
# 2024 Air Quality Annual Status Report

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

Report for: Pendle Borough Council

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**Ricardo reference:**
**ED18432104**

Contact:
Patrick Harland, Gemini Building, Fermi Avenue, Harwell, Didcot, OX11 0QR, UK

T: +44(0)7749401249
E: patrick.harland@ricardo.com

Author:
Anton Girard-Sequeira

Approved by:
[Patrick Harland]

Signed

Date:
01/05/2024

# 2024 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: May, 2024

| Information | Pendle Borough Council Details |
|---|---|
| **Local Authority Officer** | Michael Duck |
| **Department** | Housing, and Environmental Health |
| **Address** | Pendle Borough Council, Town Hall, Market Street, Nelson, BB9 7LG |
| **Telephone** | 01282662009 |
| **E-mail** | Michael.duck@pendle.gov.uk |
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# Executive Summary: Air Quality in Our Area

## Air Quality in Pendle

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. In the UK, it is estimated that the reduction in healthy life expectancy caused by air pollution is equivalent to 29,000 to 43,000 deaths a year[1].

Air pollution particularly affects the most vulnerable in society, children, the elderly, and those with existing heart and lung conditions. Additionally, people living in less affluent areas are most exposed to dangerous levels of air pollution[2].

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. |
| 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. |

[1] UK Health Security Agency. Chemical Hazards and Poisons Report, Issue 28, 2022.

[2] Defra. Air quality and social deprivation in the UK: an environmental inequalities analysis, 2006

The annual status report (ASR) covers monitoring results for 2023 and action that the council is taking in a bid to improve air quality. In Pendle Borough Council (PBC) the main pollutant of concern is nitrogen dioxide ($NO_2$). National government has set health-based objectives for a range of pollutants and, where these are not met, the local authority must declare an air quality management area (AQMA) and commit to improving local air quality through action planning. There is one designated AQMA in the borough - Colne AQMA, which was declared because of exceedances of the annual mean $NO_2$ objective due to road traffic. Details of the AQMA can be found on the UK AIR website

In 2023, for the sixth year in a row, the $NO_2$ average objective was not exceeded at any monitoring site within the borough, including within the Colne AQMA. However, given the continual evidence identifying the harmful effects of both particulate matter (PM) and $NO_2$, along with the Council's commitment to work with partners on the public health agenda and the Council's duties under the Local Air Quality Management regime, combined with the significant development within the area, it is important that work continues to maintain and improve the air quality within the borough. Therefore, Pendle Borough Council will continue to identify measures to improve and maintain the air quality within the borough, including ensuring developments do not adversely affect or significantly contribute to pollutant levels.

## 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[3] 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 of most harmful to human health. The Air Quality Strategy[4] provides more information on local authorities' responsibilities to work towards these new targets and reduce fine particulate matter in their areas.

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

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

The Road to Zero[5] 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.

In recent years, Pendle Borough Council:

- Promoted "Cycle September", which encouraged employees to cycle to work.
- Planted over 4,000 native trees to help combat climate change, support wildlife and improve Pendle's green spaces as part of the Council's Climate Action Plan[6].
- Created a funding pot of £25,000 for schools and community groups in Pendle to help tackle climate change. Successful applicants used the money to plant trees, build raised beds for planting vegetables and install water butts to help with watering.
- Consulted the public in July 2023 on options to improve traffic flow and pedestrian areas in Barnoldswick[7].
- Completed construction of a new traffic-free route in Nelson. The new route is called Pendle Water Bridleway, which encourages sustainable modes of transport.
- Trial and full implementation of an eco-fuel scheme for the council fleet

## Conclusions and Priorities

No exceedances of the $NO_2$ objectives were identified in Pendle Borough Council for 2023. Long-term monitoring data shows a noticeable reduction in $NO_2$ levels over time, particularly at roadside sites. Monitoring results in the Colne AQMA have been consistently below the air quality objective for $NO_2$, as such, there is intention to revoke the AQMA. The Council will continue to work with partner organisations and other local authority teams on the planning and implementation of the Lancashire and Blackburn with Darwen Electric Vehicle Infrastructure Strategy.

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

[6] Climate Emergency Action Plan 2020 to 2025 | Climate Change | Pendle Borough Council

[7] Barnoldswick town centre improvements | Barnoldswick town centre improvements | Pendle Borough Council

## Local Engagement and How to get Involved

If you would like to get involved in the work being undertaken to tackle air pollution within Pendle; or you would like more information on how you can help reduce your personal emissions then please contact the Environmental Health Department at Pendle Borough Council on 01282 662009 or via e-mail at Michael.Duck@Pendle.gov.uk.

For more information on Air Quality in Pendle please see: https://www.pendle.gov.uk/info/20048/pollution_and_air_quality/93/air_quality

## Local Responsibilities and Commitment

This ASR was prepared by the Housing and Environmental Health Department of Pendle Borough Council with the support and agreement of the following officers and departments:

- Michael Duck – Commercial Team Leader
- Lisa Jefferson – Technical Officer

This ASR has been approved by:

- Phillip Spurr – Director of Place

This ASR has been signed off by a Director of Public Health:

- Dr Sakthi Karunanithi – Director of Public Health Wellbeing and Communities, Lancashire County Council

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

Pendle Borough Council, Town Hall, Market Street, Nelson, BB9 7LG

01282 662009

michael.duck@pendle.gov.uk

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# Local Air Quality Management

This report provides an overview of air quality in Pendle during 2023. It fulfils the requirements of Local Air Quality Management (LAQM) as set out in Part IV of the Environment Act (1995), as amended by the Environment Act (2021), and the relevant Policy and Technical Guidance documents.

The LAQM process places an obligation on all local authorities to regularly review and assess air quality in their areas, and to determine whether or not the air quality objectives are likely to be achieved. Where an exceedance is considered likely the local authority must declare an Air Quality Management Area (AQMA) and prepare an Air Quality Action Plan (AQAP) setting out the measures it intends to put in place in 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 Pendle Borough Council to improve air quality and any progress that has been made.

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

# Actions to Improve Air Quality

## 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.

A summary of AQMAs declared by Pendle Borough Council can be found in Table 2.1. The table presents a description of the Colne AQMA that is currently designated within Pendle Borough Council. Appendix D: Map(s) of Monitoring Locations and AQMAs provides maps of the Colne AQMA and the air quality monitoring locations in relation to the AQMA. The air quality objective pertinent to the current AQMA designation is the $NO_2$ annual mean objective.

Colne AQMA has been compliant with the $NO_2$ annual mean objective since 2017. As such, Pendle Borough Council are proposing to revoke the Colne AQMA based on measured data with a detailed assessment of the AQMA area to support this revocation. The detailed assessment is attached as an addendum to this report.

### Table 2.1 – Declared Air Quality Management Areas

| AQMA Name | Date of Declaration | Pollutants and Air Quality Objectives | One Line Description | Is air quality in the AQMA influenced by roads controlled by Highways England? | Level of Exceedance: Declaration | Level of Exceedance: Current Year | Number of Years Compliant with Air Quality Objective | Name and Date of AQAP Publication | Web Link to AQAP |
|---|---|---|---|---|---|---|---|---|---|
| Colne AQMA | 1st of April 2011 | $NO_2$ Annual Mean | Area incorporating Windsor St, and Skipton Rd, Colne, between the junctions of Windsor St, Byron St and Temple St / Oak St | NO | 40.1 µg/$m^3$ | 26.4 µg/$m^3$ (PEN67) | 6 years | Colne AQMA Air Quality Action Plan, Pendle Borough Council August 2015 | https://www.pendle.gov.uk/download/meetings/id/17983/item_13_colne_air_quality_action_plan_appendix_1 |

☒ **Pendle Borough Council confirm the information on UK-Air regarding their AQMA(s) is up to date**

☒ **Pendle Borough Council confirm that all current AQAPs have been submitted to Defra**

# Progress and Impact of Measures to address Air Quality in Pendle

### 1.1.1 Defra appraisal of Pendle Borough Council's 2023 ASR

Defra's appraisal of last year's ASR concluded that *"The report is well structured, detailed, and provides the information specified in the Guidance".*

The appraiser's comments said:

- *"On the basis of the evidence provided by the local authority the conclusions reached in the report are **accepted** for all sources and pollutants, on the proviso that the grammatical and formatting errors in the report are corrected prior to publication on the council's website. ASRs are public facing documents that serve to keep local communities informed of the steps being taken by their local authority to improve air quality, and as such it is important that they are accessible and easy to read. Following the completion of this report, Pendle Borough Council should submit an Annual Status Report in 2024"*

The following comments were provided in the 2023 ASR appraisal to inform the writing of future reports. The following constructive comments have been addressed in the writing of the 2024 ASR:

- *"The date in the portal which was confirmed by UK-AIR illustrates the AQMA was declared on the 1st of April 2011 and not the 10th of March as published in the ASR."*
- *"The air quality action plan has been completed to a high level of detail, including funding sources, and the progress of each measure. This section also includes barriers or concerns to implementation, which is an example of good practice."*
- *"Relevant public health director sign off is an example of good practice, should continue in future ASRs."*
- *"The appraisal comments response section is detailed and shows Pendle Borough Council has understood the previous year's appraisal and implemented the relevant changes in this reporting year."*
- *"Pendle Borough Council have illustrated which measures they have met within the last reporting year and the progress of any current measures in great detail. This should continue. National bias adjustment factor chosen and correctly calculated and evidence with the national bias adjustment spreadsheet. This is good practice."*

### 1.1.2 Progress of measures

Pendle Borough Council has taken forward a number of direct measures during the current reporting year of 2023 in pursuit of improving local air quality. Details of all measures completed, in progress or planned are set out in Table 2.2. 45 measures are included within Table 2.2, with the type of measure and the progress Pendle Borough Council have made during the reporting year of 2023 presented. Where there have been, or continue to be, barriers restricting the implementation of the measure, these are also presented within Table 2.2.

The Council has also declared a Climate Emergency, with many actions to reduce carbon emissions towards the goal of net-zero by 2030 also helping to improve air quality.

More detail on these measures can be found in their respective Action Plans. Key completed measures are:

- Completion of the construction of the Nelson Bridleway
- Introduction of electric hire bikes for council staff
- Eco-fuel trial completed and fully implemented.
- Consultation on changes to Barnoldswick town centre

Pendle Borough Council expects the following measures to be completed over the course of the next reporting year:

- Complete the air quality monitoring programme.
- Complete the bike library pilot scheme.
- Require Air Quality Assessments to be undertaken on all relevant planning applications.
- Require mitigation measures where appropriate on planning applications.
- Progress engagement and educational programmes both internally and externally.

Pendle Borough Council worked to implement these measures in partnership with the following stakeholders during 2023:

- Lancashire County Council
- The Highways Authority

The principal challenges and barriers to implementation that Pendle Borough Council anticipates facing are lack of sufficient staff and resources to implement actions, both internally and within partner organisations. However, it is acknowledged that work to tackle

the Climate Emergency within the Council and reduce carbon emissions will also assist in improving air quality.

Progress on the following measures has been slower than expected due to the lack of sufficient staff resources. Despite these challenges, progress will be made on those internal actions to reduce Council fleet emissions and promotion and educational activities to members of the public.

Pendle Borough Council anticipates that these measures will continue to maintain the Borough's compliance with air quality objectives and improve air quality further.

## Table 2.2 – Progress on Measures to Improve Air Quality

| Measure No. | Measure Title | Category | Classification | Year Measure Introduced in AQAP | Estimated / Actual Completion Date | Organisations Involved | Funding Source | Defra AQ Grant Funding | Funding Status | Estimated Cost of Measure | Measure Status | Reduction in Pollutant / Emission from Measure | Key Performance Indicator | Progress to Date | Comments / Barriers to Implementation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | M65 to Yorkshire Relief Road (A56 Village Bypass Scheme) | Traffic Management | Strategic highway improvements, Re-prioritising road space away from cars, including Access management, Selective vehicle priority, bus priority, high vehicle occupancy lane | 2013 | 2030 | LCC | LCC | NO | Not Funded | £1 million - £10 million | Undertake further development work on a bypass including economic and | Estimated significant reduction in pollutant levels within villages along the A56 | Construction to ultimately lead to significant reduced traffic flows and associated air quality improvement within Colne AQMA | Feasibility study undertaken | Funding |
| 2 | Reinstatement of Colne to Skipton Railway Line | Transport planning and infrastructure | Train route improvements | 2015 | 2030 | LCC/PBC/SELRAP | DfT | No | Not Funded | £1 million - £10 million | Planning | Construction to lead to increased rail use and reduced traffic flows within AQMA | Increased use of public transport Improvement in management of congestion and road | A phase 1a review of previous work needs assessment were completed. Further studies warranted to identify feasibility of the scheme further. | Funding and further feasibility study |
| 3 | Accessible Nelson Scheme | Promoting travel alternatives, Traffic Management and transport planning infrastructure | Strategic highway improvements with the promotion of walking and cycling, whist improving transport cycle network | 2023 | 2028 | PBC/LCC | LUF | No | Funded | £1 million - £10 million | Planning | Increased traffic flow and a reduction in emissions | Improved sustainable infrastructure to Nelson with reduced number of vehicles and improved traffic flow | Proposed options and changes determined | LCC to implement scheme |
| 4 | Public consultation on options to improve traffic flow and pedestrian areas of Barnoldswick | Promoting travel alternatives and Traffic Management | Promotion of waling and strategic highway improvements | 2023 | 2028 | PBC, LCC | UK Shared Prosperity Fund | No | Funded | <£50k | Planning | Reduction in vehicle emissions | Improvement in traffic flow and improved pedestrian access | Consultation completed | - |
| 5 | UTC, Congestion management, traffic reduction | Traffic Management | UTC, Congestion management, traffic reduction, through highway improvements and UTC | 2015 | 2030 | DfT | DfT | NO | Not Funded | £1 million - £10 million | Planning | Reduced emissions | Improvement in management of congestion and road traffic | Design and feasibility stage | DfT / Funding |

| Measure No. | Measure Title | Category | Classification | Year Measure Introduced in AQAP | Estimated / Actual Completion Date | Organisations Involved | Funding Source | Defra AQ Grant Funding | Funding Status | Estimated Cost of Measure | Measure Status | Reduction in Pollutant / Emission from Measure | Key Performance Indicator | Progress to Date | Comments / Barriers to Implementation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | Improvements in Traffic Flows and Speeds within AQMA | Traffic Management | Strategic highway improvements and selecting of vehicle priority via signalling | 2015 | 2030 | LCC | LCC | NO | Not Funded | £1 million - £10 million | Planning | Reduce congestion | Reduced congestion and increases in average vehicle speeds through Colne AQMA via stacking out of vehicles and signalling to allow traffic flow | Some work has been undertaken in this area to improve signalling. Also, some smaller scale highway improvements which could reduce congestion and improve traffic flow further | |
| 7 | Implement 20mph speed limit in the AQMA and surrounding roads | Traffic Management | Reduction of speed limits, 20 mph zones | 2015 | 2030 | LCC and PBC | LCC | No | Not Funded | £500k - £1 million | Planning | Reduce emissions | Reduce acceleration, which is when emissions are highest. Therefore improving the air quality in Colne AQMA | LCC LTP includes commitment to introduce 20mph limits in residential areas and outside all schools over the lifetime of the LTP | |
| 8 | Freight Partnerships for Town centre deliveries | Freight and Delivery Management | Freight Partnership consolidation centre for town centre deliveries | 2015 | 2030 | PBC | - | NO | Not Funded | £500k - £1 million | Planning | ~32% NO2 reduction (3.6 µg/m3) | Implementation of FQP | None | Funding / Staffing |
| 9 | Reduction on vehicle travel, whilst increasing walking, public transport and cycling in accordance with County transport plan | Transport, Planning Infrastructure Public Information | Public transport improvements, Promoting sustainable transport | 2015 | 2032 | PBC | - | NO | Not Funded | £50k - £100k | Planning | 11% reduction in car trips; 15-33% increase in walking, cycling and use of public transport | Reduction in traffic flow | County transport plan | Staffing / Funding |
| 10 | Bus route improvements | Transport Planning and Infrastructure | Bus route improvements | 2015 | 2030 | PBC, LCC | LCC/bus company | NO | Not Funded | £1 million - £10 million | Planning | Reduction of current bus emissions which account for 4% of total NO2 | Improved bus fleet | LCC to continue to support Nelson bus station and provide financial support to key non-commercial bus services (currently 17 in Pendle)/ | Funding / Staffing / Willingness of bus company |

| Measure No. | Measure Title | Category | Classification | Year Measure Introduced in AQAP | Estimated / Actual Completion Date | Organisations Involved | Funding Source | Defra AQ Grant Funding | Funding Status | Estimated Cost of Measure | Measure Status | Reduction in Pollutant / Emission from Measure | Key Performance Indicator | Progress to Date | Comments / Barriers to Implementation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11 | Improvement in bus fleet emissions | Transport Planning and Infrastructure. Promoting low emission transport | Public transport improvements- interchanges stations and services. Public vehicle procurement- prioritising uptake of low emission vehicles | 2015 | 2030 | PBC PBC, LCC | S.106/LCC - | NO | Not Funded | £1 million - £10 million | Planning | Up to 29% of NOX emission from busses | Planning granted for P&R. Also new and improved services | N Work with bus companies to upgrade bus fleet composition. Whilst making bus use more attractive to potential users one | Funding |
| 12 | Awareness of public of idling vehicles and potential LA enforcement action for failing to do so. | Public Information and traffic management | Anti-idling enforcement. Awareness via the intenet and social media and press release. Enforcement for parking on the highway | 2015 | 2025 | PBC | PBC | NO | Not Funded | < £10k | Planning | Reduced emissions from idling vehicles | Awareness if idling and consequences. Reduction in idling and parking on the highway through enforcement | Officers to be authorised to enforce anti-idling legislation, but staff resources are limited. Also implement “No idling zones” and signage | Staff Resources |
| 13 | Freight Consolidation Centre | Freight and Delivery Management | Freight Consolidation Centre | 2015 | 2032 | PBC, LCC | - | NO | Not Funded | £1 million - £10 million | Planning | Up to 32% NO2 emissions from HGVs | Commissioning FCC, to improve traffic flows and reduce emissions in town centres | Yet to start | Funding |
| 14 | Carry out regular emissions testing of Council vehicle fleet to ensure that all vehicles comply with the law | Vehicle Fleet Efficiency and Traffic Management | Testing Vehicle Emissions. Fleet efficiency | 2015 | Ongoing | PBC | PBC | NO | Partially Funded | < £10k | Implementation | Reduced emissions from PBC fleet | Efficient less air polluting fleet | Council vehicles already undergo an enhanced service plan and regular MOT inspections to ensure | Funding to increase beyond legal minimum / lack of operational benefit |
| 15 | Fit abatement equipment if necessary to older heavy goods vehicles to help minimise pollution | Vehicle Fleet Efficiency | Vehicle Retrofitting programmes, for fleet efficiency | 2015 | 2025 | PBC | PBC | NO | Not Funded | £50k - £100k | Planning | Reduced emissions from PBC fleet | Fleet emission reduction and improvement to air quality | Review of council fleet and possibly retrofit options being considered. Trial of eco fuel scheme completed and fully implemented | Funding / Staff Resources / Technology |

| Measure No. | Measure Title | Category | Classification | Year Measure Introduced in AQAP | Estimated / Actual Completion Date | Organisations Involved | Funding Source | Defra AQ Grant Funding | Funding Status | Estimated Cost of Measure | Measure Status | Reduction in Pollutant / Emission from Measure | Key Performance Indicator | Progress to Date | Comments / Barriers to Implementation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 16 | Promote the use of cleaner or alternative fuels where possible including the introduction of electricity powered vans | Vehicle Fleet Efficiency. Promoting low emission transport. | Fleet efficiency and recognition schemes. Company vehicle procurement prioritising low emission vehicles | 2015 | Ongoing | PBC | PBC | NO | Partially Funded | £1 million - £10 million | Implementation | Reduced emissions from PBC fleet | Introduce new electric or hybrid vehicles to council fleet. Fleet emission reduction as well as promoting low emission transport | Phased approach to implementation | Funding |
| 17 | Establish and implement a rolling programme for replacing older more polluting vehicles with newer cleaner vehicles | Vehicle Fleet Efficiency. Promoting low emission transport. | Fleet efficiency and recognition schemes. Company vehicle procurement prioritising low emission vehicles | 2015 | Ongoing | PBC | PBC | NO | Partially Funded | £1 million - £10 million | Implementation | Reduced emissions from PBC fleet by replacing old vehicles with newer cleaner vehicles | Improve average euro class of the whole Council owned fleet, Increased use of low emission Council vehicles particularly heavy good reducing emissions and improving air quality | Phased approach | Funding |
| 18 | Improve the Council's vehicle fuel consumption efficiency by better management of fleet activities | Vehicle Fleet Efficiency. | Workplace, travel planning. Driving training | 2015 | Ongoing | PBC | PBC | NO | Funded | < £10k | Implementation | Awareness to drivers over braking and accelerating. Plan to reduce amount of PBC vehicle trips through AQMA | Reduction in emissions through route planning, Driving behaviour to improve air quality. | Plan for all fleet activities by reviewing routes | Funding |
| 19 | Collaboration with Sustrans to promote alternative travel | Promoting Travel Alternatives and alternatives to private vehicle use | Promoting sustainable transport. Promote use of bus, cycling, walking, waterways and rail | 2015 | Ongoing | PBC/Sustrans/LCC | PBC, Sustrans | NO | Not Funded | < £10k | Planning | Reduced emissions from car journeys, whilst encouraging sustainable travel alternatives | Reduced vehicle trips and increased use of public and sustainable transport | LCC already developing a payment NoW card to work through partnership area. Other schemes to be developed | Funding / Staff Time |
| 20 | Awareness and education of both domestic/commercial use wood burners and appropriate fuel | Public Information | Use of press releases and social media to raise awareness | 2015 | Ongoing | PBC | PBC | NO | Not Funded | £10k - 50k | Planning | Improved education resulting in lower emissions from domestic and commercial wood burners | Delivery of educational program for the Promotion, awareness of NOX to change behaviour | Information and links provided on website with further development | Funding / Staff Time |

