 2-3 QR code used for providing feedback on the Trial 'School Exclusion Zone' for Denend Primary, Cardenden



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 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.

For Clean Air Day 2023, Fife Council provided four primary schools with an educational package, including materials to carry out their own monitoring studies, whereby the participating primary schools were:

- Crossford Primary School
- Hill of Beath Primary School
- Masterton Primary School

- Dalgety Bay Primary School

Prior to Clean Air Day, each school was provided with three 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.

During Clean Air Day the schools were encouraged to post on social media what they were involved in as part of the day, examples of what was posted is shown in Figure 2-4 where pupils completed Clean Air Day pledge cards.

Figure 2-4 Fife Council Facebook Post from Clean Air Day 2023 showing pupils from Masterton and Crossford Primary Schools getting involved in Clean Air Day activities

Following Clean Air Day a final results presentation from the monitoring exercise was provided to each school by Ricardo Energy & Environment to allow the pupils to learn about and discuss the results of their monitoring studies.

Depending on future funding there would be a hope to run similar type events in future years.

2.3 IMPLEMENTATION OF AIR QUALITY ACTION PLANS AND MEASURES TO ADDRESS AIR QUALITY

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 Council has taken forward a number of measures during the current reporting year of 2023 in pursuit of improving local air quality prior to revoking both AQMAs in December 2023. Details of all measures completed, in progress or planned during 2023 are set out in Table 2-3 for Bonnygate, Cupar and Table 2-4 for Appin Crescent, Dunfermline. More detail on these measures can be found in the associated Air Quality Action Plans which are still available on the Council's website at www.fife.gov.uk/airquality.

The 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.

As mentioned above both AQMAs have now been revoked (as of December 2023) however Fife Council will continue to implement existing action plan measures for both areas (Bonnygate, Cupar and Appin Crescent, Dunfermline) over 2024 in order to maintain the improvements made to local air quality.

Table 2-3 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 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 Group which seeks to review the provisions of the CAA 1993 with a view to ensuring alignment with LAQM Regulations. Process has also allowed for the review and update of templates for AQAPs, AQMA Revocations and Annual Progress Report in line with CAFS2 commitments and Environmental Standards Scotland recommendations. Fife Council has also provided comments on the latest draft Scottish Government Policy Guidance on Air Quality. Fife Council recently attended a CAFS2 workshop event which focussed on stakeholder engagement and included representatives from numerous local authorities along with SEPA and the Scottish Government.	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)	The Local Transport Strategy for Fife 2023-2033 was approved by the Fife Council Cabinet Committee on 30th November 2023 and sets out our vision and priorities for transport in Fife over that ten year period. One of the key aims is to work with others to decarbonise the transport sector by encouraging sustainable travel and enabling the roll-out of zero-emission vehicles (including the development of a Public EV Strategy & Expansion Plan). Further information on the LTS is available here: https://www.fife.gov.uk/__data/assets/pdf_file/0020/450155/Local-Transport-Strategy-for-Fife-2023-2033.pdf.	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 Council Air Quality Developers Guide. Scotland's fourth National Planning Framework (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 is currently programmed to be adopted by the Council in 2027. The first stage involves preparation of an Evidence Report which will go through a Gatecheck process to establish an information baseline	None

Measure No.	Measure	Category	Expected/Actual Completion Year	Measure Status	Funding Status	Key Milestone	Progress to Date	Barriers to implementation
							for preparing the Proposed Local Development Plan. The Evidence Report, which will include an Environmental Scoping Report, will be considered by Full Council Committee on 21st March 2024 before submission to Gatecheck in April 2024. Milestone dates are set out in the latest update of Fife Development Plan Scheme (2023) Fife Development Scheme 2023. Fife Council Protective Services are currently working on the technical assessment stage of this process.	
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 continues to attend Fife Council's Core Air Quality Steering Group meetings. The Plan for Fife, the Fife Partnership Local Outcome Improvement Plan, was in 2020-2021. Fife Council declared a climate emergency in 2019. 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. Climate Fife includes a practical action plan. [https://www.fife.gov.uk/kb/docs/articles/environment2/climate-change,-carbon-and-energy]. Climate Fife 2024 Strategy and Action Plan sets out work for the next four years and is working to scale-up, going further and faster, and to build on our achievements so far. 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 December 2023 Fife Council approved the Fife Local Heat and Energy Efficiency Strategy and Delivery Plan. This new duty for Scottish Councils is 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 advice and input. Air quality is included	None

Measure No.	Measure	Category	Expected/Actual Completion Year	Measure Status	Funding Status	Key Milestone	Progress to Date	Barriers to implementation
							in the priorities for the plan. Work is being undertaken to understand the impact of actions on air quality. Links to air quality are also 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. During 2023-24 the Climate Change team has been continuing to work 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 as of April 2024 and updates on progress will be noted in future APRs.	
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 on-going Bonnygate AQMA now fully revoked as of December 2023. Monitoring will continue in order to ensure continued compliance with statutory air quality objectives.	N/A
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. During 2023/24 Fife Council trialled its own new travel tracker (Fresh Air Frankie Travel Tracker) at several schools with data collected daily on how pupils travel to school. It is hoped that this will be rolled out to all Fife primary schools in the next academic year (2024/25).	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	Promoting travel alternatives	2025 (when strategy is next reviewed)	In progress	Traffic counters funded annually using Scottish	All years (ensuring sustainable travel continues to be	New grant application for 2023-24 included bid for 15 traffic counters but this was unsuccessful. Although original 2023-24 funding bid was unsuccessful, we were able to obtain two from a Scottish Government underspend. New bid to be submitted next year.	Funding not granted 2023/24 Ensure support still offered to schools and

Measure No.	Measure	Category	Expected/Actual Completion Year	Measure Status	Funding Status	Key Milestone	Progress to Date	Barriers to implementation
	Implementation Phase: 2021 - 2025				Government Air Quality Grant	considered and adopted)	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 latest update of the Fife Development Plan Scheme (2023)Fife Development Scheme 2023 Continue to actively promote sustainable travel to school, including initiatives such as Bikeability and WOW (Walk Once a Week). During 2023/24 Fife Council trialled its own new travel tracker (Fresh Air Frankie Travel Tracker) at several schools with data collected daily on how pupils travel to school. It is hoped that this will be rolled out to all Fife primary schools in the next academic year (2024/25).	Bikeability volunteers continue to be recruited
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 2023 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 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. 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 latest update of the Fife Development Plan Scheme (2023) Fife Development Scheme 2023 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. Scottish Government grant funding has been applied for in 2024/25 to allow for the update of the Fife Council Air Quality Strategy and preparation works have already begun in this regard.	None

Measure No.	Measure	Category	Expected/Actual Completion Year	Measure Status	Funding Status	Key Milestone	Progress to Date	Barriers to implementation
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
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)	Although no grant funding was provided in 2023/24 Fleet were able to obtain alternative funding to allow for 15 new electric vans to be purchased. These vehicles are to be used for the Councils Meals on Wheels (MoW) service. The whole of the MoW fleet (24 vans in total) is now electric and meets service needs from three depots across Fife (Kirkcaldy, Dunfermline and Leven). As of January 2024 Fife Council had 72 full electric vehicles and 19 hybrid vehicles in service (either leased or purchased). As of January 2024 the size of the Fife Council fleet decreased significantly from the 2023 figure of 1,497 vehicles and now stands at 1,414 vehicles. The amount of diesel used by the Council Fleet increased in 2022/23 and 2023/24 to 3,953,929 and 4,075,792 litres respectively indicative of a return to normal working practices after the initial 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 2023 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.	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
							As of January 2023 there are 67 bus operators within the ECO Stars scheme (one operator went out of business) but the number of vehicles covered has increased to 1,792.	
14	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 revenue if required	All years (ensuring membership continues to increase)	Scottish Government funding issued in 2023 allowed the ECO Stars scheme to continue in Fife. As of January 2024 the Fife Commercial Fleet Membership grew to 299 members covering 10,638 vehicles operating in Fife and beyond (note this figure includes the number of bus operators and vehicles noted above). As of January 2024 the Taxi & Private Hire Membership has increased to 163 members operating 672 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 Air Quality and Planning Toolkit Implementation Phase: 2021 - 2025	Policy guidance and 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 RapidAirTM 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 including forthcoming LDP sites review for Development Management colleagues.	None – updates already actioned
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 has been applied for in 2024/25 to allow for the update of the Fife Council Air Quality Strategy and preparation works have already begun in this regard. The new updated strategy will align with the Clean Air for Scotland Strategy 2 (CAFS2) and include reference to the air quality improvement measures that will continue to be implemented now that the Bonnygate and Appin Crescent AQMAs have been fully revoked.	None – AQS recently updated and new update to follow
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	All years (ensuring Fleet being ungraded especially electric and hybrids)	As of January 2024 Fife Council had 72 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 vehicles included another electric Refuse Collection Vehicle with funding obtained to install another 150kW charging station at the principal Fife Council depot (Bankhead Central) with installation and commissioning in progress as of February 2024.	Issues with revenue funding available to Fleet Switched On Fleet funding not available now for several years for vehicles

Measure No.	Measure	Category	Expected/Actual Completion Year	Measure Status	Funding Status	Key Milestone	Progress to Date	Barriers to implementation
					Air Quality Grant and other such funding (e.g., Switched On Fleet)			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 a new 150kW charging station at principal Fife Council depot (Bankhead Central) with installation and commissioning in progress as of February 2024. In addition several new 7kW twin chargers have been installed at Council based facilities including Meals on Wheels bases and a new 22kW public charger has been installed in Kirkcaldy. 2023 EV Charging points in Cupar (ChargePlace Scotland sites only) had 1,919 public charging sessions using 40,908kW of electricity. This is up on the 2022 figure when there were 773 public charging sessions which used 14,541kW of electricity. Interestingly the number of charging sessions recorded in 2023 is broadly similar to those recorded in 2019 (1,888 public charging sessions) when the amount of electricity used was significantly lower at 15,983 kW indicating that vehicles with larger battery packs, and therefore higher ranges, are now more common and being used regularly within Fife.	None – changes to available funding could cause issues
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. Social media platforms are also utilised to promote such events.	Funding important for continued implementation of ECO Stars and CAD and make promotional materials available.
20	Promote domestic combustion best practice guidance	Policy Guidance and Development Control	2025 (when strategy is next reviewed or earlier if proposed Scottish	In progress	Funded on an ad-hoc basis using Scottish Government	2022 (Domestic Fuel Use Survey undertaken)	Scottish Government have advised they are progressing this under CAFS2. In the meantime Fife Council are investigating the potential for general guidance to be made available on social media platforms.	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
	Implementation Phase: 2021 - 2025		Government guidance is issued)		Air Quality Grant or Council revenue			
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 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 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 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 2023 with Clean Air Day bite size presentations provided to four Primary Schools across Fife along with Citizen Science Packs to allow the children to undertake their own monitoring. Following the anti-idling campaign initially undertaken at several primary schools in 2022 the winning designs for posters and a banner have been manufactured and distributed. The banner has now been installed at the winning school (Mountfleurie, Leven) in order to raise awareness and change behaviour. Copies of the posters have also been provided to the winning schools (Dunnikier, Kirkcaldy and Lynburn, Dunfermline) for them to install in and around the school grounds. Extra copies of the posters are in the process of being installed at locations where complaints of anti-idling vehicles have been received by Fife Councils Environmental Health team and at key sensitive receptors such as hospitals as shown below (Queen Margaret Hospital, Dunfermline). Any extra posters will also likely be distributed to schools taking part in Clean Air Day 2024 activities. Scottish Government grant funding offer for 2024/25 is awaited (as of April 2024) with preparation works underway for 4 primary schools in St Andrews area for 2024 CAD.	Funding important for continued implementation
23	Identify source apportionment to background PM	Vehicle Fleet Efficiency	2025 (when strategy is next reviewed)	In progress	Funded annually using Scottish Government	2021-22 (Background Particulate Matter Source Apportionment	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.	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
	Implementation Phase: 2021 - 2025				Air Quality Grant or Council revenue	study and Domestic Fuel Use Survey)	Funding applied for in 2023/24 to produce a guidance leaflet but bid was unsuccessful. Scottish Government have advised they are progressing this under CAFS2. In the meantime Fife Council are investigating the potential for general guidance to be made available on social media platforms.	
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. 2023 also saw a new sensor obtained for use on the northern side of Bonnygate. Scottish Government grant funding has been applied for in 2024/25 to allow for an additional two sensors to be obtained that will also be used for this purpose (monitoring near schools). Fife Council is also currently liaising with the Royal College of Physicians on a grant proposal for undertaking air quality monitoring near schools.	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 RapidAirTM 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 including forthcoming LDP sites review for Development Management colleagues.	None – study already actioned

Table 2-4 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	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	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 Group which seeks to review the provisions of the CAA 1993 with a view to ensuring alignment with LAQM Regulations. Process has also allowed for the review and update of templates for AQAPs, AQMA Revocations and Annual Progress Report in line with CAFS2 commitments and Environmental	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					Clean Air Act and LAQM reporting) Ongoing advice to Scottish Government regarding experience of the LAQM process.	Standards Scotland recommendations. Fife Council has also provided comments on the latest draft Scottish Government Policy Guidance on Air Quality. Fife Council recently attended a CAFS2 workshop event which focussed on stakeholder engagement and included representatives from numerous local authorities along with SEPA and the Scottish Government.	
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)	The Local Transport Strategy for Fife 2023-2033 was approved by the Fife Council Cabinet Committee on 30th November 2023 and sets out our vision and priorities for transport in Fife over that ten-year period. One of the key aims is to work with others to decarbonise the transport sector by encouraging sustainable travel and enabling the roll-out of zero-emission vehicles (including the development of a Public EV Strategy & Expansion Plan). Further information on the LTS is available here: https://www.fife.gov.uk/__data/assets/pdf_file/0020/450155/Local-Transport-Strategy-for-Fife-2023-2033.pdf	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. Scotland's fourth National Planning Framework (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 is currently programmed to be adopted by the Council in 2027. The first stage involves preparation of an Evidence Report which will go through a Gatecheck process to establish an information baseline for preparing the Proposed Local Development Plan. The Evidence Report, which will include an Environmental Scoping Report, will be considered by Full Council Committee on 21st March 2024 before submission to Gatecheck in April 2024. Milestone dates are set out in the latest update of the Fife Development Plan Scheme (2023) Fife Development Scheme 2023 Fife Council Protective Services are currently working on the technical assessment stage of this process.	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 continues to attend Fife Council's Core Air Quality Steering Group meetings. The Plan for Fife, the Fife Partnership Local Outcome Improvement Plan, was in 2020-2021. Fife Council declared a climate emergency in 2019. An updated plan for 2021-2024 sets out the key recovery and renewal priorities. On 6th February 2020 Fife Council's Environment and Protective Services Committee approved the Sustainable Energy Climate Action Plan - Climate Fife. Climate Fife includes a practical action plan. [https://www.fife.gov.uk/kb/docs/articles/environment2/climate-change,-carbon-and-energy]. Climate Fife 2024 Strategy and Action Plan sets out work for the next four years and is working to scale-up, going further and faster, and to build on our achievements so far. 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 December 2023 Fife Council approved the Fife Local Heat and Energy Efficiency Strategy and Delivery Plan. This new duty for Scottish Councils is 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 advice and input. Air quality is included in the priorities for the plan. Work is being undertaken to understand the impact of actions on air quality. Links to air quality are also 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.	None

Measure No.	Measure	Category	Expected/Actual Completion Year	Measure Status	Funding Status	Key Milestone	Progress to Date	Barriers to implementation
							During 2023-24 the Climate Change team has been continuing to work 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 as of April 2024 and updates on progress will be noted in future APRs.	
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. During 2023/24 Fife Council trialled its own new travel tracker (Fresh Air Frankie Travel Tracker) at several schools with data collected daily on how pupils travel to school. It is hoped that this will be rolled out to all Fife primary schools in the next academic year (2024/25).	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)	New grant application for 2023-24 included bid for 15 traffic counters but this was unsuccessful. Although original 2023-24 funding bid was unsuccessful, we were able to obtain two from a Scottish Government underspend. 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 updated Fife Development Plan Scheme (2023) Fife Development Scheme 2023. Continue to actively promote sustainable travel to school, including initiatives such as Bikeability and WOW (Walk Once a Week). During 2023/24 Fife Council trialled its own new travel tracker (Fresh Air Frankie Travel Tracker) at several schools with data collected daily on how pupils travel to school. It is hoped that this will be rolled out to all Fife primary schools in the next academic year (2024/25).	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	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					and 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 updated Fife Development Plan Scheme (2023) Fife Development Scheme 2023. 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 Scottish Government grant funding has been applied for in 2024/25 to allow for the update of the Fife Council Air Quality Strategy and preparation works have already begun in this regard.	
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)	Although no grant funding was provided in 2023/24 Fleet were able to obtain alternative funding to allow for 15 new electric vans to be purchased. These vehicles are to be used for the Councils Meals on Wheels (MoW) service. The whole of the MoW fleet (24 vans in total) is now electric and meets service needs from three depots across Fife (Kirkcaldy, Dunfermline and Leven). As of January 2024 Fife Council had 72 full electric vehicles and 19 hybrid vehicles in service (either leased or purchased). As of January 2024 the size of the Fife Council fleet decreased significantly from the 2023 figure of 1,497 vehicles and now stands at 1,414 vehicles. The amount of diesel used by the Council Fleet increased in 2022/23 and 2023/24 to 3,953,929 and 4,075,792 litres respectively indicative of a return to normal working practices after the initial 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 2023 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 67 bus operators within the ECO Stars scheme (one operator went out of business) but the number of vehicles covered has increased to 1,792.	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	All years (ensuring membership continues to increase)	Scottish Government funding issued in 2023 allowed the ECO Stars scheme to continue in Fife. As of January 2024 the Fife Commercial Fleet Membership grew to 299 members covering 10,638 vehicles operating in Fife and	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
					Grant and Council revenue if required		beyond (note this figure includes the number of bus operators and vehicles noted above). As of January 2024 the Taxi & Private Hire Membership has increased to 163 members operating 672 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 RapidAirTM 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 including forthcoming LDP sites review for Development Management colleagues.	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 and 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 during 2024 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 has been applied for in 2024/25 to allow for the update of the Fife Council Air Quality Strategy and preparation works have already begun in this regard. The new updated strategy will align with the Clean Air for Scotland Strategy 2 (CAFS2) and include reference to the air quality improvement measures that will continue to be implemented now that the Bonnygate and Appin Crescent AQMAs have been fully revoked.	None – AQS recently updated
14	Promote the continued expansion of	Promoting Low	2025 (when strategy is next reviewed)	In progress	Funded using various funding	All years (ensuring Fleet being	As of January 2024 Fife Council had 72 full electric vehicles and 19 hybrid vehicles in service (either leased or purchased).	Issues with revenue funding available to Fleet

Measure No.	Measure	Category	Expected/Actual Completion Year	Measure Status	Funding Status	Key Milestone	Progress to Date	Barriers to implementation
	the Councils Electric Vehicle Fleet Implementation Phase: 2021 - 2025	Emission Transport			streams including Council revenue funding and Scottish Government Air Quality Grant and other such funding (e.g., Switched On Fleet)	ungraded especially electric and hybrids)	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 vehicles included another electric Refuse Collection Vehicle with funding obtained to install another 150kW charging station at the principal Fife Council depot (Bankhead Central) with installation and commissioning in progress as of February 2024.	Switched On Fleet funding not available now for 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 within the APR. Recent charger changes in Fife include a new 150kW charging station at principal Fife Council depot (Bankhead Central) with installation and commissioning in progress as of February 2024. In addition several new 7kW twin chargers have been installed at Council based facilities including Meals on Wheels bases and a new 22kW public charger has been installed in Kirkcaldy. 2023 EV Charging points in Dunfermline (ChargePlace Scotland sites only) had 14,699 public charging sessions using 369,258kW of electricity. This is up on the 2022 figure when there were 7,852 public charging sessions which used 174,663kw of electricity. Interestingly the number of charging sessions recorded in 2023 is roughly twice of those recorded in 2020 (7,448 public charging sessions) when 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 and being used regularly within Fife.	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.,	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 http://www.fife.gov.uk/airquality and promotional materials for initiatives carried out such as Fife ECO Stars and Clean Air Day. Social media platforms are also utilised to promote such events.	Funding important for continued implementation of ECO Stars and CAD and make promotional materials available.

Measure No.	Measure	Category	Expected/Actual Completion Year	Measure Status	Funding Status	Key Milestone	Progress to Date	Barriers to implementation
					CAD and ECO Stars)			
17	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)	Scottish Government have advised they are progressing this under CAFS2. In the meantime Fife Council are investigating the potential for general guidance to be made available on social media platforms.	Scottish Government Air Quality funding not 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 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
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 2023 with Clean Air Day bite size presentations provided to four Primary Schools across Fife along with Citizen Science Packs to allow the children to undertake their own monitoring. Following the anti-idling campaign initially undertaken at several primary schools in 2022 the wining designs for posters and a banner have been manufactured and distributed. The banner has now been installed at the winning school (Mountfleurie, Leven) in order to raise awareness and change behaviour. Copies of the posters have also been provided to the winning schools (Dunnikier, Kirkcaldy and Lynburn, Dunfermline) for them to install in and around the school grounds. Extra copies of the posters are in the process of being installed at locations where complaints of anti-idling vehicles have been received by Fife Councils Environmental Health team and at key sensitive receptors such as hospitals (Queen Margaret Hospital, Dunfermline). Any extra posters will also likely be distributed to schools taking part in Clean Air Day 2024 activities.	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
							Scottish Government grant funding offer for 2024/25 is awaited (as of April 2024) with preparation works underway for 4 primary schools in St Andrews area for 2024 CAD.	
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 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. Scottish Government have advised they are progressing this under CAFS2. In the meantime Fife Council are investigating the potential for general guidance to be made available on social media platforms.	SG AQ funding not granted 2023/24 for guidance leaflet
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. 2023 saw one of the sensors in Appin Crescent being damaged. The pod is now repaired but as the original downpipe fixture location has been removed the pod is being used for alternative monitoring purposes focused on education (monitoring near schools). Scottish Government grant funding has been applied for in 2024/25 to allow for an additional two sensors to be obtained that will also be used for this purpose (monitoring near schools). Fife Council is also currently liaising with the Royal College of Physicians on a grant proposal for undertaking air quality monitoring near schools.	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 RapidAirTM 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 including forthcoming LDP sites review for Development Management colleagues.	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 61.4% from 52 µg m^{-3} in 2007 to 20 µg m^{-3} in 2023 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 42.6% from 23 µg m^{-3} to 13 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 before reducing again in 2023. The PM_{10} element of the AQMA was officially revoked in December 2023. However, Fife will continue to monitor PM_{10} within the AQMA boundary.

Figure 2-5 NO_2 Automatic Monitoring Results 2007 to 2023 – Bonnygate, Cupar

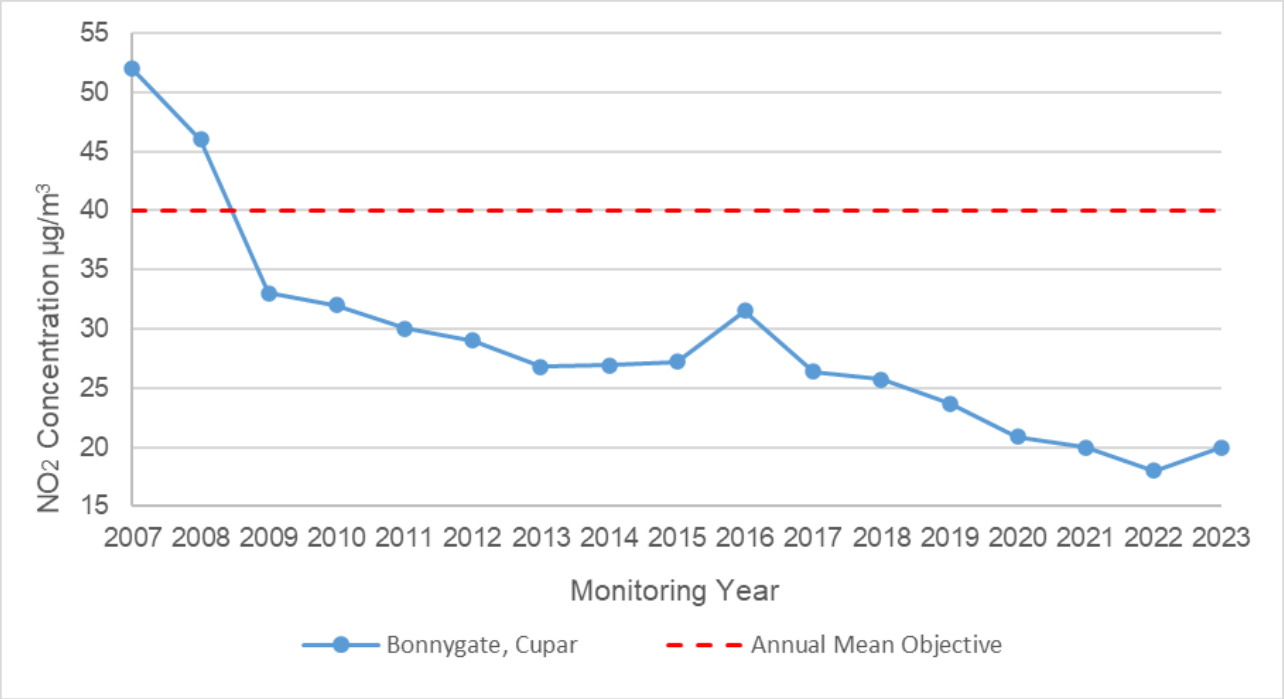
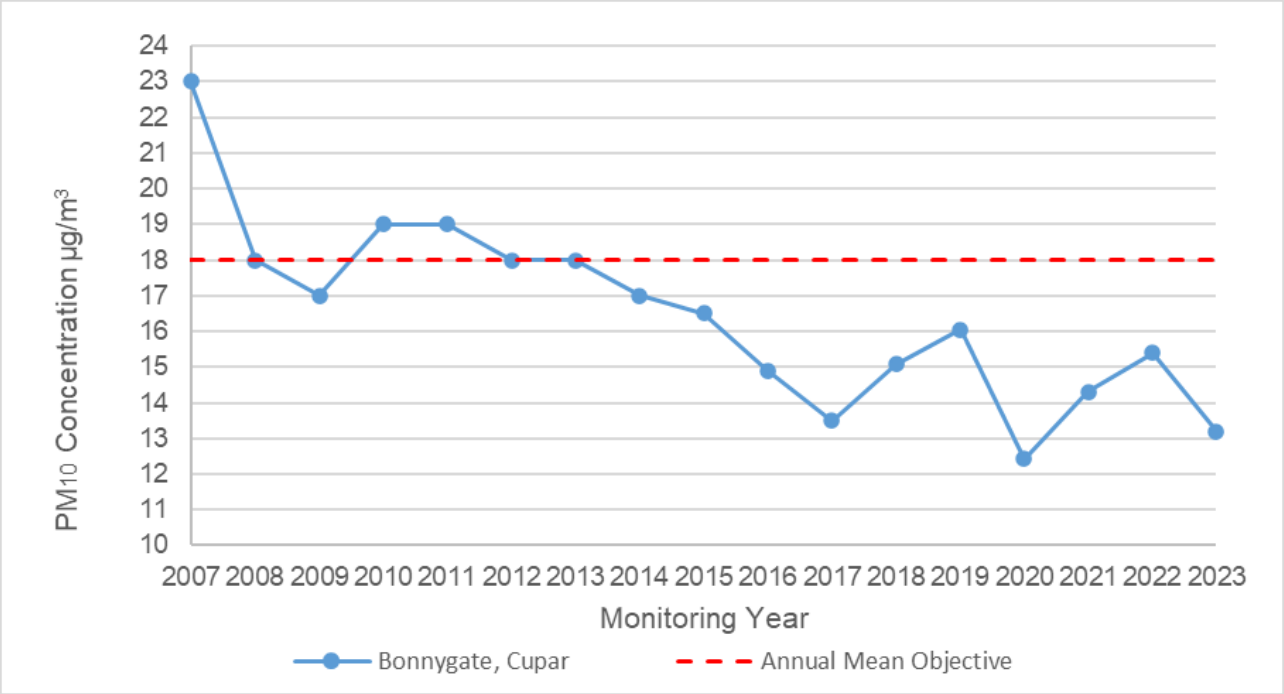


Figure 2-6 PM_{10} Automatic Monitoring Results 2007 to 2023 – Bonnygate, Cupar



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 2023 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. 2023 data shows that NO_2 concentrations have remained consistently 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 24.4% from 16 µg m^{-3} in 2012 to 12 µg m^{-3} in 2023. 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 following the easing of the COVID-19 lockdown but are still below the elevated levels of 2015. Concentrations reduced slightly in 2023 and have remained below the annual mean objective since automatic monitoring began. The PM_{10} element of the AQMA was officially revoked in December 2023. However, Fife will continue to monitor PM_{10} within the AQMA boundary.

Figure 2-7 NO_2 Automatic Monitoring Results 2007 to 2023 – Appin Crescent, Dunfermline

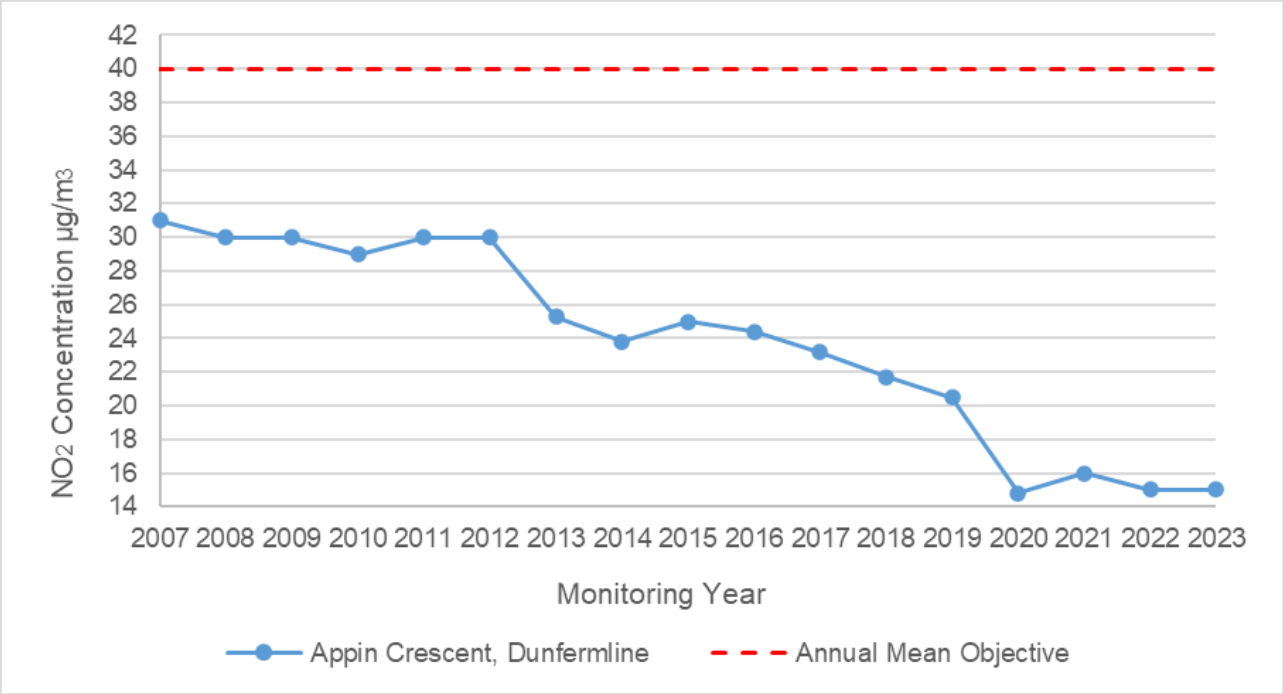
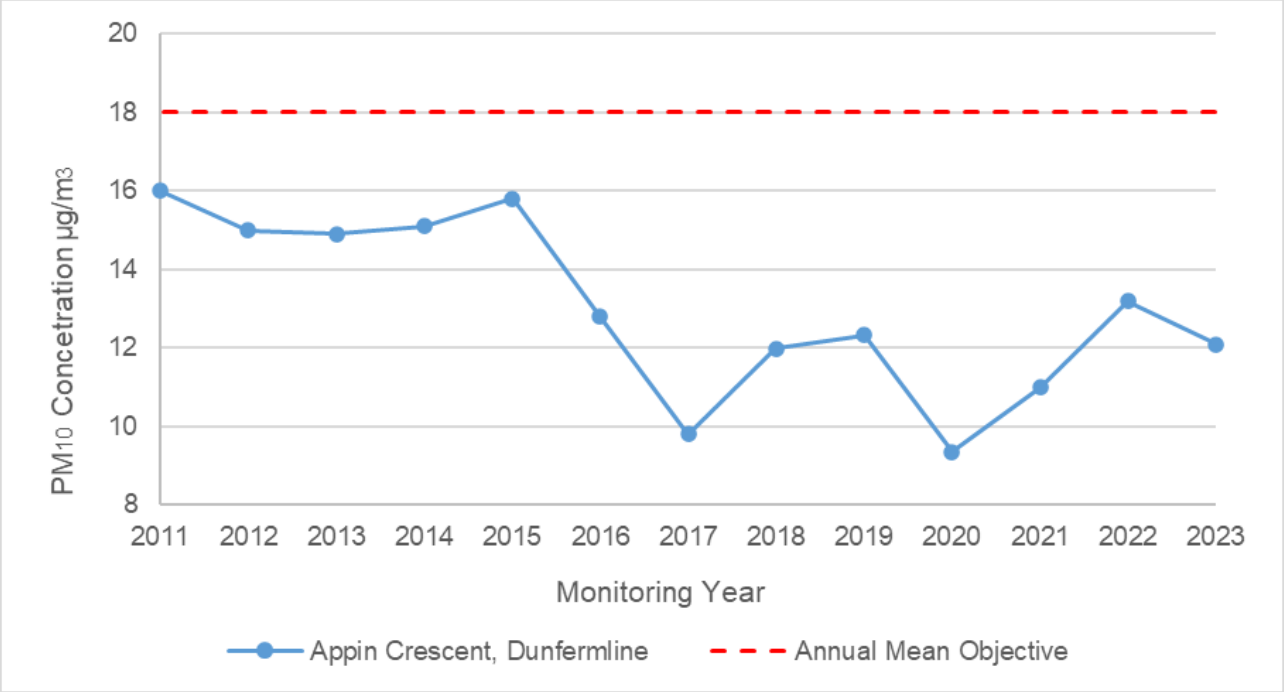


Figure 2-8 PM_{10} Automatic Monitoring Results 2011 to 2023 – Appin Crescent, Dunfermline



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 2023.

Since the Fife Fleet scheme was initiated in 2014, membership has steadily increased year on year. As of January 2024, the Fife Fleet scheme stands at 299 members (up from 282 members in January 2023) 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 10,638 vehicles (up from 10,148 vehicles in January 2023).

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 2024, the Taxi and Private Hire scheme stands at 163 members (up from 151 members in January 2023), operating 672 vehicles (up from 623 vehicles in January 2023).

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.

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 (which were both revoked in December 2023) and work towards reducing transport emissions as detailed in the AQAPs for both areas. By the start of early January 2024 Fife Council's Fleet Operations had 72 full electric vehicles and 19 hybrid vehicles in service including 15 new Nissan Townstar electric vans (Figure 2-9) which are to be used for the Councils Meals on Wheels (MoW) service. The whole of the MoW fleet (29 vans in total) is now electric and meets service needs from three depots across Fife (Kirkcaldy, Dunfermline and Leven). Additional chargers are in the process of getting installed (as of February 2024) at Leven to provide sufficient charging stations for the number of vehicles to be based at this location (this charger is being removed from another Fife Council site).

Figure 2-9 Example of new Nissan Townstar electric van brought in by Fife Council to fully electrify the MoWs fleet

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 have 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.

Due to a change in shift patterns to be adopted in 2024 22 new RCVs are being brought in from different manufacturers (with 9 replacing older RCVs) whereby FuelSense 2.00 software will be included as standard on 9 of the RCVs. 19 of the 22 RCVs in total will also have electric bin lifts which will bring about additional fuel savings due to not requiring a diesel motor to run the hydraulic bin lifts.

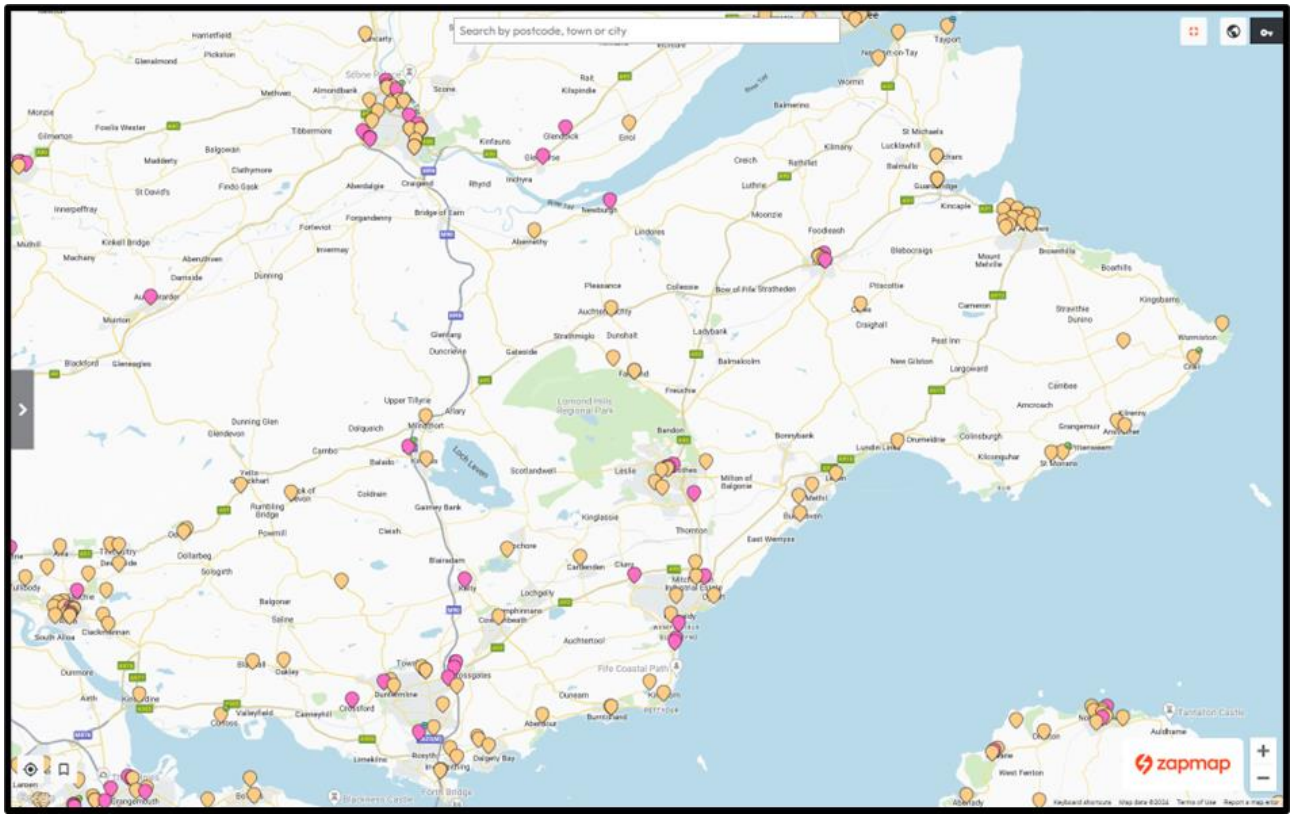
Fife Council Fleet have also been successful in obtaining additional funding for the installation of a second 150kW charger at its main depot in Glenrothes in anticipation of trialling more fully electric RCVs and other larger electric vehicles. The installation and commissioning of this charger is in progress as of February 2024. In October 2023 an electric RCV (Mercedes eEconic) was trialled. 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.

