



Llywodraeth Cymru
Welsh Government

Air Quality in Wales 2023/24



Welsh Air Quality Forum
Fforwm Ansawdd Awyr Cymru

Creating a world
fit for the future



This report has been produced by Ricardo on behalf of the
Welsh Government and Welsh Air Quality Forum



Introduction

This is the 21st annual report on air quality in Wales produced by Ricardo under the auspices of the Welsh Air Quality Forum (WAQF) for the Welsh Government. This report aims to provide Welsh citizens and the air quality community with an intuitive summary of Welsh pollution levels, impacts and monitoring during 2023/24. It also details the WAQF's activities alongside any major policy, technical and scientific developments.

More detailed information, data and analysis can be found on the [Welsh Government's website at https://airquality.gov.wales/](https://airquality.gov.wales/). The site contains a database of pollutant data collected by 22 local authorities and is used by thousands of individuals for both commercial and personal purposes. Primary uses include; data usage and download, education on air quality (including impacts and monitoring) and to provide up-to-date live information on local pollution levels. It contains comprehensive data, graphs and information on the health effects of a continually increasing number of monitoring stations and reports 5-day local air quality forecasts. This gives local residents access to reliable and accurate information on the quality of the air they breathe. OpenAir data analysis tools provide a free and open-source tool to analyse, interpret and understand air pollution data.

The user-friendly, interactive map allows users to access and analyse data at a glance.

This report is structured as follows. Chapter 2 presents the WAQF's activities in 2023/24. Chapter 3 summarises important policy developments that took place in 2023/24. Chapter 4 presents key air quality statistics from all monitoring networks in Wales and summarises the data from them. The networks include air quality monitoring stations run by Welsh local authorities, the national monitoring networks run by the Department for Environment, Food and Rural Affairs (Defra) and the Welsh Government. Chapters 5 and 6 discuss and present long-term trends and spatial distribution of air pollutants across the country. Chapter 7 outlines an update on the Local Air Quality Management grant scheme that was launched in the 2021–2022 financial year. Chapter 8 is from Public Health Wales and provides a review of Air Quality and Public Health in 2023/24. For readers wanting to find out more, additional web-based and published sources of information are summarised in Chapter 9.



The WAQF and its activities in 2023/24

The Welsh Air Quality Forum (WAQF) represents the 22 Unitary Councils of Wales and is made up of representatives from Local Authorities, the Welsh Government, Public Health Wales, Natural Resources Wales and several academic institutions. WAQF members direct the operation of the Welsh Air Quality Website and Database, the collection, quality assurance and quality control and dissemination of all data, and the provision of support and training to Local Authorities. The WAQF provides expertise and guidance to ensure that Local Air Quality Management (LAQM) statutory requirements are met and air quality in Wales is reported in an accurate, transparent and timely manner.

WAQF highlights from 2023/24

- The Air Quality in Wales website (<https://airquality.gov.wales>) continues to be a valuable resource providing real-time updates and information
- Use of the website Discussion Forum continues to enable debate and to promote best practice. Topics covered included: discussion on compact Smart sensors; consultation on the Just Transition Framework, air quality episodes such as elevated sulphur dioxide concentrations; consultations on local authorities draft Air Quality Action Plans

WAQF Annual Seminar 2023

The Annual Welsh Air Quality Forum Seminar was held as a hybrid event in 2023 on the 30th of November. Forum members were able to attend the seminar which was held at Glamorgan County Cricket Club – Sophia Gardens or join virtually.

There were 40 WAQF members and delegates attending the event in person. Topics presented were:

- Welsh Government Update
- Local perceptions of greenspaces benefits in Rhyl, North Wales
- Domestic burning
- ‘Low-Cost’ Air Quality Sensor Systems
- High speed air quality analysis and vehicle emission compliance.

Workshops were held during the afternoon sessions on delivering the new ‘Promoting Awareness of Air Pollution Duty’ and ‘Future of Local Air Quality Management’.

PDF’s of these presentations can be found at <https://airquality.gov.wales/reports-seminars/seminars>.



Llyn Ogwen, Snowdonia, North Wales, UK

Welsh Government policy update

Clean Air Plan for Wales and Air Quality in Wales

The Welsh Government is committed to improving air quality and reducing the impacts of air pollution on human health, biodiversity, the natural environment and our economy. In September 2024, and prior to that in April 2023, we published an update report on progress against actions in our Clean Air Plan for Wales – Healthy Air, Healthy Wales. Supporting that report, this Air Quality in Wales update sets out the progress we have made in collaboration with our partners and highlights the next steps we are taking.

Strengthening air quality legislation

The Environment (Air Quality and Soundscapes) (Wales) Act 2024 received Royal Assent in February 2024. The Act includes sections covering national targets, promoting awareness of air pollution, active travel, the national air quality strategy, local air quality management, smoke control, trunk road charging, stationary idling offences and the national strategy on soundscapes.

Priorities over the next 12 months relating to implementation of the Act are:

- Development of new national air quality targets for Wales, taking account of World Health Organisation Guidelines
- A delivery plan setting out how we will promote awareness of, alongside ways of reducing and limiting, the risks associated with air pollution
- Making regulations to set a penalty range for the existing offence of stationary vehicle idling. These regulations will be accompanied by guidance for local authorities and a broader communication campaign
- Guidance for local authorities in relation to legislative changes to the existing smoke control and local air quality management regimes.

Planning guidance to support air quality, noise and soundscape improvements

Between October 2022 and January 2023, we consulted on draft revised planning guidance in the form of 'Technical Advice Note 11: Air Quality, Noise and Soundscape' and 'Supporting Document'

The revised guidance included proposals to:

- Update and replace the existing advice on noise currently contained in Technical Advice Note (TAN) 11: Noise 1997
- Add advice relating to air quality and soundscape
- Issue a supporting document for the TAN on the subject of soundscape design.

Welsh Government officials have been considering the consultation responses to inform changes to the draft TAN ahead of its adoption. The final version of this TAN will also take account of the Environment (Air Quality and Soundscapes) (Wales) Act which was given Royal Assent in early 2024, and the Noise and Soundscape Plan 2023-2028, our national soundscapes strategy which was published in December 2023.

Funding to deliver local air quality improvements

Following the pilot rounds of the Local Air Quality Management Support Fund in 2021 and 2022, the Minister for Climate Change announced the official launch of the Support Fund as a grant fund in April 2023, with total capital and revenue valued at £1m per annum.

A summary of the outcomes of the 2023-2024 projects can be found on page 12.

This grant was replicated for the 2024-2025 scheme year, and a total of five Local Authorities were successful in securing funding for 19 projects.