| Measure No. | Measure Title | Category | Classification | Year Measure Introduced in AQAP | Estimated / Actual Completion Date | Organisations Involved | Funding Source | Defra AQ Grant Funding | Funding Status | Estimated Cost of Measure | Measure Status | Reduction in Pollutant / Emission from Measure | Key Performance Indicator | Progress to Date | Comments / Barriers to Implementation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21 | Promoting active travel campaigns to schools | Promoting Travel Alternatives. Public information and alternatives to private use vehicles | Promotion via school talks and travel plans. Car lift and sharing schemes | 2015 | Ongoing | PBC, LCC, Schools | PBC | NO | Partially funded | < £10k | Planning | Reduced schools' trips, reduced traffic emissions and changing behaviour | Implementation of travel plans at each school in Borough, to raise awareness, change behaviour and reduce emissions. | Encouragement of travel plans within schools underway, basic template provided | School take up of campaigns to walk to and from school as opposed to vehicle use |
| 22 | Creating public awareness of levels of pollution within locality and ways to minimise impacts on air quality | Public Information | Hold community forums/schools or media events and develop web based/share web-tools to increase air quality awareness | 2015 | Ongoing | PBC, Defra | PBC, Defra | NO | Partially Funded | £10k - 50k | Implementation | Improved knowledge | Real time data available to public | Increased public awareness of air quality issues and ultimate shift to less polluting forms of transport. Links to Defra Air Pollution Forecast website, included on PBC website | Resources |
| 23 | Work in partnership with County Council to increase uptake and implementation of workplace and residential Travel Plans | Promoting travel alternatives. Alternatives to private vehicle use | Personalised travel planning, via Car lift sharing schemes and car clubs, personalised, and workplace travel plans. | 2015 | Ongoing | LCC/PBC | LCC/PBC | No | Partially funded | £10k - 50k | Part implemented | Reduced emissions from vehicle journeys | Removal of existing road traffic from the road networks and minimisation of that introduced by new schemes | Build upon existing travel plans provisions, ensure momentum and identify new ways to promote | Resources and funding |
| 24 | Comment upon planning applications to ensure all relevant air quality issues are highlighted and mitigation measures are considered wherever possible | Policy Guidance and Development Control | Air Quality Planning and Policy Guidance | 2015 | Ongoing | PBC | PBC | NO | Partially Funded | £10k - 50k | Implementation | Reduced emissions from developments / associated traffic | Comments made on each relevant applications which could impact on air quality are properly assessed | Air Quality comments made on each relevant planning application submitted to PBC | Ongoing work |
| 25 | Contribute to and influence forthcoming development policies for Lancashire County Council | Policy Guidance and Development Control | Regional Groups-Co-ordinating programmes to develop area wide strategies to reduce emissions and improve air quality. | 2015 | Ongoing | LCC | LCC | NO | Not Funded | £10k - 50k | Partial implementation | Increased inclusion of air quality considerations within County and Borough wide policy development | Regularly liaise with LCC to increase air quality considerations within policy development influence change | Ongoing | Resources |

| Measure No. | Measure Title | Category | Classification | Year Measure Introduced in AQAP | Estimated / Actual Completion Date | Organisations Involved | Funding Source | Defra AQ Grant Funding | Funding Status | Estimated Cost of Measure | Measure Status | Reduction in Pollutant / Emission from Measure | Key Performance Indicator | Progress to Date | Comments / Barriers to Implementation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 26 | Authorise and regularly inspect industrial premises under the Environmental Permitting regulatory regime | Environmental Permits | Control of environmental emissions | 2015 | Ongoing | PBC | PBC | NO | Partially Funded | £10k - 50k | Implementation | Monitoring and control of emissions from permitted processes | Completion of permit inspection process | Ongoing, processes are being inspected as ER risk rating scheme. With reductions of industrial emissions as a result of a tighter/more regular inspections. | Ongoing work |
| 27 | Responding to burning/emissions complaints from businesses and the public | Promoting low emission plant | Regulations for fuel quality for stationary and mobile sources | 2015 | Ongoing | PBC | PBC | NO | Partially Funded | £10k - 50k | Implementation | Prevent unnecessary burning of domestic and commercial waste | Reduce emissions to air from combustion of waste | Ongoing enforcement in line with council's enforcement policy | Ongoing work |
| 28 | Continuous monitoring of NOX emissions across the Borough and within AQ | Policy Guidance.Monitoring of NOX emissions in accordance with AQAP and ASR | Air quality monitoring | 2015 | Ongoing | PBC | PBC | NO | Funded | £10k - 50k | Implementation | Monitoring of emissions to inform on actions and management via the ASR and AQAP | Sufficient monitoring is key to understanding the extent of any air quality issues allowing appropriate management measures to be implemented and monitored | Ongoing monitoring program<br>Due to improved air quality, we will be seeking to revoke the AQMA for Colne. | Ongoing work. With continued monitoring in hot spot areas, with expansion and reduction based upon results. Looking to revoke AQMA |
| 29 | Move petrol tools to battery | Policy Guidance | Sustainable procurement | 2023 | Ongoing | PBC | PBC | NO | Funded | £10k-50k | Implementation | Reduction of emissions from petrol power tools such as hedge trimmer and chainsaw | Fleet emission reduction | Replacement of machinery with suitable battery alternatives as need for replacement arises with working cycle. so far we have 1 combi unit, 1 pruning saw and 1 hedge trimmer. On order next week are 2 chainsaw, 2 hedge trimmer, 2 pole saw, 2 kombi strimmers | Not all Professional grade battery tools are yet up to worktime/power via battery - market constantly evolving. ongoing work as required. bigger battery tools such as ride on mowers will be cost prohibitive |

| Measure No. | Measure Title | Category | Classification | Year Measure Introduced in AQAP | Estimated / Actual Completion Date | Organisations Involved | Funding Source | Defra AQ Grant Funding | Funding Status | Estimated Cost of Measure | Measure Status | Reduction in Pollutant / Emission from Measure | Key Performance Indicator | Progress to Date | Comments / Barriers to Implementation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | End user training - driver behaviour, idling, braking and speeding | Vehicle Fleet Efficiency | Driver training | 2023 | Ongoing | PBC | PBC | No | Not funded | <£10k | Implementation | Changing behaviour to reduce emissions | Reduction of NOX emissions | Advice/information available in staff driver handbook and driving safely training. | Ongoing but relies on implementation by staff |
| 31 | Where applicable, reduce the need for staff travel i.e. through home working, better use of IT and flexi working | Promoting travel alternatives | Facilitate homeworking | 2020 | Ongoing | PBC | PBC | No | Funded | £10k-50k | Implemented | Opportunities for agile working, cutting down travel and NOX emissions | Reduce emissions with less staff traveling to and from the office | Existing agile workers issued with laptop to work from home | Challenge removal of agile workers |
| 32 | Undertake annual staff travel survey to baseline and understand current commuting patterns and encourage lift sharing amongst PBC staff | Promoting Travel Alternatives. Public information | Public information via surveys. Personalised and workplace travel plans | 2020 | 2024 | PBC / LCC / Go Velo | PBC/LCC | NO | Not Funded | <£10k | Planning | Reduction in emissions from vehicles, through use of travel alternatives ie. Car sharing, travel plans and alternative public transport | Look at staff travelling behaviour with a view of identifying scheme, and ways to develop use of travel plans, low emission vehicles, and car sharing | Further up to date work is needed in this area. | Staff resources / funding |
| 33 | Bike library pilot (PIF funding project underway) | Promoting Travel Alternatives and alternatives to private vehicle use. Transport planning and infrastructure | Promotion use of cycling. Public cycle hire scheme | 2023 | 2025 | PBC/LCC/Go Velo | LCC Public Health | NO | Funded | <£10k | Implementation | Reducing car use and thereby emissions/promotion of travel alternatives to change behaviour and increase use of bikes | Bikes hired out, to change behaviour, choice and increased uptake on travel alternatives | Implementation in partnership with Go-Velo and PBC | Continuity once initial pilot scheme is over |
| 34 | Planning applications – consult with colleagues re active travel measures inc. cycling | Policy Guidance and Development Control. Transport Planning and Infrastructure. Promotion of low emission transport | Air quality and policy guidance. Sustainable transport improvements. Promotion of walking, cycling and Infrastructure to promote low emission vehicles, parking and recharging. | 2023 | 2025 | PBC/LCC | - | NO | Not Funded | <£10k | Implementation | 11% reduction in car trips; 15-33% increase in walking, cycling and use of public transport, to improve air quality and reduction in vehicle emissions and improvements to EV's | Planning apps shared to promote active travel measures, ie.for improve air quality, EV provision and infrastructure. | Discussions with Planning Department | Staff time |

| Measure No. | Measure Title | Category | Classification | Year Measure Introduced in AQAP | Estimated / Actual Completion Date | Organisations Involved | Funding Source | Defra AQ Grant Funding | Funding Status | Estimated Cost of Measure | Measure Status | Reduction in Pollutant / Emission from Measure | Key Performance Indicator | Progress to Date | Comments / Barriers to Implementation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 35 | LUF funding mobility hubs | Alternatives to private vehicle use. Transport infrastructure and promoting sustainable transport. Promoting of travel alternatives | Promotion of cycling and cycle network | 2023 | 2026 | PBC/LCC | LUF | NO | Funded | £50k | Planning | Reduction in pollution levels due to less private trips | Increased uptake on cycling and reduction in vehicle use. | Public consultations by LCC and start of construction | LCC managed scheme |
| 36 | Secure bike parking as part of mobility hubs | Alternatives to private vehicle use. Transport infrastructure and promoting sustainable transport. Promotion of travel alternatives | Promotion of cycling and cycle network | 2023 | 2026 | PBC | LUF | NO | Funded | £10k | Planning | Reduction in pollution levels due to less private trips | Increased uptake on cycling and reduction in vehicle use. | Public consultations by LCC and start of construction | Staff time |
| 37 | EV charging car parks | Promoting low emission transport | Priority parking for EV's. | 2023 | 2026 | PBC | No funding sources | NO | Not Funded | >£100k | Planning | Reduction in private vehicle trips thus reduction in NOx levels | Proving electrical vehicle parking accessibility and availability | Reviewing car parking strategy policy for Pendle | Resourcing |
| 38 | EV charging on street | Promoting low emission transport | Priority parking for EV's. | 2023 | 2026 | PBC, LCC | No funding sources | NO | Not Funded | >£100k | Planning | Reduction in NOx emissions, with use of sustainable transport | Proving electrical vehicle parking accessibility and availability | Discussions with LCC and trial scheme to be implemented. In accordance with LCC electric vehicle infrastructure scheme | Resourcing |
| 39 | More staff and public EV charging points | Promoting low emission transport | Refuelling infrastructure to promote low emission vehicles and EV charging | 2023 | 2025 | PBC/LCC | LUF | NO | Not Funded | >£10k | Planning | Reduction in the level of NOx emissions | Increased provision of domestic car charging points throughout the Borough to encourage use of EV's. | Discussions with LCC and other providers. Presently at the start of construction | Staff time/funding |
| 40 | Promote electric vehicles through the staff salary sacrifice car scheme | Promoting low emission transport | Public (staff) vehicle procurement for the uptake of low emission vehicles and EV's | 2020 | Ongoing | PBC | PBC, Liberata | NO | Staff funded as salary sacrifice with discounted costs | >£100k | Implementation | Reduction in NOx emissions, with use of sustainable transport | Promotion of EV's reasonable costs to encourage uptake and Reduce emissions | Ongoing commitment to provide EV cars to staff | Viable costs and willingness of staff |

| Measure No. | Measure Title | Category | Classification | Year Measure Introduced in AQAP | Estimated / Actual Completion Date | Organisations Involved | Funding Source | Defra AQ Grant Funding | Funding Status | Estimated Cost of Measure | Measure Status | Reduction in Pollutant / Emission from Measure | Key Performance Indicator | Progress to Date | Comments / Barriers to Implementation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 41 | Introduce and promote e-bike pool for PBC staff business use | Alternatives to private use vehicles. Promotion of travel alternatives. | Promotion of e-bikes | 2020 | 2023 | PBC | Connecting East Lancashire/LCC | NO | Funded | <£10k | Implemented | Reduction in private vehicle trips thus reduction in NOx | Change of behaviour and increased awareness and use of e-bikes for staff. | Introduction of two electric bikes for staff to hire. | Staff time |
| 42 | Salary sacrifice to buy a bike through work, Introduce milage allowance on bike scheme to encourage staff to cycle more for business's needs. | Alternatives to private use vehicles. Promotion of travel alternatives. | Promotion of cycling | 2018 | 2018 | PBC | PBC | NO | Funded | <£100k | Part-Implemented | Reduction in private vehicle trips thus reduction in NOx | Encourage staff member to purchase and use bikes as opposed to polluting vehicles. Offer milage rate for use of bike by staff for business needs | Bikes purchased on cycle 2 work scheme, that also included purchasing of electric bikes. Increased allowance of £1,000 to £1,500 on the basis of a c | Further work on paying milage to staff's using bikes on work business |
| 43 | Incentivise public transport use for PBC events and activities | Alternatives to private use vehicles. Promotion of travel alternatives. | Promotion of public transport | 2021 | Ongoing | PBC | PBC | NO | Not funded | <£100k | Planned | Reduce of NOx emissions from car journeys by staff | Uptake in staff using alternative public travel instead of polluting vehicles | Planned | Seeking to formalise within policy and procedure to move forward. Appetite to action |
| 44 | New bridleway to create a traffic free route between Brierfield, Nelson and Lomeshaye. Signpost and promote other existing cycle routes for safer cycling and walking | Alternatives to private use vehicles. Promoting travel alternatives. Transport planning and infrastructure | Promotion of cycling and walking, Other-improved safe infrastructure for cycling and waking. Improvements to waling and cycling network | 2018 | 2023 | PBC | ESIF LEP & LCC | NO | Funded | £1 million | Implemented | Reduction in private vehicle trips thus reduction NOx | Increased use of walking and cycling along a traffic free route that is safe. | Construction completed | New bridleway completed but other routes can be promoted work with LCC on the LCWIPS |
| 45 | Promote the canal tow path as a safe cycling and walking route | Promotion of travel alternatives, public information. Transport planning and infrastructure | Promotion of waterway, cycling and walking. Promotion of information via social media, press and the internet. Cycle network improvements. | 2018 | 2026 | PBC | PBC, LCC, LUF | NO | Funded part of Accessible Nelson | £3.4 million | Construction | Reduction in private vehicle trips thus reduction in NOx | Improve access onto the canal tow path. Linking up with other cycling and walking networks. Also creating awareness and promotion of improvements and changes | Public consultation with construction started | Staff time/working in partnership with LCC on Accessible Nelson - other canal routes to be promoted digitally on-line - staff time is barrier. |

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

As detailed in Policy Guidance LAQM.PG22 (Chapter 8) and the Air Quality Strategy[8], 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. Indicator D01 of the Public Health Outcomes Framework indicates the fraction of mortality attributable to particulate air pollution for England standing at 5.8% for 2022.

Though Pendle Borough Council does not currently monitor $PM_{2.5}$, the following measures address $PM_{2.5}$:

- The Borough has several designated Smoke Control Areas, covering the densely populated areas, and these are enforced where necessary. The Council responds to any complaint about smoke from chimneys or rubbish burning and works proactively to advise on the harm done by smoke emissions. Where education fails, the Council will take enforcement action.
- Encouraged the provision of electric vehicle recharging points on all new developments
- Investigating options for the provision of electric vehicle recharging points on Council car parks – currently trying to source funding.
- Raise awareness of the harmful effects of $PM_{2.5}$ using the Public Health Indicators which demonstrate that Pendle suffers from an adult mortality attributed to particulate matter (D01 health indicator) of 4.4% (2021)[9].
- Lancashire County Council have set out an ambitious cycling and walking strategy, called “Actively Moving Forward”, which aims to increase the number of people

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

[9] https://fingertips.phe.org.uk/profile/public-health-outcomes-framework/data#page/4/gid/1000043/pat/6/ati/501/are/E07000122/iid/93861/age/230/sex/4/cat/-1/ctp/-1/yrr/1/cid/4/tbm/1

actively travelling across the region by 2028. Through improving and increasing access to infrastructure, alongside training and promotional activities.

- As part of the Lancashire cycling and walking strategy, work is progressing on the development of Local Cycling and Walking Infrastructure Plans (LCWIPs).

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

This section sets out the monitoring undertaken within 2023 by Pendle Borough Council and how it compares with the relevant air quality objectives. In addition, monitoring results are presented for a five-year period between 2019 and 2023 to allow monitoring trends to be identified and discussed.

# Summary of Monitoring Undertaken

### 1.1.3 Automatic Monitoring Sites

Pendle Borough Council does not undertake any automatic monitoring for any pollutant across the borough.

### 1.1.4 Non-Automatic Monitoring Sites

Pendle Borough Council undertook non- automatic (i.e. passive) monitoring of $NO_2$ at 50 sites during 2023. Table A.1 in Appendix A presents the details of the non-automatic sites.

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.

# 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.

### 1.1.5 Nitrogen Dioxide (NO2)

Table A.2 in Appendix A compares 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 2023 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.

In 2023, no exceedances of the annual mean objective were recorded at any monitoring sites either within or outside the Colne AQMA. As such, there is no need to declare additional AQMAs or extend existing AQMAs. The highest results in 2023 were 31.4 µg/m$^3$ at site PEN91/PEN92 in Brierfield and 29.3 µg/m$^3$ at PEN17 in Brierfield. The highest value within the Colne AQMA was 26.4 µg/m$^3$.

Monitored levels of $NO_2$ in the Colne AQMA have generally declined over time and no exceedances have been recorded in the five years 2019-2023. As noted in last year's report, there is a case to revoke the AQMA. A detailed assessment in support of the council's application to revoke has been attached as an addendum to this report.

### 1.1.6 Particulate Matter (PM10 , PM2.5)

Pendle Borough Council does not monitor $PM_{10}$ or $PM_{2.5}$ levels. However, a check of the Defra background maps indicates no likely exceedances of the objective levels for either of these two pollutants.

In April 2023, Defra published a new Air Quality Strategy (AQS) for local authorities[10], which includes two legally binding $PM_{2.5}$ concentration targets which local authorities are responsible in working towards achieving:

- 10 µg/m$^3$ annual mean $PM_{2.5}$ concentration nationwide by 2040, with an interim target of 12 µg/m$^3$ by January 2028
- 35% reduction in average population exposure by 2040, with an interim target of a 22% reduction by January 2028 compared to a 2018 baseline.

[10] https://www.gov.uk/government/publications/the-air-quality-strategy-for-england/air-quality-strategy-framework-for-local-authority-delivery#

From latest available 1 km x 1 km background maps for $PM_{2.5}$ for 2023 (using 2018 baseline)[11], Pendle Borough has an average background annual mean $PM_{2.5}$ concentration of 5.99 µg/m$^3$ with a highest concentration of 8.87 µg/m$^3$ which satisfies both $PM_{2.5}$ objectives. This is an improvement on the average background annual mean $PM_{2.5}$ concentration of 6.53 µg/m$^3$ with a maximum of 9.5 µg/m$^3$ in 2018.

Considering each data point at 1 km resolution from 2023 background concentration projections, 100% of the council area is still below the 12 µg/m$^3$ concentration objective for 2028 and the 10 µg/m$^3$ concentration objective for 2040.

Pendle Borough Council will be proactive in further reducing $PM_{2.5}$ emissions within the area and their control in order to maintain the projected compliance with the new $PM_{2.5}$ objectives.