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 2-10 below indicating the current position of the charging network within Fife as of March 2024.

Figure 2-10 Extent of charging infrastructure within Fife as of March 2024. 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 (SWARCO) to install and/or commission several new 7kW twin chargers across 2023 at Council based facilities, including:

- Ostlers House, Kirkcaldy (base for Meals on Wheels)
- Skills Development Centre, Kirkcaldy
- Anstruther Depot
- Cupar Depot

- Halbeath Depot (3 chargers)

Fife Councils Transportation Services also worked with ChargePlace Scotland (SWARCO) to install and commission a new 22kW public charger at Nicol Street Car Park, Kirkcaldy.

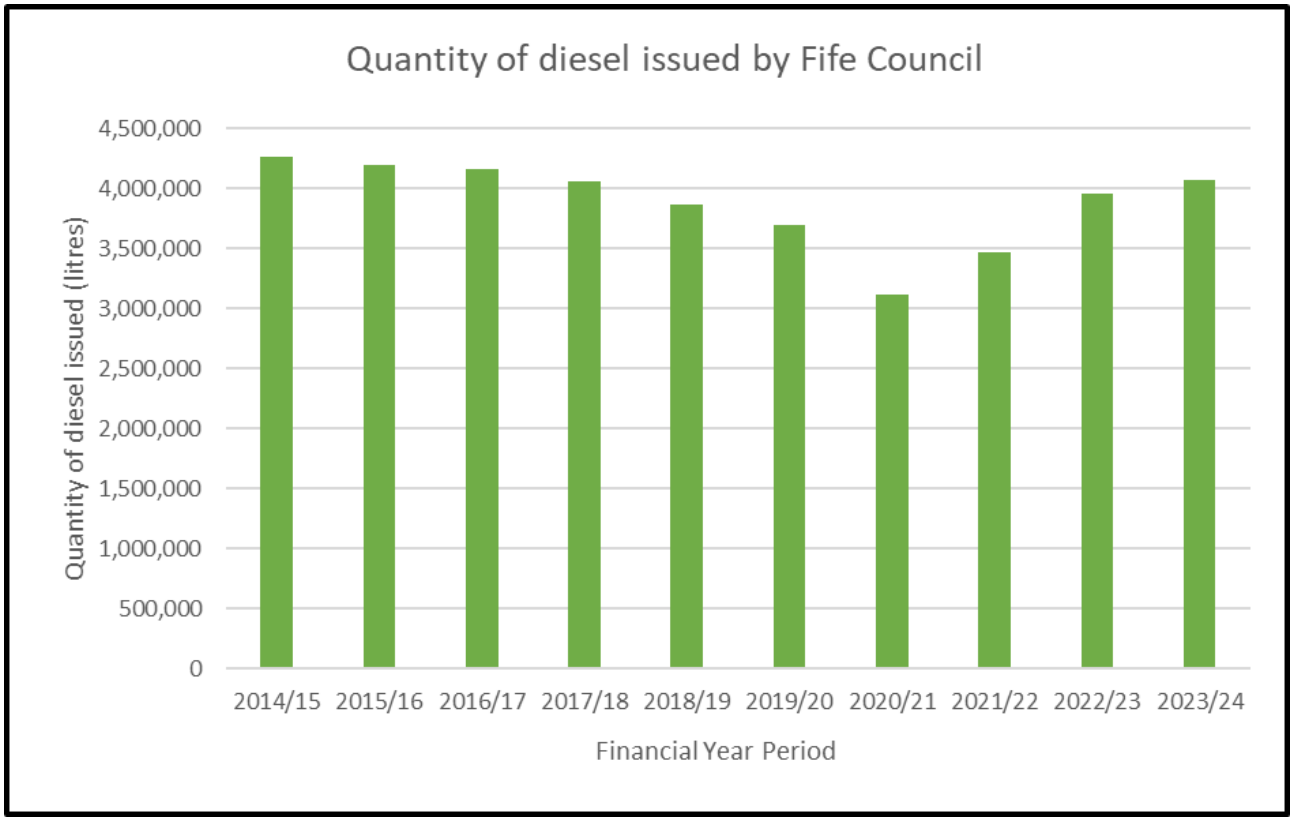
Correspondence with Transportation Services indicates that it is becoming increasingly difficult to determine the number of public charge point users owing to the number of options now available to access and utilise ChargePlace Scotland chargers so the number of charging sessions will be summarised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

During 2023 a total of 1,919 public charging sessions took place at ChargePlace Scotland charging sites in Cupar using 40,908 kW of electricity in total, up on 2022 when there were 773 public charging sessions which used 14,541 kW of electricity. Interestingly the number of charging sessions recorded in 2023 is broadly similar to those recorded in 2019 (1,888 public charging sessions) when the amount of electricity used was significantly lower at 15,983 kW indicating that vehicles with larger battery packs, and therefore higher ranges, are now more common and being used regularly within Fife.

During 2023 a total of 14,699 public charging sessions took place at ChargePlace Scotland charging sites in Dunfermline using 369,258 kW of electricity in total, up from 2022 when there were 7,852 public charging sessions using 174,663 kW of electricity in total. Interestingly the number of charging sessions recorded in 2023 is roughly twice of those recorded in 2020 (7,448 public charging sessions) when the amount of electricity used was significantly lower at 121,048 kW again indicating that vehicles with larger battery packs, and therefore higher ranges, are now more common and being used regularly within Fife.

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. Over the last five years the size of the Council Fleet has reduced from 1,551 vehicles in 2019 to 1,414 vehicles in 2024. The amount of diesel used by the Council Fleet increased in 2022/23 and 2023/24 to 3,953,929 litres and 4,075,792 litres respectively, shown in Figure 2-11, indicative of a return towards normal working practices after the initial impact of COVID-19.

Figure 2-11 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 2023, 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[4] 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[3] 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 3-6. 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 2023 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 44 sites during 2023, using 52 diffusion tubes in total. Of these, four sites are triplicate sites being co-located with the automatic analysers at Cupar, Dunfermline, Kirkcaldy and Rosyth. There were nine diffusion tube sites decommissioned during 2023 due to historically low readings and reducing triplicate tube sites to single tube sites. These were replaced by three new sites in the Crossgates area where modelling data showed NO_2 levels that would be worthy of consideration. Traffic flow data also showed these sites had over 10,000 vehicle movements per day. The new sites are 89 Dunfermline Road, 18A Dunfermline Road and 7 Springhill Brae. Table A.2 in Appendix A shows the details of the diffusion tube sites.

[6] Community Air Quality Monitoring Report, Ambient Atmospheric Survey in the vicinity of Grangemouth – 2023, INEOS April 2024

Maps showing the location of the monitoring sites are provided in Figure 3-1 to Figure 3-6. These focus on the main monitoring areas of Cupar, Dunfermline, Kirkcaldy, Rosyth, St Andrews and Crossgates. 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

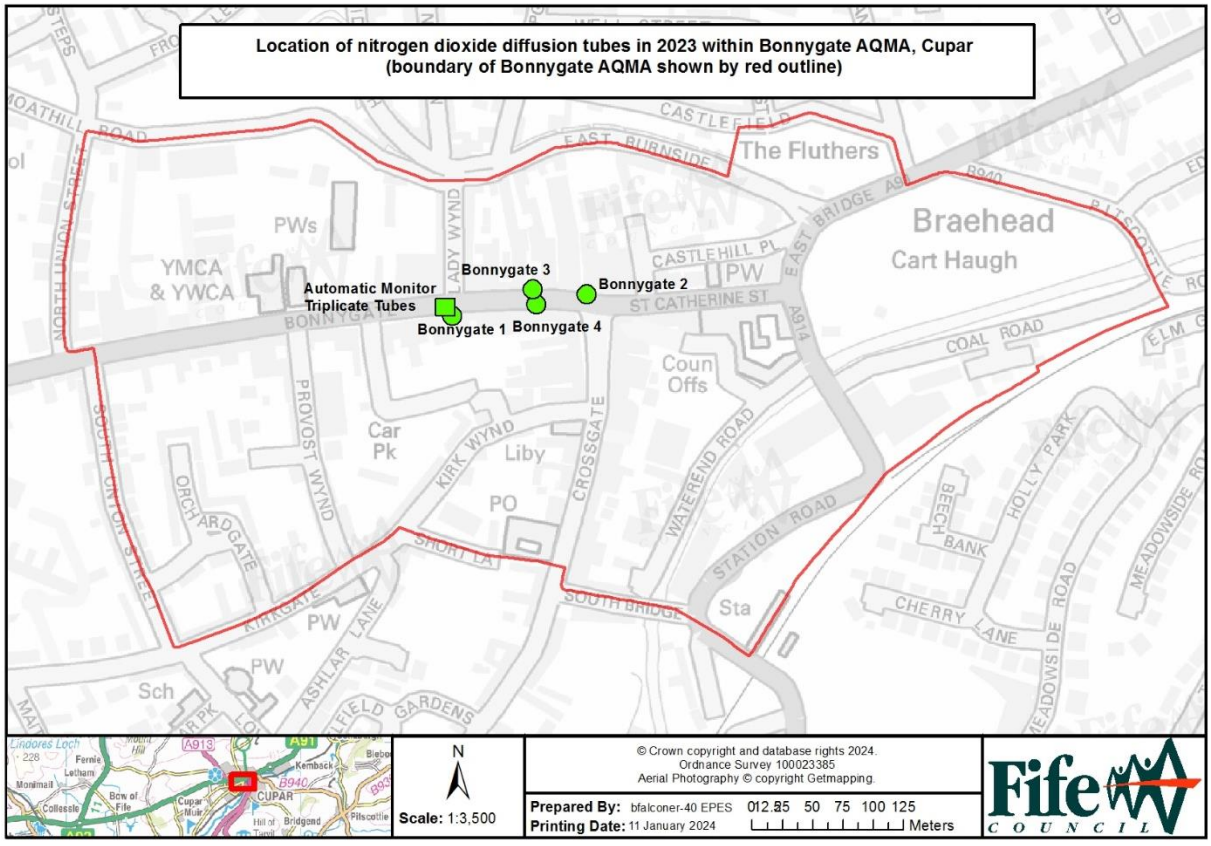


Figure 3-2 Location of automatic monitor and NO_2 diffusion tubes - Appin Crescent, Dunfermline AQMA

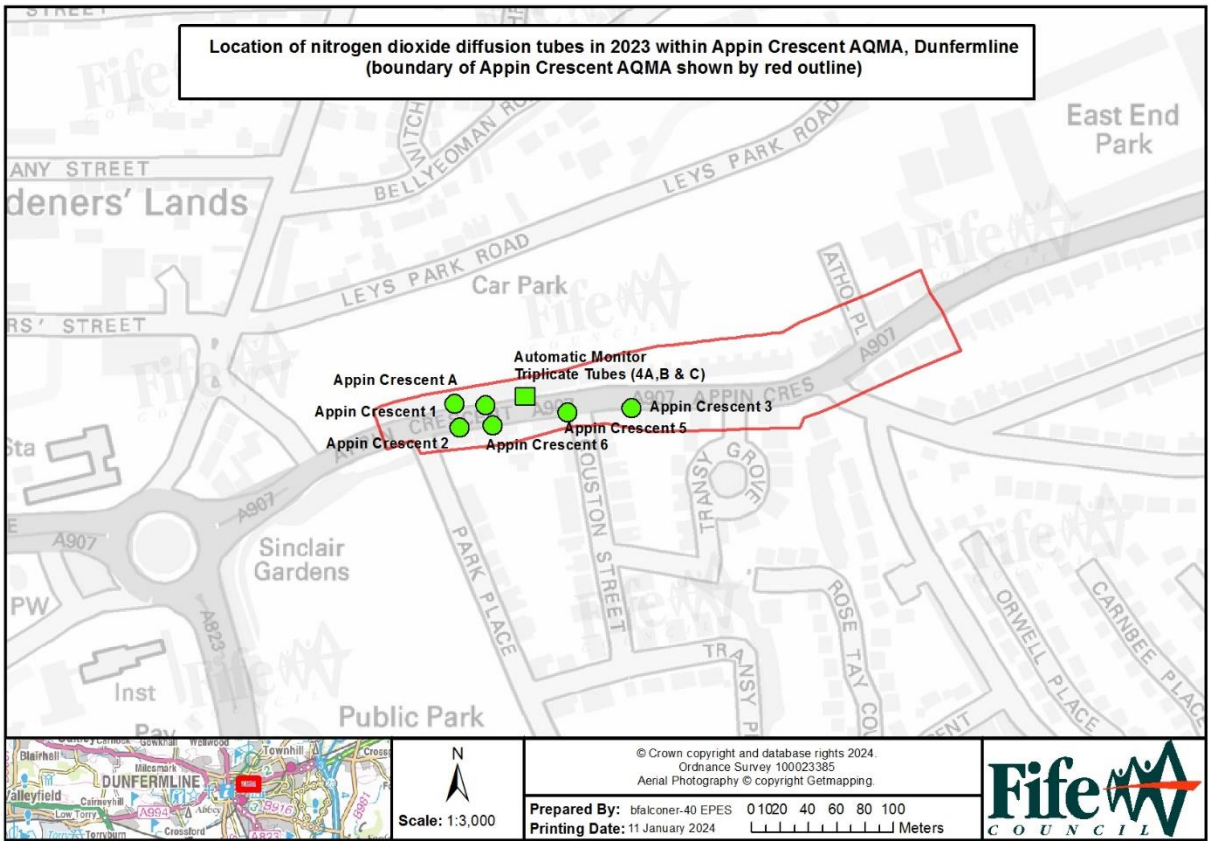


Figure 3-3 Location of automatic monitor and NO_2 diffusion tubes – St Clair Street, Kirkcaldy

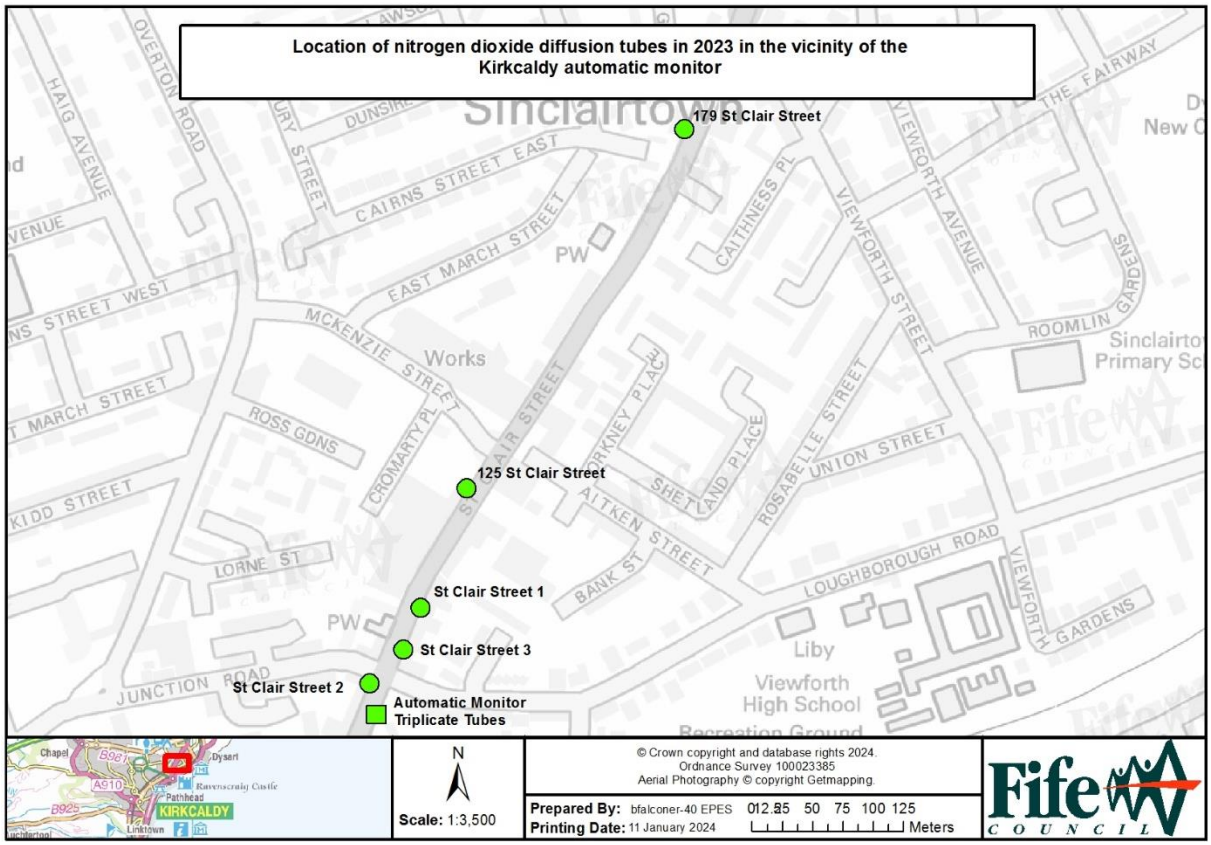


Figure 3-4 Location of automatic monitor and NO_2 diffusion tubes – Admiralty Road, Rosyth

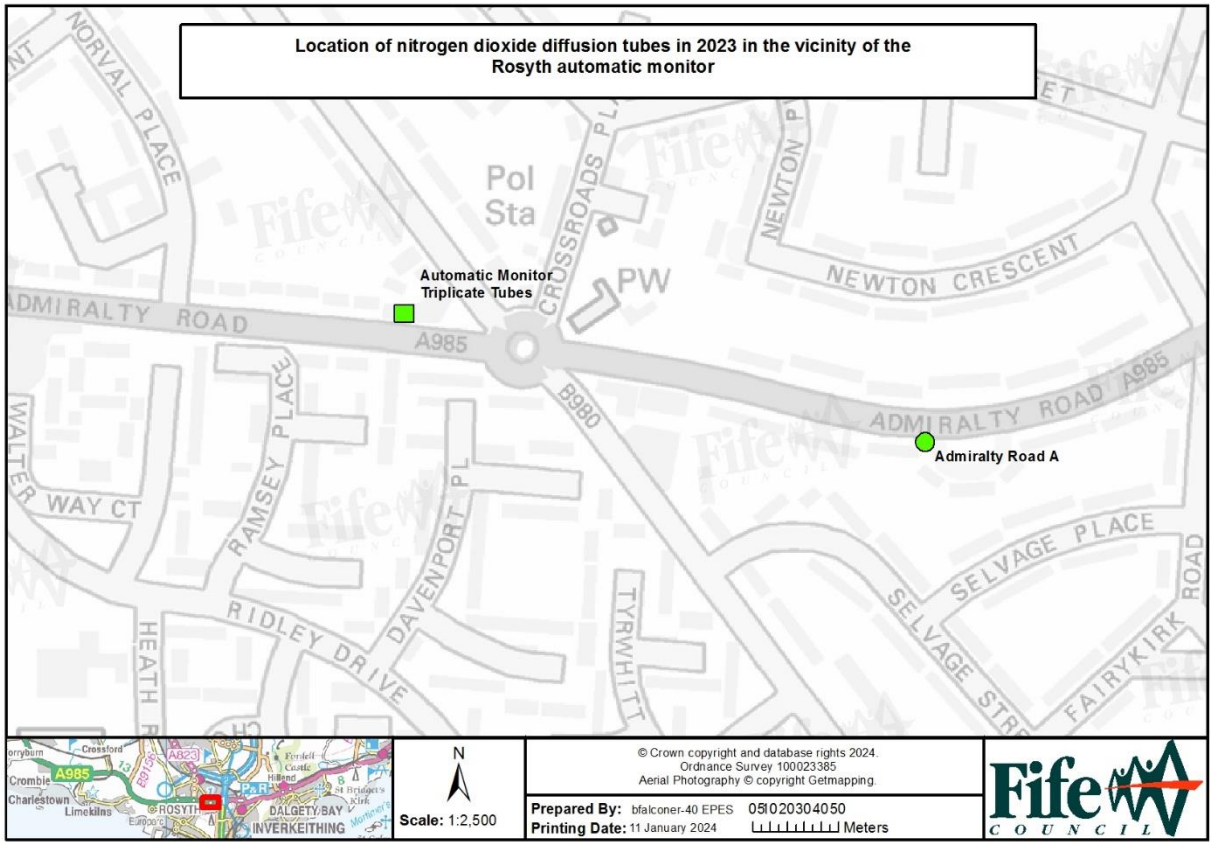


Figure 3-5 Location of nitrogen dioxide diffusion tubes – St Andrews

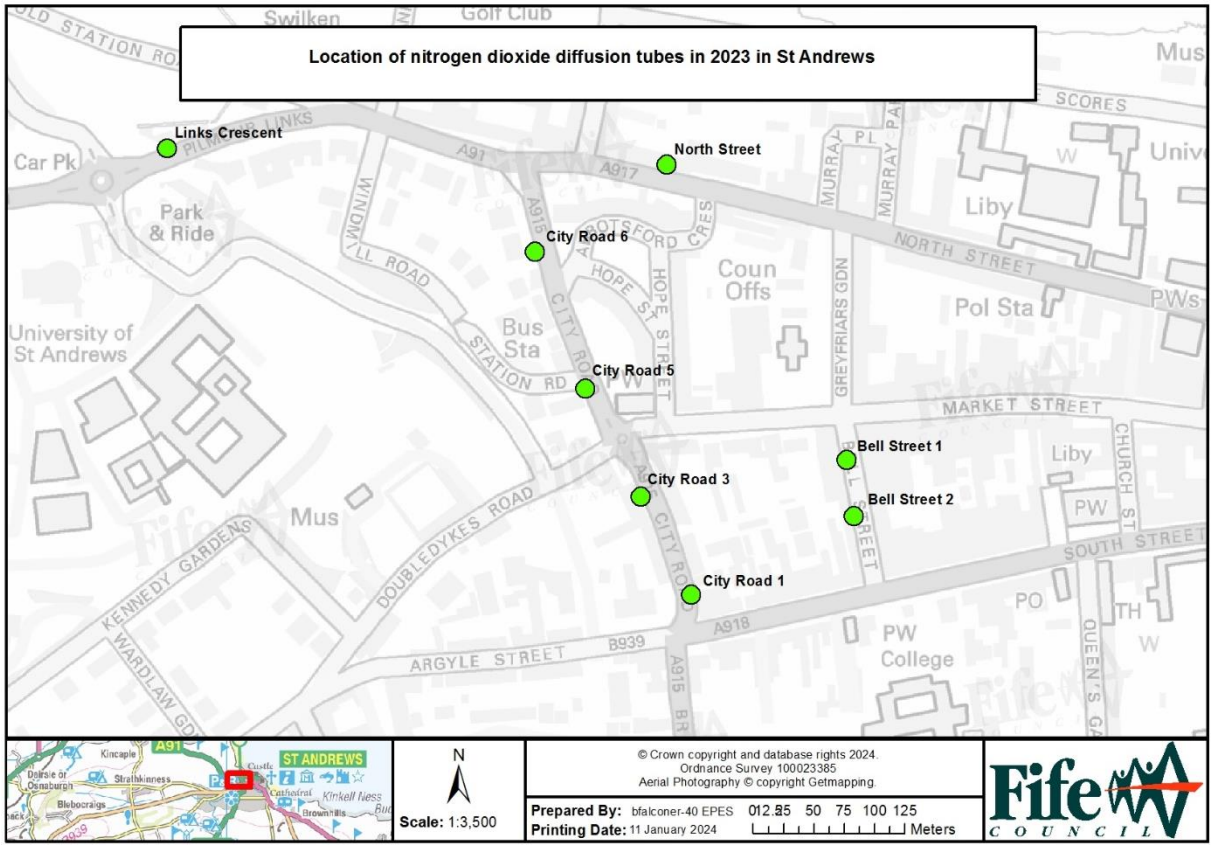
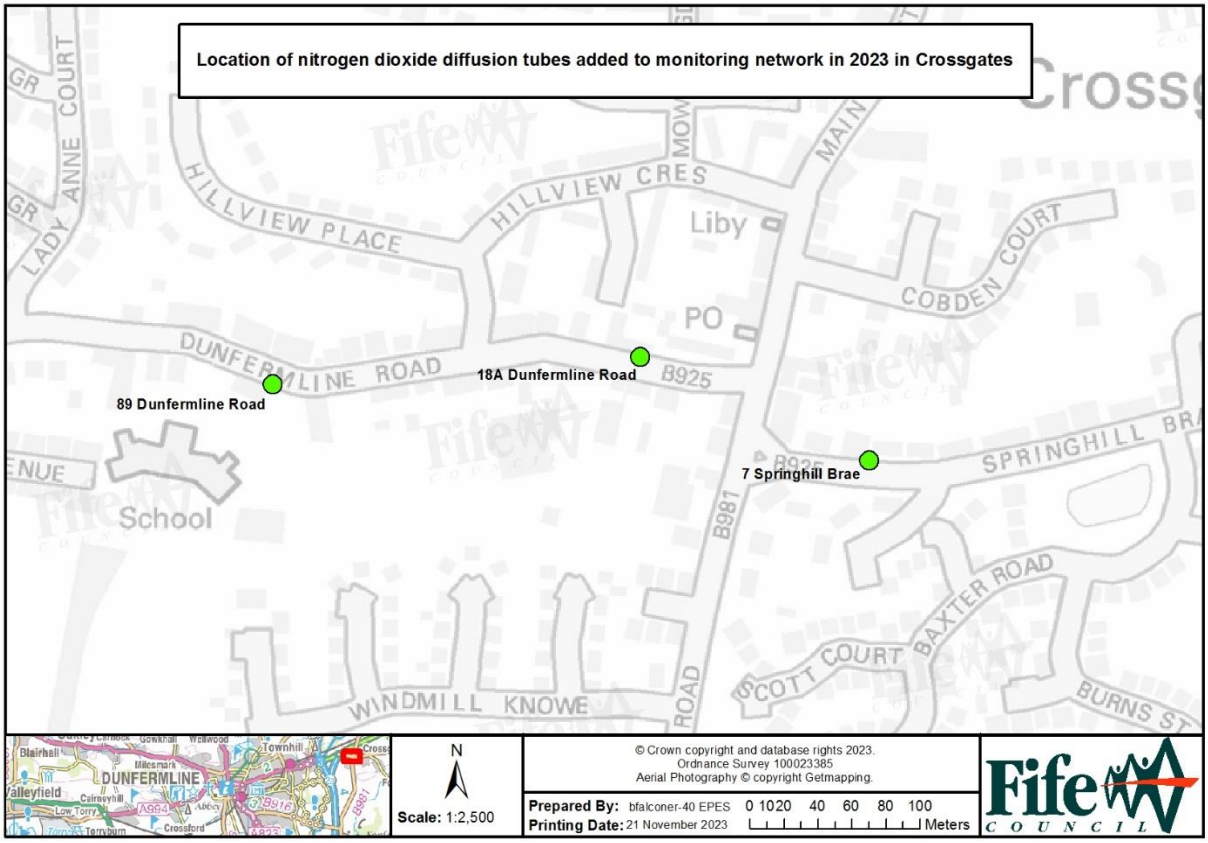


Figure 3-6 Location of nitrogen dioxide diffusion tubes – Crossgates



3.1.3 Other Monitoring Activities

Fife Council undertook AQMesh senor monitoring of NO_2, PM_{10} and $PM_{2.5}$ at six sites during 2023. In November 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). In April 2023, a further pod was installed in Bonnygate North, it should be noted that the "Bonnygate" site referenced in previous report will henceforth be referred to as "Bonnygate South".

The locations of the sensors are illustrated in Figure 3-7 to Figure 3-10. For all locations the AQMesh sensors were collocated with (or as close as possible to) existing diffusion tube sites.

Figure 3-7 Location of AQMesh pods - Appin Crescent, Dunfermline AQMA

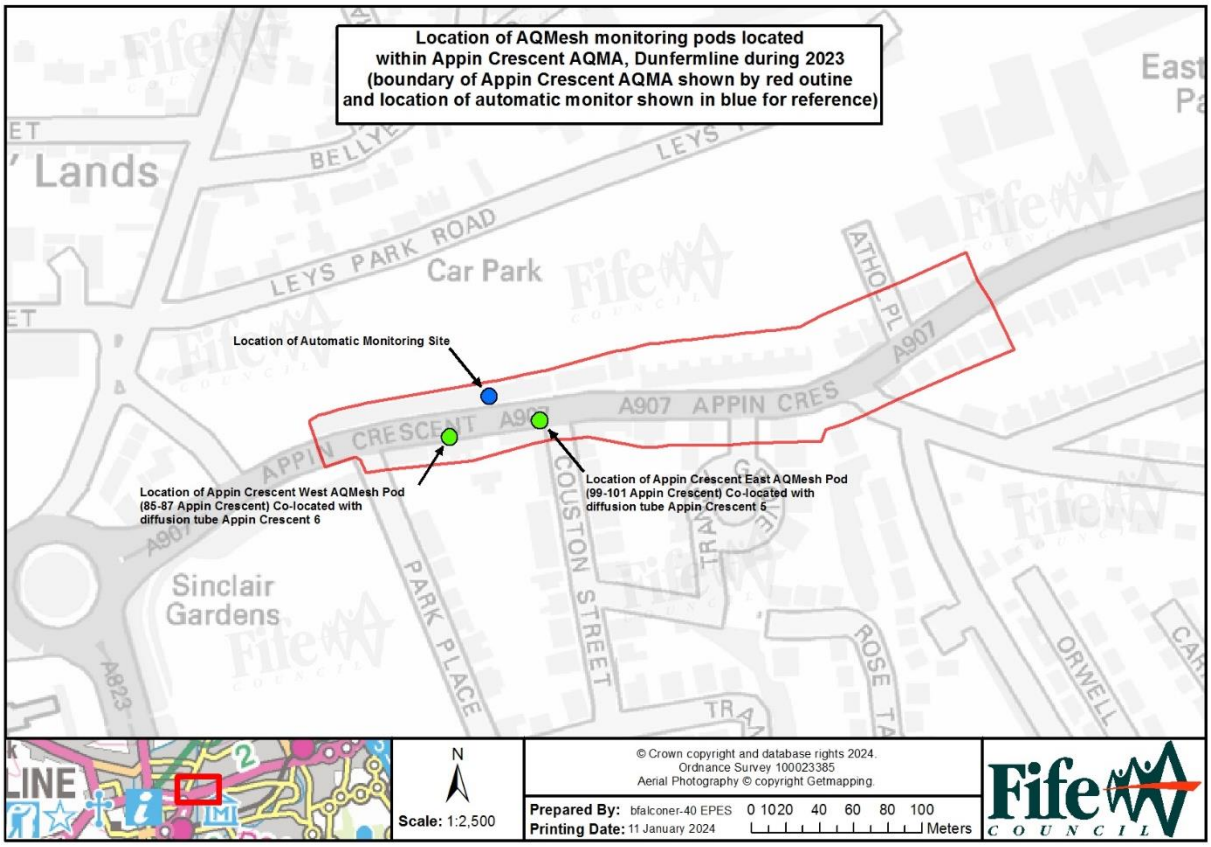


Figure 3-8 Location of AQMesh pod – Bonnygate, Cupar AQMA

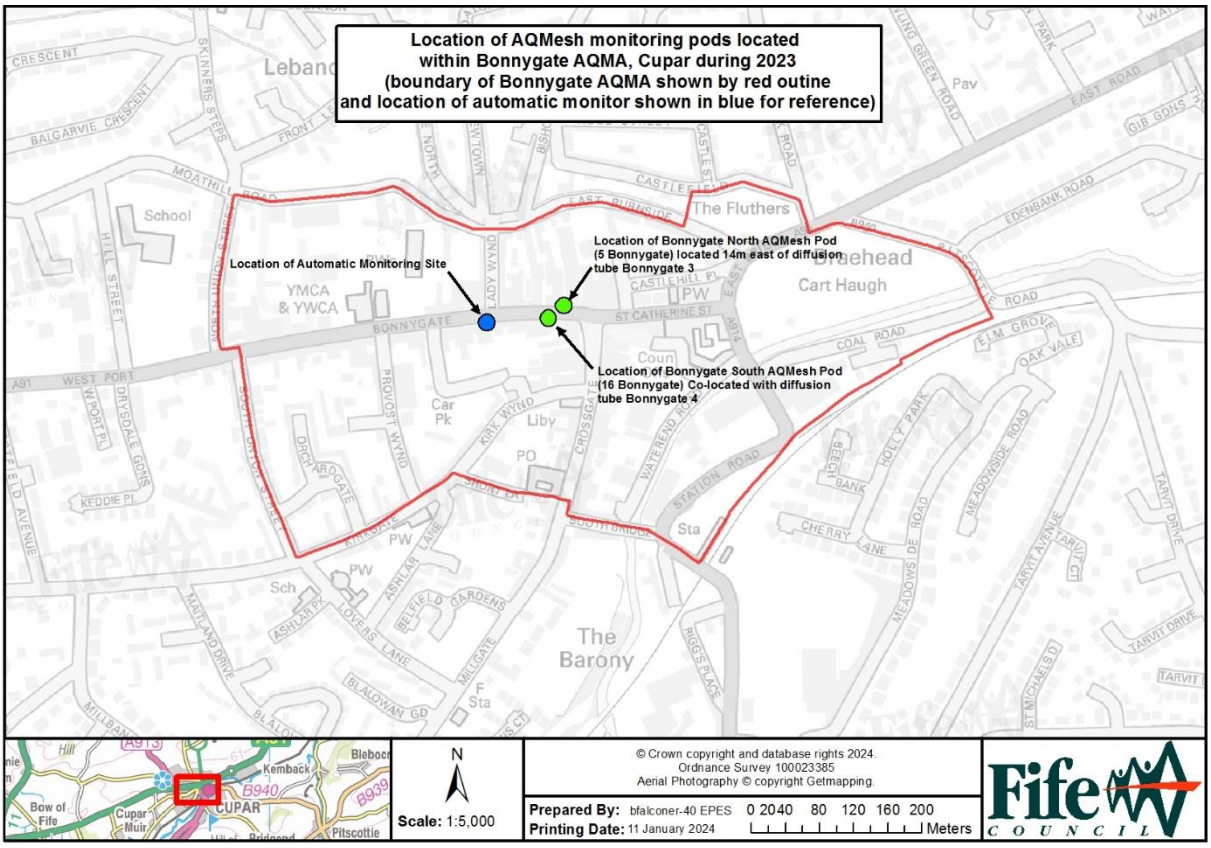


Figure 3-9 Location of AQMesh pod – St Andrews

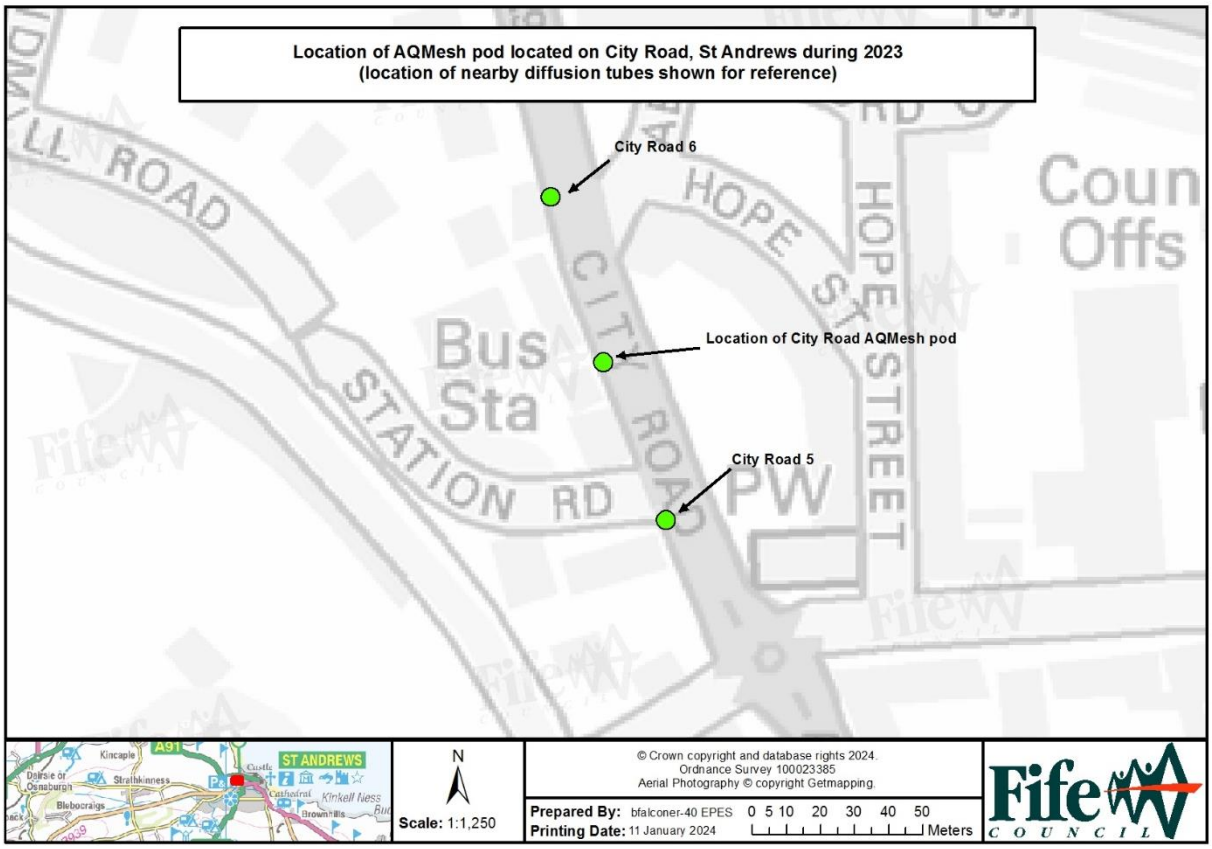
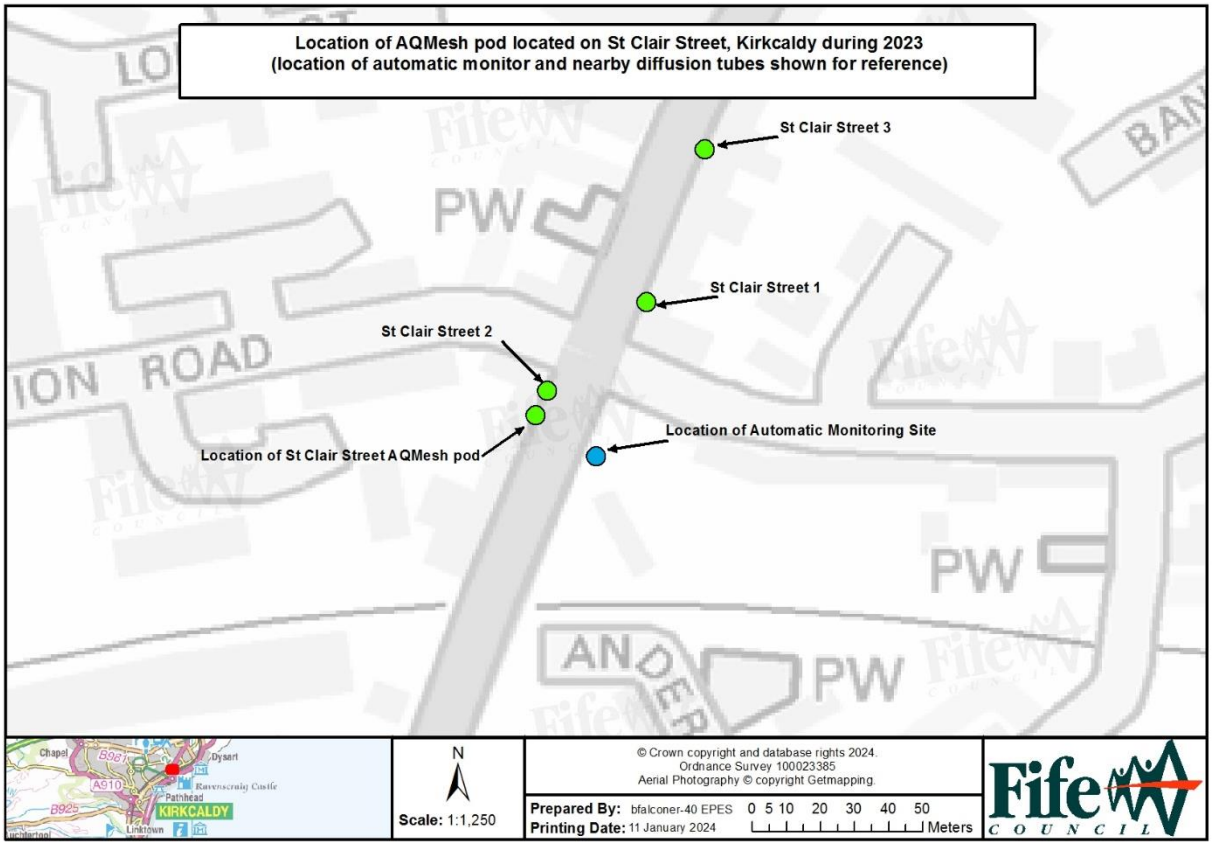


Figure 3-10 Location of AQMesh pod – Kirkcaldy



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_2023.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 2023. 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

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

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.