Monitoring networks and data highlights

The Welsh Government and the Welsh Air Quality Forum (WAQF) maintain a close collaborative relationship with air quality experts and the Department for Environment, Food and Rural Affairs (Defra) to actively oversee and mitigate air pollution within Wales. Figure 4.1 illustrates the annual average long-term trends for nitrogen dioxide (NO₂), fine particles (PM₁₀ and PM_{2.5}) and ozone (O₃) concentrations across Wales. These trends are derived from measurements taken at monitoring sites affiliated with local authorities and the Automatic Urban and Rural Network (AURN), where annual data capture was 75% or greater. With the exception of O₃, concentrations of pollutants have exhibited an overall decline since the pollutant records began. It is worth noting that O₃ qualifies as a regional pollutant, with transboundary characteristics, and as such its regulation falls beyond immediate purview of the Welsh Government and local authorities.

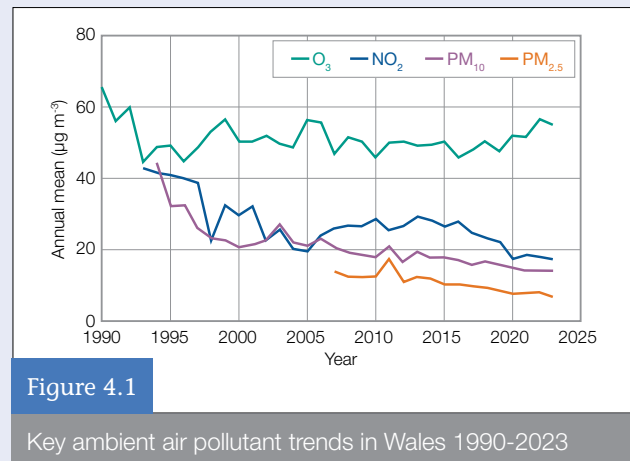
Local authority monitoring

Air quality monitoring in Wales is undertaken by local authorities and through national networks managed by the Welsh Government. There are two main types of air pollution monitoring – automatic monitoring and passive sampling. Automatic monitoring uses continuous analysis techniques to measure and record the ambient concentrations of a range of air pollutants. Passive samplers (such as diffusion tubes) contain a chemical reagent that adsorbs the pollutant from the air. Samplers are exposed for a period of time and analysed in a laboratory. At the start of 2023, there were a total of 37 automatic monitoring sites distributed across Wales that were operated by local authorities.

These sites contain equipment that automatically measures carbon monoxide (CO), nitrogen dioxide (NO₂), sulphur dioxide (SO₂), ozone (O₃), coarse (PM₁₀) and fine (PM_{2.5}) particulate matter. In addition to these, there were several hundred diffusion tubes measuring monthly mean NO₂ levels. Overall, the average data capture for the automatic instruments for 2023 was 87%. A detailed map of the location of these monitoring stations can be found at the end of this report.

Daily Air Quality Index

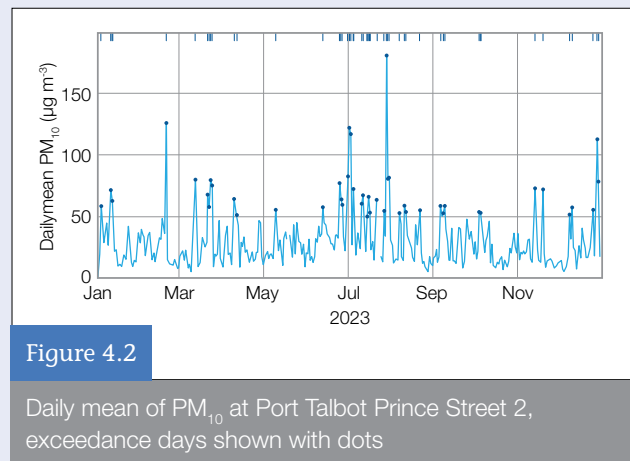
In 2023, ambient concentrations of PM₁₀ were ‘moderate’ on 59 days, ‘high’ on 11 days and ‘very high’ on 9 days (as defined by the Daily Air Quality Index bandings). For PM_{2.5} there was 1 day with ‘moderate’ concentrations, and no days were recorded as ‘high’ or ‘very high’. There were no recorded days with ‘moderate’, ‘high’ or ‘very high’ NO₂ concentrations. SO₂ also had no ‘moderate’, ‘high’ or



‘very high’ levels recorded. For O₃, there were 47 days with ‘moderate’ levels, 1 day recorded as ‘high’ and no days recorded as ‘very high’. Overall, pollution levels in Wales were low for 257 days, moderate for 90 days, high for 9 days and very high for 9 days. Therefore, 70% of the time, pollution levels were low across the whole of Wales. Details of the Daily Air Quality Index banding system used can be found [here](#).

Summary of exceedances

Exceedance statistics, generated from the Welsh Air Quality database, indicate that in 2023 no monitoring sites in Wales exceeded any Air Quality Strategy (AQS) Objective for NO₂, PM_{2.5}, CO, SO₂, benzene or lead. For PM₁₀, one site (Port Talbot Prince Street 2) recorded daily mean PM₁₀ concentrations above 50 µg/m³ on 45 days, thereby exceeding the daily mean objective of 35 days. These exceedances were spread evenly throughout the year as displayed in the graph below.



Six sites in Wales exceeded the AQS Objective for O₃ (100 µg/m³ as a maximum daily 8-hour mean) on more than the permitted 10 occasions. These were Aston Hill, Cardiff Centre, Narberth, Marchlyn Mawr, Port Talbot Margam and Swansea Cwm Level Park. These exceedances mainly occurred across two prominent high-ozone periods during heatwaves in June and September 2023; specifically on the 10th-19th of June and the 3rd-12th of September. This moderate to high ground level ozone air pollution occurred during hot sunny weather with light easterly winds coming from continental Europe.

The National Air Quality Monitoring Networks Operating in Wales

Several national air quality monitoring networks operate across Wales. These networks are used to ensure regulatory requirements are met and to provide information for air quality researchers, the medical community and members of the public.

Automatic Urban and Rural Network

There are 11 air quality monitoring sites in Wales that are part of the UK Automatic Urban and Rural Network (AURN). For gaseous pollutants, the AURN uses the reference methods of measurement defined in the relevant EU directive. For particulate matter, the AURN uses methods that have demonstrated equivalence to the reference method, but which (unlike the reference method) allow continuous monitoring and provision of this information in 'real time'.

UK Urban NO₂ Network

The UK Urban NO₂ Network (UUNN) is an air quality monitoring network that provides measurements of nitrogen dioxide (NO₂) concentrations at urban traffic sites. NO₂ measurement data provided by the UUNN is used to assess compliance against the annual mean NO₂ limit value set out in the Air Quality Standards Regulations (2010). There are currently 3 monitoring sites in Wales.

