# 2025 Air Quality Annual Status Report (ASR)

## In fulfilment of Part IV of the Environment Act 1995 Local Air Quality Management, as amended by the Environment Act 2021

Date: June 2025

| Information | Malvern Hills District Council |
|---|---|
| **Local Authority Officer** | Phil Brookes |
| **Department** | Technical Services |
| **Address** | Worcestershire Regulatory Services, Wyre Forest House, Fine Point Way, Kidderminster, DY11 7WF |
| **Telephone** | 01905 822799 |
| **E-mail** | enquiries@worcsregservices.gov.uk |
| **Report Reference Number** | MHDC/ASR25/01 |
| **Date** | June 2025 |

## Local Responsibilities and Commitment

This ASR was prepared by the Technical Services Department of Worcestershire regulatory Services of Malvern Hills District Council with the support and agreement of the following officers and departments:

- Worcestershire Regulatory Services
- Malvern Hills District Council
- Worcestershire County Council

Worcestershire Regulatory Services (WRS) is a shared service formed from the Environmental Health and Licensing departments of the six Worcestershire District Councils. Responsibility for managing (monitoring and reporting of ) local air quality transferred from the partnership councils to WRS in April 2011.

This ASR has not been signed off by a Director of Public Health. The DoPH office has requested a copy of the ASR be forwarded for information post publication.

If you have any comments on this ASR please send them to:

Technical Pollution Team, Worcestershire Regulatory Services, Wyre Forest House, Finepoint Way, Kidderminster, Worcestershire, DY11 7WF

Telephone - 01905 822799

Email - enquiries@worcsregservices.gov.uk

# Executive Summary: Air Quality in Our Area

## Air Quality in Malvern Hills District Council

Breathing in polluted air affects our health and costs the NHS and our society billions of pounds each year. Air pollution is recognised as a contributing factor in the onset of heart disease and cancer and can cause a range of health impacts, including effects on lung function, exacerbation of asthma, increases in hospital admissions and mortality.

Air pollution particularly affects the most vulnerable in society, children, the elderly, and those with existing heart and lung conditions. Low-income communities are also disproportionately impacted by poor air quality, exacerbating health and social inequalities.

Table ES 1 provides a brief explanation of the key pollutants relevant to Local Air Quality Management and the kind of activities they might arise from.

### Table ES 1 - Description of Key Pollutants

| Pollutant | Description |
|---|---|
| Nitrogen Dioxide ($NO_2$) | Nitrogen dioxide is a gas which is generally emitted from high-temperature combustion processes such as road transport or energy generation. |
| Sulphur Dioxide ($SO_2$) | Sulphur dioxide ($SO_2$) is a corrosive gas which is predominantly produced from the combustion of coal or crude oil. |
| Particulate Matter ($PM_{10}$ and $PM_{2.5}$) | Particulate matter is everything in the air that is not a gas.<br>Particles can come from natural sources such as pollen, as well as human made sources such as smoke from fires, emissions from industry and dust from tyres and brakes.<br>$PM_{10}$ refers to particles under 10 micrometres. Fine particulate matter or $PM_{2.5}$ are particles under 2.5 micrometres. |

The Malvern Hills District generally experiences good levels of air quality. There have been no Air Quality Management Areas (AQMAs) declared in this district since the review and assessment process commenced. There have been no exceedances of the air quality objective for Nitrogen Dioxide ($NO_2$) recorded at any locations, where monitoring has been undertaken for a full 12 months, since monitoring began.

The site locations are regularly assessed and selected to represent the most likely worst-case conditions (with a background control area for contrast). The results show that the level of pollution in Malvern Hills district has generally been significantly below the national objective.

During 2024, concentrations of $NO_2$ were monitored at 9 locations across the Malvern District. The highest recorded mean concentrations were 27.7µg/m$^3$ at UP1 (located in Old Street, Upton-upon-Severn), 26.4µg/m$^3$ M11 (in Powick) and 25.3µg/m$^3$ at UP3 (located in Old Street, Upton-upon-Severn).

The lowest concentration was 7.5µg/m$^3$ at M3N which is an urban background site in Teme Lane, Malvern. The results demonstrate that $NO_2$ concentrations within the Malvern Hills District area are significantly below the $NO_2$ air quality objective of 40µg/m$^3$ during 2024. In comparison with 2023, the annual results are mixed with 4 locations increasing slightly, 3 locations decreasing slightly and 1 identical result.

Long term trend analysis over the 5-year period, 2020 to 2024, suggest concentrations from 2024 appear to be broadly similar to the pre-pandemic levels recorded in 2019, following a reduction in years 2020 and 2021 due to the COVID-19 pandemic travel restrictions. No annual mean averages greater than 60µg/m$^3$ have been recorded indicating that it is extremely unlikely that there have been any exceedances of the 1-hour mean objective for $NO_2$ at any monitoring sites.

During 2024, there were no automatic $PM_{2.5}$ monitoring stations in Worcestershire that are recognised by Defra for measuring against ambient air quality directives. The nearest AURN $PM_{2.5}$ monitoring station is the Birmingham Ladywood site approximately 48km to the north-east of the Malvern Hills District. However, WRS have assisted the Defra AURN expansion project team with potential locations for two $PM_{2.5}$ monitors in Worcestershire, and a new AURN has been installed in the Tolladine area of Worcester (less than 10 miles from the Malvern Hills) during 2024 and will be available for reporting in ASR2026.

WRS has reviewed the 2021 based Defra national background maps to determine projected $PM_{2.5}$ concentrations with the Malvern Hills District for the 2024 calendar year. The average total $PM_{2.5}$ at 577 locations (centre points of 1km x 1km grids) across the Malvern Hills District is 6.03µg/m$^3$, with a minimum concentration of 5.40µg/m$^3$ and a maximum concentration of 9.47µg/m$^3$. This indicates that $PM_{2.5}$ concentrations within the Malvern Hills District are below the proposed annual average limit value for $PM_{2.5}$ target of 10µg/m$^3$ to be met across England by 2040.

WRS has reviewed the fraction of mortality attributable to particulate air pollution (indicator D01) as published by Public Health England as part of the Public Health Outcomes Framework. The fraction of mortality attributable to particulate emissions in Malvern Hills District in 2023 (the most recent year available) was 3.8% MHDC. This falls below the national figure for England (5.2% in 2023) and below the figure for the West Midlands region (5.1% in 2022). Further information on the Public Health Outcomes Framework that examines indicators that help us understand trends in public health can be found at Public Health Outcomes Framework - OHID (phe.org.uk)

## Actions to Improve Air Quality

Whilst air quality has improved significantly in recent decades, there are some areas where local action is needed to protect people and the environment from the effects of air pollution.

The Environmental Improvement Plan[1] sets out actions that will drive continued improvements to air quality and to meet the new national interim and long-term targets for fine particulate matter ($PM_{2.5}$), the pollutant most harmful to human health. The National Air Quality Strategy[2] provides more information on local authorities' responsibilities to work towards these new targets and reduce fine particulate matter in their areas.

The Road to Zero[3] details the Government's approach to reduce exhaust emissions from road transport through a number of mechanisms, in balance with the needs of the local community. This is extremely important given that cars are the most popular mode of personal travel, and the majority of Air Quality Management Areas (AQMAs) are designated due to elevated concentrations heavily influenced by transport emissions.

No specific actions have been progressed to improve air quality in the Malvern Hills district as there are currently no declared AQMAs in the area and there was no requirement to do so previously.

[1] Defra. Environmental Improvement Plan 2023, January 2023

[2] Defra. Air Quality Strategy – Framework for Local Authority Delivery, August 2023

[3] DfT. The Road to Zero: Next steps towards cleaner road transport and delivering our Industrial Strategy, July 2018

In 2013, WRS produced a countywide Air Quality Action Plan (AQAP) for Worcestershire. WRS have produced two updates to the AQAP, the latest in September 2016. For details of all measures completed, in progress or planned, please refer to the 'Air Quality Action Plan Progress Report for Worcestershire April 2015-2016'. A copy of this report is available to view or download at: Air Quality Action Plan Progress report for Worcestershire 2015/16

General actions to improve air quality detailed in the Air Quality Action Plan have applied across Worcestershire as a whole, including the Malvern Hills area.

**Air Quality Actions Plan and Air Quality Strategy**

The timeline for the various stages and delivery of a revised countywide AQAP, and establishment of a new countywide Air Quality Strategy, were set out in the ASR 2024. However, following the introduction of new enforcement policy by Defra in June 2023, it has been necessary to amend the previously published framework to prioritise production of a standalone AQAP for each district with an existing AQMA. As previously discussed, Malvern Hills District has no AQMAs therefore no individual Action Plan is required.

Development of an ambitious countywide Air Quality Strategy as reported in the last ASR, has been postponed for 2025. Progress has been delayed until local authority reorganisation, announced by government in Dec 2024, has been completed in Worcestershire. However, certain potential elements of the strategy, such as improving communication of air quality, are evolving through other work streams for example Behavioural Change interactions with local schools and communities, Clean Air Day 2025 campaign and working with LA teams around the county to ensure air quality is considered appropriately within local strategy and policy.

From 2023, local authorities that do not have any AQMAs in their areas are required to produce an Air Quality Strategy outlining how air quality will be maintained.

Production of an interim air quality strategy for the Malvern Hills District will begin from July 2025 following the completion of this ASR.

## Conclusions and Priorities

In conclusion, we would summarise the ASR as follows:

- Malvern Hills district continues to have relatively good air quality.
- There were no exceedances during 2024.

- The general trend continues to show an improvement in measured air quality, but meaningful data and trends have been skewed by the impact of Covid and disruptions to travel and commercial/social activity.
- There are no AQMAs in the district.
- No new sources or developments were identified which would significantly impact air quality from 2024.

Malvern Hills District Council's priorities for the next reporting year are to:

- Continue to monitor air pollutants at key locations across the district by use of the diffusion tube network
- Utilise the data from the new real-time low-cost sensors to inform future steps in improving air quality across the district.
- Produce an interim air quality strategy for the Malvern Hills District from July 2025.
- Review and assessment of first calendar year's data from low-cost sensors to inform future projects and strategies to improve air quality across the district.
- Promoting public access to the Earthsense portal of real time monitoring data on a range of air pollutants to enhance public knowledge and encourage behavioural change
- Exploring a potential $PM_{2.5}$ source apportionment study within Worcestershire with the University of Birmingham.
- Improving air quality information and direction to WRS webpages following recommendations of Defra's Air Quality Information Systems review
- Ensure proportionate mitigation measures are included within new developments where air quality is a relevant concern.
- Work with teams from around the county to ensure air quality is considered appropriately within local strategy and policy where appropriate.
- Maintain relationships with neighbouring authorities and institutions to stay abreast of issues and developments that could impact or benefit air quality in Malvern Hills district, and to ensure our work is recognised in the wider West Midlands community.

## How to get Involved

There are a number of ways members of the public can help to improve local air quality:

- **Walk or cycle around the District instead of driving**: Leaving your car at home and walking or cycling instead will benefit in three ways - increased exercise, reduced pollution exposure and will reduce your own pollution emissions.
- **Turn off your engine when stationary or parked,** don't 'idle', particularly outside sensitive receptors such as schools, hospitals, care homes and residential properties.
- **General travel planning advice** is available on Worcestershire County Council's website (including walking, cycling and bus maps and timetables) and Government website:

  Travel and Highways - Worcestershire County Council

  Smarter choices: changing the way we travel - GOV.UK (www.gov.uk)

- **Hold meetings by Conference Call** by phone or video conference via Teams, Zoom or Facetime rather than driving to meetings. This reduces fuel and other travel costs, vehicle maintenance and hire cost, increases productivity through reduction in hours lost through unnecessary travel.
- **Facilitate Flexible Working Arrangements** for non-front-line staff to work remotely from home or nearer home facilities for one or more days a week thus removing or reducing any journey to work. This reduces congestion which has beneficial impacts for delivery times, reduced business costs and thus economic benefits. Additionally, provides social benefits through improved work life balance for employees, reduces local air quality and reduced emergency vehicle response times.
- **Workplace Charging Scheme:** The government is currently providing grants for up to 75% of Electric Vehicle (EV) charging points, up to 40 charge points. Eligible businesses, charities and public sector organisations with off street parking for staff or vehicles fleets can apply for vouchers to redeem costs of electric vehicle charge-points.