3.2.1 Nitrogen Dioxide (NO_2)

3.2.1.1 Automatic Monitoring Data

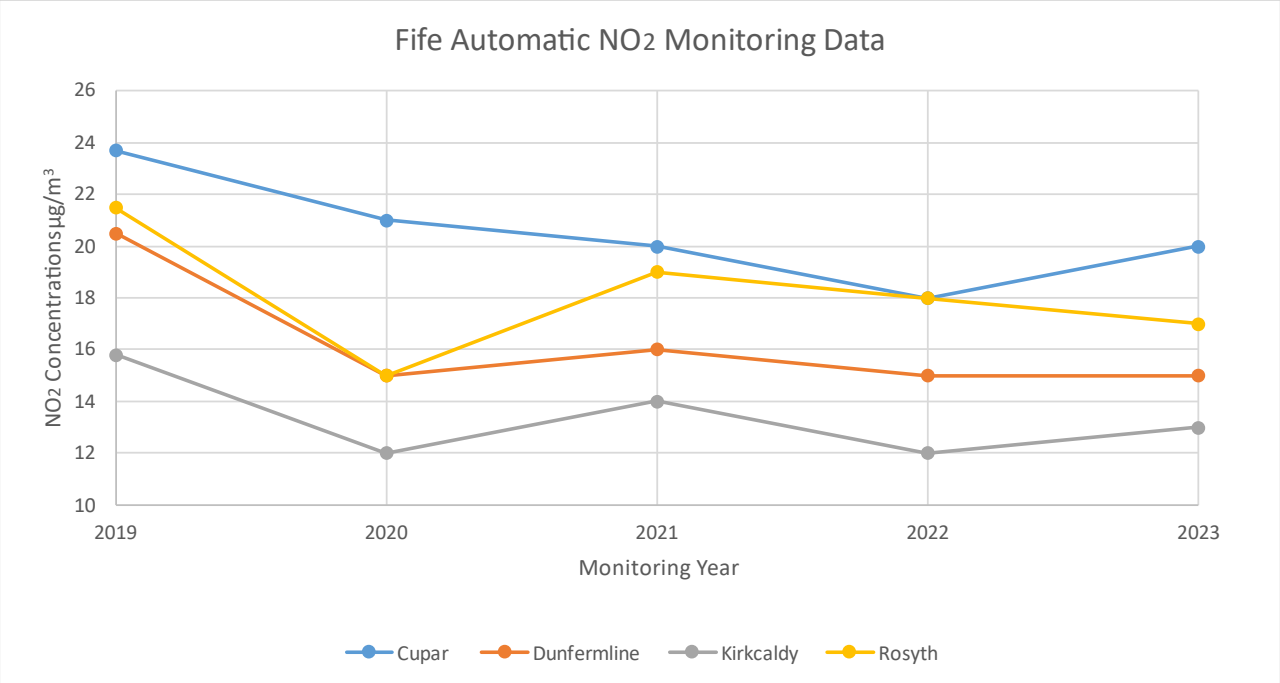
Table A.3 in Appendix A compares the ratified NO_2 annual mean concentrations for the four automatic sites for the past five years with the air quality objective of 40 µg m^{-3}.

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 3-11 provides the monitoring results for 2023 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 2023 and have been consistently well below the objectives for the past five years.

Figure 3-11 Fife automatic monitoring sites NO_2 annual mean concentrations (µg m^{-3})



The significant drop in concentrations across all sites between 2019 to 2020 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. 2023 concentrations increased slightly compared to 2022 (with the exception of Rosyth) but still remain below 2019 levels and well below the AQS annual mean objective. 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 both AQMAs was revoked in 2021.

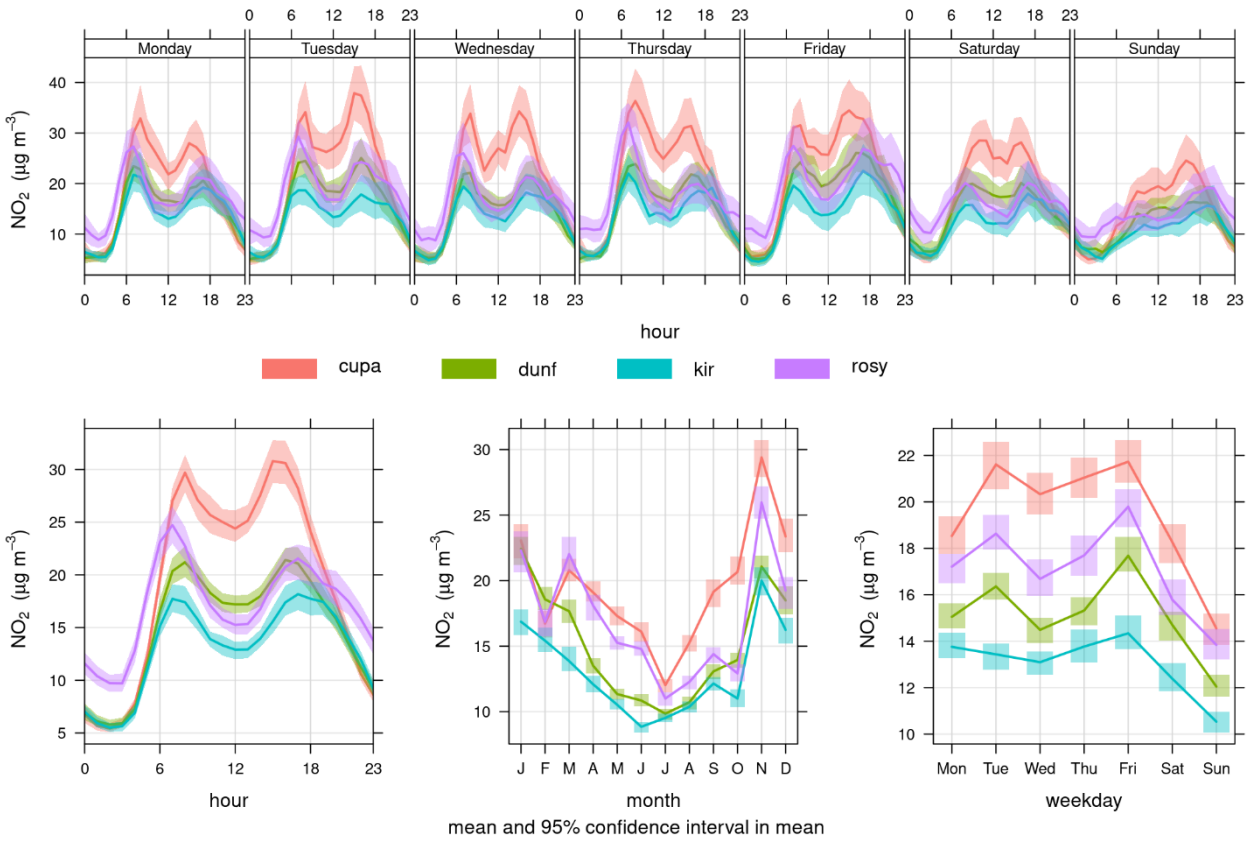
There were six AQMesh sensors in 2023 located at Appin Crescent, Dunfermline; Bonnygate, Cupar; St Clair Street, Kirkcaldy and City Road, St Andrews. 2023 AQMesh data indicated that there were no exceedances of both annual and 1-hour mean objectives during 2023.

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 2023

Figure 3-12 compares the time variation plots for NO_2 in 2023 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 3-12 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 provide an easily identifiable illustration of what days had the highest concentrations. For 2023 these plot shows that higher concentrations were in November, December and January. This is similar to 2022 when it was November and December that the concentrations were higher.

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 now revoked AQMAs at Cupar (left) and Dunfermline (right) shown in Figure 3-13. 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 2023 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 3-13 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 2023 dataset of monthly mean values is provided in Appendix B.

The diffusion tube data has been bias corrected using the average local bias adjustment factor. The following local bias adjustments were calculated for this report using the latest version of the "Diffusion Tube Data Processing Tool (v4.0)" – further details are provided in Appendix C:

- Cupar = 0.81
- Dunfermline = 0.74
- Kirkcaldy = 0.70
- Rosyth = 0.85
- Average of Local = 0.77

The average local bias adjustment factor was applied to all diffusion tubes for consistency.

Details of the diffusion tube bias adjustment are found within Appendix C of this report. Diffusion tube results from 2019 to 2023 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 2023 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 2023 was 25.9 µg m^{-3} at Appin Crescent 6A. The highest annual mean measured at Bonnygate, Cupar during 2023 was 25.1 µg m^{-3} at Bonnygate B4.

3.2.2 Particulate Matter (PM_{10})

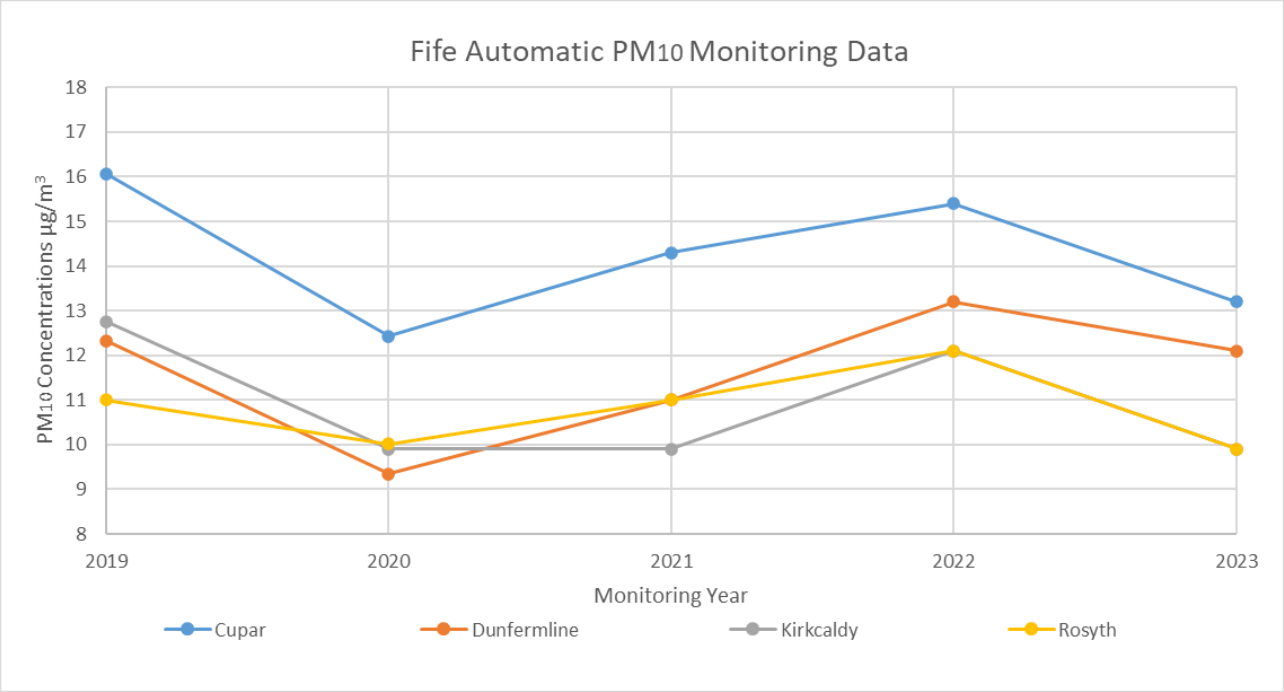
Table A.5 in Appendix A compares the ratified PM_{10} annual mean concentrations for the past five years with the air quality objective of 18 µg m^{-3}. The data provided (including historic years) has been corrected following the Scottish Government guidance[3] which states that PM_{10} data should 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 3-14 provides the PM_{10} monitoring results for 2023 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 2023 and have been consistently below the objectives for the past five years.

Figure 3-14 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), the trend in PM_{10} concentrations, though fluctuating from year to year by 2 or 3 µg m^{-3}, has not changed significantly. Longer PM_{10} trends at the two AQMAs can be seen in Figure 2-6 and Figure 2-8 above. Concentrations at all sites increased slightly from 2020 to 2023 before dropping slightly in 2023. Kirkcaldy and Rosyth measured the same concentrations in 2022 and 2023 which is difficult to see on the graph.

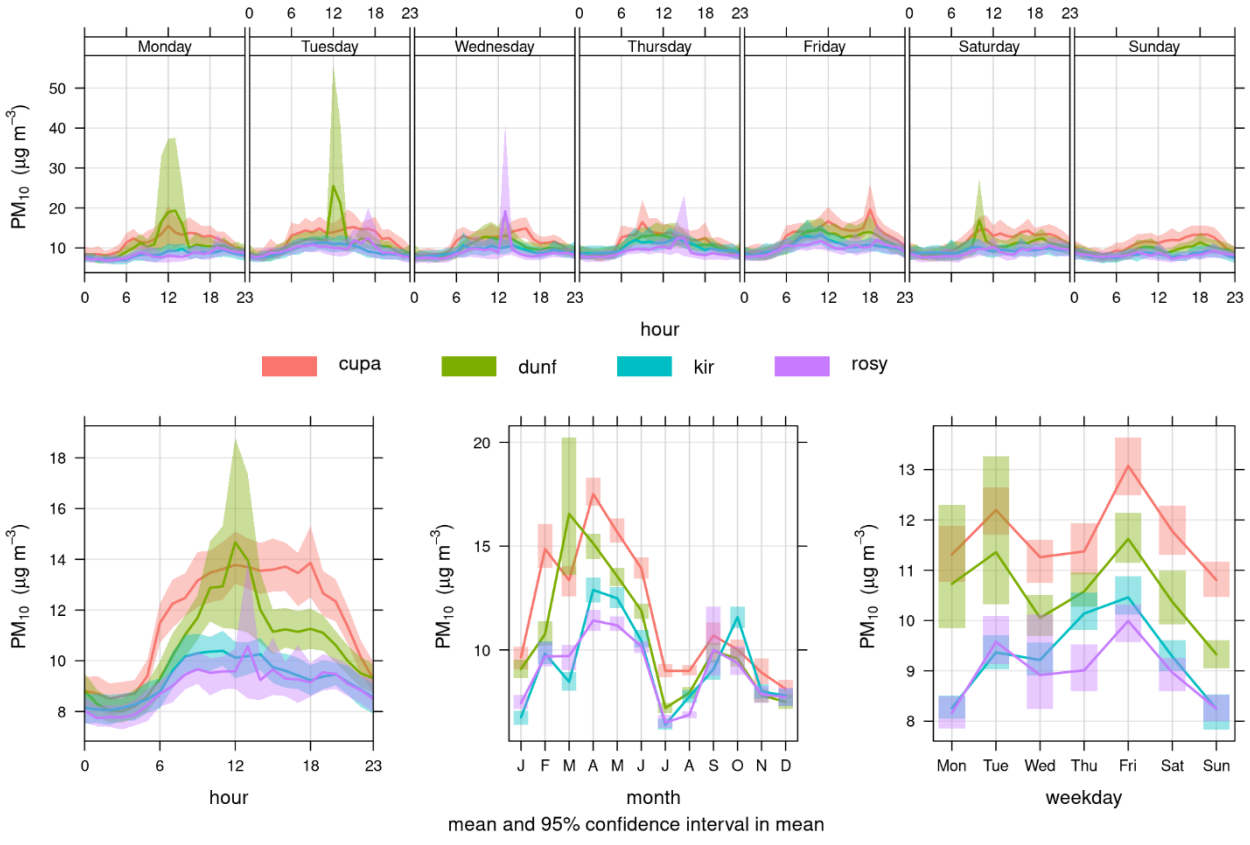
As previously stated, six AQMesh sensor units monitored PM_{10} during 2023 within the Appin Crescent and Bonnygate AQMAs and at St Clair Street, Kirkcaldy and City Road, St Andrews. 2023 AQMesh data indicated that no exceedances of both the annual and 24-hour mean objectives were measured during at 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 2023

Figure 3-15 compares the time variation plots for PM_{10} in 2023 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 time variation 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 Dunfermline appears to have a localised source of PM_{10} which affects the site on Mondays, Tuesdays and Saturdays around midday while Rosyth appears to have a localised source of PM_{10} which affects the site on Wednesdays around midday. The monthly analysis also illustrates the affect transboundary pollution has on PM_{10} concentrations between March and May. 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 3-15 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 April and May 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 now revoked AQMAs at Cupar (left) and Dunfermline (right) are shown in Figure 3-16. Both plots indicate that concentrations are highest when winds are coming from the northeast. This can indicate that the sites are being influenced by sources out with the now revoked AQMAs potentially farming and or transboundary pollution.

Figure 3-16 Polar plots of PM_{10} concentrations by wind speed and direction

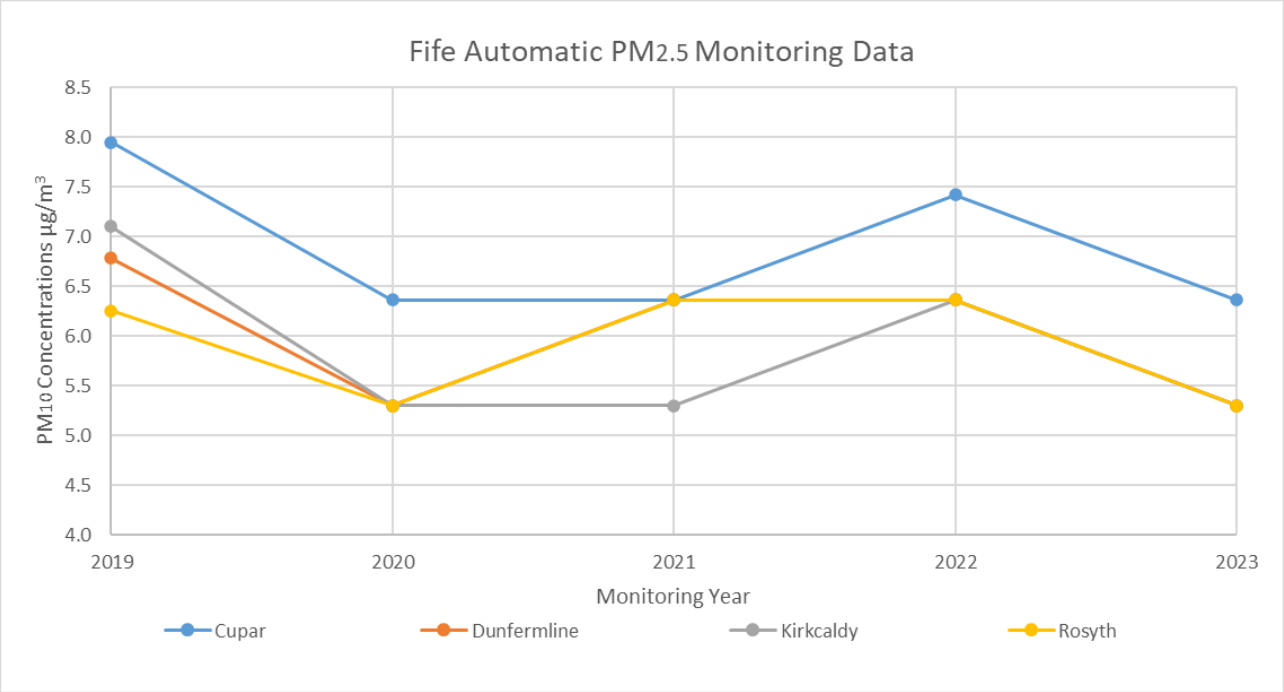
3.2.3 Particulate Matter ($PM_{2.5}$)

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[3] which states that $PM_{2.5}$ data should be multiplied by 1.06.

Figure 3-17 provides the $PM_{2.5}$ monitoring results for 2023 and the previous four years.

All four automatic monitoring sites did not record an exceedance of $PM_{2.5}$ annual mean objective during 2023 and have been consistently below the objectives for the past five years.

Figure 3-17 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. Since 2020 the concentrations have change little at all sites. Concentrations at Dunfermline, Kirkcaldy and Rosyth are the same in 2022 and 2023 which makes it difficult to see on the graph.

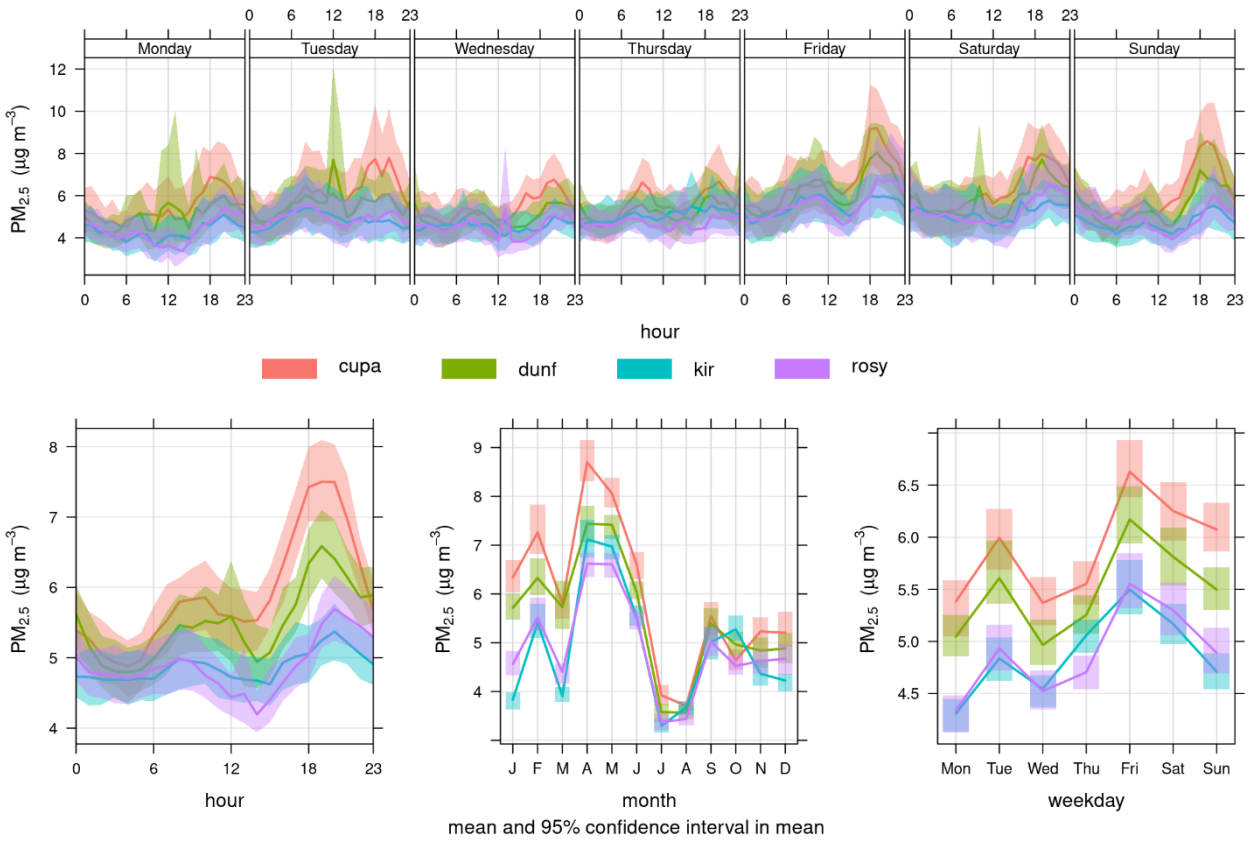
As previously stated, six AQMesh sensor units monitored $PM_{2.5}$ in 2023 at the Appin Crescent and Bonnygate AQMAs and at St Clair Street, Kirkcaldy and City Road, St Andrews. 2023 AQMesh data indicated that no exceedances of the annual mean objectives were measured.

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 2023

Figure 3-18 compares the time variation plots for $PM_{2.5}$ in 2023 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 Cupar being a kerbside site. Analysis shows that concentrations vary little across the week at all sites. Diurnal variations show that concentrations at all sites appear to increase during the night indicating a non-traffic source. As with the PM_{10}, the monthly time variation analysis illustrates the potential affect transboundary particulate matter has on $PM_{2.5}$ concentrations across all sites.

Figure 3-18 $PM_{2.5}$ 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 April and May 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 now revoked AQMAs at Cupar (left) and Dunfermline (right) shown in Figure 3-19. As with PM_{10}, the plots indicate a transboundary component with a signal seen with winds from the north-east.

Figure 3-19 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 2023, 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.

Monitoring for CO has now ceased within Fife as the monitored levels have been found to be consistently well below the objective level.

Table 3-1 CO Monitoring Fife Transportation Services

Site Number/Location	Monitoring Period	Max 8-Hour Concentration (ppm)
Site 3 - Bothwell Gardens, Dunfermline	01/04/23 to 07/04/23	0.5875
	01/07/23 to 07/07/23	0.6000
	11/10/23 to 17/10/23	0.6625
Site 7 - Glenlyon Road, Leven	17/05/23 to 23/05/23	2.5625
	01/08/23 to 07/08/23	0.6375
	01/02/24 to 07/02/24	0.2250
	01/04/23 to 07/04/23	0.2375

Site Number/Location	Monitoring Period	Max 8-Hour Concentration (ppm)
Site 13 - Carnegie Drive, Dunfermline	01/07/23 to 07/07/23	0.4875
	03/10/23 to 09/10/23	0.5625
Site 16 - Kirkcaldy, Victoria Rd / Dunnikier Rd T/L's	01/06/23 to 07/06/23	2.1875
	01/09/23 to 07/09/23	0.6750
	01/03/24 to 07/03/24	0.7250
Site 24 - Rosyth, Admiralty Rd/Queensferry Rd R/A	01/06/23 to 07/06/23	0.5750
	21/09/23 to 27/09/23	0.2750
	01/03/24 to 07/03/24	0.3500
Site 34 - Bonnygate, Cupar	17/05/23 to 23/05/23	1.0000
	01/08/23 to 07/08/23	0.7625
	01/02/24 to 07/02/24	0.5750
Site 35 - Appin Crescent, Dunfermline	01/04/23 to 07/04/23	0.3875
	01/07/23 to 07/07/23	0.3125
	18/10/23 to 24/10/23	0.6375
Site 36 - Kirkcaldy, St Clair St/Junction Rd T/L's	01/06/23 to 07/06/23	0.5125
	01/09/23 to 07/09/23	0.3875
	01/03/24 to 07/03/24	0.8000
Site 37 - Mossmorran	13/04/23 to 19/04/23	2.8000
	20/07/23 to 26/07/23	0.6000
	28/10/23 to 03/11/23	2.6875
Site 39 - Bell Street, St Andrews	06/05/23 to 12/05/23	0.7375
	17/08/23 to 23/08/23	0.4250
	01/02/24 to 07/02/24	2.600
Site 40 - City Road, St Andrews	06/05/23 to 12/05/23	0.6250
	17/08/23 to 23/08/23	0.2875
	01/02/24 to 07/02/24	0.1500

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 2023 were found to be lower than the set air quality limit for these substances. The INEOS Grangemouth[6] annual community air monitoring report for 2023 states that there were no

significant trends in the annual average concentrations for all hydrocarbon components across all locations, when compared with historical data, with the exception of Toluene. Toluene spiked significantly at one location during February. 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 2023 has not yet been published. It is anticipated that this will be finalised by the end of 2024 and the findings incorporated into any revised versions of this Annual Progress Report. The Mossmorran and Braefoot Bay Independent Air Quality Monitoring Review Annual Report 2022[8] was published in early 2024 and no associated exceedances were identified. A Summary Report is included in Appendix G for reference.

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 2023[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 2023 (30th December 2022 to 29th December 2023). Twelve locations on both shores of the Forth Valley between Edinburgh and West Wemyss were used. Benzene monitoring is presented for INEOS Houndpoint in their annual monitoring report for 2023[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;

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

[8] https://www.fife.gov.uk/__data/assets/pdf_file/0026/550268/IOM-Mossmorran-AQ-2022-Report-V4-1.pdf
[9] Ambient atmospheric survey for hydrocarbons in the vicinity of Hound Point annual survey for 2023, INEOS – March 2024

- The substance present in the greatest concentrations at all locations was n-butane for which annual mean concentrations ranged from 0.9 to 4.8 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.
- The annual mean concentrations of other individual substances ranged from <0.3 (LOD) to 7.4 ppb v/v.
- The annual mean concentrations of total hydrocarbons (C4 to C10) at different locations ranged from 5 to 12 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 2023 annual average concentrations at most sample locations for the lower molecular weight hydrocarbons (iso-butane, n-butane, iso-pentane, n-pentane, and n-hexane) have shown a decrease compared to those concentrations found in 2022. Benzene concentrations in 2023 appear to show a slight decrease in concentrations compared to 2022.

3.2.7 Summary of Compliance with AQS Objectives

Monitoring data for all pollutants measured during 2023 identified no exceedances of any of the Scottish AQS objectives.

Fife Council will continue to monitor at locations throughout Fife and seek to identify areas of concern to monitor at. The monitoring data for 2024 will be reported in the next Annual Progress Report (2025).

3.3 ADDITIONAL AQMESH SENSOR MONITORING STUDY

A shortened version (Appendix removed due to size) of the data analysis report for Fife Council's six AQMesh air quality monitoring sensor sites from 1st January – 31st December 2023 is provided in Appendix E. A full version of the AQMesh report can be obtained on request.

There was one new sensor monitoring site added to the Fife network in 2023. The site is called Bonnygate North and started monitoring on the 11th of April 2023.

In 2023, 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:

- In previous years, NO_2 annual mean concentrations for both Appin Crescent AQMesh sensors have been higher than that measured at the automatic site, and this is still the case for Appin Crescent East. However, in 2023 the Appin Crescent West NO_2 annual mean measured lower than the automatic site.
- Statistics also show that concentrations of NO_2 have remained significantly lower than that measured in 2018 and 2019 (i.e. pre-Covid19 pandemic).
- For PM_{10}, 2023 sensor site concentrations are very similar to automatic site concentrations with marginal differences in concentrations and have all seen similar

increases from the lows of 2020 and 2021. Concentrations at the sensor sites are still below the relative highs of 2018 and 2019.

- For $PM_{2.5}$, concentrations have not varied much across the years. However, concentrations have remained higher from the slight drop seen in 2020 and 2021 at Appin Crescent East.

When comparing the Bonnygate South and North AQMesh sensors with the nearby automatic site in the Cupar AQMA, the statistics show that:

- Bonnygate South AQMesh NO_2 annual mean concentrations have been consistently higher than the Cupar automatic site, with the exception of 2020 when concentrations were the same. For both the Bonnygate South AQMesh site and Cupar automatic site, 2023 levels of NO_2 are still well below that measure in 2018 and 2019.
- This is also evident for the Bonnygate North AQMesh site where the 2023 NO_2 annual mean concentration is notably higher than the automatic site, but still below the annual mean objective.
- PM_{10} and $PM_{2.5}$ concentrations measured at the Bonnygate South AQMesh site have been very similar since monitoring began in 2018 and the sensor site has always measured lower than the automatic site, except for 2019, when PM_{10} and $PM_{2.5}$ were higher. However, taking into consideration other years and site measurements 2019 does appear to be an outlier year at the Bonnygate South site.
- For the Bonnygate North AQMesh site, PM_{10} and $PM_{2.5}$ 2023 concentrations are higher than that of the automatic site and Bonnygate South AQMesh site, but still lower than the air quality objectives.

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

- PM_{10} and $PM_{2.5}$ pollutants are comparable within 1 or 2 μgm^3, however NO_2 concentrations are higher in 2023 at the AQMesh site than the automatic site and further has seen an increase from 2022 (though still below the air quality objective).

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, the statistics show that:

- In 2022, NO_2 annual mean concentrations were higher for City Road AQMesh than ‘City 6’ diffusion tube, however still well below the annual mean objective and below the diffusion tube peak years of 2018 and 2019. In 2023, NO_2 annual mean concentrations at City Road AQMesh dropped below ‘City 6’ measured concentrations.
- When comparing 2022 and 2023, there was a slight increase in PM_{10} concentrations and slight decrease in $PM_{2.5}$ concentration.

All AQMesh sensors were co-located with diffusion tubes where possible. In 2023, the co-located diffusion tubes (or nearest available) measured higher annual mean NO_2 concentrations than the AQMesh, except for St Clair Street where the AQMesh measured 4 $\mu g\ m^{-3}$ higher than diffusion tube (please note that this AQMesh is located 13 metres southwest of the diffusion tube).

Diurnal analysis was not carried out for Bonnygate South (PM_{10} and $PM_{2.5}$), Bonnygate North (NO_2, PM_{10} and $PM_{2.5}$) and Appin Crescent East (NO_2, PM_{10} and $PM_{2.5}$) 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.

NO_2 Diurnal variation analysis of the remaining sensors and automatic sites indicates:

- The Bonnygate South AQMesh site is more affected by traffic emissions than the Cupar automatic site.
- When comparing 2023 with 2022, Appin Crescent West NO_2 diurnal profile illustrates a decrease in concentrations at the sensor site and concentrations are more in line with those measured at the automatic site. The sensor site doesn't experience a significant drop in concentrations in the afternoon in 2023 as there was in 2022, indicating that daily NO_2 concentrations remained more consistent throughout 2023.
- Distinct rush hour peaks are also apparent when comparing Kirkcaldy automatic site and St Clair Street AQMesh sensor site. The sensor site exhibits overall significantly higher concentrations across the day.
- Traffic NO_2 emissions at the St Andrews sensor are contributing more in the morning than the evening throughout 2023.

PM diurnal analysis of the remaining sensors and automatic sites shows:

- That concentrations of both PM_{10} and $PM_{2.5}$ are not significantly influenced by local sources at both AQMesh sensor and automatic monitoring sites.

3.4 ADDITIONAL STUDIES

Two additional studies were carried out by Ricardo Energy & Environment on behalf of Fife Council. These include the climate change and co-benefits study and an anti-idling campaign.

3.4.1 Climate Change Co-benefits Study

During 2022/2023, an Air Quality and Climate Change co-benefits study was undertaken by Ricardo on behalf of Fife Council. The study 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. The study is ongoing, and an updated report will be issued in the near future subject to provision of grant funding.

3.4.2 Anti-idling Campaign

Following the ‘Switch your engine off and show you care about cleaner air!’ anti-idling campaign undertaken at various Fife primary schools during 2022/23 the winning posters and banner designs have now been manufactured and distributed. The banner has now been installed at the winning school (Mountfleurie, Leven) in order to raise awareness and change behaviour, shown in Figure 3-20.

Figure 3-20 Winning banner on display at Mountfleurie Primary, Leven

Copies of the posters have also been provided to the winning schools (Dunnikier, Kirkcaldy and Lynburn, Dunfermline) for them to install in and around the school grounds. Extra copies of the posters are in the process of getting installed at locations where complaints of anti-idling vehicles have been received by Fife Councils Environmental Health team and at key sensitive receptors such as hospitals as shown in Figure 3-21 below (Queen Margaret Hospital, Dunfermline).

Figure 3-21 Winning poster design on display at Queen Margaret Hospital, Dunfermline

Existing EcoStars members are also being contacted to take part and endorse our anti-idling campaign. One such member is Growforth based in Dunfermline who had their vehicles photographed alongside our ‘we care about clean air’ foam cloud. The picture was included in an associated Fife Council Facebook post.