### 1.1.7 Sulphur Dioxide (SO2)

Pendle Borough Council does not monitor $SO_2$ levels

[11] https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2018

# Appendix A: Monitoring Results

### Table A.1 – 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) |
|---|---|---|---|---|---|---|---|---|---|---|
| PEN28 | Pendle Business Centre | Urban Background | 386296 | 437592 | NO2 | No | 10.0 | 10.0 | No | 2.5 |
| PEN13, PEN14 | Brunswick Street, Nelson | Roadside | 386109 | 437634 | NO2 | No | 5.0 | 5.0 | No | 2.5 |
| PEN17 | 62 Burnley Road, Brierfield | Roadside | 384610 | 436118 | NO2 | No | 0.0 | 0.0 | No | 2.5 |
| PEN72 | 82 Burnley Road, Brierfield | Roadside | 384587 | 436098 | NO2 | No | 0.0 | 0.0 | No | 2.5 |
| PEN73 | 92 Burnley Road, Brierfield | Roadside | 384576 | 436006 | NO2 | No | 0.0 | 0.0 | No | 2.5 |
| PEN99 | 18 Burnley Road, Brierfield (Bottom Hill Street) | Roadside | 384683 | 436357 | NO2 | No | 1.0 | 1.0 | No | 2.5 |
| PEN91, PEN92 | 3 Burnley Road, Brierfield | Roadside | 384664 | 436365 | NO2 | No | 1.0 | 1.0 | No | 2.5 |
| PEN93, PEN94 | 62 Colne Road, Brierfield | Roadside | 384682 | 436650 | NO2 | No | 1.0 | 1.0 | No | 2.5 |
| PEN11, PEN12 | 25 Gisburn Road, Barrowford | Roadside | 385734 | 438965 | NO2 | No | 1.0 | 1.0 | No | 2.5 |
| PEN74 | 14 Gisburn Road, Barrowford | Roadside | 385728 | 438925 | NO2 | No | 1.0 | 1.0 | No | 2.5 |

| 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) |
|---|---|---|---|---|---|---|---|---|---|---|
| PEN75 | 17 Gisburn Road, Barrowford | Roadside | 385732 | 438936 | NO2 | No | 1.0 | 1.0 | No | 2.5 |
| PEN95, PEN96 | 145 Gisburn Road, Barrowford | Roadside | 385975 | 439719 | NO2 | No | 1.0 | 1.0 | No | 2.5 |
| PEN97, PEN98 | 2 Brookbank, Barrowford | Roadside | 386101 | 439797 | NO2 | No | 1.0 | 1.0 | No | 2.5 |
| PEN90 | 37 Parker Street, Colne | Urban Background | 388138 | 440143 | NO2 | No | 10.0 | 10.0 | No | 2.5 |
| PEN82, PEN83 | 257 North Valley Road, Colne | Roadside | 389061 | 440482 | NO2 | Yes - Colne | 0.0 | 0.0 | No | 2.5 |
| PEN84, PEN85 | Junction North Valley/Langroyd Road, Colne | Roadside | 389079 | 440492 | NO2 | Yes - Colne | 0.0 | 0.0 | No | 2.5 |
| PEN76, PEN77 | 9 Langroyd Road, Colne | Roadside | 389081 | 440519 | NO2 | No | 3.0 | 3.0 | No | 2.5 |
| PEN78, PEN79 | 10 Langroyd Road, Colne | Roadside | 389098 | 440508 | NO2 | No | 3.0 | 3.0 | No | 2.5 |
| PEN36 | 22 Langroyd Road, Colne | Roadside | 389102 | 440540 | NO2 | No | 3.0 | 3.0 | No | 2.5 |
| PEN86, PEN87 | Likkle Monkeys Nursery, Langroyd Road, Colne RHS | Roadside | 389105 | 440484 | NO2 | Yes - Colne | 3.0 | 3.0 | No | 2.5 |
| PEN65, PEN66 | 60 Windsor Street, Colne | Roadside | 389159 | 440488 | NO2 | Yes - Colne | 3.0 | 3.0 | No | 2.5 |
| PEN67, PEN68 | 44 Windsor Street, Colne | Roadside | 389207 | 440484 | NO2 | Yes - Colne | 3.0 | 3.0 | No | 2.5 |

| 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) |
|---|---|---|---|---|---|---|---|---|---|---|
| PEN69, PEN70 | 32 Windsor Street, Colne | Roadside | 389250 | 440482 | NO2 | Yes - Colne | 3.0 | 3.0 | No | 2.5 |
| PEN63, PEN64 | 100 Skipton Road, Colne | Roadside | 389425 | 440490 | NO2 | Yes - Colne | 3.0 | 3.0 | No | 2.5 |
| PEN4, PEN54, PEN3 | 92 Skipton Road, Colne | Roadside | 389410 | 440463 | NO2 | Yes - Colne | 3.0 | 3.0 | No | 2.5 |
| PEN5, PEN6 | Town Hall, Albert Road, Colne | Urban Centre | 388820 | 440045 | NO2 | No | 2.0 | 2.0 | No | 2.5 |
| PEN71 | Rowlands, 7 Albert Road, Colne | Urban Centre | 388755 | 440026 | NO2 | No | 2.0 | 2.0 | No | 2.5 |
| PEN47 | Jaipur, 19 Albert Road, Colne | Urban Centre | 388711 | 439999 | NO2 | No | 2.0 | 2.0 | No | 2.5 |
| PEN46 | 52 Albert Road, Colne | Urban Centre | 388655 | 440002 | NO2 | No | 3.0 | 3.0 | No | 2.5 |
| PEN7, PEN8 | Junc Lord St/Albert Road, Colne | Roadside | 388389 | 439924 | NO2 | No | 1.0 | 1.0 | No | 2.5 |
| PEN50 | 59 Burnley Road, Colne | Roadside | 387922 | 439500 | NO2 | No | 1.0 | 1.0 | No | 2.5 |

**Notes:**

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

(2) N/A if not applicable.

## Table A.2– Annual Mean NO2 Monitoring Results: Non-Automatic Monitoring (µg/m3)

| 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 2023 (%) [2] | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|---|---|---|---|
| PEN28 | 386296 | 437592 | Urban Background | 100 | 90.5 | 17.4 | 13.0 | 14.7 | 16.0 | 13.4 |
| PEN13, PEN14 | 386109 | 437634 | Roadside | 100 | 83.0 | 31.7 | 23.3 | 26.4 | 27.0 | 25.0 |
| PEN17 | 384610 | 436118 | Roadside | 100 | 100.0 | 34.7 | 26.9 | 27.8 | 31.2 | 29.3 |
| PEN72 | 384587 | 436098 | Roadside | 100 | 92.4 | 30.6 | 23.9 | 27.2 | 28.1 | 26.4 |
| PEN73 | 384576 | 436006 | Roadside | 100 | 100.0 | 32.0 | 25.6 | 28.8 | 29.0 | 28.2 |
| PEN99 | 384683 | 436357 | Roadside | 100 | 90.8 | 37.7 | 25.6 | 28.9 | 28.8 | 27.2 |
| PEN91, PEN92 | 384664 | 436365 | Roadside | 100 | 100.0 | 37.5 | 29.2 | 31.5 | 32.6 | 31.0 |
| PEN93, PEN94 | 384682 | 436650 | Roadside | 100 | 100.0 | 35.1 | 25.9 | 29.0 | 30.0 | 28.1 |
| PEN11, PEN12 | 385734 | 438965 | Roadside | 100 | 100.0 | 29.6 | 21.4 | 24.5 | 24.2 | 22.7 |
| PEN74 | 385728 | 438925 | Roadside | 100 | 100.0 | 29.4 | 22.2 | 24.9 | 25.2 | 22.7 |
| PEN75 | 385732 | 438936 | Roadside | 100 | 90.5 | 31.5 | 24.6 | 26.7 | 27.7 | 25.1 |
| PEN95, PEN96 | 385975 | 439719 | Roadside | 100 | 100.0 | 28.9 | 20.4 | 24.0 | 24.2 | 21.8 |
| PEN97, PEN98 | 386101 | 439797 | Roadside | 100 | 100.0 | 26.8 | 21.2 | 20.8 | 22.1 | 19.9 |

| 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 2023 (%) [2] | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|---|---|---|---|
| PEN90 | 388138 | 440143 | Urban Background | 100 | 83.0 | 26.7 | 12.3 | 21.3 | 24.0 | 20.9 |
| PEN82, PEN83 | 389061 | 440482 | Roadside | 100 | 100.0 | 31.0 | 25.0 | 25.3 | 26.1 | 23.4 |
| PEN84, PEN85 | 389079 | 440492 | Roadside | 100 | 100.0 | 27.6 | 30.0 | 30.6 | 30.6 | 28.3 |
| PEN76, PEN77 | 389081 | 440519 | Roadside | 100 | 90.8 | 28.0 | 18.1 | 22.9 | 22.8 | 20.5 |
| PEN78, PEN79 | 389098 | 440508 | Roadside | 100 | 100.0 | 31.7 | 25.4 | 27.2 | 24.9 | 25.9 |
| PEN36 | 389102 | 440540 | Roadside | 100 | 100.0 | 30.2 | 20.9 | 24.4 | 25.5 | 22.2 |
| PEN86, PEN87 | 389105 | 440484 | Roadside | 100 | 100.0 | 37.9 | 27.1 | 29.4 | 30.9 | 28.9 |
| PEN65, PEN66 | 389159 | 440488 | Roadside | 100 | 100.0 | 29.9 | 21.0 | 29.5 | 25.6 | 24.7 |
| PEN67, PEN68 | 389207 | 440484 | Roadside | 100 | 90.8 | 32.8 | 25.5 | 27.1 | 26.2 | 26.5 |
| PEN69, PEN70 | 389250 | 440482 | Roadside | 100 | 100.0 | 29.8 | 22.2 | 25.2 | 22.1 | 24.1 |
| PEN63, PEN64 | 389425 | 440490 | Roadside | 100 | 100.0 | 27.1 | 20.2 | 20.0 | 21.7 | 23.4 |
| PEN4, PEN54, PEN3 | 389410 | 440463 | Roadside | 100 | 100.0 | 26.8 | 22.1 | 24.4 | 23.9 | 24.3 |
| PEN5, PEN6 | 388820 | 440045 | Urban Centre | 100 | 100.0 | 31.1 | 23.3 | 24.7 | 26.4 | 26.0 |
| PEN71 | 388755 | 440026 | Urban Centre | 100 | 100.0 | 31.2 | 23.7 | 25.1 | 26.5 | 26.0 |

| 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 2023 (%) (2) | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|---|---|---|---|
| PEN47 | 388711 | 439999 | Urban Centre | 100 | 90.5 | 31.4 | 22.4 | 27.5 | 26.7 | 25.4 |
| PEN46 | 388655 | 440002 | Urban Centre | 100 | 81.4 | 29.9 | 21.6 | 25.3 | 24.6 | 23.5 |
| PEN7, PEN8 | 388389 | 439924 | Roadside | 100 | 100.0 | 29.3 | 19.9 | 23.9 | 22.9 | 21.1 |
| PEN50 | 387922 | 439500 | Roadside | 100 | 100.0 | 30.4 | 22.7 | 26.6 | 26.2 | 24.0 |

☒ **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$^3$.