  Workplace Charging Scheme - GOV-UK Find a grant (find-government-grants.service.gov.uk)

- If you have to drive, follow fuel efficient driving advice, often known as **'Smarter Driving Tips'**, to save on fuel and reduce your emissions. A number of websites promote such advice including:

  Save money and emissions through ecodriving - Energy Saving Trust

  How to drive economically - Eco-driving tips | AA (theaa.com)

Fuel Consumption & CO2 Databases | Vehicle Certification Agency (vehiclecertification-agency.gov.uk)

- **Reduce air pollution from open fires and wood-burning stoves**: Advice is available from Defra on choosing the right stove, using the right fuels and maintenance, enabling householders to reduce their impact on their health and air quality from open fires and wood burning stoves. Further information is available on the Smokeless Zones and Public Advice pages on WRS website.

WRS would highlight the Malvern Hills District Council's website and, most relevantly, the section entitled 'Tackling Climate Change' using the following link – Tackling Climate Change - Malvern Hills District Council

Air pollution can affect all of us over our lifetime however certain groups will be more sensitive to the effects of air pollution. Vulnerable groups include adults and children with lung or heart conditions such as asthma, chronic bronchitis, emphysema and chronic obstructive lung disease (COPD)[4,5]. Senior citizens are more likely to be affected by respiratory diseases and children are more likely to be affected by air pollution due to relatively higher breathing and metabolic rates as well as a developing lung and immune system.

Vulnerable individuals and groups can keep informed of:

- Current levels and forecasts of air pollution from Defra at: UK Air and the Earthsense website for Air Quality across Worcestershire.
- If you are sensitive to the effects of air pollution, it may be appropriate to limit the length of time spent in areas of local poor air quality – see advice from Defra at UK Air advice
- If you are on social media, sign up to the WRS Twitter feed. WRS tweet when pollution is forecast by Defra to be moderate to very high.

Further information for the general public on reducing your family's exposure to poor air quality in Worcestershire and how individuals, business and schools can assist with reducing their impact on local air quality is available at Protecting Me and Others from Air Pollution | Worcestershire Regulatory Services (worcsregservices.gov.uk)

[4] http://www.breathelondon.org/

[5] https://www.londonair.org.uk/LondonAir/guide/MyActionsForMe.aspx

# Table of Contents

## Figures



## Tables

# 1 Local Air Quality Management

This report provides an overview of air quality in Malvern Hills District Council during 2024. 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 order to achieve and maintain the objectives and the dates by which each measure will be carried out. This Annual Status Report (ASR) is an annual requirement showing the strategies employed by Malvern Hills District Council to improve air quality and any progress that has been made.

The statutory air quality objectives applicable to LAQM in England are presented in Table E.1.

# 2 Actions to Improve Air Quality

## 2.1 Air Quality Management Areas

Air Quality Management Areas (AQMAs) are declared when there is an exceedance or likely exceedance of an air quality objective. After declaration, the authority should prepare an Air Quality Action Plan (AQAP) within 18 months. The AQAP should specify how air quality targets will be achieved and maintained, and provide dates by which measures will be carried out.

Malvern Hills District Council currently does not have any declared AQMAs and there are no present plans to declare a new AQMA given the results of monitoring to date. Therefore, no specific action is required at this time.

Concentrations of Nitrogen Dioxide in Malvern Hills district continue to fall significantly below the annual mean objective at the measured locations. Maps of the Malvern Hills District Council monitoring sites are available in Appendix D.

Air Quality Management Areas (AQMAs) are declared when there is an exceedance or likely exceedance of an air quality objective. After declaration, the authority should prepare an Air Quality Action Plan (AQAP) within 18 months. The AQAP should specify how air quality targets will be achieved and maintained, and provide dates by which measures will be carried out.

Malvern Hills District Council currently does not have any declared AQMAs and there are no present plans to declare a new AQMA given the results of monitoring to date. Therefore, no specific action is required at this time.

Concentrations of Nitrogen Dioxide in Malvern Hills district continue to fall significantly below the annual mean objective at the measured locations. Maps of the Malvern Hills District Council monitoring sites are available in Appendix D.

**Table 2.1 – Declared Air Quality Management Areas**

Malvern Hills District does not have any declared Air Quality Management Areas.

## 2.2 Progress and Impact of Measures to address Air Quality in Malvern Hills District

Defra's appraisal of last year's ASR concluded, based on the evidence provided by Malvern Hills District Council, that the report was accepted for all sources and pollutants and that a further ASR should be submitted in 2025.

DEFRA further commented as follows: -

*The report is well structured, detailed, and provides the information specified in the Guidance. The following comments are designed to help inform future reports:*

*1. When calculating the local bias adjustment factor, it is recommended that a co-located reference monitor is used that is close to your jurisdiction. The bias adjustment factor will be more representative of your local area.*

*2. There is no evidence of an independent AQS by MHDC, however, it is stated that a countywide AQS is in development. Progress updates on this is encouraged for next year's report.*

*3. Air quality concerns were raised by a member of the public. MHDC acknowledged and addressed these concerns by adding an additional diffusion tube location to their monitoring schedule. MHDC are commended for engaging with the public when there are air quality concerns within their jurisdiction.*

*4. MHDC have included a comprehensive discussion of $PM_{2.5}$ concentrations within their jurisdiction. It is commended that they have included background concentrations for $PM_{2.5}$ within their jurisdiction and have discussed these results with the $PM_{2.5}$ target.*

Wyre Forest House, Kidderminster was used as a co-location study because it is the closest co-located reference monitor to the jurisdiction currently available.

A local bias adjustment factor has also been used on the passive diffusion tube results for 2024. A local bias adjustment factor of 1.03 has been utilised and all results remained significantly below the Air Quality Objective.

A new AURN has been installed in the Tolladine area of Worcester (less than 10 miles from the Malvern Hills district) during 2024 and will be available for reporting in ASR2026.

No specific actions have been progressed to improve air quality in the Malvern Hills district as there are currently no declared AQMAs in the area and there was no requirement to do

so previously. However, the general actions to improve air quality detailed in the previous Air Quality Action Plan have applied across Worcestershire as a whole, including the Malvern Hills area. WRS continue to monitor for exceedances in Malvern Hills District and across Worcestershire on behalf of the six districts.

**Air Quality Actions Plan and Air Quality Strategy**

The timeline for the various stages and delivery of a revised countywide AQAP, and establishment of a new countywide Air Quality Strategy, were set out in the ASR2023. However, following the introduction of new enforcement policy by Defra in June 2023, it has been necessary to amend the previously published framework to prioritise production of a standalone AQAP for each district with an existing AQMA. As previously discussed, Malvern Hills District has no AQMAs therefore no individual Action Plan is required.

Development of an ambitious countywide Air Quality Strategy as reported in the last ASR, has been postponed for 2025. Progress has been delayed until local authority reorganisation, announced by government in Dec 2024, has been completed in Worcestershire. However, certain potential elements of the strategy, such as improving communication of air quality, are evolving through other work streams for example Behavioural Change interactions with local schools and communities, Clean Air Day 2025 campaign and working with LA teams around the county to ensure air quality is considered appropriately within local strategy and policy.

From 2023, local authorities that do not have any AQMAs in their areas are required to produce an Air Quality Strategy outlining how air quality will be maintained. Production of an interim air quality strategy for the Malvern Hills District will begin from July 2025 following the completion of this ASR.

**Net Zero/Climate Change Action**

Malvern Hills District Council has a vision to become carbon neutral as soon as possible and by 2050 at the latest, targeting a minimum reduction of 50% to the district's carbon footprint by 2030. Net zero actions and policies often provide co-benefits of reducing air pollution. Their Destination Zero report and policies to tackle climate change, can be accessed on their website at:

Destination Zero Report

Destination Zero Annual Update 2023 to 2024

Tackling Climate Chance - Malvern Hills District Council

**Active Travel Improvements/Actions**

Local cycling and walking infrastructure plan is in development with consultation timetabled for summer 2025, alongside a number of Local Cycling and Walking Plans in South Worcestershire.

MHDC continues to encourage the use of bicycle travel with 6 newly installed bike parking facilities and *Bikeability*, *Dr Bike* and *Balanceability* sessions planned. A 'Bike Boost' scheme has been implemented enabling 75 people to claim back £50 on bike repairs from local bike businesses.

The Active Travel plan encourages schools, business and community groups to complete the removal of barriers, clearing footpaths and hedges making active travel routes more accessible. An example is the 'scraping' back of pavements from Upton to Hanley Castle High School enabling students to walk/cycle to school while distributing reflectors for safety. 13 schools took part in Street Tag, an interactive app game, encouraging active travel to school children and staff.

MHDC are working with Worcestershire Regulatory Services promoting behaviour change and encouraging Active Travel to schools, colleges and the wider community with a view to improving air quality and reducing air pollution.

The walking and cycling routes and further information can be found at the following links:

Malvern Walking & Cycling Map (worcestershire.gov.uk)

Journey planner | Cycling UK (a good route planner which allows you to look for quieter and off-road routes, as well as the fastest and most direct route).

Cycle Malvern – A good place to go by bike (cycle parking and local information).

Malvern Hills Car Clubs – Community Car Share (malvernhills-carclubs.org.uk) (e-bike to work scheme and e-bike loan scheme).

The successful Worcestershire Bus on Demand scheme has been further expanded to Malvern and the surrounding area which covers the majority of the district, extends into Herefordshire and includes significant trip attractors for leisure and retail. The full map is available at:

Worcestershire on Demand | Worcestershire County Council

ModeShift Stars is a Worcestershire County Council supported scheme to encourage making Active Travel plans:

Modeshift STARS - Travel Plan in Education, Business & Communities

A bike bus or walking bus are ideal ways to travel to school as a group. They are normally organised by parents, and both alleviate traffic congestion around schools.

What is a bike bus and how can I set one up? - Sustrans.org.uk

Organise a school walking bus - Eden Project Communities

The Worcestershire County Council Highways Department have introduced and/or completed the following major scheme(s) in or around the Malvern Hills District during 2024: Worcestershire County Council - Major Infrastructure Improvements

**The Malvern Local Cycling and Walking Infrastructure Plan** (LCWIP) secured funding from Active Travel England and are due to be completed in 2025.

Local cycling and walking infrastructure plans (LCWIPs) | Worcestershire County Council

**Southern Link Road A4440 improvements** – Work to complete dualling of carriageway between the Ketch and Powick roundabouts, capacity improvements to those junctions, an additional bridge over River Severn, and new foot/cycle bridges has been completed and link road reopened in Autumn 2022. Increase in journey time reliability and reduction in congestion on the major route linking to Worcester and the strategic road network and to south Worcestershire and Herefordshire is expected. The county completed a survey to evaluate whether this scheme met objectives in April 2024 and the Worcestershire County Council is currently researching and prioritising the planning and delivery of active travel provision for cycling, walking and wheeling routes. The development of Worcestershire's LCWIPs programme for identifying proposed routes has already been supported by £160K from the Capability Building Fund given by Active Travel (GOV.UK).

The A4440 Worcester Southern Link Road improvements | Worcestershire County Council

**Passenger Transport -** Bus 'on demand' services was added to a trial scheme in Malvern to provide an alternative option to the existing fixed route bus service. The Bus on Demand service enables passengers to use an 'app' to arrange flexible pick up and drop off points. Further details can be viewed at the following link:

On demand bus service launches in Malvern | Worcestershire County Council

**Worcestershire County Council Actions**

Worcestershire County has secured its full allocation from the Government's Local Electric Vehicle Infrastructure Fund to support the transition to electric vehicles and facilitate

charging for owners without off road parking. A procurement exercise is currently underway to secure a charge point operator.

The Electric Vehicle Infrastructure Charging Strategy has been finalised following public consultation in 2024 and will be published in summer 2025 supporting the delivery of the charge points funded through Local Electric Vehicle Infrastructure Fund.