Figure 3-22 Growforth supporting the Fife Council anti-idling campaign

3.4.3 Transition St Andrews

Transition St Andrews are part of the Core Air Quality Steering Group and a student has recently completed an air quality monitoring survey of outdoor air quality in St Andrews, focusing specifically on nitrogen dioxide (NO_2) and particulate matter (PM), to identify potential hotspots of poor air quality and provide information for public information campaigns to support active travel. St Andrews is not currently designated as having poor air quality by the Council, but Transition St Andrews wanted to understand air quality across St Andrews. They collected data using personal air quality monitors (which are not reference standard and therefore only provide indicative readings) over four years covering as much of St Andrews as possible and found that air quality is generally good. NO_2, PM_{10} and $PM_{2.5}$ are all below the Scottish Air Quality Objectives and PM_{10} and $PM_{2.5}$ are also below the WHO Air Quality Guidelines. However, there are some areas of concern around some of the busier roads, specifically Abbey Walk, Canongate, Largo Road and Buchanan Gardens. Market Street and South Street also have slightly elevated indicative pollution levels. The quieter residential neighbourhoods in the southeast and southwest of St Andrews are the least polluted areas in St Andrews. Though high pollution areas generally match up with busier roads, there is minimal correlation between areas of higher NO_2 concentrations and areas of higher PM concentrations, suggesting different sources or transmission mechanisms. The full report can be found at: St-Andrews-Air-Quality-Report-1.pdf (transitionsta.org).

Fife Council is going to take into consideration the findings of this report when reviewing the current NO_2 monitoring network.

4. NEW LOCAL DEVELOPMENTS

4.1 ROAD TRAFFIC SOURCES

There has been one change in terms of the local and trunk road network in 2023/24 which is associated with a new roundabout being constructed on the A911 in association with a residential development. The works started in 2023 and are nearing completion as of March 2024. There have also been several new residential streets adopted by Fife during 2023/24.

4.2 OTHER TRANSPORT SOURCES

Fife Council confirms that there are no new 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 two new PPC permits at Raytheon Systems Limited in Glenrothes (PPC/B/5005853) and MCP, Boiler House at Inchdairnie Distillery in Glenrothes (PPC/B/5005415). SEPA also surrendered three PPC permits at Strathruddie in Kirkcaldy (PPC/A/1098252), Dunfermline Concrete Plant in Dunfermline (PPC/B/1003205) and Asda Petrol Filling Station at Dalgety Bay (PPC/B/1184681).

SEPA has recently issued a new WML permit for a former MoD Oil Fuel Depot in Rosyth (WML/L/5004595) and substantially varied a WML permit for Muir Dean Opencast Site in Crossgate, Cowdenbeath (WML/L/1195471).

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 2023 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	44
AQIA advised and/or submitted for applications located within AQMA's	0
Biomass boiler/wood burning Stove questionnaire requested and/or submitted	7
General information provided (e.g., agreeing scope of AQIA, further info required, retain air quality condition(s) etc)	13

Applications of note include the following:

23/01909/PREAPP – Pre-application for residential development (16 houses) with associated access, parking landscaping, site infrastructure etc at 2 Carnock Road, Dunfermline, Fife

Given the nature and scale of the proposed development and its proximity to the Appin Crescent AQMA, it was advised that a suitable air quality impact assessment be undertaken. PREAPP response issued 28th September 2023 and advised an AQIA will be expected under future applications.

23/01795/PREAPP – Pre-application for residential development of up to 251 dwellinghouses (238 private and 13 affordable) with vehicular access and other engineering, infrastructure and associated works at Land to North of Manse Road, Crossgates, Fife

Given the nature and scale of the proposed development, it was advised that a suitable air quality impact assessment be undertaken. As of 9th January 2024 a PREAPP response has not yet been issued.

23/01942/FULL – Erection of high school (Class 10) and formation of associated sports pitches, landscaping and footpaths, erection of floodlighting, formation of vehicular access and associated infrastructure at land at Admiralty Park, Rosyth, Fife

An EnviroCentre 'Air Quality Assessment' dated August 2023 has been submitted and determined that the predicted NO_2, PM_{10} and $PM_{2.5}$ concentrations at all sensitive receptors

will meet the relevant air quality objectives. As of 10th January 2024 a decision notice has yet to be issued.

23/01973/PREAPP – Pre-application for residential development and associated landscaping and play facilities at land to south of Strathore Road, Thornton, Fife

Given the nature and scale of the proposed development, it was advised that a suitable air quality impact assessment be undertaken. As of 9th January 2024 a PREAPP response has not yet been issued.

6. CONCLUSIONS AND PROPOSED ACTIONS

6.1 CONCLUSIONS FROM NEW MONITORING DATA

The 2024 APR has considered the available monitoring data measured during 2023.

Nitrogen Dioxide

During 2023, NO_2 was measured at four sites using automatic monitors; Cupar, Dunfermline, Kirkcaldy and Rosyth. Non-automatic, diffusion tube monitoring was undertaken at 44 locations within Fife (covering 52 diffusion tubes in total). There were no exceedances of the NO_2 annual mean or 1-hour mean objective at any automatic or non-automatic monitoring locations during 2023. The highest annual mean concentration measured in Appin Crescent, Dunfermline during 2023 was 25.9 µg m^{-3} at Appin Crescent 6A. The highest annual mean concentration measured in Bonnygate, Cupar during 2023 was 25.1 µg m^{-3} at Bonnygate B4. There were nine diffusion tube sites decommissioned during 2023 due to historically low readings and reducing triplicate tube sites to single tube sites. These were replaced by three new sites in Crossgates. The new sites are 89 Dunfermline Road, 18A Dunfermline Road and 7 Springhill Brae.

AQMesh Sensor monitoring carried out at six locations in Fife (Appin Crescent, Dunfermline (2 locations); Bonnygate, Cupar (2 locations); 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. 2023 measured concentrations of both PM_{10} and $PM_{2.5}$ did not exceed the annual or daily mean objectives for both PM_{10} and $PM_{2.5}$.

AQMesh Sensor monitoring carried out at six locations in Fife (Appin Crescent, Dunfermline (2 locations); Bonnygate, Cupar (2 locations); 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

SO_2 was not measured in Fife during 2023. Historical SO_2 monitoring data from the Longannet power station site is available in previous year's APR reports for Fife Council.

Carbon Monoxide

Short-term monitoring undertaken by Fife Council's Transportation Services department during 2023 indicates that the AQS objective for CO is unlikely to have been exceeded during 2023.

Monitoring for CO has now ceased within Fife as the monitored levels have been found to be consistently well below the AQS objective.

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 appear to show a slight decrease in concentration compared to 2022.

At the time of writing, The Mossmorran and Braefoot Bay Independent Air Quality Monitoring Review Annual Report 2023 has not yet been published. It is anticipated that this will be finalised by the end of 2024 and the findings incorporated into a revised version of this Annual Progress Report. The Mossmorran and Braefoot Bay Independent Air Quality Monitoring Review Annual Report 2022 was published in early 2024 and no associated exceedances were identified.

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 and revocation of the AQMAs Fife Council will carry out the following actions:

1. Produce an Annual Progress Report in 2025, reporting concentrations measured during 2024.
2. Continue to implement the measures outlined in the action plans for Appin Crescent, Dunfermline and Bonnygate, Cupar.
3. Continue to monitor NO_2, PM_{10} and $PM_{2.5}$ concentrations throughout Fife including within the recently revoked AQMAs.
4. Continue to review the NO_2 diffusion tube monitoring programme and seek to relocate any tubes where deemed appropriate.
5. Start the process of updating the Fife Council Air Quality Strategy (to cover the period 2025-2029).

6.4 GRANTS AWARDED

In early June 2024 Fife Council was provided with the grant funding allocation from the Scottish Government for local air quality management and AQAP related measures/projects over 2024/25. The awarded funding (Table 6-1) will cover key areas including:

Table 6-1 Grant funding allocation 2024/25

LAQM	AQAP
Two new AQMesh units to be used for monitoring at educational establishments in light of recent findings and recommendations from the Royal College of Physicians.	Continuation of TRL Fleet and Taxi EcoStars schemes within Fife.
	AQMesh data management and reporting over 2024 for existing pods. The AQMesh pods are used at a range of locations including within recently revoked AQMAs (Bonnygate, Cupar and Appin Crescent, Dunfermline) and other sites of interest at St Clair Street, Kirkcaldy and City Road, St Andrews along with an educational establishment associated with recent findings and recommendations from the Royal College of Physicians.
	CAD 2024 – Education packages and citizen science packs to be used at four schools across Fife. CAD 2024 will also make use of materials available from the recent anti-idling campaign.
	Air Quality Strategy Update 2025-2030.

A summary of progress on the above items will be provided in the 2025 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 2023/24

Measure	Summary
Provision of three new NOx analysers to replace aging equipment at Cupar, Dunfermline and Kirkcaldy and new air conditioning unit in Kirkcaldy	Funding used to obtain three new API T200 NOx analysers to replace ageing Thermo 42i units at Kirkcaldy, Dunfermline and Cupar. The three units were replaced in June 2023 (as stated in Appendix D). Shortly after in July 2023 the air conditioning unit at Kirkcaldy was also replaced.
Continuation of TRL Fleet and Taxi EcoStars schemes within Fife	Funding was used to ensure TRL continued to recruit new members while also liaising with existing members (as detailed in Section 2.3.3)

Measure	Summary
AQMesh data management and reporting for existing pods	Funding used to ensure data from all existing AQMesh pods (including within recently revoked AQMAs) was appropriately managed, quality assured, quality controlled and reported (as detailed in Section 3.3)
CAD 2023	Funding used to provide four schools across Fife with educational packages, including materials (Citizen Science Packs) allowing them to carry out their own monitoring. Further information is provided in Section 2.2.6
Blue Green Network	GIS data provided showing areas of concern across Fife via a numerical ranking system. This replicates the air purification section of the Edinburgh Green Blue Network Report. Further information is provided in Section 3.4.3

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 (1.0)	<0.5	1.9
Dunfermline	Roadside	309926	687722	NO_2, PM_{10}, $PM_{2.5}$	YES Appin Crescent	NO_x Analyser (Chemiluminescence), FIDAS (since September 2016)	Y (1.0)	4	2
Kirkcaldy	Roadside	329143	692986	NO_2, PM_{10} $PM_{2.5}$	N	NO_x Analyser (Chemiluminescence), FIDAS (since April 2016)	N (10.0)	5	2
Rosyth	Roadside	311755	683503	NO_2, PM_{10} $PM_{2.5}$	N	NO_x Analyser (Chemiluminescence) FIDAS (since July 2015)	Y (1.5)	6	2.1

Notes:

(1) 0m 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									
Glenlyon, Leven	Kerbside	337357	701318	NO_2	No	No (26.8)	1	No	2.2
ASDA Roundabout, Kirkcaldy	Kerbside	328742	694045	NO_2	No	No (28.0)	1	No	2.2
Victoria Road, Kirkcaldy	Roadside (Façade)	328144	692315	NO_2	No	Yes	2.5	No	2.2
Dunnikier Road, Kirkcaldy	Roadside (Façade)	328152	692352	NO_2	No	Yes	3.4	No	2.2
Henry Road, Kirkcaldy	Roadside	327437	692270	NO_2	No	No (16.0)	1.7	No	2.2
Chapel Level, Kirkcaldy	Roadside	325526	694027	NO_2	No	No (10.0)	10	No	2.2
Oriel Road, Kirkcaldy	Roadside	327239	691669	NO_2	No	No (5.0)	2	No	2.2
Pratt Street, Kirkcaldy	Roadside	327415	690432	NO_2	No	No (2.0)	2	No	2.2
St Clair Street 1, Kirkcaldy	Roadside	329157	693030	NO_2	No	No (2.0)	1.3	No	2.2
St Clair Street 2, Kirkcaldy	Roadside	329131	693008	NO_2	No	No (2.0)	1.8	No	2.2
St Clair Street 3, Kirkcaldy	Roadside (Façade)	329174	693069	NO_2	No	Yes	2	No	2.2
125 St Clair Street, Kirkcaldy	Roadside (Façade)	329208	693163	NO_2	No	Yes	1.5	No	2.2
179A St Clair Street, Kirkcaldy	Roadside (Façade)	329310	693326	NO_2	No	Yes	1.5	No	2.2
St Clair Street Romon A, B, C, Kirkcaldy*	Roadside	329143	692986	NO_2	No	No (10.0)	5	Yes	2.2
East Area									
City Road 1, St Andrews	Roadside	350590	716570	NO_2	No	No (1.0)	1.5	Yes	2.2
Bell Street 1, St Andrews	Roadside (Façade)	350712	716691	NO_2	No	Yes	1.6	No	2.2
Bell Street 2, St Andrews	Roadside (Façade)	350721	716646	NO_2	No	Yes	2.1	No	2.2

City Road 3, St Andrews	Roadside	350538	716682	NO_2	No	No (14.0)	1.5	No	2.2
City Road 5, St Andrews	Roadside	350499	716748	NO_2	No	No (5.0)	1.9	No	2.2
City Road 6, St Andrews	Roadside	350470	716826	NO_2	No	No (5.0)	2.2	No	2.2
Links Crescent, St Andrews	Roadside (Façade)	350156	716947	NO_2	No	Yes	3	No	2.2
North Street, St Andrews	Roadside	350519	716935	NO_2	No	No (3.0)	2.2	No	2.2
Bonnygate B1, Cupar	Roadside (Façade)	337409	714570	NO_2	Yes, Bonnygate	Yes	5.3	No	2.2
Bonnygate B2, Cupar	Roadside (Façade)	337507	714584	NO_2	Yes, Bonnygate	Yes	1.7	No	2.2
Bonnygate B4, Cupar	Roadside (Façade)	337467	714576	NO_2	Yes, Bonnygate	Yes	1.9	No	2.2
Bonnygate B3, Cupar	Roadside (Façade)	337480	714586	NO_2	Yes, Bonnygate	Yes	1.6	Yes	2.2
Bonnygate Monitor A, B, C, Cupar*	Kerbside	337403	714571	NO_2	Yes, Bonnygate	No (4.8)	0.6	Yes	2.2
West Area									
89 Dunfermline Road, Crossgate	Roadside (façade)	314223	688775	NO_2	No	Yes	2	No	2.2
18A Dunfermline Road, Crossgate	Roadside (façade)	314440	688792	NO_2	No	Yes	2	No	2.2
7 Springhill Brae, Crossgate	Roadside	314576	688730	NO_2	No	No (5.0)	2	No	2.2
Admiralty Road A, Rosyth	Roadside (Façade)	312069	683431	NO_2	No	Yes	9	No	2.2
Admiralty Road ROMAN A, B, C, Rosyth*	Roadside (Façade)	311755	683503	NO_2	No	Yes	6.5	Yes	2.2
High Street, Cowdenbeath	Kerbside	316527	691742	NO_2	No	No (3.5)	0.5	No	2.2
Carnegie Drive A Dunfermline	Roadside (Façade)	309023	687632	NO_2	No	Yes	2.3	No	2.2
Pilmuir Street, Dunfermline	Roadside	309143	687774	NO_2	No	Yes	2	No	2.2
Mill Street, Dunfermline	Roadside	308888	687968	NO_2	No	Yes	2	No	2.2
102 Baldridgeburn, Dunfermline	Kerbside	308447	688068	NO_2	No	No (3.0)	0.5	No	2.2

Appin Crescent A Dunfermline	Roadside	309900	687716	NO_2	Yes, Appin Crescent	No (5.1)	1.6	No	2.2
Appin Crescent 1, Dunfermline	Roadside (Façade)	309888	687719	NO_2	Yes, Appin Crescent	Yes	6.5	No	2.2
Appin Crescent 4A, 4B, 4C, Dunfermline*	Roadside (Façade)	309926	687722	NO_2	Yes, Appin Crescent	Yes	3.9	Yes	2.2
Appin Crescent 2, Dunfermline	Roadside (Façade)	309883	687701	NO_2	Yes, Appin Crescent	Yes	1.5	No	2.2
Appin Crescent 3, Dunfermline	Roadside (Façade)	309975	687716	NO_2	Yes, Appin Crescent	Yes	1.8	No	2.2
Appin Crescent 5A Dunfermline	Roadside (Façade)	309957	687714	NO_2	Yes, Appin Crescent	Yes	1.5	No	2.2
Appin Crescent 6A Dunfermline	Roadside (Façade)	309904	687704	NO_2	Yes, Appin Crescent	Yes	1.5	No	2.2

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

Kerbside = 0-1m from the kerb of a busy road. Roadside = 1-5m from the kerb. Roadside (Façade) = 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 2023 (%) [2]	2019	2020	2021	2022	2023
Cupar	Kerbside	Automatic	100	98	23.6	20.9	20	18	20
Dunfermline	Roadside	Automatic	100	98	20.5	15.2	16.1	15	15
Kirkcaldy	Roadside	Automatic	100	97	15.8	12.2	14.1	12	13
Rosyth	Roadside	Automatic	100	100	21.5	15.4	19.3	18	17
Central Area									
Glenlyon, Leven	Kerbside	Diffusion Tube	100	92	23	16	20	18	17.2
ASDA Roundabout, Kirkcaldy	Kerbside	Diffusion Tube	100	100	22	16	19	17	18.7
Victoria Road, Kirkcaldy	Roadside (Façade)	Diffusion Tube	100	100	23	16	22	17	18.2
Dunnikier Road, Kirkcaldy	Roadside (Façade)	Diffusion Tube	100	100	22	16	18	15	20.5
Henry Road, Kirkcaldy	Roadside	Diffusion Tube	100	100	21	16	19	17	19.0
Chapel Level, Kirkcaldy	Roadside	Diffusion Tube	100	83	-	-	-	11	12.3
Oriel Road, Kirkcaldy	Roadside	Diffusion Tube	100	100	-	-	-	11	13.2
Pratt Street, Kirkcaldy	Roadside	Diffusion Tube	100	100	-	-	-	11	12.7
St Clair Street 1, Kirkcaldy	Roadside	Diffusion Tube	100	100	25	18	21	19	22.9
St Clair Street 2, Kirkcaldy	Roadside	Diffusion Tube	100	100	29	23	23	21	24.6
St Clair Street 3, Kirkcaldy	Roadside (Façade)	Diffusion Tube	100	100	23	16	19	17	18.9
125 St Clair Street, Kirkcaldy	Roadside (Façade)	Diffusion Tube	100	100	23	18	20	19	20.6
179A St Clair Street, Kirkcaldy	Roadside (Façade)	Diffusion Tube	100	100	22	18	18	17	19.7
St Clair Street Romon A, B, C, Kirkcaldy*	Roadside	Diffusion Tube	100	92	16	13	14	12	14.3
East Area									
City Road 1, St Andrews	Roadside	Diffusion Tube	100	100	22	13	16	14	16.8
Bell Street 1, St Andrews	Roadside (Façade)	Diffusion Tube	100	100	27	14	15	16	16.9

Bell Street 2, St Andrews	Roadside (Façade)	Diffusion Tube	100	100	22	13	14	14	13.9
City Road 3, St Andrews	Roadside	Diffusion Tube	100	100	22	16	17	16	17.3
City Road 5, St Andrews	Roadside	Diffusion Tube	100	100	18	13	15	14	15.8
City Road 6, St Andrews	Roadside	Diffusion Tube	100	100	27	21	24	21	20.3
Links Crescent, St Andrews	Roadside (Façade)	Diffusion Tube	100	100	19	14	16	15	14.0
North Street, St Andrews	Roadside	Diffusion Tube	100	100	21	13	17	16	15.4
Bonnygate B1, Cupar	Roadside (Façade)	Diffusion Tube	100	92	24	18	21	17	17.9
Bonnygate B2, Cupar	Roadside (Façade)	Diffusion Tube	100	100	23	21	23	20	21.5
Bonnygate B4, Cupar	Roadside (Façade)	Diffusion Tube	100	100	32	22	27	24	25.1
Bonnygate B3, Cupar	Roadside (Façade)	Diffusion Tube	100	100	32	20	27	22	24.8
Bonnygate Monitor A, B, C, Cupar*	Kerbside	Diffusion Tube	100	92	23	16	19	17	18.4
West Area									
89 Dunfermline Road, Crossgate	Roadside (façade)	Diffusion Tube	100	100	-	-	-	-	17.5
18A Dunfermline Road, Crossgate	Roadside (façade)	Diffusion Tube	100	100	-	-	-	-	14.0
7 Springhill Brae, Crossgate	Roadside	Diffusion Tube	100	100	-	-	-	-	13.8
Admiralty Road A, Rosyth	Roadside (Façade)	Diffusion Tube	100	92	27	20	23	22	20.9
Admiralty Road ROMAN A, B, C, Rosyth*	Roadside (Façade)	Diffusion Tube	100	83	22	17	19	18	14.9
High Street, Cowdenbeath	Kerbside	Diffusion Tube	100	100	19	14	16	14	15.4
Carnegie Drive A Dunfermline	Roadside (Façade)	Diffusion Tube	100	92	26	18	22	19	21.5
Pilmuir Street, Dunfermline	Roadside	Diffusion Tube	100	100	23	17	17	16	17.3
Mill Street, Dunfermline	Roadside	Diffusion Tube	100	92	30	22	25	23	24.1
102 Baldridgeburn, Dunfermline	Kerbside	Diffusion Tube	100	100	33	16	17	16	17.1
Appin Crescent A Dunfermline	Roadside	Diffusion Tube	100	100	27	20	21	20	21.4

Appin Crescent 1, Dunfermline	Roadside (Façade)	Diffusion Tube	100	100	26	19	21	19	20.5
Appin Crescent 4A, 4B, 4C, Dunfermline*	Roadside (Façade)	Diffusion Tube	100	100	21	15	16	15	15.4
Appin Crescent 2, Dunfermline	Roadside (Façade)	Diffusion Tube	100	100	31	24	26	24	24.4
Appin Crescent 3, Dunfermline	Roadside (Façade)	Diffusion Tube	100	100	28	21	26	24	24.9
Appin Crescent 5A Dunfermline	Roadside (Façade)	Diffusion Tube	100	75	30	23	24	23	24.4
Appin Crescent 6A Dunfermline	Roadside (Façade)	Diffusion Tube	100	100	34	24	26	25	25.9

☒ **Diffusion tube data has been bias adjusted.**

☒ **Reported concentrations are those at the location of the monitoring site (bias adjusted and annualised, as required), i.e. prior to any fall-off with distance correction.**

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.

(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.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 2023 (%) (2)	2019	2020	2021	2022	2023
Cupar	Kerbside	Automatic	100	98	0	0	0	0	0
Dunfermline	Roadside	Automatic	100	98	0	0	0	0	0
Kirkcaldy	Roadside	Automatic	100	97	0	0	0	0	0
Rosyth	Roadside	Automatic	100	100	0	0	0	0	0

Notes:

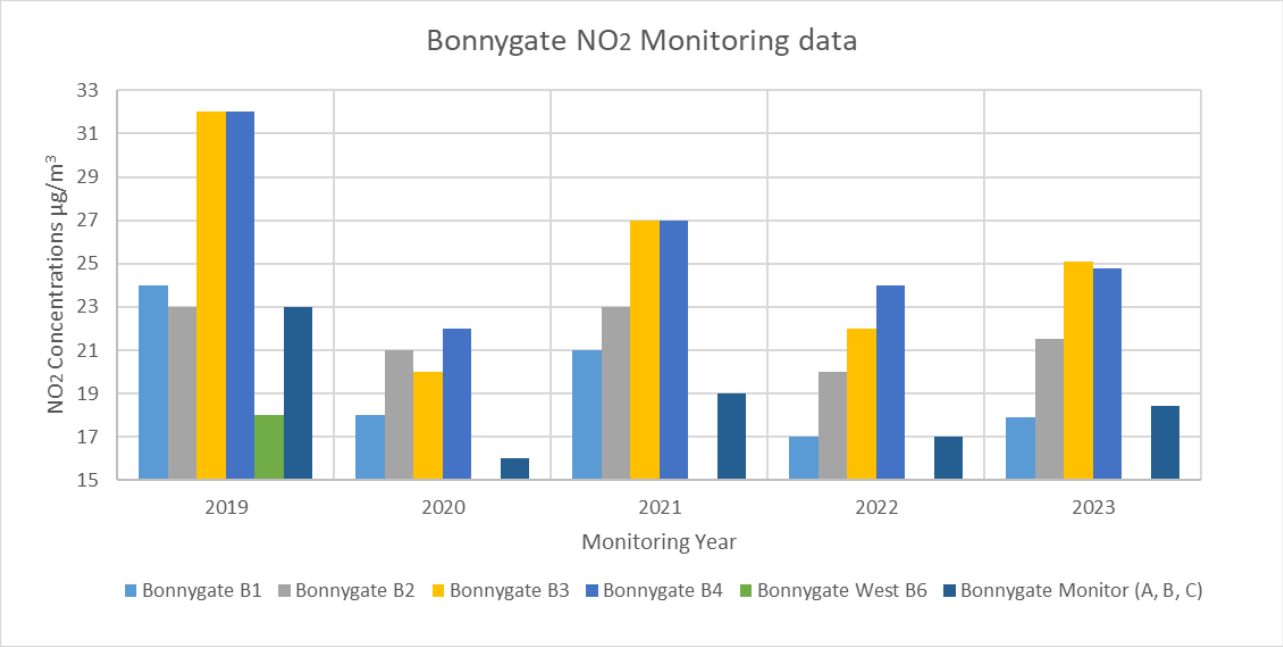
Exceedances of the NO_2 1-hour mean objective (200 µg m^{-3} not to be exceeded more than 18 times/year) are shown in bold.

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.

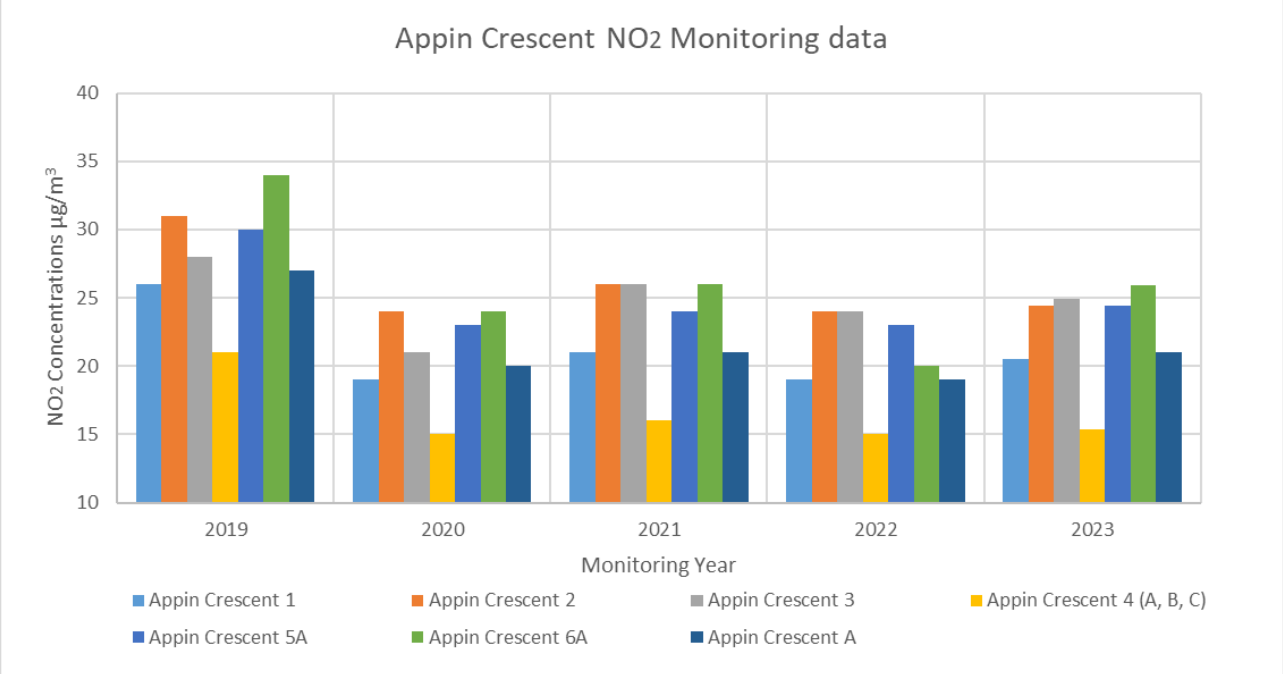
(2) Data capture for the full calendar year (e.g., if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

Figure A-1 Bonnygate Diffusion Tube Annual Mean Concentrations 2019-2023 (µg m^{-3})



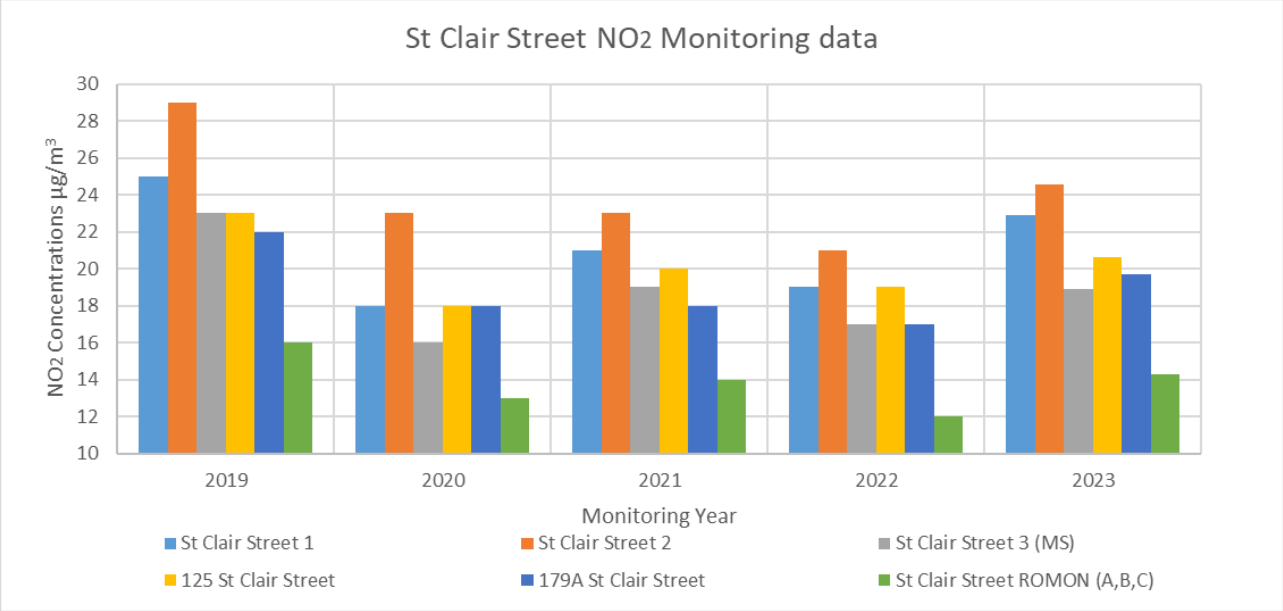
NO_2 annual mean concentrations for the Bonnygate area are presented in Figure A-1. Concentrations decreased at all sites between 2019 and 2020 before increasing in 2021, likely due to COVID-19 lockdown and restrictions easing. Concentrations dropped slightly in 2022 and increased in 2023 but still remain lower than 2019.

Figure A-2 Appin Crescent Diffusion Tube Annual Mean Concentrations 2019-2023 (µg m^{-3})



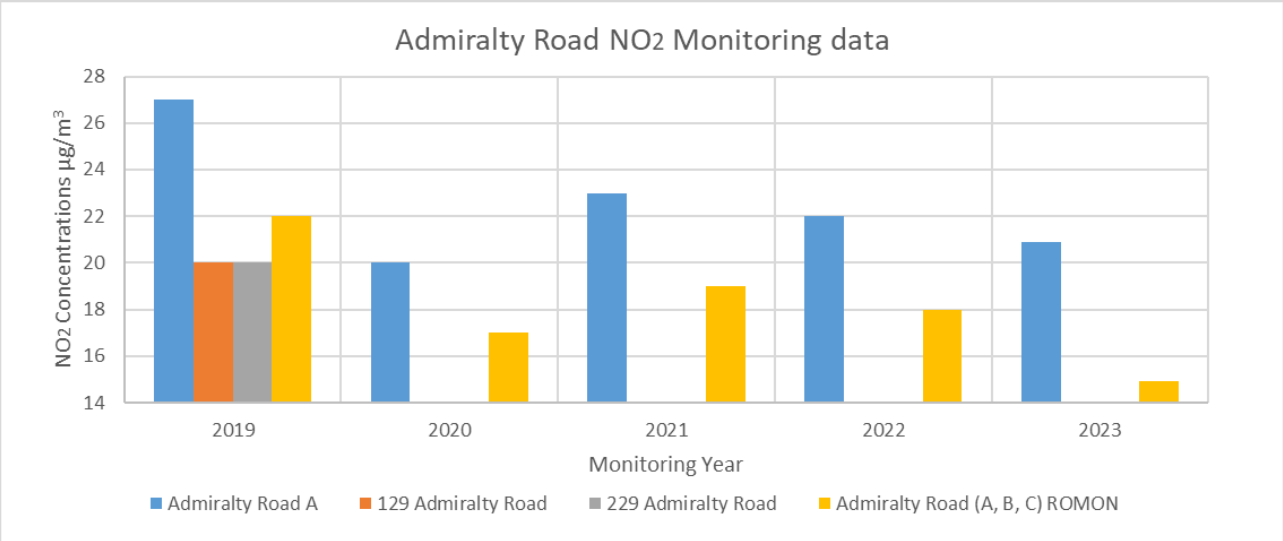
NO_2 annual mean concentrations for the Appin Crescent area are presented in Figure A-2. All sites saw a decline in concentrations between 2019 and 2020. Concentrations increased in 2021 compared to 2020, likely due to COVID-19 lockdown and restrictions easing. Concentrations dropped slightly in 2022 but again increased in 2023.

Figure A-3 St Clair Street Diffusion Tube Annual Mean Concentrations 2019-2023 (µg m^{-3})



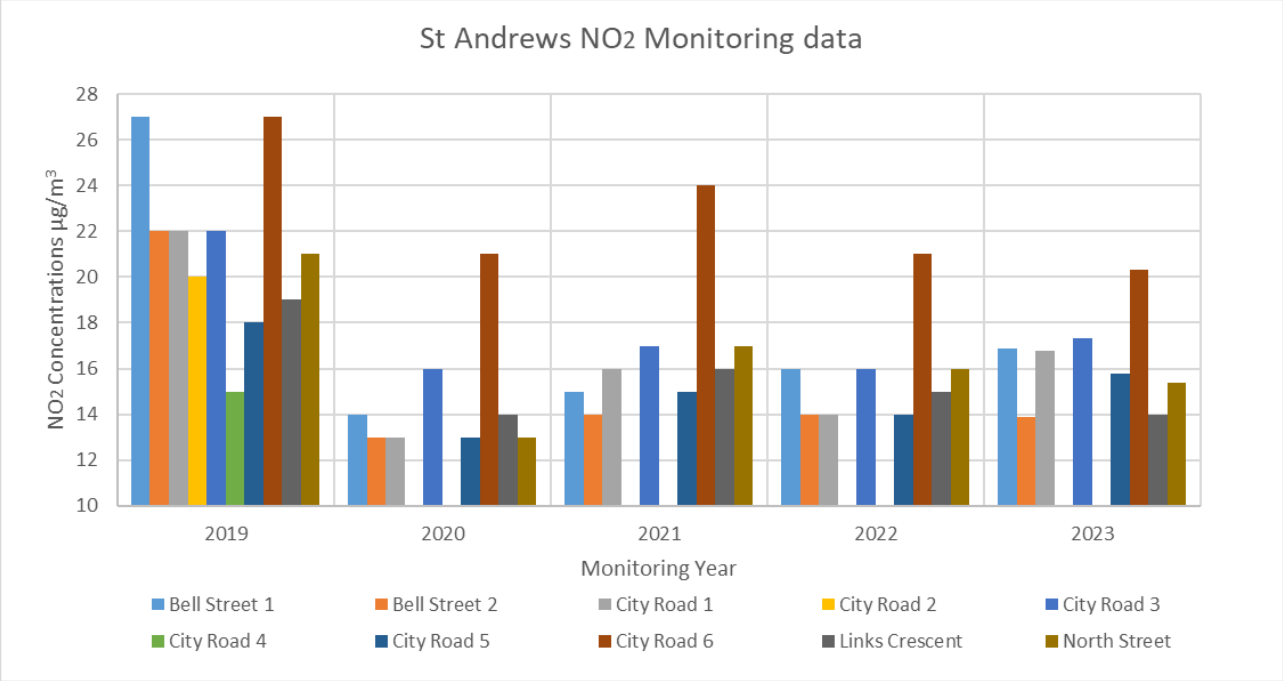
NO_2 annual mean concentrations for the St Clair Street area are presented in Figure A-3. Concentrations declined between 2019 and 2020. Following the easing of COVID-19 lockdown and restrictions concentrations increased slightly in 2021 before decreasing again in 2022. 2023 concentrations increased slightly but remain lower than 2019 levels.

Figure A-4 Admiralty Road Diffusion Tube Annual Mean Concentrations 2019-2023 (µg m^{-3})



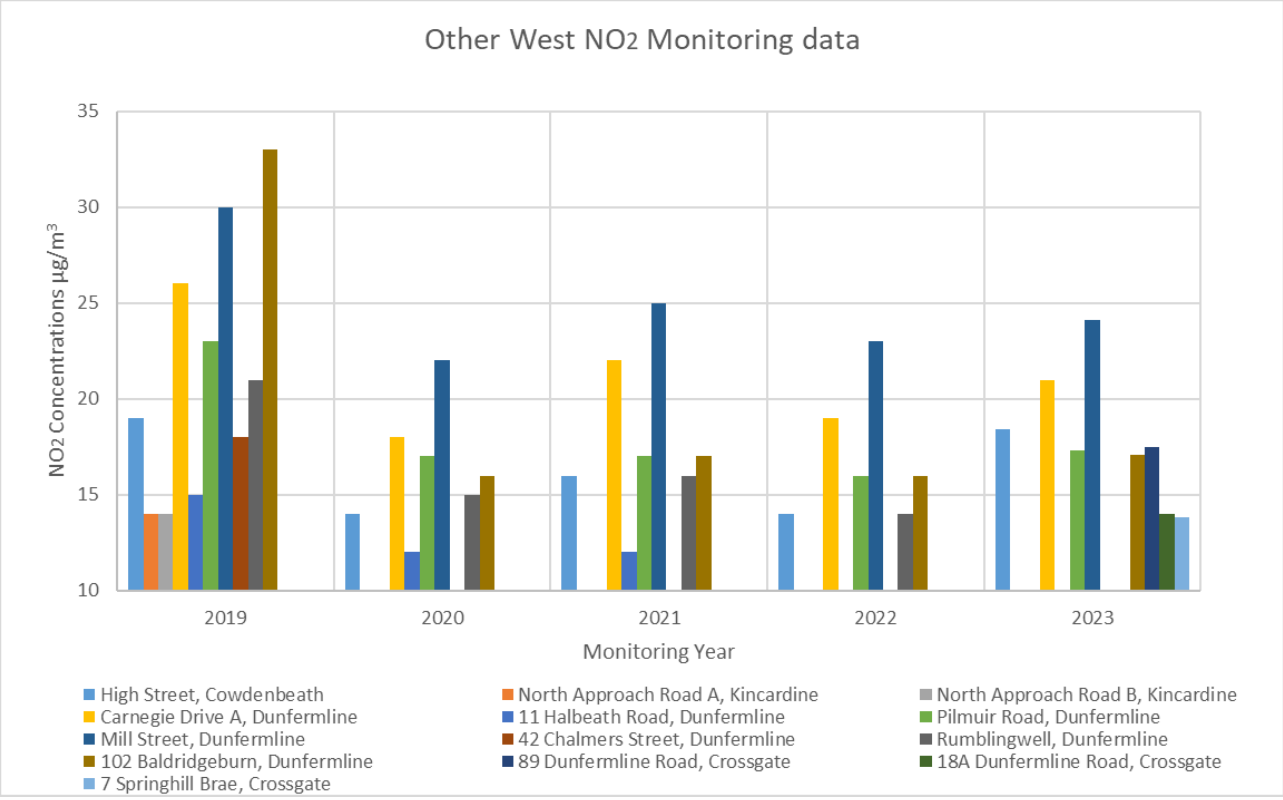
NO_2 annual mean concentrations for the Admiralty Road area are presented in Figure A-4. Concentrations gradually dropped in 2020. A few sites were decommissioned after 2019. Concentrations then increased in 2021 following the easing of COVID-19 lockdown and restrictions. 2022 concentrations decreased compared to 2021 then decreased further in 2023.