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 NO2 Concentrations

## Figure A.1.1 - Trends in annual mean $NO_2$ concentrations – Colne AQMA

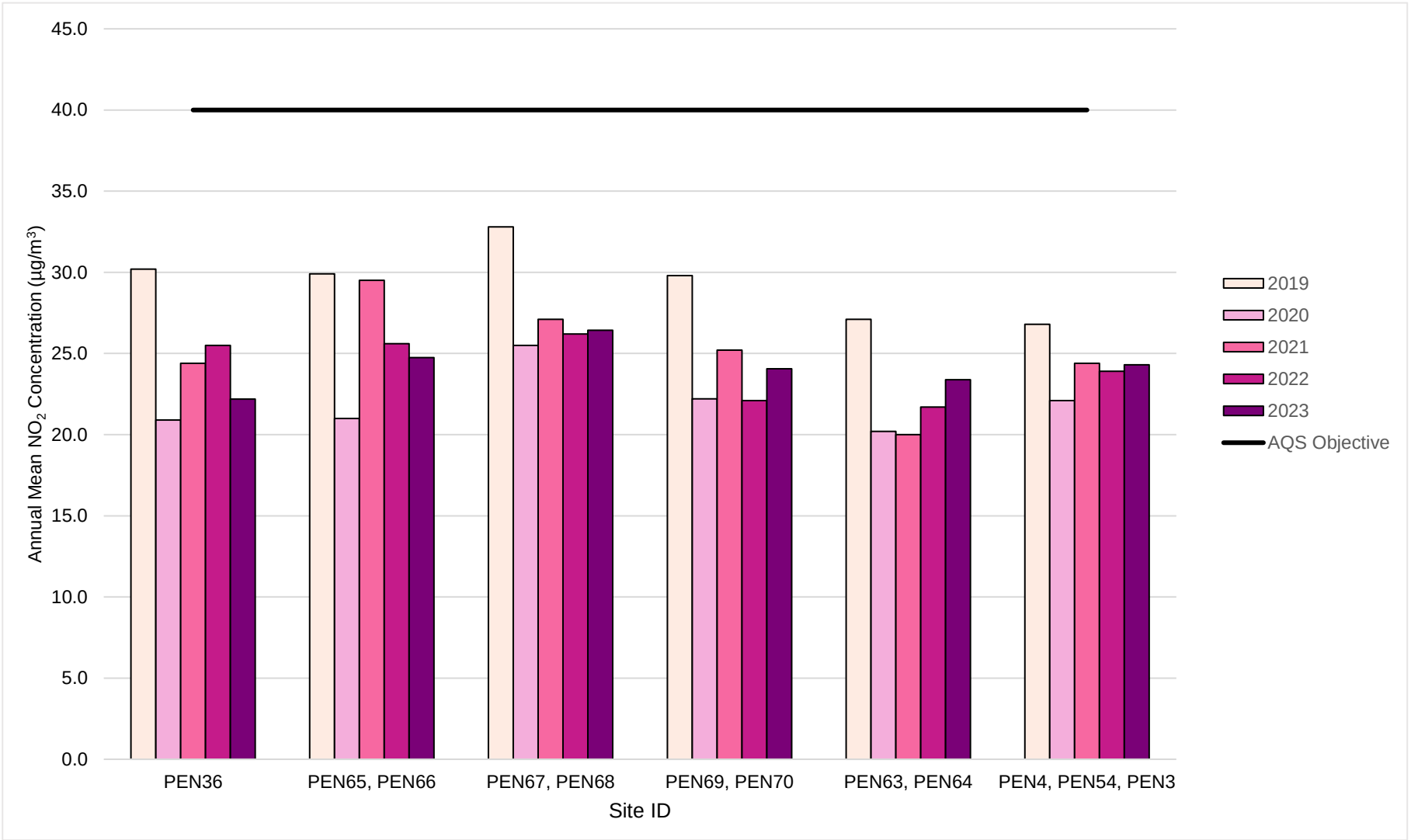


**Figure A.1.2 - Trends in annual mean $NO_2$ concentrations – Colne, Albert Road (outside of AQMA)**

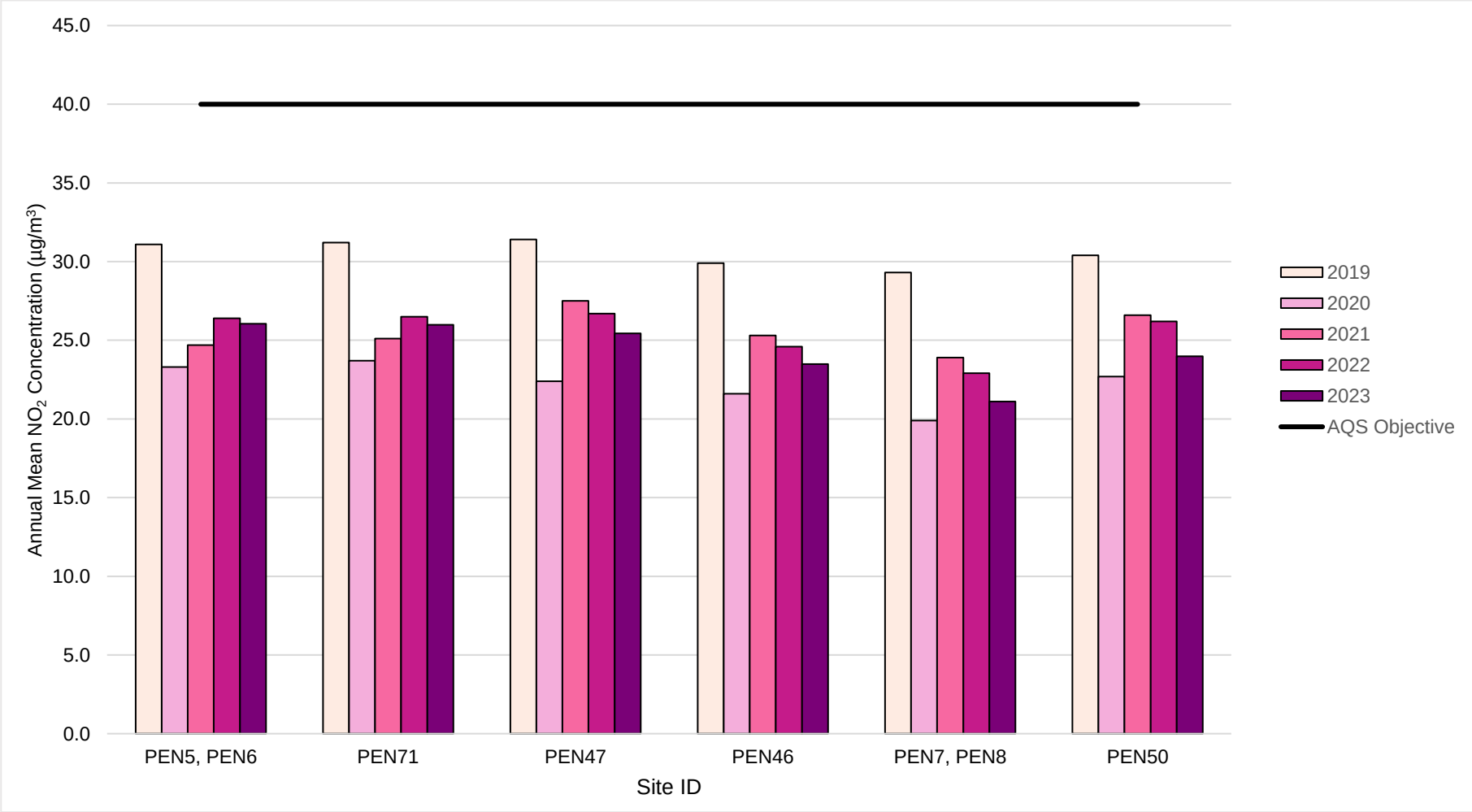


**Figure A.1.3 - Trends in annual mean $NO_2$ concentrations – Colne, A6068 (outside of AQMA)**

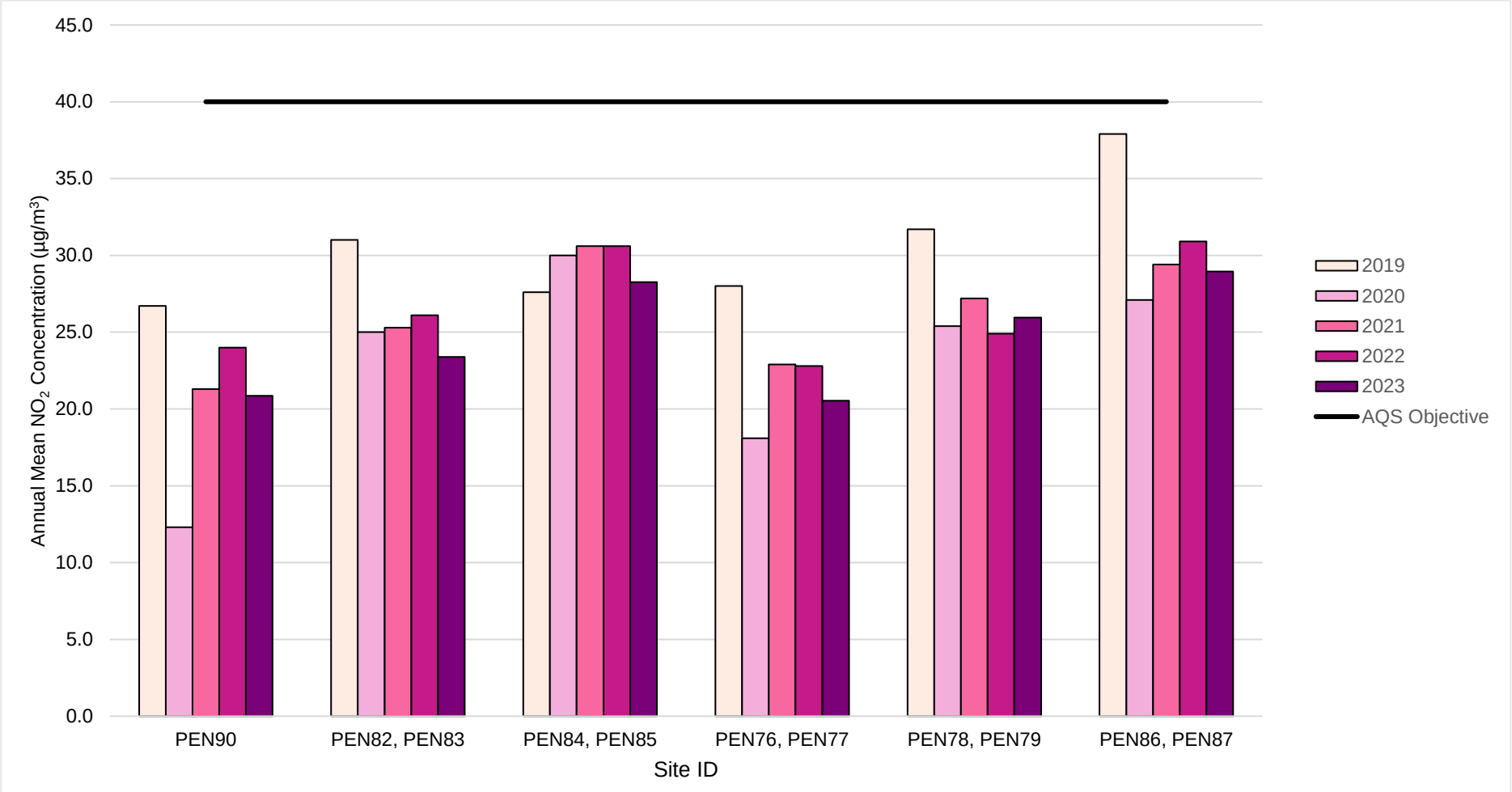


**Figure A.1.4 - Trends in annual mean $NO_2$ concentrations – Barrowford**

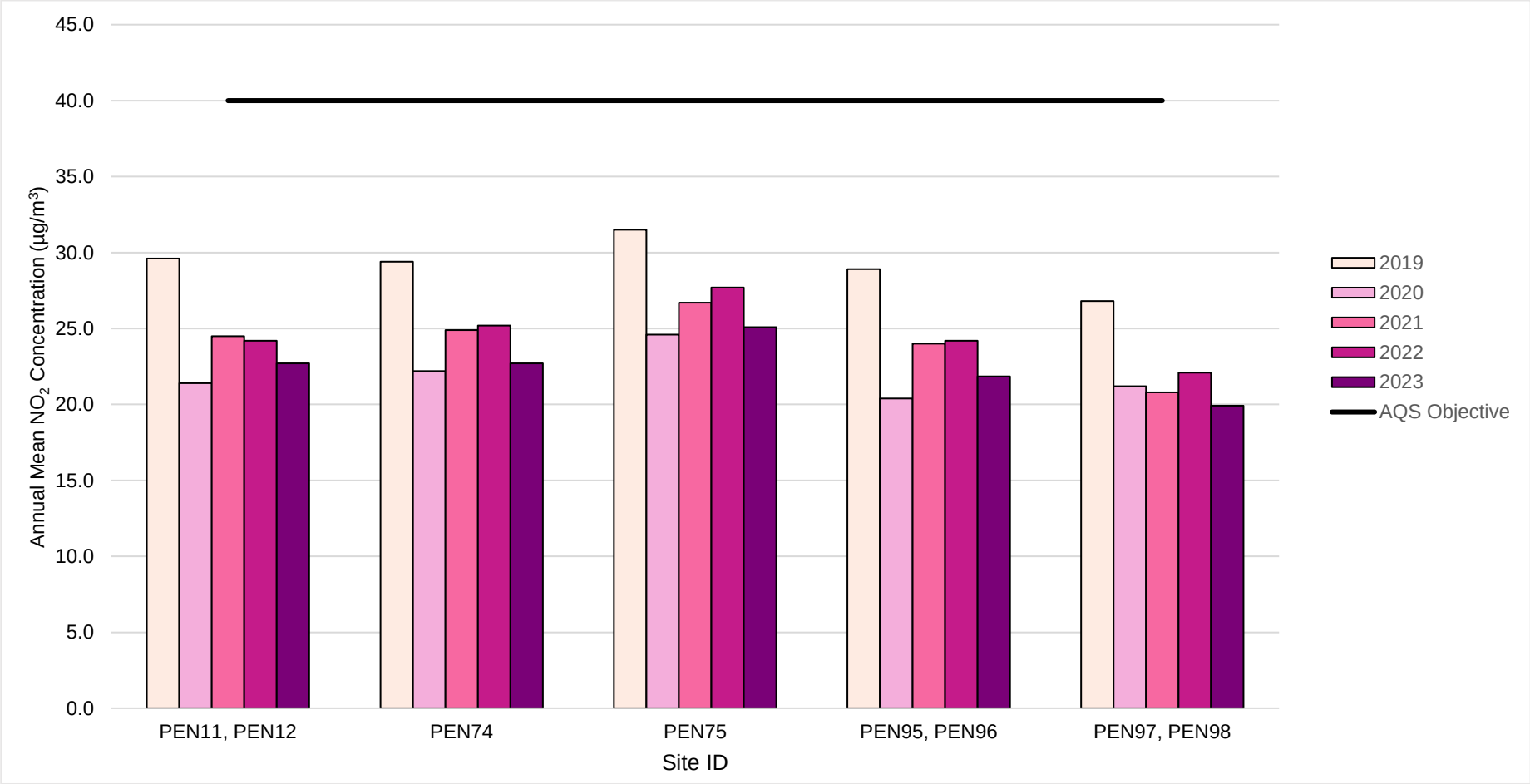
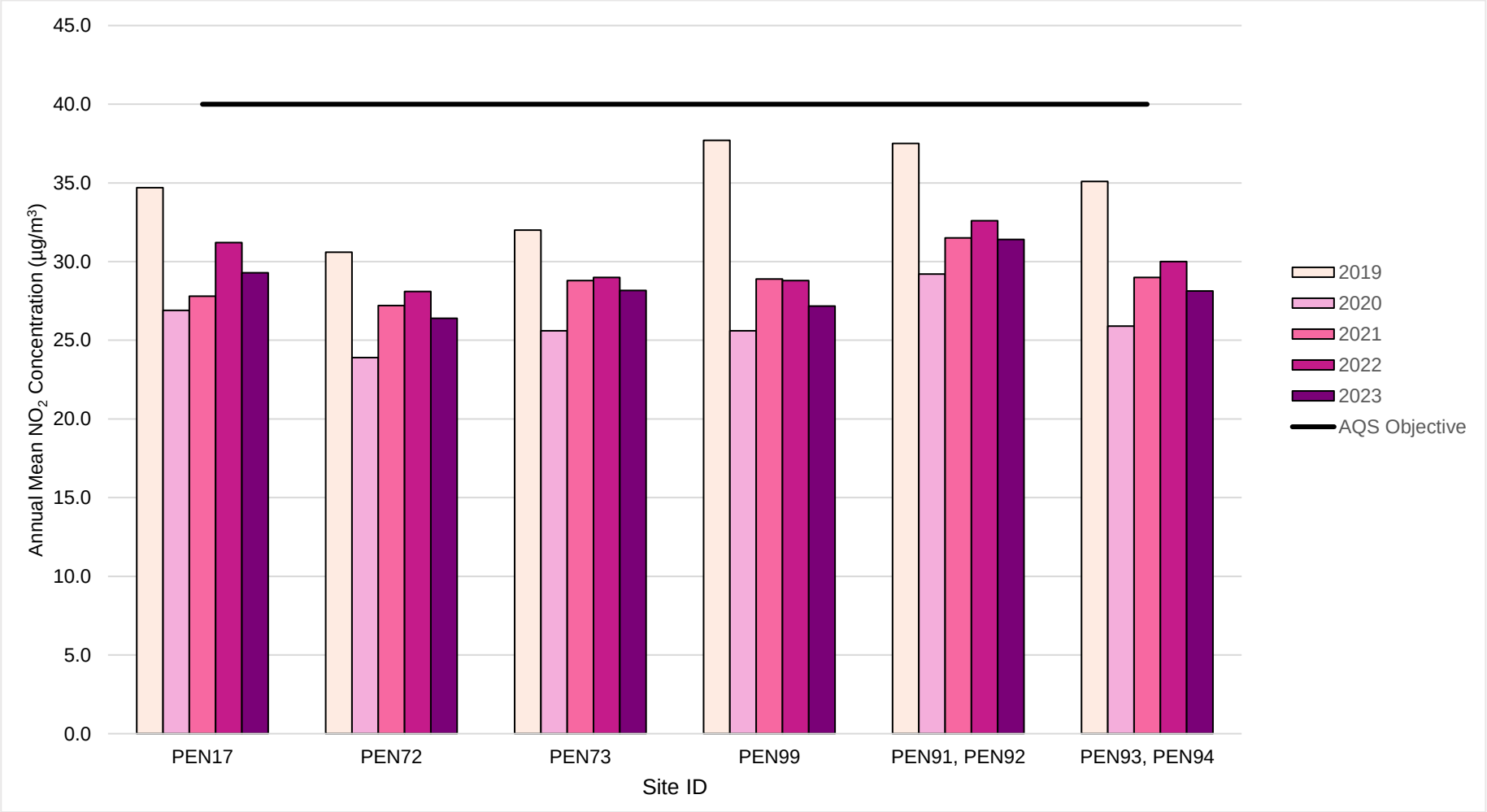
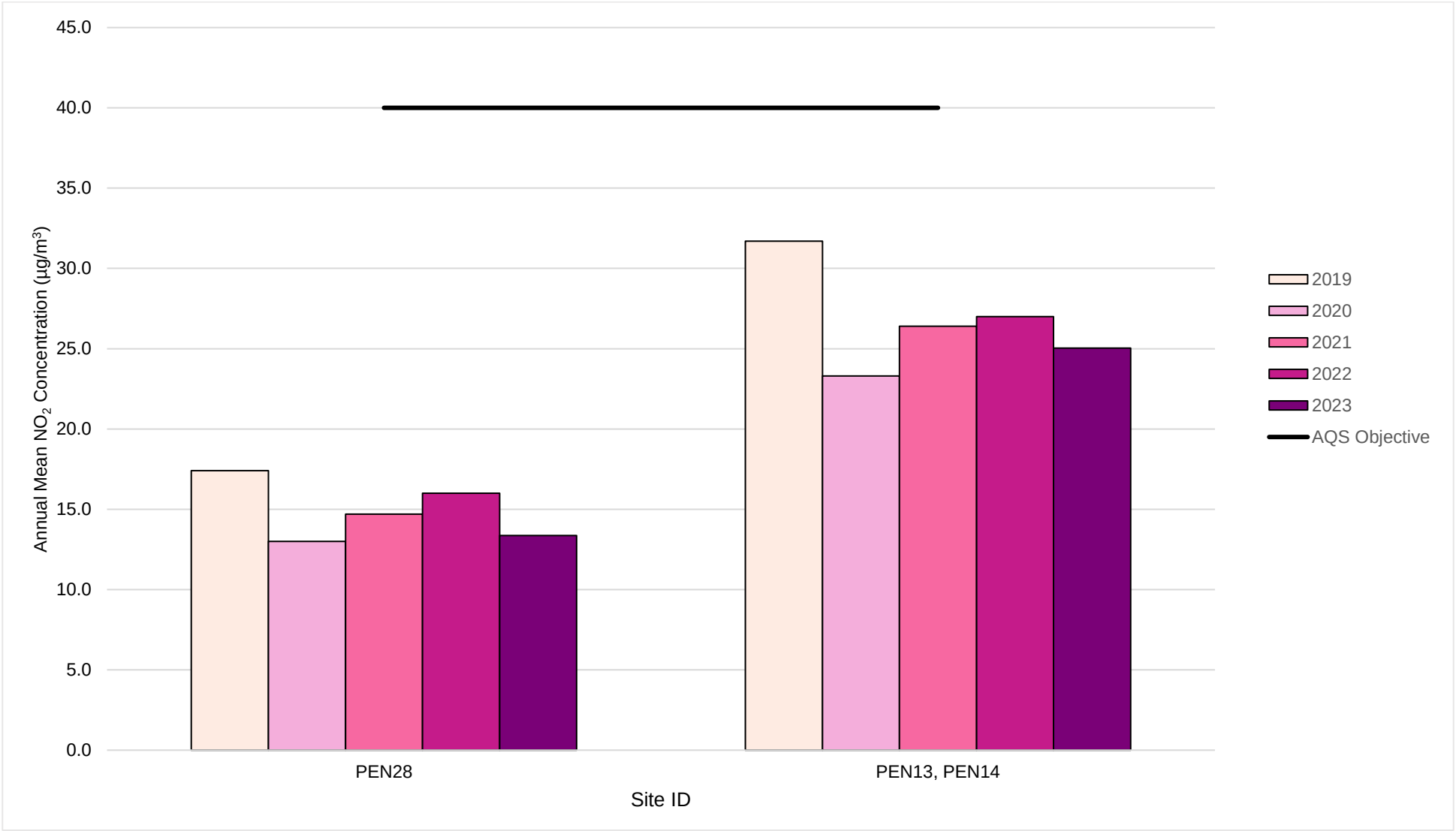


**Figure A.1.5 - Trends in annual mean $NO_2$ concentrations – Brierfield**



## Figure A.1.6 - Trends in annual mean $NO_2$ concentrations – Nelson



# Appendix B: Full Monthly Diffusion Tube Results for 2023

### Table B.1– NO2 2023 Diffusion Tube Results (µg/m3)

| 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 (0.81) | Annual Mean: Distance Corrected to Nearest Exposure | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PEN28 | 386296 | 437592 | 24.1 | 18.5 | 17.2 | 15.2 | 11.5 | 12.7 | 11.5 | 12.7 | 14.7 | 20.3 | 23.3 | | 16.5 | 13.4 | - | |
| PEN13 | 386109 | 437634 | 36.5 | 31.3 | 35.6 | | | 29.7 | 28.1 | 26.6 | 33.8 | 30.7 | 34.2 | 30.9 | - | - | - | Duplicate Site with PEN13 and PEN14 - Annual data provided for PEN14 only |
| PEN14 | 386109 | 437634 | | | 33.6 | | | 30.7 | 27.3 | 27.4 | 33.7 | 31.4 | 30.2 | 19.0 | 30.9 | 25.0 | - | Duplicate Site with PEN13 and PEN14 - Annual data provided for PEN14 only |
| PEN17 | 384610 | 436118 | 37.7 | 40.2 | 36.4 | 39.8 | 35.7 | 38.6 | 30.9 | 32.4 | 39.5 | 35.1 | 38.7 | 29.2 | 36.2 | 29.3 | - | |
| PEN72 | 384587 | 436098 | 34.0 | 34.6 | 34.3 | 35.6 | 25.6 | 30.6 | | 26.0 | 34.1 | 33.0 | 37.9 | 32.7 | 32.6 | 26.4 | - | |
| PEN73 | 384576 | 436006 | 35.4 | 39.1 | 36.8 | 39.3 | 32.0 | 37.3 | 25.8 | 27.6 | 34.2 | 37.5 | 39.7 | 32.6 | 34.8 | 28.2 | - | |
| PEN99 | 384683 | 436357 | 38.5 | 37.8 | 35.6 | 39.8 | 31.7 | 32.9 | 27.3 | 30.3 | 34.2 | 31.3 | | 29.7 | 33.5 | 27.2 | - | |
| PEN91 | 384664 | 436365 | 39.0 | 43.1 | 35.9 | 37.8 | 36.4 | | 34.9 | 37.0 | 40.8 | 38.0 | 37.5 | 35.8 | - | - | - | Duplicate Site with PEN91 and PEN92 - Annual data provided for PEN92 only |
| PEN92 | 384664 | 436365 | 43.4 | 41.2 | 37.4 | 39.0 | 35.5 | 36.4 | 34.9 | 35.7 | 40.2 | 41.0 | 46.6 | 35.8 | 38.3 | 31.0 | - | Duplicate Site with PEN91 and PEN92 - Annual data provided for PEN92 only |
| PEN93 | 384682 | 436650 | 40.5 | 37.8 | 37.0 | 34.9 | 28.6 | 28.7 | 27.8 | 28.9 | | 60.6 | 41.2 | 33.4 | - | - | - | Duplicate Site with PEN93 and PEN94 - Annual data provided for PEN94 only |
| PEN94 | 384682 | 436650 | 38.5 | 37.5 | 35.9 | 34.6 | 27.6 | 29.5 | 30.2 | 29.9 | 32.8 | 32.2 | 40.4 | 32.1 | 34.7 | 28.1 | - | Duplicate Site with PEN93 and PEN94 - Annual data provided for PEN94 only |
| PEN11 | 385734 | 438965 | 35.1 | 32.8 | 30.0 | 27.9 | 22.8 | 23.0 | | 22.9 | 28.6 | 28.1 | 34.9 | 26.4 | - | - | - | Duplicate Site with PEN11 and PEN12 - Annual data provided for PEN12 only |
| PEN12 | 385734 | 438965 | 34.0 | 34.9 | 29.8 | 27.3 | 22.7 | 23.4 | 22.6 | | 28.6 | 28.1 | 36.2 | 27.2 | 28.0 | 22.7 | - | Duplicate Site with PEN11 and PEN12 - Annual data provided for PEN12 only |
| PEN74 | 385728 | 438925 | 31.8 | 33.8 | 29.9 | 30.7 | 22.8 | 26.1 | 20.7 | 22.7 | 28.6 | 28.5 | 33.8 | 27.3 | 28.0 | 22.7 | - | |
| PEN75 | 385732 | 438936 | 36.9 | 37.5 | 32.9 | 31.1 | 24.9 | 25.0 | 25.3 | 25.0 | 34.0 | 30.3 | 37.8 | | 31.0 | 25.1 | - | |
| PEN95 | 385975 | 439719 | 30.1 | 33.4 | 29.5 | | 23.9 | 25.4 | 20.8 | 23.0 | 27.2 | 25.7 | | | - | - | - | Duplicate Site with PEN95 and PEN96 - Annual data provided for PEN96 only |
| PEN96 | 385975 | 439719 | 28.8 | 31.8 | 28.3 | 28.1 | 24.1 | | 20.3 | 23.7 | 26.8 | 25.7 | 31.6 | 27.0 | 27.0 | 21.8 | - | Duplicate Site with PEN95 and PEN96 - Annual data provided for PEN96 only |

| 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 (0.81) | Annual Mean: Distance Corrected to Nearest Exposure | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PEN97 | 386101 | 439797 | 28.4 | 30.8 | 24.8 | 24.9 | 21.2 | 22.6 | 20.2 | 20.9 | 24.9 | 24.7 | 28.5 | 23.6 | - | - | - | Duplicate Site with PEN97 and PEN98 - Annual data provided for PEN98 only |
| PEN98 | 386101 | 439797 | 26.9 | 29.9 | 26.0 | 24.6 | 21.6 | 23.1 | 20.2 | 21.2 | 25.3 | 24.6 | 27.7 | 23.7 | 24.6 | 19.9 | - | Duplicate Site with PEN97 and PEN98 - Annual data provided for PEN98 only |
| PEN90 | 388138 | 440143 | 31.7 | 28.7 |  | 23.7 |  | 23.1 | 22.5 | 22.3 | 28.2 | 27.4 | 29.9 | 20.2 | 25.8 | 20.9 | - |  |
| PEN82 | 389061 | 440482 | 32.3 | 34.4 | 31.0 | 30.1 | 30.4 | 27.0 | 20.9 | 23.4 |  | 30.4 | 33.3 | 26.3 | - | - | - | Duplicate Site with PEN82 and PEN83 - Annual data provided for PEN83 only |
| PEN83 | 389061 | 440482 | 32.3 | 33.7 | 28.3 | 29.6 | 31.9 | 27.1 | 20.9 | 22.8 | 29.5 | 28.5 |  |  | 28.9 | 23.4 | - | Duplicate Site with PEN82 and PEN83 - Annual data provided for PEN83 only |
| PEN84 | 389079 | 440492 | 42.9 | 40.4 | 36.2 | 34.6 | 25.7 | 32.8 | 31.4 | 31.0 | 35.6 | 33.9 | 37.4 | 34.7 | - | - | - | Duplicate Site with PEN84 and PEN85 - Annual data provided for PEN85 only |
| PEN85 | 389079 | 440492 | 41.3 | 40.1 | 35.3 | 34.7 | 26.1 | 34.0 | 32.5 | 34.7 | 35.6 | 33.9 | 38.5 | 33.9 | 34.9 | 28.3 | - | Duplicate Site with PEN84 and PEN85 - Annual data provided for PEN85 only |
| PEN76 | 389081 | 440519 | 30.0 | 30.5 | 25.9 | 27.7 | 22.2 | 23.8 | 20.9 | 22.6 | 25.7 | 27.5 |  |  | - | - | - | Duplicate Site with PEN76 and PEN77 - Annual data provided for PEN77 only |
| PEN77 | 389081 | 440519 | 25.9 | 32.5 | 25.9 | 27.0 | 22.3 | 23.7 | 20.2 | 21.7 | 25.9 | 26.3 |  | 24.7 | 25.3 | 20.5 | - | Duplicate Site with PEN76 and PEN77 - Annual data provided for PEN77 only |
| PEN78 | 389098 | 440508 | 37.5 | 36.5 | 32.5 | 34.7 | 32.1 | 32.0 | 24.2 | 26.2 | 31.9 | 31.5 | 35.2 | 28.7 | - | - | - | Duplicate Site with PEN78 and PEN79 - Annual data provided for PEN79 only |
| PEN79 | 389098 | 440508 | 35.4 | 38.1 | 32.3 | 34.5 | 32.2 | 33.3 | 23.8 | 27.1 | 32.8 | 32.7 | 35.1 |  | 32.0 | 25.9 | - | Duplicate Site with PEN78 and PEN79 - Annual data provided for PEN79 only |
| PEN36 | 389102 | 440540 | 28.3 | 31.9 | 28.7 | 33.7 | 28.6 | 30.0 | 15.6 | 20.9 | 27.8 | 28.0 | 30.5 | 24.9 | 27.4 | 22.2 | - |  |
| PEN86 | 389105 | 440484 | 39.1 | 41.4 | 36.1 | 39.3 | 34.4 | 38.2 | 26.3 | 34.0 | 33.9 | 36.0 | 42.1 | 28.5 | - | - | - | Duplicate Site with PEN86 and PEN87 - Annual data provided for PEN87 only |
| PEN87 | 389105 | 440484 | 41.3 | 44.8 | 33.9 | 36.2 | 34.2 | 35.1 | 28.5 | 29.8 | 38.3 | 36.6 | 38.6 | 31.2 | 35.7 | 28.9 | - | Duplicate Site with PEN86 and PEN87 - Annual data provided for PEN87 only |
| PEN65 | 389159 | 440488 | 36.5 | 40.3 | 29.1 | 28.3 | 24.7 | 24.1 |  | 26.4 | 30.1 | 27.9 | 35.4 | 29.5 | - | - | - | Duplicate Site with PEN65 and PEN66 - Annual data provided for PEN66 only |
| PEN66 | 389159 | 440488 | 40.4 | 40.3 | 30.6 | 31.4 | 29.2 | 30.6 | 23.7 | 26.7 | 29.5 | 30.6 | 37.2 | 27.1 | 30.5 | 24.7 | - | Duplicate Site with PEN65 and PEN66 - Annual data provided for PEN66 only |
| PEN67 | 389207 | 440484 | 35.1 | 37.2 | 28.3 | 29.9 |  | 28.5 | 21.1 | 27.5 | 29.0 | 31.3 | 36.4 | 56.9 | - | - | - | Duplicate Site with PEN67 and PEN68 - Annual data provided for PEN68 only |
| PEN68 | 389207 | 440484 | 35.5 | 36.8 | 28.2 | 30.0 |  | 28.4 | 23.7 | 26.3 | 29.5 | 31.2 | 35.1 | 52.7 | 32.7 | 26.5 | - | Duplicate Site with PEN67 and PEN68 - Annual data provided for PEN68 only |
| PEN69 | 389250 | 440482 | 32.2 | 36.0 | 25.7 | 27.3 | 26.0 | 27.5 | 20.5 | 24.1 | 26.7 | 29.0 | 34.2 | 53.5 | - | - | - | Duplicate Site with PEN69 and PEN70 - Annual data provided for PEN70 only |