**Real-time Air Quality Monitoring Project**

In 2023, WRS were successful in a bid to the Defra Air Quality Grant Scheme 2022/23 to establish an enhanced real-time air quality monitoring network across Worcestershire. The scope of the bid was to establish a real-time air quality monitoring network across the main areas of air quality concern in Worcestershire for purposes of providing enhanced monitoring data on a range of pollutants. Additionally, the proposal included informing the public and vulnerable groups of the status of air pollution in real time to encourage behaviour change.

The sum of £248,400 was awarded to WRS from the AQ Grant Scheme. An additional 10% of funds was provided by each district council in Worcestershire, in accordance with the match-funding requirement of the scheme, which equates to £27,600. This produced a total sum of £276,000 for the project.

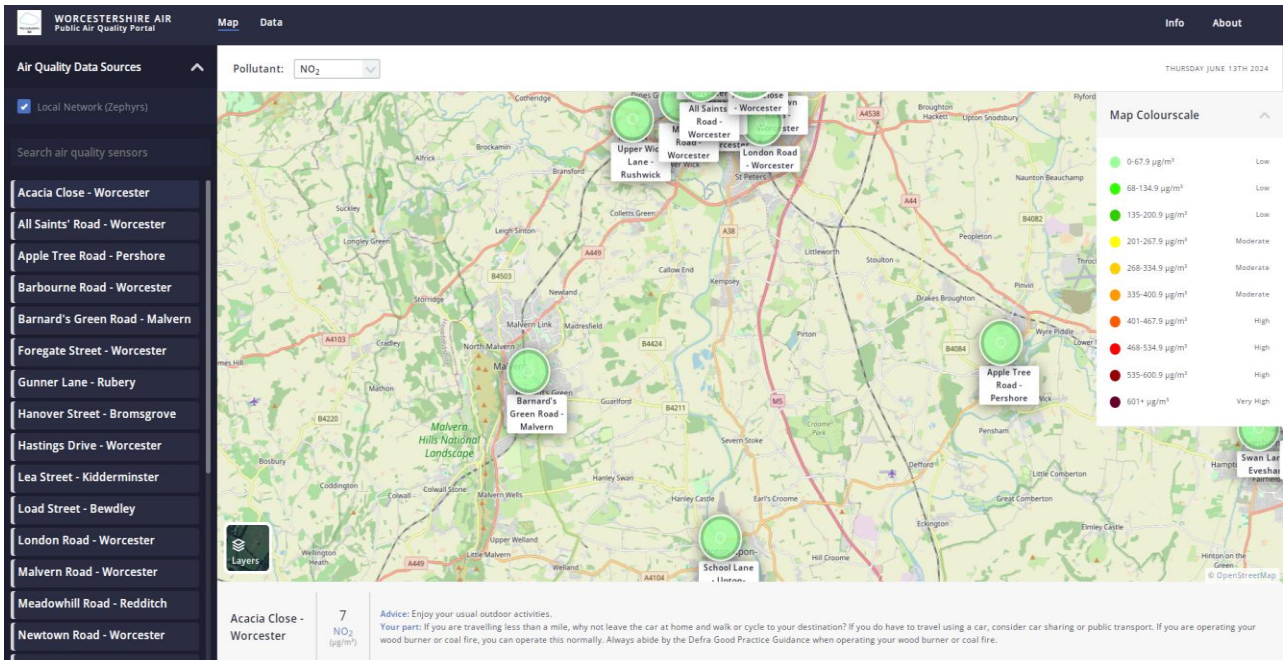
The scheme has involved the installation and operation of 26 ‘low-cost Air Quality Monitors’ which will measure $NO_2$, $PM_{10}$, $PM_{2.5}$ across the county for a period of 3 years (with EA MCERTS standard accreditation as indicative ambient particulate matter devices). The results of monitoring will be used to inform decision making and requirements for further action as necessary.

In 2023, the experienced sensor provider, Earthsense, were appointed as the successful supplier following a rigorous procurement process. The sensors (known as ‘Zephyrs’) are supplied, operated and serviced by Earthsense who also provide data access. Appropriate monitoring locations were determined by WRS in collaboration with Public Health, Worcestershire County Council Street Lighting team and Earthsense taking into consideration the requirements of Malvern Hills District Council.

Three of the monitors were deployed within the Malvern Hills district area in January 2024. Earthsense and WRS have designed a publicly accessible portal to the real-time monitoring data which launched in May 2024 and this can be viewed at the Earthsense website for Air Quality across Worcestershire.

The monitor locations are listed below and can be seen on the map taken from the portal:-

- Barnards Green Road, Malvern
- School Lane, Upton-upon-Severn
- Upper Wick Lane, Rushwick




## Key Progress in 2023/24

Malvern Hills District Council has:

- Promoted active travel and have an Active Travel Project Coordinator in place. This includes offering more advice on active travel as well as adult bikeability courses – all aimed at getting people to drive less: Active Travel - Malvern Hills District Council
- The energy efficiency of the Malvern Splash leisure centre has improved by replacement of the roof and curtain wall and installation of solar panels.
- Increased use of Hydrotreated Vegetable Oil (HVO) across the waste fleet vehicles, saving approximately 300 tonnes of $CO_2$ since 2021/21 and reducing the total fleet emissions by 39%. In 2025, over 90% of the fuel used at the waste depot will be HVO with the intention of achieving 100% Hydrotreated Vegetable Oil (HVO) usage in suitable vehicles in the future.
- Installed additional electric charging points at various sites.
- Replaced existing gas boiler heating from the Council Offices and Depot with electric air source heat pumps.
- Signed up for renewable electricity and green gas energy tariffs for 2023/24 for council energy use.

- Secured £2,772,000 for Malvern Hills district in additional funding through Home Upgrade Grant 2 to deliver further improvements to lower income households in the least energy efficient homes.

## 2.3 $PM_{2.5}$ – Local Authority Approach to Reducing Emissions and/or Concentrations

As detailed in Policy Guidance LAQM.PG22 (Chapter 8) and the Air Quality Strategy[6], local authorities are expected to work towards reducing emissions and/or concentrations of fine particulate matter ($PM_{2.5}$)). There is clear evidence that $PM_{2.5}$ (particulate matter smaller 2.5 micrometres) has a significant impact on human health, including premature mortality, allergic reactions, and cardiovascular diseases.

During 2024, there were no automatic $PM_{2.5}$ monitoring stations in Worcestershire that are recognised by Defra for measuring against ambient air quality directives. The nearest AURN $PM_{2.5}$ monitoring station is the Birmingham Ladywood site approximately 48km to the north-east of the Malvern Hills District. However, WRS have assisted the Defra AURN expansion project team with potential locations for two $PM_{2.5}$ monitors in Worcestershire, and it is expected these will be in place within the next 6 to 12 months. These are expected to be sited in Worcester City and Redditch districts.

WRS has reviewed the 2021 based Defra national background maps to determine projected $PM_{2.5}$ concentrations with the Malvern Hills District for the 2024 calendar year. The average total $PM_{2.5}$ at 577 locations (centre points of 1km x 1km grids) across the Malvern Hills District is 6.03µg/$m^3$, with a minimum concentration of 5.40µg/$m^3$ and a maximum concentration of 9.47µg/$m^3$. This indicates that $PM_{2.5}$ concentrations within the Malvern Hills District are below the proposed annual average limit value for $PM_{2.5}$ target of 10µg/$m^3$ to be met across England by 2040.

Three low-cost sensors offering publicly accessible real time monitoring data were deployed within the Malvern Hills District Council area in 2024. The sensors, known as ‘Zephyrs’ provide data on a range of pollutants including $PM_1$, $PM_{2.5}$ and $PM_{10}$. Graphical results for 2024 are shown in the appendices and $PM_{2.5}$ averages for 2024 are summarised in table below:

[6] Defra. Air Quality Strategy – Framework for Local Authority Delivery, August 2023

| Location | 2024 average $PM_{2.5}$ ($\mu g/m^3$) | Installation |
|---|---|---|
| Barnards Green Road, Malvern | 6.45 | January 2024 |
| School Lane, Upton-upon-Severn | 7.37 | January 2024 |
| Upper Wick Lane, Rushwick | 6.15 | January 2024 |

These low-cost sensors have been certified as suitable for indicative monitoring for particulate matter within the UK using the Environment Agency's Indicative instrument certification scheme (MCERTS). However, the following advice from Defra is acknowledged: 'While low-cost sensors can provide useful indicative data, at present they are not approved for use in statutory legal reporting (LAQM) of data against the National air quality objectives as they are not accurate enough to meet the expanded uncertainty requirements of equivalent [scientific reference] instruments.'

The measured data from the low-cost sensor network and Defra background pollution maps indicate that $PM_{2.5}$ concentrations within the Bromsgrove District are well below the interim and legally binding targets set out in the Air Quality Strategy (England) 2023:

| Pollutant and Metric | Target | Target Year |
|---|---|---|
| **$PM_{2.5}$ annual mean concentration** | Interim target: 12µg/$m^3$ | 2028 |
| **$PM_{2.5}$ annual mean concentration** | Legally binding target: 10µg/$m^3$ | 2040 |

WRS has reviewed the fraction of mortality attributable to particulate air pollution (indicator D01) as published by Public Health England as part of the Public Health Outcomes Framework. The fraction of mortality attributable to particulate emissions in Malvern Hills District in 2023 (the most recent year available) was 3.8% MHDC. This falls below the national figure for England (5.2% in 2023) and below the figure for the West Midlands

region (5.1% in 2022). Further information on the Public Health Outcomes Framework that examines indicators that help us understand trends in public health can be found at Public Health Outcomes Framework - OHID (phe.org.uk)

There are currently no declared smoke control areas operating within the Malvern District Council area. More information, maps and guides on the type of fuels that can be used can be found at: Smoke Control Areas | Worcestershire Regulatory Services (worcsregservices.gov.uk)

WRS hold no records of substantiated complaints of nuisance from smoke attributable to wood burning stoves in residential developments in Malvern Hills district in 2024.

In light of the above, no additional actions are currently planned by Malvern Hills District Council in relation to the reduction of $PM_{2.5}$ levels. However, it is anticipated that any action taken to improve $NO_2$ levels across the region, will likely result in a linked improvement in $PM_{2.5}$ levels. Additionally, an interim Air Quality Strategy will pay due regard to the new responsibilities on local authorities for $PM_{2.5,}$ outlined within the revised national Air Quality Strategy (25 August 2023) which can be found at National Air Quality Strategy.

# 3 Air Quality Monitoring Data and Comparison with Air Quality Objectives and National Compliance

This section sets out the monitoring undertaken within 2024 by Malvern Hills District Council and how it compares with the relevant air quality objectives. In addition, monitoring results are presented for a five-year period between 2020 and 2024 to allow monitoring trends to be identified and discussed.

## 3.1 Summary of Monitoring Undertaken

### 3.1.1 Automatic Monitoring Sites

Malvern Hills District Council did not undertake any automatic (continuous) monitoring that are recognised by Defra for measuring against ambient air quality directives during 2024.

### 3.1.2 Non-Automatic Monitoring Sites

Malvern Hills District Council undertook non-automatic (i.e. passive) monitoring of $NO_2$ at 9 sites during 2024. Table A.2 in Appendix A presents the details of the non-automatic sites. An additional tube was added in 2024 closer to the Malvern town centre where air quality was more likely to be a relevant consideration.

Maps showing the location of the monitoring sites are provided in Appendix D. Further details on Quality Assurance/Quality Control (QA/QC) for the diffusion tubes, including bias adjustments and any other adjustments applied (e.g. annualisation and/or distance correction), are included in Appendix C.
The results of the 2024 monitoring have not increased the likelihood of an AQMA being declared in the Malvern Hills District as air pollutant concentrations remain substantially below current air quality objectives and standards.

## 3.2 Individual Pollutants

The air quality monitoring results presented in this section are, where relevant, adjusted for bias, annualisation (where the annual mean data capture is below 75% and greater than 25%), and distance correction. Further details on adjustments are provided in Appendix C.