Figure A-5 St Andrews Diffusion Tube Annual Mean Concentrations 2019-2023 (µg m^{-3})



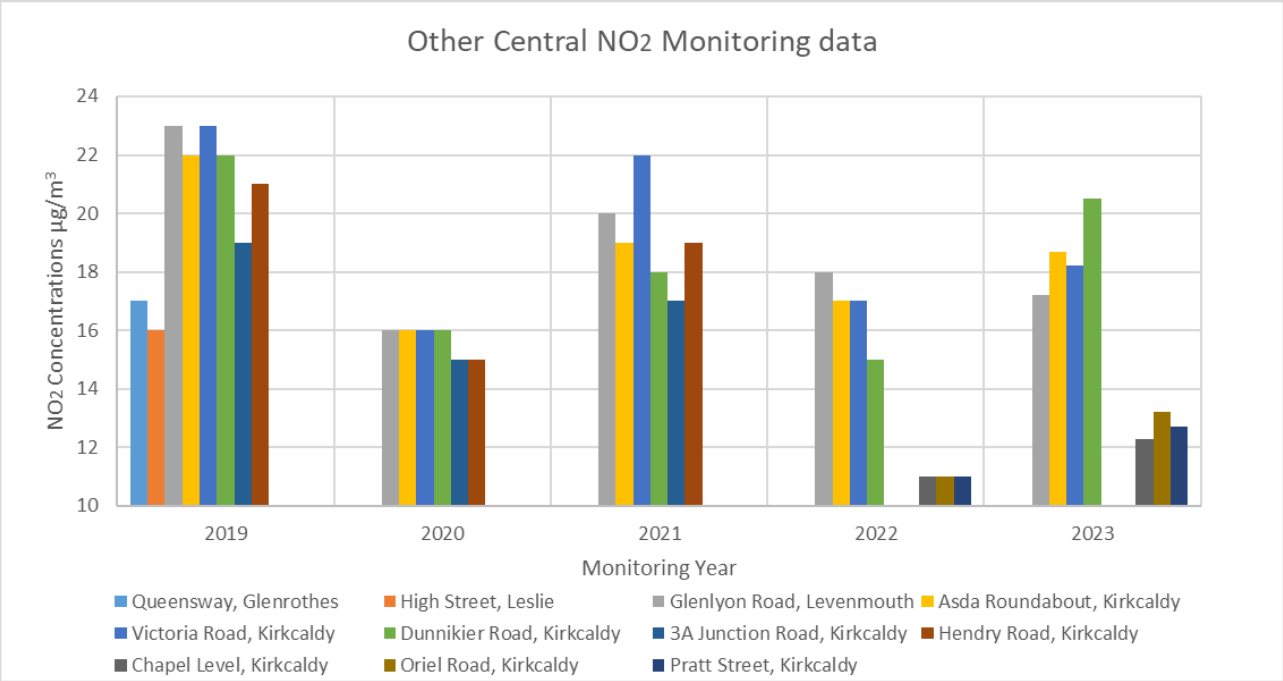
NO_2 annual mean concentrations for the St Andrews area are presented in Figure A-5. Two monitoring sites were decommissioned in 2020 and concentrations decreased at all sites compared to 2019. Concentrations increased in 2021 compared to 2020 following the easing of COVID-19 lockdown and restrictions, before decreasing slightly in 2022 and 2023, although they remain below 2019 levels.

Figure A-6 Other West Diffusion Tube Annual Mean Concentrations 2019-2023 (µg m^{-3})



NO_2 annual mean concentrations for the other west areas in Fife are presented in Figure A-6. Concentrations declined in 2020 compared to 2019. 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. Concentration increased slightly in 2023 but still remain below 2019 levels. Three new sites were added in 2023.

Figure A-7 Other Central Diffusion Tube Annual Mean Concentrations 2019-2023 (µg m^{-3})



NO_2 annual mean concentrations for the other central areas in Fife are presented in Figure A-7. Concentrations declined between 2019 and 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 in 2022 compared to 2021 and increased slightly in 2023 but remain lower than 2019 and 2021.

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 2023 (%) (2)	2019	2019 Corrected#	2020	2020 Corrected#	2021	2021 Corrected#	2022	2022 Corrected#	2023	2023 Corrected#
Cupar	Kerbside	100	97	14.6	16.1	11.3	12.4	13.0	14.3	14.0	15.4	12.0	13.2
Dunfermline	Roadside	100	100	11.2	12.3	8.5	9.4	9.6	10.6	12.0	13.2	11.0	12.1
Kirkcaldy	Roadside	100	100	11.6	12.8	9.0	9.9	9.4	10.3	11.0	12.1	9.0	9.9
Rosyth	Roadside	100	99	10.00	11.0	9.1	10.0	9.9	10.9	11.0	12.1	9.0	9.9

Notes:

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

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 2023 (%) (2)	2019	2020	2021	2022	2023
Cupar	Kerbside	100	97	0	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	99	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 2023 (%) (2)	2019	2019 Corrected#	2020	2020 Corrected#	2021	2021 Corrected#	2022	2022 Corrected#	2023	2023 Corrected#
Cupar	Kerbside	100	97	7.5	8.0	5.6	5.9	6.3	6.7	7.0	7.4	6.0	6.4
Dunfermline	Roadside	100	100	6.4	6.8	4.8	5.1	5.5	5.8	6.0	6.4	5.0	5.3
Kirkcaldy	Roadside	100	100	6.7	7.1	5.0	5.3	5.3	5.6	6.0	6.4	5.0	5.3
Rosyth	Roadside	100	99	5.9	6.3	5.1	5.4	5.5	5.8	6.0	6.4	5.0	5.3

Notes:

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

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 2023

Table B.1 – NO_2 2023 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														
Glenlyon, Leven	32.6	29.6	21.0	14.6	21.9	16.1	17.7	20.0	22.7	23.4	No return	26.1	22.3	17.2
ASDA Roundabout, Kirkcaldy	29.8	27.9	26.5	16.9	24.8	25.0	19.0	19.7	25.3	23.9	24.0	28.3	24.3	18.7
Victoria Road, Kirkcaldy	27.1	25.1	18.4	17.4	26.3	22.3	19.3	20.2	23.4	29.1	28.1	26.0	23.6	18.2
Dunnikier Road, Kirkcaldy	29.8	24.2	24.3	23.7	30.4	25.7	24.0	24.7	26.7	24.9	31.0	29.1	26.5	20.5
Henry Road, Kirkcaldy	33.9	32.1	13.7	25.3	26.3	21.4	23.7	21.8	26.2	22.9	29.4	18.6	24.6	19.0
Chapel Level, Kirkcaldy	24.4	21.0	16.8	12.4	15.6	11.6	13.9	11.4	15.7	16.7	No return	No return	16.0	12.3
Oriel Road, Kirkcaldy	20.9	17.3	17.1	17.7	18.2	17.6	14.0	13.4	15.6	15.5	18.5	19.3	17.1	13.2
Pratt Street, Kirkcaldy	22.8	20.1	19.1	17.5	15.4	12.5	11.9	12.2	12.0	14.3	19.4	20.1	16.4	12.7
St Clair Street 1, Kirkcaldy	30.6	31.6	31.4	31.2	33.7	33.4	26.6	23.2	29.3	27.3	28.0	30.5	29.7	22.9
St Clair Street 2, Kirkcaldy	44.7	45.4	32.3	29.2	28.3	23.7	27.4	26.5	29.5	27.4	34.8	33.1	31.9	24.6
St Clair Street 3, Kirkcaldy	26.8	26.8	26.9	21.1	27.4	25.0	22.1	20.9	25.2	19.9	26.4	26.0	24.5	18.9
125 St Clair Street, Kirkcaldy	39.0	34.6	28.7	21.6	23.7	18.2	22.9	21.8	24.5	23.7	32.9	28.9	26.7	20.6
179A St Clair Street, Kirkcaldy	35.8	34.4	25.0	24.2	21.8	17.4	19.9	21.5	25.4	21.4	30.9	29.7	25.6	19.7
St Clair Street Romon A, Kirkcaldy	25.6	24.3	15.4	19.0	15.0	12.3	13.5	13.8	16.7	16.8	24.1	22.4	18.7	14.3
St Clair Street Romon B, Kirkcaldy	26.5	23.6	20.2	12.2	15.6	10.9	13.6	14.3	15.7	16.9	26.2	24.3		
St Clair Street Romon C, Kirkcaldy	29.2	25.3	23.9	17.5	15.4	13.1	14.1	No return	16.2	16.1	21.7	22.3		
East														
City Road 1, St Andrews	22.5	19.9	17.4	28.5	21.5	22.2	17.0	20.2	20.2	21.2	28.7	22.4	21.8	16.8
Bell Street 1, St Andrews	21.5	25.7	23.9	22.8	22.2	19.2	17.0	18.8	22.1	21.1	25.0	23.1	21.9	16.9

Bell Street 2, St Andrews	20.3	23.3	14.7	15.7	17.1	14.2	14.5	16.3	18.5	17.9	24.1	19.3	18.0	13.9
City Road 3, St Andrews	25.4	25.6	22.0	19.8	21.8	18.4	19.3	22.5	22.8	20.5	29.4	22.6	22.5	17.3
City Road 5, St Andrews	24.3	21.3	18.0	19.8	20.0	17.9	17.4	19.5	22.5	19.2	24.8	20.6	20.4	15.8
City Road 6, St Andrews	29.5	27.7	23.8	20.3	25.8	28.8	22.9	27.6	24.5	25.7	31.5	28.2	26.4	20.3
Links Crescent, St Andrews	19.5	22.2	13.0	22.5	19.1	18.0	16.4	17.0	19.4	20.2	14.7	15.4	18.1	14.0
North Street, St Andrews	25.9	22.8	19.0	18.8	19.8	15.2	16.3	19.5	18.2	17.6	26.6	20.6	20.0	15.4
Bonnygate B1, Cupar	29.0	22.9	22.6	22.9	22.2	21.6	17.9	22.1	22.3	24.2	No return	27.2	23.2	17.9
Bonnygate B2, Cupar	34.6	31.9	33.2	31.0	24.8	22.8	17.9	19.0	28.2	23.4	33.2	35.0	27.9	21.5
Bonnygate B4, Cupar	39.4	24.6	36.7	35.8	31.5	26.8	25.4	33.0	37.5	28.3	33.9	37.6	32.5	25.1
Bonnygate B3, Cupar	37.3	36.6	39.6	38.0	32.8	30.8	24.0	26.9	23.8	27.9	37.1	32.0	32.2	24.8
Bonnygate Monitor A, Cupar	31.3	24.6	24.2	27.7	23.2	21.2	16.9	20.1	23.6	23.8	No return	26.0	23.7	18.4
Bonnygate Monitor B, Cupar	30.1	23.2	20.4	26.3	23.3	22.2	17.6	22.2	23.3	21.5	28.9	27.7		
Bonnygate Monitor C, Cupar	29.3	24.6	20.8	23.0	22.7	22.6	17.0	20.4	22.9	22.8	29.5	26.1		
West														
89 Dunfermline Road, Crossgate	32.8	21.3	23.5	21.3	23.5	16.6	15.6	19.2	23.5	22.3	24.9	27.3	22.7	17.5
18A Dunfermline Road, Crossgate	25.4	20.9	19.5	11.9	17.3	14.0	13.9	15.9	16.8	18.8	24.6	19.6	18.2	14.0
7 Springhill Brae, Crossgate	21.2	20.9	20.4	17.0	17.6	15.9	11.8	14.5	19.2	17.6	22.0	17.2	17.9	13.8
Admiralty Road A, Rosyth	31.2	27.1	30.2	No return	44.6	21.6	17.9	21.1	22.6	24.8	30.6	26.1	27.1	20.9
Admiralty Road ROMAN A, Rosyth	25.1	20.2	21.4	13.5	19.0	16.8	12.6	16.3	No return	No return	29.8	26.4	19.5	14.9
Admiralty Road ROMAN B, Rosyth	25.7	19.3	21.8	13.9	18.5	6.8	13.4	16.9	18.5	17.7	28.9	23.7		
Admiralty Road ROMAN C, Rosyth	24.5	19.9	23.1	22.7	19.4	16.4	14.3	17.3	17.3	17.3	22.2	21.7		
High Street, Cowdenbeath	21.4	18.6	28.2	21.7	17.3	16.6	14.1	17.2	19.1	18.3	25.5	22.4	20.0	15.4
Carnegie Drive A, Dunfermline	30.0	28.9	30.3	21.1	26.0	25.6	No return	22.8	30.2	20.9	33.5	37.6	27.9	21.5
Pilmuir Street, Dunfermline	32.7	25.7	23.9	18.6	20.1	17.7	16.0	17.7	20.9	25.7	23.4	26.2	22.4	17.3
Mill Street, Dunfermline	42.8	34.1	35.3	26.0	29.2	27.4	23.6	31.0	28.1	27.2	No return	39.1	31.3	24.1

102 Baldridgeburn, Dunfermline	35.0	25.5	24.1	17.7	16.7	13.4	15.2	21.2	21.2	24.0	27.0	25.7	22.2	17.1
Appin Crescent A, Dunfermline	39.3	34.4	30.5	17.3	25.4	21.0	23.0	22.5	27.5	26.9	31.9	33.6	27.8	21.4
Appin Crescent 1, Dunfermline	36.7	36.0	32.0	15.0	21.2	18.5	19.8	20.0	25.2	25.3	30.6	38.9	26.6	20.5
Appin Crescent 4A, Dunfermline	27.9	24.6	21.7	18.8	19.0	15.2	15.3	15.6	18.5	19.0	23.9	24.1	19.9	15.4
Appin Crescent 4B, Dunfermline	30.0	24.8	20.3	14.2	17.6	13.8	14.5	16.4	17.7	18.9	16.1	24.0		
Appin Crescent 4C, Dunfermline	28.3	25.8	21.1	17.5	17.9	14.5	15.1	15.7	17.0	19.4	23.5	29.7		
Appin Crescent 2, Dunfermline	40.3	37.5	33.6	21.3	29.7	28.0	26.5	26.9	33.2	29.9	34.4	38.6	31.7	24.4
Appin Crescent 3, Dunfermline	43.2	40.5	37.0	31.0	28.8	24.8	25.5	25.6	31.5	28.2	33.8	37.5	32.3	24.9
Appin Crescent 5A, Dunfermline	47.1	38.8	31.8	29.4	28.2	23.7	22.6	25.6	No return	No return	No return	37.3	31.6	24.4
Appin Crescent 6A, Dunfermline	43.3	40.7	35.8	32.9	32.6	26.6	26.4	28.6	32.4	31.2	31.0	41.8	33.6	25.9

☒ **All erroneous data has been removed from the NO_2 diffusion tube dataset presented in Table B.1.**

☒ **Annualisation has been conducted where data capture is <75% and >25% in line with LAQM.TG22.**

☒ **Local bias adjustment factor used.**

☒ **Fife Council confirm that all 2023 diffusion tube data has been uploaded to the Diffusion Tube Data Entry System**.

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 2023

Fife Council has not identified any new sources relating to air quality within the reporting year of 2023.

Additional Air Quality Works Undertaken by Fife Council During 2023

Fife Council has not completed any additional works within the reporting year of 2023.

QA/QC of Diffusion Tube Monitoring

Diffusion tubes used by Fife Council are 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 the average local bias adjustment factor to the 2023 monitoring data. A summary of average bias adjustment factors used by Fife Council over the past five years (and agreed with the Scottish Government and SEPA) is presented in Table C.1.

Table C.1 – Bias Adjustment Factor

Year	Local or National	Average Adjustment Factor
2023	Local	0.77
2022	Local	0.71
2021	Local	0.75
2020	Local	0.68
2019	Local	0.74

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 Diffusion Tube Processing 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 0.77.

The average local bias adjustment was applied to all diffusion tubes 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	11	10	10
Bias Factor A	0.81 (0.75 – 0.88)	0.74 (0.70 – 0.78)	0.70 (0.66 – 0.76)	0.85 (0.79 – 0.92)
Bias Factor B	24% (14% - 33%)	35% (28% - 43%)	42% (32% - 52%)	18% (8% – 27%)
Diffusion Tube Mean (µg m^{-3})	23.9	19.8	18.7	20.3
Mean CV (Precision)	4.1%	5.1%	4.6%	5.2%
Automatic Mean (µg m^{-3})	19.3	14.6	13.1	17.2
Data Capture (%)	100%	100%	100%	100%
Adjusted Tube Mean (µg m^{-3})	19 (18-21)	15 (14-15)	13 (12-14)	17 (16-19)
Overall Diffusion Tube Precision	Good Overall Precision	Good Overall Precision	Good Overall Precision	Good Overall Precision
Overall Continuous Monitor Data Capture	Good Overall Data Capture	Good Overall Data Capture	Good Overall Data Capture	Good Overall Data Capture

Table C.3 Local Bias Adjustment Summary

	Cupar	Dunfermline	Kirkcaldy	Rosyth	Average
Local Bias Adjustment	0.81	0.74	0.70	0.85	0.77

NO_2 Fall-off with Distance from the Road

No diffusion tube NO_2 monitoring locations within Fife Council required distance correction during 2023.

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 Services 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 checks 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[4] 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[3] 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 2023.

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 NOx – Thermo 42i (Jan to June) Teledyne API T200 (June 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

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 NOx – Thermo 42i (Jan to June) Teledyne API T200 (June 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

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 (Jan to June) Teledyne API T200 (June 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

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 Teledyne API T200
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 2023

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 sensors. During June 2022, August 2022 and April 2023 Fife Council enhanced their sensor network by installing an additional three new sensors at areas of concern to further assess air pollution in these areas. These were St Clair Street, Kirkcaldy; City Road, St Andrews and Bonnygate North, Cupar. With the addition of the Bonnygate North site, it should be noted that the site "Bonnygate" referenced in previous reports will henceforth be referred to as "Bonnygate South".

Fife Council contracted Ricardo to manage, quality assure and quality control (QA/QC) the data from this monitoring study. This report provides a summary of the data from the Fife Council air quality sensor network from 1st January – 31st December 2023.

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 sensors 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 any relevant air quality standards. For this study, all five AQMesh sensors were set to measure 15-minute averages.

The locations of the sensors are illustrated in Figure E-1 to Figure E-4.

Each AQMesh has been collocated with an existing diffusion tube where possible and where this has not been possible (Bonnygate North, City Road and St Clair Street) they have been installed as close as possible to existing diffusion tube locations.

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 Figure E-6.

Figure E-1: Bonnygate, Cupar AQMesh sensor location

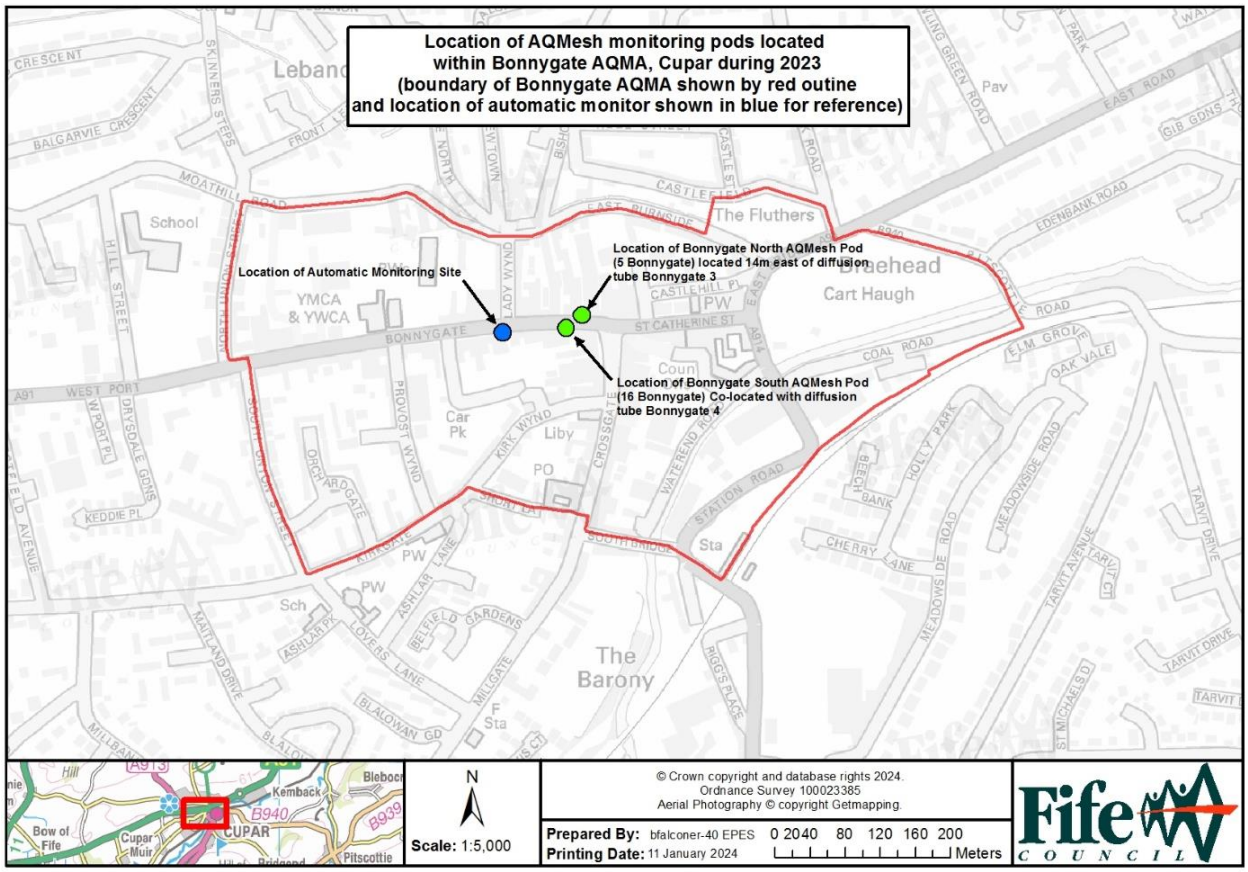


Figure E-2: Appin Crescent, Dunfermline AQMesh sensor locations

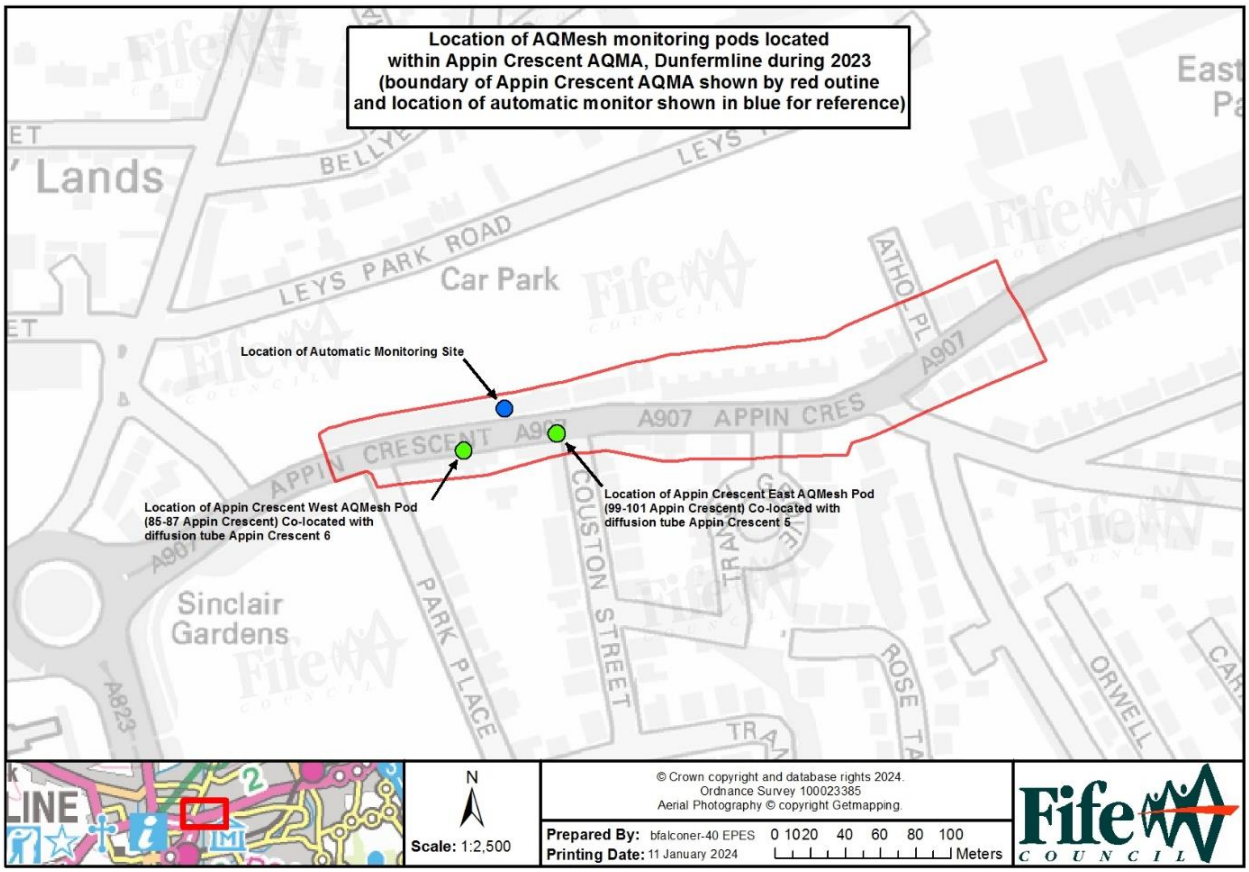


Figure E-3: St Clair St Kirkcaldy AQMesh sensor location

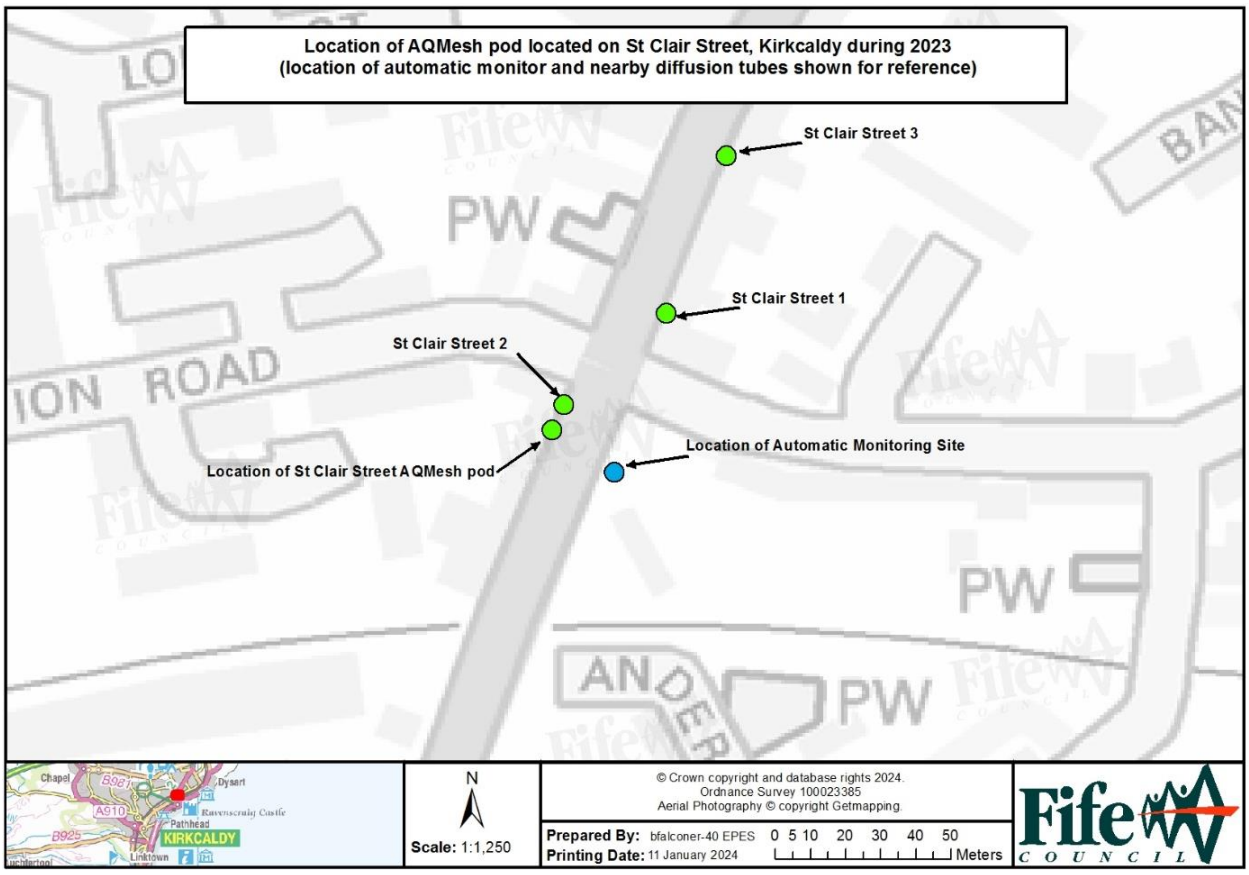


Figure E-4: City Road St Andrews AQMesh sensor location

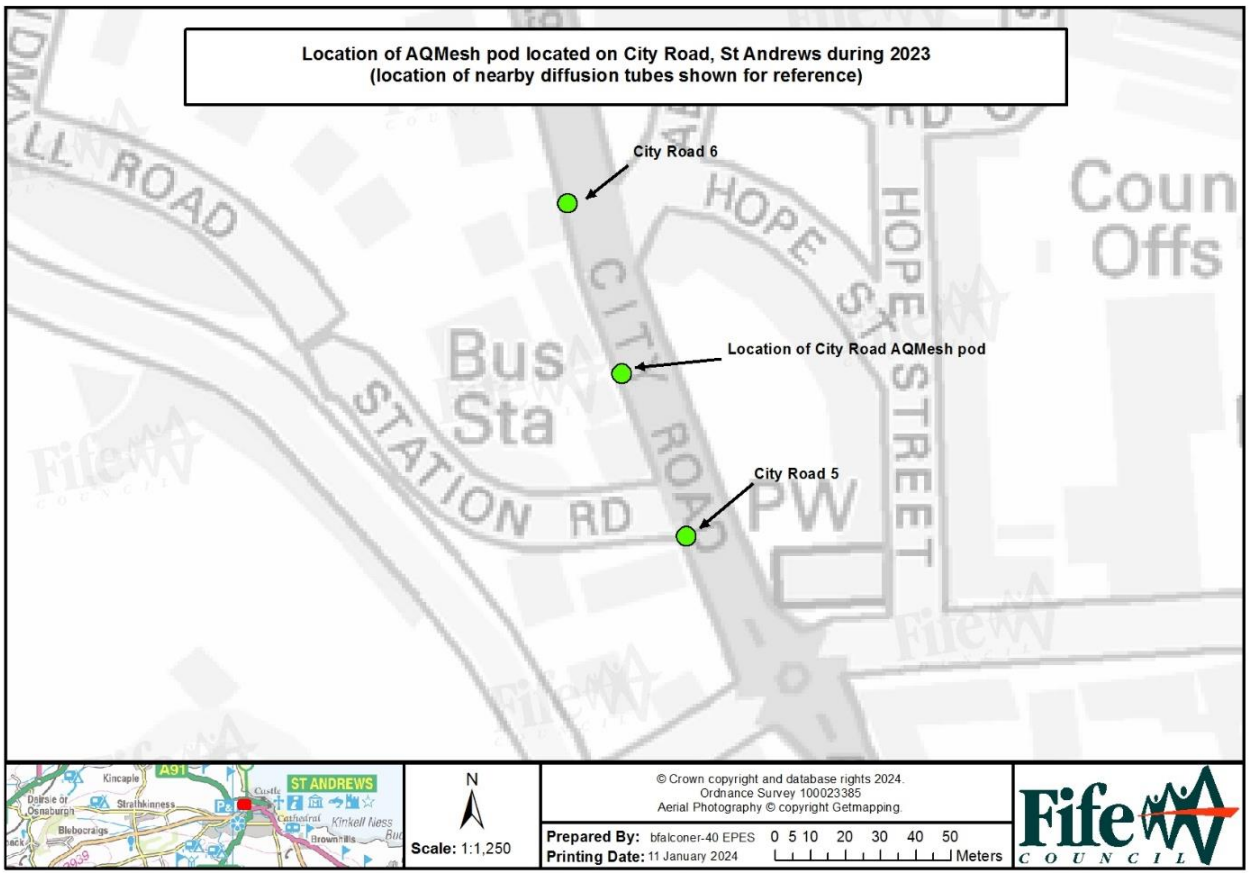


Figure E-5: Photos of the Fife AQMesh Monitoring Locations (Bonnygate and Appin Crescent)

Bonnygate North AQMesh Sensor

(co-located with triplicate diffusion tubes Bonnygate 3 (located 14 m east)

Bonnygate South AQMesh Sensor

(co-located with triplicate diffusion tubes Bonnygate B4)

St Clair Street AQMesh Sensor

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

City Road AQMesh Sensor

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

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

Data Management and QA/QC

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

Ricardo's data management system provided:

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

QA/QC was applied to this data in line with advice published by Air Quality Expert Group (AQEG) on the Defra UK air website (AQEG advice on the use of 'low-cost' pollution sensors – Defra, UK) and included:

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

During processing of the co-location data, orthogonal regression analysis was carried out to help calculate a correction factor (see Appendix Afor an example). 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 considered during the data ratification process.

Changes to the AQMesh sensor systems during 2023

The following significant changes were made to the AQMesh Sensor systems during 2023:

- City Road 2450834 – 19th December 2022 – Moved location to obtain better solar coverage.
- Bonnygate North 2451107 – 11th April 2023 – Monitoring began.
- Bonnygate South 1893150 – 4th April 2023 – Repair.
- Appin Crescent East 1894150 – 3rd October 2023 – Sent away for workshop repair due to damage.

Data and Analysis

Table E-1 to Table E-6 provide a summary of statistics for the concentrations measured by the AQMesh sensors from 1st January 2023 to the 31st December 2023. Table E-7 to Table

E-9 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. More detailed Air Pollution Reports for the AQMesh sensors and automatic sites can be found in Appendix C. 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)[10]. Annualisation calculations were also carried out where low data capture for 2023, using calculations set out in the LAQM Technical Guidance (TG22)[11].

A summary of the Scottish Air Quality (AQ) objectives, of which the data in this report is compared to, is provided in Appendix D.

As can be seen in Table E-1 to Table E-6, 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 2023. This is like previous years for Appin Crescent, Kirkcaldy and Bonnygate AQMesh sites, with exception of Bonnygate South in 2019, where exceedances were measured for annual (PM_{10} and $PM_{2.5}$) and daily (PM_{10} only) mean objectives. Table E-7 to Table E-9 show that none of Fife's automatic sites measured exceedances for any of the AQ objectives for pollutants NO_2, PM_{10} and $PM_{2.5}$ in 2023.

Pollution concentrations across all pollutants measured at all sites were generally lower in 2023 than 2022, except for PM_{10} at Appin Crescent East & City Road AQMesh sensors and NO_2 at the Cupar and Kirkcaldy automatic sites, though all still below the AQS objective.

Table E.1 Fife Bonnygate South AQMesh monitoring Statistics 1st January to 31st December 2023

	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 Period Mean Conc.	Period Data Capture (%)
NO_2 (µg m^{-3})	0	0	0	285	111	44	78	47	22	N/A	77.2
PM_{10} (µg m^{-3})	0	0	0	185	99	32	55	40	10	9.4	51.5
$PM_{2.5}$ (µg m^{-3})	0	0	0	185	51	13	27	21	4	3.7	51.5

[10] https://www.scottishairquality.scot/technical-reports/local-authority-guidance-note-laqm-reporting-scottish-pm-data
[11] https://www.scottishairquality.scot/technical-guidance/local-air-quality-management-new-technical-guidance-tg22

Table E.2 Fife Bonnygate North AQMesh monitoring Statistics 1st January to 31st December 2023

	V High (No. of Days)	High (No. of Days)	Mod (No. of Days)	Low (No. of Days)	Max. Hourly Conc.	Max. Daily Conc.	Max. Running 8 Hour Mean	Max. Running 24 Hour Mean	Period Mean Conc.	Annualised Mean Conc.	Period Data Capture (%)
NO_2 (µg m^{-3})	0	0	0	244	136	62	101	69	27	25.6	66
PM_{10} (µg m^{-3})	2	1	1	205	314	113	174	119	16	17.1	58
$PM_{2.5}$ (µg m^{-3})	0	1	2	206	200	56	108	63	8	8.6	58

Table E.3 Fife Appin Crescent West AQMesh monitoring Statistics 1st January to 31st December 2023

	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	324	84	37	55	42	16	88.0
PM_{10} (µg m^{-3})	0	0	1	314	190	51	76	55	12	87.3
$PM_{2.5}$ (µg m^{-3})	0	0	0	315	95	24	45	26	5	87.3

Table E.4 Fife Appin Crescent East AQMesh monitoring Statistics 1st January to 31st December 2023

	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 Period Mean Conc.	Period Data Capture (%)
NO_2 (µg m^{-3})	0	0	0	247	158	64	97	66	17	14.2	66.1
PM_{10} (µg m^{-3})	0	0	0	247	327	47	82	52	11	12.5	68.1
$PM_{2.5}$ (µg m^{-3})	0	0	0	247	46	26	35	30	6	6.9	68.1

Table E.5 Fife Kirkcaldy St Clair St AQMesh monitoring Statistics 1st January to 31st December 2023

	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	327	157	71	112	73	26	88.2
PM_{10} (µg m^{-3})	0	0	1	319	109	60	73	64	10	88.8
$PM_{2.5}$ (µg m^{-3})	0	0	0	333	47	31	37	33	5	92.0

Table E.6 Fife St Andrew City Road AQMesh monitoring Statistics 1st January to 31st December 2023

	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	358	115	58	94	62	19	96.7
PM_{10} (µg m^{-3})	0	0	0	337	95	47	54	48	11	93.6
$PM_{2.5}$ (µg m^{-3})	0	0	1	336	55	37	43	39	5	93.6

Table E.7 Fife Cupar Automatic monitoring site statistics 1st January to 31st December 2023

	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 ($\mu g\ m^{-3}$)	0	0	0	365	129	51	86	53	19	N/A	97.8
PM_{10} ($\mu g\ m^{-3}$)	0	0	0	351	174	46	69	46	12	13.2	96.7
$PM_{2.5}$ ($\mu g\ m^{-3}$)	0	0	0	351	46	32	37	32	6	6.4	96.7

Table E.8 Fife Dunfermline Automatic monitoring site statistics 1st January to 31st December 2023

	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 ($\mu g\ m^{-3}$)	0	0	0	365	83	49	62	50	15	N/A	97.9
PM_{10} ($\mu g\ m^{-3}$)	0	0	2	363	625	54	151	64	11	12.1	99.7
$PM_{2.5}$ ($\mu g\ m^{-3}$)	0	0	0	365	110	23	30	25	5	5.3	99.7

Table E.9 Fife Kirkcaldy Automatic monitoring site statistics 1st January to 31st December 2023

	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 ($\mu g\ m^{-3}$)	0	0	0	355	113	45	80	54	13	N/A	96.8
PM_{10} ($\mu g\ m^{-3}$)	0	0	0	365	89	33	43	37	9	9.9	99.7
$PM_{2.5}$ ($\mu g\ m^{-3}$)	0	0	0	365	45	25	28	25	5	5.3	99.7

Figure E-7 to Figure 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.