| 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 (0.81) | Annual Mean: Distance Corrected to Nearest Exposure | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PEN70 | 389250 | 440482 | 31.2 | 34.2 | 27.4 | 26.3 | 24.0 | 25.9 | 19.3 | 23.5 | 26.4 | 27.4 | 31.8 | 52.9 | 29.7 | 24.1 | - | Duplicate Site with PEN69 and PEN70 - Annual data provided for PEN70 only |
| PEN63 | 389425 | 440490 | 42.8 | 32.2 | 27.5 | 29.8 | | 28.3 | 10.3 | 22.1 | 25.5 | 26.4 | 29.2 | 49.1 | - | - | - | Duplicate Site with PEN63 and PEN64 - Annual data provided for PEN64 only |
| PEN64 | 389425 | 440490 | 39.4 | 31.9 | 28.9 | 22.1 | 24.1 | 26.5 | 19.6 | 22.3 | 25.8 | 26.9 | 29.5 | 48.6 | 28.9 | 23.4 | - | Duplicate Site with PEN63 and PEN64 - Annual data provided for PEN64 only |
| PEN4 | 389410 | 440463 | 32.4 | 36.1 | 28.1 | 28.0 | | 25.3 | 20.3 | 21.7 | 27.3 | 27.8 | 29.7 | 54.3 | - | - | - | Triplicate Site with PEN4, PEN54 and PEN3 - Annual data provided for PEN3 only |
| PEN54 | 389410 | 440463 | 31.4 | 37.9 | 28.3 | 28.2 | 24.7 | 25.2 | 19.9 | 23.7 | 26.1 | 28.6 | 32.2 | 56.7 | - | - | - | Triplicate Site with PEN4, PEN54 and PEN3 - Annual data provided for PEN3 only |
| PEN3 | 389410 | 440463 | 32.2 | 36.6 | 29.1 | | 24.4 | 25.0 | 21.2 | 23.3 | 26.7 | 28.4 | 31.8 | 54.9 | 30.0 | 24.3 | - | Triplicate Site with PEN4, PEN54 and PEN3 - Annual data provided for PEN3 only |
| PEN5 | 388820 | 440045 | 35.1 | 37.3 | 27.9 | 31.5 | 33.1 | 28.4 | 19.5 | 23.0 | 28.1 | 31.4 | 35.0 | | - | - | - | Duplicate Site with PEN5 and PEN6 - Annual data provided for PEN6 only |
| PEN6 | 388820 | 440045 | | 38.7 | 27.0 | 32.1 | 32.1 | 27.1 | 20.9 | 23.7 | 30.2 | 32.1 | 37.3 | 52.6 | 32.2 | 26.0 | - | Duplicate Site with PEN5 and PEN6 - Annual data provided for PEN6 only |
| PEN71 | 388755 | 440026 | 33.6 | 33.0 | 29.7 | 29.3 | 27.5 | 29.4 | 25.4 | 24.8 | 30.5 | 30.1 | 30.6 | 61.1 | 32.1 | 26.0 | - | |
| PEN47 | 388711 | 439999 | 35.0 | 35.4 | 32.1 | 32.1 | 29.2 | 28.1 | 28.4 | 26.2 | 32.3 | 32.2 | 34.4 | | 31.4 | 25.4 | - | |
| PEN46 | 388655 | 440002 | 31.4 | 38.2 | 26.0 | 28.1 | | 24.7 | 23.1 | 26.3 | 27.7 | 29.9 | 34.7 | | 29.0 | 23.5 | - | |
| PEN7 | 388389 | 439924 | | 35.0 | 26.8 | 25.9 | 22.5 | 24.3 | 23.2 | 23.3 | 27.2 | 29.4 | 32.1 | | - | - | - | Duplicate Site with PEN7 and PEN8 - Annual data provided for PEN8 only |
| PEN8 | 388389 | 439924 | 33.8 | 34.2 | 26.1 | 26.6 | | | 24.1 | 22.0 | 27.6 | 28.8 | | 10.0 | 26.1 | 21.1 | - | Duplicate Site with PEN7 and PEN8 - Annual data provided for PEN8 only |
| PEN50 | 387922 | 439500 | 38.5 | 31.8 | 32.9 | 31.9 | 26.7 | 27.3 | 28.0 | 26.7 | 33.1 | 30.4 | 37.1 | 10.9 | 29.6 | 24.0 | - | |

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

☒ **National bias adjustment factor used**

☒ **Pendle Borough Council confirm that all 2023 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 Pendle Borough Council During 2023

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

## Additional Air Quality Works Undertaken by Pendle Borough Council During 2023

Pendle Borough Council has not completed any additional works within the reporting year of 2023. No additional non-automatic $NO_2$ monitoring sites were added in 2023.

## QA/QC of Diffusion Tube Monitoring

The diffusion tubes used by Pendle Borough Council were supplied and analysed by Gradko Environmental Ltd, using a 20% TEA / Water solution. Gradko participate in the AIR $NO_2$ Proficiency Testing Scheme and their performance is publicly available on the Defra website.

In rounds AR037, 39, 40, 43, 45, 46, 49 and 50 (May 2020 to June 2022) Gradko achieved a satisfactory result of 75% or above. This dropped to 25% in round AR042 (Jan-Feb 2021) but an investigation was carried out and a repeat set of samples tested (Mar-21) to confirm results. It was concluded that there was no risk associated with results reported to customers. Gradko's precision score for 2022 was Good = 33 Bad = 0.

## Diffusion Tube Annualisation

For 2023, no monitoring stations recorded a data capture below 75%. Therefore, diffusion tube annualisation was not required.

## 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 $NO_x$/$NO_2$ continuous analysers. Alternatively, the national database of diffusion tube co-location surveys provides bias factors for the relevant laboratory and preparation method.

Due to a scarceness of triplicate co-location sites in Pendle, Pendle Borough Council have applied a national bias adjustment factor of 0.81 to the 2023 monitoring data. A summary of bias adjustment factors used by Pendle Borough Council over the past five years is presented in Table C.1. A screenshot of the national bias adjustment factor used is shown in Figure C.1

### Table C.1– Bias Adjustment Factor

| Monitoring Year | Local or National | If National, Version of National Spreadsheet | Adjustment Factor |
|---|---|---|---|
| **2023** | National | 03/24 | 0.81 |
| **2022** | National | 09/23 | 0.84 |
| **2021** | National | 09/22 | 0.81 |
| **2020** | National | 09/22 | 0.91 |
| **2019** | National | 03/20 | 0.92 |

## Figure C.1– National Diffusion Tube Bias Adjustment

**National Diffusion Tube Bias Adjustment Factor Spreadsheet** — Spreadsheet Version Number: 03/24

Follow the steps below **in the correct order** to show the results of **relevant** co-location studies
Data only apply to tubes exposed monthly and are not suitable for correcting individual short-term monitoring periods
Whenever presenting adjusted data, you should state the adjustment factor used and the version of the spreadsheet
This spreadsheet will be updated every few months: the factors may therefore be subject to change. This should not discourage their immediate use.

This spreadsheet will be updated at the end of June 2024
LAQM Helpdesk Website

The LAQM Helpdesk is operated on behalf of Defra and the Devolved Administrations by Bureau Veritas, in conjunction with contract partners AECOM and the National Physical Laboratory.

Spreadsheet maintained by the National Physical Laboratory. Original compiled by Air Quality Consultants Ltd.

| Step 1: | Step 2: | Step 3: | Step 4: | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Select the Laboratory that Analyses Your Tubes from the Drop-Down List | Select a Preparation Method from the Drop-Down List | Select a Year from the Drop-Down List | Where there is only one study for a chosen combination, you should use the adjustment factor shown with caution. Where there is more than one study, use the overall factor[3] shown in blue at the foot of the final column. | | | | | | | |
| If a laboratory is not shown, we have no data for this laboratory. | If a preparation method is not shown, we have no data for this method at this laboratory.[2] | If a year is not shown, we have no data[2] | If you have your own co-location study then see footnote[4]. If uncertain what to do then contact the Local Air Quality Management Helpdesk at LAQMHelpdesk@bureauveritas.com or 0800 0327953 | | | | | | | |
| Analysed By[1] | Method To undo your selection, choose (All) from the pop-up list | Year[2] To undo your selection, choose (All) | Site Type | Local Authority | Length of Study (months) | Diffusion Tube Mean Conc. (Dm) (µg/m³) | Automatic Monitor Mean Conc. (Cm) (µg/m³) | Bias (B) | Tube Precision[5] | Bias Adjustment Factor (A) (Cm/Dm) |
| Gradko | 20% TEA in water | 2023 | | Overall Factor[3] (23 studies) | | | | Use | | 0.81 |

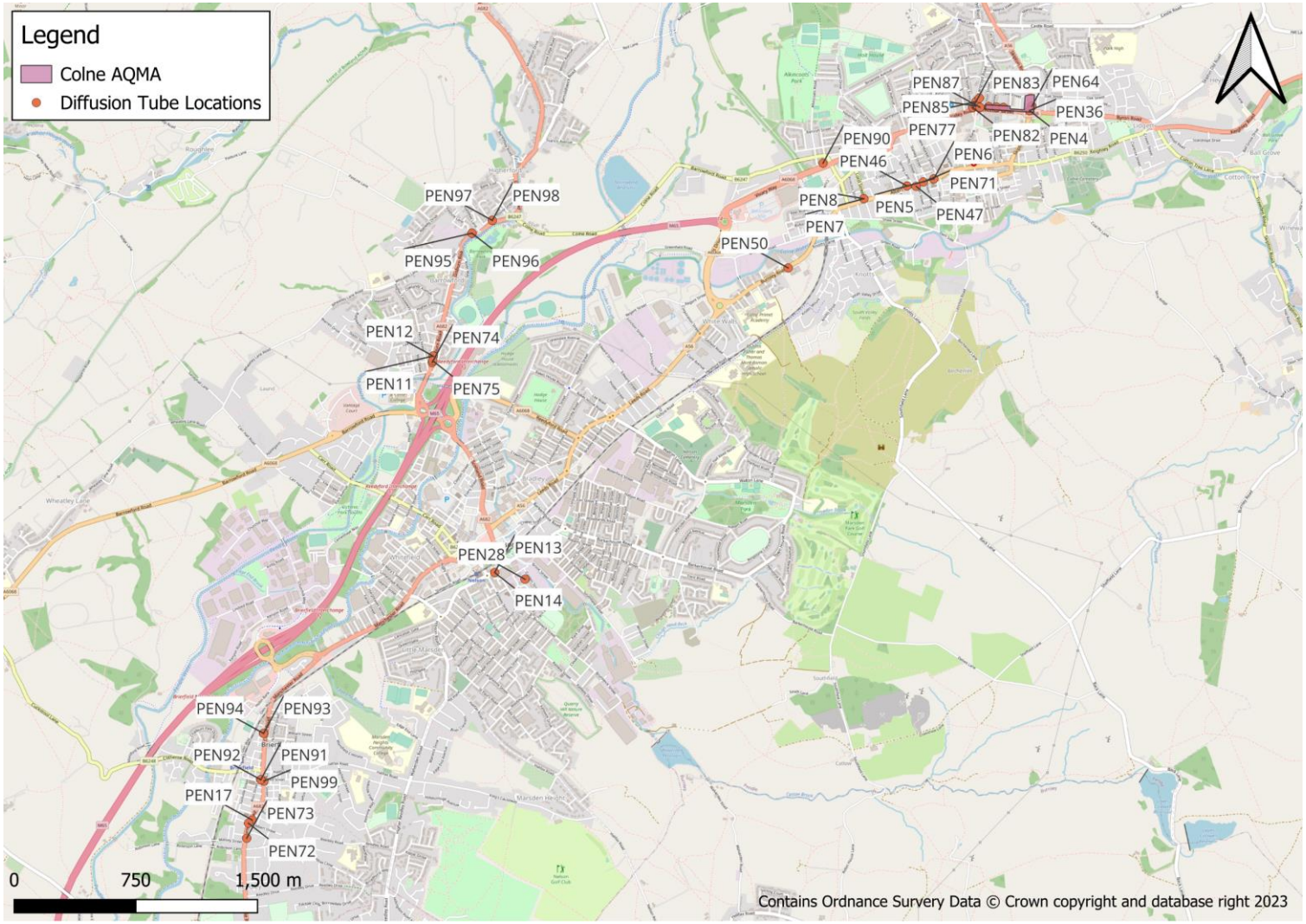
## $NO_2$ Fall-off with Distance from the Road

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.

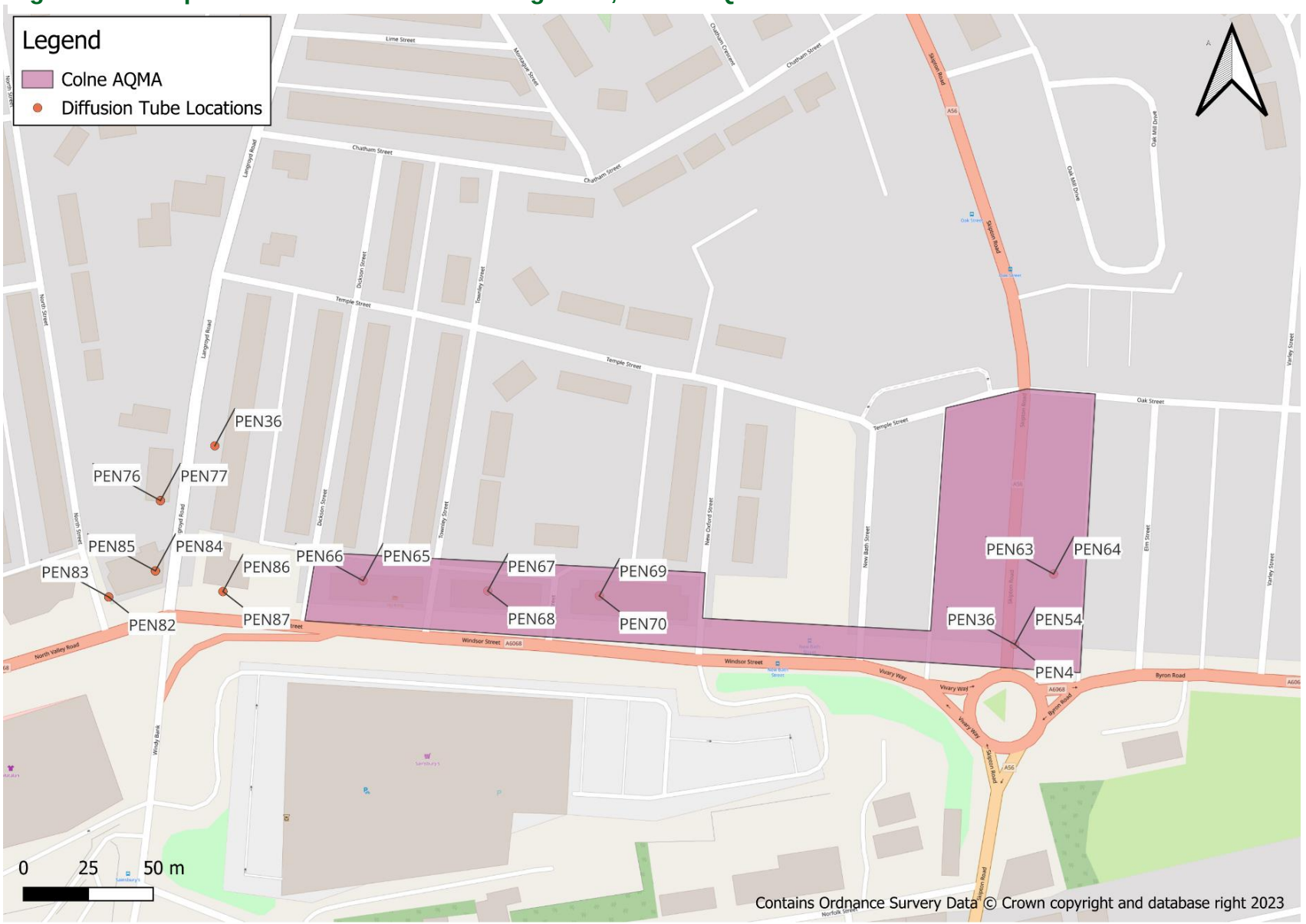
The Diffusion Tube Data Processing Tool confirmed that no diffusion tube monitoring locations within Pendle Borough Council required distance correction during 2023.

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

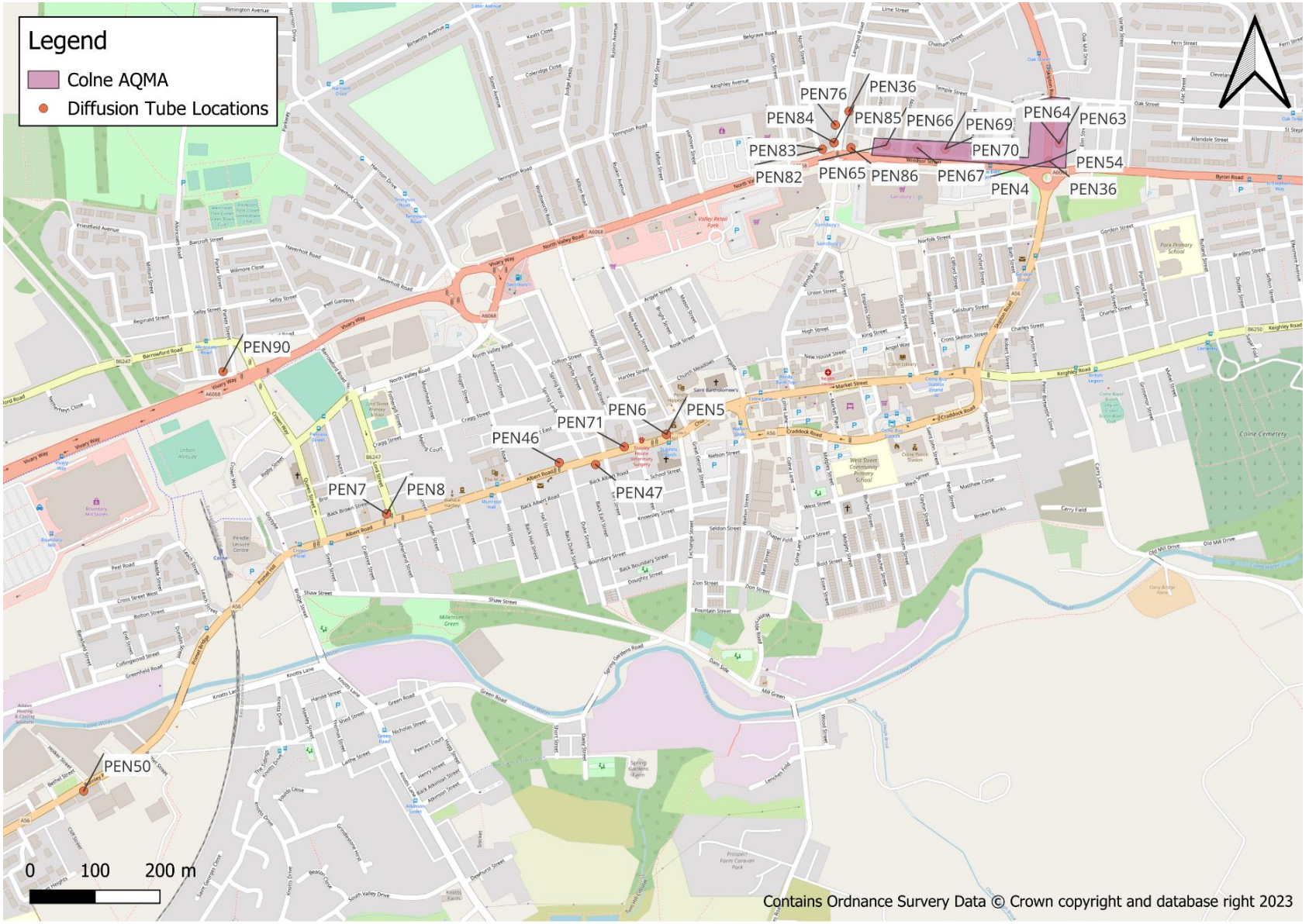
## Figure D.1 Map of Non-Automatic Monitoring Sites, Pendle Borough Council