Heavy Metals Network

There are six monitoring sites in Wales for heavy metals and they belong to the UK Heavy Metals Network. Airborne particulate matter is sampled and analysed for metal concentrations in PM₁₀. The metal concentration data are

then combined with the local meteorological data (such as rainfall) to calculate values for wet deposition (from precipitation), dry deposition (such as dust settling) and cloud deposition (condensation of cloud droplets).

PAH Monitoring Network

In 2023, Wales has five polycyclic aromatic hydrocarbon (PAH) network sites, following the opening of the Margam Youth Centre site this year. These monitor compliance the Air Quality Standards Regulations 2010 which includes a target value of 1 ngm⁻³ for the annual mean concentration of benzo[a]pyrene (C₂₀H₁₂) as a representative PAH, not to be exceeded after 31st December 2012. This network uses the PM₁₀ 'Digitel™' sampler. Ambient air is sampled through glass fibre filters and polyurethane foam pads, which capture the PAH compounds for later analysis in a laboratory.

Black Carbon Network

Black carbon is fine, dark carbonaceous particulate matter produced from the incomplete combustion of materials containing carbon (for example coal, oil and biomass (such as wood)). It is of concern due to possible health impacts and as a suspected contributor to climate change. There is one monitoring site in Wales that measures this parameter. The site, in Cardiff, is part of the Black Carbon Network. This uses an automatic instrument called an aethalometer that measures black carbon directly using a real-time optical transmission technique.

UK Eutrophying and Acidifying Pollutants Network

The UK Eutrophying and Acidifying Pollutants (UKEAP) monitoring programme consists of a number of networks that monitor the deposition of both eutrophying and acidifying compounds in the United Kingdom. Due to the success of emission reductions in sulphur dioxide, acidification is no longer the issue it once was, but nitrogen pollution continues to be a concern. While its main emphasis has always been the assessment of potential impacts on UK ecosystems, UKEAP also provides the background concentration field for secondary inorganic aerosol which is used to determine the 1 km x 1 km maps for PM_{2.5} and PM₁₀ across Wales, as well as the background 1 km x 1 km map for oxides of nitrogen used for human health impact assessments.

Air quality trends

In recent years, the number of automatic monitoring sites in Wales has significantly increased. While the expansion has enhanced our grasp of air quality throughout the country, it has introduced a potential challenge when examining changes in air quality over time. Relying on the entirety of available data for such investigations may inadvertently introduce discontinuities and misleading trends due to shifts in the network's composition. As a result, this report adopts a more focused approach by scrutinising changes in the air quality based on subsets of well-established monitoring sites that have been operational for a decade or longer and continue to provide data up to the present day. This ensures a more robust assessment of air quality trends.

Our assessment of annual mean pollutant concentrations relies on data from all sites with an annual data capture rate of 75% or higher, enhancing the accuracy of our findings. In certain instances, like the case of Port Talbot, where nearby sites have replaced the original, we treat them as a unified entity for the purposes of this report.

Nitrogen Dioxide

In Wales (and the rest of the UK), historically the most widely exceeded limit value is the annual mean NO_2 concentration ($40 \mu\text{g}/\text{m}^3$). Figure 5.1 shows the trend in annual mean NO_2 concentration at long-running Welsh sites.

Urban traffic monitoring sites, defined as those situated within 10 meters of a major road, are represented by the longest-running roadside site (Swansea Morrision Roadside) in operation since 2001 and the mean of all urban traffic long-running sites. Although urban traffic monitoring sites were open prior to 2008, we have not included this data in this report. The deliberate exclusion is due to the restricted availability of sites in operation prior to 2008 that remain open to date with an annual capture rate of 75% or higher, inclusion of this data would lead to a distorted representation.

The annual mean concentration of NO_2 at Welsh urban traffic sites has exhibited an overall decline from $33.8 \mu\text{g}/\text{m}^3$ in 2008 to $21.4 \mu\text{g}/\text{m}^3$ in 2023. Notably, 2020 marked a record low in annual mean NO_2 concentrations largely attributed to the decreased vehicular traffic resulting from COVID-19 restrictions. Following this in 2021, there was a notable upturn in annual mean concentrations, corresponding to the gradual easing of restrictions.

However, these concentrations have steadily started to decrease since, retaining the overall trend observed since records began.

The urban background sites, including the longest-running site at Cardiff Centre and the average of all similar long-running sites, have shown a consistent decline in NO_2 concentrations since 1997. In 2023, these sites recorded their lowest annual mean NO_2 concentration to date, at $12.8 \mu\text{g}/\text{m}^3$, slightly down from $12.9 \mu\text{g}/\text{m}^3$ in 2022. This is the first year that there have been no NO_2 exceedances in Wales.

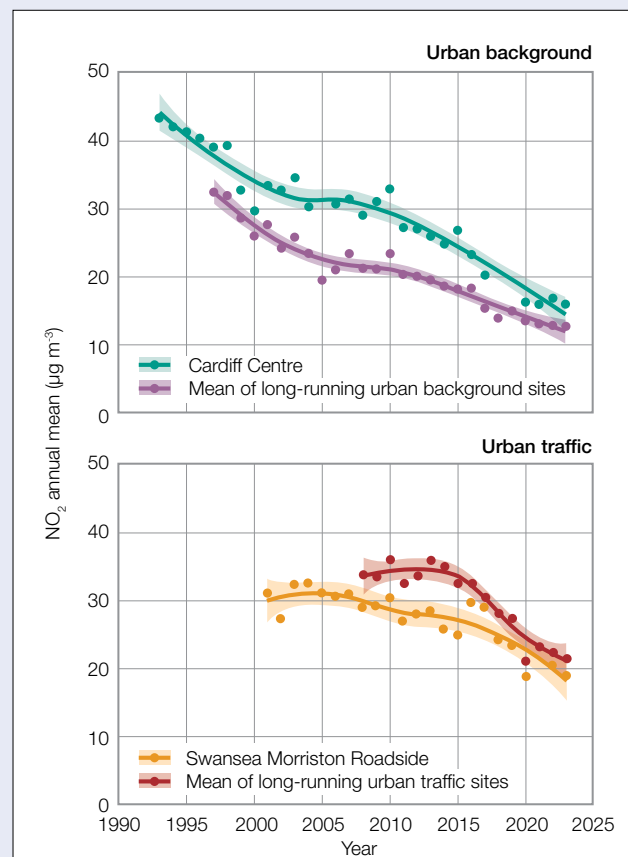


Figure 5.1

Annual mean NO_2 concentrations at long-running sites in Wales. The shaded areas represent the 95% confidence level for the annual mean concentration of the sites.