### 3.2.1 Nitrogen Dioxide ($NO_2$)

Table A.3 and Table A.4 in Appendix A compare the ratified and adjusted monitored $NO_2$ annual mean concentrations for the past five years with the air quality objective of 40µg/m$^3$. Note that the concentration data presented represents the concentration at the location of the monitoring site, following the application of bias adjustment and annualisation, as required (i.e. the values are exclusive of any consideration to fall-off with distance adjustment).

For diffusion tubes, the full 2024 dataset of monthly mean values is provided in Appendix B. Note that the concentration data presented in Table B.1 includes distance corrected values, only where relevant.

During 2024, concentrations of $NO_2$ were monitored at 9 locations across the Malvern District. The highest recorded mean concentrations were 27.7µg/m$^3$ at UP1 (located in Old Street, Upton-upon-Severn), 26.4µg/m$^3$ M11 (in Powick) and 25.3µg/m$^3$ at UP3 (located in Old Street, Upton-upon-Severn).
The lowest concentration was 7.5µg/m$^3$ at M3N which is an urban background site in Teme Lane, Malvern. The results demonstrate that $NO_2$ concentrations within the Malvern Hills District area are significantly below the $NO_2$ air quality objective of 40µg/m$^3$ during 2024. In comparison with 2023, the annual results are mixed with 4 locations increasing slightly, 3 locations decreasing slightly and 1 identical result.
The impact upon concentration levels, given the restrictions on traffic and general commercial/social activity that were in place due to Covid-19 within the 5-year period (2020-2024) are reflected in the lower concentrations levels for 2020/2021. Across all locations, there is an average decrease of approximately 2.8% between 2023 and 2024 (excluding M20 for which there is no record before 2023 and BNG1 which was added in 2024).
Long term trend analysis over the 5-year period, 2020 to 2024, suggest concentrations from 2024 appear to be broadly similar to the pre-pandemic levels recorded in 2019 following a reduction in years 2020 and 2021. No annual mean averages greater than 60µg/m$^3$ have been recorded indicating that it is extremely unlikely that there have been any exceedances of the 1-hour mean objective for $NO_2$ at any monitoring sites. The 60µg/m$^3$ value is a surrogate figure to indicate exceedances of the 1-hour objective based on annual average concentrations. The concentrations recorded across the district in 2024 are below 50% of the surrogate figure.

A new location (M20) was established near to the signalised crossroads at Graham Road/Church Street, Great Malvern in early 2023 following concerns raised by members of the public that the busiest area in Malvern was not being monitored. Historical monitoring has taken place in that vicinity over a number of years and has not highlighted a problem. However, the last monitoring ceased in 2016 so has been reinstated to ascertain current conditions at the site. The annual mean concentration during 2023 at this new site (M20) was 18.8µg/$m^3$ dropping to 18.7µg/$m^3$ in 2024. A new location (BNG1) was established near to the roundabout at Barnards Green, Malvern in early 2024, a busy area for traffic in an area of residential properties above retail premises and in proximity to two schools.

### 3.2.2 Particulate Matter ($PM_{10}$)

There were no automatic $PM_{10}$ monitoring stations within Malvern Hills District in 2024 that are recognised by Defra for measuring against ambient air quality directives.

### 3.2.3 Particulate Matter ($PM_{2.5}$)

There were no automatic $PM_{2.5}$ monitoring stations within Malvern Hills District in 2024 that are recognised by Defra for measuring against ambient air quality directives.

### 3.2.4 Sulphur Dioxide ($SO_2$)

$SO_2$ concentrations have not been monitored within the district in 2024.

# Appendix A: Monitoring Results

## Table A.1 – Details of Automatic Monitoring Sites

Malvern Hills District does not have any certified Automatic Monitoring Sites.

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

| Diffusion Tube ID | Site Name | Site Type | X OS Grid Ref (Easting) | Y OS Grid Ref (Northing) | 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) |
|---|---|---|---|---|---|---|---|---|---|---|
| UP1 | 2 Old Street, WR8 0HA | Roadside | 385171 | 240555 | $NO_2$ | No | 0m | 2m | No | 2.10m |
| UP3 | 15 Old Street, Upton, WR8 0HN | Roadside | 385157 | 240508 | $NO_2$ | No | 0m | 1.25m | No | 1.98m |
| M3N | Teme Avenue, WR14 2XA | Urban Background | 379790 | 245677 | $NO_2$ | No | 7m | 1m | No | 2.20m |
| M2 | Outside Santler Court,Howsell Road, Malvern Link, WR14 1US (Give way sign 445) | Roadside | 378320 | 247570 | $NO_2$ | No | 5m | 1m | No | 2.20m |
| M5N | Richmond Road, Malvern Link, WR14 1NE | Roadside | 378520 | 247753 | $NO_2$ | No | 0.1m | 4.5m | No | 2.30m |
| M11 | Old Post Office, Powick (on LP 233 opp Murco Garage, WR2 4QR | Roadside | 383231 | 251684 | $NO_2$ | No | 7m | 2.1m | No | 2.10m |

| Diffusion Tube ID | Site Name | Site Type | X OS Grid Ref (Easting) | Y OS Grid Ref (Northing) | 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) |
|---|---|---|---|---|---|---|---|---|---|---|
| M14 | 278 Worcester Road, Malvern, WR14 1BD on drainpipe next to bay window | Roadside | 379156 | 248248 | $NO_2$ | No | 0m | 5.9 | No | 3.2m |
| M20 | On sign o/s Koko Nail Boutique, Graham Road | Roadside | 377701 | 246066 | $NO_2$ | No | 0m | 2.0m | No | 2.2m |
| BNG1 | Barnards Green Road Malvern (Lampost by Co-op), WR14 3LY | Roadside | 378791 | 245601 | $NO_2$ | No | 0m | 3.4m | No | 2.0m |

**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.3 – Annual Mean $NO_2$ Monitoring Results: Automatic Monitoring (µg/m$^3$)

Malvern Hills District does not have any certified Automatic Monitoring Sites.

## Table A.4 – Annual Mean $NO_2$ Monitoring Results: Non-Automatic Monitoring (µg/m$^3$)

| Diffusion Tube ID | X OS Grid Ref (Easting) | Y OS Grid Ref (Northing) | Site Type | Valid Data Capture for Monitoring Period (%) (1) | Valid Data Capture 2024 (%) (2) | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|
| UP1 | 385171 | 240555 | Roadside | 92.5 | 92.5 | 21.5 | 23.0 | 27.2 | 26.0 | 27.7 |
| UP3 | 385157 | 240508 | Roadside | 100.0 | 100.0 | 20.9 | 22.7 | 27.4 | 25.6 | 25.3 |
| M3N | 379790 | 245677 | Urban Background | 83.0 | 83.0 | 6.6 | 6.5 | 7.7 | 7.1 | 7.5 |
| M2 | 378320 | 247570 | Roadside | 92.5 | 92.5 | 15.7 | 17.3 | 20.2 | 19.6 | 19.6 |
| M5N | 378520 | 247753 | Roadside | 100.0 | 100.0 | 16.4 | 18.7 | 22.3 | 21.3 | 21.9 |
| M11 | 383231 | 251684 | Roadside | 100.0 | 100.0 | 20.7 | 21.4 | 25.4 | 26.1 | 26.4 |
| M14 | 379156 | 248248 | Roadside | 100.0 | 100.0 | 13.5 | 16.1 | 17.7 | 17.5 | 17.4 |
| M20 | 377701 | 246066 | Roadside | 90.6 | 90.6 | | | | 18.8 | 18.7 |
| BNG1 | 378791 | 245601 | Roadside | 100.0 | 100.0 | | | | | 19.9 |

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

☒ **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:**

The annual mean concentrations are presented as µg/$m^3$.

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

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

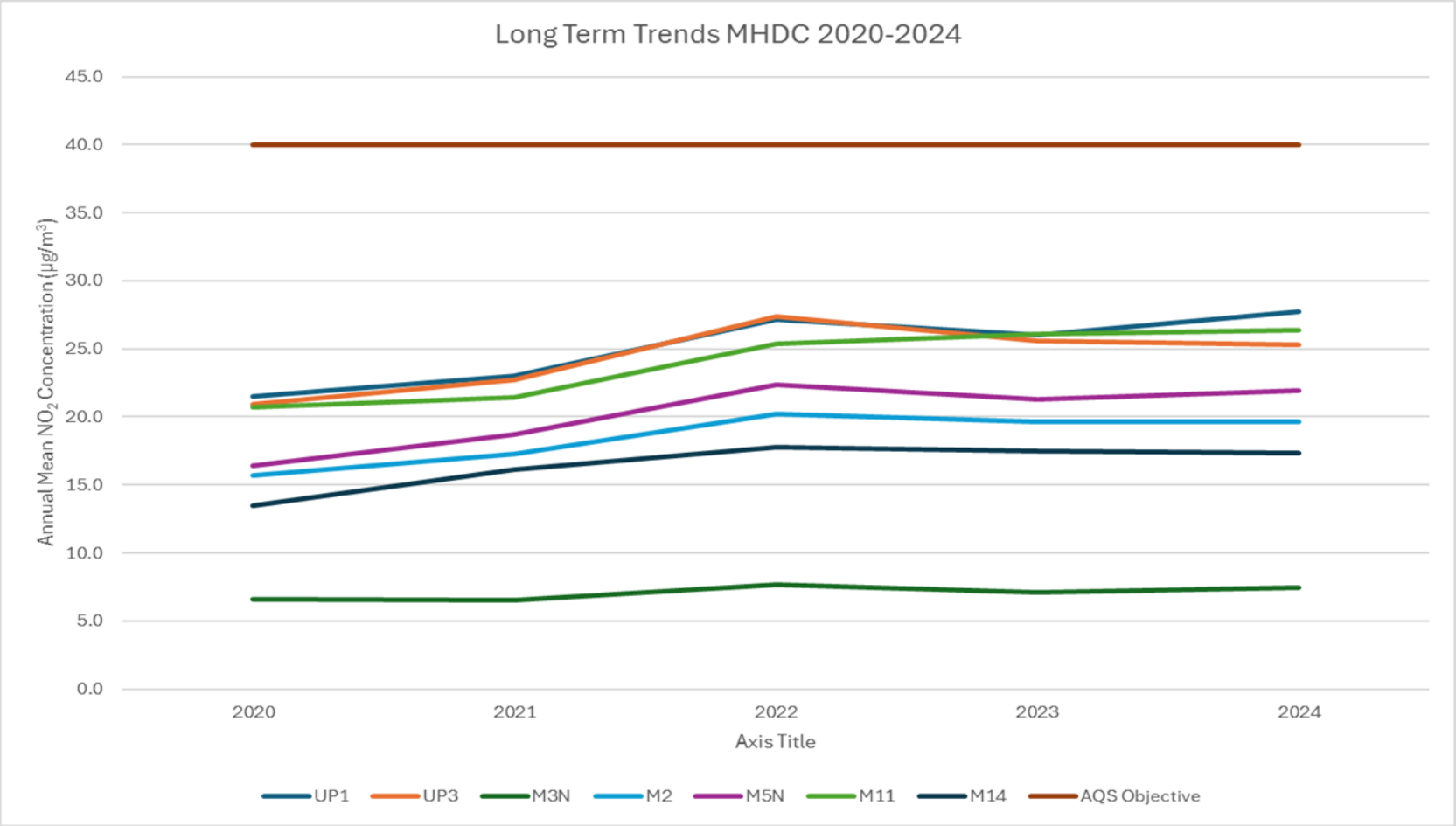
Means for diffusion tubes have been corrected for bias. All means have been "annualised" as per LAQM.TG22 if valid data capture for the full calendar year is less than 75%. See Appendix C for details.

Concentrations are those at the location of monitoring and not those following any fall-off with distance adjustment.