Appendix E of this report provides tables of annual mean concentrations for each year since monitoring began for all relevant pollutants and sites.

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 sensors have been consistently higher than that measured at the automatic site. However, in 2023, Appin Crescent East NO_2 is lower than the automatic site. It also shows that concentrations of NO_2 have remained significantly lower than that measured in 2018 and 2019 and continue to drop at both AQMesh sites. Whereas the Dunfermline automatic site NO_2 concentrations have remained generally the same since 2020.

When comparing both PM_{10} Appin Crescent AQMesh sensors data with the Dunfermline automatic site, 2023 annual mean concentrations are very similar with marginal differences in concentrations 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 and 2019. For $PM_{2.5}$, concentrations have not varied much across the years. However, concentrations have remained higher from the slight drop seen in 2020 and 2021 at Appin Crescent East.

A similar situation is seen with Bonnygate South 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. This is also evident for the Bonnygate North AQMesh where the 2023 NO_2 annual mean concentration is notably higher than the automatic site and the Bonnygate South AQMesh, but still below the annual mean objective. For both the Bonnygate South AQMesh and automatic site, 2023 levels of NO_2 are still well below that measure in 2018 and 2019.

PM_{10} and $PM_{2.5}$ concentrations measured at Bonnygate South have followed a similar trend since monitoring began in 2018 with the sensor site generally measuring slightly lower than the automatic site. The exception to this is 2019 when the Bonnygate South site measured PM_{10} and $PM_{2.5}$ concentration significantly higher concentrations at Bonnygate South exceeding AQS objectives stated previously. However, taking into consideration other years and site measurements 2019 does appear to be an outlier year at Bonnygate South.

For Bonnygate North, PM_{10} and $PM_{2.5}$ 2023 concentrations are higher than that of the automatic site and the Bonnygate South AQMesh site, but still lower than the air quality objectives.

Figure E-9 compares St Clair Street AQMesh sensor data for 2022 and 2023 with automatic data from the last five years. As can be seen, PM_{10} and $PM_{2.5}$ pollutants are comparable within 1 or 2 μgm^3, however NO_2 concentrations are higher in 2022 at St Clair Street AQMesh than the automatic site and further increases in 2023 (though still below the air quality objective), going against the general decreasing trend for this area.

Figure E-10 compares the City Road AQMesh 2022 and 2023 sensor annual mean data with the last five years of its collocated diffusion tube (City Road 6) site data. This is because automatic monitoring isn't currently and has not previously been carried out in St Andrews. In 2022, NO_2 concentrations were higher for City Road AQMesh than at City Road 6, however still well below the annual mean objective and below the peak years of 2018 and 2019. In 2023, NO_2 concentrations at City Road AQMesh dropped below City Road 6 measured concentrations.

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. When comparing the 2022 and 2023, data concentrations are well below the relevant annual mean objectives for PM_{10} and $PM_{2.5}$ and comparable within 1 µg m^{-3}.

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

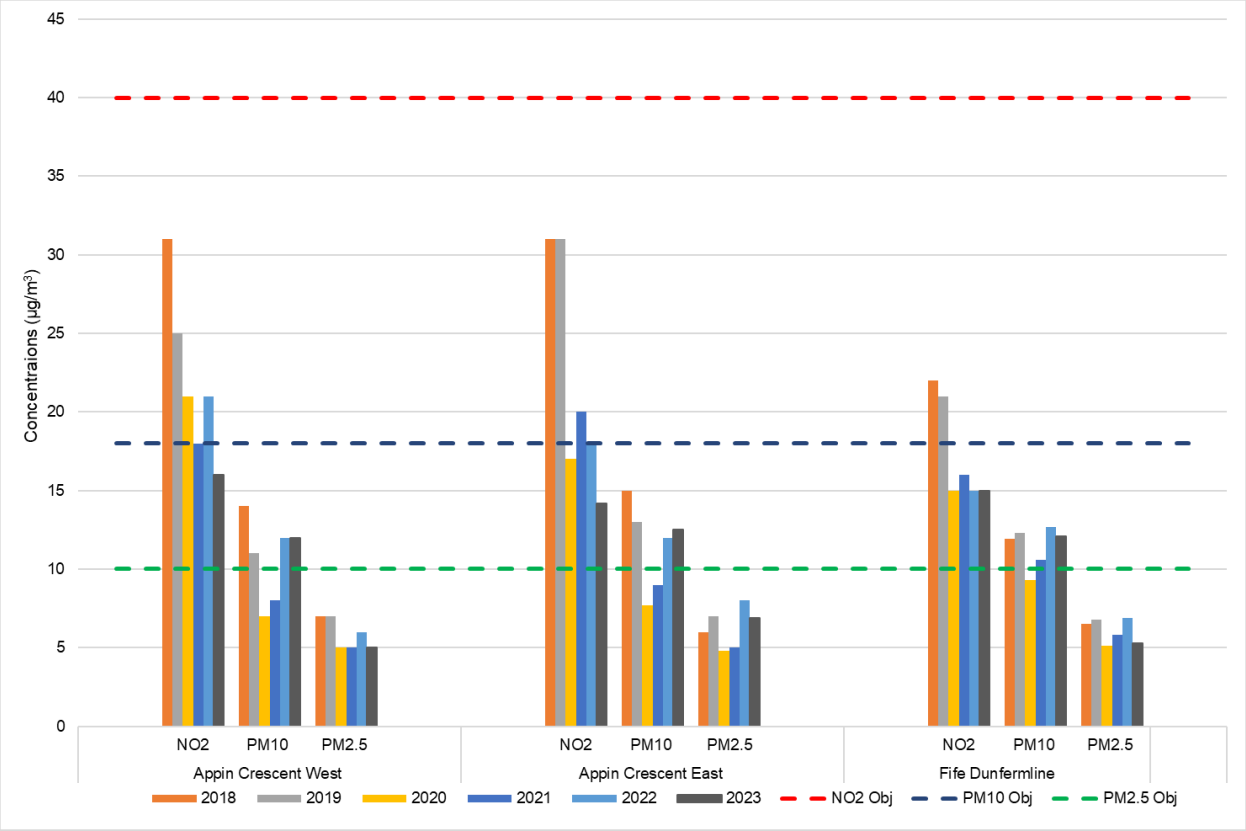


Figure E-8 Bonnygate Annual mean concentrations compared to AQ Objectives since AQMesh monitoring began (2018)

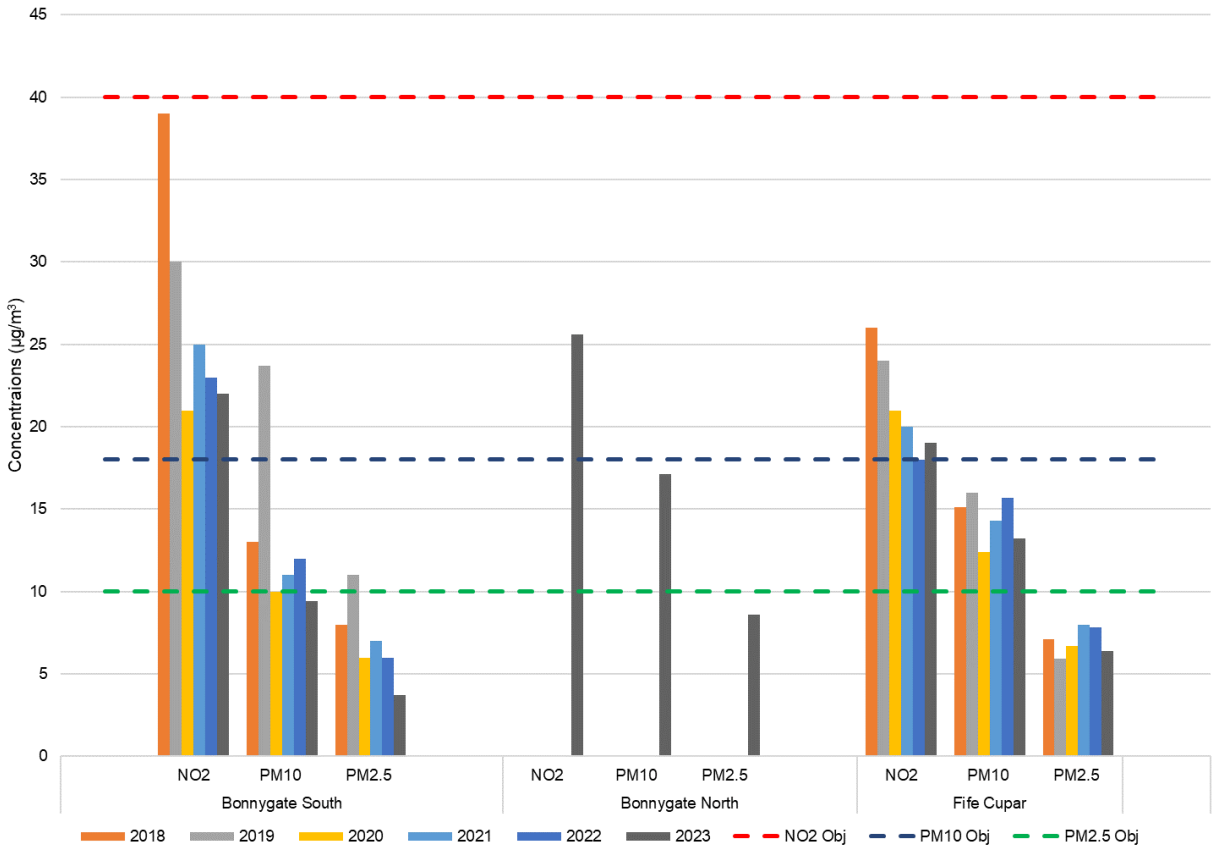


Figure E-9 Kirkcaldy St Clair St Annual mean concentrations compared to AQ Objectives since AQMesh monitoring began (2023)

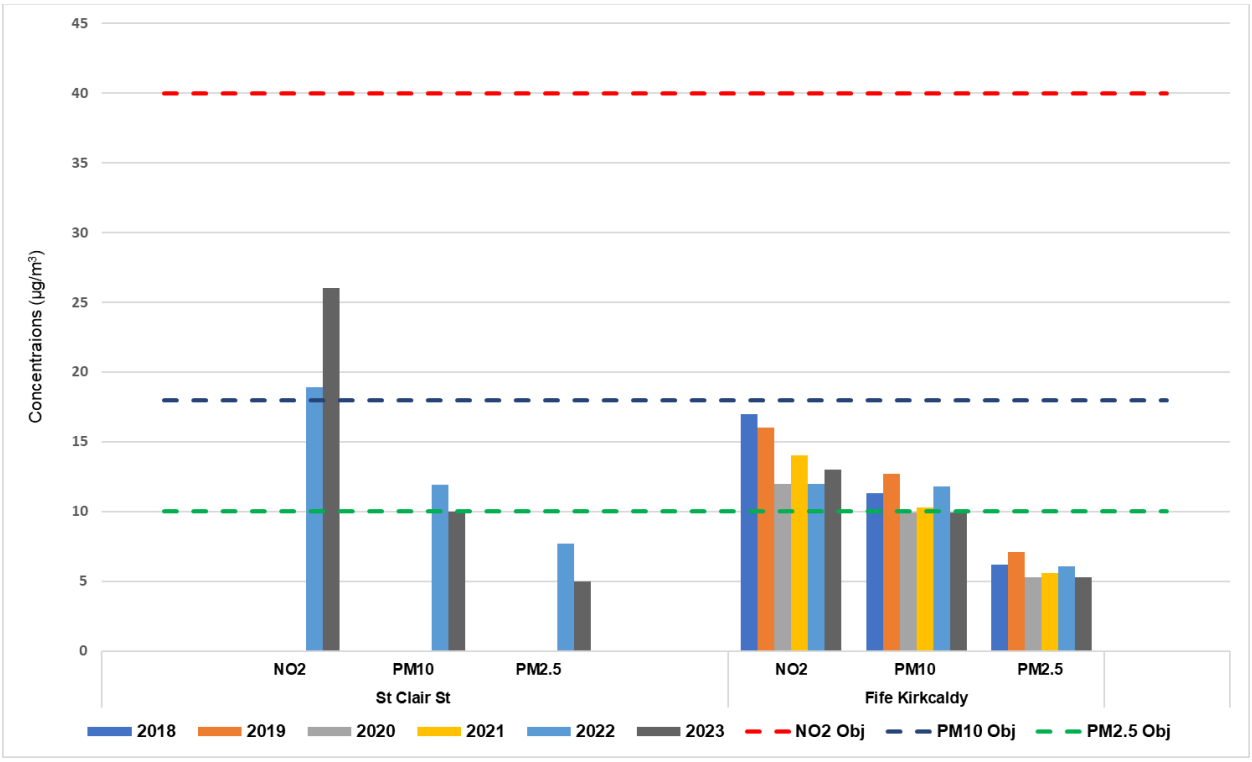
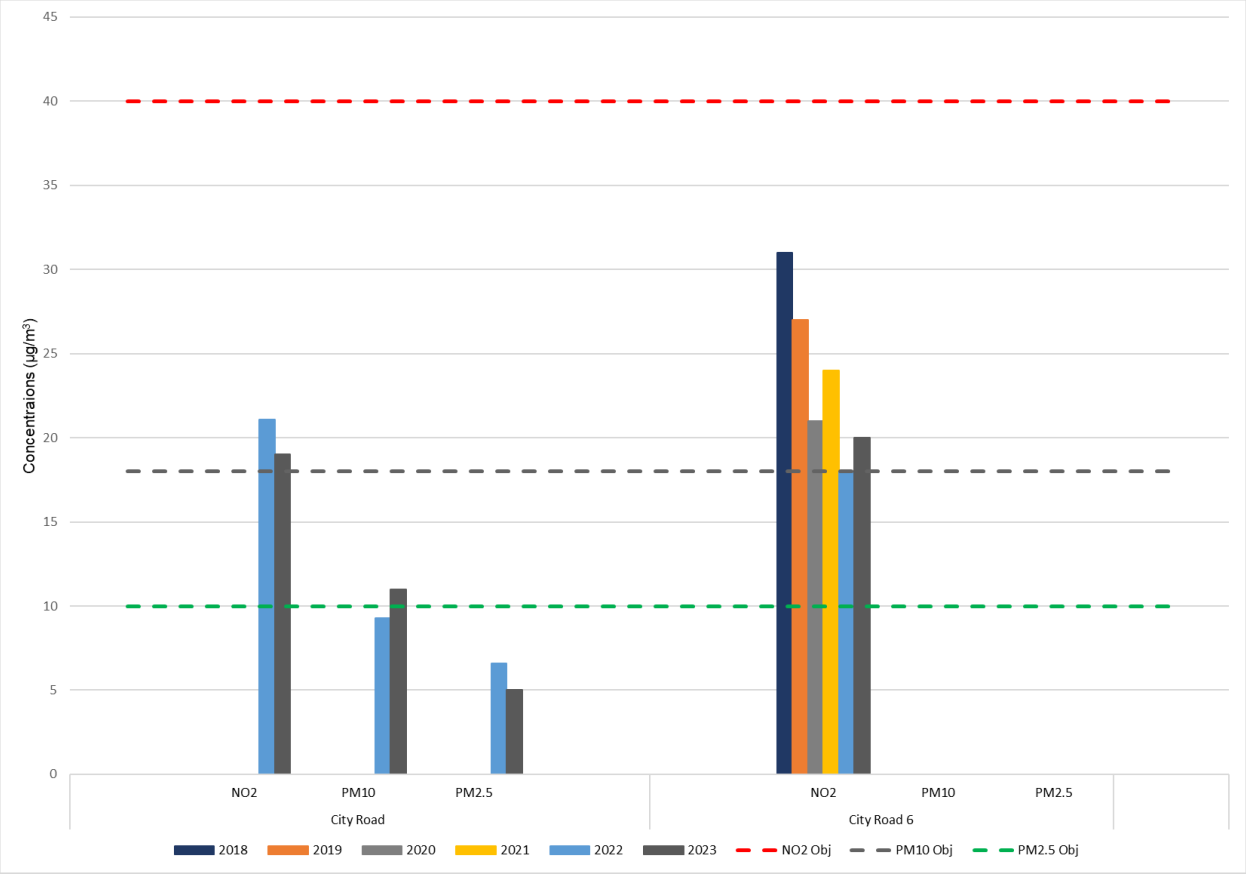


Figure E-10 St Andrews City Road Annual mean concentrations compared to AQ Objectives since AQMesh monitoring began (2023)



The AQMesh sensors were co-located with diffusion tubes where possible (as illustrated in Figure E-1 and Figure E-2 and shown in the associated maps in Figure E-3 and Figure E-4) as defined in the LAQM technical Guidance. For this analysis we are considering each sensor to have been collocated given that they are in the vicinity of existing diffusion tube sites.

Table E-10 compares the bias corrected diffusion tube annual mean concentrations with the AQMesh annual mean data. For all sites the diffusion tube measured higher concentrations than the AQMesh sensor sites, with the exception of St Clair Street.

For reference, Appendix B of this report provides daily average timeseries plots of both AQMesh and its associated automatic reference equivalent sites. This allows comparison of the data throughout the year. This analysis was not carried out for City Road, St Andrews as this location does not have automatic monitoring.

Table E.10 Co-located diffusion tube annual concentrations

Diffusion Tube Name	2023 Annual Concentration (µg m^{-3})	2023 Co-located AQMesh Annual Concentration (µg m^{-3})
Bonnygate B4 (co-located with Bonnygate South)	26	22
Bonnygate 3*	26	25.6
Appin Crescent 5A, B, C (co-located with AQMesh East)	23	14.2
Appin Crescent 6A, B, C (co-located with AQMesh West)	25	16
St Clair Street 2+	22	26
City Road 6^	20	19

* AQMesh located 14 metres east of the nearest diffusion tube site.
+ AQMesh located 13 metres south-west of the nearest diffusion tube site.
^ AQMesh located 50 metres south of the nearest diffusion tube site.

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 2023 to 31st December 2023). This section compares the respective AQMesh sensor and automatic monitoring site (Fife Cupar, Fife Kirkcaldy and Fife Dunfermline) diurnal variation data. Locations of the automatic monitoring sites are provided in E-1 and Figure E-2.

Diurnal analysis was not carried out for Bonnygate South (PM_{10} and $PM_{2.5}$), Bonnygate North (NO_2, PM_{10} and $PM_{2.5}$) and Appin Crescent East (NO_2, PM_{10} and $PM_{2.5}$) 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 μgm^{-3} for NO_2.

Figure E-11 to Figure E-16 compares automatic and AQMesh sites NO_2 diurnal analysis for 2022 and 2023.

When comparing the 2023 NO_2 diurnal profile for the Bonnygate South AQMesh and Cupar automatic site, both site profiles clearly identify the morning and evening traffic rush hour periods however the sensor site is higher than the automatic site indicating that the Bonnygate South AQMesh site is more affected by traffic NO_2 emissions than the Cupar automatic site throughout the day, this is similar to 2022. When comparing 2023 with 2022, the profile shape is very similar in that the evening rush hour peaks are less prominent.

Figure E-11 NO_2 Diurnal Variation Plot for Fife Bonnygate South AQMesh sensor and Fife Cupar automatic monitor 2023

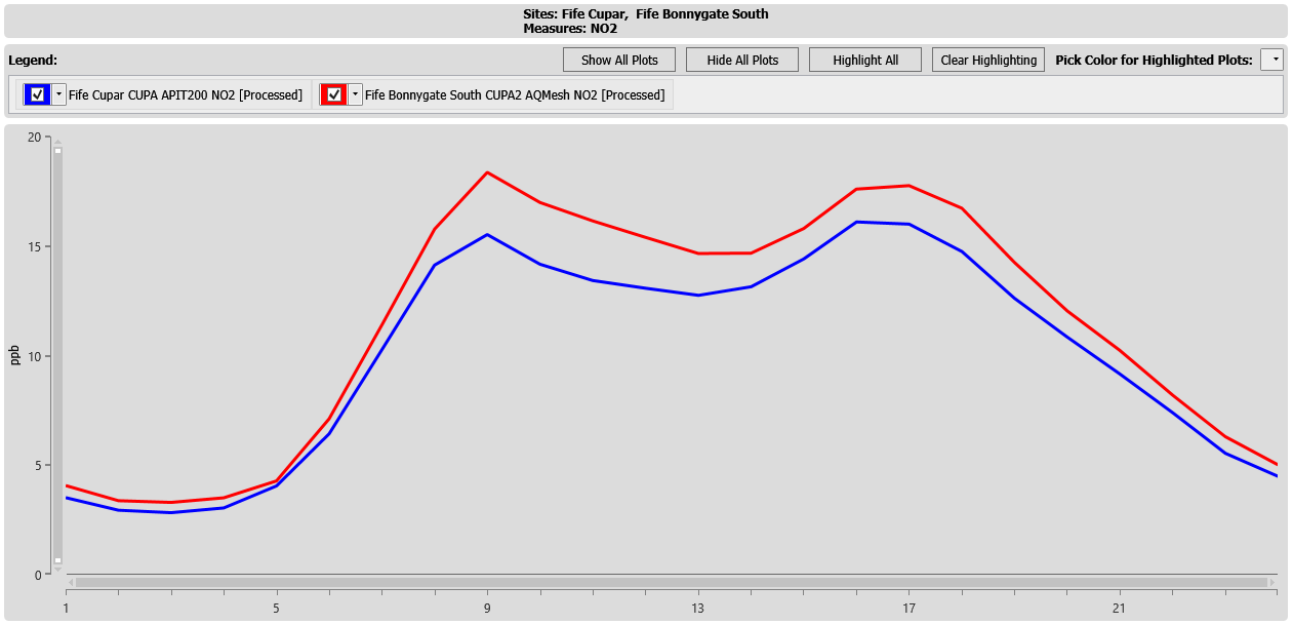
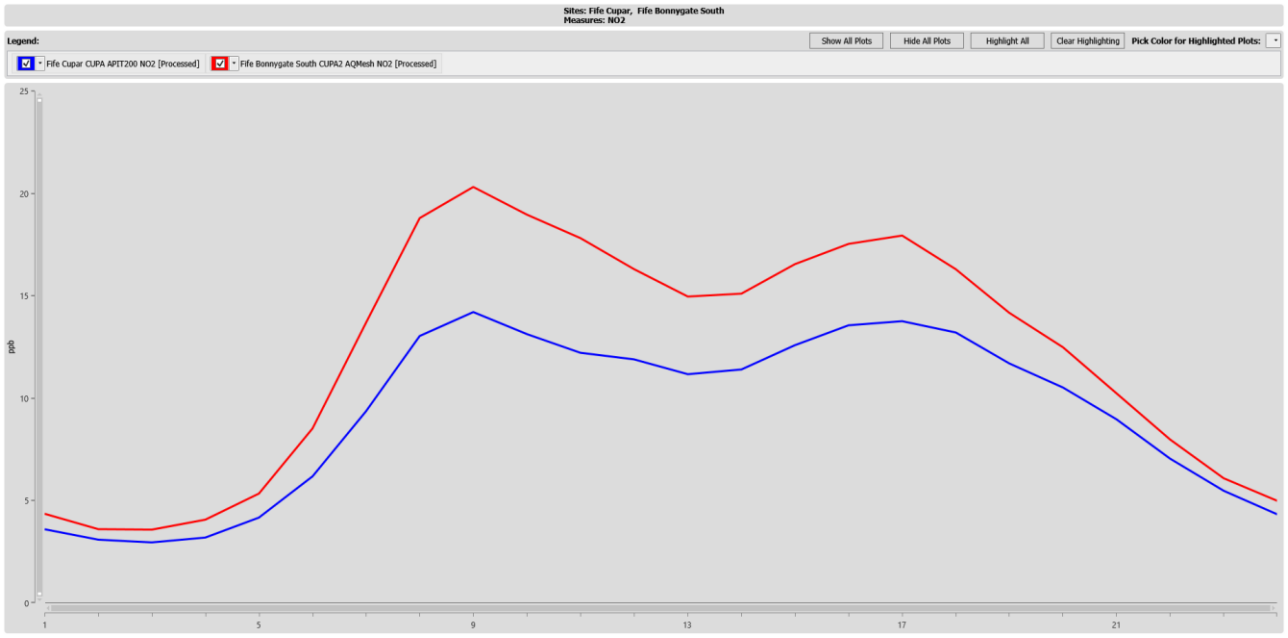


Figure E-12 NO_2 Diurnal Variation Plot for Fife Bonnygate South AQMesh sensor and Fife Cupar automatic monitor 2022



When comparing diurnals for the Appin Crescent West AQMesh and Dunfermline automatic site for NO_2 both sites have similar diurnal profiles. However, the rush hour peaks are less prominent at the Appin Crescent West AQMesh due to the fact that the concentrations do not drop of in-between rush hours as it does at the Dunfermline automatic site. This indicates a more persist source during this period at Appin Crescent West. When comparing 2023 with 2022, you can see a converging of the two profiles as concentrations at Appin Crescent West have decreased whilst the Dunfermline automatic site stays the same.

There is no diurnal profile for Appin Crescent East in 2023 due to low data capture.

Figure E-13 NO_2 Diurnal Variation Plot for Fife Appin Crescent West AQMesh sensor and Fife Dunfermline automatic monitor 2023 (NB: low data capture for Fife Appin Crescent East, therefore not included)

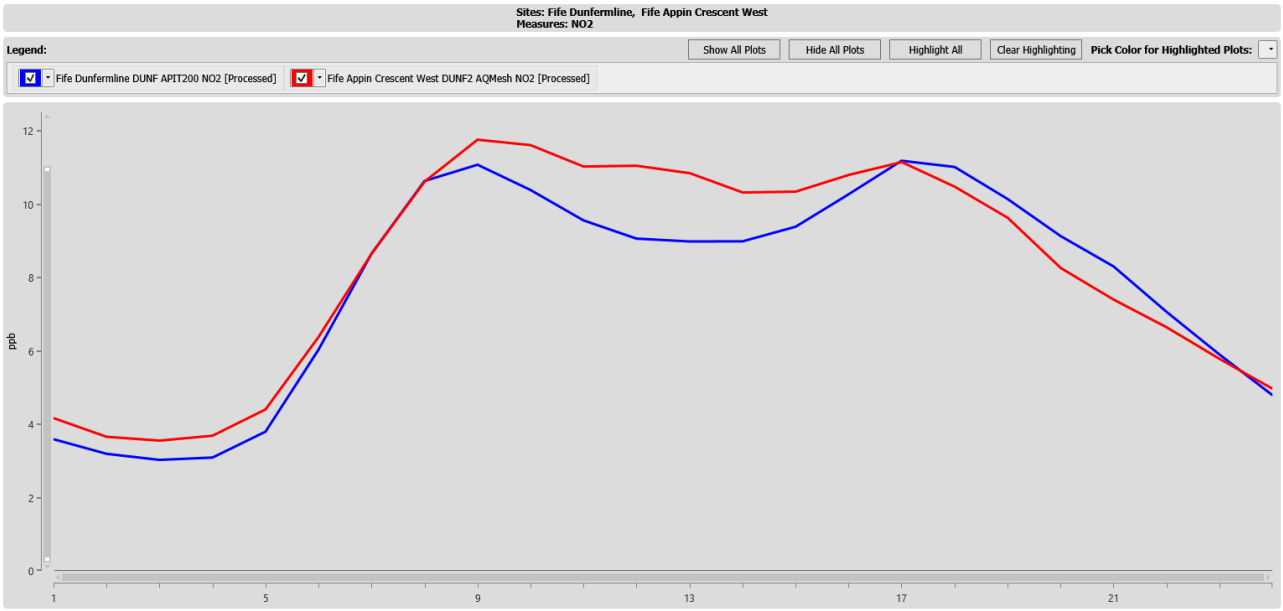
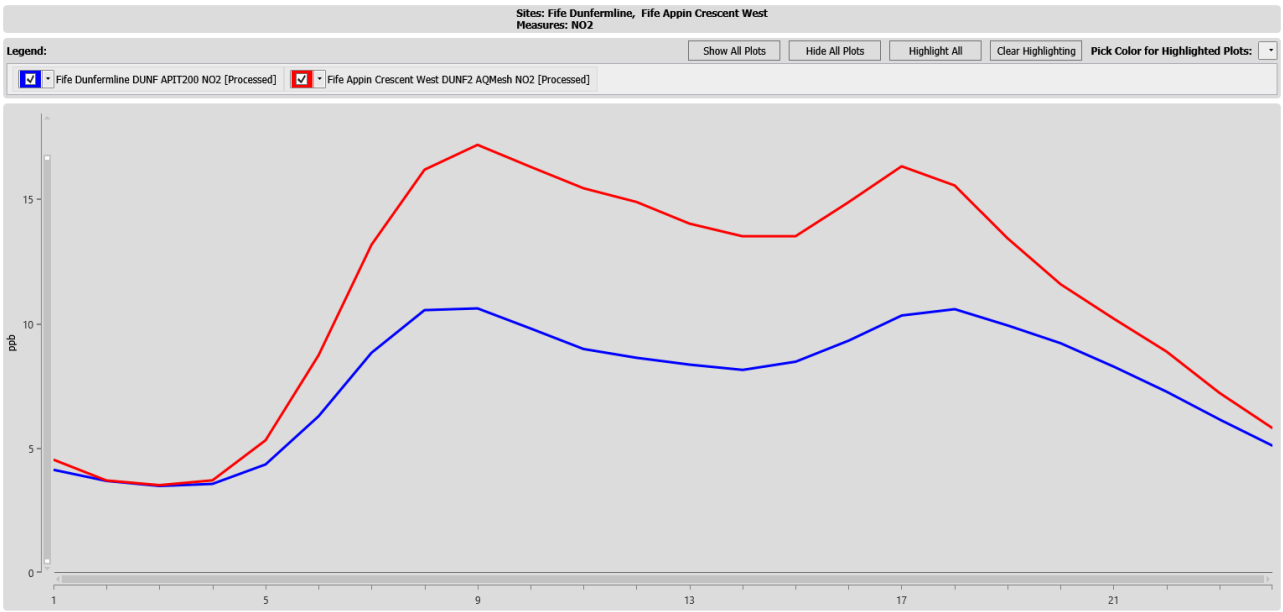


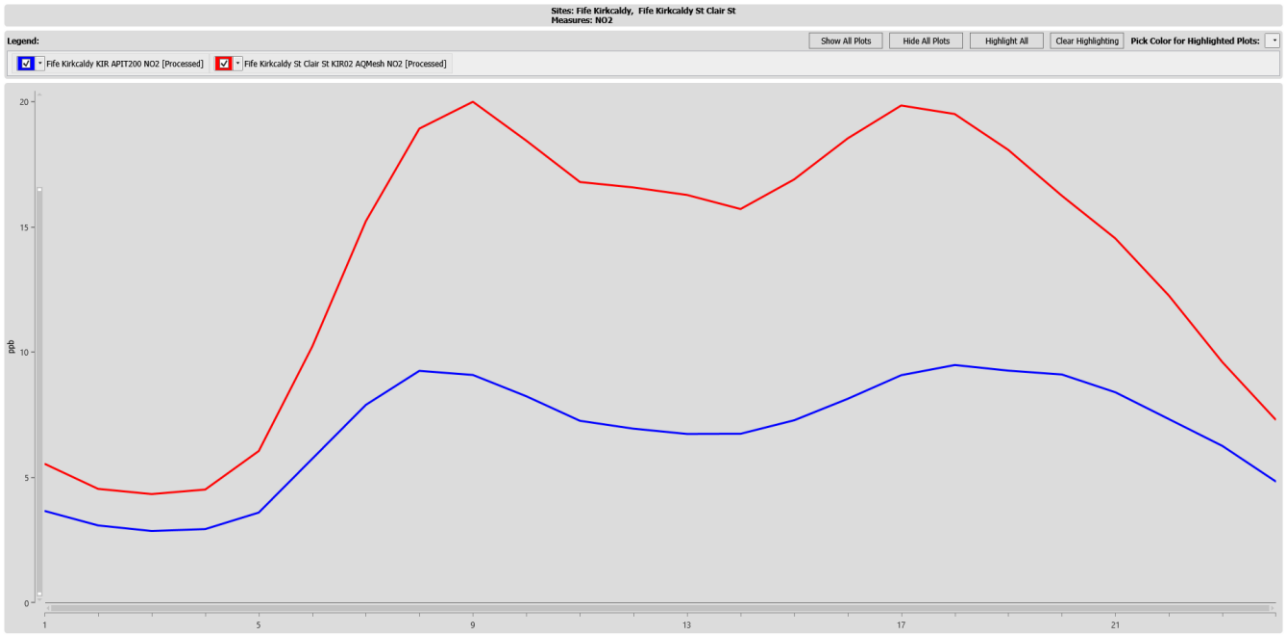
Figure E-14 NO_2 Diurnal Variation Plot for West AQMesh sensor and Fife Dunfermline automatic monitor 2022



Distinct rush hour peaks are also apparent when comparing Kirkcaldy automatic site and St Clair Street AQMesh site. The analysis also illustrates the disparity between the sensor and automatic sites, were the sensor site exhibits significantly higher concentrations across the day. This again shows how much more the sensor location is affect by NO_2 sources (mainly traffic) than the automatic location.

There is no diurnal analysis available for comparison for 2022 due to the low data capture.

Figure E-15 NO_2 Diurnal Variation Plot for St Clair Street AQMesh sensor and Fife Kirkcaldy automatic monitor 2023



For completeness, the St Andrews AQMesh sensor has been included in the diurnal variation although there is no comparison data available due to no automatic monitoring being carried out in St Andrews. In addition, there was low data capture in 2022 for this site. As with the other AQMesh sensor sites, St Andrews has the distinct morning and evening rush hour peak. The morning rush hour peak is significantly higher than the evening rush hour peak, indicating that traffic NO_2 emissions are contributing more in the morning than the evening throughout 2023.

Figure E16 NO_2 Diurnal Variation Plot for St Andrews AQMesh sensor 2023

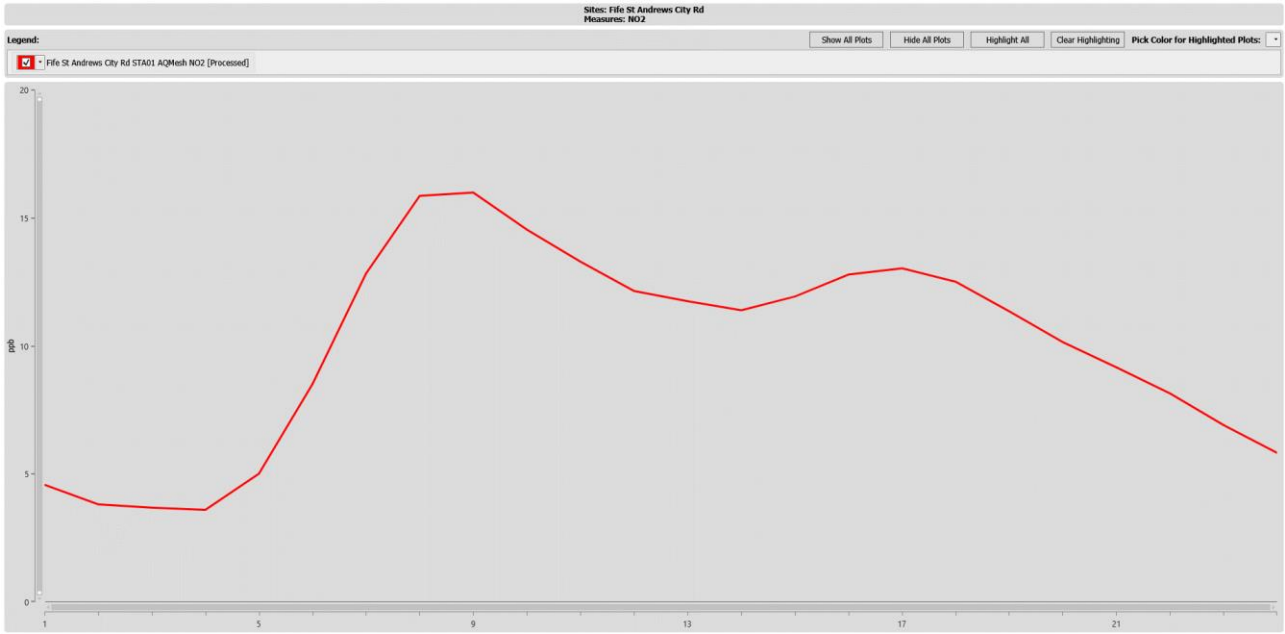


Figure E-17 to Figure E-23 compares automatic and AQMesh sites PM_{10} and $PM_{2.5}$ diurnal analysis for 2023 and 2022. Diurnal analysis was not carried out for Bonnygate South (PM_{10}

and $PM_{2.5}$), Bonnygate North (NO_2, PM_{10} and $PM_{2.5}$) and Appin Crescent East (NO_2, PM_{10} and $PM_{2.5}$) AQMesh due to the low data capture across the year.

Figure E-17 and Figure E-18 compares the PM_{10} and $PM_{2.5}$ diurnal variation data for Fife Kirkcaldy St Clair Street AQMesh sensor with the Fife Kirkcaldy automatic site for 2023 (please note that there is no 2022 PM_{10} and $PM_{2.5}$ data available due to low data capture). Looking at 2023 PM_{10} data, the overall profile of the sensor site is similar to that of the automatic site with no distinct rush hour peaks. The sensor site does however show a more pronounced increase between 8am and 8pm which is not seen at the automatic site. This can indicate that the location is affected by a different source.