Particulate Matter

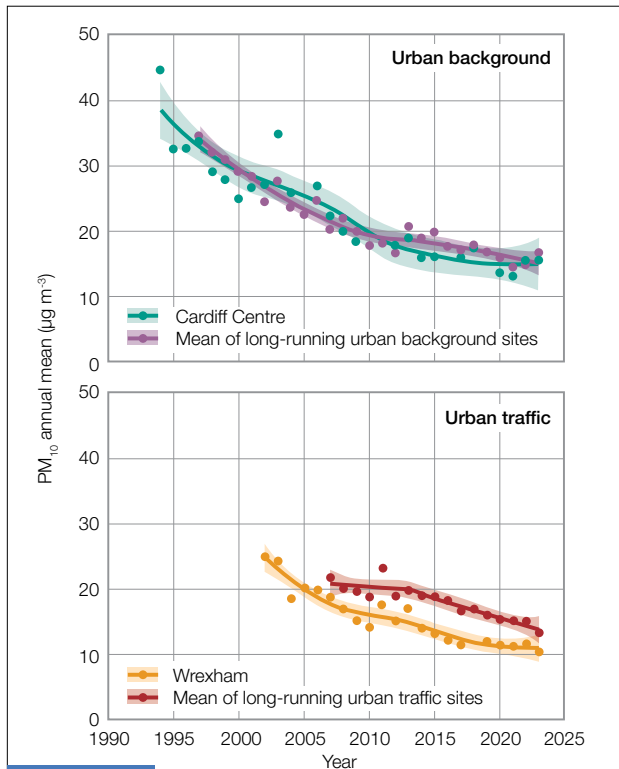


Figure 5.2

Annual mean PM_{10} concentrations at long-running sites in Wales. The shaded areas represent the 95% confidence level for the annual mean concentration of the sites.

Figures 5.2 and 5.3 show trends in annual mean concentrations of fine particulates (PM_{10} and $PM_{2.5}$). The annual mean PM_{10} concentrations at urban background sites, is represented by the longest-running site of this type (Cardiff Centre) and the average all long-running sites. Urban traffic site concentrations are represented by the longest-running PM_{10} site of this type, Wrexham, and the mean of all long-running sites.

Since records began, annual mean concentrations of PM_{10} at urban background sites have steadily declined from 34.4 $\mu\text{g}/\text{m}^3$ in 1997 to 16.7 $\mu\text{g}/\text{m}^3$ in 2023. However, in the last two years, concentrations have risen from 14.4 $\mu\text{g}/\text{m}^3$ in 2021, this maybe due to increased construction activities associated with economic growth, including housing and infrastructure projects. This rise may be further exacerbated by adverse weather conditions, which can spread dust over wider areas. While overall air quality in Wales has improved

over the long term due to stricter regulations, specific sectors such as construction have contributed to localised increases in pollution, particularly in urban areas near major projects^{1,2}.

At urban traffic sites, PM_{10} concentrations have decreased from 21.7 $\mu\text{g}/\text{m}^3$ in 2007 to a record low of 13.3 $\mu\text{g}/\text{m}^3$ in 2023, marking an 11.8% reduction from 2022 levels. This significant decline over the past decade can largely be attributed to Wales' adoption of stricter vehicle emission standards, including cleaner transport technologies and the promotion of electric vehicles. Additionally improvements in public transport infrastructure have further reduced traffic-related air pollution³.

Figure 5.3 illustrates the annual mean $PM_{2.5}$ concentrations averaged across established urban background monitoring sites. Since 2009, there has been a notable decrease in $PM_{2.5}$ levels, with the concentration falling to 7.8 $\mu\text{g}/\text{m}^3$ in 2023, marking a 28% reduction from 10.8 $\mu\text{g}/\text{m}^3$ in 2009. In 2023, $PM_{2.5}$ concentrations also saw a decline of 10.9% compared to 2022. This improvement can be attributed to several factors, including stricter emissions regulations, advancements in vehicle technology, and increased use of cleaner energy sources.

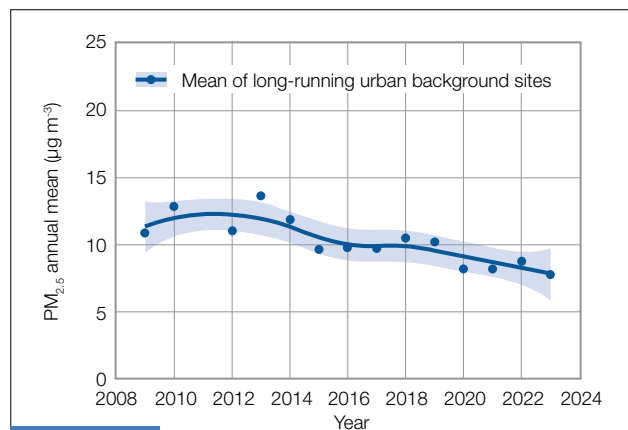


Figure 5.3

Annual mean $PM_{2.5}$ concentrations at long-running sites in Wales. The shaded areas represent the 95% confidence level for the annual mean concentration of the sites.

¹ <https://www.gov.uk/government/statistics/emissions-of-air-pollutants/emissions-of-air-pollutants-in-the-uk-summary>

² <https://media.service.gov.wales/news/building-a-stronger-future-for-welsh-construction>

³ <https://www.gov.wales/local-transport-fund-resilient-roads-fund-and-ultra-low-emission-vehicle-transformation-fund-htm>

Ozone

Due to the inverse photochemical relationship between tropospheric O_3 and NO_x – where elevated NO_x levels typically suppress O_3 concentrations and vice versa – O_3 levels are generally higher in rural areas. The concentration of O_3 can exhibit significant variability from year to year due to changes in meteorological conditions. This variability is often influenced by fluctuations in summer weather patterns, which can lead to higher O_3 levels during hotter periods.

Figure 5.4 illustrates the annual mean O_3 concentrations from various monitoring sites: Aston Hill, the longest-running rural site; Cardiff Centre, a well-established urban site; and the average across all long-running rural sites. Over time, a noticeable upward trend in rural O_3 levels is evident. The peak annual mean concentration was recorded in 2006 at $68.8 \mu\text{g}/\text{m}^3$, coinciding with an exceptionally hot European heatwave. Since records began, 2023 observed the second-highest O_3 concentration of $67.7 \mu\text{g}/\text{m}^3$, representing a 0.8% increase from 2022. This increase is relatively modest compared to the more substantial 6% rise observed from 2021 to 2022.

At the urban site of Cardiff Centre, there is a more pronounced long-term increase in annual mean O_3 concentrations. This trend reflects the inverse relationship between O_3 and NO_x ; as NO_x levels have decreased in urban areas like Cardiff Centre, O_3 concentrations have correspondingly risen. This shift highlights the impact of reduced NO_x emissions on urban air quality and the consequent rise in ozone levels.