(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 – Trends in Annual Mean $NO_2$ Concentrations**



Appendix B: Full Monthly Diffusion Tube Results for 2024

**Table B.1 – $NO_2$ 2024 Diffusion Tube Results (µg/m$^3$)**

| DT ID | X OS Grid Ref (Easting) | Y OS Grid Ref (Northing) | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual Mean: Raw Data | Annual Mean: Annualised and Bias Adjusted (1.03) | Annual Mean: Distance Corrected to Nearest Exposure | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| UP1 | 385171 | 240555 | 30.2 | 32.0 | 24.3 | | 25.6 | 24.0 | 25.8 | 24.0 | 23.5 | 31.2 | 30.8 | 24.4 | 26.9 | 27.7 | - | |
| UP3 | 385157 | 240508 | 31.0 | 26.0 | 23.2 | 21.4 | 23.8 | 21.0 | 20.9 | 19.0 | 26.2 | 28.5 | 29.9 | 23.8 | 24.6 | 25.3 | - | |
| M3N | 379790 | 245677 | 10.1 | 9.4 | 6.7 | | | 3.2 | 4.3 | 4.1 | 6.0 | 8.2 | 12.6 | 8.1 | 7.3 | 7.5 | - | |
| M2 | 378320 | 247570 | 19.9 | 19.9 | 19.4 | 16.4 | 19.7 | | 14.6 | 14.3 | 22.3 | 24.1 | 22.7 | 16.1 | 19.0 | 19.6 | - | |
| M5N | 378520 | 247753 | 23.4 | 24.8 | 21.7 | 18.3 | 20.0 | 18.8 | 17.5 | 18.6 | 19.8 | 24.2 | 25.9 | 22.1 | 21.3 | 21.9 | - | |
| M11 | 383231 | 251684 | 32.5 | 28.4 | 26.3 | 21.5 | 23.1 | 18.4 | 20.1 | 20.7 | 26.8 | 30.4 | 32.4 | 26.7 | 25.6 | 26.4 | - | |
| M14 | 379156 | 248248 | 20.6 | 21.4 | 18.6 | 13.8 | 17.2 | 11.3 | 13.6 | 12.5 | 15.5 | 21.7 | 19.6 | 16.6 | 16.8 | 17.4 | - | |
| M20 | 377701 | 246066 | 19.2 | 22.2 | 20.7 | 15.4 | | 14.2 | 16.7 | 16.0 | 16.7 | 22.6 | 17.1 | 19.1 | 18.2 | 18.7 | - | |
| BNG1 | 378791 | 245601 | 21.7 | 23.4 | 21.2 | 15.9 | 17.2 | 15.9 | 16.1 | 15.8 | 18.5 | 23.3 | 25.2 | 17.6 | 19.3 | 19.9 | - | |

☒ **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.**

☐ **National bias adjustment factor used.**

☒ **Where applicable, data has been distance corrected for relevant exposure in the final column.**

☒ **Malvern Hills District Council confirm that all 2024 diffusion tube data has been uploaded to the Diffusion Tube Data Entry System.**

**Notes:**

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

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

See Appendix C for details on bias adjustment and annualisation.

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

## New or Changed Sources Identified Within Malvern Hills District Council During 2024

Malvern Hills District Council has not identified any new sources relating to air quality within the reporting year of 2024

## Additional Air Quality Works Undertaken by Malvern Hills District Council During 2024

Malvern Hills District Council has not completed any additional works within the reporting year of 2024.

## QA/QC of Diffusion Tube Monitoring

The following UKAS accredited company provided Malvern Hills District Council with nitrogen dioxide diffusion tubes and analysis in 2023:

Gradko International Limited

St. Martins House

77 Wales Street

Winchester

SO23 0RH

Email: diffusion@gradko.com

The 20% Triethanolamine (TEA) / De-ionised Water preparation method is used.

Gradko International Limited participate in the AIR $NO_2$ Proficiency Testing Scheme (AIR-PT). All monitoring undertaken has been completed in accordance with the 2024 Diffusion Tube Monitoring Calendar, i.e. on or within ± 2 days of the specified date.

## Diffusion Tube Annualisation

All diffusion tube monitoring locations within Malvern Hills District recorded data capture in excess 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

The diffusion tube data presented within the 2024 ASR have been corrected for bias using an adjustment factor. Bias represents the overall tendency of the diffusion tubes to under or over-read relative to the reference chemiluminescence analyser. LAQM.TG22 provides guidance with regard to the application of a bias adjustment factor to correct diffusion tube monitoring. Triplicate co-location studies can be used to determine a local bias factor based on the comparison of diffusion tube results with data taken from NOx/$NO_2$ continuous analysers. Alternatively, the national database of diffusion tube co-location surveys provides bias factors for the relevant laboratory and preparation method.

Malvern Hills District Council have applied a local bias adjustment factor of 1.03 to the 2024 monitoring data. A summary of bias adjustment factors used by Malvern Hills District Council over the past five years is presented in Table C.1 below.

WRS has determined the appropriate local bias adjustment factor utilising the Diffusion Tube Data Processing Tool v5.3. The site used for the colocation study is at Wyre Forest House, Kidderminster which is the Head Office for WRS. The installation is co-located with three diffusion tubes and is largely run and managed for the purpose of undertaking a local bias adjustment factor for the county. WRS are responsible for maintaining the monitoring network across the 6 district councils within Worcestershire and therefore the handling and processing of the diffusion tubes is the same for each area.

The local bias adjustment factor has been used as it is more conservative compared with the national bias adjustment factor (0.84, Defra published National Diffusion Tube Bias Adjustment Spreadsheet Version 04/25). This approach is consistent with the two previous ASRs and undertaken following consultation with Defra LAQM helpdesk and technical guidance.

### Table C.1 – Bias Adjustment Factor

| Monitoring Year | Local or National | If National, Version of National Spreadsheet | Adjustment Factor |
|---|---|---|---|
| **2024** | Local | - | 1.03 |
| **2023** | Local | - | 0.97 |
| **2022** | Local | - | 0.97 |
| **2021** | National | 03/22 | 0.84 |
| **2020** | National | 03/21 | 0.81 |

### Table C.2 – Local Bias Adjustment Calculation

| | Local Bias Adjustment Input 1 |
|---|---|
| **Periods used to calculate bias** | 12 |
| **Bias Factor A** | 1.03 (0.97 - 1.08) |
| **Bias Factor B** | -3% (-8% - 3%) |
| **Diffusion Tube Mean (µg/m$^3$)** | 11.8 |
| **Mean CV (Precision)** | 2.8% |
| **Automatic Mean (µg/m$^3$)** | 12.1 |
| **Data Capture** | 98% |
| **Adjusted Tube Mean (µg/m$^3$)** | 12 (11-13) |

**Notes:**

A single local bias adjustment factor has been used to bias adjust the 2024 diffusion tube results.

### $NO_2$ Fall-off with Distance from the Road

Wherever possible, monitoring locations are representative of exposure. However, where this is not possible, the $NO_2$ concentration at the nearest location relevant for exposure has been estimated using the Diffusion Tube Data Processing Tool/$NO_2$ fall-off with distance calculator available on the LAQM Support website. Where appropriate, non-automatic annual mean $NO_2$ concentrations corrected for distance are presented in Table B.1. No diffusion tube $NO_2$ monitoring locations within Malvern Hills District required distance correction during 2024.