## Figure D.2 - Map of Non-Automatic Monitoring Sites, Colne AQMA



## Figure D.3– Map of Non-Automatic Monitoring Sites, Colne



## Figure D.4 - Map of Non-Automatic Monitoring Site, Nelson

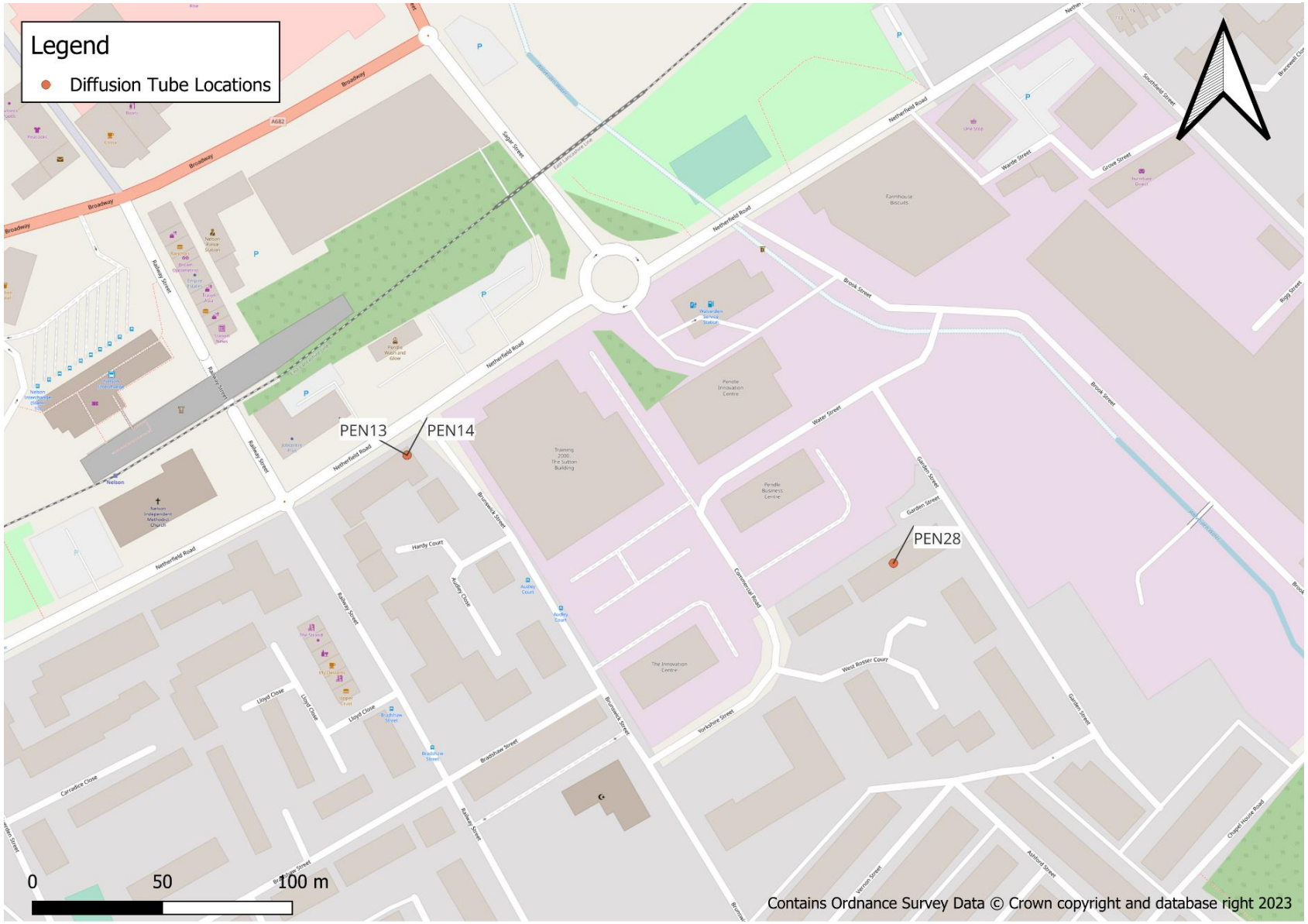
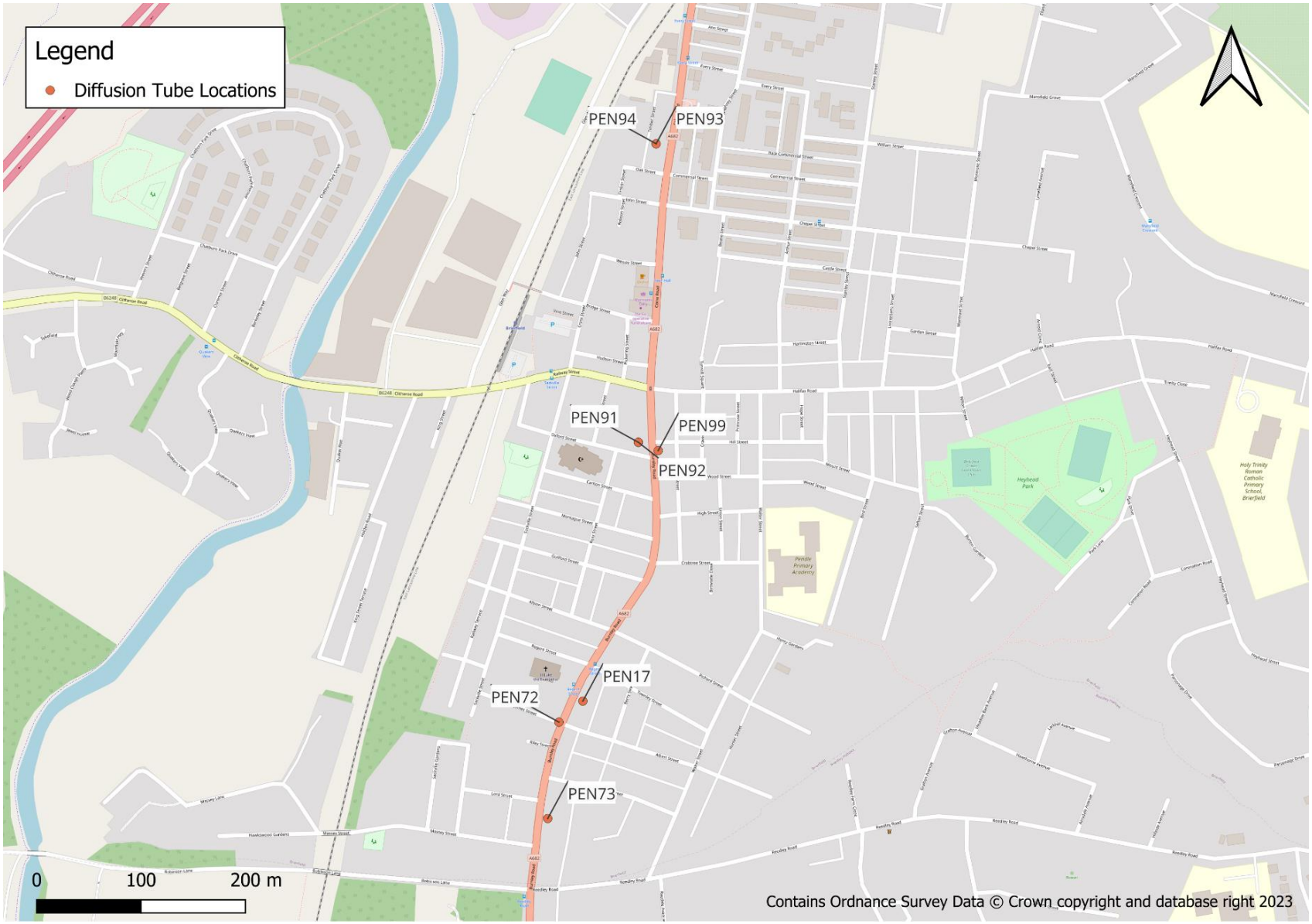


**Figure D.5 – Map of Non-Automatic Monitoring Site, Barrowford**

**Figure D.6 – Map of Non-Automatic Monitoring Site, Brierfield**



# Appendix E: Summary of Air Quality Objectives in England

### Table E.1 – Air Quality Objectives in England[12]

| 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 |

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

# 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 |
| ASR | Annual Status Report |
| Defra | Department for Environment, Food and Rural Affairs |
| DMRB | Design Manual for Roads and Bridges – Air quality screening tool produced by National Highways |
| EU | European Union |
| FDMS | Filter Dynamics Measurement System |
| LAQM | Local Air Quality Management |
| $NO_2$ | Nitrogen Dioxide |
| $NO_x$ | Nitrogen Oxides |
| $PM_{10}$ | Airborne particulate matter with an aerodynamic diameter of 10µm 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 |

# 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.
- Pendle Borough Council Climate Action Plan: Climate Emergency Action Plan 2020 to 2025 | Climate Change | Pendle Borough Council
- Barnoldswick Town Centre Improvements: Barnoldswick town centre improvements | Barnoldswick town centre improvements | Pendle Borough Council

# Appendix F: Detailed Assessment to Support the Revocation of the Colne AQMA

# COLNE AIR QUALITY MANAGEMENT AREA

## Detailed Assessment

Report for: Pendle Borough Council

Ref. HEH000080

Ricardo ref. ED18432120 Issue: 1 28/02/24

Ricardo, Gemini Building, Fermi Avenue, Harwell, Oxfordshire, OX11 0QR, UK | +44(0)1235 75 3000 | ee.ricardo.com
Registered company no. 08229264 | VAT no. GB 212 8365 24

Customer:
Pendle Borough Council

Customer reference:
HEH000080



Ricardo reference:
ED18432120

Contact:
Patrick Harland, Gemini Building, Fermi Avenue, Harwell, Didcot, OX11 0QR, UK

T: +44 7749401249
E: Patrick.Harland@ricardo.com

Author:
Patrick Harland, Olivia Blythe

Approved by:
Mark Attree

Signed

Date:
28/02/24

# EXECUTIVE SUMMARY

Ricardo have completed a Detailed Assessment of $NO_2$ concentrations in the Colne Air Quality Management Area (AQMA) in Pendle Borough Council. The local road network is the dominant source of NOx emissions within the AQMA Pendle, and this has been the focus of this study.

In undertaking this work, Ricardo have applied air quality dispersion modelling to assess:

- Whether residents of Pendle are likely to be exposed to concentrations of $NO_2$ at locations where monitoring is not currently undertaken
- How public exposure to concentrations of $NO_2$ are likely to change in 2024 based on national and local traffic growth and fleet renewal projections
- Whether residents are likely to be exposed to higher $NO_2$ concentrations in the future if fleet renewal rates are delayed relative to national projections, or if traffic growth is significantly greater than national projections.

The modelled scenarios applied to the study were as follows:

1. 2022 Baseline (Scenario 1): The impact on concentrations of $NO_2$ in 2022 based on local traffic monitoring data and national forecasted fleet compositions. This was applied to validate the model and demonstrate that the model accurately represents concentrations in and around the AQMA.
2. 2024 Baseline (Scenario 2): Accounting for the projected traffic volume and fleet composition due to forecasted fleet renewals for 2024. This is the most realistic 2024 scenario and should be used to determine whether the AQMA should be revoked.
3. 2024 Scenario 3: The projected traffic volume and fleet composition due to forecasted fleet renewals for 2024, with an additional 5000 vehicles across Pendle. This theoretical worst-case scenario is included to demonstrate the robustness of the predicted compliance given uncertainties in predictions in traffic volume for future years.

The conclusions of the study are summarised in Box 1.

Box 1: Key conclusions of the Detailed Assessment

- No location of relevant exposure is predicted to have an annual mean $NO_2$ concentration above or within 10% of the Air Quality Objective for $NO_2$ annual mean (>36 µg/m$^3$) at any location of relevant exposure in 2024 should changes in traffic volume and vehicle fleet composition follow the forecasted national trends. This is determined to be the most likely scenario for the AQA in 2024.
- No location of relevant exposure is predicted to have an annual mean $NO_2$ concentration that exceeds the Air Quality Objective for $NO_2$ annual mean (40 µg/m$^3$) in 2024 should changes in vehicle fleet composition follow the forecasted national trends and with an additional 5000 vehicles in the 2024 forecasted traffic volume. This demonstrates the robustness of the predicted compliance given uncertainties in predictions in traffic volume for future years, however, this is a less likely representation of the AQMA than scenario 2.

Based on the data available, the modelled results indicate that future exceedances of the Air Quality Objectives within the AQMA are unlikely and so this is evidence to revoke the AQMA. We recommended that the Council keep track of future monitoring results to ensure that there are not any exceedances at the monitoring sites.

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# 1. INTRODUCTION

Ricardo have been commissioned by Pendle Borough Council (PBC) to undertake a study assessing the likely level of public exposure to concentrations of Nitrogen Dioxide ($NO_2$) within the Colne AQMA. Monitoring data across the Colne AQMA indicates that concentrations across the AQMA are well below 40 µg/m$^3$ Air Quality Objective for annual mean $NO_2$ concentrations for the past three non-covid years (2018, 2019, 2021). Due to the nearby locations measuring $NO_2$ concentrations between 36 µg/m$^3$ and 40 µg/m$^3$, and so within 10% of the Air Quality Objective, Local Air Quality Management (LAQM) guidance recommends a detailed assessment should therefore be carried out to determine whether the AQMA can be revoked.

Ricardo has both provided a review of measurements recorded in the Colne AQMA between 2018 – 2022 and developed an air dispersion model to predict current exposure at locations where measurements were not collected. The model was projected to 2024 based on national forecasts for traffic volumes and fleet composition to assess whether compliance will be achieved across the Colne AQMA in future.

In order to demonstrate the robustness of compliance given uncertainties in predictions for future years, modelling was also carried out for an additional "worst-case" scenario representing conditions that lead to higher emissions in 2024 than in the baseline.

1. 2022 Baseline (Scenario 1): The impact on concentrations of $NO_2$ in 2022 based on local traffic monitoring data and national forecasted fleet compositions. This was applied to validate the model and demonstrate that the model accurately represents concentrations in and around the AQMA.
2. 2024 Baseline (Scenario 2): The projected traffic volume and fleet composition due to forecasted fleet renewals for 2024. This is the most realistic 2024 scenario.
3. Scenario 3: The projected traffic volume and fleet composition due to forecasted fleet renewals for 2024, with an additional 5000 vehicles across Pendle. This is one of the worst-case scenarios and is less realistic than Scenario 2 but is included to demonstrate the robustness of the predicted compliance given uncertainties in predictions in traffic volume for future years.

# 2. AIR QUALITY STANDARDS

The UK Clean Air Strategy was updated in 2019. This sets out the national policy approach to air quality across the UK. The strategy sets out a series of air quality objectives which Local Authorities must work towards achieving.

The objectives specified in the Clean Air Strategy mirror limit values required by EU Framework and Daughter Directives on Air Quality and have been transposed into UK law through the Air Quality Standards Regulations 2007. A more recent EU Directive 2008/50/EC consolidates the Framework and first three Daughter Directives, and this has been transposed into English law via the Air Quality (Standards) Regulations 2010.

**Error! Reference source not found.** summarises the air quality objectives relevant to this study:

Table 2.1: UK National Air Quality Objectives for $NO_2$ (AQOs)

| Pollutant | Measured As | Objective |
|---|---|---|
| Nitrogen dioxide ($NO_2$) | Annual Mean | 40 µg/m$^3$ |
| | 1-hour Mean | 200 µg/m$^3$ not to be exceeded more than 18 times a year |

This assessment refers to a compliance threshold which is between 36 µg/m$^3$ and 40 µg/m$^3$ and so is a range of values within 10 % of the annual mean $NO_2$ Objectives. $NO_2$ values below this threshold are comfortably compliant with the national Objective.

For LAQM purposes, and for the assessment of air quality against the air quality objectives, personal exposure is also important. Therefore, predicted concentrations greater than the values listed at a given location do not necessarily indicate an exceedance of the Air Quality Objective. Rather, the predicted concentrations should be considered in the context of personal exposure, with consideration given to the types of locations where the Air Quality Objectives should apply (Table 2.2).

Table 2.2 Relevant receptors for Air Quality Objectives

| Averaging period | Objectives should apply at: | Objectives should not apply at: |
|---|---|---|
| Annual mean | All locations where members of the public might be regularly exposed.<br>Building façades of residential properties, schools, hospitals, care homes etc. | Building facades of offices or other places of work where members of the public do not have regular access.<br>Hotels, unless people live there as their permanent residence.<br>Gardens of residential properties.<br>Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term. |
| 1-hour Mean | All locations where the annual mean objectives apply, together with hotels and gardens of residential properties, and:<br>Kerbside sites (for example, pavements of busy shopping streets).<br>Those parts of car parks, bus stations and railway stations etc. which are not fully enclosed, where members of the public might reasonably be expected to spend one hour or more.<br>Any outdoor locations where members of the public might reasonably be expected to spend one hour or longer. | Kerbside sites where the public would not be expected to have regular access |

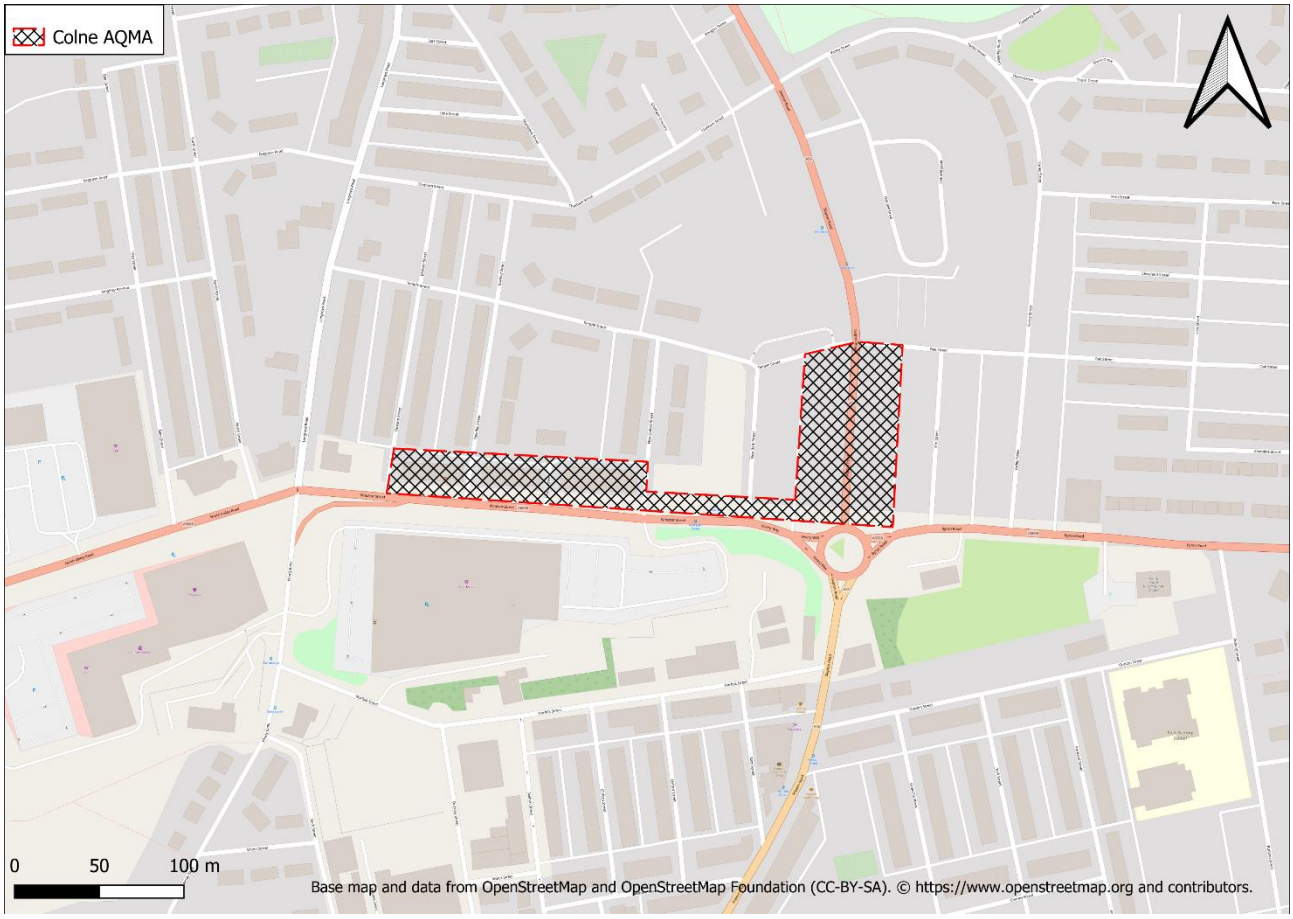
# 3. AIR QUALITY IN COLNE

The UK parliament passed the UK Environment Act (1995, updated 2021) which sets a requirement for competent authorities to undertake routine assessment of the quality of its air. To support compliance with this objective, the UK government also introduced the Local Air Quality Management framework to ensure that Local Authorities are routinely undertaking this assessment and that action is undertaken when measured concentrations of air pollutant are above threshold values set for pollutants in its Air Quality Standards regulation.

In accordance with the LAQM framework, PBC has established an air quality monitoring network around Colne to monitor the concentrations of pollutants at locations where residents are most likely to have prolonged exposure to the area's most elevated concentrations.

The data collected by the monitoring network prior to 2011 identified that concentrations of nitrogen dioxide ($NO_2$) along the High Street exceeded the $NO_2$ an annual mean concentration (40µg/m$^3$). In response, a further investigation was undertaken to fully understand a reason for elevated concentrations in this area of the town and a plan was drawn up to bring $NO_2$ concentrations into compliance with the standards regulation. As a result, part of the street was declared as an Air Quality Management Area (AQMA) in recognition of the problem in 2011. This AQMA is illustrated in Figure 3-1.

Figure 3-1: Colne AQMA




## 3.1 REVIEW OF $NO_2$ MONITORING DATA

The section provides the results of a review of measurements recorded in the Colne AQMA between 2018 – 2022. Actions subsequently implemented by PBC to reduce $NO_2$ concentrations and bring the AQMA into compliance with the AQO have been successful. Measurements show a long-term reduction trend in $NO_2$ concentration with concentrations at all monitors being compliant with the AQO in 2018 and no concentrations were within 10% of the AQO from 2020 onwards. Trends in measured $NO_2$ concentrations in Colne between 2018 and 2022 are presented in Figure 3-2.