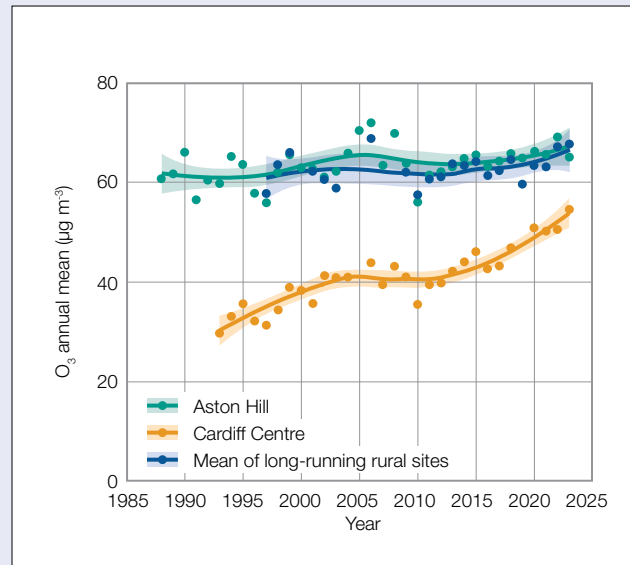
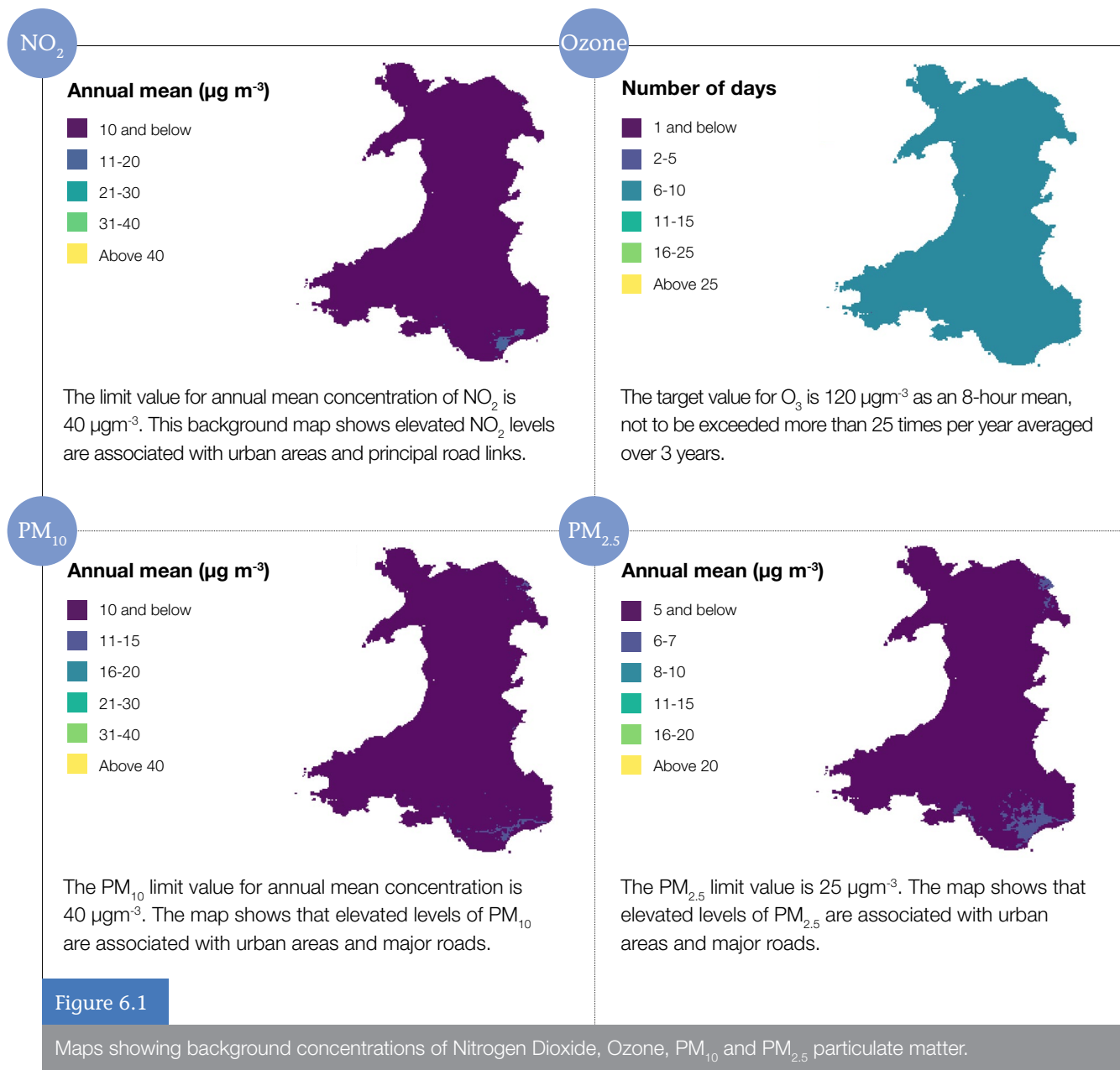


Figure 5.4

Annual mean O_3 concentrations at long-running sites in Wales. The shaded areas represent the 95% confidence level for the annual mean concentration of the sites.

Maps of air quality

The maps in Figure 6.1 present 2023 background concentrations for NO_2 , O_3 , PM_{10} and $\text{PM}_{2.5}$. These modelled maps of ambient concentrations were calculated from National Atmospheric Emissions Inventory (NAEI) data using a dispersion modelling approach. The model output was calibrated using monitored data from the national monitoring networks. These modelled maps were then verified against the local authority monitoring data. In these maps, the modelled ambient concentrations are compared with EU limit values.



The Local Air Quality Management grant scheme

The Local Air Quality Management (LAQM) Support Fund is a grant scheme run by the Welsh Government to support local authorities in carrying out their LAQM duties. Following two pilot rounds, the Minister for Climate Change announced the fund as a grant scheme from April 2023. A further fund has been made available for the 2024 financial year.

All local authorities in Wales are invited to submit bids that met one or more of the following criteria:

- Prevention – action that seeks to improve air quality and prevent worsening of concentrations and/or an exceedance of legal limits
- Mitigation – action that seeks to improve air quality in an air quality management area (AQMA)
- Innovation – action using innovative methods or technologies to improve air quality and/or reduce exposure to pollution.

A range of bids were submitted by Local Authorities across Wales, with six being successful in securing funding in 2023. The projects are summarised below:

Carmarthenshire County Council

Following being awarded the LAQM grant funding in 2023-24, the Local Authority purchased 3 real time Air Quality monitors. These were located near 4 primary schools located in our 3 AQMAs in Carmarthenshire.