For $PM_{2.5}$ there is no real trend in the automatic site diurnal plot suggesting little influence from local emission sources. The sensor site does see the same increase between 8am and 8pm similar to PM_{10} however the difference is 1 ppb so not significant.

Figure E-17 PM_{10} and $PM_{2.5}$ Diurnal Variation Plot for Fife St Clair Street AQMesh sensor and Fife Kirkcaldy automatic monitor 2023 (no 2022 data available due to low data capture)

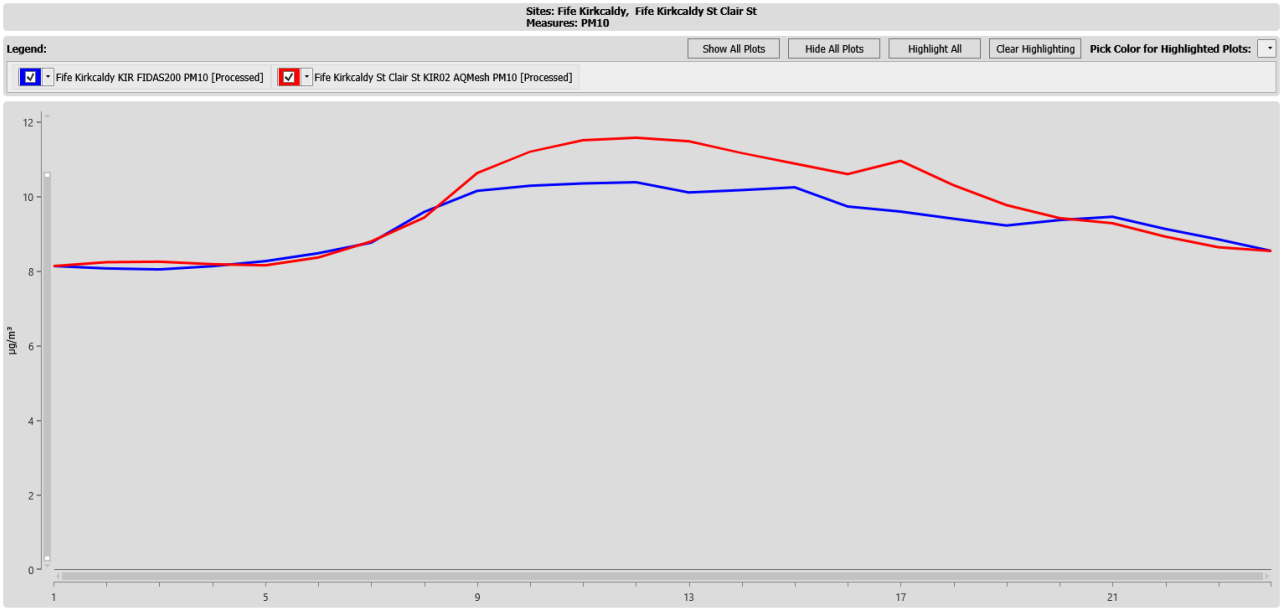


Figure E-18 $PM_{2.5}$ Diurnal Variation Plot for Fife St Clair Street AQMesh sensor and Fife Kirkcaldy automatic monitor 2023 (no 2022 data available due to low data capture)

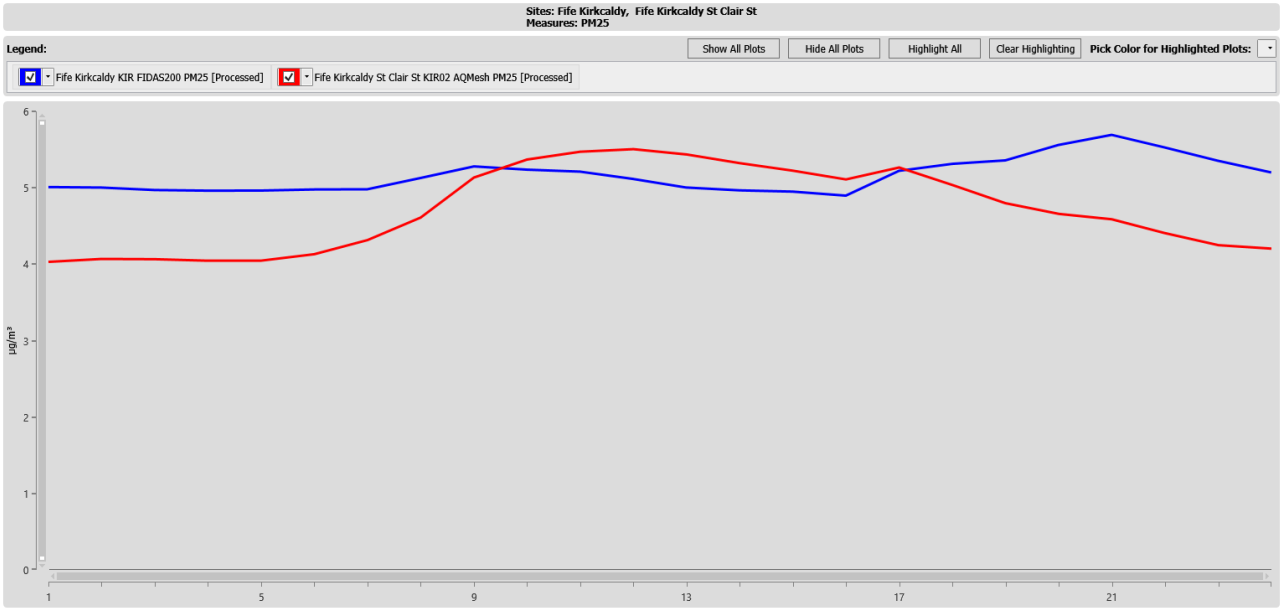


Figure E-19 provides the 2023 PM_{10} and $PM_{2.5}$ diurnal variation data for Fife St Andrews AQMesh sensor (please note that there is no automatic monitoring carried out in St Andrews and no 2022 PM data available due to low data capture). For both PM channels there is discernible diurnal trend indicating that the location isn't influenced by local sources.

Figure E-19 PM_{10} and $PM_{2.5}$ Diurnal Variation Plot for Fife St Andrews AQMesh sensor 2023 (no 2022 data available due to low data capture)

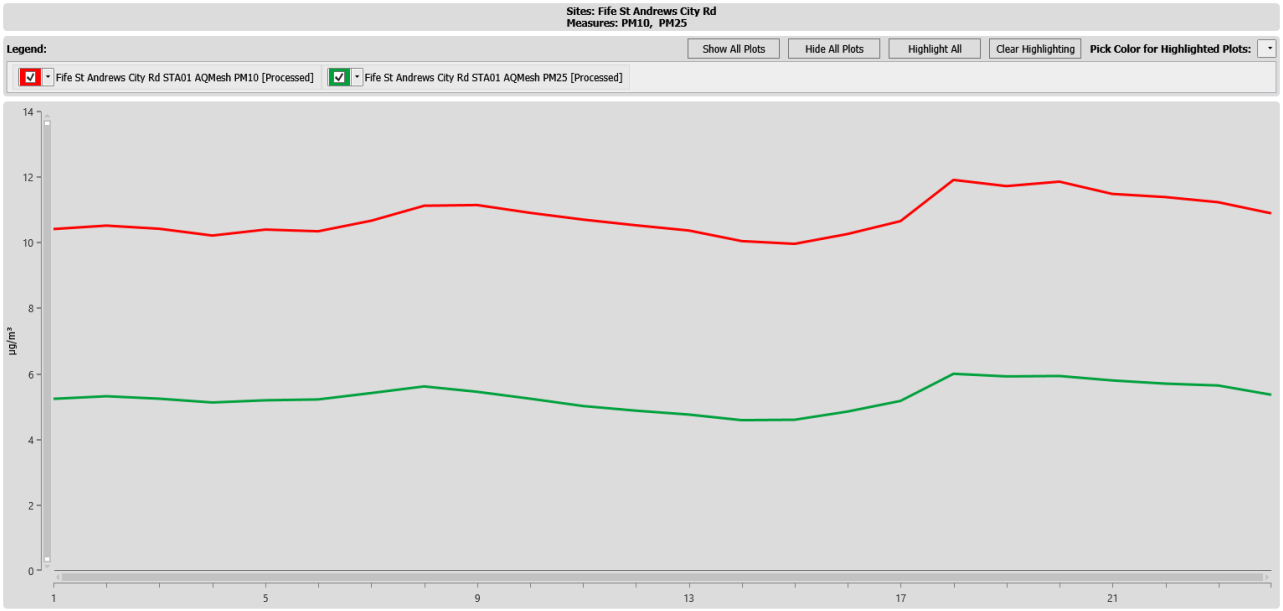


Figure E-20 to Figure E-23 illustrates the PM_{10} and $PM_{2.5}$ diurnal variation data for Fife Appin Crescent West AQMesh sensor with the Fife Dunfermline automatic site for 2023 and 2022.

The PM_{10} diurnal analysis for 2023 (Figure E-20) shows no real diurnal trend for Appin Crescent West AQMesh sensor, whereas there is a distinct peak at around 13:00 for the Dunfermline automatic site. This suggests that the automatic site is influenced by a different source. However, when you compare it to the 2022 diurnal analysis (Figure E-21), there was

no real distinguishable diurnal trend for either the AQMesh sensor or the automatic site, this suggests that it is either a new or temporary source that affects the automatic site in 2023.

For $PM_{2.5}$, there is no distinguishable diurnal trend for both sites and both years, with the automatic sites being slightly higher than the AQMesh sensor. This indicates that local traffic does not significantly influence concentrations of either PM_{10} or $PM_{2.5}$.

Figure E-20 PM_{10} Diurnal Variation Plot for Fife Appin Crescent West AQMesh sensors and Fife Dunfermline automatic monitor 2023 (low data capture for Fife Appin Crescent East, not included)

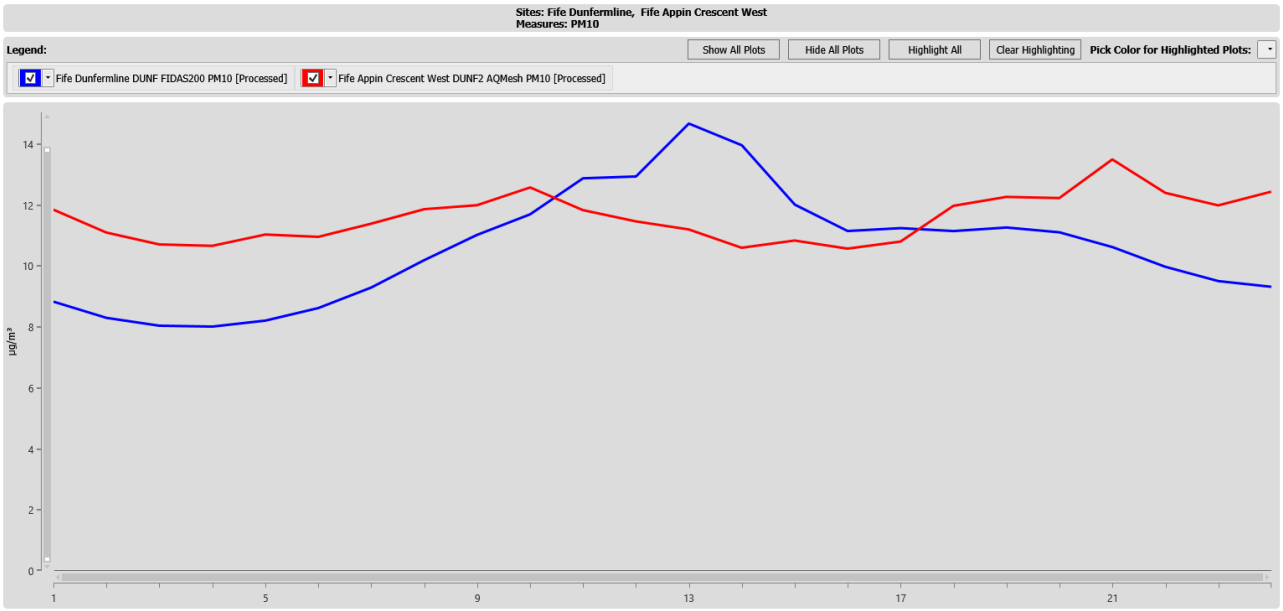


Figure E-21 PM_{10} Diurnal Variation Plot for Fife Appin Crescent West AQMesh sensors and Fife Dunfermline automatic monitor 2022

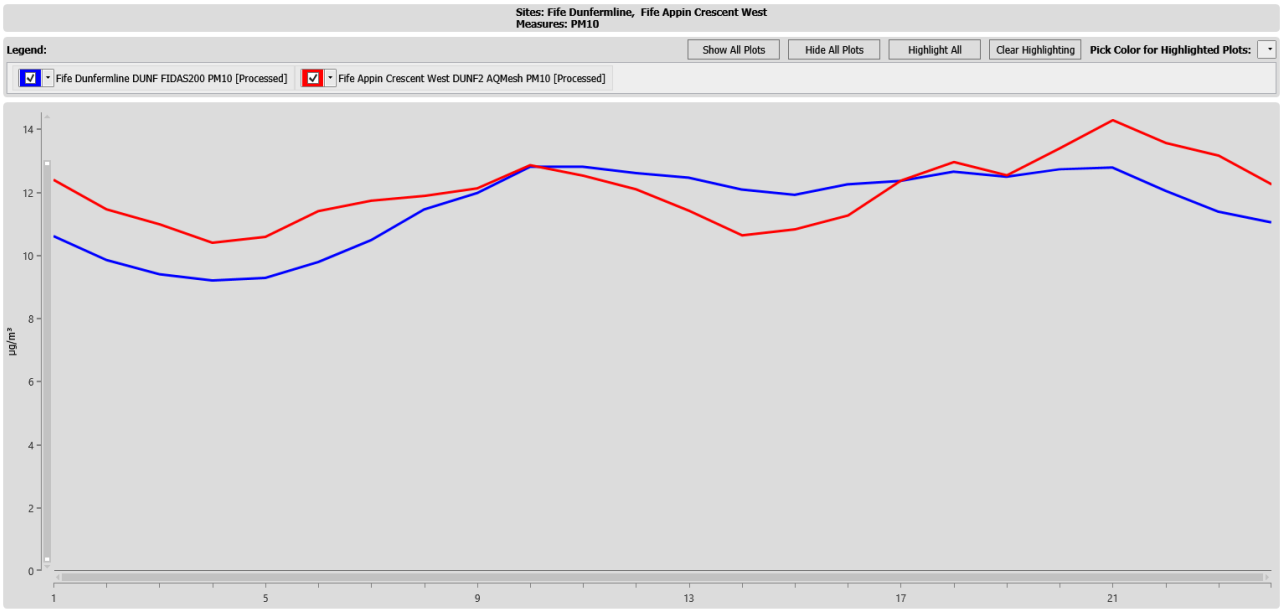


Figure E-22 $PM_{2.5}$ Diurnal Variation Plot for Fife Appin Crescent West AQMesh sensors and Fife Dunfermline automatic monitor 2023 (low data capture for Fife Appin Crescent East, not included)

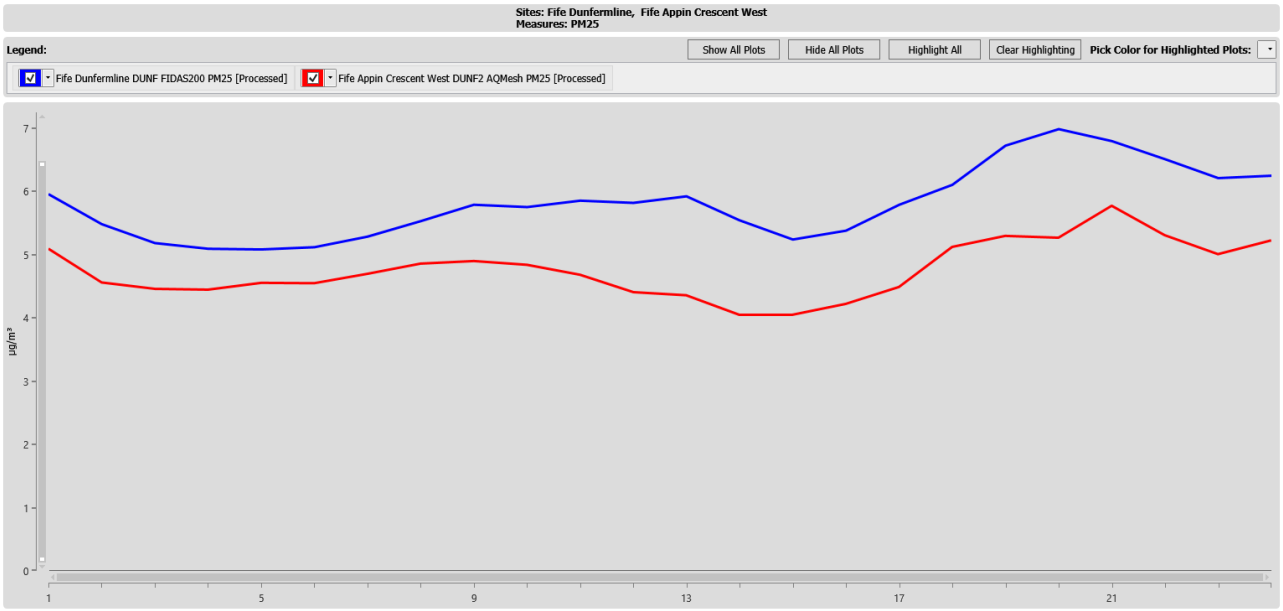
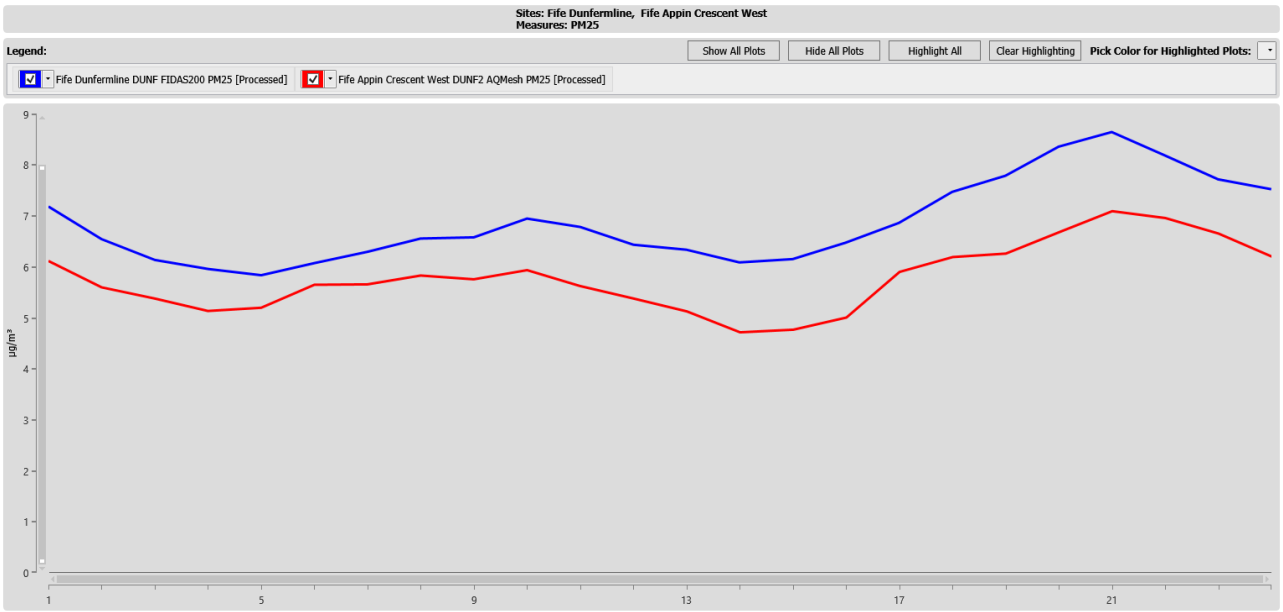


Figure E-23 $PM_{2.5}$ Diurnal Variation Plot for Fife Appin Crescent West AQMesh sensors and Fife Dunfermline automatic monitor 22



Summary

This report provides data analysis of Fife Council's six AQMesh air quality monitoring sensor sites from 1st January – 31st December 2023, measuring particulate matter (PM_{10} and $PM_{2.5}$) and nitrogen dioxide (NO_2).

There was one new sensor monitoring site added to the Fife network in 2023. The site is called Bonnygate North and started monitoring on the 11th of April 2023.

In 2023, 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:

- In previous years, NO_2 annual mean concentrations for both Appin Crescent AQMesh sensors have been higher than that measured at the automatic site, and this is still the case for Appin Crescent East. However, in 2023 Appin Crescent West NO_2 annual mean measured lower than the automatic site.
- Statistics also show that concentrations of NO_2 have remained significantly lower than that measured in 2018 and 2019 (i.e. pre-Covid19 pandemic).
- For PM_{10}, 2023 sensor site concentrations are very similar to automatic site concentrations with marginal differences in concentrations and have all seen similar increases from the lows of 2020 and 2021. Concentrations at the sensor sites are still below the relative highs of 2018 and 2019.
- For $PM_{2.5}$, concentrations have not varied much across the years. However, concentrations have remained higher from the slight drop seen in 2020 and 2021 at Appin Crescent East.

When comparing the Bonnygate South and North AQMesh sensors with the nearby automatic site in the Cupar AQMA, the statistics show that:

- Bonnygate South AQMesh NO_2 annual mean concentrations have been consistently higher than the Cupar automatic site, with the exception of 2020 when concentrations were the same. For both Bonnygate South AQMesh and Cupar automatic site, 2023 levels of NO_2 are still well below that measure in 2018 and 2019.
- This is also evident for Bonnygate North AQMesh where the 2023 NO_2 annual mean concentration is notably higher than the automatic site, but still below the annual mean objective.
- PM_{10} and $PM_{2.5}$ concentrations measured at Bonnygate South have been very similar since monitoring began in 2018 and the sensor site has always measured lower than the automatic site, except for 2019, when PM_{10} and $PM_{2.5}$ were higher. However, taking into consideration other years and site measurements 2019 does appear to be an outlier year at Bonnygate South.
- For Bonnygate North, PM_{10} and $PM_{2.5}$ 2023 concentrations are higher than that of the automatic site and Bonnygate South AQMesh site, but still lower than the air quality objectives.

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

- PM_{10} and $PM_{2.5}$ pollutants are comparable within 1 or 2 µg m^{-3}, however NO_2 concentrations are higher in 2023 at the AQMesh than the automatic site and further has seen an increase from 2022 (though still below the air quality objective).

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, the statistics show that:

- In 2022, NO_2 annual mean concentrations were higher for City Road AQMesh than 'City Road 6' diffusion tube, however still well below the annual mean objective and below the diffusion tube peak years of 2018 and 2019. In 2023, NO_2 annual mean concentrations at City Road AQMesh dropped below 'City 6' measured concentrations.
- When comparing 2022 and 2023, there was a slight increase in PM_{10} concentrations and slight decrease in $PM_{2.5}$ concentration.

All AQMesh sensors were co-located with diffusion tubes or as close as was possible. In 2023, the co-located diffusion tubes (or nearest available) measured higher annual mean NO_2 concentrations than the AQMesh, except for St Clair Street where the AQMesh measured 4 µg m^{-3} higher than diffusion tube (please note that this AQMesh is located 13 metres southwest of the diffusion tube).

Diurnal analysis was not carried out for Bonnygate South (PM_{10} and $PM_{2.5}$), Bonnygate North (NO_2, PM_{10} and $PM_{2.5}$) and Appin Crescent East (NO_2, PM_{10} and $PM_{2.5}$) 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.

NO_2 diurnal variation analysis of the remaining sensors and automatic sites indicates:

- The Bonnygate South AQMesh site is more affected by traffic emissions than the Cupar automatic site.
- When comparing 2023 with 2022, Appin Crescent West NO_2 diurnal profile illustrates a decrease in concentrations at the sensor site and concentrations are more in line with those measured at the automatic site. The sensor site doesn't experience a significant drop in concentrations in the afternoon in 2023 as there was in 2022, indicating that daily NO_2 concentrations remained more consistent throughout 2023.
- Distinct rush hour peaks are also apparent when comparing Kirkcaldy automatic site and St Clair Street AQMesh sensor site. The sensor site exhibits overall significantly higher concentrations across the day.
- Traffic NO_2 emissions at the St Andrews sensor are contributing more in the morning than the evening throughout 2023.

PM diurnal analysis of the remaining sensors and automatic sites shows:

- That concentrations of both PM_{10} and $PM_{2.5}$ are not significantly influenced by local sources at both AQMesh sensor and automatic monitoring sites.

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_2023.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 2023. 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	19.4	97.8%	129.2	50.7	365	0	0	0	92.1	64	52.1	15.2
Fife Dunfermline	15.1	97.9%	82.9	48.6	365	0	0	0	60.5	46.7	38.3	12.5
Fife Kirkcaldy	13	96.8%	112.7	44.7	355	0	0	0	69.7	48.4	35	10
Fife Rosyth	17.1	99.7%	106.5	66.5	365	0	0	0	81.4	59.8	46.9	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	11.7	97%	173.8	45.6	351	0	0	0	26.6	20.3	35.6	27.8	9.5
Fife Dunfermline	10.6	100%	625.3	53.6	363	2	0	2	24.4	18.5	31.3	24.5	8.4
Fife Kirkcaldy	9.3	100%	89.5	32.9	365	0	0	0	23.2	15.9	27.8	21.2	7.7
Fife Rosyth	9	99%	554	32.7	362	0	0	0	20.4	15.2	25.6	19.5	7.5

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	5.9	97%	31.8	351	0	0
Fife Dunfermline	5.5	100%	23.1	365	0	0
Fife Kirkcaldy	4.9	100%	24.9	365	0	0
Fife Rosyth	4.9	99%	22.7	362	0	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 Cupar	2023	11.7	12.9	173.8	191.2	45.6	50.1
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 Dunfermline	2023	10.6	11.6	625.3	687.8	53.6	59
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 Kirkcaldy	2023	9.3	10.2	89.5	98.4	32.9	36.2
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
Fife Rosyth	2023	9	9.9	554	609.5	32.7	35.9

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 Dunfermline	2023	5.5	5.8	23.1	24.5
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 Rosyth	2023	4.9	5.2	22.7	24.1
Fife Cupar	2019	7.5	8	37.1	39.3
Fife Cupar	2022	7.3	7.8	48.2	51.1
Fife Cupar	2023	5.9	6.2	31.8	33.7
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 Kirkcaldy	2023	4.9	5.2	24.9	26.4
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