Figure 3-2: Measured $NO_2$ concentrations within the AQMA (2018 – 2022)

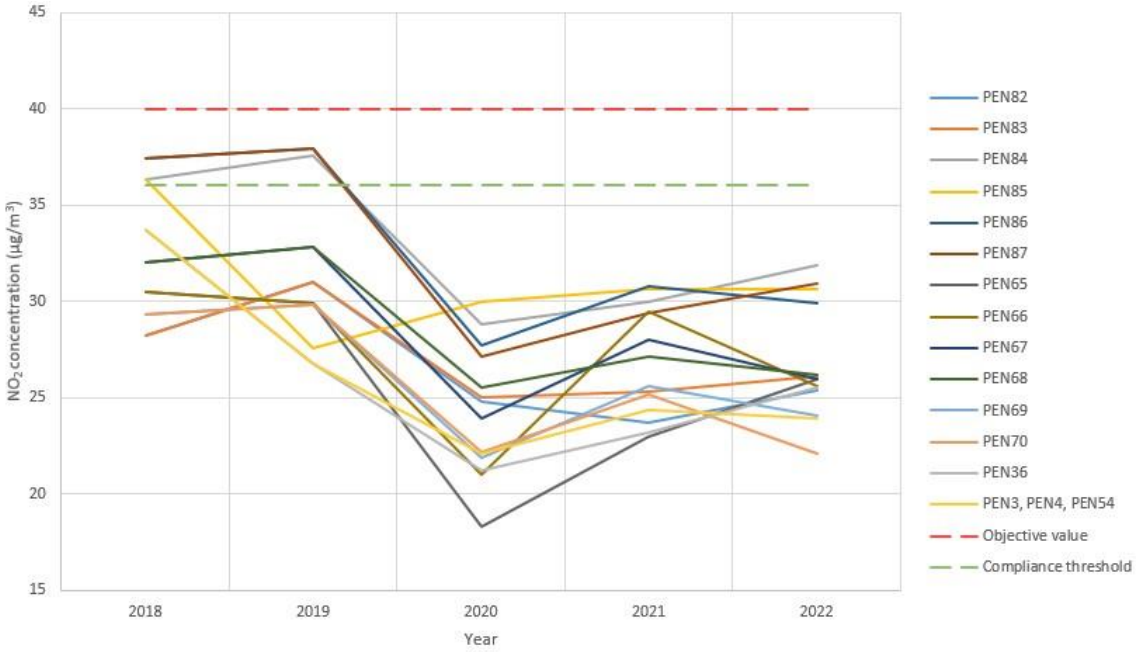



Figure 3-2 shows that:

- Annual mean concentrations of $NO_2$ measured within the AQMA have been compliant with the $NO_2$ annual mean AQO since 2018.
- Annual mean concentrations have been below 36 µg/m$^3$ at all locations since 2020.

In accordance with the most recent LAQM Technical Guidance document, concentrations of $NO_2$ have been below 90% of the $NO_2$ annual mean AQO for three successive years and PBC therefore has the option to consider revoking the AQMA if warranted.

# 4. METHODOLOGY

## 4.1 OVERALL APPROACH AND CHOICE OF MODEL

In order to predict current exposure at locations where measurements are were not collected, Ricardo constructed an air dispersion model to assess the likely public exposure to $NO_2$. The methodology undertaken to perform this was based on the summary of best available techniques detailed in the most recent Local Air Quality Management Technical Guidance document[1] and model guidance.

The latest version of ADMS-Roads (5.0.1.3) was selected as the most appropriate tool for undertaking this study. This is a model that is widely used in assessments for Local Authorities in the UK. The tool includes advanced features for treatment of street canyons and other road geometry. In summary the following datasets were required as inputs to complete this study:

- Meteorological data
- Terrain data
- Road network location and geometries
- Traffic volumes, fleet composition and speeds
- Details of any other significant sources of $NO_x$ that are likely to impact levels of $NO_2$ pollutant experienced across Colne
- Data on measured background concentrations of $NO_x$ (the level of $NO_x$ present in the air that does not originate from the local road network or other dominant emission sources)

2022 Baseline model run (Scenario 1) was performed using datasets collected which best reflected conditions experienced across Colne in 2022. Ratified measurements collected by the local $NO_2$ pollutant measurements network were then compared to the modelled result at the same location. This enabled evaluation of the model's performance and an adjustment factor was applied to further improve its results (Section 6).

The model was then used to predict the impact of changes in the volume and composition in future years on $NO_2$ concentrations (Scenario 2 – 3).

The following scenarios were modelled:

1. 2022 Baseline (Scenario 1): The impact on concentrations of $NO_2$ in 2022 based on local traffic monitoring data and national forecasted fleet compositions. This was applied to validate the model and demonstrate that the model accurately represents concentrations in and around the AQMA.
2. 2024 Baseline (Scenario 2): The projected traffic volume and fleet composition due to forecasted fleet renewals for 2024. This is the most realistic 2024 scenario and should be used to determine whether the AQMA should be revoked.
3. Scenario 3: The projected traffic volume and fleet composition due to forecasted fleet renewals for 2024, with an additional 5000 vehicles across Pendle. This is one of the worst-case scenarios and is less realistic than Scenario 2 but is included to demonstrate the robustness of the predicted compliance given uncertainties in predictions in traffic volume for future years.

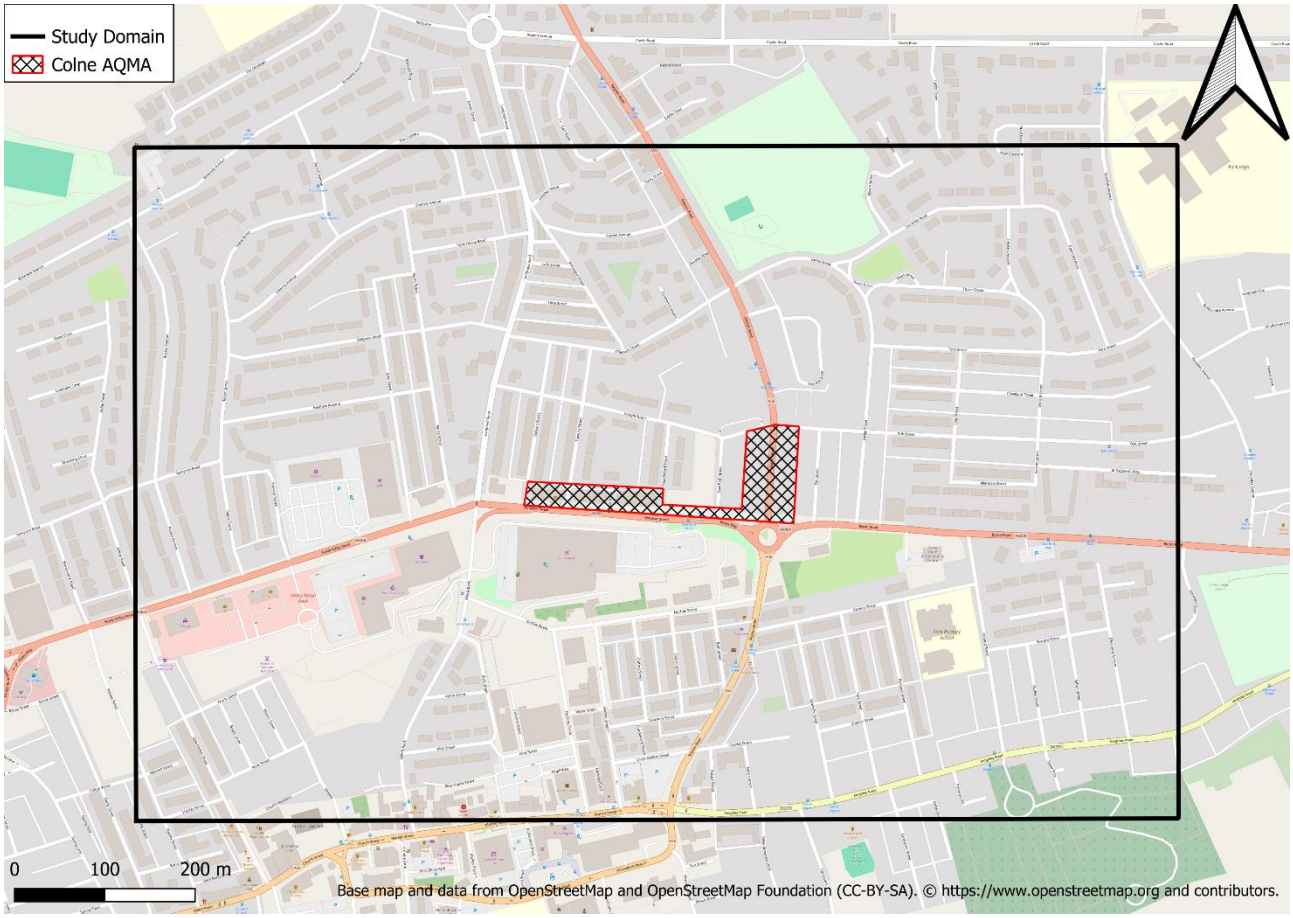
## 4.2 MODEL DOMAIN

Figure 4-1 shows the chosen study area of the model. Professional judgement was used to determine the size of the domain with the following considerations made:

- the location of road links that are mostly likely to be dominant emission sources.
- the location of sensitive receptors (i.e. areas of high population density)
- the location of $NO_2$ monitors which can be used to verify the air quality model

[1] https://laqm.defra.gov.uk/wp-content/uploads/2022/08/LAQM-TG22-August-22-v1.0.pdf

Figure 4-1: Study domain region




Comprehensive review was undertaken to understand which locations within the domain shown in Figure 4-1 were likely to be impacted by concentrations of $NO_2$ stemming from the use of the local road network. Figure 4-2 shows the location of key receptors that were identified through this process. Concentrations at each of these receptors were specifically modelled in each scenario.

Figure 4-2: Location of modelled sensitive receptors


## 4.3 SURFACE ROUGHNESS

In ADMS-Roads, a length scale parameter called the surface roughness length is used to characterise the study area in terms of its effects on wind speed and turbulence. The modelling used a surface roughness length of 0.5 m, to represent a moderately built-up area.

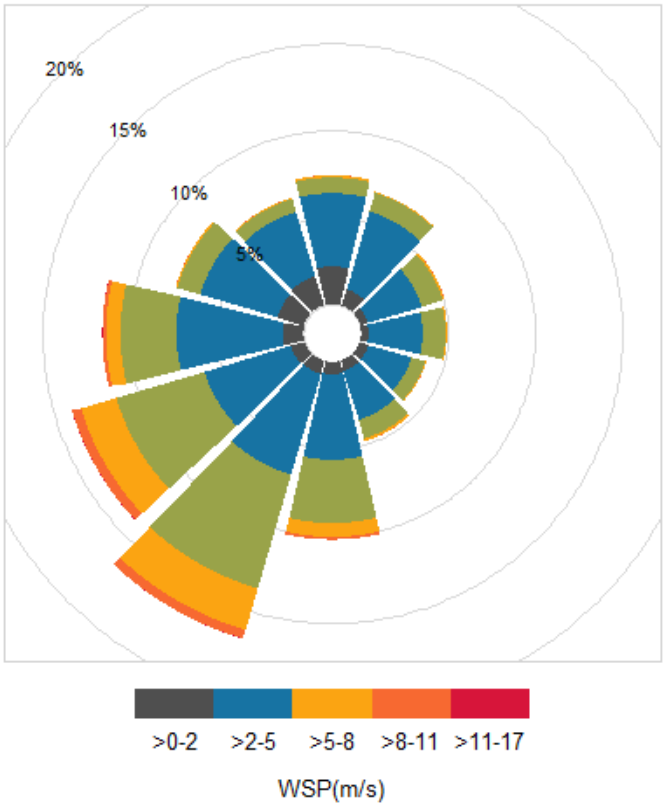
The difference in land use at the meteorological site and the model domain was accounted for by using a surface roughness of 0.25 m for the meteorological site.

## 4.4 METEOROLOGY

Review of available meteorological datasets representative of conditions across Colne was undertaken through analysis of datasets available through the NOAA data repository.

Datasets collected at Keighley Airfield and Leeds Bradford Airport were identified for use in this study. Comparison of the two datasets found similarities in the conditions presented with the Keighley dataset containing a more complete data capture for the 2022 verification year. This dataset was used in the verification and modelling scenarios. A wind rose for the Keighley 2022 dataset is presented in Figure 4-3.

Figure 4-3: Windrose of meteorological data collected at Keighley Airfield during 2022




## 4.5 CHEMISTRY AND BACKGROUND CONCENTRATIONS

The interconversion of NO and $NO_2$ emissions in the presence of ozone was calculated using the NOx:$NO_2$ calculator[2] published by Defra, in line with LAQM.TG(22). Background concentrations were taken from the background maps published by Defra for use with this tool. To avoid double-counting, contributions from local primary roads were removed from the background maps.

[2] https://laqm.defra.gov.uk/air-quality/air-quality-assessment/nox-to-no2-calculator/

# 5. EMISSIONS INVENTORY

The development of the emission inventory for Colne was carried out through the following process:

1. Collation of traffic data
2. Collation of national fleet fuel and technology statistics
3. The traffic and fleet data were combined with emission factors from the most recent version of the Emissions Factors Toolkit (EFT), version 12[3] to provide total annual emissions of NOx and PM for the modelled road links

Further detail on the emissions inventory compilation is provided below.

## 5.1 TRAFFIC FLOWS AND SPEEDS

The traffic volume dataset was collected from the DfT traffic count network[4]. Traffic flows were provided for vehicle categories including cars, LGVs, HGVs, buses and coaches, and motorcycles. Traffic speeds were estimated based on travel time data in Google Maps, together with speed limits and local knowledge.

## 5.2 EMISSION FACTORS

Emissions from all modelled road traffic sources were calculated using speed-dependent vehicle emission factors for $NO_x$, primary $NO_2$, and particulates from the Emission Factor Toolkit (EFT) version 12[3]. These factors provide emission factors categorised by vehicle size, age, and Euro classification, taking into account average vehicle mileage and engine degradation. Emission factors are provided for roads with uphill or downhill gradients.

## 5.3 VEHICLE FLEET COMPOSITION

### 5.3.1 2022

National projections provided by the EFT were used as a data source for vehicle composition in lieu of locally derived data being available. This dataset was used to split traffic volumes into vehicle age and fuel type.

Table 5.1 and Table 5.2 present the derived fleet age split for vehicles for non-London locations in 2022.

Table 5.1: Fleet age splits for 2022, light vehicles

| Region | Vehicle type | Pre-Euro 1 | Euro 1 | Euro 2 | Euro 3 | Euro 4 | Euro 5 | Euro 6 | Euro 6c | Euro 6d |
|---|---|---|---|---|---|---|---|---|---|---|
| National average | **Petrol Car** | 0% | 0% | 1% | 9% | 22% | 23% | 6% | 19% | 20% |
| | **Diesel Car** | 0% | 0% | 0% | 2% | 13% | 27% | 15% | 24% | 20% |
| | **Petrol LGV[a]** | 1% | 0% | 2% | 7% | 14% | 7% | 18% | 33% | 19% |
| | **Diesel LGV[a]** | 0% | 0% | 0% | 3% | 7% | 17% | 30% | 23% | 19% |
| | **Full Hybrid Petrol Car** | - | - | - | 1% | 14% | 21% | 10% | 26% | 27% |
| | **Plugin Hybrid Petrol Car** | - | - | - | - | 0% | 0% | 16% | 41% | 43% |
| | **Full Diesel Hybrid Car** | - | - | - | 2% | 13% | 27% | 15% | 24% | 20% |

a. The Euro 6 categories for both petrol and diesel vehicles are Euro 6_1, Euro 6_2, and Euro 6_3

[3] https://laqm.defra.gov.uk/review-and-assessment/tools/emissions-factors-toolkit.html
[4] https://roadtraffic.dft.gov.uk

Table 5.2: Fleet age splits for 2022, heavy vehicles

| Region | Vehicle type | Pre-Euro I | Euro I | Euro II | Euro III | Euro IV | Euro V EGR | Euro V SCR | Euro VI |
|---|---|---|---|---|---|---|---|---|---|
| National average | Rigid HGV | - | - | - | 0% | 1% | 0% | 1% | 97% |
| | Artic HGV | - | - | - | 0% | 0% | 0% | 1% | 98% |
| | Buses / Coaches | - | - | - | 2% | 4% | 2% | 5% | 87% |

### 5.3.2 2024

The observed vehicle fleet 2022 was projected to future years using the EFT, following the process outlined in LAQM.TG(22). The projected vehicle age split in 2024 is presented in for light and heavy vehicles in Table 5.3 and Table 5.4 respectively.

Table 5.3: Fleet age splits for 2024, light vehicles

| Region | Vehicle type | Pre-Euro 1 | Euro 1 | Euro 2 | Euro 3 | Euro 4 | Euro 5 | Euro 6 | Euro 6c | Euro 6d |
|---|---|---|---|---|---|---|---|---|---|---|
| National average | Petrol Car | 0% | 0% | 0% | 4% | 16% | 21% | 4% | 20% | 34% |
| | Diesel Car | 0% | 0% | 0% | 1% | 7% | 13% | 13% | 24% | 43% |
| | Petrol LGV | 0% | 0% | 0% | 4% | 7% | 4% | 10% | 17% | 57% |
| | Diesel LGV | 0% | 0% | 0% | 0% | 2% | 7% | 20% | 21% | 51% |
| | Full Hybrid Petrol Car | - | - | - | 1% | 6% | 10% | 9% | 28% | 46% |
| | Plugin Hybrid Petrol Car | - | - | - | - | 0% | 0% | 11% | 34% | 55% |
| | Full Diesel Hybrid Car | - | - | - | 1% | 7% | 13% | 13% | 24% | 43% |

Table 5.4: Fleet age splits for 2024, heavy vehicles

| Region | Vehicle type | Pre-Euro I | Euro I | Euro II | Euro III | Euro IV | Euro V EGR | Euro V SCR | Euro VI |
|---|---|---|---|---|---|---|---|---|---|
| National average | Rigid HGV | 0% | 0% | 0% | 0% | 1% | 0% | 1% | 98% |
| | Artic HGV | 0% | 0% | 0% | 0% | 0% | 0% | 1% | 99% |
| | Buses / Coaches | 0% | 0% | 0% | 1% | 2% | 1% | 3% | 93% |

## 5.4 GRADIENTS

Road vehicle emissions correlate to engine load, and as a result, emissions for vehicles travelling uphill are greater than those travelling on flat roads. Road gradients were calculated using Google Earth[5]. The difference in elevation at the start and end points of road segments defined in the OS open roads dataset was used to calculate the gradient of each road segment.

[5] Google Earth

# 6. MODEL ADJUSTMENT AND VERIFICATION

Once the base year model has been developed it is then verified against monitoring data and adjusted to ensure best fit, following the approach outlined in the LAQM Technical Guidance. Following this guidance, the adjustment process is carried out for $NO_X$ (NO and $NO_2$) as NO and $NO_2$ interconvert in the atmosphere following emission from vehicle exhausts in a non-linear fashion.

Any adjustment factors are then applied to all future modelled years. Following this adjustment, model verification is carried out by comparing the total predicted $NO_2$ concentrations against the measured $NO_2$ concentrations.

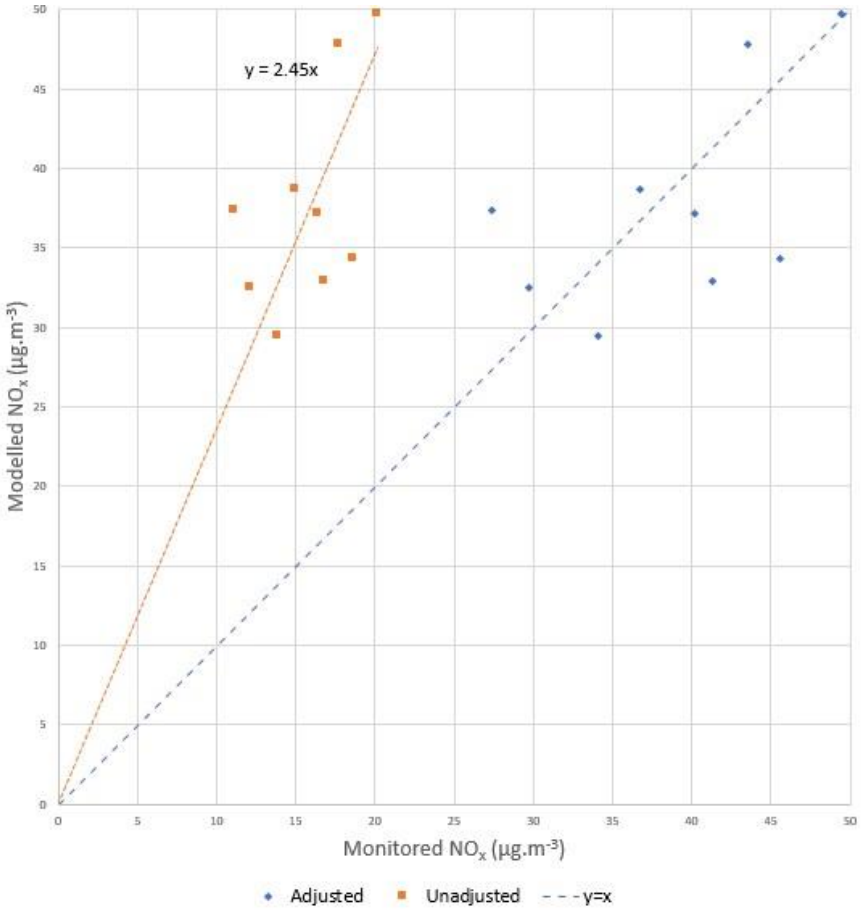
A total of 20 diffusion tubes at 10 different monitoring locations located within the study area were used for model verification. Some diffusion tube labels have been combined since they are at the same location. The road contribution to $NO_X$ concentrations at these sites was estimated using the latest version of the NOx to $NO_2$ calculator (version 8.1) published by Defra. Background $NO_X$ concentrations for use in this tool were taken from the Defra background maps. This approach uses background concentrations of $NO_X$ as an input.