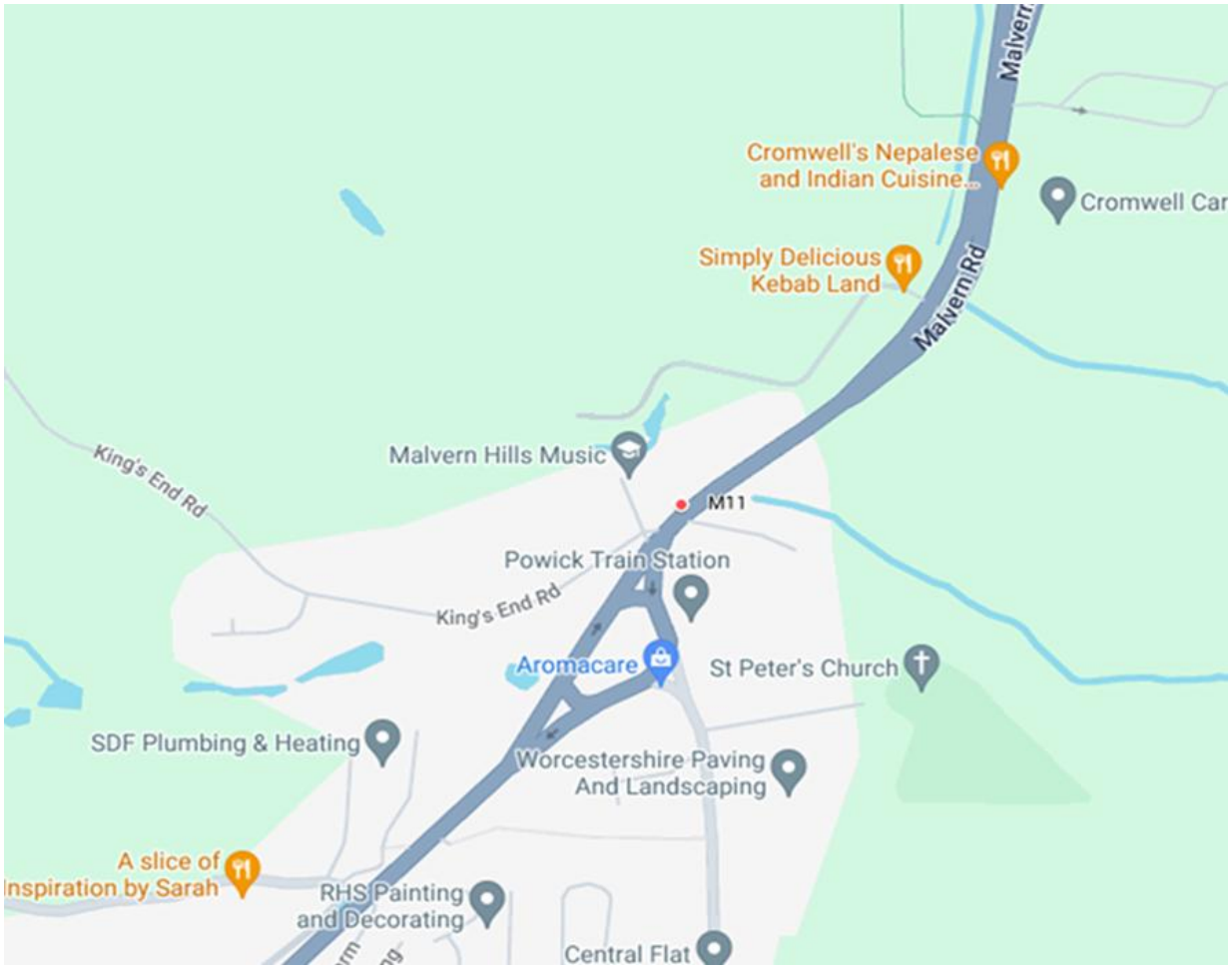
## QA/QC of Automatic Monitoring

No automatic monitoring has been undertaken

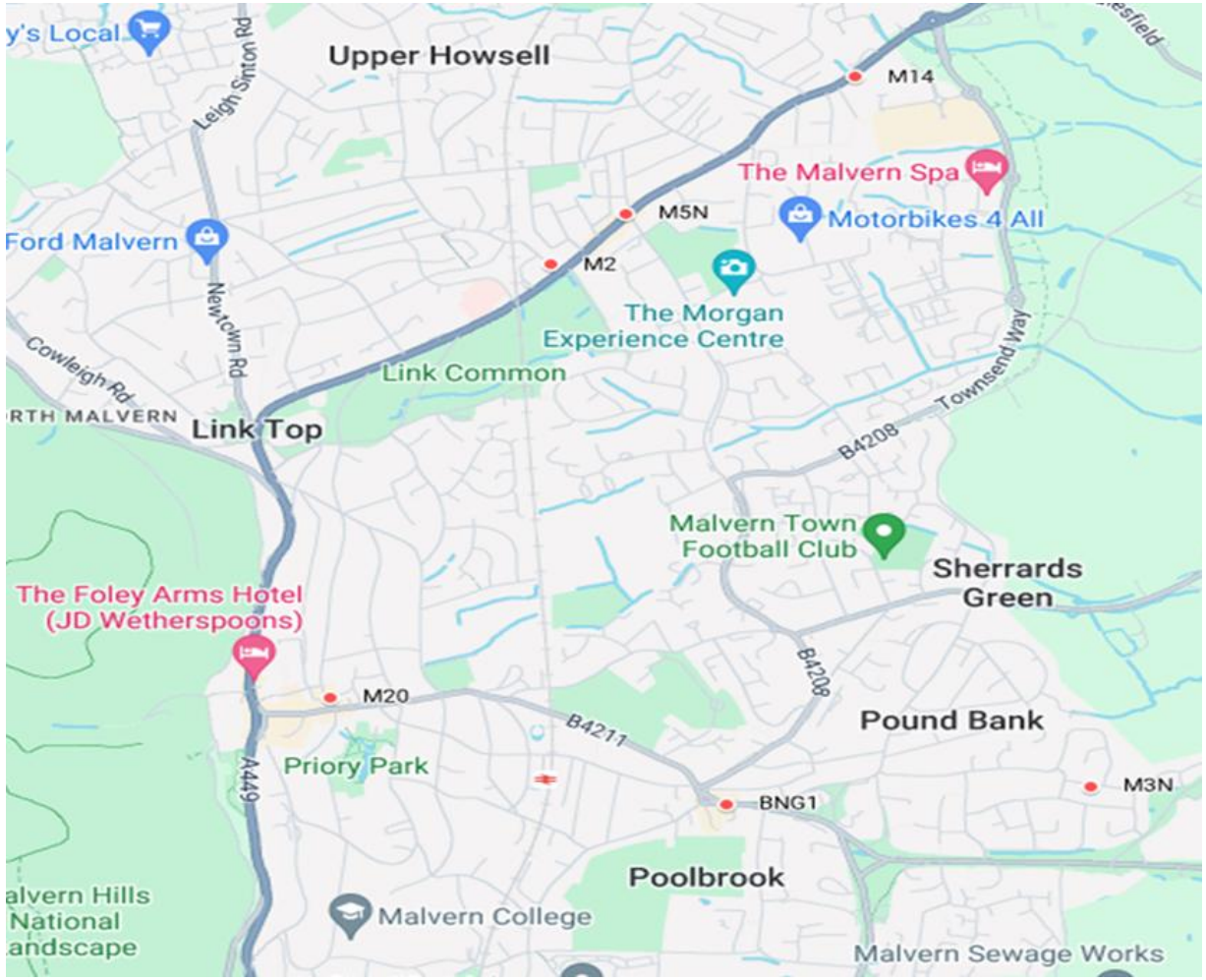
# Appendix D: Map(s) of Monitoring Locations and AQMAs

## Figure D.1 – Map of Non-Automatic Monitoring Site

**M11** is on Malvern Road near Powick and marked on the map below



**M2, M3N, M5N, M14, M20, BNG1** are located on the map below



**UP1 and UP3** are positioned in Old Street, Upton and marked in the map below

# Appendix E: Summary of Air Quality Objectives in England

### Table E.1 – Air Quality Objectives in England[7]

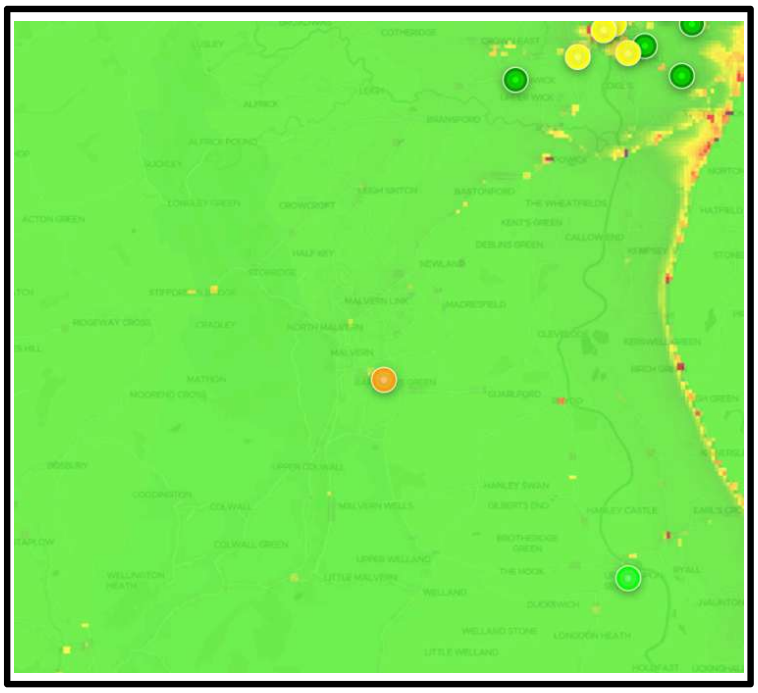
| Pollutant | Air Quality Objective: Concentration | Air Quality Objective: Measured as |
|---|---|---|
| Nitrogen Dioxide ($NO_2$) | 200µg/$m^3$ not to be exceeded more than 18 times a year | 1-hour mean |
| Nitrogen Dioxide ($NO_2$) | 40µg/$m^3$ | Annual mean |
| Particulate Matter ($PM_{10}$) | 50µg/$m^3$, not to be exceeded more than 35 times a year | 24-hour mean |
| Particulate Matter ($PM_{10}$) | 40µg/$m^3$ | Annual mean |
| Sulphur Dioxide ($SO_2$) | 350µg/$m^3$, not to be exceeded more than 24 times a year | 1-hour mean |
| Sulphur Dioxide ($SO_2$) | 125µg/$m^3$, not to be exceeded more than 3 times a year | 24-hour mean |
| Sulphur Dioxide ($SO_2$) | 266µg/$m^3$, not to be exceeded more than 35 times a year | 15-minute mean |

[7] The units are in microgrammes of pollutant per cubic metre of air (µg/$m^3$).

# Appendix F: Low-cost Sensor Results for 2024

Worcestershire
Regulatory Services
*Supporting and protecting you*

# Low-Cost Air Quality Sensors Measurements 2024: Malvern Hills



Public Portal: [Worcestershire Air | EarthSense]

## Project Information

Real time air quality monitoring for 3-year period funded by Defra Air Quality Grant (2022-23) and 10% match funding by each Worcestershire district council. Low-cost sensors (Zephyrs) installed and maintained by Earthsense who also provide real time data portal. Sensors were installed between January and May 2024.

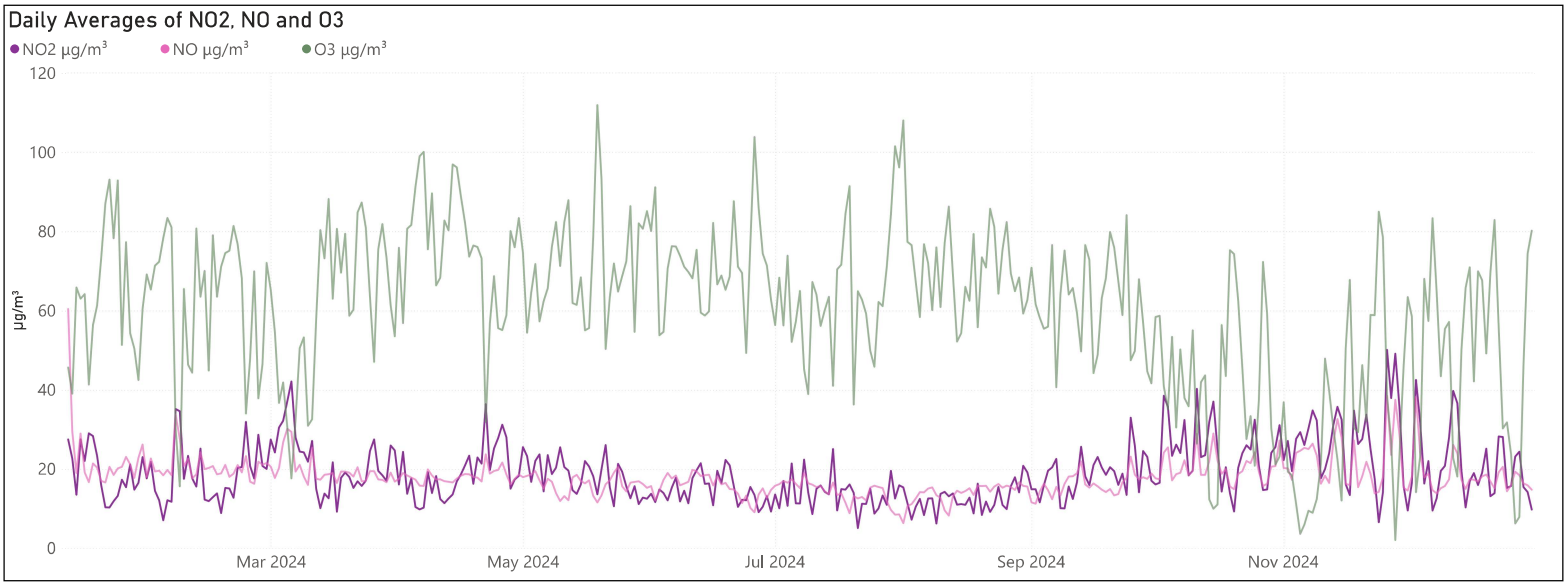
## General information

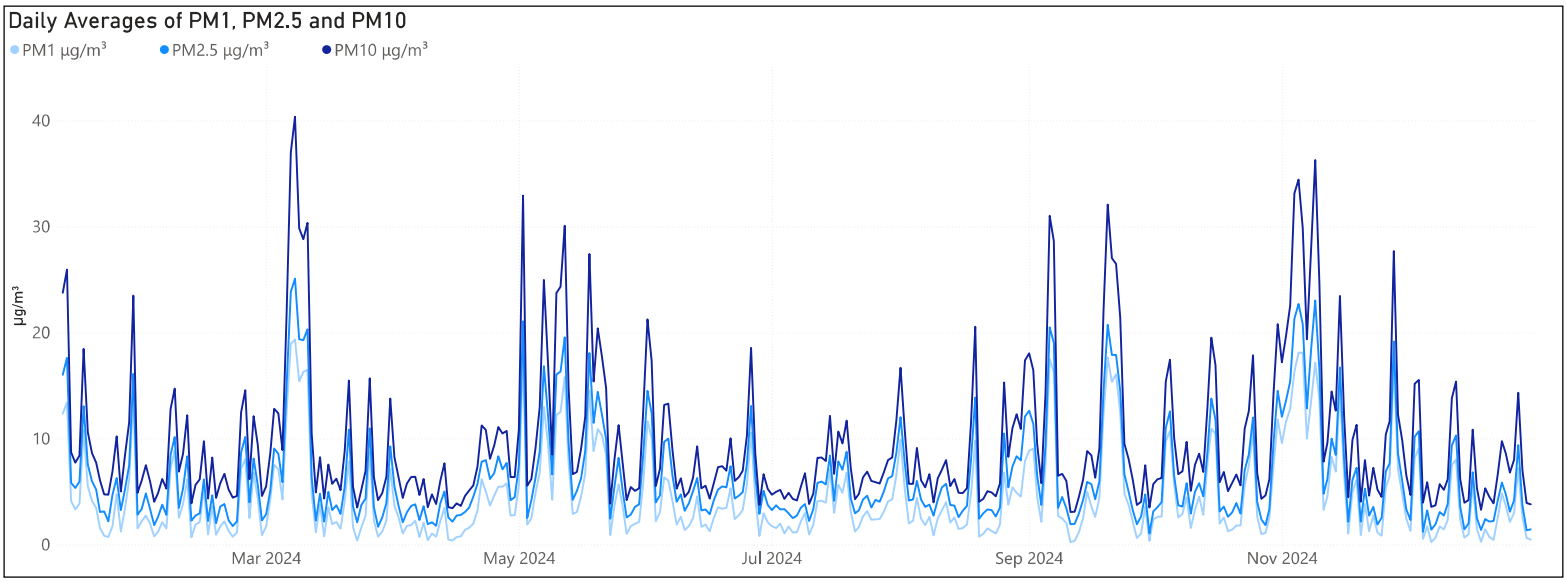
Zephyrs are one of the available low-cost sensors that have been certified as suitable for indicative monitoring for particulate matter within the UK using the Environment Agency's Indicative instrument certification scheme (MCERTS).