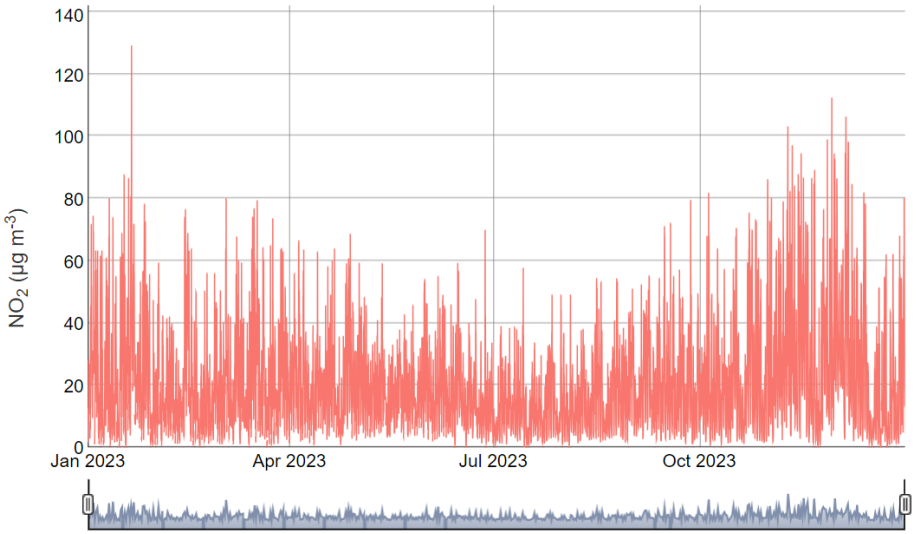


Figure F-2 Dunfermline NO_2 time series

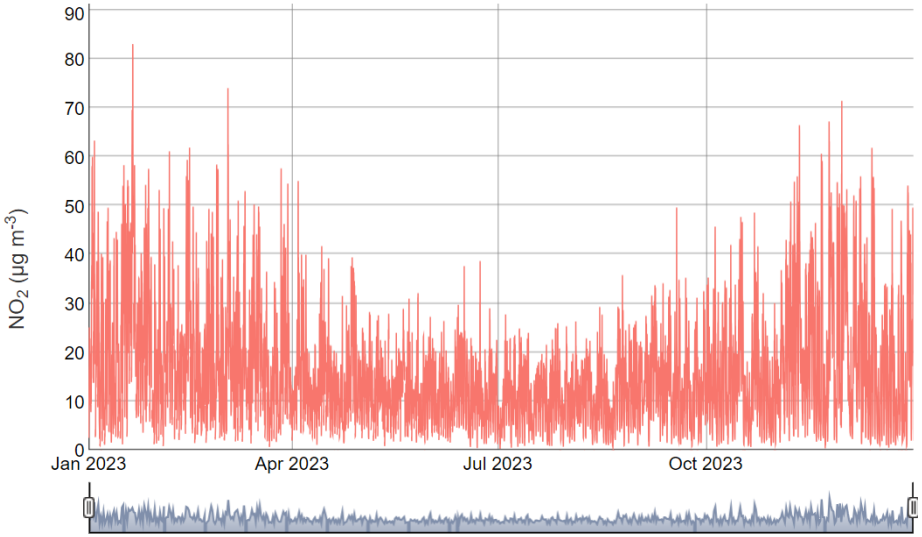


Figure F-3 Kirkcaldy NO_2 time series

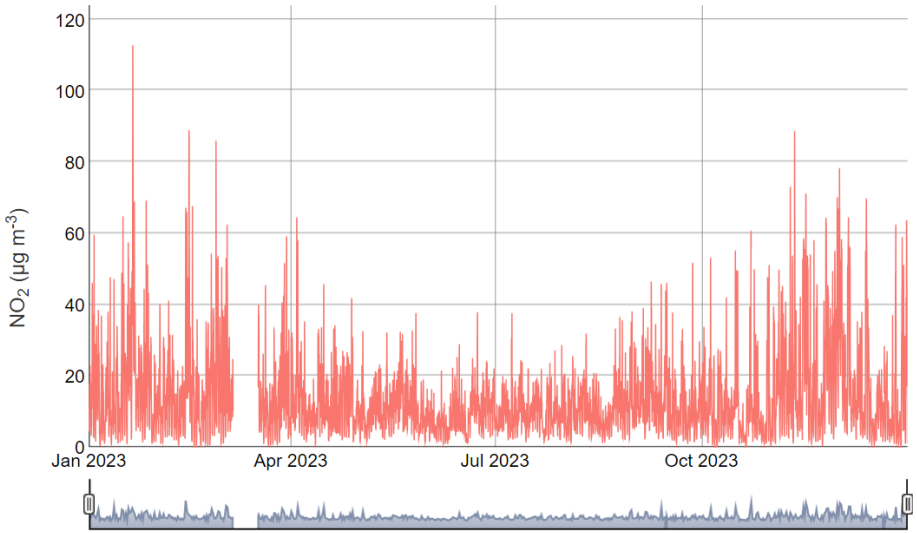


Figure F-4 Rosyth NO_2 time series

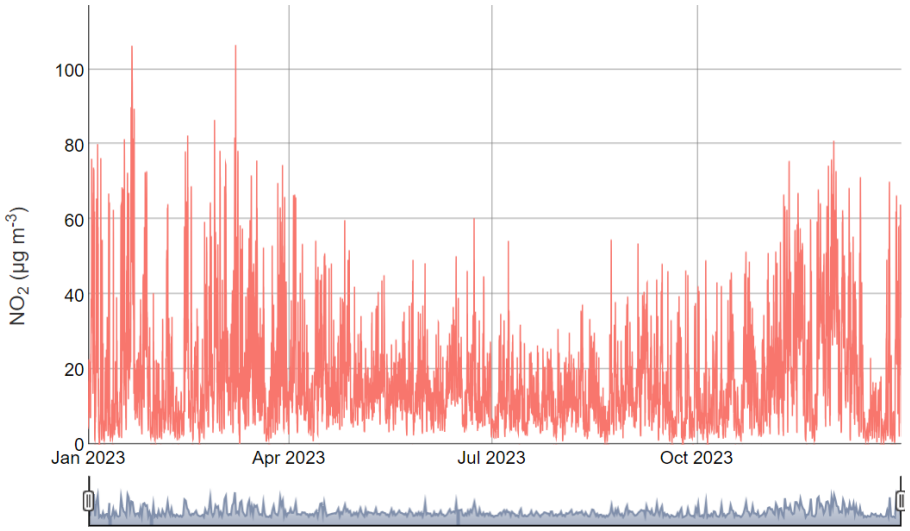


Figure F-5 Cupar PM_{10} time series

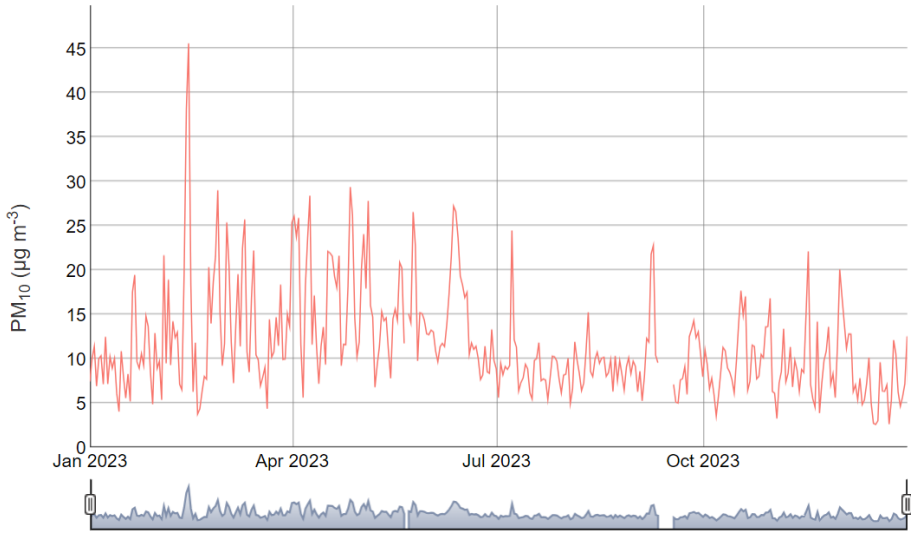


Figure F-6 Dunfermline PM_{10} time series

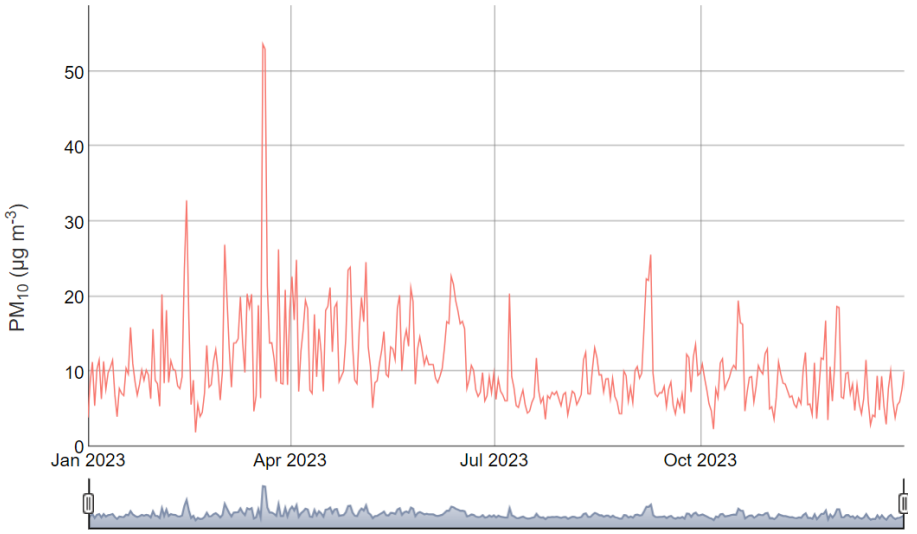


Figure F-7 Kirkcaldy PM_{10} time series

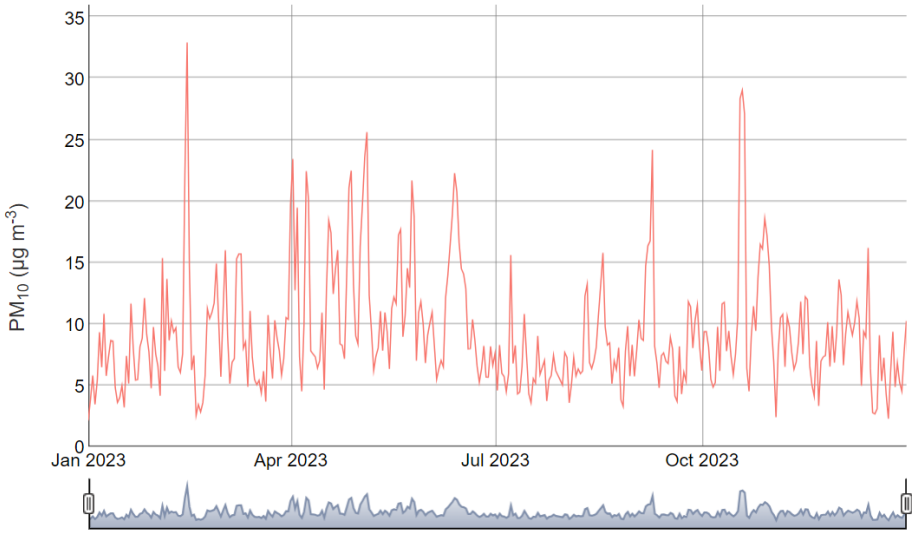


Figure F-8 Rosyth PM_{10} time series

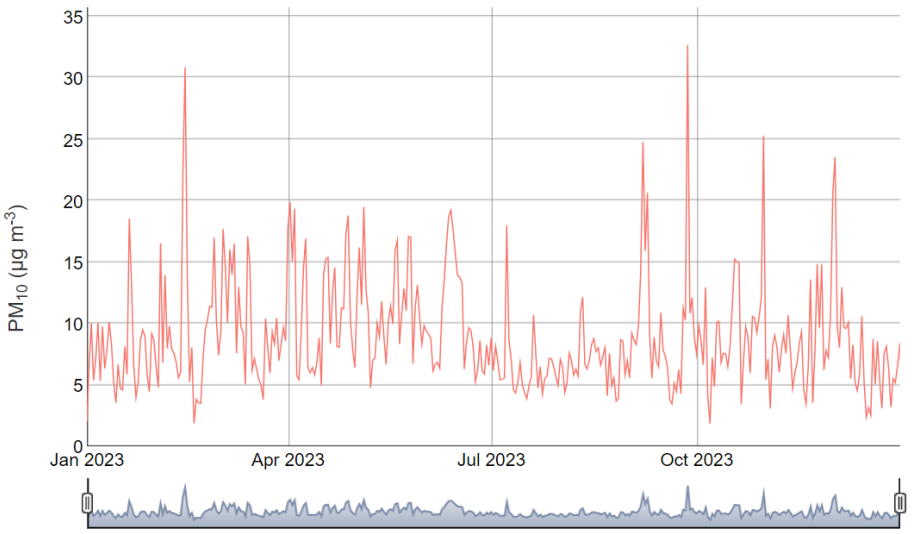


Figure F-9 Cupar $PM_{2.5}$ time series

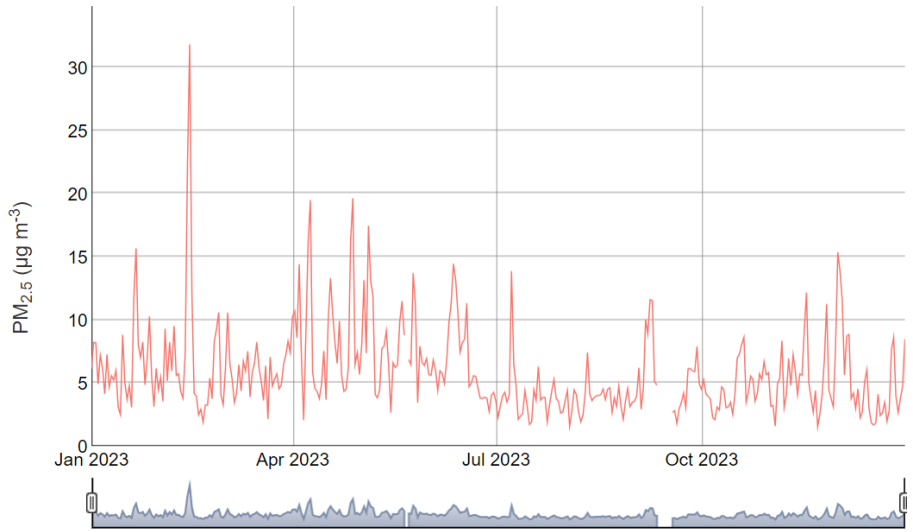


Figure F-10 Dunfermline $PM_{2.5}$ time series

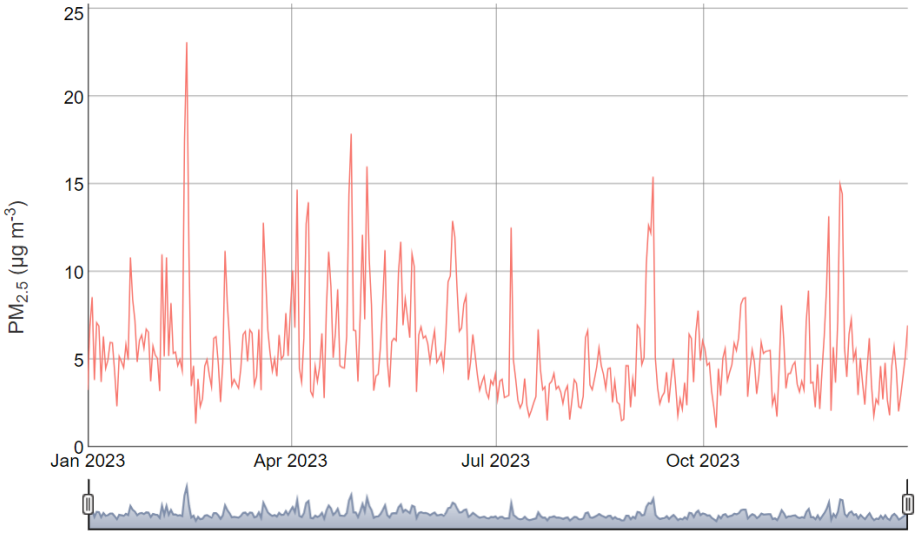


Figure F-11 Kirkcaldy $PM_{2.5}$ time series

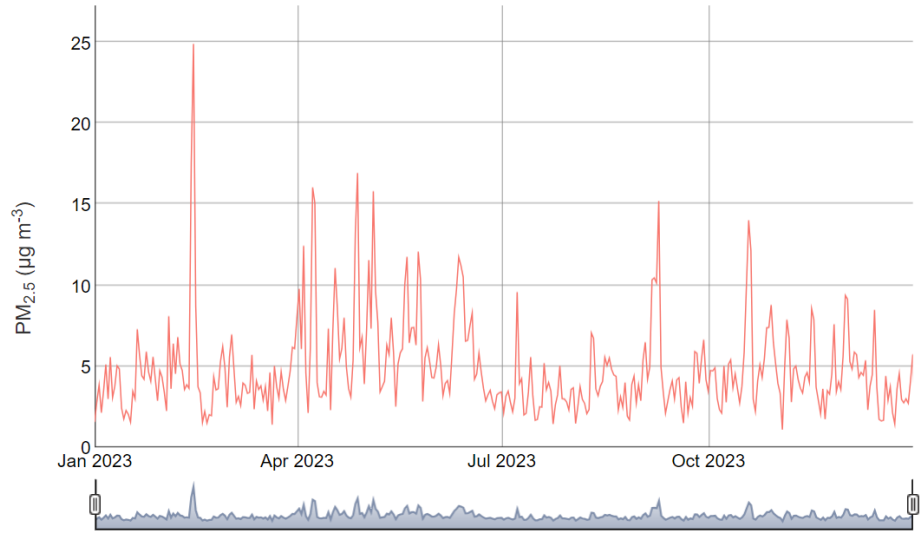


Figure F-12 Rosyth $PM_{2.5}$ time series

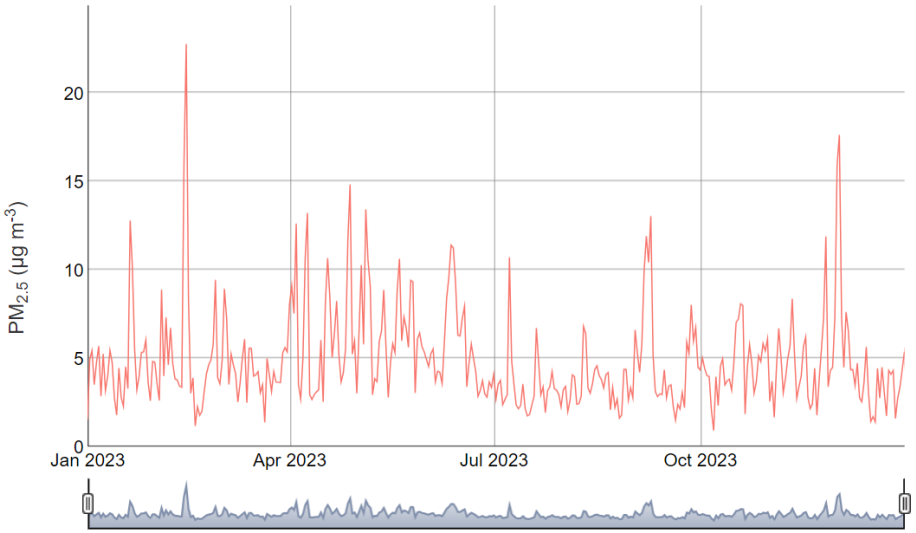


Figure F-13 Cupar NO_2 calendar plots

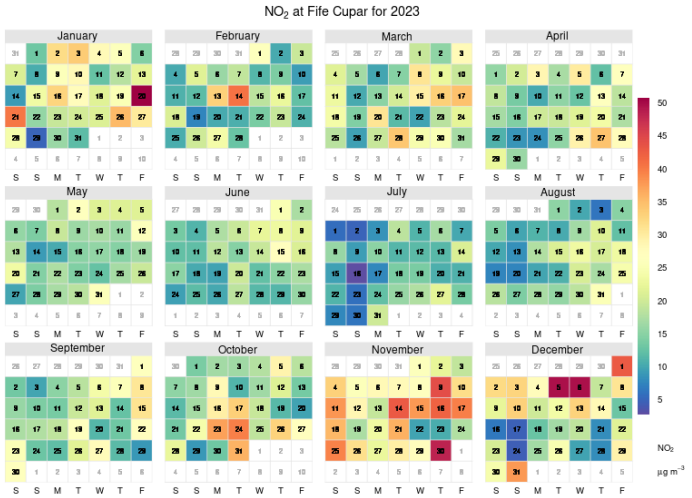


Figure F-14 Dunfermline NO_2 calendar plots

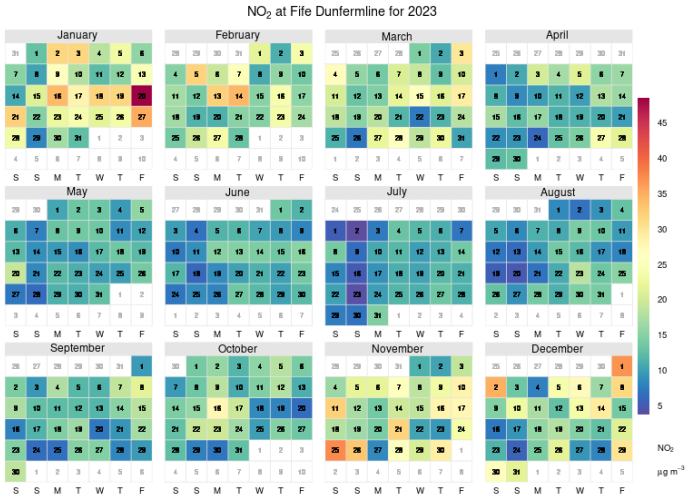


Figure F-15 Kirkcaldy NO_2 calendar plots

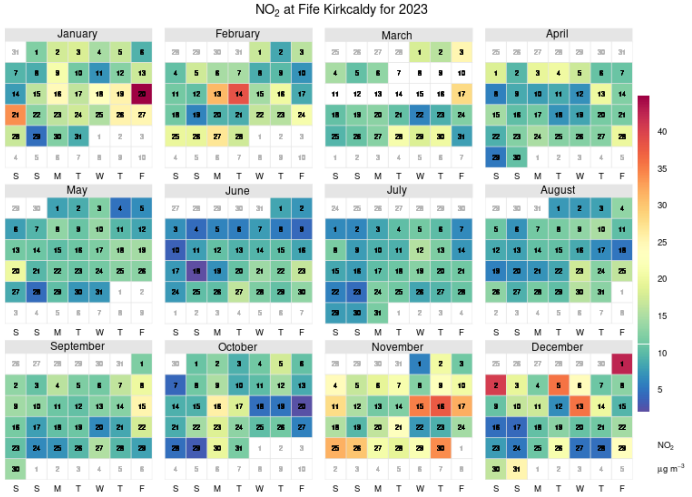


Figure F-16 Rosyth NO_2 calendar plots

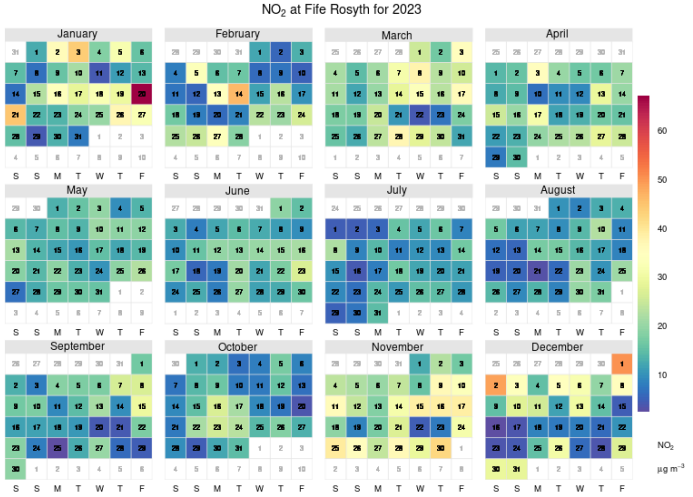


Figure F-17 Cupar PM_{10} calendar plots

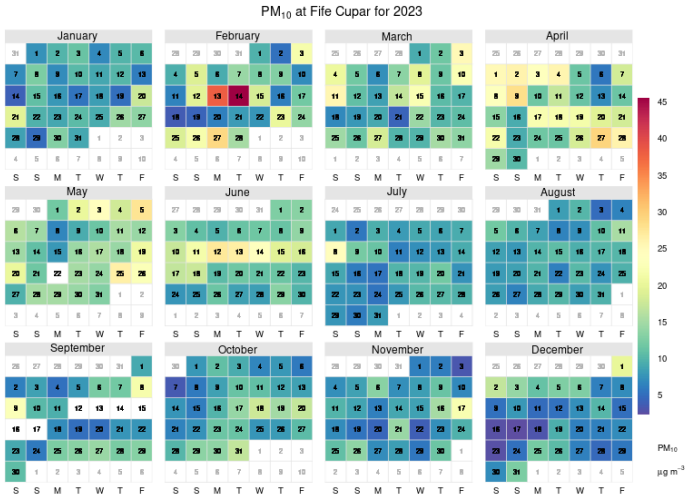


Figure F-18 Dunfermline PM_{10} calendar plots

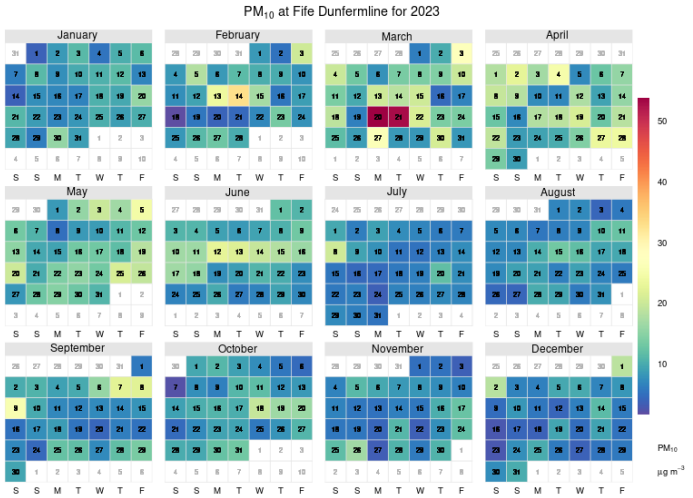


Figure F-19 Kirkcaldy PM_{10} calendar plots

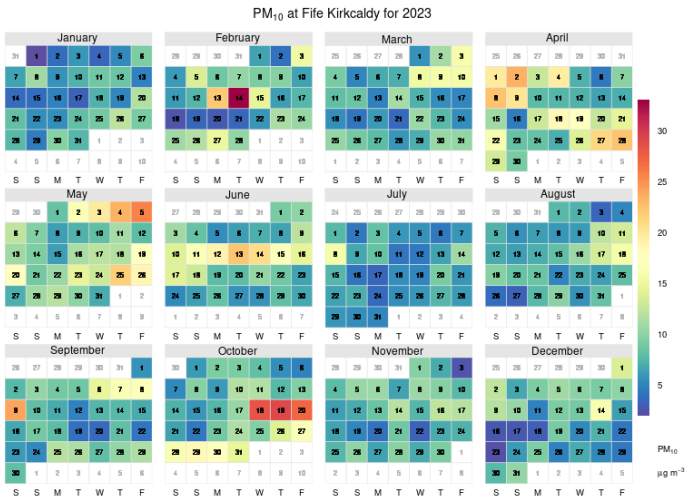


Figure F-20 Rosyth PM_{10} calendar plots

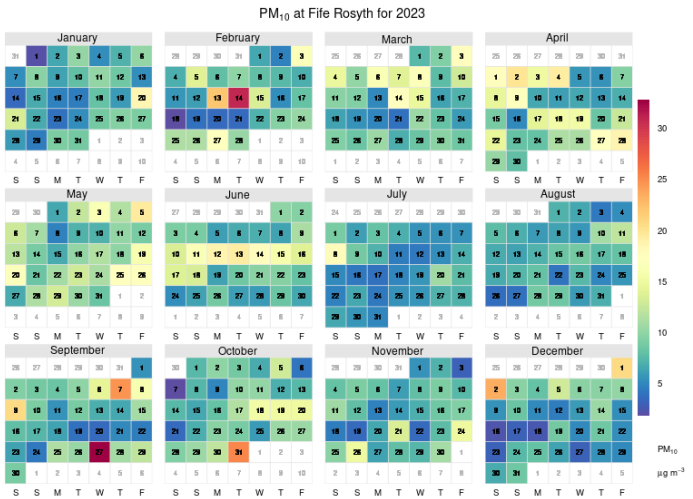


Figure F-21 Cupar $PM_{2.5}$ calendar plots

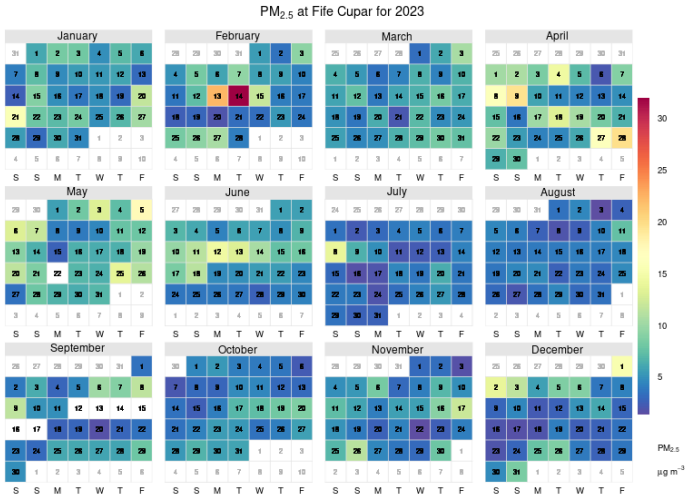


Figure F-22 Dunfermline $PM_{2.5}$ calendar plots

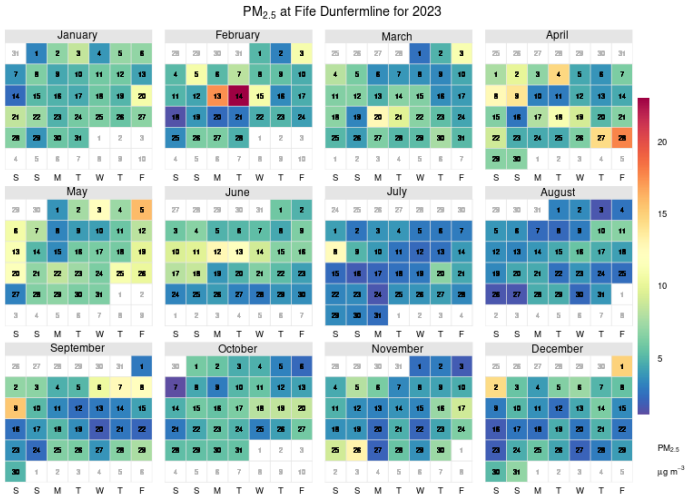


Figure F-23 Kirkcaldy $PM_{2.5}$ calendar plots

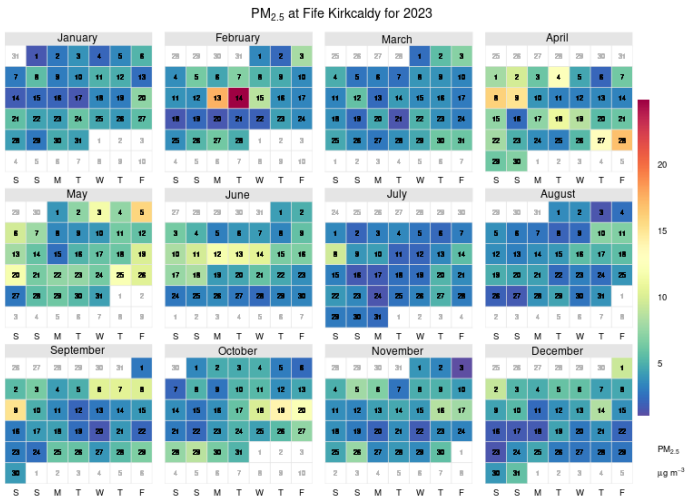


Figure F-24 Rosyth $PM_{2.5}$ calendar plots

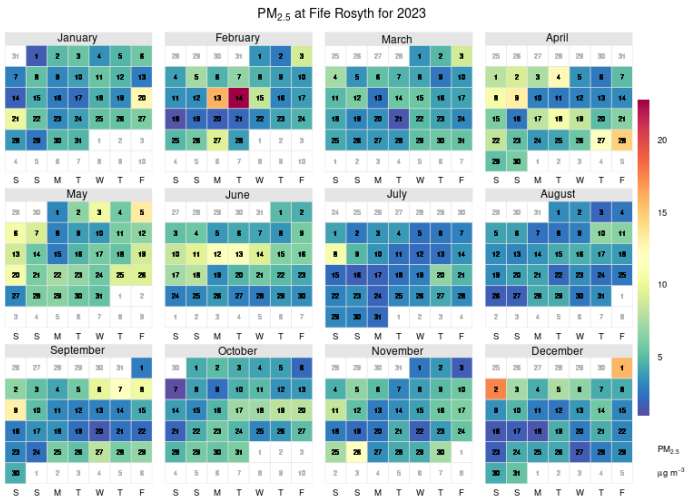


Figure F-25 Cupar NO_2 polar plot

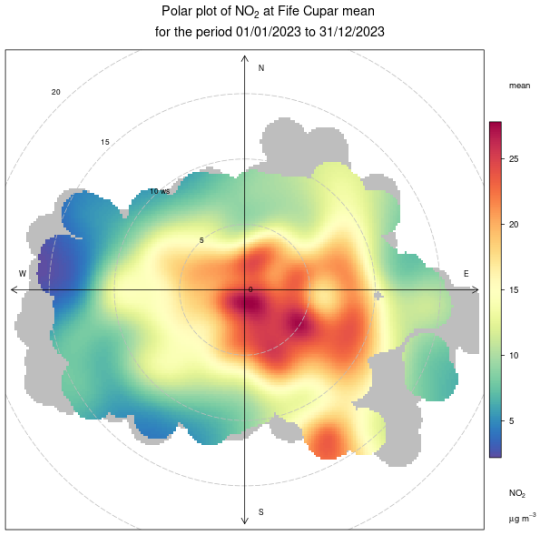


Figure F-26 Dunfermline NO_2 polar plot

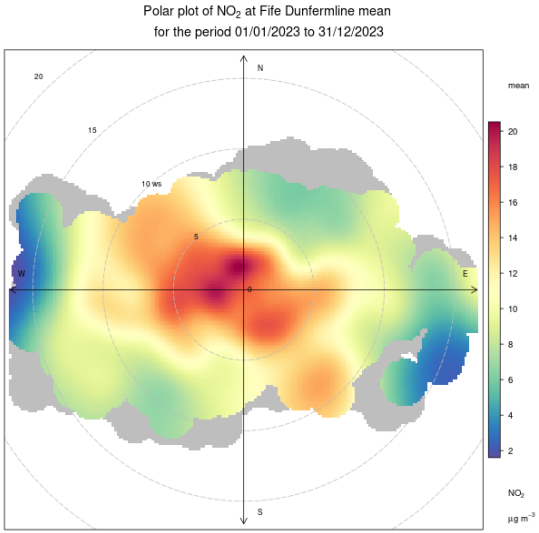


Figure F-27 Kirkcaldy NO_2 polar plot

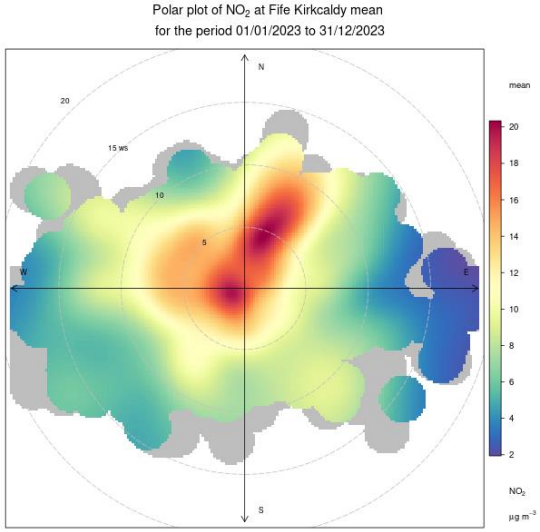


Figure F-28 Rosyth NO_2 polar plot

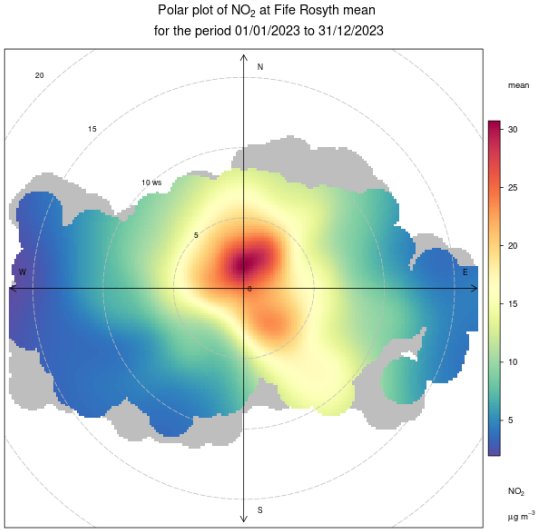


Figure F-29 Cupar PM_{10} polar plot

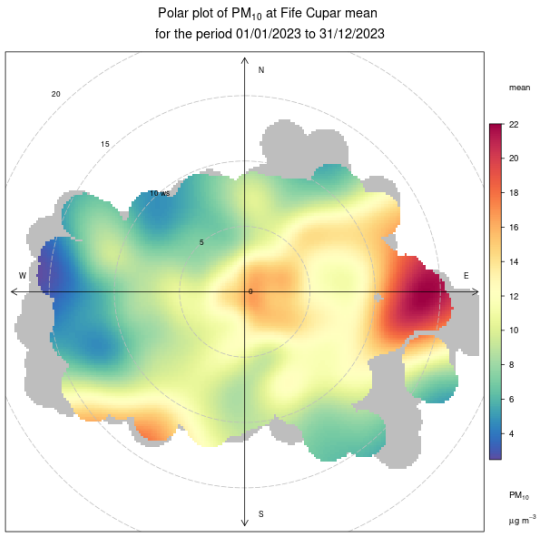


Figure F-30 Dunfermline PM_{10} polar plot

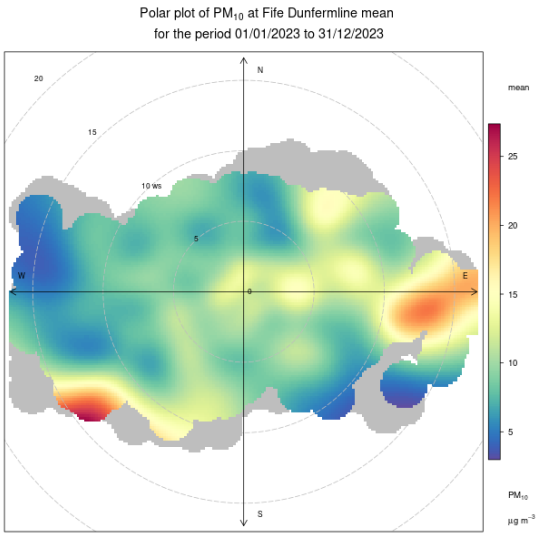


Figure F-31 Kirkcaldy PM_{10} polar plot

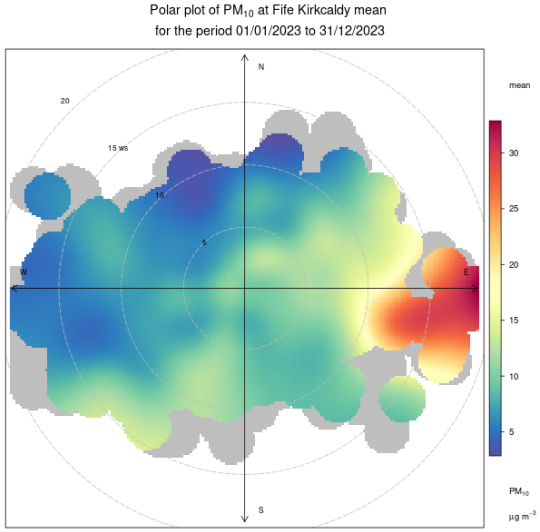


Figure F-32 Rosyth PM_{10} polar plot

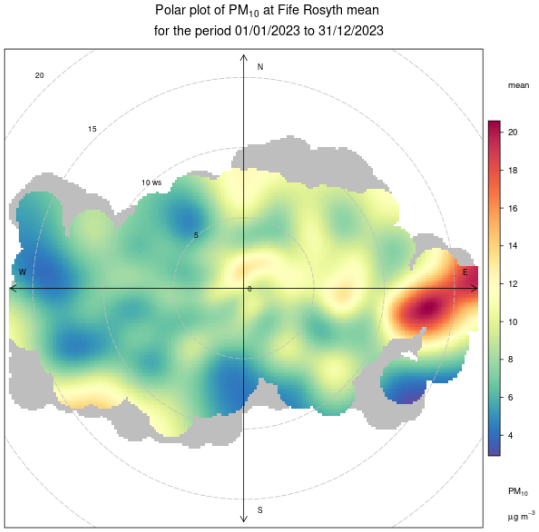


Figure F-33 Cupar $PM_{2.5}$ polar plot

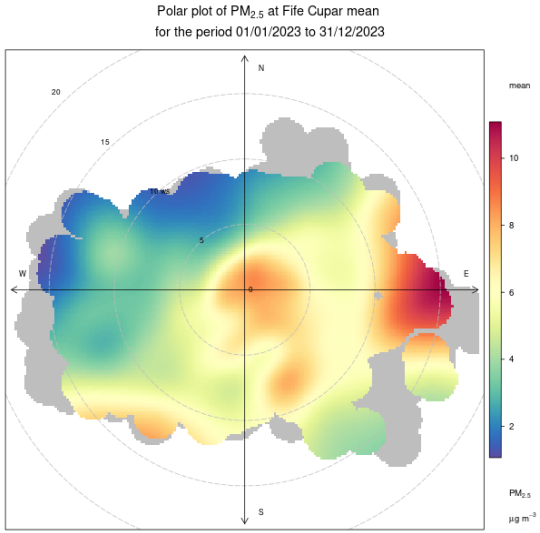


Figure F-34 Dunfermline $PM_{2.5}$ polar plot

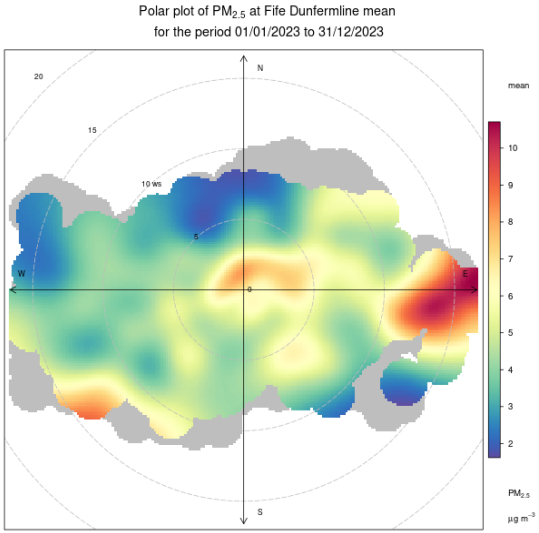


Figure F-35 Kirkcaldy $PM_{2.5}$ polar plot

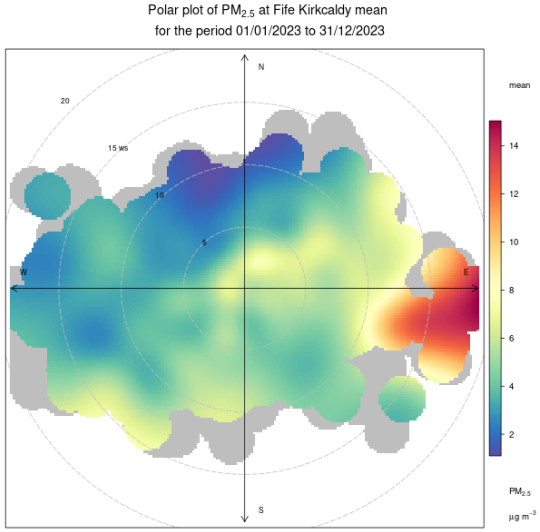


Figure F-36 Rosyth $PM_{2.5}$ polar plot

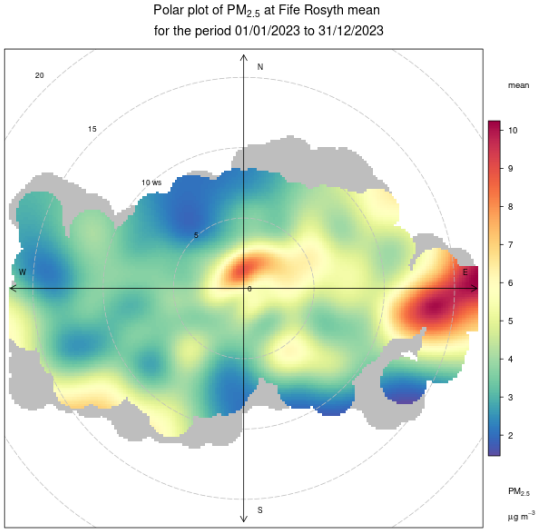


Figure F-37 Trajectory Clusters

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

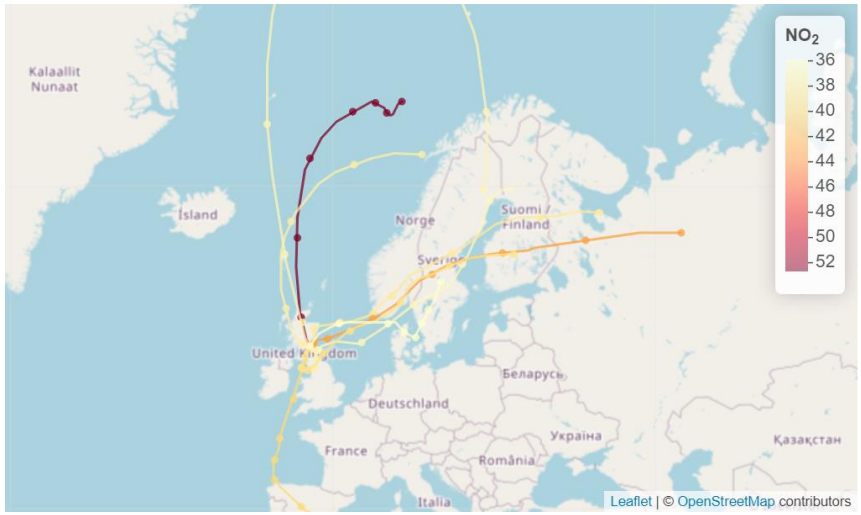


Figure F-39 Trajectory plot for top ten highest daily PM_{10} concentration

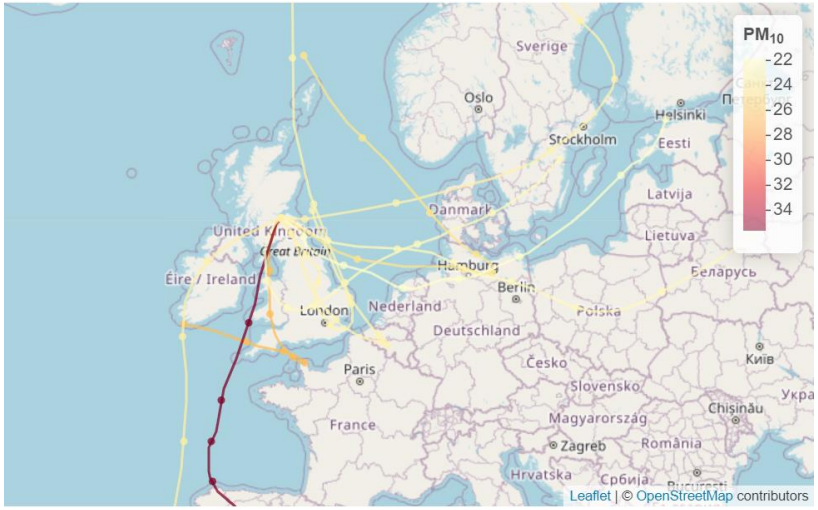
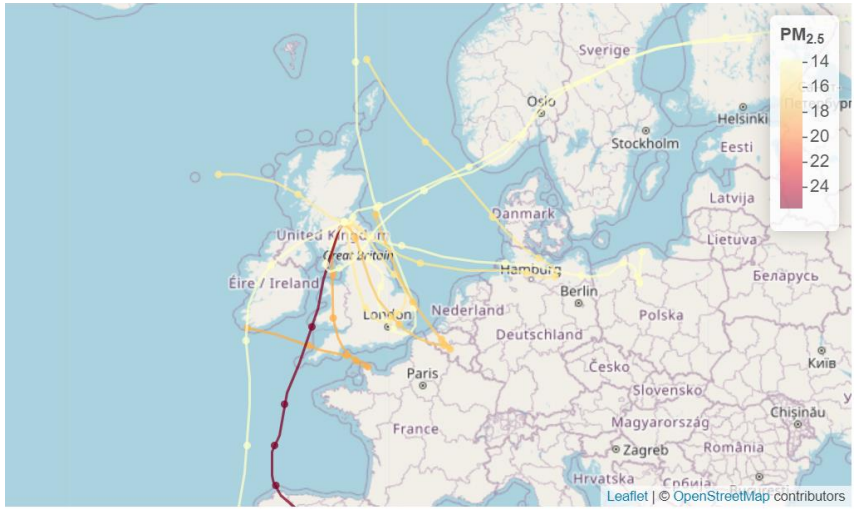


Figure F-40 Trajectory plot for top ten highest daily $PM_{2.5}$ concentration



Appendix G The Mossmorran and Braefoot Bay Independent Air Quality Monitoring Review Annual Report Summary 2022

IOM

Air Quality Around Mossmorran and Braefoot Bay 2022 – Summary Report

Image courtesy of SEPA

Monitoring has revealed no exceedances of air quality objectives in the areas around the Mossmorran Complex, which includes ExxonMobil's Fife Ethylene Plant (FEP) and Shell UK Fife Natural Gas Liquids (NGL) Plant, in 2022. 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 exposed 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 (3 monitoring sites)	Fife Council	INEOS
PM_{10}*	Highest annual mean found at Auchtertool: 9.8 µg m^{-3}	Highest annual mean found at Cupar: 15.4 µg m^{-3}	N/A
$PM_{2.5}$*	Highest annual mean found at Auchtertool: 5.1ugm^{-3}	Highest annual mean found at Cupar: 7.4 µg m^{-3}	N/A
Benzene**	N/A	N/A	1 to 0.2 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.
**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 colours indicate whether any air quality objectives were exceeded. Green means the objective for that pollutant was not exceeded. No air quality 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 produce air pollutants. 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.

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, 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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