Data from the AQ monitors were shared with the schools via Teams on a weekly basis. The data was used by the schools as an opportunity to discuss air quality issues with their pupils. The schools and pupils undertook the following activities as a direct result of the Air Quality project:

- Walk to school week
- Conducted a whole school pupil travel survey
- Carried out an Anti-idling campaign during school drop off times
- Set up an Air Quality squad to evaluate project and agree next steps. The AQ Squad presented information to fellow pupils during school assembly
- Attending the Local Authority Climate Action Consultation Group for further ideas

- Survey of air quality bio-indicators (Lichen) around schools playgrounds
- Became part of the WOW living Streets program
- Survey of vehicles idling outside school area during morning drop off time
- Received a class presentation from Officers of the Pollution Team, this provided further explanation on Air Quality and the guideline values nationally and internationally. This allowed pupils to do their own interrogation of the data provided in context with guideline values
- Some pupils attended the Senedd as part of the Climate Cymru Schools Programme to discuss their projects
- Used the information gathered as part of the Air Quality project for a Platinum Echo School award
- Used data from the monitors to compare with historical data from Nitrogen Dioxide tubes to investigate if levels are increasing or decreasing
- Research undertaken by pupils on different types of Air Pollution
- Create “Walk to School Week” poster
- Pupils created a webpage highlighting Air Pollution in their area
- Organised a “Walk to school week” this involved a walking bus
- Eco School committee looked at certain spikes in air quality noticed they were around drop off times and also a garden bonfire at a nearby allotment
- Pupils wrote and performed a rap about air pollution.

The project was delivered to 4 schools with a combined total of approximately 1180 pupils. During feedback sessions with schools the Teachers have provided anecdotal evidence that pupils have disseminated the findings and key messages back to their respective families. Due to the project with local primary schools, we have extended the Air Quality project for another year. Several schools have expressed in participating.



Vale of Glamorgan Council

An application was made to the LAQM support fund for three Vortex automatic monitoring sensors in the Vale of Glamorgan. The proposal includes installing new indicative automatic monitors, expanding the Shared Regulatory Services (SRS) Vortex indicative monitoring network beyond its existing network in Cardiff to include three roadside locations in the Vale of Glamorgan. These locations, in Barry, Dinas Powys and Cowbridge were chosen to represent a varied geographical area within the Vale of Glamorgan for both roadside and industrial emissions. The monitoring will assist in improving the understanding particulate matter concentrations at these locations. The Vale of Glamorgan does not currently have any AQMAs, and the proposed sensors may work in conjunction with a potential Air Quality Strategy for the region to ensure air pollution remains as low as practicably possible.

Swansea

Air Quality Literacy, FEMA Sign Study

The project aims to produce a prototype tool to measure individual air quality literacy. The tool will look to use simple questions to assess systems literacy for air quality (e.g., “Which of the three cars shown here will produce the most harm to air quality?”).

The survey has been developed and tested with a follow up ‘expert responses’ version being completed to look at discriminative validity. The pilot study intervention is

to commence shortly to establish whether the scale is sensitive to interventions. Once this is complete the tool will be implemented in the intervention area and the control area. A peer reviewed publication will be produced post analysis and data will be shared with Welsh Government and Local Authority colleagues.

Health impact analysis on PM_{2.5} and PM₁₀ emissions from domestic burning and Air Quality Literacy in Swansea

The health impact analysis on PM_{2.5} and PM₁₀, from domestic burning, has been finalised and is currently under review for submission. The analysis has focused on Health impact pathways for PM_{2.5} and PM₁₀ using recommended ‘concentration response functions’ (CRF) for Chronic/acute mortality, Respiratory/cardiovascular hospital admissions, Heart disease, Stroke, Lung cancer, Asthma, COPD and Diabetes.

The aim of the air quality literacy element of the project is to create self-sustaining, city-scale improvements in outdoor and indoor air quality related to wood burner use. By sharing objective air quality data with the wood burner users, paired with messaging that educates people to understand the causes of air quality problems, it aims to motivate them to act and empower them to take useful action.

The Air Quality Literacy element of the project has been tested and has had ethics approval. The survey has been run in two areas of Swansea with the final stage testing to be completed shortly.



Oystermouth Castle and Mumbles, Swansea, Wales, UK

Schools NO₂ diffusion tubes, Air Quality Literacy and mobile progressive web app

The aim of the project is to create improvements in air quality around schools in Swansea. By sharing air quality data with school children, parents and staff, paired with messaging that educates people to understand the causes of air quality problems.

The web app was developed and the beta site is in final stages of testing ahead of release for the schools to access. The diffusion tubes have been distributed to the schools taking part. The air quality literacy survey has been developed, with engagement of the teachers at the schools for primary school children. Ethics approval has been submitted for interventions to be tested and data collection continues.

Bridgend Council

During the development of the Park Street, Bridgend Air Quality Action Plan (AQAP), Shared Regulatory Services (SRS) have investigated traffic management options that were required to improve air quality at the worst effected receptors within Park Street. Sites currently exceeding air quality annual objectives are isolated to one area of Park Street. This area of Park Street experiences higher concentrations of pollutants due to the proximity of houses to a heavily trafficked primary route with congestion issues. These issues are compounded by gradients increasing engine load and poor dispersion caused by buildings. Three traffic management options were agreed within the work steering group for further modelling and assessments. The results from these assessments showed an improvement in air quality with implementation of these measures.

However, three modelled receptors still displayed slight exceedances in comparison to the NO₂ Annual Air Quality Objective. A final modelling exercise was required and funded by the LAQM support fund to understand the projected year of compliance at these locations. The results from the modelling assessment showed that without one remaining mitigation measure in place, the annual mean NO₂ concentrations will fall below the 40 µg/m³ threshold in 2026, and that the local authority could start to make a case for revoking the AQMA at these locations from 2027 onwards.

A key factor in the importance of this modelling assessment was comparing the timescales for compliance in comparison to implementation timescales for this mitigation measure. As a result of this assessment, the council decided to review and delay implementation of the final

traffic management mitigation measure, pending close evaluation of monitoring results in comparison to those within the assessment.

Neath Port Talbot

Project 1 – Clean Air for Port Talbot Short Term Action Plan Support

Funding was awarded to extend an existing project from the 2022-23 fund. Consultants Ricardo have continued to attend the Short Term Action Plan (STAP) Data Team Meetings and provide advice and guidance to the Council on their actions and engagement at those meetings. The project linked closely with Projects 2 and 4, and the outcome of the STAP review has been used to identify appropriate measures within the updated Air Quality Action Plan.

Project 2 – Air Quality Action Plan Review

This project also allowed the completion of a previously funded project from 2022-23. A draft AQAP was issued in 2023, however, prior to final publication it became apparent that the data for 2023 showed exceedances at the Prince Street monitor, which changed the trend and needed further review. Therefore, publication of this AQAP was put on hold while the data was reviewed and the AQAP will be updated with this new information and published in 2024.