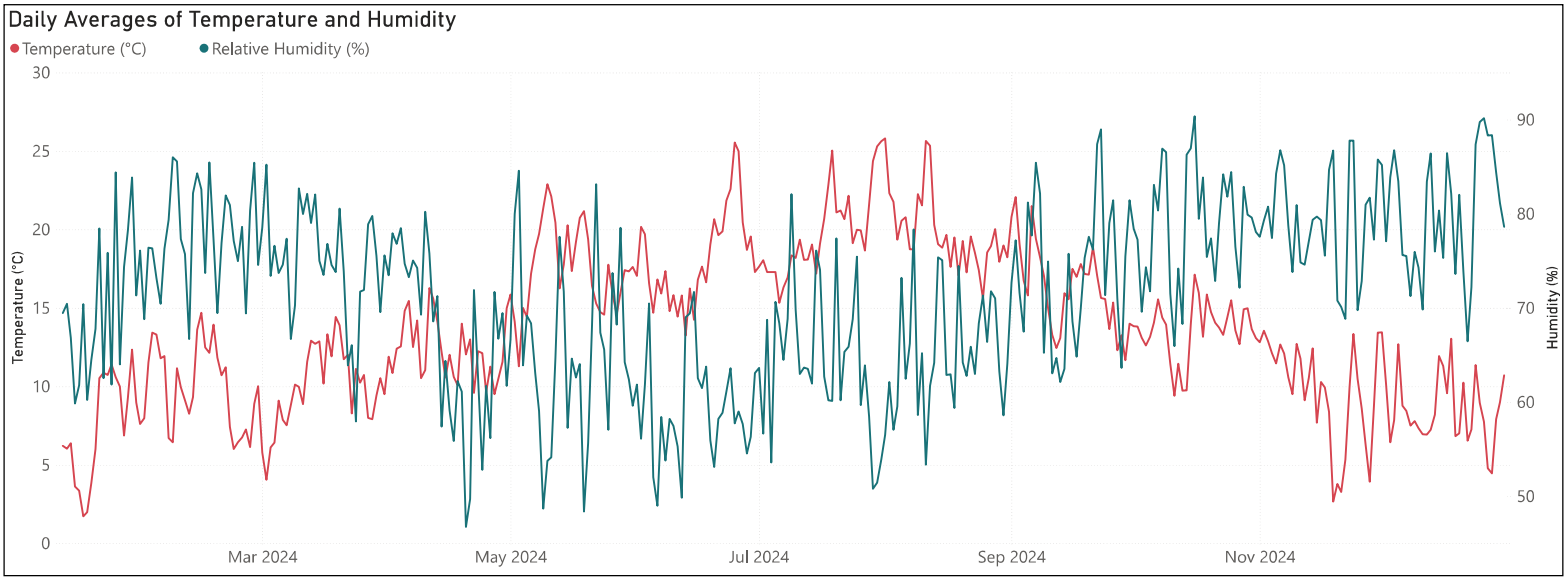
While low-cost sensors can provide useful indicative data, at present they are not approved for use in statutory legal reporting (LAQM) of data against the National air quality objectives. as they are not accurate enough to meet the expanded uncertainty requirements of equivalent [scientific reference] instruments. However, Defra recognise there is growing interest in using these sensors among local authorities and are looking into producing a new FAQ on the use of low-cost sensors to make the position clearer.

# Barnard's Green Road - Malvern

Worcestershire Regulatory Services
*Supporting and protecting you*



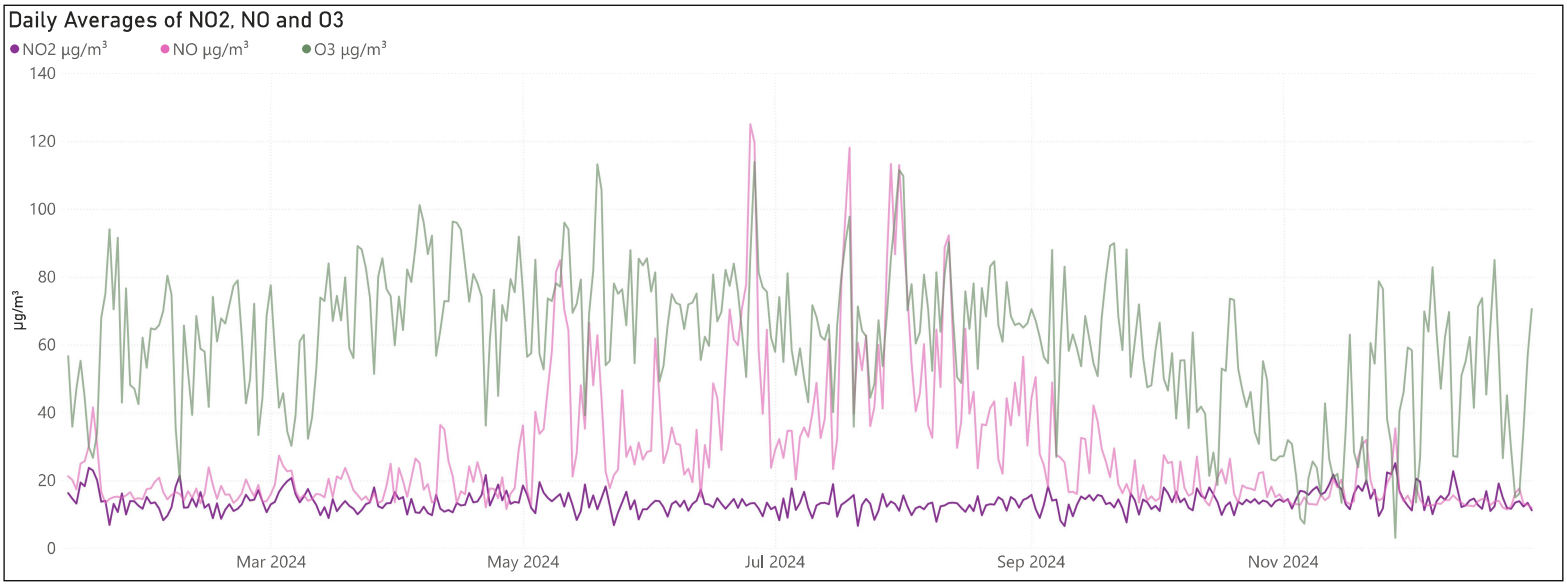



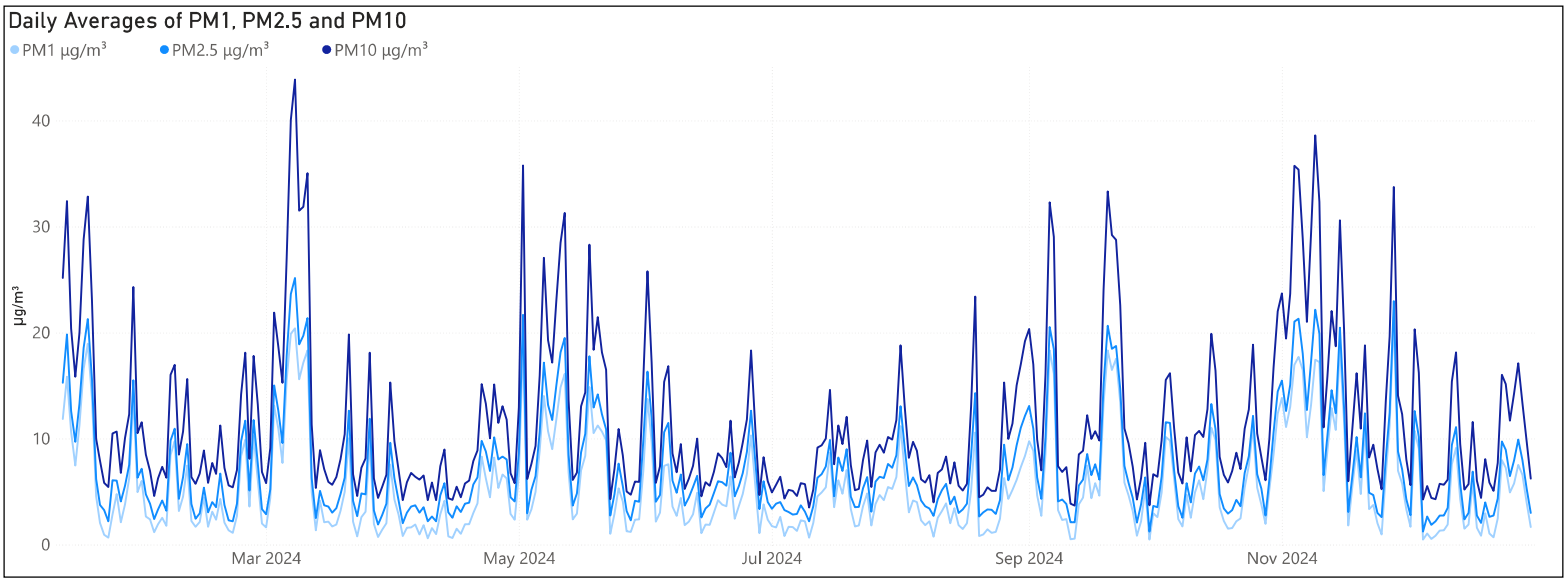

## Yearly Averages

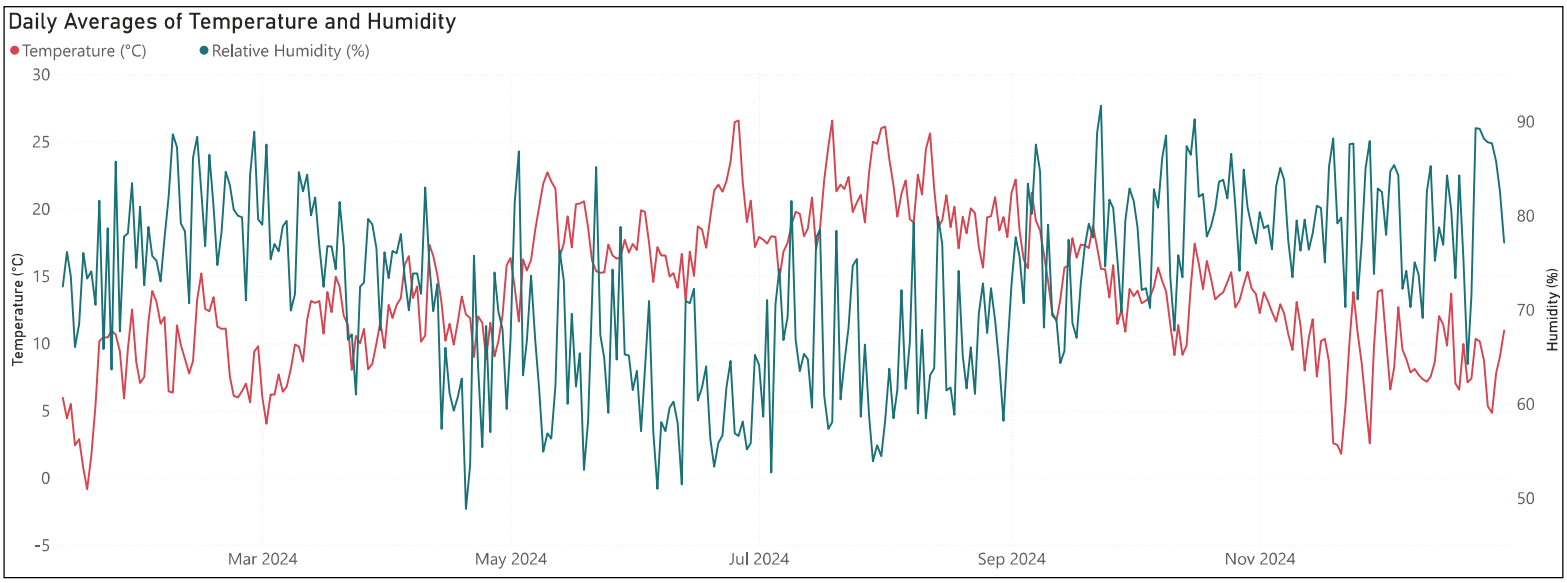
| | | | |
|---|---|---|---|
| **18.98** Average NO2 µg/m³ | **18.06** Average NO µg/m³ | **60.33** Average O3 µg/m³ | **13.81** Average Temperature (°C) |
| **4.62** Average PM1 µg/m³ | **6.45** Average PM2.5 µg/m³ | **9.84** Average PM10 µg/m³ | **71.31** Average Relative Humidity (%) |