Following an initial model verification step, iterative improvements were made to the model to improve model performance in areas where the model was not accurately predicting real-world concentrations. These improvements included refinements to road geometry, traffic speeds and street canyon locations in order to more closely reflect real-world dispersion conditions.

## 6.1 MODEL CALIBRATION AND ADJUSTMENT

Figure 6-1 shows model performance at locations where measurements were collected in 2022.

Figure 6-1: Measured and modelled annual mean road NOx contributions at monitoring sites, 2022, µg.m$^{-3}$




An adjustment factor of 2.45 was used to bias correct the results of each modelled scenario.

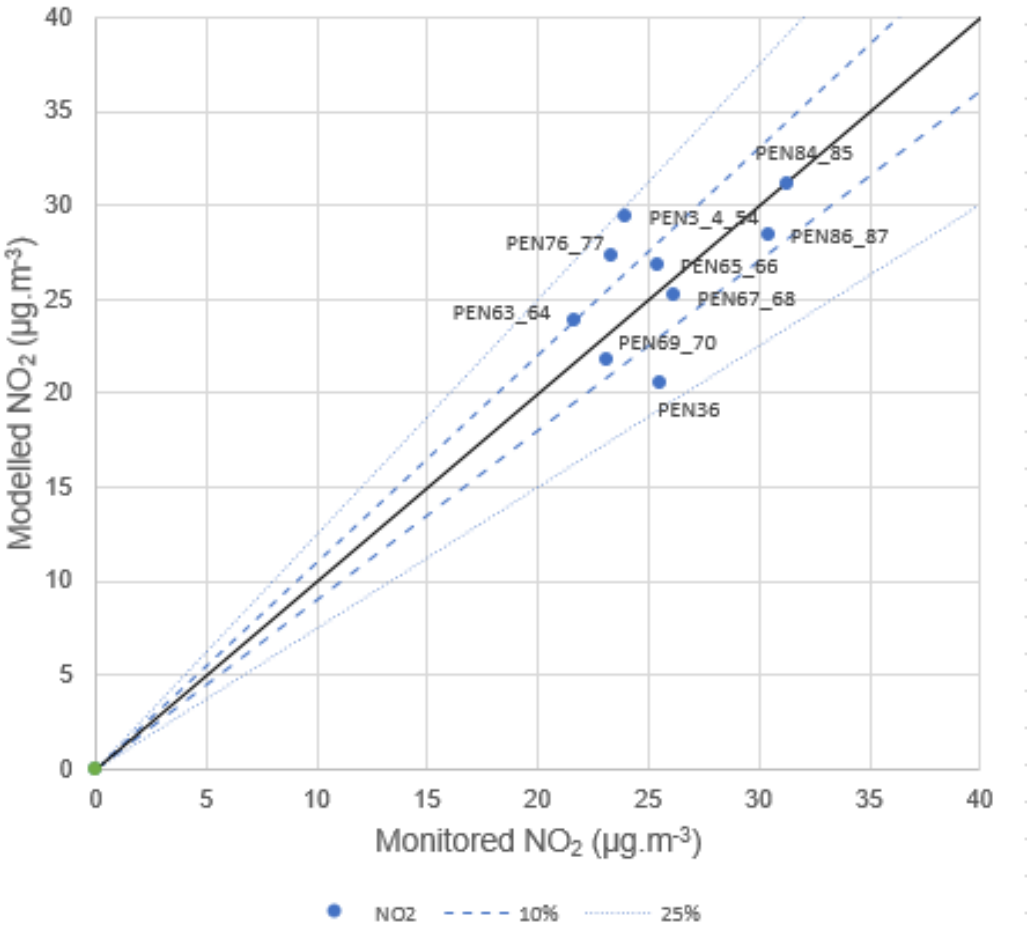
## 6.2 MODEL VERIFICATION

Figure 6-2 presents the model performance with respect to adjusted modelled $NO_2$ at monitoring locations in 2022. The model performs within the 25% acceptable threshold for model performance across all monitoring locations, and within the ideal 10% threshold at the majority of sites. The largest discrepancy between modelled and monitored concentrations occurs at PEN3_4_54, a triplicate diffusion tube site.

This monitoring site is within the AQMA, however, it is also in a complex area which includes a variety of street canyon effects. This site is located at a point where it transitions from a street canyon and a more open area, which is difficult to capture in the model; for this study, the diffusion tube was placed inside the street canyon to ensure that worst-case concentrations are predicted in future years, and as a result the model overpredicts $NO_2$ concentrations by 22% at this location.

Model performance was evaluated using the Root Mean Square Error, following LAQM.TG(22). The RMSE for this study is 3.05 $\mu g.m^{-3}$ which is below the 4 $\mu g.m^{-3}$ ideal threshold identified in the guidance, demonstrating that the model performs well and provides confidence to model predictions of concentrations in future years.

Figure 6-2: Measured and modelled annual mean road $NO_2$ contributions at monitoring sites, 2022, $\mu g.m^{-3}$




In Figure 6-2, the plotted lines of 10 % and 20 % represent the bounds at which modelled values differentiate from the monitored values by 10 % and 20 % respectively.

# 7. RESULTS

The $NO_2$ model was used to predict concentrations at buildings within the AQMA at a height of 2 m and across a grid of receptors covering the domain described in Section 4.2 for the following scenarios:

1. 2022 Baseline (Scenario 1): The impact on concentrations of $NO_2$ in 2022 based on local traffic monitoring data and national forecasted fleet compositions. This was applied to validate the model and demonstrate that the model accurately represents concentrations in and around the AQMA.
2. 2024 Baseline (Scenario 2): The projected traffic volume and fleet composition due to forecasted fleet renewals for 2024. This is the most realistic 2024 scenario and should be used to determine whether the AQMA should be revoked.
3. Scenario 3: The projected traffic volume and fleet composition due to forecasted fleet renewals for 2024, with an additional 5000 vehicles across Pendle. This is one of the worst-case scenarios and is less realistic than Scenario 2 but is included to demonstrate the robustness of the predicted compliance given uncertainties in predictions in traffic volume for future years.

Section 7.1 presents results at locations of relevant human exposure within the AQMA; Section 7.2 presents a map of concentrations across Pendle, including at locations without relevant exposure.

## 7.1 RESULTS AT SENSITIVE RECEPTORS

Table 7.1 presents the annual averaged $NO_2$ concentrations modelled at sensitive receptors identified across the study region. None of the sensitive receptor locations are predicted to exceed the annual mean AQO for $NO_2$ in the 2022 Baseline (Scenario 1), 2024 baseline (Scenario 2) or the 2024 scenario with an additional 5000 in the fleet (Scenario 3).

Table 7.1: Annual averaged $NO_2$ concentrations at key receptor locations

| | | | Annual mean $NO_2$ concentration, $\mu g.m^{-3}$ | | |
|---|---|---|---|---|---|
| Receptor ID | Sensitive receptor address / diffusion tube label | Height (m) | Scenario 1 | Scenario 2 | Scenario 3 |
| 2 | PEN82, PEN83 | 2 | 25.2 | 16.4 | 24.1 |
| 3 | PEN84, PEN85 | 2 | 21.4 | 13.7 | 20.5 |
| 4 | PEN76, PEN77 | 2 | 14.6 | 9.1 | 13.6 |
| 5 | PEN36 | 2 | 22.5 | 14.4 | 17.6 |
| 6 | PEN86, PEN87 | 2 | 20.9 | 18.4 | 22.1 |
| 7 | PEN65, PEN66 | 2 | 19.3 | 12.7 | 15.3 |
| 8 | PEN67, PEN68 | 2 | 15.8 | 9.8 | 11.9 |
| 9 | PEN69, PEN70 | 2 | 18.0 | 11.1 | 14.8 |
| 10 | PEN63, PEN64 | 2 | 23.5 | 14.9 | 21.6 |
| 11 | PEN3, PEN4, PEN54 | 2 | 26.8 | 24.8 | 29.7 |
| 12 | 56 Windsor Street | 2 | 27.0 | 28.8 | 34.4 |
| 13 | 54 Windsor Street | 2 | 27.0 | 28.6 | 34.3 |
| 14 | 52 Windsor Street | 2 | 27.7 | 28.3 | 33.9 |
| 15 | 50 Windsor Street | 2 | 26.5 | 18.9 | 22.7 |
| 16 | 48 Windsor Street | 2 | 25.3 | 17.5 | 21.0 |
| 17 | 46 Windsor Street | 2 | 25.3 | 17.1 | 20.5 |
| 18 | 44 Windsor Street | 2 | 25.4 | 17.0 | 20.4 |
| 19 | 42 Windsor Street | 2 | 25.3 | 16.8 | 20.1 |
| 20 | 40 Windsor Street | 2 | 24.8 | 16.2 | 19.5 |

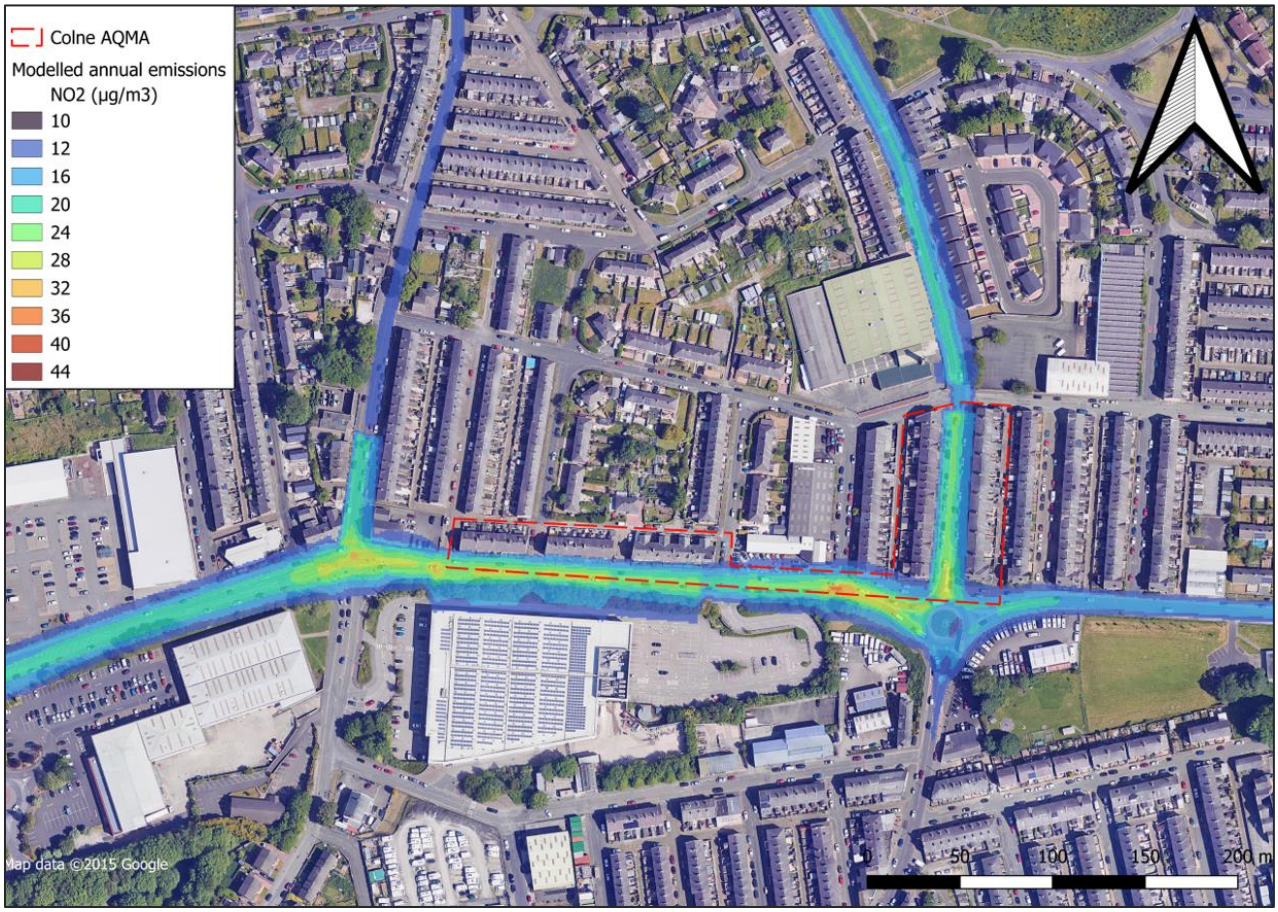
| | | | Annual mean $NO_2$ concentration, $\mu g.m^{-3}$ | | |
|---|---|---|---|---|---|
| 21 | 38 Windsor Street | 2 | 24.6 | 16.0 | 19.3 |
| 22 | 36 Windsor Street | 2 | 22.9 | 14.7 | 17.7 |
| 23 | 34 Windsor Street | 2 | 23.9 | 15.3 | 18.4 |
| 24 | 32 Windsor Street | 2 | 23.0 | 14.7 | 17.7 |
| 25 | 30 Windsor Street | 2 | 22.9 | 14.6 | 17.6 |
| 26 | 28 Windsor Street | 2 | 22.4 | 14.2 | 17.1 |
| 27 | 26 Windsor Street | 2 | 22.9 | 14.6 | 17.5 |
| 28 | 24 Windsor Street | 2 | 23.7 | 15.1 | 18.1 |
| 29 | 22 Windsor Street | 2 | 18.2 | 11.4 | 13.8 |
| 30 | 1 New Oxford Street | 2 | 4.9 | 3.0 | 3.8 |
| 31 | 3 New Oxford Street | 2 | 4.5 | 2.8 | 3.5 |
| 32 | West Riding Hyundai entrance | 2 | 9.2 | 5.6 | 7.0 |
| 33 | 4 New Bath Street | 2 | 10.7 | 6.5 | 8.4 |
| 34 | 59 Skipton Road | 2 | 36.8 | 24.8 | 33.7 |
| 35 | 61 Skipton Road | 2 | 36.0 | 24.3 | 31.9 |
| 36 | 63 Skipton Road | 2 | 34.0 | 22.6 | 29.6 |
| 37 | 65 Skipton Road | 2 | 32.4 | 21.4 | 28.0 |
| 38 | 67 Skipton Road | 2 | 31.8 | 21.0 | 27.3 |
| 39 | 69 Skipton Road | 2 | 30.1 | 19.7 | 25.5 |
| 40 | 71 Skipton Road | 2 | 30.0 | 19.6 | 25.3 |
| 41 | 73 Skipton Road | 2 | 29.5 | 19.2 | 24.9 |
| 42 | 75 Skipton Road | 2 | 29.7 | 19.4 | 25.0 |
| 43 | 77 Skipton Road | 2 | 29.1 | 19.0 | 24.4 |
| 44 | 79 Skipton Road | 2 | 29.6 | 19.3 | 24.8 |
| 45 | 81 Skipton Road | 2 | 30.3 | 19.8 | 25.4 |
| 46 | 83 Skipton Road | 2 | 29.7 | 19.4 | 24.9 |
| 47 | 85 Skipton Road | 2 | 29.2 | 19.0 | 24.4 |
| 48 | 87 Skipton Road | 2 | 29.3 | 19.1 | 24.5 |
| 49 | 89 Skipton Road | 2 | 29.4 | 19.2 | 24.6 |
| 50 | 91 Skipton Road | 2 | 29.7 | 19.4 | 24.8 |
| 51 | 95 Skipton Road | 2 | 29.7 | 19.4 | 24.7 |
| 52 | 124 Skipton Road | 2 | 21.8 | 13.7 | 17.6 |
| 53 | 122 Skipton Road | 2 | 20.9 | 13.1 | 16.8 |
| 54 | 120 Skipton Road | 2 | 20.4 | 12.8 | 16.4 |
| 55 | 118 Skipton Road | 2 | 20.2 | 12.6 | 16.2 |
| 56 | 116 Skipton Road | 2 | 19.9 | 12.4 | 16.0 |
| 57 | 114 Skipton Road | 2 | 20.7 | 13.0 | 16.7 |
| 58 | 112 Skipton Road | 2 | 20.8 | 13.0 | 16.8 |
| 59 | 110 Skipton Road | 2 | 20.3 | 12.7 | 16.5 |
| 60 | 108 Skipton Road | 2 | 20.3 | 12.7 | 16.5 |
| 61 | 106 Skipton Road | 2 | 21.4 | 13.4 | 17.4 |
| 62 | 104 Skipton Road | 2 | 21.7 | 13.7 | 17.8 |
| 63 | 102 Skipton Road | 2 | 21.4 | 13.5 | 17.6 |
| 64 | 100 Skipton Road | 2 | 22.2 | 14.0 | 18.3 |

| | | | Annual mean $NO_2$ concentration, µg.m$^{-3}$ | | |
|---|---|---|---|---|---|
| 65 | 98 Skipton Road | 2 | 22.9 | 14.5 | 19.1 |
| 66 | 96 Skipton Road | 2 | 23.4 | 14.8 | 19.7 |
| 67 | 94 Skipton Road | 2 | 25.2 | 16.1 | 21.6 |
| 68 | 92 Skipton Road | 2 | 27.6 | 17.8 | 24.3 |
| 69 | 2 Windsor lodge | 2 | 22.8 | 14.5 | 19.3 |
| 70 | 2 New Bath Street | 2 | 20.7 | 13.0 | 16.8 |
| 71 | 4 Bristol Street | 2 | 3.9 | 2.6 | 3.2 |
| 72 | 6 Bristol Street | 2 | 3.8 | 2.6 | 3.2 |
| 73 | 58 Windsor Street | 2 | 27.1 | 28.3 | 33.9 |
| 74 | 60 Windsor Street | 2 | 26.8 | 26.7 | 32.0 |
| 75 | 65 Windsor Street | 2 | 30.6 | 23.2 | 27.8 |
| 76 | 66 Windsor Street | 2 | 26.0 | 18.8 | 22.6 |
| 77 | 3 Townley street | 2 | 4.2 | 3.4 | 4.2 |
| 78 | 5 Townley street | 2 | 4.0 | 3.0 | 3.8 |
| 79 | 2 Dickson Street | 2 | 5.6 | 3.8 | 4.8 |
| 80 | 4 Dickson Street | 2 | 5.1 | 3.5 | 4.4 |

## 7.2 MAPPED CONCENTRATIONS FOR 2024 BASELINE

Figure 7-1 presents annual mean $NO_2$ concentrations in the Colne AQMA in the 2024 baseline scenario which is most likely for the AQMA in 2024.

Figure 7-1: Predicted annual mean $NO_2$ concentrations, 2024, µg.m$^{-3}$



Annual averaged $NO_2$ concentrations ($\mu g/m^3$) at relevant exposure are likely to be below the 40 $\mu g/m^3$ air quality standards regulation threshold value at all relevant locations across Colne. Some locations within the study area are predicted to exceed this threshold; however, these locations were shown to be within the width of road segments and are therefore not representative of relevant exposure.

# 8. CONCLUSIONS

Ricardo was commissioned to carry out a detailed assessment of $NO_2$ concentrations in and around the Colne AQMA to determine whether compliance with the Air Quality Objective for annual mean $NO_2$ concentrations was achieved across the area in 2022 and to determine whether compliance will be achieved in future years. Modelling was carried out for a 2022 baseline and a 2024 projected year.

In addition, to assess model uncertainty in future years, a theoretical worst-case scenario was tested to quantify the potential impacts of conditions where emissions from road transport would be higher than expected in 2024. This was scenario 3 which used the projected traffic volume and fleet composition due to forecasted fleet renewals for 2024, with an additional 5000 vehicles across Pendle. This is the worst-case scenario and is less realistic than scenario 2 but is included to demonstrate the robustness of the predicted compliance given uncertainties in predictions in traffic volume for future years.

The model accurately predicts concentrations at monitoring stations in the Colne AQMA in 2022, with a RMSE of 3.05 $\mu g.m^{-3}$, within the 4 $\mu g.m^{-3}$ ideal threshold identified in the guidance. This demonstrates that the model is correctly representing real-world conditions, lending confidence to the predictions for future years.

The modelling undertaken through this study shows that:

- No location of relevant exposure is predicted to have an annual mean $NO_2$ concentration above or within 10% of the Air Quality Objective for $NO_2$ annual mean (>36 $\mu g/m^3$) at any location of relevant exposure in 2024 should changes in traffic volume and vehicle fleet composition follow the forecasted national trends. This is determined to be the most likely scenario for the AQA in 2024.
- No location of relevant exposure is predicted to have an annual mean $NO_2$ concentration that exceeds the Air Quality Objective for $NO_2$ annual mean (40 $\mu g/m^3$) in 2024 should changes in vehicle fleet composition follow the forecasted national trends and with an additional 5000 vehicles in the 2024 forecasted traffic volume. This demonstrates the robustness of the predicted compliance given uncertainties in predictions in traffic volume for future years, however, this is a less likely representation of the AQMA than scenario 2.

Based on the data available, the modelled results indicate that future exceedances of the Air Quality Objectives within the AQMA are unlikely and so this is evidence to revoke the AQMA. We recommended that the Council keep track of future monitoring results to ensure that there are not any exceedances at the monitoring sites.


T: +44 (0) 1235 75 3000

E: enquiry@ricardo.com

W: ee.ricardo.com