Project 3 – Wall Colmonoy Air Quality and Industrial Compliance Support

This project followed up on recommendations from the Nickel in Air Group and particularly advice from Natural Resources Wales regarding Neath Port Talbot's regulation of Wall Colmonoy's Environmental Permit. Air quality consultants Ricardo were appointed to undertake a complete review of the Environmental Permit for Wall Colmonoy. They visited the site for a full understanding of the process and completed a full review of the company's Environmental Management System. A report has been issued to the Council which included a number of recommendations that are being taken forward in the update to Wall Colmonoy's Environmental Permit.

Project 4 – STAP Breach Day Reports

All reports for 23/24 breach days have been issued and shared with the STAP Data Team and have been discussed in the Data Team Meetings. The reports are used to establish likely local sources to better target interventions.

Newport

Schools Monitoring Project

The aim of this project was to provide an environmental investigative experience for students and promote learning messaging beyond school into student households. Students have shown real enthusiasm for this area of environmental enquiry which was demonstrated further at NCCs Clean Air Evet on 18th June where several hundred members of the schools AQ study participated in a circus environmental activities and exhibits at Newport Riverfront.

Schools Travel Plans Project

This project attempted to support the facilitation of school travel plans for otherwise very busy schools. Anecdotal information tells us that schools are limited in what they are able to accommodate in their available time. This projects provided valuable traffic surveys and a travel plan template that will facilitate travel planning resources across 16 AQMA schools.

ECO Stars fleet accreditation scheme refresh project

The project looked at promoting fuel efficiency and cleaner technology in fleets, whilst raising awareness of AQMA locations so higher emission fleet vehicles can be encouraged to avoid them. The ECO stars project ran in Newport in 2018 and this outcome of this project was the observation that there are still plenty of companies engaged with the ECO Stars scheme; there is scope to bring in more companies; cleaner technologies are creeping into the fleet; and a valuable opportunity to encourage AQMA avoidance in fleet routing of vehicles other than low emission ones.

ECO Posts

The basis of this was to provide community based air quality messaging with associated option to look more closely at data through an app, and track multiple sensors across Newport. AQMA communities now have a universally accessible Air Quality indicator within their areas. The wider Newport County Council community can be reassured by the presence of ECO Posts across the City in 6 locations and where any unusual Air Quality levels are observed this can be reported by both Newport County Council and the public, through use of the associated app the system has.

Nitrogen dioxide (NO₂) compliance

The Welsh Government has continued to work with its key partners to tackle elevated nitrogen dioxide concentrations at several roadside locations.

During late 2023 works were completed on a re-engineering scheme next to the A472 following demolition of homes on the south side of Hafodyrnys Road in 2022. The demolition works were necessary in order to address a 'street canyon' effect which was preventing efficient dispersion of vehicle emissions. As part of the scheme the public footway has been moved further away from the road and new landscaping installed. The existing AURN monitor was re-located alongside the new footway. Data has revealed compliance with both the hourly and annual mean limits during 2023.

Cardiff Council has completed the installation of new road infrastructure on the west and east sides of the city centre (with work on the east side scheme rolling over into spring 2024). The Council also submitted an updated plan for their proposed scheme on Castle Street on the northern side of the city centre. Each of these schemes interacts to create improved active travel and public transport connections, along with a reduction in general vehicle capacity. The automatic monitor on Castle Street revealed ongoing compliance in 2023 with the annual mean limit (the hourly limit has not previously been exceeded).

Monitoring has continued at the locations identified as exceeding annual mean limits on the motorway and trunk road network. We expect to publish, in 2024, an update to the Welsh Government supplemental Plan to the UK Plan for tackling roadside nitrogen dioxide concentrations 2024. We will also publish our monitoring data for the 2022 and 2023 calendar years along with a summary of next steps.

Air quality and public health – a year in review

Public Health Wales (PHW) continues to support efforts to improve air quality and reduce exposure to air pollution by supporting policy initiatives such as the Environment (Air Quality and Soundscapes) (Wales) Bill and reductions in speed limits to 20mph, while providing more information to the public about air pollution and how to reduce and avoid it.

Bonfire night and air quality

PHW have aimed to understand the data signals in routinely collected NHS data following air pollution events, by using the annual November Bonfire Night as a proxy event.

The research established that mean daily PM₁₀ levels peaked on the 5th November each year. Around Bonfire Night hospital admissions and 999 calls for respiratory conditions may increase slightly (29th October to 12th November). These findings have implications for monitoring acute air pollution incidents that occur in Wales and our ability to detect and prevent health harms associated with these.

20mph in Wales

On 17th September 2023 the default speed limit in Wales dropped from 30mph to 20mph. Early evidence suggests that casualties have fallen from 681 on 20 and 30mph roads between October and December 2022 to 463 in the same period in 2023.

Prior to the implementation, evidence also suggested direct and indirect air quality benefits, with less acceleration and braking producing less pollution and, over time, more active travel and less car use also contributing to improved air quality.

Recently published evidence suggested that both NO₂ and PM₁₀ emissions decrease following speed limit reduction to 20mph⁴.

Welsh Government analysis has not revealed any material difference in NO₂ concentrations between areas inside and outside the 20mph speed limited roads in study areas⁵.

Reported differences in concentrations were considered to be attributable, in part, to other local factors which may have been influencing concentrations more than slight changes in vehicle speed⁶.

Air pollution exposure inequalities in Wales, UK; a sex-based analysis

Previous research has contributed to the understanding of population susceptibilities and vulnerabilities to ambient air pollution (AP)^{7,8,9,10}. However, sex, as a susceptibility factor has been relatively less researched. The few studies that have examined sex, show that there is a growing consensus that the associations between AP and the subsequent health effects differ between females and males^{11,12,13,14}.

PHW have conducted a study that explores the differences in exposure concentrations to ambient AP between females and males, in Wales, between 2012 and 2019.

By the end of the study period, air quality in Wales was improving but inequalities in exposure could be observed between sexes. The following was concluded:

- For NO₂ in 2019, more males than females were living in areas that experienced higher concentrations of AP.
- Age-based susceptibility (those aged 0-15 and 65+) highlighted an inequality where females were disproportionately exposed to higher concentrations of PM_{2.5}, compared to males.
- Most deprived males were disproportionately exposed to higher concentrations of NO₂ compared to females.

Whilst the study cannot simply conclude that one sex is consistently disproportionately exposed to worse AP, there is evidence to suggest that the inequalities in exposure exist. The study highlights the need for continued improvements to air quality. System-wide action must ensure that air quality improvement-related benefits are equitable.

⁴ Review of City-Wide 30 km/h Speed Limit Benefits in Europe (mdpi.com)

⁵ Phase 1 20mph interim monitoring report (tfw.wales)

⁶ Default 20mph Speed Limit on Restricted Roads | Transport for Wales (tfw.wales)

⁷ Horton A, Jones SJ, Brunt H. Air pollution and public health vulnerabilities, susceptibilities and inequalities in Wales, UK. *Journal of Public Health*. 2023 Jun;45(2):432-41.