# School Lane - Upton-upon-Severn

Worcestershire Regulatory Services
*Supporting and protecting you*



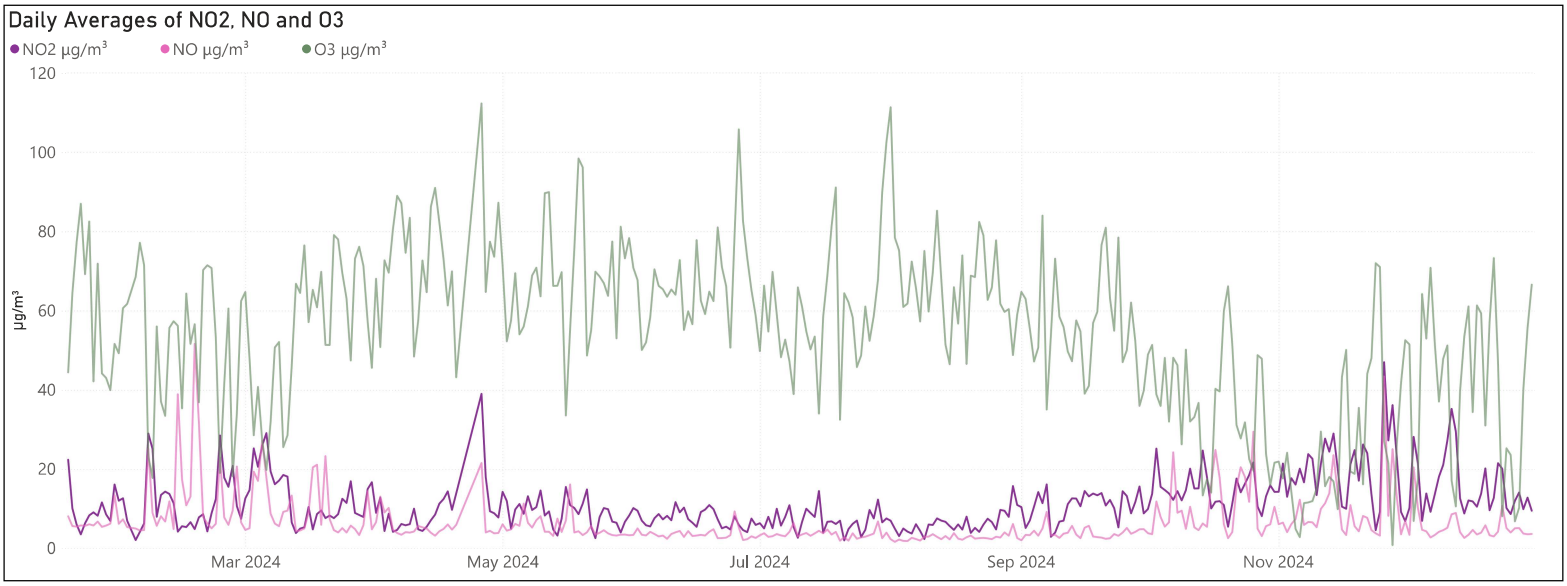



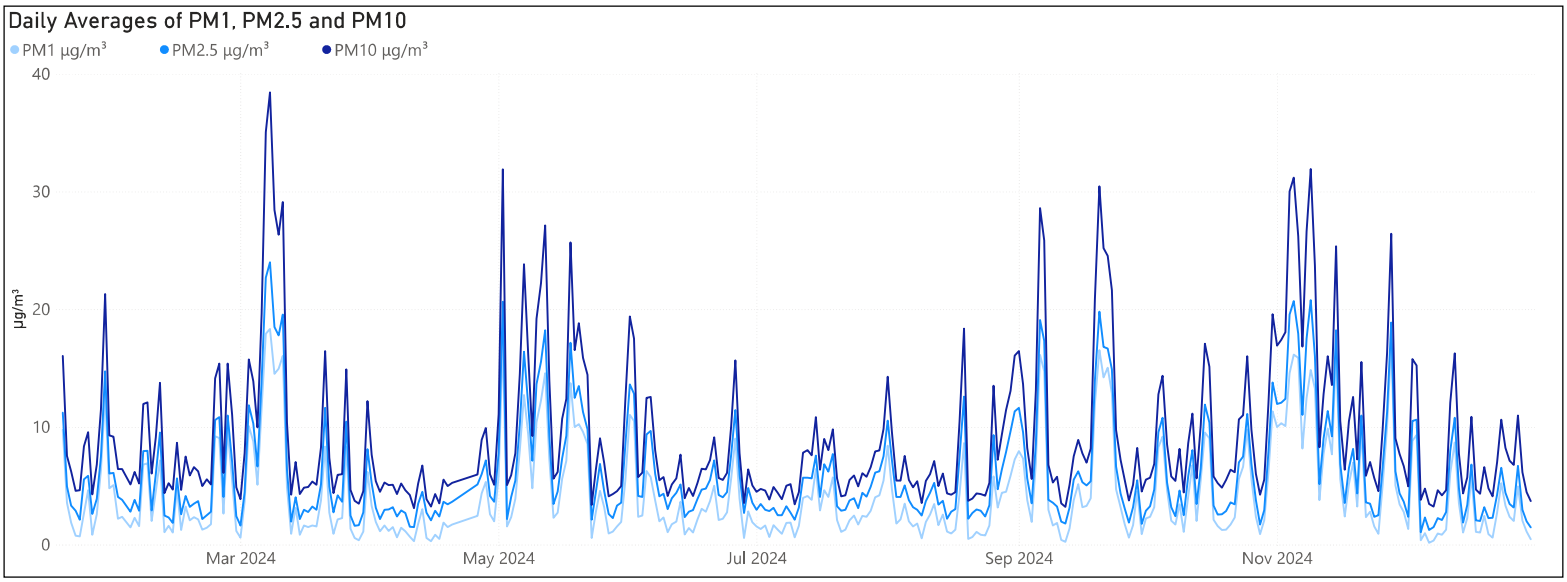

## Yearly Averages

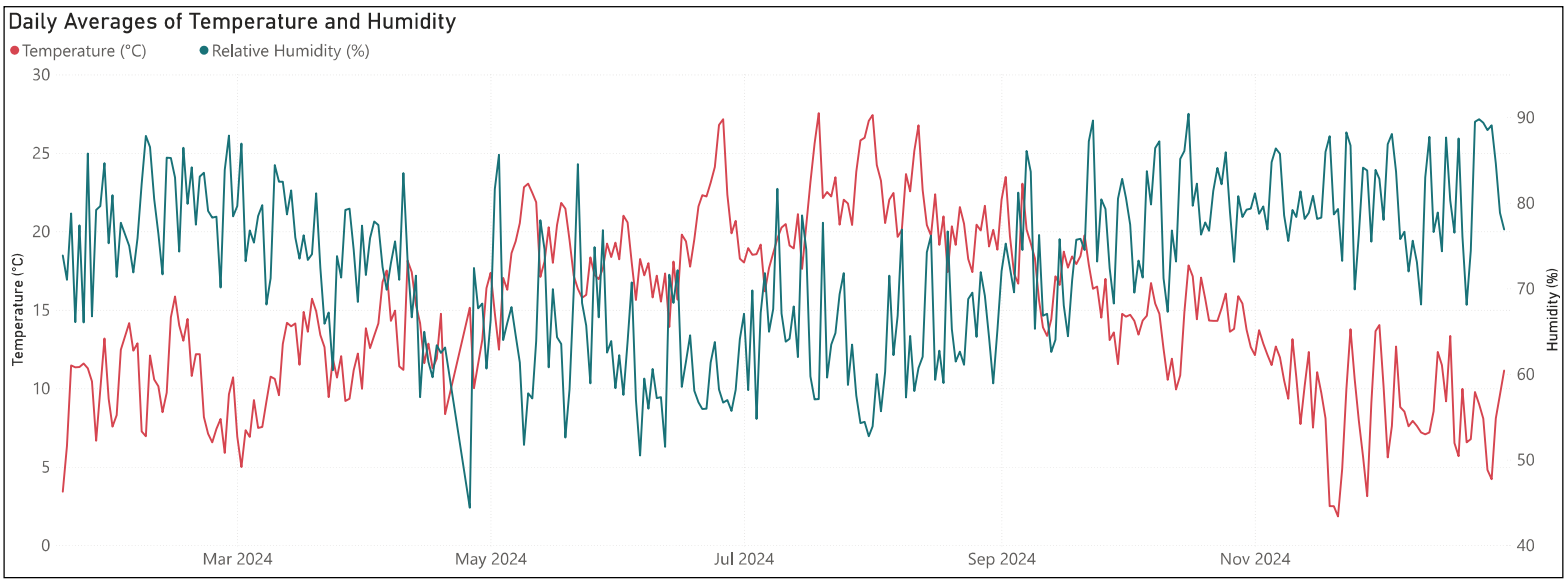
| | | | |
|---|---|---|---|
| 13.78<br>Average NO2 µg/m³ | 28.51<br>Average NO µg/m³ | 61.03<br>Average O3 µg/m³ | 13.92<br>Average Temperature (°C) |
| 5.57<br>Average PM1 µg/m³ | 7.37<br>Average PM2.5 µg/m³ | 11.78<br>Average PM10 µg/m³ | 72.68<br>Average Relative Humidity (%) |

# Upper Wick Lane - Rushwick

Worcestershire Regulatory Services
*Supporting and protecting you*




## Yearly Averages

| | | | |
|---|---|---|---|
| 11.29<br>Average NO2 µg/m³ | 6.59<br>Average NO µg/m³ | 54.37<br>Average O3 µg/m³ | 14.92<br>Average Temperature (°C) |
| 4.40<br>Average PM1 µg/m³ | 6.15<br>Average PM2.5 µg/m³ | 9.31<br>Average PM10 µg/m³ | 72.36<br>Average Relative Humidity (%) |

# Glossary of Terms

| Abbreviation | Description |
|---|---|
| AQAP | Air Quality Action Plan - A detailed description of measures, outcomes, achievement dates and implementation methods, showing how the local authority 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 |
| AQS | Air Quality Strategy |
| ASR | Annual Status Report |
| AURN | Automatic Urban and Rural Network |
| Defra | Department for Environment, Food and Rural Affairs |
| DMRB | Design Manual for Roads and Bridges – Air quality screening tool produced by National Highways |
| DoPH | Director of Public Health |
| LAQM | Local Air Quality Management |
| MHDC | Malvern Hills District Council |
| $NO_2$ | Nitrogen Dioxide |
| $NO_x$ | Nitrogen Oxides |
| $PM_{10}$ | Airborne particulate matter with an aerodynamic diameter of 10µm 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 |
| WRS | Worcestershire Regulatory Services |

# References


- Local Air Quality Management Technical Guidance LAQM.TG22. August 2022. Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland.
- Local Air Quality Management Policy Guidance LAQM.PG22. August 2022. Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland.
- Chemical hazards and poisons report: Issue 28. June 2022. Published by UK Health Security Agency
- Air Quality Strategy – Framework for Local Authority Delivery. August 2023. Published by Defra.
- DEFRA National Diffusion Tube Bias Adjustment Factor Spreadsheet v.03/24
- DEFRA Background Mapping for Local Authorities
- DEFRA Air quality and social deprivation in the UK: an environmental inequalities analysis, 2006
- DEFRA Environmental Improvement Plan 2023, January 2023
- Department for Transport The Road to Zero: Next steps towards cleaner road transport and delivering our Industrial Strategy, July 2018
- Worcestershire Regulatory Services (2013) ‘Air Quality Action Plan for Worcestershire’
- Worcestershire Regulatory Services (2016) ‘Air Quality Action Plan Progress Report for Worcestershire April 2015 – April 2016’
- Worcestershire Regulatory Services (2022) Air Quality Annual Status Report for Malvern Hills District Council