⁸ Peled R. Air pollution exposure: Who is at high risk?. *Atmospheric Environment*. 2011 Mar 1;45(10):1781-5

⁹ Royal College of Physicians and Child Health. *Every breath we take: The lifelong impact of air pollution*. London: RCP; 2016.

¹⁰ Defra. *Improving air quality in the UK: tackling nitrogen dioxide in our towns and cities*. Defra; 2017. Available from: https://consult.defra.gov.uk/airquality/air-quality-plan-for-tackling-nitrogen-dioxide/supporting_documents/Draft%20Revised%20AQ%20Plan.pdf

¹¹ Kan H, London SJ, Chen G, Zhang Y, Song G, Zhao N, et al. Season, Sex, Age, and Education as Modifiers of the Effects of Outdoor Air Pollution on Daily Mortality in Shanghai, China: The Public Health and Air Pollution in Asia (PAPA) Study. *Environmental Health Perspectives*. 2008; 116: 1183–1188. DOI: 10.1289/ehp.10851

¹² Clougherty JE. A growing role for gender analysis in air pollution epidemiology. *Ciência & Saúde Coletiva*. 2010; 118: 167–176. DOI: 10.1289/ehp.0900994

¹³ Liu, G., Sun, B., Yu, L., Chen, J., Han, B., Li, Y. and Chen, J., 2020. The gender-based differences in vulnerability to ambient air pollution and cerebrovascular disease mortality: evidences based on 26781 deaths. *Global heart*, 15(1).

¹⁴ Miller, K.A., Siscovick, D.S., Sheppard, L., Shepherd, K., Sullivan, J.H., Anderson, G.L. and Kaufman, J.D., 2007. Long-term exposure to air pollution and incidence of cardiovascular events in women. *New England Journal of Medicine*, 356(5), pp.447–458.



More information

The Air Quality in Wales website

The Air Quality in Wales website (<https://airquality.gov.wales/>) Figure 9.1 is available in English and Welsh. It provides information on all aspects of air pollution in Wales. The site is one of a family of air quality websites produced by Ricardo, which includes air quality websites for the UK, Northern Ireland, Scotland and England.

The website has been designed to be a user-friendly and interactive resource containing comprehensive information on all aspects of air pollution:

- A colour coded OpenStreetMap™ showing the overall pollution situation at sites across Wales.
- Latest data from all automatic monitoring sites in Wales, accessible from this map.
- Air pollution forecasts for the whole of Wales.
- Information on the latest, developments and publications.
- Detailed information on automatic monitoring sites.
- A wide range of background information on air pollution sources, health impacts, monitoring techniques, standards and policy issues.
- Access to air quality data and statistics – for automatic and sampler sites – going back to 1986.
- Provision to submit data via innovative web forms to the archive.
- Headline air quality indicators, trends and modelled future scenarios.
- Links to national and global information resources on air quality.
- A password-protected area for members of the Welsh Air Quality Forum (WAQF).
- Overview of the data ratification and verification procedures.

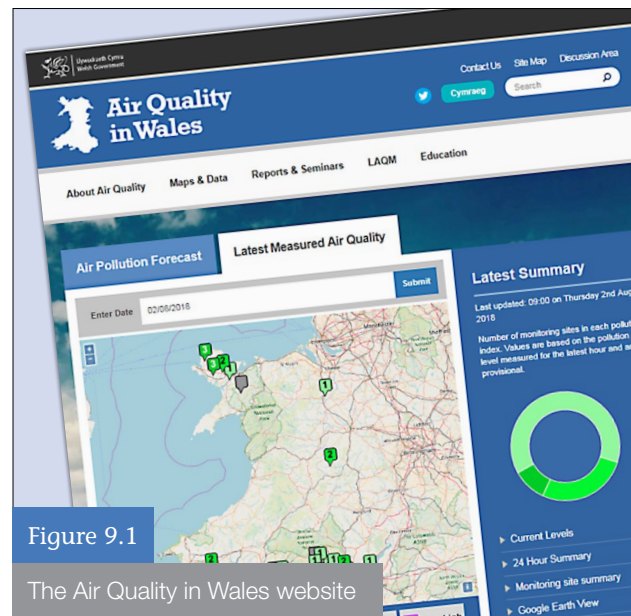


Figure 9.1

The Air Quality in Wales website

To access data used in this Annual Report, follow these simple steps:

- From the home page, select 'Maps & Data' from the main menu.
- Click on 'Measurements'.
- Click 'Download/Submit Data'.
- Click 'Download Data'.
- Select 'Parameter Group' (type of data required).
- Select 'Pollutant Species'.
- Select 'Local Authority Region'.
- Select 'Statistic Type' (for example, daily mean).
- Select 'Date Range'.
- Select 'Specific Monitoring Site(s)'.

Then, provide your email address and the data will be emailed to you with a few seconds.



New Quay – ‘Cei Newydd’, Cardigan Bay, West Wales, UK

Current and Forecast Air Quality (National and Local)

In addition to the Air Quality in Wales website, current and forecast air quality is rapidly available in a user-friendly form from:

- The Air Pollution Information Service on freephone 0800 556677.
- The UK Air Information Resource (<https://uk-air.defra.gov.uk/>).

Health Effects of Air Pollution

Information on the health effects of air pollution and the UK pollution banding system can be found on the Department for Environment, Food and Rural Affairs (Defra) website (<https://airquality.gov.wales/about-air-quality/daily-air-quality-index>).

Local Air Quality Issues

For further information on air quality issues in your area, please contact the environmental health department at your local district council office. Further information on Local Air Quality Management may also be found on:

- The local authority support site (<http://laqm.defra.gov.uk>).

General Information on Air Quality

- The Welsh Government Environment and Countryside links (<https://gov.wales/air-pollution>).
- The UK Air Information Resource (<https://uk-air.defra.gov.uk/>).
- The National Atmospheric Emissions Inventory (<http://naei.beis.gov.uk>).
- The Defra Air Quality Information Web Resource (<https://uk-air.defra.gov.uk>).
- The Northern Ireland Air Quality website (<https://www.airqualityni.co.uk/>).
- The Scottish Air Quality website (<http://www.scottishairquality.scot/>).
- The Air Quality in England website (www.airqualityengland.co.uk).
- The Pollutant Release and Transfer Register (<https://www.gov.uk/guidance/uk-pollutant-release-and-transfer-register-prtr-data-sets>).
- The Environment Agency (<https://www.gov.uk/government/organisations/environment-agency>).
- Natural Resources Wales (www.naturalresourceswales.gov.uk).

